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Machine Learning for Medical Image Reconstruction

First International Workshop, MLMIR 2018
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Proceedings

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Preface

We are proud to present the proceedings of the First Workshop on Machine Learning for Medical Image Reconstruction (MLMIR), which was held on 16th September 2018 in Granada, Spain, as part of the 21st Medical Image Computing and Computer Assisted Intervention (MICCAI) conference.

Image reconstruction is currently undergoing a paradigm shift that is driven by advances in machine learning. Whereas traditionally transform-based or optimization-based methods have dominated methods for image reconstruction, machine learning has opened up the opportunity for new data-driven approaches, which have demonstrated a number of advantages over traditional approaches. In particular, deep learning techniques have shown significant potential for image reconstruction and offer interesting new approaches. Finally, machine learning approaches also offer the possibility of application-specific image reconstruction, e.g., in motion-compensated cardiac or fetal imaging.

This is supported by the success of machine learning in other inverse problems by multiple groups worldwide, with encouraging results and increasing interest. Coincidentally, this year is the centenary of the Radon transform and the 250th anniversary of the birth of Joseph Fourier. The Fourier transform and the Radon transform provide the mathematical foundation for tomography and medical imaging. It seems appropriate and timely to consider how to invert the Radon transform and Fourier transform via machine learning, and have this workshop serve as a forum to reflect this emerging trend of image reconstruction research. In this respect, it will frame a fresh new way to recharge or redefine the reconstruction algorithms with extensive prior knowledge for superior diagnostic performance.

The aim of the workshop was to drive scientific discussion of advanced machine learning techniques for image acquisition and image reconstruction, opportunities for new applications, as well as challenges in the evaluation and validation of ML-based reconstruction approaches. We were fortunate that Jong Chul Ye (KAIST) and Michael Unser (EPFL) gave fascinating keynote lectures that summarised the state of the art in this emerging field. Finally, we received 21 submissions and were able to accept 17 papers for inclusion in the workshop. The topics of the accepted papers cover the full range of medical image reconstruction problems, and deep learning dominates the machine learning approaches that are used to tackle the reconstruction problems.

July 2018

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