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Presentation Title: Representational Learning of Resting-State fMRI Data using Variational Autoencoder

Abstract: Resting state functional magnetic resonance imaging (rsfMRI) data exhibits complex but structured patterns. However, the underlying origins are unclear and entangled in rsfMRI data. Here we establish a variational auto-encoder, as a generative model trainable with unsupervised learning, to disentangle the unknown sources of rsfMRI activity. After being trained with large data from the Human Connectome Project, the model has learned to represent and generate patterns of cortical activity and connectivity using latent variables. The latent representation and its trajectory represent the spatiotemporal characteristics of rsfMRI activity. The latent variables reflect the principal gradients of the latent trajectory and drive activity changes in cortical networks. Representational geometry captured as covariance or correlation between latent variables, rather than cortical connectivity, can be used as a more reliable feature to accurately identify subjects from a large group, even if only a short period of data is available in each subject. Our results demonstrate that VAE is a valuable addition to existing tools, particularly suited for unsupervised representation learning of resting state fMRI activity.

Brief Biosketch

Dr. Jung-Hoon Kim is currently a postdoctoral research fellow at the Developing Brain Institute at Children's National Hospital at Washington DC since 2021. Dr. Kim received his B.S. and M.A from Hanyang University majored in Biomedical Engineering. Since then, he earned his Ph.D. from Weldon School of Biomedical Engineering at the Purdue University in 2021. During his PhD program, he focused on developing a new deep learning method for better representing complex resting-state fMRI. As a postdoctoral researcher at Children's National, his current research topic is related to mapping detailed, longitudinal neurodevelopmental trajectories of the preterm functional brain connectome using deep learning model.