



University | School of  
of Glasgow | Computing Science

THE  
AWARDS  
2020

UNIVERSITY  
OF THE YEAR

# Attention and Explainability

Dr. Fani Deligianni,

[fani.deligianni@glasgow.ac.uk](mailto:fani.deligianni@glasgow.ac.uk)

Lecturer (Assistant Professor)

Lead of the Computing Technologies for Healthcare Theme

<https://www.gla.ac.uk/schools/computing/staff/fanideligianni>

WORLD  
CHANGING  
GLASGOW

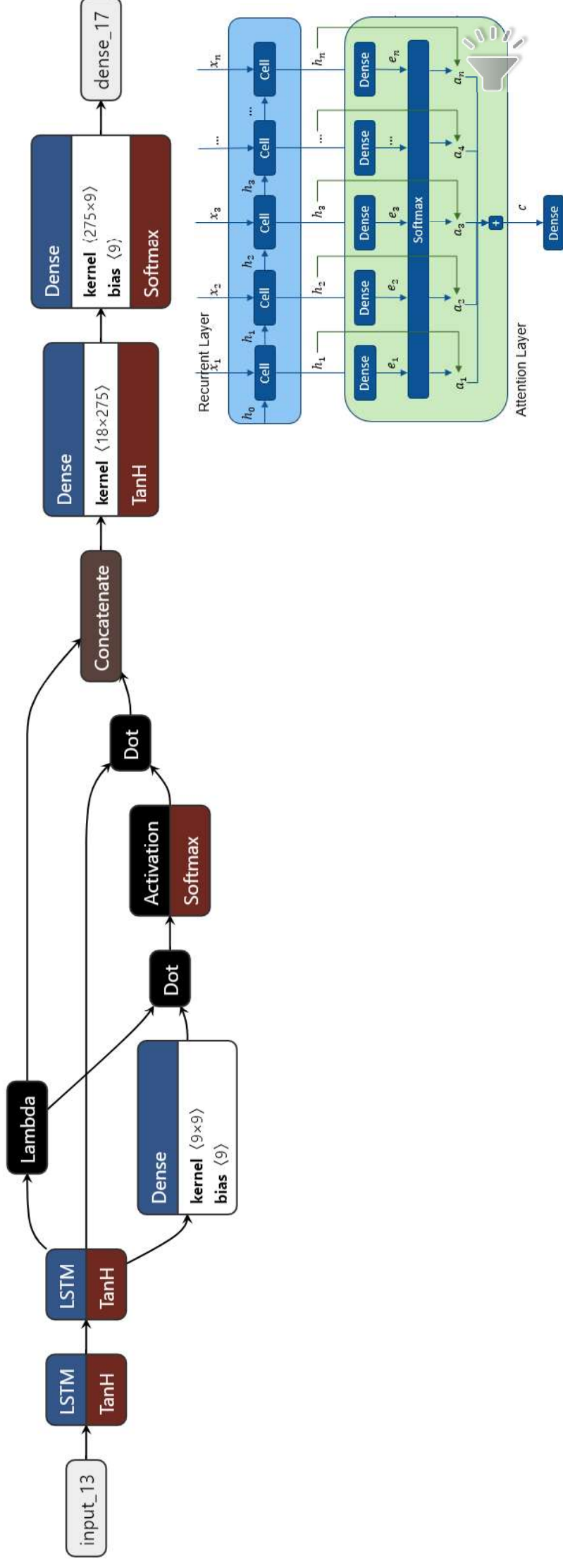


