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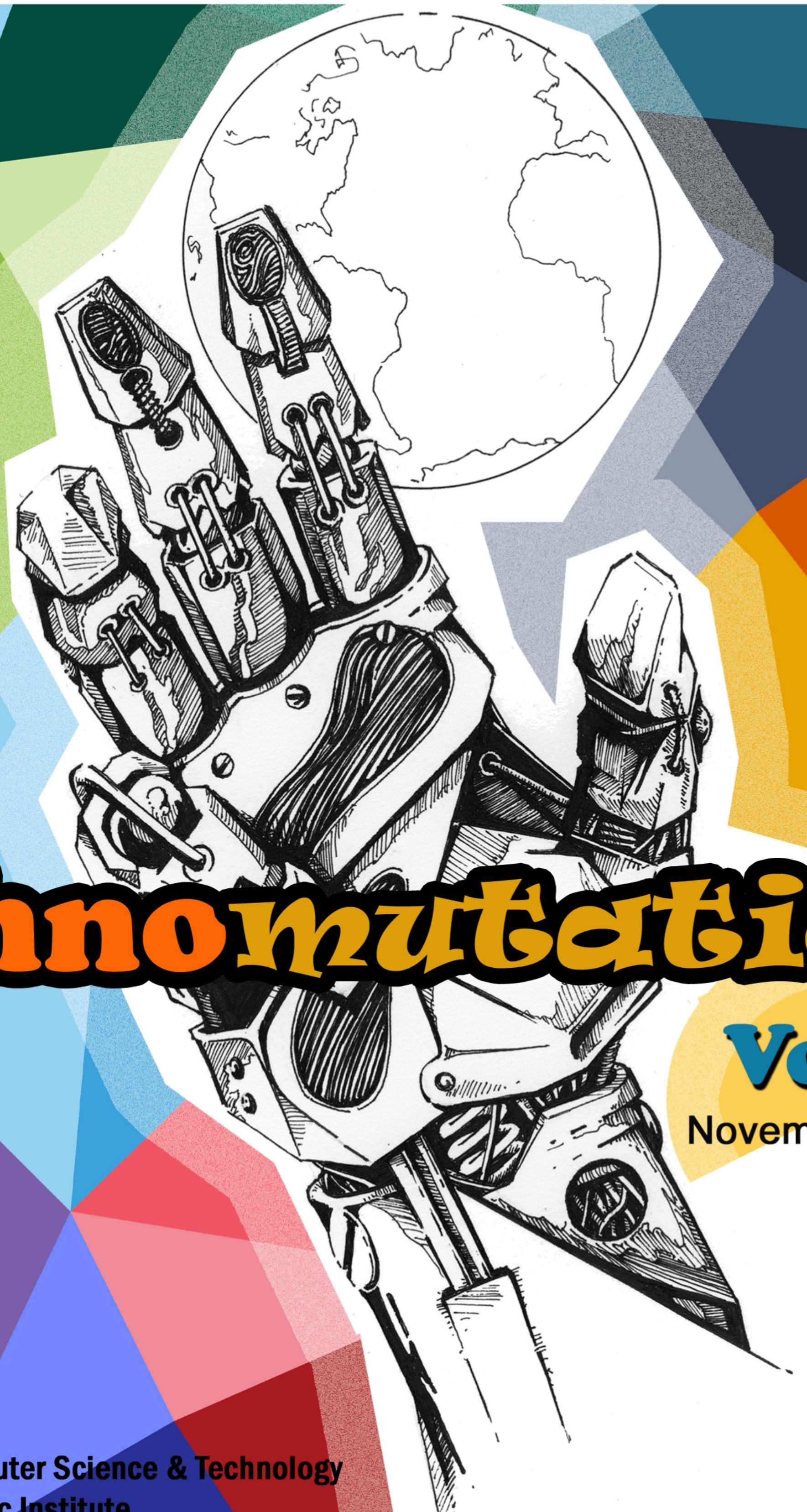

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SOFT COMPUTING AND ITS APPLICATIONS

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AIM & SCOPE

Technomutation is a departmental journal to publish significant technical information in all the areas of Computer Science & Technology. Published articles in this journal will address important research topics and new technological advancement in this area. The main aim is to motivate students in research works and to increase their knowledge domain. It will give them an opportunity to express their ability of writing technical papers and documentation. The intended audience may submit their research documents half-yearly in the community of scholars, interested in the social impact of new technologies. This Journal was initiated by the Department of Computer Science & Technology students and faculties and cordially supported by the students and faculty members of all other departments.

