

## ICP9

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GitHub Link: <https://github.com/angelreddy09/DNN/tree/main/ICP9>

```
import pandas as pd # data processing, CSV file I/O (e.g. pd.read_csv)
from keras.preprocessing.text import Tokenizer
from tensorflow.keras.preprocessing.sequence import pad_sequences
from keras.models import Sequential
from keras.layers import Dense, Embedding, LSTM, SpatialDropout1D
from matplotlib import pyplot
from sklearn.model_selection import train_test_split
from keras.utils.np_utils import to_categorical
import re

from sklearn.preprocessing import LabelEncoder

data = pd.read_csv('Sentiment.csv')
# Keeping only the necessary columns
data = data[['text', 'sentiment']]

data['text'] = data['text'].apply(lambda x: x.lower())
data['text'] = data['text'].apply((lambda x: re.sub('[^a-zA-z0-9\s]', '',
x)))

for idx, row in data.iterrows():
    row[0] = row[0].replace('rt', ' ')

max_fatures = 2000
tokenizer = Tokenizer(num_words=max_fatures, split=' ')
tokenizer.fit_on_texts(data['text'].values)
X = tokenizer.texts_to_sequences(data['text'].values)

X = pad_sequences(X)

embed_dim = 128
lstm_out = 196
def createmodel():
    model = Sequential()
    model.add(Embedding(max_fatures, embed_dim, input_length = X.shape[1]))
    model.add(LSTM(lstm_out, dropout=0.2, recurrent_dropout=0.2))
    model.add(Dense(3, activation='softmax'))
```

```

    model.compile(loss = 'categorical_crossentropy',
optimizer='adam',metrics = ['accuracy'])
    return model
# print(model.summary())

labelencoder = LabelEncoder()
integer_encoded = labelencoder.fit_transform(data['sentiment'])
y = to_categorical(integer_encoded)
X_train, X_test, Y_train, Y_test = train_test_split(X,y, test_size = 0.33,
random_state = 42)

batch_size = 32
model = createmodel()
model.fit(X_train, Y_train, epochs = 1, batch_size=batch_size, verbose =
2)
score,acc = model.evaluate(X_test,Y_test,verbose=2,batch_size=batch_size)
print(score)
print(acc)
print(model.metrics_names)

```

The screenshot displays a Google Colab notebook titled "Assignment9.ipynb". The code cell contains the same Python script as shown in the first block. The output of the code is visible in the bottom panel, showing a warning about TensorFlow's LSTM layer not using cuDNN kernels and the resulting training metrics.

```

1stm_out = 196
def createmodel():
    model = Sequential()
    model.add(Embedding(max_fatures, embed_dim,input_length = X.shape[1]))
    model.add(LSTM(1stm_out, dropout=0.2, recurrent_dropout=0.2))
    model.add(Dense(3,activation='softmax'))
    model.compile(loss = 'categorical_crossentropy', optimizer='adam',metrics = ['accuracy'])
    return model
# print(model.summary())

labelencoder = LabelEncoder()
integer_encoded = labelencoder.fit_transform(data['sentiment'])
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batch_size = 32
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model.fit(X_train, Y_train, epochs = 1, batch_size=batch_size, verbose = 2)
score,acc = model.evaluate(X_test,Y_test,verbose=2,batch_size=batch_size)
print(score)
print(acc)
print(model.metrics_names)

[ ] model.save('sentiment_model.h5')

```

WARNING:tensorflow:Layer lstm\_1 will not use cuDNN kernels since it doesn't meet the criteria. It will use a generic GPU kernel as fallback when running on GPU.

291/291 - 63s - loss: 0.8240 - accuracy: 0.6450 - 63s/epoch - 218ms/step  
144/144 - 2s - loss: 0.7616 - accuracy: 0.6658 - 2s/epoch - 11ms/step  
0.7615569829940796  
0.6657929420471191  
['loss', 'accuracy']

```
model.save('sentiment_model.h5')
```

