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Smart Irrigation System Using CNN And DNN

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Abstract:-Agriculture is considered a very important source in our country in dial and the whole world. If there is agriculture in the country, grains will grow, animals will survive. Population growth increased so much in the entire country. Agriculture has become in effective for farmers. In a view of population growth, food production has decreased. Current technique s such as deep learning, IOT and machine learning are used for agriculture. IOT is very new to agriculture and farming. IOT is used for raw material s. IOT collect data many areas. We have to face story coming from agriculture business. Smart irrigation system is used. Agriculture is important source of water. If water is irrigated, fruits will grow.

Keywords:-Machine learning, Deep Learning, Crops, farming precision, Agriculture, Node mcu

1. Introduction:- Seeing the increasing population in countries like India. Employment was given in agriculture. Agriculture provides to about 50-60 percentages of the people but due to technological development, people shifted from rural areas to urban aras to live a sophisticated life. Agriculture is important to meet the food demand and get more produce. Because it affects the economy of the country, the government organization cancels the loan support taken by the farmers and help providing food fertilizers. Many steps are taken to grow crops. Such as soil characterises climate which affect crop losses in different regions. Precision agriculture used to avoid crop looses. With the help of precision farming things like air,soil climate can be analyzed using iot in the present time precision farming improves yields by using natural resource effiecnt methods. IOT, Machine Learning, Deep Learning are being used to select the right crop. Smart irrigation system uses agriculture system and sensor information technology. Large amounts of data are generated. Data transmission electronic system has been used with the help of IOT. Smart Irrigation System can increase crop yield and quality. Can reduce pesticides and fertilizers. Water should be applied in equal quality in the fields. Sensor based system can be controlled through web site, Mobile app. saving water and diverting water also helps in monitoring irrigation. Soil Moisture also tells the moisture content of the soil. At the same time, unnecessary water is released form the body in the form of vapour by banking plants. Also information about water evaporation and other weather condition can be detected. Plant sensors are installed on them. Pants have information about water. The efficacy of smart irrigation system can increase. This helps in reducing wastages in water.

1.1 IOT in Agriculture:- efficiency of agricultural production. Soil moisture sensor, water level sensor, Temperature sensor etc. To monitor agriculture activates like irrigation monitoring etc. To save crop and plants. A Framework is provided for intelligent agriculture by taking advantage of agriculture of fields that are continually monitoring any location much more benefits are obtained from IOT basic smart agriculture is done sensors can collect large amount of data from source such as commerce sensors, social networking etc. There are 3 basic issues in IOT. Becomes actions in various real-world applications. IOT has a significant impact on the Data collection storage analysis search

