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# Perinatal, Preterm and Paediatric Image Analysis

7th International Workshop, PIPPI 2022
Held in Conjunction with MICCAI 2022
Singapore, September 18, 2022
Proceedings

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# Preface

The goal of the Perinatal, Preterm and Paediatric Image Analysis (PIPPI) workshop is to provide a focused platform for the discussion and dissemination of advanced imaging techniques applied to young cohorts. The technical program typically consists of one keynote talk from a prominent figure in the community and the presentation of previously unpublished papers. Emphasis is placed on novel methodological approaches to the study of, for instance, volumetric growth, myelination and cortical microstructure, and placental structure and function or the assessment of new technical innovations for planned intervention. Although techniques applied to MR neuroimaging provide a significant number of submissions, we are delighted to receive submissions making use of other modalities or applied to other target organs or regions of interest such as the fetal heart and the placenta.

The main objective of PIPPI is to provide a forum for researchers in the MICCAI community to discuss the challenges of image analysis techniques as applied to the preterm, perinatal and paediatric setting which are confounded by the interrelation between the normal developmental trajectory and the influence of pathology. These relationships can be quite diverse when compared to measurements taken in adult populations and exhibit highly dynamic changes affecting both image acquisition and processing requirements. Furthermore, this forum will facilitate the presentation and detailed discussion of novel and speculative works, which may be outside the scope of the main conference but are essential for the advancement of modeling and analysis of medical imaging data. Additionally, discussion of these works within a focused group may initiate new collaborations.

The application of sophisticated analysis tools to fetal, neonatal, and paediatric imaging data has gained additional interest, especially in recent years with the successful large-scale open data initiatives such as the developing Human Connectome Project, the Baby Connectome Project, and the NIH-funded Human Placenta Project. These projects enable researchers without access to perinatal scanning facilities to bring in their image analysis expertise and domain knowledge.

This year's workshop took place on September 18, 2022, as a satellite event of the 25th International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI 2022). Two keynote speakers – Ting Xu (Child Mind Institute, New York, USA) and Gentaro Taga (University of Tokyo, Japan) – were invited for PIPPI 2022 to stimulate discussions, present recent research, and highlight future challenges in this field. Speakers working at the interface of clinical relevance and technical competence ensure close connection between technical, methodological research and clinical applications.

Following our experiences from the workshops in 2020 and 2021, PIPPI 2022 made use of a hybrid setup, allowing participants to join either in person or online. The online

set up of the workshops in 2020 and 2021 had several successful elements, allowing the participation of traditionally non-MICCAI attendees (clinicians, scientists) and the inclusion of a clinical keynote, and also helping to widen participation for those unable to travel. Continuing these elements improved the participation and accessibility of our workshop, whilst not adversely influencing the traditional workshop format for those attending on site. On site oral presentations were recorded live whilst virtual presentations were projected. All presented posters were displayed in joint virtual and physical settings.

As part of our changes for 2022, PIPPI has enhanced the links with researchers working in Computer Assisted Intervention (CAI). This is becoming increasingly relevant to PIPPI as fetal and neonatal interventions become more complex and new surgical developments lead to highly specialized tools and advanced methods for surgical planning.

This year, PIPPI saw the introduction of a new session format, the PIPPI Circle, a forum for open discussion among different communities researching early life. This session brought together scientists from clinics, industry, and academia to form a round-table panel to discuss the most pressing challenges in fetal and paediatric imaging, future directions for research, and the clinical requirements from the user's and patient's perspective.

PIPPI 2022 continued the support of the Fetal Tissue Annotation and segmentation (FeTA) challenge [1] and also added a new challenge, the BabySteps 2022 challenge [2]. Roxane Licandro and Jana Hutter acted as coordinators between the PIPPI workshop organizing team and the FeTA and BabySteps challenge team, respectively.

Teaming up with the ISMRM Placenta & Fetus study group, and having Christopher Macgowan as both an organizer of PIPPI and the study group committee chair, has allowed PIPPI to foster more interactions between related but often separated fields, enabling researchers with joint interests in perinatal imaging but with diverse backgrounds to meet, interact, and develop new collaborations. Concrete topics of focus include motion correction and fetal cardiac imaging, topics of huge importance for the community and where excellent expertise is present within the ISMRM community.

This year PIPPI teamed up with the FIT'NG (Fetal Infant Toddler Neuroimaging Group) network, an organization devoted to the study of brain development during the fetal, infant, and toddler periods. This enabled the workshop to have access to an additional community and supported the popular PIPPI topic of neuroimaging, by providing both reviewers and access to the widely distributed FIT'NG network.

