The Intersection of AI in Agriculture: Transforming the future of Farming in African.

Agriculture in Africa is confronted with a range of challenges that are complex and interlinked, often exacerbated by socio-economic and environmental issues.

S **by Sebastian Obeta**

Objectives

- Is AI essential in Agriculture, or Just another Buzzword?
- What are the top key challenges that faces Agriculture in African?
- What are the top 3 challenges that faces Farmers in African?
- AI technologies that can be deployed in Agriculture in Africa.
- Different Branches of Agriculture where it can be deployed with practical or examples where it has be deployed in the world.
- The risk of using AI technology in Agriculture
- Question and Answers

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Is AI essential in Agriculture, or Just another Buzzword?

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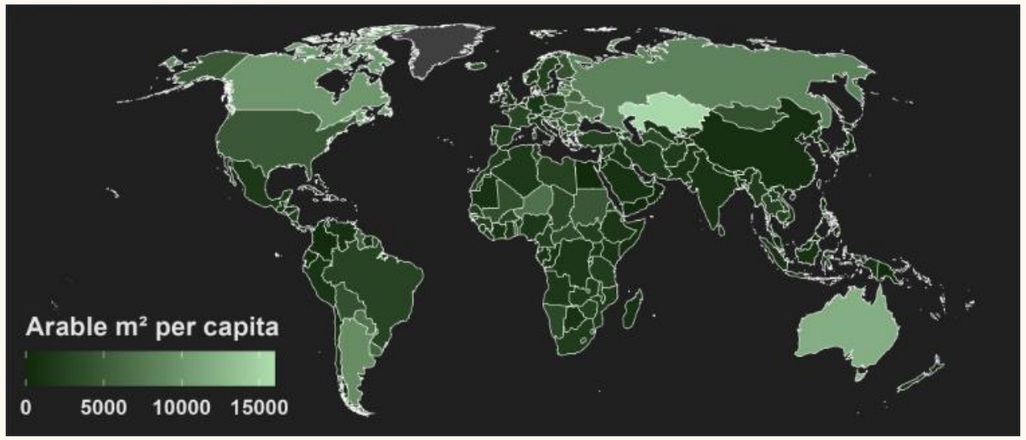
Introduction



Interesting Statistics

- Africa possesses 60 percent of the world's undeveloped arable land.
- The agricultural sector contributes to 35 percent of Africa's GDP and provides employment to more Africans than any other sector.

Ref- https://www.whitecase.com/insight-our-thinking/africa-focus-summer-2023-africas-agricultural-revolution

Big question

- Why does Africa allocate an astonishing $78 billion in limited foreign currency each year to import food, with countries like **Zimbabwe, Guinea**, and **Sudan** spending over 100 percent of their annual foreign currency earnings on these imports?
- In 2020, over 20 percent of Africans experienced hunger, a rate that was double that of any other region globally.
- Why is it that approximately 80 percent of the continent's food supply still comes from small-scale farmers, many still practicing subsistence agriculture?

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Challenges of Agriculture in Africa

- **Rapidly growing cities and an increasing rural population to feed.**

Decline in Rural Population Population Proportion:

- In 1990, 72% of the population in sub-Saharan Africa resided in rural areas.
- By 2021, this figure had dropped to 58%.

Magnitude of Rural Population Increased:

- Although the percentage of rural residents has declined, the actual number of people living in rural areas has risen.
- In 1990, rural areas were home to 374.5 million people.
- By 2021, this population had increased to 687 million.

What does this mean?

This indicates that despite a lower proportion of the population living in rural areas, the total population growth in sub-Saharan Africa has been substantial, resulting in an increase in the absolute number of rural inhabitants.
Ref: https://www.whitecase.com/insight-our-thinking/africa-focus-summer-2023-africas-agricultural-revolution

Challenges of Agriculture in Africa contd..

- **Food Insecurity**

Post-Harvest Loss: The Hidden Culprit Undermining Undermining Food Security:

- Around 650 million Africans, representing 50% of the continent's population, do not have economic or physical access to adequate food.

Ref: https://agrf.org/2023-africa-agriculture-status-report-released/

Look at this stat.....