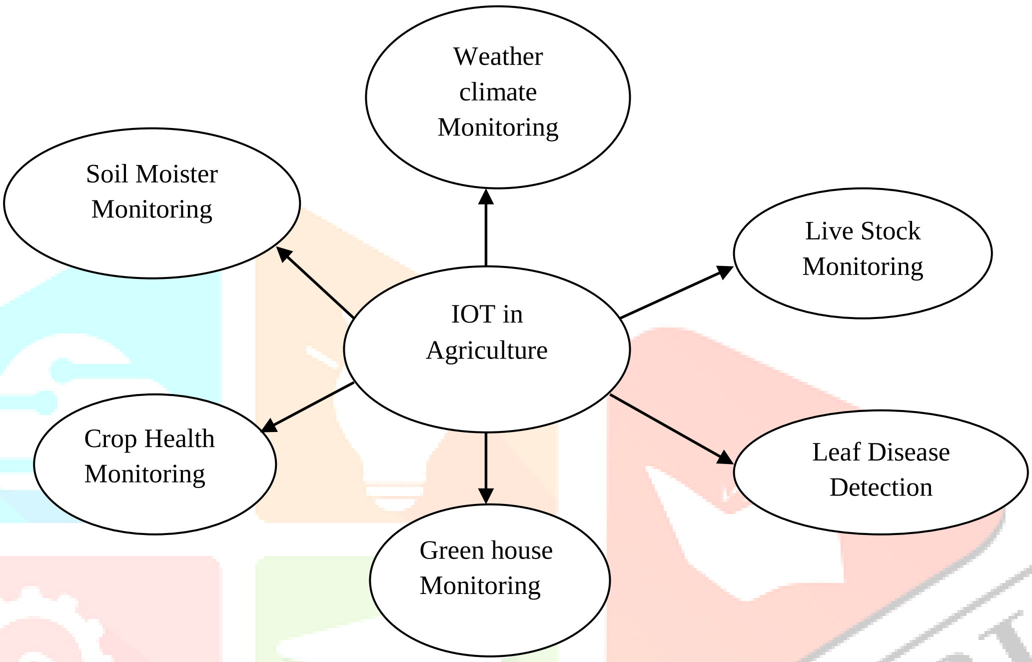


Fig: - Connecting Agriculture using Internet of Things

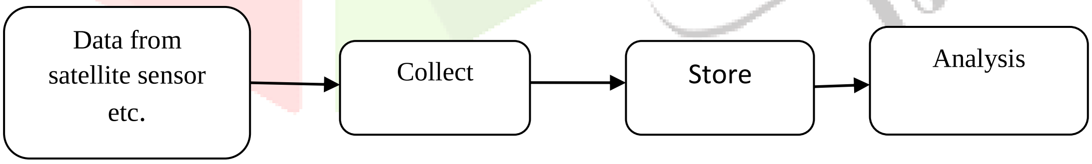


Fig: - process of data analysis Water Irrigation problems

Problem	Description
Water Irrigation problems	Of the freshwater available on the planet, 70% is used for agriculture (Project guru n.d.) To successfully use a water management system that is intelligent, a brilliant system is required
Lack of information about dirt	Crop soil is altered every day by weather conditions, and farmers must always consider which soil is best for their crops
Identifying diseases the plant-related issue	Addressing the latent danger of leaf disease may lurk in plants until it is too late to do anything about it. is a vital feature, but if it isn't done in time, there may be a delay in the diagnosis of plant disease, which makes the use of automated detection important.
Sourcing and procurement Management Problem	The supply chain might be aided by sensors that rely on location information, indicating a drop in privacy concerns and an increase in comprehension by customers
An inadequate nutrient supply accommodation of soil and plant concerning nutrient needs Detection	Intelligent objects should be handled effectively
The concentration of Nitrate was found	As with other application areas; smart farming generates massive amounts of complex data. Additionally, the data emanates from a variety of sensor systems.

1.2 Problem Statement:-it is important to detect and identify plant pests in the agricultural fields to identify them. Variations between species, such as crop diseases and pests, are explored. The detection of common agricultural commodities is more complex. It is necessary to increase and decrease crop production to prevent pest attacks. With the help of technology machine learning and deep learning are used. Technology is used to detect different types of pests. Technology is used to detect different types of pests. Technical does not have any effect. Two groups of inspects have been identified and classified. There is a lack education and skills to distinguish between harmful insects and beneficial insects. Due to this, both types of insects are destroyed. Causes damage to long term yield. And damages crops. After the plant turns yellow, fertiliser is applied to turns it greens. So that the nutrients and crop data are included. Farmer s are often unaware of the pests that destroy crops. Scheduled pesticides are used, crops harmful to human health. Food is added to the crops. The farmer is also unaware of the fertility of the soil. And spread food without permission. Plants and pesticides are heavily controlled. Smart irrigation system using CNN and DNN has been used to identify pests. Through which crop diseases are detected. Applying too much or too little water can cause damage to the crop therefore, the amount of water is determined. The Smart irrigation System uses wirelessly networked sensors to help manage various activities on the farm. Such as Soil Moisture, Temperature, content. The water level is rising due to weather conditions. In order not to divert the attention of the farmers, water level Management done by the area should be mad more comfortable with the help of computer and mobile. Farming should be easy. Farming seems more of a noun.

2. Literature Review:-

Prof C.H.Chavan and P.V.Karnade (2014) proposed a system smart wireless sensor network for monitoring environmental parameters using Zigbee. In this model, nodes can send data to a central server, which stores and further process the data and then displayed it. The drawback is weather forecasting and nutrient content is not determined in their proposed system.

This paper on "Automatic Irrigation System on Sensing Soil Moisture Content" is intended to create an automated irrigation mechanism which turns the pumping motor ON and OFF on detecting the dampness content of the earth. In this paper only soil moisture value is considered but proposed project provided extension to this existed project by adding temperature and humidity values.

By referring all above papers it is found that no such systems are existed with all integrated features but proposed system includes these all features such as displaying temperature, humidity and soil moisture values and also automatic switching on and off of motor by considering soil moisture values.

Various data mining approaches are used for agricultural related problems. One such approach used here is the classification for predicting crop loss, crop diseases, and crop production. In this work, it mainly predicts the crop loss caused by grass grub insect which uses classifiers such as Decision tree, Random forest, Naïve Bayes Support vector machine, and Neural Network are used. For that different evaluation criteria are used to select the best prediction model it includes, F1-score, accuracy, precision, recall etc. By applying the evaluation criteria to the classification algorithms the neural network and random forest produce better output, but this work states that the result can be further improved by applying some hybrid approaches. R. Ramya, C. Sandhya, R. Shwetha proposed Smart Farming using sensing technology. Their work used a smart farming system which uses different types of sensors to measure the moisture, pH, temperature, and intensity of light. These sensors will collect the information and the collected data helps the farmers to enhance the productivity by studying about the favourable environmental conditions.

