Rajshahi University of Engineering & Technology

Project Report

Project Name : Handwritten Bangla Character Recognition.

Course No. : CSE 3200

Course Title: Software Development Project II

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Problem Definition:

The total world is working with the various problems of the machine learning.The goal of the machine learning is to factorize and to manipulate the real life data and the real life part of the human interaction or complex ideas or the problems in the real life.The most curious of those is Handwritten Character Recognition because it is the building block of the human certified and the classification interaction between other humans.

So, the goal was to create an appropriate algorithm that can give the output of the handwritten character by taking just a picture of that character. If one asks about Image processing then this problem can't be solved because there can be a lot of noises in that taken image which can't be controlled by human.The main thing is when human write a handwritten character or for our case digit he has no single idea whether he has to draw it in the circulated pixels or just same as a standard image given .A machine can do that but not the human.So by matching only the pixels one can't recognize that.

The idea of machine learning lies on supervised data.Machine learning algorithm fully dependent on modeled data .If someone models the Image directly, the model will get a lot of flatten values because that picture can be drawn with various RGB format or with various pixels which can't be modeled accurately due to noise.

So, for this project one has to create a model by image processing and Machine Learning(ML).

Objective :

The main objective is to recognize Bangla handwritten characters.

Tools:

- Python 3
- Anaconda Navigator
- Jupyter Notebook

Description:

1.Training and Testing Data: 12000 images are used for training dataset and 3000 images are used for testing dataset.Images are of 50 classes. Because as we know there are 50 characters in Bengali.

```python
ImageFile.LOAD_TRUNCATED_IMAGES = True #loading image is permitted only in plain black rectangles

#Loading train and test data

train_datagen = ImageDataGenerator(rescale = 1./255,shear_range = .2,rotation_range = 25)
                                    #rescale 1./255 is used to transform pixel value from (0,255) to (0,1)
                                    #shear_range=0.2 means shear the image by 20%
                                    #using rotation_range images are allowed to rotate 0 to 360 degree
test_datagen = ImageDataGenerator(rescale=1./255)

train_data=train_datagen.flow_from_directory('Dataset/Train',target_size=(40,40),batch_size=32,class_mode='categorical')
                                    #size of input image will be 40*40
                                    #32 samples will be propagated through the network at a time
                                    #categorical->a character can't be from two classes
test_data=test_datagen.flow_from_directory('Dataset/Test',target_size=(40,40),batch_size=32,class_mode='categorical')

Found 12000 images belonging to 50 classes.
Found 3000 images belonging to 50 classes.
```

Fig 1. training and testing data

2.CNN (Convolution Neural Network) model: The convolution neural network algorithm is the result of continuous advancements in computer vision with deep learning.

CNN is a Deep learning algorithm that is able to assign importance to various objects in the image and is able to differentiate them. CNN has the ability to learn the characteristics and perform classification.

An input image has many spatial and temporal dependencies, CNN captures these characteristics using relevant filters/kernels.

A Kernel or filter is an element in CNN that performs convolution around the image in the first part. The kernel moves to the right and shifts according to the stride value. Every time during convolution a matrix multiplication operation is performed.

After convolution, we obtain another image with a different height, width, and depth. We obtain more channels than just RGB but less width and height.

We slide each filter throughout the image step by step, this step in the forward pass is called stride.

