# NCSA Program Areas

February 26, 2021

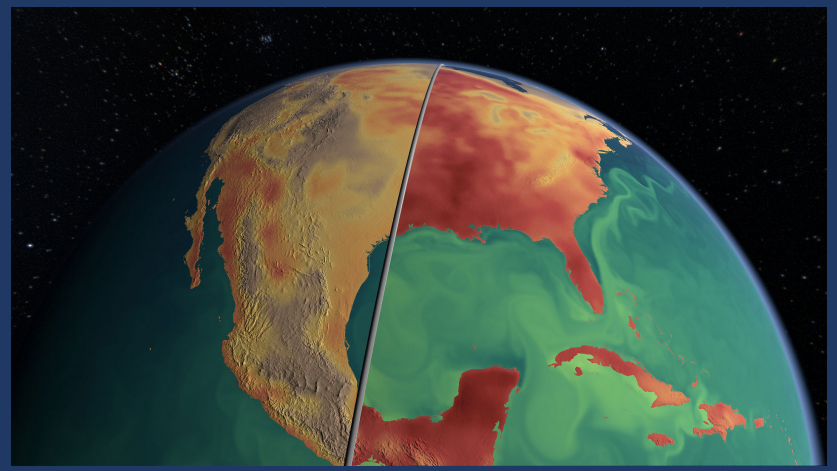
ILLINOIS

NCSA | National Center for Supercomputing Applications

# Advanced Visualization Lab (AVL)

Director: Donna Cox (donnacox@Illinois.edu) Presenter: Kalina Borkiewicz (kalina@Illinois.edu)

## Scientific Visualization



- 3D and 2D data visualization
  - Geospatial & Earth science
  - Sustainable agriculture
  - Astrophysics
  - Molecular biology …
- Video and/or interactive
- Data processing, image processing, computer vision
- Science communication

## Arts & Humanities


8

THE BIG HOUSES

AT THE MOVIE HOUSES

Coming Attractions

THURSDAY, SEPTEMBER 13, THROUGH WEDNESDAY, SEPTEMBER 19

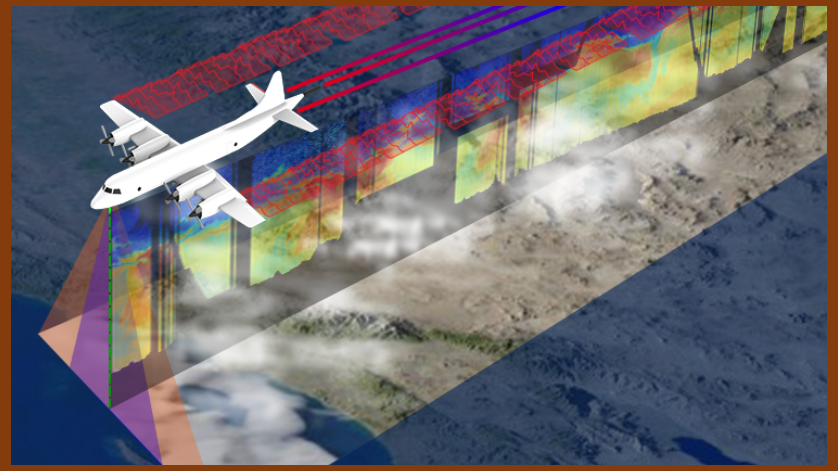
THIS IS A LIST OF FILMS AT SELECTED MOTION-PICTURE THEATRES IN MANHATTAN. FILMS OF INTEREST ARE INDICATED BY HEAVY TYPE; YOU CAN LEARN MORE ABOUT THEM ON PAGE 4, UNDER "MOTION PICTURES."

FOREIGN, SPECIAL, ETC.

WEST SIDE

- Digital humanities
- Vis. for live performances
- Mobile apps
- Virtual Reality
  - Video game technology (Unity)
- Multimedia & video production
- MOOC development
- Cinematic presentation of science

## Software



- Software prototyping
- Virtual Director: 3D navigation
- Partiview: rapid data previewing
- Ytini: cinematic visualization

## Hardware

- 2 local clusters + Blue Waters
- 4K 3D theater at NCSA

# Data Analysis and Visualization (DAV)

## http://vis.ncsa.illinois.edu

Enabling scientific discovery through data-oriented research and development

- Support:
  - Software (VisIt, ParaView, IDL, ImageMagick, etc)
  - Data preparation
  - Best practices & training
- Research and Development:
  - Data analysis (statistics, machine learning, etc)
  - Vis & I/O for HPC
  - AR/VR, sensors
  - “Is this in my data?  Can I show it?”
- Outreach: production-quality videos


