

Image-based analysis of the photoplethysmography signal for biological sex classification

Guidelines document slides



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Background and Objectives

Background

Sex-related differences could bias data-driven models
Differences related to biological sex in the photoplethysmography (PPG) signal are not explored

Objective

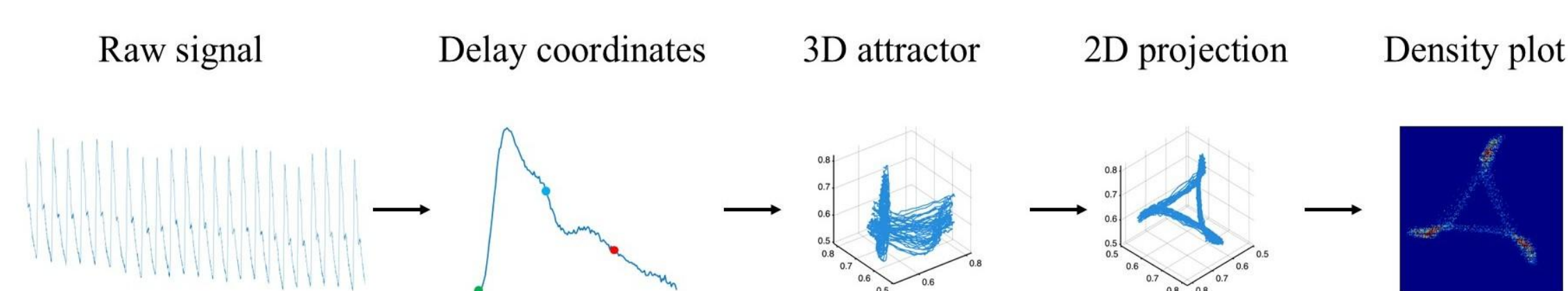
To examine whether a simple Convolutional Neural Network (CNN) captures sex-related features in Symmetric Projection Attractor Reconstruction (SPAR) images derived from PPG signals of different quality

Methods

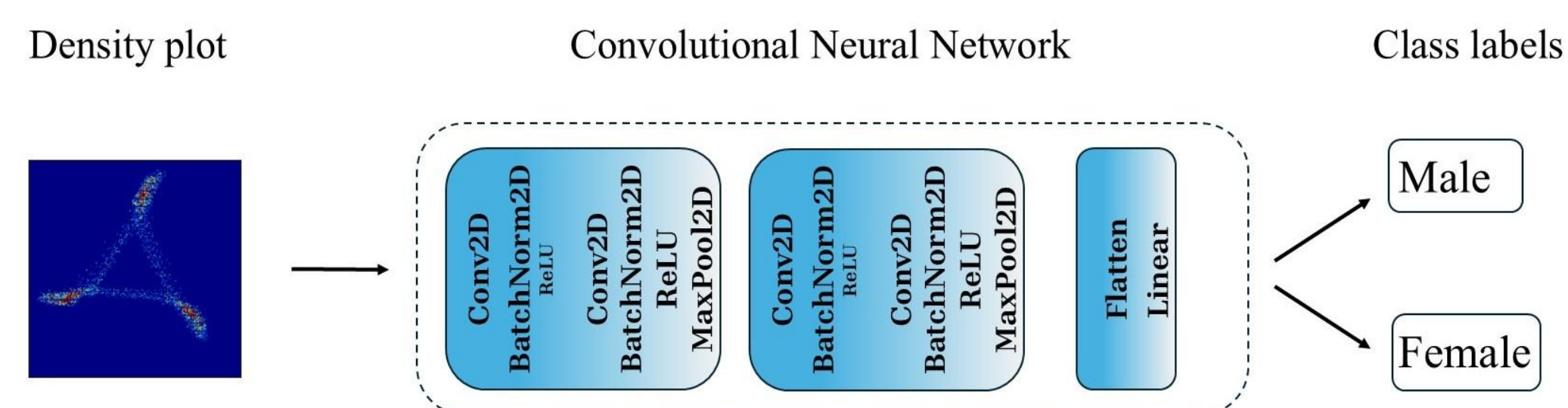
- PPG data from the **AURORA-BP** [1] dataset, stratified for quality
- Images generated from each segment using the **SPAR** method [2]
- Images given as input to a **CNN** for a binary classification task, considering 4 separate training times (25, 50, 75 and 100 epochs) 70%-10%-20% train-validation-test split

Quality	Segments	Subjects
>0.65	27 960 (14 212 M/13 784 F)	1 099 (556 M/ 543 F)
>0.75	26 612 (13 494 M/13 118 F)	1 094 (553 M/541 F)
>0.85	24 056 (12 242 M/11 814 F)	1 088 (550 M/538 F)
>0.95	15 022 (7 815 M/7 207 F)	1033 (528 M/505 F)

