Decision Analysis & Intelligent Systems Design Group

William Scherer

Professor
wts@virginia.edu
web.sys.virginia.edu/william-t-scherer.html

Dept. of Systems & Information Engineering
University of Virginia
Charlottesville, VA
434.982.2069

"Understanding the systemic risk in complex financial markets via engineering analysis."
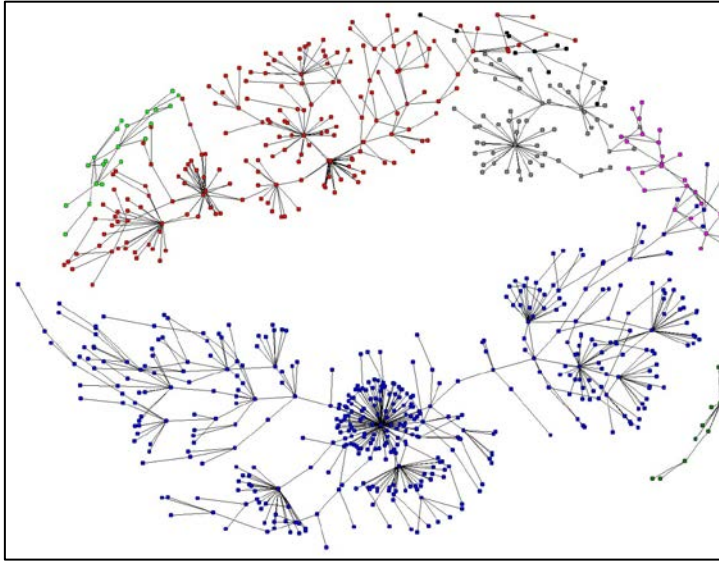
Our group is interested in systems engineering methodology, engineering design, decision analysis, stochastic control, and operations research. The goal is to turn big data into information into decision. Current research is centered on disparate data analytics an applying analytical modeling approaches such as Markov decision processes (MPDs). Our research is applied, for example, to systems involving transportation, intelligence networks, and finance.

UNIVERSITY of VIRGINIA
ENGINEERING

Intelligent Systems

We are applying dynamic network analysis to a corpus of intelligence documents to provide a superior measure of the value of individual documents. We focus on understanding which intelligence documents are most critical to understanding the current state of affairs on the ground, but more importantly, the overall picture that is developed during an analysis. Our methodology provides a framework for analysts to explore a corpus of documents in a multi-modal network and to answer a variety of analytic questions.

Decision Analysis

We apply decision tools such as agent-based model (ABM) to domains such as financial markets to study cost benefit analysis. Our ultimate goal is to provide better tools for policy makers. Additionally, we are working to develop a decision-support system to inform VDOT Traffic Operations personnel when implemented timing plans are no longer suitable for current conditions and to assist them in generating new timing plans.

Intelligent Transportation Systems

Although extensive Intelligent Transportation Systems (ITS) technology is being deployed in the field, little analysis is being performed to evaluate the benefits of implementation schemes. Our group works with the Virginia Center for Transportation Innovation and Research to develop simulation-optimization methodologies for the study of intelligent systems.

Markov Decision Processes

Electronic markets have emerged as popular venues for the trading of a wide variety of financial assets, and computer based algorithmic trading has also asserted itself as a dominant force in financial markets across the world. Identifying and understanding the impact of algorithmic trading on financial markets has become a critical issue for market operators and regulators. Our research characterizes traders' behavior in terms of the reward functions most likely to have given rise to the observed trading actions. We then model trading decisions as a Markov Decision Process, using observation of an optimal decision policy to find the reward function.

RECENT RESEARCH DEVELOPMENTS

- Research team presented at the Military Operations Research Conference (MORS) work on innovative models text mining via Latent Dirichlet Analysis (LDA)
- Research team used a smart-phone app with University subjects (students) to demonstrate the capability of forecasting appointment arrivals times

RECENT GRANTS

- US Army Training and Doctrine Command (TRADOC): Identifying Systems Thinking in Intelligence Analysis
- The MITRE Corporation: Using Geo-locating via Smartphones in Improve the Efficacy of Veterans Administration Medical Clinics
- The National Science Foundation (NSF): The Future of Systems Engineering Education

SEAS Research Information
Pamela M. Norris,
Executive Associate Dean for Research
University of Virginia
Box 400232
Charlottesville, VA 22903
pamela@virginia.edu
434.243.7683