Hypertension detection using image-based analysis of arterial tonometry waveforms

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Background

What

Hypertension: leading risk factor for premature death worldwide

Why

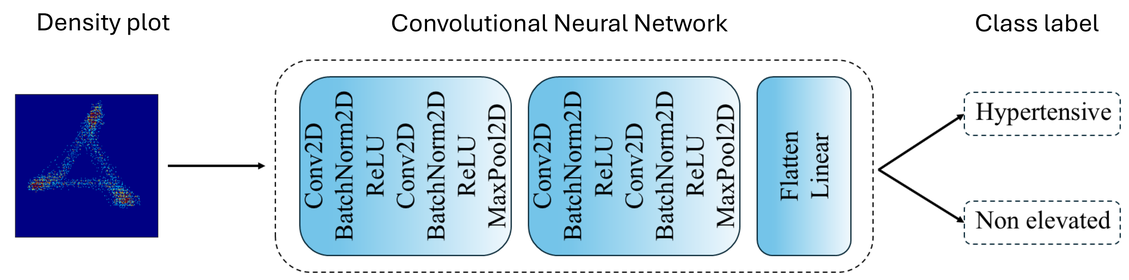
Early detection, especially in community settings, could expedite treatment and improve overall health outcomes

How

Using **CNNs** and **image-based representations** to look at **morphological changes** in the pulse wave

Model and metrics

Evaluation metrics: sensitivity (TP/(TP+FN)), specificity (TN/(TN +FP)), F1 score, accuracy and auc score



Motivation

I Hypertension classification

II Community-based continuous monitoring

Training and testing

Train set: 70% of each class

Validation set: 20% of each class

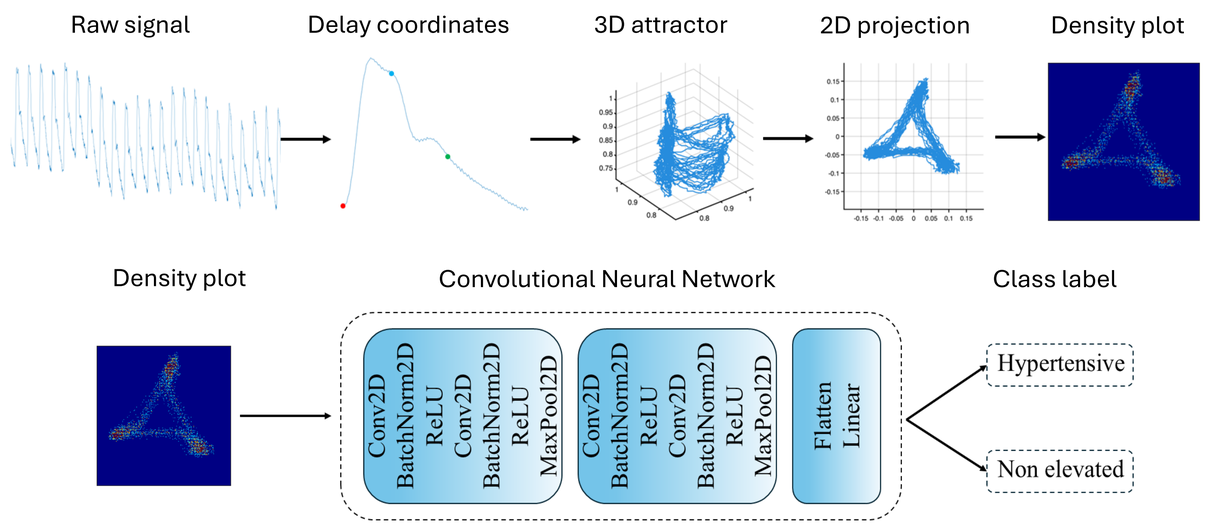
Test set: 10% of each class

10-fold cross validation was performed, due to the small size of the dataset

Task

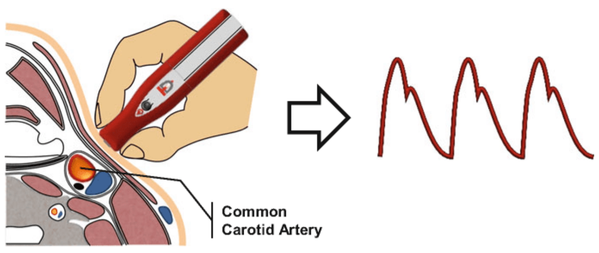
Binary classification using image-based representations, distinguishing between **non-elevated**[1] and **hypertensive** subjects, based on a clinical diagnosis

Pipeline



Arterial Tonometry

Blood pressure measurement technique, used in the clinic



Results

Mean metrics after 10-fold cross validation were:

F1 score: 85.0 %

Accuracy : 88.0 %

ROC-AUC score : 87.4%

Sensitivity: 87.6%

Specificity: 87.3%

The Asklepios[2] cohort

2,524 subjects included for analysis

Filter for:
- hypertensive status: non-elevated BP (SBP<120 mmHg and DBP<70 mmHg) or untreated hypertension (SBP>140 mmHg or DBP>90 mmHg, not taking anti-hypertension drugs)
- no associated cardiovascular disease

294 subjects with non-elevated BP

442 subjects with untreated hypertension

Discussion and conclusion

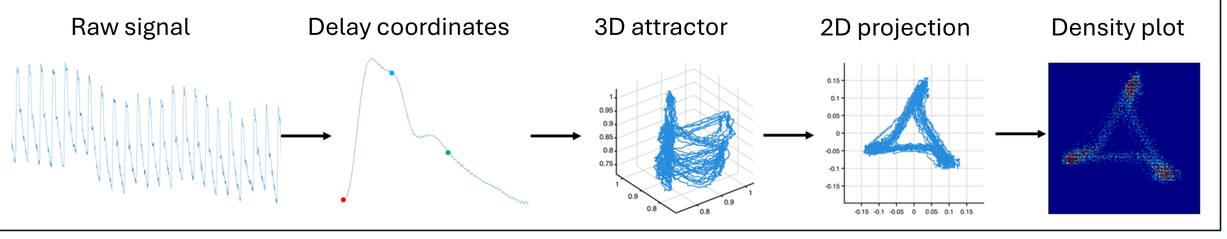
Simple **SPAR-based CNN model** that **classifies individuals** according to hypertensive status

Novel approach to studying pulse waves using **image-based representations** of the tonometry signal and CNNs for hypertension classification

These preliminary findings will be **further investigated** by conducting **longitudinal studies** and studies in **larger populations**

The SPAR method

Non-fiducial points-based method that combines mathematics and cardiovascular physiology to quantify morphological features and waveform variability [3]



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