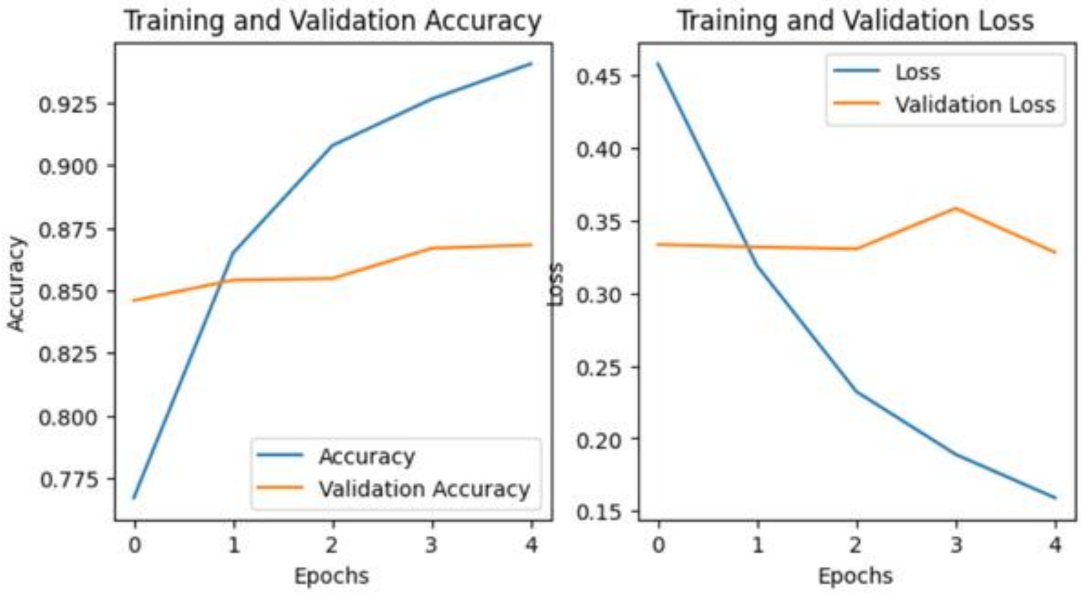
Text Processing ,Language Modeling Using RNN

Text classification

```
import tensorflow as tf
import tensorflow_datasets as tfds

import numpy as np
import matplotlib.pyplot as plt

# Obtain the imdb review dataset from tensorflow datasets
dataset = tfds.load('imdb_reviews', as_supervised=True)

# Seperate test and train datasets
train_dataset, test_dataset = dataset['train'], dataset['test']

# Split the test and train data into batches of 32
# and shuffling the training set
batch_size = 32
train_dataset = train_dataset.shuffle(10000)
train_dataset = train_dataset.batch(batch_size)
test_dataset = test_dataset.batch(batch_size)



example, label = next(iter(train_dataset))
print('Text:\n', example.numpy()[0])
print('\nLabel: ', label.numpy()[0])


# Using the TextVectorization layer to normalize, split, and map strings
# to integers.
encoder = tf.keras.layers.TextVectorization(max_tokens=10000)
encoder.adapt(train_dataset.map(lambda text, _: text))

# Extracting the vocabulary from the TextVectorization layer.
vocabulary = np.array(encoder.get_vocabulary())

# Encoding a test example and decoding it back.
original_text = example.numpy()[0]
encoded_text = encoder(original_text).numpy()
decoded_text = ' '.join(vocabulary[encoded_text])

print('original: ', original_text)
print('encoded: ', encoded_text)
print('decoded: ', decoded_text)
```

```
# Creating the model
model = tf.keras.Sequential([
    encoder,
    tf.keras.layers.Embedding(
            len(encoder.get_vocabulary()), 64, mask_zero=True),
    tf.keras.layers.Bidirectional(
            tf.keras.layers.LSTM(64, return_sequences=True)),
    tf.keras.layers.Bidirectional(tf.keras.layers.LSTM(32)),
    tf.keras.layers.Dense(64, activation='relu'),
    tf.keras.layers.Dense(1)
])

# Summary of the model
model.summary()

# Compile the model
model.compile(
    loss=tf.keras.losses.BinaryCrossentropy(from_logits=True),
    optimizer=tf.keras.optimizers.Adam(),
    metrics=['accuracy']
)



# Training the model and validating it on test set
history = model.fit(
    train_dataset,
    epochs=5,
    validation_data=test_dataset,
)


# Plotting the accuracy and loss over time

# Training history
history_dict = history.history

# Seperating validation and training accuracy
acc = history_dict['accuracy']
val_acc = history_dict['val_accuracy']

# Seperating validation and training loss
loss = history_dict['loss']
val_loss = history_dict['val_loss']

# Plotting
plt.figure(figsize=(8, 4))
plt.subplot(1, 2, 1)
plt.plot(acc)
plt.plot(val_acc)
plt.title('Training and Validation Accuracy')
plt.xlabel('Epochs')
plt.ylabel('Accuracy')
plt.legend(['Accuracy', 'Validation Accuracy'])

plt.subplot(1, 2, 2)
plt.plot(loss)
plt.plot(val_loss)
plt.title('Training and Validation Loss')
plt.xlabel('Epochs')
plt.ylabel('Loss')
plt.legend(['Loss', 'Validation Loss'])

plt.show()

sample_text = (
    '''The movie by GeeksforGeeks was so good and the animation are so dope.
    I would recommend my friends to watch it.'''
)
predictions = model.predict(np.array([sample_text]))
print(*predictions[0])

# Print the label based on the prediction
if predictions[0] > 0:
    print('The review is positive')
else:
    print('The review is negative')
```

