

Google Colab(Colaboratory)을 사용한 필기체 숫자 인식

Google Colab (Colaboratory)에서 CNN 모델 생성

◆ Google Colab (Colaboratory)

- Google에서 제공하는 Web 기반의 클라우드 주피터 노트북이며, 파이썬 프로그램 작성 및 실행 환경 제공, https://colab.research.google.com/?utm_source=scs-index
- 별도의 구성이 필요 없으며, GPU를 무료로 사용가능
- 개인별 Google drive 구성 및 사용 가능
- 본인의 desktop이나 notebook의 local disk를 mount 시켜 사용 가능
- 구글 Colab 소개 및 기본 사용법 꿀팁 정리:
<https://www.youtube.com/watch?v=v19SzGMOd2c>

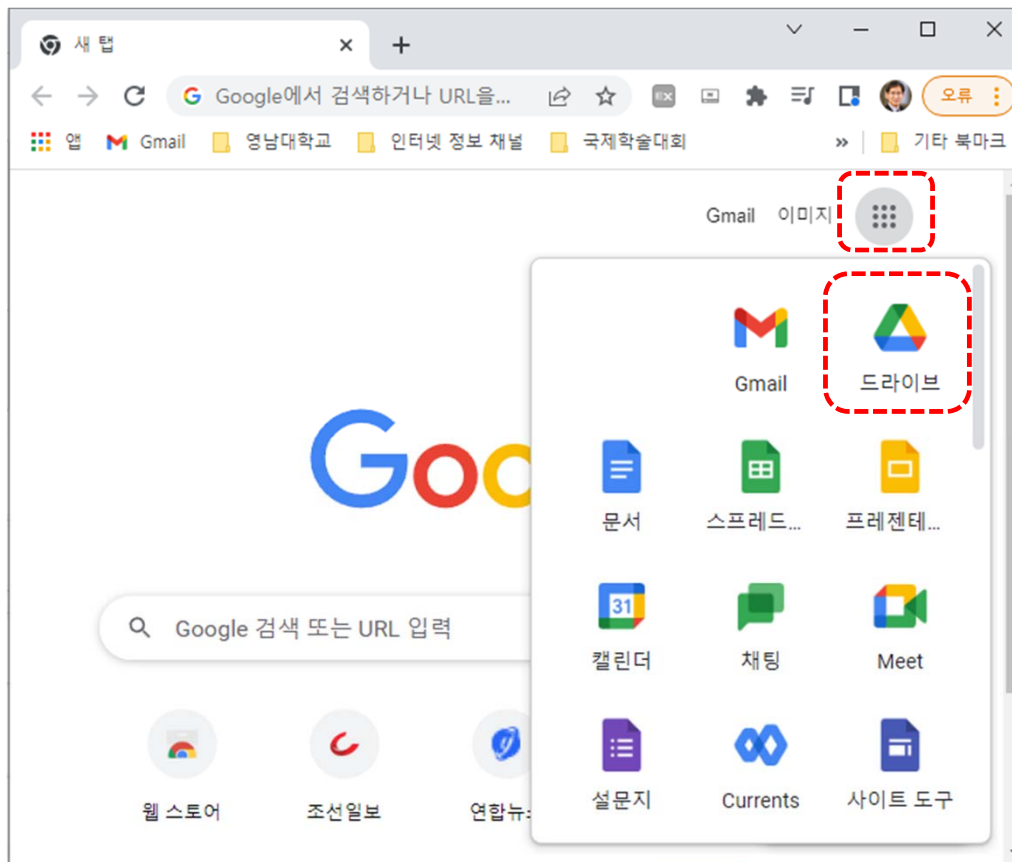
◆ Google Drive를 준비한 후, 이를 Colab과 연결하여 사용

- 구글드라이브 완벽이해, <https://www.youtube.com/watch?v=Cr8GOYdgxJg>
- 15GB 용량을 무료로 사용가능



Google Drive 준비

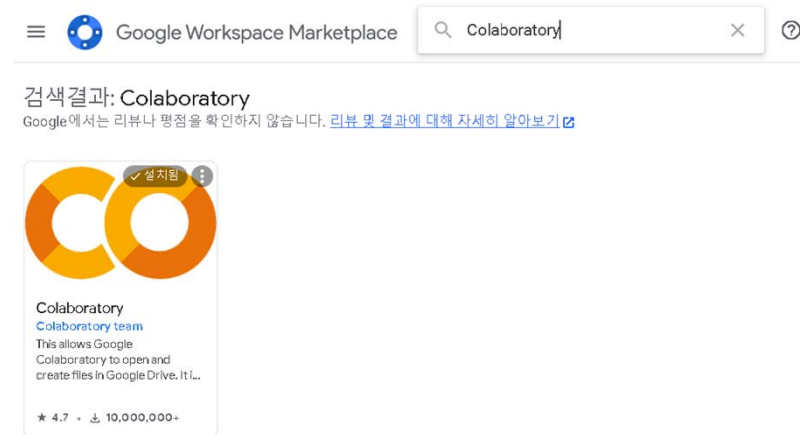
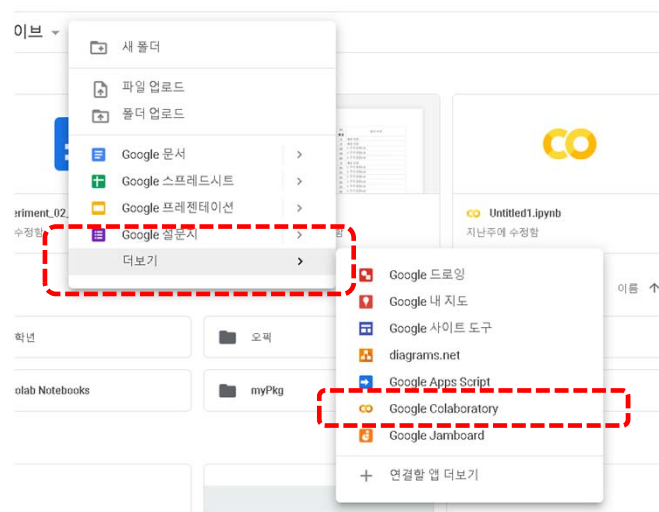
◆ Google Explorer -> Drive 클릭으로 이동



