CYBER-ShARE Center of Excellence

Sharing Resources to Advance Research and Education through Cyber-infrastructure

The University of Texas at El Paso

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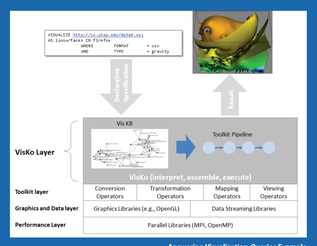
iLink Knowledge Across Disciplines, Data, and Models
Knowledge Representation, Negotiation, and Integration

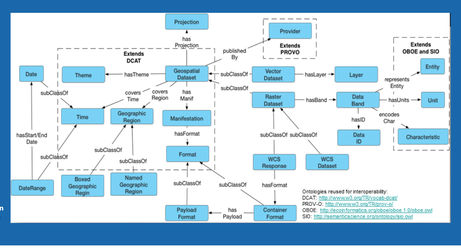
N. Villanueva-Rosales and D. Pennington

Goal:
To improve the efficiency and effectiveness of the discovery, integration, processing and interpretation of scientific data via semantic approaches.

Our current approaches link human and machine knowledge to address societal-relevant problems in the areas of biomedical informatics, environmental sciences, geosciences and climate change in partnership with our national and international collaborators.



Answering Visualization-Queries Example



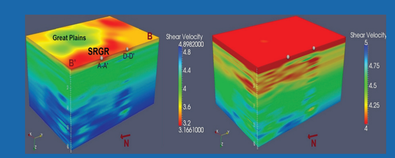
Data-to-model Integration (Data Provider Ontology)

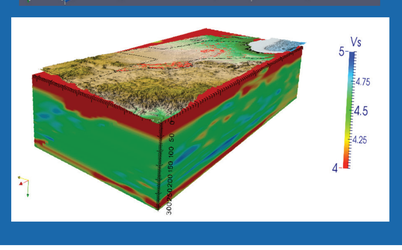
Results:
- Semantic-based data and knowledge integration across systems annotated with provenance to support reuse (RRS, iLink research knowledge base)
- Design and implementation of tools that provide provenance traces for automation of tasks, trust and re-usability: VisKO (automated generation of scientific visualizations), WDOIt (abstract workflows), semantic web services for data-to-model integration.
- Methodologies for: creating, annotating, refining, and publishing scientific resources; and exchange and integration of knowledge needed to solve complex interdisciplinary problems

iFuse Heterogeneous Data and Models
Integrated Analysis for Development of 3-D Models of Earth Structure

A. Velasco and V. Kreinovich

Goal:
To address the challenges of integrating geophysical data from diverse sources to obtain a more coherent understanding of the structure below the Earth's surface.





3-D Earth Models

3-D Shear wave velocity model of the entire state of Texas. The 3-D model shows shear wave velocities ranging from 4 km/s – 5 km/s as indicated by the Vs scale. The 3-D model shows velocities at depths of 0 km (surface of Earth) to 300 km (Upper mantle) of the Earth. The red colors represent slow shear wave velocities ad blue colors represent fast shear wave velocities.

Results:
- Developed algorithms for the fusion of seismic data and geophysical models to better understand the structure beneath the Earth's surface
- Created an inverse optimization method that provides a robust approximated model in terms of satisfying geophysical constraints, accuracy, and efficiency
- Produced a novel model fusion approach to create more accurate models of Earth structures from velocity models
- Developed an angular density approach for processing seismic data that uses innovative techniques to quantify spatial resolution of the resulting geophysical model
- Collected and analyzed data to determine the crustal structure of the Rio Grande Rift (RGR) and volcanic centers in the East Africa Rift System (EARS)

Mission:
To advance and integrate cyber-enhanced, collaborative, and interdisciplinary education and research through technologies that support the acquisition, exchange, analysis, and integration of data, information, and knowledge.

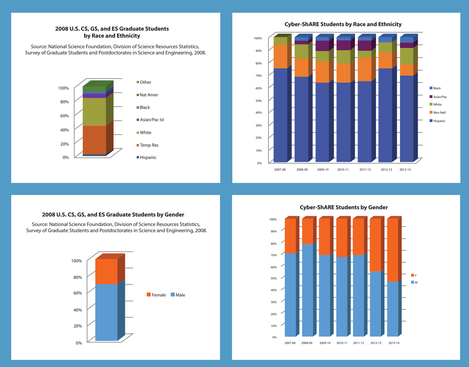
Goals:
1. Technology-enabled science research that links methods to innovate scientific data acquisition, integration, and analysis.
2. Development and training of CI products and tools to support interdisciplinary collaboration.
3. Development of a diverse workforce capable of working in interdisciplinary STEM fields.

