REPORT DEEP LEARNING

Recurrent Neural Network

Team :
NGUYEN Anh Tuan
LE Doan Phuoc
NGUYEN Ke An
PHAM Tien Duy

Professor :
Mr. Khaled AL-SAIH

University year : 2023 – 2024

1. Introduction

- **Definition of Recurrent Neural Network (RNN)**

- Recurrent Neural Networks are networks with loops, allowing information to persist.

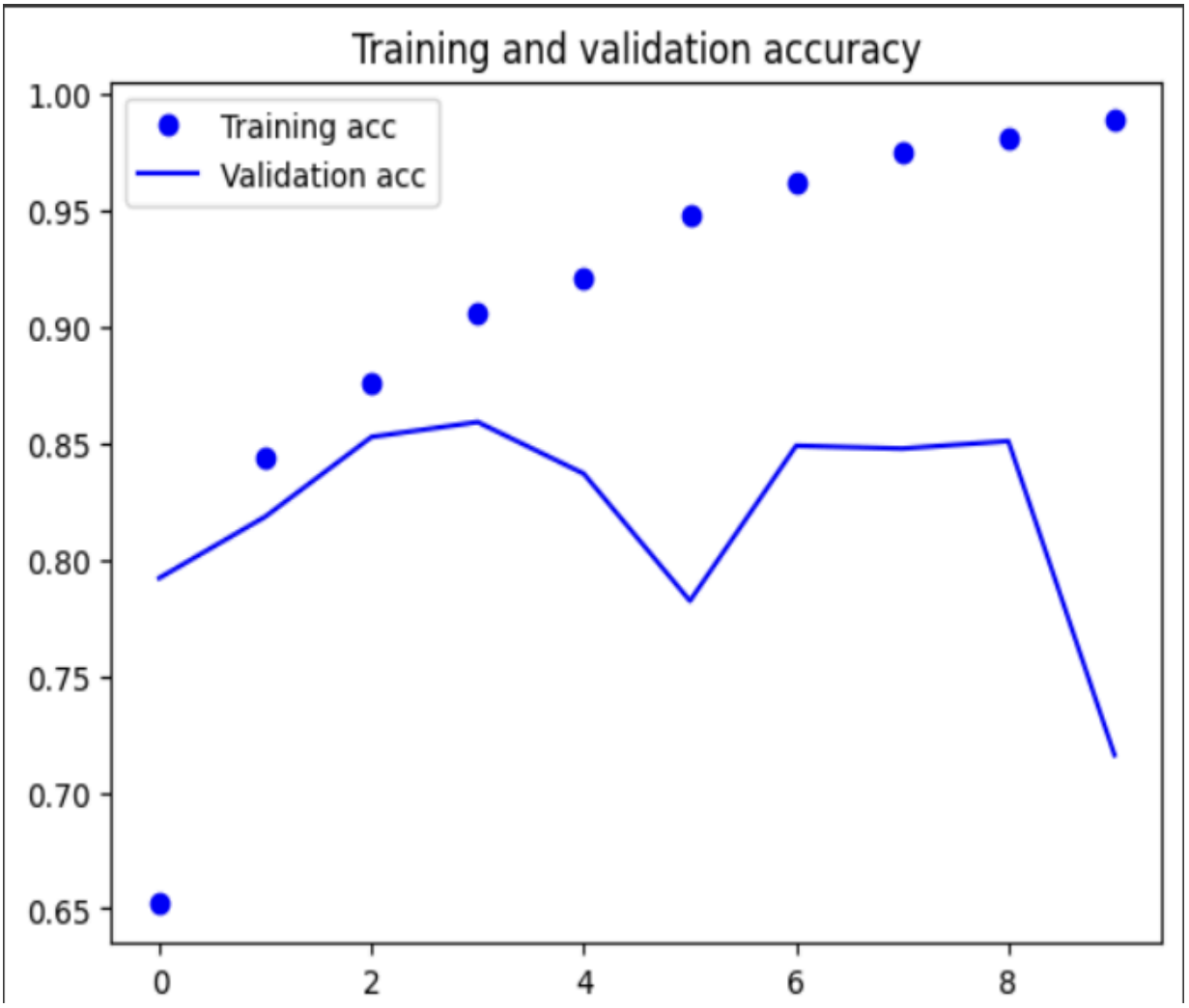
- **Dataset**

- We use the IMDB movie review classification problem. This is a dataset of around 50,000 **positive/negative** reviews for movies from the Internet Movie Database, includes :

