New AI app predicts climate change stress for farmers in Africa

September 23 2019

PlantVillage Nuru may help African farmers protect their staple crops -- such as maize, cassava and beans -- in the face of climate warming. Credit: David Hughes, Penn State

A new artificial intelligence (AI) tool available for free in a smartphone app can predict near-term crop productivity for farmers in Africa and may help them protect their staple crops—such as maize, cassava and beans—in the face of climate warming, according to Penn State

researchers. The team will unveil the new tool—which will work with their existing AI assistant, called "PlantVillage Nuru"—to coincide with the United Nations Climate Action Summit to be held today (Sept. 23) at the U.N. Headquarters in New York City.

"Hundreds of millions of African farmers are already suffering from the effects of climate change," said David Hughes, associate professor of entomology and biology. "For example, earlier this year, which has been the hottest year on record, Mozambique was hit with two cyclones, both among the strongest ever recorded in East Africa. They caused almost $1 billion in damages and destroyed nearly 80 percent of staple crops throughout the region. They also changed rainfall patterns across East Africa, which further affected the crops."

Hughes added that the majority of these farmers remain unprepared for the climate change impacts that are yet to come. For instance, many of the more than 95 percent of African farmers who rely solely on rain to irrigate their crops will be unable to deal with the increasing drought conditions that are expected, he said.

PlantVillage Nuru is an existing AI assistant that is being used across Africa to diagnose crop diseases. The researchers have rigorously tested the performance of their machine-learning models with locally sourced smartphones in the typical high light and temperature settings of an African farm. In these tests, the app was shown to be twice as good as human experts at making accurate diagnoses, and it increased the ability of farmers to discover problems on their own farms.

Now PlantVillage Nuru can draw in data from the United Nations' WaPOR (Water Productivity through Open access of Remotely sensed derived data) portal, a database that integrates 10 years' worth of satellite-derived data from NASA and computes relevant metrics for crop productivity given the available water. PlantVillage Nuru also

incorporates weather forecast data, a soil dataset for Africa, and the United Nations Crop Calendar, which is a series of algorithms on adaptive measures that can be taken under certain conditions. The PlantVillage AI tool incorporates tens of thousands of data points across Africa with hundreds more being collected every day All of these data are freely available to the global community, who can work collectively to improve the AI.

Specifically, the AI assistant has the opportunity to integrate diverse data streams to provide information about drought tolerance of crops and which [crops](#) are suitable in which areas, for example. In addition, the app offers advice that could help farmers learn about crop varieties that are climate-resilient, affordable irrigation methods, and flood mitigation and soil conservation strategies, among other [best practices](#).

Although the tool is smartphone based, it can be accessed through a webpage to inform diverse stakeholders. In Kenya, the PlantVillage AI tool informs messages that are then sent out to SMS phones across the country. According to Hughes, the team hopes that over time and with the right support, it will be able to extend that service to all of Africa, potentially helping millions of farmers prepare for climate warming.

"Our goal is to nudge behavioral changes that will help farmers prepare their farms to be climate ready," said Hughes. "There are proactive behaviors, such as planting for increased crop diversity, promoting soil moisture conservation and engaging in water harvesting, that are known to increase resiliency. Our AI tool is in the early stages, but it will get better over time and with more training. We are releasing it now so we can kick-start the necessary collaboration we need to help African farmers adapt to [climate](#) change. As the African proverb says: 'If you want to go fast, go alone. If you want to go far, go together.' Climate change means we must act together to help those most in need."