



The UNIVERSITY of OKLAHOMA



DATA INSTITUTE FOR SOCIETAL CHALLENGES

YEAR-END REPORT 2023

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MESSAGE FROM THE DIRECTOR



Dear Colleagues,

FY 2023 has been an incredible year of accomplishments for our data science community, DISC team, members, and affiliates. The DISC community continues to grow and become more active!

During FY 2023, we have hosted a variety of events to connect the OU community within and beyond OU. Our Communities of Practice have been growing to propose innovative approaches to challenging, important problems. The DISC team has been instrumental in supporting proposal submissions to various agencies and data science researchers across campus are continuing to grow their research. The new data science and data-enabled research grants awarded are growing rapidly. Many exciting projects are starting that will create extensive opportunities, and now, we have created two separate

programs for postdoctoral researchers and graduate students.

This end-of-the-year report will provide an overview of what the data science community, DISC team, members, and affiliated have accomplished in FY 2023.

We look forward to your continued support and partnership in making OU a nationally-recognized leader for data science research and data-driven solutions to solve important challenges that impact our society in FY24. As always, please feel free to reach out to our team if you need assistance in your research work or are interested in learning how our team can help advance your research.

Sincerely,

A handwritten signature in black ink that reads "David S. Ebert". The signature is fluid and cursive, written in a professional style.

Dr. David S. Ebert

*Gallogly Chair Professor of Electrical and Computer Engineering and Computer Science,
Associate Vice President of Research and Partnerships,
Director, Data Institute for Societal Challenges (DISC)
University of Oklahoma*



ABOUT DISC

Mission

Empower transdisciplinary research and collaboration to drive convergent solutions to societal challenges in Oklahoma, the nation, and the world through data science research, tools, and capabilities.

Vision

The University of Oklahoma is a nationally recognized leader for data science research and data-driven solutions to societal challenges.

Values

Collaboration – Together, we are more effective in solving challenges.

Innovation – Create new techniques, tools, and data-enabled solutions to positively impact our global community.

Inclusivity – Integrate diverse teams, education, research, and engagement with partners.

Trust – Through our actions, we build trust – core to transdisciplinary team success, transition to societal impact, and sustainability.

Empowerment – Empower convergent research teams to solve societal challenges.

Strategic Goals

Research Network – Develop, sustain, and grow a robust and transdisciplinary network of diverse OU researchers while enhancing convergent research accessibility, quality, diversity, and competitiveness.

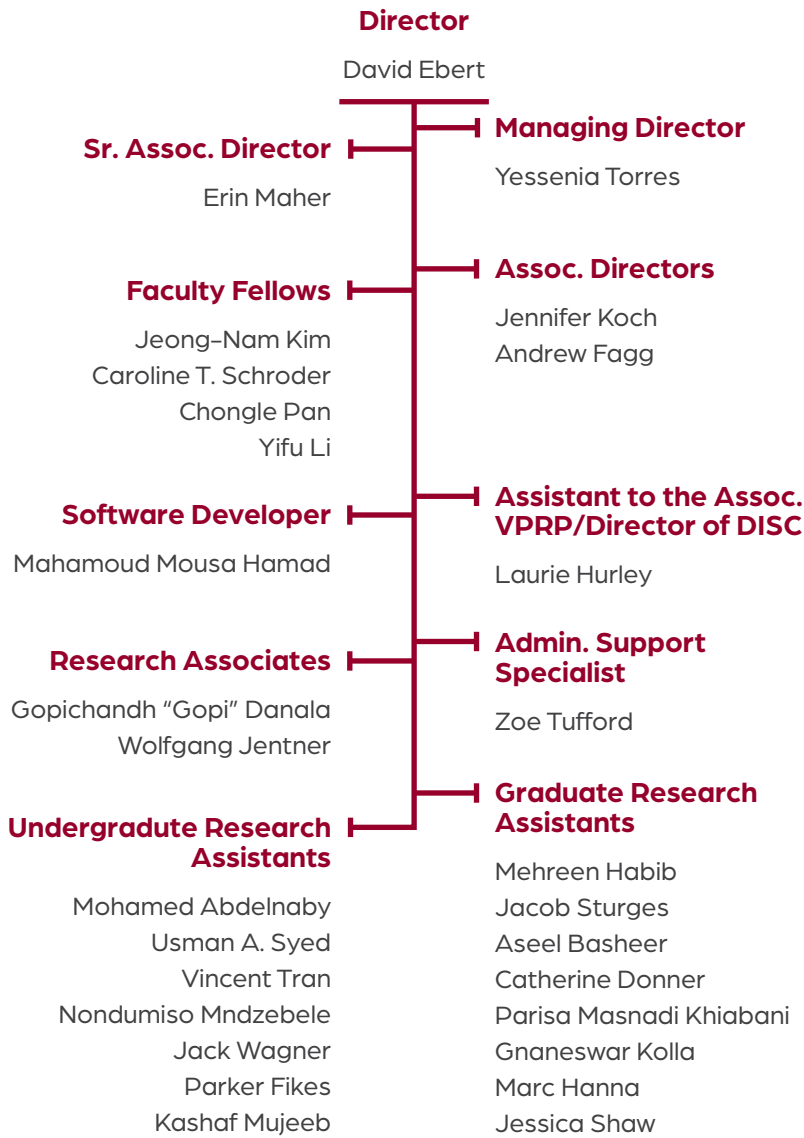
External Partners – Establish relationships and partnerships with external researchers, scholars, and industry leaders to address societal challenges using data science tools.

