ALLEVIATING ANNOTATION COSTS BY COMBINING ACTIVE AND SEMI-SUPERVISED LEARNING

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ABSTRACT

Training deep neural networks (DNNs) requires excessive amounts of labeled data, which is prohibitively expensive for medical imaging. Statistical learning theory and algorithms have attempted to alleviate this annotation cost by either actively interacting with the dataset and querying those considered most important or utilizing unlabeled data which is usually more accessible. Deep learning-based active learning (AL) algorithms have been developed with the former objective, but their performances can only outperform random sampling, or passive learning, by a modest margin. In contrast, the latter approach has seen great success with semi-supervised learning (SSL) algorithms, performing on par with fully-supervised models with far less labeled samples. Motivated by empirical pessimism of AL algorithms and success of SSL, we propose to shift the objective of AL. Rather than querying instances that help generalize upon labeling, we propose to design AL to ease optimization and use SSL to constrain the hypothesis class to those that generalize well. In this direction, we designed a novel AL algorithm using neural tangent kernels and demonstrated its efficacy to enhancing the sample complexities associated with deep learning.

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