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Faculty of Computers & Artificial Intelligence
Faculty of Computers and Artificial Intelligence

Computer Science Department

2021/2022

CS 396 Selected Topics in CS-2

Research Project

Report Submitted for Fulfillment of the Requirements and ILO's for Selected Topics in CS-2 course for Fall 2021

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Paper Details

Author Name:-

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Paper Name:-

An Architecture Combining Convolutional Neural Network (CNN) and Support Vector Machine (SVM) for Image Classification.

Publisher Name:-

Cornell University

Year of Publication:-

Submitted on 10 Dec. 2017 and Ver.2 Revised 7 Fed 2019

The Data set Used:-

MNIST[10] is an established standard handwritten digit classification dataset. It is a 10-class classification problem having 60,000 training examples.

The Implemented algorithms

An Architecture Combining Convolutional Neural Network (CNN) and Support Vector Machine (SVM) for Image Classification.

It's Results

Test accuracy of CNN-Softmax: 99%

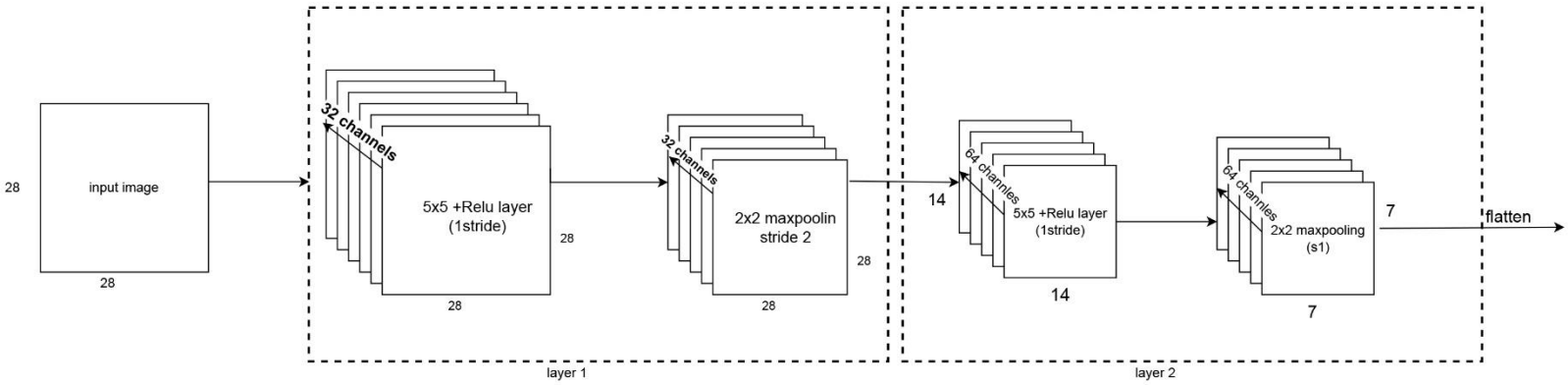
Project Description

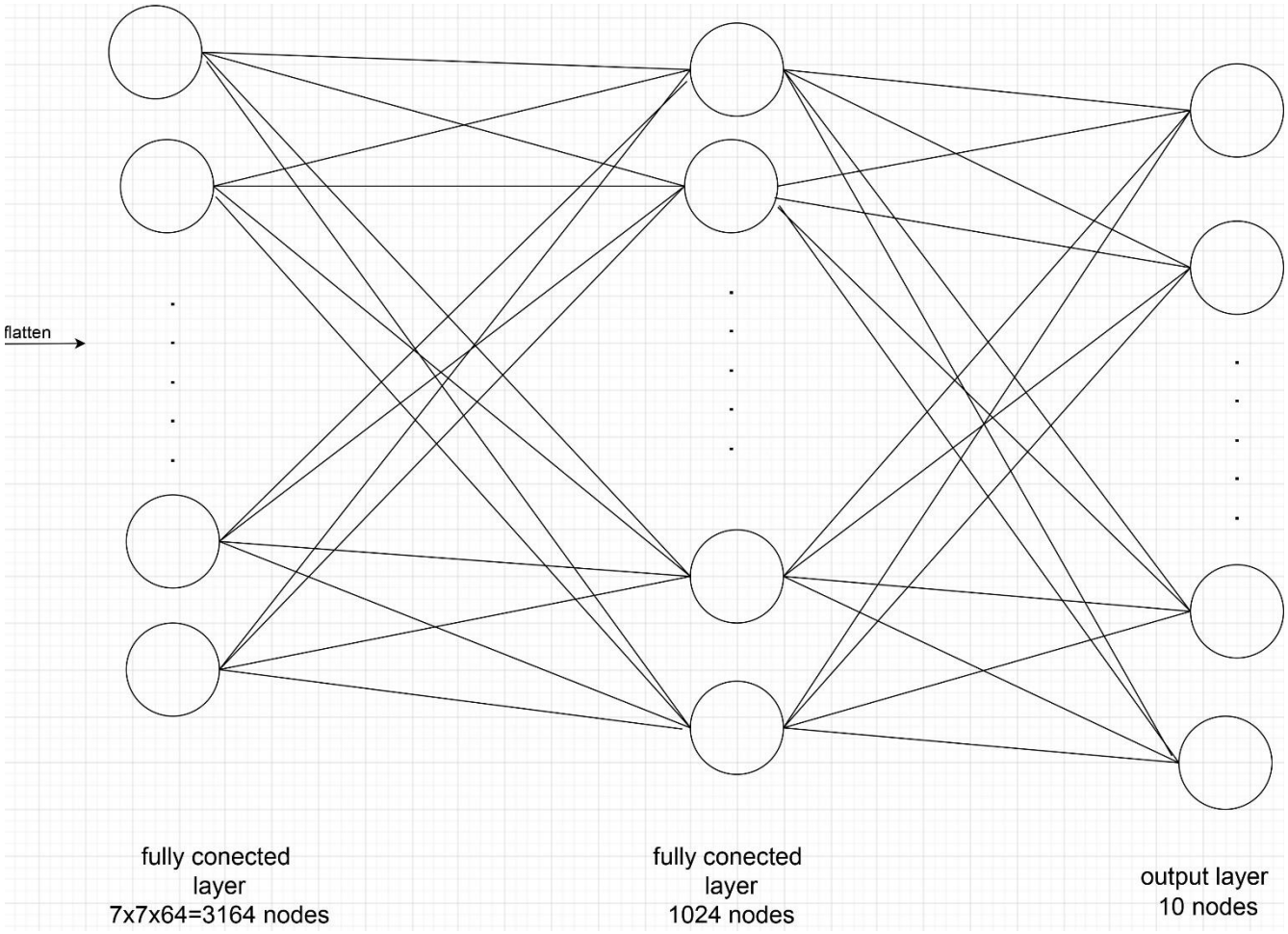
General Information on the selected dataset:

- **Name Of The Dataset Used:** Mnist Image Dataset(PNG)
- **The Link Of Dataset:** https://intuitive-robotics.tistory.com/54
- **The total number of samples in the dataset:** 60,000 samples (PNG)
- **The dimension of images:** 28 X 28 Pixels
- **Number of classes and their labels:** **10** Classes , labels [**0**,**1**,**2**,**3**,**4**,**5**,**6**,**7**,**8**,**9**]

Implementation details:

- **The ratio used for training, validation, and testing:**
  - Training: 60% of dataset = 36,000 samples (PNG).
  - Validation: 20% of dataset = 12,000 samples (PNG).
  - Testing: 20% of dataset = 12,000 samples (PNG).
- **A block diagram of your implemented mode:**





- **Hyperparameters used in your model:**
  - Input layer is 28 x 28 Pixels
  - Output layer is 10
  - Activation Functions is “relu” , “Softmax”
  - Optimizer="adam"
  - Loss="sparse_categorical_crossentropy"
  - Epochs=10

