Vol. 5

TECHNO MUTATION

2019

Technique Polytechnic institute

Panchrokhi, Sugandhya, Hooghly

Department of

Computer Science & Technology

NBA Accredited

contact : (033) 2686-3682(ext:216)

institutional Vision

To be a premier Institute in pursuit of excellence in technical education and skill development committed to serve the society.

institutional Mission

To promote excellence in learning, teaching and technology transfer

To improve the quality of skilled workforce through a structured programme and professional skills training

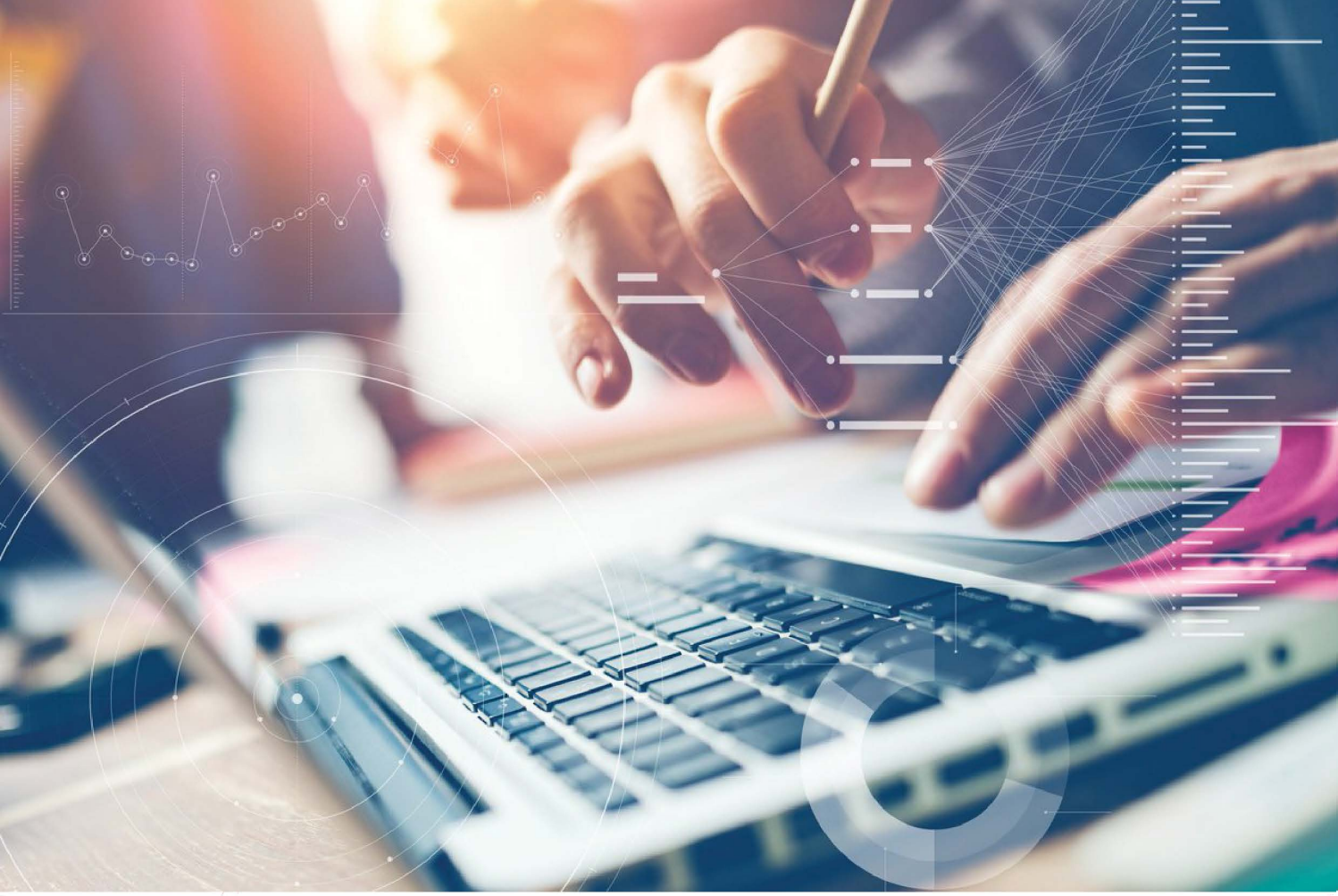
To inspire students to learn and facilitate their overall development with social orientation and values

departmental Vision

To be a dynamic and efficient department of Computer Science & Technology providing quality education and progressive atmosphere to the students so that they can implement knowledge effectively to meet the needs of society.

departmental Mission

1. To Provide a learning ambience to enhance innovations, problem solving skills, leadership qualities, team-spirit and ethical responsibilities.
2. To Provide exposure to latest tools and technologies in the area of engineering and technology.
3. To motivate student to pursue higher studies will always be alive.
4. To Support society by participating in and encouraging technology transfer.



Index

Message from editorial team

It gives us immense pleasure and satisfaction to re-introduce our departmental technical magazine "technomutation vol-5" for the session 2019
A lot of effort has gone into the making of this issue.We hope you enjoy reading the magazine.The best thing about this issue is that it represents the contemporary face of DCST students. Amidst the busy schedule of a 4-month semester, with 3-exams, surprise quizzes and all those assignments and problem sheets that make you want to bang your head on the wall, it is fascinating to see how students are keeping abreast with trending technologies.So this time we have made an attempt to bring out the talent concealed within our student community. Faculties of the department has also contributed from their end by touring the grayer side of technical issues.This volume indulges research in one hand on other it presents cutting edges technologies.We hope you enjoy reading this issue as much as we have enjoyed making it.

Symbiotic AI

Sudeshna Sani
Lecturer, DCST

In this article I am going to present a story of the experiment in which humans and AI augmented each other's strengths, demonstrates how leaders can re-imagine processes to create greater business value and prepare for the next wave of innovation which was published by **Accenture's chief technology and innovation officer from the Business school of Massachusetts Institute of Technology, Cambridge.**

Before coming to the industrial research story, I like to draw attention to the fact that it is a longstanding argument about whether AI will replace or complement human beings. Thus, a new word is introduced "symbiosis" in the world of machine learning. A symbiotic relationship is one in which organisms, people, or things exist together in a way that benefits them all. Symbiosis between humans and artificial intelligence can be said to be a relationship that enhances each other's abilities. In order to establish such a relationship, one's learning needs to have a positive influence on the other's learning. The current mainstream is to advance artificial intelligence by machine learning based on human-made data. However, if artificial intelligence can properly support human learning and human beings can generate useful data for artificial intelligence as a by-product of humans' main activities, positive circulation will be established between human and artificial intelligence learning.

In order to create a symbiotic AI workforce, their organization needed to use human-centred AI processes that motivate workers, retrain them in the context of their workflow, and shift the focus from automation to collaboration between humans and machines. To test that proposition, their company's innovation hub in Dublin, Ireland, conducted an experiment designed to see how human workers might augment the work of an existing AI system and embrace their new roles as AI trainers. The role of AI trainer was to teach AI how to perform and iterate. There was a team of design, data, software experts, and medical coders. They designed, built, and tested a software interface that enabled the medical coders to move from simply using AI to improving it.

Medical coders analyze a patient's medical chart, taking complex information about diagnoses, treatments, medications, and more, which gets translated into alphanumeric codes that are submitted to billing systems and health insurers. That coding was critical not only for billing and reimbursement but also for patient care and epidemiological studies. Previously, medical coders read through charts and highlighted relevant information with a pen. Afterwards the AI system took headaches of this process by scanning the charts and finding information about drug treatments to support insurance payments. They saw the opportunity for the medical coders, who are registered nurses, to further apply their expertise by training the AI system so it could more accurately validate genuine links between medical conditions and treatments. The resulting symbiotic system enabled the humans and the AI to each work to their strengths. As their understanding of AI grew, the coders were able to make coding decisions that were beyond the scope of a non-medically trained data scientist. Though small in scale, the experiment has big implications for leaders, workers, data scientists, and managers seeking to shape the AI systems and jobs of the future.

Finally, they have concluded to follow some basic principles in order to create exponentially more valuable symbiotic systems: -

- Challenge the assumption that AI is always superior to humans.

- When developing symbiotic systems, help workers who are not familiar with AI to develop a positive relationship with it. In their experiment, medical coders often referred to the AI they were training as a child to whom they were teaching new things.
- **Invest in people**. When we think of investing in AI, we tend to think of technology first. That's important, but people will drive the value for your business. Investing in your employees so they can build AI relationships into their roles is a long-term strategy that can unlock previously untapped expertise and value in your workforce.
- **Focus on function, not sophistication**. Successful symbiotic systems will put simplicity before sophistication and value transparency and ease of use over complexity.
- **Cocreate and experiment**. Once you have identified the process or workflow where people and AI can work symbiotically, make sure all stakeholders work and experiment together from the start.

Looking to the Future

To build such systems, organizations need to take the long view. With AI washing over virtually every industry these days, leaders are understandably eager to catch the wave in the short term. But they need to ask themselves how to position their workforce to harness the waves to come. That means thinking about and investing in roles and responsibilities that are three to five years away.

By taking this long view, coupled with a willingness to experiment, managers can make space for creativity, test for stakeholder buy-in, and design processes and jobs for maximum collaborative intelligence. As AI and humans get smarter by working together, the system grows organically in the hands of those who work with it most closely. By embracing symbiotic processes, the organization fulfils its ethical obligation to its most valuable asset — its people.

An Overview of Cognitive Computing

Sohan Goswami
Lecturer, DCST

1. Introduction

The goal of cognitive computing is to simulate human thought processes in a computerized model. Cognitive computing systems can synthesize data from various information sources, while weighing context and conflicting evidence to suggest the best possible answers. To achieve this, cognitive systems include self-learning technologies that use data mining, pattern recognition and natural language processing (NLP) to mimic the way the human brain works.

2. Characteristics

To achieve those capabilities, cognitive computing systems must have five key attributes, as listed by the Cognitive Computing Consortium.

Adaptive: Cognitive systems must be flexible enough to learn as information changes and as goals evolve. The systems must be able to digest dynamic data in real time and make adjustments as the data and environment changes.

Interactive: Human-computer interaction (HCI) is a critical component in cognitive systems. Users must be able to interact with cognitive machines and define their needs as those needs change. The technologies must also be able to interact with other processors, devices and cloud platforms.

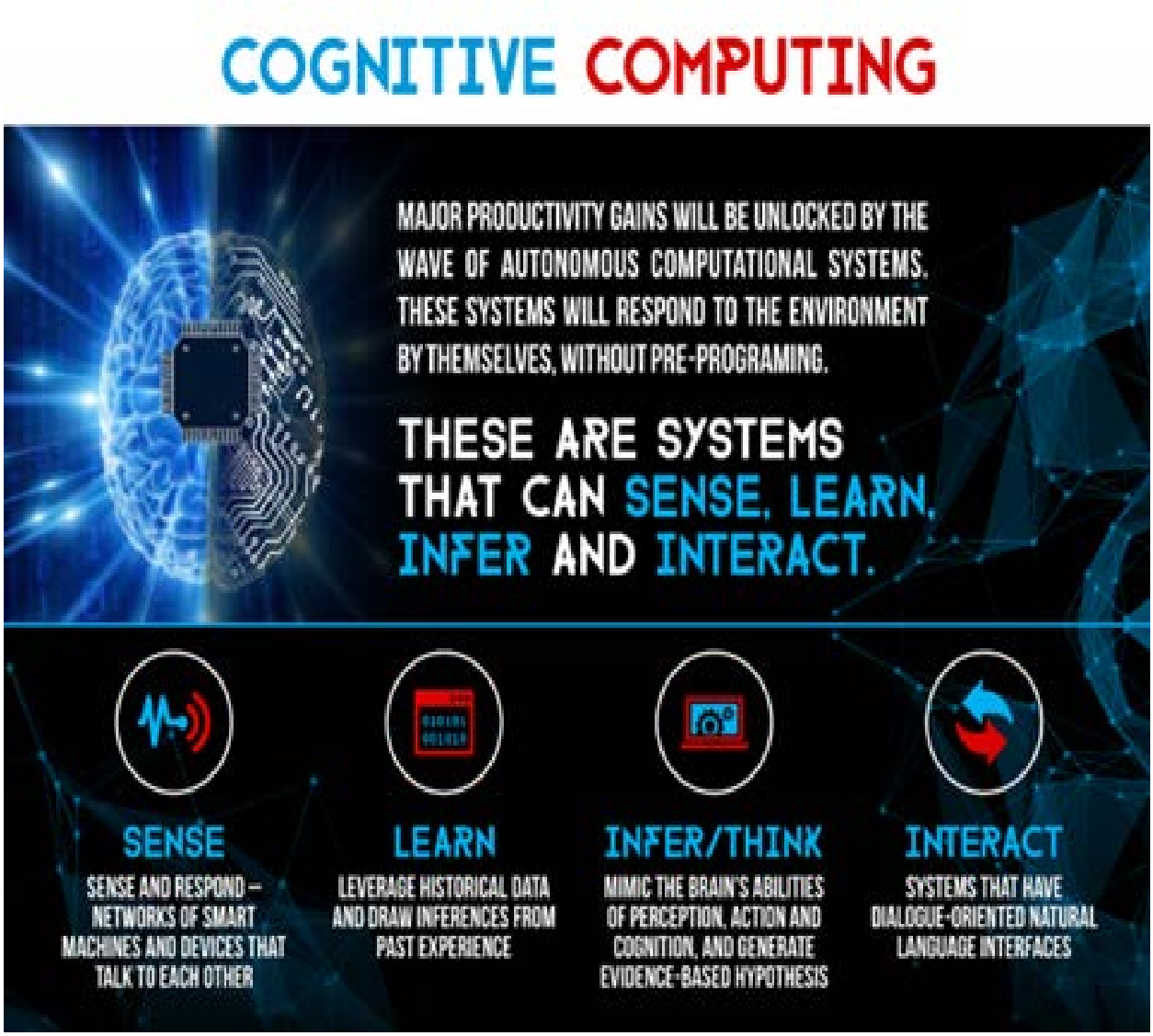
Iterative and Stateful: Cognitive computing technologies can also identify problems by asking questions or pulling in additional data if a stated problem is vague or incomplete. The systems do this by maintaining information about similar situations that have previously occurred.

Contextual: Understanding context is critical in thought processes, and so cognitive systems must also understand, identify and mine contextual data, such as syntax, time, location, domain, requirements, a specific user's profile, tasks or goals. They may draw on multiple sources of information, including structured and unstructured data and visual, auditory or sensor data.

3. How Cognitive Computing Works

A Computer with a brain that thinks and behaves like a human being. Concepts like automation, machine learning, and artificial intelligence sounded strange before they were invented and applied to modern problems. Today, these technologies improve our lives at home and at work for the

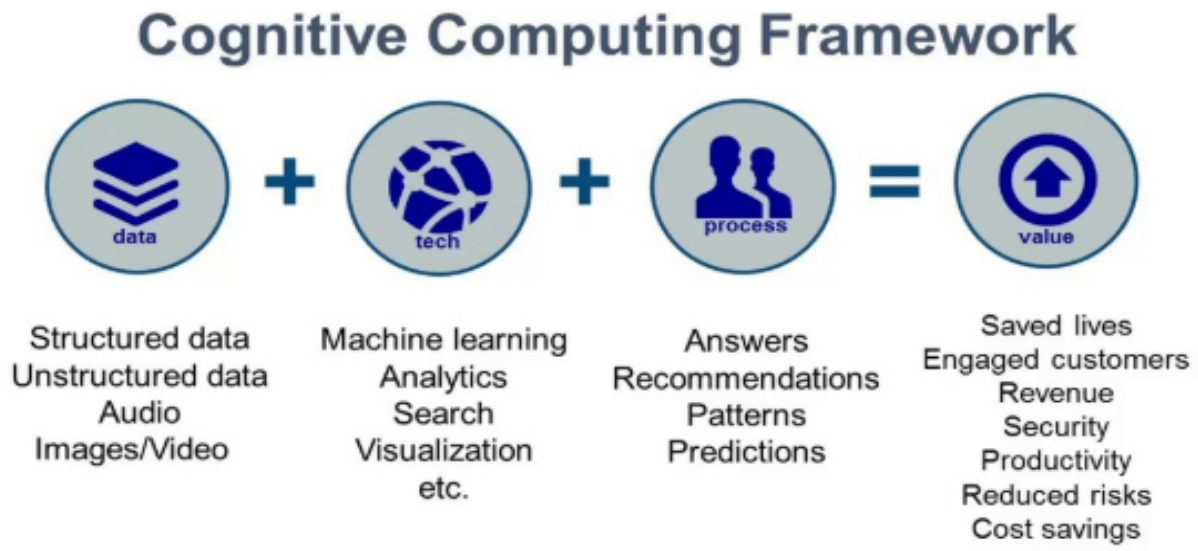
better, powering technologies like handwriting recognition, facial identification and behavioural pattern determination to any task requiring cognitive skills.



4. Cognitive Computing Framework

The Cognitive Computing Framework provides various combinations. These combinations are of data, impact, setting, and knowledge. With the help of this framework, we can make all the calculations. The framework makes use of a model to reclassify two significant things:

1) The idea to connect among various persons
2) The inescapable computer conditions



5. Building Blocks of Cognitive Computing

There are three main building blocks of Cognitive Computing:

1) Big Data Analytics
2) Machine Learning
3) Cloud Computing

Big Data Analytics

The human brain can process a vast amount of information. Understanding the context of any question is vital. For machines, we can make it happen by feeding data.

There can be two types of data – Organized & Unorganized. So, for processing this vast data, the role of **Big Data Analytics** comes into play.

Machine Learning

Machine Learning is about making use of algorithms. The purpose of this algorithm is to analyse data & predict the trends. Generally, there is a training data set for feeding information.

You need to test this data on various data sets for knowing efficiency. For Cognitive Computing, self-learning feature is essential. That's where **Machine Learning** comes into play.

Cloud Computing

If you want to process massive data, you will require high computing power. In Cognitive Computing, the demand keeps on changing. Therefore, scalability is a huge factor.

That's where Cloud Computing can be our best bet. It provides us with scalable resources. This type of scenario suits well for **Cognitive Computing**.

6. Applications of Cognitive Computing

Chatbots:

Chatbots are computer programs that can simulate human behaviour. For this purpose, it uses the concept of Natural Language Processing (NLP).

With the help of NLP, you can take input from a human. Cognitive Computing can make Chatbots more intellectual. It can understand the context & provide the answer.

Sentiment Analysis:

Sentiment Analysis deals with knowing various emotions. For a human, this thing comes naturally. But, for the machine, you need to provide training data of conversations.

You can mostly use Sentiment Analysis for dissecting social media conversation. You can analyse Likes, Tweets, Comments, Reply, etc. quickly.

Face Detection

Face Detection is the upper level of Image Processing. Any cognitive system uses contours, eye colours, etc. to detect a face. After generating a facial image, one can identify the face.

Generally, Face Detection was for 2D images. But, now you can also perform it for 3D models. Mostly Face Detection is useful in any security system.

Risk Management

Risk Management is about analysing current trends to predict the risks. This analysis involves data, behaviour, instincts, etc. It's a combination of art and science.

Cognitive Computing assists you to gather data & trends. Based on this integration, it can generate valuable insights. You can contact any analyst for further details.

Fraud Detection

Fraud Detection detects abnormal transactions. For that purpose, you need to study historical data. That's where Cognitive Computing can play a significant role.

7. Conclusion

The 21st century belongs to the latest technology innovations. We have seen plenty of trending technology emerge and take a giant stride.

Cloud Computing, Machine Learning & Artificial Intelligence have already made their mark. With this base, Chatbots are also on the horizon of greatness.

Now, the technology that is booming right now is **Cognitive Computing**. It has given a whole new dimension to the world of technology.

Fuzzy Logic Approach towards Complex Solutions: A Review

Dipra Mitra
Lecturer, DCST

Abstract— Fuzzy logic is based on the central idea that in fuzzy sets each element in the set can assume a value from0 to 1, not just 0 or 1, as in classic set theory. Thus, qualitative characteristics and numerically scaled measures can exhibit gradations in the extent to which they belong to the relevant sets for evaluation. This degree of membership of each element is a measure of the element's "belonging" to the set, and thus of the precision with which it explains the phenomenon being evaluated. Fuzzy sets can be combined to produce meaningful conclusions, and inferences can be made, given a specified fuzzy input function. The article demonstrates the application of fuzzy logic to an income-producing property, with a resulting fuzzy set output.

Index Terms— Crisp sets, rule patches shrink, fuzzy set, control problem

I. INTRODUCTION

The pricing function (or valuation) is always a problem in free market economies. Even in well-organized, relatively efficient markets, like securities markets, participants typically lack precise information, and in setting prices they consider a variety of factors and different relationships among factors. In the field of real estate the lack of precise information associated with property investments is usually greater than those involving securities because:

(1) Data are usually not readily available in consistent form;

(2) The diversity among properties often resists analysis and interpretation of general trends;

(3) Properties are place-bound, producing even greater uncertainty about the future prospects of a property than for other economic goods that can be moved.

Thus, analysts use a great deal of judgment to identify the characteristics (attributes) of properties that contribute to returns and values and the relationships among these characteristics so as to derive estimates of investment and market values. Hence, they cannot work with investment and valuation models that are shareable by a team of analysts, without simplifying the contexts.

