



University | School of
of Glasgow | Computing Science

THE
AWARDS
2020

UNIVERSITY
OF THE YEAR

Integrated Gradients in Time-Series Classification

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Lecturer (Assistant Professor)

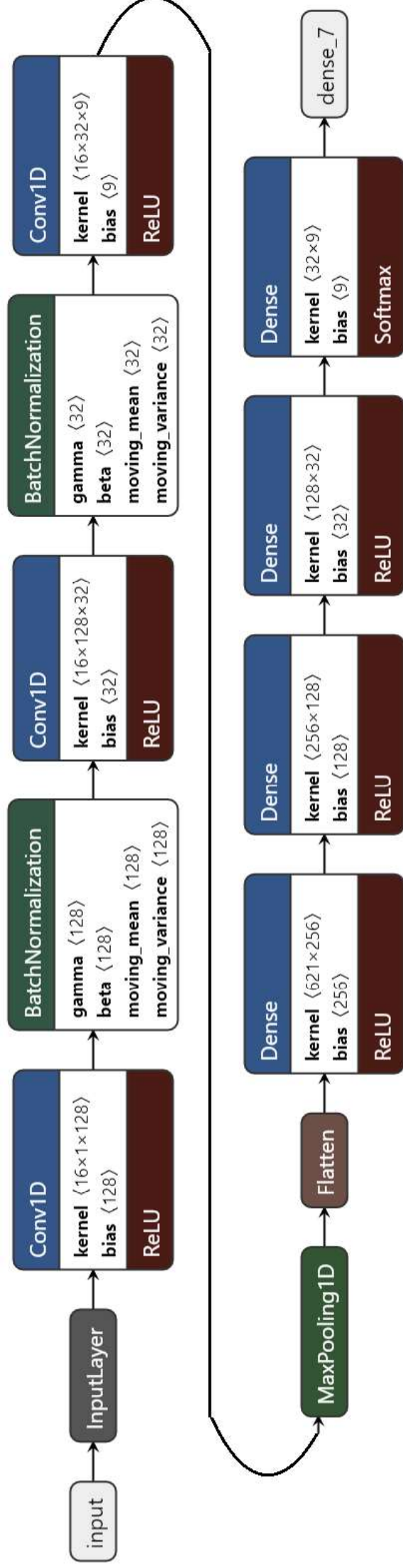
Lead of the Computing Technologies for Healthcare Theme

