Regression_150_50_50_Hanyang_Securities

February 8, 2021

[1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import warnings
import os
import sys
import tensorflow as tf

from sklearn.preprocessing import MinMaxScaler
from tqdm import tqdm
```

[2]:
```
# 예측할 종목은 한양증권(001750) 입니다
# 기간은 00-01-04 ~ 21-02-05 입니다
# Yahoo Finanace에서 다운로드 받습니다
# null값과 0값을 제거한 데이터를 사용합니다


df = pd.read_csv('C:\Jupyter_Project\HS_50_50_150.csv')
df = df.dropna()
df.head()
```

[2]:

	Date	Open	High	Low	Close	Adj Close	Volume
0	2020-02-04	9140	9150	9020	9110	9110	30886
1	2020-02-05	9200	9200	9000	9040	9040	38531
2	2020-02-06	9140	9140	8760	8920	8920	92807
3	2020-02-07	8940	8940	8750	8860	8860	49339
4	2020-02-10	8860	8920	8650	8730	8730	29151

[3]:
```
df.tail()
```

[3]:

	Date	Open	High	Low	Close	Adj Close	Volume
245	2021-02-01	9200	9480	9100	9380	9380	81355
246	2021-02-02	9460	9810	9460	9700	9700	105755
247	2021-02-03	9850	10200	9800	9990	9990	170966
248	2021-02-04	10100	10200	9940	10150	10150	133504
249	2021-02-05	10200	10800	10150	10650	10650	251300

[4]:
```
# OHLC를 Adj OHLC로 바꾸기 위한 비율입니다
# Adj OHLC는 과거의 절대가격을 현재 가격의 시점으로 보기위한 수정된 가격입니다
# 과거 발생한 액면분할과 현금배당을 반영한 Adj Close를 기준으로 조정합니다

ratio = df['Adj Close']/df['Close']
ratio
```

[4]:
```
0      1.0
1      1.0
2      1.0
3      1.0
4      1.0
      ...
245    1.0
246    1.0
247    1.0
248    1.0
249    1.0
Length: 250, dtype: float64
```

[5]:
```
df['Adj Open'] = df['Open']*ratio
df['Adj High'] = df['High']*ratio
df['Adj Low'] = df['Low']*ratio
```

[6]:
```
df.drop(['Open','High','Low','Close'], axis=1, inplace=True)
```

[7]:
```
df.rename(columns={'Adj Open':'Open', 'Adj High':'High', 'Adj Low':'Low', 'Adj␣
↪Close':'Close'}, inplace=True)
```

[8]:
```
df = df[['Open', 'High', 'Low', 'Close', 'Volume']]

df
```

[8]:

	Open	High	Low	Close	Volume
0	9140.0	9150.0	9020.0	9110	30886
1	9200.0	9200.0	9000.0	9040	38531
2	9140.0	9140.0	8760.0	8920	92807
3	8940.0	8940.0	8750.0	8860	49339
4	8860.0	8920.0	8650.0	8730	29151
..	...	...	...	...	...
245	9200.0	9480.0	9100.0	9380	81355
246	9460.0	9810.0	9460.0	9700	105755
247	9850.0	10200.0	9800.0	9990	170966
248	10100.0	10200.0	9940.0	10150	133504
249	10200.0	10800.0	10150.0	10650	251300

[250 rows x 5 columns]

[9]:
```
scaler = MinMaxScaler()
scale_cols = ['Open', 'High', 'Low', 'Close', 'Volume']
df_scaled = scaler.fit_transform(df[scale_cols])

df_scaled = pd.DataFrame(df_scaled)
df_scaled.columns = scale_cols

print(df_scaled)
```

```
         Open      High       Low   Close    Volume
0    0.775947  0.732143  0.804159  0.7536  0.008378
1    0.785832  0.740260  0.800693  0.7424  0.011118
2    0.775947  0.730519  0.759099  0.7232  0.030576
3    0.742998  0.698052  0.757366  0.7136  0.014993
4    0.729819  0.694805  0.740035  0.6928  0.007756
..        ...       ...       ...     ...       ...
245  0.785832  0.785714  0.818024  0.7968  0.026470
246  0.828666  0.839286  0.880416  0.8480  0.035218
247  0.892916  0.902597  0.939341  0.8944  0.058595
248  0.934102  0.902597  0.963605  0.9200  0.045165
249  0.950577  1.000000  1.000000  1.0000  0.087394

[250 rows x 5 columns]
```

[10]:
```
# 20일 학습하고 그 다음날 종가예측
# 테스트 기간은 21일, 따라서 5299-21 : train / 21 : test

window_size = 20
TEST_SIZE = 50
```

[11]:
```
train = df_scaled[:-TEST_SIZE]
test = df_scaled[-TEST_SIZE:]
```

[12]:
```
test.describe()
```

[12]:

	Open	High	Low	Close	Volume
count	50.000000	50.000000	50.000000	50.000000	50.000000
mean	0.860099	0.836234	0.890711	0.840928	0.029913
std	0.048146	0.054000	0.046308	0.049635	0.025879
min	0.774300	0.735390	0.805893	0.752000	0.004691
25%	0.831137	0.800325	0.861785	0.813600	0.013071
50%	0.857496	0.831981	0.887348	0.834400	0.019257
75%	0.892916	0.865260	0.923744	0.870400	0.040130
max	1.000000	1.000000	1.000000	1.000000	0.137986

[13]:
```
# 정해진 window_size에 기반하여 20일 기간의 데이터 셋을 묶어준다

def make_dataset(data, label, window_size=20):
```

```
    feature_list = []
    label_list = []
    for i in range(len(data) - window_size):
        feature_list.append(np.array(data.iloc[i:i+window_size]))
        label_list.append(np.array(label.iloc[i+window_size]))
    return np.array(feature_list), np.array(label_list)
```

[14]:
```
from sklearn.model_selection import train_test_split

feature_cols = ['Open', 'High', 'Low', 'Volume']
label_cols = ['Close']

train_feature = train[feature_cols]
train_label = train[label_cols]

# train dataset
train_feature, train_label = make_dataset(train_feature, train_label, 20)

# train set : 모델을 학습하는 유일한 dataset
# validation set : 학습이 이미 완료된 모델을 검증하기 위한 dataset(비율 0.2)

x_train, x_valid, y_train, y_valid = train_test_split(train_feature,␣
 ↪train_label, test_size=0.25)

x_train.shape, x_valid.shape
# ((4206, 20, 4), (1052, 20, 4))

# test dataset : 학습과 검증이 완료된 모델의 성능을 평가하기 위한 dataset
x_test = test[feature_cols]
y_test = test[label_cols]

x_test.shape, y_test.shape
#     (21, 4),          (21, 1)
```

[14]:
```
((50, 4), (50, 1))
```

[15]:
```
x_test, y_test = make_dataset(x_test, y_test, 20)

x_test.shape, y_test.shape
# (21-20, 20, 4),     (21-20, 1)
```

[15]:
```
((30, 20, 4), (30, 1))
```

[16]:
```
x_train.shape, x_valid.shape, y_train.shape, y_valid.shape, x_test.shape, y_test.
 ↪shape
```

[16]:
```
((135, 20, 4), (45, 20, 4), (135, 1), (45, 1), (30, 20, 4), (30, 1))
```

[17]:
```
# print proportions
print('train: {}% | validation: {}% | test {}%'.format(round(len(y_train)/
 ↪len(df_scaled),2),
                                                       round(len(y_valid)/
 ↪len(df_scaled),2),
                                                       round(len(y_test)/
 ↪len(df_scaled),2)))
```

```
train: 0.54% | validation: 0.18% | test 0.12%
```

[18]:
```
from keras.models import Sequential
from keras.layers import Dense
from keras.callbacks import EarlyStopping, ModelCheckpoint
from keras.layers import LSTM

model = Sequential()
model.add(LSTM(20,
               input_shape=(x_test.shape[1], x_test.shape[2]),
               activation='relu',
               return_sequences=False)
          )
model.add(Dense(1))
```

[19]:
```
model.summary()
```

```
Model: "sequential"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
lstm (LSTM)                  (None, 20)                2000
_________________________________________________________________
dense (Dense)                (None, 1)                 21
=================================================================
Total params: 2,021
Trainable params: 2,021
Non-trainable params: 0
_________________________________________________________________
```

[20]:
```
# val_loss가 10회 같을 시 early_stop, batch_size(=K)는 K문제 풀고 답보고 하는 식
# 위에서 모델을 구성한 후 compile 메서드를 호출하여 학습과정을 설정합니다
# optimizer : 훈련 과정을 설정한다
# loss : 최적화 과정에서 최소화될 손실 함수(loss function)을 설정합니다
# metrics : 훈련을 모니터링하기 위해 사용됩니다
# validation_data = 검증 데이터를 사용합니다. 각 에포크마다 정확도도 함께 출력됩니다
# 이 정확도는 훈련이 잘 되고 있는지를 보여줄 뿐이며 실제로 모델이 검증데이터를 학습하지
는 않습니다
# 검증 데이터의 loss가 낮아지다가 높아지기 시작하면 overfitting의 신호입니다
```

```
# verbose / 0 : 출력 없음 / 1 : 훈련 진행도 보여주는 진행 막대 보여줌 / 2 : 미니 배치
마다 손실 정보 출력

from numpy import array
from keras.models import Sequential
from keras.layers import Dense
from keras import backend as K

def RMSE(y_true, y_pred):
    return K.sqrt(K.mean(K.square(y_pred - y_true)))

def soft_acc(y_true, y_pred):
    return K.mean(K.equal(K.round(y_true), K.round(y_pred)))

def MPE(y_true, y_pred):
    return K.mean((y_true - y_pred) / y_true) * 100

def MSLE(y_true, y_pred):
    return K.mean(K.square(K.log(y_true+1) - K.log(y_pred+1)), axis=-1)

def RMSLE(y_true, y_pred):
    return K.sqrt(K.mean(K.square(K.log(y_true+1) - K.log(y_pred+1)), axis=-1))

def R2(y_true, y_pred):
    SS_res = K.sum(K.square(y_true - y_pred))
    SS_tot = K.sum(K.square(y_true - K.mean(y_true)))
    return ( 1 - SS_res/(SS_tot + K.epsilon()))

model.compile(loss = RMSE, optimizer='adam', metrics=[soft_acc, 'mse', 'mae',␣
 ↪RMSE, 'mape', MPE, MSLE, RMSLE, R2])

early_stop = EarlyStopping(monitor='val_loss', patience=10)
filename = os.path.join('tmp', 'ckeckpointer.ckpt')
checkpoint = ModelCheckpoint(filename, monitor='val_loss', verbose=1,␣
 ↪save_best_only=True, mode='auto')

history = model.fit(x_train, y_train,
                    epochs=200,
                    batch_size=1,
                    validation_data=(x_valid, y_valid),
                    callbacks=[early_stop, checkpoint])

# score_test를 만들면 테스트가 더이상 테스트가 아니고, 처음부터 모든 데이터에 대해 학습
한 것과 같기 때문에 일반화 할 수 없는 모델을 만드는 것과 같다.


score_train = model.evaluate(x_train, y_train, batch_size=2)
```

```
score_validation = model.evaluate(x_valid, y_valid, batch_size=2)
```

```
Epoch 1/200
135/135 [==============================] - 5s 21ms/step - loss: 0.3674 -
soft_acc: 0.5627 - mse: 0.2201 - mae: 0.3674 - RMSE: 0.3674 - mape: 1618303.8712
- MPE: -inf - MSLE: 0.1281 - RMSLE: 0.2783 - R2: -2200608.5248 - val_loss:
0.0503 - val_soft_acc: 0.9333 - val_mse: 0.0042 - val_mae: 0.0503 - val_RMSE:
0.0503 - val_mape: 13.9619 - val_MPE: -9.0550 - val_MSLE: 0.0019 - val_RMSLE:
0.0333 - val_R2: -42427.3672

Epoch 00001: val_loss improved from inf to 0.05027, saving model to
tmp\ckeckpointer.ckpt
INFO:tensorflow:Assets written to: tmp\ckeckpointer.ckpt\assets
Epoch 2/200
135/135 [==============================] - 1s 5ms/step - loss: 0.0592 -
soft_acc: 0.9449 - mse: 0.0071 - mae: 0.0592 - RMSE: 0.0592 - mape: 5259624.5329
- MPE: -inf - MSLE: 0.0039 - RMSLE: 0.0408 - R2: -71423.4945 - val_loss: 0.0391
- val_soft_acc: 0.9556 - val_mse: 0.0024 - val_mae: 0.0391 - val_RMSE: 0.0391 -
val_mape: 9.6158 - val_MPE: -2.3894 - val_MSLE: 0.0011 - val_RMSLE: 0.0258 -
val_R2: -24000.4336

Epoch 00002: val_loss improved from 0.05027 to 0.03905, saving model to
tmp\ckeckpointer.ckpt
INFO:tensorflow:Assets written to: tmp\ckeckpointer.ckpt\assets
Epoch 3/200
135/135 [==============================] - 1s 5ms/step - loss: 0.0566 -
soft_acc: 0.9767 - mse: 0.0069 - mae: 0.0566 - RMSE: 0.0566 - mape: 2058930.8209
- MPE: -inf - MSLE: 0.0038 - RMSLE: 0.0401 - R2: -68827.1590 - val_loss: 0.0421
- val_soft_acc: 0.9333 - val_mse: 0.0031 - val_mae: 0.0421 - val_RMSE: 0.0421 -
val_mape: 8.7500 - val_MPE: 3.2201 - val_MSLE: 0.0013 - val_RMSLE: 0.0274 -
val_R2: -31460.9277

Epoch 00003: val_loss did not improve from 0.03905
Epoch 4/200
135/135 [==============================] - 1s 5ms/step - loss: 0.0440 -
soft_acc: 0.9506 - mse: 0.0038 - mae: 0.0440 - RMSE: 0.0440 - mape: 3815424.9545
- MPE: -inf - MSLE: 0.0020 - RMSLE: 0.0300 - R2: -37879.1538 - val_loss: 0.0367
- val_soft_acc: 0.9556 - val_mse: 0.0021 - val_mae: 0.0367 - val_RMSE: 0.0367 -
val_mape: 7.9366 - val_MPE: -1.3274 - val_MSLE: 8.7780e-04 - val_RMSLE: 0.0239 -
val_R2: -21170.8574

Epoch 00004: val_loss improved from 0.03905 to 0.03674, saving model to
tmp\ckeckpointer.ckpt
INFO:tensorflow:Assets written to: tmp\ckeckpointer.ckpt\assets
Epoch 5/200
135/135 [==============================] - 1s 5ms/step - loss: 0.0463 -
soft_acc: 0.9359 - mse: 0.0042 - mae: 0.0463 - RMSE: 0.0463 - mape: 1245999.5600
- MPE: -inf - MSLE: 0.0022 - RMSLE: 0.0314 - R2: -42283.2409 - val_loss: 0.0310
```

```
- val_soft_acc: 0.9778 - val_mse: 0.0015 - val_mae: 0.0310 - val_RMSE: 0.0310 -
val_mape: 6.5865 - val_MPE: -0.7454 - val_MSLE: 6.1929e-04 - val_RMSLE: 0.0203 -
val_R2: -14830.7568

Epoch 00005: val_loss improved from 0.03674 to 0.03103, saving model to
tmp\ckeckpointer.ckpt
INFO:tensorflow:Assets written to: tmp\ckeckpointer.ckpt\assets
Epoch 6/200
135/135 [==============================] - 1s 5ms/step - loss: 0.0380 -
soft_acc: 0.9565 - mse: 0.0026 - mae: 0.0380 - RMSE: 0.0380 - mape: 418270.1099
- MPE: -inf - MSLE: 0.0012 - RMSLE: 0.0252 - R2: -25701.3898 - val_loss: 0.0548
- val_soft_acc: 0.9111 - val_mse: 0.0050 - val_mae: 0.0548 - val_RMSE: 0.0548 -
val_mape: 10.4955 - val_MPE: 7.9519 - val_MSLE: 0.0020 - val_RMSLE: 0.0356 -
val_R2: -49879.3203

Epoch 00006: val_loss did not improve from 0.03103
Epoch 7/200
135/135 [==============================] - 1s 5ms/step - loss: 0.0483 -
soft_acc: 0.9508 - mse: 0.0039 - mae: 0.0483 - RMSE: 0.0483 - mape: 977208.2420
- MPE: -inf - MSLE: 0.0019 - RMSLE: 0.0327 - R2: -38673.7334 - val_loss: 0.0305
- val_soft_acc: 1.0000 - val_mse: 0.0014 - val_mae: 0.0305 - val_RMSE: 0.0305 -
val_mape: 7.6895 - val_MPE: 1.3589 - val_MSLE: 6.2815e-04 - val_RMSLE: 0.0204 -
val_R2: -13853.3740

Epoch 00007: val_loss improved from 0.03103 to 0.03047, saving model to
tmp\ckeckpointer.ckpt
INFO:tensorflow:Assets written to: tmp\ckeckpointer.ckpt\assets
Epoch 8/200
135/135 [==============================] - 1s 5ms/step - loss: 0.0460 -
soft_acc: 0.9680 - mse: 0.0044 - mae: 0.0460 - RMSE: 0.0460 - mape: 790947.6836
- MPE: -inf - MSLE: 0.0022 - RMSLE: 0.0313 - R2: -43592.1571 - val_loss: 0.0293
- val_soft_acc: 0.9778 - val_mse: 0.0014 - val_mae: 0.0293 - val_RMSE: 0.0293 -
val_mape: 6.2176 - val_MPE: -2.5133 - val_MSLE: 5.7297e-04 - val_RMSLE: 0.0191 -
val_R2: -13500.0293

Epoch 00008: val_loss improved from 0.03047 to 0.02930, saving model to
tmp\ckeckpointer.ckpt
INFO:tensorflow:Assets written to: tmp\ckeckpointer.ckpt\assets
Epoch 9/200
135/135 [==============================] - 1s 5ms/step - loss: 0.0365 -
soft_acc: 0.9298 - mse: 0.0024 - mae: 0.0365 - RMSE: 0.0365 - mape: 29501.2424 -
MPE: -inf - MSLE: 0.0011 - RMSLE: 0.0244 - R2: -23713.6182 - val_loss: 0.0286 -
val_soft_acc: 0.9778 - val_mse: 0.0013 - val_mae: 0.0286 - val_RMSE: 0.0286 -
val_mape: 5.9128 - val_MPE: -2.2154 - val_MSLE: 5.4342e-04 - val_RMSLE: 0.0186 -
val_R2: -13002.4697

Epoch 00009: val_loss improved from 0.02930 to 0.02856, saving model to
tmp\ckeckpointer.ckpt
```

```
INFO:tensorflow:Assets written to: tmp\ckeckpointer.ckpt\assets
Epoch 10/200
135/135 [==============================] - 1s 5ms/step - loss: 0.0373 -
soft_acc: 0.9697 - mse: 0.0027 - mae: 0.0373 - RMSE: 0.0373 - mape: 5389690.8649
- MPE: -inf - MSLE: 0.0016 - RMSLE: 0.0264 - R2: -26719.7532 - val_loss: 0.0256
- val_soft_acc: 1.0000 - val_mse: 0.0011 - val_mae: 0.0256 - val_RMSE: 0.0256 -
val_mape: 5.7900 - val_MPE: -0.5525 - val_MSLE: 4.7593e-04 - val_RMSLE: 0.0168 -
val_R2: -11107.1602

Epoch 00010: val_loss improved from 0.02856 to 0.02557, saving model to
tmp\ckeckpointer.ckpt
INFO:tensorflow:Assets written to: tmp\ckeckpointer.ckpt\assets
Epoch 11/200
135/135 [==============================] - 1s 5ms/step - loss: 0.0306 -
soft_acc: 0.9901 - mse: 0.0017 - mae: 0.0306 - RMSE: 0.0306 - mape: 842735.3264
- MPE: -inf - MSLE: 8.0257e-04 - RMSLE: 0.0203 - R2: -16817.9999 - val_loss:
0.0309 - val_soft_acc: 0.9778 - val_mse: 0.0014 - val_mae: 0.0309 - val_RMSE:
0.0309 - val_mape: 7.0617 - val_MPE: 3.8992 - val_MSLE: 6.2429e-04 - val_RMSLE:
0.0204 - val_R2: -14485.9199

Epoch 00011: val_loss did not improve from 0.02557
Epoch 12/200
135/135 [==============================] - 1s 5ms/step - loss: 0.0313 -
soft_acc: 0.9871 - mse: 0.0019 - mae: 0.0313 - RMSE: 0.0313 - mape: 319247.1823
- MPE: -inf - MSLE: 7.6820e-04 - RMSLE: 0.0204 - R2: -18538.6262 - val_loss:
0.0284 - val_soft_acc: 0.9778 - val_mse: 0.0013 - val_mae: 0.0284 - val_RMSE:
0.0284 - val_mape: 6.3466 - val_MPE: 0.8690 - val_MSLE: 5.6637e-04 - val_RMSLE:
0.0186 - val_R2: -13469.7051

Epoch 00012: val_loss did not improve from 0.02557
Epoch 13/200
135/135 [==============================] - 1s 5ms/step - loss: 0.0327 -
soft_acc: 0.9771 - mse: 0.0018 - mae: 0.0327 - RMSE: 0.0327 - mape: 565585.0768
- MPE: -inf - MSLE: 8.4610e-04 - RMSLE: 0.0222 - R2: -18327.8130 - val_loss:
0.0579 - val_soft_acc: 0.9556 - val_mse: 0.0044 - val_mae: 0.0579 - val_RMSE:
0.0579 - val_mape: 12.9183 - val_MPE: 11.6980 - val_MSLE: 0.0019 - val_RMSLE:
0.0382 - val_R2: -44345.1289

Epoch 00013: val_loss did not improve from 0.02557
Epoch 14/200
135/135 [==============================] - 1s 5ms/step - loss: 0.0360 -
soft_acc: 0.9740 - mse: 0.0025 - mae: 0.0360 - RMSE: 0.0360 - mape: 463729.9948
- MPE: -inf - MSLE: 0.0011 - RMSLE: 0.0236 - R2: -25463.6582 - val_loss: 0.0273
- val_soft_acc: 0.9778 - val_mse: 0.0012 - val_mae: 0.0273 - val_RMSE: 0.0273 -
val_mape: 7.2547 - val_MPE: -1.4347 - val_MSLE: 5.7710e-04 - val_RMSLE: 0.0184 -
val_R2: -12405.9639

Epoch 00014: val_loss did not improve from 0.02557
```

```
Epoch 15/200
135/135 [==============================] - 1s 5ms/step - loss: 0.0288 -
soft_acc: 0.9089 - mse: 0.0016 - mae: 0.0288 - RMSE: 0.0288 - mape: 2772333.6392
- MPE: -inf - MSLE: 7.2277e-04 - RMSLE: 0.0195 - R2: -15517.5595 - val_loss:
0.0309 - val_soft_acc: 0.9778 - val_mse: 0.0014 - val_mae: 0.0309 - val_RMSE:
0.0309 - val_mape: 7.7390 - val_MPE: 2.5116 - val_MSLE: 6.4270e-04 - val_RMSLE:
0.0206 - val_R2: -14062.4316

Epoch 00015: val_loss did not improve from 0.02557
Epoch 16/200
135/135 [==============================] - ETA: 0s - loss: 0.0352 - soft_acc:
0.9689 - mse: 0.0024 - mae: 0.0352 - RMSE: 0.0352 - mape: 587217.1413 - MPE:
-inf - MSLE: 0.0011 - RMSLE: 0.0235 - R2: -23922.82 - 1s 5ms/step - loss: 0.0351
- soft_acc: 0.9692 - mse: 0.0024 - mae: 0.0351 - RMSE: 0.0351 - mape:
587264.2037 - MPE: -inf - MSLE: 0.0011 - RMSLE: 0.0234 - R2: -23783.8161 -
val_loss: 0.0336 - val_soft_acc: 0.9778 - val_mse: 0.0017 - val_mae: 0.0336 -
val_RMSE: 0.0336 - val_mape: 7.6544 - val_MPE: -4.3367 - val_MSLE: 7.0438e-04 -
val_RMSLE: 0.0219 - val_R2: -16757.1191

Epoch 00016: val_loss did not improve from 0.02557
Epoch 17/200
135/135 [==============================] - 1s 5ms/step - loss: 0.0331 -
soft_acc: 0.9728 - mse: 0.0018 - mae: 0.0331 - RMSE: 0.0331 - mape: 159591.8765
- MPE: -inf - MSLE: 7.3722e-04 - RMSLE: 0.0215 - R2: -17578.0593 - val_loss:
0.0275 - val_soft_acc: 1.0000 - val_mse: 0.0012 - val_mae: 0.0275 - val_RMSE:
0.0275 - val_mape: 7.4428 - val_MPE: 1.5019 - val_MSLE: 5.8120e-04 - val_RMSLE:
0.0186 - val_R2: -11965.3359

Epoch 00017: val_loss did not improve from 0.02557
Epoch 18/200
135/135 [==============================] - 1s 5ms/step - loss: 0.0307 -
soft_acc: 0.9755 - mse: 0.0016 - mae: 0.0307 - RMSE: 0.0307 - mape: 121926.8115
- MPE: -inf - MSLE: 6.8542e-04 - RMSLE: 0.0198 - R2: -16455.8940 - val_loss:
0.0522 - val_soft_acc: 0.9556 - val_mse: 0.0038 - val_mae: 0.0522 - val_RMSE:
0.0522 - val_mape: 10.5325 - val_MPE: 9.0070 - val_MSLE: 0.0015 - val_RMSLE:
0.0338 - val_R2: -37727.7539

Epoch 00018: val_loss did not improve from 0.02557
Epoch 19/200
135/135 [==============================] - 1s 5ms/step - loss: 0.0326 -
soft_acc: 0.9833 - mse: 0.0024 - mae: 0.0326 - RMSE: 0.0326 - mape: 174923.9957
- MPE: -inf - MSLE: 9.1138e-04 - RMSLE: 0.0209 - R2: -23663.5509 - val_loss:
0.0371 - val_soft_acc: 0.9556 - val_mse: 0.0021 - val_mae: 0.0371 - val_RMSE:
0.0371 - val_mape: 8.5593 - val_MPE: 6.2389 - val_MSLE: 8.9273e-04 - val_RMSLE:
0.0244 - val_R2: -21013.4609

