Hand-Written Digit Recognition

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Project Description

Hand-written Digit Recognition

It is a project based on TensorFlow and Python using MNIST dataset.
Before computers existed all the information was stored in written form, this is very efficient form of storage as the paper information cannot be stored for very long time and can lost or be destroyed. On the contrary information on computers is stored safely for long time and multiple copies of same information can be made easily. Thus, after inventing the computers lot of money was wasted in manual labor for converting this paper information into digit information.
Instead, Machine Learning can be used to identify and convert this paper information into digit information without human intervention or manual labor.
It is a Machine Learning open-source framework introduced by Google in 2015.

My project is just an introduction to this approach.

What is TensorFlow???

It is a Machine Learning open-source framework introduced by Google in 2015.
Latest version of TensorFlow is 2.6.1 (1st Nov 2021).
It is used to build various Machine Learning and Deep Learning models.
Developed by Google Brain Team.
It is one of the most in-demand tools used by ML and AI engineers.

What is MNIST Dataset:

It is a subset of NIST dataset which contains (A-Z), (a-z), (0-9) all black and white images. It is dataset of handwritten digit (0-9) with various images in 28 x 28 pixels.

Image Processing:

Image processing is a very wide field within computer science which deals mainly with analyzing images and trying to get some information out of them. The image to be processed is imported then analyzed using some computations, which by the end, results either in an image with a better quality or some of the characteristics of this image depending on the purpose of this analysis. This is a very wide field within computer science, which also has several other subfields of which optimal Digit Recognition that we will be mainly dealing with throughout this project

Our Goal (My Project):

My main goal with this project is to train my model as much as possible so that it can recognize any handwritten (using MS Paint) digit between 0 to 9 with high accuracy and correctly.

Abstract and Dataset

Abstract:

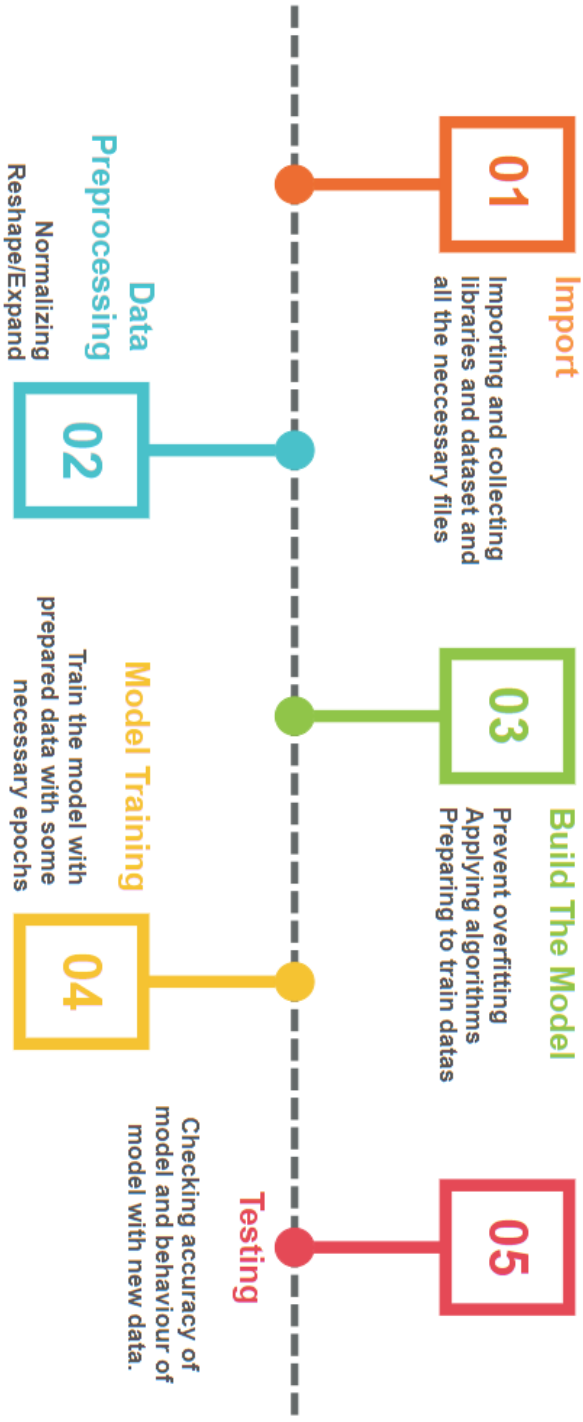
Total Labels	70,000
Total Digits	10
Number of Training Labels	60,000
Number of Testing Labels	10,000
Associated Tasks	Recognition
All Digits Counts in Dataset	
0	6,903
1	7,877
2	6,990
3	7,141
4	6,824
5	6,313
6	6,876
7	7,293
8	6,825
9	6,958

Data Set Link : MNIST Dataset | Kaggle

Original Code Link(Google Collab):
https://colab.research.google.com/drive/1v2GxOZkPa8642MlKGhOTmZYYxiwFL-yY?usp=sharing

GitHub Link :
https://github.com/sudeep0503/HandwrittenNumber_Recognition_using_Tensorflow_Keras

