## Beyond Linear Decoding: An Introduction to Deep Learning Methods

Half Day Afternoon Course / 13:00-16:30

**Organizers:**
*Pamela Douglas, UCF/UCLA, United States*

*Andrew Doyle, Montreal Neurological Institute, Canada*

Deep learning neural networks have become an indispensable tool in the field of image classification, and are increasingly applied to functional neuroimaging data (e.g., fMRI, EEG, ECoG, fNIRS). Deep neural networks have very quickly surpassed human performance in natural image recognition, and in some cases, the highest-performing architectures closely resemble the processing stream in the human visual cortex. Although these learning algorithms are routinely applied in other imaging domains, they remain in their nascent stage in their applicability to functional neuroimaging data. Here, we introduce state-of-the-art methods in deep learning with a focus on how these new techniques can readily be applied to brain imaging data. Importantly, we focus on novel methods that have recently been developed for interpreting these learning algorithms – which was previously a hindrance for their application to neuroimaging data. Given the success of these methods in other imaging fields, we feel as though introducing these topics to the brain mapping community is both timely and important.

**Course Schedule:**

13:00-13:30
**Beyond Linear Decoding**
*Pamela Douglas, UCF/UCLA, United States*

13:30-14:00
**Introduction to Deep Learning**
*Andrew Doyle, Montreal Neurological Institute, Canada*
14:00-14:30
**Hands-on Deep Learning with Keras**
*Anisha Keshavan, University of Washington, United States*

14:30-14:40
**Break**

14:40-15:10
**Generative Adversarial Networks**
*Christopher Beckham, Université de Montréal, Canada*

15:10-15:40
**Deep Learning for Segmenting Infant MRI**
*Pim Moeskops, TU Eindhoven, Netherlands*

15:40-16:10
**Interpretation of Deep Learning Algorithms for Neuroimaging**
*Alexander Binder, Singapore University of Technology and Design, Singapore*

16:10-16:30
**Questions and Answers**