Gujarat Technical University

Design Engineering 2B Semester - 6 (2018-19)

**Title: OPTICAL CHARACTER RECOGNITION SYSTEM**


**Prepared by**

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**Class** :**B.E.3rd Year**

**Semester** : **6th Semester**

**Year** : **2018-19**

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# Flow of Presentation

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# MOTIVATION

- With the advent of computer science we have increasing availability to more powerful computers. Thus by the help of neural network we could train a system to interpret alpha numeric characters.
- Neural Network is the backbone for identification of characters

# INTRODUCTION

- Optical Character Recognition (OCR) is to classify optical patterns corresponding to alphanumeric or other characters.

- It is a type of document image analysis where a scanned digital image that contains either machine printed or handwritten script is input into an OCR software engine.

- OCR works by pre-processing the digital page image into its smallest component parts with layout analysis to find text blocks, sentence/line blocks, word blocks and character blocks.

# Objective :
# Optical Character Recognition

- **Input**: scanned images of printed text
- **Output**: Computer readable version of input contents

There are several existing solutions to perform this task for English text.

The potential benefits of this approach is its flexibility, since it makes no prior assumptions on the language of the text, and it should be possible to extend it to other alphabets.

# ARTIFICIAL NEURAL NETWORK

- A **neural network** can be defined as a model of reasoning based on the human brain. The brain consists of a densely interconnected set of nerve cells, or basic information-processing units, called **neurons**.

- An artificial neural network consists of a number of very simple processors, also called **neurons**, which are analogous to the biological neurons in the brain.

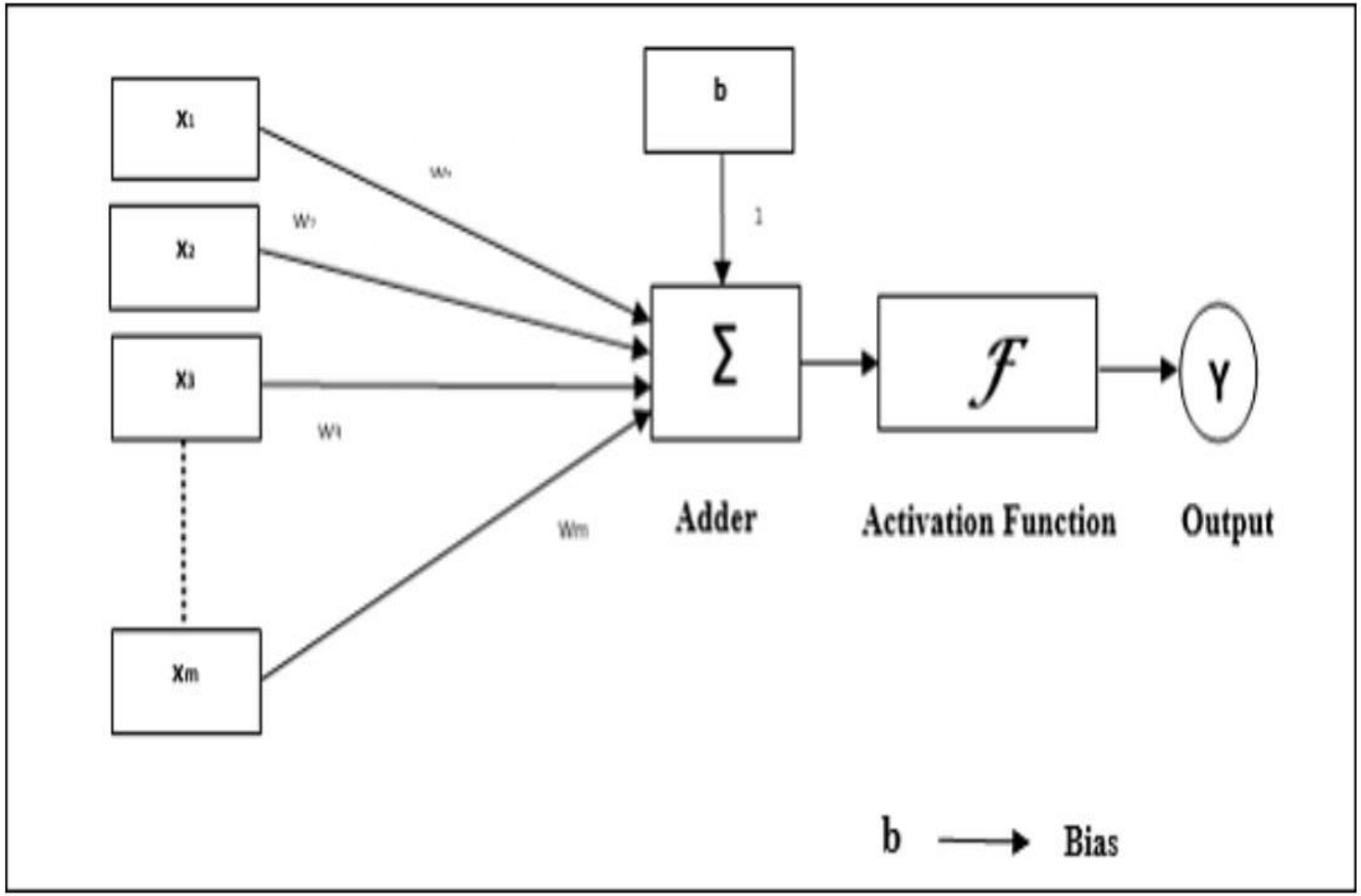



FIG 1. ARTIFICIAL NEURAL NETWORK EXPLANATION

- The neurons are connected by weighted links passing signals from one neuron to another.
- The neuron computes the weighted sum of the input signals and compares the result with a **threshold value**,
- The neuron uses the following transfer or **activation function**:

