

Press “A” for Artificial Intelligence in Agriculture: A Review

Yogesh Awasthi #

Department of Computer and Computer Information Systems, Africa University, Mutare, Zimbabwe
E-mail: awasthiy@afriau.edu

Abstract— Agriculture is the backbone of the developing country. In old era agriculture was based on the experience which was shared by people to people but in this digital era technology play a very important and significant role in agriculture. Now agriculture become a business hub therefore farmers are focusing on precision farming. They introduced the technology in agriculture to define the accurate information about seed, soil, weather, disease and all factors which affecting the farming. Artificial Intelligence uses predictive analysis, image analysis, learning techniques and Pattern analysis to declare the best cost effective and maximum gain for the agriculturist. The aim of this paper is to provide the crucial information with the help of technology which a farmers can use to harvest the variety of crops as per the demand in world so that they can get maximum benefits.

Keywords— artificial intelligence; agriculture; analysis; precision farming; information technology.

I. INTRODUCTION

Agriculture and Technology are complementary to each other in today's world. Current cultivating and country exercises work far extraordinarily rather than those a few decades earlier, essentially by virtue of progress in development, including sensors, devices, machines, and information advancement. The current agribusiness routinely uses refined advancements, for instance, robots, temperature and soginess sensors, flying pictures, and GPS development. These pushed devices and exactness agribusiness and mechanical systems grant associations to be continuously gainful, powerful, progressively secure, and even more earth neighbourly. The ascent of electronic cultivating and its related headways has opened a wealth of new data openings. Remote sensors, satellites, and UAVs can collect information 24 hours out of every day over an entire field [1][2] These can screen plant prosperity, soil condition, temperature, tenacity, etc. The proportion of data these sensors can make is overwhelming, and the criticalness of the numbers is concealed in the uncontrolled slide of that data. The idea is to allow ranchers to build an unrivalled appreciation of the condition on the ground through front line development, (for instance, remote identifying) that can reveal to them more about their situation than they can see with the independent eye. Furthermore, more absolutely just as more quickly than seeing it walking or going through the fields. Since we can see that these innovations are profoundly received and will keep on being embraced by farmers, we can investigate a portion of the advantages that accompany accuracy agribusiness innovation. The main idea

behind the utilizing these cutting-edge innovations incorporates: Efficiency being used of assets like synthetic substances, composts, water, fuel, and so on., Improving amount and nature of produce, Mellow yield in same size of land, Reducing ecological impression, Risks mitigation [3][4].

II. LITERATURE REVIEW

Artificial intelligence innovation is supporting various divisions to help profitability and productivity. Computer based intelligence arrangements are helping to beat the conventional difficulties in each field. Similarly. Computer based intelligence in horticulture is helping farmers to improve their proficiency and lessen natural antagonistic effects.[5][6]. The horticulture business emphatically and transparently grasped AI into their training to change the general result. Computer based intelligence is moving the manner in which our food is delivered where the farming area's outflows have diminished by 20%. Adjusting AI innovation is assisting with controlling and deal with any excluded characteristic condition [7].

Today, most of new businesses in farming are adjusting AI-empowered way to deal with increment the proficiency of agrarian creation. The Market study report expressed that the worldwide Artificial Intelligence (AI) in Agriculture showcase size is required to arrive at 1800 million US\$ before the finish of 2030. Actualizing AI-engaged methodologies could identify sicknesses or atmosphere changes sooner and react sagaciously. The organizations in farming with the assistance of AI are handling the agrarian information to lessen the unfavourable results [8].

Computer based intelligence in a propelled manner is helping the farmers to remain refreshed with the information identified with climate anticipating. The assessed/foreseen data help farmers with growing returns and advantages without taking a risk with the reap. The examination of the data made makes the ranchers avoid any and all risks by cognizance and learning with AI. By actualizing such practice assists with settling on a savvy choice on schedule.

Using AI is a productive method to lead or screen distinguishes potential imperfections and supplement lacks in the dirt. With image recognition approach, AI distinguishes potential deformities through pictures caught by the camera. With the assistance of AI profound learning application are created to examination verdure designs in farming. Such AI-empowered applications are strong in understanding soil deserts, plant bugs, and un-wellness [9][10].