- Millions of African farmers face the severe challenge of losing up to 40% of their crops to post-harvest losses, resulting in an annual financial loss of $14 billion.

Ref: *(World Bank, 2022)*

Contributing Factors

- Inadequate storage,
- Poor handling practices.

Challenges of Agriculture in Africa

- **Climate change**

- In 2022, African nations incurred close to $9 billion in losses and damages due to climate-related events.

Ref: https://agrf.org/2023-africa-agriculture-status-report-released/

- The 2022 report from the Intergovernmental Panel on Climate Change (IPCC) highlights that Sub-Saharan Africa is especially susceptible to climate change, projecting potential reductions in crop yields of up to 20% by 2050.

Challenges of Agriculture in Africa

Policy and Governance Issues:

IMF Funding

- **Lack of effective and intentional agricultural policies.**
- **Outdated laws not tailored to unique climatic conditions of African countries**

Ref : https://www.researchgate.net/publication/339589469_Agricultural_Promotion_Policy_and_Food_Security_in_Nigeria

Ref : https://www.sciencedirect.com/science/article/pii/S0306919216302701

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Challenges of Farmers

Pest

- Annually, pests consume about 40% of global agricultural productivity, resulting in costs of at least $70 billion.

Ref: devour

Soil Quality and Irrigation:

Soil degradation impacts nearly 33% of the Earth's soil, reducing its crop-growing capacity and resulting in an estimated $400 billion in losses.

Weed

Approximately 1800 weed species diminish plant production by about 31.5%, resulting in economic losses of around $32 billion each year.


What do
you think?

Look at this ....

According to the Food and Agriculture Organization, by the year 2050, it will be necessary to increase food production by 60 percent to meet the nutritional demands of a projected world population of 9.3 billion people.

Ref: reports

The AI in Agriculture Market is projected to grow from $1.7 billion in 2023 to $4.7 billion by 2028,

Artificial Intelligence (AI) refers to any system, particularly computers, that exhibit human-like intelligence and can perform tasks that typically require human intelligence, such as learning, reasoning, problem-solving, perception, and language understanding, with little or no interference from humans.

- **Human-like Intelligence.**
- **Autonomy.**
- **Learning and Adaptation.**
- **Problem-Solving and Reasoning.**

AI Technology

1

Machine learning

Machine learning is a subset of artificial intelligence (AI) that involves the development of algorithms and statistical models that enable computers to perform tasks without explicit instructions. Instead, these systems learn from data and improve their performance over time.

Data, Algorithm

2

Internet of things (IoT)

The Internet of Things (IoT) refers to the network of physical objects or "things" that are embedded with sensors, software, and other technologies with the aim of connecting and exchanging data with other devices and systems over the internet.

These "things" can range from ordinary household objects to sophisticated industrial tools.

3

Computer vision

Computer vision is a field of artificial intelligence (AI) that enables computers and systems to derive meaningful information from digital images, videos, and other visual inputs, and take actions or make recommendations based on that information. If AI enables computers to think, computer vision enables them to see, observe, and understand.

4

Robotics

Robotics is an interdisciplinary field of science and engineering dedicated to the design, construction, operation, and use of robots. Robots are programmable machines that can carry out a series of actions autonomously or semi-autonomously. Robotics integrates multiple fields, including mechanical engineering, electrical engineering, computer science, and artificial intelligence (AI), to create machines that can assist or replace humans in various tasks.

5

Drones

Drones, also known as unmanned aerial vehicles (UAVs), are aircraft that operate without a human pilot on board. Instead, they are controlled remotely by a human operator or autonomously by onboard computers. Drones come in various sizes and configurations, from small consumer models to large military-grade aircraft.

6

Natural Language processing

Natural Language Processing (NLP) is a subfield of artificial intelligence (AI) and linguistics that focuses on the interaction between computers and humans through natural language. The goal of NLP is to enable computers to understand, interpret, generate, and respond to human language in a way that is both meaningful and useful.

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Agronomy

Focuses on soil management and the production of field crops. Agronomists study the ways to improve soil and crop production processes.