# Attention in Clinical Time-Series

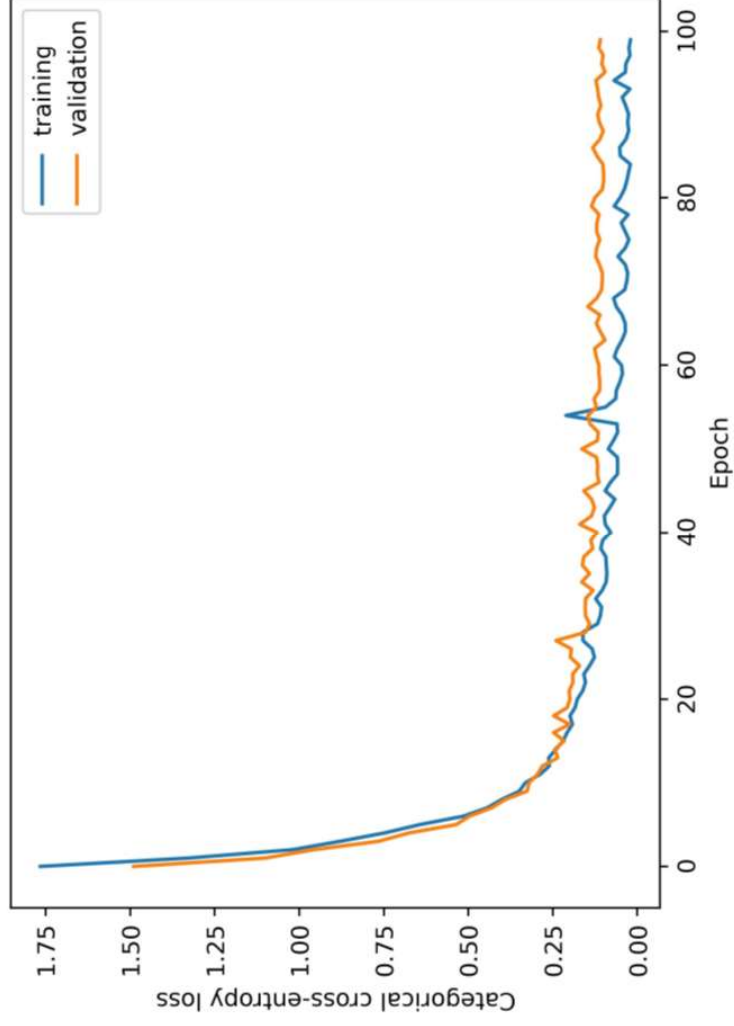
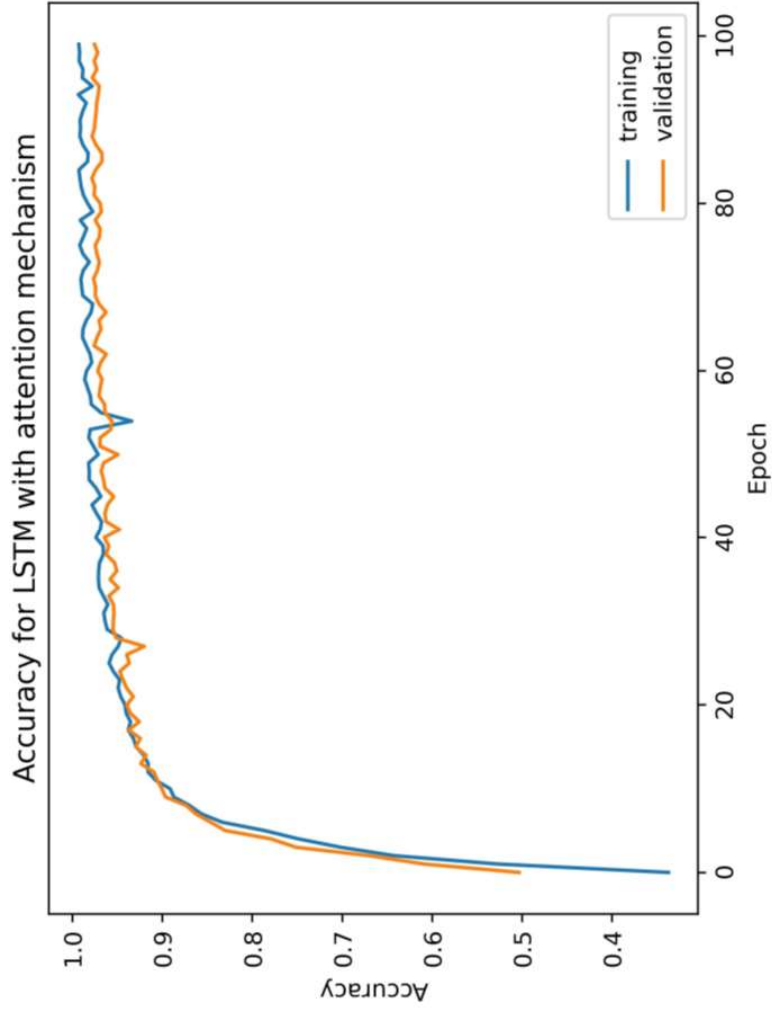
- Attention has been applied on electronic health records to enhance performance and stability of the deep learning process
- It has been used in conjunction with both CNN networks as well as RNN.
- Different flavors of attention, ie. self-attention and transformers
- MIMIC-III database is by far the most common way to test these methods on real-scale clinical datasets