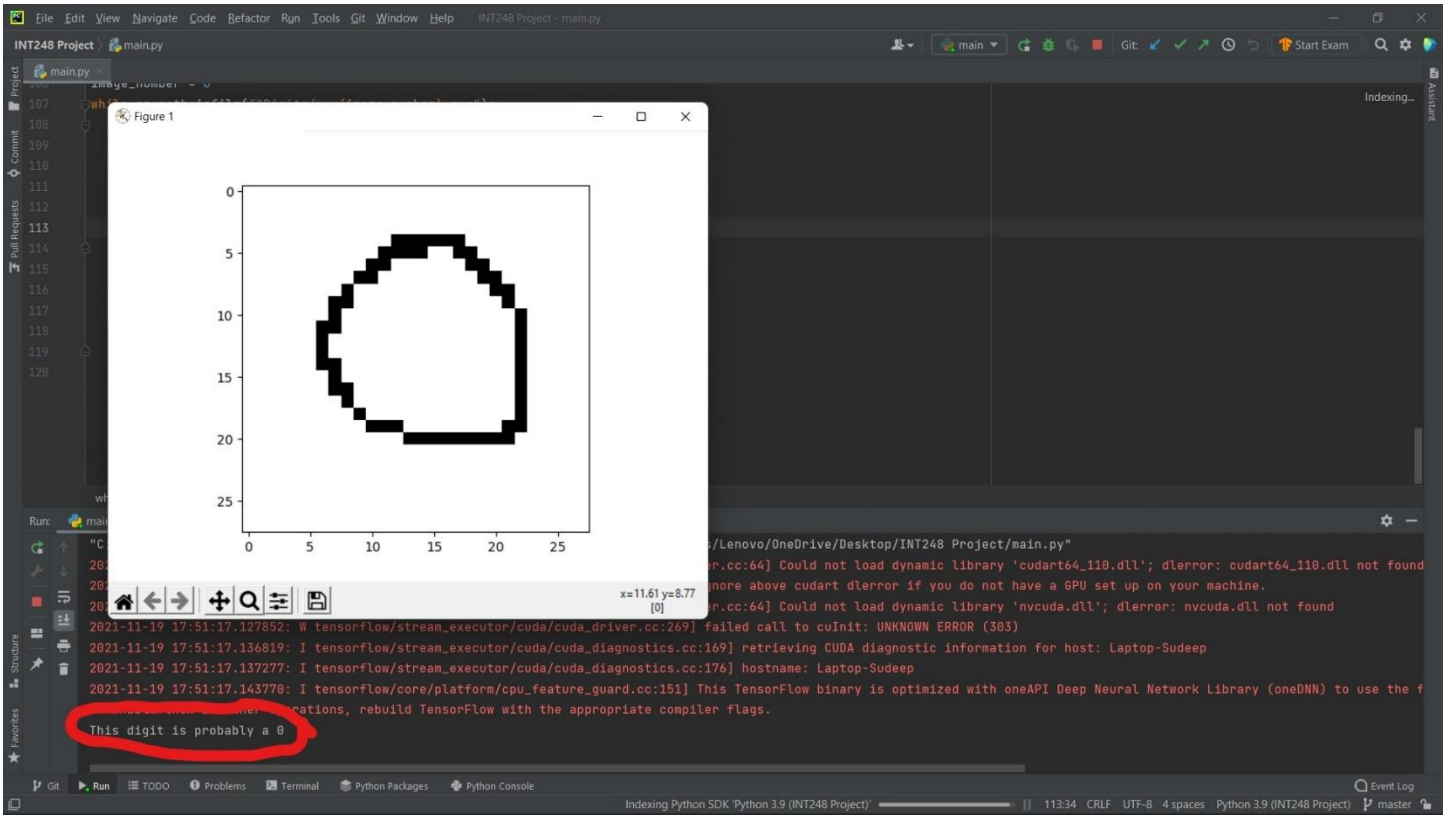
Methodology



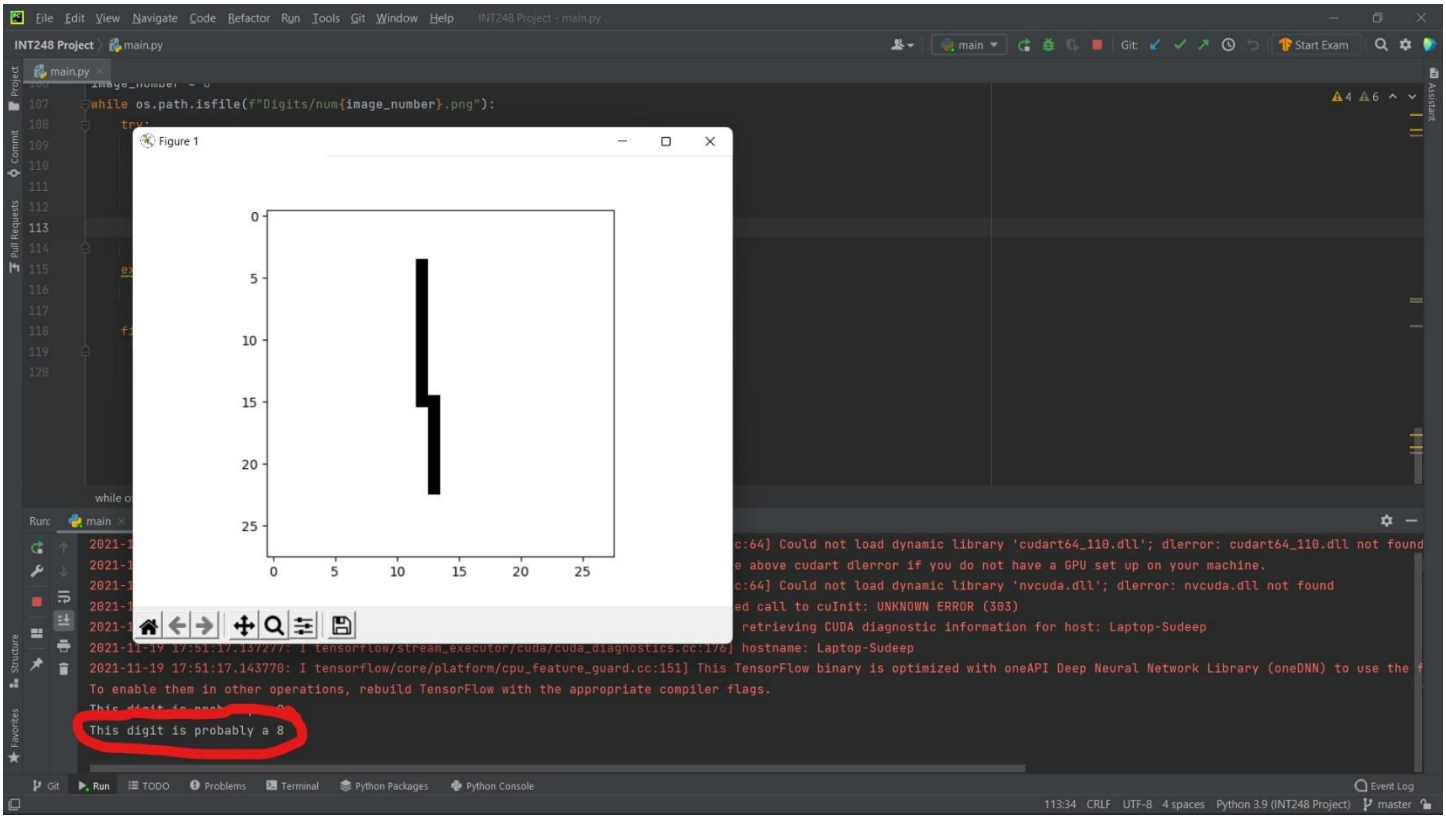
Input Layer
784
Hidden Layer 1
128
(relu)
Hidden Layer 2
64
(relu)
Output Layer
10
(softmax)
Loss Layer
(cross-entropy)

