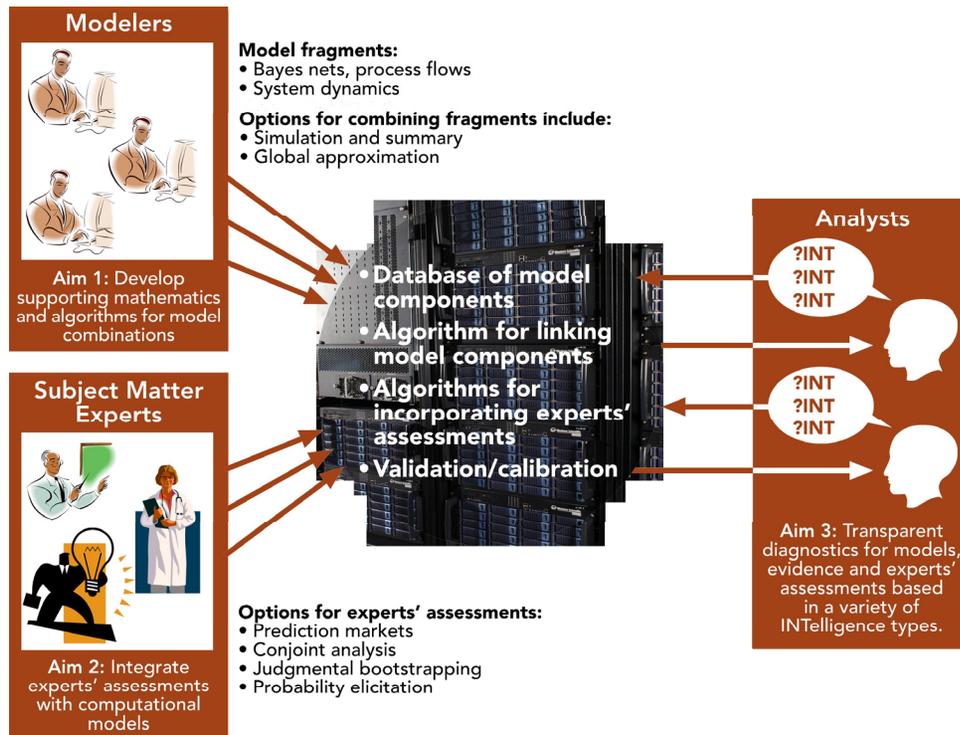


Illicit Nuclear Trafficking



Technical Approach

- Rigorous model validation
- Formal modeling of experts' assessments
- Automatic support for model integration
- Detailed quantitative comparison of dynamic behavior models to observations
- Incorporate experts' assessments through a mathematical structure linking experts' input and the computational model

Challenges

Illicit nuclear trafficking networks are a national security challenge. These networks can directly lead to nuclear proliferation, as states or non-state groups attempt to identify and acquire nuclear weapons-related expertise, technologies, components, and materials. The ability to characterize these networks and improve our ability to anticipate the key nodes, and transit mechanisms associated with them, is essential to influencing, disrupting, destroying, or interdicting the function of the network and its processes.

Solution

Mathematics and computational collaborative methodology to forecast organization behavior using models, empirical data and experts' opinions.

Technosocial Predictive Analytics Initiative

Project Lead: Paul Whitney, 509.375.6737 or paul.whitney@pnl.gov

TPAI Lead: Antonio Sanfilippo, 509.475.2677 or antonio.sanfilippo@pnl.gov

Website: <http://predictiveanalytics.pnl.gov>

Illicit Nuclear Trafficking

Objective

To develop a modeling methodology that incorporates available information through model building, calibration, data integration, and validation as possible; and account for both socio-behavioral aspects and technological aspects that can drive, hinder, or modify group behavior.

Current Practices

Decision-making processes often rely on modeling, at least on some level, for estimating the likelihood of future events based on current and historical data. Single-model paradigms constrain the scope of such models to aspects that fit well within the model of choice and associated computational capability. However, in order to explain and predict behavior of systems, especially where these systems include the actions and responses of groups of people interacting with technology, it is important and useful to design probabilistic, dynamic, integrated models that bring together the best of existing models across different modeling paradigms.

Illicit Nuclear Trafficking Approach

Our technical approach to integrate predictive information has three unique and significant aspects: rigorous model validation, formal modeling of experts' assessments and automatic support for model integration. We take an 'engineering' approach to validating the integrated forecasting model — executing a detailed quantitative comparison of dynamic behavior models to observations.

We incorporate experts' assessments through a mathematical structure linking experts' input and the computational model. Our approach treats experts as 'sensors', incorporating their opinions through sensor model component. Finally, the diverse concepts and expertise to address these challenges drives developing automatic support for model integration. These three aspects involve significant traditional science and technology expertise, combined with detailed knowledge of extant social systems (e.g. banking, energy distribution, insurance...) and technical systems.

The Transformational Change

To improve the ability to anticipate key nodes, and transit mechanisms associated with illicit nuclear trafficking networks to influence, disrupt, destroy, or interdict the function of the network and its processes.

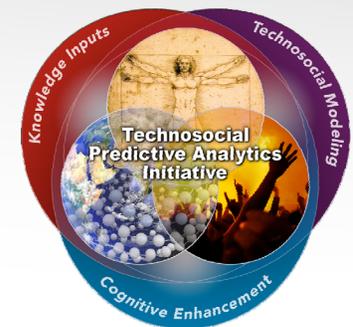
Outcomes

- Collaborative expert assessment to calibrate models
- Collection of models to support analysis in illicit trafficking
- Mathematics to support integrating trafficking models.

The Technosocial Predictive Analytics Initiative (TPAI)

is taking the next steps to addressing complex, interwoven issues with highly integrated, innovative models to help analysts and policy makers identify and counter strategic surprise.

TPAI supports a multi-perspective approach to predictive analysis through integrated reasoning, drawing knowledge insights from both the natural and social sciences.



Pacific Northwest
NATIONAL LABORATORY

Proudly Operated by **Battelle** Since 1965