II. OVERVIEW OF FUZZY LOGIC

Fuzzy logic theory was developed by Lofti A. Zadehin the 60„s and is based on the theory of fuzzy sets. The membership of an element is not strictly false or true ({0, 1}) like in Boolean logic, but rather gradual [2]. The degree of membership of an element in fuzzy logic can be any real number in the interval [0, 1]. Crisp sets as a particular case of fuzzy sets, where [0, 1] is restricted to {0, 1}.Knowledge is interpreted as a collection of elastic, fuzzy constraints on a collection of variables. Inference is viewed as a process of propagation of elastic constraints. Any logical system can be "fuzzified". Aim of fuzzy logic is to deal with the vagueness and imprecision of many real-world problems. To simulate human reasoning and its ability of decision making based on not so precise information. To model systems that have to process some kind of vague terms like old, young, tall, high, very, extremely, not so much, etc..

III. FUZZY SETS

Some formal definition of fuzzy sets given a collection of objects U, a fuzzy set A in U is defined as a set of ordered pairs $A\{x, \mu A(x) \mid x \in U\}$ *where* $\mu A(x)$ is called the membership function for the set of all objects x in U, where to each x is related a real number(membership grade) in the closed interval[0,1]. Fuzzy sets vs. Crisp sets "Crisp sets are the sets that we have used most of our life. In a crisp set, an element is either a member of the set or not." For example, a jelly bean belongs in the class of food known as candy. Mashed potatoes do not. Fuzzy sets, on the other hand, allow elements to be partially in a set. Each element is given a degree of membership in a set. This membership value can range from 0 (not an element of the set) to 1 (a member of the set). It is clear that if one only allowed the extreme membership values of 0 and 1, that this would actually be equivalent to crisp sets [1]. A membership function is the relationship between the values of an

element and its degree of membership in a set. An example of membership functions are shown in Fig.1.

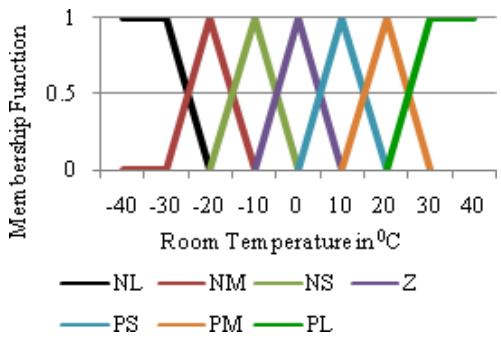


Fig.1 Membership Function

In this example, the sets (or classes) are numbers that are negative large, negative medium, negative small, near zero, positive small, positive medium, and positive large. The value, μ, is the amount of membership in the set. Membership Functions for the Set of All Numbers (N = Negative, P = Positive, L = Large, M = Medium, S = Small).

A. Temperature as Crisp Sets

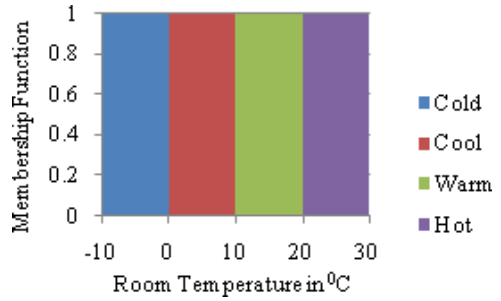


Fig.2 Temperature as Crisp Sets

B. Temperature as Fuzzy Sets

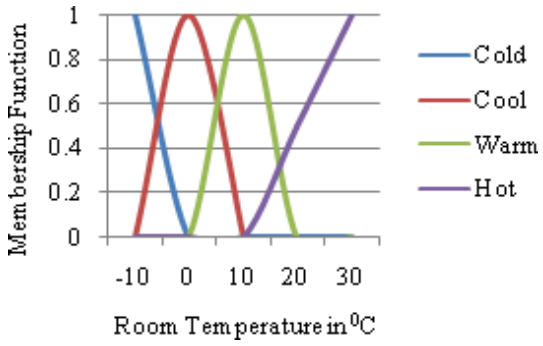


Fig. 3 Temperature as Fuzzy Sets

C. Another Example of Fuzzy Set and Crisp Set

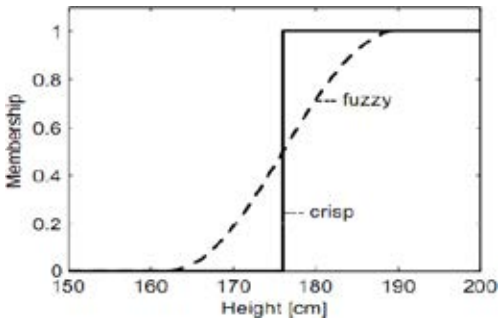
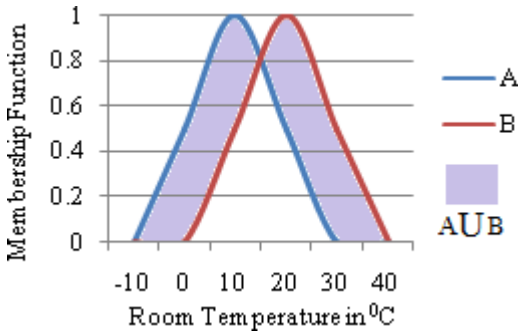


Fig.4 Two definition of the set of "tall man", a crisp set and a fuzzy set

IV. SOME BASIC OPERATIONS OF FUZZY SETS

A. Union

The membership function of the union of two fuzzy sets A and B with membership functions



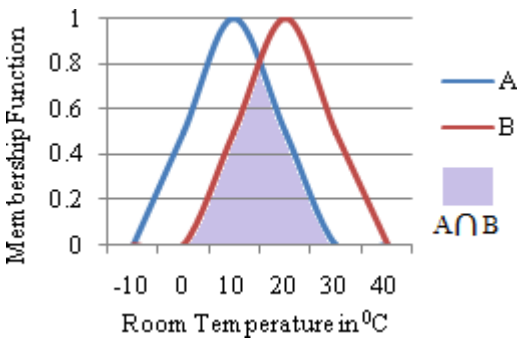


Fig.6 Intersection of Fuzzy Sets

C. Complement

The membership function of the complement of a Fuzzy set A with membership function is defined as:

$\mu\neg A(x) : 1 - \mu A(x)$

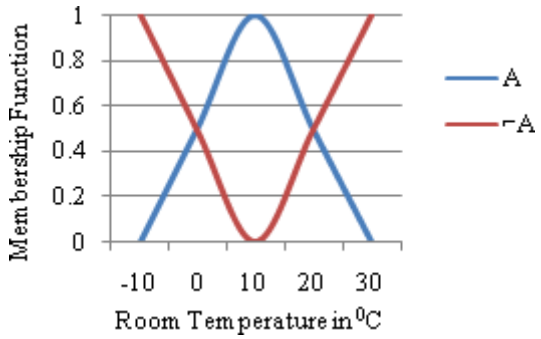


Fig.7 Complement of Fuzzy Set

V. FUZZY LOGIC OPERATIONS

The fuzzy set operations of union, intersection and complement correspond to the logical operations disjunction, conjunction and negation, respectively.

Disjunction (OR):

$\mu A \cup B(x) = \max(\mu A(x), \mu B(x))$

Conjunction (AND):

$\mu A \cap A(x) = \min(\mu A(x), \mu B(x))$

Complement (NOT): $\mu\neg A(x) : 1 - \mu A(x)$

As for example:

$\mu_{young}(John) = 0.5$ AND $\mu_{tall}(John) = 0.8$ then

$\mu_{young \cap tall}(John) = \min\{\mu_{young}(John), \mu_{tall}(John)\}$

$= \min(0.5, 0.8) = 0.5$

VI. LINGUISTIC VARIABLE

By a linguistic variable we mean a variable whose values are words or sentences in a natural or artificial language. For example, Age is a linguistic variable [7] if its values are linguistic rather than numerical, i.e., young, not young, very young, quite young, old, not very old and not very young etc.

1) The name of a linguistic variable is its label.

2) The set of values that it can take is called its term set.

3) Each value in the term set is a linguistic value or term defined over a universe.

4) In summary: A linguistic variable takes a linguistic value, which is a fuzzy set defined on the universe.

Example: (A non linear fuzzy function of age) Let x be a linguistic variable labeled Age. Its term set T could be defined as T (age) = {very young, young, not very young, more or less old, old}

Each term is defined on the universe, for example the integers from 0 to 100 years.

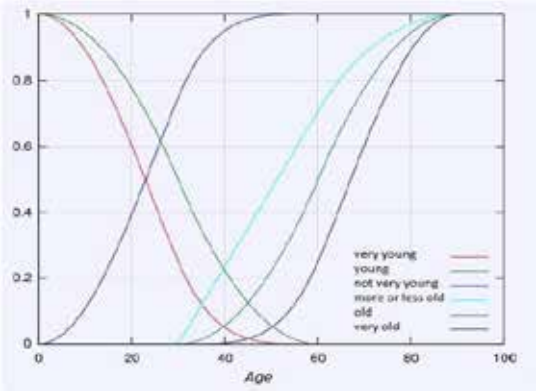


Fig.8 Linguistic variable representation

VII. FUZZY RULES

Human beings make decisions based on rules. Although, we may not be aware of it, all the decisions we make are all based on computer like if-then statements [6]. If the weather is fine, then we may decide to go out. If the forecast says the weather will be bad today, but fine tomorrow, then we make a decision not to go today, and postpone it till tomorrow. Rules associate ideas and relate
one event to another.

A. Fuzzy Patches

In a fuzzy system this simply means that all our rules can

be seen as patches and the input and output of the machine can be associated together using these patches.

Graphically, if the rule patches shrink, our fuzzy subset triangles get narrower. Is Simple enough? Yes, because even no voices can build control systems that beat the best math models of control theory. Naturally, it is math-free system.

VIII. FUZZY CONTROL

Fuzzy control, which directly uses fuzzy rules, is the most important application in fuzzy theory. Using a procedure originated by "Ebrahim Mamdani" in the late 70s, three steps are taken to create a fuzzy controlled [5] machine:

1) Fuzzy-fication (Using membership functions to graphically describe a situation)

2) Rule evaluation (Application of fuzzy rules)

3) De-fuzzy fication (Obtaining the crisp or actual results)

As a simple example on how fuzzy controls are constructed, consider the following classic situation: the inverted pendulum. Here, the problem is to balance a pole on a mobile platform that can move in only two directions, to the left or to the right. The angle between the platform and the pendulum and the angular velocity of this angle are chosen as the inputs of the system. The speed of the platform hence is chosen as the corresponding output.

Example:

Step-1

The different levels of output (high speed, low speed etc.) of the platform are defined by specifying the membership functions for the fuzzy sets. The graph of the function is shown below.

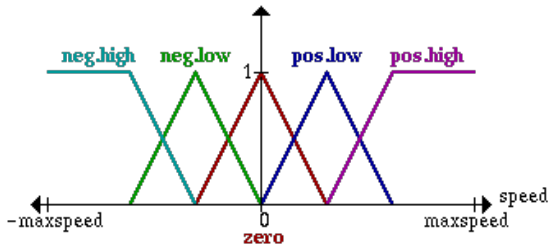


Fig.9 Representation of membership function Step-2

The next step is to define the fuzzy rules. The fuzzy rules are merely a series of if-then statements as mentioned above. These statements are usually derived by an expert to achieve optimum results. Some examples of these rules are:

i) If angle is zero and angular velocity is zero then speed is also zero.

ii) If angle is zero and angular velocity is low then the speed shall be low.

The full set of rules is summarized in the table below. The dashes are for conditions, which have no rules associated with them.

Speed	Angle				
	negative high	negative low	zero	positive low	positive high
„v negative high	-	-	negative high	-	-
„e negative low	-	-	negative low	zero	-
zero	negative high	negative low	zero	positive low	positive high
„o positive low	-	zero	low	-	-
c	-	-	high	-	-

An application of these rules is shown using specific values for angle and angular velocities. The values used for this example are 0.75 and 0.25 for zero and positive-low angles, and 0.4 and 0.6 for zero and negative-low angular velocities. These points are on the graphs below.

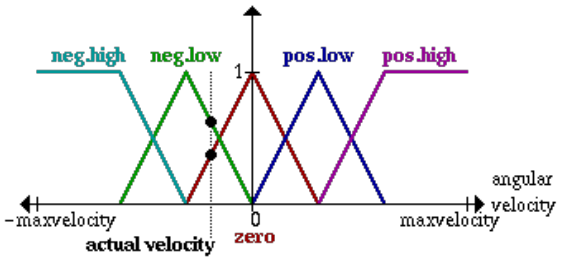


Fig.10 Velocity graph

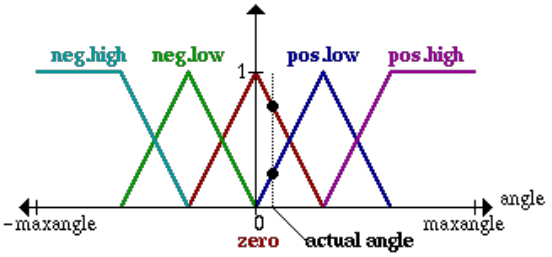


Fig.11 Angle graph

Consider the rule "if angle is zero and angular velocity is zero, the speed is zero". The actual value belongs to the fuzzy set zero to a degree of 0.75 for "angle" and 0.4 for "angular velocity". Since this is an AND operation, the minimum criterion is used , and the fuzzy set zero of the variable "speed" is cut at 0.4 and the patches are shaded up to that area. This is illustrated in the Fig.12.

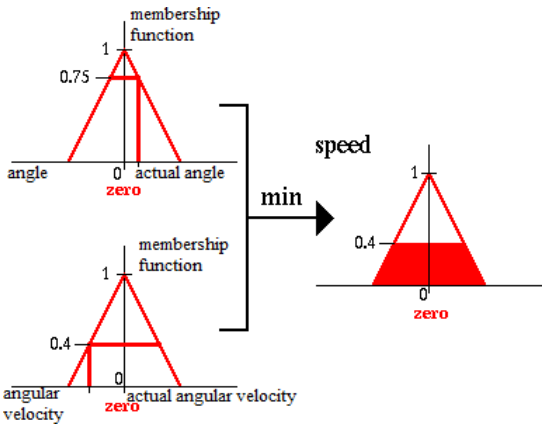
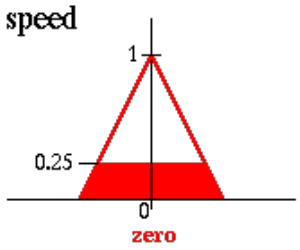
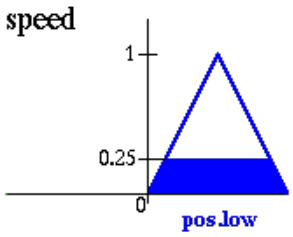


Fig.12 Final observation

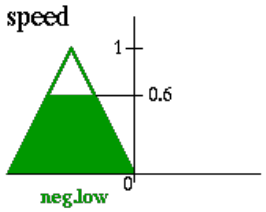
Similarly, the minimum criterion is used for the other three rules. The following figures show the result patches yielded by the rule "if angle is zero and angular velocity is negative low, the speed is negative low", "if angle is positive low and angular velocity is zero, then speed is positive low" and "if angle is positive low and angular velocity is negative low, the speed is zero". The four results overlaps and is reduced to the following figure.



(a) angle is zero and angular velocity is negative low



(b) angle is positive low and angular velocity is zero



(c) angle is positive low and angular velocity is negative low

Fig.13 Result patches yielded

The three results overlaps and is reduced to the following Fig.14

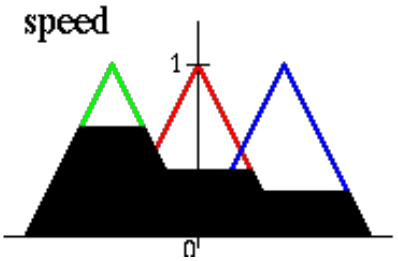


Fig.14 Final result

IX. APPLICATION AREAS

We can use this Fuzzy Systems in the following areas:

1) Digital image processing, such as edge detection

2) Washing machines and other home appliances

3) Video game artificial intelligence

4) Simplified control of robots [3] (HI Rota, Fuji Electric, Toshiba, Omron)

5) Substitution of an expert for the assessment of stock exchange activities (Yamaichi, Hitachi)

6) Efficient and stable control [5] of car-engines (Nissan)

7) Medicine technology: cancer diagnosis (Kawasaki Medical School)

8) Combination of Fuzzy Logic and Neural Nets (Matsushita)

9) Recognition of handwritten symbols with pocket computers (Sony)

X. ADVANTAGES OF FUZZY SYSTEM

Fuzzy Systems have the following advantages:

1) Robust approach to solve many real-world problems.

2) Employable in very complex systems, when there is no simple mathematical model for highly nonlinear processes.

3) Hence, low computational costs and ease at using it in embedded systems.

4) Expert knowledge in complex systems can be formulated in ordinary language.

XI. DISADVANTAGES OF FUZZY SYSTEM

Fuzzy Systems have the following advantages:

1) The number of rules can grow exponentially inverse [8] with the accuracy level. Undesirable high complexity and rule-chaining

2) The rules and the membership function for (imprecise) data must be (accurately) known and defined.

3) Must be combined with an adaptive system (such as neural networks) if some heuristics is desired.

XII. CONCLUSION

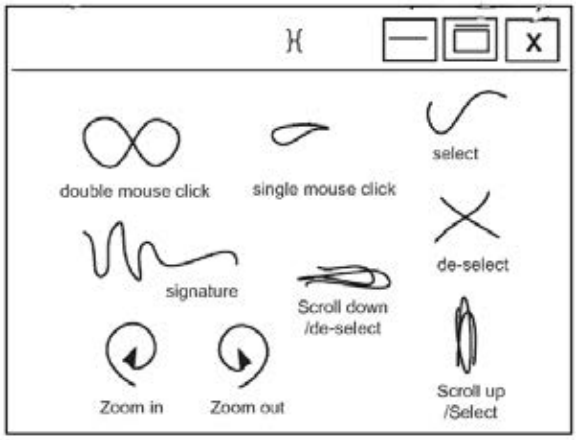
Fuzzy Logic provides a completely different, unorthodox way to approach a control problem. This method focuses on what the system should do rather than trying to understand how it works. One can concentrate on solving the problem rather than trying to model the system mathematically, if that is even possible. This almost invariably leads to quicker, cheaper solutions. Once understood, this technology is not difficult to apply and the results are usually quite surprising and pleasing.

Touchless Touchscreen User Interface

Soumali Roy
Lecturer, DCST

INTRODUCTION:

The touch less touch screen sounds like it would be nice and easy, however after closer examination it looks like it could be quite a workout. This unique screen is made by TouchKo, White Electronics Designs, and Groupe 3D. The screen resembles the Nintendo Wii without the Wii Controller. With the touch less touch screen your hand doesn't have to come in contact with the screen at all, it works by detecting your hand movements in front of it. This is a pretty unique and interesting invention, until you break out in a sweat. Now this technology doesn't compare to the hologram-like IO2 Technologies Helio display M3, but that is for anyone that has $18,100 laying around.



Thanks to **Elliptic Labs** innovative technology that lets you control your gadgets like Computers, MP3 players or mobile phones without touching them. Simply point your finger in the air towards the device and move it accordingly to control the navigation in the device. They term this as "**Touchless human/machine user interface for 3D navigation**".

TOUCH LESS MONITOR: The monitor, based on technology from TouchKo was recently demonstrated by White Electronic Designs and Tactyl Services at the CeBIT show. Designed for applications where touch may be difficult, such as for doctors who might be wearing surgical gloves, the display features capacitive sensors that can read movements from up to 15cm away from the screen. Software can then translate gestures into screen commands.

Touchscreen interfaces are great, but all that touching, like foreplay, can be a little bit of a drag. Enter the wonder kids from Elliptic Labs, who are hard at work on implementing a touchless interface. The input method is, well, in thin air. The technology detects motion in 3D and requires no special worn-sensors for operation. By

simply pointing at the screen,users can manipulate the object being displayed in 3D. Details are light on how this actually functions, but what we do know is this:

What is the technology behind it?

It obviously requires a sensor but the sensor is neither hand mounted nor present on the screen. The sensor can be placed either onthe table or near the screen. And the hardware setup is so compact that it can be fitted into a tiny device like a MP3 player or a mobile phone. It recognizes the position of an object from as 5 feet.

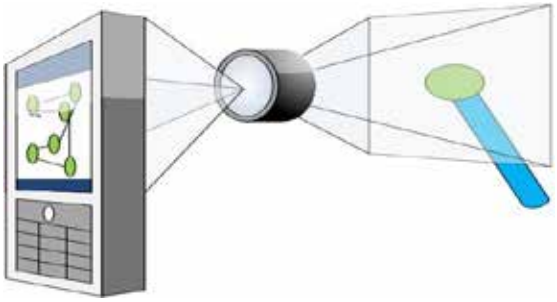
WORKING:

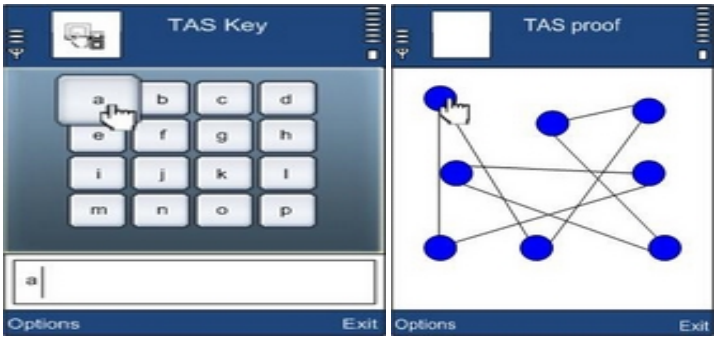
The system is capable of detecting movements in 3-dimensions without ever having to put your fingers on the screen. Their patented touchless interface doesn't require that you wear any special sensors on your hand either. You just point at the screen (from as far as 5 feet away), and you can manipulate objects in 3D.

