

# Oak Ridge National Laboratory

## Welcome!

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April 18, 2023



ORNL is managed by UT-Battelle, LLC for the US Department of Energy

# Welcome to ORNL!



Oak Ridge Leadership  
Computing Facility

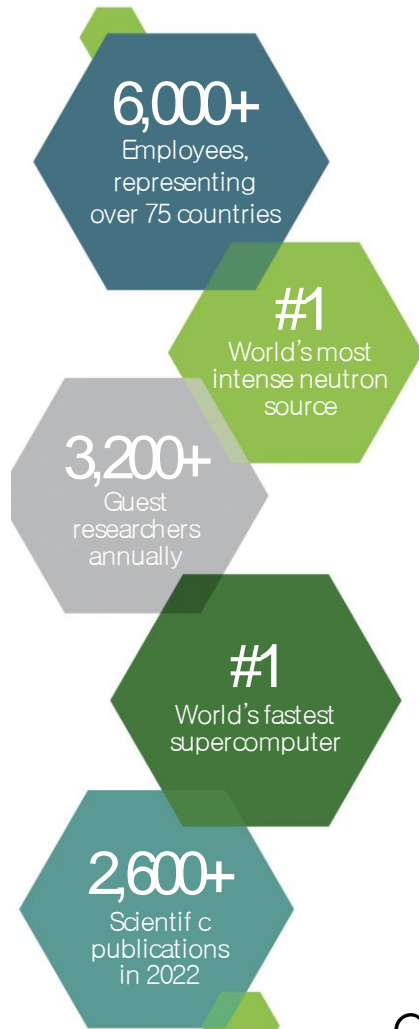
We are here!

# ORNL's mission

Deliver scientific discoveries and technical breakthroughs needed to realize solutions in clean energy and national security and provide economic benefit to the nation



# Solving Big Challenges



- **Conducting R&D with Impact**

- New materials and chemical process
- Computing and data
- Isotopes for medicine, industry, and research
- Biological and environmental systems

- **Addressing National Needs**

- Second Target Station
- Frontier, AI and quantum initiatives, cybersecurity and nations power grid

*“For 80 years, ORNL has brought together people from across diverse fields to translate fundamental knowledge to applied solutions in science, energy, and security.”*



# Solving Big Challenges

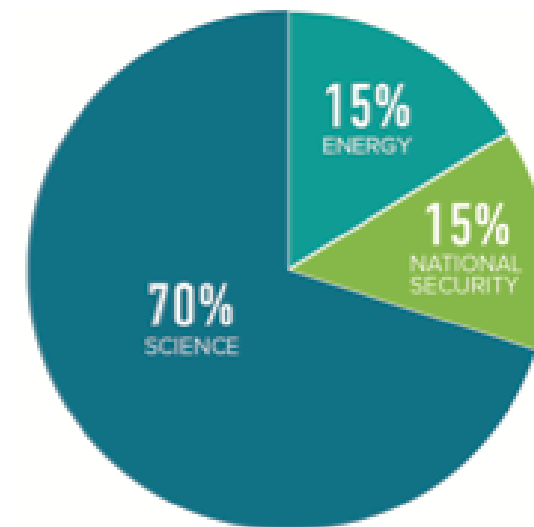
- **Recent R&D highlights**

- Supercomputing & neutrons for 3D model of major signaling protein in humans
- AI to better match cancer patients with clinical trials
- Human geography for humanitarian and disaster response