Farmers can utilize AI to oversee weeds by actualizing computer vision, apply autonomy, and AI. With the assistance of the AI, information are accumulated to keep a mind the weed which causes the farmers to shower synthetic concoctions just where the weeds are. This legitimately decreased the use of the substance splashing a whole field. Therefore, AI decreases herbicide use in the field relatively the volume of synthetic substances ordinarily splashed [11].

Computer based intelligence empowered agribusiness bots help farmers to discover progressively effective approaches to shield their yields from weeds. This is likewise assisting with beating the work challenge. Computer based intelligence bots in the farming field can collect harvests at a higher volume and quicker pace than human workers. By utilizing PC vision assists with observing the weed and splash them. Consequently, Artificial Intelligence is helping ranchers discover increasingly proficient approaches to shield their yields from weeds [12].

III. IMPACT OF ARTIFICIAL INTELLIGENCE METHODS ON AGRICULTURE

The man-made consciousness (AI) innovation is supporting various segments to help their profitability. The AI arrangements have overcome the difficulties looked by a few ventures and now it is consistently making its place in the farming segment as well. Computer based intelligence advances sizably affect the horticulture segment. This section focuses on the few AI methods or techniques which majorly related with the Agriculture:

A. Autonomous Tractor

With the substantial interest in creating self-sufficient vehicles for different requirements, the horticulture area will be likewise getting benefits with self-driving or you can say driverless tractors.

With greater quality AI and machine learning information for horticulture, the farm segment will be reformed by the enormous scope utilization of autonomous tractors for playing out different undertakings.

These self-driving or driverless tractors are modified to freely identify their furrowing position into the fields or choose the speed and keep away from impediments like

water system items, people and creatures while performing different assignments.

B. Agriculture Robotics

So also, AI organizations are creating robots that can without much of a stretch play out numerous assignments in the cultivating field. Such apply autonomy machines are prepared to control weeds and collect the yields at a lot quicker pace with higher volume contrast with humans. These robots are all around prepared to help for checking the nature of harvest and recognize undesirable plants or weeds with picking and pressing of harvests simultaneously fit to battle with different difficulties looked by the rural work force. Companies like Blue River Technology and Harvest CROO Robotics are making such mechanical technology machines that can control undesirable yields or weeds and help ranchers in picking or pressing of yields with higher volumes.

C. Pest Infestation Control

Pests are one of the most exceedingly terrible foes of the farmers harming the yields universally before it is gathered and put away for human utilization. Mainstream bugs like beetles, grasshoppers, and different creepy crawlies are eating the benefits of farmers and eating the grains implied for people. Be that as it may, presently AI in cultivating gives producers a weapon against such bugs.

Computer based intelligence and information organizations are helping farmers to get alert on his Smartphones about the grasshoppers liable to slip towards a specific homestead or developed harvest field.

Simulated intelligence organizations utilizing the new satellite pictures against photos of a similar utilizing authentic information and AI calculation distinguishes that the bugs had arrived at another area and farmers utilize such data after affirmation and convenient expel the exorbitant nuisances from their fields.

D. Health Monitoring of soil and crop

Proceeds with deforestation and debasement of soil quality are turning into a major test for food delivering nations. In any case, presently a German-based tech startup PEAT has built up a profound learning-based application called Plan tix that can recognize the expected imperfections and supplement insufficiencies in the dirt including plant bugs and ailments.

This application is chipping away at picture acknowledgment-based innovation and you can utilize your cell phone to catch the plant's picture and distinguish the deformities into the plants. You will likewise get soil reclamation procedures with tips and different arrangements on short recordings on this app. Similarly, Trace Genomics is another AI based organization gives soil investigation administrations to reformers. Such applications help farmers to screen the dirt and harvest's wellbeing conditions and produce a solid yield with a more elevated level of productivity. Sky Squirrel Technologies procured by another comparable organization Vine View brought drone-based ethereal imaging answers for checking crops wellbeing. An automaton is utilized to make a series of catching the information from the vineyards field and afterward all the

information is moved by means of a USB drive from the automaton to a PC and dissected by the experts [13]. The organization utilizes the calculations to examine the caught pictures and gives a point by point report containing the momentum soundness of the vineyard, for the most part the state of grapevine leaves as these plants are profoundly inclined to grapevine infections like moulds and microbes helping ranchers to ideal control utilizing the nuisance control and different strategies.