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

WORLD
CHANGING
GLASGOW

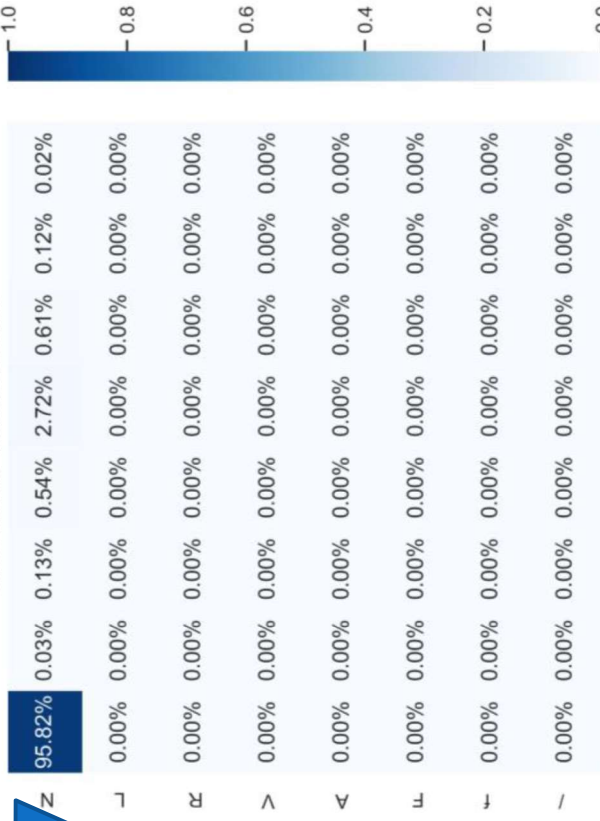


Integrated Gradients for CNN