Google Drive에 Colaboratory 파일 생성

◆ Google Drive에 Colaboratory 파일 생성

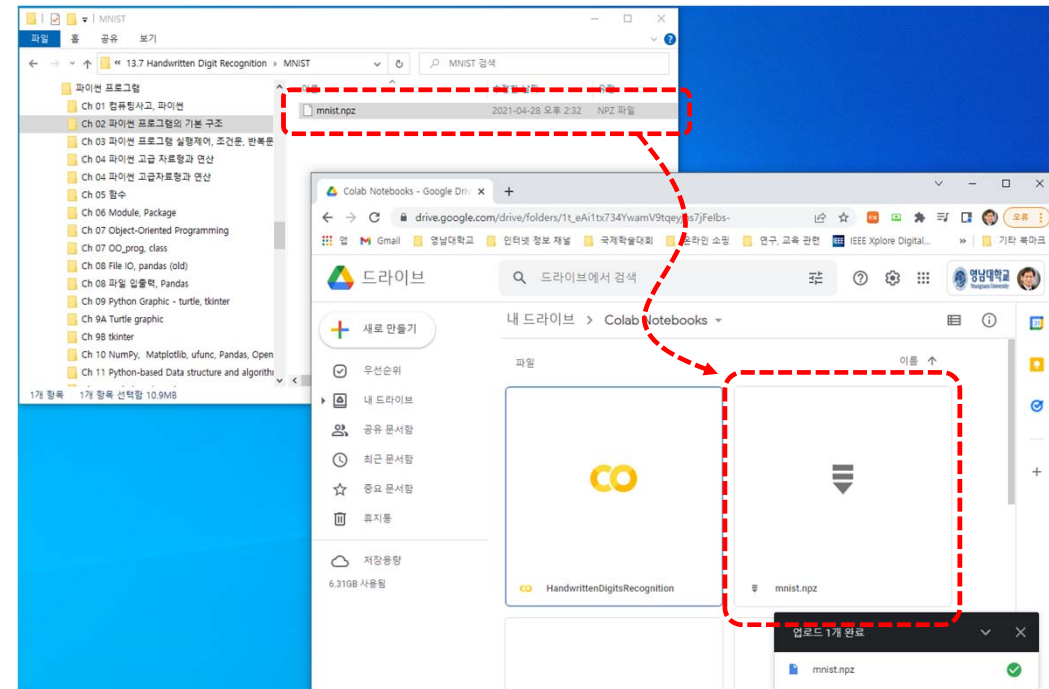
- Google drive -> 새로 만들기 -> 더 보기 -> Google Colaboratory
- Google Colaboratory(Colab)이 설치되어 있지 않는 경우, 검색기능을 사용하여 검색 후 설치



