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Machine Learning in Clinical Neuroimaging

4th International Workshop, MLCN 2021
Held in Conjunction with MICCAI 2021
Strasbourg, France, September 27, 2021
Proceedings

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ISSN 0302-9743

ISSN 1611-3349 (electronic)

Lecture Notes in Computer Science

ISBN 978-3-030-87585-5

ISBN 978-3-030-87586-2 (eBook)

<https://doi.org/10.1007/978-3-030-87586-2>

LNCS Sublibrary: SL6 – Image Processing, Computer Vision, Pattern Recognition, and Graphics

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Preface

Methodological developments in neuroimaging analysis contribute to the progress in clinical neurosciences. In specific domains of academic image analysis, impressive strides were made thanks to modern machine learning and data analysis methods such as deep artificial neural networks. The initial success in academic applications of complex neural networks started a wave of studies through the neuroimaging research field. Deep learning is now complementing more traditional machine learning as a tool for image and data analysis. It is our view that incorporating interdisciplinary domain knowledge into the machine learning models is critical to answer challenging clinically relevant research questions in the field of clinical neuroscience that eventually will translate to clinical routine. With this workshop, we aimed at creating an intellectual playing field for clinicians and machine learning experts alike to share and discuss knowledge at the interface between machine learning and clinical application.

The 4th International Workshop on Machine Learning in Clinical Neuroimaging (MLCN 2021) was held as a satellite event of the 24th International Conference on Medical Imaging Computing and Computer-Assisted Intervention (MICCAI 2021) to foster a scientific dialog between experts in machine learning and clinical neuroimaging. The call for papers was published on April 30, 2021, and the submission window closed on July 5, 2021. Each submitted manuscript was reviewed by three members of the Program Committee in a double-blind review process. The accepted manuscripts contained in this proceedings presented a methodologically sound, novel, and thematically fitting contribution to the field of clinical neuroimaging, and were presented and discussed by the authors at the virtual MLCN workshop. The contributions studied *in vivo* structural and functional magnetic resonance imaging data. Several accepted submissions were concerned with computational anatomy involving a wide range of methods including supervised image segmentation, registration, classification, anomaly detection, and generative modeling. Network analysis and time series were other topical branches of the workshop contributions in which a wide variety of methods were employed and developed including dictionary learning, graph neural networks, and space-time convolutional neural networks. The fields of applications were as diverse as the methods. They included detection and modeling of abnormal cortical folding patterns and simulation of brain atrophy, mapping histology to ex vivo imaging, mapping functional cortical regions, and mapping structural with functional connectivity graphs. The methodological developments pushed the boundaries of clinical neuroscience image analysis with fast algorithms for complex and accurate descriptors of structure, function, or the combination of multiple modalities.

This workshop was made possible by a devoted community of authors, Program Committee, Steering Committee, and workshop participants. We thank all creators and attendees for their valuable contributions.

September 2021

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