OBJECT DETECTION WITH LARGE INTRA-CLASS VARIATION

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ABSTRACT

For object detection, the state-of-the-art performance is achieved through supervised learning. The performances of object detectors of this kind are mainly determined by two factors: features and underlying classification algorithms. In this work, we aim at improving the performance of object detectors from the aspect of classification algorithm. Observing the fact that classifiers used for object detection are task dependent and data driven, we developed a hybrid learning algorithm combining global classification and local adaptations, which automatically adjusts model complexity according to data distribution. We divide data samples into two groups, easy samples and ambiguous samples, using a learned global classifier. A local adaptation approach based on spectral clustering and proposed Min-Max model adaptation is then applied to further process the ambiguous samples. The proposed algorithm automatically determines model complexity of the local learning algorithm according to the distribution of ambiguous samples. By autonomously striking a balance between model complexity and learning capacity, the proposed hybrid learning algorithm incarnates a human detector outperforming the state-of-the-art algorithms on a couple of benchmark datasets and a self-collected pedestrian dataset. Besides, the proposed Min-Max model adaptation algorithm also successfully improve the performance of an offline-trained classifier on-site by adapting the classifier towards newly acquired data, without worries about the tuning the adaptation rate parameter, which affects the performance gain substantially. Taking the object detection as a testbed, we implement an adapted object detector based on binary classification. Under different adaptation scenarios and different datasets including PASCAL, ImageNet, INRIA, and TUD Pedestrian, the proposed adaption method achieves significant performance gain and is compared favorably with the state-of-the-art adaptation method with the fine tuned adaptation rate.