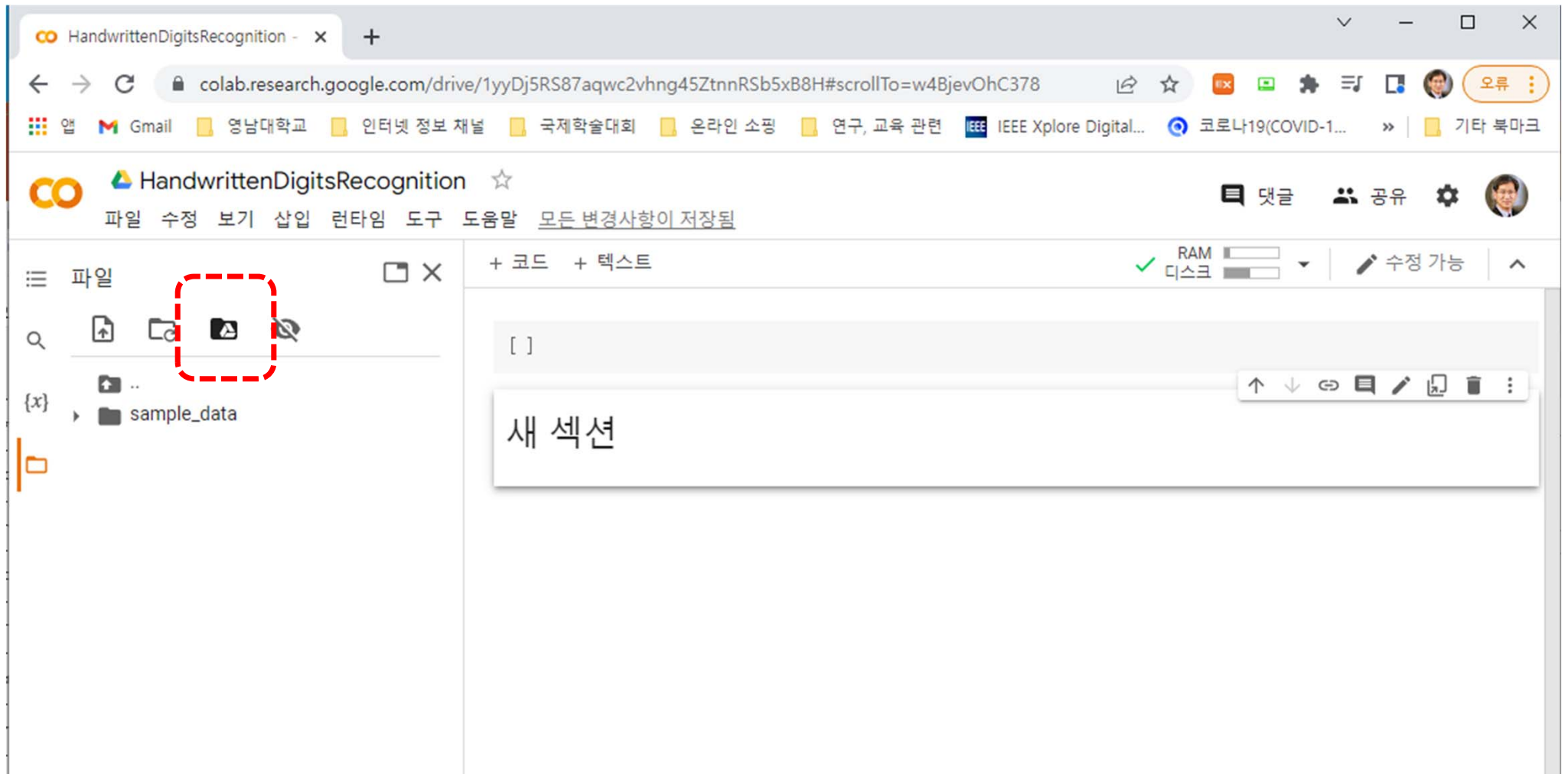
필요한 파일의 설치

◆ 필요한 파일의 복사 설치

- 필요한 파일을 drag하여 Google Drive에 설치
- Google Colab에는 Deep Learning 관련 많은 패키지가 설치되어 있음
- mnist.npz의 경우, 파일 복사없이 `mnist.load_data()` 함수를 사용하여 직접 loading 가능