Epoch 00019: val_loss did not improve from 0.02557
Epoch 20/200
```

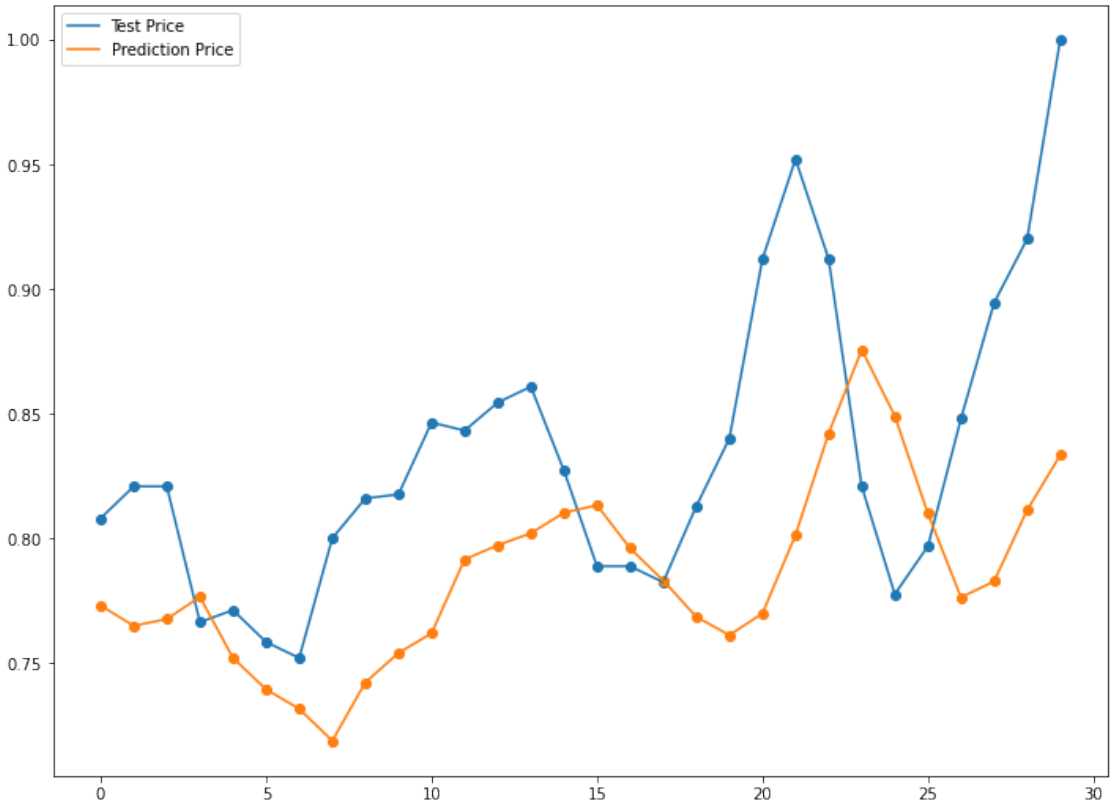
```
135/135 [==============================] - 1s 5ms/step - loss: 0.0308 -
soft_acc: 0.9601 - mse: 0.0017 - mae: 0.0308 - RMSE: 0.0308 - mape: 148144.1437
- MPE: -inf - MSLE: 6.7216e-04 - RMSLE: 0.0196 - R2: -17269.3677 - val_loss:
0.0320 - val_soft_acc: 0.9778 - val_mse: 0.0015 - val_mae: 0.0320 - val_RMSE:
0.0320 - val_mape: 7.6522 - val_MPE: 3.5180 - val_MSLE: 6.6670e-04 - val_RMSLE:
0.0211 - val_R2: -15464.7930

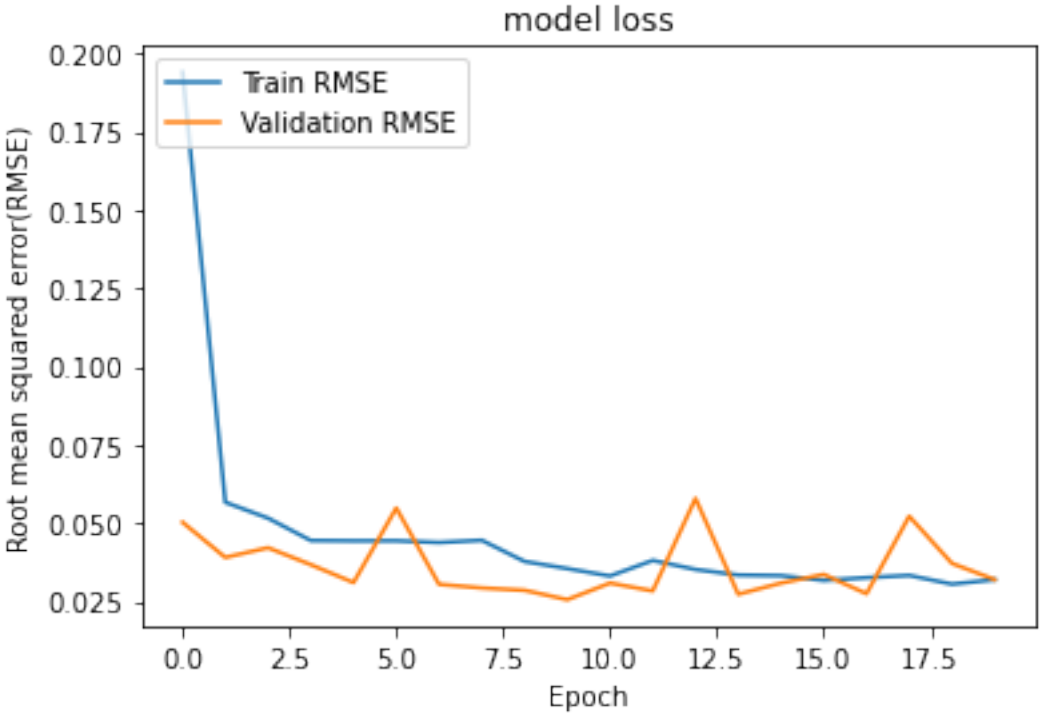
Epoch 00020: val_loss did not improve from 0.02557
68/68 [==============================] - 1s 3ms/step - loss: 0.0355 - soft_acc:
0.9706 - mse: 0.0018 - mae: 0.0307 - RMSE: 0.0359 - mape: 370261.9688 - MPE:
-inf - MSLE: 7.4561e-04 - RMSLE: 0.0199 - R2: -1094.7159
23/23 [==============================] - 0s 3ms/step - loss: 0.0340 - soft_acc:
0.9783 - mse: 0.0015 - mae: 0.0320 - RMSE: 0.0333 - mape: 7.6522 - MPE: 3.4532 -
MSLE: 6.6670e-04 - RMSLE: 0.0211 - R2: -7.0705
```

[21]:
```
pred = model.predict(x_test)
pred.shape

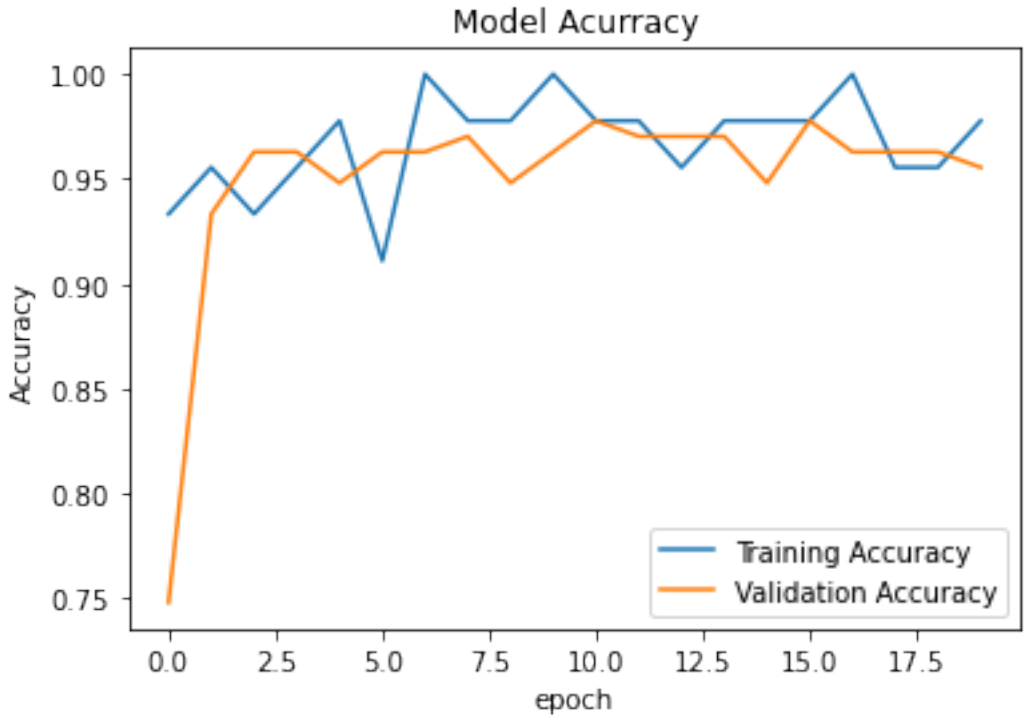
plt.figure(figsize=(12,9))
plt.plot(np.asarray(y_test), label='Test Price')
plt.plot(pred, label='Prediction Price')
x_values = list(range(30))
plt.scatter(x_values, np.asarray(y_test))
plt.scatter(x_values, pred)
plt.legend()
plt.show()

plt.plot(history.history['loss'])
plt.plot(history.history['val_loss'])
plt.title('model loss')
plt.ylabel('Root mean squared error(RMSE)')
plt.xlabel('Epoch')
plt.legend(['Train RMSE', 'Validation RMSE'], loc='upper left')
plt.show()
```


Test Price
Prediction Price
1.00
0.95
0.90
0.85
0.80
0.75
0
5
10
15
20
25
30


model loss
Train RMSE
Validation RMSE
Root mean squared error(RMSE)
0.200
0.175
0.150
0.125
0.100
0.075
0.050
0.025
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
Epoch

[22]:
```
plt.plot(history.history['val_soft_acc'])
plt.plot(history.history['soft_acc'])
plt.title('Model Acurracy')
plt.ylabel('Accuracy')
plt.xlabel('epoch')
plt.legend(['Training Accuracy', 'Validation Accuracy'], loc='lower right')
plt.show()
```



[23]:
```
accuracy_train = 100*score_train[1]
accuracy_validation = 100*score_validation[1]

print('train accuracy: %.4f%%' % accuracy_train)
print('validation accuracy: %.4f%%' % accuracy_validation)
```

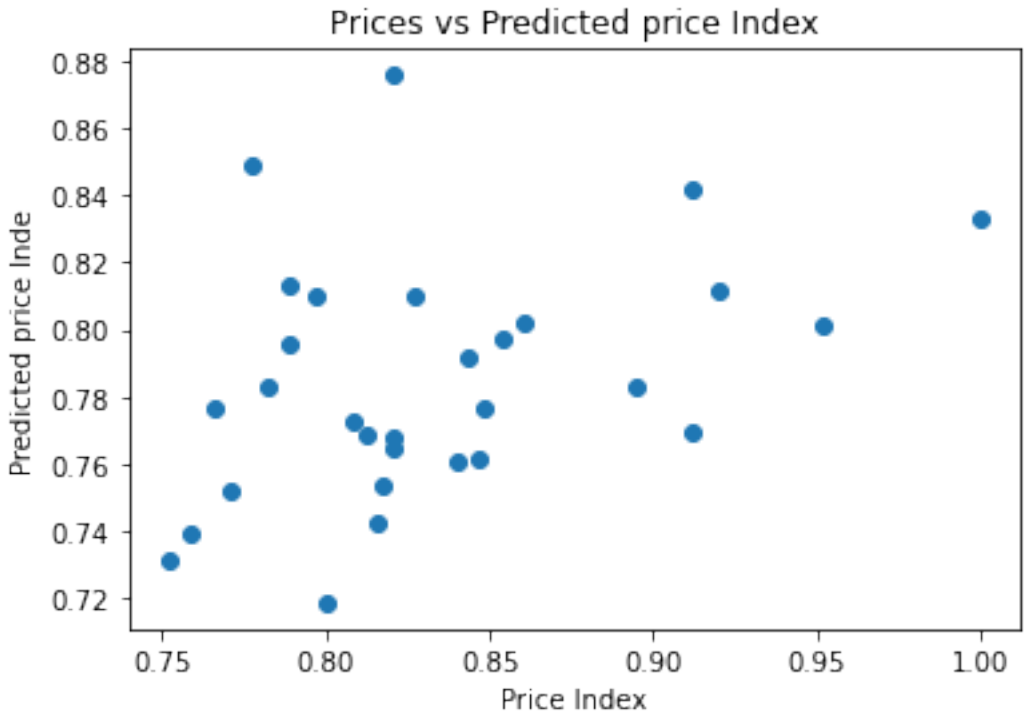
```
train accuracy: 97.0588%
validation accuracy: 97.8261%
```

[24]:
```
# 원래값과 예측 값이 일치하면 직선에 가깝게 분포가 된다

%matplotlib inline
import matplotlib.pyplot as plt
```

```
plt.scatter(np.asarray(y_test), pred)
plt.xlabel("Price Index")
plt.ylabel("Predicted price Inde")
plt.title("Prices vs Predicted price Index")
```

[24]: Text(0.5, 1.0, 'Prices vs Predicted price Index')



[25]:
```
import numpy as np
from sklearn.metrics import r2_score
from sklearn.metrics import mean_squared_log_error
from sklearn.metrics import explained_variance_score

Y = np.asarray(y_test)
Y_hat = pred

def MSE(y_true, y_pred):
    return np.mean(np.square((y_true - y_pred)))

def MAE(y_true, y_pred):
    return np.mean(np.abs((y_true - y_pred)))

def RMSE(y_true, y_pred):
    return np.sqrt(np.mean((y_pred-y_true)**2))
```

```
def MAPE(y_true, y_pred):
    return np.mean(np.abs((y_true - y_pred) / y_true)) * 100

def MPE(y_true, y_pred):
    return np.mean((y_true - y_pred) / y_true) * 100

def root_mean_squared_log_error(y_true, y_pred):
    return np.sqrt(mean_squared_log_error(y_true, y_pred))

print('R2_Score')
print('-' * 40)
print('train error: {} |\nvalid error: {} |\ntest error : {}'.
 ↪format(score_train[9], score_validation[9], r2_score(Y, Y_hat)))
print('Explained Variance Score(EVS) : {}|\n'.format(explained_variance_score(Y,␣
 ↪Y_hat)))



print('Mean Squared Error')
print('-' * 40)
print('train error: {} |\nvalid error: {} |\ntest error : {}\n'.
 ↪format(score_train[2], score_validation[2], MSE(Y, Y_hat)))

print('Mean Absolute Error')
print('-' * 40)
print('train error: {} |\nvalid error: {} |\ntest error : {}\n'.
 ↪format(score_train[3], score_validation[3], MAE(Y, Y_hat)))

print('Root Mean Squared Error')
print('-' * 40)
print('train error: {} |\nvalid error: {} |\ntest error : {}\n'.
 ↪format(score_train[4], score_validation[3], RMSE(Y, Y_hat)))

print('Mean Squared Logarithmic Error')
print('-' * 40)
print('train error: {} |\nvalid error: {} |\ntest error : {}\n'.
 ↪format(score_train[7], score_validation[7], mean_squared_log_error(Y, Y_hat)))

print('Root Mean Squared Logarithmic Error')
print('-' * 40)
print('train error: {} |\nvalid error: {} |\ntest error : {}\n'.
 ↪format(score_train[8], score_validation[8], root_mean_squared_log_error(Y,␣
 ↪Y_hat)))

print('Mean Absolute Percentage Error')
```

```
print('-' * 40)
print('train error: {} |\nvalid error: {} |\ntest error : {}\n'.
 ↪format(score_train[5], score_validation[3], MAPE(Y, Y_hat)))

print('Mean Percentage Error')
print('-' * 40)
print('train error: {} |\nvalid error: {} |\ntest error : {}\n'.
 ↪format(score_train[6], score_validation[3], MPE(Y, Y_hat)))
```

```
R2_Score
----------------------------------------
train error: -1094.7159423828125 |
valid error: -7.070473670959473 |
test error : -0.602108326531094
Explained Variance Score(EVS) : 0.08777323166578832|

Mean Squared Error
----------------------------------------
train error: 0.0018311826279386878 |
valid error: 0.00154657824896276 |
test error : 0.005447334644652418

Mean Absolute Error
----------------------------------------
train error: 0.030748600140213966 |
valid error: 0.031964030116796494 |
test error : 0.060557594979604105

Root Mean Squared Error
----------------------------------------
train error: 0.03589770197868347 |
valid error: 0.031964030116796494 |
test error : 0.07380606102924352

Mean Squared Logarithmic Error
----------------------------------------
train error: 0.0007456078310497105 |
valid error: 0.0006666950066573918 |
test error : 0.0016034491267487017

Root Mean Squared Logarithmic Error
----------------------------------------
train error: 0.01986106112599373 |
valid error: 0.021070081740617752 |
test error : 0.04004309087406592

Mean Absolute Percentage Error
----------------------------------------
```

```
train error: 370261.96875 |
valid error: 0.031964030116796494 |
test error : 7.008125790453226

Mean Percentage Error
----------------------------------------
train error: -inf |
valid error: 0.031964030116796494 |
test error : 5.4788550858086555
```

[26]:
```
df=df_scaled
df
```

[26]:

	Open	High	Low	Close	Volume
0	0.775947	0.732143	0.804159	0.7536	0.008378
1	0.785832	0.740260	0.800693	0.7424	0.011118
2	0.775947	0.730519	0.759099	0.7232	0.030576
3	0.742998	0.698052	0.757366	0.7136	0.014993
4	0.729819	0.694805	0.740035	0.6928	0.007756
..	...	...	...	...	...
245	0.785832	0.785714	0.818024	0.7968	0.026470
246	0.828666	0.839286	0.880416	0.8480	0.035218
247	0.892916	0.902597	0.939341	0.8944	0.058595
248	0.934102	0.902597	0.963605	0.9200	0.045165
249	0.950577	1.000000	1.000000	1.0000	0.087394

[250 rows x 5 columns]

[27]:
```
x_train, x_test, y_train, y_test = train_test_split(df.drop('Close',1),␣
↪df['Close'], test_size=0.2, random_state=0, shuffle=False)
```

[28]:
```
x_train.shape, x_test.shape, y_train.shape, y_test.shape
```

[28]:
```
((200, 4), (50, 4), (200,), (50,))
```

[29]:
```
from keras import models
from keras import layers
from keras import backend as K

def RMSE(y_true, y_pred):
    return K.sqrt(K.mean(K.square(y_pred - y_true)))

def soft_acc(y_true, y_pred):
    return K.mean(K.equal(K.round(y_true), K.round(y_pred)))


def build_model():
```

```
    # 동일한 모델을 여러 번 생성할 것이므로 함수를 만들어 사용합니다
    # 마지막 레이어는 주택가격인 Y값 1개만 예측하면 되기 때문에 뉴런 수는 1개
    model = models.Sequential()
    model.add(layers.Dense(20, activation='relu',
                           input_shape=(x_train.shape[1],)))
    model.add(layers.Dense(1))


    model.compile(optimizer='adam', loss= RMSE, metrics=[soft_acc])
    return model
```

[30]:
```
# k-겹 교차 검증 실시
# 현재 10겹이므로 한번 실행마다 100번 반복하고 결국 1000번을 훈련하게 된다
# #0의 10개의 mae평균, #1의 10개의 mae평균,,,100번째의 10개의 mae평균,,,이렇게 500개
의 mae를 구한다


k = 10

num_val_samples = len(x_train) // k
num_epochs = 100
all_scores = []

all_RMSE_histories_train = []

all_RMSE_histories_valid = []

all_Soft_acc_histories_train = []

all_Soft_acc_histories_valid = []

for i in range(k):
    print('처리중인 폴드 #', i)
    # 검증 데이터 준비: k번째 분할
    x_valid = x_train[i * num_val_samples: (i + 1) * num_val_samples]
    y_valid = y_train[i * num_val_samples: (i + 1) * num_val_samples]

    # 훈련 데이터 준비: 다른 분할 전체
    partial_x_train = np.concatenate(
        [x_train[:i * num_val_samples],
         x_train[(i + 1) * num_val_samples:]],
        axis=0)
    partial_y_train = np.concatenate(
        [y_train[:i * num_val_samples],
         y_train[(i + 1) * num_val_samples:]],
        axis=0)
```

```
    # 케라스 모델 구성(컴파일 포함)
    model = build_model()
    # model.fit()함수로 회귀 모델을 학습시킨다
    history = model.fit(partial_x_train, partial_y_train,
                        validation_data=(x_valid, y_valid),
                        epochs=num_epochs, batch_size=64, verbose=1)

    score_train = model.evaluate(partial_x_train, partial_y_train, batch_size=64)
    score_validation = model.evaluate(x_valid, y_valid, batch_size=64)

    RMSE_history_valid = history.history['val_loss']
    all_RMSE_histories_valid.append(RMSE_history_valid)

    RMSE_history_train = history.history['loss']
    all_RMSE_histories_train.append(RMSE_history_train)

    RMSE_history_train = history.history['soft_acc']
    all_Soft_acc_histories_train.append(RMSE_history_train)

    RMSE_history_valid = history.history['val_soft_acc']
    all_Soft_acc_histories_valid.append(RMSE_history_valid)


average_RMSE_valid = [np.mean([x[i] for x in all_RMSE_histories_valid]) for i in␣
 ↪range(num_epochs)]

average_RMSE_train = [np.mean([x[i] for x in all_RMSE_histories_train]) for i in␣
 ↪range(num_epochs)]

average_Soft_acc_train = [np.mean([x[i] for x in all_Soft_acc_histories_train])␣
 ↪for i in range(num_epochs)]

average_Soft_acc_valid = [np.mean([x[i] for x in all_Soft_acc_histories_valid])␣
 ↪for i in range(num_epochs)]
```

```
처리중인 폴드 # 0
Epoch 1/100
3/3 [==============================] - 1s 102ms/step - loss: 0.5114 - soft_acc:
0.4910 - val_loss: 0.5752 - val_soft_acc: 0.0000e+00
Epoch 2/100
3/3 [==============================] - 0s 24ms/step - loss: 0.4836 - soft_acc:
0.5053 - val_loss: 0.5529 - val_soft_acc: 0.0000e+00
Epoch 3/100
3/3 [==============================] - 0s 21ms/step - loss: 0.4639 - soft_acc:
0.4895 - val_loss: 0.5302 - val_soft_acc: 0.0000e+00
Epoch 4/100
3/3 [==============================] - 0s 27ms/step - loss: 0.4492 - soft_acc:
```

```
0.4817 - val_loss: 0.5071 - val_soft_acc: 0.0000e+00
Epoch 5/100
3/3 [==============================] - 0s 25ms/step - loss: 0.4327 - soft_acc:
0.4751 - val_loss: 0.4835 - val_soft_acc: 0.0000e+00
Epoch 6/100
3/3 [==============================] - 0s 22ms/step - loss: 0.4095 - soft_acc:
0.4688 - val_loss: 0.4596 - val_soft_acc: 0.0000e+00
Epoch 7/100
3/3 [==============================] - 0s 22ms/step - loss: 0.3933 - soft_acc:
0.4595 - val_loss: 0.4353 - val_soft_acc: 0.0000e+00
Epoch 8/100
3/3 [==============================] - 0s 28ms/step - loss: 0.3613 - soft_acc:
0.4871 - val_loss: 0.4105 - val_soft_acc: 0.0000e+00
Epoch 9/100
3/3 [==============================] - 0s 25ms/step - loss: 0.3438 - soft_acc:
0.4871 - val_loss: 0.3852 - val_soft_acc: 0.0000e+00
Epoch 10/100
3/3 [==============================] - 0s 21ms/step - loss: 0.3280 - soft_acc:
0.4608 - val_loss: 0.3594 - val_soft_acc: 0.0000e+00
Epoch 11/100
3/3 [==============================] - 0s 23ms/step - loss: 0.2972 - soft_acc:
0.5014 - val_loss: 0.3331 - val_soft_acc: 0.0000e+00
Epoch 12/100
3/3 [==============================] - 0s 22ms/step - loss: 0.2800 - soft_acc:
0.4766 - val_loss: 0.3063 - val_soft_acc: 0.0000e+00
Epoch 13/100
3/3 [==============================] - 0s 26ms/step - loss: 0.2535 - soft_acc:
0.4949 - val_loss: 0.2789 - val_soft_acc: 0.0000e+00
Epoch 14/100
3/3 [==============================] - 0s 28ms/step - loss: 0.2342 - soft_acc:
0.4902 - val_loss: 0.2505 - val_soft_acc: 0.0000e+00
Epoch 15/100
3/3 [==============================] - 0s 24ms/step - loss: 0.2131 - soft_acc:
0.5143 - val_loss: 0.2212 - val_soft_acc: 0.0000e+00
Epoch 16/100
3/3 [==============================] - 0s 23ms/step - loss: 0.1792 - soft_acc:
0.5863 - val_loss: 0.1913 - val_soft_acc: 0.1500
Epoch 17/100
3/3 [==============================] - 0s 28ms/step - loss: 0.1584 - soft_acc:
0.7193 - val_loss: 0.1609 - val_soft_acc: 0.7000
Epoch 18/100
3/3 [==============================] - 0s 30ms/step - loss: 0.1370 - soft_acc:
0.8425 - val_loss: 0.1302 - val_soft_acc: 0.7500
Epoch 19/100
3/3 [==============================] - 0s 23ms/step - loss: 0.1095 - soft_acc:
0.9148 - val_loss: 0.0996 - val_soft_acc: 0.9000
Epoch 20/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0933 - soft_acc:
```

