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NAT NATIONAL UNIVERSITY OF COMPUTER AND EMERGING SCIENCES

(KARACHI CAMPUS)

Department of Computer Science (CS)

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**Artificial Intelligence**

**Project Proposal: MNIST Digit Classification with Neural Network**

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## Abstract

Our MNIST Digit Classification project aims to develop a neural network model capable of accurately identifying handwritten digits in the MNIST dataset. The dataset consists of 60,000 training images and 10,000 test images of handwritten digits from 0 to 9.

The project will follow a supervised learning approach, where the neural network will be trained using the labeled training data. The neural network architecture will consist of multiple layers, including an input layer, one or more hidden layers, and an output layer. The model will use backpropagation to optimize the weights and biases of the neurons in the network.

Various neural network architectures will be explored, including fully connected neural networks, convolutional neural networks (CNNs), and recurrent neural networks (RNNs), to determine the optimal architecture for the problem at hand. The model's performance will be evaluated using metrics such as accuracy, precision, recall, and F1 score.

The project will be implemented using Python and the Keras library. The Keras library provides a user-friendly interface to create and train neural networks efficiently. The project will also make use of visualization tools such as Matplotlib and TensorBoard to visualize the neural network's performance.

The successful completion of this project will result in a high-performing neural network model capable of accurately classifying handwritten digits. This model can be used in various applications, such as OCR systems and automated postal sorting.

## Objectives

The main objective of building this classifier is to train our neural network in such a way that it will be able to detect the input image. Our goal is to use these input images to develop AI-based approaches to predict and detect what particular digit is represented in the input image. Our input image will consist of digits from 0 to nine and our trained neural network will have to detect which digit is represented in the image. Our neural network is a single-digit detection neural network. If we are feeding a handwritten digit in this neural network, this trained neural network will successfully tell us what that digit is. Hence, once we train our neural network to detect the digit correctly, it is then tested with some test data. This whole process of training and testing will help us in building a single-digit detection classifier.

Features

Some dependencies needed are mentioned below

* The NumPy library will produce the array from the images
* Matplotlib, numpy arrays will be visualized using this library. Once we plot the array on matplotlib we can see which image we have.
* Seaborn is also used for visualization
* cv2 is an open computer vision library. One of the important libraries used for image recognition tasks.
* TensorFlow and Keras
* Randomseeds
* Python Imaging Library (PIL)
* Confusion matrix from TensorFlow.

## Method

1. Data Collection: The dataset is available on Keras itself. MNIST dataset from Keras Library.
2. Image Processing: All the images will be converted to one single particular dimension then the RGB images will be converted to Grayscale images. We will further build the labels for these images.
3. Train Test Split: The dataset will be divided into training and testing data . Training data will be used to train the model then after the training, the data will be fed into the neural network. This trained neural network will classify the images on digits and produce the handwritten digit prediction.