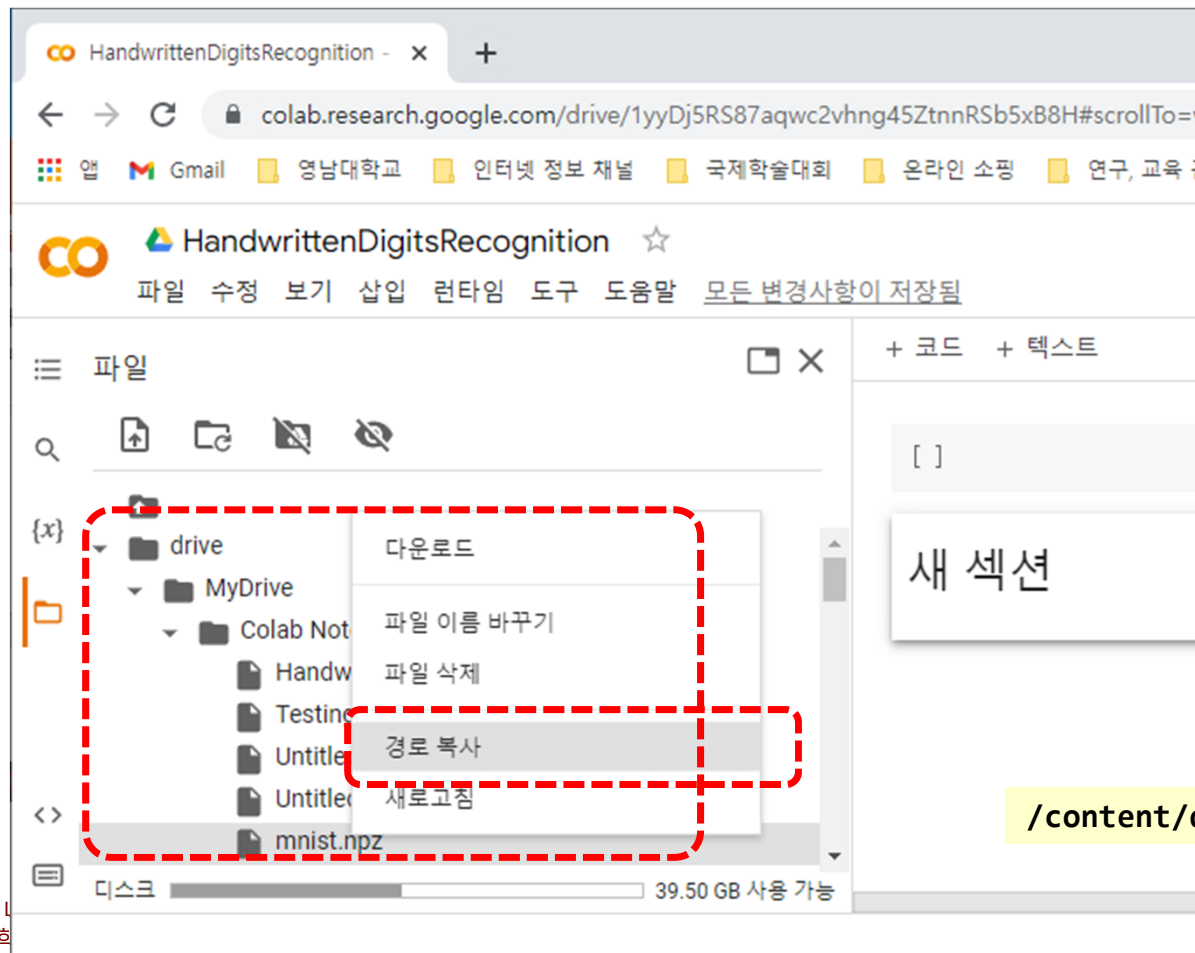


Google Colab에 Drive를 Mount



Mount된 Drive의 파일 경로 복사

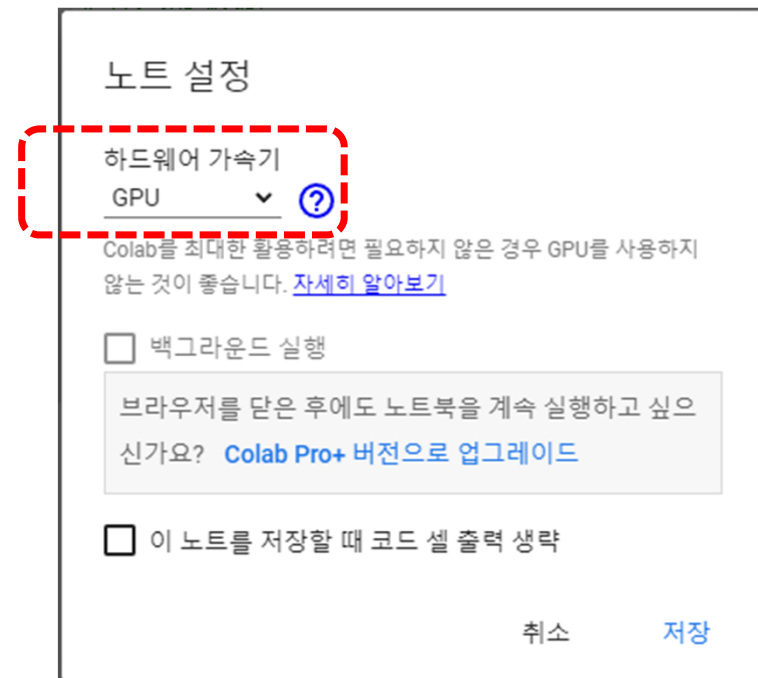
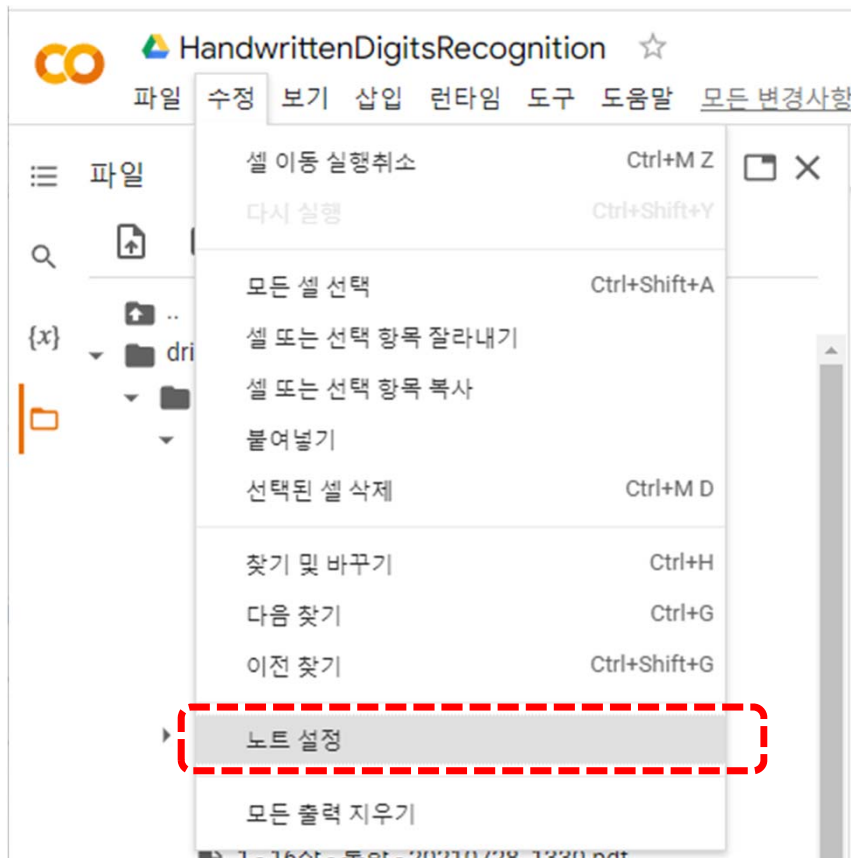
◆ /content/drive/MyDrive/CoLab Notebooks/mnist.npz



```
/content/drive/MyDrive/Colab Notebooks/mnist.npz
```