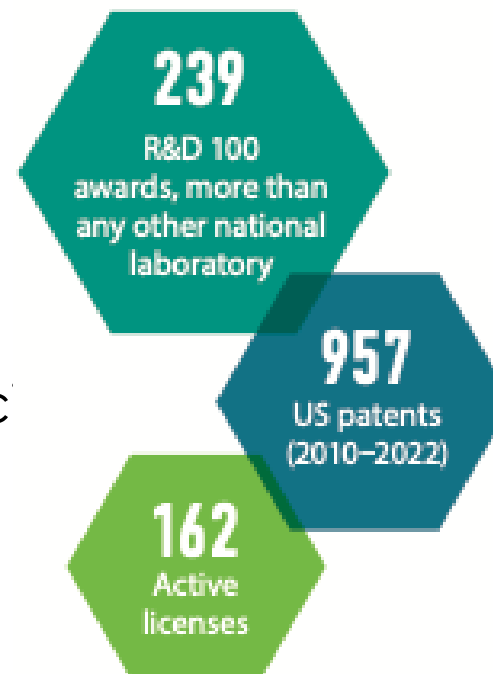
- **Partnerships and collaborations**

- **Major R&D facilities**

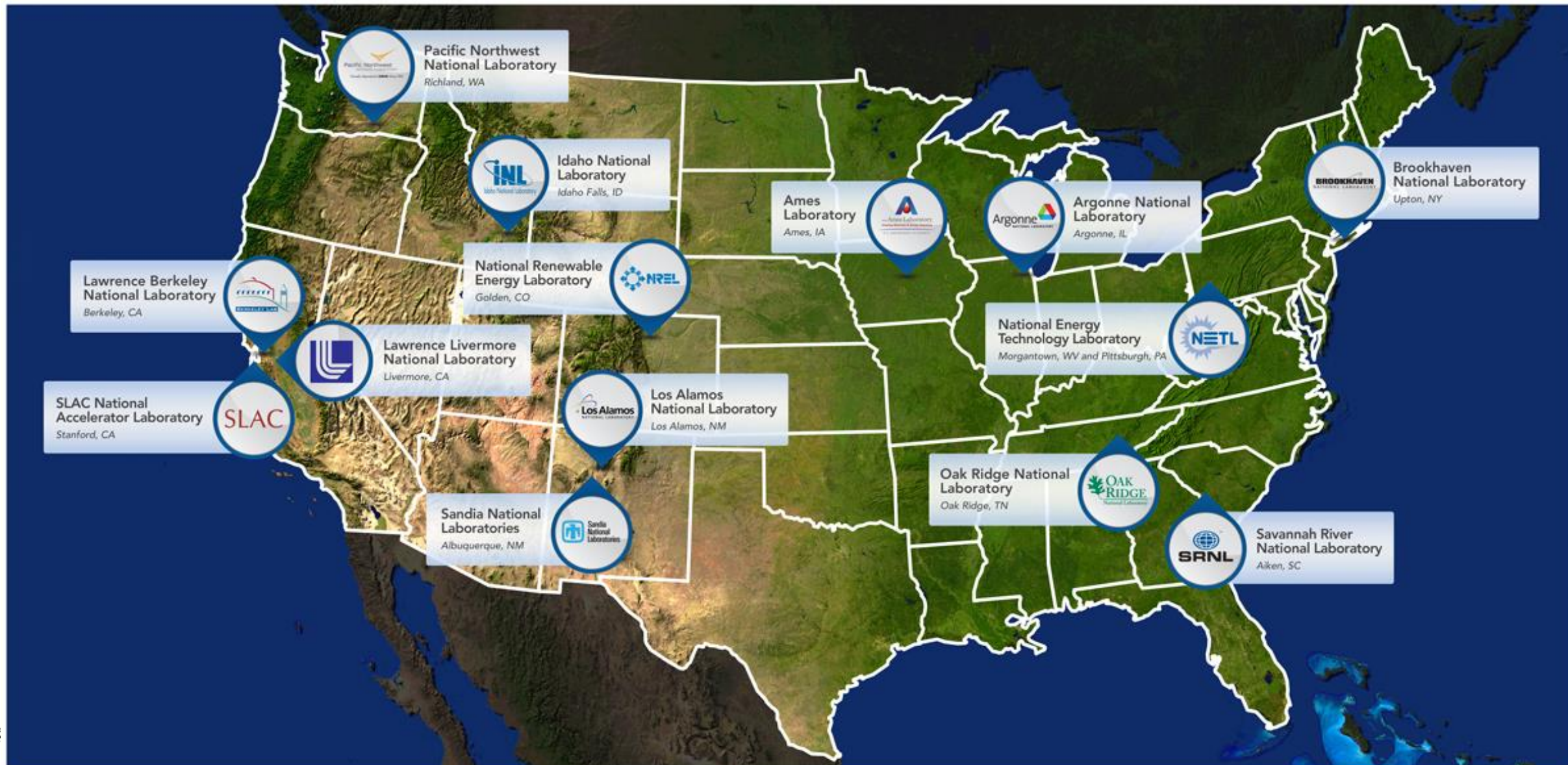
- High Flux Isotope Reactor
- Manufacturing Demonstration Facility
- Oak Ridge Leadership Computing Fac
- Spallation Neutron Source