# Healthcare Innovation

## *Program Office*

Together, we can dramatically advance healthcare by transforming data into ***actionable knowledge***

*Colleen Bushell, Director  cbushell@Illinois.edu*

*Laura Martin, Program Manager  laurarh@illinois.edu*

ILLINOIS NCSA

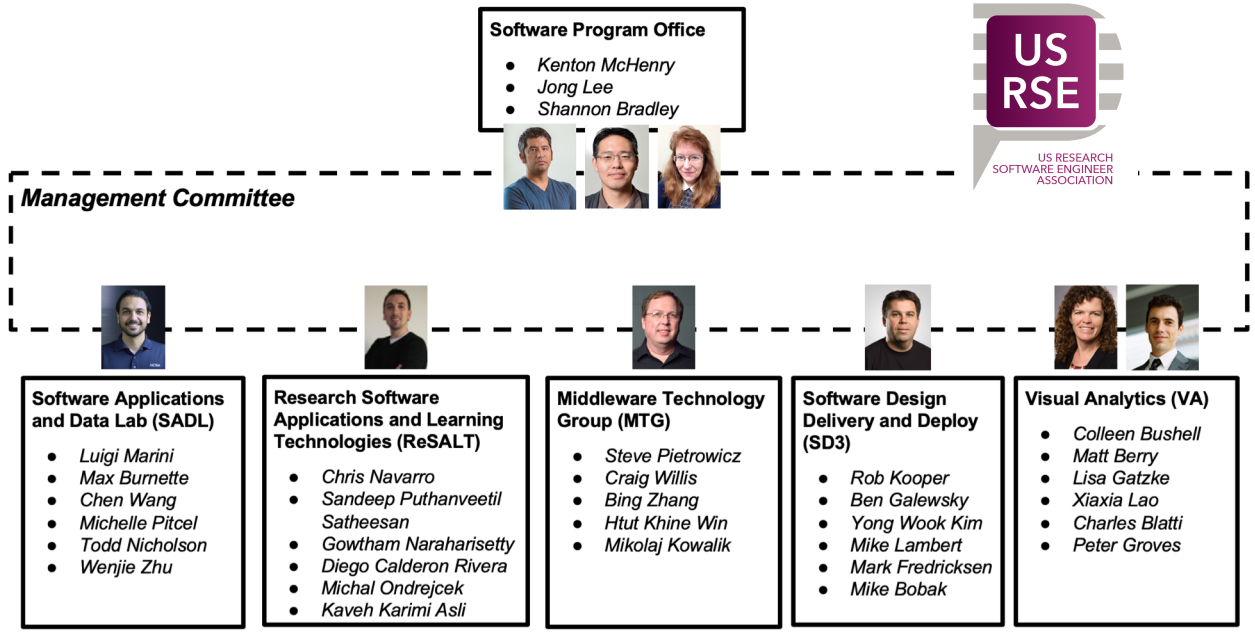
# Program Areas

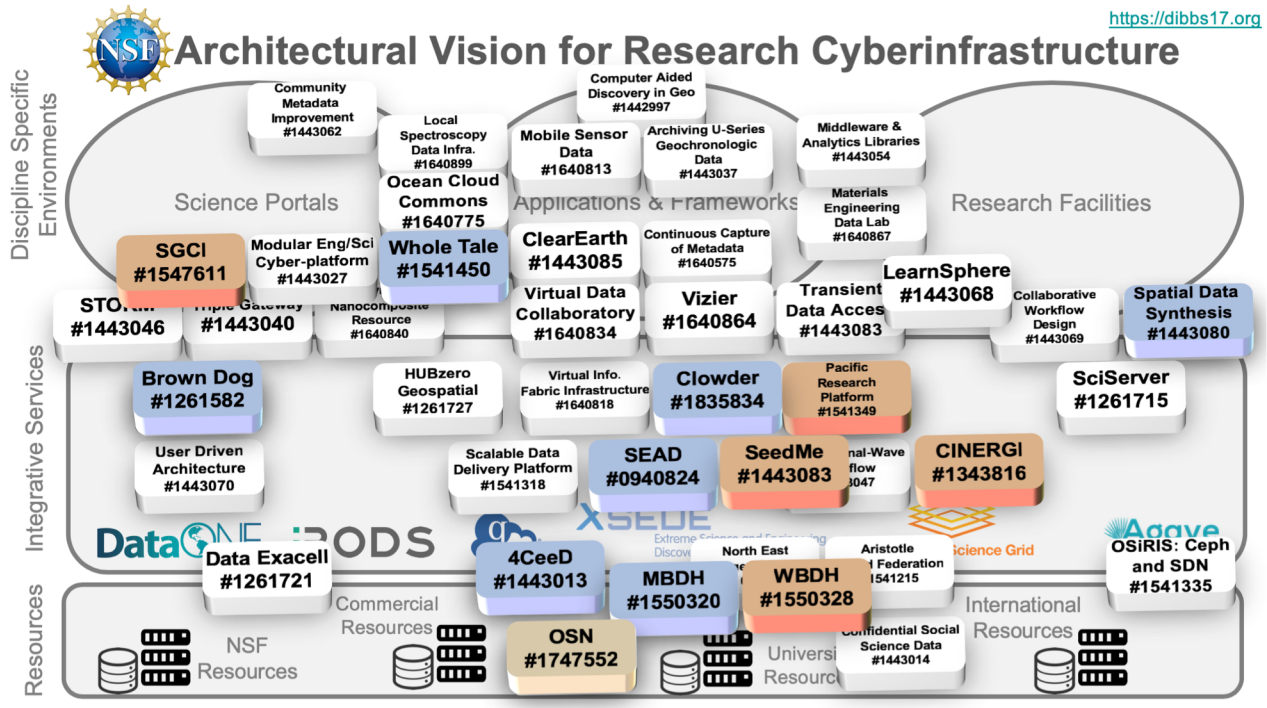
| | |
|---|---|
| **Visual Analytics Software/Frameworks** | *KnowEng, OmiX, PixSure, others… Explainability, UX* |
| **Data Analysis** | *Biomarker Discovery, Prediction, Multi-Omic, COM* |
| **Image Analysis** | *Deep Learning, Annotation/Validation Frameworks, Hardware/Systems* |
| **Remote Sensors*** | *Timeseries Analysis, Tele-medicine, Realtime analysis* |
| **Cyberinfrastructure** | *Security (HIPAA), Compute, Data Movement, Storage, LIMS, Nightingale* |
| **Computational Genomics** | *Assembly, Variant Calling, Performance, Benchmarking* |
| **User Engagement** | *Consultation, Training, User Requirements* |
| **Data Driven Decision Support, Reporting** | *Heterogeneous data, Monitoring, Prediction, Information Design* |
| **Mobile Patient Support, Monitoring** | *Mobile Apps, Backend Infrastructure* |
| **Augmented Reality / Virtual Reality*** | *Surgery prep, Student Training* |
| **Operations Analysis*** | *Biobank, ER Outcome* |
| **Crowd Sourcing*** | *Lyme Disease, patient provided information* |

**areas in development*

# NCSA Software

- Research & Development