OUTPUT:



```
The review is positive
```

Times Series Prediction Using RNN

```
import pandas as pd;
import matplotlib.pyplot as plt
from numpy import array
from numpy import hstack
from keras.models import Sequential
from keras.layers import Dense
from keras.layers import LSTM
from keras.layers import RNN, SimpleRNN
from keras.preprocessing.sequence import TimeseriesGenerator
from keras.layers import Dropout
from keras.optimizers import Adam
from keras.layers.core import Activation
from keras.callbacks import LambdaCallback
from sklearn.preprocessing import MinMaxScaler

import os
print(os.listdir("../input/bike-sharing-dataset"))
dataset = pd.read_csv('../input/bike-sharing-dataset/day.csv')

plt.figure(figsize=(15,10))
plt.plot(dataset['cnt'], color='blue')
plt.show()



temp = dataset[dataset.yr == 1]
temp = temp[temp.mnth == 10]
print(temp.cnt.mean())

temp.head()


one_hot = pd.get_dummies(dataset['weekday'], prefix='weekday')
dataset = dataset.join(one_hot)

one_hot = pd.get_dummies(dataset['weathersit'], prefix='weathersit')
dataset = dataset.join(one_hot)

scaler = MinMaxScaler(feature_range=(0, 1))
scaled = scaler.fit_transform(array(dataset['cnt']).reshape(len(dataset['cnt']), 1))
series = pd.DataFrame(scaled)
series.columns = ['cntscl']


dataset = pd.merge(dataset, series, left_index=True, right_index=True)
```

```
dataset.head()

number_of_test_data = 50
number_of_holdout_data = 50
number_of_training_data = len(dataset) - number_of_holdout_data - number_of_test_data
print ("total, train, test, holdout:", len(dataset), number_of_training_data, number_of_test_data,
number_of_holdout_data)

datatrain = dataset[:number_of_training_data]
datatest = dataset[-(number_of_test_data+number_of_holdout_data):-number_of_holdout_data]
datahold = dataset[-number_of_holdout_data:]

in_seq1 = array(datatrain['holiday'])
in_seq2 = array(datatrain['workingday'])
in_seq3 = array(datatrain['temp'])
in_seq4 = array(datatrain['atemp'])
in_seq5 = array(datatrain['hum'])
in_seq6 = array(datatrain['windspeed'])
in_seq7 = array(datatrain['weekday_0'])
in_seq8 = array(datatrain['weekday_1'])
in_seq9 = array(datatrain['weekday_2'])
in_seq10 = array(datatrain['weekday_3'])
in_seq11 = array(datatrain['weekday_4'])
in_seq12 = array(datatrain['weekday_5'])
in_seq13 = array(datatrain['weekday_6'])
in_seq14 = array(datatrain['weathersit_1'])
in_seq15 = array(datatrain['weathersit_2'])
in_seq16 = array(datatrain['weathersit_3'])
out_seq_train = array(datatrain['cntscl'])

in_seq1 = in_seq1.reshape((len(in_seq1), 1))
in_seq2 = in_seq2.reshape((len(in_seq2), 1))
in_seq3 = in_seq3.reshape((len(in_seq3), 1))
in_seq4 = in_seq4.reshape((len(in_seq4), 1))
in_seq5 = in_seq5.reshape((len(in_seq5), 1))
in_seq6 = in_seq6.reshape((len(in_seq6), 1))
in_seq7 = in_seq7.reshape((len(in_seq7), 1))
in_seq8 = in_seq8.reshape((len(in_seq8), 1))
in_seq9 = in_seq9.reshape((len(in_seq9), 1))
in_seq10 = in_seq10.reshape((len(in_seq10), 1))
in_seq11 = in_seq11.reshape((len(in_seq11), 1))
in_seq12 = in_seq12.reshape((len(in_seq12), 1))
in_seq13 = in_seq13.reshape((len(in_seq13), 1))
in_seq14 = in_seq14.reshape((len(in_seq14), 1))
in_seq15 = in_seq15.reshape((len(in_seq15), 1))
in_seq16 = in_seq16.reshape((len(in_seq16), 1))
out_seq_train = out_seq_train.reshape((len(out_seq_train), 1))

datatrain_feed = hstack((in_seq1, in_seq2, in_seq3, in_seq4, in_seq5, in_seq6, in_seq7, in_seq8,
in_seq9, in_seq10, in_seq11, in_seq12, in_seq13, in_seq14, in_seq15, in_seq16, out_seq_train))
```

```
in_seq1 = array(datatest['holiday'])
in_seq2 = array(datatest['workingday'])
in_seq3 = array(datatest['temp'])
in_seq4 = array(datatest['atemp'])
