```python
import numpy as np
import pandas as pd
from sklearn.preprocessing import StandardScaler


import tensorflow as tf
from tensorflow import keras
from keras.optimizers import Adam, SGD, Adagrad
from tensorflow.keras import layers
from tensorflow.keras import layers


from sklearn.model_selection import train_test_split
from imblearn.over_sampling import RandomOverSampler

df = pd.read_csv("./diabetes.csv")
df.head()
```

```
   Pregnancies  Glucose  BloodPressure  SkinThickness  Insulin
BMI  \
0            6      148             72             35        0  33.6

1            1       85             66             29        0  26.6

2            8      183             64              0        0  23.3

3            1       89             66             23       94  28.1

4            0      137             40             35      168  43.1


   DiabetesPedigreeFunction  Age  Outcome
0                     0.627   50        1
1                     0.351   31        0
2                     0.672   32        1
3                     0.167   21        0
4                     2.288   33        1
```

```python
df.shape
```

```
(768, 9)
```

```python
cols = df.columns
cols = list(cols)
print(cols)
```

```
['Pregnancies', 'Glucose', 'BloodPressure', 'SkinThickness',
 'Insulin', 'BMI', 'DiabetesPedigreeFunction', 'Age', 'Outcome']
```

```python
df.corr()
```

```
                              Pregnancies    Glucose  BloodPressure
SkinThickness   \
Pregnancies                      1.000000   0.129459       0.141282      -
0.081672
Glucose                          0.129459   1.000000       0.152590
0.057328
BloodPressure                    0.141282   0.152590       1.000000
0.207371
SkinThickness                   -0.081672   0.057328       0.207371
1.000000
Insulin                         -0.073535   0.331357       0.088933
0.436783
BMI                              0.017683   0.221071       0.281805
0.392573
DiabetesPedigreeFunction        -0.033523   0.137337       0.041265
0.183928
Age                              0.544341   0.263514       0.239528      -
0.113970
Outcome                          0.221898   0.466581       0.065068
0.074752

                            Insulin       BMI  DiabetesPedigreeFunction
\
Pregnancies                -0.073535  0.017683                 -0.033523

Glucose                     0.331357  0.221071                  0.137337

BloodPressure               0.088933  0.281805                  0.041265

SkinThickness               0.436783  0.392573                  0.183928

Insulin                     1.000000  0.197859                  0.185071

BMI                         0.197859  1.000000                  0.140647

DiabetesPedigreeFunction    0.185071  0.140647                  1.000000

Age                        -0.042163  0.036242                  0.033561

Outcome                     0.130548  0.292695                  0.173844


                              Age   Outcome
Pregnancies              0.544341  0.221898
Glucose                  0.263514  0.466581
BloodPressure            0.239528  0.065068
SkinThickness           -0.113970  0.074752
Insulin                 -0.042163  0.130548
BMI                      0.036242  0.292695
```

```
DiabetesPedigreeFunction   0.033561   0.173844
Age                        1.000000   0.238356
Outcome                    0.238356   1.000000
```

```python
X = df[['Pregnancies','Glucose','BMI','Age']]
```

```python
X.head()
```

```
   Pregnancies  Glucose   BMI   Age
0            6      148  33.6    50
1            1       85  26.6    31
2            8      183  23.3    32
3            1       89  28.1    21
4            0      137  43.1    33
```

```python
y = df['Outcome']
y.head()
```

```
0    1
1    0
2    1
3    0
4    1
Name: Outcome, dtype: int64
```

```python
X_train, X_test, y_train, y_test = train_test_split(X, y,
test_size=0.18, random_state=42)
```

```python
sm = RandomOverSampler(sampling_strategy='minority', random_state=42)
X_train, y_train = sm.fit_resample(X_train, y_train)
```

```python
X_train.shape
```

```
(826, 4)
```

```python
scaler = StandardScaler()
```

```python
X_train = scaler.fit_transform(X_train)
X_test = scaler.transform(X_test)
```

```python
X_test[0]
```

```
array([ 0.5764486 , -0.80159242,  0.15402396,  0.77723935])
```

```python
model = keras.Sequential()
model.add(layers.Dense(100, input_shape=(4,),
kernel_initializer='normal', activation='tanh'))
model.add(layers.Dropout(.5, input_shape=(2,)))
model.add(layers.Dense(300, kernel_initializer='normal',
activation='relu'))
model.add(layers.Dropout(.1, input_shape=(2,)))
model.add(layers.Dense(1, activation='sigmoid'))
```

```