Financial – Build a growing and sustainable financial foundation that will support the institute's operations and increase the amount and quality of data-enabled research at OU.

Capabilities – Partner with stakeholders across OU to identify, build, and provide the necessary data science capabilities and infrastructure to effectively lead and support data science research.

Data Science Leader – Be nationally recognized as a leader in data science and data-enabled science by accelerating and advancing emerging research in data science, engineering, science, and creative activities driven by real-world applications.

ORGANIZATIONAL STRUCTURE



DATA SCIENCE COMMUNITY

Designed to help researchers, students, and staff connect across disciplines and facilitate team-building and partnerships at OU.

In FY23 we had:

222
MEMBERS

367
AFFILIATES

This is an increase of **200%** and **132%**, respectively, from FY22. To learn about more becoming a member or affiliate, visit: ou.edu/disc/about/people/data-science-community



RESEARCH ADVANCEMENT EFFORTS

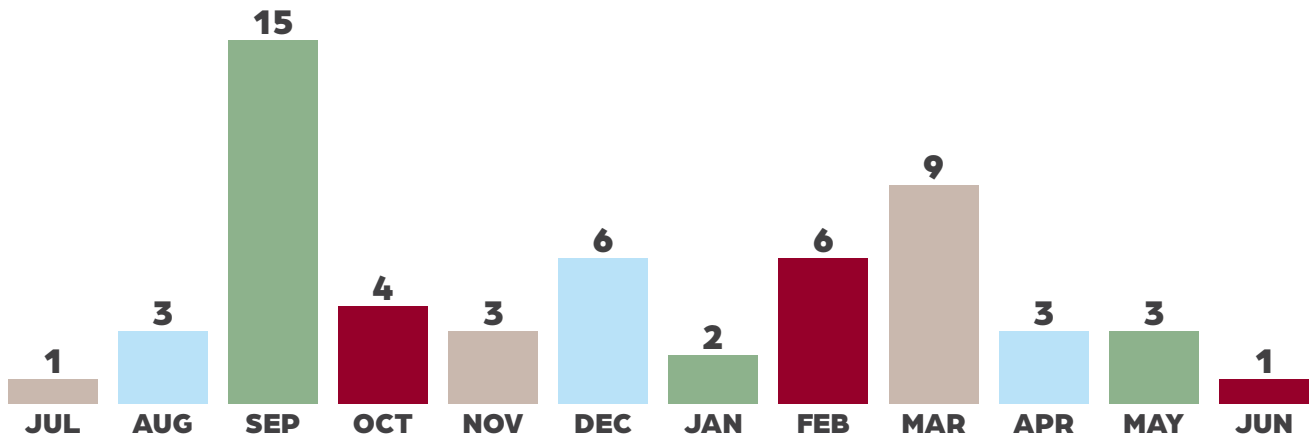
Grant/Research Workshops Co-Hosted

DISC, in partnership with other centers and institutes, has hosted a variety of research creative activities. These activities provide an opportunity for faculty/researchers to meet new colleagues and share research interests or expertise. Example activities include guest speakers, teaming workshops, community engagement events, and many others.

