```
import pandas as pd
import numpy as np
from keras.layers import Conv2D , MaxPooling2D , Dense, Flatten , Input , Dropout
from keras.models import Sequential , Model
import keras
import tensorflow as tf
from PIL import Image
from keras.models import model_from_json
import os
from keras.preprocessing.image import ImageDataGenerator
from keras import utils as np_utils
```

```
json_file = open('model.json', 'r')
loaded_model_json = json_file.read()
json_file.close()
loaded_model = model_from_json(loaded_model_json)
# load weights into new model
loaded_model.load_weights("model_digit.h5")
print("Loaded model from disk")
loaded_model.compile(loss='categorical_crossentropy', optimizer='adam', metrics=['accuracy'])
```

```
Loaded model from disk
```

```
df = pd.read_csv('train.csv')
Y = np.asarray(df['label'])
#df1 = pd.read_csv('s1.csv')
#Y1 = np.asarray(df1['Label'])
Y = np.concatenate((Y, Y, Y, Y), axis=0)
Y = np.reshape(Y, (Y.shape[0], 1))
print(Y.shape)
df = df.drop(['label'], axis=1)

a = []
for x in range(784):
  a.append('pixel'+str(783-x))
b = []
for x in range(28):
  for y in range(28):
    b.append('pixel'+str(x*28 + 27-y))
c = []
for x in range(28):
  for y in range(28):
    c.append('pixel'+str((27-x)*28 + y))
df1 = df[a]
images = df.to_numpy()
#df2 = pd.read_csv('test.csv')
#im2 = df2.to_numpy()
imr = df1.to_numpy()
df2 = df[b]
df3 = df[c]
immx = df2.to_numpy()
immy = df3.to_numpy()
#print(im2.shape)
print(images.shape)
images = np.concatenate((images, imr, immx, immy), axis=0)
print(images.shape)
images = np.reshape(images, (images.shape[0], 28, 28, 1))
X = images
del images
#del im2
X = X/255.0
print(X.shape)
Y = np_utils.to_categorical(Y)
print(Y)
```

```
(168000, 1)
(42000, 784)
(168000, 784)
(168000, 28, 28, 1)
[[0. 1. 0. ... 0. 0. 0.]
 [1. 0. 0. ... 0. 0. 0.]
 [0. 1. 0. ... 0. 0. 0.]
 ...
 [0. 0. 0. ... 1. 0. 0.]
 [0. 0. 0. ... 0. 0. 0.]
 [0. 0. 0. ... 0. 0. 1.]]
```

```
loaded_model.fit(X , Y , batch_size = 128 , epochs = 200 )
```

```
Epoch 1/200
168000/168000 [==============================] - 17s 100us/step - loss: 0.0197 - acc: 0.9933
Epoch 2/200
168000/168000 [==============================] - 16s 97us/step - loss: 0.0190 - acc: 0.9937
Epoch 3/200
168000/168000 [==============================] - 16s 97us/step - loss: 0.0188 - acc: 0.9936
Epoch 4/200
168000/168000 [==============================] - 16s 97us/step - loss: 0.0194 - acc: 0.9934
Epoch 5/200
168000/168000 [==============================] - 16s 97us/step - loss: 0.0196 - acc: 0.9933
Epoch 6/200
168000/168000 [==============================] - 16s 96us/step - loss: 0.0192 - acc: 0.9934
Epoch 7/200
168000/168000 [==============================] - 16s 97us/step - loss: 0.0183 - acc: 0.9938
Epoch 8/200
168000/168000 [==============================] - 16s 96us/step - loss: 0.0203 - acc: 0.9932
Epoch 9/200
168000/168000 [==============================] - 16s 97us/step - loss: 0.0192 - acc: 0.9935
Epoch 10/200
168000/168000 [==============================] - 16s 97us/step - loss: 0.0197 - acc: 0.9932
Epoch 11/200
168000/168000 [==============================] - 16s 98us/step - loss: 0.0192 - acc: 0.9935
Epoch 12/200
168000/168000 [==============================] - 16s 97us/step - loss: 0.0186 - acc: 0.9938
Epoch 13/200
168000/168000 [==============================] - 17s 99us/step - loss: 0.0189 - acc: 0.9937
Epoch 14/200
168000/168000 [==============================] - 17s 98us/step - loss: 0.0190 - acc: 0.9937
Epoch 15/200