# Attention Mechanism in Practice

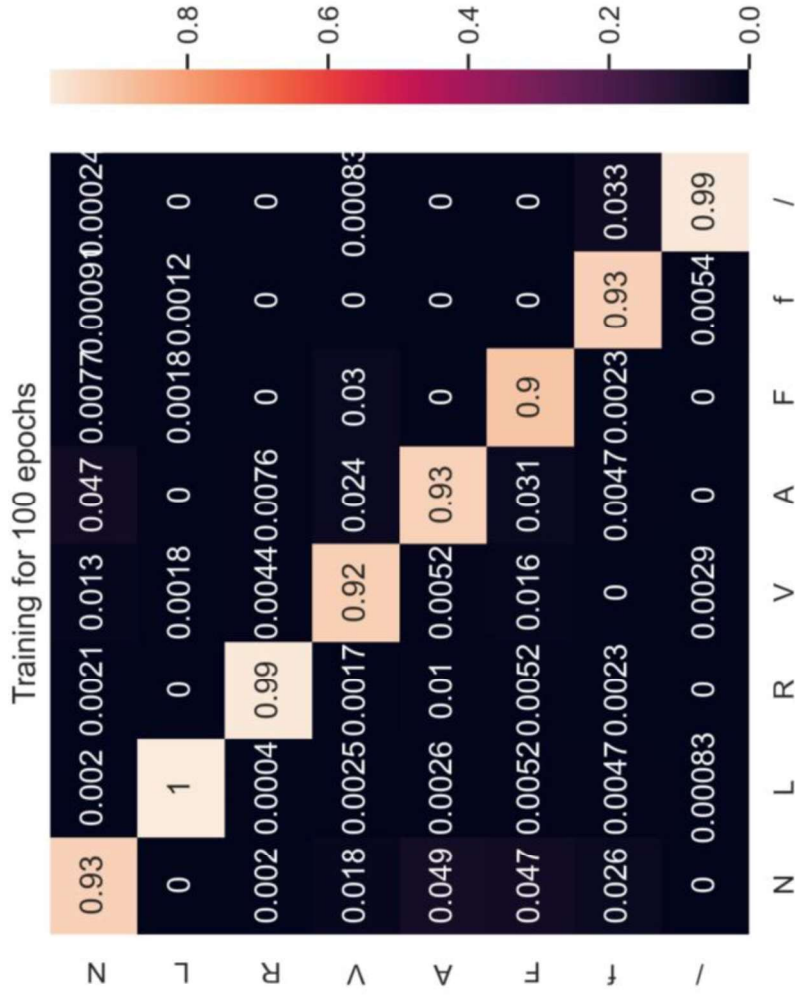
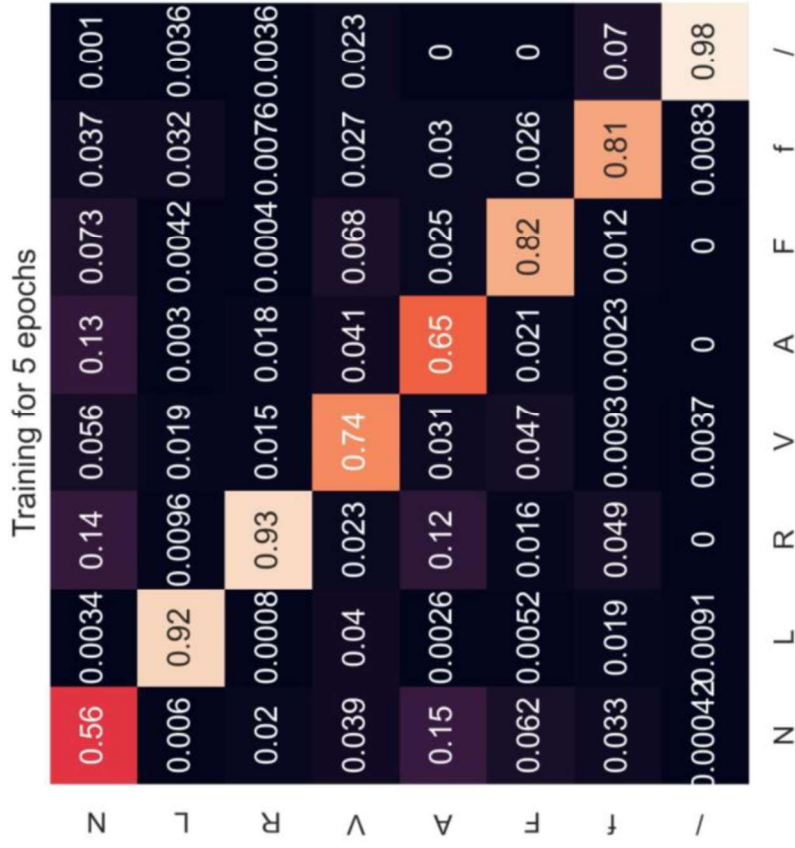