Sensors are mounted around the screen that is being used, by interacting in the line-of-sight of these sensors the motion is detected and interpreted into on-screen movements. What is to stop unintentional gestures being used as input is not entirely clear, but it looks promising nonetheless. The best part? Elliptic Labs says their technology will be easily small enough to be implemented into cell phones and the like. IPod touchless.

Touch-less UI:

The basic idea described in the patent is that there would be **sensors arrayed around the perimeter of the device** capable of sensing finger movements in 3-D space. The user could use her fingers similarly to a touch phone, but actually **without having to touch the screen**. Thus, user input will not be limited to 2-D anymore, but that user can use their thick, dirty, bandaged, etc. fingers as well (as opposed to "plain" touch UI). Finally, there is one more thing to mention, it's the **built-in accelerometer.**





Touch-less SDK:

The Touchless SDK is an open source SDK for .NET applications. It enables developers to create multi-touch based applications using a webcam for input. Color based markers defined by the user are tracked and their

information is published through events to clients of the SDK. In a nutshell, the Touchless SDK enables touch without touching. Well, Microsoft Office Labs has just released "Touchless," a webcam-driven multi-touch interface SDK that enables "touch without touching."

Using the SDK lets developers offer users "a new and cheap way of experiencing multi-touch capabilities, without the need of expensive hardware or software. All the user needs is a camera," to track the multi-colored objects as defined by the developer. Just about any webcam will work

Touch-less demo: The Touch less Demo is an open source application that anyone with a webcam can use to experience multi-touch, no geekiness required. The demo was created using the Touch less SDK and Windows Forms with C#. There are 4 fun demos: Snake - where you control a snake with a marker, Defender - up to 4 player version of a pong-like game, Map - where you can rotate, zoom, and move a map using 2 markers, and Draw the marker is used to guess what…. draw!

Touch wall:

Touch Wall refers to the touch screen hardware setup itself; the corresponding software to run Touch Wall, which is built on a standard version of Vista, is called Plex. Touch Wall and Plex are superficially similar to **Microsoft Surface**, a multi-touch table computer that was introduced in 2007 and which recently became commercially available in select **AT&T** stores. It is a fundamentally simpler mechanical system, and is also significantly cheaper to produce. While Surface retails at around $10,000, the hardware to "turn almost anything into a multi-touch interface" for Touch Wall is just "hundreds of dollars".

Touch Wall consists of three infrared lasers that scan a surface. A camera notes when something breaks through the laser line and feeds that information back to the Plex software. Early prototypes, say Pratley and Sands, were made, simply, on a cardboard screen. A projector was used to show the Plex interface on the cardboard, and a the system worked fine. Touch Wall certainly isn't the first multi-touch product we've seen (see iPhone). In addition to Surface, of course, there are a number of **earlyprototypes** emerging in this space. But what

Microsoft has done with a few hundred dollars worth of readily available hardware is stunning. It's also clear that the only real limit on the screen size is the projector, meaning that entire walls can easily be turned into a multi touch user interface. Scrap those white boards in the office, and make every flat surface into a touch display instead. You might even save some money.

What's next??

Many personal computers will likely have similar screens in the near future. But touch interfaces are nothing new -- witness ATM machines.

How about getting completely out of touch? A startup called LM3Labs says it's working with major computer makers in Japan, Taiwan and the US to incorporate touch less navigation into their laptops, Called Airstrike; the system uses tiny charge-coupled device (CCD) cameras integrated into each side of the keyboard to detect user movements.

You can drag windows around or close them, for instance, by pointing and gesturing in midair above the keyboard. You should be able to buy an Airstrike-equipped laptop next year, with high-end stand-alone keyboards to follow.

Any such system is unlikely to replace typing and mousing. But that's not the point. Airstrike aims to give you an occasional quick break from those activities.

CONCLUSION:

Today's thoughts are again around user interface. Efforts are being put to better the technology day-in and day-out. The Touchless touch screen user interface can be used effectively in computers, cell phones, webcams and laptops. May be few years down the line, our body can be transformed into a virtual mouse, virtual keyboard and what not?? Our body may be turned in to an input device!

Trust Management Techniques In Support of The Internet of Things: A Review

Debasish Hati
Lecturer, DCST

Abstract: A dream of things to come Internet is presented in such a way, that different registering gadgets are related together to shape a system called Internet of Things (IoT). This system will formulate huge information that might be utilized for diversion, security, and above all client trust. However, trust is a basic complication that may upset the IoT development and even defer the generous press of various applications. In this review, a broad examination of trust the board strategies alongside their upsides and downsides is exhibited in an alternate setting. In connection with different studies, the objective is to give an orderly description of the most significant trust the board strategies to assist analysts to know that how different frameworks fit together to bring favored functionalities without looking at changed principles. In addition, the exercises learned are exhibited and the perspectives are contended with respect to the essential objective trust is probably going to collaborate later on Internet.

***Index Term*-Trust definition & characteristics, objective of Trust Management, Trust Management Techniques.**

I. INTRODUCTION

Internet of Things (IoT) is another model created to permit a huge number of brilliant communication hubs be connected with the Internet [1]. Such hubs are sensors or potentially actuators that can process and recover information from different gadgets with or without human obstruction [2]. The IoT advancement brings a astonishing impact to different regions, for example, brilliant urban areas [3], savvy human services [4], keen transportation [5], cell interchanges [6], information mining [7], producing [8], and ecological observing [9] among others [10]– [13]. This abnormal state of heterogeneity, connected with the IoT framework, is dared to expand security dangers for the current Internet, which is utilized to give people a opportunity to interface with machines [14]. Regular protection arrangements and security arrangements don't accomplish client prerequisites due to their controlled preparing power.

In an IoT environment, a diversity of independent devices cooperates with one another to achieve different tasks. These devices in such dense environment unreasonably discover other devices. Such discovery is named as semantic discovery which creates dissimilar information trust related issues [15]. Various methods to accomplish semantic interoperability include broker based architecture and different service platforms. Broker architecture is complex and weak to handle the object-to-object discovery [16]. Trust management in an IoT environment is provided by various methods [17],[18] which employs past knowledge, sensor data abnormality, trustworthiness, and availability as trust matrices.

II. TRUST IN IOT

2.1Trust Concept

Typically, trust can be observed as a metric used to evaluate social actors in consideration of mutual benefits, harmonization, and cooperation. Actors continuously update their trust on others in response to perception fluctuations due to direct interactions and based on beliefs and opinions of others who are around. In addition, trust also affects the decision of an object to transact with another object in an IoT environment in which all participating objects must take decisions based on trust to provide/receive services to/from other objects.

However, building trust in IoT is much more complicated due to the inability of machine objects to generate perceptions about other objects around them like humans. Furthermore, it is tricky to quantify the exact trustworthiness value of an object with a high accuracy. This is even harder when each object has a different explanation and observation of the term “trustworthy”. Therefore, they may assign different trustworthiness values to a provider or a service. As an example, a service consumer object assigns “very trustworthy” to the provider for a specific transaction that it has performed. However, another consumer object might allocate “untrustworthy” for a similar transaction from the same provider. These differences further amplify the complexity to determine the precise trustworthiness of a provider.

Therefore, it is necessary to establish a generic platform which defines the blueprint of a trust management process while keeping in mind the diversity of trust features and hence the flexibility given to objects to choose best and

practical measures. To elucidate the ambiguities and definitions of trust, we bring into play the following definition in the context of the IoT.

2.2Definition: Trust

It is a subjective or quantitative property of a trustee, assessed by a trustor as a quantifiable conviction, in an abstract or target way, for a given task, in a particular setting, for a particular timeframe.

The term "trustor" is used to characterize an object that is likely to initiate an communication with another object and "trustee" as the second object that provides necessary information to the trustor upon its request.

III. OBJECTIVES OF TRUST MANAGEMENT

(1) **Trust relationship and decision (TRD):** Trust management provides an effective way to evaluate trust relationships of the IoT entities and assist them to make a wise decision to communicate and collaborate with each other. Trust relation- ship evaluation (in short trust evaluation) concerns all IoT system entities in all layers and plays a fundamental role for intelligent and autonomic trust management.

(2) **Data perception trust (DPT):** Data sensing and collection should be reliable in IoT. In this aspect, we pay attention to the trust properties like sensor sensibility, preciseness, security, reliability, and persistence, as well as data collection efficiency, i.e., the trustee's objective properties in the IoT physical perception layer.

(3) **Privacy preservation (PP):** User privacy including user data and personal information should be flexibly preserved according to the policy and expectation of IoT users. This objective relates to the IoT system objective properties in general.

(4) **Data fusion and mining trust (DFMT):** The huge amount of data collected in IoT should be processed and analyzed in a trustworthy way with regard to reliability, holographic data process, privacy preservation and accuracy. This objective also relates to trusted social computing in order to mine user demands based on their social behaviours and social relation- ship exploration and analysis. DFMT concerns the objective properties of the data processor in the IoT network layer.

(5) **Data transmission and communication trust (DTCT):** Data should be transmitted and communicated securely in the IoT system. Unauthorized system entities cannot access private data of others in data communications and transmission. This objective is related to the security and privacy properties of IoT system wherein light security/trust/privacy solution is needed. Trusted routing and key management in IoT networks are two important issues required to be solved for achieving this objective (Liu and Wang, 2010).

(6) **Quality of IoT services (QIoTS):** Quality of IoT services should be ensured. "Only here, only me and only now" services are expected (Chen, 2012), which implies that the IoT services should be personalized and precisely offered at exactly right place and time to a right person. This objective is mainly about the trust management in the IoT application layer, but required to be supported by other layers. The QIoTS TM objective concerns not only the objective properties of IoT services (the trustee), but also the objective and subjective properties of users (the trustor), as well as context.

(7) **System security and robustness (SSR):** Trust management in IoT should effectively counter system attacks to gain sufficient confidence of IoT system users. This objective concerns all system layers, focusing on system security and dependability (including reliability and availability), which are about the trustee's objective properties.

(8) **Generality (G):** Trust management for various IoT systems and services is preferred to be generic that can be widely applied, which is a system objective property.

(9) **Human–computer trust interaction (HCTI):** Trust management provides sound usability and supports human–computer inter-action in a trustworthy way, thus can be easily accepted by its users. This requirement pays more attention to the subjective properties of trustor (i.e., IoT users) at the application layer.

(10) **Identity trust (IT):** The identifiers of IoT system entities are well managed for the purpose of trustworthy IoT. Scalable and efficient identity management in IoT is expected. This objective relates all layers and need crossing-layer support. It concerns the objective properties of IoT system (e.g., identity privacy) and subjective properties of IoT entities (e.g., user hope) and context that may influence identity management policies.

IV. TRUST MANAGEMENT TECHNIQUES

IoT is a creating expansion that gives a base to override the traditional correspondence structures with a propelled one [20]. In this system, machines perform different assignments to manage evolving conditions, everything considered, without the commitment of human undertakings. IoT licenses center points (things) to have different

qualities and offer organizations and information. Things produce decentralized frameworks with flexible topologies. In this particular condition, it is essential to have a strong, versatile and trustworthy correspondence, and correspondence among these devices [21]. Various devices, for example, PCs and phones, coordinate to make individuals' life increasingly pleasant. With this increasing number of related contraptions, it is tough to acknowledge what device is trustworthy [10], [22] Thus, a couple of techniques have been made, some of which are publicized in this fragment totally.

A. E-LITHE [23]

IoT is another creating perspective that relates a considerable number of things (contraptions) through the Internet. In any case, the relationship of this immense number of devices needs a protected correspondence. To give secure correspondence inside the IoT condition, the likelihood of Datagram Transport Layer Security (DTLS) [24] is gotten to create Transport Layer Security (TLS) over datagram [25]. DTLS is a show which licenses secure correspondence between client server applications over the Internet in a sheltered manner. It relies upon the TLS that gives neutralizing activity of message impersonation, treating, and crack. It moreover deals with the package re-mentioning, loss of datagram, and size of the datagram. In any case, DTLS is defenseless for Denial of Service (DoS) attacks and needs a large number of counts for constrained devices. A DoS ambush is a kind of attack that upsets orchestrate organizations and thusly turns away a viable correspondence between two devices. In the DoS ambush, the contraption availability is engaged by the assailant and the referenced organizations are not given to the genuine customer [26].

To overcome DTLS' shortcomings for constrained devices, the proposed work focuses on an enhanced and lightweight DTLS, namely Enhanced Lightweight DTLS for IoT (E-Lithe). The concept of Trusted Third Party (TTP) is added to provide enhancement to E-Lithe. TTP provides pre- exchanging of secret keys as well as resilience against DoS attacks. In the proposed model, the Next Header Compression (NHC) and the IP Header Compression (IPHC) are used as compression schemes.

Figure 2 illustrates the enhanced handshake protocol for E-Lithe. First, before starting the actual handshaking phase, the server and the TTP protocol agree on sharing a secret key for successful communications. In the next step, the mutual key is shared between the TTP protocol and the client. The sharing of a mutual key between the client and the TTP protocol prevents extra burden of energy consumption on the server and authenticates the client-server communication. In the client-server communication, a client sends a handshake to the server with its authentication key. If the authentication key matches, the server validates the process of "Hello" message. If the key does not match, the process of Hello message is terminated.

To ensure the lightweight transmission for constrained devices, the E-Lithe adopts a compression strategy, which reduces the power consumption as well as prevents the overload of fragmentation. The compression strategy is comprised of record layer, handshake layer, and client Hello. The record layer is further composed of version, epoch, sequence number, and fragment. The handshake layer consists of message type and message sequence. Excluding length details, the message type and the sequence are sent in the actual state. In the client Hello message packet, the first four bits are set as identity bits and the last four bits represent the session ID, cookie, cipher suite, and the compression mechanism.

The E-Lithe scheme enhances security for constrained devices by adding the concept of TTP, which in turn decreases DoS attacks by sharing secret keys. The cookie exchange method in the E-Lithe scheme provides more efficiency and reduces computational overhead in comparison with the Lithe [25] and DTLS [24] schemes. However, if an intruder creates multiple handshake requests from multiple nodes, then the battery drainage is a crucial problem to handle frequent computations.

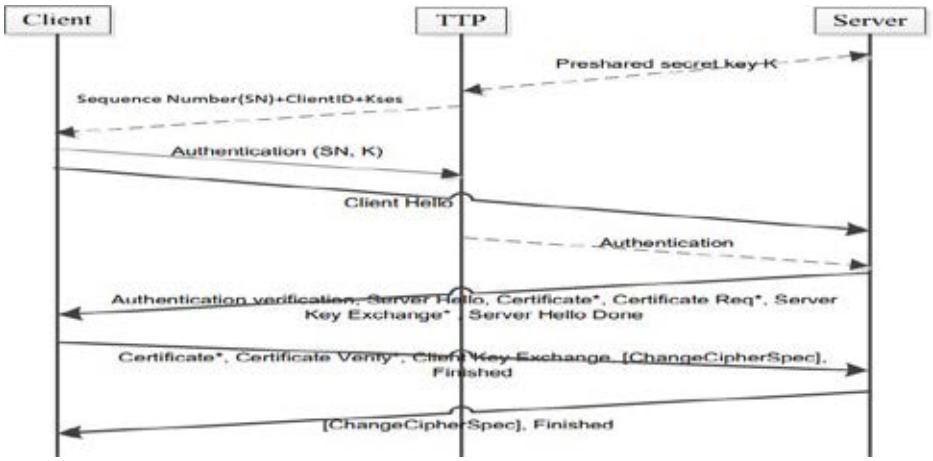


Figure 2: Communication in the E-Lithe scheme is subject to four rules: i) before the handshaking phase starts, the server and TTP approve a pre-shared secret key; ii) the client and TTP share that key for secure client-server communications; iii) the client requests the server with a handshake message and the server validates that if its authentication key matches; iv) upon authentication, the server sends Hello message to the client, otherwise, terminates the session [23].

B. GTRS [27]

Recommender Systems (RS) have a high ubiquity to predict and propose things dependent on past evaluations. A RS might be of three sorts: content-based sifting (CBF), communitarian separating (CF), and a crossover framework. In the IoT conditions, billions of gadgets are interrelated with one another, where every gadget requires and gives administrations being pieces of an IoT organize. All gadgets are found, which give a particular sort of administration. In the wake of finding the administration, the subsequent stage is the choice of administration from the rundown of accessible administrations. The serious issue in this circumstances is the administration choice, which may prompt the perplexity of confiding in different gadgets. The present focal CF recommender needs two key execution measures. To begin with, it spares the rating framework in memory to expect the best administration from the memory. Second, it prompts information shortage issues.

To address these issues, a scalable algorithm is proposed, which is based on the CF recommendation. To overcome the non-competency of the central RS, the proposed recommender predicts the best-rated service provider (SP) and selects it to retrieve services from that SP. Based on the idea of [28]; the **Graph-based Trust-enhanced Recommender System (GTRS)** adopts the concept of Social IoT (SIoT) and forms a new social relationship between nodes in the IoT network. In the circumstance of trust among devices, the use of recommendations of friends and friends-of-friends can be dealt with.

In the proposed model, a requesting node sends a request to its friends to get recommendations for the past ratings. If it finds the best-rated node, then it selects that particular node to get services from it. Otherwise, the request is forwarded to the friends-of-friends. The trust among nodes is calculated in two ways, i.e., direct social trust where nodes are connected directly, and indirect social trust in which nodes are indirectly connected. The Indirect trust can be calculated using trust propagation and aggregation. The effect of a node can be calculated using two types of methods, i.e., trust and similarity. Trust and similarity can be calculated from ratings and network structures. In the context of trust calculation from ratings, the GTRS adopts the O'Donovan *et al*. [29] approach to calculate the co relational trust among nodes. Only one predictor is used to calculate the predicted ratings for a requesting node.

Trust can also be calculated using network structures where nodes are free to develop a relationship with each other, the same way as with humans. In the IoT environment, a device can make a relationship of four types: i) The co owner relationship that occurs when nodes are owned by the same owner and its trust level is 4; ii) the friendship relationship occurs when owners of nodes are friends and its trust level is 3; iii) the co-location relationship occurs when nodes are at the same location and its trust level is 2; and iv) the co-parental relationship is given a trust level 1 and it occurs when the manufacturer of nodes is the same. Trust may also be calculated by combining centrality and trust level. Centrality represents that how one node is central to the other. Hence, trust can be measured by the combination of both parameters.

In the proposed system, each node is capable of calculating its own predictions for the best rated services. In addition, it computes the effectiveness of one node on another by combining their trust and similarity. However, the proposed recommender is not able to predict the rating for a device if somebody has not rated it. Moreover, it is difficult to tackle the prediction issues when searching nodes are similar to each other.

C. TWGA [30]

A **trustworthy gateway architecture (TWGA)** for the IoT environment is proposed against malicious attacks, such as spoofing and DoS, without the participation of a heavyweight individual security technique. The existing trust models are based on individual device security techniques and logical addressing. The proposed architecture is well-matched with the existing system, which renovates the IP address of IoT devices and uses the control server as an Identifier (ID).

The TWGA architecture consists of the following components and their functions:

1) Initially, the path is established among trust domains through the ID-path setup function. Both trust domains send a device-ID, signature, and public key to each other for establishing a trusted-ID between a home device and an SP. The virtual IP, their ID verification, and the public and private keys are stored in a cached- ID table.
2) After configuration of the path, data forwarding packets along with signatures are transmitted to a smart home gateway domain (SHGD) against the path-ID via a forwarding function. For example, before forwarding the ID-packet to the SHGD, the virtual IP address of a device is transformed into a destination address- ID. The SHGD, after verification, finds the source and destination IP addresses with the help of a cached-ID table and then forwards the data packet to a device when required.
3) For the authentication and verification of packets, private/public keys are used to verify whether the sent ID-packet is correct or not.
4) The ID-packet engine provides a route for data packets, while Domain Name System (DNS) converts these IDs into IP addresses or vice versa. The cached and registered ID tables are repositories that store information regarding private/public keys, IDs, and IP addresses.

Besides, secure key remains the same if an intruder gains the private key by any means. That is, the intruder can inject false data and make a repudiation attack.

D. TBBS [31]

In the situation of an accident or any other emergency, information sharing is a time sensitive matter and requires quick responses. Incorrect emergency messages can cause various distinct problems on roads. Thus, a secure mechanism is necessary to indicate whether the nodes are reliable and trustworthy or not. Also, it is needed to recognize that other nodes can rely on the shared information of a node. To prevent any controversy, a trust and behavior-based system (TBBS) is projected in the IoT enabled vehicular ad-hoc network (VANET). The proposed mechanism is based on trust and behavior, where the traveling information and behavior of vehicles are monitored by the base transceiver signal station (BTSS). The proposed Vehicle-to-Vehicle (V2V) and Vehicle-to-Infrastructure (V2I) communication system is shown in Figure 3.

In the TBBS, it is compulsory that all vehicles must be equipped with collision detection sensors for the convenient deployment of airbags. A vehicle must have a transceiver to distribute data among different vehicles as well as with the BTSS. The system architecture consists of traffic signals, IoT enabled vehicles, and speed detectors. Where the traffic

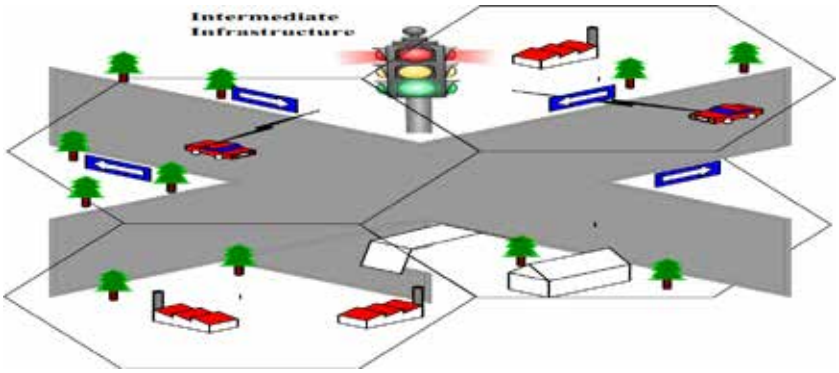


Figure 3: A scenario where two vehicles communicate using TBBS [31].

signal acts as a BTSS and responsible for the transfer of data to vehicles. Moreover, vehicles should be IoT enabled for continuous communications and transmit data to the BTSS or other vehicles. Furthermore, the detectors are responsible to identify the speed of moving vehicles. The detectors notify the BTTS or other vehicles in case of over speeding.

