aml-1-yashwanth-kothuru

July 5, 2024

[3]:

```
import numpy as np
import random
import matplotlib.pyplot as plt
from tensorflow.keras.datasets import imdb
from tensorflow.keras import layers, regularizers, models
from tensorflow.keras.callbacks import EarlyStopping

# Load the IMDb dataset
(train_data, train_labels), (test_data, test_labels) = imdb.
 ↪load_data(num_words=10000)

# Function to vectorize sequences
def vectorize_sequences(sequences, dimension=10000):
    results = np.zeros((len(sequences), dimension))
    for i, sequence in enumerate(sequences):
        results[i, sequence] = 1.0
    return results

# Vectorize the training and test data
x_train = vectorize_sequences(train_data)
x_test = vectorize_sequences(test_data)

# Convert labels to float32
y_train = np.asarray(train_labels).astype('float32')
y_test = np.asarray(test_labels).astype('float32')

# Set a random seed for reproducibility
random.seed(10)

# Split the training data into training and validation sets
x_val = x_train[:10000]
partial_x_train = x_train[10000:]
y_val = y_train[:10000]
partial_y_train = y_train[10000:]

# Experiment configurations
configurations = [
    {"layers": 1, "units": 16, "activation": "relu", "loss": "binary_crossentropy"},
    {"layers": 3, "units": 16, "activation": "relu", "loss": "binary_crossentropy"},
    {"layers": 2, "units": 32, "activation": "relu", "loss": "binary_crossentropy"},