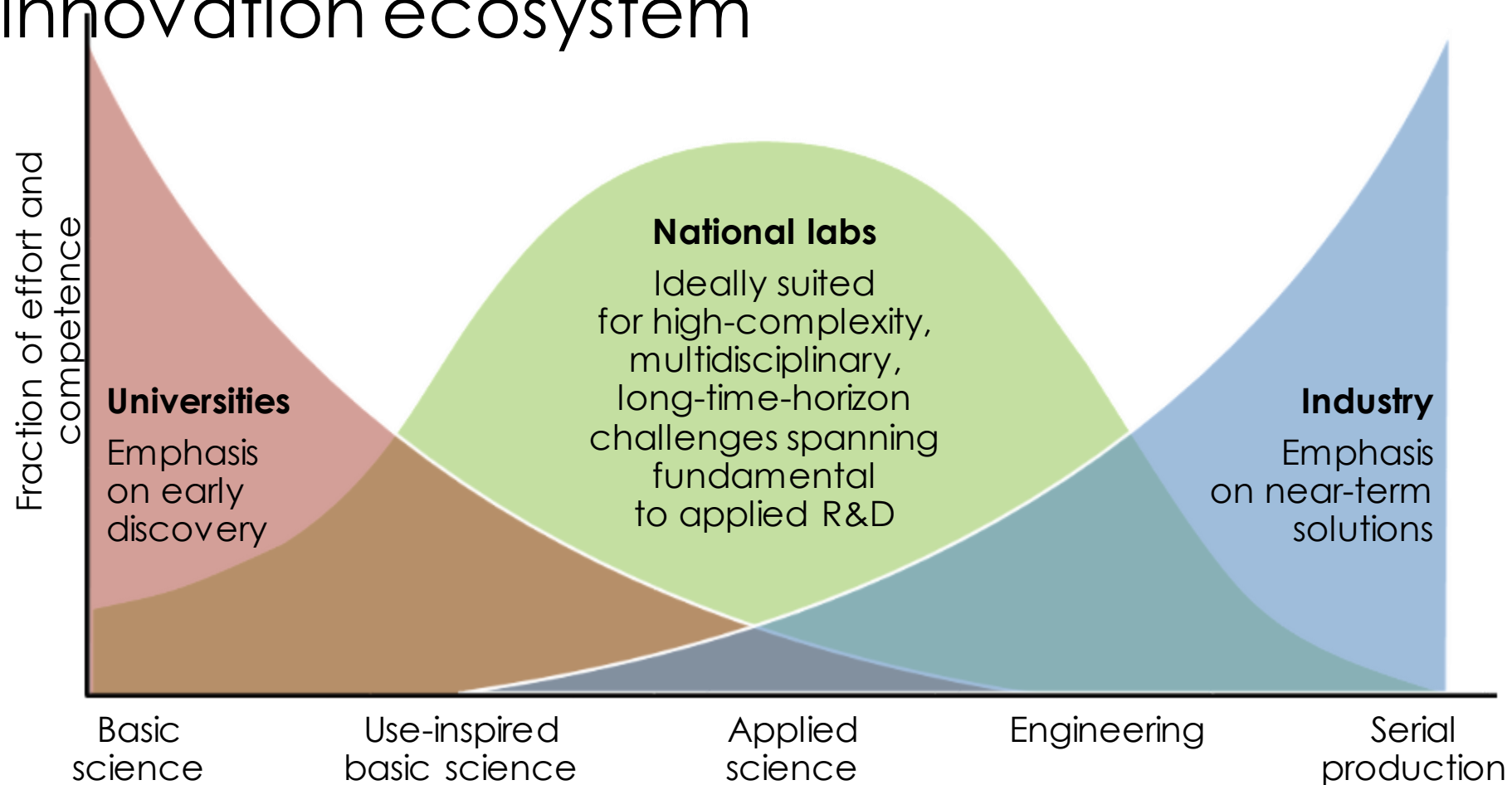
Funding by DOE mission  
FY 2022 \$2.7B



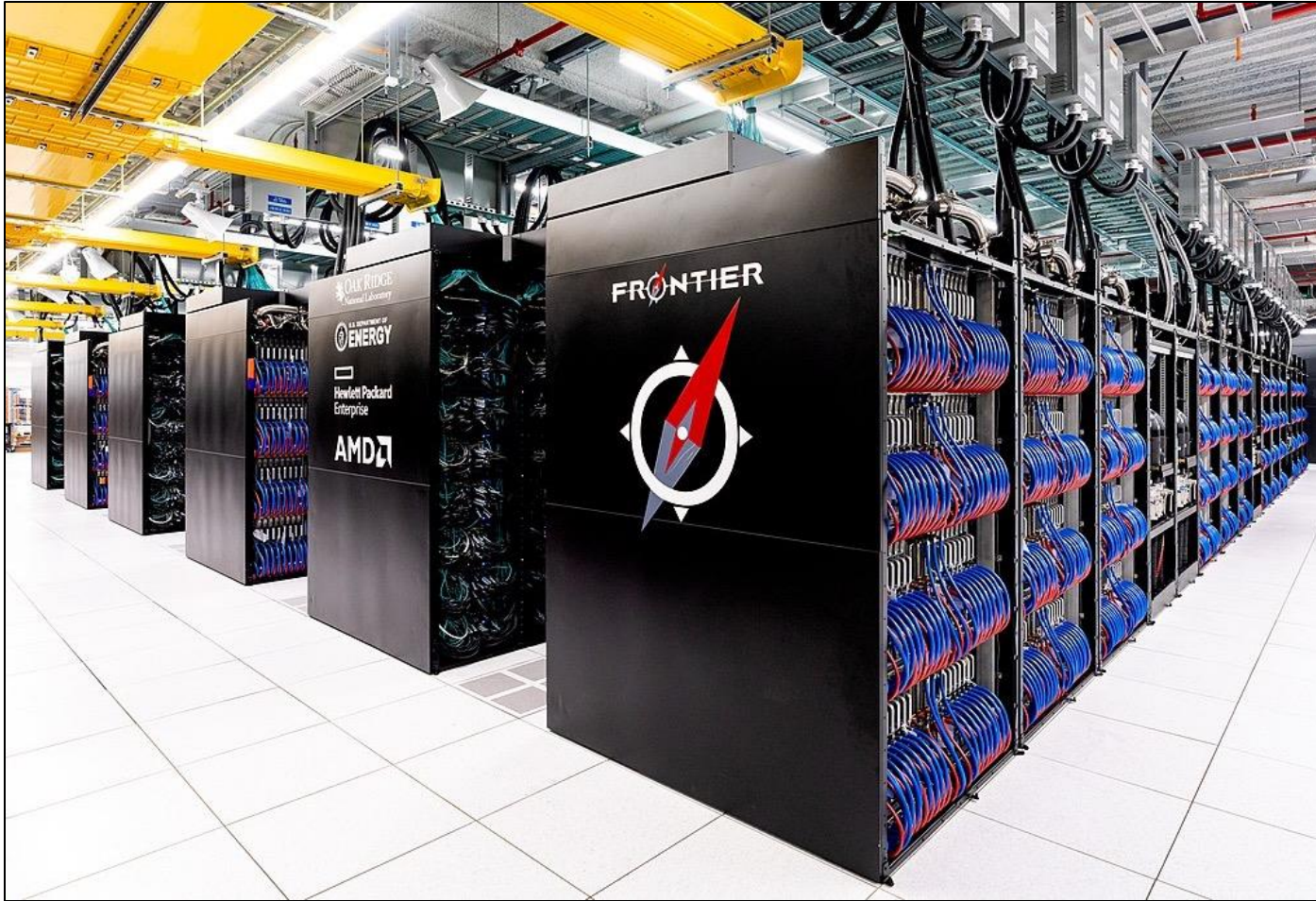
# DOE National Laboratories are solving America's toughest challenges