In FY23:

56 Total Workshops/
Events Co-Hosted

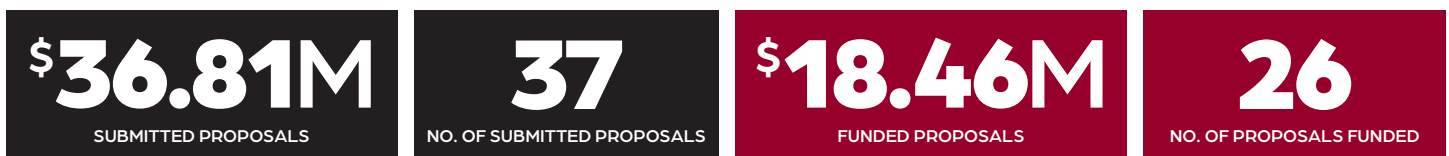
1,524 Cumulative Workshop
Attendance



FY23 Workshops/Events Co-Hosted

DISC Partnerships in External Funding Proposal Submissions

DISC plays an integral role in supporting externally-funded research across OU.



RESEARCH SEED FUNDING

DISC expanded its research seed funding program in FY23. Now, we have opportunities available for both postdoctoral researchers and graduate students in addition to faculty. Many OU researchers have benefitted from this opportunity. For example, one team created a VR application that is going to be demoed at an upcoming Construct3D conference. Another team was able to enhance existing explainable AI and machine learning clustering algorithms to better suit social science survey datasets. In addition, one team was awarded a Department of Defense grant as the seed funding provided by DISC facilitated a strong collaborative background between the labs.

DISC seed funding allowed OU researchers in FY23 to:

- Host workshops
- Hire and provide graduate students with valuable professional and pedagogical skills
- Acquire equipment necessary for data collection
- Apply for external funding from agencies such as National Science Foundation, Department of Energy, Department of Defense, Health and Human Services
- Present findings at conferences



FY23 Seed Funding Awards Recap

29
TEAMS

79
RESEARCHERS

\$215.4K

RESEARCH SEED FUNDING

FY23 Faculty Seed Funding Program

Project Title	Team Members	Amount Awarded
The Interaction between Virtual Multi-Sensory Environments and Children with Intellectual and Developmental Disabilities in Central Oklahoma	Nega Heidari Matin, Anna Nguyen, Ye Ji Yi	\$10,000
Spatially Explicit Delineation for Boundaries of Social-Environmental Systems: A Case in the Rio Grande - Rio Bravo basin	Selena Feng, Jennifer Koch	\$10,000
Implementing an automated, high-resolution tracking system to reveal social network dynamics in a socially gregarious songbird	Alexandra Bentz, Golnaz Habibi, Eli Bridge	\$10,000
Developing a Novel Methodology in R for Mapping Biometric Data onto Architectural Floorplans	Angela Person, Chris Black	\$7,500
An Improved Data Science Application to Support Operational Disease Forecasting	Mike Wimberly	\$10,000
The Water-saving Potential of Sprinkler Irrigation Systems Across Winter Wheat Farms in Oklahoma	Nishan Bhattarai, Pradeep Wagle	\$10,000
Towards a Robust Active Learning Workflow for Machine Learning Assisted Free Energy Simulation of Enzyme Reactions	Yihan Shao	\$10,000
Leveraging Machine Learning and Weather Radar to Identify Changes in Bat Migration and Implications for Pathogen Dispersal	Daniel Becker, Amy McGovern, Eli Bridge, Jeff Kelly, Jeremy Ross	\$10,000
Integrating Multiple Datasets to Develop a Historical Comprehensive Hourly Urban Weather Database (CHUWD) for Energy System Modeling	Chenghao Wang	\$10,000
Applying Micro-Level Data to Estimate the Economic Value of Hazard-Related Information	Jayash Paudel, Kim Klockow-McClain, Justin E. Sharpe	\$7,500
Essential yet Disposable: Confronting Data Challenges for Studying Refugee and Immigrant Workers During COVID-19	Annabel Ipsen	\$7,500
Nanocrystalline Transition Metal Oxides for a New Generation of Lithium-Ion Batteries	Wilson Merchan- Merchan, Jie Cai, Mrinal C. Saha, Bin Xu, Dong Zhang	\$10,000

