Review of the robot system in agriculture.

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Abstract –

The farming was done through manual efforts in the former agriculture sector. In the previous agriculture method, they using the farming sector the bulls are used. In the previous agriculture method, they using the farming sector the bulls are used. In farming plowing, harrowing, sowing, etc. methods are using by farmers. In agriculture, many types of robots are used. This robot is designed to reduce labor and time agricultural work. In agricultural areas, the main application of robots is farming, weed control, and environmental monitoring. In agriculture robots some technics which are used fuzzy logic, genetic algorithm, artificial neural network, artificial intelligence, IoT, and Image processing in Agriculture robots. This technique was used in the robot to assist the farmers. Image processing techniques, which mainly have four processes as pre-processing, apportionment, abstraction, and description, have become a promising instrument of accurate real-time weed, disease identification, automatic spraying, and crop detection.

***Keywords* — Agriculture robot, Fuzzy logic, Genetic algorithm, Artificial neural network, Artificial intelligence, Image Processing.**

I. INTRODUCTION

The history of agriculture documents the domestication of plants and animals and the production and propagation of techniques to raise them productively. India is a cultivated country and about 70 % of the population depends on agriculture. In the previous agriculture method, they using the farming sector the bulls are used. In farming plowing, harrowing, sowing, etc. methods are using by farmers. Later the tractors developed to reduce the time and effort required for the agricultural process. Tractor as a technology, they minimize the human effort some amount. In a tractor, so many agriculture instruments are used for farming. Later different attachments for tractors were developed for a process like sowing and pesticide spraying. The first agricultural robot was developed in 1920 for automatic vehicle guidance. There were many advancements in agricultural robots from 1950 to 1960. To direct their course, however, they still needed a cable system.

After the development of computers in 1980 machine vision guidance, we can possible. Later the robots were developed for harvesting oranges. Due to the unavailability of laborers the robots where input improved. Todays the robots are used for harvesting, sowing, weed detection, row detection, etc. in agriculture, facing objections including climate variability, short land and groundwater, and the threat of diseases, pests, and weed. In recent machine vision technology, the machine affects the human eye through the work for the measure and calculation in agricultural production to recover human operation. The human eye works for the measure and calculation in agricultural production to recover human operation. Machine vision technology is divided into three parts: image capture, image pre-processed, and input/output command. There are four procedures in image processing: pre-process, apportionment, features extract, and category. In image apportionment, original images from the camera need to be pre-processed. The YUV color is the basic color used in analogy color TV broadcasting. This model defines a color space in terms of one is luminance and two chrominance components. HIS (Hue, Intensity, Saturation) color space is developed to be intuitive in manipulating color and design to approximate the way humans perceive color.

In image segmentation, a threshold algorithm based on the H component is used to convert a grayscale image to a binary image. In feature extraction, the vegetation could be extracted and a mask can generate to remove the background from the original signal. Image processing is also used in crop row detection. This method is used to detect curved and straight crop rows and image capture during the initial crop and weed plant growth process. Spotting of plants outside the crop row, which is necessary for reliable independent guidance and site-specific care, including the elimination of weeds based on the spotting of plants outer the crop.

II. Literature Survey

H.K. Chiou et.al. [1] Presented a paper for an agriculture tricopter. The technique used in this paper is a modern reinforcement fusion algorithm. To develop and maximize controller gains, a fusion particle swarm optimization-evolutionary programming algorithm, which is an enhanced version of the stochastic optimization strategy PSO, was presented in this report. This study's mathematical calculations involve the propagation with particle swarm optimization of the extension principle.

Barakat M. H. et.al. [2] Designed a robot model for agriculture service using artificial fuzzy logic. In this current paper the control and reproduction of a mobile skid steering agricultural service robot for grass cutting purposes. The first thing used to design a mobile robot is fuzzy modeling as a modeling tool and the second thing is a software program called MATLAB for identification tool. The fuzzy logic controller and fuzzy self-tuning of the PID controller are used to command the path tracking of the mobile robot.