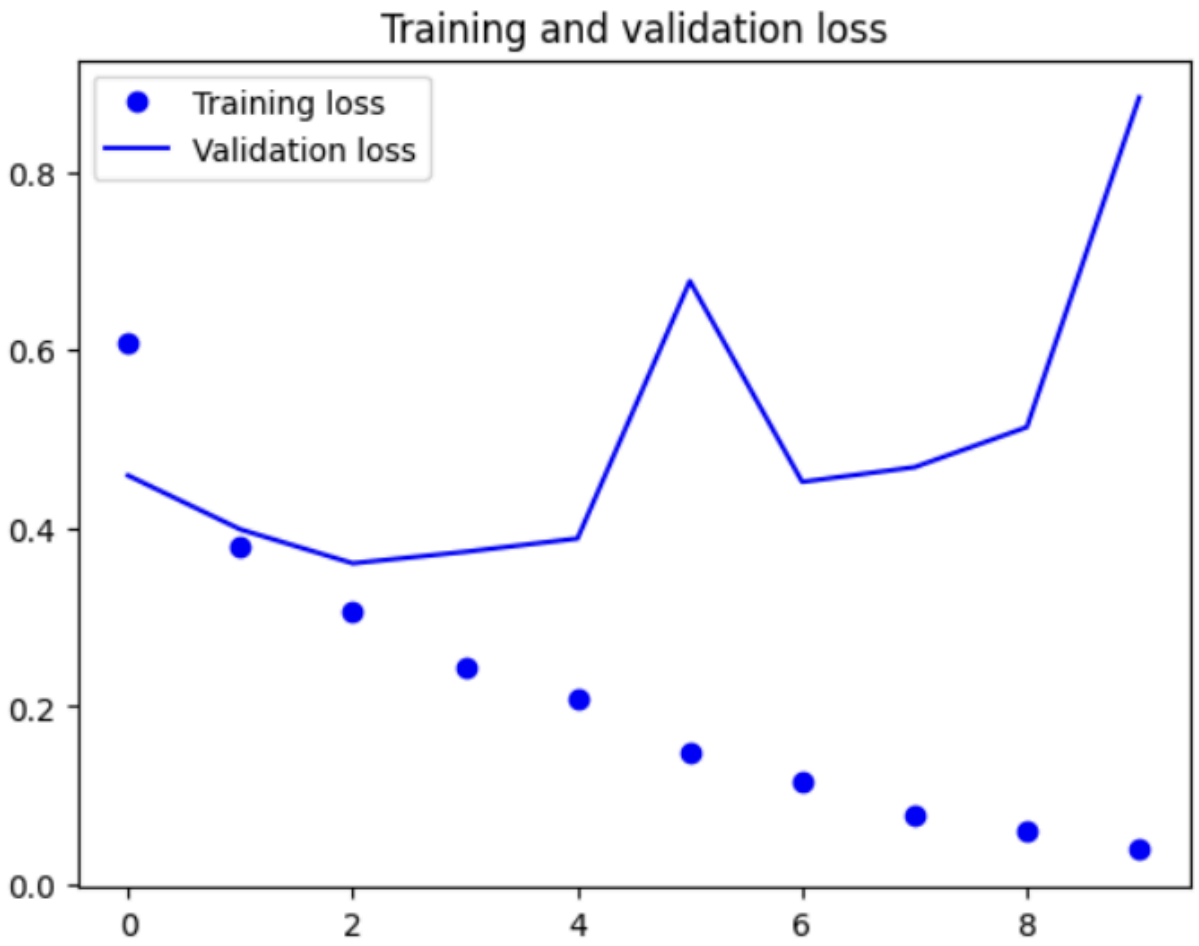
+ 25000 train sequences.
+ 25000 test sequences.