Result and Experiment Analysis

Trying Number 0:



Trying Number 1:



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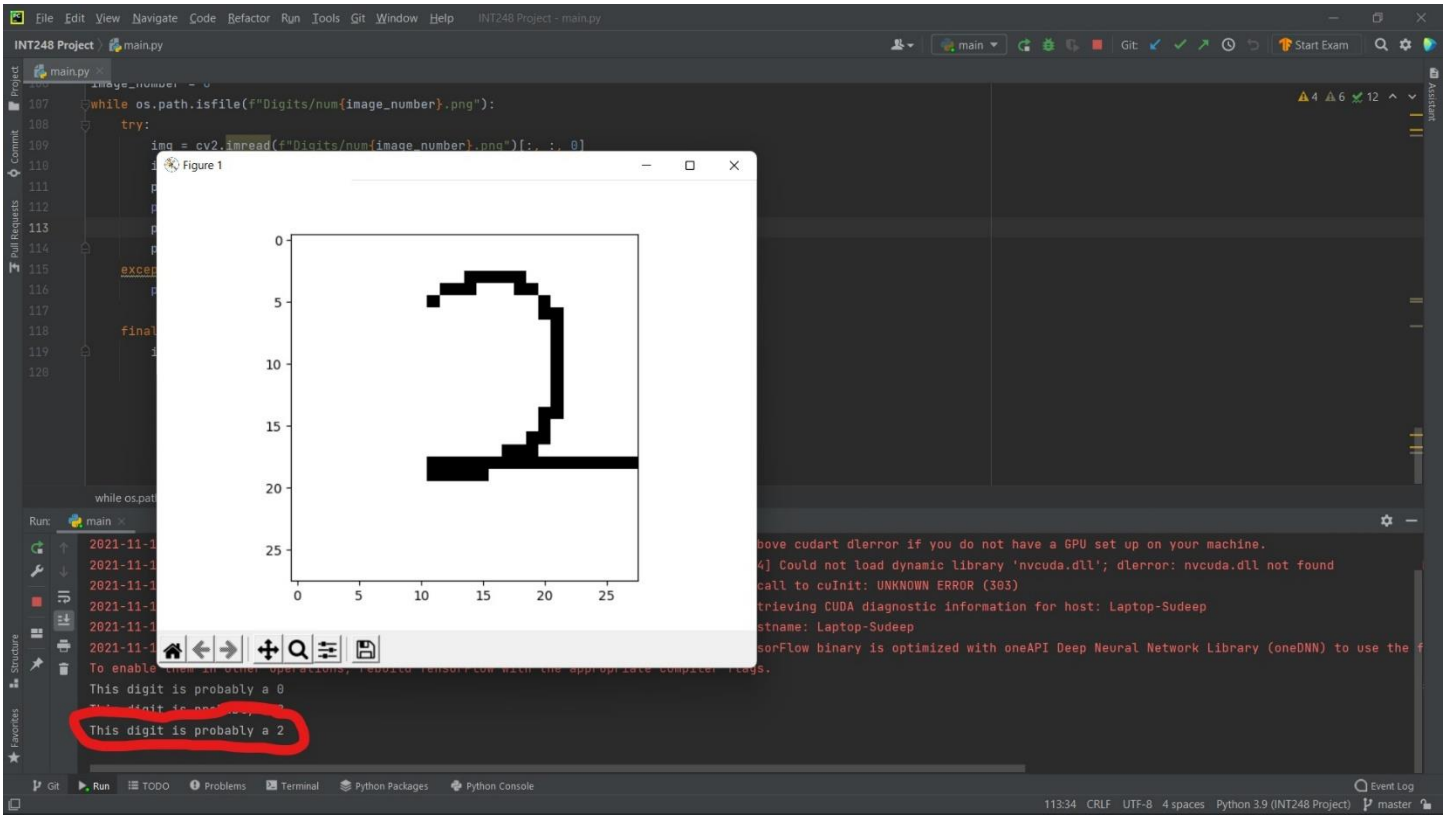

