```
import pandas as pd
from sklearn.model_selection import train_test_split

CSV_FILE = 'extract_coordinates.csv'
data = pd.read_csv(CSV_FILE)

print(data.head())

X = data.drop(columns=['Label']).values # 왼쪽 손목 발목 XY
y = data['Label'].values  # sit=0, stand=1

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.3, random_state=42, stratify=y)

print(X_train.shape, y_train.shape)
print(X_test.shape, y_test.shape)
```

```
   left_shoulder_X  left_shoulder_Y  left_wrist_X  left_wrist_Y  left_knee_X  \
0         0.284777         0.549288      0.463987      0.628845     0.539132
1         0.563711         0.547518      0.746427      0.561528     0.483818
2         0.678762         0.525664      0.721515      0.746737     0.775539
3         0.782518         0.464285      0.707022      0.575222     0.448376
4         0.287310         0.402283      0.453064      0.462743     0.411522

   left_knee_Y  Label
0     0.513473      0
1     0.713776      0
2     0.781426      0
3     0.522828      0
4     0.548255      0
(574, 6) (574,)
(246, 6) (246,)
```

```
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense, Dropout, BatchNormalization
from tensorflow.keras.optimizers import Adam

model = Sequential()
model.add(Dense(512, activation='relu', input_shape=(X_train.shape[1],)))
model.add(BatchNormalization())
model.add(Dropout(0.3))
model.add(Dense(256, activation='relu'))
model.add(BatchNormalization())
model.add(Dropout(0.3))
model.add(Dense(64, activation='relu'))
model.add(BatchNormalization())
model.add(Dropout(0.3))
model.add(Dense(32, activation='relu'))
model.add(BatchNormalization())
model.add(Dropout(0.3))
model.add(Dense(8, activation='relu'))
model.add(Dense(1, activation='sigmoid'))

model.compile(
    optimizer=Adam(learning_rate=0.001),
    loss='binary_crossentropy',
    metrics=['accuracy', 'precision']
)

model.summary()
```

```
/usr/local/lib/python3.10/dist-packages/keras/src/layers/core/dense.py:87: UserWarning: Do not pass an `input_shape`/`input_dim` argument to a la
  super().__init__(activity_regularizer=activity_regularizer, **kwargs)
```

Model: "sequential_12"

Layer (type)	Output Shape	Param #
dense_72 (Dense)	(None, 512)	3,584
batch_normalization_16 (BatchNormalization)	(None, 512)	2,048
dropout_48 (Dropout)	(None, 512)	0
dense_73 (Dense)	(None, 256)	131,328
batch_normalization_17 (BatchNormalization)	(None, 256)	1,024
dropout_49 (Dropout)	(None, 256)	0
dense_74 (Dense)	(None, 64)	16,448
batch_normalization_18 (BatchNormalization)	(None, 64)	256
dropout_50 (Dropout)	(None, 64)	0
dense_75 (Dense)	(None, 32)	2,080
batch_normalization_19 (BatchNormalization)	(None, 32)	128
dropout_51 (Dropout)	(None, 32)	0
dense_76 (Dense)	(None, 8)	264
dense_77 (Dense)	(None, 1)	9