168000/168000 [==============================] - 16s 97us/step - loss: 0.0197 - acc: 0.9934
Epoch 16/200
168000/168000 [==============================] - 16s 97us/step - loss: 0.0182 - acc: 0.9938
Epoch 17/200
168000/168000 [==============================] - 16s 97us/step - loss: 0.0186 - acc: 0.9936
Epoch 18/200
168000/168000 [==============================] - 16s 97us/step - loss: 0.0202 - acc: 0.9934
Epoch 19/200
168000/168000 [==============================] - 16s 97us/step - loss: 0.0192 - acc: 0.9935
Epoch 20/200
168000/168000 [==============================] - 16s 97us/step - loss: 0.0186 - acc: 0.9937
Epoch 21/200
168000/168000 [==============================] - 16s 97us/step - loss: 0.0194 - acc: 0.9935
Epoch 22/200
168000/168000 [==============================] - 16s 97us/step - loss: 0.0182 - acc: 0.9939
Epoch 23/200
168000/168000 [==============================] - 16s 97us/step - loss: 0.0194 - acc: 0.9937
Epoch 24/200
168000/168000 [==============================] - 16s 97us/step - loss: 0.0190 - acc: 0.9935
Epoch 25/200
168000/168000 [==============================] - 16s 97us/step - loss: 0.0178 - acc: 0.9940
Epoch 26/200
168000/168000 [==============================] - 16s 97us/step - loss: 0.0182 - acc: 0.9940
Epoch 27/200
168000/168000 [==============================] - 16s 97us/step - loss: 0.0196 - acc: 0.9936
Epoch 28/200
168000/168000 [==============================] - 16s 98us/step - loss: 0.0177 - acc: 0.9939
Epoch 29/200
168000/168000 [==============================] - 16s 98us/step - loss: 0.0185 - acc: 0.9935
Epoch 30/200
168000/168000 [==============================] - 16s 97us/step - loss: 0.0191 - acc: 0.9936
Epoch 31/200
168000/168000 [==============================] - 16s 98us/step - loss: 0.0186 - acc: 0.9937
Epoch 32/200
168000/168000 [==============================] - 16s 98us/step - loss: 0.0175 - acc: 0.9941
Epoch 33/200
168000/168000 [==============================] - 17s 99us/step - loss: 0.0190 - acc: 0.9937
Epoch 34/200
168000/168000 [==============================] - 16s 97us/step - loss: 0.0186 - acc: 0.9938
Epoch 35/200
168000/168000 [==============================] - 16s 98us/step - loss: 0.0199 - acc: 0.9933
Epoch 36/200
168000/168000 [==============================] - 16s 97us/step - loss: 0.0187 - acc: 0.9935
Epoch 37/200
168000/168000 [==============================] - 16s 96us/step - loss: 0.0181 - acc: 0.9939
Epoch 38/200
168000/168000 [==============================] - 16s 96us/step - loss: 0.0178 - acc: 0.9942
Epoch 39/200
168000/168000 [==============================] - 16s 96us/step - loss: 0.0183 - acc: 0.9939
Epoch 40/200
168000/168000 [==============================] - 16s 96us/step - loss: 0.0178 - acc: 0.9939
Epoch 41/200
168000/168000 [==============================] - 16s 96us/step - loss: 0.0184 - acc: 0.9938
Epoch 42/200
168000/168000 [==============================] - 16s 96us/step - loss: 0.0177 - acc: 0.9940
Epoch 43/200
168000/168000 [==============================] - 16s 96us/step - loss: 0.0197 - acc: 0.9932
Epoch 44/200
168000/168000 [==============================] - 16s 96us/step - loss: 0.0171 - acc: 0.9944
Epoch 45/200
168000/168000 [==============================] - 16s 96us/step - loss: 0.0191 - acc: 0.9937
Epoch 46/200
168000/168000 [==============================] - 16s 96us/step - loss: 0.0187 - acc: 0.9938
Epoch 47/200
168000/168000 [==============================] - 16s 96us/step - loss: 0.0176 - acc: 0.9942
Epoch 48/200
168000/168000 [==============================] - 16s 97us/step - loss: 0.0175 - acc: 0.9939
