Pacific Northwest NATIONAL LABORATORY

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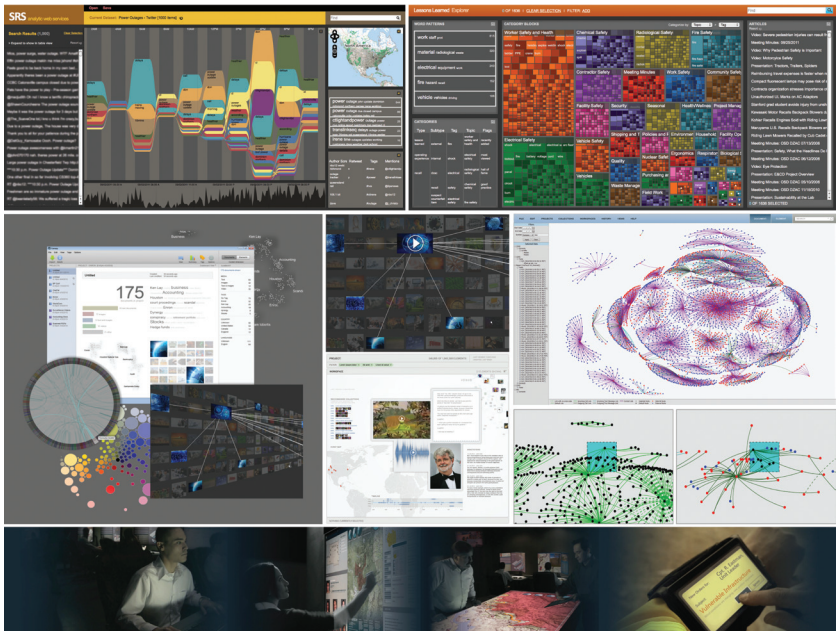
Visual Analytics at the Pacific Northwest National Laboratory

The Pacific Northwest National Laboratory has a long history of information visualization research leading to high-impact tools for its customers. The success of PNNL's information visualization software, such as IN-SPIRE™ and Starlight™, and publications in top visualization journals and conference proceedings are the results of PNNL researchers' dedication to helping people make sense of massive amounts of complex data.



A MULTI-DISCIPLINARY, COLLABORATIVE APPROACH

Visual analytics draws from information visualization and scientific visualization with a focus on analytical reasoning facilitated by interactive visual interfaces. PNNL's visual analytics team makes big, complex data useful through skillful visual design, compelling interaction, sound analytic methods, and solid engineering. This team of researchers, user experience specialists, software developers, and others invents new visual metaphors, creates analysis algorithms, and delivers software products that put powerful visual analytics capabilities into customers' hands. The team collaborates with experts across the laboratory and around the world—including statisticians, machine vision experts, modelers, and domain scientists—to solve its customers' hardest analysis challenges.

PNNL VISUAL ANALYTICS RESEARCH AND TECHNOLOGIES

PNNL creates interactive analytical environments that address dynamically changing data, allowing users to explore, discover, and learn; subset the data; run queries; perform time sequence studies; create categories and correlations of data types; and more.

PNNL has deployed visual analytics technologies in domains such as threat detection for national security, cyber analytics, intellectual property portfolio analysis, energy grid reliability, environmental safety, training, and law enforcement.

U.S. DEPARTMENT OF ENERGY

FOCUS AREAS

PNNL's visual analytics research and development activities focus on five main areas:

Information Signatures. PNNL's visual analytics team creates mathematical signatures that summarize key features in large, complex, heterogeneous data sets. Signatures are created from text, multimedia, and sensor data, with a focus on performance and scalability.

Visual Design. The team develops new ways to tell stories with data through visual representations. Appealing depictions of complex patterns and relationships visually summarize the output of information signatures.

Analytic Methods. The team designs software and methods that guide users in exploring and gaining valuable insight from visual representations. Through these visualizations, users can create and test hypotheses, communicate results, and challenge assumptions.

Natural User Interactions. In addition to creating new interactive visual environments for the web, mobile devices, and desktop applications, the team explores emerging techniques and hardware for gesture and touch interfaces that brings users closer to their data than ever before.

User Experience. Underlying all of the team's work is the ultimate goal: helping people work with information. The team's user-centered design approach includes collaborating closely with users to understand their problems, test solutions, and deliver usable and useful software products.

EXAMPLE TECHNOLOGIES

Text and Multimedia Analytics

Text analytics extracts information from narrative documents and then generates themes and identifies relationships. PNNL's IN-SPIRE and Starlight analysis tools have won R&D 100 and Federal Laboratory Consortium Excellence in Technology Transfer awards for their visual approaches to text analysis. PNNL researchers continue to advance text analytics innovations and are extending this foundational work to multimedia data as well. For example, the Canopy software suite supports analysis and discovery in mixed-media data, including text, image, video, and audio.

Cyber Analytics

Cyber analytics applies interactive visual analysis to computer networks and related transactional data. For instance, PNNL's CLIQUE models events in large amounts of streaming computer network traffic, helping analysts spot anomalous behavior quickly. A complementary tool, Traffic Circle, enables exploration of suspect behavior in detail.

Graph Analytics

Graph analytics addresses information that is represented as networks of nodes and links. PNNL has developed new algorithms for topological and content signatures and new visualizations for understanding complex graphs. Representative PNNL technologies include GreenGrid, a tool that allows visual exploration of the Western U.S. power grid and GreenSketch, which generates synthetic graph data for testing and benchmarking.

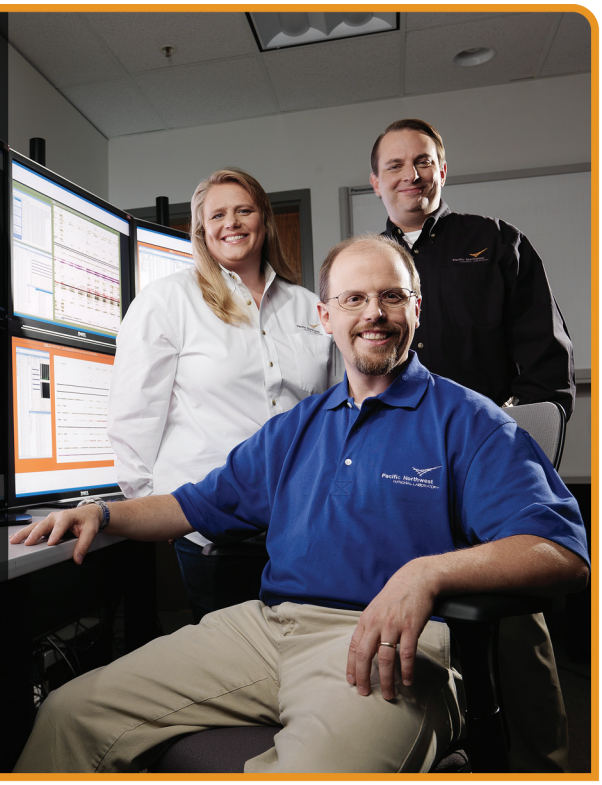
Other Capabilities

Other recent PNNL-developed visual analytics technologies include the Scalable Reasoning System, which provides users with easy access to information and visual analytics tools via the web, and Precision Information Environments, which provides decision support capabilities for emergency management professionals.

ABOUT PNNL

Interdisciplinary teams at Pacific Northwest National Laboratory address many of America's most pressing issues in energy, the environment and national security through advances in basic and applied science. PNNL employs 4,600 staff, has an annual budget of nearly $1 billion, and has been managed for the U.S. Department of Energy by Ohio-based Battelle since the laboratory's inception in 1965.

www.pnnl.gov



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