Total params: 157,169 (613.94 KB)
Trainable params: 155,441 (607.19 KB)
Non-trainable params: 1,728 (6.75 KB)

```
history = model.fit(X_train, y_train, epochs=200, batch_size=32,
                    validation_split=0.2)
```

```
Epoch 1/200
15/15 ━━━━━━━━━━━━━━━━━━━━ 0s 12ms/step - accuracy: 0.5077 - loss: 0.9841 - precision: 0.6256 - val_accuracy: 0.4435 - val_loss: 0.7082 - val_pre
Epoch 2/200
15/15 ━━━━━━━━━━━━━━━━━━━━ 0s 8ms/step - accuracy: 0.5654 - loss: 0.8789 - precision: 0.7721 - val_accuracy: 0.4435 - val_loss: 0.7236 - val_prec
Epoch 3/200
15/15 ━━━━━━━━━━━━━━━━━━━━ 0s 8ms/step - accuracy: 0.5902 - loss: 0.7563 - precision: 0.6648 - val_accuracy: 0.4435 - val_loss: 0.7465 - val_prec
Epoch 4/200
15/15 ━━━━━━━━━━━━━━━━━━━━ 0s 7ms/step - accuracy: 0.6266 - loss: 0.7178 - precision: 0.6845 - val_accuracy: 0.4435 - val_loss: 0.8132 - val_prec
Epoch 5/200
15/15 ━━━━━━━━━━━━━━━━━━━━ 0s 8ms/step - accuracy: 0.6576 - loss: 0.6804 - precision: 0.7064 - val_accuracy: 0.4435 - val_loss: 0.8933 - val_prec
Epoch 6/200
15/15 ━━━━━━━━━━━━━━━━━━━━ 0s 7ms/step - accuracy: 0.6122 - loss: 0.7034 - precision: 0.6852 - val_accuracy: 0.4435 - val_loss: 0.9384 - val_prec
Epoch 7/200
15/15 ━━━━━━━━━━━━━━━━━━━━ 0s 6ms/step - accuracy: 0.6737 - loss: 0.5849 - precision: 0.6839 - val_accuracy: 0.4435 - val_loss: 0.9896 - val_prec
Epoch 8/200
15/15 ━━━━━━━━━━━━━━━━━━━━ 0s 5ms/step - accuracy: 0.6522 - loss: 0.6128 - precision: 0.6544 - val_accuracy: 0.4435 - val_loss: 1.0265 - val_prec
Epoch 9/200
15/15 ━━━━━━━━━━━━━━━━━━━━ 0s 5ms/step - accuracy: 0.6708 - loss: 0.6043 - precision: 0.7335 - val_accuracy: 0.4435 - val_loss: 1.0682 - val_prec
Epoch 10/200
15/15 ━━━━━━━━━━━━━━━━━━━━ 0s 5ms/step - accuracy: 0.6695 - loss: 0.6103 - precision: 0.6786 - val_accuracy: 0.4435 - val_loss: 1.0986 - val_prec
Epoch 11/200
15/15 ━━━━━━━━━━━━━━━━━━━━ 0s 6ms/step - accuracy: 0.7158 - loss: 0.5893 - precision: 0.7242 - val_accuracy: 0.4435 - val_loss: 1.1318 - val_prec
Epoch 12/200
15/15 ━━━━━━━━━━━━━━━━━━━━ 0s 5ms/step - accuracy: 0.6869 - loss: 0.5646 - precision: 0.7106 - val_accuracy: 0.4435 - val_loss: 1.1690 - val_prec
Epoch 13/200
15/15 ━━━━━━━━━━━━━━━━━━━━ 0s 6ms/step - accuracy: 0.6789 - loss: 0.5867 - precision: 0.6746 - val_accuracy: 0.4435 - val_loss: 1.2064 - val_prec
Epoch 14/200
15/15 ━━━━━━━━━━━━━━━━━━━━ 0s 5ms/step - accuracy: 0.7343 - loss: 0.5601 - precision: 0.7297 - val_accuracy: 0.4435 - val_loss: 1.2464 - val_prec
Epoch 15/200
15/15 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - accuracy: 0.7181 - loss: 0.5596 - precision: 0.7030 - val_accuracy: 0.4435 - val_loss: 1.2591 - val_prec
Epoch 16/200
15/15 ━━━━━━━━━━━━━━━━━━━━ 0s 6ms/step - accuracy: 0.7041 - loss: 0.5770 - precision: 0.6874 - val_accuracy: 0.4435 - val_loss: 1.2723 - val_prec
Epoch 17/200
15/15 ━━━━━━━━━━━━━━━━━━━━ 0s 5ms/step - accuracy: 0.7065 - loss: 0.5666 - precision: 0.7082 - val_accuracy: 0.4435 - val_loss: 1.2765 - val_prec
Epoch 18/200
15/15 ━━━━━━━━━━━━━━━━━━━━ 0s 6ms/step - accuracy: 0.7429 - loss: 0.5398 - precision: 0.7288 - val_accuracy: 0.4435 - val_loss: 1.2811 - val_prec
Epoch 19/200
15/15 ━━━━━━━━━━━━━━━━━━━━ 0s 6ms/step - accuracy: 0.6926 - loss: 0.5711 - precision: 0.6653 - val_accuracy: 0.4435 - val_loss: 1.2780 - val_prec
Epoch 20/200
15/15 ━━━━━━━━━━━━━━━━━━━━ 0s 5ms/step - accuracy: 0.6990 - loss: 0.5507 - precision: 0.7286 - val_accuracy: 0.4435 - val_loss: 1.2842 - val_prec
Epoch 21/200
15/15 ━━━━━━━━━━━━━━━━━━━━ 0s 5ms/step - accuracy: 0.7169 - loss: 0.5820 - precision: 0.6974 - val_accuracy: 0.4435 - val_loss: 1.2540 - val_prec
Epoch 22/200
15/15 ━━━━━━━━━━━━━━━━━━━━ 0s 5ms/step - accuracy: 0.7279 - loss: 0.5616 - precision: 0.7311 - val_accuracy: 0.4435 - val_loss: 1.2051 - val_prec
Epoch 23/200
```

