THESIS INFOMATION

Title: **Developing Approachs for Large-Scale Multi-Class Image Classification**

Major: Computer Science
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1. ABSTRACT

Multi-class classification, which is the problem of classifying one example with a redefined set of classes, is one of the fundamental problems in the field of machine learning and computer vision. Many applications such as semantic image/video retrieval, object categorization, image/ video understanding, anotation,… require classifying with large numbers of classes.

One standard method of multi-class classification is to use multiple binary one-versus-all (OvA) classifiers. However, this method is not scalable to large-scale datasets (e.g., ImageNet-10K, includes 10,184 concepts) because all classifiers have to be evaluated at runtime for every test image, so its computational complexity is linear in the number of classes.

In this thesis, we follow in two main approaches: i) classifying by using the hierarchical structures of classes; ii) classifying by using the latent classifiers. We carried out experiments on benchmark datasets (e.g., Caltech-256, SUN-397, ImageNet-1K and ImageNet-10K). The evaluation results indicated that our method achieves a significant improvement in terms of accuracy, computational complexity and run-time compared to other methods.

The results of research and experiments are published in journals and international conferences as following: Journal of Computer Science and Cybernetics (JCC)-2016, Journal of Computer Vision and Image Understanding (CVIU) -2017 (ISI, IF 2.498), ICIAP-2015 (ERA-rankB), MMSP-2015 (ERA-rankB), ATC-2015, ICIP-2016 (ERA-rankB).

2. THE MAIN CONTRIBUTIONS OF THE THESIS ARE AS FOLLOWS:

1. A method for learning balanced trees by jointly optimizing balance and confusion constraints (using all feature vectors for each class).
2. A method for learning balanced trees by jointly optimizing balance and confusion constraints (take into account advantages of using only one mean feature vector and all feature vectors for each class).
3. A method for learning balanced trees by jointly optimizing balance and similarity of classes (computed by the sum match kernel).
4. A method for making precise branching decision by considering classification response of its child nodes, grandchild nodes and their differences with siblings.
5. A classification method is to use a small subset of latent classifiers. These classifiers are generated by analyzing the latent correlation among classes and removing redundancy.

3. OPEN PROBLEMS

- Development methods for learning label trees with imbalanced or long-tail distributed testing datasets.
- Development effective methods for learning latent classifiers.
- Analyzing the latent correlation among classes for different problems.
- Improving and applying our proposed method to many potential applications such as object categorization, scene understanding and semantic image/video retrieval

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