2. Performance of Simple Recurrent Neural Network (Simple RNN)

- **Training and validation accuracy**



- **Training and validation loss**



- **Accuracy, Specificity, Sensitivity on the test set**

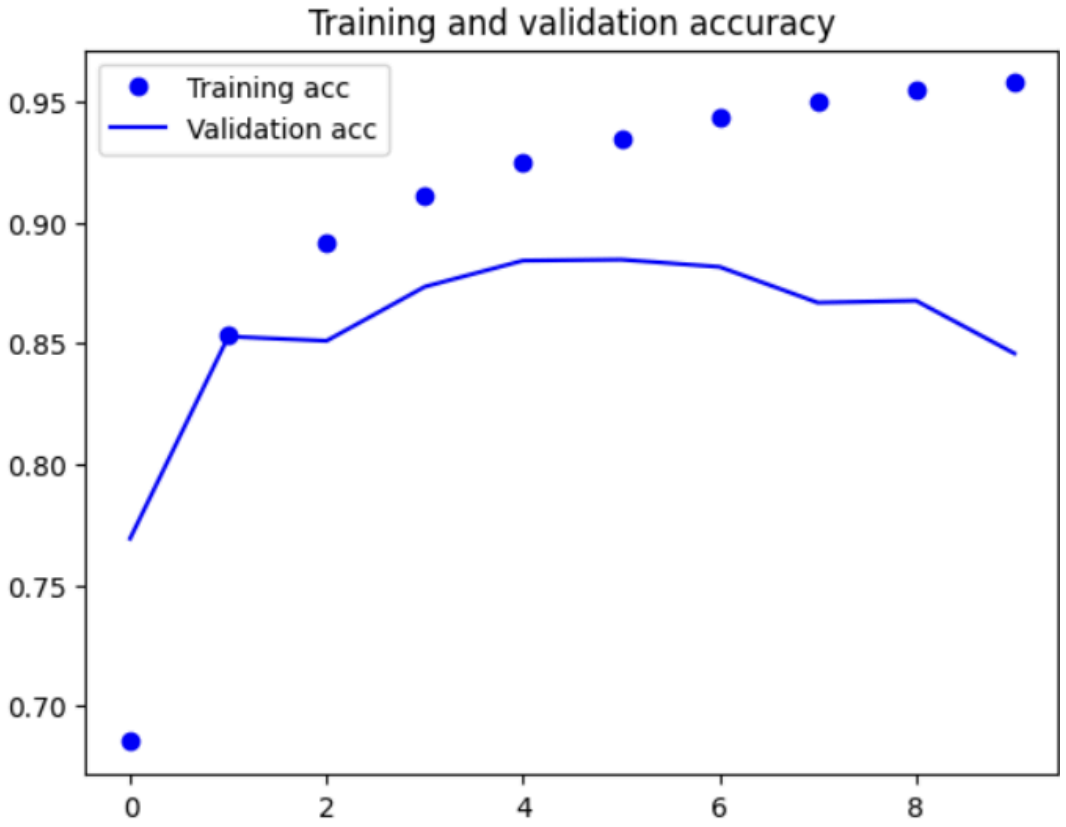
- Accuracy : 0.7541
- Sensitivity (Recall): 0.5530
- Specificity: 0.9552