    {"layers": 2, "units": 64, "activation": "relu", "loss": "binary_crossentropy"},
    {"layers": 2, "units": 16, "activation": "relu", "loss": "mse"},
    {"layers": 2, "units": 16, "activation": "tanh", "loss": "binary_crossentropy"},
]

for config in configurations:
    print(f"Testing configuration: {config}")

    # Build the model
    model = models.Sequential()
    model.add(layers.Dense(config["units"], kernel_regularizer=regularizers.l2(0.0002), activation=config["activation"]))
    model.add(layers.Dropout(0.3))

    for _ in range(config["layers"] - 1):
        model.add(layers.Dense(config["units"], kernel_regularizer=regularizers.l2(0.0002), activation=config["activation"]))
        model.add(layers.Dropout(0.3))

    model.add(layers.Dense(1, activation="sigmoid"))

    # Compile the model
    model.compile(optimizer='rmsprop', loss=config["loss"], metrics=['accuracy'])

    # Define early stopping callback
    early_stop = EarlyStopping(monitor='val_loss', patience=2, mode='min', verbose=1)

    # Train the model
    history = model.fit(partial_x_train,
                        partial_y_train,
                        epochs=20,
                        batch_size=512,
                        validation_data=(x_val, y_val),
                        callbacks=[early_stop])

    # Evaluate the model on the test data
```

```python
    results = model.evaluate(x_test, y_test)