```
0.9760 - val_loss: 0.0699 - val_soft_acc: 1.0000
Epoch 21/100
3/3 [==============================] - 0s 26ms/step - loss: 0.0785 - soft_acc:
0.9922 - val_loss: 0.0428 - val_soft_acc: 1.0000
Epoch 22/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0664 - soft_acc:
0.9721 - val_loss: 0.0232 - val_soft_acc: 1.0000
Epoch 23/100
3/3 [==============================] - 0s 24ms/step - loss: 0.0642 - soft_acc:
0.9291 - val_loss: 0.0187 - val_soft_acc: 1.0000
Epoch 24/100
3/3 [==============================] - 0s 25ms/step - loss: 0.0678 - soft_acc:
0.9195 - val_loss: 0.0227 - val_soft_acc: 1.0000
Epoch 25/100
3/3 [==============================] - 0s 24ms/step - loss: 0.0693 - soft_acc:
0.9104 - val_loss: 0.0240 - val_soft_acc: 1.0000
Epoch 26/100
3/3 [==============================] - ETA: 0s - loss: 0.0709 - soft_acc: 0.92 -
0s 26ms/step - loss: 0.0695 - soft_acc: 0.9170 - val_loss: 0.0217 -
val_soft_acc: 1.0000
Epoch 27/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0641 - soft_acc:
0.9195 - val_loss: 0.0184 - val_soft_acc: 1.0000
Epoch 28/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0629 - soft_acc:
0.9175 - val_loss: 0.0178 - val_soft_acc: 1.0000
Epoch 29/100
3/3 [==============================] - 0s 24ms/step - loss: 0.0605 - soft_acc:
0.9447 - val_loss: 0.0212 - val_soft_acc: 1.0000
Epoch 30/100
3/3 [==============================] - 0s 25ms/step - loss: 0.0592 - soft_acc:
0.9598 - val_loss: 0.0255 - val_soft_acc: 1.0000
Epoch 31/100
3/3 [==============================] - 0s 26ms/step - loss: 0.0577 - soft_acc:
0.9735 - val_loss: 0.0286 - val_soft_acc: 1.0000
Epoch 32/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0560 - soft_acc:
0.9753 - val_loss: 0.0297 - val_soft_acc: 1.0000
Epoch 33/100
3/3 [==============================] - 0s 24ms/step - loss: 0.0574 - soft_acc:
0.9845 - val_loss: 0.0284 - val_soft_acc: 1.0000
Epoch 34/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0546 - soft_acc:
0.9747 - val_loss: 0.0257 - val_soft_acc: 1.0000
Epoch 35/100
3/3 [==============================] - 0s 24ms/step - loss: 0.0530 - soft_acc:
0.9792 - val_loss: 0.0225 - val_soft_acc: 1.0000
Epoch 36/100
```

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3/3 [==============================] - 0s 26ms/step - loss: 0.0508 - soft_acc:
0.9767 - val_loss: 0.0199 - val_soft_acc: 1.0000
Epoch 37/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0503 - soft_acc:
0.9728 - val_loss: 0.0180 - val_soft_acc: 1.0000
Epoch 38/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0483 - soft_acc:
0.9552 - val_loss: 0.0169 - val_soft_acc: 1.0000
Epoch 39/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0480 - soft_acc:
0.9630 - val_loss: 0.0166 - val_soft_acc: 1.0000
Epoch 40/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0469 - soft_acc:
0.9609 - val_loss: 0.0166 - val_soft_acc: 1.0000
Epoch 41/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0441 - soft_acc:
0.9694 - val_loss: 0.0167 - val_soft_acc: 1.0000
Epoch 42/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0426 - soft_acc:
0.9845 - val_loss: 0.0170 - val_soft_acc: 1.0000
Epoch 43/100
3/3 [==============================] - 0s 24ms/step - loss: 0.0425 - soft_acc:
0.9792 - val_loss: 0.0170 - val_soft_acc: 1.0000
Epoch 44/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0393 - soft_acc:
0.9701 - val_loss: 0.0168 - val_soft_acc: 1.0000
Epoch 45/100
3/3 [==============================] - 0s 24ms/step - loss: 0.0387 - soft_acc:
0.9708 - val_loss: 0.0162 - val_soft_acc: 1.0000
Epoch 46/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0392 - soft_acc:
0.9616 - val_loss: 0.0158 - val_soft_acc: 1.0000
Epoch 47/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0354 - soft_acc:
0.9786 - val_loss: 0.0148 - val_soft_acc: 1.0000
Epoch 48/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0367 - soft_acc:
0.9668 - val_loss: 0.0143 - val_soft_acc: 1.0000
Epoch 49/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0353 - soft_acc:
0.9799 - val_loss: 0.0139 - val_soft_acc: 1.0000
Epoch 50/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0326 - soft_acc:
0.9701 - val_loss: 0.0136 - val_soft_acc: 1.0000
Epoch 51/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0318 - soft_acc:
0.9792 - val_loss: 0.0133 - val_soft_acc: 1.0000
Epoch 52/100
```

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3/3 [==============================] - 0s 26ms/step - loss: 0.0312 - soft_acc:
0.9767 - val_loss: 0.0131 - val_soft_acc: 1.0000
Epoch 53/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0307 - soft_acc:
0.9806 - val_loss: 0.0129 - val_soft_acc: 1.0000
Epoch 54/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0285 - soft_acc:
0.9831 - val_loss: 0.0127 - val_soft_acc: 1.0000
Epoch 55/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0270 - soft_acc:
0.9753 - val_loss: 0.0126 - val_soft_acc: 1.0000
Epoch 56/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0276 - soft_acc:
0.9753 - val_loss: 0.0125 - val_soft_acc: 1.0000
Epoch 57/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0269 - soft_acc:
0.9792 - val_loss: 0.0124 - val_soft_acc: 1.0000
Epoch 58/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0245 - soft_acc:
0.9792 - val_loss: 0.0125 - val_soft_acc: 1.0000
Epoch 59/100
3/3 [==============================] - 0s 24ms/step - loss: 0.0256 - soft_acc:
0.9753 - val_loss: 0.0126 - val_soft_acc: 1.0000
Epoch 60/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0233 - soft_acc:
0.9779 - val_loss: 0.0127 - val_soft_acc: 1.0000
Epoch 61/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0235 - soft_acc:
0.9819 - val_loss: 0.0126 - val_soft_acc: 1.0000
Epoch 62/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0242 - soft_acc:
0.9845 - val_loss: 0.0126 - val_soft_acc: 1.0000
Epoch 63/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0232 - soft_acc:
0.9779 - val_loss: 0.0126 - val_soft_acc: 1.0000
Epoch 64/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0231 - soft_acc:
0.9767 - val_loss: 0.0127 - val_soft_acc: 1.0000
Epoch 65/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0235 - soft_acc:
0.9714 - val_loss: 0.0129 - val_soft_acc: 1.0000
Epoch 66/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0224 - soft_acc:
0.9831 - val_loss: 0.0130 - val_soft_acc: 1.0000
Epoch 67/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0225 - soft_acc:
0.9845 - val_loss: 0.0130 - val_soft_acc: 1.0000
Epoch 68/100
```

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3/3 [==============================] - 0s 19ms/step - loss: 0.0233 - soft_acc:
0.9806 - val_loss: 0.0130 - val_soft_acc: 1.0000
Epoch 69/100
3/3 [==============================] - 0s 27ms/step - loss: 0.0197 - soft_acc:
0.9792 - val_loss: 0.0127 - val_soft_acc: 1.0000
Epoch 70/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0220 - soft_acc:
0.9792 - val_loss: 0.0125 - val_soft_acc: 1.0000
Epoch 71/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0207 - soft_acc:
0.9792 - val_loss: 0.0133 - val_soft_acc: 1.0000
Epoch 72/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0217 - soft_acc:
0.9818 - val_loss: 0.0132 - val_soft_acc: 1.0000
Epoch 73/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0218 - soft_acc:
0.9806 - val_loss: 0.0129 - val_soft_acc: 1.0000
Epoch 74/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0227 - soft_acc:
0.9740 - val_loss: 0.0127 - val_soft_acc: 1.0000
Epoch 75/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0219 - soft_acc:
0.9779 - val_loss: 0.0127 - val_soft_acc: 1.0000
Epoch 76/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0215 - soft_acc:
0.9753 - val_loss: 0.0128 - val_soft_acc: 1.0000
Epoch 77/100
3/3 [==============================] - 0s 24ms/step - loss: 0.0204 - soft_acc:
0.9740 - val_loss: 0.0126 - val_soft_acc: 1.0000
Epoch 78/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0195 - soft_acc:
0.9806 - val_loss: 0.0125 - val_soft_acc: 1.0000
Epoch 79/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0222 - soft_acc:
0.9858 - val_loss: 0.0128 - val_soft_acc: 1.0000
Epoch 80/100
3/3 [==============================] - 0s 24ms/step - loss: 0.0209 - soft_acc:
0.9753 - val_loss: 0.0129 - val_soft_acc: 1.0000
Epoch 81/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0210 - soft_acc:
0.9753 - val_loss: 0.0132 - val_soft_acc: 1.0000
Epoch 82/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0217 - soft_acc:
0.9740 - val_loss: 0.0131 - val_soft_acc: 1.0000
Epoch 83/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0221 - soft_acc:
0.9714 - val_loss: 0.0129 - val_soft_acc: 1.0000
Epoch 84/100
```

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3/3 [==============================] - 0s 20ms/step - loss: 0.0192 - soft_acc:
0.9779 - val_loss: 0.0126 - val_soft_acc: 1.0000
Epoch 85/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0204 - soft_acc:
0.9890 - val_loss: 0.0125 - val_soft_acc: 1.0000
Epoch 86/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0209 - soft_acc:
0.9792 - val_loss: 0.0126 - val_soft_acc: 1.0000
Epoch 87/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0211 - soft_acc:
0.9851 - val_loss: 0.0125 - val_soft_acc: 1.0000
Epoch 88/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0205 - soft_acc:
0.9890 - val_loss: 0.0125 - val_soft_acc: 1.0000
Epoch 89/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0213 - soft_acc:
0.9785 - val_loss: 0.0127 - val_soft_acc: 1.0000
Epoch 90/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0205 - soft_acc:
0.9904 - val_loss: 0.0132 - val_soft_acc: 1.0000
Epoch 91/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0212 - soft_acc:
0.9792 - val_loss: 0.0135 - val_soft_acc: 1.0000
Epoch 92/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0207 - soft_acc:
0.9845 - val_loss: 0.0127 - val_soft_acc: 1.0000
Epoch 93/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0214 - soft_acc:
0.9838 - val_loss: 0.0123 - val_soft_acc: 1.0000
Epoch 94/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0205 - soft_acc:
0.9785 - val_loss: 0.0126 - val_soft_acc: 1.0000
Epoch 95/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0204 - soft_acc:
0.9792 - val_loss: 0.0132 - val_soft_acc: 1.0000
Epoch 96/100
3/3 [==============================] - 0s 24ms/step - loss: 0.0213 - soft_acc:
0.9831 - val_loss: 0.0131 - val_soft_acc: 1.0000
Epoch 97/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0200 - soft_acc:
0.9785 - val_loss: 0.0129 - val_soft_acc: 1.0000
Epoch 98/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0214 - soft_acc:
0.9904 - val_loss: 0.0125 - val_soft_acc: 1.0000
Epoch 99/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0194 - soft_acc:
0.9890 - val_loss: 0.0127 - val_soft_acc: 1.0000
Epoch 100/100
```

```
3/3 [==============================] - 0s 23ms/step - loss: 0.0206 - soft_acc:
0.9838 - val_loss: 0.0128 - val_soft_acc: 1.0000
3/3 [==============================] - 0s 2ms/step - loss: 0.0198 - soft_acc:
0.9844
1/1 [==============================] - 0s 16ms/step - loss: 0.0128 - soft_acc:
1.0000
처리중인 폴드 # 1
Epoch 1/100
3/3 [==============================] - 1s 84ms/step - loss: 0.5701 - soft_acc:
0.3635 - val_loss: 0.2191 - val_soft_acc: 1.0000
Epoch 2/100
3/3 [==============================] - 0s 27ms/step - loss: 0.5493 - soft_acc:
0.3766 - val_loss: 0.2100 - val_soft_acc: 1.0000
Epoch 3/100
3/3 [==============================] - 0s 37ms/step - loss: 0.5411 - soft_acc:
0.3439 - val_loss: 0.2009 - val_soft_acc: 1.0000
Epoch 4/100
3/3 [==============================] - 0s 26ms/step - loss: 0.5158 - soft_acc:
0.3805 - val_loss: 0.1921 - val_soft_acc: 1.0000
Epoch 5/100
3/3 [==============================] - 0s 27ms/step - loss: 0.4923 - soft_acc:
0.3961 - val_loss: 0.1833 - val_soft_acc: 1.0000
Epoch 6/100
3/3 [==============================] - 0s 19ms/step - loss: 0.4901 - soft_acc:
0.3647 - val_loss: 0.1747 - val_soft_acc: 1.0000
Epoch 7/100
3/3 [==============================] - 0s 20ms/step - loss: 0.4717 - soft_acc:
0.3637 - val_loss: 0.1664 - val_soft_acc: 1.0000
Epoch 8/100
3/3 [==============================] - 0s 23ms/step - loss: 0.4660 - soft_acc:
0.3437 - val_loss: 0.1584 - val_soft_acc: 1.0000
Epoch 9/100
3/3 [==============================] - 0s 21ms/step - loss: 0.4391 - soft_acc:
0.3871 - val_loss: 0.1505 - val_soft_acc: 1.0000
Epoch 10/100
3/3 [==============================] - 0s 21ms/step - loss: 0.4292 - soft_acc:
0.3713 - val_loss: 0.1427 - val_soft_acc: 1.0000
Epoch 11/100
3/3 [==============================] - 0s 22ms/step - loss: 0.4080 - soft_acc:
0.4041 - val_loss: 0.1350 - val_soft_acc: 1.0000
Epoch 12/100
3/3 [==============================] - 0s 22ms/step - loss: 0.4012 - soft_acc:
0.3622 - val_loss: 0.1274 - val_soft_acc: 1.0000
Epoch 13/100
3/3 [==============================] - 0s 21ms/step - loss: 0.3764 - soft_acc:
0.3898 - val_loss: 0.1199 - val_soft_acc: 1.0000
Epoch 14/100
3/3 [==============================] - 0s 22ms/step - loss: 0.3645 - soft_acc:
```

```
0.3807 - val_loss: 0.1127 - val_soft_acc: 1.0000
Epoch 15/100
3/3 [==============================] - 0s 21ms/step - loss: 0.3468 - soft_acc:
0.3785 - val_loss: 0.1057 - val_soft_acc: 1.0000
Epoch 16/100
3/3 [==============================] - 0s 26ms/step - loss: 0.3323 - soft_acc:
0.3722 - val_loss: 0.0991 - val_soft_acc: 1.0000
Epoch 17/100
3/3 [==============================] - 0s 20ms/step - loss: 0.3142 - soft_acc:
0.3760 - val_loss: 0.0931 - val_soft_acc: 1.0000
Epoch 18/100
3/3 [==============================] - 0s 20ms/step - loss: 0.2971 - soft_acc:
0.3734 - val_loss: 0.0879 - val_soft_acc: 1.0000
Epoch 19/100
3/3 [==============================] - 0s 21ms/step - loss: 0.2807 - soft_acc:
0.3826 - val_loss: 0.0838 - val_soft_acc: 1.0000
Epoch 20/100
3/3 [==============================] - 0s 17ms/step - loss: 0.2627 - soft_acc:
0.3780 - val_loss: 0.0809 - val_soft_acc: 1.0000
Epoch 21/100
3/3 [==============================] - 0s 24ms/step - loss: 0.2451 - soft_acc:
0.3824 - val_loss: 0.0796 - val_soft_acc: 1.0000
Epoch 22/100
3/3 [==============================] - 0s 20ms/step - loss: 0.2286 - soft_acc:
0.3947 - val_loss: 0.0800 - val_soft_acc: 1.0000
Epoch 23/100
3/3 [==============================] - 0s 19ms/step - loss: 0.2042 - soft_acc:
0.4657 - val_loss: 0.0822 - val_soft_acc: 1.0000
Epoch 24/100
3/3 [==============================] - 0s 19ms/step - loss: 0.1892 - soft_acc:
0.4854 - val_loss: 0.0862 - val_soft_acc: 1.0000
Epoch 25/100
3/3 [==============================] - 0s 20ms/step - loss: 0.1704 - soft_acc:
0.5886 - val_loss: 0.0918 - val_soft_acc: 1.0000
Epoch 26/100
3/3 [==============================] - 0s 17ms/step - loss: 0.1524 - soft_acc:
0.7498 - val_loss: 0.0989 - val_soft_acc: 1.0000
Epoch 27/100
3/3 [==============================] - 0s 22ms/step - loss: 0.1295 - soft_acc:
0.8447 - val_loss: 0.1070 - val_soft_acc: 1.0000
Epoch 28/100
3/3 [==============================] - 0s 20ms/step - loss: 0.1165 - soft_acc:
0.9168 - val_loss: 0.1159 - val_soft_acc: 0.9500
Epoch 29/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0958 - soft_acc:
0.9774 - val_loss: 0.1254 - val_soft_acc: 0.9500
Epoch 30/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0851 - soft_acc:
```

```
0.9858 - val_loss: 0.1347 - val_soft_acc: 0.9500
Epoch 31/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0745 - soft_acc:
0.9655 - val_loss: 0.1434 - val_soft_acc: 0.9500
Epoch 32/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0719 - soft_acc:
0.9518 - val_loss: 0.1505 - val_soft_acc: 0.9500
Epoch 33/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0653 - soft_acc:
0.9272 - val_loss: 0.1556 - val_soft_acc: 0.9500
Epoch 34/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0630 - soft_acc:
0.9123 - val_loss: 0.1583 - val_soft_acc: 0.9000
Epoch 35/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0650 - soft_acc:
0.9228 - val_loss: 0.1586 - val_soft_acc: 0.9000
Epoch 36/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0661 - soft_acc:
0.8962 - val_loss: 0.1568 - val_soft_acc: 0.9000
Epoch 37/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0641 - soft_acc:
0.9058 - val_loss: 0.1538 - val_soft_acc: 0.9000
Epoch 38/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0618 - soft_acc:
0.9301 - val_loss: 0.1500 - val_soft_acc: 0.9500
Epoch 39/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0657 - soft_acc:
0.9157 - val_loss: 0.1459 - val_soft_acc: 0.9500
Epoch 40/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0622 - soft_acc:
0.9293 - val_loss: 0.1420 - val_soft_acc: 0.9500
Epoch 41/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0669 - soft_acc:
0.9305 - val_loss: 0.1386 - val_soft_acc: 0.9500
Epoch 42/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0657 - soft_acc:
0.9415 - val_loss: 0.1360 - val_soft_acc: 0.9500
Epoch 43/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0600 - soft_acc:
0.9493 - val_loss: 0.1343 - val_soft_acc: 0.9500
Epoch 44/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0608 - soft_acc:
0.9600 - val_loss: 0.1330 - val_soft_acc: 0.9500
Epoch 45/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0592 - soft_acc:
0.9337 - val_loss: 0.1321 - val_soft_acc: 0.9500
Epoch 46/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0574 - soft_acc:
```

```
0.9390 - val_loss: 0.1314 - val_soft_acc: 0.9500
Epoch 47/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0575 - soft_acc:
0.9376 - val_loss: 0.1308 - val_soft_acc: 0.9500
Epoch 48/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0611 - soft_acc:
0.9402 - val_loss: 0.1299 - val_soft_acc: 0.9500
Epoch 49/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0581 - soft_acc:
0.9390 - val_loss: 0.1292 - val_soft_acc: 0.9500
Epoch 50/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0563 - soft_acc:
0.9586 - val_loss: 0.1282 - val_soft_acc: 0.9500
Epoch 51/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0574 - soft_acc:
0.9429 - val_loss: 0.1267 - val_soft_acc: 0.9500
Epoch 52/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0542 - soft_acc:
0.9534 - val_loss: 0.1251 - val_soft_acc: 0.9500
Epoch 53/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0563 - soft_acc:
0.9402 - val_loss: 0.1232 - val_soft_acc: 0.9500
Epoch 54/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0514 - soft_acc:
0.9362 - val_loss: 0.1212 - val_soft_acc: 0.9500
Epoch 55/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0543 - soft_acc:
0.9454 - val_loss: 0.1191 - val_soft_acc: 0.9500
Epoch 56/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0536 - soft_acc:
0.9362 - val_loss: 0.1173 - val_soft_acc: 0.9500
Epoch 57/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0525 - soft_acc:
0.9454 - val_loss: 0.1157 - val_soft_acc: 0.9500
Epoch 58/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0510 - soft_acc:
0.9600 - val_loss: 0.1140 - val_soft_acc: 0.9500
Epoch 59/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0477 - soft_acc:
0.9507 - val_loss: 0.1126 - val_soft_acc: 0.9500
Epoch 60/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0451 - soft_acc:
0.9481 - val_loss: 0.1111 - val_soft_acc: 0.9500
Epoch 61/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0506 - soft_acc:
0.9495 - val_loss: 0.1094 - val_soft_acc: 0.9500
Epoch 62/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0476 - soft_acc:
```

```
0.9573 - val_loss: 0.1075 - val_soft_acc: 0.9500
Epoch 63/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0453 - soft_acc:
0.9390 - val_loss: 0.1059 - val_soft_acc: 0.9500
Epoch 64/100
3/3 [==============================] - 0s 15ms/step - loss: 0.0451 - soft_acc:
0.9507 - val_loss: 0.1041 - val_soft_acc: 0.9500
Epoch 65/100
3/3 [==============================] - 0s 18ms/step - loss: 0.0450 - soft_acc:
0.9415 - val_loss: 0.1025 - val_soft_acc: 1.0000
Epoch 66/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0423 - soft_acc:
0.9429 - val_loss: 0.1010 - val_soft_acc: 1.0000
Epoch 67/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0448 - soft_acc:
0.9271 - val_loss: 0.0990 - val_soft_acc: 1.0000
Epoch 68/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0404 - soft_acc:
0.9481 - val_loss: 0.0970 - val_soft_acc: 1.0000
Epoch 69/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0417 - soft_acc:
0.9545 - val_loss: 0.0949 - val_soft_acc: 1.0000
Epoch 70/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0423 - soft_acc:
0.9499 - val_loss: 0.0927 - val_soft_acc: 1.0000
Epoch 71/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0410 - soft_acc:
0.9623 - val_loss: 0.0904 - val_soft_acc: 1.0000
Epoch 72/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0397 - soft_acc:
0.9597 - val_loss: 0.0884 - val_soft_acc: 1.0000
Epoch 73/100
3/3 [==============================] - 0s 37ms/step - loss: 0.0359 - soft_acc:
0.9755 - val_loss: 0.0865 - val_soft_acc: 1.0000
Epoch 74/100
3/3 [==============================] - 0s 25ms/step - loss: 0.0358 - soft_acc:
0.9794 - val_loss: 0.0844 - val_soft_acc: 1.0000
Epoch 75/100
3/3 [==============================] - 0s 25ms/step - loss: 0.0342 - soft_acc:
0.9623 - val_loss: 0.0823 - val_soft_acc: 1.0000
Epoch 76/100
3/3 [==============================] - 0s 25ms/step - loss: 0.0341 - soft_acc:
0.9584 - val_loss: 0.0803 - val_soft_acc: 1.0000
Epoch 77/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0343 - soft_acc:
0.9701 - val_loss: 0.0780 - val_soft_acc: 1.0000
Epoch 78/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0331 - soft_acc:
```

```
0.9623 - val_loss: 0.0754 - val_soft_acc: 1.0000
Epoch 79/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0302 - soft_acc:
0.9689 - val_loss: 0.0729 - val_soft_acc: 1.0000
Epoch 80/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0321 - soft_acc:
0.9675 - val_loss: 0.0704 - val_soft_acc: 1.0000
Epoch 81/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0295 - soft_acc:
0.9688 - val_loss: 0.0680 - val_soft_acc: 1.0000
Epoch 82/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0277 - soft_acc:
0.9740 - val_loss: 0.0658 - val_soft_acc: 1.0000
Epoch 83/100
3/3 [==============================] - 0s 25ms/step - loss: 0.0270 - soft_acc:
0.9662 - val_loss: 0.0633 - val_soft_acc: 1.0000
Epoch 84/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0266 - soft_acc:
0.9662 - val_loss: 0.0605 - val_soft_acc: 1.0000
Epoch 85/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0249 - soft_acc:
0.9740 - val_loss: 0.0574 - val_soft_acc: 1.0000
Epoch 86/100
3/3 [==============================] - 0s 26ms/step - loss: 0.0250 - soft_acc:
0.9799 - val_loss: 0.0550 - val_soft_acc: 1.0000
Epoch 87/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0241 - soft_acc:
0.9799 - val_loss: 0.0531 - val_soft_acc: 1.0000
Epoch 88/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0226 - soft_acc:
0.9838 - val_loss: 0.0507 - val_soft_acc: 1.0000
Epoch 89/100
3/3 [==============================] - 0s 25ms/step - loss: 0.0208 - soft_acc:
0.9877 - val_loss: 0.0484 - val_soft_acc: 1.0000
Epoch 90/100
3/3 [==============================] - 0s 24ms/step - loss: 0.0205 - soft_acc:
0.9806 - val_loss: 0.0455 - val_soft_acc: 1.0000
Epoch 91/100
3/3 [==============================] - 0s 26ms/step - loss: 0.0191 - soft_acc:
0.9785 - val_loss: 0.0431 - val_soft_acc: 1.0000
Epoch 92/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0176 - soft_acc:
0.9870 - val_loss: 0.0411 - val_soft_acc: 1.0000
Epoch 93/100
3/3 [==============================] - 0s 24ms/step - loss: 0.0177 - soft_acc:
0.9936 - val_loss: 0.0390 - val_soft_acc: 1.0000
Epoch 94/100
3/3 [==============================] - 0s 24ms/step - loss: 0.0164 - soft_acc:
```