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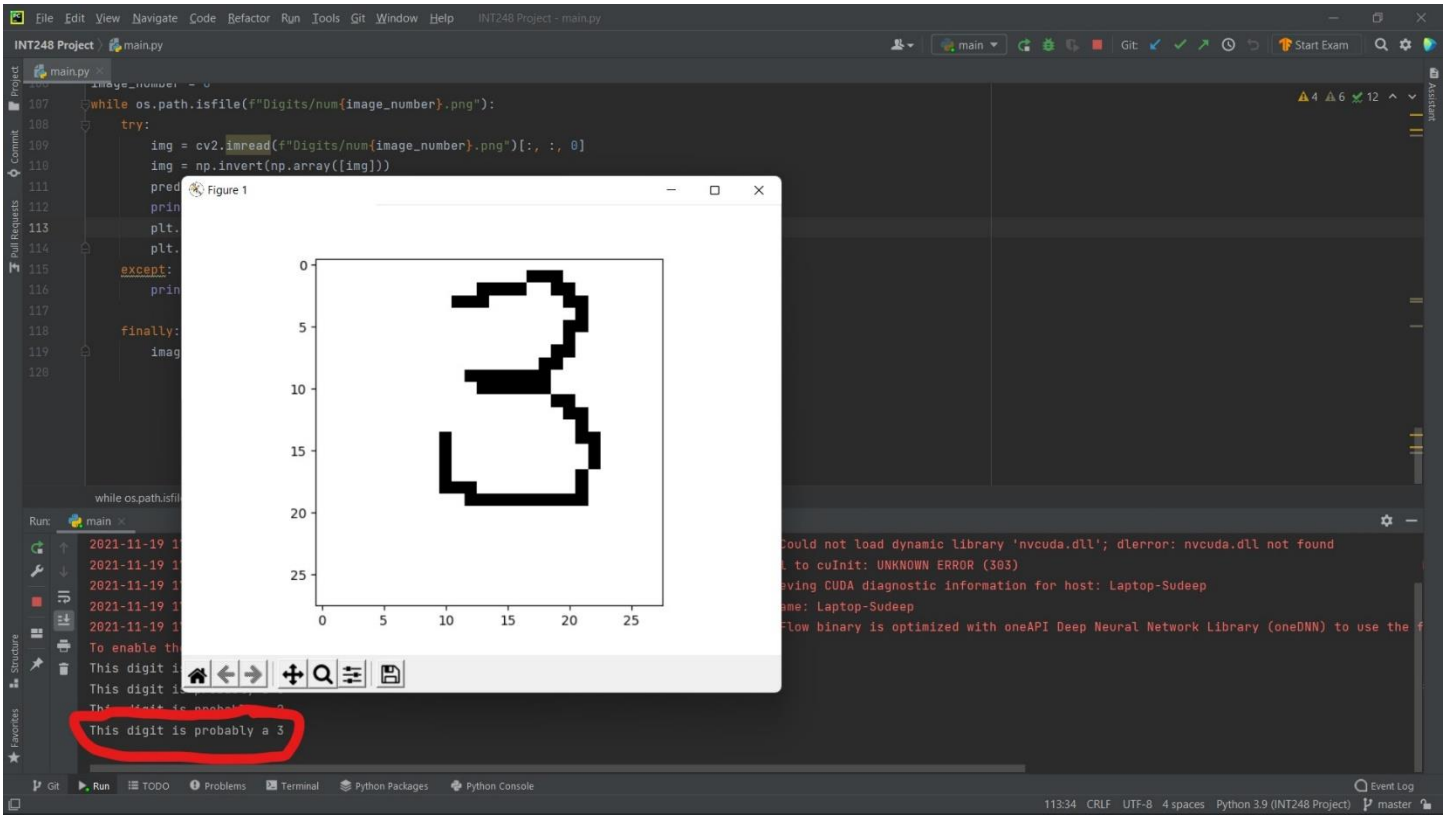
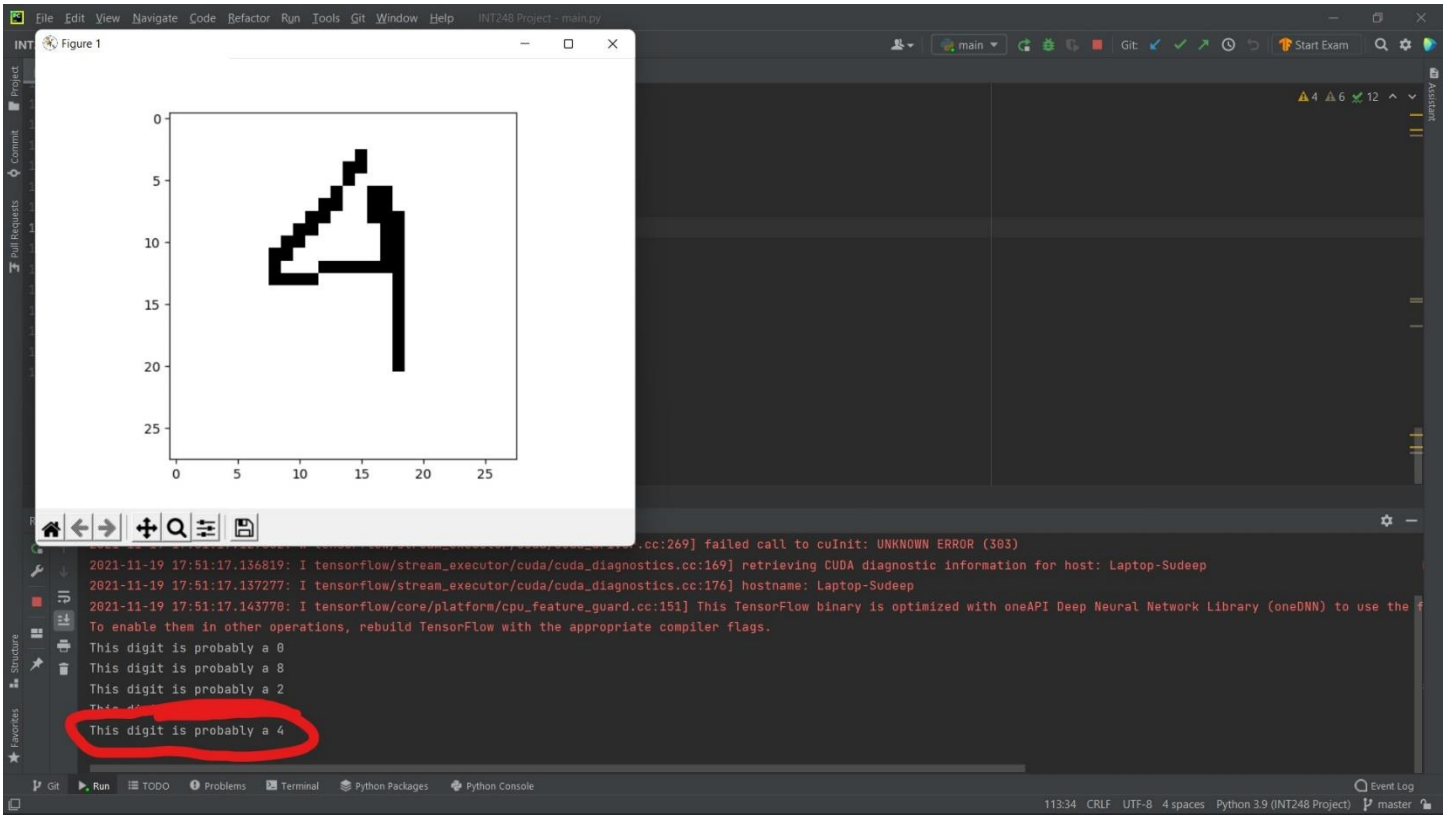