Monis J. I.et.al. [3] Designed a photovoltaic pumping irrigation system. Centered near the application of engineering rules, the suggested approach combines an abounding strategy. The goal of the irrigation system is to reduce the genetic algorithm search space to find excellent work within this search space. Due to the reduction of the search space, this technique provides fast and more precise concurrence.

Meng Q. et.al. [4] Developed an agriculture robot using machine vision. This paper provides research on the instruction of line identification for atomic vision agriculture mobile robot under essential environment. A method for line identification based on an improved genetic algorithm has been proposed in this paper. The result shows that the instruction line identification method using an improved genetic algorithm can detect the exploration line.

Thuyet D. Q. U.a. et.al. [5] developed a robot system for self-governing root-cut garlic classify and categorize. A robot was developed that uses an expert system algorithm is fitted with a deep convolution neural network to automatically grade and sort root cut garlic place on image analysis. The robot device consists of three main modules: a module for image acquisition, an image processing module, and a module for garlic sorting. The results show that the time required to cut and categorize one garlic in 11s and total grading accuracy was 89%.

Xiong G. L. et.al. [6] Developed a robot for strawberry harvesting. This paper introduces a machine vision device in a strawberry harvesting robot for the localization of strawberry and environmental perception. A deep convolution neural network is used to detect the strawberries. The outcome shows that the algorithm could correctly identify the strawberries and could recognize the weather within the healthy harvesting area of the strawberries.

Liu S. U.a. et.al. [7] Proposed irrigation pipe style tree network system. The primary purpose of the irrigation pipe type of tree network is to conserve water. An improved model is built in this paper with the impact of different layouts of the pipe network and pipe diameters. The model will guarantee the connectivity of the water source by utilizing the idea of level water nodes. An enhanced self-adaptive bat algorithm is used in the tree-style irrigation pipe network framework. The outcome shows that there are strong accuracy and extensibility of the pipe network method using an enhanced bat algorithm.

Yaseen Z. M. et.al. [8] Presented a paper for developing dam and pool operation using a hybrid bat swarm algorithm. This paper shows the efficiency of the developed algorithm to look for the global optimal solution and the time consumption for concurrence are one of the major challenges and difficulties in creating an optimal operating rule for dam and reservoir service. These results showed the proposed HB-SA algorithm could achieve minimal irrigation deficits and outperform the other optimization algorithms. Furthermore, using HB-SA, the measurement time for the convergence process is decreased.

A paper was presented by Cor Verdouw et.al. [9] On food and farm systems based on the IoT. This paper establishes and puts an architectural structure for modeling agricultural and food-related IoT-based systems. The structure contains a logical set of architectural viewpoints and a guideline for modeling the architectures of individual IoT-based systems using these viewpoints. The structure provides a valuable aid to model the IoT-based systems architecture of this varied collection of use instances in a time, prompt and logical manner.

Mobasshir Mahbub et.al. [10] Using embedded electronics, IoT, and the wireless sensor network, a smart framing concept was developed. Embedded systems-based farming systems, IoT, and wireless sensor networks for agricultural and livestock farms, as prescribed in this article. This paper covers the definition of electronic machine circuit systems, the use of network protocols, and smart remote protocols smart remote monitoring systems for smartphones and PCs.

N.N. Misra et.al. [11] Presented a paper on artificial intelligence in the agriculture and food industry. In this paper, an IoT overview of Artificial Intelligence (AI) and Big Data and their transformative position to create the future of agro-food systems is presented. Tackle the part of

IoT and big data analytics in agriculture, including greenhouse, observe, smart farm machines and drone-based crop imaging, supply network automation, food industry social media, food quality measurement.

A paper on the farming method was presented by embedded sensing with artificial intelligence by Dmitrii Shadrin et.al. [12] An embedded device enhance with the AI was presented in this paper, assure the continuous analysis and in-site prediction of the growth dynamics of plant leaves. The proposed solution ensures that the device runs autonomously for 180 days using a single Li-ion battery.