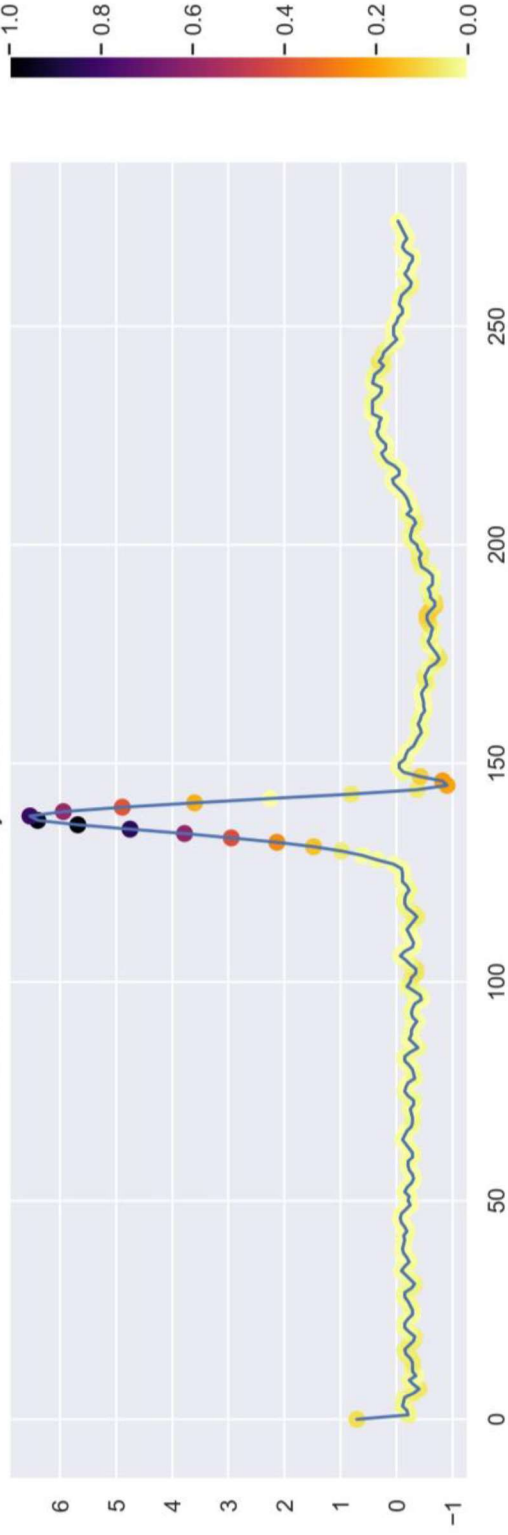


Integrated Gradients Explanations

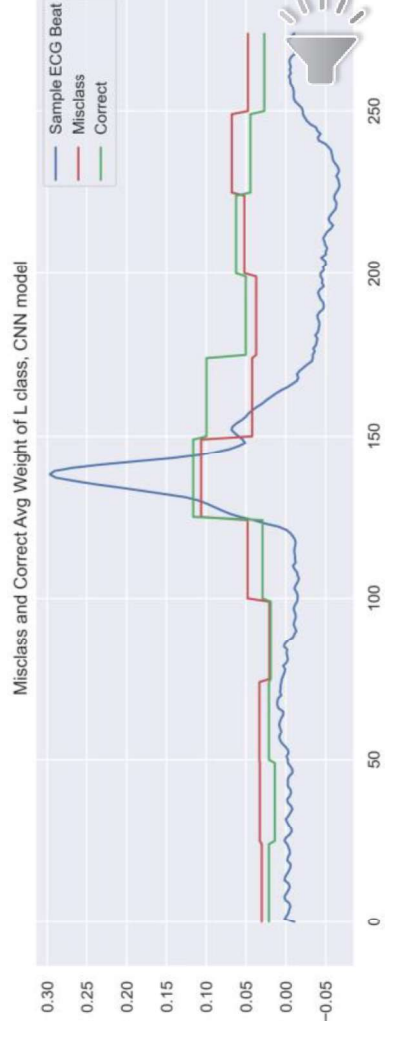
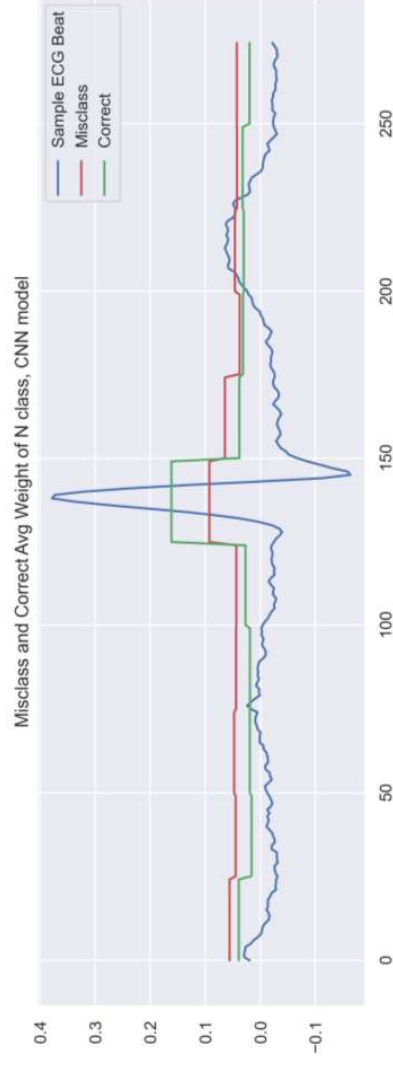