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CONTENTS

An Approach of Perceptron Model to Solve XOR Problem

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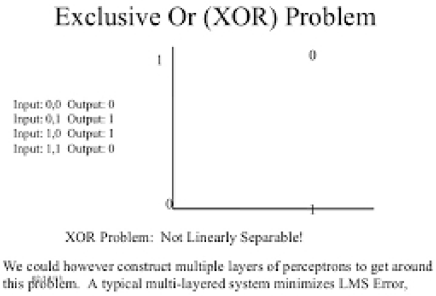
Abstract- *By using perceptron model we can linearly separate different classes of data. AND and OR operations are linearly separable problems. But XOR problem is not linearly separable. To solve this problem we can use a logical combination of two linear classifiers. Single layer feed forward type networks are used for linear decision boundary. In this paper we develop single layer topology with learning algorithms to solve non-linear problem XOR.*

I. INTRODUCTION

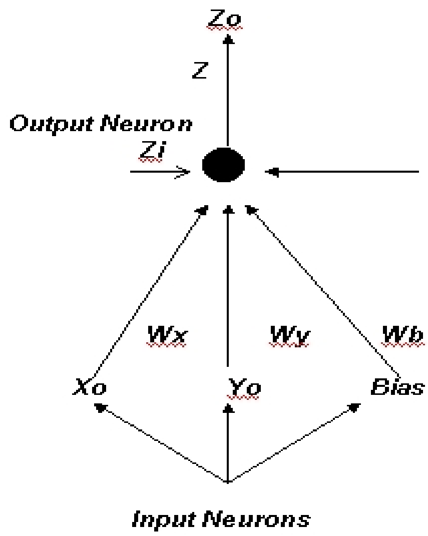
In machine learning the perceptron is an algorithm for supervised learning of binary classifiers. It decide which input will belong in which class. Specially it is a linearly separable classifiers. Frank Rosenblatt in 1957 first invent the perceptron algorithm at the Cornell Aeronautical Laboratory.The perceptron was intended to be a machine, rather than a program, and while its first implementation was in software for the IBM 704, it was subsequently implemented in custom-built hardware as the "Mark 1 perceptron". This machine was designed for image recognition: it had an array of 400 photocells, randomly connected to the "neurons". Weights were encoded in potentiometers, and weight updates during learning were performed by electric motors. Although the perceptron initially seemed very effective but it was quickly proved that perceptrons could not be trained to recognize many classes of patterns. In 1969 a famous book entitled perceptrons by Marvin Minsky and Seymour Papert showed that it was impossible to learn XOR problem. Theone drawbacks of perceptron model that it does not allow more than one layer of adaptive weights because there is no propagating. It can only solve the problem which is linearly separable. To solve this problem a back error propagating network is trained. It needs at least two layer networks.

II. XOR PROBLEM

X	Y	Z	CLASS
0	0	0	B
0	1	1	A
1	0	1	A
1	1	0	B



III. LEARNING ALGORITHM



Zo= ¦ (abs(zi)+k) (1)

where K is a constant

Here ¦(x) is a threshold function of the type - if (f(x) > 0) Zo = 1; else Zo =0;

With this activation function we need to modify the training algorithm to reinforce weights. Here, to calculate the error sensitivity of weights, we consider the activation function as,

Consider Zi = wx * xo + wy * yo + wb **(2)**

Output Zo = Zi^2 + K

Error function E = ½ *(Zo - Zd $)^2$

The error sensitivity of wx is given by -

d E / d wx = 2 * (Zo-Zi)* Zi * Xo **(3)**

From the above derivation, reinforcement of all the weights are -

wx = wx - h * (Zo-Zd) * Zi * Xo,

Similarly,

wy = wy - h * (Zo-Zd) * Zi * Yo

wb = wb - h * (Zo-Zd) * Zi (4)

where **h** is the learning coefficient and is generally varies between 0 to 1

IV. USING A LOGICAL COMBINATION OF TWO LINEAR CLASSIFIERS

g2(x) = x1+x2-(3/2)
g1(x) = x1+x2-(1/2)
Let f(x) be the unit step activation function:
f (x) = 0, x< 0
f(x) = 1, x≥ 0
Observe that the classification problem is then solved by

f (y1-y2-1/2)
where
y1=f(g1(x)) and y2=f(g2(x))
This calculation can be implemented sequentially:
1. Compute y1 and y2 from x1 and x2.
2. Compute the decision from y1 and y2.
Each layer in the sequence consists of one or more linear classifications. This is therefore a two-layer perceptron.

