United States Department of Agriculture
Agricultural Research Service

SCINet Newsletter: August 2022

Research Spotlight | News | Training | Support | Connect

RESEARCH SPOTLIGHT

Research Spotlight: Exploring Methods for Developing 3D Maps of Soil Organic Carbon

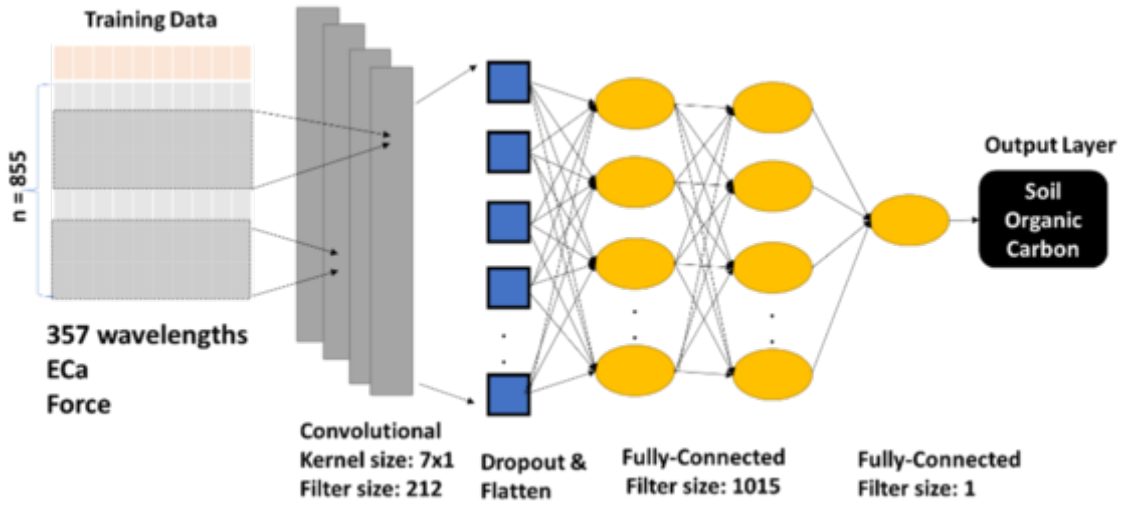

Figure 1. Diagram of the 1D-CNN model framework used to predict soil organic carbon.

By: Curtis Ransom, Research Soil Scientist.

Scientists at the Cropping Systems and Water Quality Research Unit in Columbia, Missouri have extensive experience estimating soil biological, physical, and chemical properties using proximal soil sensors. With support from the AI Innovation Fund, ARS Research Associate Dr. Curtis Ransom and recent University of Missouri graduate Dr. Chin Nee Vong, are utilizing the Ceres HPC cluster to explore methods for developing 3D maps of soil organic carbon using diffuse reflectance spectroscopy, bulk soil electrical conductivity, and soil penetration resistance measurements down to a depth of 0.90 m. To date, thousands of soil samples with corresponding sensor information have been collected across a range of soils in and around Missouri. Cleaning the data is time-intensive and has a degree of subjectivity, but these limitations have been minimized by using an interactive R shiny application on Ceres. Additionally, Ceres has been used to run Python scripts to model soil organic carbon with neural networks (Figure 1).

The initial modeling efforts have shown promising results, and the team is currently analyzing more samples to expand the dataset. Following completion of the lab work, this team will develop a framework for using the sensor data to predict soil organic carbon in three dimensions. This framework will be used to estimate rates of carbon sequestration or carbon loss under various management practices. Key findings will answer practical questions such as how many samples are needed to accurately capture the spatial variability of organic carbon within a field and how to optimize sampling protocols for different farmer management practices. This cost-effective, sensor-based method and modeling framework will improve our understanding of how agricultural lands can sequester carbon and help the United States work towards the goal of becoming carbon neutral.