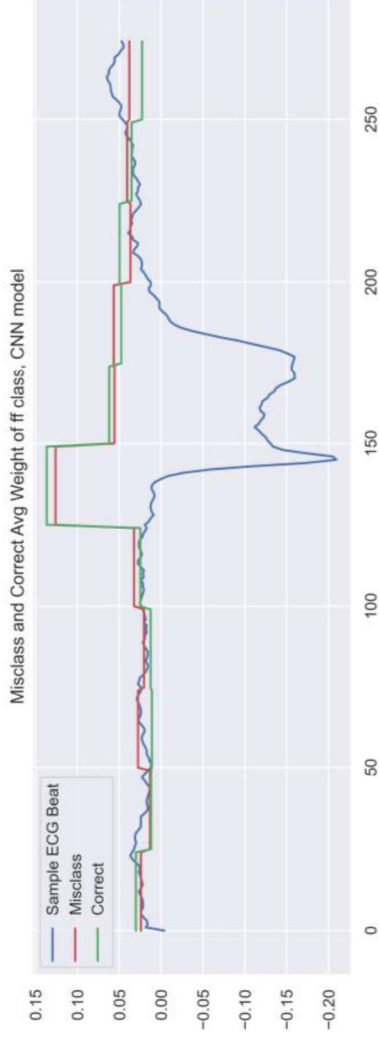
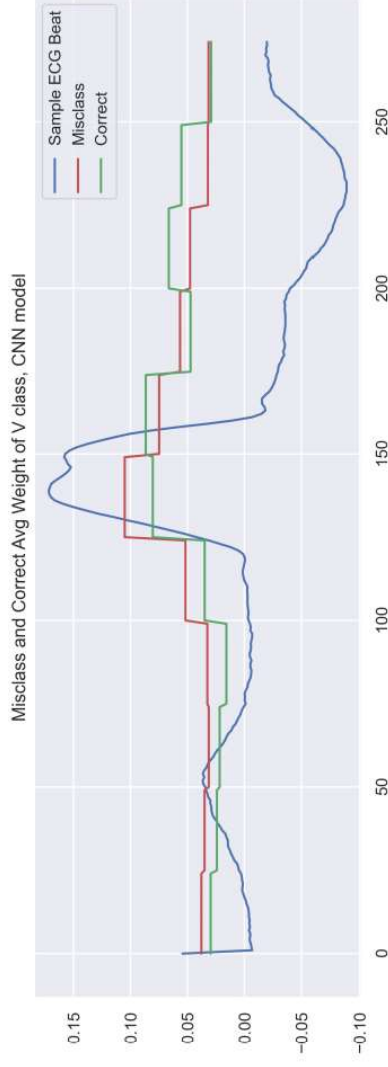
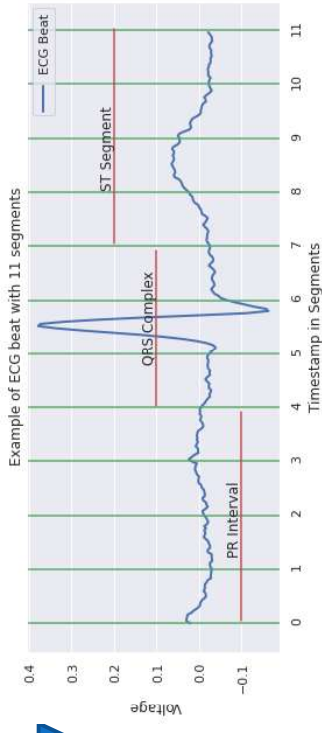
CNN Patients Confusion Matrix