E. Predicting water levels using small data sets

This innovation executes ideas from power through pressure utilized for structural designing estimation and development work at streams and sea shores. We made a capacity dependent on the tank model, utilizing AI to process past precipitation and water level information. Through this, we constructed a numerical model to infer ideal boundaries. This permitted us to foresee water levels dependent on as meagre as three days of precipitation, water levels, and woodland precipitation information [14].

F. Weather Forecasting

Artificial intelligence in a propelled manner is helping the farmers to remain refreshed with the information identified with climate gauging. The estimated/anticipated information assist ranchers with expanding returns and benefits without taking a chance with the yield. The investigation of the information produced causes the rancher to avoid potential risk by comprehension and learning with AI. By actualizing such practice assists with settling on a keen choice on schedule. IBM's Deep Thunder and Monsanto's Climate Corporation is utilized to give rural climate expectations.

G. Maximize ROI

Computer based intelligence can assist farmers with picking the correct kind of yield. In light of information, they can decide the correct blend of harvests that are tweaked for different needs and climate. Computer based intelligence advances can likewise give bits of knowledge on how a specific kind of seed will respond to a specific sort of soil profile, neighbourhood atmosphere conditions and climate estimates. By relating and examining this data, the year-to-year result can be advanced and thus, ROI can be amplified.

H. Image Analysis

Picture acknowledgment is another headway that would permit Farmers to screen their territory and harvests all the more rapidly and effectively, and furthermore comprehend past examples after some time. Computer based intelligence is being prepared to perceive more than 5000 types of plants and creatures, which would improve drone capacity to distinguish bother ailment and harvest harm. Undesirable plants developing in ranches can likewise be identified by joining picture handling and AI methods. Picture handling can likewise be utilized in natural product reviewing frameworks to fragment and arrange with extraordinary exactness. With right imaging strategies and calculations, the grouping exactness of up to 96% can be acquired.

I. Manpower Challenge

Computer based intelligence empowered agribusiness bots help farmers to discover increasingly proficient approaches to shield their harvests from weeds. This is likewise assisting with conquering the work challenge. Simulated intelligence bots in the farming field can collect yields at a higher volume and quicker pace than human workers. By utilizing AI vision assists with observing the weed and splash them. In this manner, Artificial Intelligence is helping farmers to discover progressively effective approaches to shield their yields from weeds [15][16].

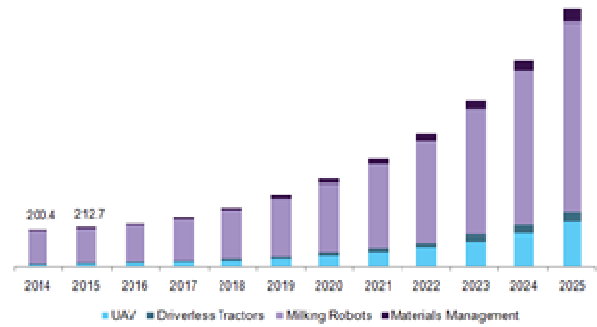


Fig. 1 Adoption of Technology in Agriculture

IV. ROLE OF INFORMATION TECHNOLOGY IN AGRICULTURE

Here figure 2 shows the how an information technology can connect with the end users. It also depicts the areas where IT may leave his impact. This figure 1 shows that what the livelihood technology are connected with rural population according to their skill set and requirement. Here AI paly a very important role to collect the data set and identify the requirements of the famers along with available resources. Now the biggest question is that how the benefits of these technologies communicate to the farmers. This is the biggest challenge because the education for the villagers or farmers are not too much tech savvy. To overcome this problem, I have suggested a prototype model in figure 3. Here the role coordinator in very important. He is the interface between the farmers and Technology. He is directly connected with the farmers and experts via internet in global world.