model.summary()

Model: "sequential"
_____
 Layer (type)                Output Shape              Param #
=================================================================
 dense (Dense)               (None, 100)               500

 dropout (Dropout)           (None, 100)               0

 dense_1 (Dense)             (None, 300)               30300

 dropout_1 (Dropout)         (None, 300)               0

 dense_2 (Dense)             (None, 1)                 301

=================================================================
Total params: 31,101
Trainable params: 31,101
Non-trainable params: 0
_____

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

model.fit(X_train, y_train, epochs=250, batch_size=32,  verbose=2,
validation_data=(X_test, y_test))

Epoch 1/250
26/26 - 1s - loss: 0.5824 - accuracy: 0.7155 - val_loss: 0.5527 -
val_accuracy: 0.7194 - 1s/epoch - 44ms/step
Epoch 2/250
26/26 - 0s - loss: 0.5171 - accuracy: 0.7324 - val_loss: 0.5698 -
val_accuracy: 0.6978 - 90ms/epoch - 3ms/step
Epoch 3/250
26/26 - 0s - loss: 0.5090 - accuracy: 0.7421 - val_loss: 0.5729 -
val_accuracy: 0.6978 - 91ms/epoch - 3ms/step
Epoch 4/250
26/26 - 0s - loss: 0.5055 - accuracy: 0.7312 - val_loss: 0.5644 -
val_accuracy: 0.7050 - 92ms/epoch - 4ms/step
Epoch 5/250
26/26 - 0s - loss: 0.5038 - accuracy: 0.7349 - val_loss: 0.5616 -
val_accuracy: 0.7050 - 88ms/epoch - 3ms/step
Epoch 6/250
26/26 - 0s - loss: 0.5028 - accuracy: 0.7337 - val_loss: 0.5560 -
val_accuracy: 0.7050 - 91ms/epoch - 3ms/step
Epoch 7/250
26/26 - 0s - loss: 0.5065 - accuracy: 0.7361 - val_loss: 0.5682 -
val_accuracy: 0.7050 - 92ms/epoch - 4ms/step
Epoch 8/250
26/26 - 0s - loss: 0.4974 - accuracy: 0.7373 - val_loss: 0.5653 -
```

```
val_accuracy: 0.6978 - 94ms/epoch - 4ms/step
Epoch 9/250
26/26 - 0s - loss: 0.4996 - accuracy: 0.7349 - val_loss: 0.5682 -
val_accuracy: 0.7050 - 90ms/epoch - 3ms/step
Epoch 10/250
26/26 - 0s - loss: 0.4975 - accuracy: 0.7361 - val_loss: 0.5544 -
val_accuracy: 0.7122 - 87ms/epoch - 3ms/step
Epoch 11/250
26/26 - 0s - loss: 0.5018 - accuracy: 0.7421 - val_loss: 0.5624 -
val_accuracy: 0.7266 - 86ms/epoch - 3ms/step
Epoch 12/250
26/26 - 0s - loss: 0.5049 - accuracy: 0.7361 - val_loss: 0.5611 -
val_accuracy: 0.7050 - 90ms/epoch - 3ms/step
Epoch 13/250
26/26 - 0s - loss: 0.5008 - accuracy: 0.7312 - val_loss: 0.5541 -
val_accuracy: 0.7050 - 99ms/epoch - 4ms/step
Epoch 14/250
26/26 - 0s - loss: 0.4991 - accuracy: 0.7458 - val_loss: 0.5676 -
val_accuracy: 0.7122 - 86ms/epoch - 3ms/step
Epoch 15/250
26/26 - 0s - loss: 0.4926 - accuracy: 0.7312 - val_loss: 0.5594 -
val_accuracy: 0.7194 - 89ms/epoch - 3ms/step
Epoch 16/250
26/26 - 0s - loss: 0.4962 - accuracy: 0.7324 - val_loss: 0.5591 -
val_accuracy: 0.7266 - 87ms/epoch - 3ms/step
Epoch 17/250
26/26 - 0s - loss: 0.5016 - accuracy: 0.7421 - val_loss: 0.5655 -
val_accuracy: 0.7122 - 92ms/epoch - 4ms/step
Epoch 18/250
26/26 - 0s - loss: 0.4916 - accuracy: 0.7433 - val_loss: 0.5593 -
val_accuracy: 0.7266 - 90ms/epoch - 3ms/step
Epoch 19/250
26/26 - 0s - loss: 0.4955 - accuracy: 0.7409 - val_loss: 0.5574 -
val_accuracy: 0.7410 - 115ms/epoch - 4ms/step
Epoch 20/250
26/26 - 0s - loss: 0.4826 - accuracy: 0.7542 - val_loss: 0.5613 -
val_accuracy: 0.7338 - 89ms/epoch - 3ms/step
Epoch 21/250
26/26 - 0s - loss: 0.4905 - accuracy: 0.7433 - val_loss: 0.5700 -
val_accuracy: 0.7338 - 89ms/epoch - 3ms/step
Epoch 22/250
26/26 - 0s - loss: 0.4965 - accuracy: 0.7385 - val_loss: 0.5736 -
val_accuracy: 0.7410 - 87ms/epoch - 3ms/step
Epoch 23/250
26/26 - 0s - loss: 0.4904 - accuracy: 0.7530 - val_loss: 0.5648 -
val_accuracy: 0.7338 - 87ms/epoch - 3ms/step
Epoch 24/250
26/26 - 0s - loss: 0.4888 - accuracy: 0.7470 - val_loss: 0.5641 -
val_accuracy: 0.7410 - 89ms/epoch - 3ms/step
Epoch 25/250
```

```
26/26 - 0s - loss: 0.4950 - accuracy: 0.7409 - val_loss: 0.5780 -
val_accuracy: 0.7338 - 91ms/epoch - 4ms/step
Epoch 26/250
26/26 - 0s - loss: 0.4924 - accuracy: 0.7446 - val_loss: 0.5657 -
val_accuracy: 0.7410 - 91ms/epoch - 3ms/step
Epoch 27/250
26/26 - 0s - loss: 0.4878 - accuracy: 0.7433 - val_loss: 0.5710 -
val_accuracy: 0.7410 - 88ms/epoch - 3ms/step
Epoch 28/250
26/26 - 0s - loss: 0.4863 - accuracy: 0.7385 - val_loss: 0.5669 -
val_accuracy: 0.7410 - 89ms/epoch - 3ms/step
Epoch 29/250
26/26 - 0s - loss: 0.4854 - accuracy: 0.7421 - val_loss: 0.5701 -
val_accuracy: 0.7266 - 90ms/epoch - 3ms/step
Epoch 30/250
26/26 - 0s - loss: 0.4908 - accuracy: 0.7433 - val_loss: 0.5800 -
val_accuracy: 0.7266 - 91ms/epoch - 4ms/step
Epoch 31/250
26/26 - 0s - loss: 0.4902 - accuracy: 0.7506 - val_loss: 0.5599 -
val_accuracy: 0.7554 - 91ms/epoch - 3ms/step
Epoch 32/250
26/26 - 0s - loss: 0.4933 - accuracy: 0.7385 - val_loss: 0.5555 -
