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THE AWARDS  
2020

UNIVERSITY  
OF THE YEAR

# CAM in Time-Series Classification

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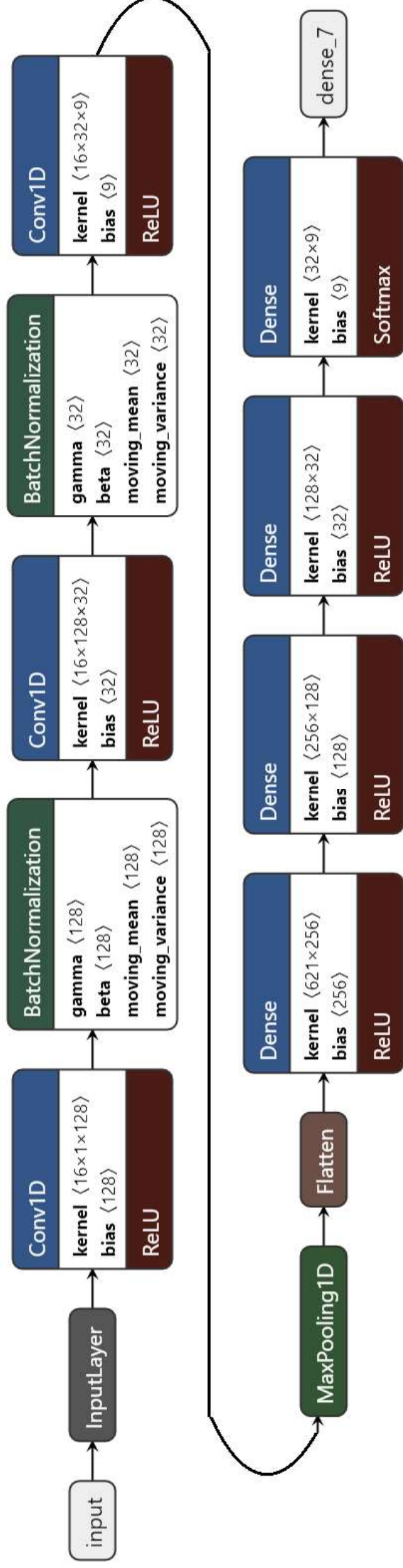
Lead of the Computing Technologies for Healthcare Theme