# Training and Validation

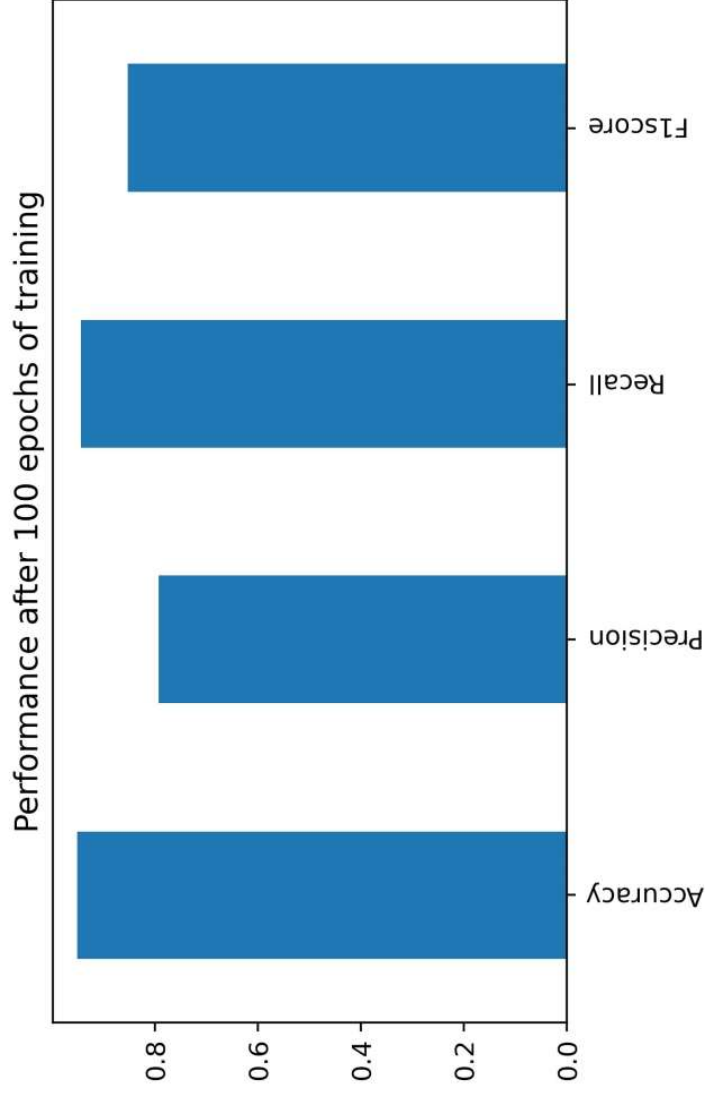