The whole smart farming system is controlled by Arduino microcontroller which is quite commonly used microcontroller board. But this work suggests the use of a wireless sensor network and to use Raspberry Pi instead of Arduino due to the advancements that it is having in the field of IoT. P. Bhargavi, S. Jyothi collected the soil database and soil classification is done using the various data relevant to the soil. In the initial step, the soil database is created and the soil samples had been taken from a particular district and to these soil samples, Naïve Bayes classification technique is applied. In addition to the Naïve Bays other data mining techniques are also compared. The classifier classifies the soil type as clay, loam, sandy loam etc. The disadvantage here is the soil samples are tested in the laboratory and then based on that the properties of the soil the database are created. Hence this work suggests conducting soil tests in the field itself in order to improve the result of soil classification. Niketa Gandhi, Leisa J. Armstrong, Owaiz

Petkar, Amiya Kumar Tripathy uses a support vector machine (SVM) machine learning method to find the yield prediction of rice. The study area contains a dataset from Maharashtra state which includes precipitation, maximum, minimum, average temperature, cultivation area, and production etc. Generally, the SVM is used to create functions and in this Sequential Minimal Optimization (SMO) classifier algorithm is taken for the current study using WEKA tool. The results showed that compared to SVM other classifiers such as Naive Bayes and Multilayer perception produces better results in terms of specificity, accuracy, and sensitivity. Niketa Gandhi, Owaiz Petkar, Leisa J. Armstrong predicted production of the rice yield using the Neural Network approach.

In Maharashtra state 27 districts are chosen and in that, publicly available records were taken, these records include parameters like minimum temperature, average temperature, maximum temperature, area, and production. For this dataset Multilayer Perception, Neural Network is applied for processing with the help of WEKA tool. But this work suggests that in the Artificial Neural Network based model the prediction capabilities can be improved by considering additional parameters. Amir Haghverdia, Robert A. Washington-Allenb, Brian G. Leibc predicted the cotton lint yield using remote sensing technology. The satellite remote sensing technology is primarily used for assessment and monitoring of the agricultural land in order to determine the area, amount and type of crop production. Deep Learning can be applied and used for this type of problems. In this Artificial Neural Network (ANN) approach is used to generate the models related to individual Crop Indices (CI) and CI phonology to map and predict the yield of cotton lint in two growing seasons.

Deep Learning is one of the techniques recently used for data analysis and for processing images. It provides better results and used for various purposes other than agriculture. The advantage of Deep Learning in agriculture is not limited. It has wide applications in agriculture like classifying images, data analysis and so on. The drawback found here is the training time taken by the Deep Learning algorithm, but it provides faster computation. The study area contains parameters like mean temperature and precipitation for the respective growing season. This shows that the yield found using spatial data highly correlates with the earlier prediction. Hence ANN can be used for providing great yield prediction using remote sensing. Umair Ayub, Syed Atif Moqurrab proposed a data mining technique for Predicting the Crop Diseases. In their method, the author focuses on the prediction of crop loss due to grass grub insect. They used different data mining techniques to overcome the problems faced in agriculture. The results suggested that classification which is one of the data mining approaches is very much effective one predicting crop-related problems and also helps the farmers to take decisions.

Computational expensive is high due to CMM index measurement

Paper Title: Modelling a Predictive Analytics Methodology for Forecasting Rice Variety and Quality on Yield On Farm and Farming Attributes using Big Data Paper Concept: Authors of this paper have investigated the diverse farm attributes with their comfort assess levels and also cropping methods to maximize the growth rate on large volume of dataset. For experimentation, rice crop is tested in

Kanchipuram, India. Big data clustering approach is proposed in this paper to predictive analytics. Paper Title: Soil based Fertilizer Recommendation System using Internet of Things Paper Concept: In this paper soil based fertilizers recommendation application is implemented in IoT. Soils are differing based on its colour, water irrigation, and cultivation. Hence this paper suggests fertilizers to crop growth based on the soil type. Naïve classifier is used in this paper to test the soil characteristics, which is a simple probabilistic model for soils testing, but it shows the strong dependency between the feature vectors.

In naïve bayes algorithm, there is an assumption (Class- Conditional Independence), which reduces the prediction accuracy and it does not work well when the features are highly correlated with each other.