in_seq5 = array(datatest['hum'])
in_seq6 = array(datatest['windspeed'])
in_seq7 = array(datatest['weekday_0'])
in_seq8 = array(datatest['weekday_1'])
in_seq9 = array(datatest['weekday_2'])
in_seq10 = array(datatest['weekday_3'])
in_seq11 = array(datatest['weekday_4'])
in_seq12 = array(datatest['weekday_5'])
in_seq13 = array(datatest['weekday_6'])
in_seq14 = array(datatest['weathersit_1'])
in_seq15 = array(datatest['weathersit_2'])
in_seq16 = array(datatest['weathersit_3'])
out_seq_test = array(datatest['cntscl'])

in_seq1 = in_seq1.reshape((len(in_seq1), 1))
in_seq2 = in_seq2.reshape((len(in_seq2), 1))
in_seq3 = in_seq3.reshape((len(in_seq3), 1))
in_seq4 = in_seq4.reshape((len(in_seq4), 1))
in_seq5 = in_seq5.reshape((len(in_seq5), 1))
in_seq6 = in_seq6.reshape((len(in_seq6), 1))
in_seq7 = in_seq7.reshape((len(in_seq7), 1))
in_seq8 = in_seq8.reshape((len(in_seq8), 1))
in_seq9 = in_seq9.reshape((len(in_seq9), 1))
in_seq10 = in_seq10.reshape((len(in_seq10), 1))
in_seq11 = in_seq11.reshape((len(in_seq11), 1))
in_seq12 = in_seq12.reshape((len(in_seq12), 1))
in_seq13 = in_seq13.reshape((len(in_seq13), 1))
in_seq14 = in_seq14.reshape((len(in_seq14), 1))
in_seq15 = in_seq15.reshape((len(in_seq15), 1))
in_seq16 = in_seq16.reshape((len(in_seq16), 1))
out_seq_test = out_seq_test.reshape((len(out_seq_test), 1))

datatest_feed = hstack((in_seq1, in_seq2, in_seq3, in_seq4, in_seq5, in_seq6, in_seq7, in_seq8,
in_seq9, in_seq10, in_seq11, in_seq12, in_seq13, in_seq14, in_seq15, in_seq16, out_seq_test))

in_seq1 = array(datahold['holiday'])
in_seq2 = array(datahold['workingday'])
in_seq3 = array(datahold['temp'])
in_seq4 = array(datahold['atemp'])
in_seq5 = array(datahold['hum'])
in_seq6 = array(datahold['windspeed'])
in_seq7 = array(datahold['weekday_0'])
in_seq8 = array(datahold['weekday_1'])
in_seq9 = array(datahold['weekday_2'])
in_seq10 = array(datahold['weekday_3'])
in_seq11 = array(datahold['weekday_4'])
in_seq12 = array(datahold['weekday_5'])
in_seq13 = array(datahold['weekday_6'])
```

```
in_seq14 = array(datahold['weathersit_1'])
in_seq15 = array(datahold['weathersit_2'])
in_seq16 = array(datahold['weathersit_3'])
out_seq_hold = array(datahold['cntscl'])

in_seq1 = in_seq1.reshape((len(in_seq1), 1))
in_seq2 = in_seq2.reshape((len(in_seq2), 1))
in_seq3 = in_seq3.reshape((len(in_seq3), 1))
in_seq4 = in_seq4.reshape((len(in_seq4), 1))
in_seq5 = in_seq5.reshape((len(in_seq5), 1))
in_seq6 = in_seq6.reshape((len(in_seq6), 1))
in_seq7 = in_seq7.reshape((len(in_seq7), 1))
in_seq8 = in_seq8.reshape((len(in_seq8), 1))
in_seq9 = in_seq9.reshape((len(in_seq9), 1))
in_seq10 = in_seq10.reshape((len(in_seq10), 1))
in_seq11 = in_seq11.reshape((len(in_seq11), 1))
in_seq12 = in_seq12.reshape((len(in_seq12), 1))
in_seq13 = in_seq13.reshape((len(in_seq13), 1))
in_seq14 = in_seq14.reshape((len(in_seq14), 1))
in_seq15 = in_seq15.reshape((len(in_seq15), 1))
in_seq16 = in_seq16.reshape((len(in_seq16), 1))
out_seq_hold = out_seq_hold.reshape((len(out_seq_hold), 1))

datahold_feed = hstack((in_seq1, in_seq2, in_seq3, in_seq4, in_seq5, in_seq6, in_seq7, in_seq8,
in_seq9, in_seq10, in_seq11, in_seq12, in_seq13, in_seq14, in_seq15, in_seq16, out_seq_hold))

n_features = datatrain_feed.shape[1]
n_input = 10
generator_train = TimeseriesGenerator(datatrain_feed, out_seq_train, length=n_input,
batch_size=len(datatrain_feed))

generator_test = TimeseriesGenerator(datatest_feed, out_seq_test, length=n_input, batch_size=1)

generator_hold = TimeseriesGenerator(datahold_feed, out_seq_hold, length=n_input, batch_size=1)

print("timesteps, features:", n_input, n_features)
```

```
timesteps, features: 10 17
```