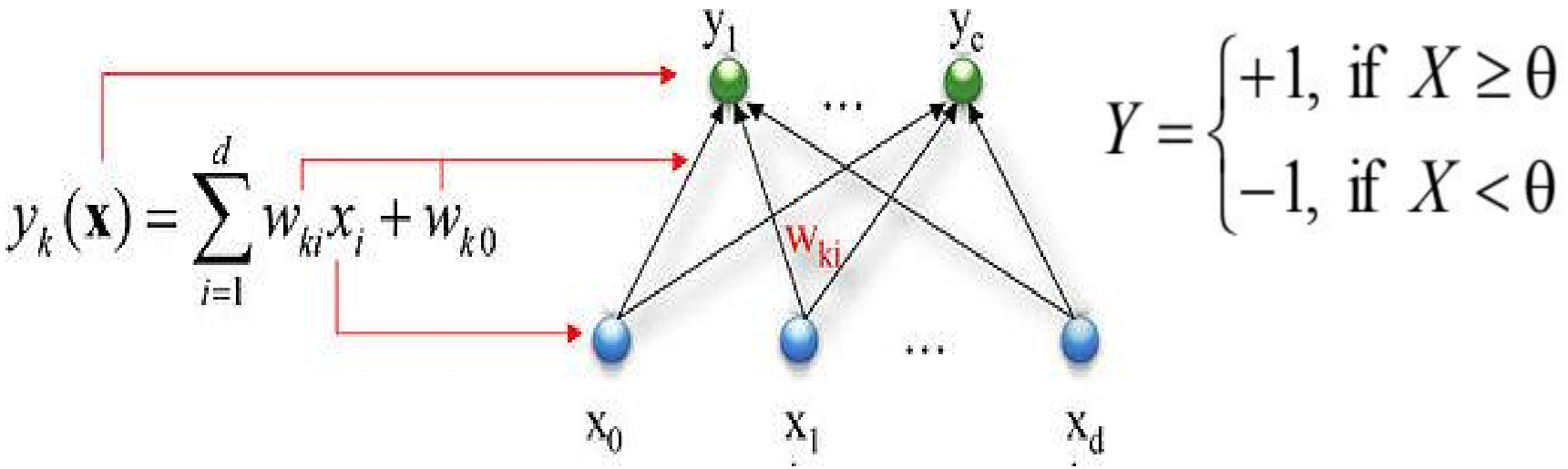



FIG 2. EXPLANATION OF FORMULA

# Feedforward neural network

- A **feedforward neural network** is an artificial neural network wherein connections between the nodes do *not* form a cycle.

- In this network, the information moves in only one direction, forward, from the input nodes, through the hidden nodes (if any) and to the output nodes.