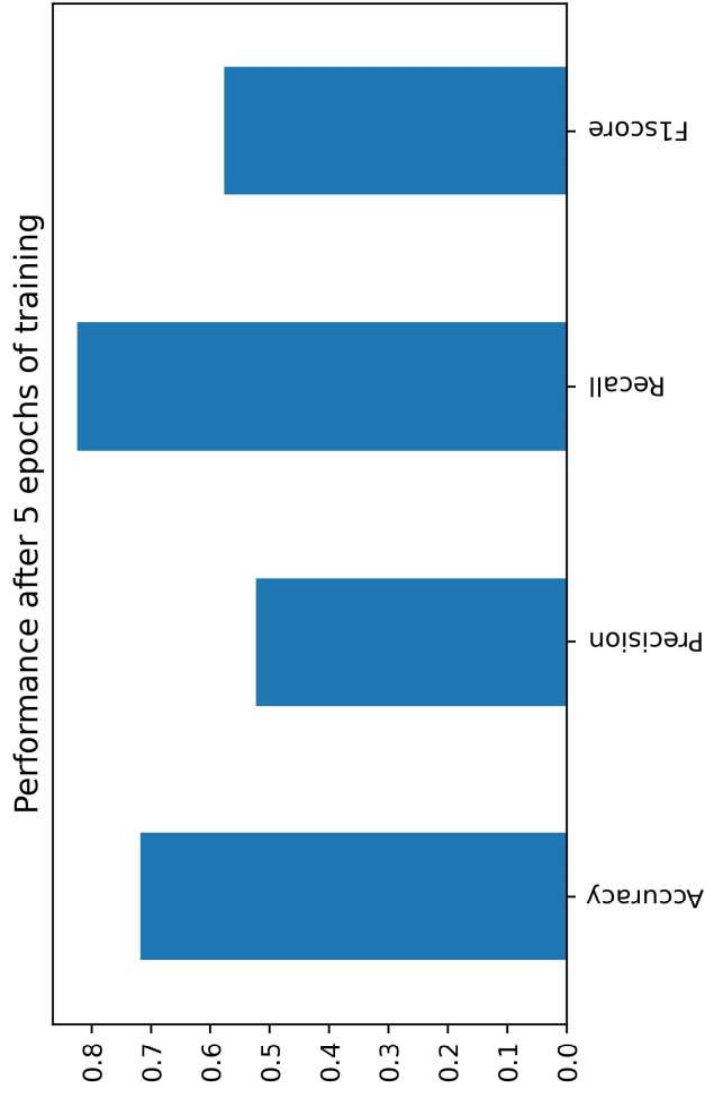