Trying Number 4:



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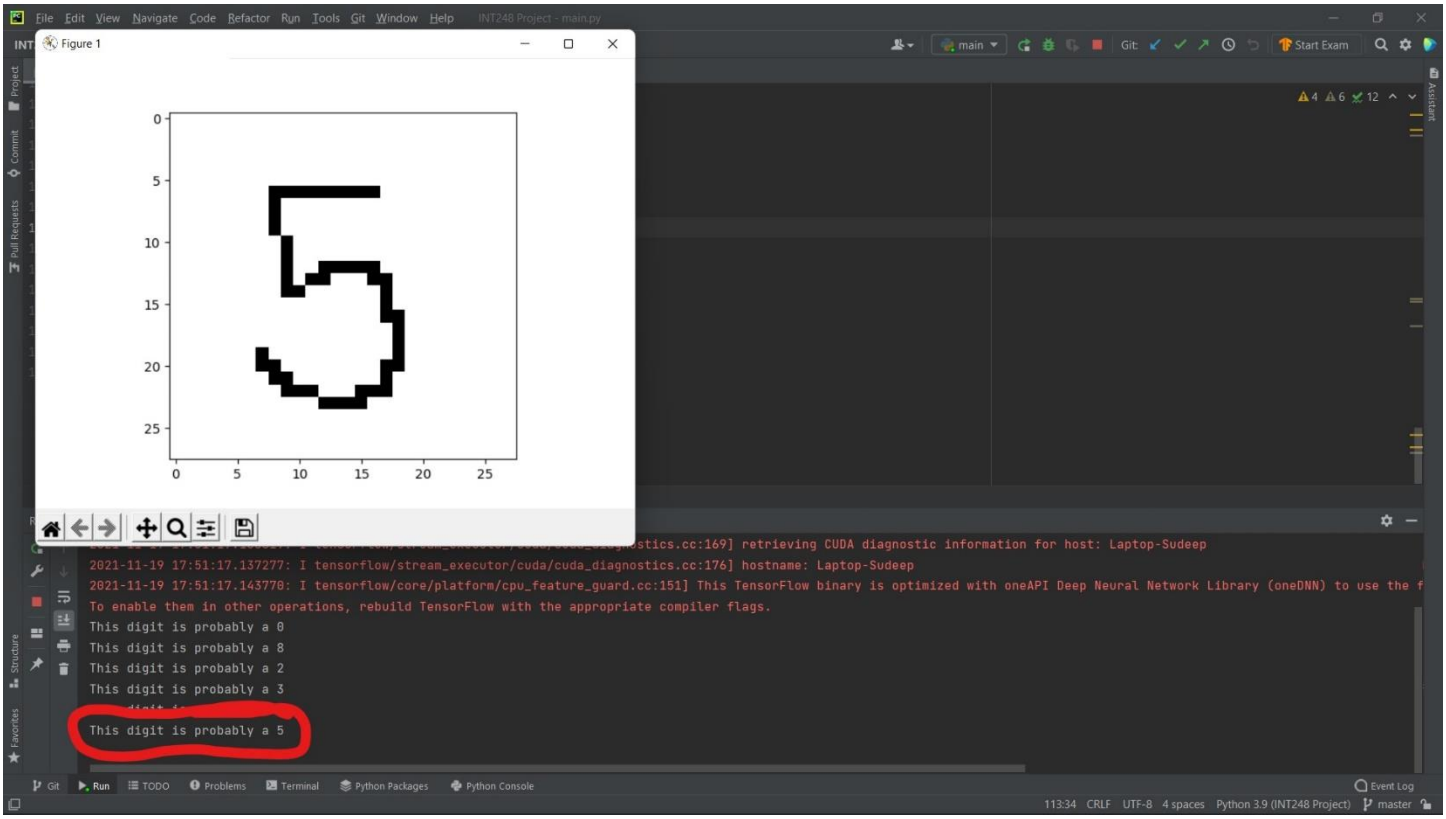