SCINet and AI COE Fellows

Welcome **Dr. Andrea Albright**, SCINet Postdoctoral Fellow. Dr. Albright has an undergraduate degree in chemistry from Grinnell College, Grinnell, IA. She then earned a M.S. (2014) in Oceanography from Oregon State University, Corvallis, OR and a Ph.D. (2022) in Geosensing Systems Engineering from the University of Houston, Houston, TX. Her dissertation combined data sets from a multispectral satellite (Sentinel-2) and the recently launched lidar satellite (ICESat-2) to map nearshore bathymetry. Her first publication was awarded the IEEE Geoscience and Remote Sensing Society 2021 Letters Prize Paper Award. She joins ARS as a SCINet Postdoctoral Fellow.

Dr. Albright's research with ARS will be three-fold: the first part is directed at moving the current UAV image processing workflow to an HPC environment and developing a workflow that can be distributed to other working groups. The second part is focused on a bathymetry study of irrigation ponds to quantify groundwater usage in the area. And thethird part will be focused on quality control of acquired hyperspectral data sets, i.e., distinguishing between high-quality and low-quality data sets early in the collection process.

Good luck **Dr. Kerri Geil**! After nearly two years as a SCInet Postdoctoral Fellow, Dr. Geil has moved to a new opportunity at Mississippi State University (MSU). As a SCINet Fellow, Dr. Geil co-led the Geospatial Working Group, organized computational workshops, developed online tutorials, and published her research.

As an Associate Research Professor at MSU, Dr. Geil will continue to assess climate model performance with the goal of selecting climate change information from the most robust sources for for different research and climate adaptation decision-making contexts. Dr. Geil will be working with colleagues at the Geospatial Research Institute and Department of Geosciences, as well as with other Gulf of Mexico regional stakeholders, to help choose appropriate sources of climate projections for specific research projects, climate change visualization tools, and climate adaptation decisions.

FY23 SCINet/AI-COE Postdoctoral Fellowships Call for Proposals

The SCINet office is anticipating an early Fall 2022 call for proposals for the SCINet and AI Center of Excellence (AI-COE) Postdoctoral Fellowship program for FY2023.SCINet and the AI-COE will again be offering fellowship funding to ARS scientists who wish to mentor SCINet/AI-COE fellows working in their labs. These fellowships provide an exciting opportunity for participants to address agricultural problems by developing and applying new and emerging technologies, including big data analytics, artificial intelligence, and machine learning. Fellows will be able to conduct research in collaboration with ARS scientists, use SCINet's High Performance Computing clusters and other computational resources, and access the numerous training opportunities available through SCINet and the AI-COE. Leadership opportunities will also be provided. Watch for an email and announcement on the SCINet website when proposal submission opens.

NEWS

Geospatial Annual Workshop

The Geospatial Research Working Group held their annual workshop from August 29 to September 2. Highlights included lightning talks by ARS scientists presenting how they utilize SCINet in their geospatial research, an introduction to the Geospatial Common Data Library, and sessions on how to use R and Python for geospatial research on SCINet. Open collaborative sessions provided an opportunity for attendees to bring their own geospatial problems and work through them as a group. Recordings of the presentations and tutorials will be posted on the SCINet website. Please contact the Geospatial Working Group leaders for more information (Heather Savoy, heather.savoy@usda.gov; John Humphreys, john.humphreys@usda.gov).

AI Innovation Fund Awardees

Congratulations to the FY2022 Artificial Intelligence Innovation Fund awardees! These five proposals (in alphabetical order by lead PI's last name) were selected from a pool of nearly 40 applications:

- **Michael Branstetter and co-PIs Brian Spiesman, Terry Griswold and Jonathan Koch:** "BeeMachine 2.0: development of machine learning approaches to rapidly identify bee museum specimens from digital images". Dr. Branstetter is a Research Entomologist with the Pollinating Insect-Biology, Management, Systematics Research Unit in Logan, UT.
- **John Humphreys and co-PIs Guofeng Cao, Bob Srygley, and Dave Branson:** "Geospatial Artificial Intelligence (GeoAI) for spatiotemporal modeling of pest insects". Dr. Humphreys is a Research Ecologist with the NPARL Pest Management Research Unit in Sidney, MT.
- **Danielle Lemay and co-PI Hamed Pirsiavash: "Modernizing Dietary Assessment:** Adapting Deep Learning to Predict Ingredients from Food Photos". Dr. Lemay is a Research Molecular Biologist with the Western Human Nutrition Research Center, Immunity and Disease Prevention Unit in Davis, CA.

