Canadian Association of Physicists

Association canadienne des physiciens et physiciennes

Contribution ID: **469** Type: **Oral Competition (Graduate Student) / Compétition orale (Étudiant(e) du 2e ou 3e cycle)**

(G*) Magnetic Resonance Relaxometry with Neural Networks

Monday 7 June 2021 17:10 (5 minutes)

Magnetic resonance imaging (MRI) is widely used as a non-invasive diagnostic technique to visualize the internal structure of biological systems. Quantitative analysis of magnetic resonance signal lifetimes, i.e., relaxation times, can reveal molecular scale information and has significance in the study of brain, spinal cord, articular cartilage, and cancer discrimination. Determination of MR relaxation spectra (relaxometry) is an inherently ill-posed problem. Conventional methods to extract MR relaxation spectra are computationally intensive, requiring high quality data and generally lacking the spectrum peak width information. A novel computationally efficient signal analysis method, based on neural networks (NN), has been developed to provide accurate real-time quantitative MR relaxation spectrum analysis.

Deep learning with NN is a technique for solving complex nonlinear problems. NN have been optimized to determine 1D and 2D MR relaxation spectra. Simulated signals with Rician noise were employed for training the neural networks. The network performance was evaluated with simulated and experimental data, and compared with the traditional inverse Laplace transform (ILT) method. NN outperformed ILT. The 1D spectrum peak widths, generally considered not reliable with the traditional approach, could be determined accurately by the NN, noise permitting.

The proposed exponential analysis method is not restricted to magnetic resonance. It is readily applicable in other areas with exponential analysis, such as fluorescence decay and radioactive decay. The method could be extended to higher dimensional spectra and adopted to solve other ill-posed problems.

Authors: Mr PARASRAM, Tristhal (University of Windsor); XIAO, Dan (University of Windsor)

Presenter: Mr PARASRAM, Tristhal (University of Windsor)

Session Classification: M4-2 MR and PET Imaging - Part 2 (DPMB) / Imagerie RM et TEP - Partie 2 (DPMB)

Track Classification: Physics in Medicine and Biology / Physique en médecine et en biologie (DPMB-DPMB)