```
0.9883 - val_loss: 0.0374 - val_soft_acc: 1.0000
Epoch 95/100
3/3 [==============================] - 0s 30ms/step - loss: 0.0163 - soft_acc:
0.9936 - val_loss: 0.0355 - val_soft_acc: 1.0000
Epoch 96/100
3/3 [==============================] - 0s 45ms/step - loss: 0.0154 - soft_acc:
0.9922 - val_loss: 0.0333 - val_soft_acc: 1.0000
Epoch 97/100
3/3 [==============================] - 0s 27ms/step - loss: 0.0147 - soft_acc:
0.9904 - val_loss: 0.0316 - val_soft_acc: 1.0000
Epoch 98/100
3/3 [==============================] - 0s 40ms/step - loss: 0.0148 - soft_acc:
0.9785 - val_loss: 0.0308 - val_soft_acc: 1.0000
Epoch 99/100
3/3 [==============================] - 0s 28ms/step - loss: 0.0140 - soft_acc:
0.9838 - val_loss: 0.0298 - val_soft_acc: 1.0000
Epoch 100/100
3/3 [==============================] - 0s 33ms/step - loss: 0.0136 - soft_acc:
0.9799 - val_loss: 0.0286 - val_soft_acc: 1.0000
3/3 [==============================] - 0s 2ms/step - loss: 0.0133 - soft_acc:
0.9844
1/1 [==============================] - 0s 18ms/step - loss: 0.0286 - soft_acc:
1.0000
처리중인 폴드 # 2
Epoch 1/100
3/3 [==============================] - 1s 172ms/step - loss: 0.6645 - soft_acc:
0.3568 - val_loss: 0.2536 - val_soft_acc: 1.0000
Epoch 2/100
3/3 [==============================] - 0s 42ms/step - loss: 0.6273 - soft_acc:
0.3766 - val_loss: 0.2400 - val_soft_acc: 1.0000
Epoch 3/100
3/3 [==============================] - 0s 59ms/step - loss: 0.6133 - soft_acc:
0.3517 - val_loss: 0.2267 - val_soft_acc: 1.0000
Epoch 4/100
3/3 [==============================] - 0s 28ms/step - loss: 0.5790 - soft_acc:
0.3728 - val_loss: 0.2138 - val_soft_acc: 1.0000
Epoch 5/100
3/3 [==============================] - 0s 32ms/step - loss: 0.5643 - soft_acc:
0.3740 - val_loss: 0.2012 - val_soft_acc: 1.0000
Epoch 6/100
3/3 [==============================] - 0s 32ms/step - loss: 0.5355 - soft_acc:
0.4041 - val_loss: 0.1889 - val_soft_acc: 1.0000
Epoch 7/100
3/3 [==============================] - 0s 32ms/step - loss: 0.5181 - soft_acc:
0.3910 - val_loss: 0.1767 - val_soft_acc: 1.0000
Epoch 8/100
3/3 [==============================] - 0s 28ms/step - loss: 0.4913 - soft_acc:
0.3990 - val_loss: 0.1646 - val_soft_acc: 1.0000
```

```
Epoch 9/100
3/3 [==============================] - 0s 29ms/step - loss: 0.4778 - soft_acc:
0.3988 - val_loss: 0.1526 - val_soft_acc: 1.0000
Epoch 10/100
3/3 [==============================] - 0s 29ms/step - loss: 0.4648 - soft_acc:
0.3622 - val_loss: 0.1407 - val_soft_acc: 1.0000
Epoch 11/100
3/3 [==============================] - 0s 29ms/step - loss: 0.4405 - soft_acc:
0.3780 - val_loss: 0.1289 - val_soft_acc: 1.0000
Epoch 12/100
3/3 [==============================] - 0s 25ms/step - loss: 0.4118 - soft_acc:
0.4107 - val_loss: 0.1171 - val_soft_acc: 1.0000
Epoch 13/100
3/3 [==============================] - 0s 25ms/step - loss: 0.3997 - soft_acc:
0.3936 - val_loss: 0.1053 - val_soft_acc: 1.0000
Epoch 14/100
3/3 [==============================] - 0s 23ms/step - loss: 0.3892 - soft_acc:
0.3488 - val_loss: 0.0934 - val_soft_acc: 1.0000
Epoch 15/100
3/3 [==============================] - 0s 28ms/step - loss: 0.3596 - soft_acc:
0.3859 - val_loss: 0.0817 - val_soft_acc: 1.0000
Epoch 16/100
3/3 [==============================] - 0s 26ms/step - loss: 0.3371 - soft_acc:
0.3976 - val_loss: 0.0699 - val_soft_acc: 1.0000
Epoch 17/100
3/3 [==============================] - 0s 23ms/step - loss: 0.3272 - soft_acc:
0.3649 - val_loss: 0.0581 - val_soft_acc: 1.0000
Epoch 18/100
3/3 [==============================] - 0s 26ms/step - loss: 0.2985 - soft_acc:
0.3936 - val_loss: 0.0465 - val_soft_acc: 1.0000
Epoch 19/100
3/3 [==============================] - 0s 25ms/step - loss: 0.2852 - soft_acc:
0.3676 - val_loss: 0.0352 - val_soft_acc: 1.0000
Epoch 20/100
3/3 [==============================] - 0s 29ms/step - loss: 0.2588 - soft_acc:
0.4039 - val_loss: 0.0250 - val_soft_acc: 1.0000
Epoch 21/100
3/3 [==============================] - 0s 25ms/step - loss: 0.2364 - soft_acc:
0.4171 - val_loss: 0.0176 - val_soft_acc: 1.0000
Epoch 22/100
3/3 [==============================] - 0s 23ms/step - loss: 0.2228 - soft_acc:
0.4105 - val_loss: 0.0170 - val_soft_acc: 1.0000
Epoch 23/100
3/3 [==============================] - 0s 26ms/step - loss: 0.2055 - soft_acc:
0.4488 - val_loss: 0.0239 - val_soft_acc: 1.0000
Epoch 24/100
3/3 [==============================] - 0s 27ms/step - loss: 0.1816 - soft_acc:
0.4959 - val_loss: 0.0338 - val_soft_acc: 1.0000
```

```
Epoch 25/100
3/3 [==============================] - 0s 23ms/step - loss: 0.1646 - soft_acc:
0.6471 - val_loss: 0.0451 - val_soft_acc: 1.0000
Epoch 26/100
3/3 [==============================] - 0s 28ms/step - loss: 0.1439 - soft_acc:
0.8155 - val_loss: 0.0567 - val_soft_acc: 1.0000
Epoch 27/100
3/3 [==============================] - 0s 25ms/step - loss: 0.1213 - soft_acc:
0.8953 - val_loss: 0.0685 - val_soft_acc: 1.0000
Epoch 28/100
3/3 [==============================] - 0s 25ms/step - loss: 0.1097 - soft_acc:
0.9657 - val_loss: 0.0802 - val_soft_acc: 1.0000
Epoch 29/100
3/3 [==============================] - 0s 24ms/step - loss: 0.0927 - soft_acc:
0.9831 - val_loss: 0.0913 - val_soft_acc: 1.0000
Epoch 30/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0799 - soft_acc:
0.9668 - val_loss: 0.1012 - val_soft_acc: 1.0000
Epoch 31/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0691 - soft_acc:
0.9501 - val_loss: 0.1098 - val_soft_acc: 1.0000
Epoch 32/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0630 - soft_acc:
0.9189 - val_loss: 0.1162 - val_soft_acc: 1.0000
Epoch 33/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0624 - soft_acc:
0.9099 - val_loss: 0.1203 - val_soft_acc: 1.0000
Epoch 34/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0667 - soft_acc:
0.8995 - val_loss: 0.1217 - val_soft_acc: 1.0000
Epoch 35/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0665 - soft_acc:
0.8739 - val_loss: 0.1208 - val_soft_acc: 1.0000
Epoch 36/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0661 - soft_acc:
0.8753 - val_loss: 0.1182 - val_soft_acc: 1.0000
Epoch 37/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0661 - soft_acc:
0.8857 - val_loss: 0.1145 - val_soft_acc: 1.0000
Epoch 38/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0636 - soft_acc:
0.8916 - val_loss: 0.1102 - val_soft_acc: 1.0000
Epoch 39/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0613 - soft_acc:
0.8953 - val_loss: 0.1058 - val_soft_acc: 1.0000
Epoch 40/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0594 - soft_acc:
0.9031 - val_loss: 0.1016 - val_soft_acc: 1.0000
```

