OBJECT DETECTION FOR BIG DATA

Guang Chen

Dr. Tony X. Han, Dissertation Supervisor

ABSTRACT

We have observed significant advances in object detection over the past few decades and gladly seen the related research has began to contribute to the world: Vehicles could automatically stop before hitting any pedestrian; Face detectors have been integrated into smart phones and tablets; Video surveillance systems could locate the suspects and stop crimes. All these applications demonstrate the substantial research progress on object detection. However learning a robust object detector is still quite challenging due to the fact that object detection is a very unbalanced big data problem.

In this dissertation, we aim at improving the object detector's performance from different aspects. 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. We have done thorough research on both of these factors. Our contribution involves model adaption, local learning, contextual boosting, template learning and feature development. Since the object detection is an unbalanced problem, in which positive examples are hard to be collected, we propose to adapt a general object detector for a specific scenario with a few positive examples; To handle the large intra-class variation problem lying in object detection task, We propose a local adaptation method to learn a set of efficient and effective detectors for a single object category; To extract the effective context from the huge amount of negative data in object detection, we introduce a novel contextual descriptor to iteratively improve the detector; To detect object with a depth sensor, we design an effective depth descriptor; To distinguish the object categories with the similar appearance, we propose a local feature embedding and template selection algorithm, which has been successfully incorporated into a real-world fine-grained object recognition application. All the proposed algorithms and features have achieved the state-of-the-art performances on extensive object detection and recognition benchmark datasets.