IIT Mandi shows the way to detect disease in Potato Crops using the Photograph of its Leaves

> ➢ _The computer application developed by the researchers using a complex computational model can detect blight in potato leaf images_
> ➢ _The team is working on converting the developed tool to a smartphone application for a more practical usage_

Video Link: https://fromsmash.com/Dr-Srikant-Srinivasan-Research-Video-Bytes

MANDI, 12th July 2021: Scientists from the Indian Institute of Technology (IIT) Mandi, have developed a computational model for automated disease detection in potato crops using photographs of its leaves. The research led by Dr. Srikant Srinivasan, Associate Professor, School of Computing and Electrical Engineering, IIT Mandi, in collaboration with the Central Potato Research Institute, Shimla, uses Artificial Intelligence (AI) techniques to highlight the diseased portions of the leaf.

Funded by the Department of Biotechnology, Govt. of India, the results of this research have recently been published in the journal _Plant Phenomics_, in a paper co-authored by Dr. Srikant Srinivasan, and Dr. Shyam K. Masakapalli along with research scholars, Mr. Joe Johnson, and Ms. Geetanjali Sharma, from IIT Mandi, and Dr. Vijay Kumar Dua, Dr. Sanjeev Sharma, and Dr. Jagdev Sharma, from Central Potato Research Institute, Shimla.

Potatoes, in the history of the world, have been the cause of the world's great famine of the mid-nineteenth century that killed over a million people in Ireland and rang the death knell for the Irish language. The reason? Potato Blight.

The Blight is a common disease of the potato plant, that starts as uneven light green lesions near the tip and the margins of the leaf and then spreads into large brown to purplish-black necrotic patches that eventually leads to rotting of the plant. If left undetected and unchecked, blight could destroy the entire crop within a week under conducive conditions.

"In India, as with most developing countries, the detection and identification of blight are performed manually by trained personnel who scout the field and visually inspect potato foliage," **explained Dr. Srinivasan.** This process, as expected, is tedious and often impractical, especially for remote areas, because it requires the expertise of a horticultural specialist who may not be physically accessible.

"Automated disease detection can help in this regard and given the extensive proliferation of the mobile phones across the country, the smartphone could be a useful tool in this regard," **said Mr. Joe Johnson, Research Scholar, IIT Mandi, while highlighting the practical usage of his research.** The advanced HD cameras, better computing power and communication avenues offered by smartphones offer a promising platform for automated disease detection in crops, which can save time and help in the timely management of diseases, in cases of outbreaks.

The computational tool developed by the IIT Mandi scientists can detect blight in potato leaf images. The model is built using an AI tool called mask region-based convolutional neural network architecture and can accurately highlight the diseased portions of the leaf amid a complex background of plant and soil matter.

In order to develop a robust model, healthy and diseased leaf data were collected from fields across Punjab, U.P and Himachal Pradesh. It was important that the model developed should have portability across the nation.

"Analysis of the detection performance indicates an overall precision of 98% on leaf images in field environments," **said Dr Srinivasan.**

Even though potato is not a staple food in most regions of the world, it is a cash crop, and failure in it can have disastrous consequences, particularly to farmers with marginal landholding. Thus, early detection of blight is important to prevent financial catastrophe to the farmer and the country's economy.

Following this success, the team is sizing down the model to a few tens of megabytes so that it can be hosted on a smartphone as an application. With this, when the farmer will photograph the leaf which appears unhealthy, the application will confirm in real-time

if the leaf is infected or not. With this timely knowledge, the farmer would know exactly when to spray the field, saving his produce and minimising costs associated with unnecessary use of fungicides.

"The model is being refined as more states are covered," **added Dr. Srinivasan** and highlighted that it would be deployed as part of the FarmerZone app that will be available to potato farmers for free.

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About IT Mandi

Since the first batch of 97 students joined in July 2009, IIT Mandi has grown to currently host 125 faculty and 1,833 students who are enrolled in various programmes of studies in undergraduate, postgraduate and research programmes, and 1516 alumni. IIT Mandi is a fully residential campus with 1.4 lakh sq. m. buildings completed. It has a guest house with 88 rooms, a 750-seater Auditorium, campus school, sports complex and hospital.

IIT Mandi has four Academic Schools and three major Research Centers. The Schools are: School of Computing and Electrical Engineering, School of Basic Sciences, School of Engineering, and School of Humanities and Social Sciences. The Centers are: Advanced Materials Research Centre (AMRC; set up with an investment of Rs. 60 crores), Centre for Design and Fabrication of Electrical Devices (C4DFED; has Rs. 50 crores worth of fabrication tools), and BioX Centre (has acquired research equipment worth Rs. 15 crores). In 2017, the Department of Biotechnology, Government of India, selected IIT Mandi to lead the prestigious Rs. 10 crore FarmerZone® Project.

To cater to the growing and changing needs of the Indian industry and the aspirations of students, IIT Mandi has introduced 7 B.Tech., 7 M.Tech., 5 M.Sc., 4 Ph.D., 1 I-Ph.D and 1 M.A programmes in the past 10 years. The unique, project-oriented B.Tech. curriculum is centred around its 4-year long Design and Innovation stream. From August 2019, IIT Mandi started 3 new and unique B. Tech. programmes in Data Science and Engineering, Engineering Physics, and Dual Degree in Bioengineering.

Since the inception of the Institute, IIT Mandi faculty have been involved in over 275 Research and Development (R&D) projects worth more than Rs. 120 crore. In the past 10 years, the Institute has signed a Memorandum of Understanding (MoU) with 11 international and 12 national universities.

IIT Mandi Catalyst, the first Technology Business Incubator in Himachal Pradesh, has helped over 75 startups since 2017 and is changing both the industry profile and entrepreneurial mindset in

the state. So far, Catalyst has secured external funding of Rs. 24 crores from various funding agencies. Enabling Women of Kamand Valley (EWOK) is another innovative programme run by IIT Mandi, which focuses on imparting skills training to rural women to start village-scale businesses.

Recently, IIT Mandi set up the IIT Mandi iHub and HCI Foundation (iHub; a section-8 company) on its campus at Kamand with significant funding of INR 110 crores from the Department of Science and Technology (DST), Government of India. The iHub is planned to fuel research and technology development, skill development, startup and innovation, and collaborations in the HCI and allied AI/ML areas in India. The iHub and its activities were inaugurated by the honorable Chief Minister of Himachal Pradesh, Shri Jai Ram Thakur, on IIT Mandi's 12th Foundation Day on 24th February 2021.

IIT Mandi has been ranked no. 31 in the Engineering Institutions Category in the India Rankings 2020 released by National Institutional Ranking Framework, Ministry of Education, Govt. of India. Apart from this, IIT Mandi is the only second-generation IIT to be featured at rank no. 7 in the Atal Ranking of Institutions on Innovation Achievements of the Innovation Cell, Ministry of Education, Govt. of India.

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