CoLaboratory의 GPU 사용 설정

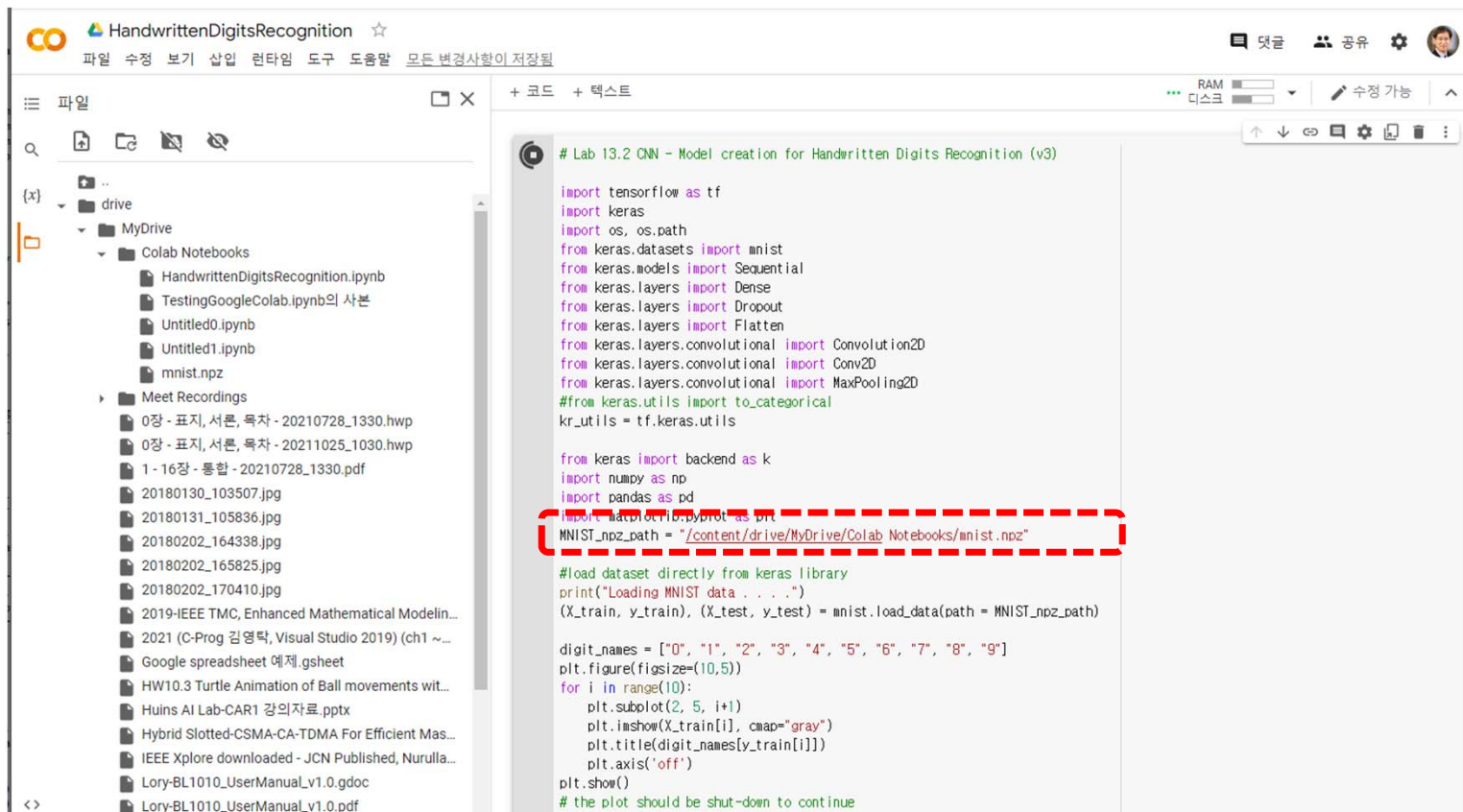
◆ Colab -> 수정 -> 노트 설정 -> 하드웨어 가속기



CNN 모델 생성

◆ Colab 환경에 파이썬 소스코드 작성

- MNIST_npz_path를 Google Drive에 저장된 파일의 경로로 설정



```
# Lab 13.2 CNN - Model creation for Handwritten Digits Recognition (v3)

import tensorflow as tf
import keras
import os, os.path
from keras.datasets import mnist
from keras.models import Sequential
from keras.layers import Dense
from keras.layers import Dropout
from keras.layers import Flatten
from keras.layers.convolutional import Convolution2D
from keras.layers.convolutional import Conv2D
from keras.layers.convolutional import MaxPooling2D
#from keras.utils import to_categorical
kr_utils = tf.keras.utils

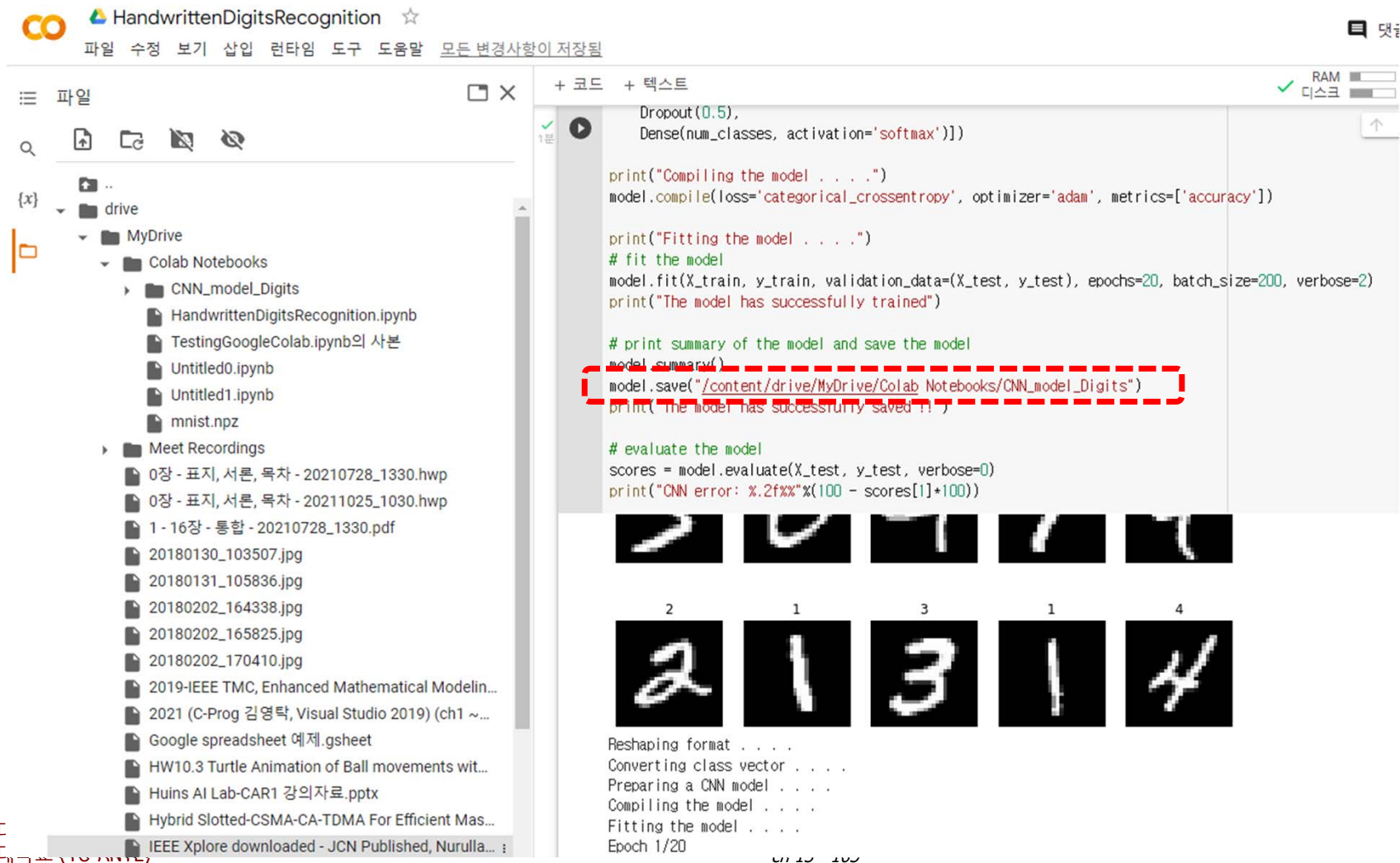
from keras import backend as k
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
MNIST_npz_path = "/content/drive/MyDrive/Colab Notebooks/mnist.npz"

#load dataset directly from keras library