1

Internet of Things

- Soil moisture and nutrient level sensors for real-time monitoring.
- Weather stations integrated with farm management systems.
- Crop condition monitoring sensors that alert farmers to changes.

2

Computer Vision

- Automated weed detection and plant health monitoring: Utilized in Canada for precision herbicide application.
- Growth monitoring through regular imaging of crop fields: Adopted in Australia to track wheat and barley development.
- Pest identification through high-resolution images: Implemented in South Africa to manage pest control in vineyards.

3

Robotics

- Autonomous tractors for tilling, planting, and harvesting: In operation across the Midwest, USA.
- Robotic arms for precise chemical application: Used in orchards in California.
- Automated seed planting systems: Deployed in large-scale farms in Russia.

Agronomy contd..

4

Drones

- Aerial imaging for crop monitoring and health assessment: Used extensively in Brazil and the U.S. Midwest.
- Spraying pesticides and fertilizers using precision drone technology: Seen in vineyards in France.
- Planting seeds in inaccessible areas: Implemented in reforestation projects in Myanmar.

5

Natural Language Processing (NLP)

- Analysis of agricultural reports and research for insights: Utilized in multinational agribusinesses.
- Chatbots for farmer assistance and query handling: Available in multiple languages across India.
- Sentiment analysis of market trends and consumer preferences: Applied in European market analysis.

6

Machine Learning

- Predictive analytics for crop yield optimization: Used in the United States to enhance decision-making on large commercial farms.
- Weed identification and management strategies: Deployed in Brazil to combat invasive species in vast soybean farms.
- Disease prediction models based on historical data and current conditions: Applied in India to prevent outbreaks in rice paddies.

Horticulture

Involves the cultivation of fruits, vegetables, nuts, seeds, herbs, sprouts, mushrooms, algae, flowers, seaweeds, and non-food crops such as grass and ornamental trees and plants.

1

Internet of Things

- Greenhouse climate control systems: Widely used in advanced greenhouses in Scandinavia.
- IoT-based irrigation control systems: Implemented in arid regions of Israel.
- Plant stress level monitoring via sensors: Utilized in vineyards across California.

2

Computer Vision

- Flower quality assessment and grading systems: Employed in the Netherlands flower markets.
- Automated fruit size and ripeness detection: Used in California for citrus management.
- Disease diagnosis through leaf image analysis: Implemented in Colombia for coffee plantations.

3

Robotics

- Pollination robots for greenhouses: Developed and tested in Japanese greenhouses.
- Automated harvesting systems for fruits and vegetables: Used in strawberry farms in the USA and Spain.
- Plant pruning robots to maintain optimal plant health: Deployed in ornamental plant nurseries in Canada.

Horticulture contd..

4 **Drones**

- Mapping of orchards and vineyards for plant health: Used in New Zealand and France for precision viticulture.
- Thermal imaging to assess plant vigor and water needs: Deployed in almond orchards in Australia.
- Precision application of growth regulators and nutrients: Used in large-scale fruit farms in Brazil.

5 **Natural Language Processing (NLP)**

- Processing customer feedback for garden centers and nurseries: Integrated into retail operations in the UK.
- Automated response systems for client gardening questions: Used in customer service platforms in the USA.
- Analysis of horticultural advice to provide personalized recommendations: Applied in digital agriculture platforms across Europe.

6 **Machine Learning**

- Climate adaptability modeling for different plant species: Used in the Netherlands to optimize greenhouse productions.
- Optimization models for watering and nutrient application: Utilized in desert regions like the UAE.
- Flower bloom prediction based on environmental data: Deployed in Japan for cherry blossom forecasts.

Animal Science

Deals with the science and business of producing domestic livestock species, including but not limited to beef cattle, dairy cattle, horses, poultry, sheep, and swine.

1

Internet of Things

- Wearable health monitors for livestock: Used in cattle farms in Australia for health monitoring.
- Environmental monitoring systems for livestock pens: Deployed in poultry houses across the USA.
- Automated alert systems for abnormal behaviour or health issues: Implemented in dairy farms in the UK.

