참고 :

- https://github.com/tensorflow/docs-l10n/blob/master/site/ko/tutorials/keras/classification.ipynb
- https://archive.is/fY0FO

```
# tensorflow와 tf.keras를 임포트합니다
import tensorflow as tf
from tensorflow import keras

# 헬퍼(helper) 라이브러리를 임포트합니다
import numpy as np
import matplotlib.pyplot as plt

print(tf.__version__)
```

```
    2.3.0
```

```
fashion_mnist = keras.datasets.fashion_mnist

(train_images, train_labels), (test_images, test_labels) = fashion_mnist.load_data()
```

- 이미지는 28x28 크기의 넘파이 배열이고 픽셀 값은 0과 255 사이입니다. 레이블(label)은 0에서 9까지의 정수 배열입니다. 이 값은 이미지에 있는 옷의 클래스(class)를 나타냅니다:
- 레이블 클래스

0	T-shirt/top
1	Trouser
2	Pullover
3	Dress
4	Coat
5	Sandal
6	Shirt
7	Sneaker
8	Bag
9	Ankle boot

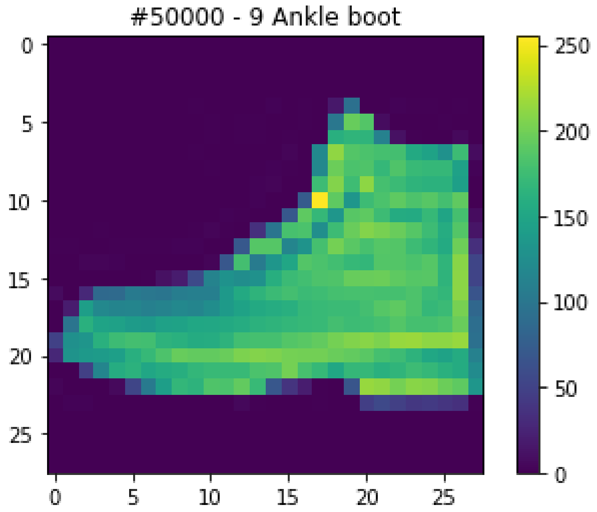
```
class_names = ['T-shirt/top', 'Trouser', 'Pullover', 'Dress', 'Coat',
               'Sandal', 'Shirt', 'Sneaker', 'Bag', 'Ankle boot']
```

```
train_images.shape
```

```
(60000, 28, 28)
```

데이터 탐색

```
plt.figure()
idx_to_draw = 50000 # 바꾸어보세요
plt.imshow(train_images[idx_to_draw])

lbl = train_labels[idx_to_draw]

plt.title('#{} - {} {}'.format(idx_to_draw, lbl, class_names[lbl]))
plt.colorbar()
plt.grid(False)
plt.show()
```



Data 전처리

신경망 모델에 주입하기 전에 이 값의 범위를 0~1 사이로 조정하겠습니다. 이렇게 하려면 255로 나누어야 합니다. 훈련 세트와 테스트 세트를 동일한 방식으로 전처리하는 것이 중요합니다:

```
train_images = train_images / 255.0

test_images = test_images / 255.0
```

```
plt.figure(figsize=(10,10))
for i in range(25):
    plt.subplot(5,5,i+1)
    plt.xticks([])
    plt.yticks([])
    plt.grid(False)
    plt.imshow(train_images[i], cmap=plt.cm.binary)
    plt.xlabel(class_names[train_labels[i]])
plt.show()
```

TDDO: 학습 코드를 위의 참조 url 을 이용하여 완성해보세요

```
model = keras.Sequential([
    keras.layers.Flatten(input_shape=(28, 28)),
    keras.layers.Dense(128, activation='relu'),
    keras.layers.Dense(10, activation='softmax')
])
```

```
model.compile(optimizer='adam',
              loss='sparse_categorical_crossentropy',
              metrics=['accuracy'])
```

```
model.fit(train_images, train_labels, epochs=5)
```

```
Epoch 1/5
1875/1875 [==============================] - 3s 2ms/step - loss: 0.4998 - accuracy: 0.8248
Epoch 2/5
1875/1875 [==============================] - 3s 2ms/step - loss: 0.3759 - accuracy: 0.8642
Epoch 3/5
1875/1875 [==============================] - 3s 2ms/step - loss: 0.3382 - accuracy: 0.8759
Epoch 4/5
```

```
1875/1875 [==============================] - 3s 2ms/step - loss: 0.3141 - accuracy: 0.8852
Epoch 5/5
1875/1875 [==============================] - 3s 2ms/step - loss: 0.2964 - accuracy: 0.8907
<tensorflow.python.keras.callbacks.History at 0x7f074f194390>
```

```
test_loss, test_acc = model.evaluate(test_images,  test_labels, verbose=2)

print('₩n테스트 정확도:', test_acc)
```

```
313/313 - 0s - loss: 0.3905 - accuracy: 0.8610

테스트 정확도: 0.8610000014305115
```

```
predictions = model.predict(test_images)
```

```
predictions[0]
```

```
array([3.35455043e-05, 2.45229603e-06, 2.78893203e-05, 2.21269033e-06,
       3.18290149e-05, 4.55124362e-04, 3.69162117e-05, 6.79957271e-02,
       1.21489415e-04, 9.31292832e-01], dtype=float32)
```

