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Self-Adaptive Asymmetric On-line Boosting for Detecting Anatomical structures

AzTE Case # M12-112

Inventors

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Invention Description

Boosting algorithms are commonly used in machine learning and pattern recognition for object detection. There are a variety of available and popular boosting algorithms including AdaBoost, TotalBoost, MadaBoost etc., with subtle differences in their weighting of training data and hypotheses. Most training data has an imbalanced number of positive and negative samples, thereby requiring an asymmetric learning algorithm. Existing asymmetric algorithms require preset parameters that are not capable of adjusting the asymmetric loss criterion during training and the preset parameters are chosen heuristically due to a lack of general rules of selecting. However, choosing preset parameters is impossible in medical image analysis because different applications may require different parameters.

Researchers at Arizona State University have developed a novel self-adaptive, asymmetric on-line boosting (SAAOB) method for detecting anatomical structures in CT pulmonary angiography. This method utilizes a new asymmetric loss criterion with self adaptability according to the ratio of exposed positive and negative samples. Moreover, the method applies advanced formulates to situations and updates a sample's importance weight based on those different situations i.e. true positive, false positive, true negative, false negative.

This method demonstrates a significant improvement of performance in more realistic sample scenarios having imbalanced conditions.

Potential Applications

- Automated detection of anatomical structures in any imaging modality

Benefits and Advantages

- The asymmetric loss function is self-adjusting during on-line training
- Updates sample's importance weight based on classification result and sample's label
- Validated from balanced condition (1 positive: 1 negative) to extremely imbalanced condition (1 positive: 1000 negative) with high accuracy
- Does not need preset parameters

Intellectual Property Status:

Patent Pending

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