# Collaboration: DOE's national laboratories occupy a distinctive space in the innovation ecosystem



# What could you achieve with Frontier at ORNL?

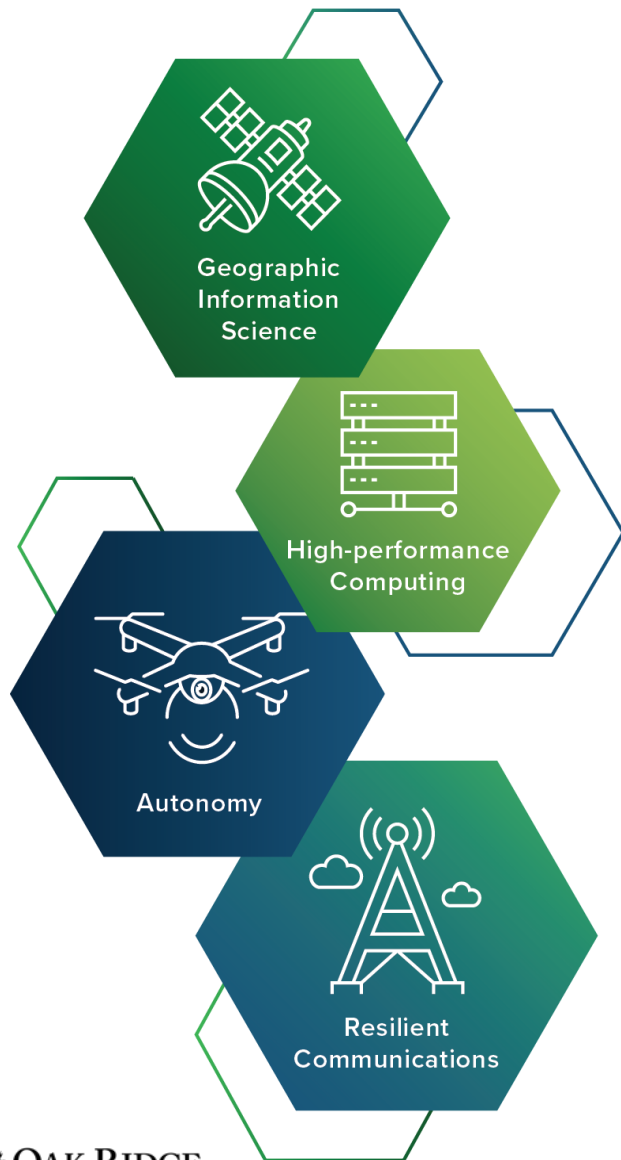


ORNL's Frontier Supercomputer is first to break Exascale barrier!