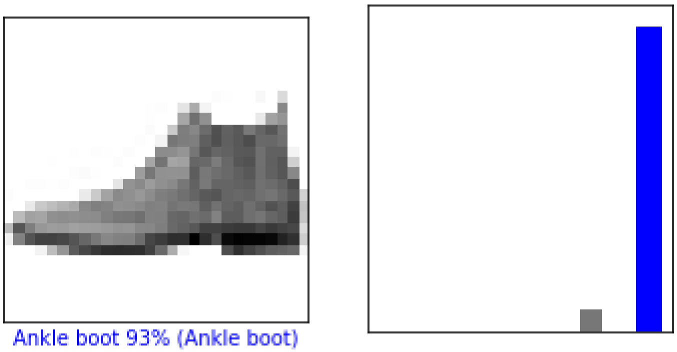
```
np.argmax(predictions[0])
```

```
9
```

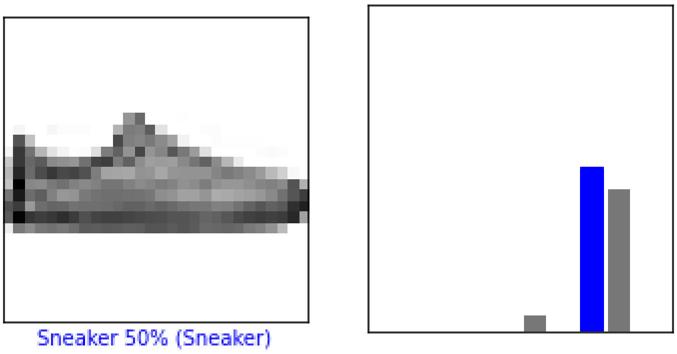
```
test_labels[0]
```

```
9
```

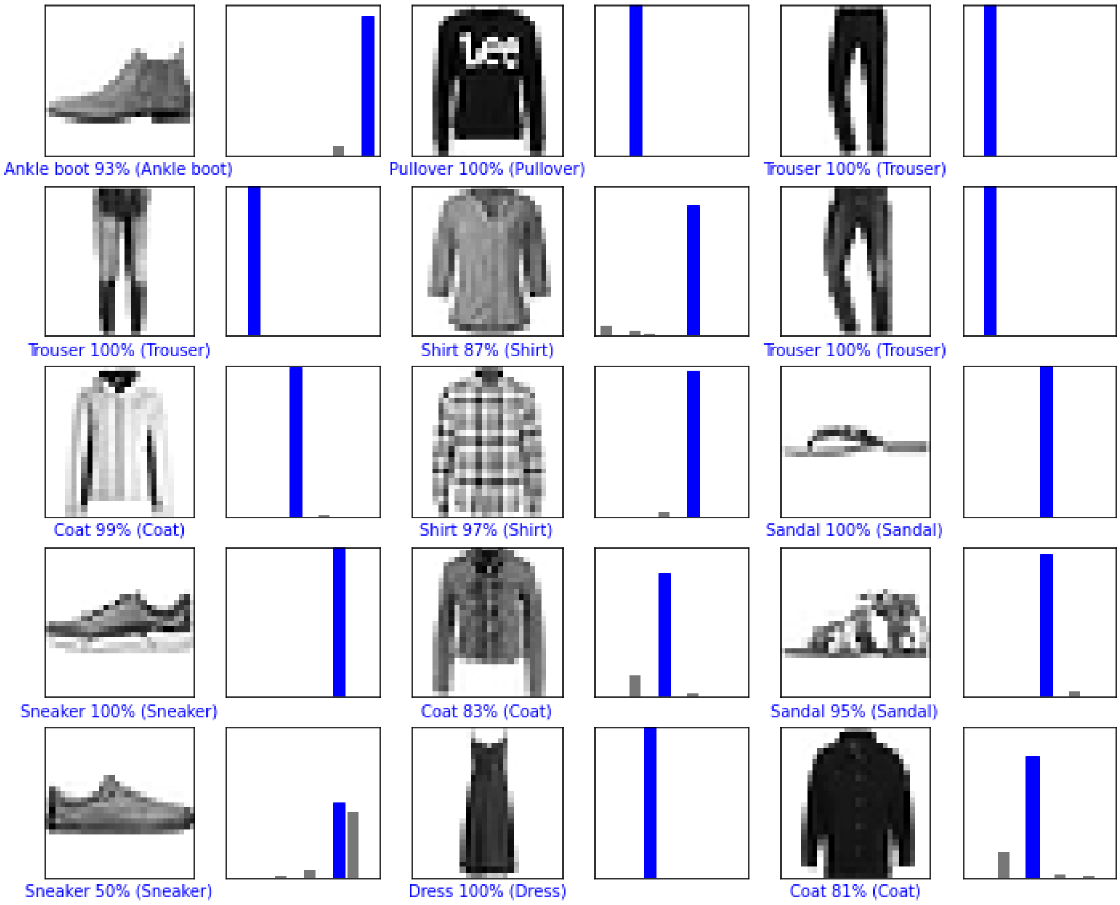
```
def plot_image(i, predictions_array, true_label, img):
  predictions_array, true_label, img = predictions_array[i], true_label[i], img[i]
  plt.grid(False)
  plt.xticks([])
  plt.yticks([])

  plt.imshow(img, cmap=plt.cm.binary)

  predicted_label = np.argmax(predictions_array)
  if predicted_label == true_label:
    color = 'blue'
  else:
    color = 'red'

  plt.xlabel("{} {:2.0f}% ({})".format(class_names[predicted_label],
                                100*np.max(predictions_array),
                                class_names[true_label]),
                                color=color)

def plot_value_array(i, predictions_array, true_label):
  predictions_array, true_label = predictions_array[i], true_label[i]
  plt.grid(False)
  plt.xticks([])
  plt.yticks([])
  plt.yticks([])
  thisplot = plt.bar(range(10), predictions_array, color="#777777")
  plt.ylim([0, 1])
  predicted_label = np.argmax(predictions_array)

  thisplot[predicted_label].set_color('red')
  thisplot[true_label].set_color('blue')


i = 0
plt.figure(figsize=(6,3))
plt.subplot(1,2,1)
plot_image(i, predictions, test_labels, test_images)