Research on new grounding technology of transmission line tower in Karst area - (2014 International Conference on Lightning Protect ion (ICLP))

Resistivity of soil in Karst area is on the high side so that resistance of transmission line tower is difficult to fulfil the requirements of lightning protection. This paper mainly studies the calculation method of transmission line tower resistance in Karst area, and influences of Karst caves to resistance. Considering Karst topographical features, according to the similarity of constant current field and electrostatic field, the model of soil and the physical model of grounding device in frequency current are built based on current distribution, electromagnetic fields, grounding and soil stricter analysis(CDEGS), the model of soil and the physical model of grounding device in impulse current are built based on COMSOL Multi-physics, frequency resistance and impulse resistance are calculated respectively. Finally, frequency and impulse simulation experiments are carried out in high voltage test platform to verify the models, based on dimensional similarity principle. The results show that the r esistances calculated by models and resistances obtained by experiments match well. What is more, factors such as cavity size, distance between cavity and grounding device, are founded to have significant influence on resistance.

Samy et al. discussed the importance of the risk of having an increased number of devices connected to IoT, especially zero-day attacks. The authors proposed a framework that uses an LSTM DL model to detect unknown attacks. They compared it with other DL models, such as GRU, LSTM, CNN, CNN-LSTM, and DNN, in five different IoT datasets. The experiment showed that the highest accuracy achieved by LSTM was 99.96% in binary classification and 99.65% in multi-class classification, with a 99.97% detection rate. However, the proposed model needs massive datasets and a long time to train. The authors in discussed the risk posed by network traffic over IoT networks. This study used machine learning methods, such as Hoeffding tree (HT) and naive Bayes, and a DL method (DNN). They used four different IoT datasets. The experiment showed that the highest accuracy achieved by DNN was 0.9975% in binary classification with seven hidden layers. The highest precision, recall, and F score were 0.9937%, 0.9937%, and 0.9937%, respectively. However, the experiment tested only four different attacks (scanning, DoS, MITM, and Mirai), which are not enough to represent real-world attacks. According to, DL methods exhibit extensive performance but have a prominent drawback: they need massive data for training algorithms. This study used two methods: LSTM and ensemble learning. A comparative analysis was performed between LSTM and other machine learning approaches, such as RF, stacking, bagging, AdaBoost, and XGBoost, by using Smart-Fall datasets. The experiment showed that the highest accuracy achieved in LSTM was 0.934%; the precision reached 0.920%, the recall was 0.934%, and the F score was 0.9178%. The highest accuracy achieved in RF was 0.999%. The accuracy of LSTM was lower than that of other methods and techniques. However, the study applied the method on only one dataset for an evaluation, which is considered a limitation.

The authors of propose an irrigation system using control-based scheduling to manage different factors such as humidity, wind speed, wind velocity, soil moisture, etc. The sensor-based predict- tion for managing irrigation and soil moisture sensor senses different soil conditions, and mobile applications are used to measure and monitor different activities of the irrigation system. Different recommendation systems such as statistical, machine-learning and deep- learning models are used to manage the prediction.

The irreversibility of urbanization will lead to the emergence of more and more cities and megacities. Given that cities are not only the centre of human activity, but also where social, economic, and environmental needs are magnified, urbanization has induced important social, economic, and demo graphic transitions.

.Indeed, urbanization has greatly improved people's quality of life. In particular, as cities become the economic, political, and cultural centre of a region, they can improve the living conditions to people in many ways. However, urbanization can also inevitably bring about a variety of negative effects, resulting in more challenges and problems faced by cities: the ecological environment has been devastated; natural resources are gradually being depleted; pollution (air, water, and sound) is increasing; and infectious diseases and cancer cases are growing; criminal activities remain rampant; and so on.

3. Methodology: -

Working:-Data sets measuring Soil Moisture, Humidity, Temperature, etc. Are used by smart irrigation system. A Motor pump is installed to control the water with the help of a relay. Power supply has been used in Node MCU. With which the motor can be switched on and off with the help of a relay. It can be used to use water Form Rivers, tanks, ponds, wells etc. Crops in the fields are irrigated using water rain from the soil moisture itself. Because if the amount of water in the fields is more or less, the crops will be damaged; hence, water should be applied in equal quality. If you use more water, the field will be water logged and the crops will suffer more losses. IOT with machine learning and deep learning, CNN and DNN connected to micro controller Node Mcu have been used. Soil moisture is used to measure content of the soil in the field's plants grow due to soil moisture. And the amount of soil moisture is detected by a computer. The quantity of smart irrigation system is used through an computer display input to output. With this, one can do farming easily. With this, one can do farming easily. With the smart irrigation system, we measure the soil moisture of the field and the moisture of the roots of the plants using deep neural network and conventional neural networks. Through this, microscope cells are detected. Disease and micro programs in plants are detected. Because if there is moisture in the plants, roots and moisture in the soil and seeds, then the crop will be irrigated. Pests are identified. Soil moisture, humidity, concentration and temperature are detected. Node MCU connected to CNN and DNN in prediction and algorithm.