Project Title	Team Members	Amount Awarded
Pilot Study to Investigate a Systematic Framework to Improve Data Quality for a National Child Welfare Database	Yutian Thompson, Hairong Song, David Bard, Jane Silovsky, Jonathan Picklesimer, Yaqi Li	\$10,000
Availability of Electric Vehicle (EV) Charging Stations and EV Adoption Rate	Kwangyul Choi, Anni Yang	\$10,000
Interactive Visual Analytics Framework for Identifying Unique Motifs in Cas9 Protein Sequences	Ji Hwan Park, Rakhi Rajan	\$7,000
Asian Immigrants' Diabetes Disparity	Yong-Mi Kim, Sunny Kim, Suchismita Bhattacharjee, June Abbas, Sailatha Thomas, Pranay Kathuria, Insung Kim	\$10,000
Examining the Role of Large-Scale Language Models and Prompt Engineering in Enhancing Department of Defense Supply Chain Readiness	Naveen Kumar, Pankhuri Malhotra	\$14,000
Interweaving Hydrology and Indigenous Knowledge for Flood-related Environmental Justice with the Otoe-Missouria Tribe	Farina King, Yang Hong, Allen Li, Mengye Chen, Chengbin Deng, Theresa Tsoodle	\$10,000 from DISC \$20,000 from ICAST
Leveraging Big Data to Improve Quality in Infants' and Toddlers' Language Learning Environments	Wonkyung Jang, Diane Horm, Ryan Kasak, Kun Lu, Ji Hwan Park, Kyong-Ah Kwon	\$10,000 from DISC \$20,000 from ICAST

FY23 Graduate Seed Funding Program

Project Title	Team Members	Amount Awarded
Assessing the knowledge, awareness, and perception of micro, small, and medium enterprises (MSMEs) on renewable energy technologies in Nigeria: A paradigm shift in energy education.	Chinedu Candidus Nsude	\$2,500
Trends In Adolescent Suicide Attempts During The Onset Of A Global Pandemic, And The Protective Factors Of School Based Socialization	Adon Rosen, Justin Durham	\$2,500
Rockfish Project	Robin Singleton, Alice Lee	\$2,500
Synthesizing Graduate Student Research with Global Climate Science Priorities	Angela Rosellini-Labombarde, Ebone Smith	\$2,500
Urban Landscape: Eco-Social Interactions and Park Configurations Influencing Human Exposure to Ticks in Oklahoma City	Melissa Marquez, Himel Talukder, Shu Sun	\$2,411
Facilitating Graduate Student Involvement in the CODE Workshop	Elizabeth Besozzi, Paula Cimprich, Mehrnaz Afkhami	\$2,500
With Our Own Eyes: Using Photovoice for Youth in Foster Care to Understand Aspirations	Rin Ferraro, Sarah Connelly, Heather Lepper Pappan	\$2,490

FY23 Postdoctoral Fellowship Program

Project Title	Awardee	Amount Awarded
Mass spectrometry profiling of metabolite distribution and spatial clustering of metabolomics data in Chagas disease	Azadeh Nasuhidehnavi	\$4,500
Bat immunology across taxonomy, ecology, and infections using comparative proteomics	Amanda Vicente-Santos	\$5,000
Quantifying bat cellular immunity under multiple stressors in western North America	Molly Simonis	\$5,000

