1154-90-961 **Robert A Bridges*** (bridgesra@ornl.gov), 1 Bethel Valley Road, PO Box 2008, MS 6418, Bldg 6012, office 208, Oak Ridge, TN 37831. *Recent mathematical developments for vehicle security, analyzing host logs, and other applications.*

I plan to discuss a few projects involving applications of math and machine learning.

First, I'll introduce how modern vehicles use controller area networks (CANs), their inherent security flaws, and our efforts to pioneer a vehicle-agnostic intrusion detection system. Machine learning to reverse engineer proprietary signals from the CAN data in route to a detection capability will be discussed. Next, we consider security operation centers (SOCs), which now collect, store, and analyze an enormous amount of logging data from. Because host logging data is semi-structured and non-uniform, automated use of the logs is difficult. Our approach defines and embeds log sequences into a metric space structure that preserves semantic meaning of the data. We show initial results using the metric space for ransomware detection, user classification, and visualization of user activity.

Finally, I'll consider the more general problem of regression and sensitivity analysis of a function in $C^1(\mathbb{R}^n)$, where we assume the given observation set includes gradient information, $\{(x_i, f(x_i), \nabla f(x_i)\}$. Our proposed approach is to reduce the analysis of the function to a 1-D manifold, the "Active Manifold" by exploiting a gradient / tangent space decomposition. (Received September 12, 2019)