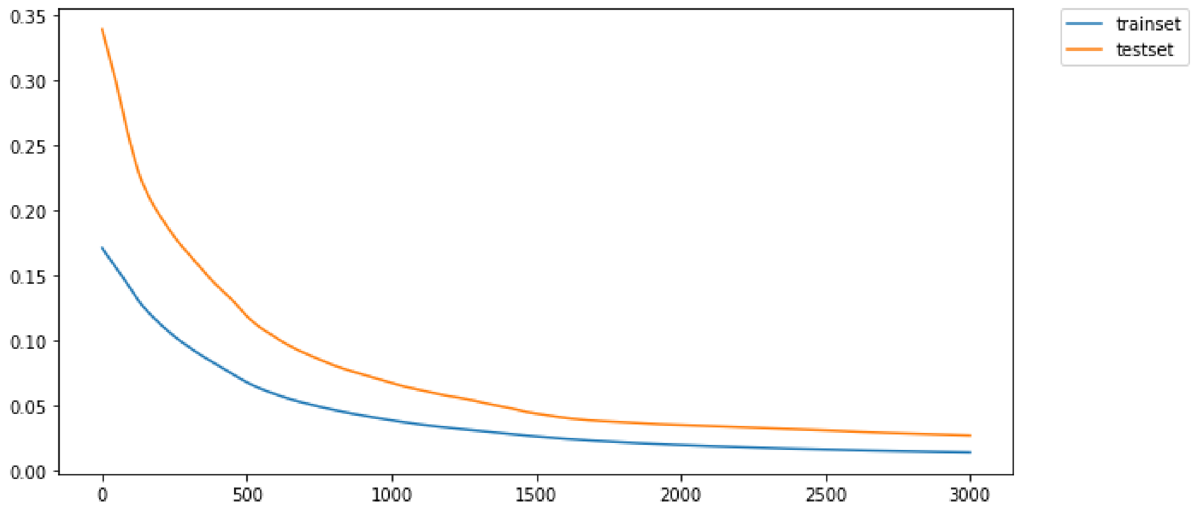
```
model = Sequential()

model.add(SimpleRNN(4, activation='relu', input_shape=(n_input, n_features), return_sequences =
False))
model.add(Dense(1, activation='relu'))

adam = Adam(lr=0.0001)
model.compile(optimizer=adam, loss='mse')

model.summary()

score = model.fit_generator(generator_train, epochs=3000, verbose=0,
validation_data=generator_test)
```

```
losses = score.history['loss']
val_losses = score.history['val_loss']
plt.figure(figsize=(10,5))
plt.plot(losses, label="trainset")
plt.plot(val_losses, label="testset")
plt.legend(bbox_to_anchor=(1.05, 1), loc=2, borderaxespad=0.)
plt.show()
```