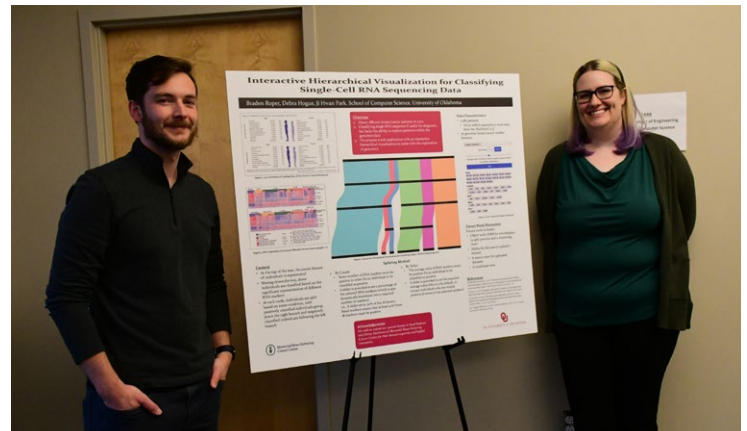


CURRENT COMMUNITIES OF PRACTICE

Our Communities of Practice (CoPs) are designed to bring together researchers across the University of Oklahoma who share a common interest and come together to brainstorm possible solutions to address societal challenges. In FY23, many of our CoPs hosted a variety of engagement opportunities for the OU community. Below you will find a snapshot of the activities accomplished. Be in the lookout for opportunities to be involved in FY24!

Brain and Behavior

This CoP is led by [Dr. Andy Fagg](#) and is focused on the neural control of human behavior, and how the neuromotor systems change with learning, development, disease onset, injury, recovery, and therapeutic interventions. This group includes experts in brain imaging (including EEG and fNIRS), psychology, systems neuroscience, human motor control, rehabilitation sciences, motion capture (including kinematics, kinetics, and EMG), neural modeling, and high-dimensional data analysis.



Environmental Systems Science

This CoP is led by [Dr. Jennifer Koch](#) with the goal of developing research ideas with a focus on environmental systems observation and modeling. More specifically, this group brings together researchers working on understanding processes in the biosphere, geosphere, hydrosphere, atmosphere, and their linkages. In our conversations, we apply a systems approach, identify synergies and shared research interests around the broader topics of environmental systems science, observation and prediction of environmental systems, and work towards describing these ideas and synergies in one-page summaries. One of the underlying motivations is to be prepared for emerging funding opportunities and to reach out to program managers of potential funding agencies. More opportunities to engage with this community of practice will be coming in FY24.

Digital Humanities

This CoP is led by [Drs. Carrie Schroeder](#) and [Kimberly Marshall](#) to bring together people who work in digital humanities or would like to engage in digital humanities work to foster collaboration. This group had a successful year with several initiatives that brought together researchers from multiple units at OU. In the fall, we had a meet-and-greet with the Associate Dean for Digital Strategies and Innovation, OU Libraries, and shared with her the needs and capacities of OU's DH community. Our lecture and workshop by Dr. Roopika Risam of Dartmouth University inspired several of our members who are developing grant proposals. At the end of the year, our three seed grant awardees from the previous year shared the results of their research. In addition, this year several members of the CoP were awarded National Endowment for the Humanities grants for digital or data-related projects.

Neuroscience

This CoP is led by [Dr. Andy Fagg](#) and focused on developing deeper research and educational connections between the Department of Neurosciences on the OU Health Sciences Campus and those working at OU-Norman. Faculty and other researchers in this group work at many levels – from cellular systems to system neuroscience and musculo-skeletal systems.



Opioid Research Group

This CoP is led by [Dr. Erin Maher](#) with the goal of keeping abreast of opportunities for opioid-related funding, sharing ongoing research to foster collaboration and expansion of the research, and, ultimately, using research to develop and implement solutions. In Spring 2023, the Opioid Research Group hosted an OU-wide presentation by the Southwest Prevention Center at OU Outreach. The presenters discussed their federally and state-funded research to prevent substance use disorders. New collaborations were pursued.