Power	21 MW
Space	680 m <sup>2</sup> (7,300 sq ft)
Speed	1.102 <a href="#">exaFLOPS</a> (Rmax) / 1.685 <a href="#">exaFLOPS</a> (Rpeak) <sup>[11]</sup>
Cost	US\$600M (estimated cost)



# Geospatial Science and Human Security Division

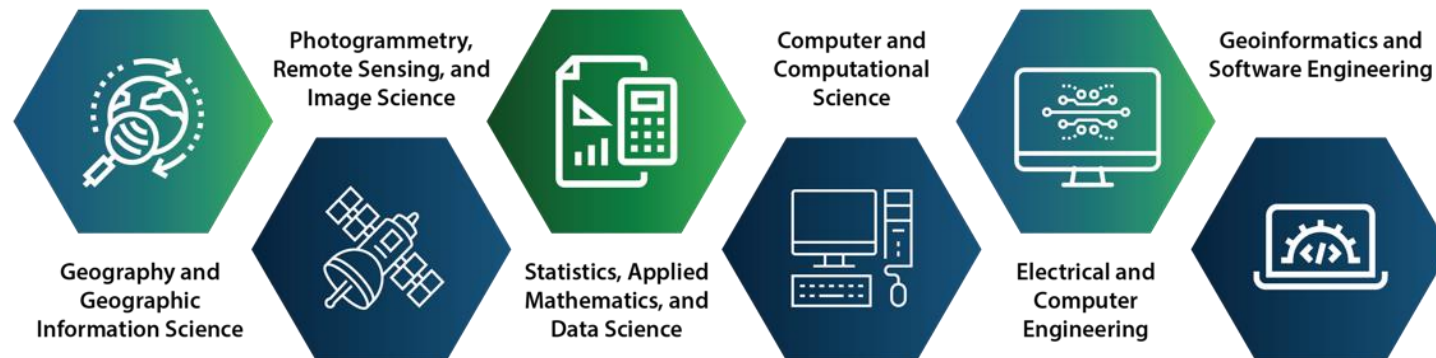


## Research Focus Areas

- High-performance geocomputation
- Human dynamics modeling and simulation
- Critical infrastructure resilience
- Remote sensing and autonomous systems
- GeoAI for mapping and monitoring

## Impacts

- Situational awareness
- Time-critical decision support
- Crisis management
- Energy and climate resiliency



# Collaboration and strategic partnerships

## Academia

- Purdue University
- UC Santa Barbara
- Rochester Institute of Technology
- NC State University
- Duke University
- Ohio State University
- Penn State University
- University of Arkansas
- University of Tennessee
- University of Alabama Huntsville

## Industry

- Maxar
- Planet
- Esri
- Google
- NVIDIA
- AWS
- Umbra
- Capella Space
- Orbital Sidekick

## FFRDCs

- Pacific Northwest National Laboratory
- Sandia National Laboratory
- Argonne National Laboratory
- Los Alamos National Laboratory
- NASA MSFC

## ORNL

- Computing and Computational Sciences
  - HPC and AI
- Energy and Environmental Sciences
  - Autonomous vehicles
  - Building technologies

# Commitment to workforce development

Maintain an international network for academic engagement

- Recruit and train post-BS, post-MS, and postdoctoral researchers
  - Post-BS and most post-MS move onto graduate school
  - We develop joint doctoral dissertations
  - Engage joint faculty members (some of them were former students)
  - Outreach to middle and high schools

Benefits all stakeholders

- Grow all source analysts organically from the Millennials
- Develop future workforce for the mission partners