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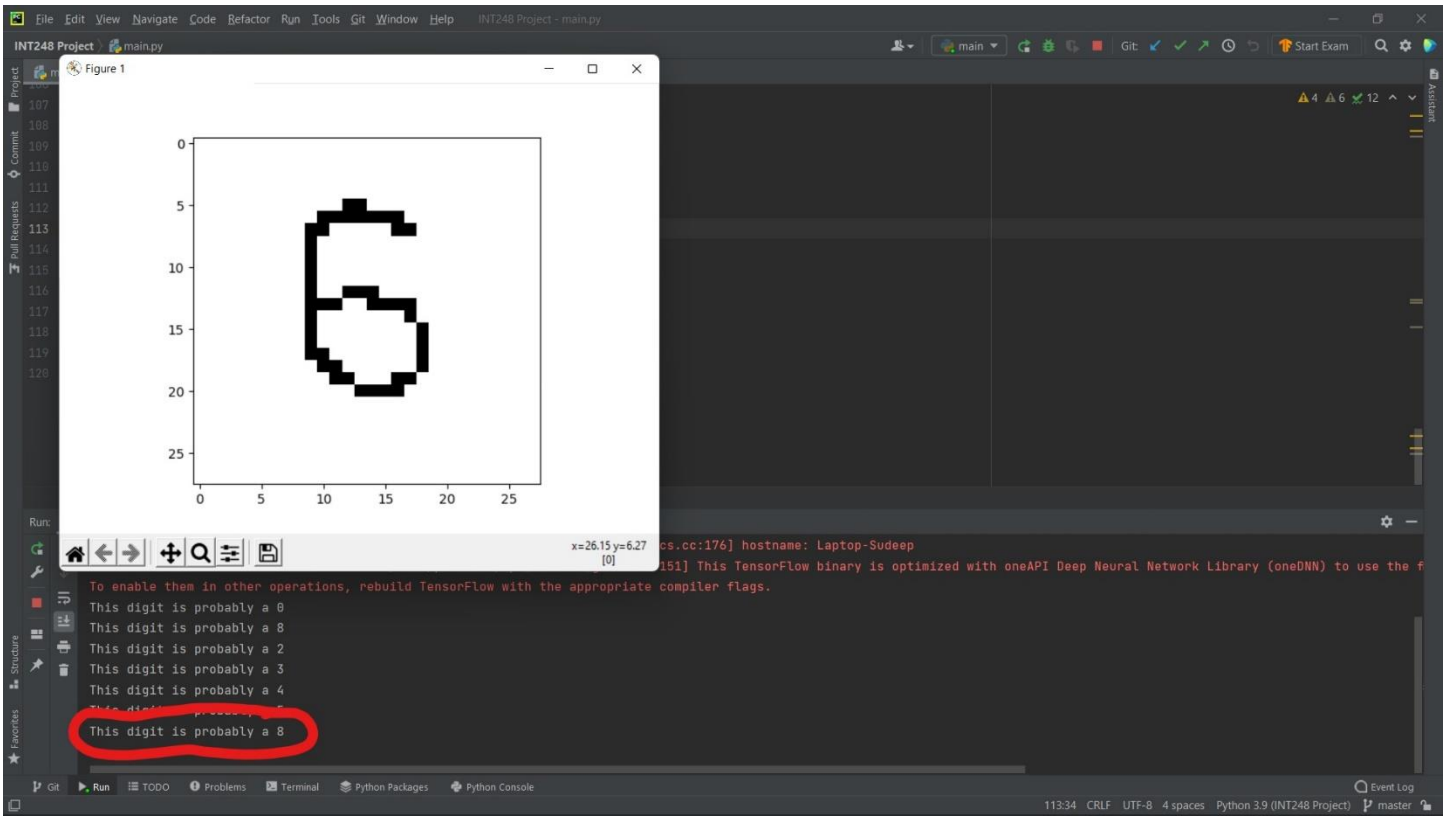