    print(f'Test loss: {results[0]}, Test accuracy: {results[1]}')

    # Plotting training and validation loss
    history_dict = history.history
    loss_values = history_dict["loss"]
    val_loss_values = history_dict["val_loss"]
    epochs = range(1, len(loss_values) + 1)
    plt.plot(epochs, loss_values, "bo", label="Training loss")
    plt.plot(epochs, val_loss_values, "b", label="Validation loss")
    plt.title("Training and validation loss")
    plt.xlabel("Epochs")
    plt.ylabel("Loss")
    plt.legend()
    plt.show()

    # Plotting training and validation accuracy
    plt.clf()
    acc = history_dict["accuracy"]
    val_acc = history_dict["val_accuracy"]
    plt.plot(epochs, acc, "bo", label="Training accuracy")
    plt.plot(epochs, val_acc, "b", label="Validation accuracy")
    plt.title("Training and validation accuracy")
    plt.xlabel("Epochs")
    plt.ylabel("Accuracy")
    plt.legend()
    plt.show()
```

```
Testing configuration: {'layers': 1, 'units': 16, 'activation': 'relu', 'loss':
'binary_crossentropy'}
Epoch 1/20
30/30                 6s 126ms/step -
accuracy: 0.6844 - loss: 0.6047 - val_accuracy: 0.8644 - val_loss: 0.4260
Epoch 2/20
30/30                 0s 12ms/step -
accuracy: 0.8683 - loss: 0.3943 - val_accuracy: 0.8760 - val_loss: 0.3540
Epoch 3/20
30/30                 0s 14ms/step -
accuracy: 0.8941 - loss: 0.3207 - val_accuracy: 0.8894 - val_loss: 0.3176