- **Yakov Pachepsky and co-PI Matthew Stocker:** "Microbial Water Quality Determinations using Machine Learning: Application and Algorithm Comparison". Dr. Pachepsky is a Soil Scientist with the Environmental Microbial and Food Safety Laboratory in Beltsville, MD.
- **Zhanyou Xu and co-PIs Jo Heuschele and Zhou Zhang:** "Putting AI technology into the hands of farmers: developing an APP to make intelligent decisions". Dr. Xu is a Research Geneticist with the Plant Science Research Unit in St. Paul, MN.

We're looking forward to sharing the results from these exciting research projects with the SCINet community!

SCINet-X Expansion Project Status

The SCINet-X initiative, launched in early 2021, aims to provide all ARS locations with high-speed connections to SCINet. The SCINet-X team is working hard to get more ARS sites connected despite a number of challenges, including significant supply chain issues. So far, SCINet-X has been deployed to pilot sites in Madison (WI), Fargo (ND), Athens (GA), Tifton (GA), New Orleans (LA), and Grand Forks (ND). Sites in Maricopa (AZ), Florence (SC), Hilo (HI), Wyndmoor (PA), and Columbia (MO) are planned to go live in late August or September. For near real-time updates on SCINet-X progress, we encourage you to check out our SCINet-X Dashboard. Finally, thank you to the ARS locations who are working with us to help make SCINet-X a success!

TRAINING

Training Opportunities

Getting Started: With the expansive list of free training available online, finding the right training to meet your learning needs can be daunting. Take the first steps in getting started with the SCINet Introductory Learning Pathway. Learn about SCINet, how to sign up for an account, and what is possible when supported by SCINet infrastructure. Then dive in with hands-on tutorials available across multiple searchable platforms to find the information you need for just in time learning.

Become a Certified Carpentries Instructor: The SCINet Office is collaborating with The Carpentries to provide Carpentries Instructor Training for ARS participants. The course dates are tentatively scheduled for 1-5 pm (EDT) October 24-27, 2022. If you are interested in taking this course, please fill out this form. If you filled out the form previously, you have already been added to the list of interested ARS scientists.

Courses by Mississippi State University: Mississippi State regularly offers Introduction to Atlas courses. Additionally, there are waiting lists available for several other courses, including an Intensive R course to help scientists with no R experience become familiar with the programming language and start performing statistical analyses in 4 days. Sign up to get notified when these courses are offered.

Coursera.org Courses Update: The SCINet Office and the AI-COE are excited to provide training opportunities through Coursera. Coursera licenses are availableto ARS scientists and support staff for training focused on scientific computing, data science,artificial intelligence, and related topics. Successful completion of courses and specializations result in widely recognized certificates and credentials. Please visit the SCINet Coursera Training Page to request a license. Licenses will be assigned on a rolling basis and are active for three months. Users may be able to extend their licenses upon request.

Training opportunities are continuously being updated on the SCINet Upcoming Training webpage. For more information on any of the above trainings, registration questions or suggestions, please email SCINet-training@usda.gov.

SUPPORT

Getting Started with SCINet is as Easy as 1,2,3

1. Request a SCINet account to get started.
2. Read the SCINet FAQs covering general info, accounts/login, software, storage, data transfer, support/policy/O&M, parallel computing, and technical issues.
3. Register for a SCINet Forum account to connect to other users, ask questions, and learn how SCINet can enable your research.

P.S. Don't forget to complete your annual security training! This is required to maintain your account.

For technical assistance with your SCINet account, please email scinet_vrsc@usda.gov.