```
Epoch 41/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0614 - soft_acc:
0.9344 - val_loss: 0.0982 - val_soft_acc: 1.0000
Epoch 42/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0615 - soft_acc:
0.9377 - val_loss: 0.0956 - val_soft_acc: 1.0000
Epoch 43/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0571 - soft_acc:
0.9397 - val_loss: 0.0940 - val_soft_acc: 1.0000
Epoch 44/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0574 - soft_acc:
0.9429 - val_loss: 0.0928 - val_soft_acc: 1.0000
Epoch 45/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0576 - soft_acc:
0.9376 - val_loss: 0.0919 - val_soft_acc: 1.0000
Epoch 46/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0557 - soft_acc:
0.9376 - val_loss: 0.0914 - val_soft_acc: 1.0000
Epoch 47/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0558 - soft_acc:
0.9415 - val_loss: 0.0909 - val_soft_acc: 1.0000
Epoch 48/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0553 - soft_acc:
0.9342 - val_loss: 0.0901 - val_soft_acc: 1.0000
Epoch 49/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0538 - soft_acc:
0.9330 - val_loss: 0.0892 - val_soft_acc: 1.0000
Epoch 50/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0525 - soft_acc:
0.9449 - val_loss: 0.0879 - val_soft_acc: 1.0000
Epoch 51/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0514 - soft_acc:
0.9461 - val_loss: 0.0864 - val_soft_acc: 1.0000
Epoch 52/100
3/3 [==============================] - 0s 24ms/step - loss: 0.0500 - soft_acc:
0.9310 - val_loss: 0.0846 - val_soft_acc: 1.0000
Epoch 53/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0489 - soft_acc:
0.9441 - val_loss: 0.0826 - val_soft_acc: 1.0000
Epoch 54/100
3/3 [==============================] - 0s 24ms/step - loss: 0.0477 - soft_acc:
0.9390 - val_loss: 0.0803 - val_soft_acc: 1.0000
Epoch 55/100
3/3 [==============================] - 0s 24ms/step - loss: 0.0464 - soft_acc:
0.9415 - val_loss: 0.0781 - val_soft_acc: 1.0000
Epoch 56/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0460 - soft_acc:
0.9513 - val_loss: 0.0757 - val_soft_acc: 1.0000
```

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Epoch 57/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0449 - soft_acc:
0.9461 - val_loss: 0.0735 - val_soft_acc: 1.0000
Epoch 58/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0430 - soft_acc:
0.9540 - val_loss: 0.0717 - val_soft_acc: 1.0000
Epoch 59/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0434 - soft_acc:
0.9539 - val_loss: 0.0695 - val_soft_acc: 1.0000
Epoch 60/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0431 - soft_acc:
0.9559 - val_loss: 0.0670 - val_soft_acc: 1.0000
Epoch 61/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0394 - soft_acc:
0.9506 - val_loss: 0.0647 - val_soft_acc: 1.0000
Epoch 62/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0417 - soft_acc:
0.9603 - val_loss: 0.0621 - val_soft_acc: 1.0000
Epoch 63/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0415 - soft_acc:
0.9630 - val_loss: 0.0599 - val_soft_acc: 1.0000
Epoch 64/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0370 - soft_acc:
0.9486 - val_loss: 0.0571 - val_soft_acc: 1.0000
Epoch 65/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0336 - soft_acc:
0.9675 - val_loss: 0.0544 - val_soft_acc: 1.0000
Epoch 66/100
3/3 [==============================] - 0s 24ms/step - loss: 0.0347 - soft_acc:
0.9689 - val_loss: 0.0516 - val_soft_acc: 1.0000
Epoch 67/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0341 - soft_acc:
0.9747 - val_loss: 0.0483 - val_soft_acc: 1.0000
Epoch 68/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0315 - soft_acc:
0.9760 - val_loss: 0.0449 - val_soft_acc: 1.0000
Epoch 69/100
3/3 [==============================] - 0s 27ms/step - loss: 0.0297 - soft_acc:
0.9792 - val_loss: 0.0419 - val_soft_acc: 1.0000
Epoch 70/100
3/3 [==============================] - 0s 27ms/step - loss: 0.0293 - soft_acc:
0.9753 - val_loss: 0.0390 - val_soft_acc: 1.0000
Epoch 71/100
3/3 [==============================] - 0s 26ms/step - loss: 0.0275 - soft_acc:
0.9872 - val_loss: 0.0355 - val_soft_acc: 1.0000
Epoch 72/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0267 - soft_acc:
0.9863 - val_loss: 0.0320 - val_soft_acc: 1.0000
```

```
Epoch 73/100
3/3 [==============================] - 0s 24ms/step - loss: 0.0269 - soft_acc:
0.9785 - val_loss: 0.0290 - val_soft_acc: 1.0000
Epoch 74/100
3/3 [==============================] - 0s 26ms/step - loss: 0.0237 - soft_acc:
0.9877 - val_loss: 0.0264 - val_soft_acc: 1.0000
Epoch 75/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0219 - soft_acc:
0.9785 - val_loss: 0.0232 - val_soft_acc: 1.0000
Epoch 76/100
3/3 [==============================] - 0s 28ms/step - loss: 0.0219 - soft_acc:
0.9904 - val_loss: 0.0203 - val_soft_acc: 1.0000
Epoch 77/100
3/3 [==============================] - 0s 24ms/step - loss: 0.0209 - soft_acc:
0.9851 - val_loss: 0.0175 - val_soft_acc: 1.0000
Epoch 78/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0182 - soft_acc:
0.9799 - val_loss: 0.0156 - val_soft_acc: 1.0000
Epoch 79/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0183 - soft_acc:
0.9877 - val_loss: 0.0145 - val_soft_acc: 1.0000
Epoch 80/100
3/3 [==============================] - 0s 26ms/step - loss: 0.0185 - soft_acc:
0.9877 - val_loss: 0.0131 - val_soft_acc: 1.0000
Epoch 81/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0173 - soft_acc:
0.9831 - val_loss: 0.0124 - val_soft_acc: 1.0000
Epoch 82/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0167 - soft_acc:
0.9870 - val_loss: 0.0124 - val_soft_acc: 1.0000
Epoch 83/100
3/3 [==============================] - 0s 25ms/step - loss: 0.0176 - soft_acc:
0.9922 - val_loss: 0.0128 - val_soft_acc: 1.0000
Epoch 84/100
3/3 [==============================] - 0s 24ms/step - loss: 0.0168 - soft_acc:
0.9922 - val_loss: 0.0134 - val_soft_acc: 1.0000
Epoch 85/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0152 - soft_acc:
0.9909 - val_loss: 0.0140 - val_soft_acc: 1.0000
Epoch 86/100
3/3 [==============================] - 0s 24ms/step - loss: 0.0151 - soft_acc:
0.9831 - val_loss: 0.0143 - val_soft_acc: 1.0000
Epoch 87/100
3/3 [==============================] - 0s 26ms/step - loss: 0.0160 - soft_acc:
0.9870 - val_loss: 0.0143 - val_soft_acc: 1.0000
Epoch 88/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0165 - soft_acc:
0.9883 - val_loss: 0.0150 - val_soft_acc: 1.0000
```

```
Epoch 89/100
3/3 [==============================] - 0s 24ms/step - loss: 0.0164 - soft_acc:
0.9831 - val_loss: 0.0161 - val_soft_acc: 1.0000
Epoch 90/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0157 - soft_acc:
0.9922 - val_loss: 0.0159 - val_soft_acc: 1.0000
Epoch 91/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0156 - soft_acc:
0.9883 - val_loss: 0.0154 - val_soft_acc: 1.0000
Epoch 92/100
3/3 [==============================] - 0s 24ms/step - loss: 0.0155 - soft_acc:
0.9883 - val_loss: 0.0156 - val_soft_acc: 1.0000
Epoch 93/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0160 - soft_acc:
0.9922 - val_loss: 0.0157 - val_soft_acc: 1.0000
Epoch 94/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0159 - soft_acc:
0.9831 - val_loss: 0.0160 - val_soft_acc: 1.0000
Epoch 95/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0154 - soft_acc:
0.9922 - val_loss: 0.0159 - val_soft_acc: 1.0000
Epoch 96/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0159 - soft_acc:
0.9870 - val_loss: 0.0155 - val_soft_acc: 1.0000
Epoch 97/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0152 - soft_acc:
0.9922 - val_loss: 0.0153 - val_soft_acc: 1.0000
Epoch 98/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0155 - soft_acc:
0.9883 - val_loss: 0.0157 - val_soft_acc: 1.0000
Epoch 99/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0157 - soft_acc:
0.9922 - val_loss: 0.0157 - val_soft_acc: 1.0000
Epoch 100/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0158 - soft_acc:
0.9870 - val_loss: 0.0152 - val_soft_acc: 1.0000
3/3 [==============================] - 0s 1ms/step - loss: 0.0157 - soft_acc:
0.9896
1/1 [==============================] - 0s 15ms/step - loss: 0.0152 - soft_acc:
1.0000
처리중인 폴드 # 3
Epoch 1/100
3/3 [==============================] - 1s 104ms/step - loss: 0.4099 - soft_acc:
0.4027 - val_loss: 0.2373 - val_soft_acc: 1.0000
Epoch 2/100
3/3 [==============================] - 0s 22ms/step - loss: 0.3901 - soft_acc:
0.3557 - val_loss: 0.2182 - val_soft_acc: 0.9500
Epoch 3/100
```

```
3/3 [==============================] - 0s 22ms/step - loss: 0.3609 - soft_acc:
0.3829 - val_loss: 0.1990 - val_soft_acc: 0.9500
Epoch 4/100
3/3 [==============================] - 0s 22ms/step - loss: 0.3307 - soft_acc:
0.3941 - val_loss: 0.1801 - val_soft_acc: 0.9500
Epoch 5/100
3/3 [==============================] - 0s 20ms/step - loss: 0.3087 - soft_acc:
0.3851 - val_loss: 0.1620 - val_soft_acc: 0.9500
Epoch 6/100
3/3 [==============================] - 0s 23ms/step - loss: 0.2797 - soft_acc:
0.3934 - val_loss: 0.1447 - val_soft_acc: 0.9500
Epoch 7/100
3/3 [==============================] - 0s 23ms/step - loss: 0.2519 - soft_acc:
0.3928 - val_loss: 0.1287 - val_soft_acc: 0.9500
Epoch 8/100
3/3 [==============================] - 0s 21ms/step - loss: 0.2156 - soft_acc:
0.4568 - val_loss: 0.1146 - val_soft_acc: 0.9500
Epoch 9/100
3/3 [==============================] - 0s 26ms/step - loss: 0.1931 - soft_acc:
0.5020 - val_loss: 0.1035 - val_soft_acc: 0.9500
Epoch 10/100
3/3 [==============================] - 0s 24ms/step - loss: 0.1632 - soft_acc:
0.6601 - val_loss: 0.0967 - val_soft_acc: 0.9500
Epoch 11/100
3/3 [==============================] - 0s 26ms/step - loss: 0.1351 - soft_acc:
0.8396 - val_loss: 0.0951 - val_soft_acc: 0.9500
Epoch 12/100
3/3 [==============================] - 0s 19ms/step - loss: 0.1067 - soft_acc:
0.8830 - val_loss: 0.0987 - val_soft_acc: 0.9500
Epoch 13/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0840 - soft_acc:
0.9668 - val_loss: 0.1066 - val_soft_acc: 0.9500
Epoch 14/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0639 - soft_acc:
0.9715 - val_loss: 0.1172 - val_soft_acc: 0.9500
Epoch 15/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0588 - soft_acc:
0.9559 - val_loss: 0.1263 - val_soft_acc: 0.9500
Epoch 16/100
3/3 [==============================] - 0s 25ms/step - loss: 0.0626 - soft_acc:
0.9397 - val_loss: 0.1306 - val_soft_acc: 0.9000
Epoch 17/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0645 - soft_acc:
0.9157 - val_loss: 0.1293 - val_soft_acc: 0.9000
Epoch 18/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0618 - soft_acc:
0.9184 - val_loss: 0.1234 - val_soft_acc: 0.9500
Epoch 19/100
```

```
3/3 [==============================] - 0s 21ms/step - loss: 0.0576 - soft_acc:
0.9292 - val_loss: 0.1143 - val_soft_acc: 0.9500
Epoch 20/100
3/3 [==============================] - ETA: 0s - loss: 0.0433 - soft_acc: 0.92 -
0s 21ms/step - loss: 0.0505 - soft_acc: 0.9330 - val_loss: 0.1044 -
val_soft_acc: 0.9500
Epoch 21/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0499 - soft_acc:
0.9564 - val_loss: 0.0949 - val_soft_acc: 0.9500
Epoch 22/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0477 - soft_acc:
0.9577 - val_loss: 0.0872 - val_soft_acc: 0.9500
Epoch 23/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0498 - soft_acc:
0.9662 - val_loss: 0.0813 - val_soft_acc: 0.9500
Epoch 24/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0474 - soft_acc:
0.9630 - val_loss: 0.0770 - val_soft_acc: 0.9500
Epoch 25/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0421 - soft_acc:
0.9688 - val_loss: 0.0738 - val_soft_acc: 0.9500
Epoch 26/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0415 - soft_acc:
0.9570 - val_loss: 0.0706 - val_soft_acc: 0.9500
Epoch 27/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0380 - soft_acc:
0.9668 - val_loss: 0.0663 - val_soft_acc: 0.9500
Epoch 28/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0361 - soft_acc:
0.9721 - val_loss: 0.0607 - val_soft_acc: 0.9500
Epoch 29/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0297 - soft_acc:
0.9694 - val_loss: 0.0543 - val_soft_acc: 0.9500
Epoch 30/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0270 - soft_acc:
0.9792 - val_loss: 0.0475 - val_soft_acc: 0.9500
Epoch 31/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0246 - soft_acc:
0.9845 - val_loss: 0.0419 - val_soft_acc: 0.9500
Epoch 32/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0238 - soft_acc:
0.9740 - val_loss: 0.0391 - val_soft_acc: 0.9500
Epoch 33/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0246 - soft_acc:
0.9831 - val_loss: 0.0380 - val_soft_acc: 0.9500
Epoch 34/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0225 - soft_acc:
0.9785 - val_loss: 0.0363 - val_soft_acc: 0.9500
```

```
Epoch 35/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0220 - soft_acc:
0.9838 - val_loss: 0.0329 - val_soft_acc: 0.9500
Epoch 36/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0224 - soft_acc:
0.9799 - val_loss: 0.0288 - val_soft_acc: 0.9500
Epoch 37/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0215 - soft_acc:
0.9792 - val_loss: 0.0264 - val_soft_acc: 0.9500
Epoch 38/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0198 - soft_acc:
0.9753 - val_loss: 0.0248 - val_soft_acc: 0.9500
Epoch 39/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0207 - soft_acc:
0.9806 - val_loss: 0.0235 - val_soft_acc: 0.9500
Epoch 40/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0219 - soft_acc:
0.9877 - val_loss: 0.0217 - val_soft_acc: 1.0000
Epoch 41/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0203 - soft_acc:
0.9753 - val_loss: 0.0203 - val_soft_acc: 1.0000
Epoch 42/100
3/3 [==============================] - 0s 24ms/step - loss: 0.0201 - soft_acc:
0.9845 - val_loss: 0.0195 - val_soft_acc: 1.0000
Epoch 43/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0213 - soft_acc:
0.9831 - val_loss: 0.0189 - val_soft_acc: 1.0000
Epoch 44/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0192 - soft_acc:
0.9806 - val_loss: 0.0188 - val_soft_acc: 1.0000
Epoch 45/100
3/3 [==============================] - 0s 25ms/step - loss: 0.0206 - soft_acc:
0.9701 - val_loss: 0.0183 - val_soft_acc: 1.0000
Epoch 46/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0216 - soft_acc:
0.9779 - val_loss: 0.0177 - val_soft_acc: 1.0000
Epoch 47/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0202 - soft_acc:
0.9779 - val_loss: 0.0175 - val_soft_acc: 1.0000
Epoch 48/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0204 - soft_acc:
0.9753 - val_loss: 0.0173 - val_soft_acc: 1.0000
Epoch 49/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0207 - soft_acc:
0.9753 - val_loss: 0.0169 - val_soft_acc: 1.0000
Epoch 50/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0205 - soft_acc:
0.9806 - val_loss: 0.0165 - val_soft_acc: 1.0000
```

```
Epoch 51/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0202 - soft_acc:
0.9838 - val_loss: 0.0164 - val_soft_acc: 1.0000
Epoch 52/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0214 - soft_acc:
0.9799 - val_loss: 0.0155 - val_soft_acc: 1.0000
Epoch 53/100
3/3 [==============================] - 0s 26ms/step - loss: 0.0200 - soft_acc:
0.9819 - val_loss: 0.0151 - val_soft_acc: 1.0000
Epoch 54/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0205 - soft_acc:
0.9838 - val_loss: 0.0149 - val_soft_acc: 1.0000
Epoch 55/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0202 - soft_acc:
0.9838 - val_loss: 0.0148 - val_soft_acc: 1.0000
Epoch 56/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0204 - soft_acc:
0.9851 - val_loss: 0.0141 - val_soft_acc: 1.0000
Epoch 57/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0203 - soft_acc:
0.9890 - val_loss: 0.0136 - val_soft_acc: 1.0000
Epoch 58/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0193 - soft_acc:
0.9714 - val_loss: 0.0133 - val_soft_acc: 1.0000
Epoch 59/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0188 - soft_acc:
0.9890 - val_loss: 0.0133 - val_soft_acc: 1.0000
Epoch 60/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0182 - soft_acc:
0.9799 - val_loss: 0.0129 - val_soft_acc: 1.0000
Epoch 61/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0209 - soft_acc:
0.9851 - val_loss: 0.0122 - val_soft_acc: 1.0000
Epoch 62/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0197 - soft_acc:
0.9785 - val_loss: 0.0120 - val_soft_acc: 1.0000
Epoch 63/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0192 - soft_acc:
0.9909 - val_loss: 0.0120 - val_soft_acc: 1.0000
Epoch 64/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0207 - soft_acc:
0.9863 - val_loss: 0.0117 - val_soft_acc: 1.0000
Epoch 65/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0193 - soft_acc:
0.9890 - val_loss: 0.0115 - val_soft_acc: 1.0000
Epoch 66/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0198 - soft_acc:
0.9870 - val_loss: 0.0112 - val_soft_acc: 1.0000
```

```
Epoch 67/100
3/3 [==============================] - 0s 25ms/step - loss: 0.0193 - soft_acc:
0.9785 - val_loss: 0.0110 - val_soft_acc: 1.0000
Epoch 68/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0202 - soft_acc:
0.9824 - val_loss: 0.0108 - val_soft_acc: 1.0000
Epoch 69/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0195 - soft_acc:
0.9890 - val_loss: 0.0108 - val_soft_acc: 1.0000
Epoch 70/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0197 - soft_acc:
0.9838 - val_loss: 0.0107 - val_soft_acc: 1.0000
Epoch 71/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0198 - soft_acc:
0.9838 - val_loss: 0.0104 - val_soft_acc: 1.0000
Epoch 72/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0202 - soft_acc:
0.9838 - val_loss: 0.0103 - val_soft_acc: 1.0000
Epoch 73/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0187 - soft_acc:
0.9838 - val_loss: 0.0103 - val_soft_acc: 1.0000
Epoch 74/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0185 - soft_acc:
0.9909 - val_loss: 0.0101 - val_soft_acc: 1.0000
Epoch 75/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0186 - soft_acc:
0.9870 - val_loss: 0.0100 - val_soft_acc: 1.0000
Epoch 76/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0185 - soft_acc:
0.9838 - val_loss: 0.0099 - val_soft_acc: 1.0000
Epoch 77/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0180 - soft_acc:
0.9785 - val_loss: 0.0099 - val_soft_acc: 1.0000
Epoch 78/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0199 - soft_acc:
0.9883 - val_loss: 0.0098 - val_soft_acc: 1.0000
Epoch 79/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0189 - soft_acc:
0.9870 - val_loss: 0.0096 - val_soft_acc: 1.0000
Epoch 80/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0201 - soft_acc:
0.9909 - val_loss: 0.0096 - val_soft_acc: 1.0000
Epoch 81/100
3/3 [==============================] - 0s 26ms/step - loss: 0.0194 - soft_acc:
0.9851 - val_loss: 0.0095 - val_soft_acc: 1.0000
Epoch 82/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0189 - soft_acc:
0.9883 - val_loss: 0.0095 - val_soft_acc: 1.0000
```

```
Epoch 83/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0192 - soft_acc:
0.9922 - val_loss: 0.0095 - val_soft_acc: 1.0000
Epoch 84/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0187 - soft_acc:
0.9785 - val_loss: 0.0095 - val_soft_acc: 1.0000
Epoch 85/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0181 - soft_acc:
0.9851 - val_loss: 0.0094 - val_soft_acc: 1.0000
Epoch 86/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0177 - soft_acc:
0.9851 - val_loss: 0.0095 - val_soft_acc: 1.0000
Epoch 87/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0199 - soft_acc:
0.9909 - val_loss: 0.0094 - val_soft_acc: 1.0000
Epoch 88/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0179 - soft_acc:
0.9785 - val_loss: 0.0094 - val_soft_acc: 1.0000
Epoch 89/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0185 - soft_acc:
0.9870 - val_loss: 0.0093 - val_soft_acc: 1.0000
Epoch 90/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0194 - soft_acc:
0.9922 - val_loss: 0.0093 - val_soft_acc: 1.0000
Epoch 91/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0194 - soft_acc:
0.9883 - val_loss: 0.0093 - val_soft_acc: 1.0000
Epoch 92/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0187 - soft_acc:
0.9824 - val_loss: 0.0094 - val_soft_acc: 1.0000
Epoch 93/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0197 - soft_acc:
0.9909 - val_loss: 0.0092 - val_soft_acc: 1.0000
Epoch 94/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0195 - soft_acc:
0.9870 - val_loss: 0.0092 - val_soft_acc: 1.0000
Epoch 95/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0194 - soft_acc:
0.9870 - val_loss: 0.0093 - val_soft_acc: 1.0000
Epoch 96/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0196 - soft_acc:
0.9870 - val_loss: 0.0091 - val_soft_acc: 1.0000
Epoch 97/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0175 - soft_acc:
0.9883 - val_loss: 0.0090 - val_soft_acc: 1.0000
Epoch 98/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0179 - soft_acc:
0.9922 - val_loss: 0.0091 - val_soft_acc: 1.0000
```

```
Epoch 99/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0195 - soft_acc:
0.9922 - val_loss: 0.0091 - val_soft_acc: 1.0000
Epoch 100/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0188 - soft_acc:
0.9785 - val_loss: 0.0089 - val_soft_acc: 1.0000
3/3 [==============================] - 0s 4ms/step - loss: 0.0187 - soft_acc:
0.9896
1/1 [==============================] - 0s 15ms/step - loss: 0.0089 - soft_acc:
1.0000
처리중인 폴드 # 4
Epoch 1/100
3/3 [==============================] - 0s 89ms/step - loss: 0.6700 - soft_acc:
0.3844 - val_loss: 0.4906 - val_soft_acc: 1.0000
Epoch 2/100
3/3 [==============================] - 0s 25ms/step - loss: 0.6525 - soft_acc:
0.3554 - val_loss: 0.4694 - val_soft_acc: 1.0000
Epoch 3/100
3/3 [==============================] - 0s 20ms/step - loss: 0.6232 - soft_acc:
0.3701 - val_loss: 0.4481 - val_soft_acc: 1.0000
Epoch 4/100
3/3 [==============================] - 0s 21ms/step - loss: 0.5947 - soft_acc:
0.3793 - val_loss: 0.4269 - val_soft_acc: 1.0000
Epoch 5/100
3/3 [==============================] - 0s 23ms/step - loss: 0.5683 - soft_acc:
0.3832 - val_loss: 0.4057 - val_soft_acc: 1.0000
Epoch 6/100
3/3 [==============================] - 0s 22ms/step - loss: 0.5358 - soft_acc:
0.3897 - val_loss: 0.3849 - val_soft_acc: 1.0000
Epoch 7/100
3/3 [==============================] - 0s 20ms/step - loss: 0.5208 - soft_acc:
0.3688 - val_loss: 0.3656 - val_soft_acc: 1.0000
Epoch 8/100
3/3 [==============================] - 0s 23ms/step - loss: 0.4904 - soft_acc:
0.3898 - val_loss: 0.3469 - val_soft_acc: 1.0000
Epoch 9/100
3/3 [==============================] - 0s 22ms/step - loss: 0.4844 - soft_acc:
0.3502 - val_loss: 0.3281 - val_soft_acc: 1.0000
Epoch 10/100
3/3 [==============================] - 0s 22ms/step - loss: 0.4509 - soft_acc:
0.3698 - val_loss: 0.3093 - val_soft_acc: 1.0000
Epoch 11/100
3/3 [==============================] - 0s 20ms/step - loss: 0.4261 - soft_acc:
0.3886 - val_loss: 0.2903 - val_soft_acc: 1.0000
Epoch 12/100
3/3 [==============================] - 0s 22ms/step - loss: 0.4078 - soft_acc:
0.3766 - val_loss: 0.2713 - val_soft_acc: 1.0000
Epoch 13/100
```

```
3/3 [==============================] - 0s 20ms/step - loss: 0.3860 - soft_acc:
0.3635 - val_loss: 0.2520 - val_soft_acc: 1.0000
Epoch 14/100
3/3 [==============================] - 0s 22ms/step - loss: 0.3614 - soft_acc:
0.3871 - val_loss: 0.2326 - val_soft_acc: 1.0000
Epoch 15/100
3/3 [==============================] - 0s 19ms/step - loss: 0.3387 - soft_acc:
0.3831 - val_loss: 0.2131 - val_soft_acc: 1.0000
Epoch 16/100
3/3 [==============================] - 0s 21ms/step - loss: 0.3295 - soft_acc:
0.3281 - val_loss: 0.1930 - val_soft_acc: 1.0000
Epoch 17/100
3/3 [==============================] - 0s 22ms/step - loss: 0.3003 - soft_acc:
0.3647 - val_loss: 0.1730 - val_soft_acc: 1.0000
Epoch 18/100
3/3 [==============================] - 0s 21ms/step - loss: 0.2670 - soft_acc:
0.4068 - val_loss: 0.1523 - val_soft_acc: 1.0000
Epoch 19/100
3/3 [==============================] - 0s 20ms/step - loss: 0.2498 - soft_acc:
0.3754 - val_loss: 0.1317 - val_soft_acc: 1.0000
Epoch 20/100
3/3 [==============================] - 0s 23ms/step - loss: 0.2248 - soft_acc:
0.3915 - val_loss: 0.1111 - val_soft_acc: 1.0000
Epoch 21/100
3/3 [==============================] - 0s 23ms/step - loss: 0.1964 - soft_acc:
0.4612 - val_loss: 0.0901 - val_soft_acc: 1.0000
Epoch 22/100
3/3 [==============================] - 0s 21ms/step - loss: 0.1727 - soft_acc:
0.5366 - val_loss: 0.0690 - val_soft_acc: 1.0000
Epoch 23/100
3/3 [==============================] - 0s 21ms/step - loss: 0.1504 - soft_acc:
0.7355 - val_loss: 0.0484 - val_soft_acc: 1.0000
Epoch 24/100
3/3 [==============================] - 0s 19ms/step - loss: 0.1286 - soft_acc:
0.8732 - val_loss: 0.0297 - val_soft_acc: 1.0000
Epoch 25/100
3/3 [==============================] - 0s 22ms/step - loss: 0.1082 - soft_acc:
0.9355 - val_loss: 0.0185 - val_soft_acc: 1.0000
Epoch 26/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0927 - soft_acc:
0.9838 - val_loss: 0.0254 - val_soft_acc: 0.9500
Epoch 27/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0756 - soft_acc:
0.9831 - val_loss: 0.0399 - val_soft_acc: 0.7500
Epoch 28/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0726 - soft_acc:
0.9877 - val_loss: 0.0533 - val_soft_acc: 0.6500
Epoch 29/100
```

```
3/3 [==============================] - 0s 20ms/step - loss: 0.0674 - soft_acc:
0.9623 - val_loss: 0.0620 - val_soft_acc: 0.6000
Epoch 30/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0671 - soft_acc:
0.9794 - val_loss: 0.0645 - val_soft_acc: 0.5500
Epoch 31/100
3/3 [==============================] - ETA: 0s - loss: 0.0636 - soft_acc: 0.96 -
0s 21ms/step - loss: 0.0666 - soft_acc: 0.9662 - val_loss: 0.0624 -
val_soft_acc: 0.6000
Epoch 32/100
3/3 [==============================] - 0s 25ms/step - loss: 0.0680 - soft_acc:
0.9794 - val_loss: 0.0566 - val_soft_acc: 0.6000
Epoch 33/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0670 - soft_acc:
0.9721 - val_loss: 0.0491 - val_soft_acc: 0.6500
Epoch 34/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0596 - soft_acc:
0.9831 - val_loss: 0.0420 - val_soft_acc: 0.6500
Epoch 35/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0573 - soft_acc:
0.9915 - val_loss: 0.0359 - val_soft_acc: 0.7500
Epoch 36/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0557 - soft_acc:
1.0000 - val_loss: 0.0327 - val_soft_acc: 0.7500
Epoch 37/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0560 - soft_acc:
1.0000 - val_loss: 0.0313 - val_soft_acc: 0.7500
Epoch 38/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0562 - soft_acc:
1.0000 - val_loss: 0.0318 - val_soft_acc: 0.7500
Epoch 39/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0529 - soft_acc:
1.0000 - val_loss: 0.0328 - val_soft_acc: 0.7500
Epoch 40/100
3/3 [==============================] - 0s 24ms/step - loss: 0.0487 - soft_acc:
1.0000 - val_loss: 0.0343 - val_soft_acc: 0.7500
Epoch 41/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0487 - soft_acc:
1.0000 - val_loss: 0.0348 - val_soft_acc: 0.7000
Epoch 42/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0455 - soft_acc:
1.0000 - val_loss: 0.0348 - val_soft_acc: 0.7000
Epoch 43/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0462 - soft_acc:
1.0000 - val_loss: 0.0333 - val_soft_acc: 0.7000
Epoch 44/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0444 - soft_acc:
1.0000 - val_loss: 0.0311 - val_soft_acc: 0.7500
```

```
Epoch 45/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0404 - soft_acc:
1.0000 - val_loss: 0.0288 - val_soft_acc: 0.7500
Epoch 46/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0384 - soft_acc:
1.0000 - val_loss: 0.0271 - val_soft_acc: 0.7500
Epoch 47/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0380 - soft_acc:
1.0000 - val_loss: 0.0257 - val_soft_acc: 0.7500
Epoch 48/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0381 - soft_acc:
1.0000 - val_loss: 0.0245 - val_soft_acc: 0.7500
Epoch 49/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0343 - soft_acc:
1.0000 - val_loss: 0.0234 - val_soft_acc: 0.8000
Epoch 50/100
3/3 [==============================] - 0s 24ms/step - loss: 0.0333 - soft_acc:
1.0000 - val_loss: 0.0227 - val_soft_acc: 0.8000
Epoch 51/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0290 - soft_acc:
1.0000 - val_loss: 0.0221 - val_soft_acc: 0.8000
Epoch 52/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0306 - soft_acc:
1.0000 - val_loss: 0.0213 - val_soft_acc: 0.8000
Epoch 53/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0273 - soft_acc:
1.0000 - val_loss: 0.0199 - val_soft_acc: 0.8000
Epoch 54/100
3/3 [==============================] - 0s 25ms/step - loss: 0.0273 - soft_acc:
0.9968 - val_loss: 0.0185 - val_soft_acc: 0.9000
Epoch 55/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0248 - soft_acc:
0.9915 - val_loss: 0.0179 - val_soft_acc: 0.9000
Epoch 56/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0235 - soft_acc:
0.9968 - val_loss: 0.0171 - val_soft_acc: 0.9500
Epoch 57/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0208 - soft_acc:
0.9954 - val_loss: 0.0164 - val_soft_acc: 0.9500
Epoch 58/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0199 - soft_acc:
0.9883 - val_loss: 0.0157 - val_soft_acc: 0.9500
Epoch 59/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0193 - soft_acc:
0.9883 - val_loss: 0.0152 - val_soft_acc: 0.9500
Epoch 60/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0193 - soft_acc:
0.9922 - val_loss: 0.0151 - val_soft_acc: 0.9500
```

```
Epoch 61/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0174 - soft_acc:
0.9909 - val_loss: 0.0146 - val_soft_acc: 0.9500
Epoch 62/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0172 - soft_acc:
0.9909 - val_loss: 0.0142 - val_soft_acc: 0.9500
Epoch 63/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0151 - soft_acc:
0.9922 - val_loss: 0.0141 - val_soft_acc: 0.9500
Epoch 64/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0154 - soft_acc:
0.9883 - val_loss: 0.0139 - val_soft_acc: 0.9500
Epoch 65/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0165 - soft_acc:
0.9831 - val_loss: 0.0138 - val_soft_acc: 0.9500
Epoch 66/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0153 - soft_acc:
0.9870 - val_loss: 0.0138 - val_soft_acc: 0.9500
Epoch 67/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0153 - soft_acc:
0.9922 - val_loss: 0.0138 - val_soft_acc: 0.9500
Epoch 68/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0144 - soft_acc:
0.9831 - val_loss: 0.0138 - val_soft_acc: 0.9500
Epoch 69/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0155 - soft_acc:
0.9883 - val_loss: 0.0138 - val_soft_acc: 0.9500
Epoch 70/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0159 - soft_acc:
0.9870 - val_loss: 0.0138 - val_soft_acc: 0.9500
Epoch 71/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0161 - soft_acc:
0.9870 - val_loss: 0.0138 - val_soft_acc: 0.9500
Epoch 72/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0153 - soft_acc:
0.9831 - val_loss: 0.0138 - val_soft_acc: 0.9500
Epoch 73/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0158 - soft_acc:
0.9870 - val_loss: 0.0138 - val_soft_acc: 0.9500
Epoch 74/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0161 - soft_acc:
0.9909 - val_loss: 0.0138 - val_soft_acc: 0.9500
Epoch 75/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0144 - soft_acc:
0.9883 - val_loss: 0.0137 - val_soft_acc: 0.9500
Epoch 76/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0151 - soft_acc:
0.9831 - val_loss: 0.0137 - val_soft_acc: 0.9500
```

```
Epoch 77/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0161 - soft_acc:
0.9883 - val_loss: 0.0137 - val_soft_acc: 0.9500
Epoch 78/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0150 - soft_acc:
0.9870 - val_loss: 0.0137 - val_soft_acc: 0.9500
Epoch 79/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0143 - soft_acc:
0.9922 - val_loss: 0.0137 - val_soft_acc: 0.9500
Epoch 80/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0148 - soft_acc:
0.9909 - val_loss: 0.0137 - val_soft_acc: 0.9500
Epoch 81/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0160 - soft_acc:
0.9831 - val_loss: 0.0137 - val_soft_acc: 0.9500
Epoch 82/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0141 - soft_acc:
0.9870 - val_loss: 0.0137 - val_soft_acc: 0.9500
Epoch 83/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0145 - soft_acc:
0.9883 - val_loss: 0.0137 - val_soft_acc: 0.9500
Epoch 84/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0146 - soft_acc:
0.9922 - val_loss: 0.0136 - val_soft_acc: 0.9500
Epoch 85/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0157 - soft_acc:
0.9909 - val_loss: 0.0136 - val_soft_acc: 0.9500
Epoch 86/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0157 - soft_acc:
0.9870 - val_loss: 0.0136 - val_soft_acc: 0.9500
Epoch 87/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0161 - soft_acc:
0.9883 - val_loss: 0.0137 - val_soft_acc: 0.9500
Epoch 88/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0156 - soft_acc:
0.9831 - val_loss: 0.0136 - val_soft_acc: 0.9500
Epoch 89/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0144 - soft_acc:
0.9936 - val_loss: 0.0136 - val_soft_acc: 0.9500
Epoch 90/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0157 - soft_acc:
0.9936 - val_loss: 0.0136 - val_soft_acc: 0.9500
Epoch 91/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0151 - soft_acc:
0.9883 - val_loss: 0.0135 - val_soft_acc: 0.9500
Epoch 92/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0155 - soft_acc:
0.9870 - val_loss: 0.0136 - val_soft_acc: 0.9500
```

```
Epoch 93/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0154 - soft_acc:
0.9922 - val_loss: 0.0135 - val_soft_acc: 0.9500
Epoch 94/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0153 - soft_acc:
0.9831 - val_loss: 0.0135 - val_soft_acc: 0.9500
Epoch 95/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0148 - soft_acc:
0.9922 - val_loss: 0.0135 - val_soft_acc: 0.9500
Epoch 96/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0140 - soft_acc:
0.9922 - val_loss: 0.0135 - val_soft_acc: 0.9500
Epoch 97/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0155 - soft_acc:
0.9922 - val_loss: 0.0135 - val_soft_acc: 0.9500
Epoch 98/100
3/3 [==============================] - 0s 26ms/step - loss: 0.0153 - soft_acc:
0.9831 - val_loss: 0.0135 - val_soft_acc: 0.9500
Epoch 99/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0146 - soft_acc:
0.9870 - val_loss: 0.0135 - val_soft_acc: 0.9500
Epoch 100/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0146 - soft_acc:
0.9922 - val_loss: 0.0135 - val_soft_acc: 0.9500
3/3 [==============================] - 0s 4ms/step - loss: 0.0148 - soft_acc:
0.9896
1/1 [==============================] - 0s 12ms/step - loss: 0.0135 - soft_acc:
0.9500
처리중인 폴드 # 5
Epoch 1/100
3/3 [==============================] - 0s 86ms/step - loss: 0.5153 - soft_acc:
0.4220 - val_loss: 0.4397 - val_soft_acc: 0.4000
Epoch 2/100
3/3 [==============================] - 0s 21ms/step - loss: 0.4820 - soft_acc:
0.4469 - val_loss: 0.4153 - val_soft_acc: 0.4000
Epoch 3/100
3/3 [==============================] - 0s 19ms/step - loss: 0.4652 - soft_acc:
0.4245 - val_loss: 0.3883 - val_soft_acc: 0.4000
Epoch 4/100
3/3 [==============================] - 0s 23ms/step - loss: 0.4334 - soft_acc:
0.4350 - val_loss: 0.3603 - val_soft_acc: 0.4000
Epoch 5/100
3/3 [==============================] - 0s 22ms/step - loss: 0.3995 - soft_acc:
0.4535 - val_loss: 0.3318 - val_soft_acc: 0.4000
Epoch 6/100
3/3 [==============================] - 0s 22ms/step - loss: 0.3707 - soft_acc:
0.4600 - val_loss: 0.3031 - val_soft_acc: 0.4000
Epoch 7/100
```

```
3/3 [==============================] - 0s 23ms/step - loss: 0.3388 - soft_acc:
0.4429 - val_loss: 0.2742 - val_soft_acc: 0.4000
Epoch 8/100
3/3 [==============================] - 0s 23ms/step - loss: 0.3173 - soft_acc:
0.4272 - val_loss: 0.2452 - val_soft_acc: 0.4000
Epoch 9/100
3/3 [==============================] - 0s 19ms/step - loss: 0.2717 - soft_acc:
0.4824 - val_loss: 0.2162 - val_soft_acc: 0.4000
Epoch 10/100
3/3 [==============================] - 0s 22ms/step - loss: 0.2540 - soft_acc:
0.4480 - val_loss: 0.1869 - val_soft_acc: 0.4000
Epoch 11/100
3/3 [==============================] - 0s 23ms/step - loss: 0.2257 - soft_acc:
0.4297 - val_loss: 0.1575 - val_soft_acc: 0.4000
Epoch 12/100
3/3 [==============================] - 0s 21ms/step - loss: 0.1943 - soft_acc:
0.5168 - val_loss: 0.1282 - val_soft_acc: 0.4000
Epoch 13/100
3/3 [==============================] - 0s 19ms/step - loss: 0.1657 - soft_acc:
0.7066 - val_loss: 0.0991 - val_soft_acc: 0.4000
Epoch 14/100
3/3 [==============================] - 0s 22ms/step - loss: 0.1410 - soft_acc:
0.9253 - val_loss: 0.0707 - val_soft_acc: 0.5500
Epoch 15/100
3/3 [==============================] - 0s 23ms/step - loss: 0.1139 - soft_acc:
0.9936 - val_loss: 0.0448 - val_soft_acc: 0.8000
Epoch 16/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0879 - soft_acc:
0.9915 - val_loss: 0.0271 - val_soft_acc: 0.9500
Epoch 17/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0728 - soft_acc:
0.9845 - val_loss: 0.0300 - val_soft_acc: 0.7500
Epoch 18/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0689 - soft_acc:
0.9742 - val_loss: 0.0435 - val_soft_acc: 0.7000
Epoch 19/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0678 - soft_acc:
0.9449 - val_loss: 0.0538 - val_soft_acc: 0.6500
Epoch 20/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0674 - soft_acc:
0.9072 - val_loss: 0.0578 - val_soft_acc: 0.6000
Epoch 21/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0693 - soft_acc:
0.9202 - val_loss: 0.0559 - val_soft_acc: 0.6000
Epoch 22/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0609 - soft_acc:
0.9226 - val_loss: 0.0475 - val_soft_acc: 0.6500
Epoch 23/100
```

```
3/3 [==============================] - 0s 23ms/step - loss: 0.0563 - soft_acc:
0.9408 - val_loss: 0.0335 - val_soft_acc: 0.7500
Epoch 24/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0480 - soft_acc:
0.9701 - val_loss: 0.0224 - val_soft_acc: 0.9500
Epoch 25/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0503 - soft_acc:
0.9767 - val_loss: 0.0191 - val_soft_acc: 1.0000
Epoch 26/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0488 - soft_acc:
0.9824 - val_loss: 0.0185 - val_soft_acc: 0.9500
Epoch 27/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0468 - soft_acc:
0.9753 - val_loss: 0.0192 - val_soft_acc: 1.0000
Epoch 28/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0421 - soft_acc:
0.9806 - val_loss: 0.0224 - val_soft_acc: 0.9000
Epoch 29/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0422 - soft_acc:
0.9721 - val_loss: 0.0253 - val_soft_acc: 0.9000
Epoch 30/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0399 - soft_acc:
0.9708 - val_loss: 0.0250 - val_soft_acc: 0.9000
Epoch 31/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0361 - soft_acc:
0.9760 - val_loss: 0.0220 - val_soft_acc: 0.9500
Epoch 32/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0352 - soft_acc:
0.9629 - val_loss: 0.0189 - val_soft_acc: 1.0000
Epoch 33/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0319 - soft_acc:
0.9792 - val_loss: 0.0167 - val_soft_acc: 1.0000
Epoch 34/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0319 - soft_acc:
0.9701 - val_loss: 0.0161 - val_soft_acc: 1.0000
Epoch 35/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0298 - soft_acc:
0.9806 - val_loss: 0.0162 - val_soft_acc: 1.0000
Epoch 36/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0280 - soft_acc:
0.9740 - val_loss: 0.0167 - val_soft_acc: 1.0000
Epoch 37/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0251 - soft_acc:
0.9806 - val_loss: 0.0159 - val_soft_acc: 1.0000
Epoch 38/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0243 - soft_acc:
0.9746 - val_loss: 0.0146 - val_soft_acc: 1.0000
Epoch 39/100
```

```
3/3 [==============================] - 0s 20ms/step - loss: 0.0204 - soft_acc:
0.9883 - val_loss: 0.0136 - val_soft_acc: 0.9500
Epoch 40/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0201 - soft_acc:
0.9870 - val_loss: 0.0131 - val_soft_acc: 0.9500
Epoch 41/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0197 - soft_acc:
0.9831 - val_loss: 0.0127 - val_soft_acc: 0.9500
Epoch 42/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0175 - soft_acc:
0.9915 - val_loss: 0.0126 - val_soft_acc: 0.9500
Epoch 43/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0176 - soft_acc:
0.9954 - val_loss: 0.0121 - val_soft_acc: 0.9500
Epoch 44/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0169 - soft_acc:
0.9968 - val_loss: 0.0114 - val_soft_acc: 0.9500
Epoch 45/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0157 - soft_acc:
0.9954 - val_loss: 0.0113 - val_soft_acc: 0.9500
Epoch 46/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0156 - soft_acc:
0.9954 - val_loss: 0.0114 - val_soft_acc: 0.9500
Epoch 47/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0158 - soft_acc:
0.9954 - val_loss: 0.0115 - val_soft_acc: 0.9500
Epoch 48/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0152 - soft_acc:
0.9954 - val_loss: 0.0109 - val_soft_acc: 0.9500
Epoch 49/100
3/3 [==============================] - 0s 26ms/step - loss: 0.0148 - soft_acc:
0.9915 - val_loss: 0.0109 - val_soft_acc: 0.9500
Epoch 50/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0148 - soft_acc:
0.9915 - val_loss: 0.0109 - val_soft_acc: 0.9500
Epoch 51/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0152 - soft_acc:
0.9968 - val_loss: 0.0110 - val_soft_acc: 0.9500
Epoch 52/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0153 - soft_acc:
0.9968 - val_loss: 0.0108 - val_soft_acc: 0.9500
Epoch 53/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0149 - soft_acc:
0.9954 - val_loss: 0.0108 - val_soft_acc: 0.9500
Epoch 54/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0135 - soft_acc:
0.9954 - val_loss: 0.0107 - val_soft_acc: 0.9500
Epoch 55/100
```

```
3/3 [==============================] - 0s 22ms/step - loss: 0.0149 - soft_acc:
0.9968 - val_loss: 0.0109 - val_soft_acc: 0.9500
Epoch 56/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0138 - soft_acc:
0.9915 - val_loss: 0.0108 - val_soft_acc: 0.9500
Epoch 57/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0145 - soft_acc:
0.9954 - val_loss: 0.0107 - val_soft_acc: 0.9500
Epoch 58/100
3/3 [==============================] - 0s 24ms/step - loss: 0.0147 - soft_acc:
0.9968 - val_loss: 0.0106 - val_soft_acc: 0.9500
Epoch 59/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0148 - soft_acc:
0.9954 - val_loss: 0.0107 - val_soft_acc: 0.9500
Epoch 60/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0136 - soft_acc:
0.9968 - val_loss: 0.0110 - val_soft_acc: 0.9500
Epoch 61/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0144 - soft_acc:
0.9954 - val_loss: 0.0107 - val_soft_acc: 0.9500
Epoch 62/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0144 - soft_acc:
0.9968 - val_loss: 0.0106 - val_soft_acc: 0.9500
Epoch 63/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0139 - soft_acc:
0.9954 - val_loss: 0.0107 - val_soft_acc: 0.9500
Epoch 64/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0141 - soft_acc:
0.9915 - val_loss: 0.0108 - val_soft_acc: 0.9500
Epoch 65/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0137 - soft_acc:
0.9954 - val_loss: 0.0106 - val_soft_acc: 0.9500
Epoch 66/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0146 - soft_acc:
0.9968 - val_loss: 0.0106 - val_soft_acc: 0.9500
Epoch 67/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0138 - soft_acc:
0.9954 - val_loss: 0.0105 - val_soft_acc: 0.9500
Epoch 68/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0139 - soft_acc:
0.9954 - val_loss: 0.0108 - val_soft_acc: 0.9500
Epoch 69/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0144 - soft_acc:
0.9954 - val_loss: 0.0106 - val_soft_acc: 0.9500
Epoch 70/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0140 - soft_acc:
0.9915 - val_loss: 0.0105 - val_soft_acc: 0.9500
Epoch 71/100
```

```
3/3 [==============================] - 0s 21ms/step - loss: 0.0139 - soft_acc:
0.9915 - val_loss: 0.0106 - val_soft_acc: 0.9500
Epoch 72/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0140 - soft_acc:
0.9968 - val_loss: 0.0106 - val_soft_acc: 0.9500
Epoch 73/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0145 - soft_acc:
0.9954 - val_loss: 0.0106 - val_soft_acc: 0.9500
Epoch 74/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0137 - soft_acc:
0.9954 - val_loss: 0.0104 - val_soft_acc: 0.9500
Epoch 75/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0137 - soft_acc:
0.9915 - val_loss: 0.0105 - val_soft_acc: 0.9500
Epoch 76/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0131 - soft_acc:
0.9954 - val_loss: 0.0105 - val_soft_acc: 0.9500
Epoch 77/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0135 - soft_acc:
0.9968 - val_loss: 0.0106 - val_soft_acc: 0.9500
Epoch 78/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0141 - soft_acc:
0.9915 - val_loss: 0.0104 - val_soft_acc: 0.9500
Epoch 79/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0139 - soft_acc:
0.9968 - val_loss: 0.0104 - val_soft_acc: 0.9500
Epoch 80/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0140 - soft_acc:
0.9915 - val_loss: 0.0104 - val_soft_acc: 0.9500
Epoch 81/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0139 - soft_acc:
0.9954 - val_loss: 0.0104 - val_soft_acc: 0.9500
Epoch 82/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0142 - soft_acc:
0.9954 - val_loss: 0.0104 - val_soft_acc: 0.9500
Epoch 83/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0136 - soft_acc:
0.9915 - val_loss: 0.0104 - val_soft_acc: 0.9500
Epoch 84/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0135 - soft_acc:
0.9915 - val_loss: 0.0104 - val_soft_acc: 0.9500
Epoch 85/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0138 - soft_acc:
0.9968 - val_loss: 0.0104 - val_soft_acc: 0.9500
Epoch 86/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0137 - soft_acc:
0.9968 - val_loss: 0.0104 - val_soft_acc: 0.9500
Epoch 87/100
```

```
3/3 [==============================] - 0s 21ms/step - loss: 0.0132 - soft_acc:
0.9968 - val_loss: 0.0103 - val_soft_acc: 0.9500
Epoch 88/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0141 - soft_acc:
0.9968 - val_loss: 0.0104 - val_soft_acc: 0.9500
Epoch 89/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0135 - soft_acc:
0.9954 - val_loss: 0.0103 - val_soft_acc: 0.9500
Epoch 90/100
3/3 [==============================] - 0s 24ms/step - loss: 0.0136 - soft_acc:
0.9968 - val_loss: 0.0104 - val_soft_acc: 0.9500
Epoch 91/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0131 - soft_acc:
0.9954 - val_loss: 0.0103 - val_soft_acc: 0.9500
Epoch 92/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0142 - soft_acc:
0.9954 - val_loss: 0.0103 - val_soft_acc: 0.9500
Epoch 93/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0139 - soft_acc:
0.9968 - val_loss: 0.0103 - val_soft_acc: 0.9500
Epoch 94/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0133 - soft_acc:
0.9968 - val_loss: 0.0103 - val_soft_acc: 0.9500
Epoch 95/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0134 - soft_acc:
0.9968 - val_loss: 0.0102 - val_soft_acc: 0.9500
Epoch 96/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0138 - soft_acc:
0.9915 - val_loss: 0.0103 - val_soft_acc: 0.9500
Epoch 97/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0132 - soft_acc:
0.9954 - val_loss: 0.0103 - val_soft_acc: 0.9500
Epoch 98/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0138 - soft_acc:
0.9954 - val_loss: 0.0103 - val_soft_acc: 0.9500
Epoch 99/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0130 - soft_acc:
0.9968 - val_loss: 0.0102 - val_soft_acc: 0.9500
Epoch 100/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0137 - soft_acc:
0.9915 - val_loss: 0.0104 - val_soft_acc: 0.9500
3/3 [==============================] - 0s 1ms/step - loss: 0.0137 - soft_acc:
0.9948
1/1 [==============================] - 0s 14ms/step - loss: 0.0104 - soft_acc:
0.9500
처리중인 폴드 # 6
Epoch 1/100
3/3 [==============================] - 1s 91ms/step - loss: 0.6571 - soft_acc:
```

```
0.4889 - val_loss: 0.8674 - val_soft_acc: 0.0000e+00
Epoch 2/100
3/3 [==============================] - 0s 22ms/step - loss: 0.6336 - soft_acc:
0.4956 - val_loss: 0.8388 - val_soft_acc: 0.0000e+00
Epoch 3/100
3/3 [==============================] - 0s 21ms/step - loss: 0.6253 - soft_acc:
0.4641 - val_loss: 0.8110 - val_soft_acc: 0.0000e+00
Epoch 4/100
3/3 [==============================] - 0s 21ms/step - loss: 0.6063 - soft_acc:
0.4680 - val_loss: 0.7830 - val_soft_acc: 0.0000e+00
Epoch 5/100
3/3 [==============================] - 0s 22ms/step - loss: 0.5767 - soft_acc:
0.4953 - val_loss: 0.7544 - val_soft_acc: 0.0000e+00
Epoch 6/100
3/3 [==============================] - 0s 22ms/step - loss: 0.5440 - soft_acc:
0.5008 - val_loss: 0.7250 - val_soft_acc: 0.0000e+00
Epoch 7/100
3/3 [==============================] - 0s 22ms/step - loss: 0.5379 - soft_acc:
0.4549 - val_loss: 0.6929 - val_soft_acc: 0.0000e+00
Epoch 8/100
3/3 [==============================] - 0s 22ms/step - loss: 0.4859 - soft_acc:
0.5218 - val_loss: 0.6584 - val_soft_acc: 0.0000e+00
Epoch 9/100
3/3 [==============================] - 0s 22ms/step - loss: 0.4541 - soft_acc:
0.5269 - val_loss: 0.6223 - val_soft_acc: 0.0000e+00
Epoch 10/100
3/3 [==============================] - 0s 22ms/step - loss: 0.4510 - soft_acc:
0.4772 - val_loss: 0.5852 - val_soft_acc: 0.0000e+00
Epoch 11/100
3/3 [==============================] - 0s 22ms/step - loss: 0.4183 - soft_acc:
0.4666 - val_loss: 0.5476 - val_soft_acc: 0.0000e+00
Epoch 12/100
3/3 [==============================] - 0s 21ms/step - loss: 0.3784 - soft_acc:
0.4995 - val_loss: 0.5094 - val_soft_acc: 0.0000e+00
Epoch 13/100
3/3 [==============================] - 0s 20ms/step - loss: 0.3568 - soft_acc:
0.4943 - val_loss: 0.4707 - val_soft_acc: 0.0000e+00
Epoch 14/100
3/3 [==============================] - 0s 21ms/step - loss: 0.3318 - soft_acc:
0.4746 - val_loss: 0.4315 - val_soft_acc: 0.0000e+00
Epoch 15/100
3/3 [==============================] - 0s 22ms/step - loss: 0.2994 - soft_acc:
0.4733 - val_loss: 0.3920 - val_soft_acc: 0.0000e+00
Epoch 16/100
3/3 [==============================] - 0s 23ms/step - loss: 0.2663 - soft_acc:
0.4785 - val_loss: 0.3523 - val_soft_acc: 0.0000e+00
Epoch 17/100
3/3 [==============================] - 0s 20ms/step - loss: 0.2347 - soft_acc:
```

```
0.4956 - val_loss: 0.3124 - val_soft_acc: 0.0000e+00
Epoch 18/100
3/3 [==============================] - 0s 21ms/step - loss: 0.2049 - soft_acc:
0.4975 - val_loss: 0.2725 - val_soft_acc: 0.1000
Epoch 19/100
3/3 [==============================] - 0s 21ms/step - loss: 0.1798 - soft_acc:
0.5472 - val_loss: 0.2332 - val_soft_acc: 0.5000
Epoch 20/100
3/3 [==============================] - 0s 20ms/step - loss: 0.1540 - soft_acc:
0.6607 - val_loss: 0.1945 - val_soft_acc: 0.8000
Epoch 21/100
3/3 [==============================] - 0s 22ms/step - loss: 0.1396 - soft_acc:
0.8556 - val_loss: 0.1577 - val_soft_acc: 1.0000
Epoch 22/100
3/3 [==============================] - 0s 22ms/step - loss: 0.1178 - soft_acc:
0.9538 - val_loss: 0.1237 - val_soft_acc: 1.0000
Epoch 23/100
3/3 [==============================] - 0s 22ms/step - loss: 0.1034 - soft_acc:
0.9689 - val_loss: 0.0943 - val_soft_acc: 1.0000
Epoch 24/100
3/3 [==============================] - 0s 22ms/step - loss: 0.1076 - soft_acc:
0.9376 - val_loss: 0.0724 - val_soft_acc: 1.0000
Epoch 25/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0969 - soft_acc:
0.9072 - val_loss: 0.0588 - val_soft_acc: 1.0000
Epoch 26/100
3/3 [==============================] - 0s 24ms/step - loss: 0.1026 - soft_acc:
0.8999 - val_loss: 0.0543 - val_soft_acc: 1.0000
Epoch 27/100
3/3 [==============================] - 0s 22ms/step - loss: 0.1002 - soft_acc:
0.8999 - val_loss: 0.0562 - val_soft_acc: 1.0000
Epoch 28/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0864 - soft_acc:
0.9091 - val_loss: 0.0599 - val_soft_acc: 1.0000
Epoch 29/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0856 - soft_acc:
0.9397 - val_loss: 0.0632 - val_soft_acc: 1.0000
Epoch 30/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0887 - soft_acc:
0.9330 - val_loss: 0.0655 - val_soft_acc: 1.0000
Epoch 31/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0781 - soft_acc:
0.9402 - val_loss: 0.0644 - val_soft_acc: 1.0000
Epoch 32/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0791 - soft_acc:
0.9486 - val_loss: 0.0598 - val_soft_acc: 1.0000
Epoch 33/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0762 - soft_acc:
```

```
0.9422 - val_loss: 0.0553 - val_soft_acc: 1.0000
Epoch 34/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0687 - soft_acc:
0.9461 - val_loss: 0.0521 - val_soft_acc: 1.0000
Epoch 35/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0672 - soft_acc:
0.9499 - val_loss: 0.0496 - val_soft_acc: 1.0000
Epoch 36/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0585 - soft_acc:
0.9669 - val_loss: 0.0471 - val_soft_acc: 1.0000
Epoch 37/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0558 - soft_acc:
0.9728 - val_loss: 0.0442 - val_soft_acc: 1.0000
Epoch 38/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0546 - soft_acc:
0.9584 - val_loss: 0.0434 - val_soft_acc: 1.0000
Epoch 39/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0468 - soft_acc:
0.9806 - val_loss: 0.0413 - val_soft_acc: 1.0000
Epoch 40/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0431 - soft_acc:
0.9792 - val_loss: 0.0396 - val_soft_acc: 1.0000
Epoch 41/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0426 - soft_acc:
0.9740 - val_loss: 0.0380 - val_soft_acc: 1.0000
Epoch 42/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0386 - soft_acc:
0.9746 - val_loss: 0.0353 - val_soft_acc: 1.0000
Epoch 43/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0344 - soft_acc:
0.9838 - val_loss: 0.0316 - val_soft_acc: 1.0000
Epoch 44/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0258 - soft_acc:
0.9877 - val_loss: 0.0273 - val_soft_acc: 1.0000
Epoch 45/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0270 - soft_acc:
0.9785 - val_loss: 0.0252 - val_soft_acc: 1.0000
Epoch 46/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0210 - soft_acc:
0.9851 - val_loss: 0.0229 - val_soft_acc: 1.0000
Epoch 47/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0173 - soft_acc:
0.9824 - val_loss: 0.0205 - val_soft_acc: 1.0000
Epoch 48/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0170 - soft_acc:
0.9838 - val_loss: 0.0183 - val_soft_acc: 1.0000
Epoch 49/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0133 - soft_acc:
```

```
0.9909 - val_loss: 0.0172 - val_soft_acc: 1.0000
Epoch 50/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0129 - soft_acc:
0.9870 - val_loss: 0.0168 - val_soft_acc: 1.0000
Epoch 51/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0131 - soft_acc:
0.9799 - val_loss: 0.0167 - val_soft_acc: 1.0000
Epoch 52/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0132 - soft_acc:
0.9824 - val_loss: 0.0161 - val_soft_acc: 1.0000
Epoch 53/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0132 - soft_acc:
0.9824 - val_loss: 0.0159 - val_soft_acc: 1.0000
Epoch 54/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0130 - soft_acc:
0.9870 - val_loss: 0.0162 - val_soft_acc: 1.0000
Epoch 55/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0130 - soft_acc:
0.9824 - val_loss: 0.0178 - val_soft_acc: 1.0000
Epoch 56/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0126 - soft_acc:
0.9785 - val_loss: 0.0160 - val_soft_acc: 1.0000
Epoch 57/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0126 - soft_acc:
0.9883 - val_loss: 0.0171 - val_soft_acc: 1.0000
Epoch 58/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0124 - soft_acc:
0.9851 - val_loss: 0.0182 - val_soft_acc: 1.0000
Epoch 59/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0124 - soft_acc:
0.9851 - val_loss: 0.0169 - val_soft_acc: 1.0000
Epoch 60/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0123 - soft_acc:
0.9909 - val_loss: 0.0178 - val_soft_acc: 1.0000
Epoch 61/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0118 - soft_acc:
0.9838 - val_loss: 0.0189 - val_soft_acc: 1.0000
Epoch 62/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0123 - soft_acc:
0.9890 - val_loss: 0.0177 - val_soft_acc: 1.0000
Epoch 63/100
3/3 [==============================] - 0s 28ms/step - loss: 0.0116 - soft_acc:
0.9870 - val_loss: 0.0166 - val_soft_acc: 1.0000
Epoch 64/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0123 - soft_acc:
0.9922 - val_loss: 0.0185 - val_soft_acc: 1.0000
Epoch 65/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0121 - soft_acc:
```

```
0.9785 - val_loss: 0.0180 - val_soft_acc: 1.0000
Epoch 66/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0121 - soft_acc:
0.9922 - val_loss: 0.0168 - val_soft_acc: 1.0000
Epoch 67/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0126 - soft_acc:
0.9831 - val_loss: 0.0177 - val_soft_acc: 1.0000
Epoch 68/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0119 - soft_acc:
0.9883 - val_loss: 0.0184 - val_soft_acc: 1.0000
Epoch 69/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0117 - soft_acc:
0.9922 - val_loss: 0.0165 - val_soft_acc: 1.0000
Epoch 70/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0118 - soft_acc:
0.9870 - val_loss: 0.0171 - val_soft_acc: 1.0000
Epoch 71/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0124 - soft_acc:
0.9883 - val_loss: 0.0181 - val_soft_acc: 1.0000
Epoch 72/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0118 - soft_acc:
0.9785 - val_loss: 0.0172 - val_soft_acc: 1.0000
Epoch 73/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0116 - soft_acc:
0.9936 - val_loss: 0.0165 - val_soft_acc: 1.0000
Epoch 74/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0120 - soft_acc:
0.9909 - val_loss: 0.0177 - val_soft_acc: 1.0000
Epoch 75/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0124 - soft_acc:
0.9838 - val_loss: 0.0178 - val_soft_acc: 1.0000
Epoch 76/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0124 - soft_acc:
0.9883 - val_loss: 0.0164 - val_soft_acc: 1.0000
Epoch 77/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0118 - soft_acc:
0.9870 - val_loss: 0.0185 - val_soft_acc: 1.0000
Epoch 78/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0120 - soft_acc:
0.9838 - val_loss: 0.0172 - val_soft_acc: 1.0000
Epoch 79/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0122 - soft_acc:
0.9883 - val_loss: 0.0168 - val_soft_acc: 1.0000
Epoch 80/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0118 - soft_acc:
0.9870 - val_loss: 0.0175 - val_soft_acc: 1.0000
Epoch 81/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0121 - soft_acc:
```

```
0.9890 - val_loss: 0.0172 - val_soft_acc: 1.0000
Epoch 82/100
3/3 [==============================] - 0s 24ms/step - loss: 0.0125 - soft_acc:
0.9870 - val_loss: 0.0170 - val_soft_acc: 1.0000
Epoch 83/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0121 - soft_acc:
0.9799 - val_loss: 0.0182 - val_soft_acc: 1.0000
Epoch 84/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0121 - soft_acc:
0.9799 - val_loss: 0.0171 - val_soft_acc: 1.0000
Epoch 85/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0121 - soft_acc:
0.9831 - val_loss: 0.0167 - val_soft_acc: 1.0000
Epoch 86/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0117 - soft_acc:
0.9922 - val_loss: 0.0180 - val_soft_acc: 1.0000
Epoch 87/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0122 - soft_acc:
0.9877 - val_loss: 0.0169 - val_soft_acc: 1.0000
Epoch 88/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0120 - soft_acc:
0.9870 - val_loss: 0.0171 - val_soft_acc: 1.0000
Epoch 89/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0122 - soft_acc:
0.9909 - val_loss: 0.0171 - val_soft_acc: 1.0000
Epoch 90/100
3/3 [==============================] - 0s 25ms/step - loss: 0.0115 - soft_acc:
0.9909 - val_loss: 0.0177 - val_soft_acc: 1.0000
Epoch 91/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0119 - soft_acc:
0.9831 - val_loss: 0.0166 - val_soft_acc: 1.0000
Epoch 92/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0120 - soft_acc:
0.9870 - val_loss: 0.0176 - val_soft_acc: 1.0000
Epoch 93/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0118 - soft_acc:
0.9824 - val_loss: 0.0172 - val_soft_acc: 1.0000
Epoch 94/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0119 - soft_acc:
0.9870 - val_loss: 0.0165 - val_soft_acc: 1.0000
Epoch 95/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0126 - soft_acc:
0.9922 - val_loss: 0.0181 - val_soft_acc: 1.0000
Epoch 96/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0121 - soft_acc:
0.9877 - val_loss: 0.0170 - val_soft_acc: 1.0000
Epoch 97/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0120 - soft_acc:
```

```
0.9909 - val_loss: 0.0171 - val_soft_acc: 1.0000
Epoch 98/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0119 - soft_acc:
0.9909 - val_loss: 0.0178 - val_soft_acc: 1.0000
Epoch 99/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0123 - soft_acc:
0.9746 - val_loss: 0.0174 - val_soft_acc: 1.0000
Epoch 100/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0116 - soft_acc:
0.9922 - val_loss: 0.0172 - val_soft_acc: 1.0000
3/3 [==============================] - 0s 4ms/step - loss: 0.0118 - soft_acc:
0.9896
1/1 [==============================] - 0s 13ms/step - loss: 0.0172 - soft_acc:
1.0000
처리중인 폴드 # 7
Epoch 1/100
3/3 [==============================] - 1s 195ms/step - loss: 0.8129 - soft_acc:
0.4883 - val_loss: 0.9685 - val_soft_acc: 0.0000e+00
Epoch 2/100
3/3 [==============================] - 0s 23ms/step - loss: 0.7688 - soft_acc:
0.5185 - val_loss: 0.9441 - val_soft_acc: 0.0000e+00
Epoch 3/100
3/3 [==============================] - 0s 21ms/step - loss: 0.7600 - soft_acc:
0.5055 - val_loss: 0.9200 - val_soft_acc: 0.0000e+00
Epoch 4/100
3/3 [==============================] - 0s 22ms/step - loss: 0.7421 - soft_acc:
0.4988 - val_loss: 0.8960 - val_soft_acc: 0.0000e+00
Epoch 5/100
3/3 [==============================] - 0s 20ms/step - loss: 0.7315 - soft_acc:
0.4922 - val_loss: 0.8722 - val_soft_acc: 0.0000e+00
Epoch 6/100
3/3 [==============================] - 0s 23ms/step - loss: 0.7236 - soft_acc:
0.4620 - val_loss: 0.8485 - val_soft_acc: 0.0000e+00
Epoch 7/100
3/3 [==============================] - 0s 21ms/step - loss: 0.6788 - soft_acc:
0.5014 - val_loss: 0.8249 - val_soft_acc: 0.0000e+00
Epoch 8/100
3/3 [==============================] - 0s 20ms/step - loss: 0.6518 - soft_acc:
0.5028 - val_loss: 0.7995 - val_soft_acc: 0.0000e+00
Epoch 9/100
3/3 [==============================] - 0s 22ms/step - loss: 0.6571 - soft_acc:
0.4490 - val_loss: 0.7702 - val_soft_acc: 0.0000e+00
Epoch 10/100
3/3 [==============================] - 0s 41ms/step - loss: 0.6085 - soft_acc:
0.5118 - val_loss: 0.7401 - val_soft_acc: 0.0000e+00
Epoch 11/100
3/3 [==============================] - 0s 36ms/step - loss: 0.5879 - soft_acc:
0.4934 - val_loss: 0.7095 - val_soft_acc: 0.0000e+00
```

```
Epoch 12/100
3/3 [==============================] - 0s 29ms/step - loss: 0.5770 - soft_acc:
0.4635 - val_loss: 0.6785 - val_soft_acc: 0.0000e+00
Epoch 13/100
3/3 [==============================] - 0s 32ms/step - loss: 0.5381 - soft_acc:
0.4910 - val_loss: 0.6472 - val_soft_acc: 0.0000e+00
Epoch 14/100
3/3 [==============================] - 0s 34ms/step - loss: 0.5138 - soft_acc:
0.4883 - val_loss: 0.6157 - val_soft_acc: 0.0000e+00
Epoch 15/100
3/3 [==============================] - 0s 28ms/step - loss: 0.4886 - soft_acc:
0.4843 - val_loss: 0.5834 - val_soft_acc: 0.0000e+00
Epoch 16/100
3/3 [==============================] - 0s 26ms/step - loss: 0.4601 - soft_acc:
0.4793 - val_loss: 0.5499 - val_soft_acc: 0.0000e+00
Epoch 17/100
3/3 [==============================] - 0s 24ms/step - loss: 0.4355 - soft_acc:
0.4750 - val_loss: 0.5160 - val_soft_acc: 0.0000e+00
Epoch 18/100
3/3 [==============================] - 0s 26ms/step - loss: 0.4134 - soft_acc:
0.4739 - val_loss: 0.4817 - val_soft_acc: 0.0000e+00
Epoch 19/100
3/3 [==============================] - 0s 25ms/step - loss: 0.3759 - soft_acc:
0.4922 - val_loss: 0.4472 - val_soft_acc: 0.0000e+00
Epoch 20/100
3/3 [==============================] - 0s 24ms/step - loss: 0.3459 - soft_acc:
0.4975 - val_loss: 0.4124 - val_soft_acc: 0.0000e+00
Epoch 21/100
3/3 [==============================] - 0s 19ms/step - loss: 0.3115 - soft_acc:
0.5148 - val_loss: 0.3776 - val_soft_acc: 0.0000e+00
Epoch 22/100
3/3 [==============================] - 0s 23ms/step - loss: 0.2937 - soft_acc:
0.4799 - val_loss: 0.3438 - val_soft_acc: 0.0000e+00
Epoch 23/100
3/3 [==============================] - 0s 23ms/step - loss: 0.2704 - soft_acc:
0.4746 - val_loss: 0.3107 - val_soft_acc: 0.0000e+00
Epoch 24/100
3/3 [==============================] - 0s 21ms/step - loss: 0.2373 - soft_acc:
0.4810 - val_loss: 0.2776 - val_soft_acc: 0.0000e+00
Epoch 25/100
3/3 [==============================] - 0s 21ms/step - loss: 0.2181 - soft_acc:
0.4785 - val_loss: 0.2444 - val_soft_acc: 0.0000e+00
Epoch 26/100
3/3 [==============================] - 0s 21ms/step - loss: 0.1862 - soft_acc:
0.5467 - val_loss: 0.2116 - val_soft_acc: 0.0000e+00
Epoch 27/100
3/3 [==============================] - 0s 21ms/step - loss: 0.1705 - soft_acc:
0.6592 - val_loss: 0.1791 - val_soft_acc: 0.4500
```

