Training Next Generation AI Users & Developers at NCSA

Daniel S. Katz (d.katz@ieee.org, @danielskatz)
Chief Scientist, NCSA
Associate Research Professor, CS, ECE, iSchool
University of Illinois at Urbana Champaign

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ILLINOIS
NCSA | National Center for Supercomputing Applications

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The university

- Mission: The University of Illinois Urbana Champaign is charged by our state to enhance the lives of citizens in Illinois, across the nation and around the world through our leadership in learning, discovery, engagement and economic development

- Research: At Illinois, our focus on research shapes our identity, permeates our classrooms and fuels our outreach. Fostering discovery and innovation is our fundamental mission. As a public, land-grant university, we have the responsibility to create new knowledge and new ideas and translate these into better ways of working, living and learning for our state, nation and world.

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NCSA's role

Mission: NCSA leads and supports partnerships around campus, the nation, and the world by developing our staff and leveraging their expertise, experience, and innovation in digitally-enabled scholarship to solve the most scientifically and societally important and challenging problems

Vision: NCSA envisions a world in which interdisciplinary approaches that leverage advanced computing, data, and data-driven methods are used to create solutions to the most important and challenging problems

NCSA is one of ten campus interdisciplinary research institutes

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Quick facts: Funding

(as of December 31, 2022)

FY22 Project Portfolio Value	FY22 NCSA All Funding Sources Expenditures	FY22 Grant Expenditures
$408M	$70M	$51.6M

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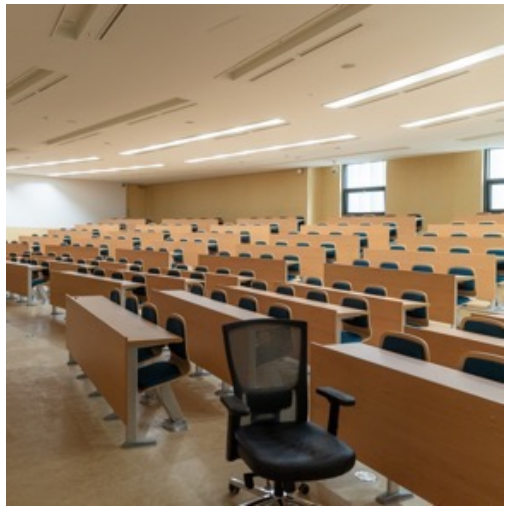
Quick facts: Students, faculty, staff

(as of December 31, 2022)

Staff & Post-Docs

242



Faculty & Campus Affiliates

184

Departments

58

Colleges/Schools

9

Students

143

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Strategic research foci

- Strategy is to balance bottom-up entrepreneurial research activities (across many areas) with top-down strategic aims (in a few areas)
- Most NCSA funds are research grant for specific research, and most of NCSA's university funding is dedicated to specific support activities, leaving only a small amount of funding that can be used for strategic growth
- Bottom-up successes can lead to changes in strategy, while strategic investments can support individual activities and areas
- Two current strategic foci are quantum computing and AI
- We consider these areas in terms of applications, infrastructure, and expertise
- To grow these areas, we
  - Partner with existing applications, infrastructure, and experts on campus and off
  - Develop our own applications, infrastructure, and expertise

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AI area

- We've created a Center for AI Innovation (CAII), led by Dr. Volodymyr Kindratenko
- We've won a number of projects where CAII collaborates with other groups, in computer science, high energy physics, life sciences, with partners from Illinois, other universities, national labs, and industry
- We've won awards for AI-focused systems
  - HAL: AI research platform, 16 IBM Power9 servers with 4x NVIDIA V100 GPUs, DDN parallel file system, Mellanox EDR IB interconnect, funded by NSF Major Research Instrumentation (MRI)
  - Delta: National production HPC system, most performant NSF GPU computing resource, 124 quad-core SSD CPU nodes, 200 quad-CPU (A100/A40) SSD nodes, SlingShot network, 10 PB Lustre & Flash storage, funded by NSF Innovative HPC program
  - Delta AI: National production HPC system being built, advanced computing and data resource ("a vast array of next-generation GPUs") as companion system to Delta, will triple NCSA's AI-focused computing capacity, funded by NSF Innovative HPC program
- And building on previous student programs, we won an NSF Research Experiences for Undergraduates award: FoDOMMaT

