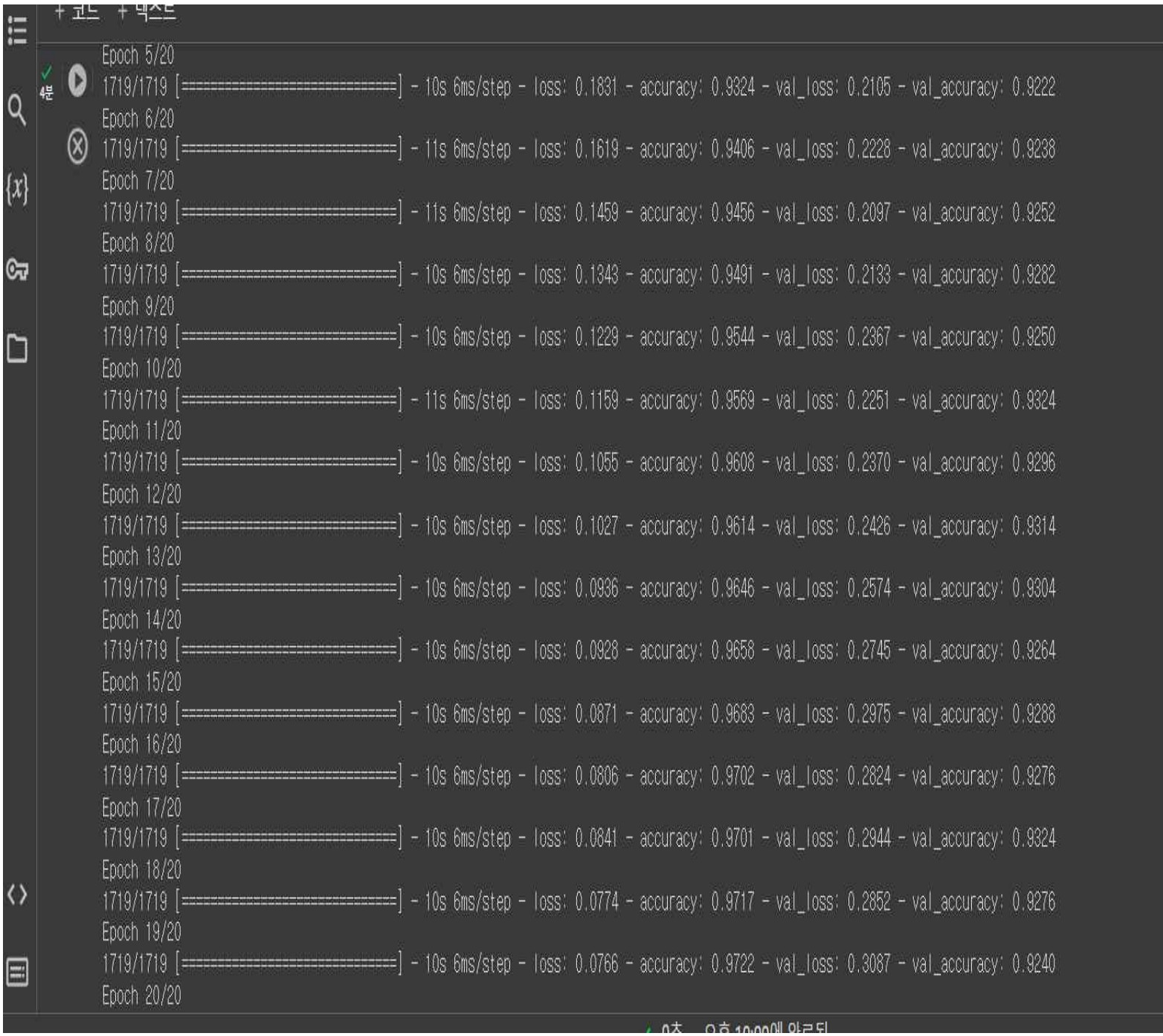
1.CNN 모델 구조 Summary

+ 코드 + 텍스트

0초

```
Model: "sequential_1"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv2d_2 (Conv2D)           (None, 28, 28, 64)        3200

 max_pooling2d_1 (MaxPoolin  (None, 14, 14, 64)        0
 g2D)

 conv2d_3 (Conv2D)           (None, 14, 14, 128)       73856

 conv2d_4 (Conv2D)           (None, 14, 14, 128)       147584

 max_pooling2d_2 (MaxPoolin  (None, 7, 7, 128)         0
 g2D)

 conv2d_5 (Conv2D)           (None, 7, 7, 256)         295168

 conv2d_6 (Conv2D)           (None, 7, 7, 256)         590080

 max_pooling2d_3 (MaxPoolin  (None, 3, 3, 256)         0
 g2D)

 flatten_1 (Flatten)         (None, 2304)              0

 dense_2 (Dense)             (None, 128)               295040

 dropout_2 (Dropout)         (None, 128)               0

 dense_3 (Dense)             (None, 64)                8256

 dropout_3 (Dropout)         (None, 64)                0

 dense_4 (Dense)             (None, 10)                650

=================================================================
Total params: 1413834 (5.39 MB)
Trainable params: 1413834 (5.39 MB)
Non-trainable params: 0 (0.00 Byte)
_________________________________________________________________
```

2. Epoch 로그


+ 코드 + 텍스트
Epoch 5/20
1719/1719 [==========] - 10s 6ms/step - loss: 0.1831 - accuracy: 0.9324 - val_loss: 0.2105 - val_accuracy: 0.9222
Epoch 6/20
1719/1719 [==========] - 11s 6ms/step - loss: 0.1619 - accuracy: 0.9406 - val_loss: 0.2228 - val_accuracy: 0.9238
Epoch 7/20
