

# ACMS Statistics Seminar

**Yeseul Jeon**

**The Ohio State University**

**Tuesday, November 1 2022**

**101A Crowley Hall**

**3:30 PM – 4:30 PM**



## **A Bayesian Convolutional Neural Network-based Generalized Linear Model**

Convolutional neural networks (CNNs) provide flexible function approximations for a wide variety of applications when the input variables are in the form of images or spatial data. Although CNNs often outperform traditional statistical models in prediction accuracy, statistical inference such as estimating the effects of covariates and quantifying the prediction uncertainty is not trivial due to the highly complicated model structure and overparameterization. To address this challenge, we propose a new Bayes approach by embedding CNNs within the generalized linear model (GLM) framework. We use extracted nodes from the last hidden layer of CNN with Monte Carlo dropout as informative covariates in GLM. This improves prediction accuracy and provides an interpretation of regression coefficients. By fitting ensemble GLMs across multiple realizations from Monte Carlo dropout, we can fully account for uncertainties in model estimation. We apply our methods to simulated and real data examples, including non-Gaussian spatial data, brain tumor image data, and fMRI data. The algorithm can be broadly applicable to image regressions or correlated data analysis by providing accurate Bayesian inference quickly.

The Department of Applied and Computational  
Mathematics and Statistics

Please visit [acms.nd.edu](http://acms.nd.edu) to view the full list of speakers.