val_accuracy: 0.7482 - 88ms/epoch - 3ms/step
Epoch 33/250
26/26 - 0s - loss: 0.4817 - accuracy: 0.7433 - val_loss: 0.5597 -
val_accuracy: 0.7410 - 90ms/epoch - 3ms/step
Epoch 34/250
26/26 - 0s - loss: 0.4885 - accuracy: 0.7373 - val_loss: 0.5585 -
val_accuracy: 0.7554 - 90ms/epoch - 3ms/step
Epoch 35/250
26/26 - 0s - loss: 0.4905 - accuracy: 0.7409 - val_loss: 0.5800 -
val_accuracy: 0.7410 - 91ms/epoch - 3ms/step
Epoch 36/250
26/26 - 0s - loss: 0.4829 - accuracy: 0.7530 - val_loss: 0.5527 -
val_accuracy: 0.7482 - 87ms/epoch - 3ms/step
Epoch 37/250
26/26 - 0s - loss: 0.4843 - accuracy: 0.7446 - val_loss: 0.5667 -
val_accuracy: 0.7266 - 93ms/epoch - 4ms/step
Epoch 38/250
26/26 - 0s - loss: 0.4871 - accuracy: 0.7518 - val_loss: 0.5576 -
val_accuracy: 0.7482 - 89ms/epoch - 3ms/step
Epoch 39/250
26/26 - 0s - loss: 0.4839 - accuracy: 0.7458 - val_loss: 0.5568 -
val_accuracy: 0.7482 - 90ms/epoch - 3ms/step
Epoch 40/250
26/26 - 0s - loss: 0.4783 - accuracy: 0.7530 - val_loss: 0.5678 -
val_accuracy: 0.7554 - 92ms/epoch - 4ms/step
Epoch 41/250
26/26 - 0s - loss: 0.4825 - accuracy: 0.7397 - val_loss: 0.5563 -
val_accuracy: 0.7554 - 90ms/epoch - 3ms/step
```

```
Epoch 42/250
26/26 - 0s - loss: 0.4853 - accuracy: 0.7433 - val_loss: 0.5515 -
val_accuracy: 0.7482 - 89ms/epoch - 3ms/step
Epoch 43/250
26/26 - 0s - loss: 0.4845 - accuracy: 0.7518 - val_loss: 0.5567 -
val_accuracy: 0.7482 - 90ms/epoch - 3ms/step
Epoch 44/250
26/26 - 0s - loss: 0.4809 - accuracy: 0.7542 - val_loss: 0.5635 -
val_accuracy: 0.7482 - 92ms/epoch - 4ms/step
Epoch 45/250
26/26 - 0s - loss: 0.4819 - accuracy: 0.7506 - val_loss: 0.5723 -
val_accuracy: 0.7482 - 90ms/epoch - 3ms/step
Epoch 46/250
26/26 - 0s - loss: 0.4778 - accuracy: 0.7542 - val_loss: 0.5694 -
val_accuracy: 0.7482 - 90ms/epoch - 3ms/step
Epoch 47/250
26/26 - 0s - loss: 0.4808 - accuracy: 0.7458 - val_loss: 0.5757 -
val_accuracy: 0.7410 - 90ms/epoch - 3ms/step
Epoch 48/250
26/26 - 0s - loss: 0.4813 - accuracy: 0.7446 - val_loss: 0.5644 -
val_accuracy: 0.7626 - 89ms/epoch - 3ms/step
Epoch 49/250
26/26 - 0s - loss: 0.4762 - accuracy: 0.7615 - val_loss: 0.5642 -
val_accuracy: 0.7482 - 90ms/epoch - 3ms/step
Epoch 50/250
26/26 - 0s - loss: 0.4807 - accuracy: 0.7458 - val_loss: 0.5621 -
val_accuracy: 0.7482 - 89ms/epoch - 3ms/step
Epoch 51/250
26/26 - 0s - loss: 0.4785 - accuracy: 0.7433 - val_loss: 0.5626 -
val_accuracy: 0.7410 - 89ms/epoch - 3ms/step
Epoch 52/250
26/26 - 0s - loss: 0.4775 - accuracy: 0.7567 - val_loss: 0.5635 -
val_accuracy: 0.7482 - 88ms/epoch - 3ms/step
Epoch 53/250
26/26 - 0s - loss: 0.4699 - accuracy: 0.7554 - val_loss: 0.5599 -
val_accuracy: 0.7482 - 88ms/epoch - 3ms/step
Epoch 54/250
26/26 - 0s - loss: 0.4815 - accuracy: 0.7603 - val_loss: 0.5587 -
val_accuracy: 0.7626 - 89ms/epoch - 3ms/step
Epoch 55/250
26/26 - 0s - loss: 0.4794 - accuracy: 0.7446 - val_loss: 0.5524 -
val_accuracy: 0.7482 - 89ms/epoch - 3ms/step
Epoch 56/250
26/26 - 0s - loss: 0.4777 - accuracy: 0.7518 - val_loss: 0.5748 -
val_accuracy: 0.7410 - 84ms/epoch - 3ms/step
Epoch 57/250
26/26 - 0s - loss: 0.4706 - accuracy: 0.7676 - val_loss: 0.5592 -
val_accuracy: 0.7626 - 88ms/epoch - 3ms/step
Epoch 58/250
26/26 - 0s - loss: 0.4749 - accuracy: 0.7591 - val_loss: 0.5559 -
```

```
val_accuracy: 0.7554 - 89ms/epoch - 3ms/step
Epoch 59/250
26/26 - 0s - loss: 0.4827 - accuracy: 0.7542 - val_loss: 0.5682 -
val_accuracy: 0.7410 - 89ms/epoch - 3ms/step
Epoch 60/250
26/26 - 0s - loss: 0.4714 - accuracy: 0.7639 - val_loss: 0.5611 -
val_accuracy: 0.7482 - 86ms/epoch - 3ms/step
Epoch 61/250
26/26 - 0s - loss: 0.4717 - accuracy: 0.7603 - val_loss: 0.5562 -
val_accuracy: 0.7554 - 89ms/epoch - 3ms/step
Epoch 62/250
26/26 - 0s - loss: 0.4844 - accuracy: 0.7518 - val_loss: 0.5460 -
val_accuracy: 0.7482 - 95ms/epoch - 4ms/step
Epoch 63/250
26/26 - 0s - loss: 0.4735 - accuracy: 0.7651 - val_loss: 0.5483 -
val_accuracy: 0.7554 - 87ms/epoch - 3ms/step
Epoch 64/250
26/26 - 0s - loss: 0.4686 - accuracy: 0.7688 - val_loss: 0.5439 -
val_accuracy: 0.7482 - 88ms/epoch - 3ms/step
Epoch 65/250
26/26 - 0s - loss: 0.4714 - accuracy: 0.7712 - val_loss: 0.5630 -
val_accuracy: 0.7482 - 88ms/epoch - 3ms/step
Epoch 66/250
26/26 - 0s - loss: 0.4688 - accuracy: 0.7482 - val_loss: 0.5582 -
val_accuracy: 0.7482 - 90ms/epoch - 3ms/step
Epoch 67/250
26/26 - 0s - loss: 0.4743 - accuracy: 0.7591 - val_loss: 0.5622 -
val_accuracy: 0.7410 - 89ms/epoch - 3ms/step
Epoch 68/250
26/26 - 0s - loss: 0.4676 - accuracy: 0.7579 - val_loss: 0.5481 -
val_accuracy: 0.7482 - 90ms/epoch - 3ms/step
Epoch 69/250
26/26 - 0s - loss: 0.4812 - accuracy: 0.7615 - val_loss: 0.5712 -
val_accuracy: 0.7338 - 84ms/epoch - 3ms/step
Epoch 70/250