Epoch 4/20
30/30                 0s 14ms/step -
accuracy: 0.9083 - loss: 0.2787 - val_accuracy: 0.8885 - val_loss: 0.3036
Epoch 5/20
30/30                 1s 16ms/step -
accuracy: 0.9212 - loss: 0.2456 - val_accuracy: 0.8907 - val_loss: 0.2927
Epoch 6/20
30/30                 1s 15ms/step -
```

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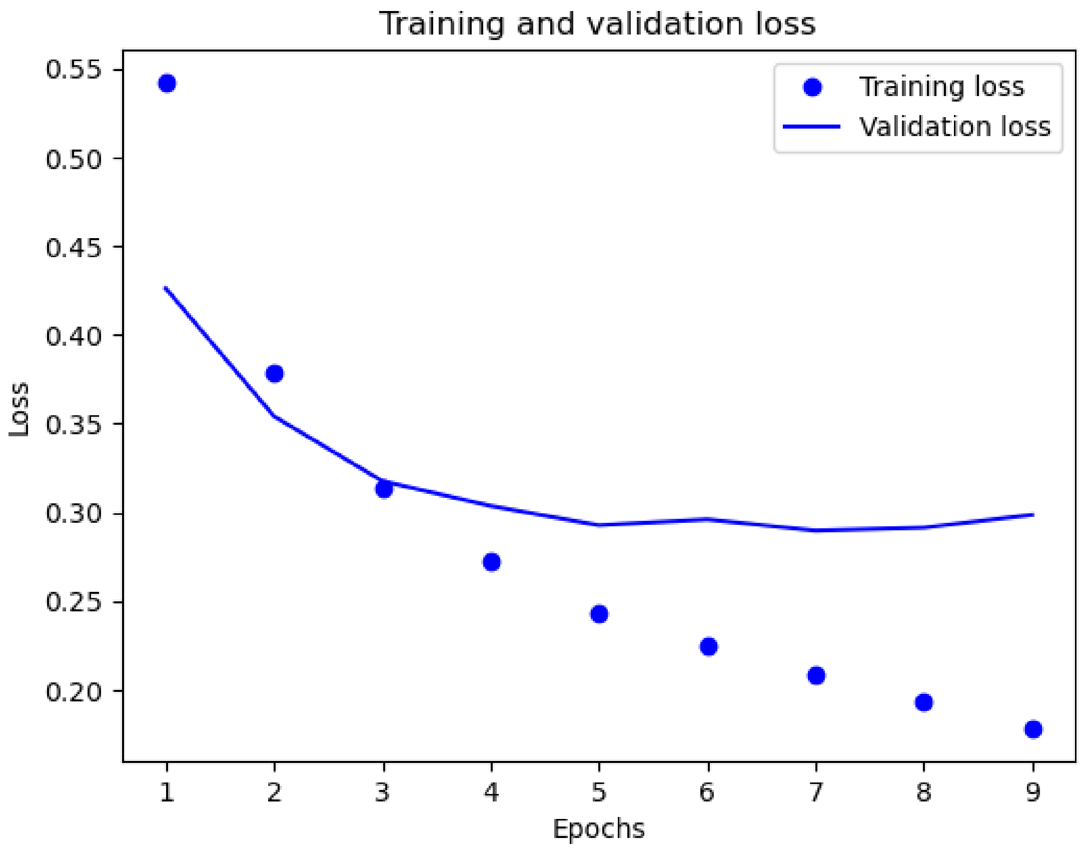
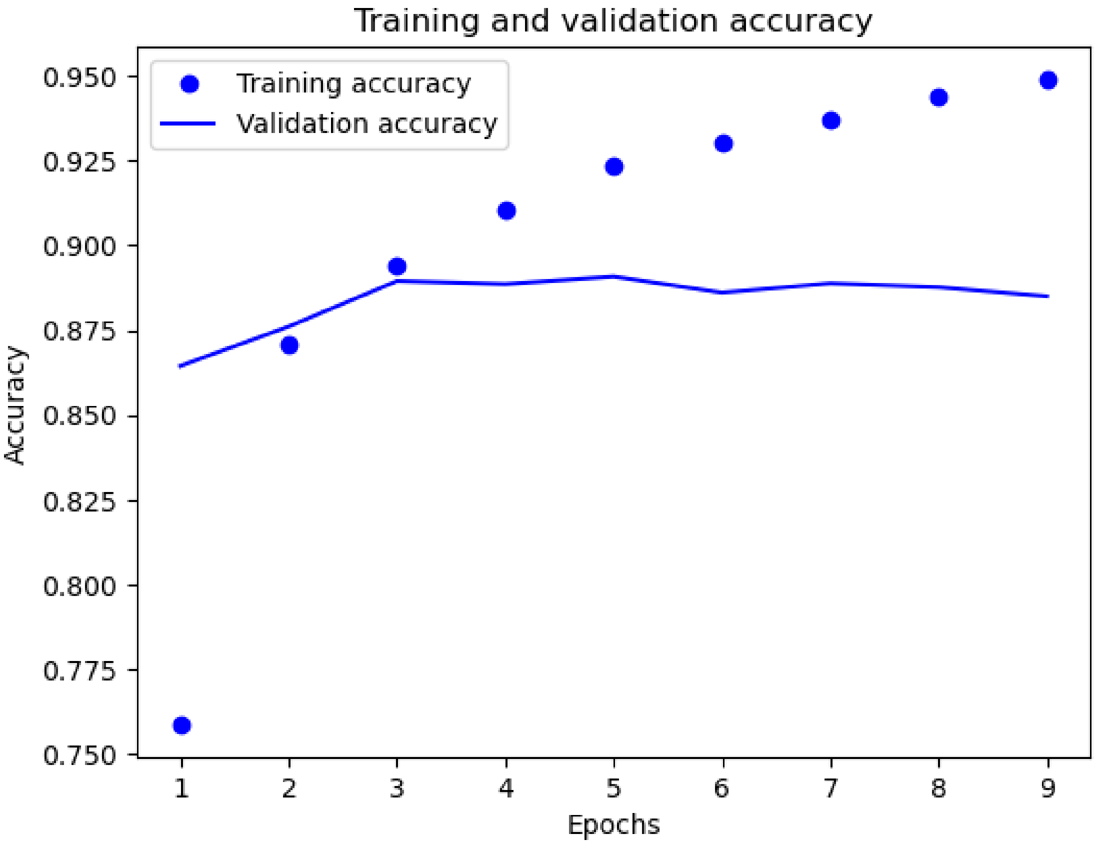
accuracy: 0.9318 - loss: 0.2230 - val_accuracy: 0.8860 - val_loss: 0.2960
Epoch 7/20
30/30            1s 15ms/step -
accuracy: 0.9395 - loss: 0.2055 - val_accuracy: 0.8887 - val_loss: 0.2896
Epoch 8/20
30/30            0s 14ms/step -
accuracy: 0.9489 - loss: 0.1860 - val_accuracy: 0.8876 - val_loss: 0.2914
Epoch 9/20
30/30            0s 13ms/step -
accuracy: 0.9514 - loss: 0.1768 - val_accuracy: 0.8849 - val_loss: 0.2986
Epoch 9: early stopping
782/782            2s 2ms/step -
accuracy: 0.8765 - loss: 0.3163
Test loss: 0.3158580958843231, Test accuracy: 0.8791999816894531
```





```
Testing configuration: {'layers': 3, 'units': 16, 'activation': 'relu', 'loss':
'binary_crossentropy'}
Epoch 1/20
30/30           6s 117ms/step -
accuracy: 0.5812 - loss: 0.6772 - val_accuracy: 0.8510 - val_loss: 0.5021
Epoch 2/20
30/30           0s 14ms/step -
accuracy: 0.7938 - loss: 0.5075 - val_accuracy: 0.8735 - val_loss: 0.3744
Epoch 3/20
30/30           0s 12ms/step -