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

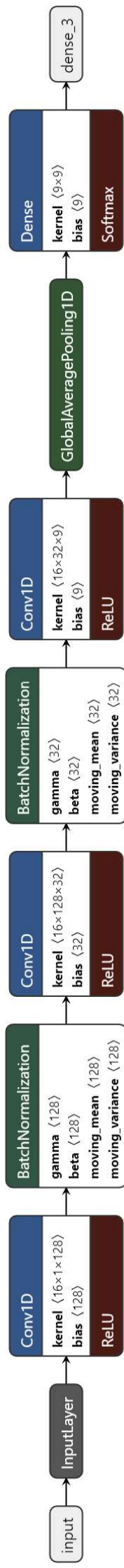
WORLD  
CHANGING  
GLASGOW



# Original CNN Architecture



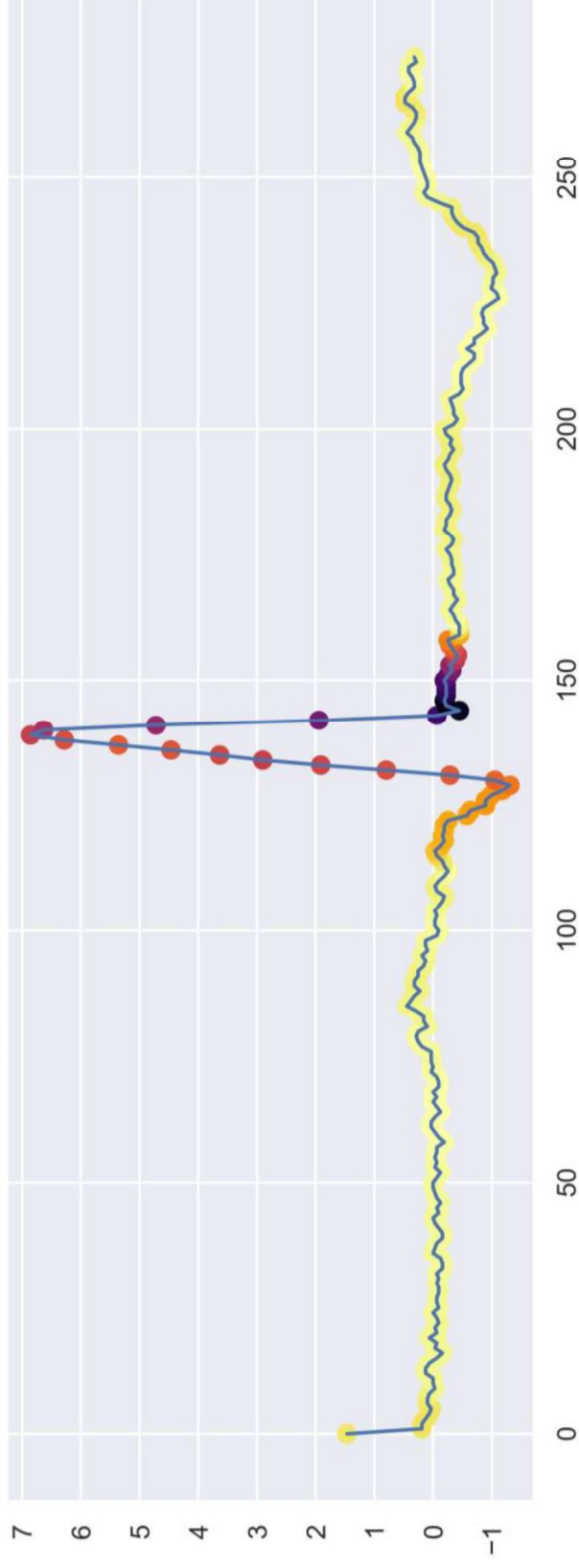
# CAM Architecture





# CAM Examples

True label:1.0 Probability of label 1.0: 0.88215315



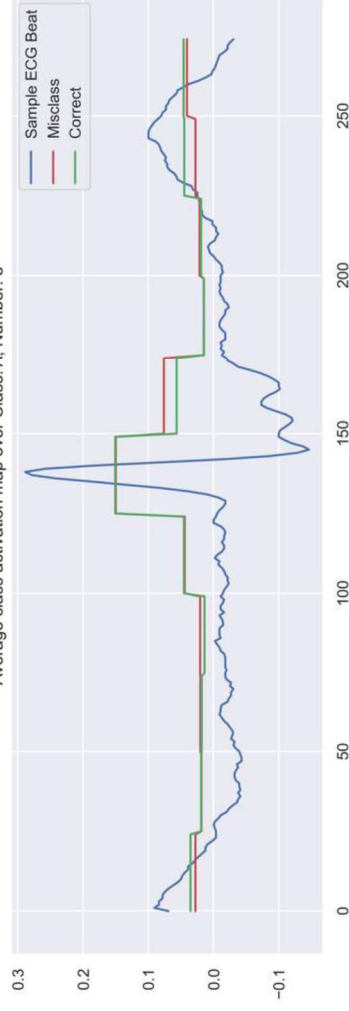
CNN Holdout Beats Confusion Matrix

	N	L	R	V	A	F	f	/
N	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
L	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
R	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
V	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
A	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
F	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
f	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%	0.71%	99.21%