Epoch 49/200
168000/168000 [==============================] - 16s 96us/step - loss: 0.0181 - acc: 0.9939
Epoch 50/200
168000/168000 [==============================] - 16s 95us/step - loss: 0.0177 - acc: 0.9940
Epoch 51/200
168000/168000 [==============================] - 16s 97us/step - loss: 0.0175 - acc: 0.9942
Epoch 52/200
168000/168000 [==============================] - 16s 97us/step - loss: 0.0179 - acc: 0.9941
Epoch 53/200
168000/168000 [==============================] - 16s 95us/step - loss: 0.0178 - acc: 0.9940
Epoch 54/200
168000/168000 [==============================] - 16s 96us/step - loss: 0.0172 - acc: 0.9942
Epoch 55/200
168000/168000 [==============================] - 16s 95us/step - loss: 0.0180 - acc: 0.9941
Epoch 56/200
168000/168000 [==============================] - 16s 95us/step - loss: 0.0177 - acc: 0.9941
Epoch 57/200
168000/168000 [==============================] - 16s 95us/step - loss: 0.0182 - acc: 0.9941
```

```
168000/168000 [==============================] - 16s 95us/step - loss: 0.0182 - acc: 0.9941
Epoch 58/200
168000/168000 [==============================] - 16s 95us/step - loss: 0.0187 - acc: 0.9939
Epoch 59/200
168000/168000 [==============================] - 16s 95us/step - loss: 0.0171 - acc: 0.9941
Epoch 60/200
168000/168000 [==============================] - 16s 95us/step - loss: 0.0181 - acc: 0.9939
Epoch 61/200
168000/168000 [==============================] - 16s 95us/step - loss: 0.0183 - acc: 0.9938
Epoch 62/200
168000/168000 [==============================] - 16s 95us/step - loss: 0.0178 - acc: 0.9941
Epoch 63/200
168000/168000 [==============================] - 16s 95us/step - loss: 0.0170 - acc: 0.9941
Epoch 64/200
168000/168000 [==============================] - 16s 95us/step - loss: 0.0179 - acc: 0.9939
Epoch 65/200
168000/168000 [==============================] - 16s 95us/step - loss: 0.0183 - acc: 0.9939
Epoch 66/200
168000/168000 [==============================] - 16s 95us/step - loss: 0.0182 - acc: 0.9940
Epoch 67/200
168000/168000 [==============================] - 16s 96us/step - loss: 0.0181 - acc: 0.9939
Epoch 68/200
168000/168000 [==============================] - 16s 95us/step - loss: 0.0180 - acc: 0.9941
Epoch 69/200
168000/168000 [==============================] - 16s 95us/step - loss: 0.0175 - acc: 0.9941
Epoch 70/200
168000/168000 [==============================] - 16s 95us/step - loss: 0.0181 - acc: 0.9941
Epoch 71/200
168000/168000 [==============================] - 16s 96us/step - loss: 0.0162 - acc: 0.9945
Epoch 72/200
168000/168000 [==============================] - 16s 95us/step - loss: 0.0183 - acc: 0.9940
Epoch 73/200
168000/168000 [==============================] - 16s 95us/step - loss: 0.0174 - acc: 0.9940
Epoch 74/200
168000/168000 [==============================] - 16s 95us/step - loss: 0.0183 - acc: 0.9941
Epoch 75/200
168000/168000 [==============================] - 16s 95us/step - loss: 0.0177 - acc: 0.9941
Epoch 76/200
168000/168000 [==============================] - 16s 95us/step - loss: 0.0180 - acc: 0.9941
Epoch 77/200
168000/168000 [==============================] - 16s 95us/step - loss: 0.0176 - acc: 0.9940
Epoch 78/200
168000/168000 [==============================] - 16s 95us/step - loss: 0.0175 - acc: 0.9943
Epoch 79/200
168000/168000 [==============================] - 16s 95us/step - loss: 0.0168 - acc: 0.9943
Epoch 80/200
168000/168000 [==============================] - 16s 95us/step - loss: 0.0179 - acc: 0.9941
