OCR letter recognition using Deep Learning

```
import numpy as np
import pandas as pd
import tensorflow as tf
from sklearn.model selection import train test split
from sklearn.preprocessing import LabelEncoder
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import *
import matplotlib.pyplot as plt
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 warnings.warn(f"file system plugins are not loaded: {e}")
# Load the OCR letter recognition dataset
url =
'https://archive.ics.uci.edu/ml/machine-learning-databases/letter-
recognition/letter-recognition.data'
dataset = pd.read csv(url, header=None)
```

OR

```
Load the OCR letter recognition dataset, Link

url = 'letter-recognition.data'

dataset = pd.read_csv(url, header=None)

# Split the dataset into features and labels

X = dataset.iloc[:, 1:].values #selecting all rows and selecting all
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columns from index 1
y = dataset.iloc[:, 0].values #selecting all rows and selecting
column with index 0
print(y[0])
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# Encode the labels into numeric value
label encoder = LabelEncoder()
y = label encoder.fit transform(y)
print(y[0])
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#splitting dataset into training and testing
X_train, X_test, y_train, y_test = train_test_split(X, y,
test size=0.2, random state=1)
X \text{ train} = X \text{ train} / 15.0
X \text{ test} = X \text{ test} / 15.0
#we are using sequential model where layers are stacked one after
another,
#output of previous layer is given to as input to next layer
model = Sequential()
#1st layer is dense layer which consists on 128 neurons, since it is
1st layer we need to define input shape of our training data
model.add(Dense(128, activation='relu', input shape=(16,)))
model.add(Dropout(0.5))
model.add(Dense(64, activation='relu'))
model.add(Dropout(0.5))
model.add(Dense(26, activation='softmax')) #softmax is used to
predict multiclass category outcome
#now we will compile the model
#sparse_categorical_crossentropy (scce) produces a category index of
the most likely matching category.
model.compile(loss='sparse_categorical_crossentropy',
optimizer='adam', metrics =['accuracy'])
#The batch size is a number of samples processed before the model is
updated.
#verbose is the choice that how you want to see the output of your
Nural Network while it's training.
#If you set verbose = 0, It will show nothing
history = model.fit(X_train, y_train, validation_data=(X_test,
y test), epochs=50, batch size=12, verbose=1)
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Epoch 1/50
2.6237 - accuracy: 0.2200 - val loss: 1.7889 - val accuracy: 0.5200
1.8675 - accuracy: 0.4152 - val_loss: 1.4179 - val_accuracy: 0.5953
Epoch 3/50
1.6275 - accuracy: 0.4778 - val loss: 1.2190 - val accuracy: 0.6525
Epoch 4/50
1.4847 - accuracy: 0.5254 - val loss: 1.1180 - val accuracy: 0.6752
Epoch 5/50
1.4018 - accuracy: 0.5551 - val_loss: 1.0480 - val_accuracy: 0.6917
Epoch 6/50
1.3509 - accuracy: 0.5724 - val_loss: 0.9991 - val_accuracy: 0.7220
Epoch 7/50
1.2906 - accuracy: 0.5952 - val loss: 0.9567 - val accuracy: 0.7117
Epoch 8/50
1.2478 - accuracy: 0.6033 - val loss: 0.9193 - val accuracy: 0.7305
Epoch 9/50
1.2148 - accuracy: 0.6179 - val_loss: 0.8796 - val_accuracy: 0.7368
Epoch 10/50
1.1853 - accuracy: 0.6227 - val loss: 0.8424 - val accuracy: 0.7588
Epoch 11/50
1.1550 - accuracy: 0.6326 - val_loss: 0.8344 - val_accuracy: 0.7552
Epoch 12/50
1.1416 - accuracy: 0.6398 - val loss: 0.7991 - val accuracy: 0.7625
Epoch 13/50
1.1110 - accuracy: 0.6500 - val_loss: 0.7890 - val_accuracy: 0.7582
Epoch 14/50
1.0993 - accuracy: 0.6546 - val loss: 0.7669 - val accuracy: 0.7790
Epoch 15/50
1.0911 - accuracy: 0.6551 - val loss: 0.7460 - val accuracy: 0.7800
Epoch 16/50
1.0815 - accuracy: 0.6576 - val_loss: 0.7507 - val_accuracy: 0.7692
Epoch 17/50