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Epoch 28/100
3/3 [==============================] - 0s 21ms/step - loss: 0.1548 - soft_acc:
0.8175 - val_loss: 0.1473 - val_soft_acc: 1.0000
Epoch 29/100
3/3 [==============================] - 0s 24ms/step - loss: 0.1356 - soft_acc:
0.8907 - val_loss: 0.1177 - val_soft_acc: 1.0000
Epoch 30/100
3/3 [==============================] - 0s 28ms/step - loss: 0.1206 - soft_acc:
0.9636 - val_loss: 0.0903 - val_soft_acc: 1.0000
Epoch 31/100
3/3 [==============================] - 0s 24ms/step - loss: 0.1112 - soft_acc:
0.9616 - val_loss: 0.0673 - val_soft_acc: 1.0000
Epoch 32/100
3/3 [==============================] - 0s 25ms/step - loss: 0.1122 - soft_acc:
0.9215 - val_loss: 0.0496 - val_soft_acc: 1.0000
Epoch 33/100
3/3 [==============================] - 0s 20ms/step - loss: 0.1104 - soft_acc:
0.8591 - val_loss: 0.0377 - val_soft_acc: 1.0000
Epoch 34/100
3/3 [==============================] - 0s 23ms/step - loss: 0.1123 - soft_acc:
0.8342 - val_loss: 0.0313 - val_soft_acc: 1.0000
Epoch 35/100
3/3 [==============================] - 0s 23ms/step - loss: 0.1094 - soft_acc:
0.8416 - val_loss: 0.0291 - val_soft_acc: 1.0000
Epoch 36/100
3/3 [==============================] - 0s 23ms/step - loss: 0.1109 - soft_acc:
0.8482 - val_loss: 0.0336 - val_soft_acc: 1.0000
Epoch 37/100
3/3 [==============================] - 0s 21ms/step - loss: 0.1041 - soft_acc:
0.8956 - val_loss: 0.0406 - val_soft_acc: 1.0000
Epoch 38/100
3/3 [==============================] - 0s 22ms/step - loss: 0.1040 - soft_acc:
0.9013 - val_loss: 0.0472 - val_soft_acc: 1.0000
Epoch 39/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0973 - soft_acc:
0.9363 - val_loss: 0.0517 - val_soft_acc: 1.0000
Epoch 40/100
3/3 [==============================] - 0s 24ms/step - loss: 0.0923 - soft_acc:
0.9448 - val_loss: 0.0545 - val_soft_acc: 1.0000
Epoch 41/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0888 - soft_acc:
0.9447 - val_loss: 0.0546 - val_soft_acc: 1.0000
Epoch 42/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0920 - soft_acc:
0.9461 - val_loss: 0.0531 - val_soft_acc: 1.0000
Epoch 43/100
3/3 [==============================] - 0s 24ms/step - loss: 0.0895 - soft_acc:
0.9552 - val_loss: 0.0499 - val_soft_acc: 1.0000
```

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Epoch 44/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0892 - soft_acc:
0.9395 - val_loss: 0.0460 - val_soft_acc: 1.0000
Epoch 45/100
3/3 [==============================] - 0s 24ms/step - loss: 0.0874 - soft_acc:
0.9449 - val_loss: 0.0422 - val_soft_acc: 1.0000
Epoch 46/100
3/3 [==============================] - 0s 24ms/step - loss: 0.0822 - soft_acc:
0.9252 - val_loss: 0.0385 - val_soft_acc: 1.0000
Epoch 47/100
3/3 [==============================] - 0s 24ms/step - loss: 0.0800 - soft_acc:
0.9502 - val_loss: 0.0355 - val_soft_acc: 1.0000
Epoch 48/100
3/3 [==============================] - 0s 24ms/step - loss: 0.0751 - soft_acc:
0.9463 - val_loss: 0.0347 - val_soft_acc: 1.0000
Epoch 49/100
3/3 [==============================] - 0s 27ms/step - loss: 0.0755 - soft_acc:
0.9323 - val_loss: 0.0346 - val_soft_acc: 1.0000
Epoch 50/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0733 - soft_acc:
0.9415 - val_loss: 0.0351 - val_soft_acc: 1.0000
Epoch 51/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0663 - soft_acc:
0.9545 - val_loss: 0.0351 - val_soft_acc: 1.0000
Epoch 52/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0683 - soft_acc:
0.9655 - val_loss: 0.0352 - val_soft_acc: 1.0000
Epoch 53/100
3/3 [==============================] - 0s 30ms/step - loss: 0.0692 - soft_acc:
0.9655 - val_loss: 0.0346 - val_soft_acc: 1.0000
Epoch 54/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0660 - soft_acc:
0.9552 - val_loss: 0.0323 - val_soft_acc: 1.0000
Epoch 55/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0616 - soft_acc:
0.9604 - val_loss: 0.0298 - val_soft_acc: 1.0000
Epoch 56/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0594 - soft_acc:
0.9603 - val_loss: 0.0277 - val_soft_acc: 1.0000
Epoch 57/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0542 - soft_acc:
0.9655 - val_loss: 0.0252 - val_soft_acc: 1.0000
Epoch 58/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0521 - soft_acc:
0.9630 - val_loss: 0.0242 - val_soft_acc: 1.0000
Epoch 59/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0494 - soft_acc:
0.9648 - val_loss: 0.0228 - val_soft_acc: 1.0000
```