26/26 - 0s - loss: 0.4676 - accuracy: 0.7663 - val_loss: 0.5566 -
val_accuracy: 0.7482 - 90ms/epoch - 3ms/step
Epoch 71/250
26/26 - 0s - loss: 0.4799 - accuracy: 0.7591 - val_loss: 0.5396 -
val_accuracy: 0.7482 - 89ms/epoch - 3ms/step
Epoch 72/250
26/26 - 0s - loss: 0.4723 - accuracy: 0.7736 - val_loss: 0.5653 -
val_accuracy: 0.7482 - 90ms/epoch - 3ms/step
Epoch 73/250
26/26 - 0s - loss: 0.4702 - accuracy: 0.7676 - val_loss: 0.5626 -
val_accuracy: 0.7482 - 91ms/epoch - 4ms/step
Epoch 74/250
26/26 - 0s - loss: 0.4736 - accuracy: 0.7615 - val_loss: 0.5549 -
val_accuracy: 0.7410 - 89ms/epoch - 3ms/step
Epoch 75/250
```

```
26/26 - 0s - loss: 0.4797 - accuracy: 0.7591 - val_loss: 0.5527 -
val_accuracy: 0.7410 - 89ms/epoch - 3ms/step
Epoch 76/250
26/26 - 0s - loss: 0.4684 - accuracy: 0.7688 - val_loss: 0.5697 -
val_accuracy: 0.7410 - 91ms/epoch - 3ms/step
Epoch 77/250
26/26 - 0s - loss: 0.4783 - accuracy: 0.7676 - val_loss: 0.5588 -
val_accuracy: 0.7554 - 91ms/epoch - 4ms/step
Epoch 78/250
26/26 - 0s - loss: 0.4666 - accuracy: 0.7712 - val_loss: 0.5629 -
val_accuracy: 0.7554 - 93ms/epoch - 4ms/step
Epoch 79/250
26/26 - 0s - loss: 0.4672 - accuracy: 0.7724 - val_loss: 0.5610 -
val_accuracy: 0.7554 - 91ms/epoch - 4ms/step
Epoch 80/250
26/26 - 0s - loss: 0.4784 - accuracy: 0.7554 - val_loss: 0.5410 -
val_accuracy: 0.7554 - 120ms/epoch - 5ms/step
Epoch 81/250
26/26 - 0s - loss: 0.4657 - accuracy: 0.7809 - val_loss: 0.5696 -
val_accuracy: 0.7410 - 90ms/epoch - 3ms/step
Epoch 82/250
26/26 - 0s - loss: 0.4677 - accuracy: 0.7676 - val_loss: 0.5512 -
val_accuracy: 0.7482 - 85ms/epoch - 3ms/step
Epoch 83/250
26/26 - 0s - loss: 0.4720 - accuracy: 0.7712 - val_loss: 0.5608 -
val_accuracy: 0.7554 - 91ms/epoch - 3ms/step
Epoch 84/250
26/26 - 0s - loss: 0.4699 - accuracy: 0.7615 - val_loss: 0.5606 -
val_accuracy: 0.7482 - 90ms/epoch - 3ms/step
Epoch 85/250
26/26 - 0s - loss: 0.4671 - accuracy: 0.7736 - val_loss: 0.5474 -
val_accuracy: 0.7554 - 87ms/epoch - 3ms/step
Epoch 86/250
26/26 - 0s - loss: 0.4686 - accuracy: 0.7639 - val_loss: 0.5521 -
val_accuracy: 0.7554 - 90ms/epoch - 3ms/step
Epoch 87/250
26/26 - 0s - loss: 0.4668 - accuracy: 0.7603 - val_loss: 0.5611 -
val_accuracy: 0.7338 - 90ms/epoch - 3ms/step
Epoch 88/250
26/26 - 0s - loss: 0.4683 - accuracy: 0.7663 - val_loss: 0.5291 -
val_accuracy: 0.7410 - 90ms/epoch - 3ms/step
Epoch 89/250
26/26 - 0s - loss: 0.4722 - accuracy: 0.7579 - val_loss: 0.5556 -
val_accuracy: 0.7482 - 90ms/epoch - 3ms/step
Epoch 90/250
26/26 - 0s - loss: 0.4680 - accuracy: 0.7736 - val_loss: 0.5435 -
val_accuracy: 0.7554 - 90ms/epoch - 3ms/step
Epoch 91/250
26/26 - 0s - loss: 0.4623 - accuracy: 0.7627 - val_loss: 0.5523 -
val_accuracy: 0.7482 - 90ms/epoch - 3ms/step
```

```
Epoch 92/250
26/26 - 0s - loss: 0.4619 - accuracy: 0.7797 - val_loss: 0.5399 -
val_accuracy: 0.7482 - 91ms/epoch - 4ms/step
Epoch 93/250
26/26 - 0s - loss: 0.4712 - accuracy: 0.7615 - val_loss: 0.5559 -
val_accuracy: 0.7482 - 90ms/epoch - 3ms/step
Epoch 94/250
26/26 - 0s - loss: 0.4715 - accuracy: 0.7615 - val_loss: 0.5454 -
val_accuracy: 0.7410 - 90ms/epoch - 3ms/step
Epoch 95/250
26/26 - 0s - loss: 0.4600 - accuracy: 0.7663 - val_loss: 0.5324 -
val_accuracy: 0.7338 - 92ms/epoch - 4ms/step
Epoch 96/250
26/26 - 0s - loss: 0.4726 - accuracy: 0.7506 - val_loss: 0.5557 -
val_accuracy: 0.7482 - 96ms/epoch - 4ms/step
Epoch 97/250
26/26 - 0s - loss: 0.4631 - accuracy: 0.7809 - val_loss: 0.5563 -
val_accuracy: 0.7410 - 99ms/epoch - 4ms/step
Epoch 98/250
26/26 - 0s - loss: 0.4596 - accuracy: 0.7881 - val_loss: 0.5376 -
val_accuracy: 0.7410 - 109ms/epoch - 4ms/step
Epoch 99/250
26/26 - 0s - loss: 0.4648 - accuracy: 0.7688 - val_loss: 0.5475 -
val_accuracy: 0.7410 - 89ms/epoch - 3ms/step
Epoch 100/250
26/26 - 0s - loss: 0.4554 - accuracy: 0.7833 - val_loss: 0.5353 -
val_accuracy: 0.7338 - 87ms/epoch - 3ms/step
Epoch 101/250
26/26 - 0s - loss: 0.4618 - accuracy: 0.7797 - val_loss: 0.5751 -
val_accuracy: 0.7410 - 87ms/epoch - 3ms/step
Epoch 102/250
26/26 - 0s - loss: 0.4719 - accuracy: 0.7615 - val_loss: 0.5458 -
val_accuracy: 0.7338 - 87ms/epoch - 3ms/step
Epoch 103/250
26/26 - 0s - loss: 0.4646 - accuracy: 0.7724 - val_loss: 0.5324 -
val_accuracy: 0.7410 - 89ms/epoch - 3ms/step
Epoch 104/250
26/26 - 0s - loss: 0.4568 - accuracy: 0.7663 - val_loss: 0.5439 -
val_accuracy: 0.7410 - 89ms/epoch - 3ms/step
Epoch 105/250
26/26 - 0s - loss: 0.4651 - accuracy: 0.7724 - val_loss: 0.5325 -
val_accuracy: 0.7338 - 92ms/epoch - 4ms/step
Epoch 106/250
26/26 - 0s - loss: 0.4676 - accuracy: 0.7748 - val_loss: 0.5384 -
val_accuracy: 0.7410 - 89ms/epoch - 3ms/step
Epoch 107/250
26/26 - 0s - loss: 0.4637 - accuracy: 0.7615 - val_loss: 0.5353 -