- **Confusion Matrix**

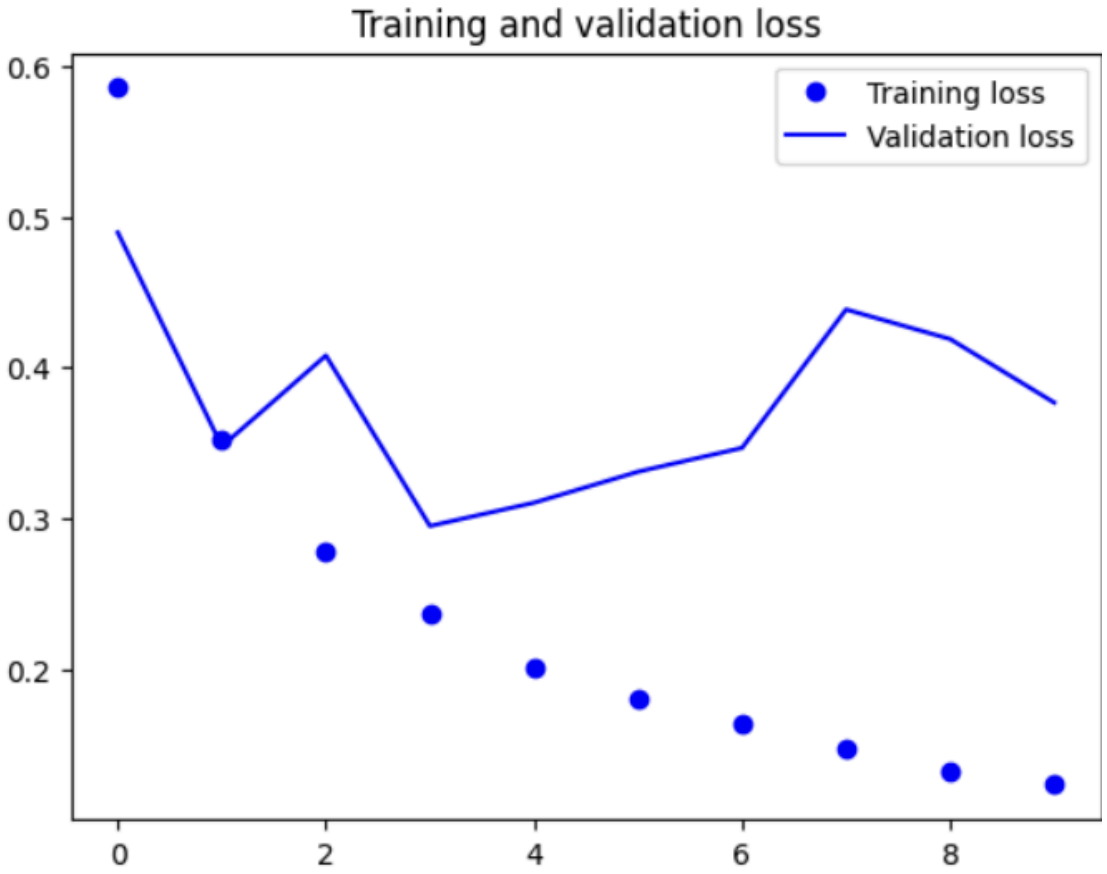
```
Confusion Matrix:
[[11940   560]
 [ 5588  6912]]
```

