Overview

- For diagnosis of coronary artery disease (CAD) in patients with stable ischemic heart disease, myocardial perfusion scintigraphy (MPS) is commonly used. [1]
- Previous works, [2,3], have tried to automate this using neural networks.
- In this work, we extend the idea by using deep convolutional neural networks (CNN).
- To improve the performance, additional data such as angina symptoms are included by a second input layer.
- We investigate if the performance can be improved by using augmentation.

Method

The CNN architecture, where the auxiliary parameters are concatenated with one of the latent layers, is shown below.

To train the network for multilabel classification with imbalanced classes, the loss was weighted such that each class and each label had the same importance.

The model was trained both with and without augmentation, both on the images (rotation, intensity clipping) and the auxiliary parameters. Five-fold cross-validation was used to train and evaluate the method. Each fold had the same number of examples with and without disease.

Results

Receiver operating characteristic (ROC) curves for the three regions and per-patient level, using the model trained without augmentation but including the auxiliary parameters.

Area under ROC curve (AUC) for different configurations of the algorithm; trained with and without augmentation and including or excluding the auxiliary parameters.

<table>
<thead>
<tr>
<th>Algorithm</th>
<th>AUC</th>
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<tbody>
<tr>
<td>Incl. Augm. Aux. Im. Aux.</td>
<td>LAD</td>
</tr>
<tr>
<td>- - -</td>
<td>.84</td>
</tr>
<tr>
<td>- x -</td>
<td>.83</td>
</tr>
<tr>
<td>x - -</td>
<td>.88</td>
</tr>
<tr>
<td>x x -</td>
<td>.89</td>
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<td>x x x</td>
<td>.88</td>
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Conclusions

- CAD can with good performance be predicted based on MPS using deep learning.
- Additional information from the auxiliary parameters improves the performance.
- Augmentation, on images or auxiliary parameters, did not improve the performance significantly.

References