val_accuracy: 0.7266 - 92ms/epoch - 4ms/step
Epoch 108/250
26/26 - 0s - loss: 0.4722 - accuracy: 0.7676 - val_loss: 0.5390 -
```

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val_accuracy: 0.7482 - 89ms/epoch - 3ms/step
Epoch 109/250
26/26 - 0s - loss: 0.4628 - accuracy: 0.7542 - val_loss: 0.5325 -
val_accuracy: 0.7482 - 92ms/epoch - 4ms/step
Epoch 110/250
26/26 - 0s - loss: 0.4610 - accuracy: 0.7724 - val_loss: 0.5455 -
val_accuracy: 0.7410 - 84ms/epoch - 3ms/step
Epoch 111/250
26/26 - 0s - loss: 0.4505 - accuracy: 0.7845 - val_loss: 0.5377 -
val_accuracy: 0.7410 - 90ms/epoch - 3ms/step
Epoch 112/250
26/26 - 0s - loss: 0.4524 - accuracy: 0.7785 - val_loss: 0.5306 -
val_accuracy: 0.7338 - 87ms/epoch - 3ms/step
Epoch 113/250
26/26 - 0s - loss: 0.4631 - accuracy: 0.7663 - val_loss: 0.5568 -
val_accuracy: 0.7338 - 89ms/epoch - 3ms/step
Epoch 114/250
26/26 - 0s - loss: 0.4562 - accuracy: 0.7809 - val_loss: 0.5456 -
val_accuracy: 0.7266 - 89ms/epoch - 3ms/step
Epoch 115/250
26/26 - 0s - loss: 0.4653 - accuracy: 0.7821 - val_loss: 0.5318 -
val_accuracy: 0.7266 - 88ms/epoch - 3ms/step
Epoch 116/250
26/26 - 0s - loss: 0.4470 - accuracy: 0.7748 - val_loss: 0.5380 -
val_accuracy: 0.7266 - 91ms/epoch - 4ms/step
Epoch 117/250
26/26 - 0s - loss: 0.4627 - accuracy: 0.7554 - val_loss: 0.5384 -
val_accuracy: 0.7266 - 90ms/epoch - 3ms/step
Epoch 118/250
26/26 - 0s - loss: 0.4535 - accuracy: 0.7809 - val_loss: 0.5322 -
val_accuracy: 0.7410 - 123ms/epoch - 5ms/step
Epoch 119/250
26/26 - 0s - loss: 0.4530 - accuracy: 0.7772 - val_loss: 0.5456 -
val_accuracy: 0.7410 - 88ms/epoch - 3ms/step
Epoch 120/250
26/26 - 0s - loss: 0.4592 - accuracy: 0.7663 - val_loss: 0.5354 -
val_accuracy: 0.7266 - 88ms/epoch - 3ms/step
Epoch 121/250
26/26 - 0s - loss: 0.4621 - accuracy: 0.7785 - val_loss: 0.5527 -
val_accuracy: 0.7482 - 86ms/epoch - 3ms/step
Epoch 122/250
26/26 - 0s - loss: 0.4607 - accuracy: 0.7615 - val_loss: 0.5479 -
val_accuracy: 0.7410 - 90ms/epoch - 3ms/step
Epoch 123/250
26/26 - 0s - loss: 0.4474 - accuracy: 0.7797 - val_loss: 0.5419 -
val_accuracy: 0.7410 - 91ms/epoch - 3ms/step
Epoch 124/250
26/26 - 0s - loss: 0.4608 - accuracy: 0.7821 - val_loss: 0.5293 -
val_accuracy: 0.7266 - 90ms/epoch - 3ms/step
Epoch 125/250
```

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26/26 - 0s - loss: 0.4560 - accuracy: 0.7736 - val_loss: 0.5371 -
val_accuracy: 0.7266 - 94ms/epoch - 4ms/step
Epoch 126/250
26/26 - 0s - loss: 0.4632 - accuracy: 0.7688 - val_loss: 0.5233 -
val_accuracy: 0.7410 - 98ms/epoch - 4ms/step
Epoch 127/250
26/26 - 0s - loss: 0.4368 - accuracy: 0.7893 - val_loss: 0.5424 -
val_accuracy: 0.7338 - 101ms/epoch - 4ms/step
Epoch 128/250
26/26 - 0s - loss: 0.4457 - accuracy: 0.7772 - val_loss: 0.5303 -
val_accuracy: 0.7266 - 90ms/epoch - 3ms/step
Epoch 129/250
26/26 - 0s - loss: 0.4647 - accuracy: 0.7542 - val_loss: 0.5372 -
val_accuracy: 0.7410 - 91ms/epoch - 4ms/step
Epoch 130/250
26/26 - 0s - loss: 0.4537 - accuracy: 0.7809 - val_loss: 0.5188 -
val_accuracy: 0.7554 - 90ms/epoch - 3ms/step
Epoch 131/250
26/26 - 0s - loss: 0.4509 - accuracy: 0.7639 - val_loss: 0.5391 -
val_accuracy: 0.7554 - 90ms/epoch - 3ms/step
Epoch 132/250
26/26 - 0s - loss: 0.4650 - accuracy: 0.7663 - val_loss: 0.5445 -
val_accuracy: 0.7266 - 89ms/epoch - 3ms/step
Epoch 133/250
26/26 - 0s - loss: 0.4561 - accuracy: 0.7833 - val_loss: 0.5372 -
val_accuracy: 0.7482 - 88ms/epoch - 3ms/step
Epoch 134/250
26/26 - 0s - loss: 0.4595 - accuracy: 0.7797 - val_loss: 0.5376 -
val_accuracy: 0.7410 - 88ms/epoch - 3ms/step
Epoch 135/250
26/26 - 0s - loss: 0.4545 - accuracy: 0.7676 - val_loss: 0.5301 -
val_accuracy: 0.7338 - 87ms/epoch - 3ms/step
Epoch 136/250
26/26 - 0s - loss: 0.4525 - accuracy: 0.7833 - val_loss: 0.5399 -
val_accuracy: 0.7482 - 87ms/epoch - 3ms/step
Epoch 137/250
26/26 - 0s - loss: 0.4546 - accuracy: 0.7772 - val_loss: 0.5351 -
val_accuracy: 0.7554 - 92ms/epoch - 4ms/step
Epoch 138/250
26/26 - 0s - loss: 0.4584 - accuracy: 0.7724 - val_loss: 0.5315 -
val_accuracy: 0.7338 - 90ms/epoch - 3ms/step
Epoch 139/250
26/26 - 0s - loss: 0.4504 - accuracy: 0.7748 - val_loss: 0.5446 -
val_accuracy: 0.7410 - 88ms/epoch - 3ms/step
Epoch 140/250
26/26 - 0s - loss: 0.4414 - accuracy: 0.7785 - val_loss: 0.5375 -
val_accuracy: 0.7410 - 91ms/epoch - 3ms/step
Epoch 141/250
26/26 - 0s - loss: 0.4542 - accuracy: 0.7797 - val_loss: 0.5262 -
val_accuracy: 0.7266 - 91ms/epoch - 4ms/step
```

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Epoch 142/250
26/26 - 0s - loss: 0.4493 - accuracy: 0.7797 - val_loss: 0.5272 -
val_accuracy: 0.7410 - 84ms/epoch - 3ms/step
Epoch 143/250
26/26 - 0s - loss: 0.4449 - accuracy: 0.7881 - val_loss: 0.5342 -
val_accuracy: 0.7482 - 92ms/epoch - 4ms/step