Community Engagement

This CoP is led by [Drs. Joy Pendley](#) from the Center of Faculty Excellence and [David Ebert](#) and emphasizes community engagement for OU researchers, educators, and scholars across campuses and disciplines. The goal of this CoP is to provide opportunities for faculty and staff to interact with community partners (primarily in the Norman and OKC areas) who have a variety of data, service learning, and infrastructure needs. Future opportunities will be forthcoming in FY24.

Bioinformatics

This CoP is led by [Drs. Chongle Pan](#) and [Andy Fagg](#) with the goal of developing a research and learning community across OU Norman, OUHSC, and OMRF that focuses on bioinformatics, computational biology, and biomedical data science. To date, DISC has organized a number of research discussions and provided regular tutorials on machine learning and the use of the OU supercomputer facilities. The Bioinformatics CoP held multiple meetings with their current members this year and a mini-symposium. The event showcased current work in the single-cell omics field and provided an overview of advanced computational approaches for omics, with the objective of fostering collaboration, increasing understanding of cutting-edge tools, and exploring opportunities to strengthen the bioinformatics and computational workforce supporting research across the university.

Machine Learning & Big Data in the Social Sciences

This CoP is led by [Dr. Heather Bedle](#) and brings together a multidisciplinary group of researchers from the undergraduate to faculty level who want to explore how machine learning can be used in conjunction with traditional statistical methods for data analysis of datasets that span the social and natural sciences. This is the newest CoP, and engagement opportunities will be available in FY24.



Supply Chain

This CoP is led by [Dr. Andrés González](#) and is working to enhance the understanding, design, and resilience of supply chains and supply-demand networks. In today's world, supply chains are highly interconnected, and their proper operation is affected by diverse types of hazards, both natural (e.g., pandemics, earthquakes, floods, or climate-change induced events) and anthropogenic (e.g., attacks to physical and/or cyber infrastructure). During FY23, this CoP brought together researchers across campus to learn about the challenges facing the Department of Defense. Specifically, the senior leadership of the 448th Supply Chain Management Wing from Tinker Air Force Base visited OU on May 3, 2022 and provided an overview of their geographically dispersed mission as the U.S. Air Force's sole organization responsible for the wholesale supply chain network.

3D Workflow

This CoP is led by [Kristi Wyatt](#) and works to bring together researchers who work with 3D data. The 3D Workflow Community of Practice kicked off in the FY22 with a campus-wide survey assessing who was interested in using or already using 3D data. It also looked at how 3D data was created, what it was used for, and the challenges faced when using and or creating it. During the first Meet and Greet event, attendees were able to network and discuss their research using 3D data. During FY23, a workshop was held in collaboration with the Office of Digital Learning, where attendees learned how to share their 3D models on their OUCreate sites using the 3DHOP web-plugin.

Interested in starting a Community of Practice?

Reach out to disc@ou.edu for questions or more information about how to get started.

FY23 HIGHLIGHTS

DHS Undersecretary for Science and Technology Visits OU

Dr. Dimitri Kusnezov, the Undersecretary for the Science and Technology Directorate at the U.S. Department of Homeland Security, visited OU for a two-day engagement in Feb. 2023. The event brought together the OU community, industry leaders, tribal nation partners, and other prominent leaders in Oklahoma. A townhall and fireside chat was hosted at the Sam Noble Museum of Natural History, during which Dr. Kusnezov discussed ways to drive innovation, engage the nation's full ecosystem, and address future challenges of homeland security.



NEH Preservation Grant Expands Digital Coptic Collections

For over a decade, the [Coptic Scriptorium project](#) has developed open access, online resources for Coptic Language and literature. The Coptic language is the last phase of the Egyptian language family, a direct descendant of the hieroglyphs of ancient Egypt. Coptic texts and the study of Coptic linguistics are important for multiple academic disciplines and for the heritage community of Coptic Orthodox Christians who use the language for liturgy and their cultural identity. This Humanities Collections and Reference Resources Implementation grant, led by Carrie Schroeder (PI and primary grantwriter) and Amir Zeldes (co-PI, Georgetown University), will enable the project to improve the user experience, to expand a digital database of richly annotated texts in the classical dialect of the language, and to develop natural language tools and searchable, annotated, digitized corpora for additional dialect.