1719/1719 [==========] - 11s 6ms/step - loss: 0.1459 - accuracy: 0.9456 - val_loss: 0.2097 - val_accuracy: 0.9252
Epoch 8/20
1719/1719 [==========] - 10s 6ms/step - loss: 0.1343 - accuracy: 0.9491 - val_loss: 0.2133 - val_accuracy: 0.9282
Epoch 9/20
1719/1719 [==========] - 10s 6ms/step - loss: 0.1229 - accuracy: 0.9544 - val_loss: 0.2367 - val_accuracy: 0.9250
Epoch 10/20
1719/1719 [==========] - 11s 6ms/step - loss: 0.1159 - accuracy: 0.9569 - val_loss: 0.2251 - val_accuracy: 0.9324
Epoch 11/20
1719/1719 [==========] - 10s 6ms/step - loss: 0.1055 - accuracy: 0.9608 - val_loss: 0.2370 - val_accuracy: 0.9296
Epoch 12/20
1719/1719 [==========] - 10s 6ms/step - loss: 0.1027 - accuracy: 0.9614 - val_loss: 0.2426 - val_accuracy: 0.9314
Epoch 13/20
1719/1719 [==========] - 10s 6ms/step - loss: 0.0936 - accuracy: 0.9646 - val_loss: 0.2574 - val_accuracy: 0.9304
Epoch 14/20
1719/1719 [==========] - 10s 6ms/step - loss: 0.0928 - accuracy: 0.9658 - val_loss: 0.2745 - val_accuracy: 0.9264
Epoch 15/20
1719/1719 [==========] - 10s 6ms/step - loss: 0.0871 - accuracy: 0.9683 - val_loss: 0.2975 - val_accuracy: 0.9288
Epoch 16/20
1719/1719 [==========] - 10s 6ms/step - loss: 0.0806 - accuracy: 0.9702 - val_loss: 0.2824 - val_accuracy: 0.9276
Epoch 17/20
1719/1719 [==========] - 10s 6ms/step - loss: 0.0841 - accuracy: 0.9701 - val_loss: 0.2944 - val_accuracy: 0.9324
Epoch 18/20
1719/1719 [==========] - 10s 6ms/step - loss: 0.0774 - accuracy: 0.9717 - val_loss: 0.2852 - val_accuracy: 0.9276
Epoch 19/20
1719/1719 [==========] - 10s 6ms/step - loss: 0.0766 - accuracy: 0.9722 - val_loss: 0.3087 - val_accuracy: 0.9240
Epoch 20/20

