

LetNet

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Batch: G-5 (2017-21)

Convert this to LetNet Architecture

Design with 2 conv layer (32 and 64) filters Maxpooling (2x2) Dropout(0.5) Flatten() Dense(128) Dropout(0.5) Dense(10 with softmax activation)

```
[1]: import keras
from keras.datasets import mnist
from keras.models import Sequential
from keras.layers import Dense #Fully connected layer
from keras.layers import Dropout #Neurons get dropped
from keras.layers.normalization import BatchNormalization
from keras.optimizers import SGD
from keras import regularizers
import matplotlib.pyplot as plt
from keras.layers import Dense, Dropout, Flatten, Conv2D, MaxPooling2D
```

Load Data

```
[2]: (x_train,y_train),(x_test,y_test)=mnist.load_data()
```

Downloading data from <https://storage.googleapis.com/tensorflow/tf-keras-datasets/mnist.npz>

11493376/11490434 [=====] - 0s 0us/step

```
[3]: x_train.shape
```

```
[3]: (60000, 28, 28)
```

```
[4]: #Flatting the image using reshape with 32 bit precision
x_train = x_train.reshape(60000, 28, 28, 1).astype('float32')
x_test = x_test.reshape(10000, 28, 28, 1).astype('float32')
```

```
[5]: # Matrix range is from 0-255
x_train /= 255
x_test /= 255
```

```
[6]: # Every image belonging to one perticular class= 10
n_classes = 10
y_train = keras.utils.to_categorical(y_train, n_classes)
```

```
y_test = keras.utils.to_categorical(y_test, n_classes)
```

```
[7]: Model_new = Sequential()
```

```
[8]: Model_new.add(Conv2D(32, kernel_size=(5, 5), input_shape=(28, 28, 1)))  
Model_new.add(Conv2D(64, kernel_size=(5, 5), activation='relu'))  
Model_new.add(MaxPooling2D(pool_size=(2, 2)))  
Model_new.add(Dropout(0.5))  
Model_new.add(Flatten())  
Model_new.add(Dense(128, activation='tanh'))  
Model_new.add(Dropout(0.5))  
Model_new.add(Dense(10, activation='softmax'))
```

```
[9]: Model_new.compile(loss='categorical_crossentropy', optimizer='adam',  
    ↪metrics=['accuracy'])
```

```
[10]: Model_new.summary()
```

Model: "sequential"

Layer (type)	Output Shape	Param #
conv2d (Conv2D)	(None, 24, 24, 32)	832
conv2d_1 (Conv2D)	(None, 20, 20, 64)	51264
max_pooling2d (MaxPooling2D)	(None, 10, 10, 64)	0
dropout (Dropout)	(None, 10, 10, 64)	0
flatten (Flatten)	(None, 6400)	0
dense (Dense)	(None, 128)	819328
dropout_1 (Dropout)	(None, 128)	0
dense_1 (Dense)	(None, 10)	1290

Total params: 872,714
Trainable params: 872,714
Non-trainable params: 0

```
[11]: history= Model_new.fit(x_train, y_train, batch_size=64, epochs=2, verbose=1,  
    ↪validation_data=(x_test, y_test))
```