Epoch 81/200
168000/168000 [==============================] - 16s 95us/step - loss: 0.0169 - acc: 0.9941
Epoch 82/200
168000/168000 [==============================] - 16s 95us/step - loss: 0.0175 - acc: 0.9942
Epoch 83/200
168000/168000 [==============================] - 16s 94us/step - loss: 0.0170 - acc: 0.9943
Epoch 84/200
168000/168000 [==============================] - 16s 93us/step - loss: 0.0172 - acc: 0.9944
Epoch 85/200
168000/168000 [==============================] - 16s 93us/step - loss: 0.0179 - acc: 0.9942
Epoch 86/200
168000/168000 [==============================] - 16s 95us/step - loss: 0.0168 - acc: 0.9944
Epoch 87/200
168000/168000 [==============================] - 16s 94us/step - loss: 0.0181 - acc: 0.9941
Epoch 88/200
168000/168000 [==============================] - 16s 95us/step - loss: 0.0166 - acc: 0.9945
Epoch 89/200
168000/168000 [==============================] - 16s 94us/step - loss: 0.0163 - acc: 0.9944
Epoch 90/200
168000/168000 [==============================] - 16s 94us/step - loss: 0.0169 - acc: 0.9945
Epoch 91/200
168000/168000 [==============================] - 16s 96us/step - loss: 0.0170 - acc: 0.9943
Epoch 92/200
168000/168000 [==============================] - 16s 94us/step - loss: 0.0170 - acc: 0.9944
Epoch 93/200
168000/168000 [==============================] - 16s 94us/step - loss: 0.0178 - acc: 0.9941
Epoch 94/200
168000/168000 [==============================] - 16s 94us/step - loss: 0.0174 - acc: 0.9944
Epoch 95/200
168000/168000 [==============================] - 16s 93us/step - loss: 0.0166 - acc: 0.9945
Epoch 96/200
168000/168000 [==============================] - 16s 93us/step - loss: 0.0164 - acc: 0.9947
Epoch 97/200
168000/168000 [==============================] - 16s 93us/step - loss: 0.0177 - acc: 0.9943
Epoch 98/200
168000/168000 [==============================] - 15s 92us/step - loss: 0.0172 - acc: 0.9943
Epoch 99/200
168000/168000 [==============================] - 16s 92us/step - loss: 0.0168 - acc: 0.9943
Epoch 100/200
168000/168000 [==============================] - 15s 92us/step - loss: 0.0170 - acc: 0.9944
Epoch 101/200
168000/168000 [==============================] - 16s 93us/step - loss: 0.0167 - acc: 0.9945
Epoch 102/200
168000/168000 [==============================] - 16s 93us/step - loss: 0.0169 - acc: 0.9944
Epoch 103/200
168000/168000 [==============================] - 15s 92us/step - loss: 0.0175 - acc: 0.9943
Epoch 104/200
168000/168000 [==============================] - 15s 92us/step - loss: 0.0168 - acc: 0.9945
Epoch 105/200
168000/168000 [==============================] - 15s 92us/step - loss: 0.0171 - acc: 0.9943
Epoch 106/200
168000/168000 [==============================] - 16s 94us/step - loss: 0.0169 - acc: 0.9945
Epoch 107/200
168000/168000 [==============================] - 15s 92us/step - loss: 0.0163 - acc: 0.9946
Epoch 108/200
168000/168000 [==============================] - 15s 91us/step - loss: 0.0178 - acc: 0.9943
Epoch 109/200
168000/168000 [==============================] - 15s 92us/step - loss: 0.0172 - acc: 0.9943
Epoch 110/200
168000/168000 [==============================] - 15s 92us/step - loss: 0.0174 - acc: 0.9943
Epoch 111/200
168000/168000 [==============================] - 16s 94us/step - loss: 0.0171 - acc: 0.9943
Epoch 112/200
168000/168000 [==============================] - 15s 92us/step - loss: 0.0163 - acc: 0.9945
Epoch 113/200
168000/168000 [==============================] - 15s 92us/step - loss: 0.0167 - acc: 0.9946
Epoch 114/200
```