# Professional community leadership and engagement

## GIScience

- Role of volunteered geographic information in advancing science

## ACM SIGSPATIAL

- GeoAI; Analytics for Big geospatial data

## IEEE ICDM



# Discussion

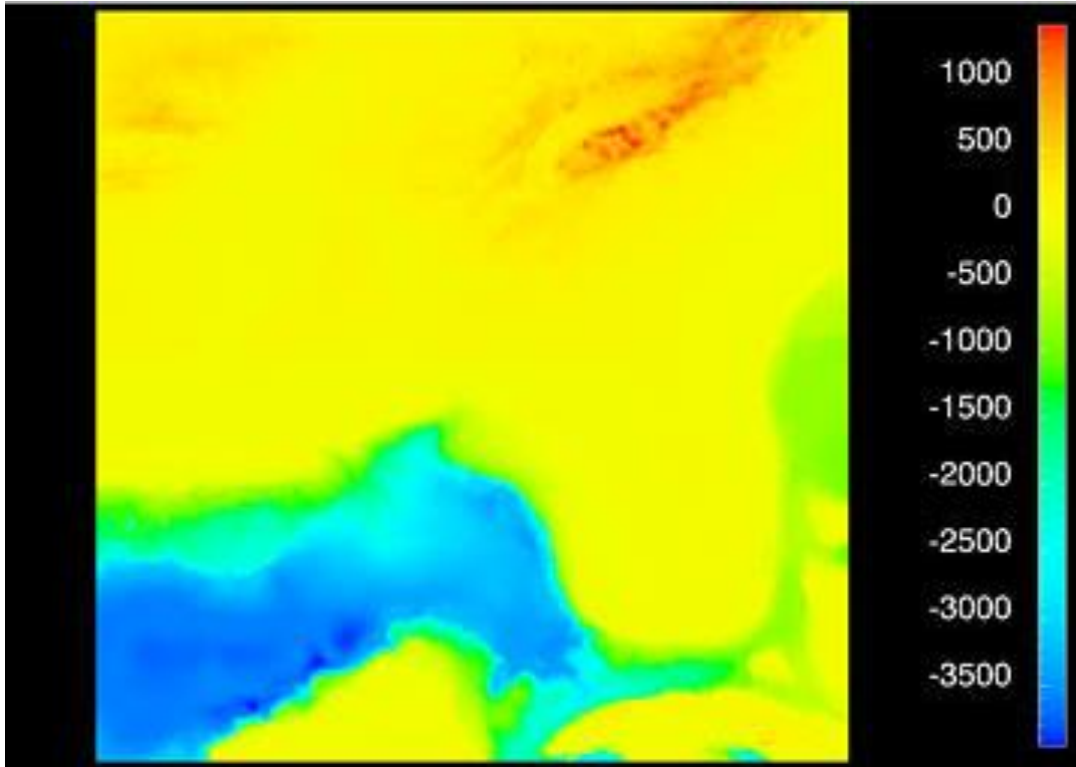




*That's all Folks!*

Let's start with a brief pop quiz...

# Be Careful with Color Visualizations...

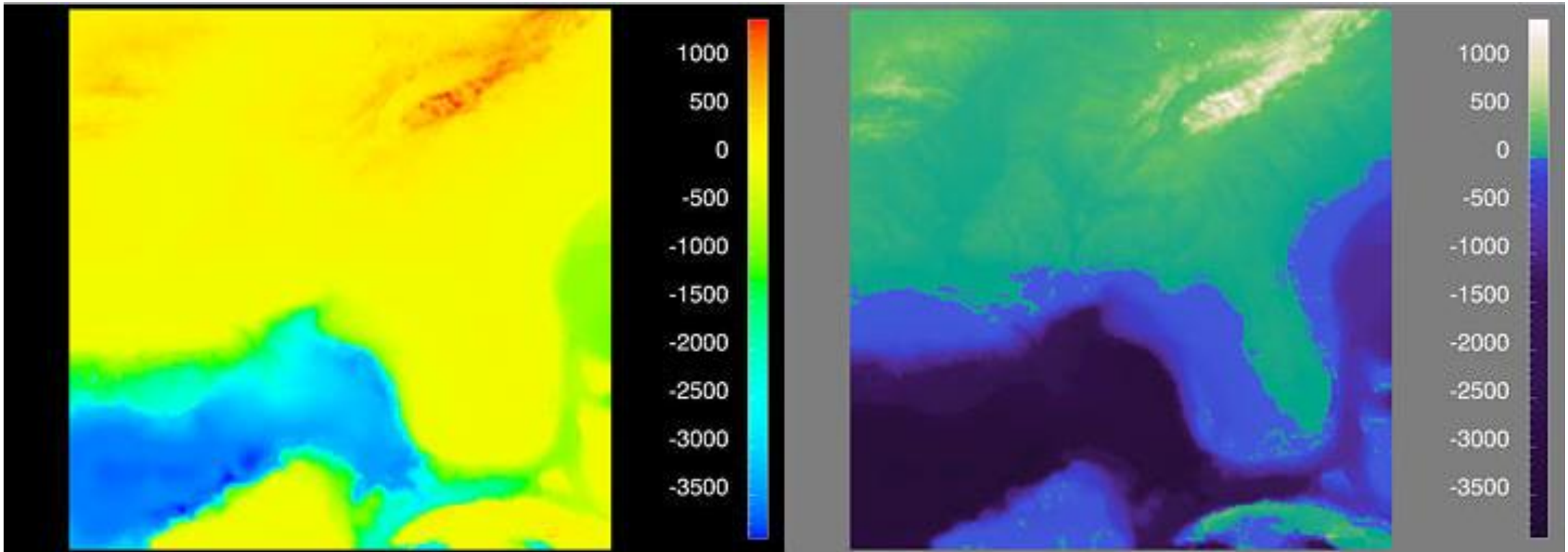


What does this  
visualization  
portray?