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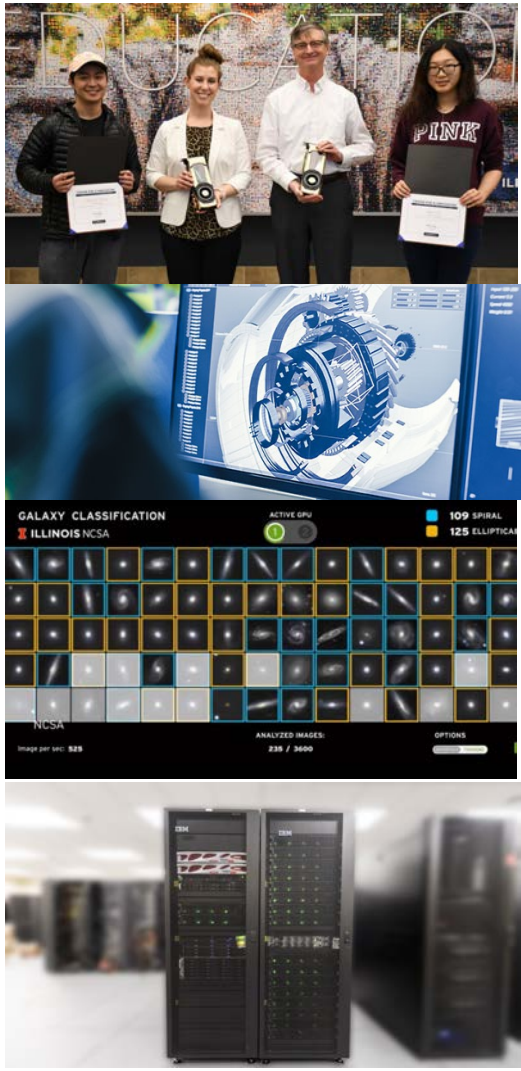
Center for AI Innovation

Three Primary Themes

1. **Research (Academic)**
2. **Scholarship (Students)**
3. **Industry (Companies)**

- Bring together University AI research community for opportunities to collaborate
- Align academic research with industry challenges and opportunities
- Provide students with opportunities to learn and work in AI domain
- Partner with leading researchers and technology developers to bring state-of-the-art AI capabilities to the University research community



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The Future of Discovery: Training Students to Build and Apply Open Source Machine Learning Models and Tools (FoDOMMaT)

- Summer REU (research experience for undergrads) program
- 10 weeks, on-site at NCSA/U Illinois
- Includes $600/week stipend, paid housing, meal plan, one round trip to/from campus
- 10 undergraduate students/year, particularly those who would otherwise lack such an opportunity, to work on cutting-edge projects
  - Week 1: training on machine learning (ML) methods
  - Weeks 2-10: work on a specific research project with pair of research mentors, one from project's research area and one with ML expertise
  - Students openly share models and tools, including at home institutions, in undergraduate research symposium at U Illinois, and in science & engineering research community
  - Students attend seminars by visiting researchers from industry & academia, social activities, networking and professional development events
- https://reu.ncsa.Illinois.edu

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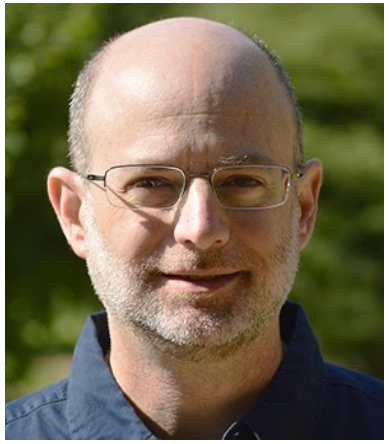
REU FoDOMMaT Team

Dr. Volodymyr Kindratenko
Director of Center for AI Innovation, NCSA
Adjunct Associate Professor, ECE
Research Associate Professor, CS
REU FoDOMMaT Program PI



Dr. Daniel S. Katz
Chief Scientist, NCSA
Research Associate Professor, CS
Research Associate Professor, ECE
Research Associate Professor, iSchool
REU FoDOMMaT Program Co-PI

Olena Kindratenko, MS., M.Ed.
Senior Research Coordinator, NCSA
REU FoDOMMaT Program Coordinator

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FoDOMMaT student outputs and activities