SCINet User Tip

Did you know that you can use Juno, SCINet's long-term data storage system, even if you are not using SCINet's high-performance computing (HPC) clusters? Juno is ideal for long-term, archival storage of scientific data and related files, including:

- Original scientific data (i.e., data not already archived somewhere else)
- Final analysis results and related artifacts

Please note that Juno should not be used to store any data that includes personal identifiable information (PII), controlled unclassified information (CUI), or other sensitive information. USDA ARS scientists can get access to and space on Juno by following these steps:

1. Acquire a SCINet Account (see "Getting Started with SCINet is as Easy as 1,2,3", above)
2. Complete the storage request form to request space on Juno for your data.

Once you have storage space on Juno, you are ready to begin transferring your data to Juno. We recommend you use Globus for all file transfers to Juno. Globus provides a convenient, graphical interface that you can access from your Web browser. An instructional video, including how to transfer data using Globus, can be found here.

Do you have tips to share? Email them to SCINet-Newsletter@usda.gov to be included in future newsletters.

SCINet Corner: Third Thursdays Each Month

SCINet Corner is a VRSC moderated virtual space for people to share knowledge, discuss best practices, learn about new opportunities, and explore resources to support progress on their projects.

This reoccurring meeting occurs on the first Thursday each month. The next event is on Thursday, October 6th (1pm EST). It is recommended to join the event via Google Chrome or Firefox. In addition to meeting spaces to discuss research questions, there will be a meeting space to learn how to become a SCINet Carpentries instructor.

Register at https://forms.gle/7DcBoBvbGcjQDBP38

Have a question that just can't wait? Want to see what other users are doing? Reach out to the ever-expanding SCINet Forum community for ideas, support, or just someone to bounce ideas off of at https://forum.scinet.usda.gov/.

CONNECT

The SCINet Team

Every newsletter highlights SCINet community members as a way to connect the ARS scientific computing community. To see all the SCINet community and review past newsletters, visit the Newsletter Archive.

Dr. Deb Peters, Retired- After 24 years of distinguished service to the ARS, including serving as Acting Chief Science Information Officer (CSIO) since January of 2019, Dr. Debra Peters retired from the agency in April of 2022. As CSIO, Dr. Peters significantly expanded the scope, reach, and impact of SCINet at ARS. She established the SCINet Office, developed new initiatives that grew SCINet's user community and science applications, founded the ARS AI Center of Excellence, the SCINet and AI COE Postdoctoral Fellows Program, and helped lead numerous data- and computing-related efforts at ARS. She also co-led the development of a new research program with Mississippi State University and the development of the ARS data management guidelines. Dr. Peters' accomplishments as a research scientist at ARS are far too numerous to detail here, but they include leading the Jornada Basin Long-Term Ecological Research (LTER) program for many years, co-leading the Vesicular Stomatitis Disease Ecology Grand Challenge Program, pioneering "big data" methods and applications in landscape ecology, and founding the influential ecology journal, Ecosphere. Dr. Peters received the ARS Senior Research Scientist of the Year award in 2006, and she is a fellow of the Ecological Society of America and the American Association for the Advancement of Science. We congratulate Dr. Peters on her retirement and wish her the best in her future endeavors!

Richard (Rich) Grow- Rich started working for USDA in 2022 as Project Manager for the SCINet-X Project. Rich is a certified Project Management Professional (PMP) since 2004 and he is working towards his senior-level Federal Acquisition Certification (FAC) for Program and Project Managers. Rich is proud to have served in the U.S. Navy during the Gulf War. He has additional federal government experience working with the Departments of Interior and Energy. Rich wishes he would have found this job sooner because he enjoys the supportive environment and the opportunity to make a difference. Throughout his IT career (half of which was in the healthcare industry), he has worked as a project manager, business analyst, applications manager, ten-year program manager, escalation manager, DBA, programmer, and computer operator. Rich holds a bachelor's degree in IT management.

Contribute

Do you use SCINet for your research? We would love to share your story! Email SCINet-Newsletter@usda.gov to contribute content, ask questions, or provide feedback on the SCINet newsletter or website.

SCINet Leadership Team

Brian Stucky, Acting Chief Science Information Officer
Rob Butler, Acting SCINet Project Manager
Adam Rivers, Science Advisory Committee (SAC) Chair
Steve Kappes, Associate Administrator

Note: This newsletter is edited to comply with ARS editorial standards.

SCINet Website