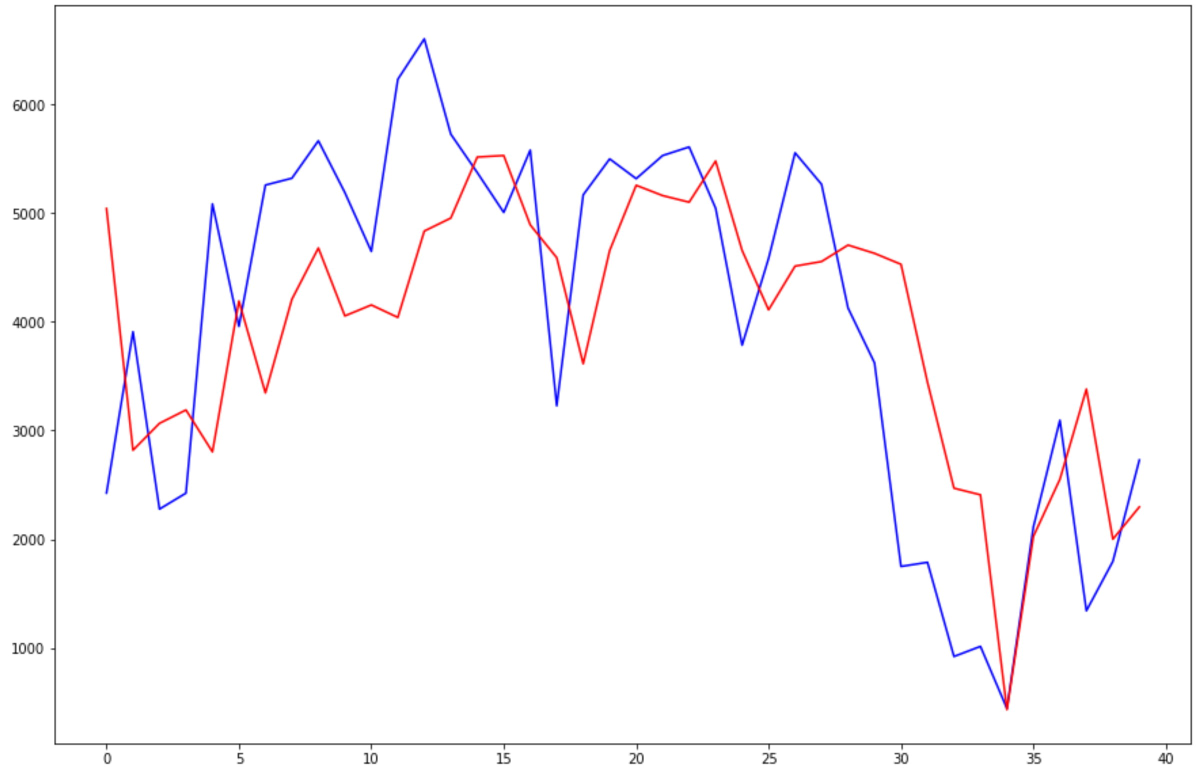
OUTPUT:

```
Layer (type)               Output Shape             Param #
=================================================================
simple_rnn_1 (SimpleRNN)     (None, 4)                 88

dense_1 (Dense)             (None, 1)                 5
=================================================================
Total params: 93
Trainable params: 93
Non-trainable params: 0
```

