

Finding the fields of the world

The dream of feeding the planet begins with mapping where food is grown

By Kelly deVos, ASU News
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What's for dinner?

The question plagues parents and household partners every night. Figuring out what to eat involves a certain amount of information. What's in the fridge? Or which restaurants are around the corner?

But the first step in sorting out how to feed *everybody* is knowing what resources are available. In the Kerner Lab, researchers are pondering those types of questions on a global scale.

[Hannah Kerner](#) is an assistant professor of computer science and engineering in the [School of Computing and Augmented Intelligence](#), part of the [Ira Fulton Schools of Engineering](#) at Arizona State University. She studies how to use artificial intelligence to analyze the vast amounts of data collected each day by the [more than 11,000 satellites](#) orbiting the Earth.

Kerner is playing a leading role in the [Fields of The World](#) project that is spearheaded by the [Taylor Geospatial Engine](#) and supported by the [Microsoft AI for Good Research Lab](#).

For the work, Kerner and her team of students are developing machine learning models that train computers to process satellite images to identify cropland or farmland and find the boundaries of individual fields.

The project will result in a set of data where every piece of cropland is defined as a polygon, or a simple geometric shape. The work is an essential step in efforts to improve global agricultural monitoring and assessments.

"With this project, there's a lot of value for both industry and research for optimization and statistics," Kerner says. "Basically, almost every aspect of agriculture benefits from having a digital version of agricultural fields."

So, the researchers are finding the fields of the world.

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Leveling the playing field

From the start, Kerner and the team knew they'd need to deal with a challenging paradox: there is so much imagery but so little of it has been analyzed to describe what has been captured. Satellites whiz overhead constantly photographing the Earth. However, there is little publicly available information about what the pictures are actually of.

"The initial available data of agricultural field boundaries covered very little of the planet," Kerner says. "Our goal is to train machine learning models on that limited set of data and learn to make predictions on the rest of the world to fill in all of these gaps."

With so little data to start, the team created an innovative AI solution. The machine learning system developed by the researchers analyzes images at multiple points in time, comparing pictures taken at the approximate planting and harvesting periods of each region. By observing the changes in the images, the AI models can identify and draw the boundaries of the fields.

The work sets the stage for future projects to specify crop types and develop better tools for assessing agricultural resources, providing information to stakeholders that helps them make the best decisions to ensure everyone gets enough to eat. The project is already having an impact: Researchers in Lebanon are using the lab's results to [estimate the country's wheat production](#) and determine if it's adequate to feed its citizens.

While the ultimate goal of the work is to promote global food security, Kerner notes that the technology has other applications, particularly in supply chain management.

The technology will help farmers more easily prove that they are following national and international rules designed to make better use of land — for example, by limiting deforestation. It will also help supply chain managers easily understand where the materials they need are being produced.

Jennifer Marcus, executive director of the Taylor Geospatial Engine, agrees that the project has many potential uses in both industry and academia.

"Our mission at the Taylor Geospatial Engine is to build bridges between cutting-edge academic research and commercial usage of innovations with a global impact," Marcus says. "Dr. Kerner's visionary research, interdisciplinary expertise and eye on impact make her an ideal choice for us as we build bridges to transform academic research into commercial capabilities."

AI for all

One of Kerner's most important goals is to use AI for broad societal benefit. For that reason, she says it's essential that the data and tools generated by the Fields of The World team be publicly accessible and available to all, including for commercial purposes — a type of use that is often restricted.

The Fields of The World research team includes [Nathan Jacobs](#), a professor of computer science and engineering at Washington University in St. Louis, and [Chris Holmes](#), an industry fellow at the Taylor Geospatial Engine, who have well-established track records in guiding open-source

geospatial data analysis projects.

“A major driving principle of the project is its open-source nature,” Kerner says. “Providing these resources breaks down boundaries and encourages community contributions.”

[Ross Maciejewski](#), director of the School of Computing and Augmented Intelligence, says Kerner’s work significantly enhances the school’s reputation as a major contributor to computer science innovation.

“The Fields of The World research being led by Hannah Kerner shows how AI can be used in really meaningful ways,” Maciejewski says. “It also provides valuable opportunities for students to engage in groundbreaking projects that shape the future of artificial intelligence.”

Caleb Robinson, principal research science manager in the Microsoft AI for Good Research Lab, is one of Kerner’s collaborators on the project. He says the aim of the work is to make sure everyone has a meal on the table at dinner time.