plt.subplot(1,2,2)
plot_value_array(i, predictions,  test_labels)
plt.show()
```



```
i = 12
plt.figure(figsize=(6,3))
plt.subplot(1,2,1)
plot_image(i, predictions, test_labels, test_images)
plt.subplot(1,2,2)
plot_value_array(i, predictions,  test_labels)
plt.show()
```



```
# 처음 X 개의 테스트 이미지와 예측 레이블, 진짜 레이블을 출력합니다
# 올바른 예측은 파랑색으로 잘못된 예측은 빨강색으로 나타냅니다
num_rows = 5
num_cols = 3
num_images = num_rows*num_cols
plt.figure(figsize=(2*2*num_cols, 2*num_rows))
for i in range(num_images):
  plt.subplot(num_rows, 2*num_cols, 2*i+1)
  plot_image(i, predictions, test_labels, test_images)
  plt.subplot(num_rows, 2*num_cols, 2*i+2)
  plot_value_array(i, predictions, test_labels)
plt.show()
```



```
# 테스트 세트에서 이미지 하나를 선택합니다
img = test_images[0]

print(img.shape)
```

```
(28, 28)
```

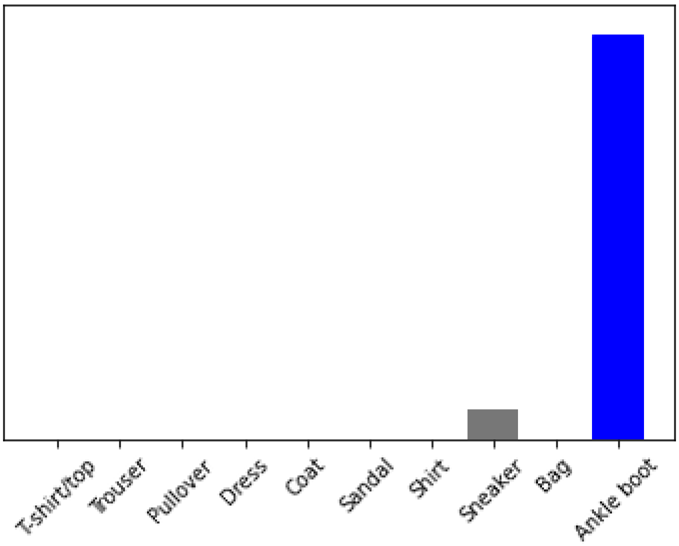
```
# 이미지 하나만 사용할 때도 배치에 추가합니다
img = (np.expand_dims(img,0))

print(img.shape)
```

```
(1, 28, 28)
```

```
predictions_single = model.predict(img)

print(predictions_single)
```

```
[[3.3545475e-05 2.4523008e-06 2.7889324e-05 2.2126949e-06 3.1829048e-05
  4.5512442e-04 3.6916146e-05 6.7995675e-02 1.2148933e-04 9.3129295e-01]]
```

```
plot_value_array(0, predictions_single, test_labels)
_ = plt.xticks(range(10), class_names, rotation=45)
```



```
np.argmax(predictions_single[0])
```

```
9
```