Every node has a default trust value and these values are stored in a vehicle, which can be used in the future if required. Later on, the behavior-based trust value will depend on three attributes, i.e., review, sensory data, and mobile agents. The review is the data taken from vehicles. The vehicles can get information regarding the route that they expect to travel on. This information can also be based on traffic status, road accidents, expected travel time, and any other alternate available route.

The speed detector gathers data of moving vehicles and generates sensory data to identify whether the vehicle is moving above or within the speed limit. The detection of an over speeding vehicle helps to analyze those nodes which may cause collisions. The detector works as an event-driven function and uploads data to the BTSS or a moving node towards the BTSS.

v. CONCLUSION

IoT grants the possibility of interfacing billions of minor contraptions to recoup and impart information to regard to different applications, for instance, restorative administrations, condition, and organizations among others. Then again, IoT has unpredictable characteristics (for example, security, assurance, and trust), which are indispensable in specific conditions, for instance, VANETs. This paper surveys trust the officials frameworks estimated for the Internet of Things (IoT). In light of expansive assessment of trust the officials, considerable methods are requested and their duties and obstructions are shown. We visualize that this review will force for the IoT investigate arrange, tackling trust the board, to welcome the points of view and issues IoT faces in trust association.

REFERENCES

[1] N. C. Luong, D. T. Hoang, P. Wang, D. Niyato, D. I. Kim, and Z. Han, “Data collection and wireless communication in internet of things (iot) using economic analysis and pricing models: A survey,” IEEE Commu- nications Surveys & Tutorials, vol. 18, no. 4, pp. 2546–2590, 2016.

[2] R. Minerva, A. Biru, and D. Rotondi, “Towards a definition of the internet of things (iot),” IEEE Internet Initiative, vol. 1, 2015.

[3] A. Gharaibeh, M. A. Salahuddin, S. J. Hussini, A. Khreishah, I. Khalil,

M. Guizani, and A. Al-Fuqaha, "Smart cities: A survey on data man- agement, security, and enabling technologies," IEEE Communications Surveys & Tutorials, vol. 19, no. 4, pp. 2456–2501, 2017.

[4] G. Acampora, D. J. Cook, P. Rashidi, and A. V. Vasilakos, "A survey on ambient intelligence in healthcare," Proceedings of the IEEE, vol. 101, no. 12, pp. 2470–2494, 2013.

[5] S. Pellicer, G. Santa, A. L. Bleda, R. Maestre, A. J. Jara, and A. G. Skarmeta, "A global perspective of smart cities: A survey," in Innovative Mobile and Internet Services in Ubiquitous Computing (IMIS), 2013 Seventh International Conference on. IEEE, 2013, pp. 439–444.

[6] M. Elsaadany, A. Ali, and W. Hamouda, "Cellular lte-a technologies for the future internet-of-things: Physical layer features and challenges," IEEE Communications Surveys & Tutorials, vol. 19, no. 4, pp. 2544– 2572, 2017.

[7] C.-W. Tsai, C.-F. Lai, M.-C. Chiang, L. T. Yang et al., "Data mining for internet of things: A survey." IEEE Communications Surveys and Tutorials, vol. 16, no. 1, pp. 77–97, 2014.

[8] D. Georgakopoulos, P. P. Jayaraman, M. Fazia, M. Villari, and R. Ranjan, "Internet of things and edge cloud computing roadmap for manufactur- ing," IEEE Cloud Computing, vol. 3, no. 4, pp. 66–73, 2016.

[9] N. Zhao, F. R. Yu, H. Sun, A. Nallanathan, and H. Yin, "A novel interference alignment scheme based on sequential antenna switching in wireless networks," IEEE Transactions on Wireless Communications, vol. 12, no. 10, pp. 5008–5021, 2013.

[10] J. Gubbi, R. Buyya, S. Marusic, and M. Palaniswami, "Internet of things (iot): A vision, architectural elements, and future directions," Future generation computer systems, vol. 29, no. 7, pp. 1645–1660, 2013.

[11] C. Perera, A. Zaslavsky, P. Christen, and D. Georgakopoulos, "Context aware computing for the internet of things: A survey," IEEE communica- tions surveys & tutorials, vol. 16, no. 1, pp. 414–454, 2014.

[12] M. Nitti, V. Pilloni, G. Colistra, and L. Atzori, "The virtual object as a major element of the internet of things: a survey," IEEE Communications Surveys & Tutorials, vol. 18, no. 2, pp. 1228–1240, 2016.

[13] S. Verma, Y. Kawamoto, Z. M. Fadlullah, H. Nishiyama, and N. Kato, "A survey on network methodologies for real-time analytics of massive iot data and open research issues," IEEE Communications Surveys & Tutorials, vol. 19, no. 3, pp. 1457–1477, 2017.

[14] Z. Yan, P. Zhang, and A. V. Vasilakos, "A survey on trust management for internet of things," Journal of network and computer applications, vol. 42, pp. 120–134, 2014.

[15] J. Caminha, A. Perkusich, and M. Perkusich, "A smart middleware to per- form semantic discovery and trust evaluation for the internet of things," in Consumer Communications & Networking Conference (CCNC), 2018 15th IEEE Annual. IEEE, 2018, pp. 1–2.

[16] L. C. De Biase, P. C. Calcina-Ccori, F. S. Silva, and M. K. Zuffo, "The semantic mediation for the swarm: An adaptable and organic solution for the internet of things," in Consumer Electronics (ICCE), 2017 IEEE International Conference on. IEEE, 2017, pp. 78–79.

[17] M. Nitti, R. Girau, and L. Atzori, "Trustworthiness management in the social internet of things," IEEE Transactions on knowledge and data engineering, vol. 26, no. 5, pp. 1253–1266, 2014.

[18] J. Guo, R. Chen, and J. J. Tsai, "A survey of trust computation models for service management in internet of things systems," Computer Communi- cations, vol. 97, pp. 1–14, 2017.

[19] S. Sicari, A. Rizzardi, L. A. Grieco, and A. Coen-Porisini, "Security, privacy and trust in internet of things: The road ahead," Computer networks, vol. 76, pp. 146–164, 2015.

[20] M. Vidya and N. P. KS, "Adaptation trust based protocol for iot using smartphones in social media: Travel map guide," in Applied and Theo- retical Computing and Communication Technology (iCATccT), 2016 2nd International Conference on. IEEE, 2016, pp. 109–113.

[21] S. E. A. Rafey, A. Abdel-Hamid, and M. A. El-Nasr, "Cbstm-iot: Context-based social trust model for the internet of things," in Selected Topics in Mobile & Wireless Networking (MoWNeT), 2016 International Conference on. IEEE, 2016, pp. 1–8.

[22] J. Heuer, J. Hund, and O. Pfaff, "Toward the web of things: Applying web technologies to the physical world," Computer, vol. 48, no. 5, pp. 34–42, 2015.

[23] A. Haroon, S. Akram, M. A. Shah, and A. Wahid, "E-lithe: A lightweight secure dtls for iot," in Vehicular Technology Conference (VTC-Fall), 2017 IEEE 86th. IEEE, 2017, pp. 1–5.

[24] N. Modadugu and E. Rescorla, "The design and implementation of datagram tls." in NDSS, 2004.

[25] S. Raza, H. Shafagh, K. Hewage, R. Hummen, and T. Voigt, "Lithe: Lightweight secure coap for the internet of things," IEEE Sensors Journal, vol. 13, no. 10, pp. 3711–3720, 2013.

[26] P. Kasinathan, C. Pastrone, M. A. Spirito, and M. Vinkovits, "Denial-of- service detection in 6lowpan based internet of things," in Wireless and Mobile Computing, Networking and Communications (WiMob), 2013 IEEE 9th International Conference on. IEEE, 2013, pp. 600–607.

[27] N. S. Nizamkari, "A graph-based trust-enhanced recommender system for service selection in iot," in Inventive Systems and Control (ICISC), 2017 International Conference on. IEEE, 2017, pp. 1–5.

[28] L. Atzori, A. Iera, and G. Morabito, "Siot: Giving a social structure to the internet of things," IEEE communications letters, vol. 15, no. 11, pp. 1193–1195, 2011.

[29] J. O'Donovan and B. Smyth, "Trust in recommender systems," in Pro- ceedings of the 10th international conference on Intelligent user inter- faces. ACM, 2005, pp. 167–174.

[30] E. Kim and C. Keum, "Trustworthy gateway system providing iot trust domain of smart home," in Ubiquitous and Future Networks (ICUFN), 2017 Ninth International Conference on. IEEE, 2017, pp. 551–553.

[31] R. Talreja, S. Sathish, K. Nenwani, and K. Saxena, "Trust and behavior based system to prevent collision in iot enabled vanet," in Signal Pro- cessing, Communication, Power and Embedded System (SCOPES), 2016 International Conference on. IEEE, 2016, pp. 1588–1591.


Student corner

3D INTERNET

Somenath Ghosh
DCST, 3rd Year

3D INTERNET

To most of the 3D users, the 3D internet seems very comforting for all their necessary works and everyone is dependent on its circumstances that they forgot to think about its nature anymore just as we don't think about the ohm's law whenever we switch on the light. From this point of view, what we have today is the 2D version and the 3D internet is the next level of it. Well, if we stop for a while and think about the nature of internet then it is nothing but a real environment where people exchange the information and communicate with each other.

For all these activities people are confined to the 2D pages and it is based on flat principles or theories and consist of a group of documents, images. Whenever a user enters the website then at every flat surface of communication the developers need to provide the conducting and managing help, if not then the user might get lost soon. As it is based on the flat principles there is no chance of providing a direct managing and conducting help which recognizes the human beings, this kind of situation is even worse when moving between the websites.

An example, of the current situation of web surfing, is perfect because we have no power over the web and it's traveling with the next click. Another effect or result of it is the necessity of search engine and there is nothing astonishing in describing Google as the power internet company. There is much better way of arranging data which everyone knows and everyone uses it too, we spend our lives in a 3D world by managing, conducting and moving between places, representing the objects and where we rarely use the search engines.

On the current internet, we are like the 2D creatures on flat files or documents without the knowledge of where we are transporting ourselves from one flat surface to another flat surface, getting lost every time and asking for the directions. Although the 3D internet doesn't provide the solution to all these issues but furnishes an HCI framework that reduces the mental load and enhances the rich, innovative schemes through spatial relationships. Another vital feature of it is that it enables the natural means of communication between people. With this, the online business will have revolutionary effect as the 3D internet have the large commercial potential.

The 3D internet is based on the following features or parameters:

1. **Networking or distributed computing:** A point of fact is that avatars have more data or information about the user who visits a 3D world than cookies do about a 2D website visitor. For example, avatars contain information about the appearance of visitor or behavior of a visitor.
2. **Latency minimization:** Latency which is observed by the clients when they are involving in communication with the servers is minimized. It proposed a hybrid peer-to-peer communication and server independent peer-to-peer communication.
3. **Security and trust:** There is a group of alternatives for transporting authentication of users and avatars. Systems like 'Microsoft Passport' and many other are developed based on this.
4. **Intelligent Environment:** They give the extra stress on user-friendly and efficient service support. The intelligent environment also consists of intelligent services, intelligent agents, and rendering.

Along with this, we can avail the 3D internet:

- With the use of artificial intelligence
- By availing a 3d eyewear like the Google glass
- By the implementation of sixth sense applied science.

Technology, Components, and Implementations of the 3D internet:

- 3D internet multi-users can read the same document and connect with the people who share the same interest.
- It also provides other facilities like virtual meetings, training charts, and shopping etc.
- Speed and hardware are the two technical implementations of it.

Advantages:

- Facility of open communication is available.
- Permits the employees to discuss the ideas and share the links.
- Furnishes an opportunity to enlarge the business contacts.
- Targets a large number of audiences.
- Enhances the business fame.

Disadvantages:

Along with the advantages, it has the disadvantages like:

- It increases for hackers to commit frauds and launch virus attacks.
- The risk of online scams is also increased.

<u>However, the 3d internet is necessary and vital to start and continue</u>

Graphical Password Authentication

Sonia Das
DCST, 3rd Year

Graphical Password Authentication

Now a days people do not go to a bank to make a transaction, do not go to an Electric board to pay bill, do not go to railway station to make a train reservation and what not. All these time consuming and non productive tasks are simplified because of Internet. To carry out these tasks everyone hits respective portals/sites or make use of a smartphone app. There are many such areas where we need human interaction with computers and these systems should be secured against Cyber Crime. User authentication is the most fundamental component in all computer security systems.
Security practitioners and researchers have made their efforts to protect systems and correspondingly, individual users' digital assets. Because of increasing threats over the internet or networked computer systems, there is great need for preventions of such activities. We use alphanumerical usernames and passwords for authentication purpose but studies shows that user can only remember a limited number of passwords. They tend to note them down somewhere or will use the same passwords for different accounts. In some cases, to avoid the complexity, users often pick passwords that is simple and easy to remember.

Biometrics is one of the various alternatives to increase the security but it requires lot of investments. To increase security to next level, some researchers have developed authentication methods that use pictures as passwords or a second level of authentication. So, in this article we will deal with another alternative: using image as passwords. The below image is used for spam prevention as a second level of authentication.

Problems With Passwords:

Users have difficulty remembering complex, random passwords over time for their long term memory limitation. A user is likely to forget a password that is not used regularly as the memory is not "refreshed" or "activated" sufficiently. Having multiple passwords, the user may either jumble the elements of the different passwords or confuse them of which system it corresponds to. Users normally deal with the password memory problems by decreasing the complexity and number of passwords, which reduces password security. A secure password should be 8 characters or longer, random, with upper-case characters, lowercase characters, digits, and special characters. Users ignore such password recommendations, using instead short, simple passwords that are relatively easy to discover using dictionary attacks. Recent surveys have shown that users often choose, short, alphabetic-only passwords consisting of personal names of family or friends, pets, etc. Users typically write down their passwords, sometime share the passwords with others, or use the same password for multiple systems.

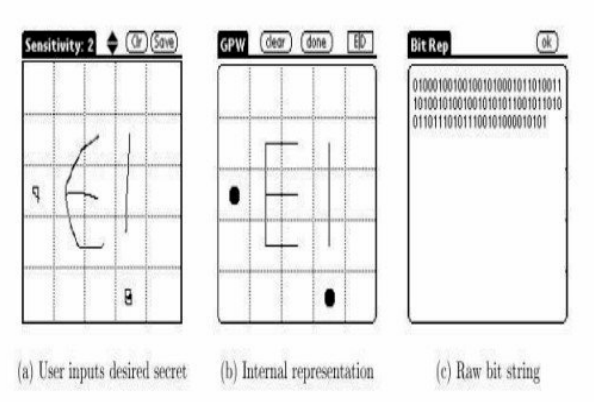
PROPOSED SYSTEM

Graphical passwords were first introduced by BLONDER in 1996. A graphical password is an authentication system which allows the users to select from images, in a specific order, presented in a graphical user interface (GUI). Graphical passwords can be easily remembered, as users remember images better than words. Graphical passwords techniques are categorized into two main techniques: recall-based and recognition-based graphical techniques.

§ **Recognition Based System**

In recognition-based techniques, Authentication is done by challenging the user to identify image or images that the user had selected during the registration stage. Another name for recognition-based systems is search metric systems. It is generally require that users memorize a number of images during password creation, and then to log in, must identify their images among them. Humans have unique ability to identify images previously seen, even those which has been viewed very briefly. Recognition based systems have been proposed using usability and security considerations, and offers usability. In some graphical password schemes, Knowledge of some details of the shared secret must be retained by the system, i.e., user specific profile data e.g. in recognition schemes, the system must know which images belong to a user's portfolio in order to display them.

Sobrado and Birget Scheme is recognition based system that displays a number of pass-objects (pre-selected by user) among many other objects, user click inside the convex hull bounded by pass-objects. In Pass face scheme human faces are used as password. And in Dhamija and Perrig Scheme Pick several pictures out of many choices, identify them later in authentication.



(a) User inputs desired secret (b) Internal representation (c) Raw bit string

§ ***Recall Based System***

In recall-based techniques, a user is asked to reproduce something that he or she created or selected earlier during the registration stage. Recall-based graphical password systems are occasionally referred as draw metric systems since a secret drawing is recalled and reproduced by the user. In these systems, users typically draw their password either on a blank canvas or on a grid. You can secure your password using various techniques in graphical authentication.

To authenticate, we use a grid based approach by using image as a reference. Draw-A-Secret (DAS) Scheme User draws a simple picture on a 2D grid, the coordinates of the grids occupied by the picture are stored in the order of drawing. Redrawing has to touch the same grids in the same sequence

in authentication. Then certain grids are selected by the user to set his/her password as shown in the figure below a major drawback of graphical password authentication is shoulder surfing.

Another one is Pass Point Scheme which allows users to click on any place on an image to create a password. A tolerance around each chosen pixel is calculated. In order to be authenticated, user must click within the tolerances in the correct sequence. Signature scheme is another graphical user authentication conducted by having the user drawing their signature using a mouse.

- ***Implementation and Discussion***

Graphical Password can be implemented in authenticating several systems and websites. The implementation has few focuses:

- Password: Contain image as reference & encryption algorithm.
- Login: Contains username, images, Graphical password and related methods.
- SSR shield: Contains shield for Shoulder surfing.
- Grids: Contains unique grid values and grid clicking related methods.

Advantages of graphical authentication method:

- The security of the system is very high.
- **Graphical** password schemes provide a **way** of making more human-friendly passwords.
- Dictionary attacks and brute force search are infeasible.

Disadvantage :

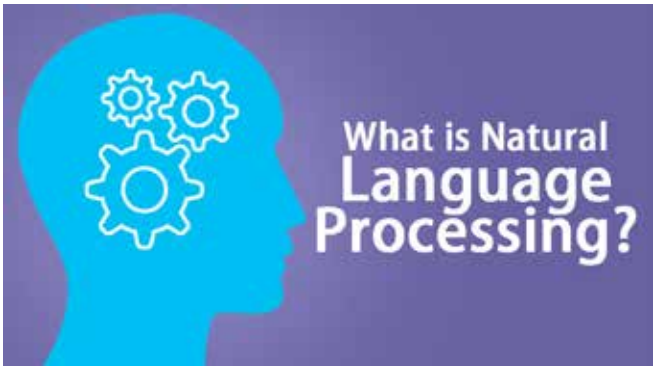
The main drawback of these algorithms is that the log in process can be slow. During the **authentication**, the user must enter the registered images in the correct sequence. One drawback of this **technique** is that since the number of thumb nail images is limited to 30, the password space is small.

Natural Language Processing

Rima Bar
DCST, 3rd Year

What is Natural Language Processing?

Artificial intelligence means making computers as intelligent as a human. Natural language processing is a component of AI. Natural language processing enables computers to understand, perform an action and interact with Humans using their language. It can be used in many areas like passing commands to perform some action, converting speech to text and document it, telling directions in automobiles, etc.



But NLP (Natural Language Processing) is not easy to implement. Computers are designed to work with structured data, follow well-defined commands and use standardized language. They are very systematic in terms of their processing. But natural language is not structured. There are many factors that may influence the language spoken by a person like a region, locality, slang, pronunciation, etc. Even the same word can have different meaning depending upon the context. Hence, to make computer smart enough to understand and work with a human in their language, it needs to be designed in a way that it understands the flexibility of Natural Language. It should be able to decipher what exactly a person wants to say in a given context.

With the power of machine learning, computers can be taught natural language. Multiple sets of text will be fed to computers and process the sets using text analyzer algorithms to teach the computer about how natural language works.

Why natural language processing is important?

By “natural language” we mean a language that is used for communication by humans such as English, German, or Korean. In contrast to artificial languages, the natural languages are hard to define with an explicit set of rules. By combining the power of artificial intelligence, computational linguistics and computer science, Natural Language Processing (NLP) helps machines to understand the natural language. The ability of a computer program to understand human language as it is spoken is Natural language processing.

A computer could be considered intelligent if it could carry on a conversation with a human being without the human realizing they were talking to a machine. -Alan Turing

The development of NLP applications is challenging because computers traditionally work with precise, unambiguous and highly structured languages such as programming languages, however, the natural language is often ambiguous and the linguistic structure can depend on many complex variables, including slang, regional dialects and social context.