3. Performance of Long Short-Term Memory (LSTM)

- **Training and validation accuracy**



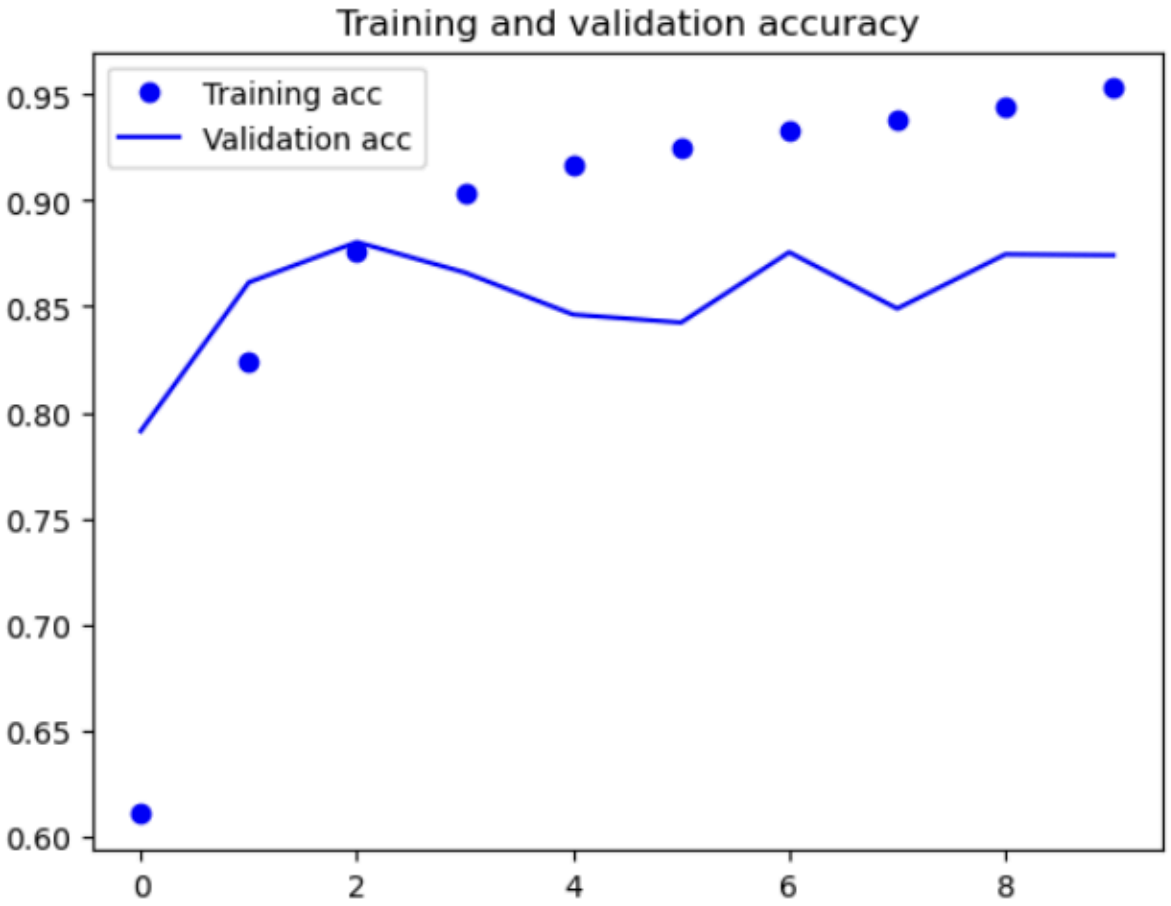
- **Training and validation loss**



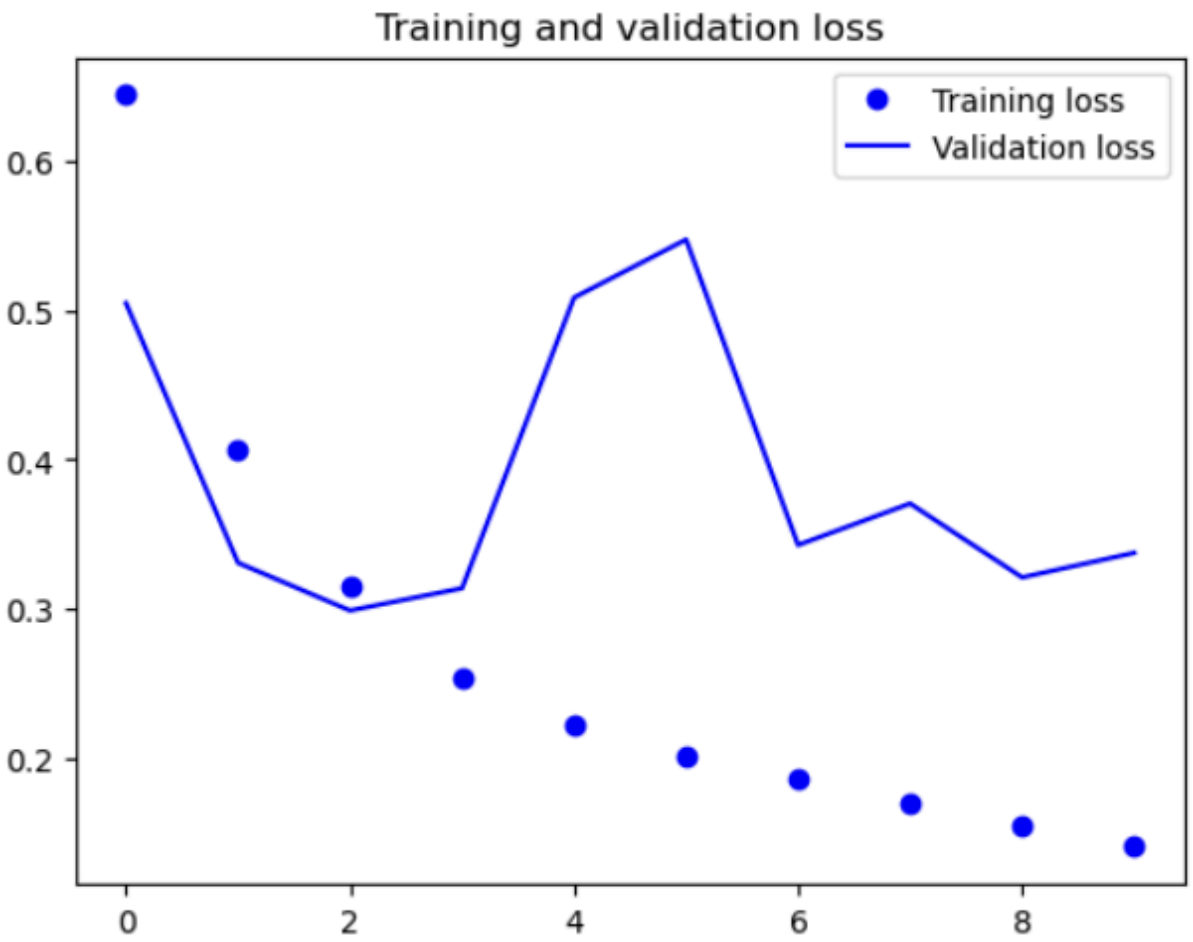
- **Accuracy, Specificity, Sensitivity on the test set**
- Accuracy: 0.8711
- Sensitivity (Recall): 0.8534
- Specificity: 0.8887
- **Confusion Matrix**

