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Domain Adaptation and Representation Transfer and Medical Image Learning with Less Labels and Imperfect Data

First MICCAI Workshop, DART 2019
and First International Workshop, MIL3ID 2019
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Preface

Computer vision and medical imaging have been revolutionized by the introduction of advanced machine learning and deep learning methodologies. Recent approaches have shown unprecedented performance gains in tasks such as segmentation, classification, detection, and registration. Although these results (obtained mainly on public datasets) represent important milestones for the MICCAI community, most methods lack generalization capabilities when presented with previously unseen situations (corner cases) or different input data domains. This limits clinical applicability of these innovative approaches and therefore diminishes their impact. Transfer learning, representation learning, and domain adaptation techniques have been used to tackle problems such as: model training using small datasets while obtaining generalizable representations; performing domain adaptation via few-shot learning; obtaining interpretable representations that are understood by humans; and leveraging knowledge learned from a particular domain to solve problems in another.

The first MICCAI workshop on Domain Adaptation and Representation Transfer (DART 2019) aimed at creating a discussion forum to compare, evaluate, and discuss methodological advancements and ideas that can improve the applicability of machine learning (ML)/deep learning (DL) approaches to clinical settings by making them robust and consistent across different domains.

During the first edition of DART, 18 papers were submitted for consideration and, after peer review, 12 full papers were accepted for presentation. Each paper was rigorously reviewed by three reviewers in a double-blind review process. The papers were automatically assigned to reviewers taking into account and avoiding potential conflicts of interest and recent work collaborations between peers. Reviewers have been selected among the most prominent experts in the field from all over the world. Once the reviews were obtained the area chairs formulated final decisions over acceptance or rejection of each manuscript. These decisions were always taken according to the reviews and were unappealable.

Additionally, the workshop organization granted the Best Paper Award to the best submission presented at DART 2019. The Best Paper Award was assigned as a result of a secret voting procedure where each member of the committee indicated two papers worthy of consideration for the award. The paper collecting the majority of votes was then chosen by the committee.

We believe that the paper selection process implemented during DART 2019 as well as the quality of the submissions have resulted in scientifically validated and interesting contributions to the MICCAI community and in particular to researchers working on domain adaptation and representation transfer.

We would therefore like to thank the authors for their contributions, the reviewers for their dedication and professionality in delivering expert opinions about the submissions, and NVIDIA Corporation, which has sponsored DART, for the support, resources, and help in organizing the workshop. NVIDIA Corporation has also

sponsored the prize for the best paper at DART 2019, which consisted of a NVIDIA Titan V GPU card.

November 2018

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MIL3ID 2019 Preface

MIL3ID 2019 is the First International Workshop on Medical Image Learning with Less Labels and Imperfect Data. The MIL3ID 2019 proceedings contain 16 high-quality papers of 8 pages each, which were selected through a rigorous peer-review process.

We hope this workshop will create a forum for discussing best practices in medical image learning with label scarcity and data imperfection. This forum is urgently needed because the issues of label noises and data scarcity are highly practical but largely under investigated in the medical image analysis community. Traditional approaches for dealing with these challenges include transfer learning, active learning, denoising, and sparse representation. The majority of these algorithms were developed prior to the recent advances of deep learning and might not benefit from the power of deep networks. The revision and improvement of these techniques in the new light of deep learning are long overdue.

This workshop potentially helps answer many important questions. For example, several recent studies found that deep networks are robust to massive random label noises but more sensitive to structured label noises. What implication do these findings have on dealing with noisy medical data? Recent work on Bayesian neural networks demonstrates the feasibility of estimating uncertainty due to the lack of training data. In other words, it enables our classifiers to be aware of what they do not know. Such a framework is important for medical applications where safety is critical. How can researchers of MICCAI community leverage this approach to improve their systems robustness in the case of data scarcity? Our prior work shows that a variant of capsule networks generalizes better than convolutional neural networks with an order of magnitude fewer training data. This gives rise to an interesting question: are there better classes of networks that intrinsically require less labeled data for learning? Humans always have an edge over deep networks when it comes to learning with small amounts of data. However, recent work on one-shot deep learning has surpassed humans in an image recognition task using only a few training samples for each task. Do these results still hold for medical image analysis tasks?

The proceedings of the workshop are published as a joint LNCS volume alongside other satellite events organized in conjunction with MICCAI. In addition to the LNCS volume, to promote transparency, the papers' reviews and preprints are publicly

available on the workshop website. In addition, the papers, abstracts, slides, and posters presented during the workshop will be made publicly available on the MIL3ID website.

August 2019

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