**Reconstruction of Coronary Vessels from Angiographic Data using a Convolutional Neural Network**

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**Text:** This goal of this study is to develop a method to reconstruct the 3D geometry of the coronary arteries using machine learning and angiographic data. In our approach, we used both synthetic and clinical angiograms to train a deep convolutional neural network (CNN) for automatic segmentation of the coronary vessels. Clinical angiograms were obtained from the adult cardiology service from Michigan Medicine. Synthetic data were generated by 3D printing and imaging patient-specific coronary trees in the cath lab. The performance of the CNN was assessed using sensitivity, specificity and the Dice score.

Once accurate segmentation is achieved, the images must be processed to reconstruct a 3D structure using back-projection algorithms. Several back-projection algorithms were implemented and tested.

**S**ensitivity, specificity, and Dice score of our vessel segmentation CNN were 0.98, 0.99, and 0.98 on synthetic data and 0.95, 0.99, and 0.92 on clinical data when using human review as the gold standard, showing excellent overall performance. This workflow demonstrates a proof-of-concept ability to reconstruct the 3D geometry of coronary arteries from 2D angiography planes using machine learning.