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A Study of AI Agents in Agriculture – Present Application & Impact

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Abstract: Artificial Intelligence is being used for many practical purposes like development of expert system, machine vision, speech recognition, legal assessment, autonomous weapon system, precision-based agriculture etc. The population of world is increasing drastically and to cope up demand of increased food items it is very much required that traditional farming techniques are empowered by AI based techniques. AI can be utilized to detect and target weeds and the decision about which herbicides to apply and what will be the right buffer zone can be taken easily. In present manuscript various types of AI based methods and AI agents which could be used in agriculture has been discussed.

I. INTRODUCTION TO ARTIFICIAL INTELLIGENCE

Artificial intelligence consists of two words, artificial which means "man-made" and intelligence means "power of thinking", that is it is a man-made thinking power.It may be portrayed as the piece of programming building with the help of it we can make sharp intelligent machines that are able to imitate itself as an individual (i.e. human), think like individuals and prepare to make decision [1].

With the help of AI we not only make machines which will do the work they are assigned to do, we can create machines with programmed algorithms which are able to work using its own intelligence such as personal virtual assistants like Cortana, Google Assistant, Siri, etc. Robots are machines which resembles human being and canimitate human activities and eventsmechanically can easily be created with the help of AI.

The goals for AI are: -

- Imitate human knowledge
- Solve Knowledge-intensive tasks
- Creating the machine that requires human knowledge to solve assignments, for example,
- solving theorem
- Playing mind games like chess
- Surgical/medical operations
- Driving vehicles in traffic
- Creating machines in such a way that they can exhibit smart behaviour which includes able to learn things from itself (that is self-learning), present, explain and smart enough to give advice to its user.

1. Types of AI

Artificial Intelligence is subdivided into two types:

- Type 1: Based on Capabilities
- Type 2: Based on functionalities

AI Type 1: Based on Capabilities AI is Sub Categorised into Three Forms

- **Week AI or Narrow AI**

This kind of AI is always prepared to execute an ardent task smartly. The most common and presently accessible AI is slender AI within the world of computer science. Narrow AI cannot perform on the far side its field or limitations, because it is simply trained for one specific slender AI will fail in unpredictable ways in which if it goes. Apple's Siri is a decent example of AI, but it operates with a restricted pre-defined range of functions [2].

- **General AI**

General AI may be a variety of intelligence that may perform any intellectual task expeditiously like a human. The thought behind the general Artificial Intelligence to form such a system that can be smarter and assume itself as sort of a human on its own. As systems with general AI is still beneath analysis and it'll take much more effort and time to develop such systems [3].

- **Super AI**

Super AI could be a degree of Intelligence of Systems at those machines that may surpass human intelligenceand might perform any task higher than a human with psychological feature properties. It is an outcome of general AI. Some key characteristics of sturdy Artificial Intelligence is embracing its capability, embracing the power to assume,

to give reasons, to solve the puzzles, learn, to make decisions, plans, and able to communicate by its own. Super AI remains a theoretical construct of computer science. The development or creation of such machines in real remains the world's dynamical tasks. Types of AI are shown in Figure 1 [1].

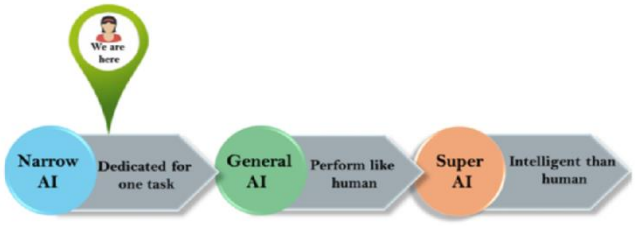

Figure 1: Types of AI

AI TYPE-2: Based on Functionality AI is Subdivided into Four Categories

- **Reactive Machines**

Purely reactive machines are the foremost basic styles of computing. Such AI systems don't store reminiscences or past experiences for future actions. These machines solely specialize in current situations and react there on after attainable best action. IBM's Deep Blue system is Associate in Nursing and Google's AlphaGo is additionally an Associate in nursing is example for reactive machines [4].

- **Limited Memory**

This kind of AI technical machines can store data from its past experiences but only for short period of time. One of the best examples for Limited Memory systems is Self-driving cars. These cars can store recent speed of nearby cars, the distance of other cars from it, speed limit, and other information which helps it to navigate the road.