- Customn/novel, reusable software tools & frameworks
- Bridging and amplifying efforts across different projects




# Innovative Systems Lab – Vlad Kindratenko

- Expertise
  - Machine Learning (ML), Deep Learning (DL)
  - Computational accelerators: GPUs, FPGAs
  - Parallel computing, HPC, special-purpose architectures
- Resources
  - Hardware Accelerated Learning (HAL) cluster for deep learning
    - 16-node IBM Power9 system with 64 NVIDIA V100 GPUs
  - NVIDIA DGX A100 system
    - 8 NVIDIA A100 GPUs
  - Systems with FPGAs
- Areas of research interest
  - ML/DL tools, techniques, and applications
  - Accelerated computing (with GPUs, FPGAs)

# Center for Artificial Intelligence Innovation

NATIONAL CENTER FOR SUPERCOMPUTING APPLICATIONS | NCSA

Eliu Huerta
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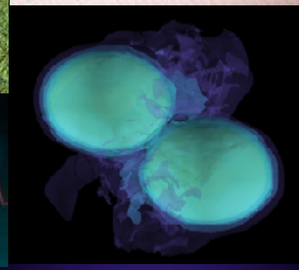

- Expertise
  - Translational AI research and advanced computing for big-data research
  - Domain-inspired, accelerated, reproducible and interoperable AI
  - Convergence of AI, extreme scale computing and scientific visualization
- Resources
  - Access to HAL cluster - managed by Innovative Systems Lab (Vlad Kindratenko)
  - Summit@Oak Ridge, Bridges & Bridges-AI@XSEDE and GPU resources at Theta@ANL
- Areas of interests
  - Any domain that requires innovative computing and advanced signal-processing methodologies
  - Transfer of academic AI innovation into tangible industrial and business solutions