Train vs test loss



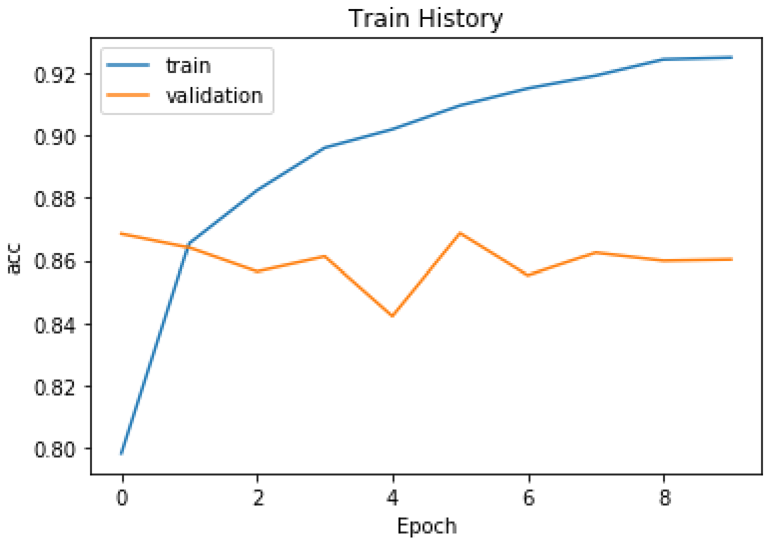
Actual vs prediction

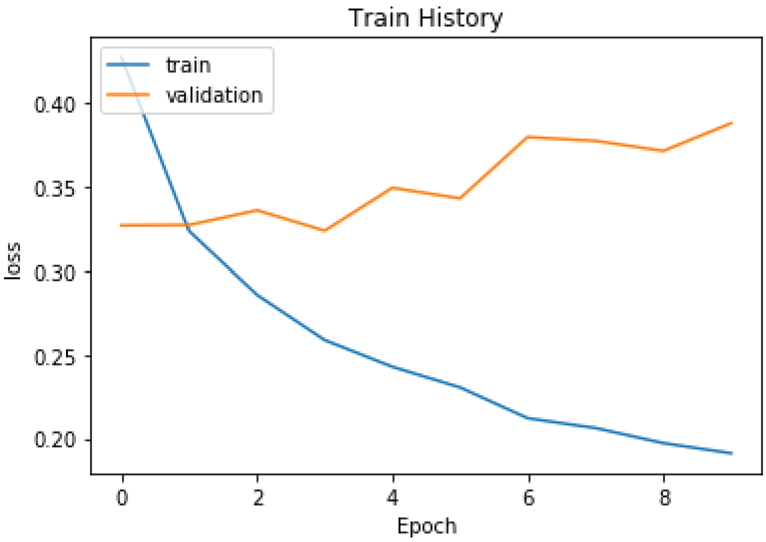


Sentimental Analysis Using LSTM

```
from tensorflow.keras.preprocessing import sequence
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense, Embedding
from tensorflow.keras.layers import LSTM
from tensorflow.keras.datasets import imdb

print('Loading data...')
# num_words: how many unique words that you want to load into your training and testing
dataset
(x_train, y_train), (x_test, y_test) = imdb.load_data(num_words=20000)

x_train = sequence.pad_sequences(x_train, maxlen=80)
x_test = sequence.pad_sequences(x_test, maxlen=80)

model = Sequential()
model.add(Embedding(20000, 128))
model.add(LSTM(128, dropout=0.2, recurrent_dropout=0.2))
model.add(Dense(1, activation='sigmoid'))
model.compile(loss='binary_crossentropy',
              optimizer='adam',
              metrics=['accuracy'])
model.fit(x_train, y_train,
              batch_size=32,
              epochs=15,
              verbose=2,
              validation_data=(x_test, y_test))

def show_train_history(train_history,train,validation):
   plt.plot(train_history.history[train])
   plt.plot(train_history.history[validation])
   plt.title('Train History')
   plt.ylabel(train)
   plt.xlabel('Epoch')
   plt.legend(['train', 'validation'], loc='upper left')
   plt.show()

show_train_history(train_history,'acc','val_acc')

score, acc = model.evaluate(x_test, y_test,
                            batch_size=32,
                            verbose=2)
print('Test score:', score)
print('Test accuracy:', acc)
```