This code loads the saved model using the `load_model` function, and then preprocesses the new text data in the same way as the training data. The `predict` method is called on the loaded model to get the predicted class probabilities for the new text data. The class with the highest probability is chosen as the predicted sentiment. The predicted sentiment and probabilities are then printed to the console. To apply `GridSearchCV` on the provided source code, we can use the `GridSearchCV` class from `sklearn` to search for the best combination of hyperparameters for the LSTM model. The hyperparameters that can be tuned are the number of LSTM units, the dropout rate, and the learning rate of the optimizer

```
from keras.models import load_model
import numpy as np

loaded_model = load_model('sentiment_model.h5')

new_text = ["A lot of good things are happening. We are respected again
throughout the world, and that's a great thing.@realDonaldTrump"]
new_text = tokenizer.texts_to_sequences(new_text)
new_text = pad_sequences(new_text, maxlen=X.shape[1], dtype='int32',
value=0)
sentiment_prob = loaded_model.predict(new_text, batch_size=1,
verbose=2)[0]

sentiment_classes = ['Negative', 'Neutral', 'Positive']
sentiment_pred = sentiment_classes[np.argmax(sentiment_prob)]

print("Predicted sentiment: ", sentiment_pred)
print("Predicted probabilities: ", sentiment_prob)
```

```
from keras.models import load_model
import numpy as np

loaded_model = load_model('sentiment_model.h5')

new_text = ["A lot of good things are happening. We are respected again throughout the world, and that's a great thing.@realDonaldTrump"]
new_text = tokenizer.texts_to_sequences(new_text)
new_text = pad_sequences(new_text, maxlen=X.shape[1], dtype='int32', value=0)
sentiment_prob = loaded_model.predict(new_text, batch_size=1, verbose=2)[0]

sentiment_classes = ['Negative', 'Neutral', 'Positive']
sentiment_pred = sentiment_classes[np.argmax(sentiment_prob)]

print("Predicted sentiment: ", sentiment_pred)
print("Predicted probabilities: ", sentiment_prob)

WARNING:tensorflow:Layer lstm_1 will not use cuDNN kernels since it doesn't meet the criteria. It will use a generic GPU kernel as fallback when running on GPU.
1/1 - 0s - 428ms/epoch - 428ms/step
Predicted sentiment: Positive
Predicted probabilities: [0.39611092 0.19630554 0.4075835 ]
```

```
from keras.wrappers.scikit_learn import KerasClassifier
from sklearn.model_selection import GridSearchCV
from keras.optimizers import Adam

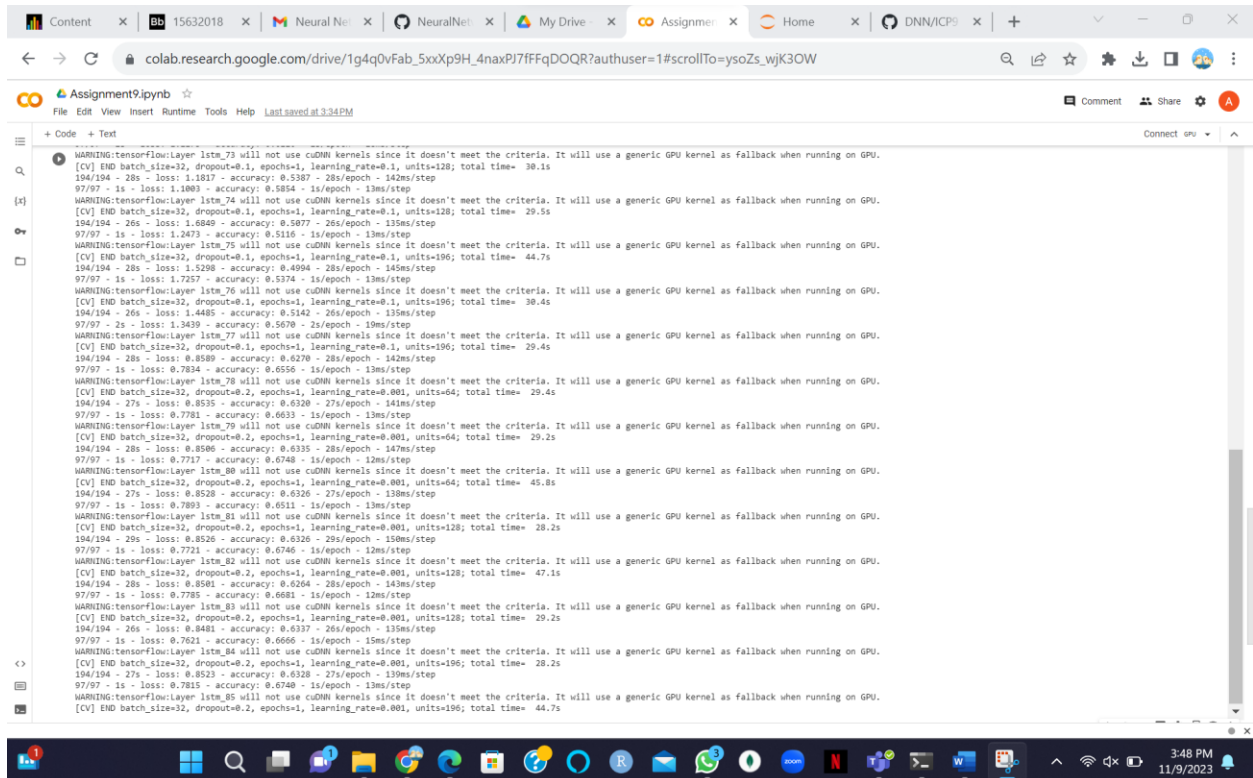
def create_model(units=196, dropout=0.2, learning_rate=0.001):
    model = Sequential()
    model.add(Embedding(max_features, embed_dim, input_length = X.shape[1]))
    model.add(LSTM(units, dropout=dropout, recurrent_dropout=dropout))
    model.add(Dense(3, activation='softmax'))
    optimizer = Adam(lr=learning_rate)
    model.compile(loss='categorical_crossentropy', optimizer=optimizer,
metrics=['accuracy'])
    return model