PIPPI 2022 received original, innovative, and mathematically rigorous papers for the analysis of both imaging data and the application of surgical and interventional techniques applied to fetal and paediatric conditions. The methods presented in these papers, and hence these proceedings, cover the full scope of medical image analysis: segmentation, registration, classification, reconstruction, atlas construction, tractography, population analysis and advanced structural, and functional and longitudinal modeling, all with an application to younger cohorts or to the long-term outcomes of perinatal conditions. All papers were reviewed by three expert reviewers

from the Program Committee and ten papers were selected for presentation at PIPPI 2022 and are thus included in these proceedings. We are grateful to everyone who helped make this year's workshop a success.

September 2022

Jana Hutter
Roxane Licandro
Andrew Melbourne
Esra Abaci Turk
Christopher Macgowan

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# Contents

Automatic Segmentation of the Placenta in BOLD MRI Time Series ..... 1
*S. Mazdak Abulnaga, Sean I. Young, Katherine Hobgood, Eileen Pan, Clinton J. Wang, P. Ellen Grant, Esra Abaci Turk, and Polina Golland*

A Fast Anatomical and Quantitative MRI Fetal Exam at Low Field ..... 13
*Jordina Aviles, Kathleen Colford, Megan Hall, Massimo Marenzana, Alena Uus, Sharon Giles, Philippa Bridgen, Mary A. Rutherford, Shaihan J. Malik, Joseph V. Hajnal, Raphael Tomi-Tricot, and Jana Hutter*

Automatic Fetal Fat Quantification from MRI ..... 25
*Netanell Avisdris, Aviad Rabinowich, Daniel Fridkin, Ayala Zilberman, Sapir Lazar, Jacky Herzlich, Zeev Hananis, Daphna Link-Sourani, Liat Ben-Sira, Liran Hiersch, Dafna Ben Bashat, and Leo Joskowicz*

Continuous Longitudinal Fetus Brain Atlas Construction via Implicit Neural Representation ..... 38
*Lixuan Chen, Jiangjie Wu, Qing Wu, Hongjiang Wei, and Yuyao Zhang*

Automated Segmentation of Cervical Anatomy to Interrogate Preterm Birth .... 48
*Alicia B. Dagle, Yucheng Liu, David Crosby, Helen Feltovich, Michael House, Qi Yan, Kristin M. Myers, and Sachin Jambawalikar*

Deep Learning Framework for Real-Time Fetal Brain Segmentation in MRI ... 60
*Razieh Faghihpirayesh, Davood Karimi, Deniz Erdoğmuş, and Ali Gholipour*

Attention-Driven Multi-channel Deformable Registration of Structural and Microstructural Neonatal Data ..... 71
*Irina Grigorescu, Alena Uus, Daan Christiaens, Lucilio Cordero-Grande, Jana Hutter, Dafnis Batalle, A. David Edwards, Joseph V. Hajnal, Marc Modat, and Maria Deprez*

Automated Multi-class Fetal Cardiac Vessel Segmentation in Aortic Arch Anomalies Using T2-Weighted 3D Fetal MRI ..... 82
*Paula Ramirez Gilliland, Alena Uus, Milou P. M. van Poppel, Irina Grigorescu, Johannes K. Steinweg, David F. A. Lloyd, Kuberan Pushparajah, Andrew P. King, and Maria Deprez*

Segmentation of Periventricular White Matter in Neonatal Brain MRI: Analysis of Brain Maturation in Term and Preterm Cohorts . . . . . 94
*Alena U. Uus, Mohammad-Usamah Ayub, Abi Gartner, Vanessa Kyriakopoulou, Maximilian Pietsch, Irina Grigorescu, Daan Christiaens, Jana Hutter, Lucilio Cordero Grande, Anthony Price, Dafnis Batalle, Serena Counsell, Joseph V. Hajnal, A. David Edwards, Mary A. Rutherford, and Maria Deprez*

Knowledge-Guided Segmentation of Isointense Infant Brain . . . . . 105
*Jana Vujadinovic, Jaime Simarro Viana, Ezequiel de la Rosa, Els Ortibus, and Diana M. Sima*

Correction to: Knowledge-Guided Segmentation of Isointense Infant Brain . . . . C1
*Jana Vujadinovic, Jaime Simarro Viana, Ezequiel de la Rosa, Els Ortibus, and Diana M. Sima*

**Author Index** . . . . . 115