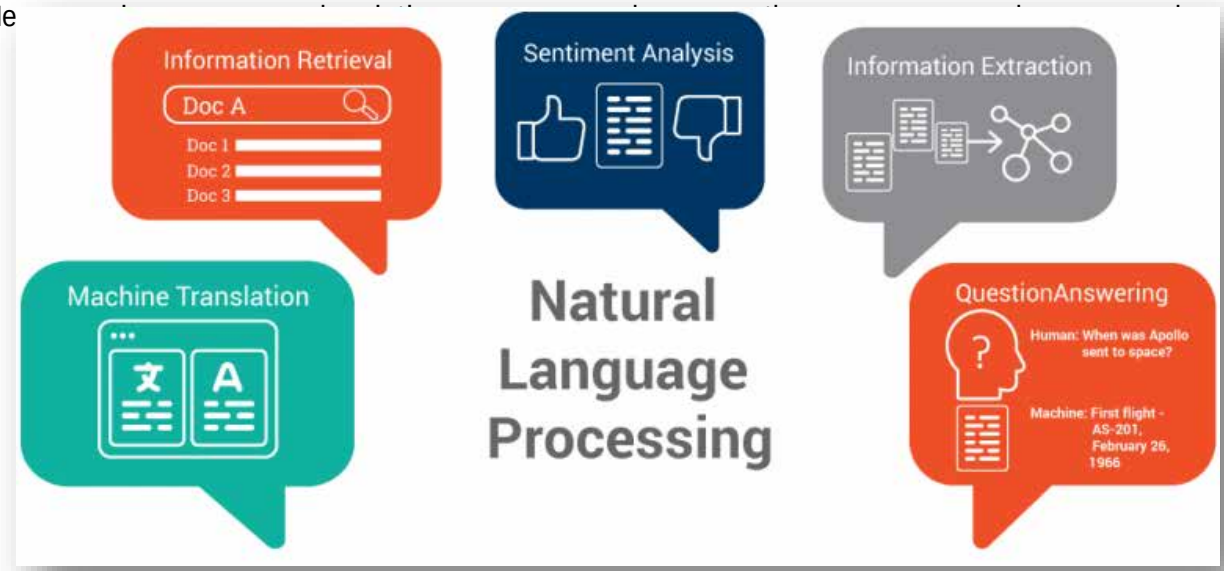
With the ongoing growth of the World Wide Web and social media, there is a drastic increase in online data. As the amount of data increases the mechanisms to process these unstructured data and to extract meaningful information from it becomes more challenging. It will be very difficult to find a specific piece of information from a large knowledge base. These challenges and difficulties can be overcome with the advanced NLP techniques.

The most widely used NLP application is machine translation which helps to overcome the language barriers. As the amount of information available online is increasing day by day, the need to access and process it becomes more important. To convert information from one language to another, machine translation can be used. The NLP techniques help the machine to understand the meaning of sentences, which improves the efficiency of machine translation.

What are the techniques used in NLP?

Syntactic analysis and semantic analysis are the main techniques used to complete Natural Language Processing tasks.

He



1. Syntax

Syntax refers to the arrangement of words in a sentence such that they make grammatical sense.

In NLP, syntactic analysis is used to assess how the natural language aligns with the grammatical rules.

Computer algorithms are used to apply grammatical rules to a group of words and derive meaning from them.

Here are some syntax techniques that can be used:

- Lemmatization: It entails reducing the various inflected forms of a word into a single form for easy analysis.
- Morphological segmentation: It involves dividing words into individual units called morphemes.
- Word segmentation: It involves dividing a large piece of continuous text into distinct units.
- Part-of-speech tagging: It involves identifying the part of speech for every word.
- Parsing: It involves undertaking grammatical analysis for the provided sentence.
- Sentence breaking: It involves placing sentence boundaries on a large piece of text.
- Stemming: It involves cutting the inflected words to their root form.

2. Semantics

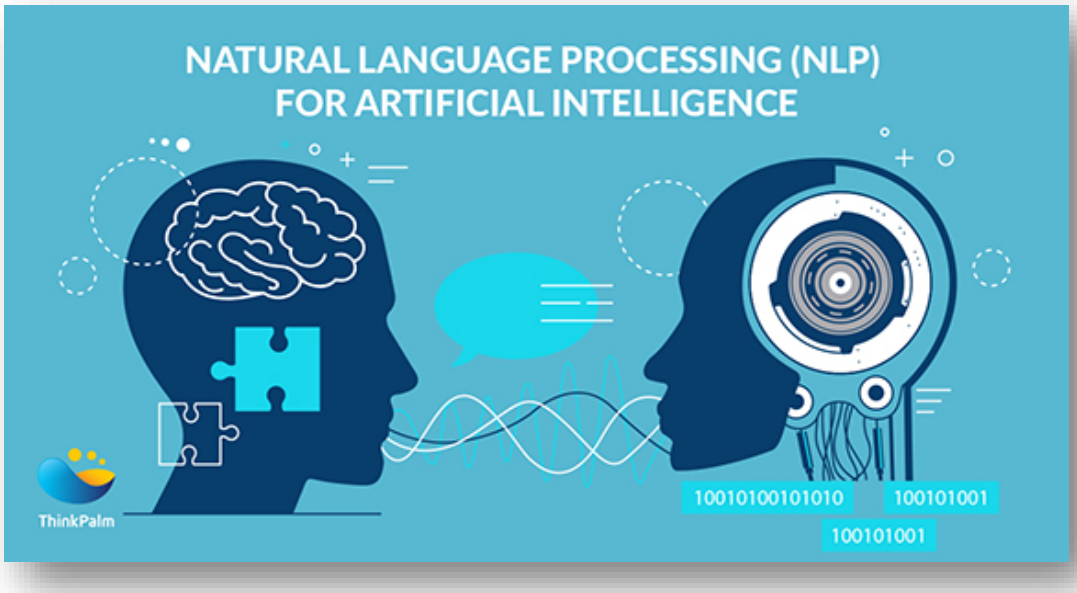
Semantics refers to the meaning that is conveyed by a text. Semantic analysis is one of the difficult aspects of Natural Language Processing that has not been fully resolved yet.

It involves applying computer algorithms to understand the meaning and interpretation of words and how sentences are structured.

Here are some techniques in semantic analysis:

- Named entity recognition (NER): It involves determining the parts of a text that can be identified and categorized into preset groups. Examples of such groups include names of people and names of places.
- Word sense disambiguation: It involves giving meaning to a word based on the context.
- Natural language generation: It involves using databases to derive semantic intentions and convert them into human language.

APPLICATION OF NATURAL LANGUAGE PROCESSING:



Sentiment Analysis

Mostly used on the web & social media monitoring, Natural Language Processing is a great tool to comprehend and analyse the responses to the business messages published on social media platforms. It helps to analyse the attitude and emotional state of the writer (person commenting/engaging with posts).

Chatbots

We hear a lot about Chatbots these days, chatbots are the solution for consumer frustration regarding customer care call assistance. They provide modern-day virtual assistance for simple problems of the customer and offload low-priority, high turnover tasks which require no skill. Intelligent Chatbots are going to offer personalised assistance to the customer in the near future.

Customer Service

Ensuring customer loyalty by keeping them content and happy is the supreme challenge and responsibility of every business organisation. NLP has aided in multiple functions of customer service and served as an excellent tool to gain insight into audience tastes, preferences and perceptions. Speech separation where the AI will identify each voice to the corresponding speaker and answer each of the callers separately. An excellent text to speech systems could even aid the blind.

Market Intelligence

Business markets are influenced and impacted by market knowledge and information exchange between various organisations, stakeholders, governments and regulatory bodies. It is vital to stay up to date with industry trends and changing standards.

ADVANTAGES OF NLP

The benefits of natural language processing are innumerable. Natural language processing can be leveraged by companies to improve the efficiency of documentation processes, improve the accuracy of documentation, and identify the most pertinent information from large databases. For example, a hospital might use natural language processing to pull a specific diagnosis from a physician's unstructured notes and assign a billing code.

The Buzzlogix API offers advanced natural language processing capabilities, allowing your company to harness the full power of natural language processing.

Automated Content Creation

What NLG is mainly capable of is its ability to create on organized structure of data from the information processed in previous stages of NLP and NLU. By placing this well-structured data in a carefully configured template, NLG can automate the output and supply documentable form of data such as analytics reports, product description, data-centric blog posts, etc. In such case, algorithmically programmed machines are at complete liberty to create content in a format as desired by content developers. The only thing left for them to do then is to promote it to the target audience via popular media channels. Thus, Natural Language Generation fulfils two purposes for content developers & marketers:

1. Automation of content generation &
2. Data delivery in the expected format

Content Generation revolves around web mining and relies on search engine APIs to develop effective content made from using various online search results and references.

So far, several NLG-based text report generation systems have been built to produce textual weather forecast reports from input weather data.

Additionally, a firm destined to generate accurate weather forecast reports will be able to translate the statistical structure of weather forecast data into an organized, reader-friendly textual format using the real-time analytical power of Natural Language Generation.

Significant Reduction in Human Involvement

With Natural Language Generation in place, it becomes inessential to hire data-literate professionals and train them for the job they do. So far, as corporate theories go, human force is key to understanding consumer's interests, their needs and converting them in written stories.

However, with Natural Language Generation, machines are programmed to scrutinize what customers want, identify important business-relevant insights and prepare the summaries around it.

The value of NLG is doubled after realizing how expensive and ineffective it is to employ people who spend hours in understanding complex data. Even Gartner predicts that 20% of business content will be authored through machines using Natural Language Generation and will be integrated into major smart data discovery platforms by 2018. Legal documents, shareholder reports, press releases or case studies will no longer require humans to create.

Predictive Inventory Management

The success of inventory management for any store results in a great boost in terms of business goals and overall resultant profit given that certain products have very high margins. Data matters most and plays a key role in areas such as supply chain, production rate and sales analytics. Based on this information, store managers can make decisions about maintaining inventory to its optimal levels. However, it is not reliable to always expect managers to be sound with data and interpret them efficiently.

When it comes to advanced NLG, it can work as an interactive medium for data analysis and makes the overall reporting process seamless and insightful. Instead of having to go through several charts and bar graphs of data, store managers get clear narratives and analysis in desired format telling them whether or not they require specific item next week. With natural language generation, managers have the best predictive model with clear guidance and recommendations on store performance and inventory management.

Performance Activity Management at Call Centre

It is prudent to conduct performance reviews and accurate training for further improvements within a call centre. However, as covered in the above use cases, charts won't help much in communicating the exact pain points and areas of improvement unless it has strong narratives in form of feedback. This is where the advantages of Natural Language Generation accompanied with NLP lies.

NLG can be strategically integrated in major call centre processes with in-depth analysis of call records and performance activities to generate personalized training reports. It can clearly state just how call centre employees are doing, their progress and where to improve in order to reach a target milestone.

Neural Networks

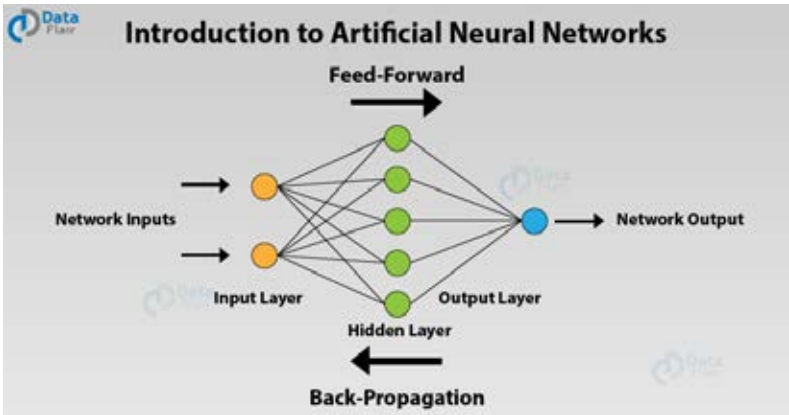
Subhrajyoti Samanta
DCST, 3rd Year

What is Neural Network actually is?

A neural network is a series of algorithms that endeavours to recognize underlying relationships in a set of data through a process that mimics the way the human brain operates. In this sense, neural networks refer to systems of neurons, either organic or artificial in nature. Neural networks can adapt to changing input; so, the network generates the best possible result without needing to redesign the output criteria. The concept of neural networks, which has its roots in Artificial Intelligence, is swiftly gaining popularity in the development of trading systems.

Basics of Neural Networks:

Neural networks, in the world of finance, assist in the development of such process as time-series forecasting, algorithmic trading, securities classification, credit risk modelling and constructing proprietary indicators and price derivatives.



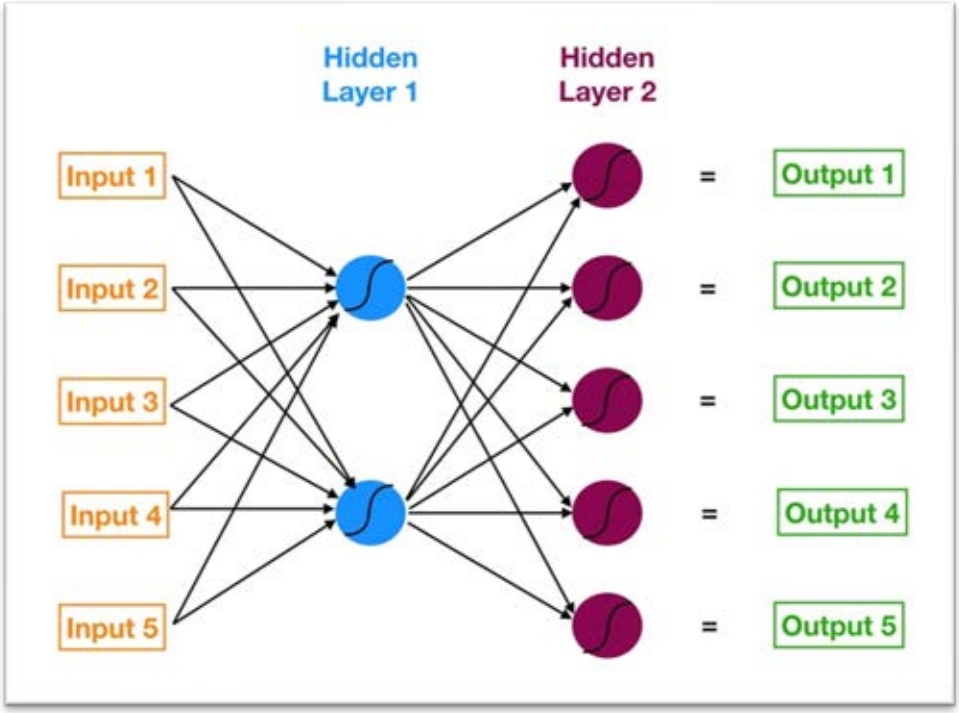
A neural network works similarly to the human brain's neural network. A "neuron" in a neural network is a mathematical function that collects and classifies information according to a specific architecture. The network bears a strong resemblance to statistical methods such as curve fitting and regression analysis.

A neural network contains layers of interconnected nodes. Each node is a perceptron and is similar to a multiple linear regression. The perceptron feeds the signal produced by a multiple linear regression into an activation function that may be nonlinear. In a multi-layered perceptron (MLP), perceptions are arranged in interconnected layers. The input layer collects input patterns. The output layer has classifications or output signals to which input patterns may map. For instance, the patterns may comprise a list of quantities for technical indicators about a security; potential outputs could be "buy," "hold" or "sell."

Hidden layers fine-tune the input weightings until the neural network's margin of error is minimal. It is hypothesized that hidden layers extrapolate salient features in the input data that have predictive power regarding the outputs. This describes feature extraction, which accomplishes a utility similar to statistical techniques such as principal component analysis.

The 30,000 Feet View

Let's start with a really high-level overview so we know what we are working with. **Neural networks are multi-layer networks of neurons (the blue and magenta nodes in the chart below) that we use to classify things, make predictions, etc**. Below is the diagram of a simple neural network with five inputs, 5 outputs, and two hidden layers of neurons.



Starting from the left, we have:

1. The input layer of our model in orange.
2. Our first hidden layer of neurons in blue.
3. Our second hidden layer of neurons in magenta.
4. The output layer (a.k.a. the prediction) of our model in green.

The arrows that connect the dots shows how all the neurons are interconnected and how data travels from the input layer all the way through to the output layer. Later we will calculate step by step each output value. We will also watch how the neural network learns from its mistake using a process known as backpropagation.

What Neural Network actually do?

But first let's get our bearings. What exactly is a neural network trying to do? Like any other model, it's trying to make a good prediction. We have a set of inputs and a set of target values — and we are trying to get predictions that match those target values as closely as possible.

Forget for a second the more complicated looking picture of the neural network I drew above and focus on this simpler one below.

Logistic regression (with only one feature) implemented via a neural network

This is a single feature logistic regression (we are giving the model only one X variable) expressed through a neural network (if you need a refresher on logistic regression, I wrote about that here). To see how they connect we can rewrite the logistic regression equation using our neural network colour codes.

$$Sigmoid(B_1 * X + Bo) = Predicted\ Probability$$

Logistic regression equation

Time for the Neural Network to Learn

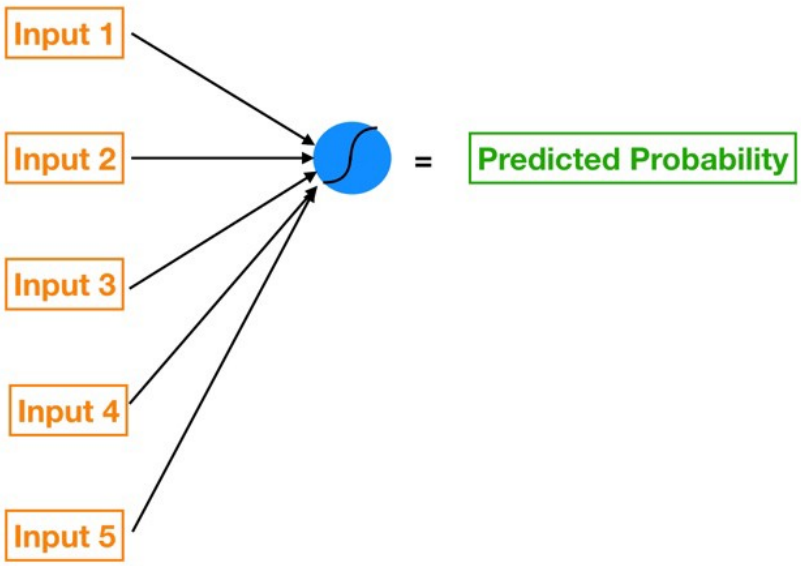
This is going to be a long post so feel free to take a coffee break now. Still with me? Awesome! Now that we know how a neural network's output values are calculated, it is time to train it.

The training process of a neural network, at a high level, is like that of many other data science models — **define a cost function and use gradient descent optimization to minimize it**.

First let's think about what levers we can pull to minimize the cost function. In traditional linear or logistic regression, we are searching for beta coefficients (B0, B1, B2, etc.) that minimize the cost

function. For a neural network, we are doing the same thing but at a much larger and more complicated scale.

In traditional regression, we can change any particular beta in isolation without impacting the other beta coefficients. So by applying small isolated shocks to each beta coefficient and measuring its impact on the cost function, it is relatively straightforward to figure out in which direction we need to move to reduce and eventually minimize the cost function.



Five feature logistic regression implemented via a neural network

In a neural network, changing the weight of any one connection (or the bias of a neuron) has a reverberating effect across all the other neurons and their activations in the subsequent layers**.**

That's because each neuron in a neural network is like its own little model. For example, if we wanted a five-feature logistic regression, we could express it through a neural network, like the one on the left, using just a singular neuron!

So, each hidden layer of a neural network is basically **a stack of models** (each individual neuron in the layer acts like its own model) **whose outputs feed into even more models further downstream** (each successive hidden layer of the neural network holds yet more neurons).

APPLICATIONS

Neural networks can be used in different fields. The tasks to which artificial neural networks are applied tend to fall within the following broad categories:

- Function approximation, or regression analysis, including time series prediction and modeling.
- Classification, including pattern and sequence recognition, novelty detection and sequential decision making.
- Data processing, including filtering, clustering, blind signal separation and compression.

Application areas of ANNs include nonlinear system identification and control (vehicle control, process control), game-playing and decision making (backgammon, chess, racing), pattern recognition (radar systems, face identification, object recognition), sequence recognition (gesture, speech, handwritten text recognition), medical diagnosis, financial applications, data mining (or knowledge discovery in databases, "KDD"), visualization and e-mail spam filtering. For example, it is possible to create a semantic profile of user's interests emerging from pictures trained for object recognition.

Virtual Reality

Shubhranil Mazumder
DCST, 3rd Year

Abstract

The recent appearance of low-cost virtual reality (VR) technologies – like the Oculus Rift, the HTC Vivi and the Sony PlayStation VR – and Mixed Reality Interfaces (MRITF) – like the HoloLens – is attracting the attention of users and researchers suggesting it may be the next largest stepping stone in technological innovation. However, the history of VR technology is longer than it may seem: the concept of VR was formulated in the 1960s and the first commercial VR tools appeared in the late 1980s. For this reason, during the last 20 years, 100s of researchers explored the processes, effects, and applications of this technology producing 1000s of scientific papers. What is the outcome of this significant research work? This paper wants to provide an answer to this question by exploring, using advanced scient metric techniques, the existing research corpus in the field. We collected all the existent articles about VR in the Web of Science Core Collection scientific database, and the resultant dataset contained 21,667 records for VR and 9,944 for augmented reality (AR). The bibliographic record contained various fields, such as author, title, abstract, country, and all the references (needed for the citation analysis). The network and cluster analysis of the literature showed a composite panorama characterized by changes and evolutions over the time. Indeed, whether until 5 years ago, the main publication media on VR concerned both conference proceeding and journals, more recently journals constitute the main medium of communication. Similarly, if at first computer science was the leading research field, nowadays clinical areas have increased, as well as the number of countries involved in VR research. The present work discusses the evolution and changes over the time of the use of VR in the main areas of application with an emphasis on the future expected VR's capacities, increases and challenges. We conclude considering the disruptive contribution that VR/AR/MRITF will be able to get in scientific fields, as well in human communication and interaction, as already happened with the advent of mobile phones by increasing the use and the development of scientific applications (e.g., in clinical areas) and by modifying the social communication and interaction among people.

