USCOTS 2019 Posters & Beyond Proposal

Name: Adam Loy

Institution: Carleton College

e-mail: [aloy@carleton.edu](mailto:aloy@carleton.edu)

Presentation title: Bringing Visual Inference to the Classroom

Brief abstract (150 words):

In introductory statistics, we traditionally visualize inferential concepts related to inference using static graphics or interactive apps. For example, there is a long history of using apps to visualize sampling distributions. Recent developments in statistical graphics have created an opportunity to bring additional visualizations into the classroom to hone student understanding. Specifically, the lineup protocol (Buja et al., 2009) provides a framework for students see the difference between signal and noise. This protocol involves embedding a plot of observed data in field of “noise plots.” This approach has proved valuable in visualizing randomization/permutation tests, diagnosing models, and even conducting valid inference when distributional assumptions break down (Loy, Follett & Hofmann, 2016; Loy, Hofmann & Cook, 2017). This poster will provide an overview of the lineup protocol for visual inference and how we use it in our statistics courses, most notably the first and second courses in statistics.

Connection to the theme (evaluating evidence):

A fundamental skill in evaluation of evidence is to understand how to discern signal from noise. Training students to understand this difference is something that statistics educators must grapple with throughout the statistics curriculum. For example, in the first statistics course, students encounter residual plots and must determine whether structure is present or whether the plot exhibits “random scatter.” We have found the lineup protocol to be an effective way of training a student’s intuition, since the observed plot is imbedded in a field of plots created from valid models. The lineup protocol shows students what terms like “random scatter” or “noise” mean in practice. Further, the lineup protocol is general enough to apply to many tasks common throughout the statistics curriculum, including visualizing randomization tests, training students to read Q-Q plots, and interpreting plots from complex models (such as GLMs or hierarchical linear models). These plots help students evaluate the evidence about the appropriateness of a model, which is inherently linked to their evaluation of the evidence presented by the model.

Citations:

Buja, A., Cook, D., Hofmann, H., Lawrence, M., Lee, E.-K., Swayne, D. F., & Wickham, H. (2009). Statistical inference for exploratory data analysis and model diagnostics. *Philosophical Transactions. Series A, Mathematical, Physical, and Engineering Sciences*, *367*(1906), 4361–4383.

Loy, A., Follett, L., & Hofmann, H. (2016). Variations of Q–Q Plots: The Power of Our Eyes! *The American Statistician*, *70*(2), 202–214.  
  
Loy, A., Hofmann, H., & Cook, D. (2017). Model Choice and Diagnostics for Linear Mixed-Effects Models Using Statistics on Street Corners. *Journal of Computational and Graphical Statistics,* *26*(3), 478–492.