Handwriting Recognition on MNIST Digit dataset

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Abstract:

The Handwriting recognition system is used in many applications now a days. They can be implemented using various algorithms. I have used Sequential model for this. The dataset used for the same is MNIST Digit Classification Dataset.

Key terms:

Keras, Tensorflow, digit recognition

Introduction:

The Sequential model from tensorflow keras library allows us to create a machine learning model by adding various layers to it. Every node in a particular layer is connected to all the nodes from the previous layer.

Metadata of dataset used:

Total images: 70,000 (60,000 training images, 10,000 testing images)

Image properties: 28 x 28 grayscale images

Total classes: 10

Neural Network Structure

For the model training I have used Sequential model from tenserflow keras library. The structure of the same is as follows:

1) Layer 1:

Convolution2D layer with 8 filters, 5x5 kernel size and relu activation function. Input shape si 28x28x1.

2) Layer 2:

MaxPool2D with pool size of (2, 2). It is used for downsampling the input.

3) Layer 3:

Dropout layer with ¼ dropout rate.

4) Layer 4:

Convolution2D layer with 16 filters, 3x3 kernel and relu activation function.

5) Layer 5:

MaxPool2D layer with poolsize of 2x2 and 2x2 strides.

6) Layer 6:

Dropout layer with ¼ droupout rate.

7) Layer 7:

Flattern layer to flat out the input.

8) Layer 8:

Dense layer with 256 output space and relu activation function.

9) Layer 9:

Dropout layer with ½ droupout rate.

10) Layer 10:

Dense layer with 10 output space, denoting 10 possible predictions with softmax activation function.

Implementation:

https://colab.research.google.com/drive/
1D_cg9Y5clpGvSFJM4_4jj8O2yzGlacAN?
usp=sharing

 This code is the main notebook for my model.

With the above mentioned network structure, the model was trained for 5 epochs on the training images.

Moreover, I used adam optimizer for the model. Adam uses exponential decaying average of the past squared gradients to provide adaptive learning rate.

For loss function I used categorical crossentropy loss function. This is one of the common functions used in multi-class classification models, for example our case.

The training **accuracy** I got was **98.9%**.

Further more, I have made a GUI canvas with python tinker module to test the model. The application provides a simple interface to write a digit and calls the model. It outputs the guess and the accuracy related to the guess, as shown in the figure.
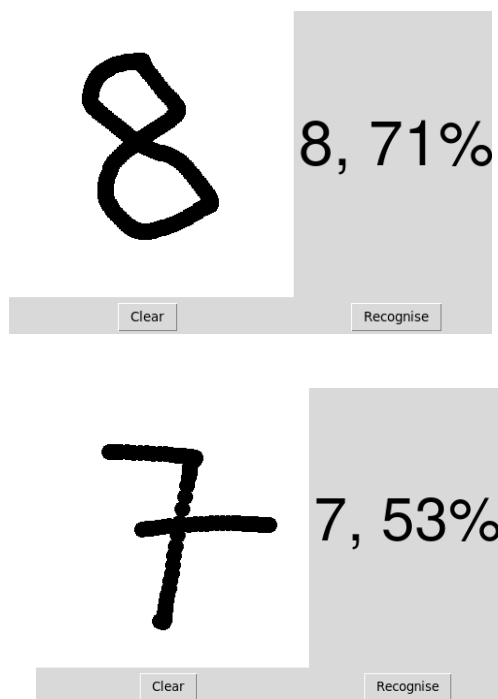
Fig. Python GUI

Future improvements:

Curently, the accuracy when running model from GUI is not very high. This is due to improper image preprocessing, which can be improved in future.

Moreover, this model can be extended in future for recognizing handwritten alphabets and symbols.

Conclusion:

We can conclude that Sequential model with 2D convolution neural network was very great for handwritten digit recognition.

References:

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