Impact:
- Institutional-level cyberinfrastructure: visualization wall and Expertise Connector system to support collaborations.
- STEM-integrated learning modules with culturally relevant, immersive technologies in impacting Latino middle school students' STEM performance and motivation to study STEM.
- Data management tool.
- Diversifying the STEM workforce.

http://cybershare.utep.edu

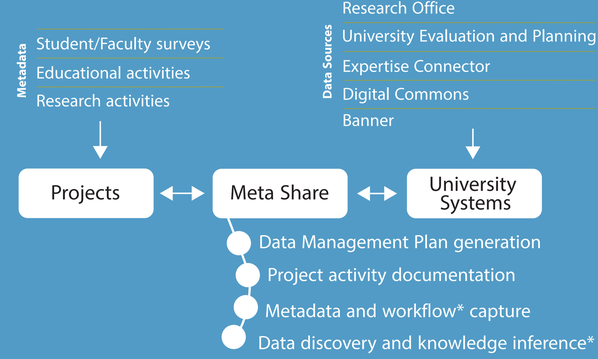
iConnect People and Expertise
CREST Cyber-ShARE Center of Excellence

A.Gates, D. Pennington, and M. Akbar



Cyber-ShARE Student Metrics

MetaShare Data Management System



iSense Environments Autonomously
Advancing Understanding of Ecosystem Processes Using Cyberinfrastructure

C. Tweedie and V. Kreinovich

Goal:
To address issues of integrating data collected at different spatiotemporal scales to better understand the exchange dynamics and biophysical controls of land-atmosphere carbon, water, and energy exchange in several extreme environments, including the Chihuahuan Desert, Arctic tundra in northern Alaska, and tropical forests in East Kalimantan on the island of Borneo.

New wireless phenocam (top left), phenology analyzer software showing use of alternate color space to characterize vegetation phenology (top center), eddy covariance tower on the USDA Jornada Experimental Range (top right), remote weather station northern Alaska (lower left), advanced web mapping application at www.barrowmapped.org (lower right).

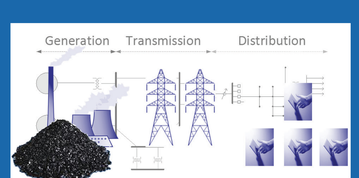
Results:
- Improved capacities for data property specification and quality flagging, and gap filling.
- Optimized algorithms for unmanned aerial vehicle guidance and flight planning.
- Expanded understanding of the relationship between surface hydrology, vegetation greenness, and remote sensing.
- Cross correlation of digital elevation models derived from terrestrial LIDAR, airborne LIDAR, kite aerial photography, and satellite imagery.
- Improved standard for interoperability in Web mapping applications.
- New automated camera system and analytical software for determining patterns and controls of plant and landscape phenology.
- Software for the rapid processing and quality checking of data derived from proximal hyperspectral remote sensing.
- Innovative web mapping applications that permit advanced data analysis and decision making.

Cyber-ShARE Collaborations

CREST interdisciplinary Center of Research Excellence in Design of Intelligent Technologies for Smart grids (iCREDITS)—New Mexico State University

Focus: Research and training in Intelligent Smart grid Technologies.

Cyber-ShARE Contributions:
- **Research:** Power and energy with a focus on uncertainty, optimization, and decision making.
- **Students:** Internships and exchange between centers.



iCREDITS Motivation and Focus

Center for the Advancement of Space Safety and Mission Assurance Research (CASSMAR)

Focus: Interdisciplinary, cross-functional research center focused on the enhancement of the safety, reliability, and mission assurance of spaceflight - from the materials, vehicle, and systems perspectives.

Cyber-ShARE Contributions:
- **Services:** Visualization.
- **Research:** Geophysical systems, computational and computer science.

Materials Response to Simulated Atmospheric Reentry

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Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and not necessarily reflect the views of the National Science foundation.