# Performance Evaluation - Confusion Matrices

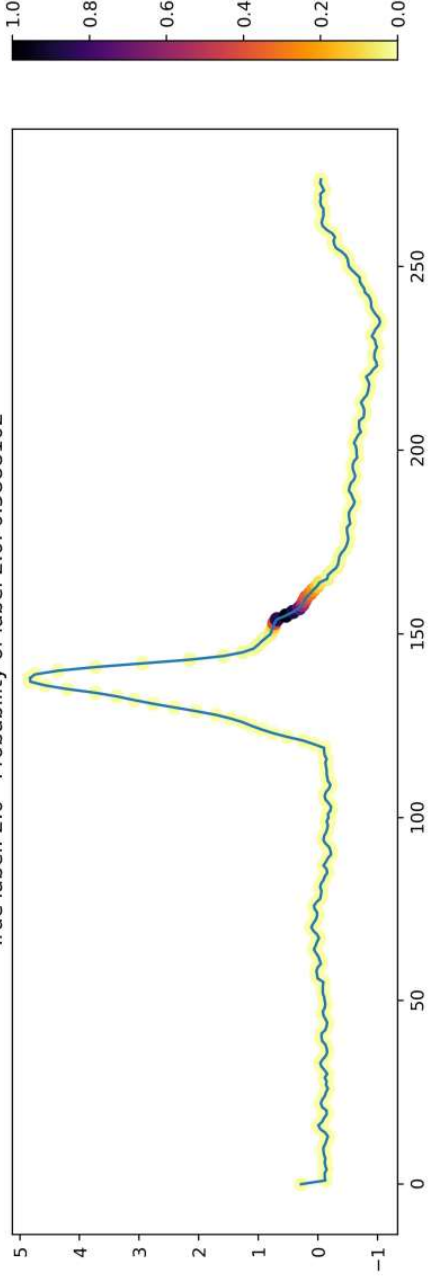


# Performance Evaluation

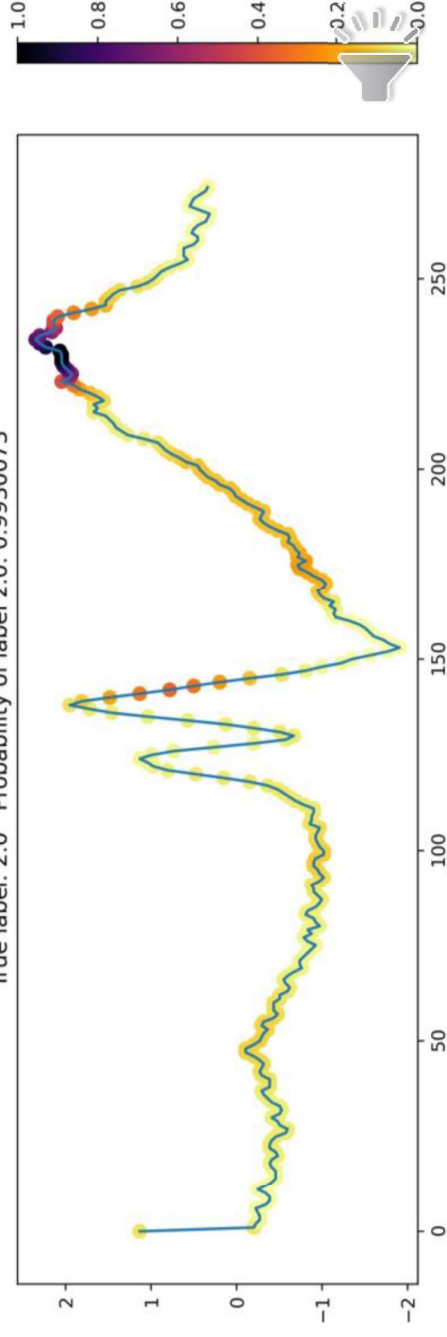


# Attention Weights after 5 Epochs

True label: 2.0 Probability of label 2.0: 0.5888102

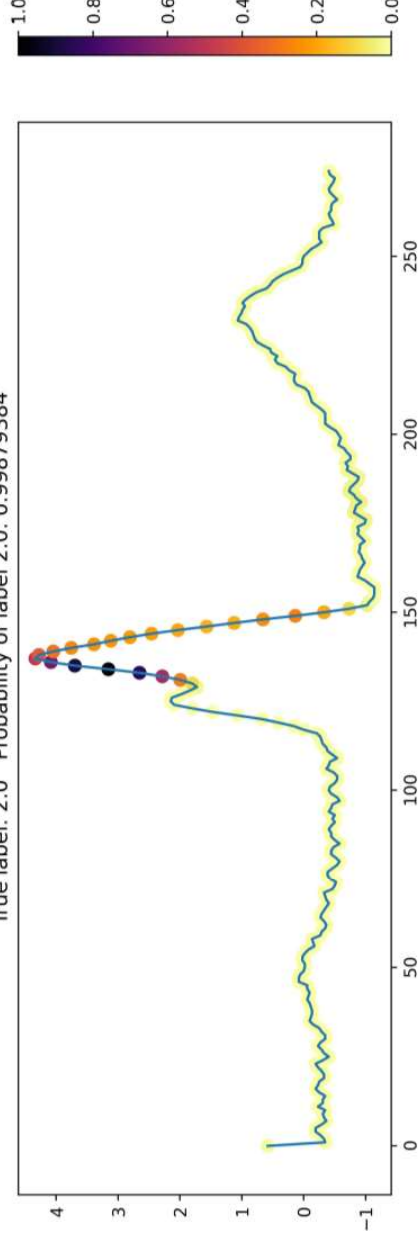