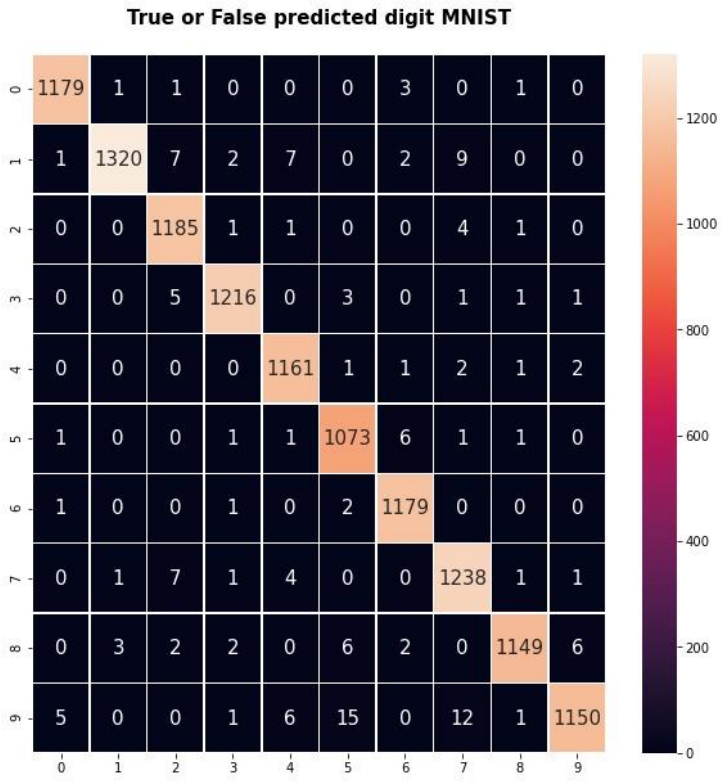
Results details:

- **Training Results:**
  - Accuracy: 0.9985 (99.8%)
  - Loss: 0.0033
  - Val_accuracy: 0.9877 (98.77%)

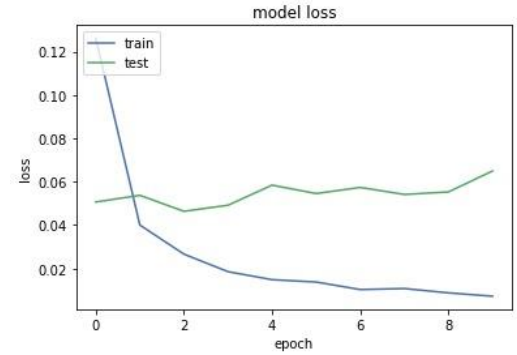
- Val_loss: 0.0649

- **Testing Results:**
  - Accuracy: 0.9875 (98.7%)
  - Loss: 0.0673

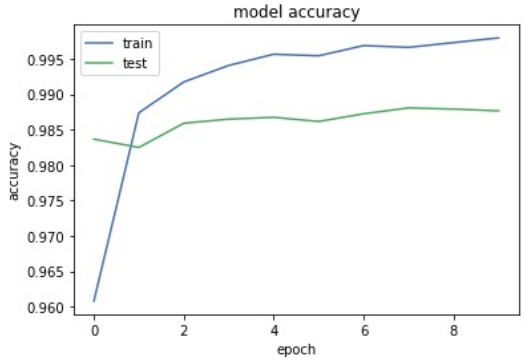
```
Epoch 10/10
1125/1125 [==============================] - 53s 47ms/step
- loss: 0.0072 - accuracy: 0.9980 - val_loss: 0.0649 -
val_accuracy: 0.9877 - ETA: 44s - loss: 0.0033 - accuracy:
0.9985
375/375 [==============================] - 6s 16ms/step -
loss: 0.0673 - accuracy: 0.9875
```



Confusion Matrix



Loss Plot



Acc. Plot