Physics

Physics-I *Machine Learning in MRI: design, acquisition, and analysis*
(3 speakers, 90 min)

Physics-II *Chemical Exchange Saturation Transfer: signal origin, animal model, and human applications*
(3 speakers, 90 min)

Physics-III *Diffusion MRI: from basic principles to advanced applications*
(3 speakers, 90 min)

Physics-IV ***Quantitative MRI: from parametric mapping to multi-parametric application***
(2 speakers, 60 min)

Physics-V *Novel MRI modalities*
(2 speakers, 60 min)

Hsiao-Wen Chung, PhD
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Time Table

Sunday, May 22, 2022
Room 205

Time	Topics	Speakers	Moderators
13:30-14:00 (30mins)	Quantitative Parametric Mapping using Multiple Echo Pathways in Spin Echo MRI	Mei-Lan Chu	Shin-Lei Peng Ping-Huei Tsai
14:00-14:30 (30mins)	Multiparametric MR in Prostate Cancer	Naranamangalam R. Jagannathan	Shin-Lei Peng Ping-Huei Tsai

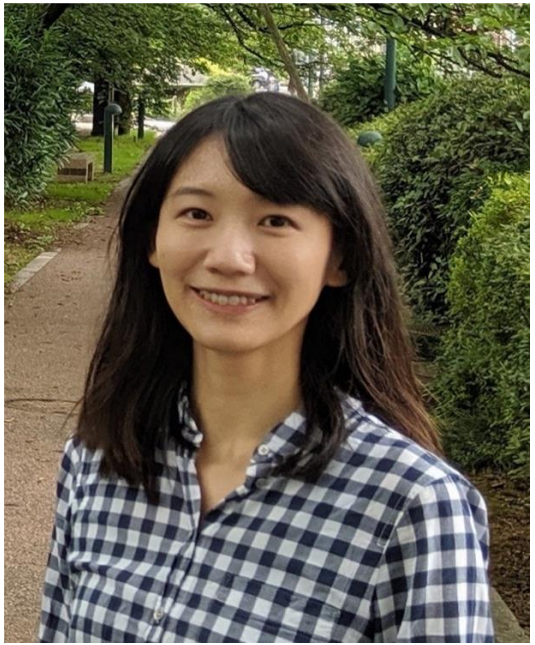
Quantitative MRI: from parametric mapping to multi-parametric application

Organizer:Hsiao-Wen Chung

Overview:

Quantitative MRI has a broad and loose definition. As its name suggests, all attempts to give numerical values from a series of MRI images fit the territory of quantitative MRI. In this session, two distinctly different approaches to quantitative MRI are presented. The first one describes the accurate mapping of relaxation times from multi-echo spin-echo MRI, utilizing sophisticated computational algorithms on the multiple signal pathways. The second lecture addresses the integration of multiple parameters obtained from MRI (including MR spectroscopy) to assist clinical diagnosis and treatment planning of prostate cancer.

Quantitative Parametric Mapping using Multiple Echo Pathways in Spin Echo MRI



Mei-Lan Chu, Ph.D., U.S.A.

- Senior computational scientist, Genentech
- Iterative mathematical algorithms for reconstruction of MRI for artifact-minimized imaging under free breathing, dedicated separation of signal pathways from multi-echo imaging data

Quantitative Parametric Mapping using Multiple Echo Pathways in Spin Echo MRI

- **Synopsis:**
- Quantitative mapping of the T2 relaxation time using Carr-Purcell-Meiboom-Gill (CPMG) MRI actually contains inevitable contamination from nonprimary echo pathways, unless these residual signals could be taken into consideration during reconstruction incorporating extended phase graph modeling. This can be accomplished using a parametric multiplexed sensitivity encoding method based on projection onto convex sets (parametric-POCSMUSE). Evaluation on human at 3 Tesla demonstrated accurate T2 maps that were obtained at a speed of <0.2 seconds per slice. An extension utilizing the nonprimary echo pathways further demonstrated the possibility of T1 mapping using a Dixon-like approach.
- **Key Reference:**

- Chu ML, Chang HC, Oshio K, Chen NK. A single-shot T2 mapping protocol based on echo-split gradient-spin-echo acquisition and parametric multiplexed sensitivity encoding based on projection onto convex sets reconstruction. Magn Reson Med. 2018;79:383-393.
- Chu ML, Chang HC, Chung HW, Truong TK, Bashir MR, Chen NK. POCS-based reconstruction of multiplexed sensitivity encoded MRI (POCSMUSE): A general algorithm for reducing motion-related artifacts. Magn Reson Med. 2015;74:1336-1348.

Multiparametric MR in Prostate Cancer

Naranamangalam R. Jagannathan, Ph.D., India

- J.C. Bose National Fellow (SERB, Govt. of India)
- Professor of Eminence of Radiology, Chettinad Hospital and Research Institute, Kelambakkam, India
- Department of Electrical Engineering, Indian Institute of Technology, Madras, Chennai, India
- Fellow, India Academy of Sciences (IASc), Indian National Science Academy (INSA), National Academy of Sciences (NASI) and National Academy of Medical Academy (NAMS), India
- Fellow, International Society for Magnetic Resonance in Medicine (ISMRM) and served as a member of AMPC, Young Investigator, Educational, Chapter' s and Publication committees of ISMRM
- Member of Editorial Boards of *NMR Biomed., MAGMA, MRI, Biophys. Rev., Biomedical Spectro.* and other journals
- Clinical applications of molecular and functional MRI and in- vivo MR spectroscopy in cancer

Multiparametric MR in Prostate Cancer

- **Synopsis:**
- Prostate cancer (PCa) is one of the most prevalent cancers in men and the clinical behavior ranges from low-grade indolent tumors to aggressive and invasive tumors. Challenges in clinical management of PCa include at levels of screening, diagnosis, treatment, and follow-up after treatment. MR methods have shown potential in detection, localization, staging, assessment of aggressiveness, and targeting biopsies. Multiparametric MRI (mpMRI) is emerging as an option compared to the individual MR imaging methods and attempts to improve the reproducibility and reliability by using an objective scoring system proposed in the PIRADS for standardized reporting. This talk presents a description of various mpMRI methods applied for anatomical, functional and metabolic parameters with regard to investigations of PCa.

- **Key Reference:**

- Sharma U, Jagannathan NR. Metabolism of prostate cancer by magnetic resonance spectroscopy (MRS). Biophys Rev. 2020;12:1163-1173
- Kumar V, Bora GS, Kumar R, Jagannathan NR. Multiparametric (mp) MRI of prostate cancer. Prog Nucl Magn Reson Spectrosc. 2018;105:23-40.
- Dwivedi DK, Kumar R, Bora GS, Thulkar S, Sharma S, Gupta SD, Jagannathan NR. Stratification of the aggressiveness of prostate cancer using pre-biopsy multiparametric MRI (mpMRI). NMR Biomed. 2016;29:232-238