International Data Visualization Conference Welcomed Visitors to OU Open House

More than 100 volunteers and attendees participated in an OU Open House event comprised of a series of tours around campus hosted by DISC on October 20, 2022. The Open House was an optional tour held in conjunction with the IEEE Vis conference held Oct. 17-21 in Oklahoma City. The conference convened more than 1,300 in-person and virtual attendees from around the world – researchers and practitioners from universities, government, and industry to exchange recent findings on the design and use of visualization tools and to discuss theory, methods, and applications of visualization and visual analytics.

NVivo Software Now Free for OU Faculty, Staff, and Students

OU faculty, staff, and students can now download NVivo, a qualitative data analysis computer software package, for free thanks to a partnership between DISC, the Office of the Vice President of Research and Partnerships, and the Institute for Community and Society Transformation. The NVivo software allows users to import and organize a wide range of data, including text documents, images, audio and video clips, and more.



DISC Develops MOUs with Two South Korean Institutions

The University of Oklahoma and two South Korean institutes have signed memorandums of understanding to facilitate collaborative research to solve societal challenges in data science, data-enabled science, public policy and strategic communication, and to develop data science informed policy intervention for Asia-specific and global problems.

These agreements bring together faculty and student researchers from OU, coordinated by DISC, with those from the Moon Soul Graduate School of Future Strategy at the Korea Advanced Institute of Science and Technology (KAIST) and Sejong University.

Training in Machine Learning

Dr. Andy Fagg, provided a variety of machine learning training opportunities to the OU community over the past year. These include:

- Introduction to deep learning and its use on the OU supercomputer (live and recorded tutorials).
- A full set of videos on applying conventional machine learning techniques to a wide range of problem types and data sets.
- Multi-part tutorial on 1D and 2D Transformer Models (a subset of deep learning) for classification and generation of content (live and recorded).
- A tutorial on optimizing deep learning models on the OU supercomputer (and others).

To view these tutorials, visit ou.edu/disc/resources/supercomputer-and-machine-learning-tutorials.

CPU and GPU Resources on the OSCER Supercomputer

With funding from the OU Vice President for Research, the Data Institute for Societal Challenges has acquired a set of CPU and GPU nodes for the OSCER Supercomputer, as well as large-scale storage on OURdisk. These resources are available for use by all members of DISC who are located on the OU campuses, including: faculty, researchers, postdocs, and students.

[Apply for access to the DISC supercomputer resources](#)

PUBLICATION SAMPLES BY DISC MEMBERS AND AFFILIATES

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DIRECTION FOR THE FUTURE

DISC will continue its commitment to support the OU community to ensure that we position the university as a nationally-recognized leader for data science research and data-driven solutions to societal challenges.

DISC will continue to fulfill our role as a partner in advancing data science and data-enabled research by:

- **Empowering:** Provide teams with the necessary tools and support to launch innovative research.
- **Connecting:** Encourage collaboration between faculty and other partners across synergistic fields, industries, and sectors.
- **Leading:** Pave the way for new methods, testing, and analysis by advancing data science, and data-enabled research techniques.
- **Establishing:** Support OU's goal of being a top-tier research university by establishing a national reputation for data science and data-enabled research.
- **Developing:** Nurture and grow students for careers in the burgeoning field of data science and allied fields.
- **Belonging:** Increase the diversity, inclusion, and sense of belonging of students interested in pursuing data science research and careers.
- **Impacting:** Work directly with partners to make observable improvements through the ethical use of data science in the lives of people in our state, the nation, and the global environment.

Ways DISC Can Support You:

- Facilitate connections
- Grant development support
- Seed funding opportunities
- Letters of support
- Research promotion
- Mentorship opportunities



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