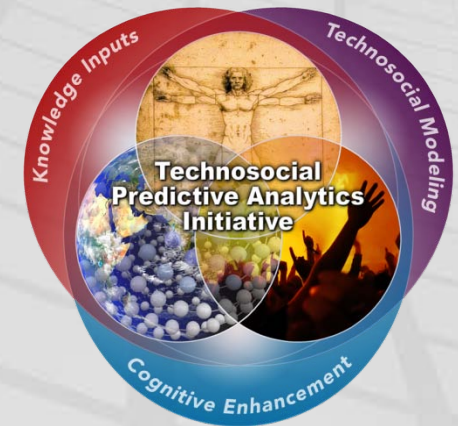


# Workshop on Current Issues in Predictive Approaches to Intelligence and Security Analytics

Fostering the Creation of Decision Advantage through Model Interoperability and Evaluation



**Antonio Sanfilippo**

*IEEE International Conference on Intelligence and Security Informatics  
Vancouver, BC, May 23-26, 2010*

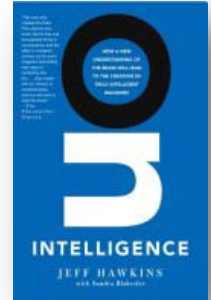
# Why are we doing this?

- ▶ Factors such as globalization and the increased speed of knowledge sharing keep escalating the asymmetric nature of threats to the security, health and sustainable growth of our society
  - Strategic surprises emerging from non-linear relationships between trigger and target events
- ▶ Anticipatory analysis has to become an everyday activity in decision-making to counter adversities and maximize opportunities



# Why do we need computers to perform anticipatory reasoning?

- ▶ The human brain provides a unique framework for memory and prediction
  - The ability to focus “in the moment” to take decisions by insight and intuition make human judgment uniquely effective
- ▶ However, human judgment can lead to fallacious reasoning when biased
  - Lack of knowledge/expertise (Klein 1998)
  - Groupthink (Janis 1972)
  - Positive framing, trust in extreme judgments, neglect of uncorrelated observables (Tversky & Kahneman 1973, 1981)
  - Memory and focus attention limitations (Miller 1956, Heuer 1999)
  - ...



# Current Issues in Predictive Analytics

- ▶ Currently, the use of anticipatory reasoning is hindered by the lack of systematic methods for model integration and model evaluation
  - Failure to achieve interoperability across models from diverse domains and disciplines curtails our ability to address complex problems
  - Failure to verify and validate models hinders user acceptance and realistic understanding of a model's analytic reach

# What is model interoperability and why do we need it?

- ▶ Link models built using different approaches
  - **Knowledge Coalescence:** Combine heterogeneous elements of knowledge
  - **Mathematical interoperability:** Link across diverse modeling algorithms (Bayesian nets, system dynamics, agent-based)
- ▶ Knowledge Coalescence promotes model fidelity and reliability
- ▶ Mathematical interoperability enables us to use the right tool for the right job and leverage legacy models

# Model evaluation

- ▶ Accuracy and validity of the inferences yielded by the model and the utility that such inferences provide to the user, e.g. validation of model output against historical data
- ▶ Verify that the model is implemented correctly and matches agreed-upon specifications and assumptions
- ▶ Assess how model exploration and output help the human user to achieve his/her goals with reference to pre-established metrics such as time efficiency, elimination of biases, better understanding of high impact variables

# Workshop program

- ▶ Workshop themes
  - Model Interoperability and Meta-Modeling
  - Model Diagnostics and Evaluation
  - Collection Analysis and Coalescence of Evidence
- ▶ Panel on Model Interoperability – main conference event
  - Antonio Sanfilippo (PNNL), Alexander Levis (GMU), Lucas Overbey (SPAWAR), Bill Reynolds (LSS Inc.), Ed Waltz (BAE Systems)
- ▶ Invited talk by Ed Waltz, BAE Systems
  - *Anticipatory Intelligence Analysis: Integrating Multiple Models for Joint Intelligence Preparation*

# Guidelines

- ▶ Recommendations to presenters
  - Invited talk 40 minutes, including questions
  - Remaining presentations 20 minutes + 5 minutes transition time
    - Please make sure you do your presentation in under 20 minutes so as to leave some time for questions
    - Time alerts at minutes 5, 2, 1. When you see the sign “STOP” ... run for cover 😊
- ▶ We have a tight schedule: please do not be late coming back from breaks!
- ▶ Ask questions, interact, talk to your fellow workshop attendees, and most of all ... have FUN!