- **Theoryof Mind**

This kind of Artificial Intelligence can understand the human emotions, other people, beliefs, and be able to interrelate socially like humans. But this functionality is still not fully developed in AI machines. Research is still going on to implement Theory of Mind concept in AI technologies for use in agriculture.

- **Self-Awareness**

The future of Artificial Intelligence is Self-awareness AI is. Hypothetically these machines will be brilliant intelligent, they will be equipped with their own consciousness, emotions, and self-awareness similar to humans or it is also possible that these machines will be cleverer even than the humans. Though the Self-Awareness AI does not exist and still is a hypothetical theory.

II. TYPES OF AI AGENTS

AI Agents are categorised into five different classes based on their degree of perceived intelligence and capability.

- **Simple Reflex Agent**

These specialists make choices on the premise of the present perception and disregard the remainder of the percept history. These specialists just prevail in the completely observable condition. The Simple reflex specialist doesn't consider any piece of perception of history during their choice what's more, activity process. The Simple reflex specialist takes a shot at Condition-activity rule, which implies it maps the current state to activity. For example, a Room Cleaner operator, it works just if there is the soil in the room [4].

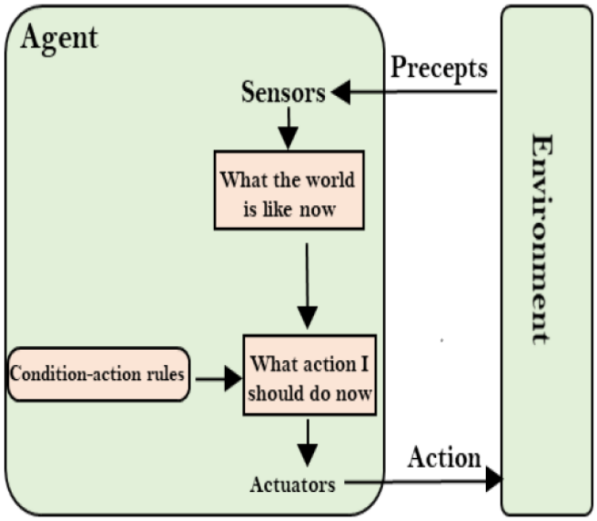

Figure 2: Simple Reflex Agent [2]

Issues for the straightforward reflex operator configuration approach: -

- They have restricted knowledge
- They don't know about non-perceptual pieces of the present state

- Generally, too enormous to produce and to store.
- Not versatile to changes in nature.

- **Model-Based Reflex Agent:**
  The Model-based operator can work in a somewhat perceptible condition and track the circumstance. A model-based specialist has two significant variables:

  - **Model:** It is information about "how things occur on the planet," so it is known as a Model-based specialist.
  - **Inner State:** It is a portrayal of the present state-dependent on percept history.

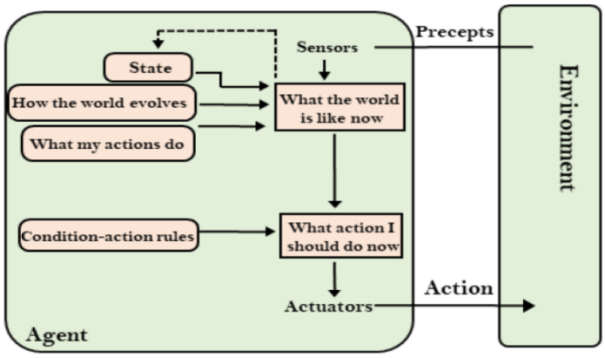

Figure 3: Model Based Reflex Agent [2]

Refreshing the agent state requires data about:

- How does the world advances?
- How is agent's activity influencing the world?

- **Goal-Based Agents:**

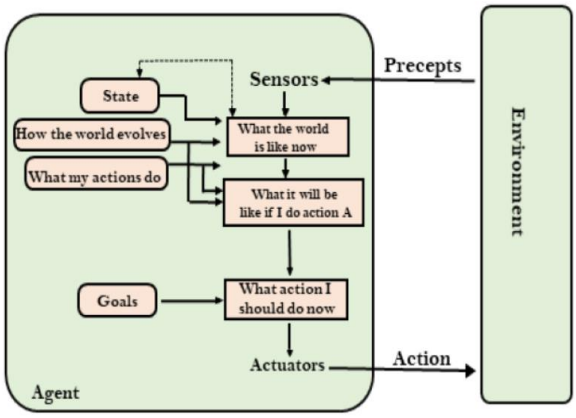

Figure 3: Goal Based Agents [2]

The information on the present state condition isn't constantly adequate to choose for a specialist to what to do. The specialist has to know its objective which portrays alluring circumstances. Objective based operators extend the abilities of the model-based specialist by having the "objective" data. They pick an activity with the goal that they can accomplish the objective. These specialists may need to consider a long grouping of potential activities before choosing whether the objective is accomplished or not. Such contemplations of various situations are called looking and arranging, which makes an operator proactive [5].