Bernice Rogowitz at IBM



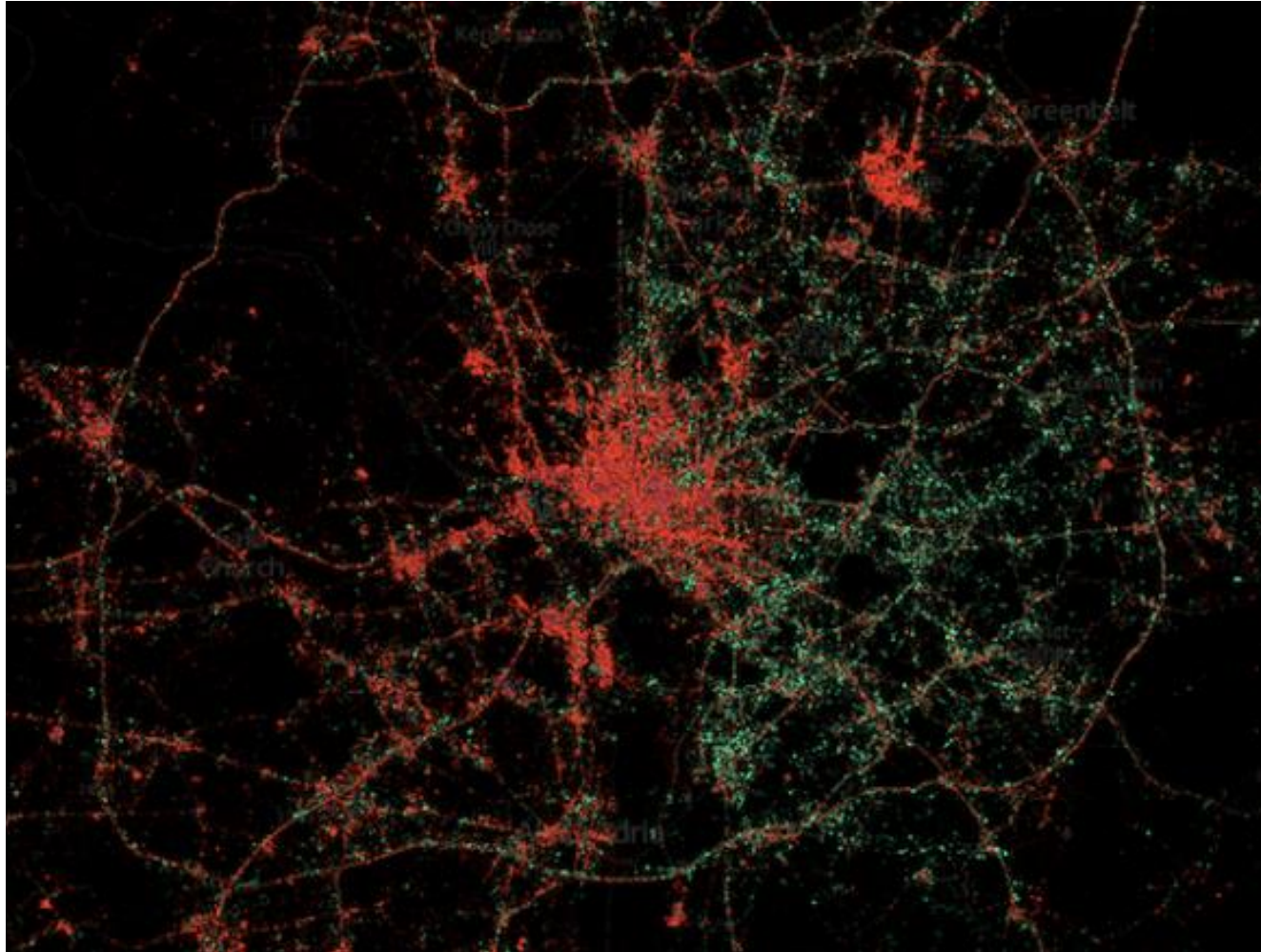
# Be Careful with Color Visualizations...



Bernice Rogowitz at IBM

The ubiquitous “rainbow” coloring often yields misleading perceptual interpretations.