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1.0675 - accuracy: 0.6633 - val_loss: 0.7371 - val_accuracy: 0.7835
Epoch 18/50
1.0426 - accuracy: 0.6670 - val_loss: 0.7095 - val accuracy: 0.7928
Epoch 19/50
1.0241 - accuracy: 0.6747 - val loss: 0.6862 - val accuracy: 0.8018
Epoch 20/50
1.0250 - accuracy: 0.6739 - val loss: 0.6884 - val accuracy: 0.8030
Epoch 21/50
1.0161 - accuracy: 0.6771 - val loss: 0.6768 - val accuracy: 0.7940
Epoch 22/50
0.9871 - accuracy: 0.6864 - val_loss: 0.6749 - val_accuracy: 0.7933
Epoch 23/50
1.0140 - accuracy: 0.6823 - val loss: 0.6662 - val accuracy: 0.8067
Epoch 24/50
0.9924 - accuracy: 0.6890 - val loss: 0.6563 - val accuracy: 0.8025
Epoch 25/50
0.9856 - accuracy: 0.6877 - val loss: 0.6504 - val accuracy: 0.8123
Epoch 26/50
0.9879 - accuracy: 0.6846 - val loss: 0.6529 - val accuracy: 0.8115
Epoch 27/50
0.9805 - accuracy: 0.6832 - val loss: 0.6500 - val accuracy: 0.8165
Epoch 28/50
0.9765 - accuracy: 0.6931 - val loss: 0.6297 - val accuracy: 0.8165
Epoch 29/50
0.9791 - accuracy: 0.6924 - val loss: 0.6396 - val accuracy: 0.8125
Epoch 30/50
0.9591 - accuracy: 0.6978 - val loss: 0.6327 - val accuracy: 0.8117
Epoch 31/50
0.9679 - accuracy: 0.6915 - val_loss: 0.6185 - val_accuracy: 0.8205
Epoch 32/50
0.9586 - accuracy: 0.6957 - val_loss: 0.6110 - val_accuracy: 0.8253
Epoch 33/50
0.9602 - accuracy: 0.6945 - val loss: 0.6108 - val accuracy: 0.8230
Epoch 34/50
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0.9362 - accuracy: 0.6998 - val loss: 0.6139 - val accuracy: 0.8255
Epoch 35/50
0.9339 - accuracy: 0.6994 - val_loss: 0.5955 - val accuracy: 0.8282
Epoch 36/50
0.9429 - accuracy: 0.7021 - val loss: 0.5999 - val accuracy: 0.8265
Epoch 37/50
0.9315 - accuracy: 0.7054 - val loss: 0.5874 - val accuracy: 0.8278
Epoch 38/50
0.9401 - accuracy: 0.7034 - val loss: 0.5890 - val accuracy: 0.8278
Epoch 39/50
0.9241 - accuracy: 0.7041 - val loss: 0.5909 - val accuracy: 0.8265
Epoch 40/50
0.9168 - accuracy: 0.7109 - val loss: 0.5894 - val accuracy: 0.8305
Epoch 41/50
0.9074 - accuracy: 0.7098 - val loss: 0.5930 - val accuracy: 0.8200
Epoch 42/50
0.9054 - accuracy: 0.7084 - val loss: 0.5810 - val accuracy: 0.8255
Epoch 43/50
0.9192 - accuracy: 0.7062 - val loss: 0.5760 - val accuracy: 0.8303
Epoch 44/50
0.8950 - accuracy: 0.7171 - val loss: 0.5801 - val accuracy: 0.8257
Epoch 45/50
0.9087 - accuracy: 0.7116 - val loss: 0.5602 - val accuracy: 0.8313
Epoch 46/50
0.9110 - accuracy: 0.7074 - val loss: 0.5716 - val accuracy: 0.8303
Epoch 47/50
0.9053 - accuracy: 0.7141 - val loss: 0.5759 - val accuracy: 0.8313
Epoch 48/50
0.9121 - accuracy: 0.7105 - val loss: 0.5714 - val accuracy: 0.8332
Epoch 49/50
0.8995 - accuracy: 0.7120 - val loss: 0.5664 - val accuracy: 0.8360
Epoch 50/50
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0.8945 - accuracy: 0.7156 - val loss: 0.5663 - val accuracy: 0.8322
loss, accuracy = model.evaluate(X test, y test)
print("Test accuracy:", accuracy)
print("Test loss:", loss)
- accuracy: 0.8322
Test accuracy: 0.8322499990463257
Test loss: 0.5662633776664734
model.save('ocr model.h5')
# Save the trained model
from tensorflow.keras.models import load model
model = load model('ocr model.h5')
# Load the trained model
sample records = X test[:1000]
# Select a few records for classification
# Perform classification
predictions = model.predict(sample records)
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predicted_labels = np.argmax(predictions, axis=1)
predicted letters = label encoder.inverse transform(predicted labels)
actual letters = label encoder.inverse transform(y test)
# Calculate accuracy
accuracy = np.sum(predicted labels == y[:1000]) /
len(predicted labels)
# Print the predicted labels and corresponding actual labels
print("Predicted Labels\tActual Labels")
for i in range(len(predicted letters)):
   print(f"{predicted letters[i]}\t\t\t{actual letters[i]}")
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