V. SINGLE LAYER NEURAL NETWORK SOLUTION FOR XOR PROBLEM

```
#include "stdio.h"
#include "math.h"
#include "graphics.h"
#include "conio.h"
#include "stdlib.h"
#include "time.h"
 #define OR 1;
 #define AND 2;
 #define XOR 3;

 int x1,y1,x2,y2;
 float wx,wy,wb;
 float m10,m12;
 float eta=0.4;
 unsigned inttx[5000],ty[5000],td[5000];
/*___________________________________*/
int update(int x0, int y0, float *zi)
{
intzo;
*zi=wx*x0+wy*y0+wb;
zo=fabs(*zi)+10;
if (zo>0) zo=0; else zo=1;
 return(zo);
}
/*___________________________________*/
int reinforce(int x0, int y0, intzd)
{
interr,zo;
float zi;
zo=update(x0,y0,&zi);
err=zo-zd;
wx=wx-eta*err*zi*x0;
wy=wy-eta*err*zi*y0;
wb=wb-eta*err*zi;
return(err);
}
/*___________________________________*/
int train(intnmax)
{
intn,e,err=0;
int x0,y0,zd;
static int m=0;
for(n=0;n<nmax;n++){
x0=tx[m];
```

```
y0=ty[m];
zd=td[m];
e=reinforce(x0,y0,zd);
err=err+abs(e);
 m++;
 m=m% 5000;
 }
 return(err);
}
/*______________________________________*/
void desiredout(intsmax)
{
int n,x0,y0,zd;
 for(n=0;n<smax;n++){
  x0=random(2);
  y0=random(2);
  /* XOR */
 zd=x0 ^ y0;
 tx[n]=x0;
 ty[n]=y0;
 td[n]=zd;
  }
}
/*______________________________________*/
void initweights (void)
{
wx=1.0-random(1000)/500.0;
wy=1.0-random(1000)/500.0;
wb=1.0-random(1000)/500.0;
}
/*______________________________________*/
void main(void)
{
  intm,r,err;
   clrscr();
   getch();
   randomize();
   clrscr();
    printf("\n       Single layer solution for XOR  problem  ");
    printf("\n       --------------------------------------  ");
    printf("\t\n\nExp no.     wx                         wy                  wb        ");
    printf("\n ");
   initweights();
    desiredout(5000);
      for(r=1;r<=10;r++) {
        for(m=1;m<=700;m++){
         err=train(16);
         //printf("\n%d Error=%d",m,err);
         if(err==0)break;
         //getch();
         }
   printf("\t\t\t\n%d \t %f  %f   %f",r,wx,wy,wb);
    initweights();
     }
    getch();
    printf("\n\nThe weights and output error for XOR problem" );
    getch();
 }
```

VI. CONCLUSION

Here we can see that the non-linear problems cannot be solved by single layer network with conventional type of neuron activation function. To solve this problem we use alogicalcombination of two linear classifiers.

ACKNOWLEDGEMENT

I take this opportunity to convey my sincere gratitude to my project guide Mr. Arnab Acharya of Computer Science & Technology department not only for suggesting the project but also for constant guidance, inspiration, motivation, patience and faith throughout the project.

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Applications of Fuzzy Logic

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Abstract: *Fuzzy Logic is one of the most popular technologies nowadays used in all branches of technology from medical science to automotive control. The aim of this paper is to present an overview of applications of fuzzy logic and its basic difference from conventional theory. The paper describes introduction and basic conception of fuzzy logic, historical beginning, early applications of fuzzy logic and nowadays real life, modern and industrial applications based on fuzzy logic. The paper also presents the overview of the future of Fuzzy Logic.*

Keywords: *Fuzzy Logic, Applications, Future of Fuzzy Logic.*

I. INTRODUCTION

Fuzzy logic is a complex mathematical method that allows solving difficult simulated problems with many inputs and output variables. Fuzzy logic is able to give results in the form of recommendation for a specific interval of output state, so it is essential that this mathematical method is strictly distinguished from the more familiar logics, such as Boolean algebra. This paper contains of applications of fuzzy logic.

Fuzzy logic is a form of many-valued logic in which the truth values of variables may be any real number between 0 and 1. In Boolean logic, the truth values of variables may only be 0 or 1. Fuzzy logic has been extended to handle the concept of partial truth, where the truth value may range between completely true and completely false.