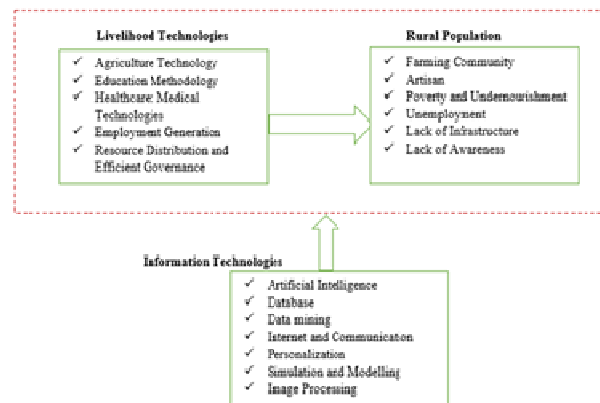


Fig. 2 Relation of Information Technology with Farmers

V. PROPOSED PROTOTYPE MODEL FOR FARMERS TO USE AI

This is the proposed model for the farmers to develop in their areas. Here, Farmers register into the system by sending their information about crop, soil and all other related information. The coordinator sends the crop status through the images and text data. Then the team Agriculture expert collect the information and matches with artificial Intelligence Information System and send back to the advice to the farmer on weekly basis based on the crop status supplied by the coordinator. The coordinator explains the advices to the farmers. Farmers follow the advice take appropriate steps and send the feedback. By this approach this model will work. Here purchaser and investor may also participate directly to the farmers so they can get proper price of the crop.

VI. CHALLENGES OF ARTIFICIAL INTELLIGENCE IN AGRICULTURE

Man-made consciousness in horticulture division can be actualized for different mechanical progressions. These incorporate Machine Learning administrations, Artificial Intelligence counselling administrations, information investigation, web of things and accessibility of sensors and cameras, and so on.

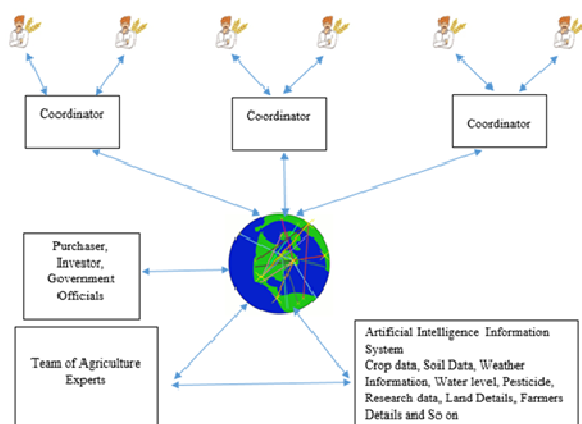


Fig. 3 A Prototype Model of Agriculture for Formers

Machine vision advances can possibly reform applications in the agrarian segment. The utilization of some in cultivating can be utilized in rural procedures like reaping, utilization of exact weed-executing synthetic concoctions, and so on but there are numerous difficulties to send the AI in farming.

A. Skill Requirement

Usage of AI methods in agriculture requires a different level of skill set. These technologies based on hardware, software's, sensors and various tools which requires a training to operate properly. This prompt the proper education should be incorporated at each level.

B. Response Time and Accuracy

In this instance, AI has a very important role. Sometime farmers want to test small part of the soil for particular crop. The behaviour of the crop should be analysed in the shortest period of time with accurate information because to develop

a crop they have fixed season and if the time passes this will be very difficult to carry on. Therefore, the response time and accuracy play a vital role in agriculture.

C. Durability

Whenever farmers are going to deploy a technology that must be durable. In this digital era technology is changing very fast. This will not be economical for farmers to change the devices and sensors in a short period of time because this will not be cost effective for small scale farmers.

D. Initial Costing

As the government is planning to double the income of farmer in next five years but still majority of farmers are not so worthy to afford these type technologies in their fields. The Main issue behind this is initial cost of installation. So companies has to focuses on this issues how they can help to farmers. They can start the usages of these machine or technology on rental basis or percentage of crop basis.

E. Maintenance Cost

Maintenance of specialized hardware is also big issue. Maintenance cost is also count as an investment of crop. If the maintenance cost is higher, then price of your crop may be higher than others. For small scale farmers this will not be suitable and their crop may waste.

