

**VACCINE**  
Visual Analytics for Command, Control, and Interoperability Environments  
A U.S. Department of Homeland Security Center of Excellence



## The Command, Control and Interoperability Center Of Excellence

*A DHS Center of Excellence*

### CCI COE Overview

The Command, Control and Interoperability Center of Excellence (CCI COE) provides a continuing influx of basic and applied research to the technology development and investment process of the Command, Control and Interoperability (CCI) Division. This ensures CCI is always ready to apply the latest science to the complex and continuously evolving problems confronting the homeland security enterprise. This is the 12th member of the U.S. Department of Homeland Security (DHS) Centers of Excellence Network, managed by the Office of University Programs within the DHS Science and Technology Directorate. Center research and education efforts will directly support the activities of the CCI Division and will focus on issues related to information analysis, knowledge management, threat assessment, situational awareness, decision support, information sharing, interoperable communications, surveillance and investigative operations, and cyberinfrastructure protection.

The CCI COE is organized as two teams: the Visualization Sciences Team (VACCINE), led by Purdue University, and the Data Sciences Team (CCICADA), led by Rutgers University. These teams are focusing on seven research topics:

- *Dynamic, on-Demand Data Processing and Visualization*
- *Hypothesis-driven Analysis*
- *Visualization of Structured, Unstructured, and Streaming Data*
- *Mathematics of Discrete and Visual Analytics*
- *Scalable Filtering and Dissemination*
- *Visualization and Simulation of Data*
- *Mobile and Light-Weight Information Analytics and Sharing*



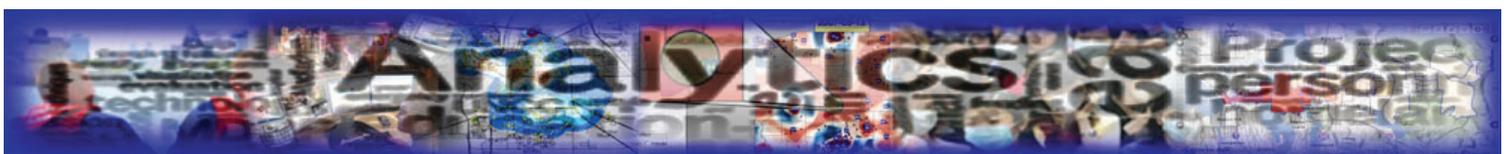
The expected research outcomes of this center are diverse but reflect the needs of the broad stakeholder base that CCI and S&T services; namely, innovation and science leadership in the areas of analytics, critical thinking, and decision-making; information sharing and communication, including interoperability and privacy preservation; approaches for moving theory into technology and operations across Federal, state, tribal, and local governments and with international partners, such as Canada, the United Kingdom, and Germany; and education for the next generation of law enforcement, public safety, and emergency response communities, including curricula for all educational levels and continuing education and professional development.

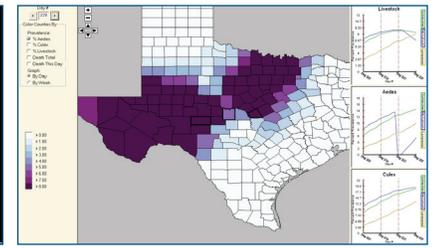
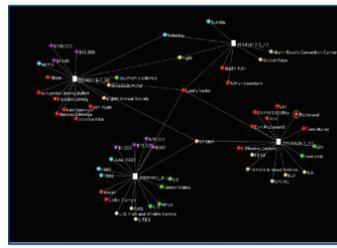
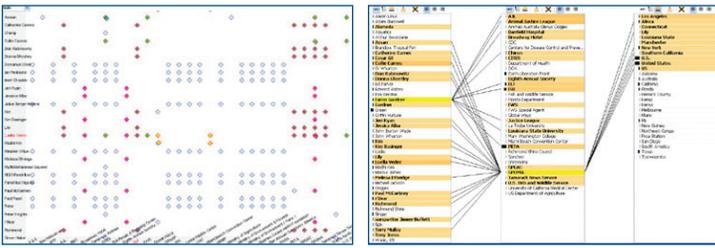
### VACCINE Partners:

