Homeland Security

Science and Technology

Center for Visualization and Data Analytics (CVADA)

A DHS Science and Technology Center of Excellence

CCICADA — Command, Control, and Interoperability Center for Advanced Data Analysis — A Department of Homeland Security Center Of Excellence

Rutgers, the State University of New Jersey (CCICADA)
Computing Research & Education Building (CoRE)
96 Frelinghuysen Road
Piscataway, NJ 08854-8018

Phone: (848) 445-5928
Fax: (732) 445-5932
www.ccicada.org

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

Purdue University (VACCINE)
Potter Engineering Center
500 Central Drive, Suite 226 W.
West Lafayette, IN 47907

Phone: (765) 496-3747
Fax: (765) 494-1028
vaccine@purdue.edu
www.VisualAnalytics-CCI.org

"The cgSARVA tool is especially helpful in guiding operations and resource decisions by carefully analyzing data in a way that ensures the best return on investment. This project serves as a great example of positive partnerships that are being forged between the Coast Guard, the DHS Center of Excellence, and academia."

– Vice Admiral Rob Parker
Commander
Coast Guard Atlantic Area

Mission: *To explore and implement new science and technology to identify, analyze, and understand massive amounts of complex and dynamic information (the three Vs of Volume, Variability, and Velocity) and disseminate, share, and secure such information in support of real-time decision-making by the homeland security enterprise.*

Quick Facts

- Co-led by Purdue University (VACCINE) and Rutgers University (CCICADA).
- Research and education spans the full spectrum of information analysis tasks, including data collection, distillation, management, sharing, and visualization.
- Creates methods and tools to help the nation's 2.3 million homeland security personnel perform their jobs safely and more effectively.
- Educates and trains the next generation of homeland security professionals and researchers in the emerging practices and strategies in visual and data analytics.

Homeland Security Clients and Partners

- U.S. Coast Guard, Transportation Security Administration, Immigration and Customs Enforcement, Federal Emergency Management Agency, Customs and Border Protection, Federal Bureau of Investigation, Domestic Nuclear Detection Office, Centers for Disease Control and Prevention, more than 40 state and local agencies (law enforcement and emergency management), and the private sector.

Research and Education Areas

- Dynamic, On-demand Data Analysis & Visualization • Visual Analytics of Unstructured and Streaming Data • Information-driven Visualization, Modeling, and Simulation of Data • Mobile and Light-weight Information Visualization, Analytics, and Sharing • Hypothesis-driven Analysis • Data-driven Decision Support • Big Data Visual Analytics • Network Analysis • Information Distillation, Scalable Filtering, and Dissemination

Key Accomplishments

- Increasing the availability of advanced education programs in data and visual analysis to undergraduate and graduate students and homeland security professionals.
- Advancing the science and field of data and visual analysis by addressing real-world data issues for clients through enhanced partnerships and cooperation.
  - Federal, state, and local agencies and corporations are using and testing CVADA applications and technologies.
  - The U.S. Coast Guard is using CVADA's novel, risk-based visual analytics for decision-making.
- Developing new computational methods for port container inspection, sensor management, risk analysis, cyber infrastructure, and infrastructure protection.

"GARI can really help the street officers because it's available 24/7 —it's quick and instantaneous."

– Detective Steven Schafer
Computer and Digital Forensics Unit
Indianapolis Metropolitan Police Department

Research Partners

CVADA–Purdue:

Arizona State University
Bethune Cookman University
Carleton University, CA
Dalhousie University, CA
Florida International University
Georgia Institute of Technology
Jackson State University
Morgan State University
Motorola Solutions
Oak Ridge National Labs
Ontario Institute of Technology, CA
Pennsylvania State University
Purdue University
Simon Fraser University, CA
Swansea University, U.K.
University of British Columbia, CA
University of Calgary, CA
University of Manitoba, CA
University of North Carolina, Charlotte
University of Oxford, U.K.
University of Stuttgart, Germany
University of Texas, Austin
University of Victoria, CA
University of Washington
Virginia Tech

CVADA–Rutgers:

Alcatel-Lucent Bell Labs
Applied Communications Sciences
AT&T Labs, Research
Carnegie Mellon University
Geosemble Technologies
Howard University
Morgan State University
New Jersey Medical School - Rutgers University
Princeton University
Regal Decision Systems
Rensselaer Polytechnic Institute
Rutgers University
Tennessee State University
Texas Southern University
The City College of New York
Tuskegee University
University of Illinois, Urbana-Champaign
University of Massachusetts, Lowell
University of Southern California
University of Texas at San Antonio

CVADA Highlights

SMART (Social Media Analytics and Reporting Toolkit)

SMART monitors social media and allows users to map, interactively explore and navigate large volumes of data, topics and anomalies that occur in real time via social media networks such as Facebook or Twitter. This novel approach from CVADA-Purdue allows for filtering on key words, examining anomalies, and exploring geographic distribution of information.

GARI (Gang Graffiti Automatic Recognition and Interpretation)

CVADA researchers at Purdue developed an application, for both Android and iOS (Apple) mobile platforms, which helps law enforcement and gang task force officers identify and interpret gang graffiti or tattoo images. An officer takes a photo of the graffiti and uses GARI to analyze the image. GARI sends the photo to a central server that compares it against a graffiti image database. The officer receives details about the identity and meaning of the graffiti or tattoo image and can use this information to refine his or her analysis. GARI is currently being used by the INGang Network and the Cook County Sheriff's Department.

cgSARVA (Coast Guard Search and Rescue Visual Analytics)

cgSARVA, the first COE-developed tool validated and accredited by the U.S. Coast Guard (USCG), is an interactive visualization, analysis, and assessment tool that helps USCG decision-makers understand the risks associated with resource reallocation for search and rescue missions. The cgSARVA system was developed by CVADA-Purdue and incorporates financial, safety, and risk-based comparative analysis into the decision-making process. The Atlantic Command and District 9 use cgSARVA, and it was used during Superstorm Sandy in 2012 to suggest resource allocation in light of damage caused to stations in New Jersey.

USCG Boat Allocation Module (BAM and BAM II)

The Boat Allocation Module (BAM), developed by CVADA-Rutgers with the Coast Guard under its Coastal Operations Analytical Suite of Tools (COAST), matches the capability and mission-hour requirements of each boat station to the available resources and assets. This can inform senior USCG leaders' decisions regarding asset capabilities, allocations, acquisitions, and mission trade-offs. In its current implementation, BAM is projected to save the USCG $120 million over the next 20 years.

The BAM2 project develops a tool for the practical implementation of boat sharing. In developing BAM, the CVADA-Rutgers team observed that allowing "fractional" solutions to the boat allocation problem could give rise to more efficient solutions. In practice, fractional solutions correspond to sharing boats between boat stations and could provide additional potential savings.

SAFETY Act — Best Practices for Stadium Security

The Support Anti-terrorism by Fostering Effective Technologies (SAFETY) Act provides liability protection to developers and providers of Qualified Anti-Terrorism Technologies (QAATs); QAATs include products or services. DHS's Office of SAFETY Act Implementation (OSAI) is collaborating with CVADA-Rutgers to develop a resource guide of best practices and performance standards in anti-terrorism security for large structure sports venues. OSAI will use the guide to develop tiered levels of certification with corresponding levels of liability protection. It will also help OSAI evaluate applicants who seek SAFETY Act Certification or Designation for their sports venue and possibly the sports league organizations. The best practices guide is available.