2

Computer Vision

- Monitoring animal health and behavior in real-time: Deployed in poultry farms in the United States.
- Automated body condition scoring: Used in dairy herds across the Netherlands.
- Recognition systems to track individual animals: Implemented in beef operations in Australia.

3

Robotics

- Milking robots in dairy farming: Widely used across Europe, particularly in Sweden and Finland.
- Automated feeding systems: Deployed in livestock farms in Germany.
- Cleaning robots for animal housing areas: Used in large-scale swine facilities in the United States.

Animal Science contd...

4 **Drones**

- Monitoring grazing patterns and pasture health: Utilized in ranches in Argentina and Brazil.
- Checking water sources and fences in large pastures: Employed in remote cattle stations in Australia.
- Herding livestock in remote or difficult terrains: Tested in mountainous regions of Switzerland.

5 **Natural Language Processing (NLP)**

- Analyzing veterinary reports for trends and preventive measures: Applied in multinational veterinary services.
- Automated translation of animal care documentation: Used in the European Union to standardize care instructions.
- Voice-enabled systems for managing livestock databases: Deployed in the USA for enhanced data management.

6 **Machine Learning**

- Predictive health analytics to prevent diseases in livestock: Utilized in dairy farms across New Zealand.
- Behavioral analysis to optimize feeding patterns: Implemented in pig farms in Denmark.
- Genetic improvement through breeding pattern analysis: Used in cattle breeding programs in Canada.

Forestry

Involves the management, planting, replanting, harvesting of forests and woodland. Forestry focuses on the natural growth of trees to supply wood and wood products.

1

Internet of Things

- Sensor networks for environmental monitoring: Used in forests across Germany to track climate conditions.
- Soil moisture and acidity sensors: Deployed in sustainable forestry operations in the Pacific Northwest, USA.
- Tree growth tracking sensors: Utilized in commercial forests in New Zealand.

2

Computer Vision

- Tree health monitoring from aerial images: Employed in European forests to detect disease and pest infestations.
- Automated counting and classification of tree species: Used in reforestation projects in Southeast Asia.
- Detection of illegal logging activities: Deployed in the rainforests of Brazil.

3

Robotics

- Tree planting drones and robots: Used in reforestation projects in Myanmar and Brazil.
- Automated logging equipment: Employed in the forestry industries of Scandinavia.
- Surveillance robots for monitoring wildlife and forest health: Tested in national parks across the USA.

Forestry contd:

4 **Drones**

- Mapping and surveying large forest areas: Employed in the Canadian and Russian vast forest landscapes.
- Monitoring deforestation and land use change: Used in the Congo Basin and the Amazon.
- Precision application of pesticides in infected areas: Deployed selectively in forests in California.

5 **Natural Language Processing (NLP)**

- Analysis of regulatory and conservation documents: Used to streamline compliance in the USA and EU.
- Automated processing of forestry operation logs: Implemented in commercial forestry in Scandinavia.
- Real-time translation services for multinational forestry teams: Used in global conservation projects.

6 **Machine Learning**

- Forest fire prediction models: Used in California and Australia to anticipate and mitigate wildfire risks.
- Species identification and biodiversity assessment: Applied in the Amazon rainforest for conservation efforts.
- Timber volume and biomass estimation: Utilized in Canada for sustainable forest management.

Aquaculture

Concerns the breeding, raising, and harvesting of fish, shellfish, and aquatic plants. Essentially farming in water environments.

1

Internet of Things

- IoT sensors for monitoring water parameters: Used globally in aquaculture to ensure water quality.
- Automated alert systems for oxygen levels and temperature changes: Deployed in shrimp farms in Thailand.
- Real-time data collection for aquaculture management systems: Utilized in the Mediterranean aquaculture sector.

2

Computer Vision

- Monitoring fish health and growth: Used in Canada to assess the well-being of farmed fish.
- Automatic counting and sizing of fish: Employed in hatcheries across Southeast Asia.
- Detection of parasites and skin lesions: Utilized in Norway’s aquaculture industry.