2.1 Layers in CNN:

Keras Convolution layer: It is the first layer to extract features from the input image. Here we define the kernel as the layer parameter. We perform matrix multiplication operations on the input image using the kernel.
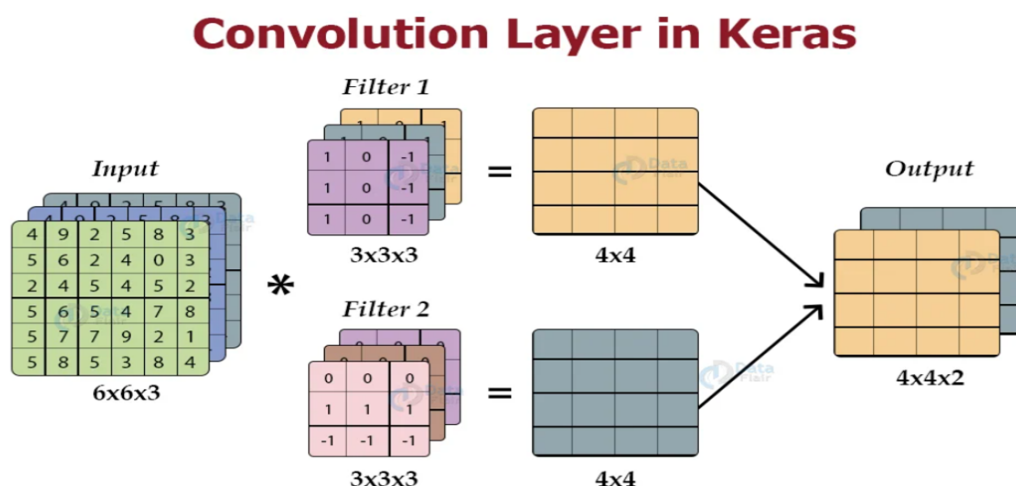

Fig 2.Convolution Layer

Keras Pooling Layer: After convolution, we perform pooling to reduce the number of parameters and computations.

Fig 3. Maxpooling

Keras Dropout Layer: It is used to prevent the network from overfitting. In this layer, some fraction of units in the network is dropped in training such that the model is trained on all the units.
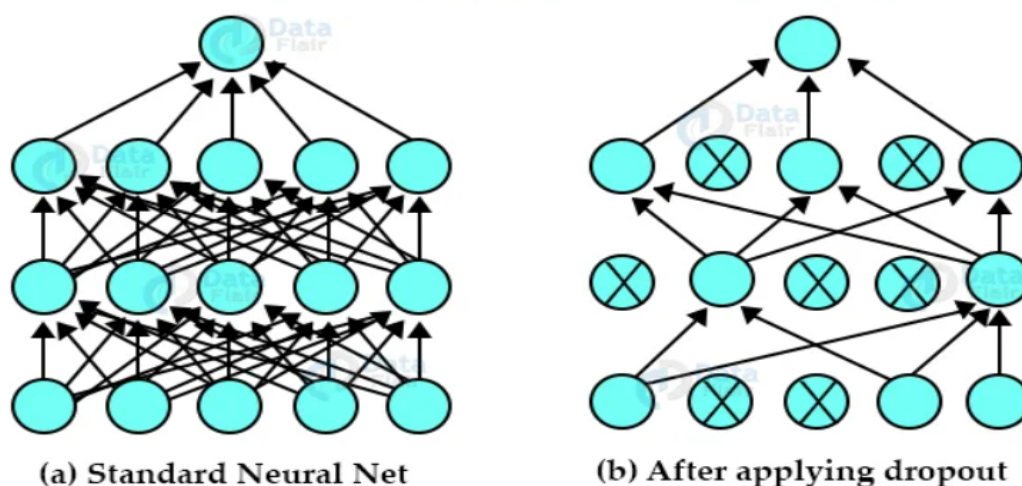

Fig 4.Droupout Layer

Keras Flatten Layer: It is used to convert the data into 1D arrays to create a single feature vector. After flattening we forward the data to a fully connected layer for final classification.
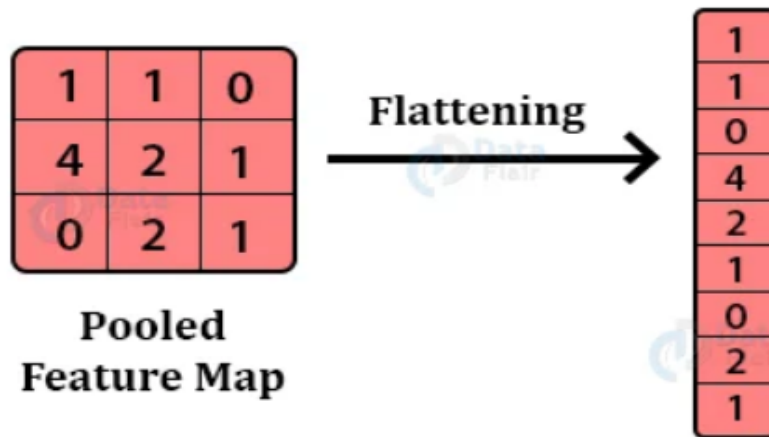

