

Preface

This volume contains the Proceedings of the Fourth International Conference on Medical Imaging with Deep Learning – MIDL 2021. The conference was organized jointly by three institutes (Robotics and Cognitive Systems; Medical Informatics; Mathematics in Image Computing) of the University of Lübeck and one institute (Medical Technology and Intelligent Systems) of Hamburg University of Technology, Germany. While initially we had hoped to convene at the Musik- und Kongresshalle Lübeck from July 7 to 9, 2021, this was impossible due to the COVID-19 pandemic. Instead, we moved to a fully virtual meeting but maintained the interactive nature of MIDL in a Gather.Town (<http://gather.town>) environment providing at least some views to Lübeck. The meeting also addressed the different time zones of the participants by focussing on discussion in a window accessible to all of the MIDL community while offering different ways to view the long or short presentations upfront and further individual discussion in Gather.Town subsequently. All sessions, presentations and discussions were accessible via interactive Webex webinars as well as on YouTube and remain available at <https://2021.midl.io>.

A novelty of this year’s MIDL was the first MIDL satellite event specifically designed for young researchers: The Doctoral Symposium. It took place on July 2nd as a virtual event and brought together PhD students from all over the world, with a special emphasis on including under-represented research groups during the selection process (acceptance rate 51.4% (53 out of 103 applicants)).

MIDL 2021 attracted world-class researchers, scientists, engineers, as well as clinicians, who are keen on developing novel algorithms to solve medical imaging problems using deep learning techniques. The conference had two submission tracks: *full paper* and *short papers*. Through the OpenReview system, 124 full paper and 119 short paper submissions were received (without counting early rejections). For both tracks, the review process was single blind, i.e. the reviewers knew the names and affiliations of the authors but not vice versa. All submitted papers were on display at the OpenReview system from the time of their submission. All reviews, rebuttals, and further discussions were made publicly available after the decision process and remain available at <https://openreview.net/group?id=MIDL.io/2021/Conference>. Authors were, however, given the option of removing rejected submissions from the system. Finally, reviewers were given the option to sign their reviews with their names.

The review process was initiated by the Program Chairs (PC), and was handled by one primary Area Chair (AC) for each paper. The AC assigned ten candidate reviewers per paper, upon which a matching algorithm assigned four reviewers per paper taking AC preference, reviewer preference, and reviewer expertise on the topic of the paper into account. After all reviews and rebuttals, for full papers, were received, area chairs wrote an additional metareview and provided their recommendation to accept or reject based on the submission,

the anonymous reviews, and the rebuttals. Review and metareview reports for each paper were checked by one Program Chair and all papers where the decision of the reviewers and AC was not unanimous were discussed in detail among all four Program Chairs. Final decisions were based on careful examination of the submission, AC and reviewer comments, the rebuttals and interactions during the discussion period. The final acceptance rate of the full paper track is 48.3% (60/124). Among the 60 accepted full paper articles, 18 were selected as oral presentations (14.5% of all submissions), based on reviewer and AC proposals, and 42 for poster presentations with short oral teasers. Among the 119 submitted short papers, 63 were accepted as posters with short oral teasers. The final acceptance rate of the short paper track is 52.9% (63/119). The proceedings of machine learning research (PMLR) only contains the accepted full paper submissions, the short papers can be found in the OpenReview system and in the corresponding arXiv compendium. Furthermore, 13 papers – selected from both long and short submissions – were recommended for submitting an extended version of their work in a special issue of Medical Image Analysis.

An independent award committee composed of members of the program committee, *Ivana Išgum, Archana Venkataraman, Ender Konokoglu*, who had no conflicts of interest with any of the authors of the oral presentations, has selected one best paper award and one runner-up among five finalists determined by the Program Chairs:

Best paper: *Beyond pixel-wise supervision: semantic segmentation with higher-order shape descriptors* by Hoel Kervadec et al. and Runner-up: *Semantic similarity metrics for learned image registration* by Steffen Czolbe et al.

The MIDL 2021 best paper award recognizes the highest quality full-length paper presented at the conference. The focus lies on novel methodological concepts with great potential of medical impact. Those full papers that were recommended for inclusion in the special issue were eligible. Further audience prizes were awarded to the best presentations as detailed on the website.

The review process included a mechanism for Area Chairs to score the quality of the reviews. Based on these scores, nine reviewers received an outstanding reviewer award. These reviewers are listed separately below, while honorable mentions are marked in bold in the list of reviewers.

The PCs and organizing chairs would like to thank the OpenReview staff for their support in hosting the submission site, TPMS for their support in assigning papers to ACs and reviewers, and PMLR staff for their support in finalizing these proceedings.

Most importantly, we would like to thank all authors and all our Area Chairs and Reviewers for their hard work in preparing and helping us shape the technical program of MIDL 2021. The conference and the current proceedings are a result of their work.

Even though the meeting was held as a virtual conference, it would have been impossible to host MIDL without the help of our students, staff, and volunteers. They managed the numerous video sessions with 20'000 total minutes watched and up to 200 concurrent participants in Webinars. We would like to extend a special thank you to all of them. We also

appreciate the support of Nina Leistikow from SCHMIDT-RÖMHILD Kongressgesellschaft that helped process 470 participant registrations and organise the sponsor events.

Finally, we would like to thank all our sponsors, for the financial support, which made the MIDL 2021 conference possible. Specifically, we acknowledge the support the German Research Foundation (DFG, grant no. ER 817/5-1) and the Government of the State of Schleswig-Holstein. We look forward to seeing you in Zürich in 2022 for the next edition of MIDL.

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Shanshan Wang, Miaomiao Zhang, S. Kevin Zhou.

Recognition of Outstanding Reviewers

Christian F. Baumgartner, Christian Desrosiers, Monika Grewal, Jannis Hagenah, Alessa
Hering, Raghav Mehta, Hans Meine, Nick Pawlowski, Antoine Théberge.

Reviewers *(Honorable mentions are marked in bold)*

Vincent Andrearczyk, **Elsa Angelini**, Mohamed Hassan Attia, Murat Seçkin Ay-
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Guang Yang, Lequan Yu, Jia-Xing Zhong, Xiahai Zhuang, Lilla Zollei.