“The really important thing here is to improve food security for people,” Robinson says. “Better global agricultural monitoring through open, high-quality field boundary data can help progress to this end.”

About this story

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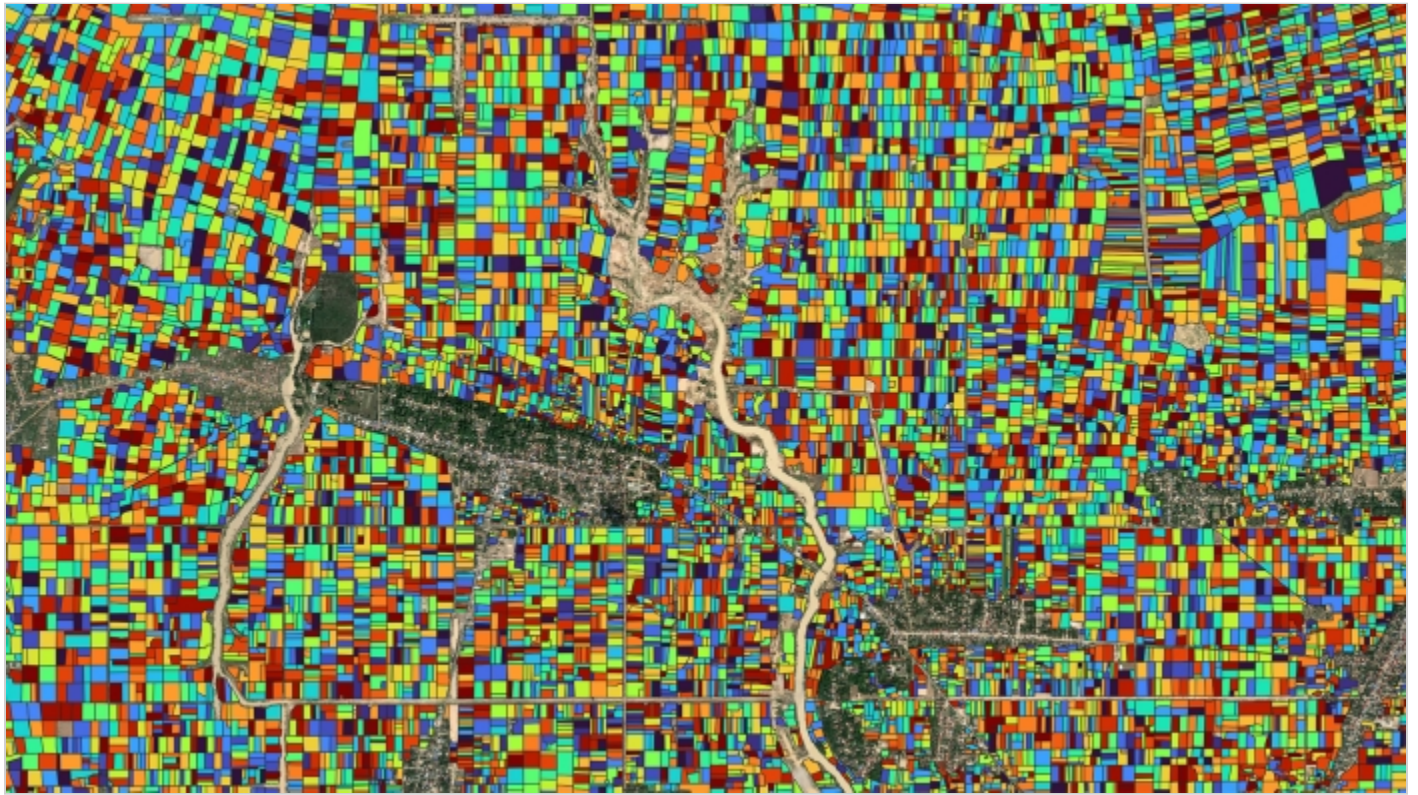
The ASU research in this article was possible only because of the longstanding agreement between the U.S. government and America’s research universities. That compact provides that universities would not only undertake the research but would also build the necessary infrastructure in exchange for grants from the government.

That agreement and all the economic and societal benefits that come from such research have recently been put at risk.