Fig 5.Flattering

Keras Dense Layer: It is a fully connected layer. Each node in this layer is connected to the previous layer i.e densely connected. This layer is used at the final stage of CNN to perform classification.
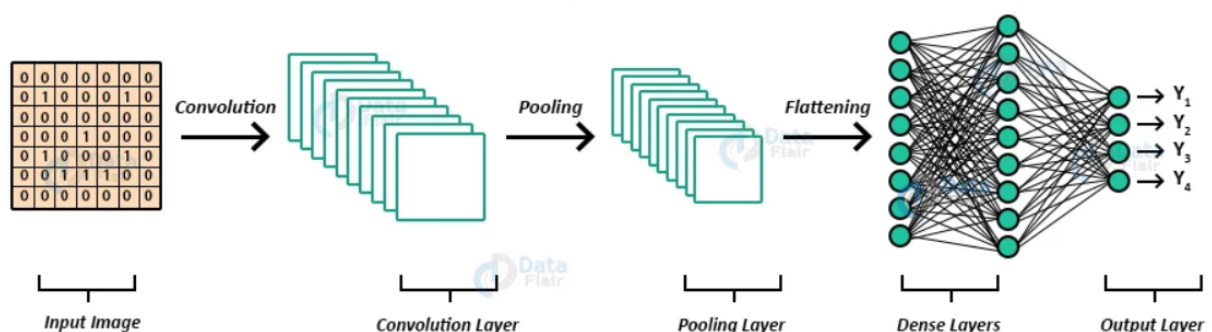

Fig 6.Dense Layer

3.Save the Model: JSON is a simple file format for describing data hierarchically.

Keras provides the ability to describe any model using JSON format with a to_json() function.The weights are saved directly from the model using the save weights() function and later loaded using the symmetrical load weights() function.

4.Load the input Image : Load the desired input image from the computer and predict the character.

5.Plot the Image : Plot the predicted image as output using matplotlib.

Example : matplotlib.pyplot.imshow(input_image)
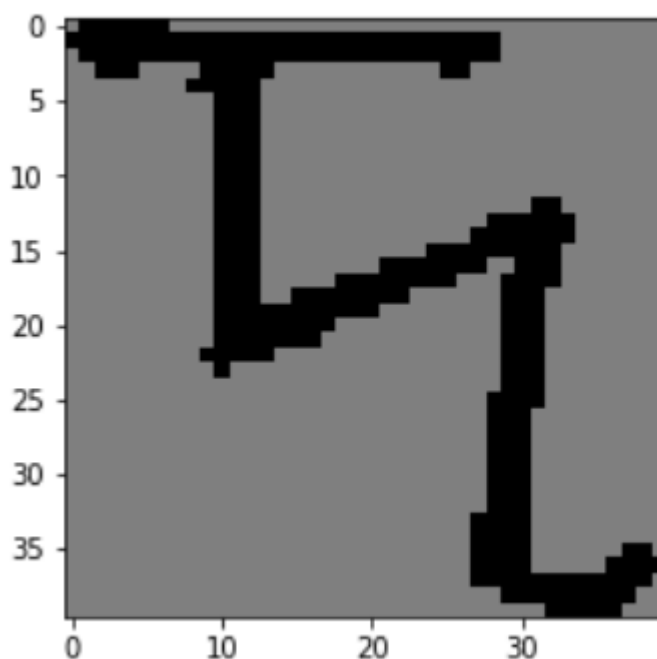

Fig 7.Predicted image

Application :

- Pattern recognition

- Bank check processing

- Form of data entry

Conclusion:

Machine learning is an approach to get the real life data into the action over human analysis .This project has an aim to achieve that goal because all machine learning algorithms intend to go to a better way than a human.

This project is a very much preliminary project.This project entitled some different new ideas on:

- Image processing

- Machine learning

- Digit extraction

- Statistical prediction

- Activation function