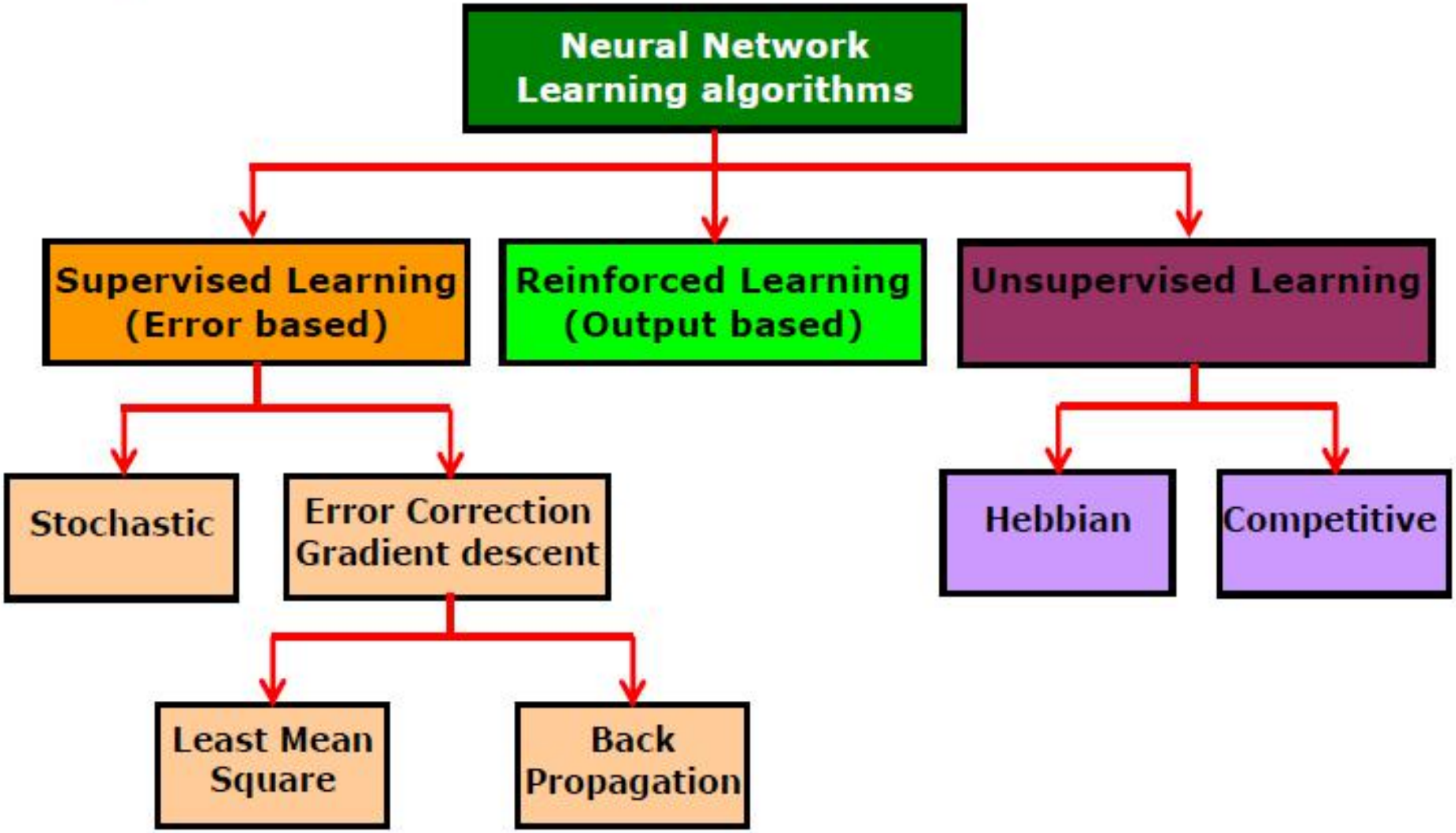



Fig. Classification of learning algorithms

# SUPERVISED LEARNING

- Supervised learning is where you have input variables (x) and an output variable (Y) and you use an algorithm to learn the mapping function from the input to the output.

- It is called supervised learning because the process of an algorithm learning from the training dataset can be thought of as a teacher supervising the learning process.

# REINFORCED LEARNING

- Reinforcement learning refers to goal-oriented algorithms, which learn how to attain a complex objective (goal) or maximize along a particular dimension over many steps; for example, maximize the points won in a game over many moves. They can start from a blank slate, and under the right conditions they achieve superhuman performance.

# UNSUPERVISED LEARNING

- Unsupervised learning is where you only have input data (X) and no corresponding output variables.

- The goal for unsupervised learning is to model the underlying structure or distribution in the data in order to learn more about the data.
- These are called unsupervised learning because unlike supervised learning above there is no correct answers and there is no teacher. Algorithms are left to their own devises to discover and present the interesting structure in the data.

# Work done in DE-IIA

- Completed basic feed forward network algorithm in matlab.

- Trained the network for limited number of characters i.e. A and B.

# Work done in DE-IIB

- Experimented with different neural network algorithms such as back propagation.

- Worked with various data sets such as numbers and different characters. i.e small a-z and capital A - Z.

# Literature Review

Literature review in divied into two sections as followed:

**RECOGNITION**

- Klouver's research on recognition text in PayPal HIP and Ho Co. He researched on License Plate Recognition(LPR) used Templates Matching to recognize the character in image.
- Klouver detailed the matching classifier into four types of classifier that are

1. Pixel Counting
2. Horizontal Projection
3. Vertical Projection
4. Template Correlations.

# Literature Review

**SEGMENTATION**

- Study on Malaysian License Plate Recognition by Othman proposed a modal specifically to detect and recognize the text in Malasian license plate.

- For segmentation, connected components method has been proposed however this method only can use if the license plate are single row license plate.