Ali Bolat et.al. [13] Presented a paper on the opinion of target-direction weed control system using machine vision. In this paper, we study was to create and test an automatic spraying robot based on machine vision for the identification, monitoring, and spraying on weeds using the programming language of Lab VIEW. To discern green objects in the picture, the greenness method was used. Conforming to the existence of an artificial weed, a time-controlled spray nozzle was run. Conforming to the results, on average, site-specific spraying applications saved 89.48 %, 79.98 %, and 73.93 % of application volumes for spraying duration of 500 ms, 1000 ms, and 1500 ms, respectively, relative to broadcast spraying application at all spraying speeds.

Jose Miguel Guerrero et.al. [14] A paper on field weed identification using a computer vision system was presented. In this paper we study a new machine vision system based on the identification of crop rows with three objectives: achieve correct direction for each direction at the start point in the field, arrive at precise instruction during the follow-up path, and to determine the density and overlap of weeds. An identification of crop rows with precise adjustment and extraction, determining the data weed densities for site-specific treatments, guidance, and overlap the region to be handled.

Kaspars Sudars et.al. [15] A paper on food crop and weed image data set for robotic computer vision control was presented. Artificial intelligence solutions based on a computer vision approach are required for weed conduct technologies that can recognize weeds and differentiate them from crops to allow the advancement of precisely targeted and autonomous robotic weed management systems. An open-access dataset with manually interpret images for weed detection in this data paper was suggested. The dataset consists of 1,118 images in which 6 food crops and 8 species of weed are described, with a total of 7,853 annotations. The photos were taken at various growth stages of food crops and weeds grown in managed environments and field conditions.

V.K. Tewari et.al. [16] A paper on an image processing-dependent chemical sparing method for disease control was presented. An actual-time flexible-rate chemical spraying system based on image processing was developed to accurately apply agrochemicals to disease paddy crops based on crop disease severity details. The system growth consisted of image acquisition web cameras, image processing laptops, system feature control microcontrollers, and spraying nozzles assisted by solenoid valves. In contrast with the CRA mode, the field test results showed a minimum 33.88 % reduction in applied chemicals when working in the VRA mode.

III. AGRICULTURE ROBOT

In this study, the prototype of the agricultural robot in 1920 began to take shape, to integrate vehicle guidance into agriculture. This development in research between 1959 and 1960 of the autonomous vehicle of agriculture. Using cables, this vehicle guides its route. Continuous growth in the agricultural sector, including technology in other industries. In 1980, computer development made it possible for machine vision guidance to be provided. The robot has been integrated into robotics for indoor and outdoor farming, which are more complicated and difficult to create. In the agricultural zone, with a population, a lot of labor demand. Currently, the US depends on a big number of staff, but they can reduce the framework and avoid attempts to increase. There are questions about the increasing population that will have to be nurtured in the coming years. There is a great need, therefore, to upgrade agricultural machinery to extra cost-effective and feasible for last use. The latest research on autonomous agricultural vehicles continues to operate. Modern robots are capable of harvesting apples every five to ten seconds at a rate of one, whereas the average human harvest is one per second. In agriculture, robots have many areas of use. The Merlin Robot Milker, Rosphere, Harvest Automation, Orange Harvester, Lettuce Bot, and Weeder are some examples and prototypes of robots. In agriculture robots some technics are used first is fuzzy logic, genetic algorithm, artificial neural network, artificial intelligence, IoT, and Image processing.