Epoch 144/250
26/26 - 0s - loss: 0.4498 - accuracy: 0.8027 - val_loss: 0.5341 -
val_accuracy: 0.7266 - 92ms/epoch - 4ms/step
Epoch 145/250
26/26 - 0s - loss: 0.4465 - accuracy: 0.7845 - val_loss: 0.5295 -
val_accuracy: 0.7266 - 90ms/epoch - 3ms/step
Epoch 146/250
26/26 - 0s - loss: 0.4550 - accuracy: 0.7615 - val_loss: 0.5304 -
val_accuracy: 0.7410 - 90ms/epoch - 3ms/step
Epoch 147/250
26/26 - 0s - loss: 0.4542 - accuracy: 0.7748 - val_loss: 0.5141 -
val_accuracy: 0.7338 - 88ms/epoch - 3ms/step
Epoch 148/250
26/26 - 0s - loss: 0.4503 - accuracy: 0.7857 - val_loss: 0.5348 -
val_accuracy: 0.7338 - 86ms/epoch - 3ms/step
Epoch 149/250
26/26 - 0s - loss: 0.4504 - accuracy: 0.7869 - val_loss: 0.5410 -
val_accuracy: 0.7338 - 89ms/epoch - 3ms/step
Epoch 150/250
26/26 - 0s - loss: 0.4562 - accuracy: 0.7676 - val_loss: 0.5319 -
val_accuracy: 0.7410 - 89ms/epoch - 3ms/step
Epoch 151/250
26/26 - 0s - loss: 0.4465 - accuracy: 0.7676 - val_loss: 0.5406 -
val_accuracy: 0.7338 - 84ms/epoch - 3ms/step
Epoch 152/250
26/26 - 0s - loss: 0.4589 - accuracy: 0.7857 - val_loss: 0.5272 -
val_accuracy: 0.7482 - 89ms/epoch - 3ms/step
Epoch 153/250
26/26 - 0s - loss: 0.4412 - accuracy: 0.8027 - val_loss: 0.5306 -
val_accuracy: 0.7554 - 89ms/epoch - 3ms/step
Epoch 154/250
26/26 - 0s - loss: 0.4538 - accuracy: 0.7760 - val_loss: 0.5478 -
val_accuracy: 0.7482 - 125ms/epoch - 5ms/step
Epoch 155/250
26/26 - 0s - loss: 0.4384 - accuracy: 0.7857 - val_loss: 0.5244 -
val_accuracy: 0.7482 - 90ms/epoch - 3ms/step
Epoch 156/250
26/26 - 0s - loss: 0.4473 - accuracy: 0.7785 - val_loss: 0.5414 -
val_accuracy: 0.7482 - 93ms/epoch - 4ms/step
Epoch 157/250
26/26 - 0s - loss: 0.4364 - accuracy: 0.8002 - val_loss: 0.5444 -
val_accuracy: 0.7482 - 96ms/epoch - 4ms/step
Epoch 158/250
26/26 - 0s - loss: 0.4426 - accuracy: 0.7918 - val_loss: 0.5260 -
```

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val_accuracy: 0.7482 - 84ms/epoch - 3ms/step
Epoch 159/250
26/26 - 0s - loss: 0.4445 - accuracy: 0.7869 - val_loss: 0.5254 -
val_accuracy: 0.7554 - 90ms/epoch - 3ms/step
Epoch 160/250
26/26 - 0s - loss: 0.4525 - accuracy: 0.7712 - val_loss: 0.5371 -
val_accuracy: 0.7554 - 89ms/epoch - 3ms/step
Epoch 161/250
26/26 - 0s - loss: 0.4468 - accuracy: 0.7785 - val_loss: 0.5216 -
val_accuracy: 0.7554 - 89ms/epoch - 3ms/step
Epoch 162/250
26/26 - 0s - loss: 0.4420 - accuracy: 0.7772 - val_loss: 0.5318 -
val_accuracy: 0.7410 - 89ms/epoch - 3ms/step
Epoch 163/250
26/26 - 0s - loss: 0.4465 - accuracy: 0.7845 - val_loss: 0.5130 -
val_accuracy: 0.7554 - 92ms/epoch - 4ms/step
Epoch 164/250
26/26 - 0s - loss: 0.4529 - accuracy: 0.7845 - val_loss: 0.5482 -
val_accuracy: 0.7338 - 97ms/epoch - 4ms/step
Epoch 165/250
26/26 - 0s - loss: 0.4362 - accuracy: 0.7966 - val_loss: 0.5288 -
val_accuracy: 0.7410 - 103ms/epoch - 4ms/step
Epoch 166/250
26/26 - 0s - loss: 0.4454 - accuracy: 0.7736 - val_loss: 0.5252 -
val_accuracy: 0.7554 - 104ms/epoch - 4ms/step
Epoch 167/250
26/26 - 0s - loss: 0.4421 - accuracy: 0.7857 - val_loss: 0.5488 -
val_accuracy: 0.7338 - 105ms/epoch - 4ms/step
Epoch 168/250
26/26 - 0s - loss: 0.4395 - accuracy: 0.7942 - val_loss: 0.5226 -
val_accuracy: 0.7410 - 110ms/epoch - 4ms/step
Epoch 169/250
26/26 - 0s - loss: 0.4430 - accuracy: 0.7821 - val_loss: 0.5503 -
val_accuracy: 0.7410 - 117ms/epoch - 4ms/step
Epoch 170/250
26/26 - 0s - loss: 0.4431 - accuracy: 0.8002 - val_loss: 0.5216 -
val_accuracy: 0.7410 - 108ms/epoch - 4ms/step
Epoch 171/250
26/26 - 0s - loss: 0.4498 - accuracy: 0.7893 - val_loss: 0.5271 -
val_accuracy: 0.7338 - 106ms/epoch - 4ms/step
Epoch 172/250
26/26 - 0s - loss: 0.4457 - accuracy: 0.7772 - val_loss: 0.5347 -
val_accuracy: 0.7482 - 114ms/epoch - 4ms/step
Epoch 173/250
26/26 - 0s - loss: 0.4507 - accuracy: 0.7809 - val_loss: 0.5333 -
val_accuracy: 0.7482 - 117ms/epoch - 5ms/step
Epoch 174/250
26/26 - 0s - loss: 0.4504 - accuracy: 0.7833 - val_loss: 0.5208 -
val_accuracy: 0.7554 - 107ms/epoch - 4ms/step
Epoch 175/250
```

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26/26 - 0s - loss: 0.4476 - accuracy: 0.7857 - val_loss: 0.5339 -
val_accuracy: 0.7410 - 109ms/epoch - 4ms/step
Epoch 176/250
26/26 - 0s - loss: 0.4348 - accuracy: 0.7930 - val_loss: 0.5263 -
val_accuracy: 0.7482 - 106ms/epoch - 4ms/step
Epoch 177/250
26/26 - 0s - loss: 0.4389 - accuracy: 0.7881 - val_loss: 0.5334 -
val_accuracy: 0.7482 - 101ms/epoch - 4ms/step
Epoch 178/250
26/26 - 0s - loss: 0.4481 - accuracy: 0.7772 - val_loss: 0.5367 -
val_accuracy: 0.7482 - 96ms/epoch - 4ms/step
Epoch 179/250
26/26 - 0s - loss: 0.4346 - accuracy: 0.7906 - val_loss: 0.5394 -
val_accuracy: 0.7482 - 98ms/epoch - 4ms/step
Epoch 180/250
