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Graphs in Biomedical Image Analysis *and* Integrating Medical Imaging and Non-Imaging Modalities


Second International Workshop, GRAIL 2018
and First International Workshop, Beyond MIC 2018
Held in Conjunction with MICCAI 2018
Granada, Spain, September 20, 2018
Proceedings

Editors

Danail Stoyanov
University College London
London
UK

Zeike Taylor
University of Leeds
Leeds
UK

Enzo Ferrante 
CONICET/Universidad Nacional del Litoral
Santa Fe
Argentina

Adrian V. Dalca 
Harvard Medical School
Cambridge, MA
USA

Additional Workshop Editors *see next page*

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Germany


Graphs in Biomedical Image Analysis, GRAIL 2018


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AimBrain
London,
UK

Bartłomiej Papiez
University of Oxford
Oxford,
UK

Aristeidis Sotiras 
University of Pennsylvania
Philadelphia, PA
USA

Integrating Medical Imaging and Non-imaging Modalities, Beyond MIC 2018

Mert R. Sabuncu 
Cornell University
Ithaca, NY
USA

Li Shen 
University of Pennsylvania
Philadelphia, PA
USA

GRAIL 2018 Preface

GRAIL 2018 was the 2nd International Workshop on Graphs in Biomedical Image Analysis, organized as a satellite event of the 21st International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI 2018) in Granada, Spain. After the success and positive feedback obtained last year, this was the second time we brought GRAIL to MICCAI, in the spirit of strengthening the links between graphs and biomedical imaging.

The workshop provides a unique opportunity to meet and discuss both theoretical advances in graphical methods, as well as the practicality of such methods when applied to complex biomedical imaging problems. Simultaneously, the workshop seeks to be an interface to foster future interdisciplinary research including signal processing and machine learning on graphs.

Graphs and related graph-based modelling have attracted significant research focus as they enable us to represent complex data and their interactions in a perceptually meaningful way. With the advent of Big Data in the medical imaging community, the relevance of graphs as a means to represent data sampled from irregular and non-Euclidean domains is increasing, together with the development of new inference and learning methods that operate on such structures. There is a wide range of well-established and emerging biomedical imaging problems that can benefit from these advances; we believe that the research presented in this volume constitutes a clear example of that.

The GRAIL 2018 proceedings contain 5 high-quality papers of 8 to 11 pages that were pre-selected through a rigorous peer review process. All submissions were peer reviewed through a double-blind process by at least 2 members of the Program Committee, comprising 18 experts in the field of graphs in biomedical image analysis. The accepted manuscripts cover a wide set of graph based medical image analysis methods and applications, including neuroimaging and brain connectivity, graph matching algorithms, graphical models for image segmentation, brain modeling through neuronal networks and deep learning models based on graph convolutions. In addition to the papers presented in this LNCS volume, the workshop comprised short abstracts and two keynote presentations from world-renowned experts: Prof. Michael Bronstein and Prof. Dimitri Van De Ville. We hope this event will foster the development of more powerful graph-based models for the analysis of biomedical images.

We wish to thank all the GRAIL 2018 authors for their participation and the members of the Program Committee for their feedback and commitment to the workshop. We are very grateful to our sponsors Entelai (<https://entelai.com/>) and the UK EPSRC-funded Medical Image Analysis Network (MedIAN - <https://www.median.ac.uk/>) for their valuable support.

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 (<http://grail-miccai.github.io/>) together with their corresponding optional response to reviewers. In addition to the papers, abstracts, slides, and posters presented during the workshop will be made publicly available on the GRAIL website.

August 2018

Enzo Ferrante
Sarah Parisot
Aristeidis Sotiras
Bartłomiej Papież

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Beyond MIC 2018 Preface

Beyond MIC (<http://beyondmic.mit.edu>) is a full-day workshop on integrating medical imaging and non-imaging modalities to answer novel clinical and healthcare challenges. Recent large-scale, multi-site data collection efforts - such as the ADNI, TCIA, and UK Biobank - and the hospital open-data initiatives are resulting in growing datasets of medical images. Increasingly, these studies often also include non-imaging modalities such as electronic health records, insurance data, pathology reports, laboratory tests, and genomic data. Alongside medical images, these rich external sources of information present an opportunity for improving traditional medical image computing tasks like diagnosis, prediction, and segmentation, as well as facilitate newer tasks like automatic image annotation. However, these heterogeneous data also poses unprecedented technical obstacles, including pre-processing different or inconsistent formats, modeling the complex noise and heterogeneity, jointly handling high dimensionality and multi-modality, and optimizing computational resources to handle significantly larger amounts of data.

Machine learning methods tackling data-driven health care problems have been gaining interest, and workshops specializing on machine learning in health care typically boast more than 300 attendees from various fields. MICCAI offers an ideal and timely opportunity to combine this rising interest in data-driven health care with medical imaging expertise. Beyond MIC assembles researchers of different specializations and shared interests in this newly evolving field, facilitating the advancement of novel methods and technologies. Specifically, the mathematical, statistical, and algorithmic thinking, and image processing experience of the MICCAI community can help develop new methods for the analysis of emerging imaging and non-imaging modalities. Beyond MIC offers an ideal meeting to bridge the gap between the various communities that can contribute to these solutions. Beyond MIC includes keynote sessions introducing the state of the art and challenges of the field, as well as presentations of accepted papers published here, discussing novel methods or new applications.

August 2018

Adrian V. Dalca
Mert R. Sabuncu
Li Shen

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Organizing Committee

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Li Shen	The Perelman School of Medicine, University of Pennsylvania, USA

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