# Software Requirement

Matlab R2012 or greater

# BLOCK DIAGRAM

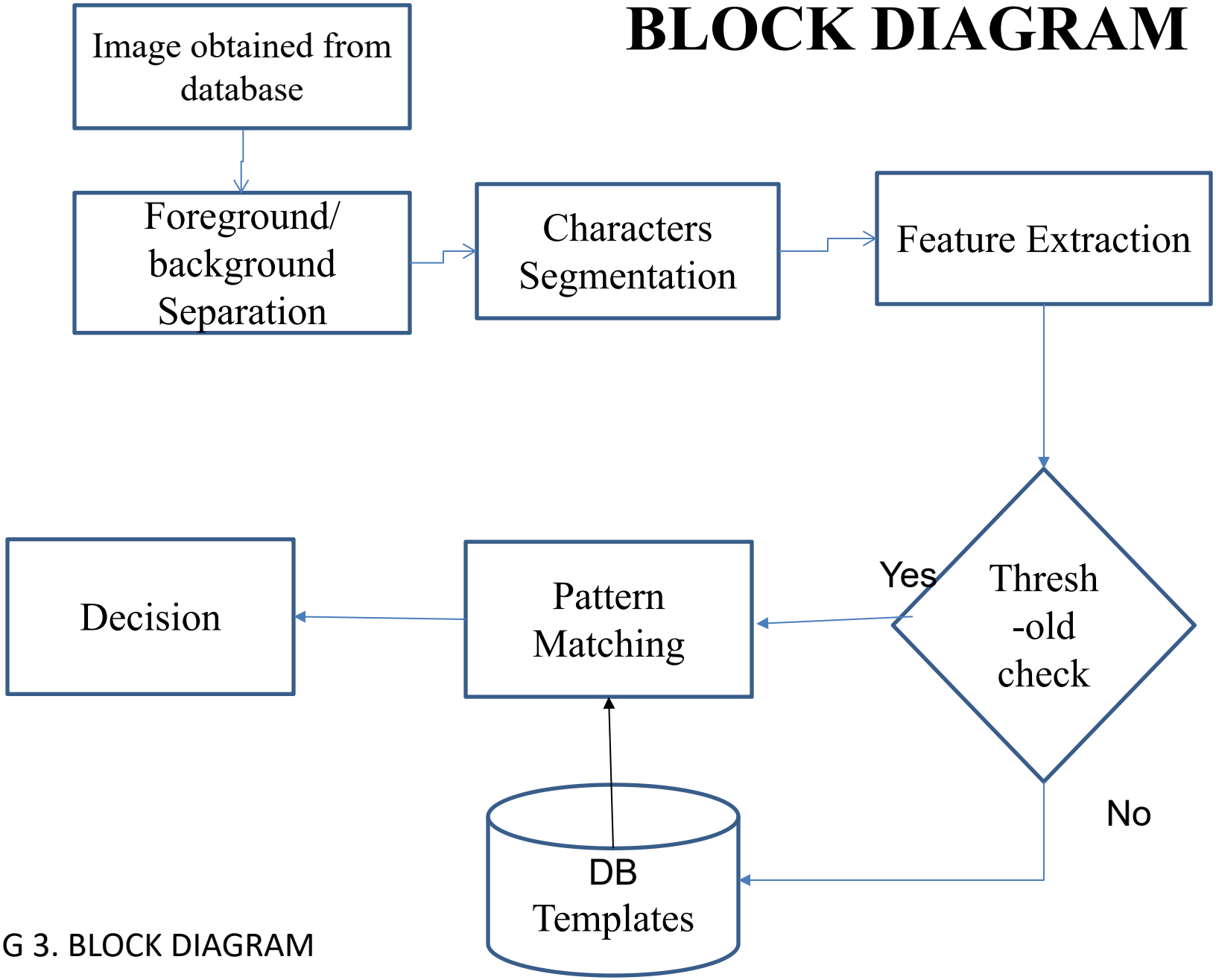
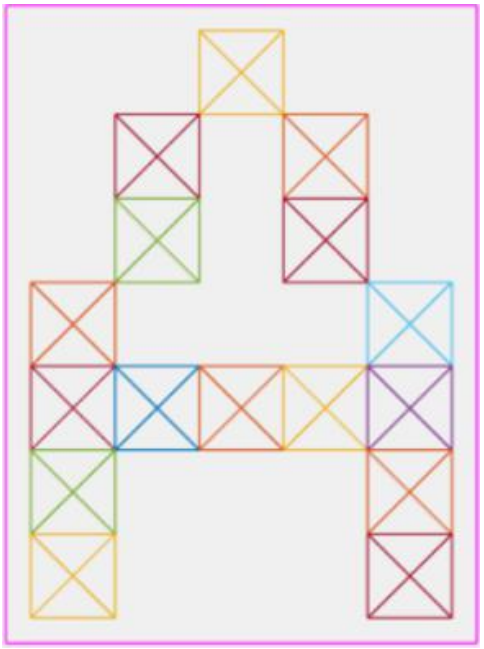
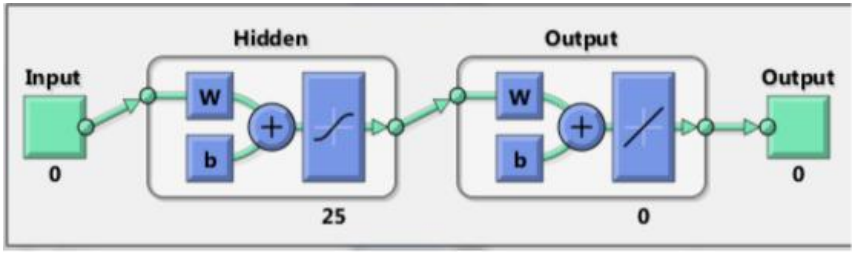