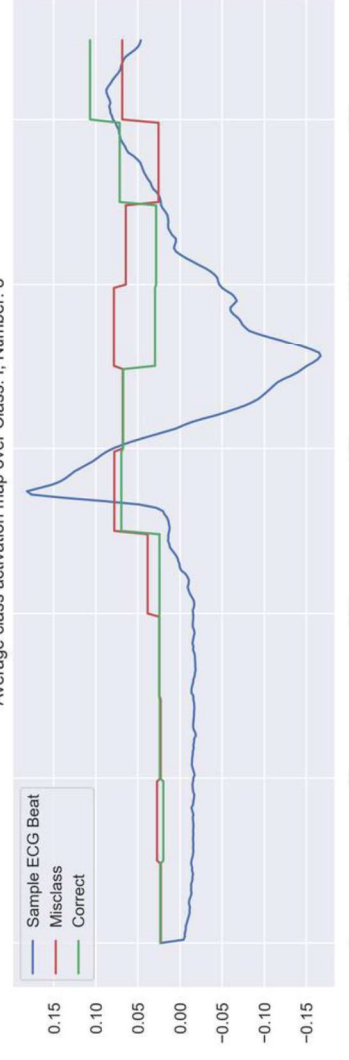


# CAM Explanations over Classes

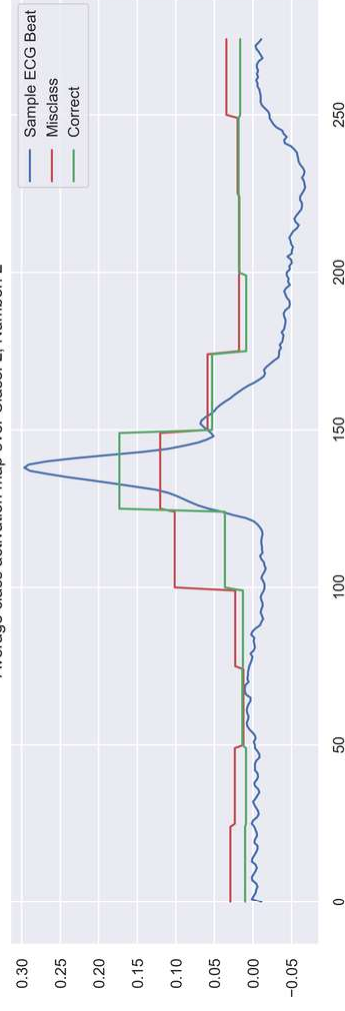
Average class activation map over Class: A, Number: 5



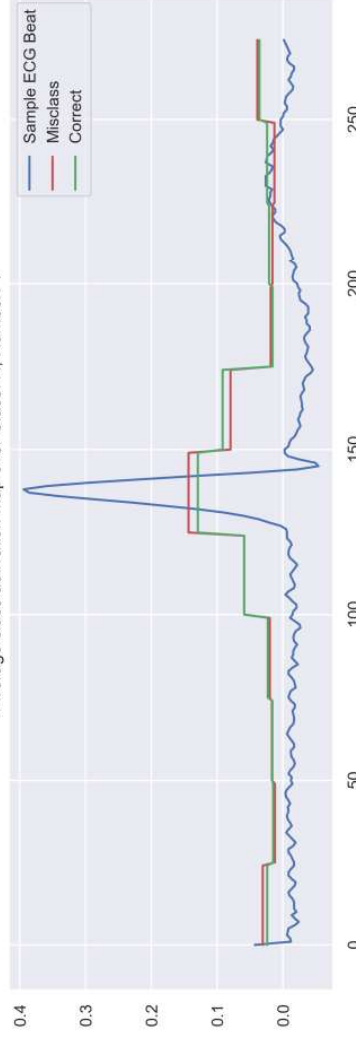
Average class activation map over Class: I, Number: 8



Average class activation map over Class: L, Number: 2



Average class activation map over Class: N, Number: 1



# Summary

- CAM provided convincing local explanations of the ECG classification task
- CAM required to change the network architecture
- Local explanations over several samples might be able to provide some insight between correctly and incorrectly classified beats



# References

- Zhou et al. 'Learning Deep Features for Discriminative Localization', CVPR, 2016.
- Selvaraju et al. 'Grad-CAM: Visual Explanations from Deep Networks via Gradient-based Localization', International Journal of Computer Vision, 2019.
- Yola et al. 'Improving ECG Classification Interpretability using Saliency Maps', IEEE BIBE, 2020.