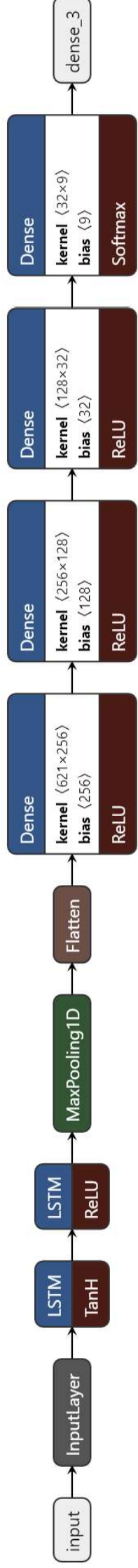
True label:1.0 Probability of label 1.0: 0.99999976



Average Explanations per Class



Integrated Gradients for LSTM

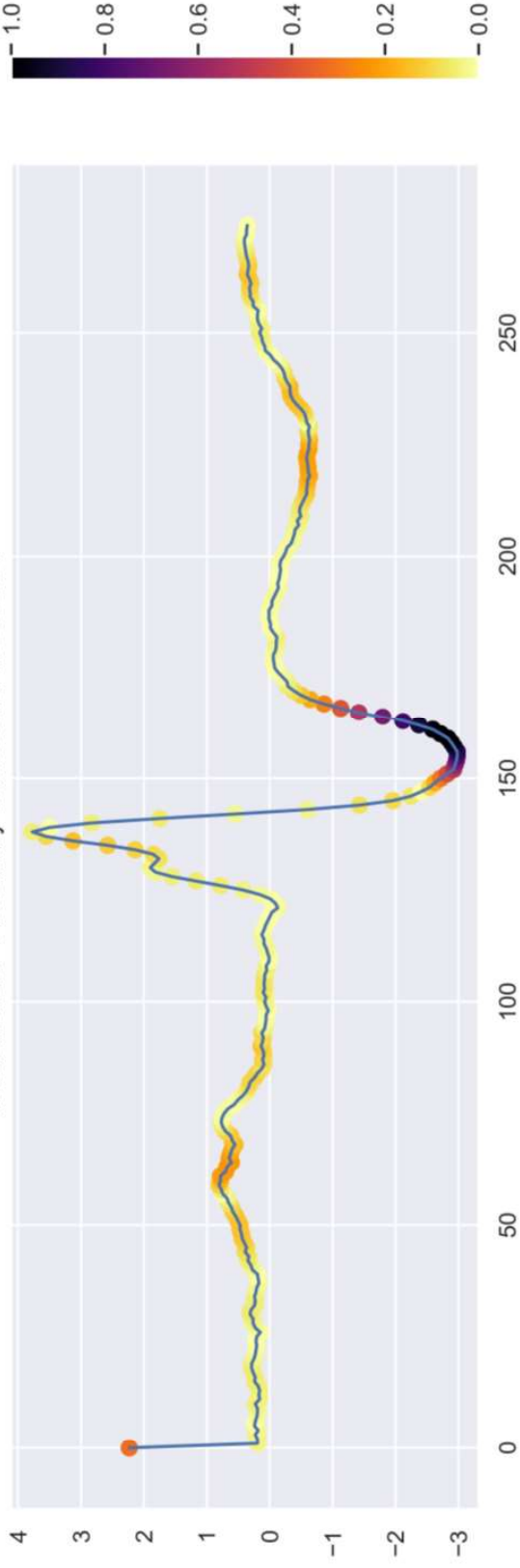


Integrated Gradients - LSTM

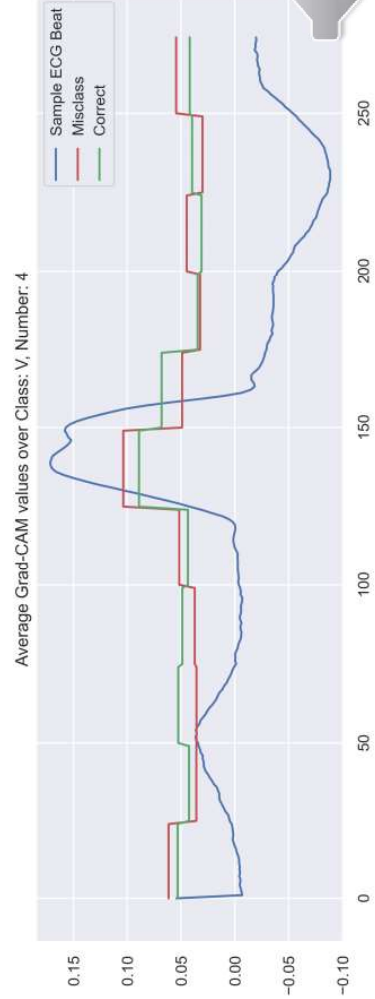
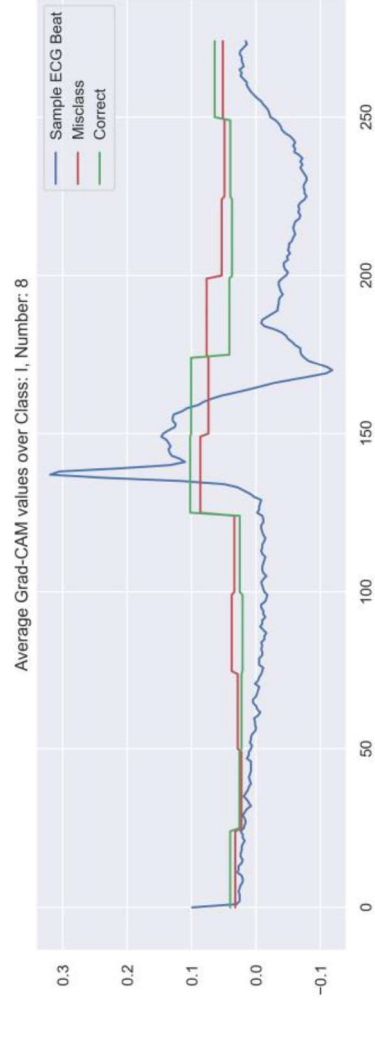
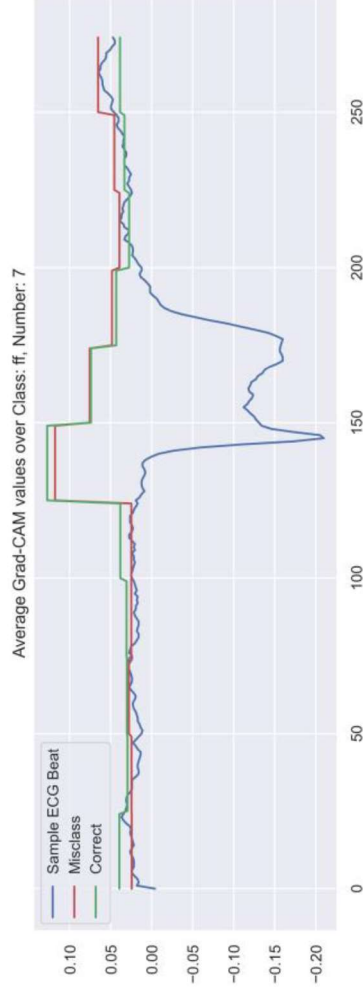
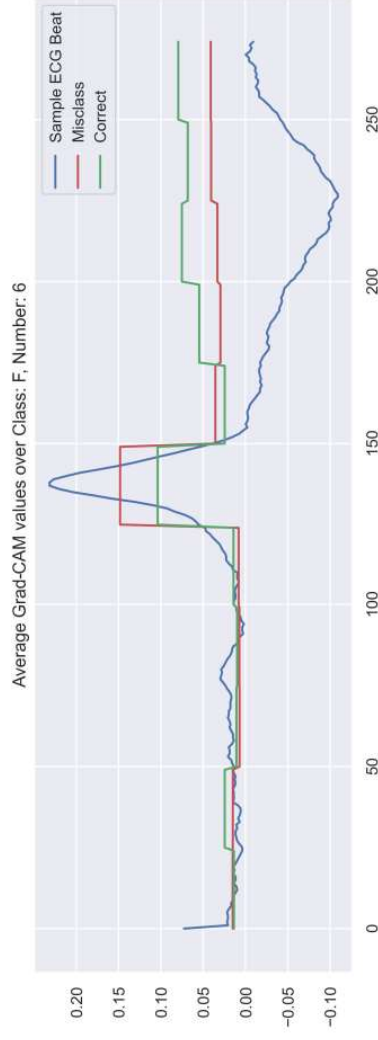
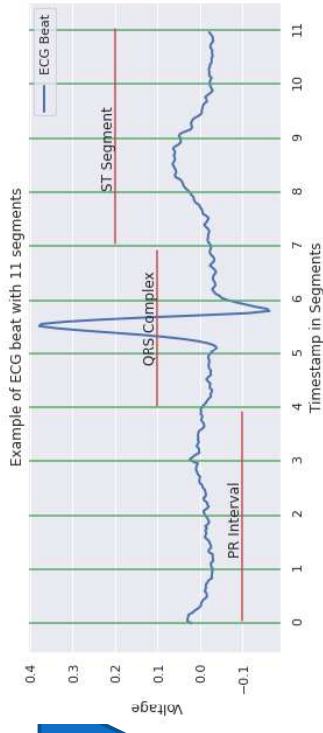
LSTM Holdout Beats Confusion Matrix

	N	L	R	V	A	F	f	/
Z	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
3	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
4	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
5	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
6	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
7	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
/	0.00%	0.00%	0.00%	0.08%	0.00%	0.00%	0.25%	99.67%

True label:3.0 Probability of label 3.0: 0.9999181



Average Explanations per Class



Summary

- Integrated gradients applied successfully in CNN and LSTM models for ECG classification
- Similar to image classification domain we used zero as a baseline



References

- Sundararajan et al. 'Axiomatic Attribution for Deep Networks', ICML, 2017.
- Klaise et al. 'Alibi Explain: Algorithms for Explaining Machine Learning Models', Journal of Machine Learning Research, 2021.