# Industrial Application Domain Teams


## Seid Korić

Tech. Assist. Director –NCSA

Research Assoc. Professor –MechSE

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National Center for Supercomputing Applications

UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

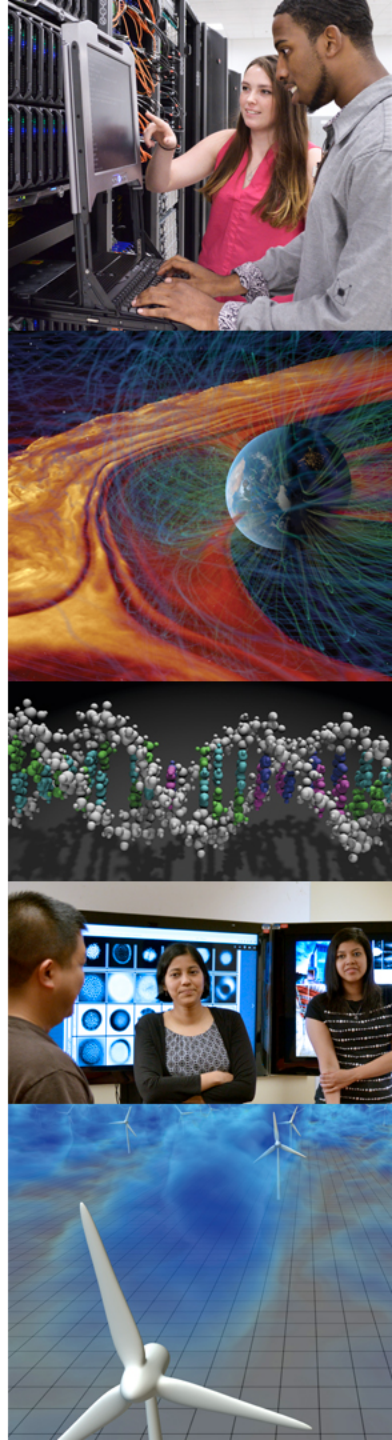
# Industrial Application Domain Teams at NCSA

## Technical Support and Consulting for NCSA Industry Program

- Modeling & Simulation
- Bioinformatics and Genomics
- “Big” Data Analytics with Machine Learning and GIS
- Interdisciplinary confluences with Artificial Intelligence (AI)
- Application Benchmarking, Profiling & Optimization
- Rapid User Support and Domain/HPC/Cloud Training

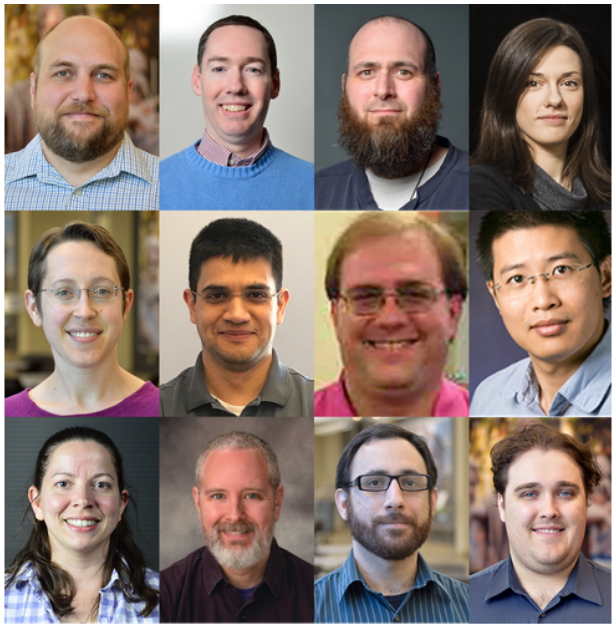
## Research and Education Support and Collaborations

- Staff made of mostly PhD-s, MSc-s and Students
- >30 Active research collaborators worldwide
- Publish ~20 joint publications / year
- Joint interdisciplinary proposals to NSF and NIH
- Speak 8 world and over 20 programming languages
- Work with >100 of scientific and engineering applications and codes (commercial, community, open source)



# Cybersecurity Division

http://csd.ncsa.illinois.edu/



## Interests

- High Performance Networks & HPC Security
- Federated Identity Management (IdM)
- High Resolution Network Monitoring
- Evaluating Industry Products @ Scale
- Education and Outreach for Scientific Cyberinfrastructure providers

## Current Projects

- ***Blue Waters*** – Securing & supporting the Blue Waters petascale machine
- ***XSEDE*** - Leading the distributed security team & advancing the federated IdM capabilities
- ***LSST*** – Security, network, and IdM design and capabilities for the Large Synoptic Survey Telescope
- ***CI Logon*** – Providing a platform for federated identity to access scientific resources
- ***TrustedCI*** – Protecting NSF resources w/ the Cyber Security Center of Excellence
- ***Industry Program*** – Providing expertise and value to Industry Partners
- ***Healthcare Computing*** – Research computing on ePHI data within the context of HIPAA
- ***Data-driven security and reliability***
  - analyses of longitudinal authentication logs
  - Mining attack patterns from security incident reports.