model = KerasClassifier(build_fn=create_model, verbose=2)

units = [64, 128, 196]
dropout = [0.1, 0.2, 0.3]
learning_rate = [0.001, 0.01, 0.1]
epochs = [1]
batch_size = [32]

param_grid = dict(units=units, dropout=dropout,
learning_rate=learning_rate, epochs=epochs, batch_size=batch_size)
grid = GridSearchCV(estimator=model, param_grid=param_grid, cv=3,
verbose=2)
grid_result = grid.fit(X_train, Y_train)

print("Best: %f using %s" % (grid_result.best_score_,
grid_result.best_params_))
```



```
WARNING:tensorflow:Layer lstm_73 will not use cuDNN kernels since it doesn't meet the criteria. It will use a generic GPU kernel as fallback when running on GPU.
[CV] END batch_size=32, dropout=0.1, epochs=1, learning_rate=0.1, units=128; total time= 30.1s
194/194 - 28s - loss: 1.1817 - accuracy: 0.5387 - 28s/epoch - 142ms/step
97/97 - 1s - loss: 1.1803 - accuracy: 0.5854 - 1s/epoch - 13ms/step
WARNING:tensorflow:Layer lstm_74 will not use cuDNN kernels since it doesn't meet the criteria. It will use a generic GPU kernel as fallback when running on GPU.
[CV] END batch_size=32, dropout=0.1, epochs=1, learning_rate=0.1, units=128; total time= 29.5s
194/194 - 26s - loss: 1.6849 - accuracy: 0.5877 - 26s/epoch - 135ms/step
97/97 - 1s - loss: 1.2473 - accuracy: 0.5116 - 1s/epoch - 13ms/step
WARNING:tensorflow:Layer lstm_75 will not use cuDNN kernels since it doesn't meet the criteria. It will use a generic GPU kernel as fallback when running on GPU.
[CV] END batch_size=32, dropout=0.1, epochs=1, learning_rate=0.1, units=196; total time= 44.7s
194/194 - 28s - loss: 1.5298 - accuracy: 0.4994 - 28s/epoch - 145ms/step
97/97 - 1s - loss: 1.7257 - accuracy: 0.5174 - 1s/epoch - 13ms/step
WARNING:tensorflow:Layer lstm_76 will not use cuDNN kernels since it doesn't meet the criteria. It will use a generic GPU kernel as fallback when running on GPU.
[CV] END batch_size=32, dropout=0.1, epochs=1, learning_rate=0.1, units=196; total time= 30.4s
194/194 - 26s - loss: 1.4485 - accuracy: 0.5142 - 26s/epoch - 135ms/step
97/97 - 2s - loss: 1.3439 - accuracy: 0.5678 - 2s/epoch - 19ms/step
WARNING:tensorflow:Layer lstm_77 will not use cuDNN kernels since it doesn't meet the criteria. It will use a generic GPU kernel as fallback when running on GPU.
[CV] END batch_size=32, dropout=0.1, epochs=1, learning_rate=0.1, units=196; total time= 29.4s
194/194 - 28s - loss: 0.8589 - accuracy: 0.6278 - 28s/epoch - 142ms/step
97/97 - 1s - loss: 0.7834 - accuracy: 0.6556 - 1s/epoch - 13ms/step
WARNING:tensorflow:Layer lstm_78 will not use cuDNN kernels since it doesn't meet the criteria. It will use a generic GPU kernel as fallback when running on GPU.
[CV] END batch_size=32, dropout=0.2, epochs=1, learning_rate=0.001, units=64; total time= 29.4s
194/194 - 27s - loss: 0.8535 - accuracy: 0.6328 - 27s/epoch - 141ms/step
97/97 - 1s - loss: 0.7781 - accuracy: 0.6633 - 1s/epoch - 13ms/step
WARNING:tensorflow:Layer lstm_79 will not use cuDNN kernels since it doesn't meet the criteria. It will use a generic GPU kernel as fallback when running on GPU.
