Report on Image Processing using Deep Learning basics with Python, TensorFlow and Keras

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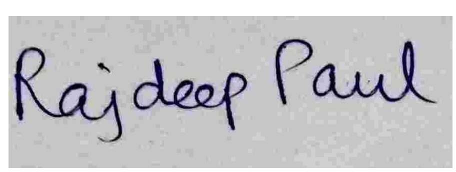
Abstract - Image Processing is most commonly termed as 'Digital Image Processing' and the domain in which it is frequently used is 'Computer Vision'.Image Processing algorithm algorithms take an image as input and the output is also an image.

About Dataset - The MNIST database (Modified National Institute of Standards and Technology database) is a large collection of handwritten digits. It has a training set of 60,000 examples, and a test set of 10,000 examples. It is a subset of a larger NIST Special Database 3 (digits written by employees of the United States Census Bureau) and Special Database 1 (digits written by high school students) which contain monochrome images of handwritten digits. The digits have been size-normalized and centered in a fixed-size image. The original black and white (bilevel) images from NIST were size normalized to fit in a 20x20 pixel box while preserving their aspect ratio. The resulting images contain grey levels as a result of the anti-aliasing technique used by the normalization algorithm. the images were centered in a 28x28 image by computing the center of mass of the pixels, and translating the image so as to position this point at the center of the 28x28 field.

Learning Methods Used - To begin, we need to find some balance between treating neural networks like a total black box, and understanding every single detail with them.A basic neural network consists of an input layer, which is just your data, in numerical form. After your input layer, you will have some number of what are called "hidden" layers. A hidden layer is just in between your input and output layers.



One hidden layer means you just have a neural network.Two or more hidden layers means deep neural network.The idea is a single neuron is just sum of all of the inputs x weights, fed through some sort of activation function. The activation function is meant to simulate a neuron firing or not. A simple example would be a stepper function, where, at some point, the threshold is crossed, and the neuron fires a 1, else a 0. Let's say that neuron is in the first hidden layer, and it's going to communicate with the next hidden layer. So it's going to send it's 0 or a 1 signal, multiplied by the weights, to the next neuron, and this is the process for all neurons and all layers.

Model Evaluation -

```
import tensorflow as tf
mnist = tf.keras.datasets.mnist
(x_train, y_train),(x_test, y_test) = mnist.load_data()
x_train = tf.keras.utils.normalize(x_train, axis=1)
x_test = tf.keras.utils.normalize(x_test, axis=1)
model = tf.keras.models.Sequential()
model.add(tf.keras.layers.Flatten())
model.add(tf.keras.layers.Dense(128, activation=tf.nn.relu))
model.add(tf.keras.layers.Dense(128, activation=tf.nn.relu))
model.add(tf.keras.layers.Dense(10, activation=tf.nn.softmax))
model.compile(optimizer='adam',
          loss='sparse_categorical_crossentropy',
          metrics=['accuracy'])
model.fit(x_train, y_train, epochs=3)
val_loss, val_acc = model.evaluate(x_test, y_test)
print(val_loss)
print(val_acc)
```

Evaluation Result -

Samples - 6000
Epochs - 3
Loss - 0.09292
Accuracy - 0.972