FIG 3. BLOCK DIAGRAM

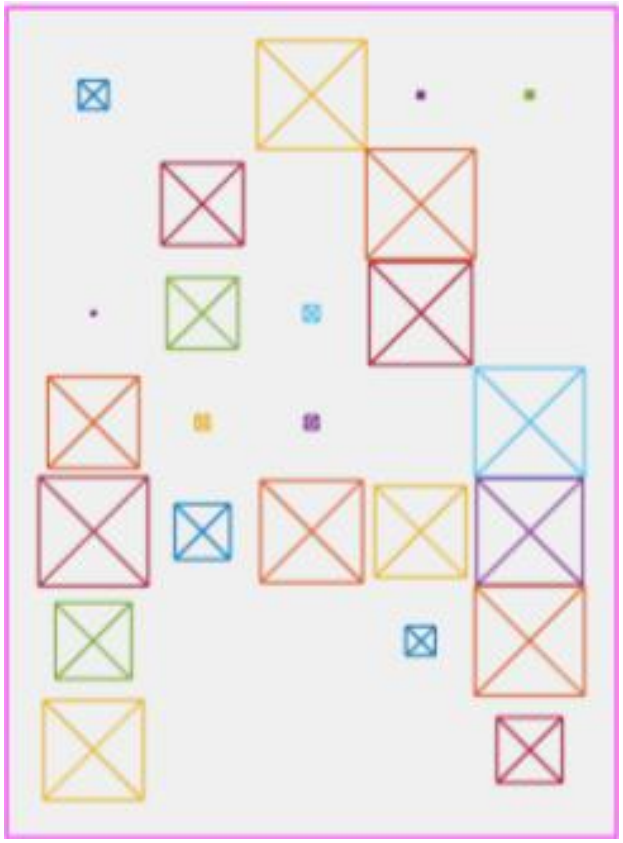
# Results – 2A



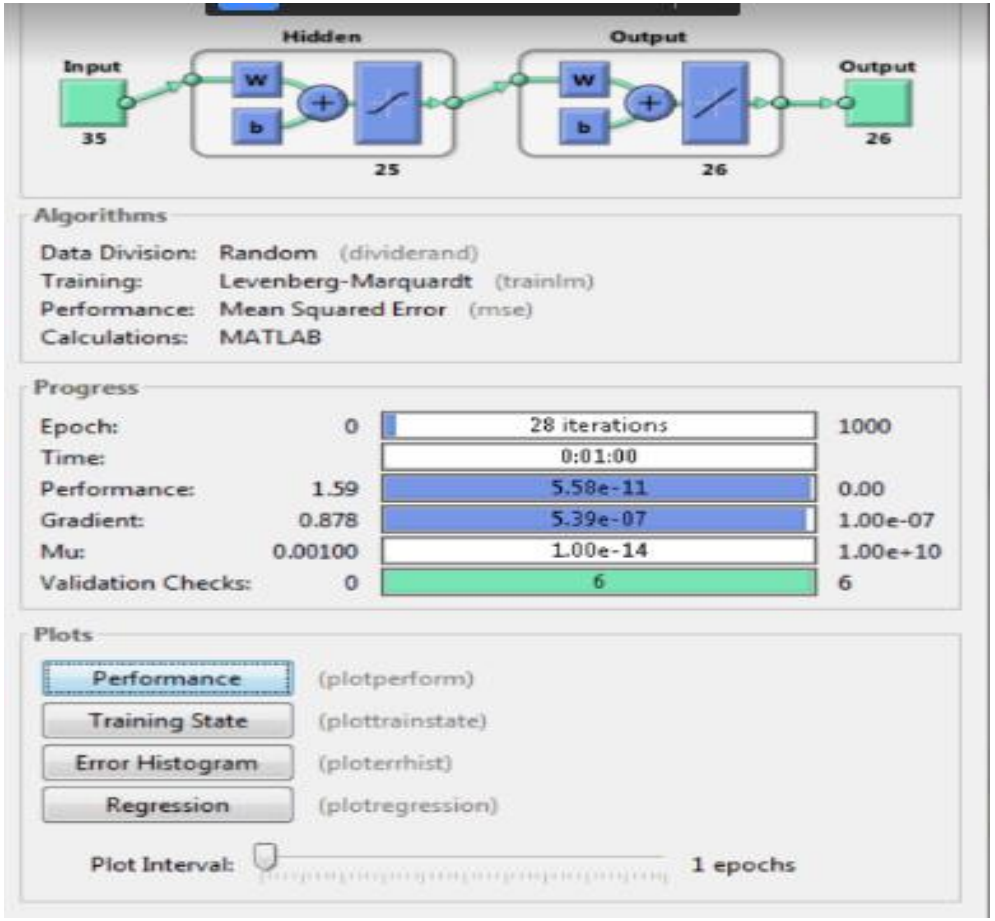
Input to ANN without noise




Neural Chart for 0 Noise

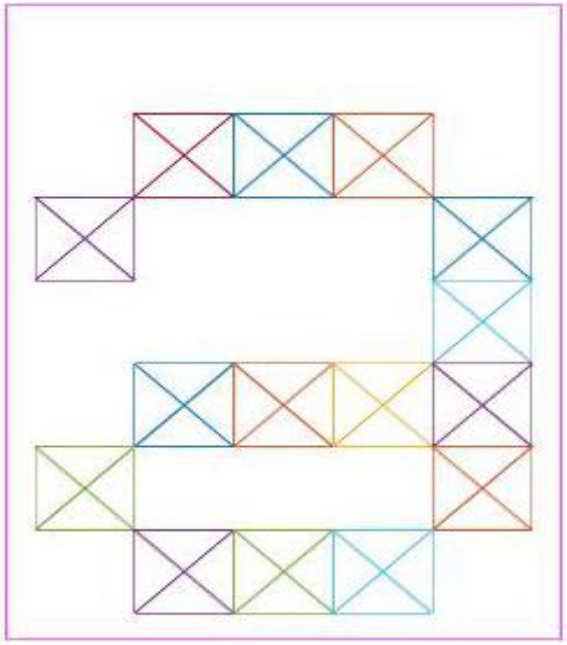


Input With
Noise to ANN

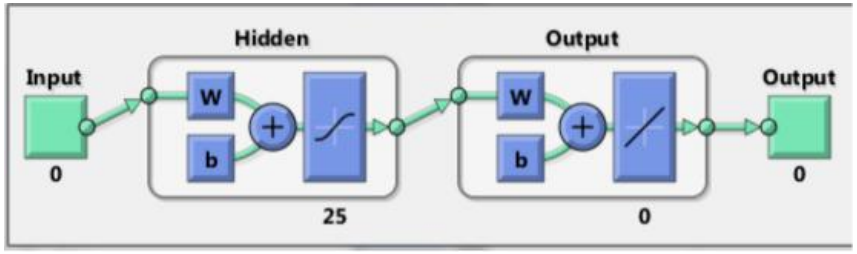



Neural Chart for
Noise Input

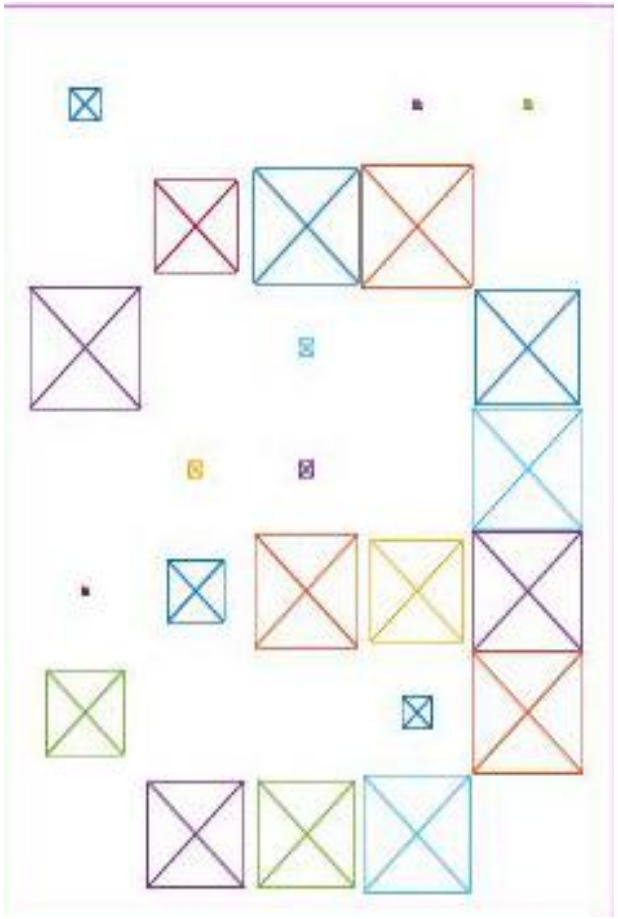
# Results – 2B



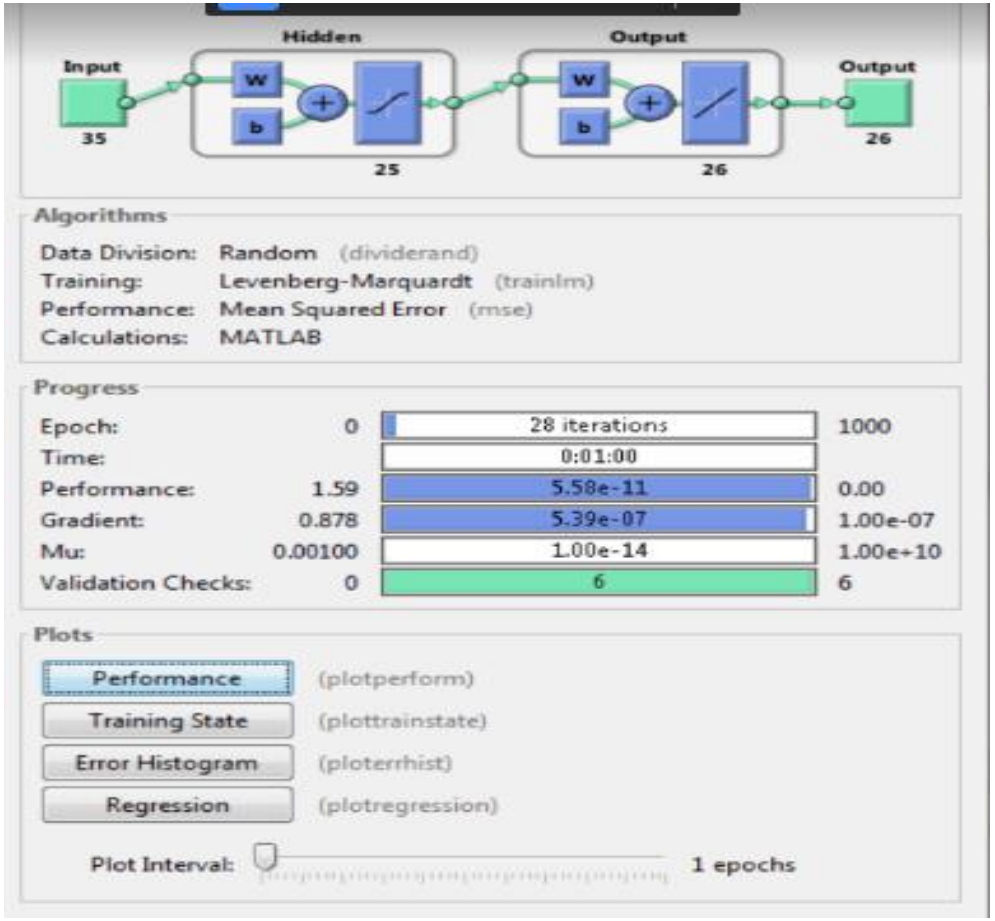
Input to ANN without noise