Keywords: virtual reality, augmented reality, quantitative psychology, measurement, psychometrics, scient metrics, computational psychometrics, mathematical psychology

Introduction

In the last 5 years, virtual reality (VR) and augmented reality (AR) have attracted the interest of investors and the general public, especially after Mark Zuckerberg bought Oculus for two billion dollars. Currently, many other companies, such as Sony, Samsung, HTC, and Google are making huge investments in VR and AR. However, if VR has been used in research for more than 25 years, and now there are 1000s of papers and many researchers in the field, comprising a strong, interdisciplinary community, AR has a more recent application history. The study of VR was initiated in the computer graphics field and has been extended to several disciplines. Currently, videogames supported by VR tools are more popular than the past, and they represent valuables, work-related tools for neuroscientists, psychologists, biologists, and other researchers as well. Indeed, for example, one of the main research purposes lies from navigation studies that include complex experiments that could be done in a laboratory by using VR, whereas, without VR, the researchers would have to go directly

into the field, possibly with limited use of intervention. The importance of navigation studies for the functional understanding of human memory in dementia has been a topic of significant interest for a long time, and, in 2014, the Nobel Prize in "Physiology or Medicine" was awarded to John M. O'Keefe, May-Britt Moser, and Edvard I. Moser for their discoveries of nerve cells in the brain that enable a sense of place and navigation. Journals and magazines have extended this knowledge by writing about "the brain GPS," which gives a clear idea of the mechanism. A huge number of studies have been conducted in clinical settings by using VR, and Nobel Prize winner, Edvard I. Moser commented about the use of VR, highlighting its importance for research and clinical practice. Moreover, the availability of free tools for VR experimental and computational use has made it easy to access any field.

Augmented reality is a more recent technology than VR and shows an interdisciplinary application framework, in which, nowadays, education and learning seem to be the most field of research. Indeed, AR allows supporting learning, for example increasing-on content understanding and memory preservation, as well as on learning motivation. However, if VR benefits from clear and more definite fields of application and research areas, AR is still emerging in the scientific scenarios.

In this article, we present a systematic and computational analysis of the emerging interdisciplinary VR and AR fields in terms of various co-citation networks in order to explore the evolution of the intellectual structure of this knowledge domain over time.

Virtual Reality Concepts and Features

The concept of VR could be traced at the mid of 1960 when Ivan Sutherland in a pivotal manuscript attempted to describe VR as a window through which a user perceives the virtual world as if looked, felt, sounded real and in which the user could act realistically.

Since that time and in accordance with the application area, several definitions have been formulated: for example, defined VR as "real-time interactive graphics with 3D models, combined with a display technology that gives the user the immersion in the model world and direct manipulation" described VR as "The illusion of participation in a synthetic environment rather than external observation of such an environment. VR relies on a 3D, stereoscopic head-tracker displays, hand/body tracking and binaural sound. VR is an immersive, multi-sensory experience" and "Virtual reality refers to immersive, interactive, multi-sensory, viewer-centred, 3D computer generated environments and the combination of technologies required building environments".

As we can notice, these definitions, although different, highlight three common features of VR systems: immersion, perception to be present in an environment, and interaction with that environment. Specifically, immersion concerns the amount of senses stimulated, interactions, and the reality's similarity of the stimuli used to simulate environments. This feature can depend on the properties of the technological system used to isolate user from reality.

Higher or lower degrees of immersion can depend by three types of VR systems provided to the user:

- simple • Non-immersive systems are the simplest and cheapest type of VR applications that use desktops to reproduce images of the world.
- simple • Immersive systems provide a complete simulated experience due to the support of several sensory outputs devices such as head mounted displays (HMDs) for enhancing the stereoscopic view of the environment through the movement of the user's head, as well as audio and haptic devices.
- simple • Semi-immersive systems such as Fish Tank VR are between the two above. They provide a stereo image of a three-dimensional(3D) scene viewed on a monitor using a perspective projection coupled to the head position of the observer. Higher technological immersive systems have showed a closest experience to reality, giving to the user the illusion of technological non-

mediation and feeling him or her of "being in" or present in the virtual environment. Furthermore, higher immersive systems, than the other two systems, can give the possibility to add several sensory outputs allowing that the interaction and actions were perceived as real.

Finally, the user's VR experience could be disclosed by measuring presence, realism, and reality's levels. Presence is a complex psychological feeling of "being there" in VR that involves the sensation and perception of physical presence, as well as the possibility to interact and react as if the user was in the real world. Similarly, the realism's level corresponds to the degree of expectation that the user has about of the stimuli and experience. If the presented stimuli are similar to reality, VR user's expectation will be congruent with reality expectation, enhancing VR experience. In the same way, higher is the degree of reality in interaction with the virtual stimuli, higher would be the level of realism of the user's behaviours.

Virtual Reality Technologies

Technologically, the devices used in the virtual environments play an important role in the creation of successful virtual experiences. According to the literature, can be distinguished input and output devices. Input devices are the ones that allow the user to communicate with the virtual environment, which can range from a simple joystick or keyboard to a glove allowing capturing finger movements or a tracker able to capture postures. More in detail, keyboard, mouse, trackball, and joystick represent the desktop input devices easy to use, which allow the user to launch continuous and discrete commands or movements to the environment. Other input devices can be represented by tracking devices as bend-sensing gloves that capture hand movements, postures and gestures, or pinch gloves that detect the fingers movements, and trackers able to follow the user's movements in the physical world and translate them in the virtual environment.

On the contrary, the output devices allow the user to see, hear, smell, or touch everything that happens in the virtual environment. As mentioned above, among the visual devices can be found a wide range of possibilities, from the simplest or least immersive (monitor of a computer) to the most immersive one such as VR glasses or helmets or HMD or CAVE systems.

Furthermore, auditory, speakers, as well as haptic output devices are able to stimulate body senses providing a more real virtual experience. For example, haptic devices can stimulate the touch feeling and force models in the user.

Virtual Reality Applications

Since its appearance, VR has been used in different fields, as for gaming, military training, architectural design, education, learning and social skills training, simulations of surgical procedures, assistance to the elderly or psychological treatments are other fields in which VR is bursting strongly. A recent and extensive review of reported the main VR application evidences, including weakness and advantages, in several research areas, such as science, education, training, physical training, as well as social phenomena, moral behaviors, and could be used in other fields, like travel, meetings, collaboration, industry, news, and entertainment. Furthermore, another review published this year by focused on VR in mental health, showing the efficacy of VR in assessing and treating different psychological disorders as anxiety, schizophrenia, depression, and eating disorders.

There are many possibilities that allow the use of VR as a stimulus, replacing real stimuli, recreating experiences, which in the real world would be impossible, with a high realism. This is why VR is widely used in research on new ways of applying psychological treatment or training, for example, to problems arising from phobias (agoraphobia, phobia to fly, etc. Or, simply, it is used like improvement of the traditional systems of motor rehabilitation, developing games that ameliorate the tasks. More in detail, in psychological treatment, Virtual Reality Exposure Therapy (VRET) has showed its efficacy,

allowing to patients to gradually face fear stimuli or stressed situations in a safe environment where the psychological and physiological reactions can be controlled by the therapist.

Blade Server

Oindrilla Chattopadhyay
DCST, 2nd Year

Definition

A **blade server** is a stripped-down server computer with a modular design optimized to minimize the use of physical space and energy. Blade servers have many components removed to save space, minimize power consumption and other considerations, while still having all the functional components to be considered a computer. Unlike a rack-mount server, a blade server fits inside a **blade enclosure**, which can hold multiple blade servers, providing services such as power, cooling, networking, various interconnects and management. Together, blades and the blade enclosure form a blade system, which may itself be rack-mounted. Different blade providers have differing principles regarding what to include in the blade itself, and in the blade system as a whole.

In a standard server-rack configuration, one rack unit or 1U—19 inches (480 mm) wide and 1.75 inches (44 mm) tall—defines the minimum possible size of any equipment. The principal benefit and justification of blade computing relates to lifting this restriction so as to reduce size requirements. The most common computer rack form-factor is 42U high, which limits the number of discrete computer devices directly mountable in a rack to 42 components. Blades do not have this limitation. As of 2014, densities of up to 180 servers per blade system (or 1440 servers per rack) are achievable with blade systems.

Blade enclosure

Enclosure (or chassis) performs many of the non-core computing services found in most computers. Non-blade systems typically use bulky, hot and space-inefficient components, and may duplicate these across many computers that may or may not perform at capacity. By locating these services in one place and sharing them among the blade computers, the overall utilization becomes higher. The specifics of which services are provided varies by vendor.

HP BladeSystem c7000 enclosure (populated with 16 blades), with two 3U UPS units below

Power

Computers operate over a range of DC voltages, but utilities deliver power as AC, and at higher voltages than required within computers. Converting this current requires one or more power supply units (or PSUs). To ensure that the failure of one power source does not affect the operation of the computer, even entry-level servers may have redundant power supplies, again adding to the bulk and heat output of the design.

The blade enclosure's power supply provides a single power source for all blades within the enclosure. This single power source may come as a power supply in the enclosure or as a dedicated separate PSU supplying DC to multiple enclosures.[3][4] This setup reduces the number of PSUs required to provide a resilient power supply.

The popularity of blade servers, and their own appetite for power, has led to an increase in the number of rack-mountable uninterruptible power supply (or UPS) units, including units targeted specifically towards blade servers (such as the BladeUPS).

Cooling

During operation, electrical and mechanical components produce heat, which a system must dissipate to ensure the proper functioning of its components. Most blade enclosures, like most computing systems, remove heat by using fans.

A frequently underestimated problem when designing high-performance computer systems involves the conflict between the amount of heat a system generates and the ability of its fans to remove the heat. The blade's shared power and cooling means that it does not generate as much heat as traditional servers. Newer blade-enclosures feature variable-speed fans and control logic, or even liquid cooling systems that adjust to meet the system's cooling requirements.

At the same time, the increased density of blade-server configurations can still result in higher overall demands for cooling with racks populated at over 50% full. This is especially true with early-generation blades. In absolute terms, a fully populated rack of blade servers is likely to require more cooling capacity than a fully populated rack of standard 1U servers. This is because one can fit up to 128 blade servers in the same rack that will only hold 42 1U rack-mount servers.[7]

Networking

Blade servers generally include integrated or optional network interface controllers for Ethernet or host adapters for Fibre Channel storage systems or converged network adapter to combine storage and data via one Fibre Channel over Ethernet interface. In many blades, at least one interface is embedded on the motherboard and extra interfaces can be added using mezzanine cards.

A blade enclosure can provide individual external ports to which each network interface on a blade will connect. Alternatively, a blade enclosure can aggregate network interfaces into interconnect devices (such as switches) built into the blade enclosure or in networking blades.[8][9]

Storage

While computers typically use hard disks to store operating systems, applications and data, these are not necessarily required locally. Many storage connection methods (e.g. FireWire, SATA, E-SATA, SCSI, SAS DAS, FC and iSCSI) are readily moved outside the server, though not all are used in enterprise-level installations. Implementing these connection interfaces within the computer presents similar challenges to the networking interfaces (indeed iSCSI runs over the network interface), and similarly these can be removed from the blade and presented individually or aggregated either on the chassis or through other blades.

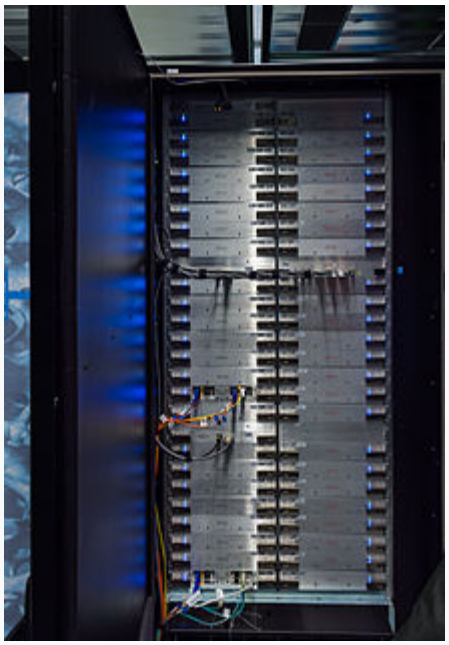
The ability to boot the blade from a storage area network (SAN) allows for an entirely disk-free blade, an example of which implementation is the Intel Modular Server System.

Other blades

Since blade enclosures provide a standard method for delivering basic services to computer devices, other types of devices can also utilize blade enclosures. Blades providing switching, routing, storage, SAN and fibre-channel access can slot into the enclosure to provide these services to all members of the enclosure.

Systems administrators can use storage blades where a requirement exists for additional local storage.[10][11][12]

Uses



Cray XC40 supercomputer cabinet with 48 blades, each containing 4 nodes with 2 CPUs each

Blade servers function well for specific purposes such as web hosting, virtualization, and cluster computing. Individual blades are typically hot-swappable. As users deal with larger and more diverse workloads, they add more processing power, memory and I/O bandwidth to blade servers. Although blade-server technology in theory allows for open, cross-vendor systems, most users buy modules, enclosures, racks and management tools from the same vendor.

Eventual standardization of the technology might result in more choices for consumers;[13][14] as of 2009 increasing numbers of third-party software vendors have started to enter this growing field.[15]

Blade servers do not, however, provide the answer to every computing problem. One can view them as a form of productized server-farm that borrows from mainframe packaging, cooling, and power-supply technology. Very large computing tasks may still require server farms of blade servers, and because of blade servers' high power density, can suffer even more acutely from the heating, ventilation, and air conditioning problems that affect large conventional server farms.

History

Developers first placed complete microcomputers on cards and packaged them in standard 19-inch racks in the 1970s, soon after the introduction of 8-bit microprocessors. This architecture was used in the industrial process control industry as an alternative to minicomputer-based control systems. Early

models stored programs in EPROM and were limited to a single function with a small real-time executive.

server market are HPE, Dell and IBM, though the latter sold its x86 server business to Lenovo in 2014 after selling its consumer PC line to Lenovo in 2005.[22]

In 2009, Cisco announced blades in its Unified Computing System product line, consisting of 6U high chassis, up to 8 blade servers in each chassis. It has a heavily modified Nexus 5K switch, rebranded as a fabric interconnect, and management software for the whole system.[23] HP's line consists of two chassis models, the c3000 which holds up to 8 half-height ProLiant line blades (also available in tower form), and the c7000 (10U) which holds up to 16 half-height ProLiant blades. Dell's product, the M1000e is a 10U modular enclosure and holds up to 16 half-height PowerEdge blade servers or 32 quarter-height blades.

Chatbot

Ankit Das
DCST, 2nd Year

Humans are constantly fascinated with auto-operating AI-driven gadgets. The latest trend that is catching the eye of the majority of the tech industry is chatbots. And with so much research and advancement in the field, the programming is winding up more human-like, on top of being automated. The blend of immediate response reaction and consistent connectivity makes them an engaging change to the web applications trend.

What is a Chatbot?

In general terms, a bot is nothing but a software that will perform automatic tasks. In other terms, a bot is a computer program that is designed to communicate with human users through the internet. This article will focus on the class of bots that live on chat platforms and websites, i.e. chatbots.

The most natural definition of a chatbot is – a developed a program that can have a discussion/conversation with a human. For example, any user could ask the bot an inquiry or a statement, and the bot will respond or perform an activity as appropriate.

A chatbot interacts on a format similar to instant messaging. By artificially replicating the patterns of human interactions in machine learning allows computers to learn by themselves without programming natural language processing.

While a bot is a computer's ability to understand human speech or text short for chat robot. A chatbot is merely a computer program that fundamentally simulates human conversations. It allows a form of interaction between a human and a machine the communication, which happens via messages or voice command.

A chatbot is programmed to work independently from a human operator. It can answer questions formulated to it in natural language and respond like a real person. It provides responses based on a combination of predefined scripts and machine learning applications.

When it is asked a question, the chatbot will respond based on the knowledge database available to it at that point in time. If the conversation introduces a concept it is not programmed to understand, it will either deflect the conversation or potentially pass the communication to a human operator. Either way, it will also learn from that interaction as well as from future interactions. Thus, the chatbot will gradually grow in scope and gain relevance.

For example, if you've asked Amazon's Alexa, Apple Siri, or Microsoft's Cortana, "What's the weather?", it would respond according to the latest weather reports it has access to. The complexity of a chatbot is determined by the sophistication of its underlying software and the data it can access.

Every enterprise has expanded IT infrastructure. From different fields, on-premise to cloud, companies with different supply providers, run on many different, internal and characterized-built applications, as well as ERP, encompass applications. There are other core applications like CRM and customer portals, which are the backbone of ERP.

Currently, many e-commerce companies are looking at various ways to use chatbots to improve their customer experiences. Whether for shopping, booking tickets or simply for customer service. The next time you hear about a chatbot, especially in business and travel, remember to look beyond the fancy term. And ask about how it really adds value to your travel program.

How are human languages processed by chatbots?

A chatbot is like a normal application. There is an app layer, a database and APIs to call other external administrations. Users can easily access chatbots, it adds intricacy for the application to handle.
However, there is a common problem that must be tackled. It can't comprehend the plan of the customer. At the moment, bots are trained according to the past information available to them. So, most organizations have a chatbot that maintains logs of discussions. Developers utilize these logs to analyze what clients are trying to ask. With a blend of machine learning tools and models, developers coordinate client inquiries and reply with the best appropriate answer. For example, if any customer is asking about payments and receipts, such as, "where is my product payment receipt?" and "I haven't received a payment receipt?", both sentences are taken to have the same meaning.
If there is no comprehensive data available, then different APIs can be utilized to train the chatbot.

How are Chatbots Trained?

Training a chatbot occurs at a considerably faster and larger scale than human education. While normal customer service representatives are given a manual instruction which they must be thorough with, a customer support chatbot is nourished with a large number of conversation logs, and from those logs, the chatbot can understand what type of question needs, what kind of answers.

Architecture & Work Methods of Chatbots.
The Chatbots work based on three classification methods:
1.***Pattern Matches***: Bots utilize pattern matches to group the text and it produces an appropriate response from the clients. "Artificial Intelligence Markup Language (AIML), is a standard structured model of these Patterns.
A simple example of Pattern matching is;
pattern1
Then the machine gives the following output:
Human: Who invented the email?
Robot: According to Google, Ray Tomlinson invented email.
The Chatbot knows the appropriate answer because her or his name is in the related pattern. Similarly, the chatbots react to anything relating it to the correlate patterns. But it can't go past the related pattern. To take it to a progressive stage, algorithms can help.
For every sort of question, a remarkable pattern must be accessible in the database to give a reasonable response. With a number of pattern combinations, it makes a hierarchical structure. We utilize algorithms to lessen the classifiers and produce the more reasonable structure.
2. ***Natural Language Understanding (NLU)***
This NLU has 3 specific concepts as follows:

Entities: This essentially represents an idea to your chatbot. For example, it may be a payment system in your E-commerce chatbot.
Context: When a natural language understanding algorithm examines a sentence, it doesn't have the historical backdrop of the user's text conversation. This implies that, if it gets a response to a question it has been recently asked, it won't recall the inquiry. So, the phases during the conversation of chat are separately stored. It can either be banners like "Ordering Pizza". Or could include other parameters like "Domino's: Restaurant". With context, you can easily relate expectations with the necessity of comprehending the last question.
Expectations: This is what a chatbot must fulfill when the customer says sends an inquiry. Which can be the same for different inquiries. For example, the goal triggered for, "I want to purchase a white pair of shoes", and "Do you have white shoes? I want to purchase them" or "show me a white pair of shoes", is the same: a list of shops selling white shoes. Hence, all user typing text show a single command which is the identifying tag; white shoes.

3. ***Natural Language Processing (NLP***)

(NLP) Natural Language Processing Chatbots finds a way to convert the user's speech or text into structured data. Which is then utilized to choose a relevant answer. Natural Language Processing includes the following steps;

Tokenization: The NLP separates a series of words into tokens or pieces that are linguistically representative, with a different value in the application.
Sentiment Analysis: It will study and learn the user's experience, and transfer the inquiry to a human when necessary
Normalization: This program model processes the text to find out the typographical errors and common spelling mistakes that might alter the intended meaning of the user's request.
Named Entity Recognition: The program model of chatbot looks for different categories of words, similar to the name of the particular product, the user's address or name, whichever information is required.
Dependency Parsing: The Chatbot searches for the subjects, verbs, objects, common phrases and nouns in the user's text to discover related phrases that what users want to convey.

In conclusion

For many applications, the chatbot is connected to the database. The database is utilized to sustain the chatbot and provide appropriate responses to every user. NLP can translate human language into data information with a blend of text and patterns that can be useful to discover applicable responses.
There are NLP applications, programming interfaces, and services that are utilized to develop chatbots. And make it possible for all sort of businesses – small, medium or large-scale industries. The primary point here is that smart bots can help increase the customer base by enhancing the customer support services, thereby helping to increase sales

Cognitive Computing

Monish Paul
DCST, 2nd Year

Cognitive computing (**CC**) describes technology platforms that, broadly
Speaking, are based on the scientific disciplines of artificial intelligence and signal processing. These platforms encompass machine learning, reasoning, natural language processing, speech recognition and vision (object recognition), human-computer inter action, dialog and narrative generation, among other technologies.

Definition

At present, there is no widely agreed upon definition for cognitive computing in either academia or industry.

In general, the term cognitive computing has been used to refer to new hardware and/or software that mimics the functioning of the human brain (2004) and helps to improve human decision-making. In this sense, CC is a new type of computing with the goal of more accurate models of how the human brain/mind senses, reasons, and responds to stimulus. CC applications link data analysis and adaptive page displays (AUI) to adjust content for a particular type of audience. As such, CC hardware and applications strive to be more affective and more influential by design.

Some features that cognitive systems may express are:

Adaptive

They may learn as information changes, and as goals and requirements evolve. They may resolve ambiguity and tolerate unpredictability. They may be engineered to feed on dynamic data in real time, or near real time.

Interactive

They may interact easily with users so that those users can define their needs comfortably. They may also interact with other processors, devices, and cloud services, as well as with people.