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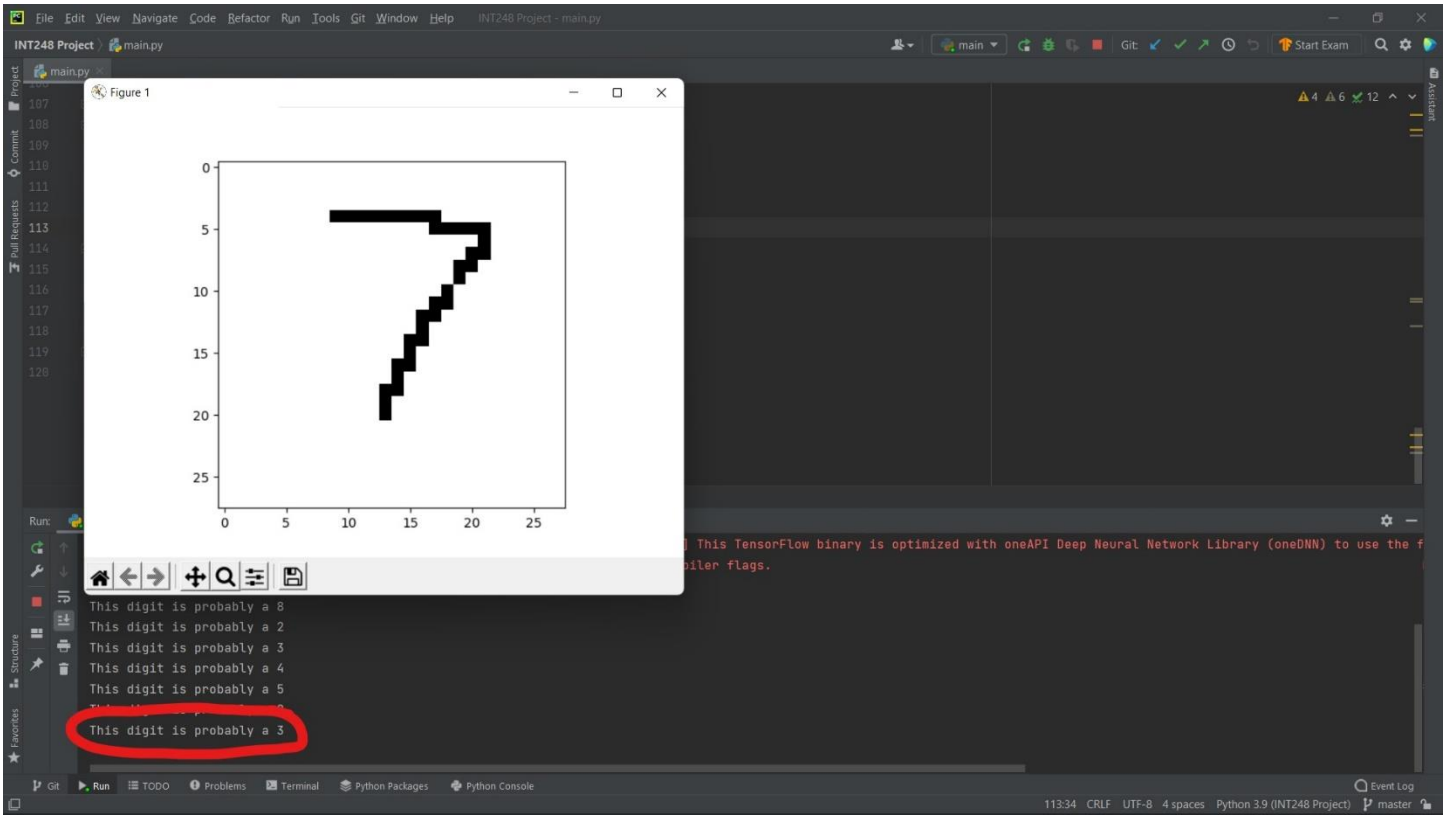