F. Regular Updates

Regular updates of machine and software's are required. As the technology updated farmer have to update their system to get more accurate and fresh information. Some system will not work properly with old version.

VII. CONCLUSION

Agribusiness is gradually getting advanced and AI in farming is rising in three significant classifications, (i) agrarian apply autonomy, (ii) soil and yield observing, and (iii) prescient investigation. Farmers are progressively utilizing sensors and soil inspecting to assemble information and this information is put away on farm the executive's frameworks that takes into account better preparing and examination. The accessibility of this information and other related information is clearing an approach to send AI in agribusiness.

Computer based intelligence System in agribusiness helping farmers to computerize their cultivating as well as moving to exact development for higher harvest yield and better quality while utilizing less assets.

Artificial intelligence fuelled arrangements won't just empower farmers to accomplish more with less, however it will likewise improve quality and guarantee quicker go-to-advertise for crops. While we may simply be at the beginning phase of this change, here are some significant ways AI is changing the agrarian part.

The AI-controlled innovations can help the agribusiness division to yield more beneficial harvests, control bugs, screen soil, and developing conditions, compose information for ranchers, help with the remaining burden, and advance a huge scope of horticulture related assignments in the whole food gracefully chain. These developments to cultivating

have been significantly determined by environmental change, populace development and food security concerns.

REFERENCES

- [1] <https://customerthink.com/the-role-of-artificial-intelligence-in-agriculture-sector/>
- [2] <https://emerj.com/ai-sector-overviews/ai-agriculture-present-applications-impact/>
- [3] <https://www.analyticsinsight.net/ai-in-agriculture-strengthening-the-future-of-farming/>
- [4] <https://www.analyticsinsight.net/ai-in-agriculture-strengthening-the-future-of-farming/>
- [5] <http://www.fao.org/e-agriculture/news/can-artificial-intelligence-help-improve-agricultural-productivity>
- [6] <https://www.pluginandplaytechcenter.com/resources/artificial-intelligence-agtech/>
- [7] Kumar, N., Y. Awasthi, and R. P. Agarwal. "Authenticating cloud and data centre with iris," *International Journal of Engineering and Research*, vol 4(3), pp. 213-216, 2016.
- [8] Deepak G. Panpatte. "Artificial Intelligence in Agriculture: An Emerging Era of Research," *Intuition Science*, CANADA, 2018.
- [9] R. Tomar and Y. Awasthi, "Prevention Techniques Employed in Wireless Ad-Hoc Networks," 2019 International Conference on Advanced Science and Engineering (ICOASE), Zakho - Duhok, Iraq, pp. 192-197, 2019, doi: 10.1109/ICOASE.2019.8723725.
- [10] N. Singh and Y. Awasthi, "WSN-AI based Cloud Computing Architectures for Energy Efficient Climate Smart Agriculture with Big Data analysis," 2019 International Journal of Advanced Trends in Computer Science and Engineering, pp. 91-97, 2019.
- [11] Thangadurai Natarajan and Niraj Prasad Bhatta, "Utilization of IOT and AI for Agriculture," *International Journal of Advanced Technology and Engineering Exploration*, vol. 8(5), pp. 2731-2735, 2019.
- [12] Awasthi, Yogesh, R. P. Agarwal, and B. K. Sharma. "A Novel Secure Watermarking Scheme for RDBMS," *International Journal of Data Warehousing & Mining*, vol. 4. 2014.
- [13] Medar, Ramesh, Vijay S. Rajpurohit, and Shweta Shweta. "Crop Yield Prediction using Machine Learning Techniques." 2019 IEEE 5th International Conference for Convergence in Technology (I2CT). IEEE, 2019.
- [14] Pathan, Misbah, et al. "Artificial cognition for applications in smart agriculture: A comprehensive review." *Artificial Intelligence in Agriculture*, 2020.
- [15] Geli, Hatim, et al. "Climate Adaptive Smart Systems for Future Agricultural and Rangeland Production.", 2019.
- [16] Ruggieri, Sara. "Ai and robots: the impact on the labour market." (2019).