print("Loading MNIST data . . . .")
(X_train, y_train), (X_test, y_test) = mnist.load_data(path = MNIST_npz_path)

digit_names = ["0", "1", "2", "3", "4", "5", "6", "7", "8", "9"]
plt.figure(figsize=(10,5))
for i in range(10):
    plt.subplot(2, 5, i+1)
    plt.imshow(X_train[i], cmap="gray")
    plt.title(digit_names[y_train[i]])
    plt.axis('off')
plt.show()
# the plot should be shut-down to continue
```



CNN Model 저장 경로 설정



HandwrittenDigitsRecognition ☆

파일 수정 보기 삽입 런타임 도구 도움말 모든 변경사항이 저장됨

파일

drive

MyDrive

Colab Notebooks

CNN_model_Digits

HandwrittenDigitsRecognition.ipynb

TestingGoogleColab.ipynb의 사본

Untitled0.ipynb

Untitled1.ipynb

mnist.npz

Meet Recordings

0장 - 표지, 서론, 목차 - 20210728_1330.hwp

0장 - 표지, 서론, 목차 - 20211025_1030.hwp

1 - 16장 - 통합 - 20210728_1330.pdf

20180130_103507.jpg

20180131_105836.jpg

20180202_164338.jpg

20180202_165825.jpg

20180202_170410.jpg

2019-IEEE TMC, Enhanced Mathematical Modelin...