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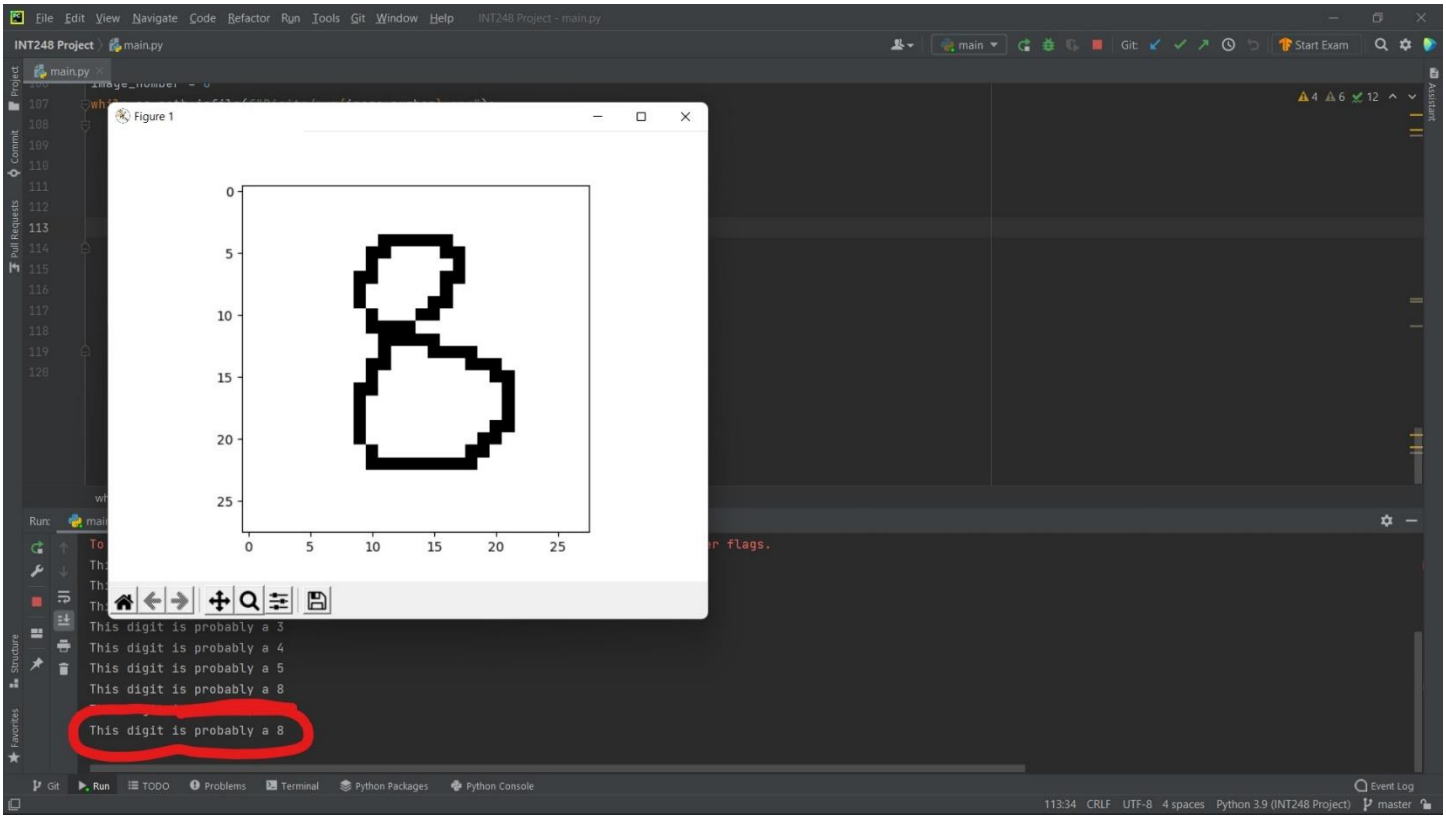
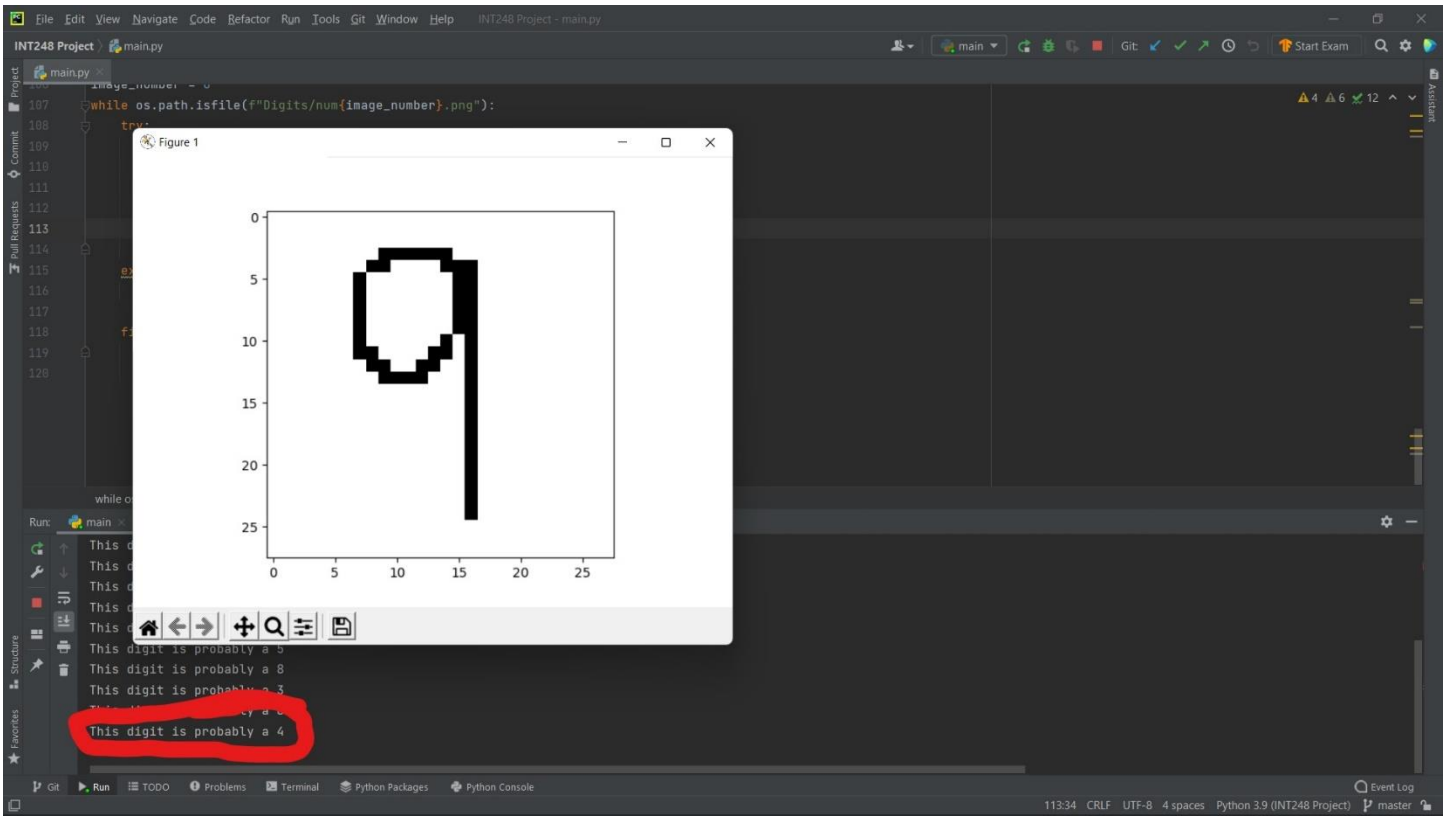


Trying Number 9:



Conclusion & Future Scope

Future Scope:

Extend the model to work on NIST dataset.
Increase the accuracy further by implementing a greater number of hidden layers AND/OR epochs.
Detect custom hand-written digits.
Use CNN with less layers to get better accuracy.

Conclusion:

The hand-written digit has proved to be of a fairly good efficiency with Sequential model.
It works much better than any other algorithm with high
Accuracy rate(Training) of 99.21%, and
Testing loss of 0.05%.

References

Dataset : MNIST Dataset | Kaggle

Original Code Link(Google Collab):
https://colab.research.google.com/drive/1v2GxOZkPa8642MlKGhOTmZYYxiwFL-yY?usp=sharing

GitHub Link :
https://github.com/sudeep0503/HandwrittenNumber_Recognition_using_Tensorflow_Keras

Wikipedia:
Handwriting recognition - Wikipedia

Google Scholar (Research Papers):

Improved method of handwritten digit recognition tested on MNIST database - ScienceDirect
The MNIST Database of Handwritten Digit Images for Machine Learning Research [Best of the Web] | IEEE Journals & Magazine | IEEE Xplore
https://www.aui.ma/sse-capstone-repository/pdf/spring-2018/HANDWRITTEN%20DIGITS%20RECOGNITION.pdf