accuracy: 0.8570 - loss: 0.3950 - val_accuracy: 0.8837 - val_loss: 0.3135
Epoch 4/20
30/30           0s 12ms/step -
accuracy: 0.8973 - loss: 0.3148 - val_accuracy: 0.8898 - val_loss: 0.2974
Epoch 5/20
30/30           0s 13ms/step -
accuracy: 0.9174 - loss: 0.2673 - val_accuracy: 0.8876 - val_loss: 0.3021
Epoch 6/20
30/30           0s 12ms/step -
accuracy: 0.9394 - loss: 0.2196 - val_accuracy: 0.8875 - val_loss: 0.3125
```

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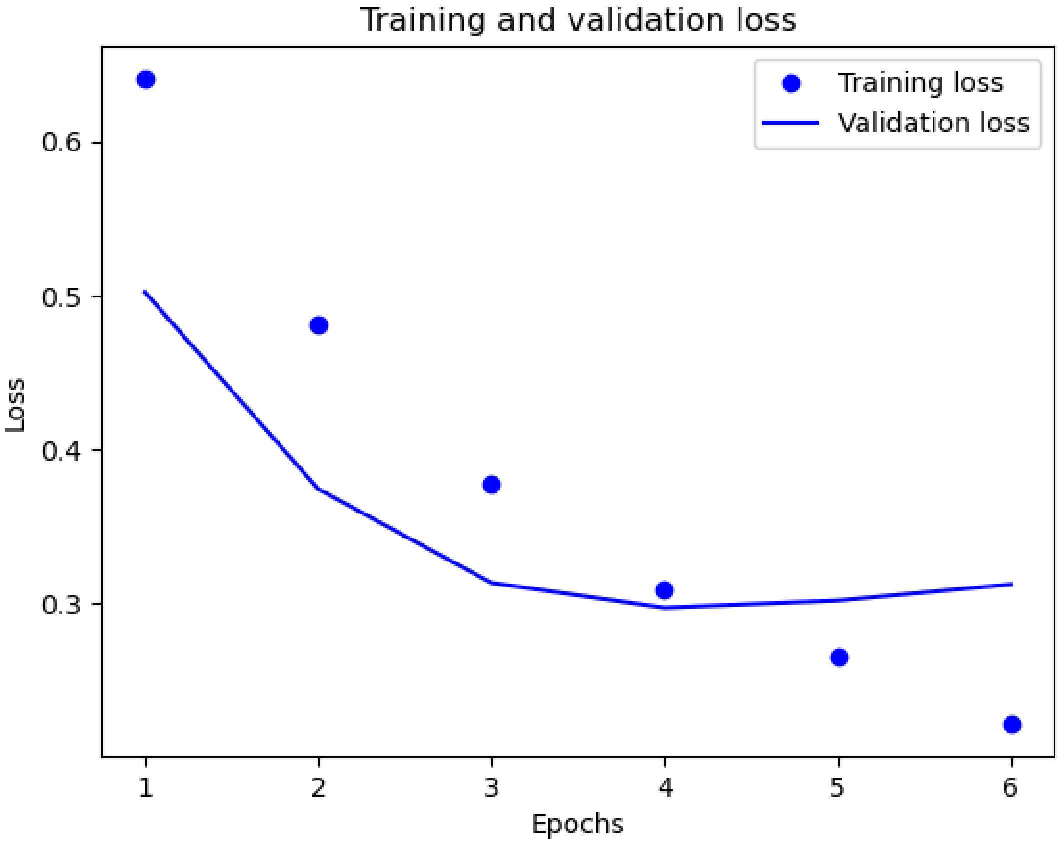
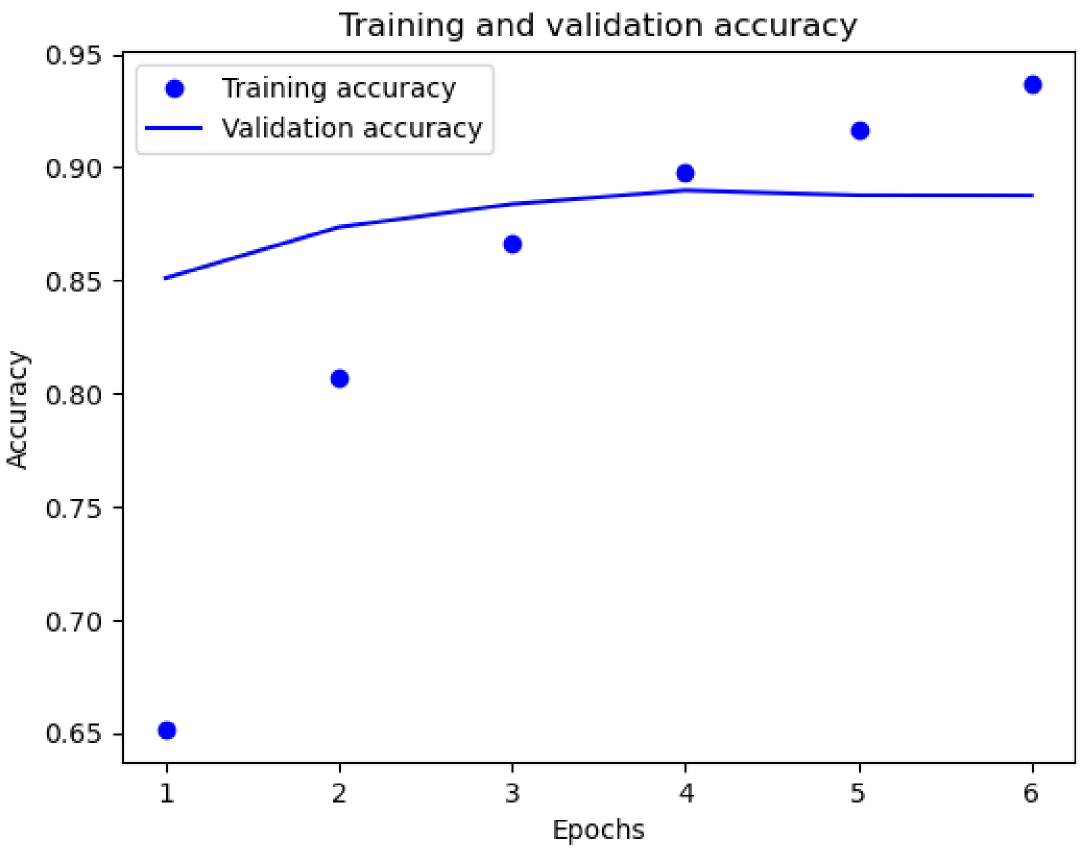
Epoch 6: early stopping
782/782             1s 2ms/step -
accuracy: 0.8755 - loss: 0.3325
Test loss: 0.32643842697143555, Test accuracy: 0.8800399899482727
```





```
Testing configuration: {'layers': 2, 'units': 32, 'activation': 'relu', 'loss':
'binary_crossentropy'}
Epoch 1/20
30/30                 4s 77ms/step -
accuracy: 0.6471 - loss: 0.6453 - val_accuracy: 0.8631 - val_loss: 0.4226
Epoch 2/20
30/30                 1s 19ms/step -
accuracy: 0.8537 - loss: 0.4167 - val_accuracy: 0.8837 - val_loss: 0.3287
Epoch 3/20
30/30                 1s 18ms/step -
accuracy: 0.8953 - loss: 0.3169 - val_accuracy: 0.8784 - val_loss: 0.3186
Epoch 4/20
30/30                 1s 18ms/step -
accuracy: 0.9225 - loss: 0.2538 - val_accuracy: 0.8804 - val_loss: 0.3177
Epoch 5/20
30/30                 1s 15ms/step -