- **Research projects**

  - ***Privacy-Preserving Intelligence Sharing*****:** disseminate intelligence data in real-time and privately.

  - ***Federated Learning* -** Intrusion Detection across sites**.**

  - ***Formal verification* -** certify the correctness of complicated access control policies

# Midwest Big Data Innovation Hub

## Priority Areas & Cross-Cutting Themes

- Advanced Materials and Manufacturing
- Big Data and Health
- Digital Agriculture
- Smart and Resilient Communities
- Water Quality
- Data Science Education and Workforce Development
- Cyberinfrastructure, Data Access, and Use

## Working Groups and Projects

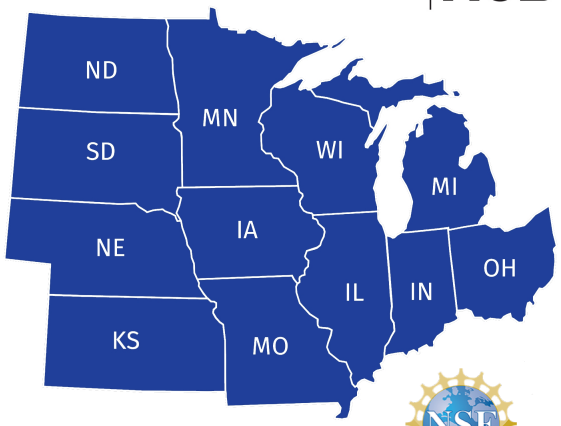
- Midwest Carpentries Community
- Midwest Consortium for Computational Pathology
- Democratizing Neuroscience Education project
- COVID Information Commons community
- Midwest Sustainable Transportation Datathon

## Goals

- Build and cultivate diverse, multi-discipline, cross-sector **Communities** around data challenges and cyberinfrastructure resources
- Foster innovative activities across our **Priority Areas**
- Increase **Education and Training** around data science, particularly in small institutions and under-represented populations
- Incubate new regional initiatives through our **Community Development and Engagement** program

## Join Us!

- Water Data Forum monthly series
- Cyberinfrastructure and Data Sharing Working Group (monthly call)
- Data science student webinar series
- COVID Info Commons monthly lightning talks with NSF-funded researchers




MIDWEST BIG DATA HUB

NORTHEAST BIG DATA INNOVATION HUB

SOUTH BDHUB

WEST BIG DATA INNOVATION HUB

**MidwestBigDataHub.org | @MWBigDataHub**

Iowa State University

University of Michigan

University of North Dakota

1550320
1916613

# User Services SEAS Group

- Science and Engineering Application Support on Blue Waters
- Support the NGA and Illinois projects currently on Blue Waters.
- Support ranges from porting, debugging, performance analysis, scaling studies, code improvements, workflow implementation.
- Assist with implementation of programming models: MPI, OpenMP and OpenACC.

- Galen Arnold
  - Performance Tuning, Debugging, HPC Python
- Robert Brunner
  - NAMD, VMD, HPC runtimes (Charm++)
- Jing Li
  - Numerical algorithms and methods
- Ryan Mokos
  - Application porting, debugging, network simulation
- Craig Steffen
  - Accelerators, IO
- Roland Haas
  - Numerical Relativity, HPC Python






# A couple of ways to add staff to your project!

www.xsede.org

- Access to NSF-funded high performance computing resources and staff.
  - Variety of resources (cloud, AI, scalable compute, long-tail, GPU)
  - Project support (Extended Collaborative Support Service) – diverse set of capabilities
  - No cost to your project
- Single submission at https://portal.xsede.org

- Research Software Collaborative Service
  - University of Illinois ResearchIT-provided service
  - Collaborative support of your project
  - Some support available at no cost to your project
  - https://researchit.illinois.edu/get-help/research-software-collaborative-services

Talk with Jay Alameda (alameda@illinois.edu) to learn more!