Purdue University (Lead) • Virginia Tech University • Jackson State University • Georgia Institute of Technology • Pennsylvania State University • University of North Carolina at Charlotte • University of Washington • Stanford University • Simon Fraser University • University of British Columbia • University of Stuttgart • University of Houston, Downtown • Florida International University • North Carolina A&T State University • University of Texas at Austin

### CCICADA Partners:

Rutgers University (Lead) • University of Massachusetts – Lowell • Alcatel-Lucent Bell Labs • Howard University • Princeton University • Carnegie Mellon University • Texas Southern University • Morgan State University • Rensselaer Polytechnic Institute • University of Illinois at Urbana/Champaign • University of Southern California • Tuskegee University • AT&T Labs, Research • Geosemble Technologies





## Visualization Sciences Team (VACCINE)

The amount of information gathered during a crisis can be crushing if not managed correctly. DHS views VACCINE's research and education in visualization sciences as critical to the protection and security of America and its allies. In the event of a catastrophe, such as a chemical spill, natural disaster, disease outbreak or a terrorist attack, information will be coming from many sources, such as camera images, data from sensors and simulations, and text documents from police and health-care agencies. VACCINE focuses on education, research, development, and deployment of interactive visual analytic environments for communicating and disseminating information and deriving insight from the massive homeland security data deluge.

VACCINE will create and deploy novel tools that improve the effectiveness of homeland security personnel, ranging from emergency responders and public safety officers, to investigative analysts, and to policy and decision makers.

The long-term research plan of VACCINE includes three fundamental research areas that form the foundation for addressing homeland security mission directives through innovative and effective integrations of data and visual analytics environments: Interactive Visual Analytic Foundations, Visually-Adapted Analytical Techniques, and Investigative Analysis and Decision Making Environments. The goal is to not just derive ad-hoc solutions to problems, but to address fundamental research questions, advance the science of visual analytics, deliver solutions to homeland security professionals around the world, and create a solid theoretical foundation for future research.

### For Further Information:

<http://www.purdue.edu/discoverypark/vaccine/about/>

## DATA SCIENCES TEAM (CCICADA)

The data sciences component of the CCI COE, CCICADA, focuses its work on algorithmic methods for challenging problems in data analysis. CCICADA is developing the types of capabilities homeland security relies on to ferret out patterns and draw inferences from massive amounts of unstructured data contained in books, newspapers, reports, blogs, images, geospatial data, sensor readings, and audio and video streams.

CCICADA researchers are building the mathematical foundations for a new generation of computational methods being developed. Center research touches a wide variety of applications that include: container inspection in ports; sensor management for nuclear detection; syndromic surveillance for early warning of disease outbreaks; risk analysis; data management for law enforcement and emergency response; defense against attacks on cyber infrastructure; and resource planning for infrastructure protection. Through these and other applications, CCICADA partners with a wide variety of agencies in local, state, and Federal government, as well as in the private sector.

In addition to research, CCICADA is committed to building pioneering educational programs that are fully integrated with ongoing research, and designed to meet a broad spectrum of educational needs. CCICADA involves graduate students in all of its research projects and hosts a variety of summer programs tailored to the needs of graduate and undergraduate students, college faculty, homeland security professionals, and K-12 teachers. Programs for educators feature new courses, certificate programs, guidance for faculty who want to bring homeland security topics into their classrooms.

For Further Information: <http://ccicada.org>

## CCI COE Educational Activities

To have the greatest impact on the DHS mission, the CCI COE partner centers, VACCINE and CCICADA, work together to identify potential collaborative efforts within the entire education pipeline. They leverage existing expertise within the network of partner schools for program development and dissemination, thereby reducing duplication of effort.

Collaborative programs that utilize their Center's ability to obtain speakers and faculty for events, maximize promotional efforts, and share teacher and school contacts are described below. These programs range from PK-12 programs through undergraduate and graduate level work, to professional education and training programs.