accuracy: 0.9313 - loss: 0.2170 - val_accuracy: 0.8842 - val_loss: 0.3123
Epoch 6/20
30/30                 1s 16ms/step -
accuracy: 0.9472 - loss: 0.1820 - val_accuracy: 0.8853 - val_loss: 0.3180
```

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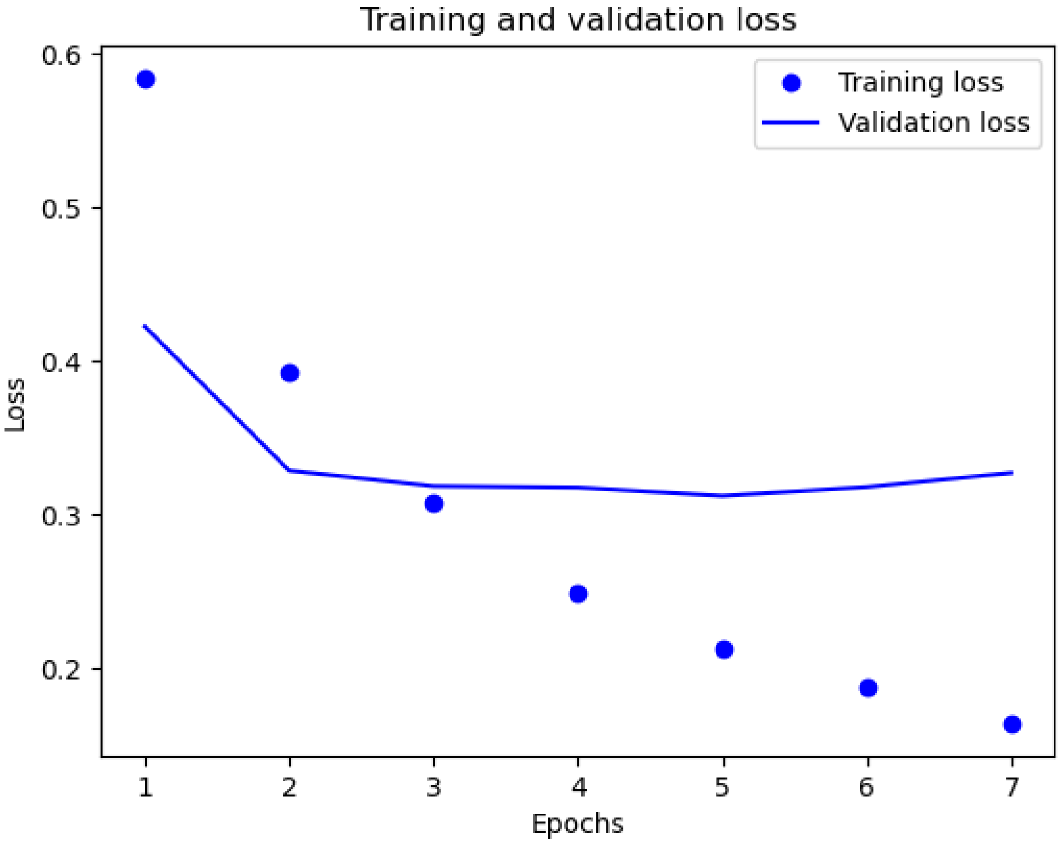
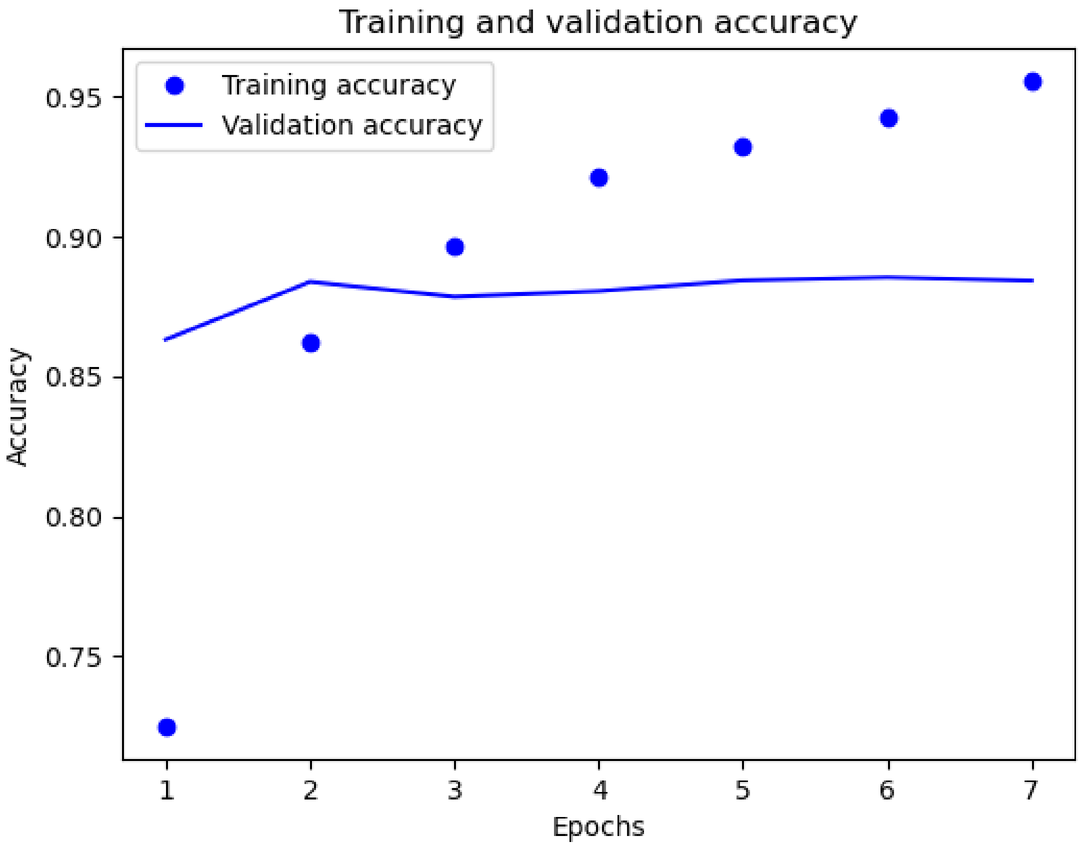
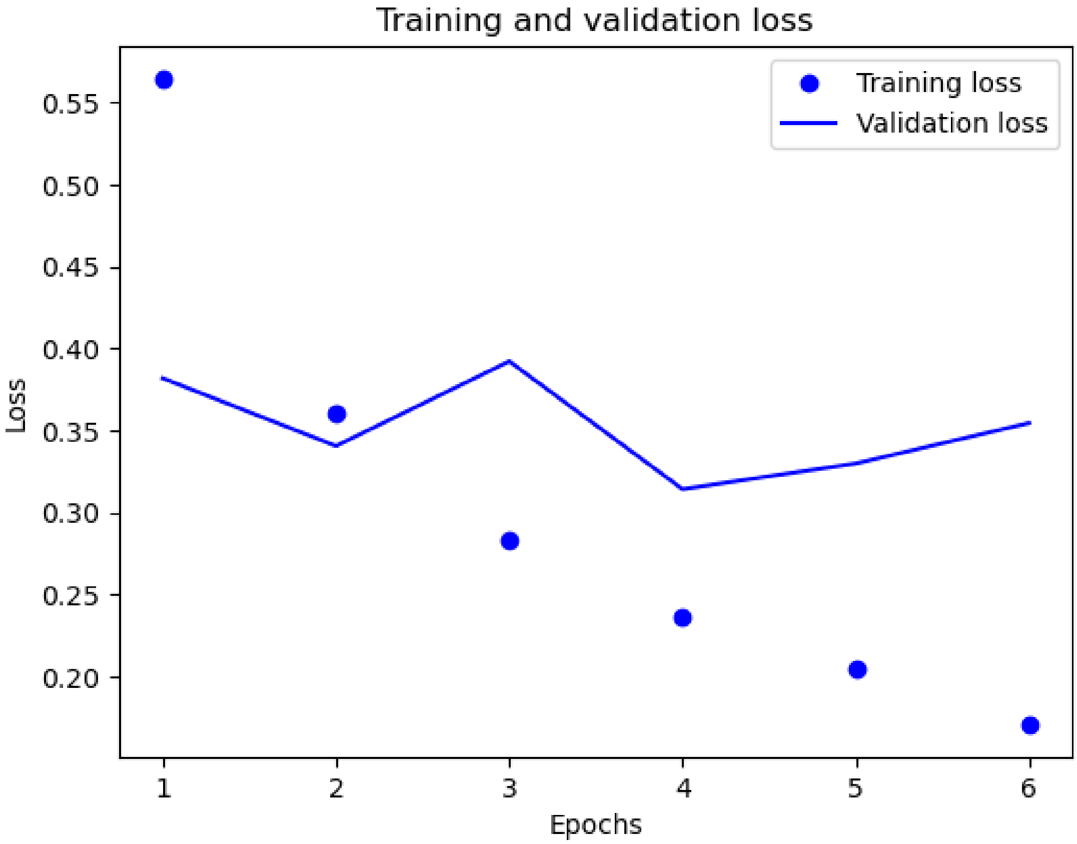
Epoch 7/20
30/30            1s 16ms/step -
accuracy: 0.9594 - loss: 0.1599 - val_accuracy: 0.8841 - val_loss: 0.3272
Epoch 7: early stopping
782/782            2s 2ms/step -
accuracy: 0.8763 - loss: 0.3525
Test loss: 0.3493797183036804, Test accuracy: 0.8791999816894531
```

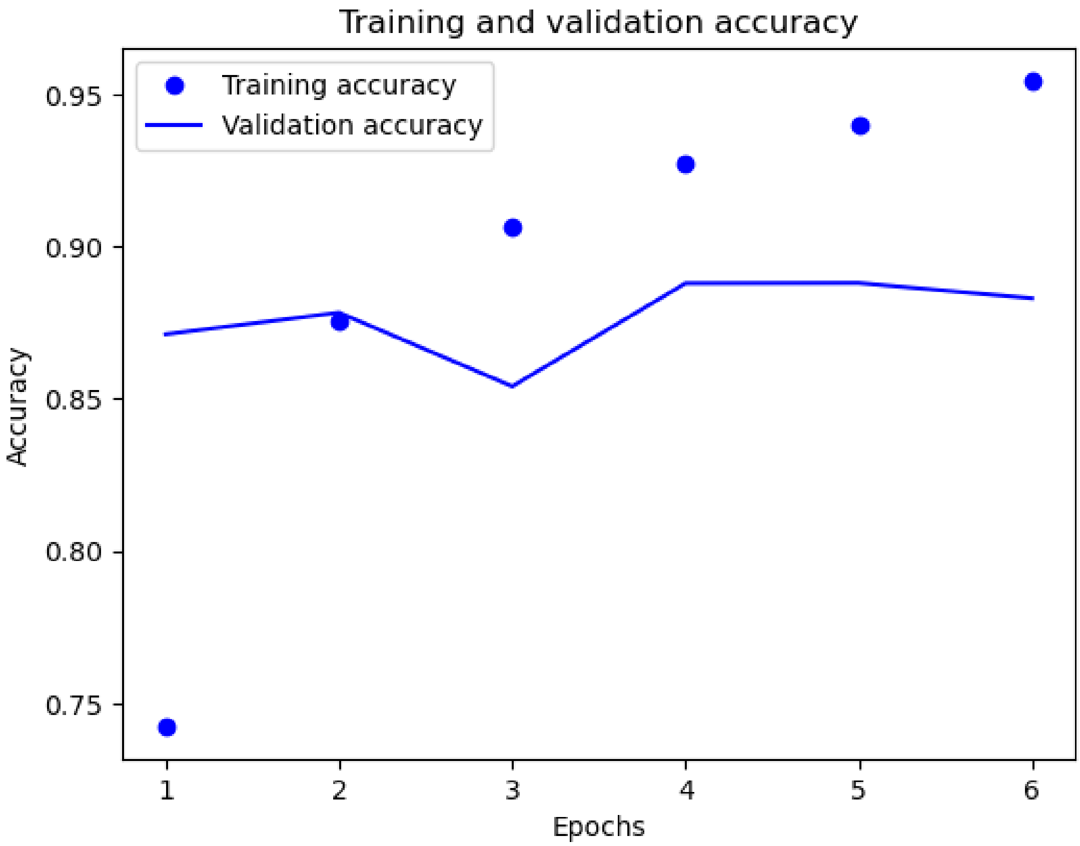




```
Testing configuration: {'layers': 2, 'units': 64, 'activation': 'relu', 'loss':
'binary_crossentropy'}
Epoch 1/20
30/30           5s 73ms/step -
accuracy: 0.6633 - loss: 0.6396 - val_accuracy: 0.8712 - val_loss: 0.3817
Epoch 2/20
30/30           1s 23ms/step -
accuracy: 0.8742 - loss: 0.3661 - val_accuracy: 0.8783 - val_loss: 0.3403
Epoch 3/20
30/30           1s 21ms/step -
accuracy: 0.9092 - loss: 0.2820 - val_accuracy: 0.8541 - val_loss: 0.3920
Epoch 4/20
30/30           1s 24ms/step -
accuracy: 0.9269 - loss: 0.2405 - val_accuracy: 0.8879 - val_loss: 0.3141
Epoch 5/20
30/30           1s 20ms/step -
accuracy: 0.9474 - loss: 0.1935 - val_accuracy: 0.8880 - val_loss: 0.3297
Epoch 6/20
30/30           1s 21ms/step -
