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Fighting Fire with Data Science

UC San Diego brings Los Alamos researcher to campus for five-year joint appointment

The University of California San Diego has announced a joint appointment with Los Alamos National Laboratory with the appointment of Senior Scientist Rodman Linn to a five-year position with the Halicioğlu Data Science Institute (HDSI). Linn's expertise lies in solving and modeling problems involving complex thermal, mechanical and fluid dynamics systems, including wildfire behavior. This is the university's first joint appointment with a national laboratory in this area and the first joint appointment program between Los Alamos and a UC campus.



*2020 August Complex wildfire burning near Forest Glen, CA
(cr: Pacific Southwest Forest Service, USDA)*

National labs were created by the Department of Energy (DOE) in the postwar era to address large scale, complex research and development challenges with a multidisciplinary approach that places an emphasis on translating basic science to innovation—an objective that aligns well with UC San Diego's goal to transform lives and society through multidisciplinary research. The University of California is a partner in DOE's managing and operating contract for Los Alamos, a role it has had since 1943.

“Partnerships and collaborations with multiple research organizations reap widespread benefits,” says UC San Diego Chancellor Pradeep K. Khosla. “In bringing together data science expertise from the Halicioğlu Data Science Institute and thermal expertise from Los Alamos National Laboratory, we will leverage our collective skills and knowledge to develop better wildfire forecasting and modeling. Discoveries made together will help mitigate the catastrophic impacts of severe wildfires that increasingly threaten communities across the globe.”

Although interest in joint appointments between the UC-affiliated national laboratories and the UC campuses goes back decades, the establishment of the Southern Hub in 2020 helped put the pieces into place. The hub is a consortium of the five southern UC campuses and the three UC-affiliated national laboratories to create a collaborative network that will enhance research partnerships and education and support a workforce pipeline to the three laboratories.

Los Alamos leadership, including National Security Education Center Executive Advisor Alan Hurd, worked together with UC San Diego Vice Chancellor for Research Sandra A. Brown and Senior Associate Vice Chancellor Miroslav Krstic to develop a single-employer, dual-appointment model, enabling the joint appointments to proceed as seamlessly as possible.



*Los Alamos National Laboratory Senior Scientist
Rod Linn*

Linn first began talking to Ilkay Altintas, chief data science officer at San Diego Supercomputer Center (SDSC) and founding faculty fellow with HDSI in 2019. They realized that collaborative work might amplify the research they were each doing on their own.

Altintas is also the director of WIFIRE, a cyberinfrastructure platform at SDSC that integrates data systems to help monitor, predict and mitigate wildfires. Linn joins the lab as associate director of fire science for the WIFIRE program. Historically, WIFIRE has been focused on fire response and data integration to support decision-makers with real-time data models, but now they are contemplating how to use novel data models to support a more proactive approach to fire management, including prescribed burns.

Leveraging the skills and talents of HDSI students and faculty also provides a novel approach to using data science in addressing wildfires. HDSI was designed to bring together UC San Diego faculty and researchers, industry partners and other professionals, to identify problems and offer real-world solutions to address our most critical challenges.

“We are training and integrating students in our research and development efforts in areas including data management, scalable computing, deep learning for fire detection, and utility wildfire mitigation efforts,” stated Altintas. “We are also working with students and faculty to carry out our efforts across the border.”

Fighting Fire with Fire

Prescribed burns or controlled burns are a critical tool used to manage wildfires. Prescribed burns are ignited to reduce hazardous fuel loads near developed areas, manage landscapes and restore natural woodlands. In addition to clearing away fuel, prescribed fires can reduce invasive species and increase biodiversity.

Yet over the last century their use has been diminished. As a result, there is an overabundance of vegetation and dead material build-up, which acts as fuel in wildfires, often increasing the intensity and size. Now the build-up needs to be cleared and ecosystems need to be rebalanced.

To effectively control the burns and optimize their use, forest management needs to understand how fuel, land size and environmental conditions all work together in a fire and how to interpret and control the variables. This is where Altintas' and Linn's work will come together through data integration and analysis and computer modeling.

Data will also be used for staffing and resource allocations. For example, with the correct planning and computer modeling, management teams can assess wind conditions on any given day. If a burn was planned for one plot, but the wind conditions are unfavorable, resources can instead be deployed to another plot where conditions are better.

Linn noted, "Our expectation is that by helping decision-makers and prescribed-fire managers decide when, where and how to burn safely and effectively today, we can reduce the chance of catastrophic fire tomorrow."

The joint appointment between HDSI and Los Alamos is for five years with the option to renew. The university hopes to create more joint appointments with Los Alamos and other national labs in the future to accelerate research development that positively impacts society.

Vice Chancellor Brown stated, "Bringing together the brightest minds from UC San Diego and our national labs has the potential to more effectively address complex global challenges and speed discovery and innovation that can change lives around the world for the better."

Los Alamos Deputy Director John Sarrao echoed this sentiment, adding, "Collaboration between Los Alamos and UC San Diego has been the source of substantial intellectual commerce and talent development for many decades. The new joint appointment program promises to fortify that relationship."

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