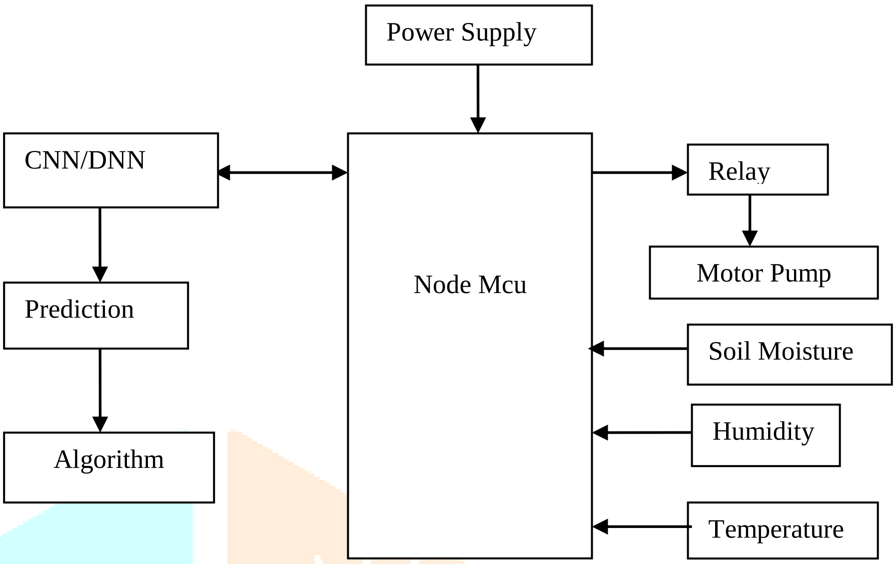


Fig: - smart irrigation system using CNN and DNN block diagram

3.1 Convoluted Neural Network: - Deep Neural Networks (DNNs) are one of the most powerful and disruptive achievements in artificial intelligence and machine learning. These elaborate models are intended to emulate the intricate operations of the human brain, allowing robots to learn and make judgments from complex data. DNNs are distinguished by their ability to automatically extract complicated hierarchical features from data, allowing them to excel in applications ranging from image recognition to natural language processing. DNNs are built on a network architecture made up of numerous layers, each of which contains nodes or "neurons." These layers are divided into three categories: output layers, hidden layers, and input layers. The word "deep" refers to the presence of numerous hidden layers, which enables DNNs to grasp complex and abstract correlations inside data. Weighted connections connect neurons inside each layer, and the network learns to change these weights during training to minimize the discrepancy between its predictions and the actual target values. Back propagation is a technique used in DNN training in which the model computes the gradient of the error with respect to its weights and then modifies them using optimization techniques. The network's parameters are continually fine-tuned through this iterative process, allowing it to produce more accurate predictions over time. The breadth of DNN applications demonstrates their adaptability. They have revolutionized picture categorization, object identification, and facial recognition in computer vision. DNNs have enabled machines to interpret and create human-like language in natural language processing, leading to advances in machine translation, sentiment analysis, and chatbots. They've also found use in industries including banking, healthcare, and robotics. Despite their impressive capabilities, DNNs are not without problems. Because of their sophisticated design and enormous datasets, they frequently necessitate significant computational resources for training. Another issue is over fitting, which occurs when the model becomes overly specialized to the training data, necessitating procedures like as regularization and cross-validation. Deep Neural Networks, in conclusion, offer a paradigm leap in machine learning, allowing machines to tackle complicated tasks with surprising precision. Their capacity to discover complicated patterns from data has accelerated progress in a wide range of fields. While issues remain, DNNs have had an indisputable influence on technology and society as large, ushering in a new era of intelligent automation and data-driven decision-making.