3

Robotics

- Automated feeding systems: Deployed widely in fish farms around the world, including Greece and China.
- Robotic cleaning systems for tanks and enclosures: Used in intensive aquaculture operations in Denmark.
- Underwater drones for facility inspection and environmental monitoring: Employed in offshore

Aquaculture Contd...

4 **Drones**

- Aerial monitoring of large aquaculture ponds: Used in China and Indonesia to oversee and manage large-scale operations.
- Water quality assessment using equipped sensors: Employed in aquaculture research in the USA.
- Drone-assisted remote feeding: Tested in remote aquaculture sites in Canada.

5 **Natural Language Processing (NLP)**

- Processing regulatory compliance documents: Used in the EU to ensure aquaculture practices meet environmental standards.
- Customer service chatbots for aquaculture product vendors: Employed by suppliers in the USA.
- Analysis of market trends and consumer feedback on aquaculture products: Applied in market research across Asia.

6 **Machine Learning**

- Water quality analysis and prediction: Used in fish farms in Norway and Chile to maintain optimal living conditions.
- Predictive analytics for disease outbreak in fish populations: Employed in aquaculture facilities in Japan.
- Feed optimization models to reduce waste and improve growth: Applied in salmon farms in Scotland.

Soil Science

Studies soil as a natural resource on the surface of the earth including soil formation, classification, and mapping; physical, chemical, biological, and fertility properties of soils; and these properties in relation to the use and management of soils.

1

Internet of Things

- IoT sensors for real-time soil moisture and nutrient tracking: Widely used in irrigated farms in Israel and California.
- Networked sensor systems for salinity and pH monitoring: Deployed in vineyards in France.
- Data integration from soil sensors into farm management systems: Utilized for data-driven farming in New Zealand.

2

Computer Vision

- Analysis of soil images for texture and composition: Employed in research facilities in Germany.
- Detection of soil contaminants through hyperspectral imaging: Utilized in environmental monitoring in China.
- Automated soil health assessment systems: Used in precision farming operations in the USA.

3

Robotics

- Automated soil sampling robots: Deployed in large-scale survey projects in Australia.
- Robotic systems for in-situ soil analysis: Used in field conditions in South Africa.
- Precision planting robots that adjust based on soil conditions: Employed in variable-rate seeding systems in Canada.

Soil Science contd..

4

Drones

- Soil moisture and topography mapping using drones: Employed in water-sensitive farming areas in the USA.
- Aerial soil analysis to determine variations in soil types across large fields: Used in agricultural research in Russia.
- Drone-based remote sensing for soil erosion monitoring: Deployed in conservation efforts in Canada.

5

Natural Language Processing(NLP)

- Analysis of soil research papers and reports for better knowledge dissemination: Used in academic and research institutions.
- Automated text-based customer support for soil testing kits: Employed by agricultural tech companies.
- Language processing tools for translating soil science research across languages: Utilized in international agricultural collaborations.

6

Machine Learning

- Soil classification and mapping for better land use decisions: Utilized in agricultural extensions in India.
- Prediction models for soil nutrient depletion: Employed in sustainable farming practices in the Netherlands.
- Machine learning models for precision agriculture, optimizing fertilizer use: Used in Brazil's soybean farms.

Agricultural Engineering

Focuses on the technology and structures involved in farming, from the design of farm machinery, equipment, and structures to the management of soil and water resources.

1

Internet of Things

- IoT-based control systems for farm equipment automation: Widely used in precision agriculture settings globally.
- Real-time monitoring of agricultural machinery to optimize usage and reduce downtime: Utilized in large estates in Argentina.
- Integration of IoT with climate control systems in controlled environment agriculture: Employed in high-tech greenhouses in the Netherlands.

2

Computer Vision

- Automated inspection of agricultural machinery components: Used in manufacturing and maintenance facilities in Germany.
- Vision systems for robotic weed control: Employed in organic farming in California.
- Monitoring system performance and detecting anomalies in real time: Utilized in automated grain silos in Brazil.

3

Robotics

- Unmanned ground vehicles for field operations: Deployed in row crop farming in the USA and Europe.
- Robotic systems for automated planting and harvesting: Used in specialty crops like lettuce in Japan.
- Advanced robotic systems for precise pesticide application: Employed in vineyards in Italy to reduce chemical usage.