IV. FUZZY LOGIC

Fuzzy logic has developed in 1965 with the context of the theory of fuzzy sets by Lotfi Zadeh. The first application of fuzzy logic is implemented in Japan. A fuzzy set is typically a real number of the interval of [0, 1]. The sets of truth value are [0, 1], where 0 represent as false and 1 represents as true and another value is a partial truth. Fuzzy logic is based on observation of people decide on accurate and not number information. In fuzzy logic, the models have the capability of recognizing, representing, manipulating, interpreting, and useful information. In the current application, fuzzy logic is used in medical decision-making. It is a benefit for medical and health care data. Fuzzy logic is also used in computer-aided diagnosis in medicine. The fuzzy logic used in the agriculture sector, soil moisture, temperature, water, plant diseases, etc. fuzzy logic has quickly captured knowledge of the agriculture sector. Fuzzy logic will calculate and predict the risk of diseases on plant-based on factors and symptoms.

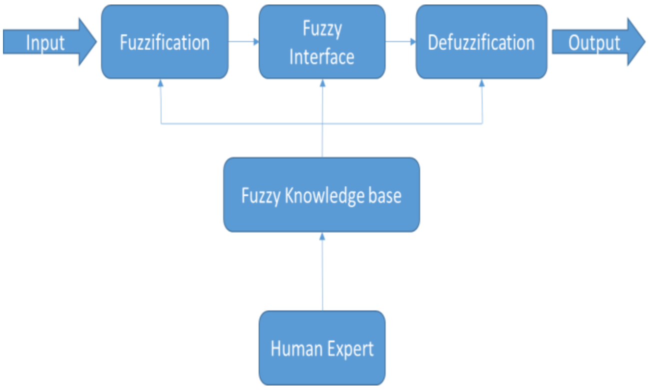

Fig.1 A framework of fuzzy modeling in agriculture

V. GENETIC ALGORITHM

A genetic algorithm is a method for optimization used as a met heuristic (evolutionary) algorithm. In 1958, Bremermann HJ discovered it. Then, in 1975, its use in information technology was introduced by John Holland. The genetic algorithm is an AI technique inspired by genetic values and natural section measures. A genetic algorithm is a technique is based on the principle of genetic and Natural Selection. It is used to find optimal or near-optimal solutions to a difficult problem, otherwise to solve the problem lifetime. A genetic algorithm solved an optimization problem to get a better solution. The algorithm produced a maximum number of generations or satisfy fitness level. It is a good advantage of genetic algorithm it is faster and efficient as compared to others methods. In a genetic algorithm, we take a random population of people who go through each person to find the highest fitness value for the best individuals. The situation is tested here as to whether or not the solution will solve the problem. If not then the process again goes for the new population by adding the genetic information (crossover) of old best individuals, this individual's species go through mutation, then we go for the section of an individual with the highest fitness value, this continues till we get the best fitness value of the solution for complex problems.