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Epoch 60/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0492 - soft_acc:
0.9623 - val_loss: 0.0210 - val_soft_acc: 1.0000
Epoch 61/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0431 - soft_acc:
0.9781 - val_loss: 0.0196 - val_soft_acc: 1.0000
Epoch 62/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0437 - soft_acc:
0.9708 - val_loss: 0.0179 - val_soft_acc: 1.0000
Epoch 63/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0376 - soft_acc:
0.9721 - val_loss: 0.0154 - val_soft_acc: 1.0000
Epoch 64/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0345 - soft_acc:
0.9747 - val_loss: 0.0141 - val_soft_acc: 1.0000
Epoch 65/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0311 - soft_acc:
0.9675 - val_loss: 0.0132 - val_soft_acc: 1.0000
Epoch 66/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0272 - soft_acc:
0.9754 - val_loss: 0.0129 - val_soft_acc: 1.0000
Epoch 67/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0273 - soft_acc:
0.9682 - val_loss: 0.0119 - val_soft_acc: 1.0000
Epoch 68/100
3/3 [==============================] - 0s 26ms/step - loss: 0.0225 - soft_acc:
0.9753 - val_loss: 0.0108 - val_soft_acc: 1.0000
Epoch 69/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0213 - soft_acc:
0.9792 - val_loss: 0.0108 - val_soft_acc: 1.0000
Epoch 70/100
3/3 [==============================] - 0s 24ms/step - loss: 0.0199 - soft_acc:
0.9845 - val_loss: 0.0106 - val_soft_acc: 1.0000
Epoch 71/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0179 - soft_acc:
0.9824 - val_loss: 0.0107 - val_soft_acc: 1.0000
Epoch 72/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0181 - soft_acc:
0.9785 - val_loss: 0.0117 - val_soft_acc: 1.0000
Epoch 73/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0176 - soft_acc:
0.9904 - val_loss: 0.0126 - val_soft_acc: 1.0000
Epoch 74/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0170 - soft_acc:
0.9877 - val_loss: 0.0132 - val_soft_acc: 1.0000
Epoch 75/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0171 - soft_acc:
0.9838 - val_loss: 0.0126 - val_soft_acc: 1.0000
```

```
Epoch 76/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0156 - soft_acc:
0.9922 - val_loss: 0.0137 - val_soft_acc: 1.0000
Epoch 77/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0170 - soft_acc:
0.9922 - val_loss: 0.0135 - val_soft_acc: 1.0000
Epoch 78/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0164 - soft_acc:
0.9922 - val_loss: 0.0141 - val_soft_acc: 1.0000
Epoch 79/100
3/3 [==============================] - 0s 24ms/step - loss: 0.0173 - soft_acc:
0.9870 - val_loss: 0.0134 - val_soft_acc: 1.0000
Epoch 80/100
3/3 [==============================] - 0s 24ms/step - loss: 0.0161 - soft_acc:
0.9909 - val_loss: 0.0128 - val_soft_acc: 1.0000
Epoch 81/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0165 - soft_acc:
0.9922 - val_loss: 0.0135 - val_soft_acc: 1.0000
Epoch 82/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0167 - soft_acc:
0.9806 - val_loss: 0.0139 - val_soft_acc: 1.0000
Epoch 83/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0169 - soft_acc:
0.9740 - val_loss: 0.0133 - val_soft_acc: 1.0000
Epoch 84/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0161 - soft_acc:
0.9883 - val_loss: 0.0121 - val_soft_acc: 1.0000
Epoch 85/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0154 - soft_acc:
0.9799 - val_loss: 0.0138 - val_soft_acc: 1.0000
Epoch 86/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0164 - soft_acc:
0.9831 - val_loss: 0.0135 - val_soft_acc: 1.0000
Epoch 87/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0160 - soft_acc:
0.9922 - val_loss: 0.0118 - val_soft_acc: 1.0000
Epoch 88/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0150 - soft_acc:
0.9870 - val_loss: 0.0125 - val_soft_acc: 1.0000
Epoch 89/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0169 - soft_acc:
0.9806 - val_loss: 0.0137 - val_soft_acc: 1.0000
Epoch 90/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0161 - soft_acc:
0.9838 - val_loss: 0.0121 - val_soft_acc: 1.0000
Epoch 91/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0161 - soft_acc:
0.9883 - val_loss: 0.0125 - val_soft_acc: 1.0000
```

```
Epoch 92/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0153 - soft_acc:
0.9883 - val_loss: 0.0122 - val_soft_acc: 1.0000
Epoch 93/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0154 - soft_acc:
0.9870 - val_loss: 0.0130 - val_soft_acc: 1.0000
Epoch 94/100
3/3 [==============================] - 0s 24ms/step - loss: 0.0159 - soft_acc:
0.9806 - val_loss: 0.0135 - val_soft_acc: 1.0000
Epoch 95/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0167 - soft_acc:
0.9740 - val_loss: 0.0130 - val_soft_acc: 1.0000
Epoch 96/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0162 - soft_acc:
0.9909 - val_loss: 0.0118 - val_soft_acc: 1.0000
Epoch 97/100
3/3 [==============================] - ETA: 0s - loss: 0.0167 - soft_acc: 0.98 -
0s 21ms/step - loss: 0.0163 - soft_acc: 0.9870 - val_loss: 0.0129 -
val_soft_acc: 1.0000
Epoch 98/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0161 - soft_acc:
0.9819 - val_loss: 0.0136 - val_soft_acc: 1.0000
Epoch 99/100
3/3 [==============================] - 0s 26ms/step - loss: 0.0166 - soft_acc:
0.9831 - val_loss: 0.0128 - val_soft_acc: 1.0000
Epoch 100/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0161 - soft_acc:
0.9909 - val_loss: 0.0122 - val_soft_acc: 1.0000
3/3 [==============================] - 0s 5ms/step - loss: 0.0159 - soft_acc:
0.9896
1/1 [==============================] - 0s 13ms/step - loss: 0.0122 - soft_acc:
1.0000
처리중인 폴드 # 8
Epoch 1/100
3/3 [==============================] - 0s 87ms/step - loss: 0.2237 - soft_acc:
0.5520 - val_loss: 0.2666 - val_soft_acc: 0.0000e+00
Epoch 2/100
3/3 [==============================] - 0s 22ms/step - loss: 0.2132 - soft_acc:
0.5336 - val_loss: 0.2436 - val_soft_acc: 0.0500
Epoch 3/100
3/3 [==============================] - 0s 21ms/step - loss: 0.1939 - soft_acc:
0.5889 - val_loss: 0.2199 - val_soft_acc: 0.1500
Epoch 4/100
3/3 [==============================] - 0s 21ms/step - loss: 0.1706 - soft_acc:
0.6706 - val_loss: 0.1960 - val_soft_acc: 0.2000
Epoch 5/100
3/3 [==============================] - 0s 19ms/step - loss: 0.1542 - soft_acc:
0.7605 - val_loss: 0.1726 - val_soft_acc: 0.4500
```

```
Epoch 6/100
3/3 [==============================] - 0s 24ms/step - loss: 0.1348 - soft_acc:
0.8684 - val_loss: 0.1485 - val_soft_acc: 0.8000
Epoch 7/100
3/3 [==============================] - 0s 20ms/step - loss: 0.1146 - soft_acc:
0.8903 - val_loss: 0.1227 - val_soft_acc: 0.9000
Epoch 8/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0944 - soft_acc:
0.9319 - val_loss: 0.0956 - val_soft_acc: 1.0000
Epoch 9/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0762 - soft_acc:
0.9662 - val_loss: 0.0688 - val_soft_acc: 1.0000
Epoch 10/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0629 - soft_acc:
0.9668 - val_loss: 0.0438 - val_soft_acc: 1.0000
Epoch 11/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0557 - soft_acc:
0.9577 - val_loss: 0.0238 - val_soft_acc: 1.0000
Epoch 12/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0506 - soft_acc:
0.9630 - val_loss: 0.0135 - val_soft_acc: 1.0000
Epoch 13/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0539 - soft_acc:
0.9591 - val_loss: 0.0125 - val_soft_acc: 1.0000
Epoch 14/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0477 - soft_acc:
0.9559 - val_loss: 0.0125 - val_soft_acc: 1.0000
Epoch 15/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0464 - soft_acc:
0.9461 - val_loss: 0.0136 - val_soft_acc: 1.0000
Epoch 16/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0473 - soft_acc:
0.9682 - val_loss: 0.0190 - val_soft_acc: 1.0000
Epoch 17/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0402 - soft_acc:
0.9682 - val_loss: 0.0259 - val_soft_acc: 1.0000
Epoch 18/100
3/3 [==============================] - 0s 25ms/step - loss: 0.0396 - soft_acc:
0.9643 - val_loss: 0.0324 - val_soft_acc: 1.0000
Epoch 19/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0424 - soft_acc:
0.9564 - val_loss: 0.0353 - val_soft_acc: 1.0000
Epoch 20/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0350 - soft_acc:
0.9460 - val_loss: 0.0339 - val_soft_acc: 1.0000
Epoch 21/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0382 - soft_acc:
0.9577 - val_loss: 0.0299 - val_soft_acc: 1.0000
```

```
Epoch 22/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0314 - soft_acc:
0.9570 - val_loss: 0.0234 - val_soft_acc: 1.0000
Epoch 23/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0278 - soft_acc:
0.9715 - val_loss: 0.0184 - val_soft_acc: 1.0000
Epoch 24/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0249 - soft_acc:
0.9742 - val_loss: 0.0149 - val_soft_acc: 1.0000
Epoch 25/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0247 - soft_acc:
0.9655 - val_loss: 0.0151 - val_soft_acc: 1.0000
Epoch 26/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0207 - soft_acc:
0.9767 - val_loss: 0.0174 - val_soft_acc: 1.0000
Epoch 27/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0207 - soft_acc:
0.9779 - val_loss: 0.0181 - val_soft_acc: 1.0000
Epoch 28/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0230 - soft_acc:
0.9838 - val_loss: 0.0156 - val_soft_acc: 1.0000
Epoch 29/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0189 - soft_acc:
0.9858 - val_loss: 0.0131 - val_soft_acc: 1.0000
Epoch 30/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0190 - soft_acc:
0.9792 - val_loss: 0.0129 - val_soft_acc: 1.0000
Epoch 31/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0200 - soft_acc:
0.9753 - val_loss: 0.0140 - val_soft_acc: 1.0000
Epoch 32/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0182 - soft_acc:
0.9785 - val_loss: 0.0148 - val_soft_acc: 1.0000
Epoch 33/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0180 - soft_acc:
0.9824 - val_loss: 0.0141 - val_soft_acc: 1.0000
Epoch 34/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0178 - soft_acc:
0.9877 - val_loss: 0.0133 - val_soft_acc: 1.0000
Epoch 35/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0163 - soft_acc:
0.9863 - val_loss: 0.0131 - val_soft_acc: 1.0000
Epoch 36/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0159 - soft_acc:
0.9824 - val_loss: 0.0133 - val_soft_acc: 1.0000
Epoch 37/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0175 - soft_acc:
0.9863 - val_loss: 0.0138 - val_soft_acc: 1.0000
```

```
Epoch 38/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0165 - soft_acc:
0.9877 - val_loss: 0.0133 - val_soft_acc: 1.0000
Epoch 39/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0166 - soft_acc:
0.9890 - val_loss: 0.0132 - val_soft_acc: 1.0000
Epoch 40/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0172 - soft_acc:
0.9824 - val_loss: 0.0133 - val_soft_acc: 1.0000
Epoch 41/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0170 - soft_acc:
0.9824 - val_loss: 0.0132 - val_soft_acc: 1.0000
Epoch 42/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0174 - soft_acc:
0.9877 - val_loss: 0.0134 - val_soft_acc: 1.0000
Epoch 43/100
3/3 [==============================] - 0s 24ms/step - loss: 0.0172 - soft_acc:
0.9851 - val_loss: 0.0133 - val_soft_acc: 1.0000
Epoch 44/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0155 - soft_acc:
0.9785 - val_loss: 0.0130 - val_soft_acc: 1.0000
Epoch 45/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0158 - soft_acc:
0.9838 - val_loss: 0.0131 - val_soft_acc: 1.0000
Epoch 46/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0160 - soft_acc:
0.9785 - val_loss: 0.0137 - val_soft_acc: 1.0000
Epoch 47/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0164 - soft_acc:
0.9890 - val_loss: 0.0138 - val_soft_acc: 1.0000
Epoch 48/100
3/3 [==============================] - 0s 24ms/step - loss: 0.0160 - soft_acc:
0.9877 - val_loss: 0.0130 - val_soft_acc: 1.0000
Epoch 49/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0161 - soft_acc:
0.9838 - val_loss: 0.0131 - val_soft_acc: 1.0000
Epoch 50/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0160 - soft_acc:
0.9785 - val_loss: 0.0134 - val_soft_acc: 1.0000
Epoch 51/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0162 - soft_acc:
0.9799 - val_loss: 0.0138 - val_soft_acc: 1.0000
Epoch 52/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0150 - soft_acc:
0.9799 - val_loss: 0.0131 - val_soft_acc: 1.0000
Epoch 53/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0159 - soft_acc:
0.9890 - val_loss: 0.0130 - val_soft_acc: 1.0000
```

```
Epoch 54/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0147 - soft_acc:
0.9838 - val_loss: 0.0133 - val_soft_acc: 1.0000
Epoch 55/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0144 - soft_acc:
0.9824 - val_loss: 0.0137 - val_soft_acc: 1.0000
Epoch 56/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0153 - soft_acc:
0.9851 - val_loss: 0.0137 - val_soft_acc: 1.0000
Epoch 57/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0156 - soft_acc:
0.9785 - val_loss: 0.0130 - val_soft_acc: 1.0000
Epoch 58/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0162 - soft_acc:
0.9746 - val_loss: 0.0131 - val_soft_acc: 1.0000
Epoch 59/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0158 - soft_acc:
0.9746 - val_loss: 0.0139 - val_soft_acc: 1.0000
Epoch 60/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0148 - soft_acc:
0.9824 - val_loss: 0.0132 - val_soft_acc: 1.0000
Epoch 61/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0158 - soft_acc:
0.9838 - val_loss: 0.0130 - val_soft_acc: 1.0000
Epoch 62/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0150 - soft_acc:
0.9890 - val_loss: 0.0132 - val_soft_acc: 1.0000
Epoch 63/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0149 - soft_acc:
0.9838 - val_loss: 0.0134 - val_soft_acc: 1.0000
Epoch 64/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0160 - soft_acc:
0.9799 - val_loss: 0.0132 - val_soft_acc: 1.0000
Epoch 65/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0152 - soft_acc:
0.9838 - val_loss: 0.0131 - val_soft_acc: 1.0000
Epoch 66/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0155 - soft_acc:
0.9799 - val_loss: 0.0136 - val_soft_acc: 1.0000
Epoch 67/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0156 - soft_acc:
0.9890 - val_loss: 0.0133 - val_soft_acc: 1.0000
Epoch 68/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0147 - soft_acc:
0.9863 - val_loss: 0.0129 - val_soft_acc: 1.0000
Epoch 69/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0163 - soft_acc:
0.9877 - val_loss: 0.0131 - val_soft_acc: 1.0000
```