Agricultural Engineering contd..

4

Drones

- Drones for crop dusting and seeding in inaccessible areas: Used in mountainous regions in Switzerland.
- Thermal imaging drones for detecting irrigation issues: Employed in water management studies in Egypt.
- Drone surveillance of large agricultural machinery in operation: Utilized for safety and efficiency assessments in Australia.

5

Natural Language Processing (NLP)

- Text-based analysis of engineering reports to enhance machine performance: Used in machinery development labs.
- Automated documentation and reporting tools for agricultural engineering projects: Employed by multinational agri-engineering firms.
- Real-time translation services for international agricultural engineering teams: Utilized in global agricultural projects.

6

Machine Learning

- Optimization of irrigation systems using predictive models: Employed in desert agriculture in Israel and the UAE.
- Machine learning algorithms for equipment maintenance prediction: Used in the maintenance of large machinery in the USA.
- Energy consumption optimization models for agricultural operations: Applied in greenhouse operations in Canada.

Agricultural Economics

Deals with the business aspects of agriculture, including the management of agricultural businesses, agricultural policy, and economic impacts of agricultural production and farming practices.

1. **Internet of Things**
   - **Real-Time Market Data Integration**: IoT devices collect and transmit real-time data from agricultural fields to market traders and economists, enhancing the accuracy of economic forecasting. This system is utilized in the U.S. Midwest to align corn production forecasts with market needs.
   - **IoT for Inventory Management**: Sensors track inventory levels of agricultural inputs and produce, optimizing the supply chain and reducing costs, a practice implemented in the warehouses of large agribusinesses globally.
   - **Economic Resource Management**: IoT technologies manage resources such as water and electricity consumption in farming, directly affecting the economic efficiency of farms, notably in water-scarce regions like Israel and California.
2. **Computer Vision**
   - **Quality Assessment for Trade**: Computer vision systems are used to automatically inspect and grade agricultural products based on quality standards, which are critical for determining market prices. For instance, in European wine production, computer vision helps classify and price wines based on grape quality.
   - **Monitoring Economic Activities from Satellite Images**: Analyzing images from drones and satellites to assess crop health and predict yields influences economic decisions on a regional scale, such as in India and China, where it supports government subsidy and resource allocation decisions.
   - **Automated Trading Systems**: These systems use image data to predict market movements and automate trading decisions based on visual cues from market behavior, a technique becoming increasingly popular in financial markets including agricultural commodities.

Agricultural Economics contd…

3

Robotics

- **Automated Commodity Sampling and Analysis**: Robotics are used at commodity exchange points to automatically sample and analyze the quality of bulk agricultural products like grains and coffee, ensuring fair pricing and compliance with trade standards. This is particularly useful in coffee trading in Colombia and Brazil.
- **Precision Application of Economic Inputs**: Robotic systems apply economic inputs (fertilizers, pesticides) precisely where needed, reducing waste and cost, an approach used extensively in precision farming practices in North America and Europe.
- **Robotic Auctioneers in Livestock Markets**: In Australia, robots are being piloted as auctioneers in livestock markets, helping streamline the sales process and ensuring transparency in pricing.

4

Drones

- **Aerial Surveys for Property Valuation**: Drones perform aerial surveys of agricultural land to assess its value based on size, condition, and use, influencing real estate decisions and tax assessments, as seen in large estate farms in South Africa and Brazil.
- **Monitoring Commodity Transportation**: Drones monitor the transport of agricultural commodities, providing real-time information that can influence trading decisions and logistical planning. This application is beginning to be used in remote and rural areas of Russia and Canada.
- **Inspection of Agricultural Infrastructure**: Used to inspect and appraise the condition of agricultural infrastructure which is essential for economic assessments and insurance purposes, such as in cyclone-prone areas in the Philippines.