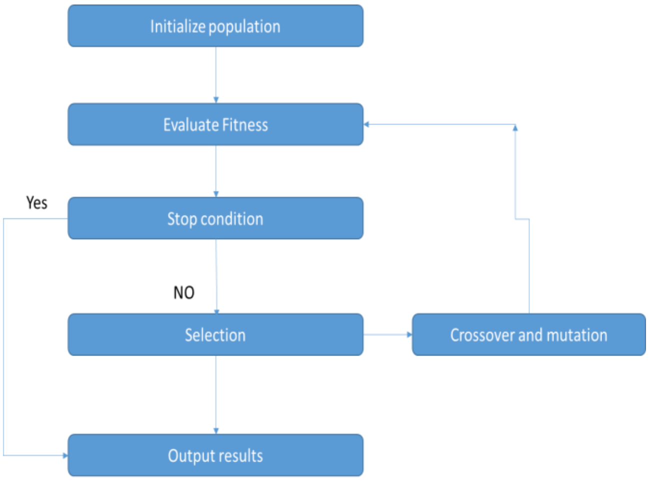

Fig.2 Flow Diagram of Genetic Algorithm

VI. ARTIFICIAL NEURAL NETWORK

Alexander Bain introduced the neural network concept in 1873. The trending area of study is the neural network. The neural network is inspired by the human brain's neural system, which acts by analyzing the effects, emerging with the perfect action on the change. In 1943 Warren Mcculloch and Walter Pitts invent a computing idea for the neural network. The components of the artificial neural network are Neurons, Connection, and weight, and propagation function. The neurons manifold coat, particularly for wide assimilate. Each layer connects to nerve cell are instantly previous and following layers. The following layer that collects the external data is an input layer and produces many results in an output from. In an artificial neural network, a hyperparameter is a continuous framework is set before a learning process. Neural networks help solve complex, dynamic problems. In three different layers, such as the input coat, the hidden coat, and the last output coat, an artificial neural network operates. This layer is formed by a nodes-called activation function. The nodes have distinct data and data sets that are used to analyze new input features. With the help of pre-learning data sets, the input layer continually recognizes the set of input characteristics. Artificial neural networks so many applications include system identification and control, radar system, Face identification, signal classification, 3D reconstruction. It is also used in the agriculture sector. It is also used in the type of cancer and to distinguish highly cancer cell lines.

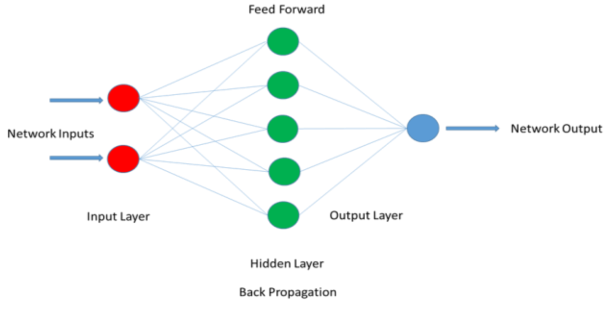

Fig. 3 Artificial Neural Network

VII. ARTIFICIAL INTELLIGENCE

We have been dependent on the growth of agriculture since old age. In our lives, the production of agriculture plays a significant role in meeting our energy requirements in the form of healthy food. In several developing countries, the agricultural growth revolution of 1.0 to 4.0 has replaced the hard work of farmers with AI-based smart robots. Nevertheless, due to some major problems such as less production of such advanced robots for unpredictable agricultural conditions, less understanding of modern development, higher costs of available robots. The creation of such new and advanced robotics technology is being ignored by Indian farmers. To build user-friendly robots for the Indian agricultural sector, researchers are working on this major issue. The researchers' workspace is focused on the implementation of AI techniques in the production of agricultural robotics technology. AI-based robots with advanced data management technology for sensor technology and intelligent decision algorithms help to solve complex agricultural problems that lead to the development of AI techniques. With the support of AI algorithms, several researchers are working on the advancement of agricultural robotics technology. The development of this new robot technology in the industry has led to the growth of the industry and precision operations. With the same inspiration, several researchers have applied artificial intelligence techniques for different applications in the field of robotics. In the agricultural industry, the implementation of AI can be split into two sensor modules, the First Vision System and the Second Navigation System.