Iterative and stateful

They may aid in defining a problem by asking questions or finding additional source input if a problem statement is ambiguous or incomplete. They may "remember" previous interactions in a process and return information that is suitable for the specific application at that point in time.

Contextual

They may understand, identify, and extract contextual elements such as meaning, syntax, time, location, appropriate domain, regulations, user's profile, process, task and goal. They may draw on multiple sources of information, including both structured and unstructured digital information, as well as sensory inputs (visual, gestural, auditory, or sensor-provided).

Use Cases

- Speech recognition
- Sentiment analysis

- Face detection
- Risk assessment
- Fraud detection
- Behavioral recommendation

Cognitive Analytics

Cognitive computing-branded technology platforms typically specialize in the processing and analysis of large, unstructured datasets.

Word processing documents, emails, videos, images, audio files, presentations, webpages, social media and many other data formats often need to be manually tagged with metadata before they can be fed to a computer for analysis and insight generation. The principal benefit of utilizing cognitive analytics over traditional big data analytics is that such datasets do not need to be pretagged.

Other characteristics of a cognitive analytics system include:

Adaptability: cognitive analytics systems can use machine learning to adapt to different contexts with minimal human supervision

Natural language interaction: cognitive analytics systems can be equipped with a chatbot or search assistant that understands queries, explains data insights and interacts with humans in natural language.

Application

Education

Even if Cognitive Computing can not take the place of teachers, it can still be a heavy driving force in the education of students. Cognitive Computing being used in the classroom is applied by essentially having an assistant that is personalized for each individual student. This cognitive assistant can relieve the stress that teachers face while teaching students, while also enhancing the student's learning experience over all. Teachers may not be able to pay each and every student individual attention, this being the place that cognitive computers fill the gap. Some students may need a little more help with a particular subject. For many students, Human interaction between student and teacher can cause anxiety and can be uncomfortable. With the help of Cognitive Computer tutors, students will not have to face their uneasiness and can gain the confidence to learn and do well in the classroom. While a student is in class with their personalized assistant, this assistant can develop various techniques, like creating lesson plans, to tailor and aid the student and their needs.

Healthcare

Numerous tech companies are in the process of developing technology that involves Cognitive Computing that can be used in the medical field. The ability to classify and identify is one of the main goals of these cognitive devices. This trait can be very helpful in the study of identifying carcinogens. This cognitive system that can detect would be able to assist the examiner in interpreting countless numbers of documents in a lesser amount of time than if they did not use Cognitive Computer technology. This technology can also evaluate information about the patient, looking through every medical record in depth, searching for indications that can be the source of their problems.

Industry Work

Cognitive Computing in conjunction with big data and algorithms that comprehend customer needs, can be a major advantage in economic decision making.

The powers of Cognitive Computing and AI hold the potential to affect almost every task that humans are capable of performing. This can negatively affect employment for humans, as there would be no such need for human labor anymore. It would also increase the inequality of wealth; the people at the head of the Cognitive Computing industry would grow significantly richer, while workers who are not getting employed anymore would be getting poorer.

The more industries start to utilize Cognitive Computing, the more difficult it will be for humans to compete. Increased use of the technology will also increase the amount of work that AI-driven robots and machines can perform. Only extraordinarily talented, capable and motivated humans would be able to keep up with the machines. The influence of competitive individuals in conjunction with AI/CC with has the potential to change the course of humankind.

Robotic Process Automation

Soham Bose
DCST, 2nd Year

Robotic process automation (or RPA) is an emerging form of business process automation technology based on metaphorical software robots (bots) or artificial intelligence (AI) workers.

In traditional workflow automation tools, a software developer produces a list of actions to automate a task and interface to the back-end system using internal application programming interfaces (APIs) or dedicated scripting language. In contrast, RPA systems develop the action list by watching the user perform that task in the application's graphical user interface (GUI), and then perform the automation by repeating those tasks directly in the GUI. This can lower the barrier to use of automation in products that might not otherwise feature APIs for this purpose.

RPA tools have strong technical similarities to graphical user interface testing tools. These tools also automate interactions with the GUI, and often do so by repeating a set of demonstration actions performed by a user. RPA tools differ from such systems including features that allow data to be handled in and between multiple applications, for instance, receiving email containing an invoice, extracting the data, and then typing that into a bookkeeping system.

As a form of automation, the same concept has been around for a long time in the form of screen scraping but RPA is considered to be a significant technological evolution of this technique in the sense that new software platforms are emerging which are sufficiently mature, resilient, scalable and reliable to make this approach viable for use in large enterprises (who would otherwise be reluctant due to perceived risks to quality and reputation).

By way of illustration of how far the technology has developed since its early form in screen scraping, it is useful to consider the example cited in one academic study. Users of one platform at Xchanging anthropomorphized their robot into a co-worker named "Poppy" and even invited "her" to the Christmas party. Such an illustration perhaps serves to demonstrate the level of intuition, engagement and ease of use of modern RPA technology platforms, that leads their users (or "trainers") to relate to them as beings rather than abstract software services. The "code-free" nature of RPA (described below) is just one of a number of significant differentiating features of RPA vs. screen scraping. [citation needed]

Deployment

The hosting of RPA services also aligns with the metaphor of a software robot, with each robotic instance having its own virtual workstation, much like a human worker. The robot uses keyboard and mouse controls to take actions and execute automations. Normally all of these actions take place in a virtual environment and not on screen; the robot does not need a physical screen to operate, rather it interprets the screen display electronically. The scalability of modern solutions based on architectures such as these owes much to the advent of virtualization technology, without which the scalability of

large deployments would be limited by available capacity to manage physical hardware and by the associated costs. The implementation of RPA in business enterprises has shown dramatic cost savings when compared to traditional non-RPA solutions.

There are however several risks with RPA. Criticism include risks of stifling innovation and creating a more complex maintenance environment of existing software that now needs to consider the use of graphical user interfaces in a way they weren't intended to be used.

According to Harvard Business Review, most operations groups adopting RPA have promised their employees that automation would not result in layoffs. Instead, workers have been redeployed to do more interesting work. One academic study highlighted that knowledge workers did not feel threatened by automation: they embraced it and viewed the robots as team-mates. The same study highlighted that, rather than resulting in a lower "headcount", the technology was deployed in such a way as to achieve more work and greater productivity with the same number of people.

Conversely, however, some analysts proffer that RPA represents a threat to the business process outsourcing (BPO) industry. The thesis behind this notion is that RPA will enable enterprises to "repatriate" processes from offshore locations into local data centers, with the benefit of this new technology. The effect, if true, will be to create high-value jobs for skilled process designers in onshore locations (and within the associated supply chain of IT hardware, data center management, etc.) but to decrease the available opportunity to low skilled workers offshore. On the other hand, this discussion appears to be healthy ground for debate as another academic study was at pains to counter the so-called "myth" that RPA will bring back many jobs from offshore.

Impact on society

Academic studies project that RPA, among other technological trends, is expected to drive a new wave of productivity and efficiency gains in the global labour market. Although not directly attributable to RPA alone, Oxford University conjectures that up to 35% of all jobs may have been automated by 2035.

In a TEDx talk[10] hosted by University College London (UCL), entrepreneur David Moss explains that digital labour in the form of RPA is not only likely to revolutionize the cost model of the services industry by driving the price of products and services down, but that it is likely to drive up service levels, quality of outcomes and create increased opportunity for the personalization of services.

In a separate TEDx in 2019 talk, Japanese business executive, and former CIO of Barclays bank, Koichi Hasegawa noted that digital robots can be a positive effect on society if we start using a robot with empathy to help every person. He provides a case study of the Japanese insurance companies – Sompo Japan and Aioi – both of whom deployed bots to speed up the process of insurance pay-outs in past massive disaster incidents.

Meanwhile, Professor Willcocks, author of the LSE paper cited above, speaks of increased job satisfaction and intellectual stimulation, characterising the technology as having the ability to "take the robot out of the human", a reference to the notion that robots will take over the mundane and

repetitive portions of people's daily workload, leaving them to be redeployed into more interpersonal roles or to concentrate on the remaining, more meaningful, portions of their day.

Robotic process automation 2.0

Robotic process automation 2.0, often referred to as "unassisted RPA," is the next generation of RPA related technologies. Technological advancements and improvements around artificial intelligence technologies are making it easier for businesses to take advantage of the benefits of RPA without dedicating a large budget for development work.

While unassisted RPA has a number of benefits, it is not without drawbacks. Utilizing unassisted RPA, a process can be run on a computer without needing input from a user, freeing up that user to do other work. However, in order to be effective, very clear rules need to be established in order for the processes to run smoothly.

Hyperautomation

Hyperautomation is the application of advanced technologies like RPA, Artificial Intelligence, machine learning (ML) and Process Mining to augment workers and automate processes in ways that are significantly more impactful than traditional automation capabilities. Hyperautomation is the combination of automation tools to deliver work.

Gartner's report notes that this trend was kicked off with robotic process automation (RPA). The report notes that, "RPA alone is not hyperautomation. Hyperautomation requires a combination of tools to help support replicating pieces of where the human is involved in a task."

RPA failures

RPA automates a clearly defined process, but most enterprise doesn't have clearly defined processes, So they start automating, and either automate the wrong thing or get lost in trying to reverse engineer the process.

One way to avoid RPA failure begins with identifying, optimizing, and prioritizing processes. Business process experts will play a vital role in helping functions and business units identify, analyze and prioritize the tasks and processes to automate.

RPA in business

Grand View Research, Inc. performed a study in October, 2018, and said that the primary companies in the RPA market included: Automation Anywhere, Inc.; Blue Prism Group PLC; UIPath Inc.; Be Informed B.V.; OpenSpan; and Jacada, Inc. UIPath, Automation Anywhere, Blue Prism, NICE are the Leaders in the industry according to research firm Everest Group. A recent report released in 2019 predicts the CAGR of robotic process automation market in India at 20% annually

In 2019, Gartner released its first 'Magic Quadrant' for RPA. UiPath, Blue Prism and Automation

Anywhere was named in the market in this order.

LiFi (Light Fidelity)

Sainoor Alam Mridha
DCST, 2nd Year

Introduction

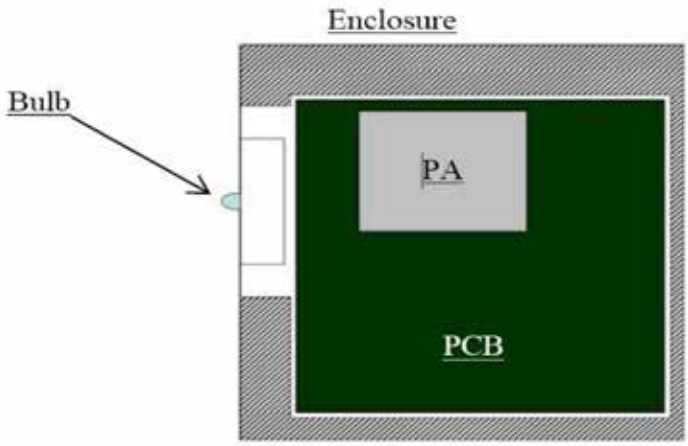
In the era of overcrowded (data communication) world, Li-Fi is a new way of wireless communication that uses LED lights to transmit data wirelessly. Transmission of data is one of the most important day to day activities in the fast-growing world. The current wireless networks that connect us to the Internet are very slow when multiple devices are connected. Also, with the increase in the number of devices which access the Internet, the availability of fixed bandwidth makes it much more difficult to enjoy high data transfer rates and to connect a secure network. Radio waves are just a small part of the electromagnetic spectrum available for data transfer. Li-Fi has got a much broader spectrum for transmission compared to conventional methods of wireless communications that rely on radio waves. The basic ideology behind this technology is that the data can be transferred through LED light by varying light intensities faster than the human eyes can perceive. This technology uses a part of the electromagnetic spectrum that is still not greatly utilized- The Visible Spectrum, instead of Gigahertz radio waves for data transfer.

The idea of Li-Fi was introduced for the first time by a German physicist Harald Hass in the TED (Technology, Entertainment, Design) Global talk on Visible Light Communication (VLC) in July 2011, by referring to it as "data through illumination". He used a table lamp with an LED bulb to transmit a video of a blooming flower that was then projected onto a screen. In simple terms, Li-Fi can be thought of as a light-based Wi-Fi i.e. instead of radio waves it uses light to transmit data. In place of Wi-Fi modems, Li-Fi would use transceivers fitted with LED lamps that could light a room as well as transmit and receive information. By adding new and unutilized bandwidth of visible light to the currently available radio waves for data transfer, LiFi can play a major role in relieving the heavy loads which the current wireless system is facing. Thus, it may offer additional frequency band of the order of 400 THz compared to that available in RF communication which is about 300 GHz. Also, as the Li-Fi uses the visible spectrum, it will help alleviate concerns that the electromagnetic waves coming with Wi-Fi could adversely affect our health.

By Communication through visible light, Li-Fi technology has the possibility to change how we access the Internet, stream videos, receive emails and much more. Security would not be an issue as data can't be accessed in the absence of light. As a result, it can be used in high security military areas where RF communication is prone to eavesdropping.

Architecture of Li-Fi system

Li-Fi which can be the future of data communication appears to be a fast and cheap optical version of Wi-Fi. Being a Visible Light Communication (VLC), Li-Fi uses visible light of electromagnetic spectrum between 400 THz and 800 THz as optical carrier for data transmission and illumination. It uses fast pulses of light to transmit



information in wireless medium. The main components of a basic Li-Fi system may contain the following:

a) A high brightness white LED which acts as transmission source.

b) A silicon photodiode with good response to visible light as the receiving element.

Switching the LEDs on and off can make them generate digital strings with different combination of 1s and 0s. To generate a new data stream, data can be encoded in the light by varying the flickering rate of the LED. In this way, the LEDs work as a sender by modulating the light with the data signal. The LED output appears constant to the human because they are made to flicker at a phenomenal speed (millions of times per second) and it's impossible for human eye to detect this frequency. Communication rate more than 100 Mbps can be achieved by using high speed LEDs with the help of various multiplexing techniques. And this VLC data rate can be further increased to as high as 10 Gbps via parallel data transmission using an array of LED lights with each LED transmitting a different data stream.

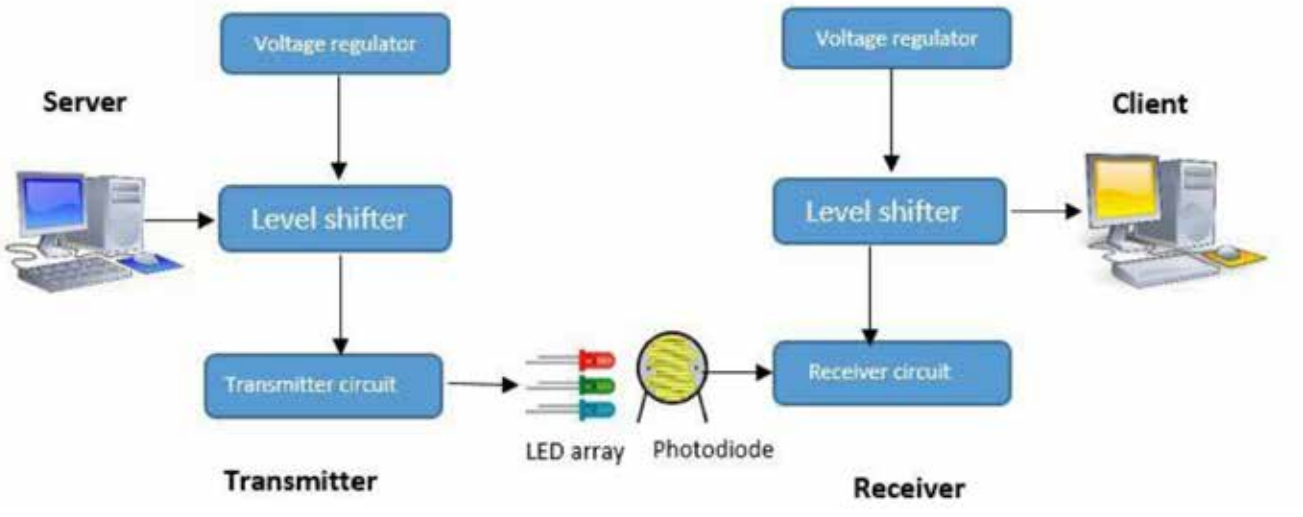
The Li-Fi transmitter system comprises of four primary subassemblies:

- Bulb
- RF Power Amplifier Circuit (PA)
- Printed Circuit Board (PCB)
- Enclosure

The Printed circuit board (PCB) controls the electrical inputs and outputs of the lamp and houses the microcontroller used to manage different lamp functions. A Radio Frequency (RF) signal is generated by the Power Amplifier and is directed into the electric field of the bulb. As a result of the high concentration of energy in the electric field, the contents of the bulb will get vaporized into a plasma state at the bulb's center. And this controlled plasma in turn will produce an intense source of light. All of these subassemblies are contained in an aluminum enclosure as shown in Fig. above.

Important factors that should be considered while designing Li-Fi are as follows:

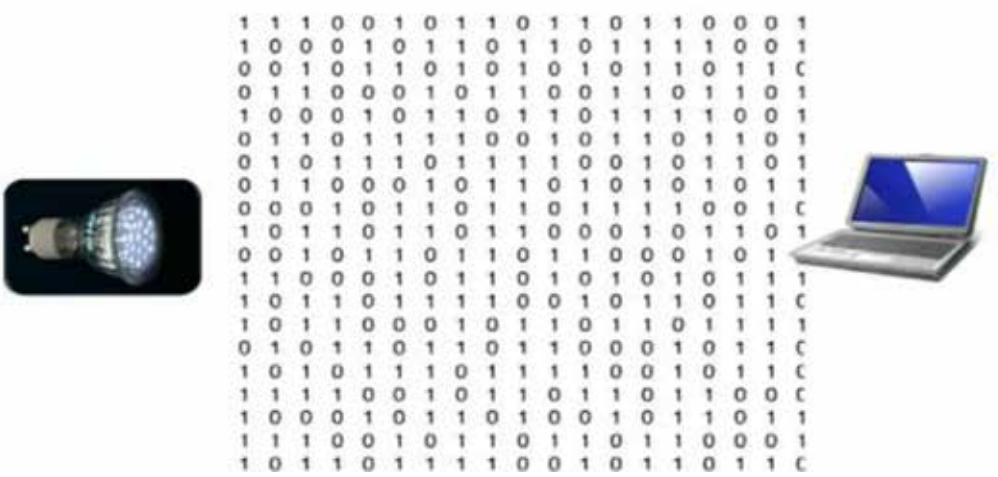
1) Presence of Light
2) Line of Sight (Los)
3) for better performance use fluorescent light & LED



Working

Basic Concept:

Light Fidelity (Li-Fi) technology is a wireless communication system based on the use of visible light between the violet (800 THz) and red (400 THz). Unlike Wi-Fi which uses the radio part of the electromagnetic spectrum, Li-Fi uses the optical spectrum i.e. Visible light part of the electromagnetic spectrum. The principle of Li-Fi is based on sending data by amplitude modulation of the light source in a well-defined and standardized way. LEDs can be switched on and off faster than the human eyes can detect since the operating speed of LEDs is less than 1 microsecond. This invisible on-off activity enables data transmission using binary codes. If the LED is on, a digital '1' is transmitted and if the LED is off, a digital '0' is transmitted. Also, these LEDs can be switched on and off very quicklywhich gives us a very nice opportunity for transmitting data through LED lights, because there are no interfering light frequencies like that of the radio frequencies in Wi-Fi. Li-Fi is thought to be 80% more efficient, which means it can reach speeds of up to 1Gbps and even beyond. Li-Fi differs from fibre optic because the Li-Fi protocol layers are suitable for wireless communication over short distances (up to 10 meters).



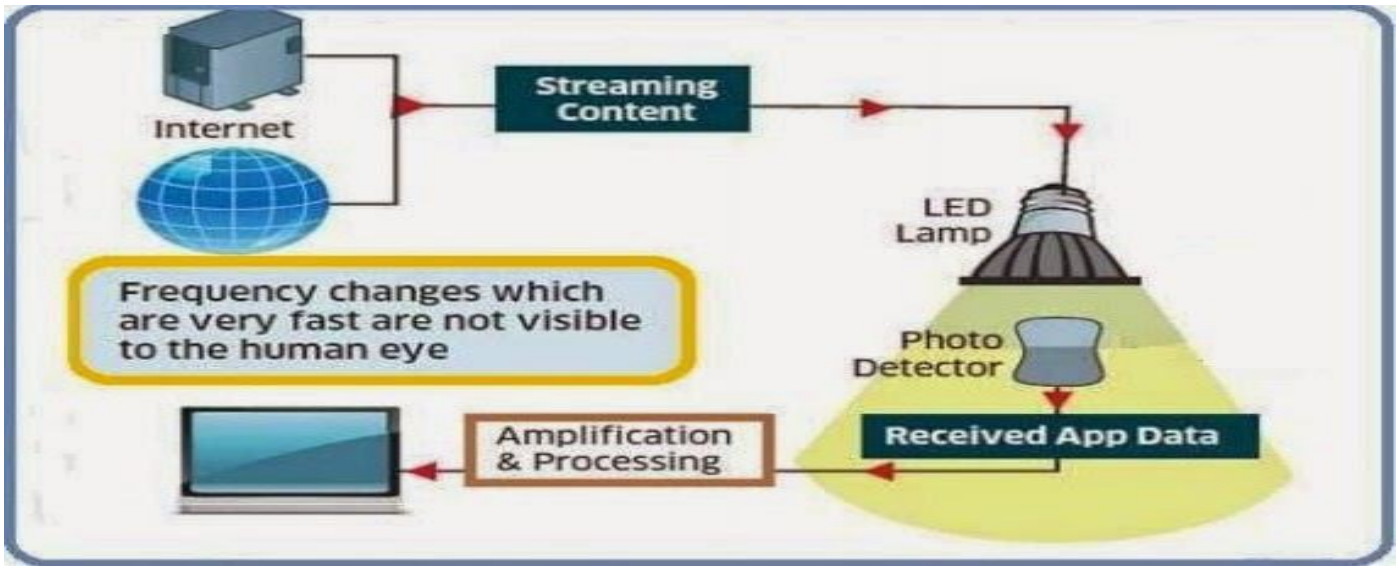
This puts Li-Fi in a unique position of extremely fast wireless communication over short distances.

How it Works:

The working of Li-Fi is very simple. There is a light emitter on one end i.e. an LED transmitter, and a photo detector (light sensor) on the other. The data input to the LED transmitter is encoded in to the light (technically referred to as Visible Light Communication) by varying the flickering rate at which the LEDs flicker 'on' and 'off' to generate different strings of 1s and 0s. The on off activity of the LED transmitter which seems to be invisible (The LED intensity is modulated so rapidly that human eye cannot notice, so the light of the LED appears constant to humans), enables data transmission in light form in accordance with the incoming binary codes: switching ON a LED is a logical '1', switching it OFF is a logical '0'. By varying the rate at which the LEDs flicker on and off, information can be encoded in the light to different combinations of 1s and 0s.

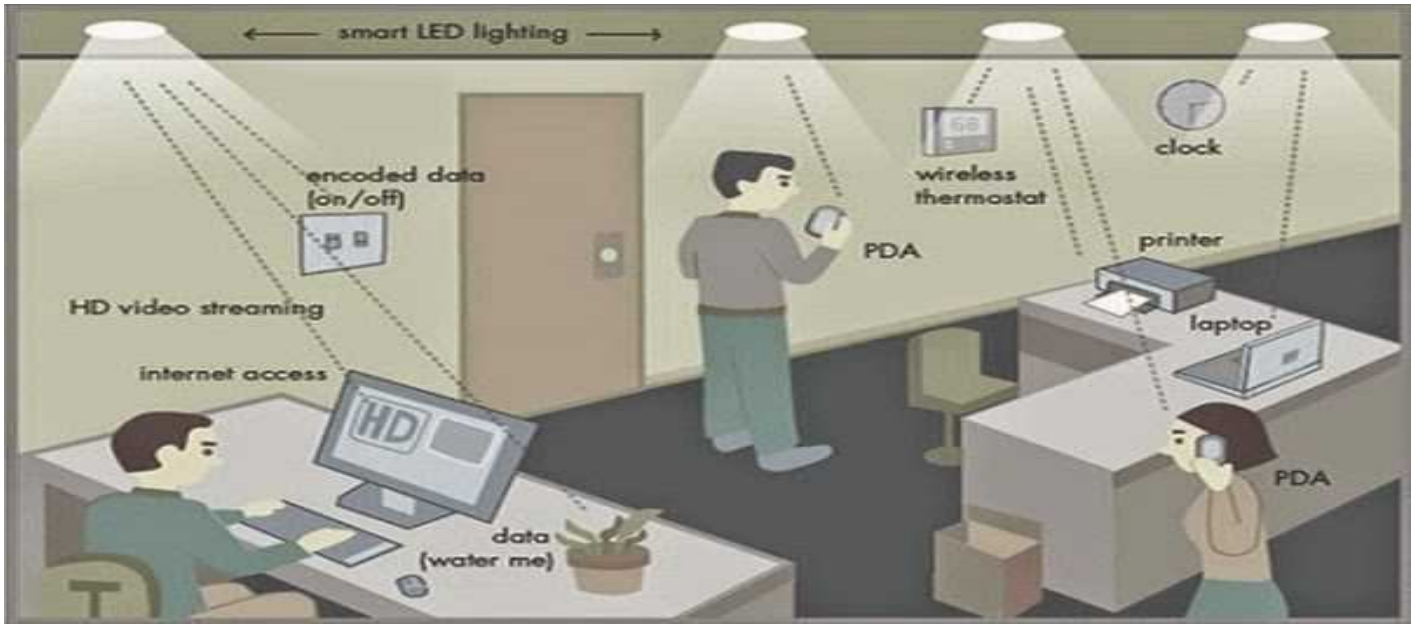
In a typical setup, the transmitter (LED) is connected to the data network (Internet through the modem) and the receiver (photo detector/light sensor) on the receiving end receives the data as light signal and decodes the information, which is then displayed on the device connected to the receiver. The receiver (photo detector) registers a binary '1' when the transmitter (LED) is ON and a binary '0' when the transmitter (LED) is OFF. Thus, flashing the LED numerous times or

using an array of LEDs (perhaps of a few different colors) will eventually provide data rates in the range of hundreds of Mbps. The Li-Fi working is explained in a block diagram (Fig. below).



Block diagram of Li-Fi Sub System

Hence all that is required, is some or an array of LEDs and a controller that controls/encodes data into those LEDs. All one has to do is to vary the rate at which the LEDs flicker depending upon the data input to LEDs. Further data rate enhancements can be made in this method, by using array of the LEDs for parallel data transmission, or using mixtures of red, green and blue LEDs to alter the light's frequency, with each frequency encoding a different data channel.
Fig. shows working/deployment of a Li-Fi system connecting the devices in a room.



Li-Fi system connecting devices in a room

Comparison Between Li-Fi and, Wi-Fi and other Radio Communication

Both Wi-Fi and Li-Fi can provide wireless Internet access to users, and both the technologies transmit data over electromagnetic spectrum. Li-Fi is a visible light communication technology useful to obtain high speed wireless communication. The difference is: Wi-Fi technology uses radio waves for transmission, whereas Li-Fi utilizes light waves. Wi-Fi works well for general wireless coverage within building/campus/compound, and Li-Fi is ideal for high density wireless data coverage inside a confined area or room and is free from interference issues unlike the Wi-Fi.

Table I shows a comparison of transfer speed of various wireless technologies.

Table 1: Comparison of speed of various wireless technologies

Technology	*Speed*
Li-Fi	~1 Gbps
Wi-Fi – IEEE 802.11n	~150 Mbps
IrDA	~4 Mbps
Bluetooth	~3 Mbps
NFC	~424 Kbps

Shortcomings of Radio Waves Transmission vis-à-vis Li-Fi Transmission:

The following are the basic issues with radio waves:

a) *Capacity:* Wireless data is transmitted through radio waves which are limited and expensive. It has a limited bandwidth, vis-à-vis Li-Fi. With the rapidly growing world and development of technologies like 3G, 4G and so on we are running out of radio spectrum.
b) *Energy Efficiency:* There are a large number of cellular radio base stations that consume massive amount of energy. Most of the energy is used for cooling down the base station instead of transmission. Therefore, efficiency of such Radio base stations is very low.
c) *Availability:* Availability of radio waves is a big concern. Further, Radio waves are not advisable to be used in airplanes and at places where radio interference may cause undesirable/catastrophic result.
d) *Security:* Radio waves can penetrate through walls. They can be intercepted. If someone has knowledge and bad intentions, they may misuse it. This causes a major security concern for Wi-Fi.

Advantages of Li-Fi:

Li-Fi, which uses visible light to transmit signals wirelessly, is an emerging technology poised to compete with Wi-Fi. Also, Li-Fi removes the limitations that have been put on the user by the Radio wave transmission such as Wi-Fi as explained above vide 4.1. Advantages of Li-Fi technology include:

a) *Efficiency:* Energy consumption can be minimized with the use of LED illumination which are already available in the home, offices and Mall etc. for lighting purpose. Hence the transmission of data requiring negligible additional power, which makes it very efficient in terms of costs as well as energy.
b) *High speed:* Combination of low interference, high bandwidths and high-intensity output, help Li-Fi provide high data rates i.e. 1 Gbps or even beyond.
c) *Availability:* Availability is not an issue as light sources are present everywhere.

   Wherever there is a light source, there can be Internet. Light bulbs are present everywhere – in homes, offices, shops, malls and even planes, which can be used as a medium for the data transmission.
d) *Cheaper*: Li-Fi not only requires fewer components for its working, but also uses only a negligible additional power for the data transmission.
e) *Security:* One main advantage of Li-Fi is security. Since light cannot pass through opaque structures, Li-Fi internet is available only to the users within a confined area and cannot be intercepted and misused, outside the area under operation.
f) Li-Fi technology has a great scope in future. The extensive growth in the use of LEDs for illumination indeed provides the opportunity to integrate the technology into a plethora of environments and applications.

Limitations of Li-Fi:

Some of the major limitations of Li-Fi are:

- Internet cannot be accessed without a light source. This could limit the locations and situations in which Li-Fi could be used.
- It requires a near or perfect line-of-sight to transmit data
- Opaque obstacles on pathways can affect data transmission
- Natural light, sunlight, and normal electric light can affect the data transmission speed
- Light waves don't penetrate through walls and so Li-Fi has a much shorter range than Wi-Fi High initial installation cost, if used to set up a full-fledged data network.
- Yet to be developed for mass scale adoption.

Applications of Li-Fi

There are numerous applications of Li-Fi technology, from public Internet access through existing lighting (LED) to auto-piloted cars that communicate through their headlights (LED based). Applications of Li-Fi can extend in areas where the Wi-Fi technology lacks its presence like aircrafts and hospitals (operation theatres), power plants and various other areas, where electromagnetic (Radio) interference is of great concern for safety and security of equipment and people. Since Li-Fi uses just the light, it can be used safely in such locations or areas. In future with the Li-Fi enhancement all the street lamps can be transformed to Li-Fi connecting points to transfer data. As a result of it, it will be possible to access internet at any public place and street.
Some of the future applications of Li-Fi could be as follows:

a) *Education systems:* Li-Fi is the latest technology that can provide fastest speed for Internet access. So, it can augment/replace Wi-Fi at educational institutions and at companies so that the people there can make use of Li-Fi with the high speed.

b) *Medical Applications:* Operation theatres (OTs) do not allow Wi-Fi due to radiation concerns. Usage of Wi-Fi at hospitals interferes/blocks the signals for monitoring equipment. So, it may have hazardous effect to the patient's health, due to improper working of medical apparatus. To overcome this and to make OT tech savvy Li-Fi can be used to access internet and also to control medical equipment. This will be beneficial for conducting robotic surgeries and other automated procedures.

c) *Cheaper Internet in Aircrafts:* The passengers travelling in aircrafts get access to low speed Internet that too at a very high price. Also, Wi-Fi is not used because it may interfere with the navigational systems of the pilots. In aircrafts Li-Fi can be used for data transmission. Li-Fi can easily provide high speed Internet via every light source such as overhead reading bulb, etc. present inside the airplane.

d) *Underwater applications:* Underwater ROVs (Remotely Operated Vehicles) operate from large cables that supply their power and allow them to receive signals from their pilots above. But the tether used in ROVs is not long enough to allow them to explore larger areas. If their wires were replaced with light — say from a submerged, high-powered lamp — then they would be much freer to explore. They could also use their headlamps to communicate with each other, processing data autonomously and sending their findings periodically back to the surface. Li-Fi can even work underwater where Wi-Fi fails completely, thereby throwing open endless opportunities for military underwater operations.

e) *Disaster management:* Li-Fi can be used as a powerful means of communication in times of disaster such as earthquake or hurricanes. The average people may not know the protocols during such disasters. Subway stations and tunnels, common dead zones for most emergency communications, pose no obstruction for Li-Fi.

f) *Applications in sensitive areas:* Power plants need fast, inter-connected data systems so that demand, grid integrity and core temperature (in case of nuclear power plants) can be monitored. The Radio communication interference is considered to be bad for such sensitive areas surrounding these power plants. Li-Fi can offer safe, abundant connectivity for all areas of these sensitive locations. Also, the pressure on a power plant 's own reserves (power consumption for Radio communications deployments) will be lessened.

g) *Traffic management:* In traffic signals Li-Fi can be used to communicate with passing vehicles (through the LED lights of the cars etc.) which can help in managing the traffic in a better manner resulting into smooth flow of traffic and reduction in accident numbers. Also, LED car lights can alert drivers when other vehicles are too close.

h) *Mobile Connectivity:* Mobiles, laptops, tablets, and other smart phones can easily connect with each other. The short-range network of Li-Fi can yield exceptionally high data rates and higher security.

i) *Replacement for other technologies:* Li-Fi doesn't work using radio waves. So, it can be easily used in the places where Bluetooth, infrared, Wi-Fi, etc. are banned.

Future Scope:

As light is everywhere and free to use, there is a great scope for the use and evolution of LiFi technology. If this technology becomes mature, each Li-Fi bulb can be used to transmit wireless data. As the Li-Fi technology becomes popular, it will lead to a cleaner, greener, safer communications and have a bright future and environment. The concept of Li-Fi is deriving many people as it is free (require no license) and faster means of data transfer. If it evolves faster, people will use this technology more and more.

Li-Fi Roadmap:

Li-Fi Roadmap

Currently, LBS (location Based Service) or Broadcast solution are commercially available. The next step could be a Li-Fi WLAN for B2B market with high added value on specific business cases and could grow towards mass market. In the long term, the Li-Fi could become an alternative solution to radio for wireless high data rate room connectivity and new adapted service, such as augmented or virtual reality.

Conclusion

Although there's still a long way to go to make this technology a commercial success, it promises a great potential in the field of wireless internet. A significant number of researchers and companies are currently working on this concept, which promises to solve the problem of lack of radio spectrum, space and low internet connection speed. By deployment of this technology, we can migrate to greener, cleaner, safer communication networks. The very concept of Li-Fi promises to solve issues such as, shortage of radio-frequency bandwidth and eliminates the disadvantages of Radio communication technologies. Li-Fi is the upcoming and growing technology acting as catalyst for various other developing and new inventions/technologies. Therefore, there is certainty of development of future applications of the Li-Fi which can be extended to different platforms and various walks of human life.

*****

Network Security and Cryptography

Indrani Majumder
DCST, 2nd Year

INTRODUCTION:

Network security consists of the policies and practices adopted to prevent and monitor unauthorized access, misuse, modification, or denial of a computer network and network-accessible resources. Network security involves the authorization of access to data in a network, which is controlled by the network administrator. Users choose or are assigned an ID and password or other authenticating information that allows them access to information and programs within their authority. Network security covers a variety of computer networks, both public and private, that are used in everyday jobs; conducting transactions and communications among businesses, government agencies and individuals. Networks can be private, such as within a company, and others which might be open to public access. Network security is involved in organizations, enterprises, and other types of institutions. It does as its title explains: it secures the network, as well as protecting and overseeing operations being done. The most common and simple way of protecting a network resource is by assigning it a unique name and a corresponding password.

☑ *DEFINATION:*

Network security is any activity designed to protect the usability and integrity of your network and data.

- Ø It includes both hardware and software technologies
- Ø It targets a variety of threats.
- Ø It stops them from entering or spreading on your network.
- Ø Effective network security manages access to the network.

CRYPTOGRAPHY:

. The conversion of data into a secret code for transmission over a public **network**. Today, most **cryptography** is digital, and the original ("plaintext") is turned into a coded equivalent called "ciphertext" via an **encryption** algorithm.

SECUIRITY MANAGEMENT:

Security management for networks is different for all kinds of situations. A home or small office may only require basic security while large businesses may require high-maintenance and advanced software and hardware to prevent malicious attacks from hacking and spamming. In order to minimize susceptibility to malicious attacks from external threats to the network, corporations often employ tools which carry out network security verifications.

- v **Types of attacks**

Networks are subject to attacks from malicious sources. Attacks can be from two categories: "Passive" when a network intruder intercepts data traveling through the network, and "Active" in which an

intruder initiates commands to disrupt the network's normal operation or to conduct reconnaissance and lateral movements to find and gain access to assets available via the network.

Ø Types of attacks include:

- Passive
  - Network
    - § Wiretapping
    - § Port scanner
    - § Idle scan
    - § Encryption
    - § Traffic analysis
- Active:

Ø Virus
Ø Data Modification
Ø Buffer Overflow
Ø Heap Overflow

§ **IMPLEMENT OF NETWORK SECURITY:**

Network security can be delivered in three ways. these include the use of a hardware appliance, software or a cloud service.

§ **METHODS OF NETWORK SECURITY**:

To implement this kind of in depth, there are a variety of specialized techniques and types of network security you will want to roll out. Cisco, a networking infrastructure company, uses the following schema to break down the different types of network security, and while some of it is informed by their product categories, it's a useful way to think about the different ways to secure a network.

- **Access control:** You should be able to block unauthorized users and devices from accessing your network. Users that are permitted network access should only be able to work with the limited set of resources for which they've been authorized.
- **Anti-malware:** Viruses, worms, and trojans by definition attempt to spread across a network, and can lurk dormant on infected machines for days or weeks. Your security effort should do its best to prevent initial infection and also root out malware that does make its way onto your network.
- **Application security:** Insecure applications are often the vectors by which attackers get access to your network. You need to employ hardware, software, and security processes to lock those apps down.

Ø **Advantages of Network Security:**

- **Protect data**
- As discussed, network security keeps a check on unauthorized access. A network contains a lot of confidential data like the personal client data. Anybody who breaks into the network may hamper these sensitive data. So, network security should be there in place to protect them.

- **Prevents cyber attack**

- **Levels of access**

- The security software gives different levels of access to different users. The authentication of the user is followed by the authorization technique where it is checked whether the user is authorized to access certain resource. You may have seen certain shared documents password protected for security. The software clearly knows which resources are accessible by whom.

- **Centrally controlled**

v **Disadvantages of Network Security**

- Network security is a real boon to the users to ensure the security of their data. While it has many advantages, it has lesser disadvantages. Let us discuss some of them.

- **Time consuming**
- The software installed on some networks is difficult to work with. It needs authentication using two passwords to ensure double security which has to be entered every time you edit a document. It also requires the passwords to be unique with numbers, special characters and alphabets.

CONCLUSION:

Ø Network security is very important for any organization.
Ø It plays a major role in protecting the network from any type of instruction s virus attacks, spyware e. t. c.

Quantum Computing

Tushar Kar
DCST, 2nd Year

Quantum computing is the study of a non-classical model of computation. Whereas traditional models of computing such as the Turing machine or Lambda calculus rely on "classical" representations of computational memory, a quantum computation could transform the memory into a quantum superposition of possible classical states. A quantum computer is a device that could perform such a computation.

DEFINITION: -

Quantum computing is an area of computing focused on developing computer technology based on the principles of quantum theory, which explains the behavior of energy and material on the atomic and subatomic levels.

Basic concept

A classical computer contains memory made up of fundamental units called bits, where each bit represents either a one or a zero. The memory of a quantum computer, on the other hand, is made up of bits which can represent a one, a zero, or some combination. The combination is known as a quantum superposition, and bits with these quantum properties are known as qubits.

The defining property of a quantum computer is the ability to turn bits into qubits, and vice versa. This is in contrast to classical computers in that they are designed to only perform computations with memory that never deviates from clearly defined values. A quantum computer can perform operations on qubits which include possibilities not available to classical computers. The final result returned by a quantum computer is not deterministic. The measurement process is inherently probabilistic, meaning that the output is frequently random, so special algorithms are required to compensate.

Quantum search

Besides factorization and discrete logarithms, quantum algorithms offering a more than polynomial speedup over the best known classical algorithm have been found for several problems,[20] including the simulation of quantum physical processes from chemistry and solid state physics, the approximation of Jones polynomials, and solving Pell's equation. No mathematical proof has been found that shows that an equally fast classical algorithm cannot be discovered, although this is considered unlikely.[21] However, quantum computers offer polynomial speedup for some problems. The most well-known example of this is *quantum database search*, which can be solved by Grover's algorithm using quadratically fewer queries to the database than that are required by classical algorithms. In this case, the advantage is not only provable but also optimal, it has been shown that Grover's algorithm gives the maximal possible probability of finding the desired element for any number of oracle lookups. Several other examples of provable quantum speedups for query problems have subsequently been discovered, such as for finding collisions in two-to-one functions and evaluating NAND trees.

Problems that can be addressed with Grover's algorithm have the following properties:

1. There is no searchable structure in the collection of possible answers,
2. The number of possible answers to check is the same as the number of inputs to the algorithm, and
3. There exists a Boolean function which evaluates each input and determines whether it is the correct answer

For problems with all these properties, the running time of Grover's algorithm on a quantum computer will scale as the square root of the number of inputs (or elements in the database), as opposed to the linear scaling of classical algorithms. A general class of problems to which Grover's algorithm can be applied is Boolean satisfiability problem. In this instance, the *database* through which the algorithm is iterating is that of all possible answers. An example (and possible) application of this is a password cracker that attempts to guess the password or secret key for an encrypted file or system. Symmetric ciphers such as Triple DES and AES are particularly vulnerable to this kind of attack. This application of quantum computing is a major interest of government agencies.

Quantum computing models

There are a number of quantum computing models, distinguished by the basic elements in which the computation is decomposed. The four main models of practical importance are:

- Quantum gate array (computation decomposed into a sequence of few-qubit quantum gates)
- One-way quantum computer (computation decomposed into a sequence of one-qubit measurements applied to a highly entangled initial state or cluster state)
- Adiabatic quantum computer, based on quantum annealing (computation decomposed into a slow continuous transformation of an initial Hamiltonian into a final Hamiltonian, whose ground states contain the solution)
- Topological quantum computer (computation decomposed into the braiding of anyons in a 2D lattice)

The quantum Turing machine is theoretically important but the direct implementation of this model is not pursued. All four models of computation have been shown to be equivalent; each can simulate the other with no more than polynomial overhead.

Industry Applications of Quantum Computing

A quantum computer can process a superposition of many different classical inputs and produce a superposition of outputs and quantum parallelism can be utilized. This provides speed for financial analysis and transportation calculations.