Agricultural Economics contd…

5

Natural Language Processing (NLP)

- **Sentiment Analysis on Market Trends**: NLP tools analyze news, reports, and social media to gauge market sentiment, influencing economic decisions in commodity trading. This is widely used by traders and economists in global markets to predict price movements in commodities like wheat and coffee.
- **Automated Financial Reporting**: NLP systems automatically generate financial reports for agricultural businesses, enhancing transparency and compliance, as utilized by multinational agribusiness corporations.
- **Language Translation for Global Trade**: NLP facilitates communication across different languages in international trade agreements and negotiations, essential for global markets with participants from diverse linguistic backgrounds, such as the United Nations Food and Agriculture Organization (FAO) meetings.

6

Machine Learning

- **Market Demand Forecasting**: Machine learning models are used to predict market trends and demand for various agricultural products. This helps farmers and agribusinesses optimize their production plans and pricing strategies. An example is in the U.S., where predictive analytics help corn and soybean farmers anticipate market demands and adjust supply.
- **Price Prediction Models**: Employed to forecast commodity prices by analyzing historical data, current market conditions, and external economic factors. This application is widely used in commodity trading firms globally to aid in decision-making and risk management.
- **Supply Chain Optimization**: Machine learning algorithms optimize logistics and distribution routes, reducing costs and improving efficiency in the agricultural supply chain. This technology is crucial in large agricultural exporters like Brazil and Argentina, where it helps manage the distribution of grains and meats to global markets.

Agricultural Education

Focuses on teaching and disseminating information related to agriculture. This can occur in formal education settings or through extension services provided to farmers and agricultural businesses.

1

Internet of Things

- IoT kits for students to learn real-time crop monitoring: Used in practical sessions in agricultural schools in Israel.
- Smart greenhouse projects for educational purposes: Employed in universities to teach controlled environment agriculture.
- IoT-enabled soil monitoring systems as educational tools: Utilized in field classes in Australia.

2

Computer Vision

- Virtual reality (VR) environments for training on agricultural techniques: Deployed in training centers in Japan.
- Automated analysis of student actions in simulation-based learning: Used in advanced agricultural courses.
- Image-based plant disease identification training tools: Employed in plant pathology education.

3

Robotics

- Educational robots for teaching precision farming techniques: Used in agricultural universities in South Korea.
- Robotic simulations for understanding farm automation: Deployed in technical schools in Germany.
- Use of small robotic kits for teaching agricultural engineering principles: Utilized in secondary schools with agricultural programs.

Agricultural Education contd…

Focuses on teaching and disseminating information related to agriculture. This can occur in formal education settings or through extension services provided to farmers and agricultural businesses.

4 **Drones**

- Drone piloting courses for agricultural surveying: Offered in vocational training programs in the USA.
- Use of drones in agricultural research projects by university students: Employed in field studies in Brazil.
- Drone mapping techniques taught in agricultural engineering courses: Utilized in curriculum in China.

5 **Natural Language Processing (NLP)**

- NLP tools for analyzing agricultural research papers in education settings: Used in university courses to teach advanced topics in agriculture.
- Chatbots for supporting students in online agricultural courses: Deployed in e-learning platforms.
- Language processing for developing multilingual agricultural education materials: Utilized in international agricultural programs.

6 **Machine Learning**

- Development of personalized learning platforms based on student performance data: Utilized in agricultural colleges in the USA.
- Prediction of educational outcomes to tailor agricultural curriculum: Employed in vocational training centers in Europe.
- Machine learning-enhanced virtual labs for remote agriculture education: Used in distance learning programs globally.

Plant Pathology

The science of plant diseases and the pathogens that infect them, including their biology, ecology, and management.

1

Internet of Things

- IoT sensors for detecting microclimatic conditions that favor disease spread: Used in potato farms in Ireland.
- Real-time monitoring systems for orchard diseases: Deployed in apple farms in the USA.
- Networked devices for synchronized disease response strategies: Utilized in grape growing regions in Italy.

2

Computer Vision

- Automated image analysis for early disease detection: Deployed in vineyards in France to detect fungal infections.
- High-throughput imaging systems for pathogen identification in labs: Used in research facilities in the USA.
- Machine vision for monitoring disease progression in field conditions: Employed in crop monitoring systems in India.