2021 (C-Prog 김영탁, Visual Studio 2019) (ch1 ~...

Google spreadsheet 예제.gsheets

HW10.3 Turtle Animation of Ball movements wit...

Huins AI Lab-CAR1 강의자료.pptx

Hybrid Slotted-CSMA-CA-TDMA For Efficient Mas...

IEEE Xplore downloaded - JCN Published, Nurulla...

+ 코드 + 텍스트

```
Dropout(0.5),
Dense(num_classes, activation='softmax'))

print("Compiling the model . . . .")
model.compile(loss='categorical_crossentropy', optimizer='adam', metrics=['accuracy'])

print("Fitting the model . . . .")
# fit the model
model.fit(X_train, y_train, validation_data=(X_test, y_test), epochs=20, batch_size=200, verbose=2)
print("The model has successfully trained")

# print summary of the model and save the model
model.summary()
model.save("/content/drive/MyDrive/Colab Notebooks/CNN_model_Digits")
print("The model has successfully saved!")

# evaluate the model
scores = model.evaluate(X_test, y_test, verbose=0)
print("CNN error: %.2f%%"%(100 - scores[1]*100))
```

Reshaping format

Converting class vector

Preparing a CNN model

Compiling the model

Fitting the model

Epoch 1/20

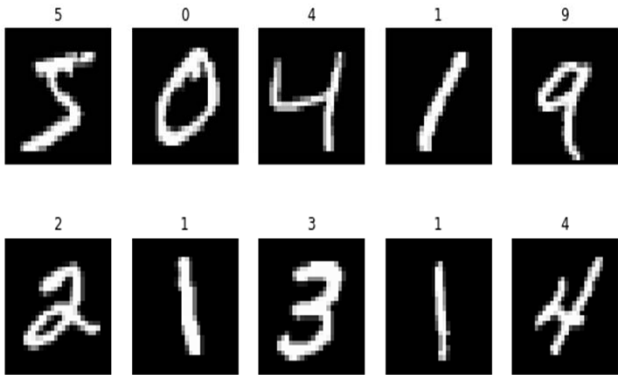
0.15 100

프로그램 실행

```
# print summary of the model and save the model
model.summary()
model.save("/content/drive/MyDrive/Colab Notebooks/CNN_model_Digits")
print("The model has successfully saved !!")

# evaluate the model
scores = model.evaluate(X_test, y_test, verbose=0)
print("CNN error: %.2f%%"%(100 - scores[1]*100))
```

Loading MNIST data



Reshaping format
 Converting class vector
 Preparing a CNN model
 Compiling the model
 Fitting the model

Epoch 1/20
 300/300 - 13s - loss: 0.2313 - accuracy: 0.9308 - val_loss: 0.0517 - val_accuracy: 0.9820 - 13s/epoch - 45ms/step

Epoch 2/20
 300/300 - 2s - loss: 0.0679 - accuracy: 0.9794 - val_loss: 0.0348 - val_accuracy: 0.9873 - 2s/epoch - 7ms/step

• • • • •

Epoch 20/20
 300/300 - 2s - loss: 0.0061 - accuracy: 0.9979 - val_loss: 0.0302 - val_accuracy: 0.9934 - 2s/epoch - 6ms/step
 The model has successfully trained
 Model: "sequential"

Layer (type)	Output Shape	Param #
conv2d (Conv2D)	(None, 26, 26, 32)	320
max_pooling2d (MaxPooling2D)	(None, 13, 13, 32)	0
conv2d_1 (Conv2D)	(None, 11, 11, 64)	18496
flatten (Flatten)	(None, 7744)	0
dense (Dense)	(None, 256)	1982720
dropout (Dropout)	(None, 256)	0
dense_1 (Dense)	(None, 10)	2570

Total params: 2,004,106
 Trainable params: 2,004,106
 Non-trainable params: 0

INFO:tensorflow:Assets written to: /content/drive/MyDrive/Colab Notebooks/CNN_model_Digits/assets
 The model has successfully saved !!
 CNN error: 0.66%



실행결과 생성된 CNN 모델 확인

HandwrittenDigitsRecognition ☆

파일 수정 보기 삽입 런타임 도구 도움말 모든 변경사항이 저장됨

파일

drive

MyDrive

Colab Notebooks

CNN_model_Digits

assets

variables

keras_metadata.pb

saved_model.pb

HandwrittenDigitsRecognition.ipynb

TestingGoogleColab.ipynb의 사본

Untitled0.ipynb

Untitled1.ipynb

mnist.npz

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2019-IEEE TMC, Enhanced Mathematical Mod...

2021 (C-Prog 김영탁, Visual Studio 2019) (c...

Google spreadsheet 예제.gsheets

HW10.3 Turtle Animation of Ball movements ...