[CV] END batch_size=32, dropout=0.2, epochs=1, learning_rate=0.001, units=64; total time= 29.2s
194/194 - 28s - loss: 0.8506 - accuracy: 0.6335 - 28s/epoch - 147ms/step
97/97 - 1s - loss: 0.7717 - accuracy: 0.6748 - 1s/epoch - 12ms/step
WARNING:tensorflow:Layer lstm_80 will not use cuDNN kernels since it doesn't meet the criteria. It will use a generic GPU kernel as fallback when running on GPU.
[CV] END batch_size=32, dropout=0.2, epochs=1, learning_rate=0.001, units=64; total time= 45.8s
194/194 - 27s - loss: 0.8528 - accuracy: 0.6326 - 27s/epoch - 138ms/step
97/97 - 1s - loss: 0.7893 - accuracy: 0.6511 - 1s/epoch - 13ms/step
WARNING:tensorflow:Layer lstm_81 will not use cuDNN kernels since it doesn't meet the criteria. It will use a generic GPU kernel as fallback when running on GPU.
[CV] END batch_size=32, dropout=0.2, epochs=1, learning_rate=0.001, units=128; total time= 28.2s
194/194 - 29s - loss: 0.8526 - accuracy: 0.6326 - 29s/epoch - 150ms/step
97/97 - 1s - loss: 0.7721 - accuracy: 0.6746 - 1s/epoch - 12ms/step
WARNING:tensorflow:Layer lstm_82 will not use cuDNN kernels since it doesn't meet the criteria. It will use a generic GPU kernel as fallback when running on GPU.
[CV] END batch_size=32, dropout=0.2, epochs=1, learning_rate=0.001, units=128; total time= 47.1s
194/194 - 28s - loss: 0.8501 - accuracy: 0.6264 - 28s/epoch - 143ms/step
97/97 - 1s - loss: 0.7785 - accuracy: 0.6681 - 1s/epoch - 12ms/step
WARNING:tensorflow:Layer lstm_83 will not use cuDNN kernels since it doesn't meet the criteria. It will use a generic GPU kernel as fallback when running on GPU.
[CV] END batch_size=32, dropout=0.2, epochs=1, learning_rate=0.001, units=128; total time= 29.2s
194/194 - 26s - loss: 0.8481 - accuracy: 0.6337 - 26s/epoch - 135ms/step
97/97 - 1s - loss: 0.7621 - accuracy: 0.6666 - 1s/epoch - 15ms/step
WARNING:tensorflow:Layer lstm_84 will not use cuDNN kernels since it doesn't meet the criteria. It will use a generic GPU kernel as fallback when running on GPU.
[CV] END batch_size=32, dropout=0.2, epochs=1, learning_rate=0.001, units=196; total time= 28.2s
194/194 - 27s - loss: 0.8523 - accuracy: 0.6328 - 27s/epoch - 139ms/step
97/97 - 1s - loss: 0.7815 - accuracy: 0.6748 - 1s/epoch - 13ms/step
WARNING:tensorflow:Layer lstm_85 will not use cuDNN kernels since it doesn't meet the criteria. It will use a generic GPU kernel as fallback when running on GPU.
[CV] END batch_size=32, dropout=0.2, epochs=1, learning_rate=0.001, units=196; total time= 44.7s
```

This code defines the `create_model` function that returns a Keras model with the specified hyperparameters. The `KerasClassifier` class is used to create a wrapper for the `create_model` function, which can be used as an estimator for `GridSearchCV`. The hyperparameters to be tuned are defined in the `param_grid` dictionary. `GridSearchCV` is then called with the `KerasClassifier` object, the `param_grid` dictionary