AN EFFICIENT APPROACH FOR AGRICULTURE MANAGEMENT USING ARTIFICIAL INTELLIGENCE

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ABSTRACT_ The United Nations Food and Agriculture Organization asserts that the whole world's population would rise by an additional 2 billion in 2050, whereas at that time, the increased land area for farming will solely account for 4%. In the aforementioned situation, more coherent cultivation practices need to be accomplished by utilizing modern technological advancements and unravel the ongoing barriers in farming. An undeviating use of Artificial Intelligence and its subsets in agriculture can serve to be an embodiment of a shift in the way that farming is exercised during the present time. The agricultural domain faces countless obstacles for instance disease, improper soil analysis, pest infestation, irrigation, and inadequate drainage, and a lot more. These challenges lead to dangerous environmental hazards and intense crop loss as a result of using redundant chemicals. The realm of Artificial Intelligence along with its meticulous learning abilities has evolved to form akey approach for dealing with diverse

farming-related issues. This paper emphasizes the applications of Artificial Intelligence practices in different domains of agricultural science, the industry insights, and the challenges to adopting AI in agriculture.

1.INTRODUCTION

THE machines were deployed during the industrial revolution as a substitute for human labour in the 19th century. Eventually, with the growth in Information Technology in the 20th century, after the advent of computers, the innovation of Artificial Intelligence powered machines was initiated. In the ongoing era, it is an actuality that Artificial Intelligence is slowly but strongly replacing human labour. Artificial intelligence denotes the imitation of human intelligence in machines that are designed to think like humans and replicate their behaviour such as learning and problem-solving. Machine learning is a subset of artificial intelligence as shown in Fig. 1. Machine learning is the tool used to identify, understand and analyse a pattern in the data. One of the important areas of research in this advanced technological world of computer science is Artificial Intelligence. This technology is becoming persistent very quickly because of its speedy technological advancements and its stout applicability in problems, mostly that cannot be resolved well by traditional computing structures and also humans [1]. A similar field of much priority is farming where around 30.7% of the entire world's population is precisely committed to 2781 million hectares of agricultural land [2]. Therefore the farmers have to face numerous challenges from sowing to harvest. The extensive predicament in agriculture is yield protection, insufficient use of chemicals, pest and disease infestation, inadequate irrigation and drainage, weed control, and much more. Agriculture is a vigorous field where circumstances cannot be concluded to provide a collective explanation. Artificial Intelligence techniques have empowered us to seize the elaborate specifics of every circumstance and deliver the answer that is the finest fist for that specific problem. Progressively appropriate compound problems are being unraveled through the progress of numerous AI techniques. MACHINE LEARNING DEEP LEARNING The core focus of this paper is on the significant Artificial Intelligence (AI) techniques that are used to face the issues in agriculture. The three essential AI techniques: Expert Systems, Fuzzy Systems, and Artificial Neural Networks are measured as the concentrated areas. This paper discourses the use of Artificial Intelligence techniques in a vast subdomain of farming to capture the measured growth of the agrointelligentsystem
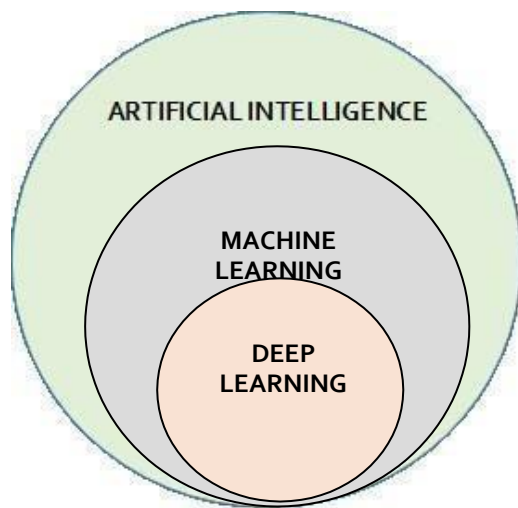
2.LITERATURE REVIEW

The prospect of agriculture and the farming industry relies heavily on inventive concepts and technological developments to intensify yields and improved utilization of resources with the help of unconventional computing tools. Crop models and decision-making tools are being progressively used in the agricultural field to improve production and resource use efficiency, there is an enormous scope for Artificial Intelligence to revolutionize agriculture by integrating advanced technologies to forecast agricultural productivity [2].