- **Utility-Based Agents**

These specialists are like the goal-based agents however give an additional segment of utility estimation which makes them diverse by giving a proportion of achievement at a given state. Utility-based agents act based objectives as well as the most ideal approach to accomplish the objective [6]. The Utility-based specialist is valuable when there are different potential other options and an operator needs to pick so as to play out the best activity. The utility capacity maps each state to a genuine number to check how effectively each activity accomplishes the objectives.

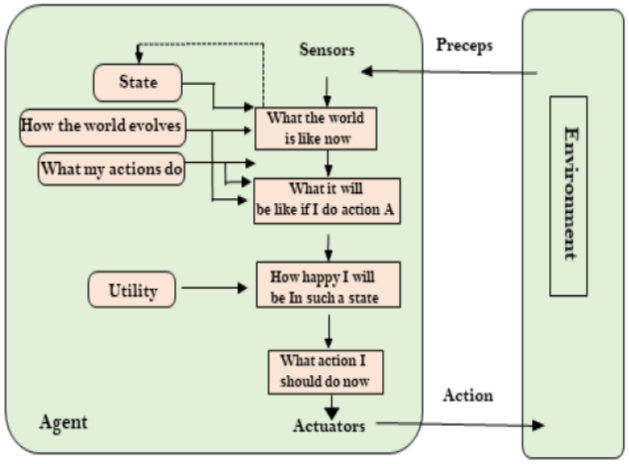

Figure 4: Utility Based Agents [2]

- **Learning Agents**

A learning operator in AI is the kind of specialist which can gain from its past encounters, or it has learning capacities. It begins to act with fundamental information and afterwards ready to act and adjust consequently through learning.

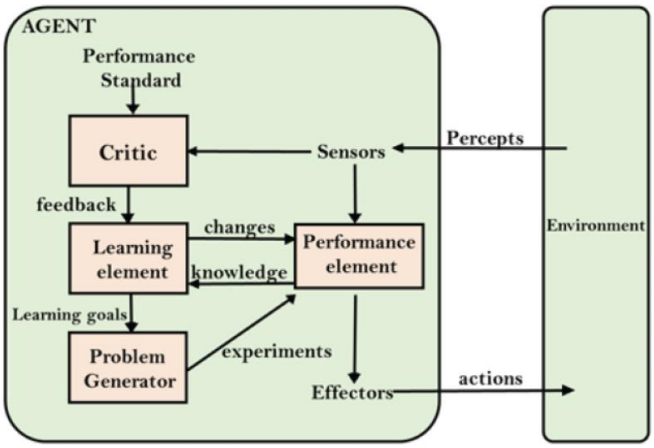

Figure 5: Learning Agents [2]

A learning operator has basically four applied segments, which are:

a. Learning component: It is answerable for making enhancements by gaining from nature
b. Pundit: Learning component takes input from pundit which portrays how well the operator is doing concerning a fixed presentation standard.
c. Execution component: It is liable for choosing the outside activity
d. Issue Generator: This segment is answerable for proposing activities that will prompt new and instructive encounters [7].

Thus, learning specialists can learn, dissect execution, and search for better approaches to improve execution.

III. LITERATURE SURVEY

Agriculture in India plays a vital role for Indian economy. More than 50% of rural households depend upon agriculture sector according to an IBEF report.To make an economical and operational decisions for their field farmers need the prediction of weather forecast in much advance. Presently with the existing scenario farmers are unable to take the precautionary measures as the required information is not available with them [8].

Since 2016, there are numerous farming applications have been industrialized and applied for benefit of farmers and Agri sector. Intelligent farming in India has helped in increase crop yield by 30%.Using AI, we may create smart cultivating practices to limit loss of farmers which will provide them high return. Utilizing man-made brainpower stages, one can assemble huge measure of data from government and open sites or constant observing of various information is likewise conceivable by utilizing IoT (Internet of Things) and afterward are often examined with exactness to empower the ranchers for tending to all or any the dubious issues looked by farmers within the agriculture part.