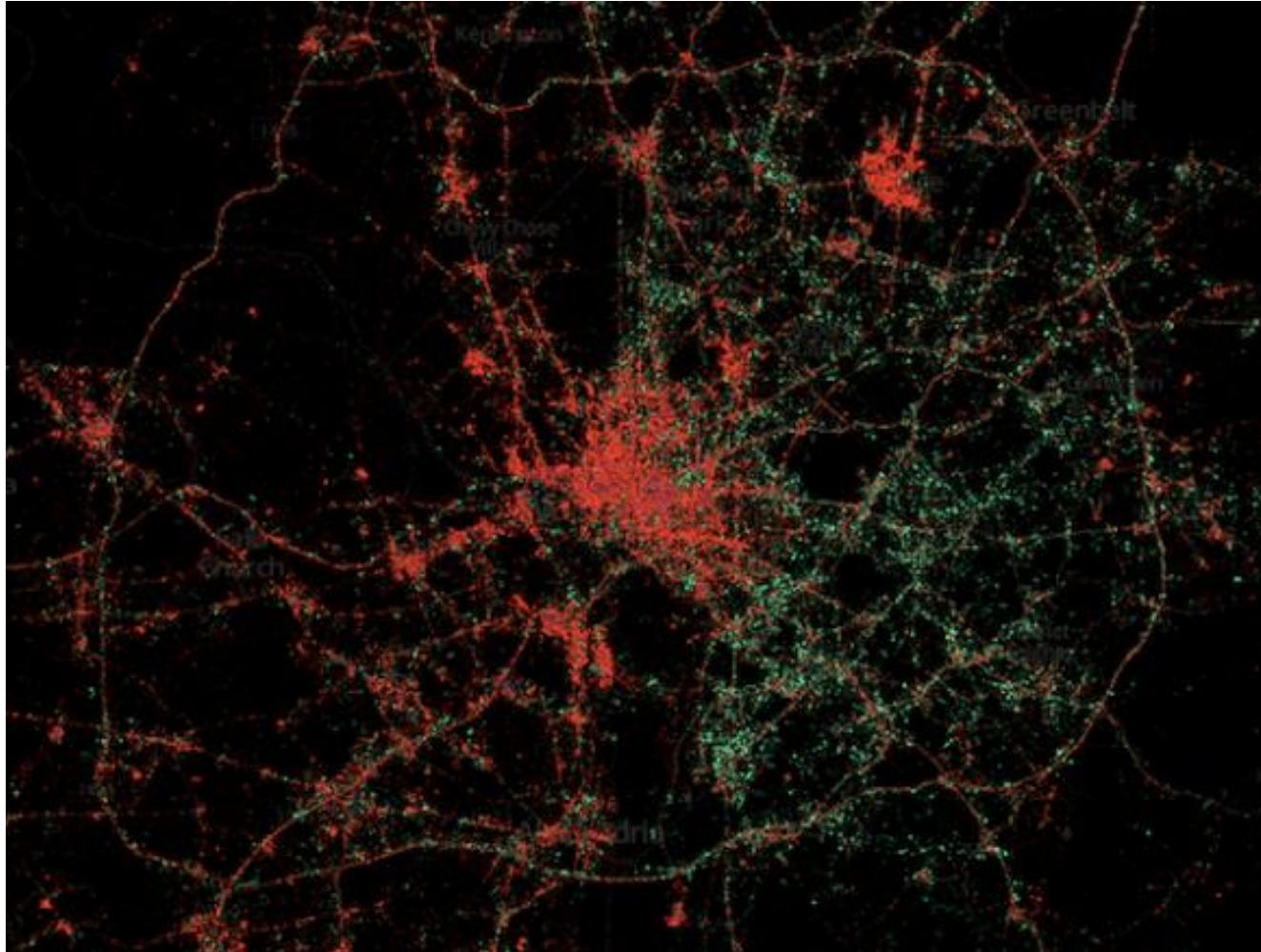
# Human vs. Machine



Interpretation  
of this data?

Badger, 2013

# Human vs. Machine

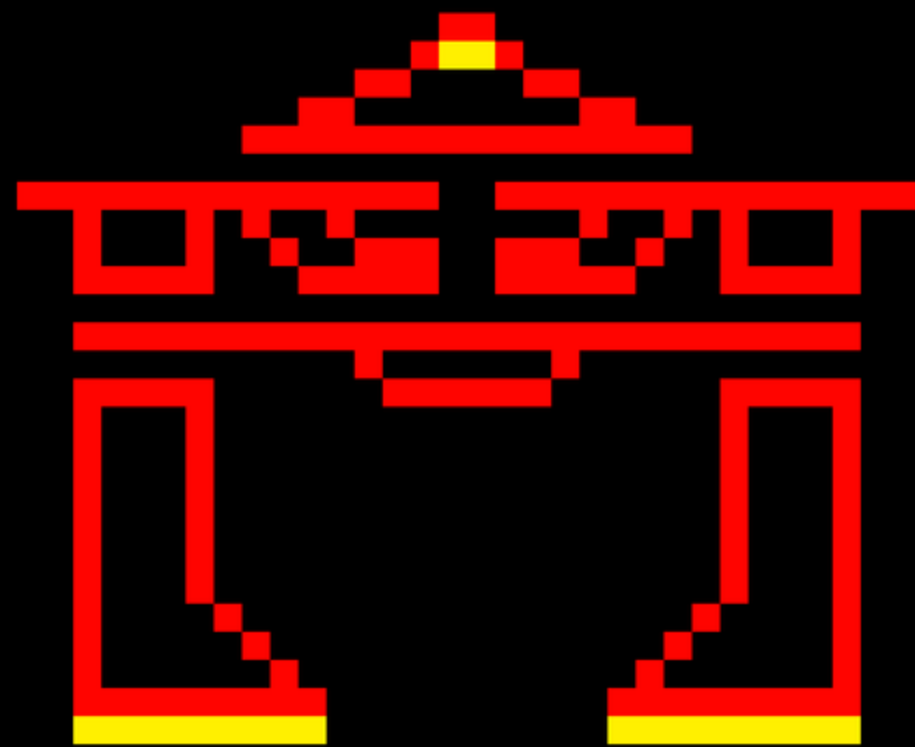


## Map of Washington, DC

- Geolocated twitter feeds
- Cell phone meta data
- Red dots – iPhone devices
- Green dots – Android devices

**Machine** = Churn and burn

**Human** = Pattern recognition



END OF LINE.