accuracy: 0.9607 - loss: 0.1598 - val_accuracy: 0.8830 - val_loss: 0.3543
```

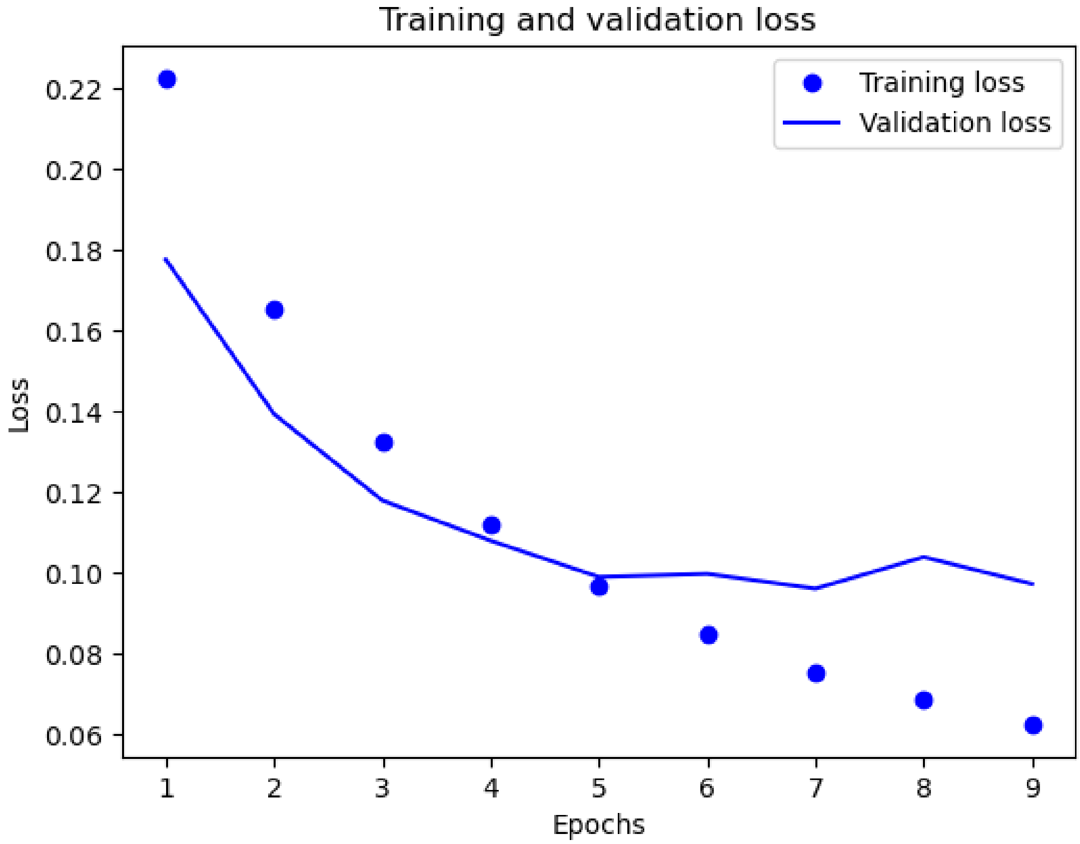
```
Epoch 6: early stopping
782/782             2s 2ms/step -
accuracy: 0.8698 - loss: 0.3766
Test loss: 0.37123459577560425, Test accuracy: 0.8729599714279175
```

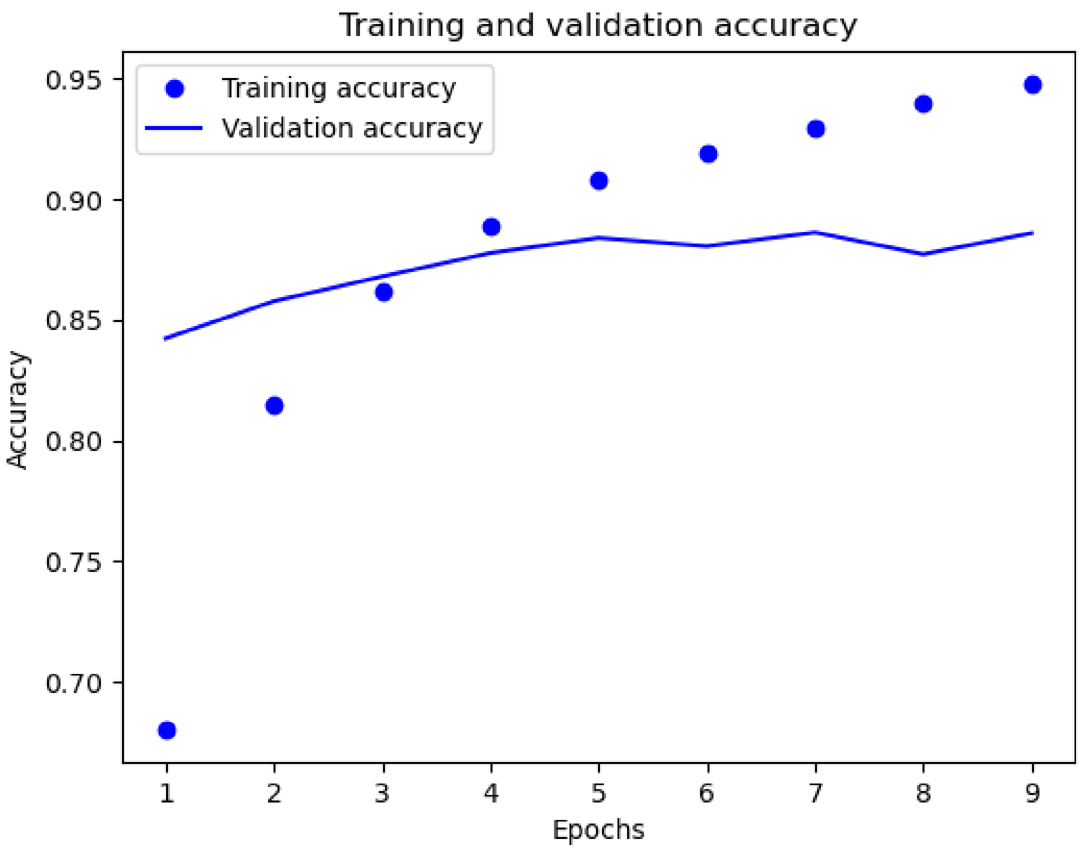




```
Testing configuration: {'layers': 2, 'units': 16, 'activation': 'relu', 'loss':
'mse'}
Epoch 1/20
30/30           4s 72ms/step -
accuracy: 0.6111 - loss: 0.2397 - val_accuracy: 0.8423 - val_loss: 0.1777
Epoch 2/20
30/30           0s 14ms/step -
accuracy: 0.8021 - loss: 0.1739 - val_accuracy: 0.8577 - val_loss: 0.1395
Epoch 3/20
30/30           0s 14ms/step -
accuracy: 0.8544 - loss: 0.1365 - val_accuracy: 0.8679 - val_loss: 0.1181
Epoch 4/20
30/30           0s 14ms/step -
accuracy: 0.8840 - loss: 0.1146 - val_accuracy: 0.8777 - val_loss: 0.1081
Epoch 5/20
30/30           1s 14ms/step -
accuracy: 0.9070 - loss: 0.0993 - val_accuracy: 0.8839 - val_loss: 0.0991
Epoch 6/20
30/30           0s 13ms/step -
accuracy: 0.9183 - loss: 0.0870 - val_accuracy: 0.8805 - val_loss: 0.0999
```

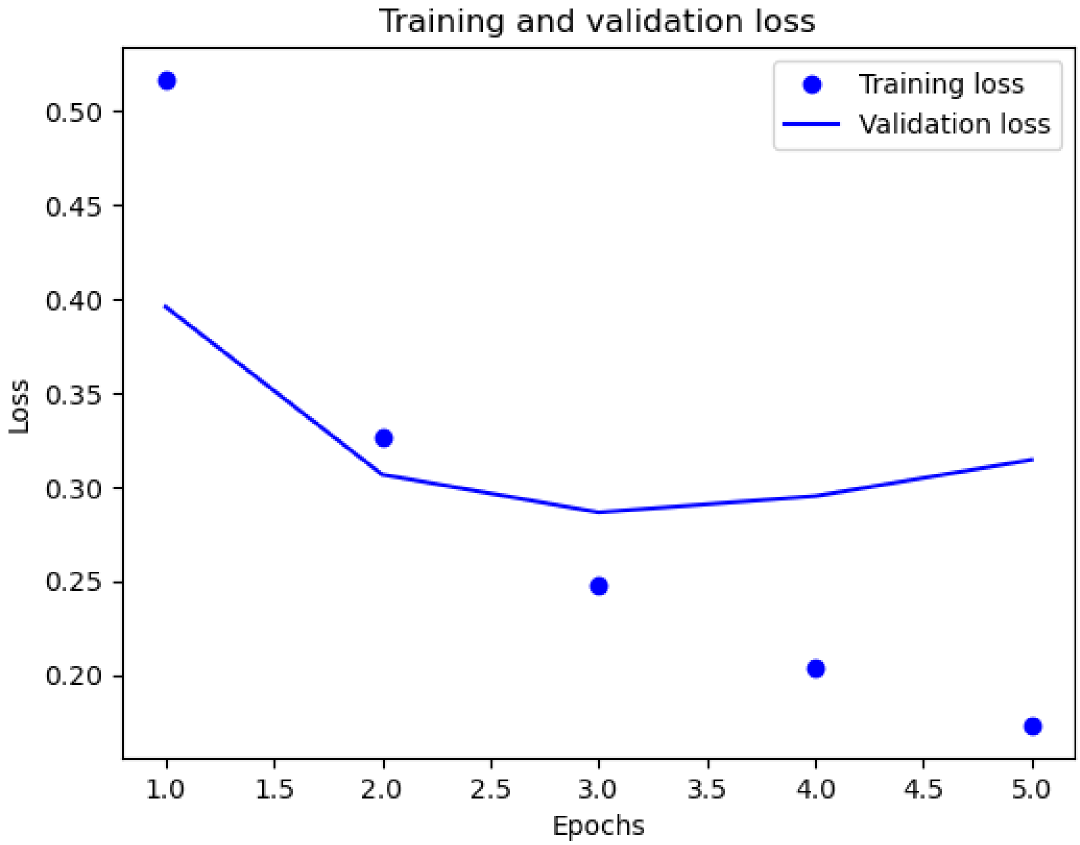
```
Epoch 7/20
30/30            0s 13ms/step -
accuracy: 0.9329 - loss: 0.0746 - val_accuracy: 0.8862 - val_loss: 0.0962
Epoch 8/20
30/30            0s 13ms/step -
accuracy: 0.9405 - loss: 0.0692 - val_accuracy: 0.8772 - val_loss: 0.1041
Epoch 9/20