- Write a research plan (2 pages) early in the program
- Attend scheduled joint lightning talks with other undergraduate programs
- Give one lightning talk on the progress of their project
- Attend scheduled FoDOMMaT social and professional development events
- Meet regularly with their FoDOMMaT mentors and NCSA Senior Research Coordinator
- Write a research report (3-4 pages)
- Write weekly short reports about project work and progress
- Participate in NCSA Research Open House and Illinois Summer Undergraduate Research Symposium

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FoDOMMaT goals

- Give undergraduate students opportunities to learn and contribute to AI research, particularly those who otherwise wouldn't have such opportunities
- Allow mentors to explore new research ideas
- Create tools and products to benefit the scholarly community
- Attract good students to graduate programs at Illinois or elsewhere
- Train students to make them ready for industry

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FoDoMMaT lessons and successes

- Having a motivated graduate student program mentor involved has been key
  - Priyam Mazumdar, was MS student in Statistics, now PhD student in ECE
  - Understands undergraduates, understands research, understands mentors
  - Sits between them and makes the program and projects work
- Successes:
  - Bringing in members of underrepresented groups
    - 2022: 5 of 8 participants were female, 2 of whom were also minorities
    - 2023: 7 of 10 were from underrepresented groups (5 female, 1 Black, 1 Latino)
  - 2022: 1 conference paper (first author was REU student)
  - 2023: 1 workshop paper (first two authors were REU students), 3 students continuing work on two projects in Fall semester, 1 student applying for UIUC CS PhD program
  - 2022 HPCwire Editors' Choice: Workforce Diversity & Inclusion Leadership Award

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REU FoDOMMaT (The Future of Discovery: Training Students to Build and Apply Open-Source Machine Learning Models and Tools)

2024 program dates: May 20-July 26

- **Program focus:** training experience in machine learning at the National Center for Supercomputing Applications (NCSA) in which students will work on developing open-source machine learning models and tools and applying them to solving real world problems
- **Eligibility:**
  - U.S. Citizen or Permanent Resident
  - Enrolled in a degree program (part-time or full-time) leading to a baccalaureate or associate degree
  - Enrolled in any major and in any year of undergraduate studies
  - At least 18 years of age by the start date of the program
  - Some software development experience with Python is required as well as some exposure to machine learning (ML) via coursework, self-study, or other project
- **Stipend/support:** $6000, plus housing, meal plan, and travel to/from program
- **Contact:** Olena Kindratenko at kindrat2@Illinois.edu

Apply November – March for next summer https://reu.ncsa.illinois.edu

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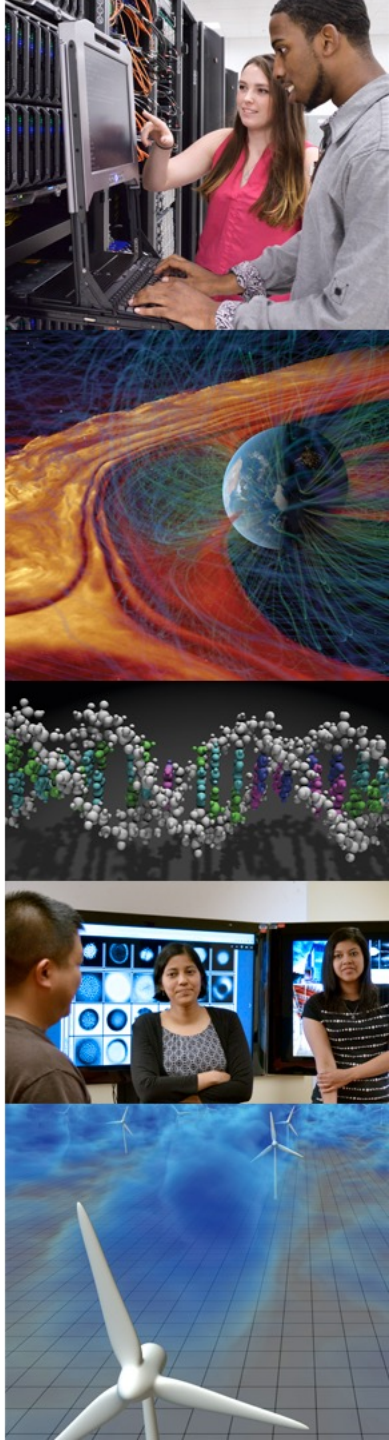
Thanks!



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