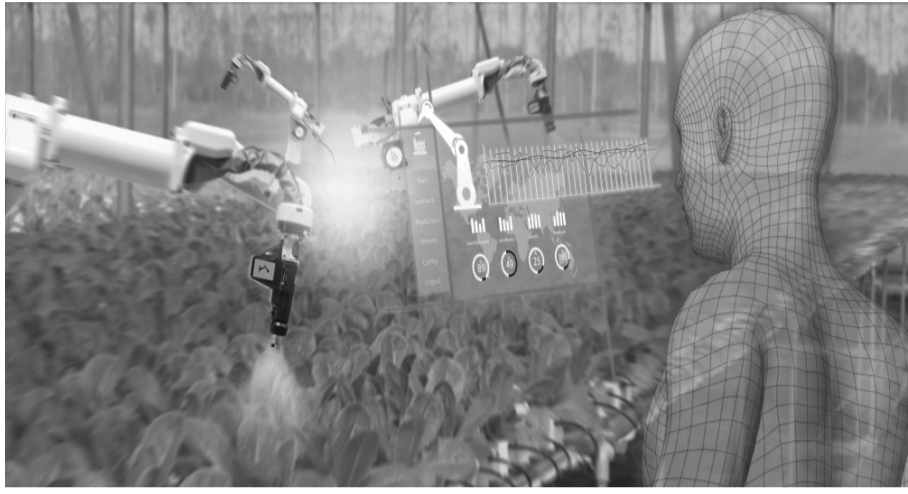# IT matters

AI-based robots deployed to boost agri output

Tokyo: Smart agriculture is increasingly being employed in Japan, arousing expectations that producers will be able to entrust artificial intelligence with more labor-intensive tasks to alleviate severe manpower shortages.

Large-scale greenhouse farmers are leading the way, having begun to use AI-equipped robots developed by venture businesses in ways that seem, more or less, to change the future shape of cultivating and harvesting agricultural products.

In September, a four-wheeled AI robot slowly rolled through the lush green leaves of a plastic greenhouse at a farm in Hanyu, Saitama

Prefecture, eastern Japan, gathering only the ripest cucumbers.

"We were initially afraid that the robot might cut off the cucumber stems, but it moves accurately," said Takeshi Yoshida, head of the farm called Takamiya No Aisai. "We expect much out of the robot now that labor is in such short supply."

The firm is operated by a subsidiary of Takamiya Co, which manages agricultural greenhouses and other facilities, while the robot was developed by startup Agrist Inc. and uses a camera and AI to determine if it is the right time to harvest crops.

The farm leased the automated cucumber

harvester from Agrist, which has been developing harvesting robots since its founding in 2019 in the southwestern Japan prefecture of Miyazaki.

The robot checks the size of cucumbers based on images it captures from a camera mounted on the robot, recognizing ripe ones and cutting off one to three spheres roughly every two minutes before placing them in a case.

The robot also accurately positions its arm vis-a-vis cucumbers so as to avoid damaging their stems.

The startup hopes that, with more success, other farms will adopt systems of this kind.

Inaho Inc., an agricultural venture company in Kamakura,

Kanagawa Prefecture, near Tokyo, has leased an AI-equipped robot to a farm in the Netherlands. It can automatically pick cherry tomatoes in bunches or individually, depending on the mechanism employed.

As tomatoes bunch around the leaves and

stems, harvesting robots require a complicated mechanism, making it costly when developing ones that can carry out the entire process.

Inaho has therefore developed a robot that reaps some 40 percent of matured tomatoes at night and leaves the rest

for harvesting by humans during the daytime.

Starting with the Netherlands, which is an agri-food powerhouse, Inaho hopes to export its smart agriculture technology around the world.

It is pertinent to note that the United

How is AI used in farming?
AI algorithms can analyze the chemical composition of soil samples to determine which nutrients may be lacking. AI can also identify or even predict crop diseases. AI in irrigation is useful for identifying optimal patterns and nutrient application times, while predicting the optimal mix of agronomic products

AI driven India soon
AI can help detect field boundaries and bodies of water to enable sustainable farming practices, improve crop yields, and support India's 1.4 billion people and the rest of the world.

