





Prediction of Obstructive Coronary Artery Disease from Myocardial Perfusion Scintigraphy using Deep Neural Networks ICPR, 2021



Ida Arvidsson¹, Niels Christian Overgaard¹, Miguel Ochoa Figueroa², Jeronimo Frias Rose², Anette Davidsson², Kalle Åström¹, Anders Heyden¹

¹ Lund University² Linköping University





Coronary Artery Disease

- Myocardial perfusion scintigraphy (MPS) is commonly used for diagnosis of coronary artery disease
- We try to automate this using convolutional neural networks (CNNs)
- Additional information is included by a second input layer
- We investigate if augmentation can improve the performance



Dataset, Coronary Artery Disease



Patient with LCx defect. Images in artificial colouring in upright and supine position

Auxiliary parameters			
Parameter	Range of Values	Comment	
Gender	$\{0,1\}$	35% women	
Angina symptoms	$\{0,1\}$	-	
AHA	$\{0, 1, 2, 3\}$	-	
Age	[21, 98]	-	
BMI	[16, 52]	14 values missing	
Pre-test prob. ESC	[0, 100]	-	





Method I

C3+M



- Multilabel classification
- Imbalanced classes
- Train with weighted loss, to give each class and label equal importance



Method II

- Convert colour images to intensity images:
 - ages: g

250 200

150 _B 100

- Augmentation of images:
 - Rotation
 - Intensity clipping

- Augmentation of auxiliary parameters:
 - Altered (if binary)
 - Increased or decreased

Parameter	Range of Values	Comment	
Gender	$\{0, 1\}$	35% women	
Angina symptoms	$\{0,1\}$	-	
AHA	$\{0, 1, 2, 3\}$	-	
Age	[21, 98]	-	
BMI	[16, 52]	14 values missing	
Pre-test prob. ESC	[0, 100]	-	

Results

Five-fold cross-validation, 588 patients

Algorithm							
Incl.	Augm.		AUC				
aux.	Im.	Aux.	LAD	RCA	LCx	Average	Patient
-	-	-	.84	.85	.86	.85	.89
-	X	-	.83	.85	.83	.83	.88
Х	-	-	.88	.89	.90	.89	.95
Х	X	-	.89	.89	.90	.89	.95
Х	-	х	.88	.88	.90	.89	.94
X	X	X	.86	.89	.89	.88	.93



Conclusion

- 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



ida.arvidsson@math.lth.se