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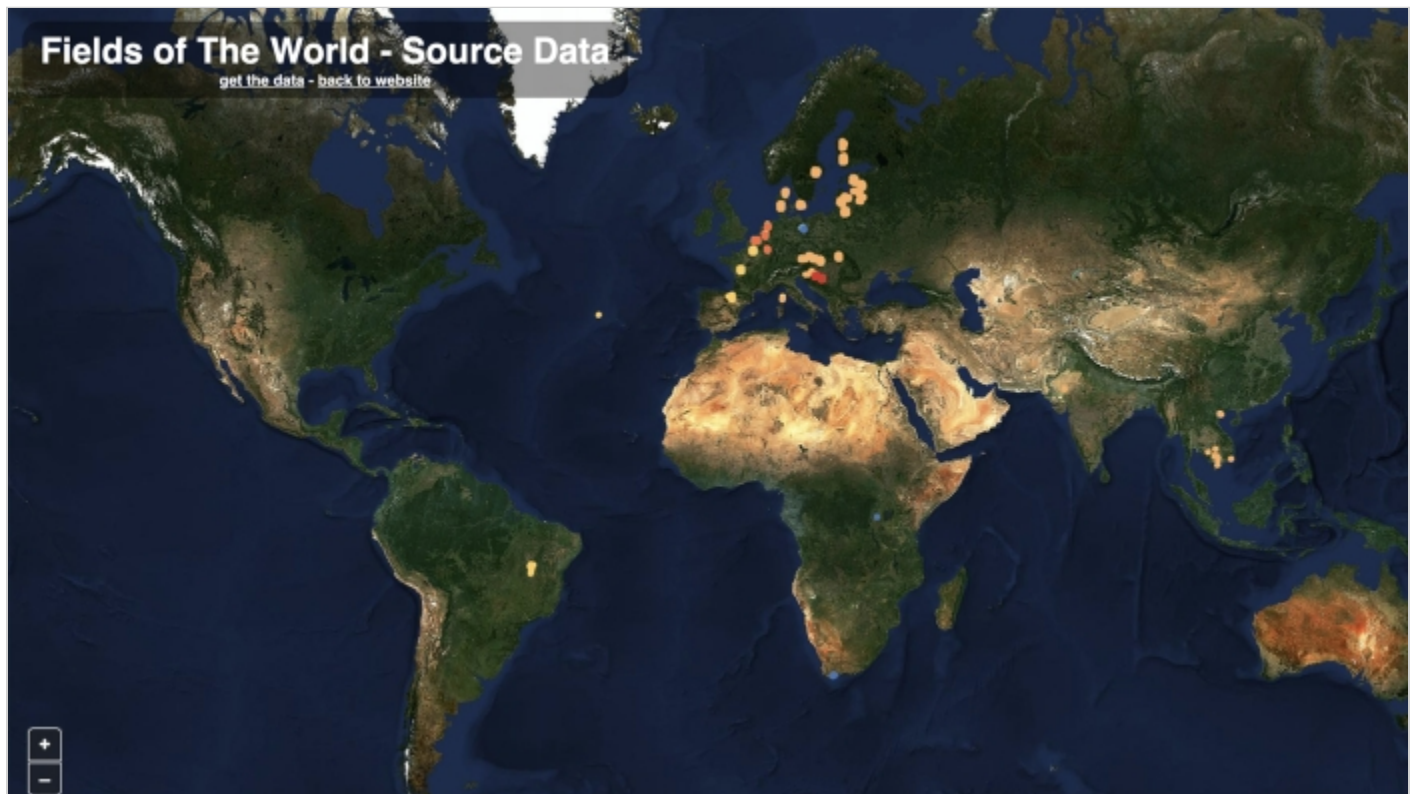
This story originally appeared on [ASU News](#).

Main image



A map generated by the Fields of The World research team illustrating cropland in rural Cambodia. In the Kerner Lab, a research group in the School of Computing and Augmented Intelligence, part of the Ira A. Fulton Schools of Engineering at Arizona State University, the team is using artificial intelligence to map the world's fields, combining satellite imagery and machine learning insights. The project aims to improve food security and provide better tools for supply chain management. Photo courtesy of Fields of The World/ASU

Text image(s)



A map showing the source data available to the Fields of The World team illustrates the daunting task of mapping all the planet's fields. The colored dots indicate the tiny portion of the Earth where data on cropland boundaries was publicly available. With this information, the team has trained machine learning models to fill in the gaps. Illustration provided by the Kerner Lab



Hannah Kerner is an assistant professor of computer science and engineering in the School of Computing and Augmented Intelligence. She leads the Kerner Lab where her team, including ASU students, study ways to use AI for social good. Photographer Samantha Chow/ASU