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Statistical Atlases and Computational Models of the Heart

Imaging and Modelling Challenges

7th International Workshop, STACOM 2016
Held in Conjunction with MICCAI 2016
Athens, Greece, October 17, 2016
Revised Selected Papers

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Preface

Recently, there has been considerable progress in cardiac image analysis techniques, cardiac atlases, and computational models, which can integrate data from large-scale databases of heart shape, function, and physiology. Integrative models of cardiac function are important for understanding disease, evaluating treatment, and planning intervention. However, significant clinical translation of these tools is constrained by the lack of complete and rigorous technical and clinical validation as well as by benchmarking of the developed tools. For doing so, common and available ground-truth data capturing generic knowledge on the healthy and pathological heart are required. This knowledge can be acquired through the building of statistical models of the heart. Several efforts are now established to provide Web-accessible structural and functional atlases of the normal and pathological heart for clinical, research, and educational purposes. We believe all these approaches will only be effectively developed through collaboration across the full research scope of the imaging and modelling communities.

STACOM 2016 was held in conjunction with the MICCAI 2016 conference (Athens, Greece) and followed on from the past six editions: STACOM 2015 (Munich, Germany), STACOM 2014 (Boston, USA), STACOM 2013 (Nagoya, Japan), STACOM 2012 (Nice, France), STACOM 2011 (Toronto, Canada), and STACOM 2010 (2010, Beijing, China). Our main goal was to organize an international event to provide a forum for the discussion of the latest developments in the areas of statistical atlases and computational imaging and modelling of the heart. The topics of the workshop included: cardiac image processing, atlas construction, statistical modelling of cardiac function across different patient populations, cardiac mapping, cardiac computational physiology, model customization, image-based modelling and image-guided interventional procedures, atlas-based functional analysis, ontological schemata for data and results, integrated functional and structural analyses, as well as the pre-clinical and clinical applicability of these methods. STACOM 2016 received many submissions from around the World, with 24 excellent papers finally accepted to be presented at the workshop and to be published in an LNCS proceedings volume by Springer. Besides regular contributions on state-of-the-art cardiac image analysis techniques, atlases, and computational models that integrate data from large-scale databases of heart shape, function and physiology, computational electrophysiology, and biomechanics, additional efforts of this year's STACOM 2016 workshop included a challenge dedicated to the segmentation of left atrial wall thickness (SLAWT), described here.

Atrial wall thickness is an important parameter for biophysical electromechanical modelling of the atria and potentially important for planning ablation therapy for atrial arrhythmias. The data were sourced at St. Thomas' Hospital, King's College London, from individuals that are being treated for atrial fibrillation and from patients with normal cardiac anatomy. The ground truth was selected by consensus manual expert annotations using the STAPLE method. Several research groups had expressed interest

in participating in the challenge. Three groups had their final results submitted for evaluation. A collate paper including detailed data description and the results from participating groups was written by the SLAWT organizers and is included in these proceedings. The SLAWT data will be made publicly available via the Cardiac Atlas Project. We also anticipate a joint journal publication, as has been the case with all of our previous challenges.

We hope that the results obtained by the challenge, together with all regular paper contributions, will act to accelerate progress in the important areas of heart function and structure analysis.

In addition to the papers presented, two keynote lectures were included in the program of STACOM 2016: Dr. Sophie Mavrogeni, MD, FESC (Onassis Cardiac Surgery Centre, Athens, Greece), talk title “Cardiovascular Magnetic Resonance. Current Status and Future Applications,” and Prof. Dr. Dimitris Metaxas (Rutgers University, USA), talk title “Model-Based Large-Scale Cardiac Analytics.”

October 2016

Kristin Mcleod
Tommaso Mansi
Mihaela Pop
Kawal Rhode
Maxime Sermesant
Alistair Young

Organization

We would like to thank all organizers, additional reviewers, contributing authors, and sponsors for their time, effort, and financial support in making STACOM 2016 a successful event.

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SLAWT Challenge: Organizing Team

SLAWT Segmentation of Left Atrial Wall Thickness: Rashed Karim, Kawal Rhode, Oleg Aslanidi, Marta Valera, Ross Morgan, Ronak Rajani, Pranav Bhagirath

http://www.doc.ic.ac.uk/~rkarim/la_lv_framework/wall/index.html

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<http://stacom2016.cardiacatlas.org/>

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