

Artificial intelligence applications in sugarcane

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Today doubling the farmers' income is a major issue at national level. Sugarcane is an industrial crop. Now-a-days it is treated as energy crop and through intercropping, farm mechanization and with the intervention of Artificial Intelligence, a major breakthrough can be achieved in doubling farmer's income.

Key words: App, Artificial intelligence, Drone, Robotics, Sugarcane

ARTIFICIAL Intelligence (AI) is a branch of Science which deals with helping machines find solutions to complex problems in a more human-like fashion. It generally involves borrowing characteristics from human intelligence, and applying them as algorithms in a computer friendly way. A more or less flexible or efficient approach can be taken depending on the requirements established, which influences how artificial the intelligent behavior appears. Artificial intelligence is a new electronic machine that stores large amount of information and process it at a very high speed.

Application of AI in sugarcane

Artificial intelligence software is being developed by many countries to support decision-making by sugar mill operators. It will provide predictive decision support by working with current operators and sugar mill systems. This may help in improving sugar productivity and quality, reduction of production costs, increasing equipment utilization and improving the decision making process undertaken by factory staff within the sugar mill crystallization stage and fugal operational areas.

At present in India, in Andhra Pradesh, Microsoft Corporation is

working with farmers and rendering farm advisory services using Machine Learning and Power BI, which enables in transforming the data into Intelligent Actions. This pilot project makes use of an AI based sowing application which recommends sowing date, preparation of cultivable land, fertigation based on soil analysis, FYM requirement and application, seed treatment and selection, optimization of sowing depth suggestions to the farmers which had resulted in 30% increase in the average crop yield per ha. AI models can also be employed in recognizing optimal sowing period in various seasons, statistical climatic data, real time Moisture Adequacy Data (MAI) from daily rainfall statistics and soil moisture to construct forecast charts and also carter inputs on best sowing time to farmers.

Forecasting potential pest attacks

Microsoft in collaboration with United Phosphorus Limited is developing a Pest Risk Prediction Application Programming Interface (API) that has a strategic advantage of AI and machine learning to signal in advance, the potential chances of pest attack. Grounded on the weather conditions, growth stage of the crop in field, pest attacks are forecast as high, medium or low.

Here are some major ways that AI may be explored in the sugarcane industry.

Robotics

Robots are capable of harvesting crops at a much faster pace and higher volume than human workers. The robots are designed to assist in picking and packing crops while also combating other challenges within the agricultural labour force. Additionally, agricultural robots have the ability to protect crops from harmful weeds that may be resistant to herbicide chemicals that are meant to eliminate them.

Image-based insight generation

Precision farming is one of the most discussed areas in farming today. Drone-based images can help in in-depth field analysis, crop monitoring, scanning of fields and so on. Computer vision technology, IoT (Internet of Things) and drone data can be combined to ensure rapid actions by farmers. Feeds from drone image data can generate alerts in real time to accelerate precision farming. Some companies have implemented IBM Watson IoT Platform and the Visual Recognition APIs in commercial drones for image analysis in real time. Computer vision technology may be applied in — detection of insect pest, diseases and

nutrient deficiency, varietal identification, field survey, crop maturity identification and application of harvest scheduling, field management, identifying areas where crops require water, fertilizer or pesticides. This helps in resource optimization to a huge extent, based on multiple parameters like soil condition, weather forecast, type of seeds, and infestation in a certain area and so on, cognitive solutions make recommendations to farmers on the best choice of crops and seeds.

Health monitoring of crops

Remote sensing techniques along with hyper spectral imaging and 3-D laser scanning are essential to build crop metrics across thousands of acres. It has the potential to bring in a revolutionary change in terms of how farmlands are monitored by farmers both from time and effort perspective. This technology will also be used to monitor crops along with their entire lifecycle including report generation in case of anomalies.

Automation techniques in irrigation

In terms of human intensive processes in farming, irrigation is one such process. Machines trained on historical weather pattern, soil quality and kind of crops to be grown, can automate irrigation and increase overall yield. With close to 70% of the world's freshwater being used in irrigation, automation can help farmers better manage their water problems.

Drone based technology

One of the most important and promising areas is agriculture, where drones have efficiency to address major challenges. Drone technology is giving agriculture a high-tech makeover. By producing precise 3-D maps for early soil analysis, drones can play a role in planning. Here are six ways drones will be used throughout the crop cycle.

- **Soil and field analysis:** It plays important role in seed planting and gathering data for managing irrigation and nitrogen levels in the field.
- **Planting:** These systems increase number of shoots with proper

growth and nutrients into the soil, providing all the nutrients necessary for growing crops.

- **Crop spraying:** Drones are able to scan the ground, spraying in real time for even coverage. The result of aerial spraying is five times faster with drones than traditional equipment.
- **Crop monitoring:** Crop monitoring is a huge obstacle in sugarcane agro ecosystem. With the help of drones, time-series animations can show the development of a crop and reveal production inefficiencies, enabling better management.
- **Irrigation:** Sensor drones can easily identify which parts of a field are dry or need improvement.
- **Health assessment:** By scanning of the crop using both visible and near-infrared light, drone-carried devices can help track changes in plants and indicate their health and alert farmers about pests/disease.

Recently used AI technologies in agriculture

- **Blue River technology:** Founded in 2011. This California-based startup combines artificial intelligence, computer vision and robotics to build next-generation agricultural equipment that reduces chemicals and saves costs. The use of sensors that detect weeds, the type of weeds and the right herbicides to apply within the right buffer around the plant.
- **Farm Bot:** Founded in 2011. This company has taken precision farming to a different level by enabling environment conscious people with precision farming technology to grow crops at their own place. The product, FarmBot comes at a price of \$4000 and helps the owner to do end-to-end farming all by himself. Ranging from seed plantation to weed detection and soil testing to watering of plants, everything is taken care of by this physical bot using an open source software system.
- **Harvest CROO Robotics – Crop Harvesting:** Harvest CROO

Robotics has developed a robot to help strawberry farmers pick and pack their crops. Lack of labourers has reportedly led to millions of dollars of revenue losses in key farming regions such as California and Arizona. The robot picks up strawberries, helping farmers reduce the cost of harvest labour.

- **Plant diseases diagnosis app - Plantix:** The Berlin-based agricultural tech startup PEAT developed the Plantix app that identifies potential defects and nutrient deficiencies in soil. The app uses images to detect plant diseases, a smartphone collects image which is matched with a server image and then a diagnosis of the plant health is provided. In this way the application uses AI and machine learning to solve the plant pests/diseases.
- **Prospera:** Founded in 2014. This Israeli startup has revolutionized the way farming is done. It has developed a cloud-based solution that aggregates all existing data that farmers have like soil/water sensors, aerial images and so on.

Conclusion

AI technologies help farmers to analyse land/soil/health of crop etc. and save time and allow farmers to grow right crop in each season that has best yield. Vertical cropping can reduce water usage, make efficient land usage. It can reduce the problems with labour unavailability. Allows prediction of next year crop seasons/weather/climate/rainfall etc. AI based predictions enable suggesting appropriate pesticides/crops/place at right time before large scale incidence of diseases. With a huge space still untouched in agriculture for the intrusion of automatic response systems, there is a vast opportunity for the sugar industry to leverage emerging technology of catboats for assisting farmers with the answers to all their queries and giving relevant advice and recommendations to their specific farm related problems.

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