Microsoft

AI for Earth Grantee Profile

Mamta Sharma and ICRISAT

Plant pest prediction and farm advisory

Summary

Dr. Mamta Sharma and a team at ICRISAT are using Microsoft cloud computing and AI together with IoT sensors to help with real-time monitoring of small farms in developing countries and provide pest diagnosis and farm and market advice to farmers through an AI-supported mobile application that displays personalized prediction results and recommend actions for each farmer.

Helping solve the big challenges of small farmers

By 2050, the world population is projected to reach 9.7 billion, thirty-three percent higher than it is today. Much of this growth will happen in developing countries where food is produced by small farms with less than two hectares—roughly the size of two sports fields. Small farmers make up one-third of the world's population and produce more than seventy percent of all food consumed worldwide.

Yet, small farms often struggle with low crop yields, compared to larger, industrial farming organizations in more developed parts of the world. Crop destruction from pests is one of the primary reasons for the discrepancy. However, crop protection is costly. Large farming organizations in more developed countries benefit from resources—such as subsidies and cutting-edge agricultural research—that aren't accessible to many small farmers. Because small farms are critical to the sustainable growth of the worldwide population, it's critical to reduce pest-driven crop destruction.

> In the developing world, 40-50 percent of all crop yields are lost to pests, crop diseases, or post-harvest losses, compared to 20-25 percent in the US. (USDA)

Concurrently, pest forecasting models are becoming increasingly significant for strategic planning, such as farm decisions, resistance breeding, climate smart crops, sustainable development in future climate scenarios, and policy making. These prediction models rely on variables such as weather conditions, native pests, and crop information to provide accurate predictions. Additionally, the context of specific crop systems and

environments—such as agro-climatic regions, specific cropping seasons, cropping methods used, soil type—all affect the accuracy of the models. Accurate, relevant pest prediction modeling and farm advisory is cumbersome and difficult to deliver directly to farmers.

While many pest prediction models already exist today, most are based on simpler statistical models that pull probabilities from historical weather, insect, temperature, and rainfall data. This often results in inaccurate predictions for smallholder farmers because they don't account for current conditions.

Bringing agro-tech to small farms

Better data means more accurate models. However, while industrial farmers often have the resources to implement today's agro-tech innovation—such as IoT devices, personnel to manage resources, and access to experts—smallholder farmers do not. Dr. Sharma and the team at the International Crops Research Institute for Semi-Arid Topics (ICRISAT) are using the latest advancements in AI and cloud computing to bring pest and disease prediction modeling and farm advisory to smallholder farmers without the cost and resources typically incurred by industrial farmers, and deliver them in a user-friendly mobile application.

Using their Microsoft AI for Earth grant, the team is enhancing current historical data-based models with real-time weather conditions and geographical information, resulting in remote pest modelling that is significantly more accurate and reliable, at a much larger scale.

> "Nearly all the farmers I've met have an internet-enabled smartphone now. With Microsoft's cloud storage and predictive analytics tools, we can help these farmers pre-empt pest attacks and preserve their farms." - Dr. Mamta Sharma

The advanced machine learning capabilities built into Microsoft Azure, such as artificial neural networks, support vector machines, and Bayesian networks, will enable the models to more accurately predict the impact of current weather conditions from the satellite imagery. And by running the results through the ESRI ArcGIS Pro mapping platform, the team will be able to visualize model results, delivering pest advisories in a more user-friendly method.

Accurate predictions will only be useful if farmers have access to the results fast enough to act. To ensure smallholder farmers have access to information in time, the team is also planning to link this with AI-supported mobile application that displays personalized prediction results and recommended actions for each farmer. Using a cloud hosted service and Cortana Intelligence Services, the mobile app will pull together important information like prediction results, crop selection for their location, cropping season and time, plant production and protection, processing, storage, and market to deliver personalized results and recommendations for farmers.

Going forward

Currently, research is focused on enhancing the pest predication models to include current weather conditions and overlay the results with ESRI ArcGIS Pro. The team then plans to validate the model starting with primary pests and diseases for two to three crops in specific regions for a couple of seasons. Once the initial validation is complete, the team hopes to get started on the decision-support app for farmers. With growing demands on the world's food supply chain, it's crucial to maximize agriculture resources in a sustainable manner. Dr. Sharma and her team hope to use AI, cloud computing, IoT sensors, and cognitive services to help with real-time monitoring of farms and provide pest diagnosis and farm and market advice to farmers.

About Dr. Mamta Sharma and ICRISAT

Dr. Mamta Sharma is a principal scientist and theme leader for integrated crop management at the International Crops Research Institute for the Semi-Arid Topics (ICRISAT), where she is researching how to address the emerging and alarming diseases affecting today's agriculture. ICRISAT is an international nonprofit organization that conducts agricultural research to help reduce poverty, hunger, malnutrition, and environmental degradation in the dryland tropics.

Resources

Websites

ICRISAT
Microsoft AI for Earth
Microsoft environmental sustainability

Press

Does AI Hold the Key to a New and Improved 'Green Revolution' in Agriculture