An Overview on the Concept of AUC and Evolution-based Fine-tuning of CNNs for Higher AUC Performance

Ernest (Khashayar) Namdar

Medical Imaging Department, University of Toronto

knamdar@lunenfeld.ca

Abstract:

Receiver operating characteristic (ROC) curve is an informative tool in binary classification and Area Under ROC Curve (AUC) is a popular metric for reporting performance of binary classifiers. During the presentation, after a profound review of ROC and AUC, we propose an edited version of AUC. We show not only does our edited AUC take confidence of the model into account, but also its local maximums correlate to local minimums of the binary cross entropy loss. Furthermore, we have published a new python library, where functions for AUC and edited AUC are available. Unlike alternative libraries, we provide numerous metrics including sensitivity, specificity, recall, precision, and F1 for each point of the ROC curve. Given that AUC is not differentiable, common practice is to train the CNN using a loss functions based on other performance metrics such as cross entropy and monitoring AUC to select the best model. We propose to fine-tune a trained CNN for prostate cancer detection using a Genetic Algorithm to achieve a higher AUC. Our dataset contained 6-channel Diffusion-Weighted MRI slices of prostate. On a cohort of 2,955 training, 1,417 validation, and 1,334 test slices, we reached test AUC of 0.773; a 9.3% improvement compared to the base CNN model.