True label: 2.0 Probability of label 2.0: 0.9930073

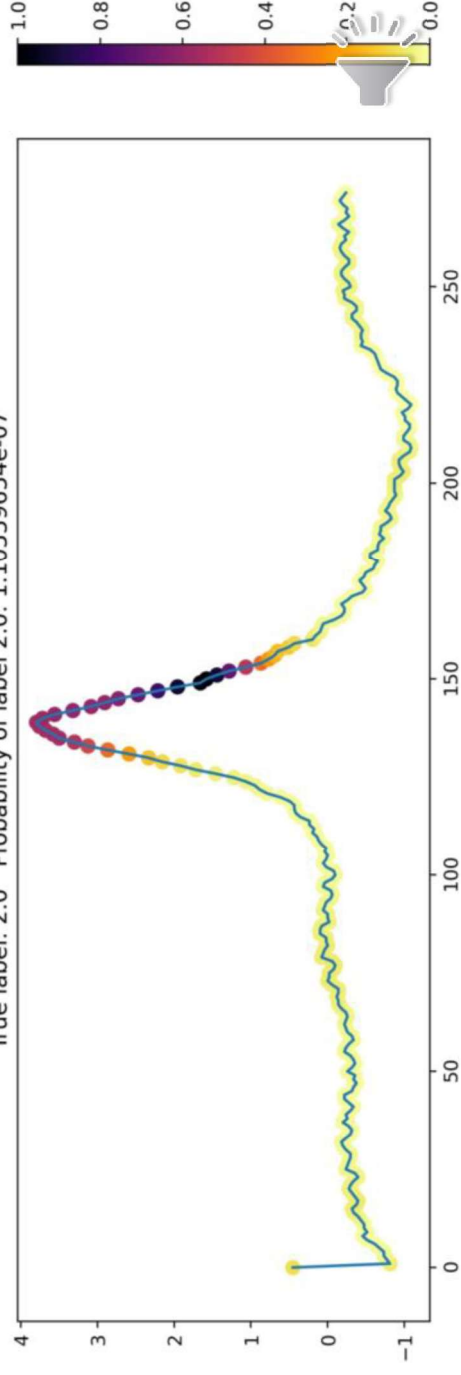


# Attention Weights after 100 Epochs

True label: 2.0 Probability of label 2.0: 0.99879384



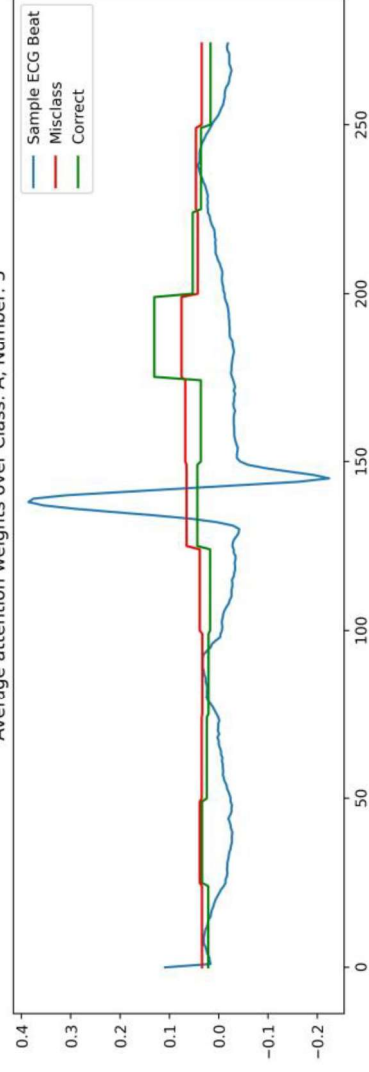
True label: 2.0 Probability of label 2.0: 1.10559654e-07