```
Epoch 70/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0150 - soft_acc:
0.9838 - val_loss: 0.0135 - val_soft_acc: 1.0000
Epoch 71/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0145 - soft_acc:
0.9851 - val_loss: 0.0132 - val_soft_acc: 1.0000
Epoch 72/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0159 - soft_acc:
0.9877 - val_loss: 0.0130 - val_soft_acc: 1.0000
Epoch 73/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0147 - soft_acc:
0.9838 - val_loss: 0.0130 - val_soft_acc: 1.0000
Epoch 74/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0150 - soft_acc:
0.9799 - val_loss: 0.0133 - val_soft_acc: 1.0000
Epoch 75/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0154 - soft_acc:
0.9746 - val_loss: 0.0134 - val_soft_acc: 1.0000
Epoch 76/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0146 - soft_acc:
0.9824 - val_loss: 0.0133 - val_soft_acc: 1.0000
Epoch 77/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0144 - soft_acc:
0.9838 - val_loss: 0.0129 - val_soft_acc: 1.0000
Epoch 78/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0156 - soft_acc:
0.9838 - val_loss: 0.0131 - val_soft_acc: 1.0000
Epoch 79/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0153 - soft_acc:
0.9799 - val_loss: 0.0134 - val_soft_acc: 1.0000
Epoch 80/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0150 - soft_acc:
0.9838 - val_loss: 0.0131 - val_soft_acc: 1.0000
Epoch 81/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0146 - soft_acc:
0.9890 - val_loss: 0.0129 - val_soft_acc: 1.0000
Epoch 82/100
3/3 [==============================] - 0s 20ms/step - loss: 0.0151 - soft_acc:
0.9824 - val_loss: 0.0134 - val_soft_acc: 1.0000
Epoch 83/100
3/3 [==============================] - 0s 24ms/step - loss: 0.0139 - soft_acc:
0.9877 - val_loss: 0.0132 - val_soft_acc: 1.0000
Epoch 84/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0143 - soft_acc:
0.9824 - val_loss: 0.0129 - val_soft_acc: 1.0000
Epoch 85/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0152 - soft_acc:
0.9785 - val_loss: 0.0132 - val_soft_acc: 1.0000
```

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Epoch 86/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0150 - soft_acc:
0.9863 - val_loss: 0.0134 - val_soft_acc: 1.0000
Epoch 87/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0143 - soft_acc:
0.9851 - val_loss: 0.0131 - val_soft_acc: 1.0000
Epoch 88/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0150 - soft_acc:
0.9824 - val_loss: 0.0130 - val_soft_acc: 1.0000
Epoch 89/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0150 - soft_acc:
0.9824 - val_loss: 0.0132 - val_soft_acc: 1.0000
Epoch 90/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0155 - soft_acc:
0.9785 - val_loss: 0.0133 - val_soft_acc: 1.0000
Epoch 91/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0148 - soft_acc:
0.9838 - val_loss: 0.0131 - val_soft_acc: 1.0000
Epoch 92/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0152 - soft_acc:
0.9799 - val_loss: 0.0130 - val_soft_acc: 1.0000
Epoch 93/100
3/3 [==============================] - 0s 19ms/step - loss: 0.0153 - soft_acc:
0.9824 - val_loss: 0.0130 - val_soft_acc: 1.0000
Epoch 94/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0152 - soft_acc:
0.9799 - val_loss: 0.0130 - val_soft_acc: 1.0000
Epoch 95/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0157 - soft_acc:
0.9746 - val_loss: 0.0130 - val_soft_acc: 1.0000
Epoch 96/100
3/3 [==============================] - 0s 21ms/step - loss: 0.0150 - soft_acc:
0.9824 - val_loss: 0.0129 - val_soft_acc: 1.0000
Epoch 97/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0150 - soft_acc:
0.9890 - val_loss: 0.0131 - val_soft_acc: 1.0000
Epoch 98/100
3/3 [==============================] - 0s 22ms/step - loss: 0.0146 - soft_acc:
0.9890 - val_loss: 0.0136 - val_soft_acc: 1.0000
Epoch 99/100
3/3 [==============================] - 0s 23ms/step - loss: 0.0149 - soft_acc:
0.9785 - val_loss: 0.0128 - val_soft_acc: 1.0000
Epoch 100/100
3/3 [==============================] - 0s 25ms/step - loss: 0.0145 - soft_acc:
0.9799 - val_loss: 0.0130 - val_soft_acc: 1.0000
3/3 [==============================] - ETA: 0s - loss: 0.0165 - soft_acc: 1.00 -
0s 5ms/step - loss: 0.0147 - soft_acc: 0.9844
1/1 [==============================] - 0s 20ms/step - loss: 0.0130 - soft_acc:
```

```
1.0000
처리중인 폴드 # 9
Epoch 1/100
3/3 [==============================] - 1s 90ms/step - loss: 0.8417 - soft_acc:
0.5055 - val_loss: 1.2059 - val_soft_acc: 0.0000e+00
Epoch 2/100
3/3 [==============================] - 0s 25ms/step - loss: 0.8018 - soft_acc:
0.4886 - val_loss: 1.1435 - val_soft_acc: 0.0000e+00
Epoch 3/100
3/3 [==============================] - 0s 30ms/step - loss: 0.7586 - soft_acc:
0.4949 - val_loss: 1.0812 - val_soft_acc: 0.0000e+00
Epoch 4/100
3/3 [==============================] - 0s 34ms/step - loss: 0.7221 - soft_acc:
0.4792 - val_loss: 1.0197 - val_soft_acc: 0.0000e+00
Epoch 5/100
3/3 [==============================] - 0s 35ms/step - loss: 0.6760 - soft_acc:
0.4831 - val_loss: 0.9590 - val_soft_acc: 0.0000e+00
Epoch 6/100
3/3 [==============================] - 0s 40ms/step - loss: 0.6228 - soft_acc:
0.5014 - val_loss: 0.8981 - val_soft_acc: 0.0000e+00
Epoch 7/100
3/3 [==============================] - 0s 34ms/step - loss: 0.5827 - soft_acc:
0.4804 - val_loss: 0.8365 - val_soft_acc: 0.0000e+00
Epoch 8/100
3/3 [==============================] - 0s 37ms/step - loss: 0.5411 - soft_acc:
0.4686 - val_loss: 0.7743 - val_soft_acc: 0.0000e+00
Epoch 9/100
3/3 [==============================] - 0s 39ms/step - loss: 0.4973 - soft_acc:
0.4727 - val_loss: 0.7118 - val_soft_acc: 0.0000e+00
Epoch 10/100
3/3 [==============================] - 0s 33ms/step - loss: 0.4437 - soft_acc:
0.4988 - val_loss: 0.6490 - val_soft_acc: 0.0000e+00
Epoch 11/100
3/3 [==============================] - 0s 37ms/step - loss: 0.4032 - soft_acc:
0.4659 - val_loss: 0.5858 - val_soft_acc: 0.0000e+00
Epoch 12/100
3/3 [==============================] - 0s 34ms/step - loss: 0.3616 - soft_acc:
0.4792 - val_loss: 0.5223 - val_soft_acc: 0.0000e+00
Epoch 13/100
3/3 [==============================] - 0s 35ms/step - loss: 0.3116 - soft_acc:
0.4883 - val_loss: 0.4587 - val_soft_acc: 0.0000e+00
Epoch 14/100
3/3 [==============================] - 0s 38ms/step - loss: 0.2699 - soft_acc:
0.4587 - val_loss: 0.3949 - val_soft_acc: 0.0000e+00
Epoch 15/100
3/3 [==============================] - 0s 41ms/step - loss: 0.2217 - soft_acc:
0.4851 - val_loss: 0.3314 - val_soft_acc: 0.0500
Epoch 16/100
```

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3/3 [==============================] - 0s 34ms/step - loss: 0.1794 - soft_acc:
0.5076 - val_loss: 0.2685 - val_soft_acc: 0.8000
Epoch 17/100
3/3 [==============================] - 0s 33ms/step - loss: 0.1445 - soft_acc:
0.6470 - val_loss: 0.2073 - val_soft_acc: 1.0000
Epoch 18/100
3/3 [==============================] - 0s 31ms/step - loss: 0.1134 - soft_acc:
0.9285 - val_loss: 0.1505 - val_soft_acc: 1.0000
Epoch 19/100
3/3 [==============================] - 0s 40ms/step - loss: 0.0974 - soft_acc:
0.9664 - val_loss: 0.1023 - val_soft_acc: 1.0000
Epoch 20/100
3/3 [==============================] - 0s 41ms/step - loss: 0.0895 - soft_acc:
0.8983 - val_loss: 0.0676 - val_soft_acc: 1.0000
Epoch 21/100
3/3 [==============================] - 0s 38ms/step - loss: 0.0951 - soft_acc:
0.8435 - val_loss: 0.0501 - val_soft_acc: 1.0000
Epoch 22/100
3/3 [==============================] - 0s 41ms/step - loss: 0.0923 - soft_acc:
0.8089 - val_loss: 0.0511 - val_soft_acc: 1.0000
Epoch 23/100
3/3 [==============================] - 0s 34ms/step - loss: 0.0836 - soft_acc:
0.8485 - val_loss: 0.0635 - val_soft_acc: 1.0000
Epoch 24/100
3/3 [==============================] - 0s 33ms/step - loss: 0.0842 - soft_acc:
0.9038 - val_loss: 0.0805 - val_soft_acc: 1.0000
Epoch 25/100
3/3 [==============================] - 0s 35ms/step - loss: 0.0762 - soft_acc:
0.9454 - val_loss: 0.0953 - val_soft_acc: 1.0000
Epoch 26/100
3/3 [==============================] - 0s 33ms/step - loss: 0.0718 - soft_acc:
0.9604 - val_loss: 0.1029 - val_soft_acc: 1.0000
Epoch 27/100
3/3 [==============================] - 0s 31ms/step - loss: 0.0723 - soft_acc:
0.9708 - val_loss: 0.1025 - val_soft_acc: 1.0000
Epoch 28/100
3/3 [==============================] - 0s 34ms/step - loss: 0.0677 - soft_acc:
0.9701 - val_loss: 0.0957 - val_soft_acc: 1.0000
Epoch 29/100
3/3 [==============================] - 0s 37ms/step - loss: 0.0613 - soft_acc:
0.9701 - val_loss: 0.0833 - val_soft_acc: 1.0000
Epoch 30/100
3/3 [==============================] - 0s 37ms/step - loss: 0.0591 - soft_acc:
0.9668 - val_loss: 0.0708 - val_soft_acc: 1.0000
Epoch 31/100
3/3 [==============================] - 0s 38ms/step - loss: 0.0554 - soft_acc:
0.9760 - val_loss: 0.0626 - val_soft_acc: 1.0000
Epoch 32/100
```

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3/3 [==============================] - 0s 40ms/step - loss: 0.0525 - soft_acc:
0.9629 - val_loss: 0.0585 - val_soft_acc: 1.0000
Epoch 33/100
3/3 [==============================] - 0s 37ms/step - loss: 0.0467 - soft_acc:
0.9806 - val_loss: 0.0550 - val_soft_acc: 1.0000
Epoch 34/100
3/3 [==============================] - 0s 33ms/step - loss: 0.0458 - soft_acc:
0.9701 - val_loss: 0.0527 - val_soft_acc: 1.0000
Epoch 35/100
3/3 [==============================] - 0s 34ms/step - loss: 0.0418 - soft_acc:
0.9792 - val_loss: 0.0490 - val_soft_acc: 1.0000
Epoch 36/100
3/3 [==============================] - 0s 34ms/step - loss: 0.0375 - soft_acc:
0.9701 - val_loss: 0.0457 - val_soft_acc: 1.0000
Epoch 37/100
3/3 [==============================] - 0s 33ms/step - loss: 0.0352 - soft_acc:
0.9838 - val_loss: 0.0415 - val_soft_acc: 1.0000
Epoch 38/100
3/3 [==============================] - 0s 38ms/step - loss: 0.0319 - soft_acc:
0.9824 - val_loss: 0.0370 - val_soft_acc: 1.0000
Epoch 39/100
3/3 [==============================] - 0s 40ms/step - loss: 0.0296 - soft_acc:
0.9890 - val_loss: 0.0314 - val_soft_acc: 1.0000
Epoch 40/100
3/3 [==============================] - 0s 38ms/step - loss: 0.0261 - soft_acc:
0.9877 - val_loss: 0.0269 - val_soft_acc: 1.0000
Epoch 41/100
3/3 [==============================] - 0s 38ms/step - loss: 0.0228 - soft_acc:
0.9824 - val_loss: 0.0265 - val_soft_acc: 1.0000
Epoch 42/100
3/3 [==============================] - 0s 38ms/step - loss: 0.0205 - soft_acc:
0.9890 - val_loss: 0.0228 - val_soft_acc: 1.0000
Epoch 43/100
3/3 [==============================] - 0s 37ms/step - loss: 0.0178 - soft_acc:
0.9799 - val_loss: 0.0176 - val_soft_acc: 1.0000
Epoch 44/100
3/3 [==============================] - 0s 41ms/step - loss: 0.0154 - soft_acc:
0.9824 - val_loss: 0.0160 - val_soft_acc: 1.0000
Epoch 45/100
3/3 [==============================] - 0s 42ms/step - loss: 0.0151 - soft_acc:
0.9870 - val_loss: 0.0138 - val_soft_acc: 1.0000
Epoch 46/100
3/3 [==============================] - 0s 42ms/step - loss: 0.0149 - soft_acc:
0.9909 - val_loss: 0.0122 - val_soft_acc: 1.0000
Epoch 47/100
3/3 [==============================] - 0s 40ms/step - loss: 0.0145 - soft_acc:
0.9831 - val_loss: 0.0108 - val_soft_acc: 1.0000
Epoch 48/100
```

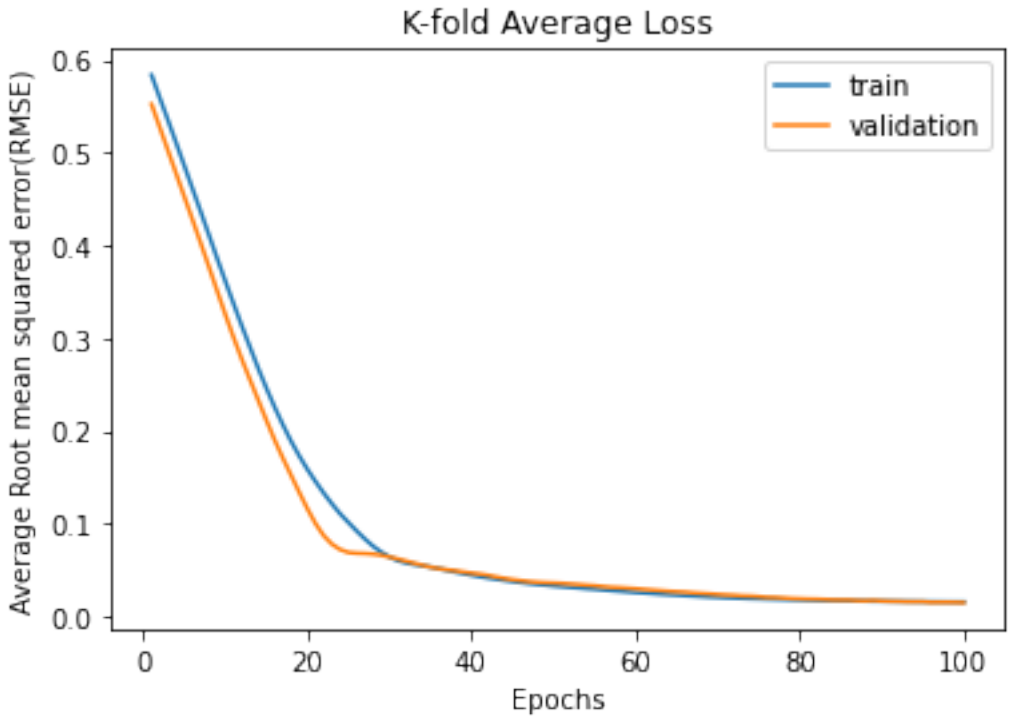
```
3/3 [==============================] - 0s 38ms/step - loss: 0.0140 - soft_acc:
0.9883 - val_loss: 0.0114 - val_soft_acc: 1.0000
Epoch 49/100
3/3 [==============================] - 0s 35ms/step - loss: 0.0148 - soft_acc:
0.9922 - val_loss: 0.0113 - val_soft_acc: 1.0000
Epoch 50/100
3/3 [==============================] - 0s 39ms/step - loss: 0.0149 - soft_acc:
0.9883 - val_loss: 0.0113 - val_soft_acc: 1.0000
Epoch 51/100
3/3 [==============================] - 0s 41ms/step - loss: 0.0155 - soft_acc:
0.9883 - val_loss: 0.0111 - val_soft_acc: 1.0000
Epoch 52/100
3/3 [==============================] - 0s 41ms/step - loss: 0.0155 - soft_acc:
0.9883 - val_loss: 0.0113 - val_soft_acc: 1.0000
Epoch 53/100
3/3 [==============================] - 0s 38ms/step - loss: 0.0142 - soft_acc:
0.9909 - val_loss: 0.0119 - val_soft_acc: 1.0000
Epoch 54/100
3/3 [==============================] - 0s 41ms/step - loss: 0.0134 - soft_acc:
0.9831 - val_loss: 0.0125 - val_soft_acc: 1.0000
Epoch 55/100
3/3 [==============================] - 0s 37ms/step - loss: 0.0147 - soft_acc:
0.9870 - val_loss: 0.0126 - val_soft_acc: 1.0000
Epoch 56/100
3/3 [==============================] - 0s 43ms/step - loss: 0.0135 - soft_acc:
0.9922 - val_loss: 0.0134 - val_soft_acc: 1.0000
Epoch 57/100
3/3 [==============================] - 0s 44ms/step - loss: 0.0133 - soft_acc:
0.9831 - val_loss: 0.0124 - val_soft_acc: 1.0000
Epoch 58/100
3/3 [==============================] - 0s 34ms/step - loss: 0.0142 - soft_acc:
0.9870 - val_loss: 0.0128 - val_soft_acc: 1.0000
Epoch 59/100
3/3 [==============================] - 0s 41ms/step - loss: 0.0140 - soft_acc:
0.9922 - val_loss: 0.0134 - val_soft_acc: 1.0000
Epoch 60/100
3/3 [==============================] - 0s 32ms/step - loss: 0.0132 - soft_acc:
0.9870 - val_loss: 0.0137 - val_soft_acc: 1.0000
Epoch 61/100
3/3 [==============================] - 0s 43ms/step - loss: 0.0128 - soft_acc:
0.9870 - val_loss: 0.0120 - val_soft_acc: 1.0000
Epoch 62/100
3/3 [==============================] - 0s 42ms/step - loss: 0.0143 - soft_acc:
0.9863 - val_loss: 0.0125 - val_soft_acc: 1.0000
Epoch 63/100
3/3 [==============================] - 0s 39ms/step - loss: 0.0133 - soft_acc:
0.9870 - val_loss: 0.0132 - val_soft_acc: 1.0000
Epoch 64/100
```

```
3/3 [==============================] - 0s 38ms/step - loss: 0.0137 - soft_acc:
0.9883 - val_loss: 0.0113 - val_soft_acc: 1.0000
Epoch 65/100
3/3 [==============================] - 0s 33ms/step - loss: 0.0138 - soft_acc:
0.9922 - val_loss: 0.0124 - val_soft_acc: 1.0000
Epoch 66/100
3/3 [==============================] - 0s 39ms/step - loss: 0.0135 - soft_acc:
0.9922 - val_loss: 0.0136 - val_soft_acc: 1.0000
Epoch 67/100
3/3 [==============================] - 0s 35ms/step - loss: 0.0136 - soft_acc:
0.9883 - val_loss: 0.0114 - val_soft_acc: 1.0000
Epoch 68/100
3/3 [==============================] - 0s 39ms/step - loss: 0.0141 - soft_acc:
0.9890 - val_loss: 0.0122 - val_soft_acc: 1.0000
Epoch 69/100
3/3 [==============================] - 0s 33ms/step - loss: 0.0136 - soft_acc:
0.9870 - val_loss: 0.0142 - val_soft_acc: 1.0000
Epoch 70/100
3/3 [==============================] - 0s 35ms/step - loss: 0.0142 - soft_acc:
0.9883 - val_loss: 0.0122 - val_soft_acc: 1.0000
Epoch 71/100
3/3 [==============================] - 0s 36ms/step - loss: 0.0142 - soft_acc:
0.9936 - val_loss: 0.0118 - val_soft_acc: 1.0000
Epoch 72/100
3/3 [==============================] - 0s 42ms/step - loss: 0.0133 - soft_acc:
0.9883 - val_loss: 0.0134 - val_soft_acc: 1.0000
Epoch 73/100
3/3 [==============================] - 0s 40ms/step - loss: 0.0139 - soft_acc:
0.9922 - val_loss: 0.0118 - val_soft_acc: 1.0000
Epoch 74/100
3/3 [==============================] - 0s 37ms/step - loss: 0.0140 - soft_acc:
0.9831 - val_loss: 0.0131 - val_soft_acc: 1.0000
Epoch 75/100
3/3 [==============================] - 0s 35ms/step - loss: 0.0140 - soft_acc:
0.9883 - val_loss: 0.0135 - val_soft_acc: 1.0000
Epoch 76/100
3/3 [==============================] - 0s 38ms/step - loss: 0.0130 - soft_acc:
0.9883 - val_loss: 0.0105 - val_soft_acc: 1.0000
Epoch 77/100
3/3 [==============================] - 0s 41ms/step - loss: 0.0137 - soft_acc:
0.9838 - val_loss: 0.0129 - val_soft_acc: 1.0000
Epoch 78/100
3/3 [==============================] - 0s 42ms/step - loss: 0.0135 - soft_acc:
0.9922 - val_loss: 0.0129 - val_soft_acc: 1.0000
Epoch 79/100
3/3 [==============================] - 0s 38ms/step - loss: 0.0138 - soft_acc:
0.9904 - val_loss: 0.0117 - val_soft_acc: 1.0000
Epoch 80/100
```

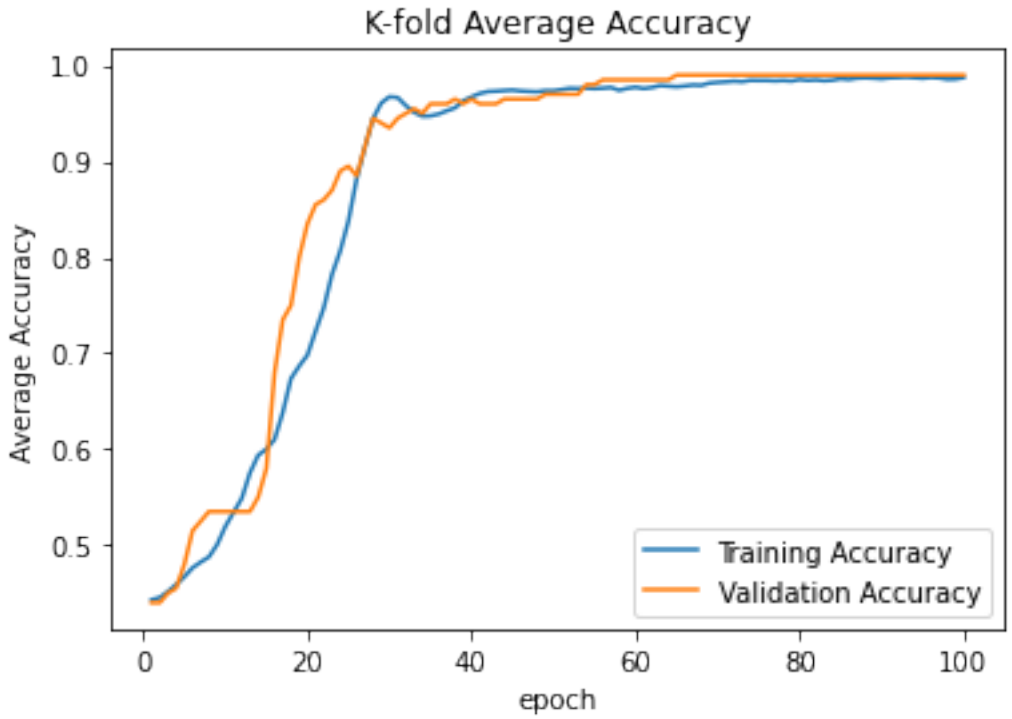
```
3/3 [==============================] - 0s 33ms/step - loss: 0.0136 - soft_acc:
0.9831 - val_loss: 0.0130 - val_soft_acc: 1.0000
Epoch 81/100
3/3 [==============================] - 0s 37ms/step - loss: 0.0128 - soft_acc:
0.9870 - val_loss: 0.0124 - val_soft_acc: 1.0000
Epoch 82/100
3/3 [==============================] - 0s 38ms/step - loss: 0.0139 - soft_acc:
0.9870 - val_loss: 0.0128 - val_soft_acc: 1.0000
Epoch 83/100
3/3 [==============================] - 0s 32ms/step - loss: 0.0133 - soft_acc:
0.9909 - val_loss: 0.0117 - val_soft_acc: 1.0000
Epoch 84/100
3/3 [==============================] - 0s 35ms/step - loss: 0.0130 - soft_acc:
0.9922 - val_loss: 0.0123 - val_soft_acc: 1.0000
Epoch 85/100
3/3 [==============================] - 0s 37ms/step - loss: 0.0136 - soft_acc:
0.9870 - val_loss: 0.0124 - val_soft_acc: 1.0000
Epoch 86/100
3/3 [==============================] - 0s 41ms/step - loss: 0.0138 - soft_acc:
0.9922 - val_loss: 0.0124 - val_soft_acc: 1.0000
Epoch 87/100
3/3 [==============================] - 0s 39ms/step - loss: 0.0134 - soft_acc:
0.9883 - val_loss: 0.0121 - val_soft_acc: 1.0000
Epoch 88/100
3/3 [==============================] - 0s 35ms/step - loss: 0.0126 - soft_acc:
0.9936 - val_loss: 0.0109 - val_soft_acc: 1.0000
Epoch 89/100
3/3 [==============================] - 0s 38ms/step - loss: 0.0132 - soft_acc:
0.9883 - val_loss: 0.0143 - val_soft_acc: 1.0000
Epoch 90/100
3/3 [==============================] - 0s 36ms/step - loss: 0.0132 - soft_acc:
0.9831 - val_loss: 0.0119 - val_soft_acc: 1.0000
Epoch 91/100
3/3 [==============================] - 0s 37ms/step - loss: 0.0132 - soft_acc:
0.9922 - val_loss: 0.0120 - val_soft_acc: 1.0000
Epoch 92/100
3/3 [==============================] - 0s 37ms/step - loss: 0.0130 - soft_acc:
0.9870 - val_loss: 0.0128 - val_soft_acc: 1.0000
Epoch 93/100
3/3 [==============================] - 0s 36ms/step - loss: 0.0126 - soft_acc:
0.9870 - val_loss: 0.0117 - val_soft_acc: 1.0000
Epoch 94/100
3/3 [==============================] - 0s 36ms/step - loss: 0.0122 - soft_acc:
0.9922 - val_loss: 0.0125 - val_soft_acc: 1.0000
Epoch 95/100
3/3 [==============================] - 0s 42ms/step - loss: 0.0130 - soft_acc:
0.9870 - val_loss: 0.0130 - val_soft_acc: 1.0000
Epoch 96/100
```

```
3/3 [==============================] - 0s 38ms/step - loss: 0.0133 - soft_acc:
0.9870 - val_loss: 0.0113 - val_soft_acc: 1.0000
Epoch 97/100
3/3 [==============================] - 0s 45ms/step - loss: 0.0134 - soft_acc:
0.9785 - val_loss: 0.0129 - val_soft_acc: 1.0000
Epoch 98/100
3/3 [==============================] - 0s 38ms/step - loss: 0.0132 - soft_acc:
0.9838 - val_loss: 0.0120 - val_soft_acc: 1.0000
Epoch 99/100
3/3 [==============================] - 0s 42ms/step - loss: 0.0129 - soft_acc:
0.9936 - val_loss: 0.0132 - val_soft_acc: 1.0000
Epoch 100/100
3/3 [==============================] - 0s 41ms/step - loss: 0.0128 - soft_acc:
0.9870 - val_loss: 0.0127 - val_soft_acc: 1.0000
3/3 [==============================] - 0s 0s/step - loss: 0.0127 - soft_acc:
0.9896
1/1 [==============================] - 0s 30ms/step - loss: 0.0127 - soft_acc:
1.0000
```

[31]:
```
plt.plot(range(1, len(average_RMSE_train) + 1), average_RMSE_train)
plt.plot(range(1, len(average_RMSE_valid) + 1), average_RMSE_valid)
plt.title('K-fold Average Loss')
plt.xlabel('Epochs')
plt.ylabel('Average Root mean squared error(RMSE)')
plt.legend(['train', 'validation'], loc='upper right')
plt.show()
```



[32]:
```
plt.plot(range(1, len(average_Soft_acc_train) + 1), average_Soft_acc_train)
plt.plot(range(1, len(average_Soft_acc_valid) + 1), average_Soft_acc_valid)
plt.title('K-fold Average Accuracy')
plt.ylabel('Average Accuracy')
plt.xlabel('epoch')
plt.legend(['Training Accuracy', 'Validation Accuracy'], loc='lower right')
plt.show()
```



[ ]: