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Interpretability of Machine Intelligence in Medical Image Computing, and Topological Data Analysis and Its Applications for Medical Data

4th International Workshop, iMIMIC 2021
and 1st International Workshop, TDA4MedicalData 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 978-3-030-87443-8

ISBN 978-3-030-87444-5 (eBook)

<https://doi.org/10.1007/978-3-030-87444-5>

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

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The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

iMIMIC 2021

It is our genuine honor and great pleasure to welcome you to the 4th Workshop on Interpretability of Machine Intelligence in Medical Image Computing (iMIMIC 2021), a satellite event at the 24th International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI 2021). Following in the footsteps of the three previous successful meetings in Granada, Spain (2018), Shenzhen, China (2019), and Lima, Peru (2020), we gathered for this new edition. iMIMIC is a single-track, half-day workshop consisting of high-quality, previously unpublished papers, presented either orally, and intended to act as a forum for research groups, engineers, and practitioners to present recent algorithmic developments,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 September 27, 2021, virtually in Strasbourg, France. There was a very positive response to the call for papers for iMIMIC 2021. We received 12 full papers and 7 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 2021 was due to, first, to the authors who submitted excellent contributions and, second, 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 Mihaela van der Schaar, Cambridge University, USA: Been Kim, Google Brain: and Cynthia Rudin, Duke University, USA. We would like to express our sincere gratitude to these world-renowned experts.

September 2021

Mauricio Reyes
Pedro H. Abreu
Jaime Cardoso

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TDA4MedicalData 2021

TDA4MedicalData 2021 is the First International Workshop on Topological Data Analysis and its Applications for Medical Data. TDA4MedicalData 2021 proceedings contain 5 high-quality papers of 8 pages that were selected through a rigorous peer review process.

Recent years have witnessed an increasing interest in the role topology plays in machine learning and data science. Topology offers a collection of techniques and tools that have matured to a field known today as Topological Data Analysis (TDA). TDA provides a general and multi-purpose set of robust tools that have shown excellent performance in several real-world applications. These tools are naturally applicable to numerous types of data, including images, points cloud, graphs, meshes, time-varying data, and more. TDA techniques have been increasingly used with other techniques, such as deep learning, to increase the performance, and generalizability of a generic learning task. Further, the properties of the topological tools allow the discovery of complex relationships and separation of signals that are hidden in the data from noise. Finally, topological methods naturally lend themselves to visualization, rendering them useful for tasks that require interpretability and explainability.

All these properties of topological-based methods strongly motivate the adoption of TDA tools to various applications and domains including neuroscience, bioscience, biomedicine, and medical imaging. This workshop will focus on using TDA techniques to enhance the performance, generalizability, efficiency, and explainability of the current methods applied to medical data. In particular, the workshop will focus on using TDA tools solely or combined with other computational techniques (e.g., feature engineering and deep learning) to analyze medical data including images/videos, sounds, physiological, texts and sequence data. The combination of TDA and other computational approaches is more effective in summarizing, analyzing, quantifying, and visualizing complex medical data. This workshop brought together mathematicians, biomedical engineers, computer scientists, and medical doctors for the purpose of showing the strength of using TDA-based tools for medical data analysis.

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 papers, abstracts, slides, and posters presented during the workshop will be made publicly available on the TDA4MedicalData 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, the workshop chairs and editors for their help with the organization of the first TDA4MedicalData workshop.

September 2021

Mustafa Hajj
Ghada Zamzmi
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