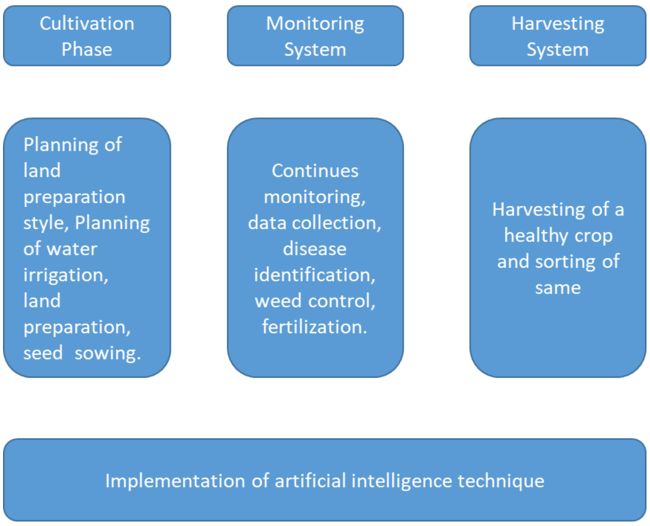

Fig. 4 agricultural process of any crop cycle goes through three-phase

The vision-based navigation system has recently taken the lead in developing agricultural robotics. The vision system and artificial intelligence-based navigation system allow agricultural robots to learn all the parameters of crops and weeds for easy weed control, route planning, and field monitoring followed by safe productivity harvesting. All the activities of three different types of crop cycle phases are conducted using the advancement of robotics technology based on artificial intelligence techniques. To name a few inventions such as John Deere ITEC pro, AGBOT II driverless tractors, which is a field robot prototype used for automatic fertilizer, weed detection, and classification, wall-Ye is a farm robot used for surveillance mapping and classification, the latest research in swarm robotics called MARS used for data collection is small in size and teamwork to complete the tasks. Harvey, Seeds, Dogtooth, are used for fruit and vegetable harvesting. For Apple harvesting, the main evolution of harvesting robots is seen.

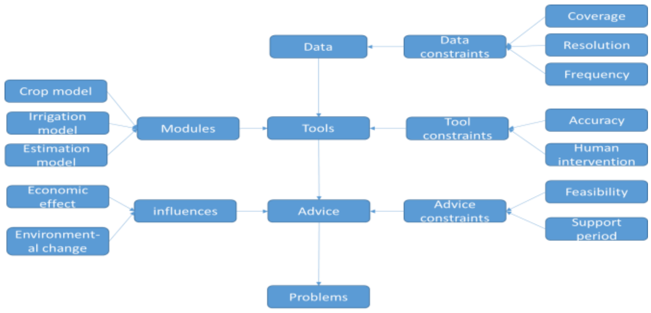

Fig. 5 A general framework of agriculture decision support system

VIII. IMAGE PROCESSING

In the 1960s, the image processing technique was established. A few other research facilities with satellite imagery application, conversion of wire-photo standards, medical imaging, videophone, character recognition, and enhancement of photography. Advance the quality of the image was the intention of early image processing. It was intended to enhance human beings' visual effects. The input is a low-quality image in image processing, and the output is an image of better quality. Popular image processing includes enhancement, recovery, encoding, and compression of images. Improved image information for image processing is a method of performing some operations on an image. It is a form of signal processing in which an image is an input and the image associated with that image output. The few stages in image processing are pre-processing, segmentation, image recognition, and extraction and feature classification. In the agriculture sector, this step is used to identify crop detection, row detection, weed detection, and disease detection.

8.1 Pre-processing

Image pre-processing is the name for image operations at the low level of distraction, aim is to improve image data that eliminates unwanted distortions or enhances certain image characteristics that are important for further processing. Image pre-processing makes use of image redundancy. In particular, comparison acclimates, strength acclimate, and histogram coordination, linearization, and grammatical operation are collated to the achievement of four pre-processing methods. Color space change, regularize, rescale, contrast enhancement, and de-noising are involved in image pre-processing. RGB, HIS, HSV are used in the color space models. All these color space models can be obtained from RGB via the transformation function. RGB is the most widely used in color space and, due to the high similarity between the components R, G, and B, is a suite for color display, but not ideal for apportionment and examination. The HSV color space is more consistent with the understanding of human color and resilient to the variance of illumination.

8.2 Segmentation

Picture Segmentation is the mechanism by which a digital image is divided into different subgroups (of pixels) called image artifacts, which may decrease the image's complexity, making it easier to interpret the image. In general, segmentation is characterized for image processing as a process of assembling relevant pixels to composition connected objects that have comparatively corresponding properties. In robotics, image segmentation has a vast application area, such as RPA, self-driving cars, etc. Implementations of image segmentation are commonly used for the process in Python, MATLAB, and other languages.