Examples of artificial intelligence on farms include self-driving tractors and combine harvesters, robot swarms for crop inspection and autonomous sprayers
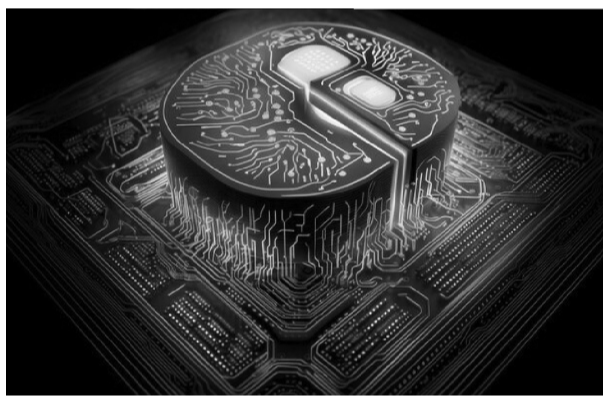
Brazil, one of the world's largest agricultural producers, is also adopting AI in its agriculture sector. The country is using AI to monitor crops, manage resources, and predict yields. Companies like Strider, a Brazilian AgTech company, are using AI to help farmers manage pests and diseases.

States and China remain at the forefront of AI investment, with the former leading overall

since 2013 with nearly $250 billion invested in 4,643 companies cumulatively

Hardware key to success of neuromorphic computing

Technology is edging closer and closer to the super-speed world of computing with artificial intelligence. But is the world equipped with the proper hardware to be able to handle the workload of new AI technological breakthroughs?

"The brain-inspired codes of the AI revolution are largely being run on conventional silicon computer architectures which were not designed for it," explains Erica Carlson, 150th Anniversary Professor of Physics and Astronomy at Purdue University.

A joint effort between Physicists from Purdue University, University of California San Diego (USCD) and École Supérieure de Physique et de Chimie Industrielles (ESPCI) in Paris, France, believe they may have discovered a way to rework the hardware.... By mimicking the synapses of the human brain. They recently published their findings "Spatially Distributed Ramp Reversal Memory in VO2".

New paradigms in hardware will be necessary to handle the complexity of tomorrow's computational advances. According to Carlson, lead

theoretical scientist of this research, "neuromorphic architectures hold promise for lower energy consumption processors, enhanced computation, fundamentally different computational modes, native learning and enhanced pattern recognition."

Neuromorphic architecture basically boils down to computer chips mimicking brain behavior. Neurons are cells in the brain that transmit information. Neurons have small gaps at their ends that allow signals to pass from one neuron to the next which are called synapses. In biological brains, these synapses encode memory. This team of scientists concludes that vanadium oxides show tremendous promise for neuromorphic computing because they can be used to make

both artificial neurons and synapses.

"The dissonance between hardware and software is the origin of the enormously high energy cost of training, for example, large language models like ChatGPT," explains Carlson. "By contrast, neuromorphic architectures hold promise for lower energy consumption by mimicking the basic components of a brain: neurons and synapses. Whereas silicon is good at memory storage, the material does not easily lend itself to neuron-like behavior. Ultimately, to provide efficient, feasible neuromorphic hardware solutions requires research into materials with radically different behavior from silicon -- ones that can naturally mimic synapses and neurons. Unfortunately,

the competing design needs of artificial synapses and neurons mean that most materials that make good synaptors fail as neuristors, and vice versa. Only a handful of materials, most of them quantum materials, have the demonstrated ability to do both."

The team relied on a recently discovered type of non-volatile memory which is driven by repeated partial temperature cycling through the insulator-to-metal transition. This memory was discovered in vanadium oxides.

Alexandre Zimmers, lead experimental scientist from Sorbonne University and École Supérieure de Physique et de Chimie Industrielles, Paris, explains, "Only a few quantum materials are good candidates for future neuromorphic devices, i.e., mimicking artificial synapses and neurons. For the first time, in one of them, vanadium dioxide, we can see optically what is changing in the material as it operates as an artificial synapse. We find that memory accumulates throughout the entirety of the sample, opening new opportunities on how and where to control this property."

"The microscopic videos show that, surprisingly, the repeated advance and retreat of metal and insulator domains causes memory to be accumulated throughout the entirety of

the sample, rather than only at the boundaries of domains," explains Carlson. "The memory appears as shifts in the local temperature at which the material transitions from insulator to metal upon heating, or from metal to insulator upon cooling. We propose that these changes in the local transition temperature accumulate due to the preferential diffusion of point defects into the metallic domains that are interwoven through the insulator as the material is cycled partway through the transition."