Abstract

Inter-coronary plaques quantification is one of the key research area in the present era of cardiovascular centers where different imaging techniques based on sound and light are being deployed. Optical Coherence tomography is one of such kind emerging imaging modality being practiced worldwide to visualize the inter-coronary plaques along with their tissue type in order to initiate the proactive measures after high definition diagnostic process. Typical OCT machines are catheter based which pull back to produce inter-coronary video using light source. These videos are observed by the physician to point out the Minimum Lumen Diameter (MLD) identifying the position of the plaque and it type as well. High resolution OCT frames have originated a new research domain intended to make the diagnostic process automatic to facilitate the medical science. Automation of Fourier Domain OCT can provide a better alternative for the plaque quantification in comparison to the physician's observation. Machine learning further Deep Learning has brought major revolution in the present span of Artificial Intelligence being incorporated in every sector of the world. Consequently Biomedical Imaging based on Deep Learning has provided great insight for highly reliable diagnosis and treatment of various diseases. In this context Deep Learning based plaques identification and classification in OCT patients can prove a state of the art topology for the cardiovascular diagnosis. This project proposes automation and classification of inter-coronary plaques using Image Processing techniques and Deep Learning classifiers. Both the aforesaid techniques were implemented separately in Matlab and their accuracy was gauged by comparing the machine based results with those of physician. Traditional Image processing schemes are used to figure out the plaque type by demarcating the region of interest and using the ST Jude criteria for different possible tissue types. Categorically there are fibrous, calcified, lipid, white or red thrombus and mixed plaques present in a typical OCT patient. Resultantly the proposed algorithm exhibited appreciable accuracy, in the form of ACU ROC, of 0.974, 0.914 and 0.80 for Fibrous, Lipid and Calcified plaques respectively. In the same verge transfer learning concept was incorporated using Pre-trained Deep

Learning models like Alexnet, GoogleNet, Resnet50, Resnet101 and Densnet which were trained and tested with the same dataset of 30 patients. In our dataset 400 OCT frames are used for the training and 120 frames for testing purpose of each pre-trained model. Consequently all the Deep Neural Network models presented up to the mark above 80% accuracy value for 100 epochs and 2800 iterations. Since elapsed time is also a significant factor in Deep Learning therefore, these models were trained and cross validated for different epochs according to their respective smooth training curve. Finally it was noticed that the performance of Alexnet and GoogleNet remained little bit better in the context of cross validation accuracy but more noteworthy in context of elapsed time which unveiled significant difference.