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Interpretable and Annotation- Efficient Learning for Medical Image Computing

Third International Workshop, iMIMIC 2020
Second International Workshop, MIL3ID 2020
and 5th International Workshop, LABELS 2020
Held in Conjunction with MICCAI 2020
Lima, Peru, October 4–8, 2020
Proceedings

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iMIMIC 2020 Preface

It is our genuine honor and great pleasure to welcome you to the Third Workshop on Interpretability of Machine Intelligence in Medical Image Computing (iMIMIC 2020), a satellite event at the 23rd International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI 2020). Following in the footsteps of the two previous successful meetings in Granada, Spain (2018) and Shenzhen, China (2019), we gathered for this new edition.

iMIMIC is a single-track, half-day workshop consisting of high-quality, previously unpublished papers, presented either orally or as a poster, intended to act as a forum for research groups, engineers, and practitioners to present recent algorithmic developments, new results, and promising future directions in interpretability of machine intelligence in medical image computing. Machine learning systems are achieving remarkable performances at the cost of increased complexity. Hence, they become less interpretable, which may cause distrust, potentially limiting clinical acceptance. As these systems are pervasively being introduced to critical domains, such as medical image computing and computer assisted intervention, it becomes imperative to develop methodologies allowing insight into their decision making. Such methodologies would help physicians to decide whether they should follow and trust automatic decisions. Additionally, interpretable machine learning methods could facilitate defining the legal framework of their clinical deployment. Ultimately, interpretability is closely related to AI safety in healthcare.

This year's iMIMIC was held on October 4, 2020, virtually in Lima, Peru, and was hosted by INESC TEC and the University of Coimbra, with the support of University of Porto and CISUC, all located in Portugal. There was a very positive response to the call for papers for iMIMIC 2020. We received 18 full papers from 10 countries and 8 were accepted for presentation at the workshop, where each paper was reviewed by at least three reviewers. The accepted papers present fresh ideas of Interpretability in settings such as regression, multiple instance learning, weakly supervised learning, local annotations, classifier re-training, and model pruning.

The high quality of the scientific program of iMIMIC 2020 was due first to the authors who submitted excellent contributions and second to the dedicated collaboration of the International Program Committee and the other researchers who reviewed the papers. We would like to thank all the authors for submitting their contributions and for sharing their research activities.

We are particularly indebted to the Program Committee members and to all the reviewers for their precious evaluations, which permitted us to set up this publication.

We were also very pleased to benefit from the participation of the invited speakers Himabindu Lakkaraju, Harvard University, USA, and Wojciech Samek, Fraunhofer HHI, Germany. We would like to express our sincere gratitude to these world-renowned experts.

October 2020

Jaime Cardoso
Pedro Henriques Abreu
Ivana Isgum
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MIL3ID 2020 Preface

Welcome to the Second International Workshop on Medical Image Learning with Less Labels and Imperfect Data (MIL3ID 2020). The MIL3ID 2020 proceedings contain 11 high-quality papers of 8 pages that 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 human 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: <https://www.hvnguyen.com/lesslabelsimperfectdataml2020>. In addition to the papers, abstracts, slides, and posters presented during the workshop will be made publicly available on the MIL3ID website.

We would like to thank all the speakers and authors for joining our workshop, the Program Committee for their excellent work with the peer reviews, and the workshop chairs and editors for their help with the organization of the second MIL3ID workshop.

August 2020

Hien Van Nguyen
Vishal Patel
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LABELS 2020 Preface

This volume contains the proceedings of the 5th International Workshop on Large-scale Annotation of Biomedical data and Expert Label Synthesis (LABELS 2020), which was held on October 8, 2020, in conjunction with the 23rd International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI 2020), originally planned for Lima, Peru, but ultimately held virtually, due to the COVID-19 pandemic. The first workshop in the LABELS series was held in 2016 in Athens, Greece. This was followed by workshops in Quebec City, Canada, in 2017, Granada, Spain, in 2018, and Shenzhen, China, in 2019.

As data-hungry methods continue to drive advancements in medical imaging, the need for high-quality annotated data to train and validate these methods continues to grow. Further, with the pressing need to address health disparities and to prevent learned systems from internalizing biases, there has never been a greater need for thorough study and discussion of best practices in data collection and annotation. For the past four years, LABELS has aimed to facilitate exactly this.

Following the success of the previous four LABELS workshops, the fifth workshop was planned for 2020. This year's edition of the workshop included invited talks by Anand Malpani (Johns Hopkins University, USA) and Amber Simpson (Queen's University, Canada), as well as several papers and abstracts. After peer review, a total of 10 papers and 3 abstracts were selected. The papers appear in this volume, and the abstracts are available on the workshop website: <https://miccailabels.org>. The research presented this year ranged from how to quantify and mitigate demographic biases, to probing the reproducibility of expert labels, to new tools for more efficient annotation of emerging image modalities. LABELS takes pride in the fact that theoretical novelty is not a prerequisite for work presented at the workshop, instead the event embraces the messy, tedious reality of medical image collection and annotation in an effort to expose and formalize its underlying principles.

We would like to thank all the speakers and authors for joining our workshop, the Program Committee for their excellent work with the peer reviews, our sponsors – Retinai and Auris Health – for their support, and the workshop chairs for their help with the organization of the fifth LABELS workshop.

August 2020

Nicholas Heller
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