

RNC Org

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Contents

1	Load libraries	1
2	Set parameters	1
3	Pre-process	2
4	Create the model	2
5	Set the parameters, compile and train the model	3
6	Evaluate the performance of the trained model	3

1 Load libraries

```
import os; os.environ['TF_CPP_MIN_LOG_LEVEL'] = '2'
import matplotlib.pyplot as plt
import numpy as np
import keras
from keras import layers
import tensorflow as tf
import argparse
from sklearn.preprocessing import LabelBinarizer
from keras.datasets import mnist
```

2 Set parameters

```
num_classes = 10
input_shape = (28, 28, 1)
```

3 Pre-process

```
(x_train, y_train), (x_test, y_test) = keras.datasets.mnist.load_data()
```

```
x_train = x_train.astype("float32") / 255  
x_test = x_test.astype("float32") / 255
```

```
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")
```

```
label_binarizer = LabelBinarizer()  
y_train = label_binarizer.fit_transform(y_train)  
y_test = label_binarizer.fit_transform(y_test)
```

```
x_train shape: (60000, 28, 28, 1)  
60000 train samples  
10000 test samples
```

4 Create the model

```
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()
```

Model: "sequential_3"

Layer (type)	Output Shape	Param #
conv2d_6 (Conv2D)	(None, 26, 26, 32)	320
max_pooling2d_6 (MaxPooling2D)	(None, 13, 13, 32)	0
conv2d_7 (Conv2D)	(None, 11, 11, 64)	18496
max_pooling2d_7 (MaxPooling2D)	(None, 5, 5, 64)	0
flatten_3 (Flatten)	(None, 1600)	0
dropout_3 (Dropout)	(None, 1600)	0
dense_3 (Dense)	(None, 10)	16010

=====
Total params: 34826 (136.04 KB)
Trainable params: 34826 (136.04 KB)
Non-trainable params: 0 (0.00 Byte)
=====

5 Set the parameters, compile and train the model

```
batch_size = 128  
epochs = 1
```

```
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)
```

6 Evaluate the performance of the trained model

```
test_loss, test_accuracy = model.evaluate(x_test, y_test, verbose=2)  
print(f"Test accuracy: {test_accuracy * 100:.2f}%")
```

```
f"{test_accuracy * 100:.2f}%"
```

The test accuracy is 97.59%.