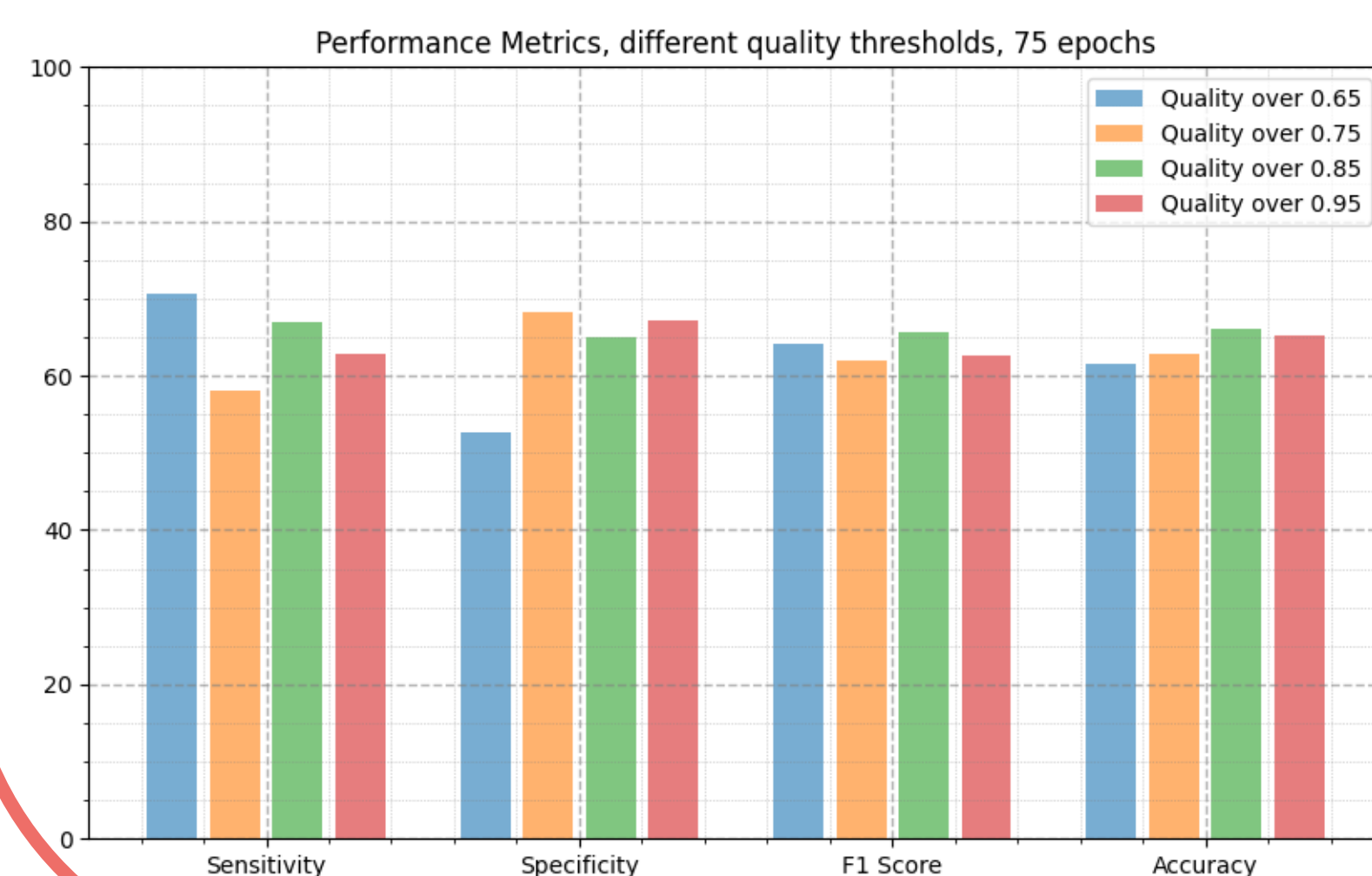
a) SPAR pipeline



b) CNN pipeline



Results



Conclusions

Data quality matters (see guidelines presentation): model performances for the higher quality threshold remain constant across training times

Sex-related differences can be appreciated in the model's ability to classify between the two groups

Therefore

Sex must be considered as a potential bias factor when training AI models

Acknowledgements

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References

- [1] Mieloszyk, R. et al., "A Comparison of Wearable Tonometry, Photoplethysmography, and Electrocardiography for Cuffless Measurement of Blood Pressure in an Ambulatory Setting", IEEE Journal of Biomedical and Health Informatics, 2022
- [2] Aston, Philip J., et al. "Beyond HRV: attractor reconstruction using the entire cardiovascular waveform data for novel feature extraction." *Physiological measurement* 39.2 (2018).