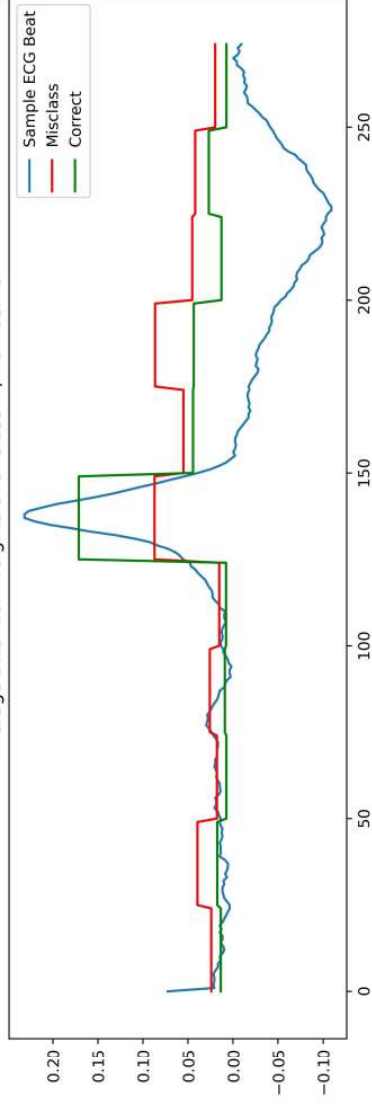


# Average Attention Weights

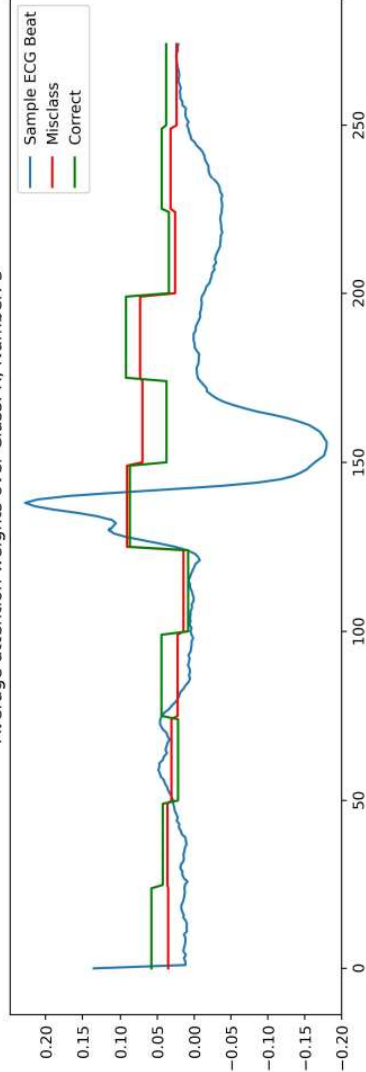
Average attention weights over Class: A, Number: 5



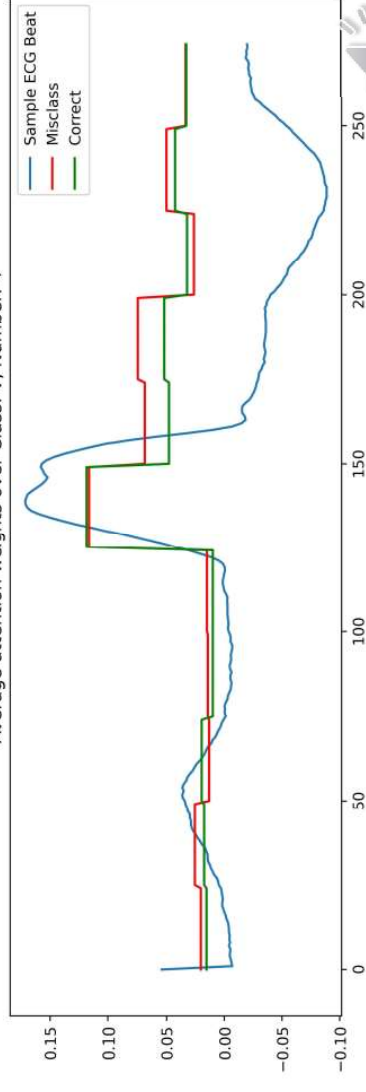
Average attention weights over Class: F, Number: 6



Average attention weights over Class: R, Number: 3



Average attention weights over Class: V, Number: 4



# Summary

- Attention has been mostly applied to enhance performance
- Attention weight visualisations offer some degrees of understanding of the deep network decision process
- Attention has been very little studied in terms of explainability



# References

- Niu et al. 'A review on the attention mechanism of deep learning', Neurocomputing, 2021
- Harerimana et al. 'A deep attention model to forecast the Length Of Stay and the in-hospital mortality right on admission from ICD codes and demographic data', Journal of Biomedical Informatics, 2021