Data synthesis for object recognition

Xi Zhang, Ph.D.

Illinois Institute of Technology, December 2017

Adviser: Dr. Gady Agam

Large and balanced datasets are normally crucial for many machine learning models, especially when the problem is defined in a high dimensional space due to high complexity. In real-world applications, it is usually very hard and/or expensive to obtain adequate amounts of labeled data, even with the help of crowd-sourcing. To address these problems, a possible approach is to create synthetic data and use it for training. This approach has been applied in many application areas of computer vision including document recognition, object retrieval, and object classification. While a boosted performance has been demonstrated using synthetic data, the boosted performance is limited by two main factors in existing approaches. First, most existing approaches for creating and using synthetic data are application-specific and thus lack the ability to benefit other application areas. Further, such application specific approaches are often heuristic in nature. Second, existing approaches do not recognize an inherent difference between synthetic data and actual data which is termed as a synthetic gap in my proposal. The synthetic gap in existing approaches is due to the fact that not all possible patterns and structures of actual data are present in the synthetic data. To address the problems of using synthetic data and using it to better improve the performance of learning algorithm, this proposal considers general ways of creating and using synthetic data. The problem caused by the synthetic gap is studied and approaches to overcome the gap are proposed. Experimental results demonstrate that the proposed approach is efficient and can boost the performance of many computer vision applications including building roof classification, character classification, and point cloud object classification.