26/26 - 0s - loss: 0.4355 - accuracy: 0.7833 - val_loss: 0.5269 -
val_accuracy: 0.7410 - 108ms/epoch - 4ms/step
Epoch 181/250
26/26 - 0s - loss: 0.4477 - accuracy: 0.7881 - val_loss: 0.5329 -
val_accuracy: 0.7482 - 110ms/epoch - 4ms/step
Epoch 182/250
26/26 - 0s - loss: 0.4563 - accuracy: 0.7942 - val_loss: 0.5439 -
val_accuracy: 0.7482 - 107ms/epoch - 4ms/step
Epoch 183/250
26/26 - 0s - loss: 0.4418 - accuracy: 0.7857 - val_loss: 0.5217 -
val_accuracy: 0.7410 - 112ms/epoch - 4ms/step
Epoch 184/250
26/26 - 0s - loss: 0.4412 - accuracy: 0.7845 - val_loss: 0.5379 -
val_accuracy: 0.7410 - 107ms/epoch - 4ms/step
Epoch 185/250
26/26 - 0s - loss: 0.4422 - accuracy: 0.7833 - val_loss: 0.5253 -
val_accuracy: 0.7410 - 108ms/epoch - 4ms/step
Epoch 186/250
26/26 - 0s - loss: 0.4445 - accuracy: 0.7857 - val_loss: 0.5400 -
val_accuracy: 0.7482 - 159ms/epoch - 6ms/step
Epoch 187/250
26/26 - 0s - loss: 0.4398 - accuracy: 0.7906 - val_loss: 0.5275 -
val_accuracy: 0.7410 - 108ms/epoch - 4ms/step
Epoch 188/250
26/26 - 0s - loss: 0.4324 - accuracy: 0.7869 - val_loss: 0.5278 -
val_accuracy: 0.7410 - 109ms/epoch - 4ms/step
Epoch 189/250
26/26 - 0s - loss: 0.4455 - accuracy: 0.8039 - val_loss: 0.5159 -
val_accuracy: 0.7410 - 106ms/epoch - 4ms/step
Epoch 190/250
26/26 - 0s - loss: 0.4435 - accuracy: 0.7966 - val_loss: 0.5198 -
val_accuracy: 0.7410 - 110ms/epoch - 4ms/step
Epoch 191/250
26/26 - 0s - loss: 0.4379 - accuracy: 0.8027 - val_loss: 0.5447 -
val_accuracy: 0.7482 - 105ms/epoch - 4ms/step
```

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Epoch 192/250
26/26 - 0s - loss: 0.4515 - accuracy: 0.7845 - val_loss: 0.5232 -
val_accuracy: 0.7338 - 114ms/epoch - 4ms/step
Epoch 193/250
26/26 - 0s - loss: 0.4310 - accuracy: 0.8015 - val_loss: 0.5277 -
val_accuracy: 0.7482 - 109ms/epoch - 4ms/step
Epoch 194/250
26/26 - 0s - loss: 0.4411 - accuracy: 0.7785 - val_loss: 0.5140 -
val_accuracy: 0.7482 - 108ms/epoch - 4ms/step
Epoch 195/250
26/26 - 0s - loss: 0.4403 - accuracy: 0.7906 - val_loss: 0.5139 -
val_accuracy: 0.7554 - 92ms/epoch - 4ms/step
Epoch 196/250
26/26 - 0s - loss: 0.4383 - accuracy: 0.7760 - val_loss: 0.5277 -
val_accuracy: 0.7410 - 98ms/epoch - 4ms/step
Epoch 197/250
26/26 - 0s - loss: 0.4480 - accuracy: 0.7785 - val_loss: 0.5155 -
val_accuracy: 0.7482 - 98ms/epoch - 4ms/step
Epoch 198/250
26/26 - 0s - loss: 0.4372 - accuracy: 0.7869 - val_loss: 0.5358 -
val_accuracy: 0.7410 - 100ms/epoch - 4ms/step
Epoch 199/250
26/26 - 0s - loss: 0.4360 - accuracy: 0.7918 - val_loss: 0.5227 -
val_accuracy: 0.7410 - 111ms/epoch - 4ms/step
Epoch 200/250
26/26 - 0s - loss: 0.4401 - accuracy: 0.7869 - val_loss: 0.5291 -
val_accuracy: 0.7554 - 96ms/epoch - 4ms/step
Epoch 201/250
26/26 - 0s - loss: 0.4312 - accuracy: 0.7966 - val_loss: 0.5492 -
val_accuracy: 0.7410 - 109ms/epoch - 4ms/step
Epoch 202/250
26/26 - 0s - loss: 0.4351 - accuracy: 0.7821 - val_loss: 0.5270 -
val_accuracy: 0.7410 - 113ms/epoch - 4ms/step
Epoch 203/250
26/26 - 0s - loss: 0.4316 - accuracy: 0.8039 - val_loss: 0.5425 -
val_accuracy: 0.7410 - 100ms/epoch - 4ms/step
Epoch 204/250
26/26 - 0s - loss: 0.4233 - accuracy: 0.7881 - val_loss: 0.5406 -
val_accuracy: 0.7410 - 92ms/epoch - 4ms/step
Epoch 205/250
26/26 - 0s - loss: 0.4393 - accuracy: 0.7881 - val_loss: 0.5289 -
val_accuracy: 0.7554 - 96ms/epoch - 4ms/step
Epoch 206/250
26/26 - 0s - loss: 0.4268 - accuracy: 0.8015 - val_loss: 0.5391 -
val_accuracy: 0.7410 - 97ms/epoch - 4ms/step
Epoch 207/250
26/26 - 0s - loss: 0.4229 - accuracy: 0.8002 - val_loss: 0.5276 -
val_accuracy: 0.7338 - 103ms/epoch - 4ms/step
Epoch 208/250
26/26 - 0s - loss: 0.4395 - accuracy: 0.7869 - val_loss: 0.5218 -
```

val_accuracy: 0.7482 - 105ms/epoch - 4ms/step
Epoch 209/250
26/26 - 0s - loss: 0.4289 - accuracy: 0.8027 - val_loss: 0.5339 -
val_accuracy: 0.7482 - 103ms/epoch - 4ms/step
Epoch 210/250
26/26 - 0s - loss: 0.4372 - accuracy: 0.7881 - val_loss: 0.5385 -
val_accuracy: 0.7338 - 89ms/epoch - 3ms/step
Epoch 211/250
26/26 - 0s - loss: 0.4359 - accuracy: 0.7930 - val_loss: 0.5151 -
val_accuracy: 0.7554 - 91ms/epoch - 4ms/step
Epoch 212/250
26/26 - 0s - loss: 0.4500 - accuracy: 0.7797 - val_loss: 0.5185 -
val_accuracy: 0.7410 - 134ms/epoch - 5ms/step
Epoch 213/250
26/26 - 0s - loss: 0.4486 - accuracy: 0.7881 - val_loss: 0.5270 -
val_accuracy: 0.7410 - 96ms/epoch - 4ms/step
Epoch 214/250
26/26 - 0s - loss: 0.4283 - accuracy: 0.7857 - val_loss: 0.5253 -
val_accuracy: 0.7338 - 91ms/epoch - 4ms/step
Epoch 215/250
26/26 - 0s - loss: 0.4397 - accuracy: 0.7772 - val_loss: 0.5092 -
val_accuracy: 0.7482 - 88ms/epoch - 3ms/step
Epoch 216/250
26/26 - 0s - loss: 0.4400 - accuracy: 0.7748 - val_loss: 0.5394 -
val_accuracy: 0.7410 - 97ms/epoch - 4ms/step
Epoch 217/250