OUTPUT:



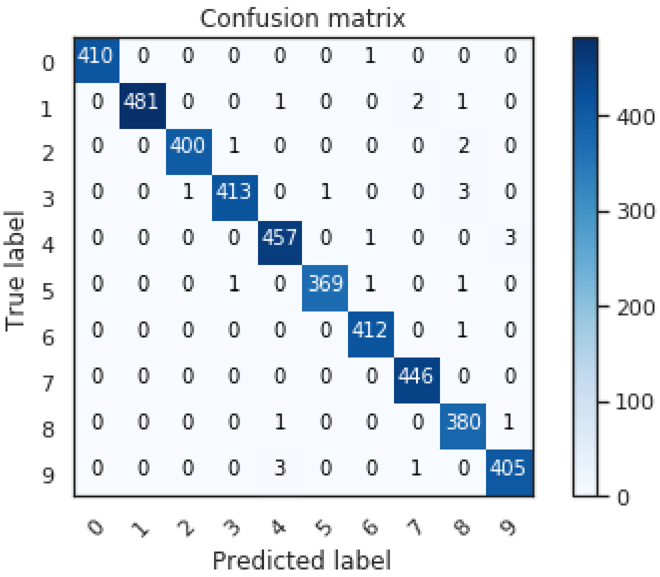


Test loss 0.37
test accuracy 0.87

MNIST data CNN

```
import numpy as np
import keras
from keras import layers

# Model / data parameters
num_classes = 10
input_shape = (28, 28, 1)

# Load the data and split it between train and test sets
(x_train, y_train), (x_test, y_test) = keras.datasets.mnist.load_data()

# Scale images to the [0, 1] range
x_train = x_train.astype("float32") / 255
x_test = x_test.astype("float32") / 255
# Make sure images have shape (28, 28, 1)
x_train = np.expand_dims(x_train, -1)
x_test = np.expand_dims(x_test, -1)
print("x_train shape:", x_train.shape)
print(x_train.shape[0], "train samples")
print(x_test.shape[0], "test samples")


# convert class vectors to binary class matrices
y_train = keras.utils.to_categorical(y_train, num_classes)
y_test = keras.utils.to_categorical(y_test, num_classes)

model = keras.Sequential(
    [
        keras.Input(shape=input_shape),
        layers.Conv2D(32, kernel_size=(3, 3), activation="relu"),
        layers.MaxPooling2D(pool_size=(2, 2)),
        layers.Conv2D(64, kernel_size=(3, 3), activation="relu"),
        layers.MaxPooling2D(pool_size=(2, 2)),
        layers.Flatten(),
        layers.Dropout(0.5),
        layers.Dense(num_classes, activation="softmax"),
    ]
)

model.summary()

batch_size = 128
epochs = 15

model.compile(loss="categorical_crossentropy", optimizer="adam", metrics=["accuracy"])
model.fit(x_train, y_train, batch_size=batch_size, epochs=epochs, validation_split=0.1)
y_pred=model.predict(x_test)
sns.heatmap(confusion_matrix(y_pred,y_test),annot=True)

score = model.evaluate(x_test, y_test, verbose=0)
print("Test loss:", score[0])
print("Test accuracy:", score[1])
```

OUTPUT:



	0	1	2	3	4	5	6	7	8	9
0	410	0	0	0	0	0	1	0	0	0
1	0	481	0	0	1	0	0	2	1	0
2	0	0	400	1	0	0	0	0	2	0
3	0	0	1	413	0	1	0	0	3	0
4	0	0	0	0	457	0	1	0	0	3
5	0	0	0	1	0	369	1	0	1	0
6	0	0	0	0	0	0	412	0	1	0
7	0	0	0	0	0	0	0	446	0	0
8	0	0	0	0	1	0	0	0	380	1
9	0	0	0	0	3	0	0	1	0	405

```
Test loss:


0.02499214932322502
Test accuracy: 0.9919000267982483
```