Neural Chart for 0 Noise

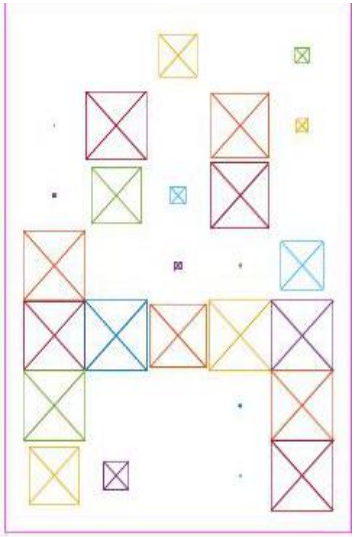


Input With
Noise to ANN

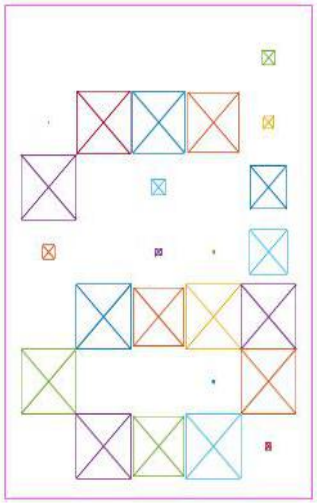


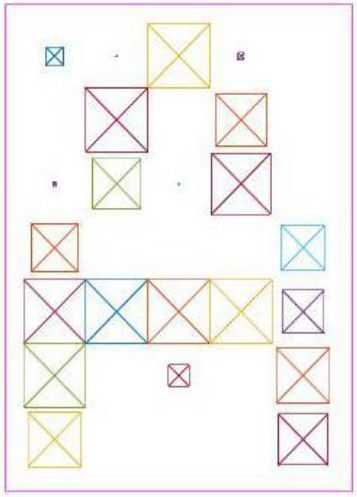

Neural Chart for
Noise Input

# Combined results for different noise levels

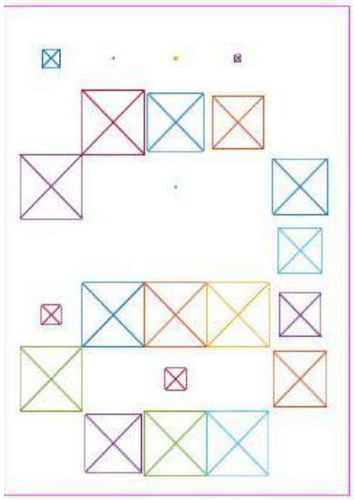


Noise level 40

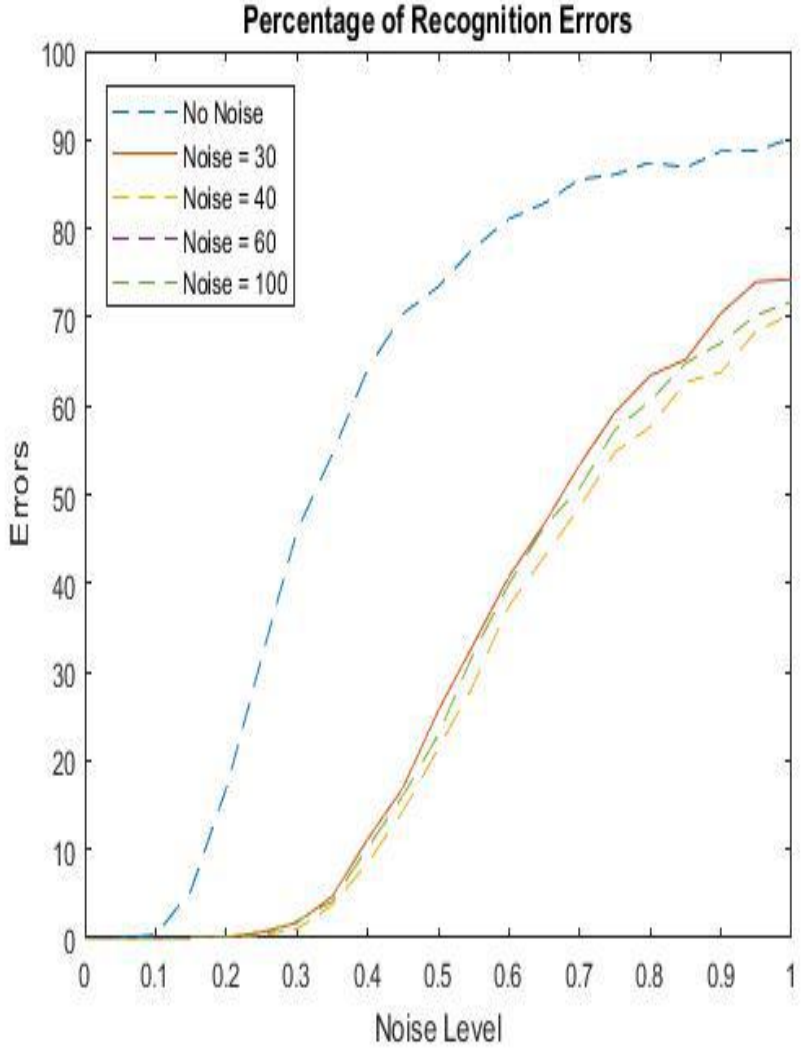


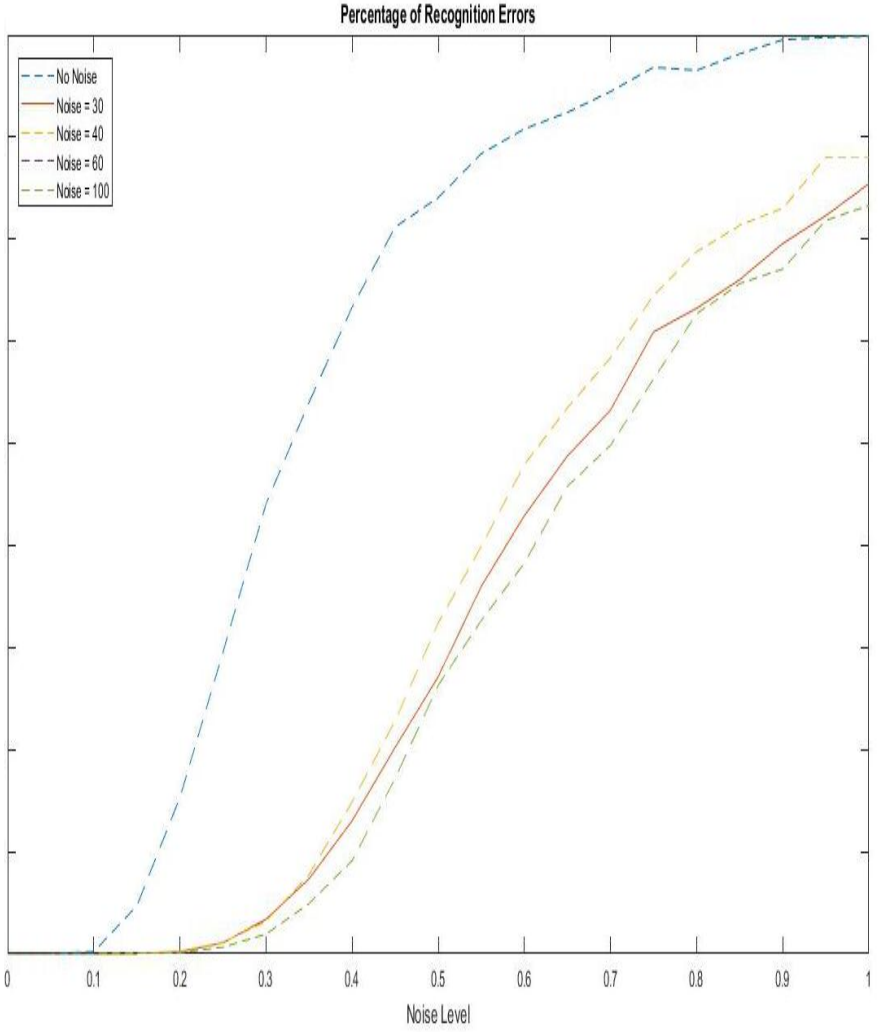


Noise level 60



# Work done in 2A vs 2B



# Summary

- During this entire Design Engineering session we learned about various neural networks.
- Studied different algorithms.
- To achieve more efficiency we will require a more robust network solution such as CNN.

# References


[1] Christine Guillemot and Olivier Le Meur , " IMAGE INPAINTING OVERVIEW AND RECENT ADVANCES ," *IEEE SIGNAL PROCESSING MAGAZINE*, JANUARY 2014

[2] M. Bertalmio, L. Vese, G. Sapiro, and S. Osher, "Simultaneous structure and texture image inpainting," *IEEE Trans. Image Processing, vol. 12, no. 8, pp. 882–889,* Aug. 2003.

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[6] A. Criminisi, P. Pérez, and K. Toyama, "Region filling and object removal by examplar-based inpainting," *IEEE Trans. Image Processing, vol. 13, no. 9, pp. 1200*–1212, Sept. 2004

[7] M. Bertalmio, G. Sapiro, C. Ballester, and V. Caselles, "Image inpainting," in Proc. ACM SIGGRAPH, July 2000, pp. 417–424.

Thank you