Photonics: New spectral camera uses AI to boost farm yields by 20%

A team of EU scientists is developing a new advanced camera that uses photonics to reveal what the eye cannot see. This innovative system is being developed to transform various industries, including vertical farming. It will allow farmers growing crops like salads, herbs, and microgreens to detect plant diseases early, monitor crop health with precision, and optimise harvest times - boosting yields by up to 20%.

A new European consortium funded under the Photonics Partnership is developing a new imaging platform that ensures everything from crops to factory products is of the highest quality by detecting things humans simply cannot.

Called 'HyperImage', the project aims to revolutionise quality assurance and operational efficiency across different sectors. This high-tech imaging system uses AI machine learning algorithms to identify objects for more precise decision-making.

The system can be used to reduce farming costs, produce less waste, and generate up to 20% more yields than traditional methods.

Sight Beyond Sight

Hyperspectral imaging is a clever way of revealing what the human eye cannot see. Unlike regular cameras that capture just red, green, and blue, hyperspectral cameras capture hundreds of different wavelengths of light (from infrared up to ultraviolet light) called the spectral dimension.

Scientists can then analyse this spectral data in real-time with AI to classify different objects and materials, instantly and unequivocally spotting things like paint, pollutants, or diseases in crops.

Alexander Kabardiadi-Virkovski, head of the HyperImage project at Fraunhofer IWS, explains: "The integration of hyperspectral cameras into autonomous systems represents a significant advancement in both technology and application. This imaging technique promises to enhance productivity and sustainability in industry and agriculture.

Although hyperspectral imaging has existed since the 1980s, it has never been used in real-time with artificial intelligence for the applications the HyperImage team is now exploring.

"Our new system is being developed for automated vertical farming but is simultaneously being used to improve quality control, navigation in off-road autonomous driving, and vision systems for unmanned geo-surveillance drones.

"The innovative HyperImage approach will enable autonomous vehicles to perform detailed landscape analysis and make informed decisions regarding passability in outdoor environments. By standardising hyperspectral data across different camera manufacturers, we aim to create a universal solution for object recognition and quality control."

Geo Surveillance Drones

The HyperImage team is working to improve the efficiency of a string of other use cases, including for surveillance drones.

The photonic components and spectral imaging technology deployed in the HyperImage platform will eventually enable UAVs to perform longer missions with greater energy efficiency and improved operational effectiveness in surveillance and monitoring.

"Tasks that use UAVs, like environmental monitoring, infrastructure inspection, disaster management, and agricultural surveys, could all be improved by the HyperImage system. By using hyperspectral imaging, drones will be able to capture detailed data across several different wavelengths, allowing them to detect subtle changes in vegetation, identify materials, or monitor the integrity of infrastructure with much better precision than traditional sensors," Kabardiadi-Virkovski said.

The team is working on a 10% reduction in drone weight (in the 25 kg maximum take-off weight class) by developing a lightweight, high-resolution hyperspectral vision system. This weight reduction creates additional space for a larger battery, which in turn boosts flight time by 50%.

The project, which will conclude in 2027, is funded by the European Union and brings together a consortium of twelve partners from industry and academia, which include 4K-MEMS, AMIRES, DIVE imaging systems GmbH, Growy, Infineon Technologies Bipolar, KETMarket GmbH, Netcompany-Intrasoft, Norsk Elektro Optikk AS, Optotune, Robotnik Automation, SILIOS Technologies, Stichting Wageningen Research, HySpex.