Epoch 1/2

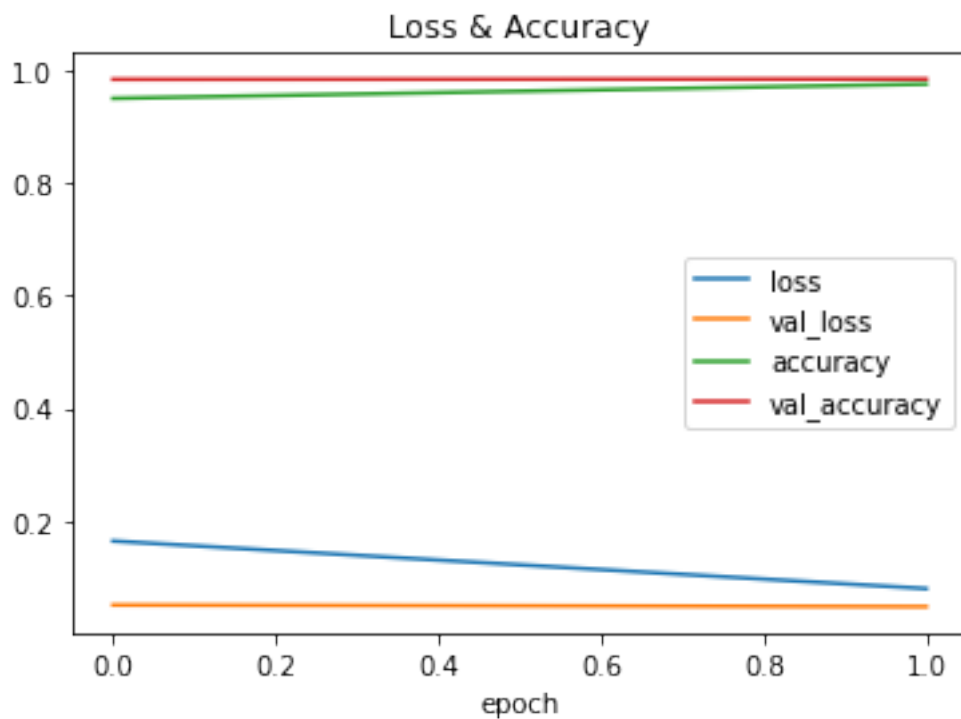
938/938 [=====] - 235s 250ms/step - loss: 0.3199 -
accuracy: 0.9002 - val_loss: 0.0515 - val_accuracy: 0.9835

Epoch 2/2
938/938 [=====] - 234s 249ms/step - loss: 0.0808 -
accuracy: 0.9746 - val_loss: 0.0485 - val_accuracy: 0.9840

Model Evaluation

```
[13]: import matplotlib.pyplot as plt
plt.plot(history.history['loss'])
plt.plot(history.history['val_loss'])
plt.plot(history.history['accuracy'])
plt.plot(history.history['val_accuracy'])
plt.legend(['loss', 'val_loss', 'accuracy', 'val_accuracy'])
plt.title('Loss & Accuracy')
plt.xlabel('epoch')
```

[13]: Text(0.5, 0, 'epoch')



```
[15]: score = Model_new.evaluate(x_test, y_test, verbose = 1)
print('Test Score', score[0])
print('Test Accuracy', score[1])
```

313/313 [=====] - 10s 32ms/step - loss: 0.0485 -
accuracy: 0.9840
Test Score 0.04853018745779991
Test Accuracy 0.984000027179718

```
[ ]: !wget -nc https://raw.githubusercontent.com/brpy/colab-pdf/master/colab_pdf.py
from colab_pdf import colab_pdf
colab_pdf('LetNet.ipynb')
```

```
--2021-04-17 08:26:42-- https://raw.githubusercontent.com/brpy/colab-
pdf/master/colab_pdf.py
Resolving raw.githubusercontent.com (raw.githubusercontent.com)...
185.199.108.133, 185.199.109.133, 185.199.110.133, ...
Connecting to raw.githubusercontent.com
(raw.githubusercontent.com)|185.199.108.133|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 1864 (1.8K) [text/plain]
Saving to: colab_pdf.py
```

```
colab_pdf.py          100%[=====>]    1.82K  --.-KB/s    in 0s
```

```
2021-04-17 08:26:42 (27.9 MB/s) - colab_pdf.py saved [1864/1864]
```

```
Mounted at /content/drive/
```

```
WARNING: apt does not have a stable CLI interface. Use with caution in scripts.
```

```
WARNING: apt does not have a stable CLI interface. Use with caution in scripts.
```

```
Extracting templates from packages: 100%
```