Most popular applications introduced in Indian agriculture are based on:

- **Crop and Soil Monitoring**
  - **Intello Labs** – Using Deep Learning for Image Analysis
  - **Cropln–** It uses AI to increase per-Acre values. With the help of Cropln's "Intelligent Farm" clients or farmers will able to analyze and predict data.
- **Predictive Agricultural Analytics**

AI -sowing app [9] was result of collaborative research project between Microsoft, non-governmental agricultural research organization, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) [9]. This app helps farmers by sending advices on sowing and for that farmers only need to have feature phone which is capable of receiving text messages.

- **Agri Supply ChainGobasco**

The of AI and other related technologies in various stages, it claims to employ real time data analytics on data streams which will help farmers to increase the efficiency of agriculture supply chain [12].

IV. ADVANTAGES OF USING AI IN AGRICULTURE

Using Artificial Intelligence in agriculture helps farmers understand and analyze the data insights such as **temperature, solar radiation, precipitation and wind speed.** The farmers could compare the data analytics reports from historic values.

- AI gives increasingly effective approaches to deliver, collect and sell fundamental yields.
- AI execution accentuation on checking inadequate yields and improving the potential for sound harvest creation.
- The development in Artificial Intelligence innovation has reinforced agro-based organizations to run all the more effectively.
- AI is being utilized in applications, for example, mechanized machine modifications for climate determining and infection or vermin recognizable proof [11].

- Artificial insight can improve crop the board right now, various tech associations put assets into counts that are getting significant in agribusiness.
- AI arrangements can possibly tackle the difficulties ranchers' face, for example, atmosphere variety, an invasion of irritations and weeds that diminishes yields.

V. IMPACT OF ARTIFICIAL INTELLIGENCE AGENTS IN AGRICULTURE

AI technology is quickly rectifying the issues whereas recommending specific action that's needed to overcome the matter. AI is efficient in observing the data and solutions quickly. However, AI is being used in agriculture to enhance results with a smallest environmental price [10]. By implementing AI will identify a malady with 98% accuracy. Thus, AI helps farmers monitor the agriculture field by adjusting the light to accelerate or to increase production.

VI. AI AGRICULTURE BOTS

AI-enabled agriculture bots facilitate farmers to and a lot of economical ways in which to safeguard their crops from weeds. This is often additionally serving to beat the labour challenge. AI bots within the agriculture field will harvest crops at the next volume and quicker pace than human labourers. By investment pc vision helps to observe the weed and spray them. Thus, computing helps farmers and a lot of economical ways in which to safeguard their crops from weeds.

VII. CHALLENGES WITH AI IN AGRICULTURE

Regardless of the way that Artificial Intelligence offers numerous chances for application in agri-business yet there still exists an absence of recognition with high tech machine for many people. Introduction of cultivating to outside components like climate conditions, soil conditions and presence of pest is a considerable amount. So, what may resemble a better solution while arranging during the beginning of harvesting may not be an ideal one as a result of changes in outside parameters? [13].

Artificial Intelligence structures also need a ton of information to prepare machines and to predict exact forecasts. If there should be an occurrence of tremendous farming area, however spatial data can be collected adequately, transient information is hard to get. For instance, the greater part of the yield explicit information can be acquired just once in a year when the harvests are developing. Since the information foundation sets aside some effort to develop, it requires a lot of time to assemble a hearty AI model. This is one motivation behind why AI sees a ton of utilization in agronomic items, for example: seeds, compost, pesticides, etc. instead of infield accuracy arrangements [14].

VIII. CONCLUSION

Artificial intelligence technologies will help ranchers to examine land/soil/wellbeing of harvest and so forth and spare time and permit ranchers to develop the correct yield in each season that has the best yield. AI-based forecasts empower recommending fitting pesticides/crops/place at the perfect time before huge scope occurrence of infection. With a colossal space still immaculate in agriculture for the interruption of programmed responsive frameworks, there is a tremendous opportunities for the agribusiness to use rising innovation of catboats for helping ranchers with the responses to every one of their inquiries and offering significant guidance and suggestions to their particular homestead related issues. AI agents can be used for analysing the history of field and various useful predictions can be made.

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