3. 훈련 그래프

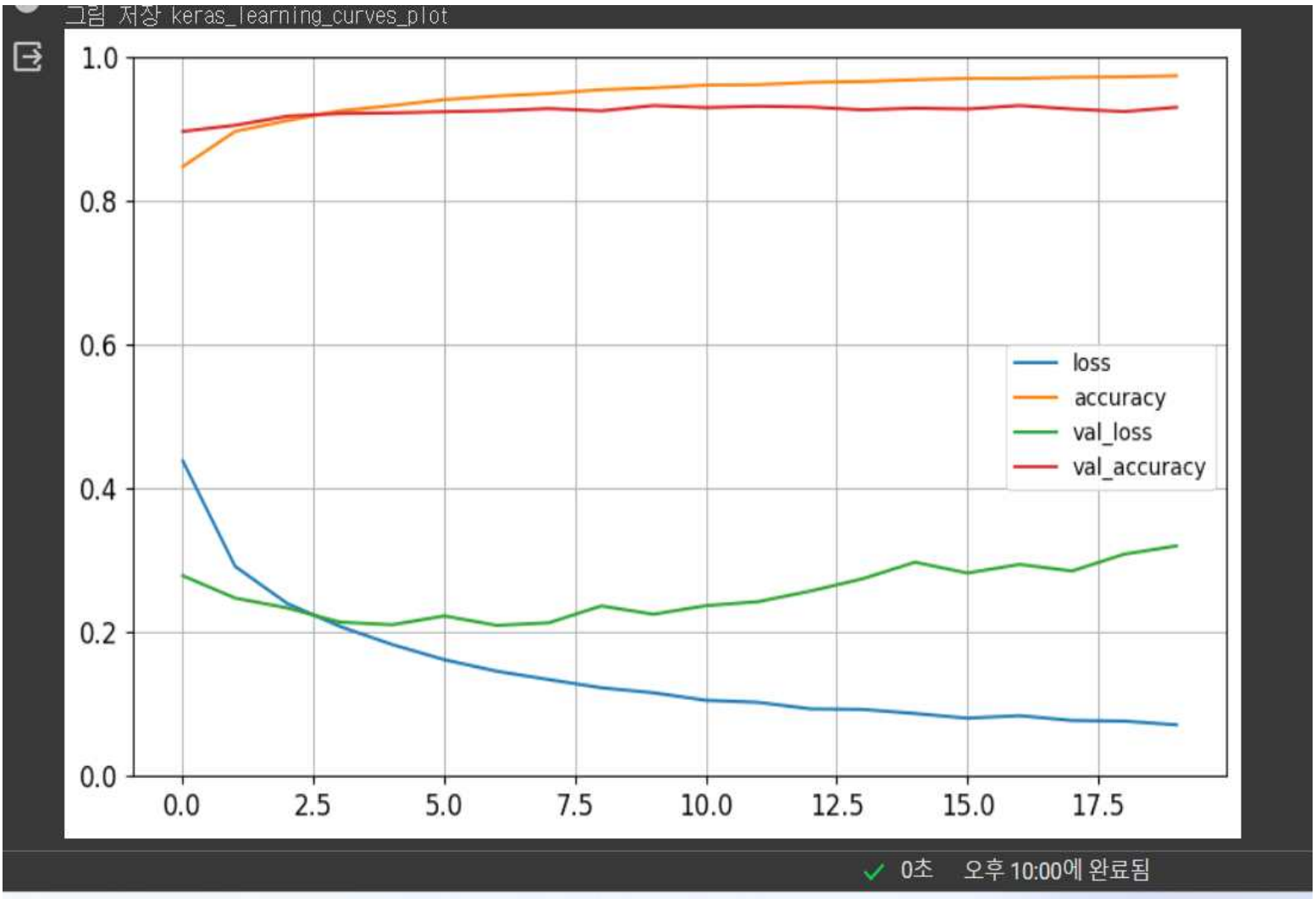


그림 저장 keras_learning_curves_plot
1.0
0.8
0.6
0.4
0.2
0.0
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
loss
accuracy
val_loss
val_accuracy
0초 오후 10:00에 완료됨

4.테스트 데이터 평가

```
[195]  1 model.evaluate(X_test, y_test)

    313/313 [==============================] - 1s 3ms/step - loss: 0.3873 - accuracy: 0.9229
    [0.38725095987319946, 0.9229000210762024]
```