In agriculture the first use of agriculture was conveyed in 1983 [3]. To solve the current difficulties in agriculture , many methodologies have been proposed, starting from database to the decision support systems [4]. Among these elucidations, systems that make use of Artificial Intelligence are tremendous performers as long as the robustness and accurateness are concerned.

Climatic change, increase in the cost of prductions, decreasing water supply for irrigation and inclusive drop in the farm workforce have caused a lost of trouble to the agriculture production systems over a last few decades [5]. In addition to this, the disorder of supply systems and food production is threatened due to the COVID-19 pandemic, [6]. Such factors are a threat to the sustainability of the environment, of the present and the future food source chain [7]. Substantial inventions are always a necessity to stay ahead of the persistent climate change [8]. The understandable problem here is by

what means to harvest adequate quantity of food for the ever growing population. The research scientists are continuously applying state-ofthe-art expertise and discovering new ways to assimilate them into agricultural system [5].
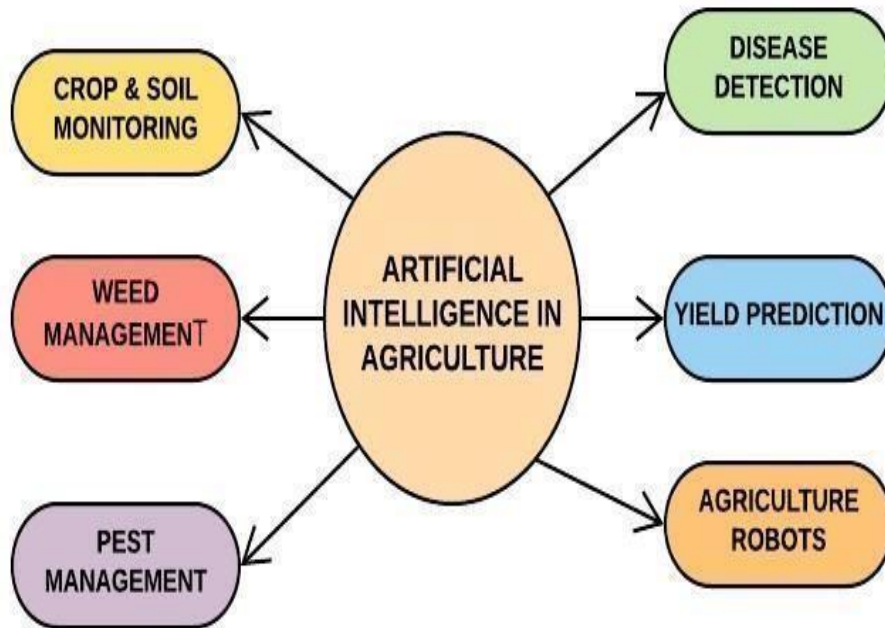

Fig. 2. Application of AI in Agricultu

3.INDUSTRYINSIGHTS

Global AI in the agronomy market scope was treasured at USD 608.9 million in 2018 and is predicted to record a CAGR of 25.4% from 2019 to 2025 [32]. AI practises applied to cultivation can be useful for the growth of yield and productivity. Consequently, agribusiness organizations implement AI technologies in the form of predictive analytics-based solutions. The Artificial Intelligence-based techniques and applications benefit by controlling pests, monitoring the soil, yielding healthier crops, and improving the agriculture-related responsibilities that are involved in the all-inclusive food stock. AI is progressively increasing in the farming industry

aimed at the enhancement of yield significance and accurateness as it aids in analyzing the farm data.

The rapidly escalating populace requires the necessity for the enactment of AI in the industry of agriculture. Inadequate arable availability of the land and the requirement for amplified production of food, because security of the food determines the requisite for a green uprising fuelled by the Internet of Things, artificial intelligence, and data. Applications assisted with AI supply to numerous regions in the farming business, for instance, recommendation and predictive analytics, detection of pest infestation, monitoring of soil, and identifying plant diseases.

AI-inspired resolutions encompassing drones, robots, and ground centered wireless sensors are progressively being positioned in the agri-business. For example, Microsoft co-operated with ICRISAT (International Crop Research Institute for the Semi-Arid Tropics) to manufacture an AI grounded planting app. Additionally, Nature Fresh Farms, an American technology firm, is occupied in evolving a technology based on AI to evaluate data about the plant at scale to yield precise forecasts and harvest. This particular technology calculates how much time blossom would take to mature by means of an AI algorithm. The various advantages of AI applications inspire numerous technology based start-ups and companies to manufacture IoT-based equipments for disposition of Artificial Intelligence enabled applications for farming on a huge scale.