3

Robotics

- Robotic samplers for collecting plant tissues in field conditions: Used in large-scale surveys in Brazil.
- Automated robotic systems for applying treatments to infected plants: Deployed in nurseries and greenhouses.
- Precision application robots for fungicides and other disease-control chemicals: Utilized in

Plant Pathology contd...

4

Drones

- Aerial surveillance for spotting disease outbreaks in remote fields: Used in rice paddies in Vietnam.
- Thermal imaging for detecting plant stress related to disease: Employed in citrus groves in Florida.
- Precision spraying of plant health products to manage disease: Utilized in large-scale farming operations.

5

Natural Language Processing (NLP)

- Analysis of global disease outbreak reports to predict risks: Used in international agriculture agencies.
- Automated translation of plant pathology research for global dissemination: Employed in multinational research collaborations.
- Text-based diagnostic systems to assist farmers in identifying plant diseases: Utilized in agricultural extension services.

6

Machine Learning

- Predictive modeling for disease outbreak and spread: Used in managing crop diseases in Colombia's coffee plantations.
- Machine learning algorithms for identifying pathogen genomes: Employed in genetic research for disease resistance.
- Data-driven diagnostics for plant diseases: Utilized in mobile apps for farmers worldwide.

Entomology

The study of insects and their relationship to human life, crops, and the environment. Entomologists may work on reducing the effects of pest insects on crops and human health.

1

Internet of Things

- IoT-enabled pheromone traps for monitoring pest populations: Used in vineyards in France to predict pest outbreaks.
- Sensor networks for tracking the movement of pest swarms: Deployed in agricultural fields in China.
- Real-time data collection from multiple sensors to inform pest management decisions: Utilized in corn fields in the Midwest USA.

2

Computer Vision

- Automated pest detection systems in fields: Used in vegetable farms in California to manage pest control.
- Image-based identification of beneficial vs. harmful insects: Employed in integrated pest management (IPM) programs.
- High-resolution imaging for studying insect behavior: Utilized in research labs studying pollinators like bees.

3

Robotics

- Robotic insect traps that automatically identify and count captured pests: Deployed in greenhouse environments in the Netherlands.

Entomology contd:

4

Drones

- Drones equipped with specialized sensors to monitor insect activity: Used in forest areas in Canada to track pest infestations.
- Aerial imaging for large-scale pest monitoring: Employed in wheat fields in Australia.
- Drone-based application of biocontrol agents: Utilized in organic farming practices.

5

Natural Language Processing (NLP)

- Text analysis of entomological research for new insights into pest control: Used in academic settings.
- Automated reporting tools for pest surveillance data: Employed by government agriculture departments.
- NLP-driven educational tools for training farmers in pest identification and management: Utilized in extension services.

6

Machine Learning

- Prediction models for insect population dynamics: Employed in managing locust outbreaks in East Africa.
- Machine learning algorithms for classifying insect species based on imaging data: Used in biodiversity studies in the Amazon.
- Predictive analytics for the impact of climate change on pest populations: Applied in long-term crop management strategies in Europe.

Live pictures of AI Application in Agriculture

Ref: https://www.latentview.com/blog/artificial-intelligence-in-agriculture/

Are there any risks associated with a rapid deployment of agricultural AI?

Ref: https://www.cam.ac.uk/research/news/risks-of-using-ai-to-grow-our-food-are-substantial-and-must-not-be-ignored-warn-researchers

Recap

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- The risk of using AI technology
- The risk of using AI technology

Who is Sebastian Obeta?

Sebastian is an esteemed member of the European AI Alliance, demonstrating his deep commitment to advancing the field of artificial intelligence in a responsible and ethical manner.

As a digital transformation leader specialising in natural language processing, he currently serves as a data scientist at Cambridge University.

Sebastian is also the founder of the Artificial Intelligence Society at the University of Bradford, where he leads initiatives to demystify AI's complexities.

His expertise and dedication extend beyond academia to multiple advisory boards, where he influences the strategic integration of AI technologies in a rapidly evolving technological landscape. Sebastian's contributions are vital in shaping how AI is understood and implemented globally.


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