3.2 Deep Neural Network:-Deep Neural Networks (DNNs) are one of the most powerful and disruptive achievements in artificial intelligence and machine learning. These elaborate models are intended to emulate the intricate operations of the human brain, allowing robots to learn and make judgments from complex data. DNNs are distinguished by their ability to automatically extract complicated hierarchical features from data, allowing them to excel in applications ranging from image recognition to natural language processing. DNNs are built on a network architecture made up of numerous layers, each of which contains nodes or "neurons." These layers are divided into three categories: output layers, hidden layers, and input layers. The word "deep" refers to the presence of numerous hidden layers, which enables DNNs to grasp complex and abstract correlations inside data. Weighted connections connect neurons inside each layer, and the network learns to change these weights during training to minimize the discrepancy between its predictions and the actual target values. Back propagation is a technique used in DNN training in which the model computes the gradient of the error with respect to its weights and then modifies them using optimization techniques. The network's parameters are continually fine-tuned through this iterative process, allowing it to produce more accurate predictions over time. The breadth of DNN applications demonstrates their adaptability. They have revolutionized picture categorization, object identification, and facial recognition in computer vision. DNNs have enabled machines to interpret and create human-like language in natural language processing, leading to advances in machine translation, sentiment analysis, and chat bots. They've also found use in industries including banking, healthcare, and robotics. Despite their impressive capabilities, DNNs are not without problems. Because of their sophisticated design and enormous datasets, they frequently necessitate significant computational resources for training. Another issue is overfitting, which occurs when the model becomes overly specialized to the training data, necessitating procedures like as regularization and cross-validation. Deep Neural Networks, in conclusion, offer a paradigm leap in machine learning, allowing machines to tackle complicated tasks with surprising precision. Their capacity to discover complicated patterns from data has accelerated progress in a wide range of fields. While issues remain, DNNs have had an indisputable influence on technology and society as large, ushering in a new era of intelligent automation and data-driven decision-making.

4. Result and Discussion:-

Specification for experiments and implements and implements requirements are described in tables 2 and. the data was collected from research Centre of metrological deportment and crops of India. Initially, requirements like X1, surrounding moisture, root moisture and humidity values are also collected. Apart from this, the maximum and minimum is water requirements are collected manually from the farmers. A maximum 50 percentage water requirement of 1-2 months and irrigation interval of 7-8 days are collect to decide the threshold values for training and education.

S.NO.	Parameters and Requirements	Values
1.	Number of farms	4
2.	Number of trees in each farms	300
3.	Maximum requirement of water per month	50l
4.	Irrigation Interval	February to November
5.	Minimum Temperature	0 degree calicos
6.	Maximum Temperature	38 degree callous
7.	Interval of Irrigation	7 Days
8.	Average Requirement Water per Month	36 L

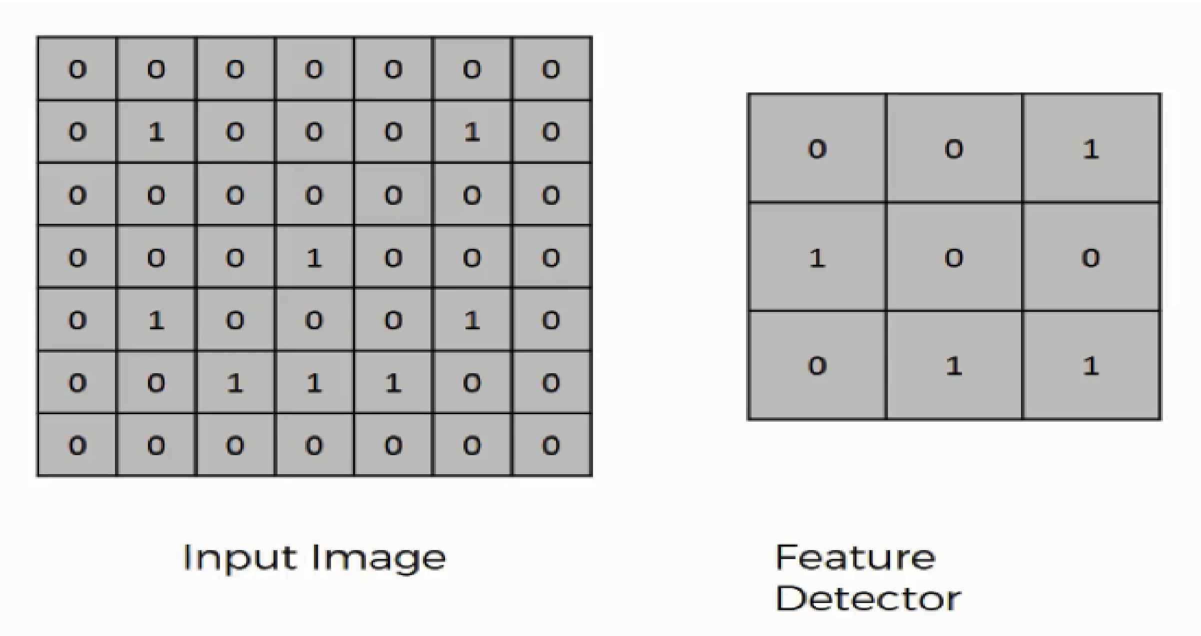
In a Smart Irrigation System, Year, Month, Date, Hours, Minute, Second, Moisture of Plant surface moisture, soil moisture and root moisture are detected in the data set. Temperature, Humidity, Air of motion (mil per hour) are included Rain and Water Irrigation.