+ 코드 + 텍스트

Epoch 16/20

300/300 - 2s - loss: 0.0089 - accuracy: 0.9969 - val_loss: 0.0281 - val_accuracy: 0.9928 - 2s/epoch - 6ms/step

Epoch 17/20

300/300 - 2s - loss: 0.0073 - accuracy: 0.9974 - val_loss: 0.0285 - val_accuracy: 0.9932 - 2s/epoch - 7ms/step

Epoch 18/20

300/300 - 2s - loss: 0.0069 - accuracy: 0.9976 - val_loss: 0.0295 - val_accuracy: 0.9925 - 2s/epoch - 7ms/step

Epoch 19/20

300/300 - 2s - loss: 0.0067 - accuracy: 0.9976 - val_loss: 0.0349 - val_accuracy: 0.9918 - 2s/epoch - 6ms/step

Epoch 20/20

300/300 - 2s - loss: 0.0061 - accuracy: 0.9979 - val_loss: 0.0302 - val_accuracy: 0.9934 - 2s/epoch - 6ms/step

The model has successfully trained

Model: "sequential"

Layer (type)	Output Shape	Param #
conv2d (Conv2D)	(None, 26, 26, 32)	320
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Total params: 2,004,106

Trainable params: 2,004,106

Non-trainable params: 0

INFO:tensorflow:Assets written to: /content/drive/MyDrive/Colab Notebooks/CNN_model_Digits/assets

The model has successfully saved !!

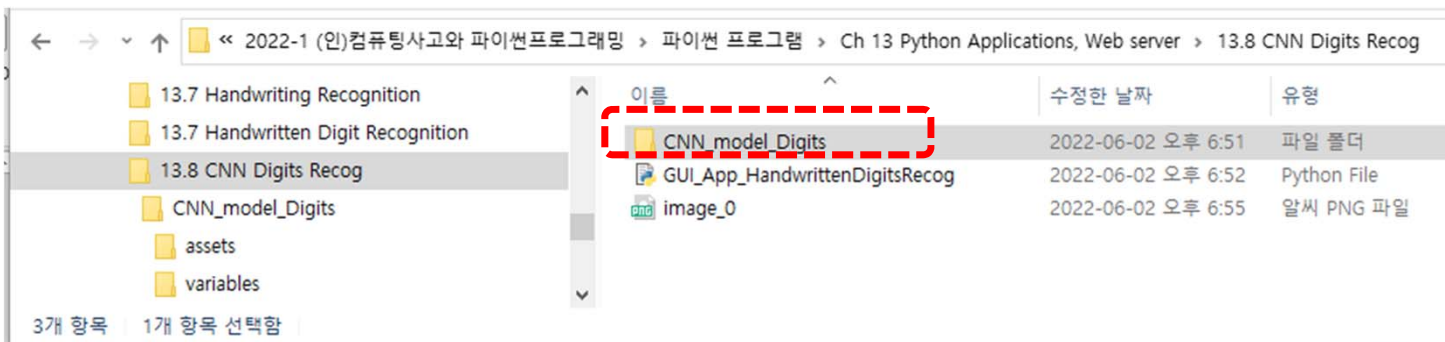
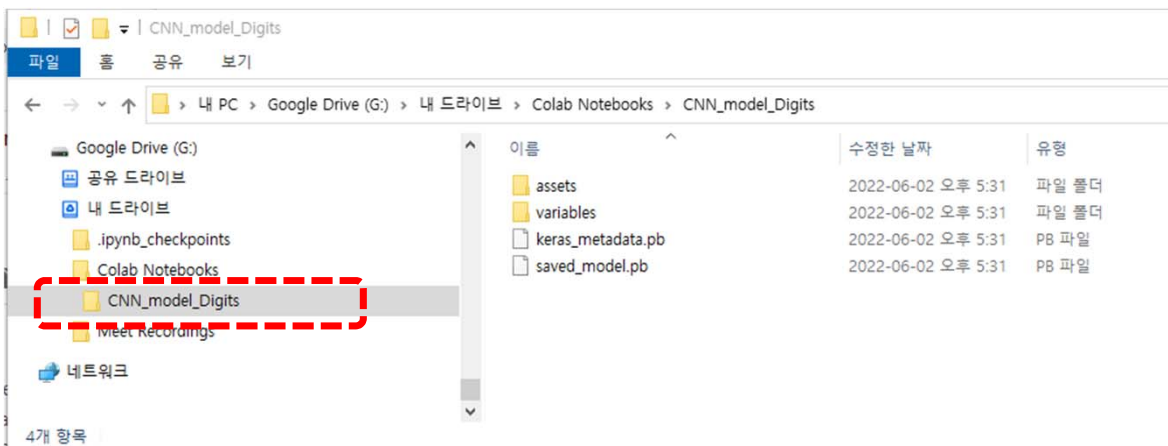
CNN error: 0.66%



CNN 모델의 복사

◆ CNN 모델의 복사

- 생성된 CNN 모델을 숫자 인식 프로그램 (tkinter GUI 기능 포함)이 있는 폴더로 복사



CNN 모델 기반 숫자 인식 기능 실험

◆ CNN 모델 기반 숫자 인식 기능 실험

- 숫자 인식 프로그램 (tkinter GUI 기능 포함)을 실행