30/30            0s 13ms/step -
accuracy: 0.9481 - loss: 0.0626 - val_accuracy: 0.8859 - val_loss: 0.0974
Epoch 9: early stopping
782/782            2s 2ms/step -
accuracy: 0.8791 - loss: 0.1017
Test loss: 0.10072687268257141, Test accuracy: 0.8817200064659119
```

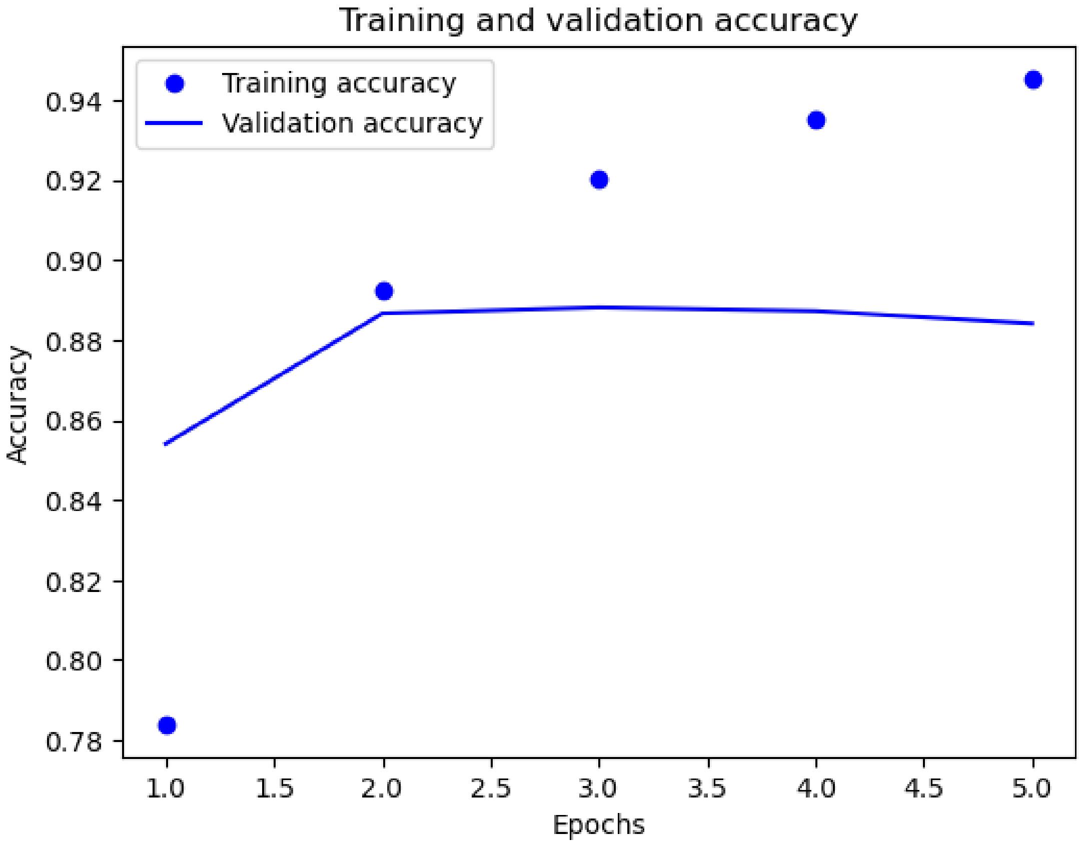




```
Testing configuration: {'layers': 2, 'units': 16, 'activation': 'tanh', 'loss':
'binary_crossentropy'}
Epoch 1/20
30/30                 6s 102ms/step -
accuracy: 0.7036 - loss: 0.5901 - val_accuracy: 0.8541 - val_loss: 0.3958
Epoch 2/20
30/30                 0s 13ms/step -
accuracy: 0.8912 - loss: 0.3445 - val_accuracy: 0.8867 - val_loss: 0.3066
Epoch 3/20
30/30                 0s 13ms/step -
accuracy: 0.9198 - loss: 0.2554 - val_accuracy: 0.8882 - val_loss: 0.2865
Epoch 4/20
30/30                 0s 14ms/step -
accuracy: 0.9380 - loss: 0.2027 - val_accuracy: 0.8873 - val_loss: 0.2951
Epoch 5/20
30/30                 0s 13ms/step -
accuracy: 0.9487 - loss: 0.1701 - val_accuracy: 0.8842 - val_loss: 0.3144
Epoch 5: early stopping
782/782                 1s 2ms/step -
accuracy: 0.8752 - loss: 0.3326
```

```
Test loss: 0.3286976218223572, Test accuracy: 0.8774799704551697
```




Training and validation accuracy
Training accuracy
Validation accuracy
Accuracy
0.94
0.92
0.90
0.88
0.86
0.84
0.82
0.80
0.78
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Epochs

```
[ ]:
```