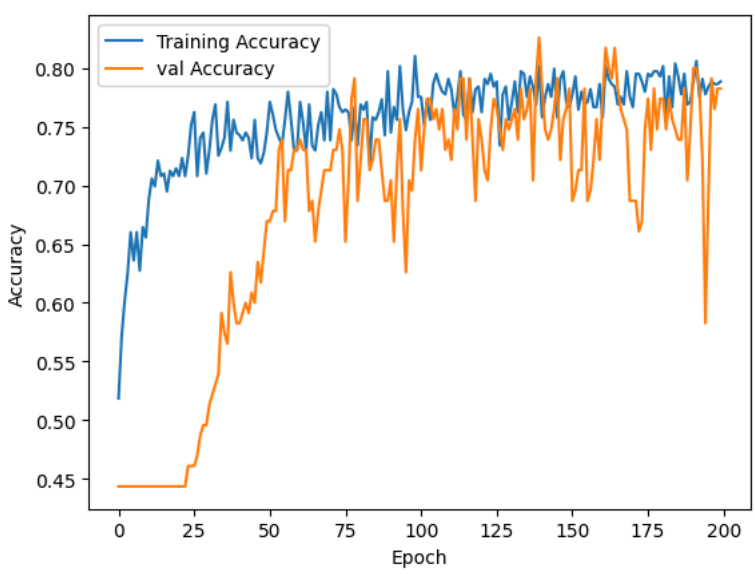
```
15/15 ━━━━━━━━━━━━━━━━━━━━ 0s 5ms/step - accuracy: 0.6964 - loss: 0.5852 - precision: 0.6669 - val_accuracy: 0.4435 - val_loss: 1.1557 - val_pre
Epoch 24/200
15/15 ━━━━━━━━━━━━━━━━━━━━ 0s 4ms/step - accuracy: 0.7280 - loss: 0.5443 - precision: 0.7181 - val_accuracy: 0.4609 - val_loss: 1.1596 - val_pre
Epoch 25/200
15/15 ━━━━━━━━━━━━━━━━━━━━ 0s 5ms/step - accuracy: 0.7629 - loss: 0.5147 - precision: 0.7353 - val_accuracy: 0.4609 - val_loss: 1.1461 - val_pre
Epoch 26/200
15/15 ━━━━━━━━━━━━━━━━━━━━ 0s 6ms/step - accuracy: 0.7921 - loss: 0.4699 - precision: 0.7667 - val_accuracy: 0.4609 - val_loss: 1.1585 - val_pre
Epoch 27/200
15/15 ━━━━━━━━━━━━━━━━━━━━ 0s 6ms/step - accuracy: 0.7195 - loss: 0.5172 - precision: 0.7233 - val_accuracy: 0.4696 - val_loss: 1.1646 - val_pre
Epoch 28/200
15/15 ━━━━━━━━━━━━━━━━━━━━ 0s 5ms/step - accuracy: 0.7413 - loss: 0.5271 - precision: 0.7285 - val_accuracy: 0.4870 - val_loss: 1.1404 - val_pre
Epoch 29/200
15/15 ━━━━━━━━━━━━━━━━━━━━ 0s 5ms/step - accuracy: 0.7519 - loss: 0.5165 - precision: 0.7268 - val_accuracy: 0.4957 - val_loss: 1.1339 - val_pre
```

```
test_loss, test_accuracy, test_presicion = model.evaluate(X_test, y_test)
print(f"Test Accuracy: {test_accuracy * 100:.2f}%")
```

```
8/8 ━━━━━━━━━━━━━━━━━━━━ 0s 2ms/step - accuracy: 0.7802 - loss: 0.5400 - precision: 0.7208
Test Accuracy: 80.49%
```

```
import matplotlib.pyplot as plt

# 정확도 시각화
plt.plot(history.history['accuracy'], label='Training Accuracy')
plt.plot(history.history['val_accuracy'], label='val Accuracy')
plt.xlabel('Epoch')
plt.ylabel('Accuracy')
plt.legend()
plt.show()
```



코딩을 시작하거나 AI로 코드를 생성하세요.