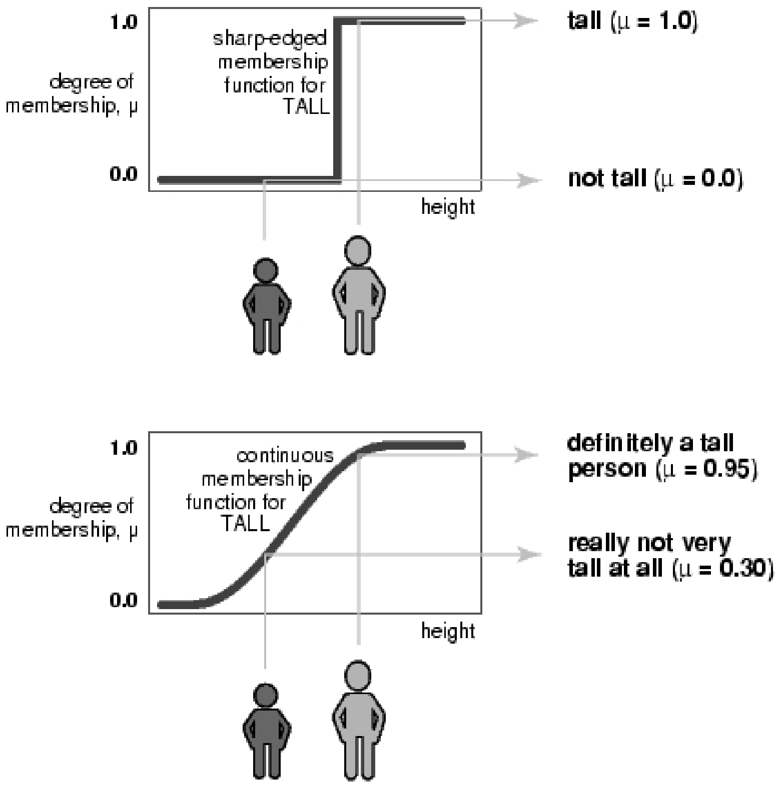

Figure 1 Height Measurement of Two Men Based on Fuzzy Logic System

II. HISTORICAL BEGINNING

Fuzzy logic was first introduced and coined by Lotfi A. Zadeh, Professor of Systems Theory at the University of California, Berkeley, USA, in a publication in 1965. However, during its early years, it was met with a lot of criticisms, some of which are from Prof. Zadeh's colleagues themselves**.**

The Japanese were the first to utilize fuzzy logic for practical applications. The first notable application was on the high-speed train in Sendai, in which fuzzy logic was able to improve the economy, comfort, and precision of the ride. It has also been used in recognition of hand written symbols in Sony pocket computers; flight aid for helicopters; controlling of subway systems in order to improve driving comfort, precision of halting, and power economy; improved fuel consumption for auto mobiles; single-button control for washing machines; automatic motor control for vacuum cleaners with recognition of surface condition and degree of soiling; and prediction systems for early recognition of earthquakes through the Institute of Seismology Bureau of Metrology, Japan.

III. APPLICATIONS

Air Conditioners: Old AC's used simple on-off mechanism. When the temperature dropped below a preset level, the AC was turned off. When it rose above a preset level, the AC was turned on. There was a slight gap between the two preset values to avoid high frequency on-off cycling. Example would be "When the temperature rises above 25 C, turn on the unit, and when temperature falls below 20 C, turn off the unit". Using Fuzzy Rules like "If the ambient air is getting warmer, turn the cooling power up a little; if the air is getting chilly, turn the cooling power down moderately" etc. The machine will become smoother as a result of this and give more consistent comfortable room temperatures.

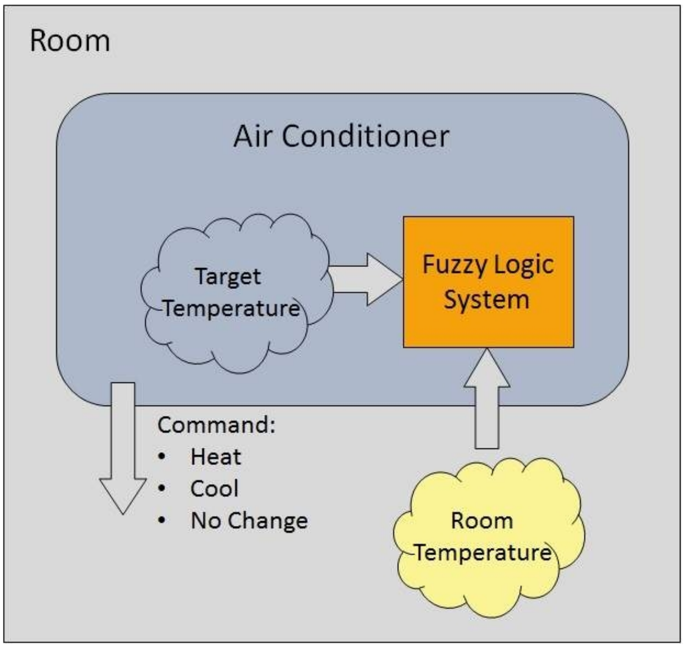

Figure 2 Simple Architecture Of Fuzzy Logic Controlled Air Conditioner

Automatic Gear Transmission System: It uses several variables like speed, acceleration, throttle opening, rate of change of throttle opening, engine load and assigns a weight to each of these. A Fuzzy aggregate is calculated from these weights and is used to decide whether to shift gears.

Washing Machine: Sense the load size, detergent amount etc. Keep a track of the water clarity. At start of cycle, the water will be clean and will allow light to pass through it easily. As the wash cycle proceeds, the water becomes discolored and allows less light to pass through it. This information is used and control decisions are made.

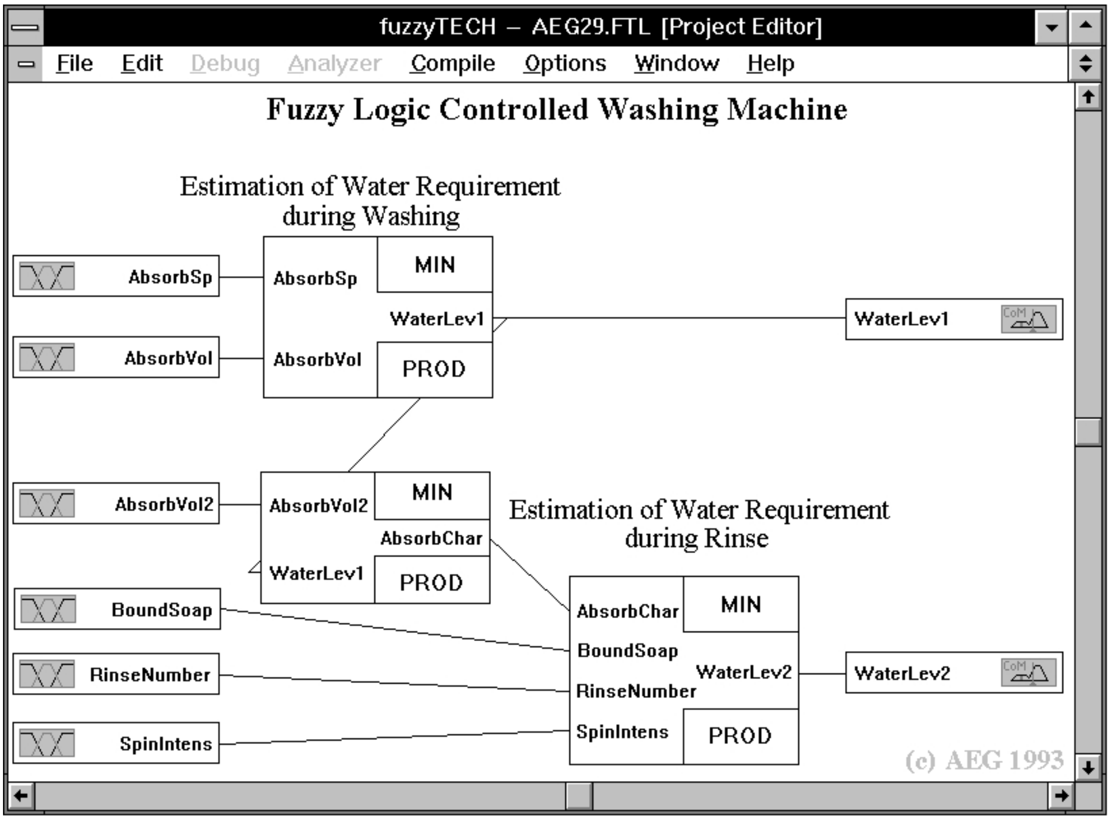

Figure 3 Simple Architecture Of Fuzzy Logic Controlled Washing Machine

Reading: Hand written input and interpreting the characters for data entry.

Television: A Fuzzy logic scheme uses sensed variables such as ambient lighting, time of the day and user profile to adjust parameters such as screen brightness, color, contrast and sound.

Criminal Search System: Helps in criminal investigation by analyzing photos of the suspects along with their characteristics like "short, young-looking." form witnesses to determine the most likely criminals.

Online Disease Diagnostic System: Analyses the user's symptoms and tries to identify the disease he/she may be suffering from.

Error Correction in Information Reception: Basically for limited-bandwidth communication link which is affected by data-corrupting noise. The front-end of a decoder produces a likelihood measure for the value intended by the sender (0 or 1) for each bit in the data stream. The likelihood measures might use a scale of 256 values between extremes of "Certainly 0" and "certainly 1". The two decoders may analyse the data in parallel, ariving at different likelihood results for the values intended by the sender. Each can then use as additional data, the other's likelihood results and repeat the process to improve the results untill consensus is reached as to the most likely values. Massive engine used in The Lord of the Rings which helped show huge scale armies create random, yet orderly movements.

IV. FUTURE OF FUZZY LOGIC

It is clear that fuzzy logic can be used in numerous applications. It can appear almost anyplace where computers and modern control theory are overly precise as well as in tasks requiring delicate human intuition and experience-based knowledge. Consider, the example below which is currently undergoing intensive research in OMRON Research Center, Japan.

It may seem obvious that babies nowadays don't drink the way it is described in child care books. They may drink a little or a lot depending on their physical condition, mood, and other factors. But if a fuzzy-logic program can be created that would recommend how much to feed the baby, mothers would have an easier time raising the child. The basis of the research is to develop a program to determine the appropriate amount of milk to feed the child according to a knowledge base that includes the child's personality, physical condition, and some environmental factors. This can prevent the child from being fed unnecessarily. Now although adapting fuzzy logic to babies may seem silly, one can easily imagine using it to control the feeding of animals in captivity, for instance.

Well, here are some of the future fuzzy uses as predicted by Professor Bart Kosko from UC Southern California:

1. Vast expert decision makers, theoretically able to distill the wisdom of every document ever written.
2. Sex robots with a humanlike repertoire of behavior.
3. Computers that understand and respond to normal human language.
4. Machines that write interesting norvels and screenplays in a selected style, such as Hemingway's.
5. Molecule-sized soldiers of health that will roam the blood-stream, killing cancer cells and slowing aging process.

Hence, it can be seen that with the enormous reseach currently being done in Japan and many other countries whose eyes have opened, the future of fuzzy logic is undetermined. There is no limit to where it can go. The future is bright. The future is fuzzy.

V. CONCLUSION

Basic conception of fuzzy logic and its applications are presented in this paper. The paper presents the basic principles of the fuzzy logic and its difference to the conventional logic theory. The historical beginning and early application of fuzzy logic are described here. A brief overview of the real life, modern, industrial applications of fuzzy logic is presented. The paper also presents an overview of the future of fuzzy logic.

ACKNOWLEDGEMENT

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A Conceptual Study on Digital Image Processing

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Abstract: *In this article we have tried to give a concept on Digital Image Processing. We have discuss about Digital Image, Digital image processing, Image, Dimensions of image, pixel, ISO, Binary image, Resolution, Aspect ratio, Optical zoom and Digital zoom, Brightness, Contrast and edges. We have also discussed about the uses of this Digital Image Processing.*

Keywords: *digital image, pixel, zoom, ccd sensor, aspect ratio*

I. INTRODUCTION

Digital images are electronic snapshots taken of a scene or scanned from documents, such as photographs, manuscripts, printed texts, and artwork. The digital image is sampled and mapped as a grid of dots or picture elements (pixels).

What is digital image processing?

Digital signal processing (DSP) is the mathematical manipulation of an information signal to modify or improve it in some way. It is characterized by the representation of discrete time, discrete frequency, or other discrete domain signals by a sequence of numbers or symbols and the processing of these signals.

II. HOW IT WORKS

In the above figure, an image has been captured by a camera and has been sent to a digital system to remove all the other details, and just focus on the water drop by zooming it in such a way that the quality of the image remains the same.

What is an image?

An image is nothing more than a two dimensional signal. It is defined by the mathematical function f(x,y) where x and y are the two co-ordinates horizontally and vertically.
The value of f(x,y) at any point is gives the pixel value at that point of an image.

Digital signals

As compared to analog signals, digital signals are very easy to analyze. They are discontinuous signals. They are the appropriation of analog signals.The word digital stands for discrete values and hence it means that they use specific values to represent any information. In digital signal, only two values are used to represent something i-e: 1 and 0 (binary values). Digital signals are less accurate then analog signals because they are the discrete samples of an analog signal taken over some period of time. However digital signals are not subject to noise. So they last long and are easy to interpret. Digital signals are denoted by square waves.

Systems

A system is a defined by the type of input and output it deals with. Since we are dealing with signals, so in our case, our system would be a mathematical model, a piece of code/software, or a physical device, or a black box whose input is a signal and it performs some processing on that signal, and the output is a signal. The input is known as excitation and the output is known as response.

The history of the camera lies in ASIA. The principles of the camera were first introduced by a Chinese philosopher MOZI. It is known as camera obscura. The cameras evolved from this principle. The concept of Chinese was bring in reality by a Muslim scientist Abu Ali Al-Hassan Ibn al-Haitham commonly known as Ibn al-Haitham. He built the first camera obscura.

In 1685, a first portable camera was built by Johann Zahn. Before the advent of this device, the camera, consists of a size of room and were not portable.

First photograph

The first photograph was taken in 1814 by a French inventor Joseph Nicephore Niepce. He captures the first photograph of a view from the window at Le Gras, by coating the pewter plate with bitumen and after that exposing that plate to light.

III. HISTORICAL BACKGROUND

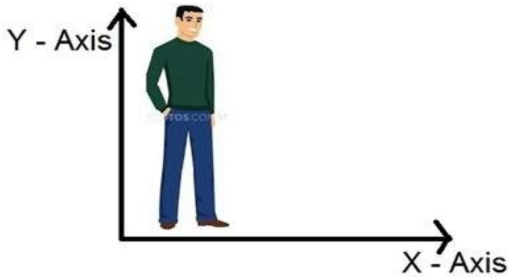
The origin of film was introduced by an American inventor and a philanthropist known as George Eastman who is considered as the pioneer of photography,In the farther year different types of inventions takes place such as , Leica and argus are the two analog cameras developed in 1925 and in 1939 respectively. The camera Leica wasbuilt using a 35mm cine film. In 1942 a German engineer Walter Bruch developed and installed the very first system of the analog CCTV cameras. He is also credited for the invention of color television in the 1960. The first disposable camera was introduced in 1949 by Photo Pac. The camera was only a one time use camera with a roll of film already included in it.

Digital cameras

Mavica (the magnetic video camera) was launched by Sony in 1981 was the first game changer in digital camera world. The images were recorded on floppy disks and images can be viewed later on any monitor screen. Fuji DS-1P camera by Fuji films 1988 was the first true digital cameraNikon D1 was a 2.74 mega pixel camera and the first commercial digital SLR camera developed by Nikon , and was very much affordable by the professionals.

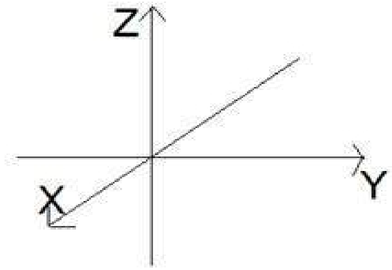
Dimensions of image

So if we live in the 3d world, means a 3 dimensional world, then what are the dimensions of an image that we capture. An image is a two dimensional, thats why we also define an image as a 2 dimensional signal. An image has only height and width. An image does not have depth. Just have a look at this image below.



3 Dimension signal

Three dimensional signal as it names refers to those signals which has three dimensions. The most common example has been discussed in the beginning which is of our world. We live in a three dimensional world. This example has been discussed very elaborately. Another example of a three dimensional signal is a cube or a volumetric data or the most common example would be animated or 3d cartoon character.
The mathematical representation of three dimensional signal is:
F(x,y,z) = animated character.
Another axis or dimension Z is involved in a three dimension, that gives the illusion of depth. In a Cartesian co-ordinate system it can be viewed as:



4 dimension signal

In a four dimensional signal, four dimensions are involved. The first three are the same as of three dimensional signal which are: (X, Y, Z), and the fourth one which is added to them is T(time). Time is often referred to as temporal dimension which is a way to measure change. Mathematically a four d signal can be stated as:
F(x,y,z,t) = animated movie.

IV. IMAGE FORMATION ON DIGITAL CAMERAS

In the digital cameras , the image formation is not due to the chemical reaction that take place , rather it is a bit more complex than this. In the digital camera , a CCD array of sensors is used for the image formation.

Image formation through CCD array

CCD stands for charge-coupled device. It is an image sensor, and like other sensors it senses the values and converts them into an electric signal. In case of CCD it senses the image and convert it into electric signal e.t.c.

This CCD is actually in the shape of array or a rectangular grid. It is like a matrix with each cell in the matrix contains a censor that senses the intensity of photon.