4. CHALLENGES TO ADOPT AI IN AGRICULTURE

Tremendous opportunities are presented by Artificial Intelligence in the field of agriculture, but still, there is insufficient knowledge when it comes to advanced high tech machine learning solutions in farming. Divulging farming with exterior factors like soil conditions, weather conditions and susceptibility to the outbreak of pests is high. When the harvesting is started, the planned schedule of crop raising at the beginning of the season might not appear to be good because it gets predisposed by the exterior parameters. A lot of data is needed by the AI system to train the machines, for making

accurate predictions. In cases of enormous land area for farming, it is easy to collect spatial data whereas the accomplishment of temporal data is challenging. It is also problematic to develop the knowledge-based rules and put them in a correct sequence for a huge number of parameters. Numerous crop-specific information could be attained once in a year only when the crops are grown. Because it takes time for the database to mature, it comprises a considerable amount of stretch to build a robust AI ML model. This is the foremost purpose for the application of AI in agriculture-related products like pesticides, fertilizers, and seeds.

Another decisive factor is the expensive cost of many cognitive solutions for agriculture that is readily accessible in the market. The AI-inspired solutions have to be more feasible to ensure that the technology influences the agricultural community. The AI cognitive solutions if offered in some open-sourced platform then that would help to make the solutions additionally reasonably priced, which will then lead to earlier adoption and better insight among the farmers.

TABLE I. **APPLICATION OF EXPERT SYSTEM IN AGRICULTURE**

System Name	Crop Name	Description
AGREX	Fruits, Vegetables, Paddy	In Kerala, The Centre for Informatics Research and Advancement (CIRA) has built an expert system program named as AGREX which can support the farmers to receive well- timed and trustworthy guidance. This expert program finds increased use in paddy, vegetables, postharvest technology, and fruits in the field of crop protection, fertilizer application, disease diagnostics, and irrigation scheduling.
TEAPEST	Tea	It is an object-oriented, rule-based expert system that can identify serious insect pests of tea and therefore suggest a suitable control mechanism.

JAFexpert	Jute	Central Research Institute for Jute and Allied Fibres (ICAR- CRIJAF) developed a web- based expert system called JAFexpert. It is capable of providing data for management and accurate identification of injurious organisms and abiotic damages for jute and allied fibre crops.
AMPRAPALIKA	Mango	This expert system program is utilized for making a diagnosis of a specific disease of mango. The system's knowledge base includes information about the indicators and therapies of 14 mango tree illnesses that exist during the non-fruiting and fruiting seasons.
Rice-Crop Doctor	Rice	The National Institute for Agricultural Extension Management (MANAGE) developed this expert system program which is used to detect diseases and rice pests and then suggest the cure.

Table I names some Expert Systems that were developed by therefore take and action before hunger lingers as a Institutes and Organizations precisely for use in agriculture. The expert systems are designed specifically for particular crops. The description field mentioned above discusses how the expert systems provide facilities for the crops

5.CONCLUSION

Artificial Intelligence has proven to be worthy in the field of real-time monitoring of data. This has been implemented to manage crops, pests, weeds, and yield. The machines communicate with each other to choose which crop is suitable for marketing and harvesting. The substantial methods can assure the farmers with suitable field management and healthier crops. Timely information is provided by the AI from the right channels and can therefore build resilience among the users.

This paper showcases the use of Artificial Intelligence in the field of farming during the previous years starting from 1983. The paper has been prepared to provide as much information as possible, about the different AI techniques that have been used in agriculture. The expert systems based on rules were comprehensively utilized from the 1980s to the 1990s, whereas from the onset of 1990, fuzzy inference systems and the artificial neural network took the major role. In the current years, the practice of hybrid systems such as image processing or neuro-fuzzy combined with artificial neural networks is in use.

The usage of AI will benefit the farmers to attain their objective of a healthier harvest by taking improved decisions in the field. The supremacy of data can be utilized more resourcefully to predict risk and analyze scenarios and humanitarian crisis, which in turn can help in the complete development of the world because food is the most important necessity for human beings.

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