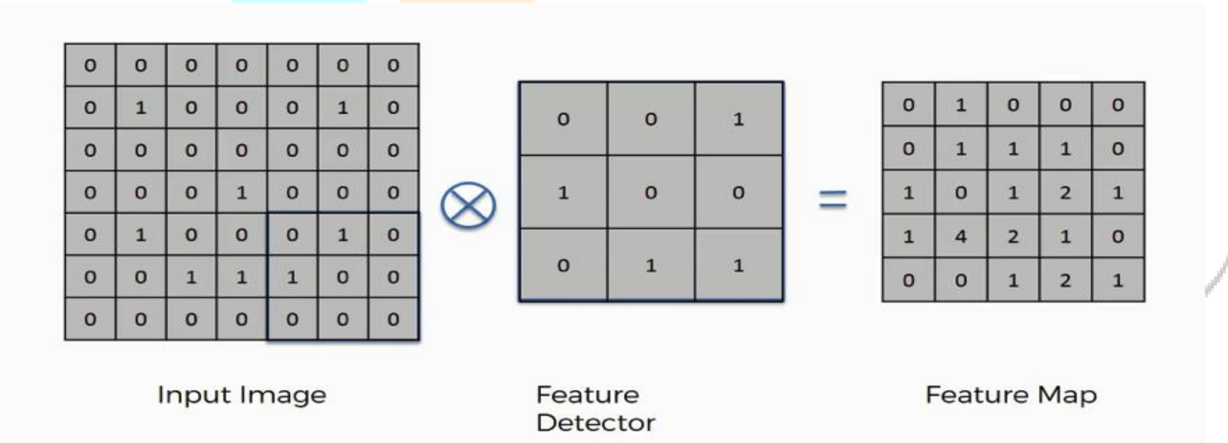
CNN Formula:-

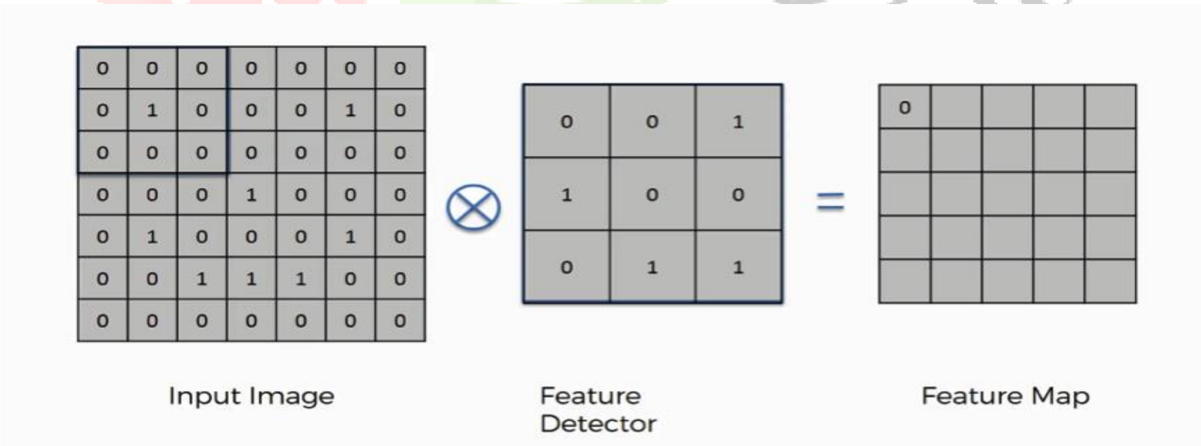
Operation	**Formula**
Convolution	zl = hl-1 * Wl
Max pooling	hl xy = max i=0..s,j=0..s hl-1 (x+i)(y+j)
Fully connected layer	$zl = Wl * hl{-}1$
Relu(Rectifier)	ReLU(zi)= max(0,zi)
Softmax	softmax(zi) = ezi / ∑j ezj

$$(f * g)(t) \stackrel{\text{def}}{=} \int_{-\infty}^{\infty} f(\tau)\, g(t-\tau)\, d\tau$$