26/26 - 0s - loss: 0.4390 - accuracy: 0.7942 - val_loss: 0.5190 -
val_accuracy: 0.7410 - 110ms/epoch - 4ms/step
Epoch 218/250
26/26 - 0s - loss: 0.4366 - accuracy: 0.7918 - val_loss: 0.5211 -
val_accuracy: 0.7554 - 105ms/epoch - 4ms/step
Epoch 219/250
26/26 - 0s - loss: 0.4376 - accuracy: 0.8039 - val_loss: 0.5351 -
val_accuracy: 0.7554 - 115ms/epoch - 4ms/step
Epoch 220/250
26/26 - 0s - loss: 0.4352 - accuracy: 0.7942 - val_loss: 0.5077 -
val_accuracy: 0.7410 - 97ms/epoch - 4ms/step
Epoch 221/250
26/26 - 0s - loss: 0.4272 - accuracy: 0.8002 - val_loss: 0.5233 -
val_accuracy: 0.7410 - 95ms/epoch - 4ms/step
Epoch 222/250
26/26 - 0s - loss: 0.4337 - accuracy: 0.7942 - val_loss: 0.5154 -
val_accuracy: 0.7410 - 104ms/epoch - 4ms/step
Epoch 223/250
26/26 - 0s - loss: 0.4354 - accuracy: 0.7906 - val_loss: 0.5345 -
val_accuracy: 0.7410 - 138ms/epoch - 5ms/step
Epoch 224/250
26/26 - 0s - loss: 0.4433 - accuracy: 0.7809 - val_loss: 0.5384 -
val_accuracy: 0.7338 - 114ms/epoch - 4ms/step
Epoch 225/250

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26/26 - 0s - loss: 0.4404 - accuracy: 0.7978 - val_loss: 0.5343 -
val_accuracy: 0.7410 - 102ms/epoch - 4ms/step
Epoch 226/250
26/26 - 0s - loss: 0.4295 - accuracy: 0.8039 - val_loss: 0.5207 -
val_accuracy: 0.7554 - 108ms/epoch - 4ms/step
Epoch 227/250
26/26 - 0s - loss: 0.4319 - accuracy: 0.8075 - val_loss: 0.5396 -
val_accuracy: 0.7554 - 111ms/epoch - 4ms/step
Epoch 228/250
26/26 - 0s - loss: 0.4432 - accuracy: 0.7821 - val_loss: 0.5431 -
val_accuracy: 0.7554 - 101ms/epoch - 4ms/step
Epoch 229/250
26/26 - 0s - loss: 0.4227 - accuracy: 0.8063 - val_loss: 0.5301 -
val_accuracy: 0.7482 - 96ms/epoch - 4ms/step
Epoch 230/250
26/26 - 0s - loss: 0.4384 - accuracy: 0.7833 - val_loss: 0.5371 -
val_accuracy: 0.7482 - 96ms/epoch - 4ms/step
Epoch 231/250
26/26 - 0s - loss: 0.4438 - accuracy: 0.7954 - val_loss: 0.5105 -
val_accuracy: 0.7410 - 96ms/epoch - 4ms/step
Epoch 232/250
26/26 - 0s - loss: 0.4344 - accuracy: 0.7833 - val_loss: 0.5082 -
val_accuracy: 0.7338 - 103ms/epoch - 4ms/step
Epoch 233/250
26/26 - 0s - loss: 0.4346 - accuracy: 0.8002 - val_loss: 0.5068 -
val_accuracy: 0.7482 - 99ms/epoch - 4ms/step
Epoch 234/250
26/26 - 0s - loss: 0.4329 - accuracy: 0.7881 - val_loss: 0.5377 -
val_accuracy: 0.7410 - 95ms/epoch - 4ms/step
Epoch 235/250
26/26 - 0s - loss: 0.4237 - accuracy: 0.8015 - val_loss: 0.5221 -
val_accuracy: 0.7410 - 100ms/epoch - 4ms/step
Epoch 236/250
26/26 - 0s - loss: 0.4374 - accuracy: 0.8111 - val_loss: 0.5196 -
val_accuracy: 0.7410 - 101ms/epoch - 4ms/step
Epoch 237/250
26/26 - 0s - loss: 0.4304 - accuracy: 0.8087 - val_loss: 0.5333 -
val_accuracy: 0.7554 - 103ms/epoch - 4ms/step
Epoch 238/250
26/26 - 0s - loss: 0.4207 - accuracy: 0.8027 - val_loss: 0.5387 -
val_accuracy: 0.7482 - 146ms/epoch - 6ms/step
Epoch 239/250
26/26 - 0s - loss: 0.4337 - accuracy: 0.7797 - val_loss: 0.5384 -
val_accuracy: 0.7482 - 96ms/epoch - 4ms/step
Epoch 240/250
26/26 - 0s - loss: 0.4282 - accuracy: 0.7966 - val_loss: 0.5126 -
val_accuracy: 0.7410 - 93ms/epoch - 4ms/step
Epoch 241/250
26/26 - 0s - loss: 0.4228 - accuracy: 0.8099 - val_loss: 0.5210 -
val_accuracy: 0.7482 - 94ms/epoch - 4ms/step
```

```
Epoch 242/250
26/26 - 0s - loss: 0.4284 - accuracy: 0.8002 - val_loss: 0.5251 -
val_accuracy: 0.7338 - 108ms/epoch - 4ms/step
Epoch 243/250
26/26 - 0s - loss: 0.4383 - accuracy: 0.7869 - val_loss: 0.5493 -
val_accuracy: 0.7554 - 106ms/epoch - 4ms/step
Epoch 244/250
26/26 - 0s - loss: 0.4235 - accuracy: 0.8148 - val_loss: 0.5268 -
val_accuracy: 0.7482 - 98ms/epoch - 4ms/step
Epoch 245/250
26/26 - 0s - loss: 0.4324 - accuracy: 0.7906 - val_loss: 0.5226 -
val_accuracy: 0.7338 - 94ms/epoch - 4ms/step
Epoch 246/250
26/26 - 0s - loss: 0.4269 - accuracy: 0.7966 - val_loss: 0.5094 -
val_accuracy: 0.7482 - 112ms/epoch - 4ms/step
Epoch 247/250
26/26 - 0s - loss: 0.4282 - accuracy: 0.7857 - val_loss: 0.5024 -
val_accuracy: 0.7338 - 107ms/epoch - 4ms/step
Epoch 248/250
26/26 - 0s - loss: 0.4341 - accuracy: 0.7893 - val_loss: 0.5350 -
val_accuracy: 0.7410 - 109ms/epoch - 4ms/step
Epoch 249/250
26/26 - 0s - loss: 0.4381 - accuracy: 0.7930 - val_loss: 0.5305 -
val_accuracy: 0.7482 - 107ms/epoch - 4ms/step
Epoch 250/250
26/26 - 0s - loss: 0.4424 - accuracy: 0.7893 - val_loss: 0.5265 -
val_accuracy: 0.7554 - 97ms/epoch - 4ms/step

<keras.callbacks.History at 0x2480aa35f70>

_, accuracy = model.evaluate(X_test, y_test)
print('Accuracy: %.2f' % (accuracy*100))

5/5 [==============================] - 0s 3ms/step - loss: 0.5265 -
accuracy: 0.7554
Accuracy: 75.54

predict_x = model.predict(X_test)
classes_x=np.argmax(predict_x,axis=1)

5/5 [==============================] - 0s 3ms/step
```