Shiraz University

Proposal of Image Processing

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Deep learning on COVID-CT-Dataset: A CT Scan Dataset about COVID-19

COVID-CT

The utility of this dataset has been confirmed by a senior radiologist in Tongji Hospital, Wuhan, China, who has performed diagnosis and treatment of a large number of COVID-19 patients during the outbreak of this disease between January and April.

Problem Description:

We plan to work on medical image classification related to recent crises caused by a coronavirus. Many medical image classification tasks have a severe class imbalance problem. These medical image classification tasks share a common issue. That is, only a small labeled training set is available due to the expensive manual labeling by highly skilled medical experts. Convolutional Neural Network (CNN) is currently a state-of-the-art method for image classification. CNN relies on a large training dataset to achieve high classification performance. However, manual labeling is costly and may not even be feasible, which limits CNN from offering high classification performance in practice. This proposal addresses this issue with the ultimate goal of improving classification effectiveness and minimizing manual labeling effort by the domain experts.

Related works:

Our Method:

Transfer learning (TL) is a research problem in machine learning (ML) that focuses on storing knowledge gained while solving one problem and applying it to a different but related problem. [1] For example, the knowledge gained while learning to recognize cars could apply when trying to recognize trucks. This research area bears some relation to the long history of psychological literature on the transfer of learning, although formal ties between the two fields are limited. From a practical standpoint, reusing or transferring information from previously learned tasks to the learning of new tasks has the potential to improve the sample efficiency of a reinforcement learning agent significantly. [2]

Andrew Ng said in his NIPS 2016 tutorial [3][4] that TL would be the next driver of ML commercial success after supervised learning to highlight the importance of TL.

Ensemble Learning(EL), to further improve the effectiveness of CNN, we propose using several CNNs instead of only one. To achieve good performance, the individual classifiers of the ensemble should be diverse. There are several methods for achieving diversity among the base classifiers. We propose to use different transformations one the training set of each classifier to realize a good boost of accuracy in the final ensemble.

1. *West, Jeremy; Ventura, Dan; Warnick, Sean (2007). "Spring Research Presentation: A Theoretical Foundation for Inductive Transfer". Brigham Young University, College of Physical and Mathematical Sciences. Archived from the original on 2007-08-01. Retrieved 2007-08-05.*
2. *George Karimpanal, Thommen; Bouffanais, Roland (2019). "Self-organizing maps for storage and transfer of knowledge in reinforcement learning". Adaptive Behavior. **27** (2): 111–126. arXiv:1811.08318. doi:10.1177/1059712318818568. ISSN 1059-7123.*
3. *NIPS 2016 tutorial: "Nuts and bolts of building AI applications using Deep Learning" by Andrew Ng, retrieved 2019-12-28*
4. *"NIPS 2016 Schedule". nips.cc. Retrieved 2019-12-28.*
5. https://github.com/UCSD-AI4H/COVID-CT
6. https://lib.dr.iastate.edu/cgi/viewcontent.cgi?article=8137&context=etd