4. Performance of Bidirectional Long Short-Term Memory (BiLSTM)

- **Training and validation accuracy**



- **Training and validation loss**



- **Accuracy, Specificity, Sensitivity on the test set**

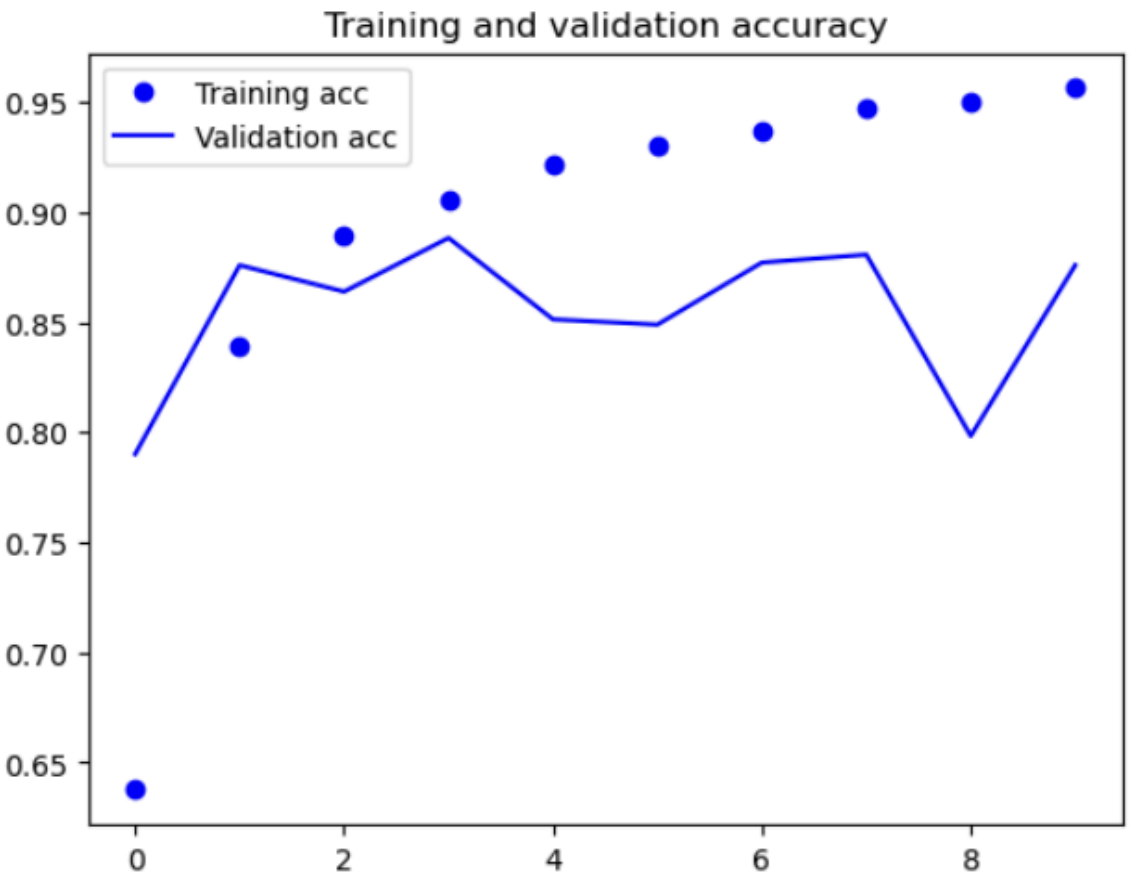
- Accuracy: 0.8738
- Sensitivity (Recall): 0.8899
- Specificity: 0.8577