CNN operation:-

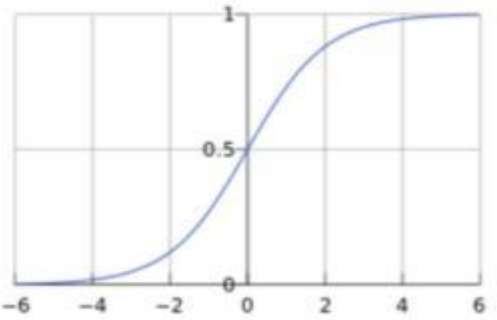


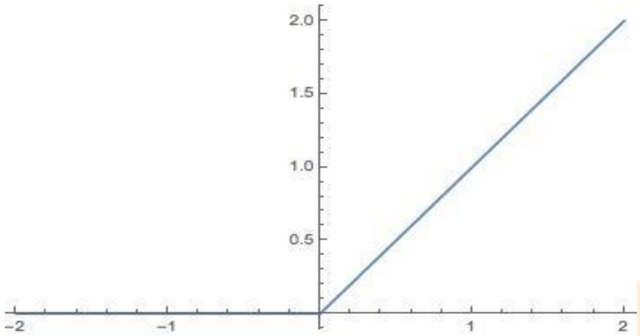




DNN Formula:- :- y=mx+c

Activation:- f=sigmode(semestion(Wn*x+Bn)

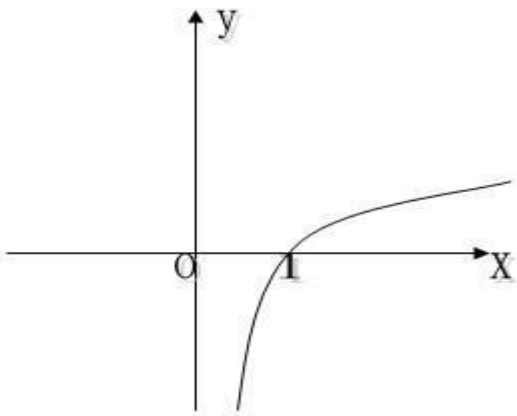




Softmax:-

$$S_i = \frac{e^{V_i}}{\sum_j e^{V_j}}$$

Accury and loss function:-y=log10(x)



Discussion:-The results of the experiment showed that the moisture stress applied in the intelligent irrigation system completed the phonological period of the plant faster, and due to the earlier harvest of the field, irrigation water consumption was reduced by 35%, but water productivity decreased. The Technology of smart Irrigation System results in les water green farming can increase the yield and quality of its crop. Sensor based control is done through LCD Display and Computer Agriculture is Similar sector. This is more dependent on water. Smart Irrigation System can increase the efficiency of Irrigation. Helps is reducing wastage of water. Farmers. Can increase crop production and income even in the face of water shortage. And with micro Irrigation, crops can be grown with less water.

5. Conclusion:-there is need to give importance to the agriculture sector in our country. More efficient were made to distance crops from agricultural areas. Insects and worms in plants are detected. The amount of water detected soil moisture is used to moisture. Water level sensor is used to measure water. Efficient analysis is done to improve the quality of agriculture. The exact crop recommended only then. Accurate results are given when agricultural crops are development. Farmers are informed about the amount of irrigation for their crops. And farming becomes. Easier. In this way weather information is detected. Collection IOT data analysis is found to be issue in agriculture areas. The then, by the analysing data the data collected, the result of the analysis can be received by farmers and help them grow the crop at the right time to increasing productivity. As technology is increasing dramatically. On the other hand, the quality of electronic hardware components in improving. Costs are coming down. It helps farmer achieve higher profits and yields despite changes in growing and cultivating crops. Farmers get more profit from water irrigation. Water irrigation is done easily. With the help of this futuristic model, a reliable communication system is used to improve the farm. To promote food production for farmers to produce food. The government emphasises encouraging farmers to adapt contemporary technology. Used to earn the maximum profit. Detecting soil moisture, nutrients, food fertiliser and water use evaluation and control for plant growth. Deep learning and machine learning are used.

Future scope:- Smart irrigation system in the CNN and DNN using data being trained and analyzed. It is used to predict future result and forecasts according to the market situation using product analysis. Soil moisture data is helpful to farmers by providing realistic information about changes that need to be incorporated in the crop patterns. In the future this work could be extended to deployment of soil moisture sensor nodes in the area of interst to collect measurements. We will perform intrusion detection in future smart irrigation system using IOT. This take is done by detecting the data set. Work can be extended to study other features of the classifier, such as genetic algorithms and bidirectional short-term memory.

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