Perhaps the most simple and effective technique for defining the appropriate objects in an image is the Threshold Process. The image pixels are split by comparing the intensity of the pixel to a threshold value depending on the intensity. When the objects in the image in question are considered to have more amplitude than the background of the image, the threshold approach proves to be beneficial. Simple Thresholding is a technique that substitutes either black or white for the pixels in an image. If the strength at the location of a pixel is less than the threshold, then we substitute that for black, and if it is more than that, then we substitute that pixel for white. That's a binary thresholding strategy. For different components of the picture, we need an adaptive approach that can alter the threshold. In algorithm divide an image into different small parts and determines the threshold of image parts. The segmentation techniques based on the area include the algorithm generating segments by splitting the image into different components with similar characteristics.

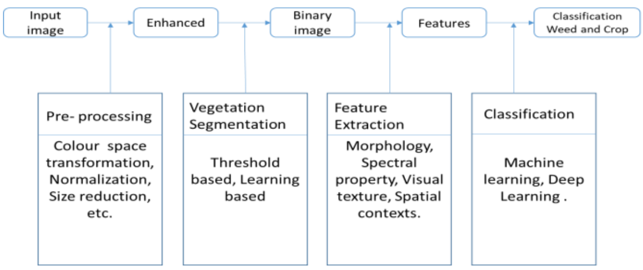

Fig. 6 General workflow of Image Processing

8.3 Feature Extraction

Extraction of features is the name for methods are combined variables into features, essentially reduced some amount of data to be processed, still representing the original data set accurately and fully. Feature extraction begins from a beginning collection of calculated data in machine learning, design identification, and image pre-processing and constructs derived values calculated to be penetrating and non- diffuse, enabling the subsequent steps are follow and conclusion, and in some cases prime to suitable human explanation. The evocation of features is connected to reducing measurement. It is anticipated that the selected features will contain the required input data information so that the chosen task can be accomplished by using this cut chart instead of the full data. In feature extraction techniques are build the order provide numeric program environment such as MATLAB. Feature evocation is a form of reduction in complexity where a large number of feature pixels are effectively represented in such a way that useful parts of the image are efficiently captured. Extraction of features is a method that determines the data's significant features or attributes. Pattern identification and recognizing common patterns within a wide number of documents are some examples of this technique. Spam-detection program is one example of feature extraction that all of us can relate to.

8.4 classification

The object of the classification process is to categorize all pixels into one of several land cover groups or "themes" in a digital image. It is then possible to use this categorized data to generate thematic maps of the land cover present in a picture. You may use the resulting raster from the classification of images to construct thematic maps. The classification process is a multi-stage workflow, the toolbar provides Image Classification was designed to provide an integrated environment to classify the tools. The numerous algorithms are used to pick efficient quality, include hybrid artificial neural networks-cultural algorithm, optimization of particle swarm-based methods based on evolution. The classification is divided into two groups: a classification based on traditional machine learning and a classification based on deep learning. Conventional classifications based on machine learning typically follow the procedures: pre-possessing, segmentation, extraction, and classification of features. In a newly developed deep learning algorithm, a plant classification that is used by the convolutional neural network was investigated. The procedures usually adopt traditional classifications based on machine learning: pre-possessing, segmentation, extraction, and classification of features. A plant classification that is used by the convolutional neural network was explored in a newly developed deep learning algorithm.

IX. CONCLUSION

A few research papers with some techniques that are used for robotics are published based on agriculture robots. We review research papers on fuzzy logic and the genetic algorithm used in agriculture robots in a short period to learn and calibrate its controller online and incorporate a lifelong learning strategy. We are studying research papers on artificial neural networks used in agricultural robots that are used throughout the growing period to accurately classify crops and weeds. Use this tool to measure the height and width of the crop. We study research paper on Agricultural robot artificial intelligence, it helps to control the pest, help organize farming data, and improve the effectiveness of crops, reducing framing workload. We study research papers on image processing that can recognize the detection of crops and weeds, identification of diseases, and the detection of plant rows.

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