- **Confusion Matrix**

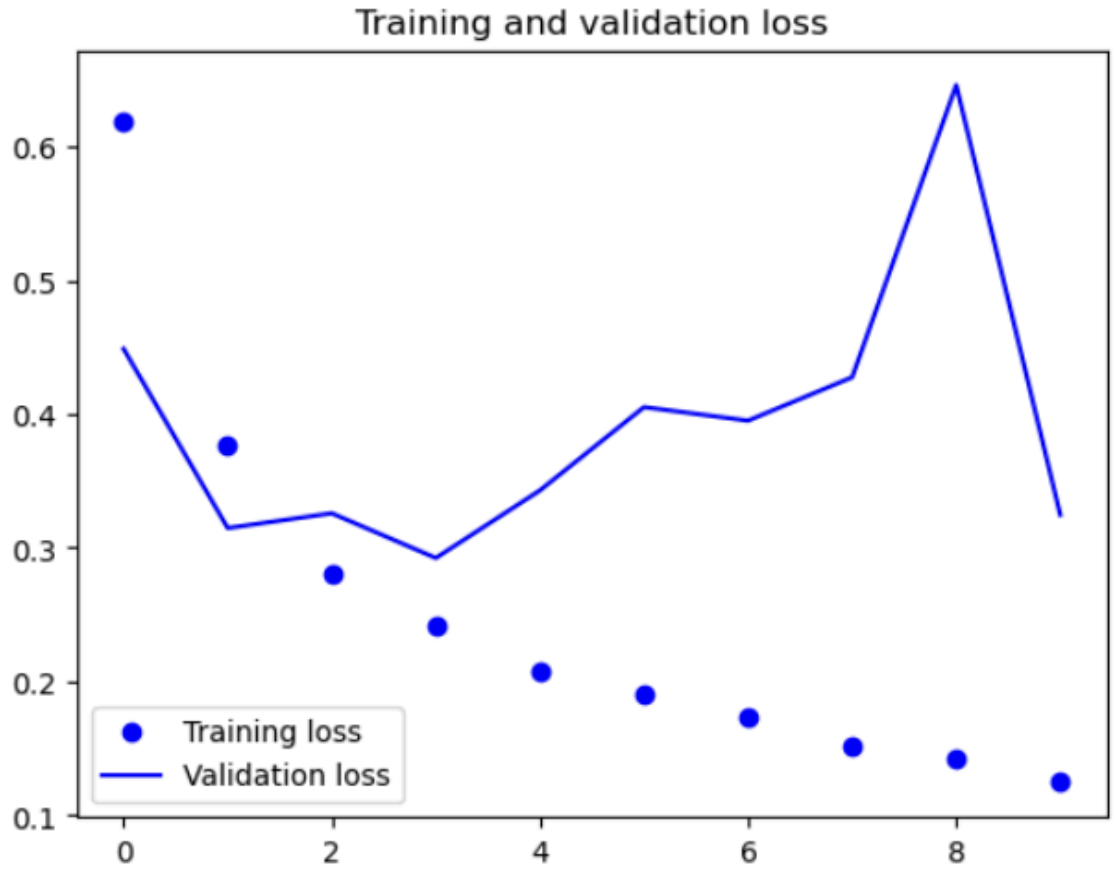
```
Confusion Matrix:
[[10721  1779]
 [ 1376 11124]]
```

5. Performance of Gate Recurrent Long Short-Term Memory (GRU LSTM)

- **Training and validation accuracy**



- **Training and validation loss**



- **Accuracy, Specificity, Sensitivity on the test set**
- Accuracy: 0.8647
- Sensitivity (Recall): 0.8554
- Specificity: 0.8739
- **Confusion Matrix**

```
Confusion Matrix:
[[10924  1576]
 [ 1807 10693]]
```

6. Comparison between the performance of these models

- Accuracy: The Bidirectional LSTM model performs the best in terms of accuracy, followed closely by the LSTM and GRU LSTM models. The Simple RNN model has the lowest accuracy, which is not surprising as Simple RNN often struggles with long-term dependencies in the data.

- Sensitivity (Recall): Bidirectional LSTM also leads in sensitivity, suggesting it is better at correctly identifying positive reviews as positive. The Simple RNN model significantly lags behind the others, which may indicate difficulty in capturing the nuances in the sequence data that are indicative of positive sentiment.

- Specificity: The Simple RNN, despite its lower overall accuracy and sensitivity, has the highest specificity. This suggests that while it struggles to correctly identify positive reviews, it is very good at correctly identifying negative reviews.