Introduction to pixel

The value of each sensor of the CCD array refers to each the value of the individual pixel. The number of sensors = number of pixels. It also means that each sensor could have only one and only one value. Pixel is the smallest element of an image. Each pixel correspond to any one value. In an 8-bit gray scale image, the value of the pixel between 0 and 255. The value of a pixel at any point correspond to the intensity of the light photons striking at that point. Each pixel store a value proportional to the light intensity at that particular location.

ISO

ISO factor is measured in numbers. It denotes the sensitivity of light to camera. If ISO number is lowered, it means our camera is less sensitive to light and if the ISO number is high, it means it is more sensitive.

Number of different colors

Now as we said it in the beginning, that the number of different colors depend on the number of bits per pixel.

The table for some of the bits and their color is given below.

Bits per pixel	Number of colors
1 bpp	2 colors
2 bpp	4 colors
3 bpp	8 colors
4 bpp	16 colors
5 bpp	32 colors
6 bpp	64 colors
7 bpp	128 colors
8 bpp	256 colors
10 bpp	1024 colors
16 bpp	65536 colors
24 bpp	16777216 colors (16.7 million colors)
32 bpp	4294967296 colors (4294 million colors)

This table shows different bits per pixel and the amount of color they contain.

The binary image

The binary image as it name states, contain only two pixel values.0 and 1.In our previous tutorial of bits per pixel, we have explained this in detail about the representation of pixel values to their respective colors.Here 0 refers to black color and 1 refers to white color. It is also known as Monochrome.

Decimal Code:

(255,255,255)

Explanation:

Since each portion of R, G, B is an 8 bit portion. So in 8-bit, the white color is formed by 255. It is explained in the tutorial of pixel. So in order to make a white color we set each portion to 255 and thats how we got a white color. By setting each of the value to 255, we get overall value of 255, thats make the color white.

Resolution

The resolution can be defined in many ways. Such as pixel resolution, spatial resolution, temporal resolution, spectral resolution. Out of which we are going to discuss pixel resolution.You have probably seen that in your own computer settings, you have monitor resolution of 800 x 600, 640 x 480 e.t.c.

Aspect ratio

Another important concept with the pixel resolution is aspect ratio.Aspect ratio is the ratio between width of an image and the height of an image. It is commonly explained as two numbers separated by a colon (8:9). This ratio differs in different images, and in different screens. The common aspect ratios are:
1.33:1, 1.37:1, 1.43:1, 1.50:1, 1.56:1, 1.66:1, 1.75:1, 1.78:1, 1.85:1, 2.00:1, e.t.c

Zooming

Zooming simply means enlarging a picture in a sense that the details in the image became more visible and clear. Zooming an image has many wide applications ranging from zooming through a camera lens, to zoom an image on internet e.t.c.

V. APPLICATIONS OF DIGITAL IMAGE PROCESSING

Banking

The uses of OCR vary across different fields. One widely known application is in banking, where OCR is used to process checks without human involvement. A check can be inserted into a machine, the writing on it is scanned instantly, and the correct amount of money is transferred. This technology has nearly been perfected for printed checks, and is fairly accurate for handwritten checks as well, though it occasionally requires manual confirmation. Overall, this reduces wait times in many banks.

Blind and visually impaired persons

One of the major factors in the beginning of research behind the OCR is that scientist want to make a computer or device which could read book to the blind people out loud. On this research scientist made flatbed scanner which is most commonly known to us as document scanner.

Legal department

In the legal industry, there has also been a significant movement to digitize paper documents. In order to save space and eliminate the need to sift through boxes of paper files, documents are being scanned and entered into computer databases. OCR further simplifies the process by making documents text-searchable, so that they are easier to locate and work with once in the database. Legal professionals now have fast, easy access to a huge library of documents in electronic format, which they can find simply by typing in a few keywords.

Retail Industry

Barcode recognition technology is also related to OCR. We see the use of this technology in our common day use.

Other Uses

OCR is widely used in many other fields, including education, finance, and government agencies. OCR has made countless texts available online, saving money for students and allowing knowledge to be shared. Invoice imaging applications are used in many businesses to keep track of financial records and prevent a backlog of payments from piling up. In government agencies and independent organizations, OCR simplifies data collection and analysis, among other processes. As the technology continues to develop, more and more applications are found for OCR technology, including increased use of handwriting recognition.

VI. CONCLUSION

Digital Image Processing is now used in various ways. We have discussed different parts of Image like Resolution, Aspect ratio, ISO. We have also discussed about some attributes of Images like zoom, brightness, edges. We tried to give a concept of Digital Image Processing and the applications of Digital Image Processing.

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