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Region based crop selection Using Deep learning

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ABSTRACT:

The agriculture yield mostly depends on climate factors. Any information associated with climatic factors will help farmers in foreordained farming. Choosing a right crop at right time is most important to get proper yield. To help the farmers in decision making process a classification model is built by considering the agro climatic parameters of a crop like Nitrogen, Phosphorous, Potassium, Ph Level, Rainfall, State, Season, Area and a recommendation system is built based on three factors namely crop, type of crop and the production. Predicting the state is the novel approach in which crop pattern of 28 states in India is marked and based on that classification model is built. Thorough analysis of Deep Learning algorithms incorporating pre-processing, data augmentation and comparison of optimizers and activation function of CNN & LSTM. The results shows that CNN is the best predictive model for classification of crops, crop type and Production based on agro meteorological climatic condition.

INTRODUCTION

Farming is the primary and most important occupation in India. Almost 50% of India's manpower has their occupation directly or indirectly linked to agriculture. India is hence rightfully called as an agricultural country. Agriculture provides almost 20% contributions to the Gross Domestic Product. India has exported agricultural goods worth $25 billion until November 2017. India is one of the leading countries worldwide in terms of farm output. Even after being a leading producer of agricultural products, India still lacks farm productivity. Farmers have very less income because of the lack of farm productivity. There needs to be an increase in productivity, to get more income for the farmers. To increase productivity, farmers should know which crop would suit the specific piece of land. If the right type of crop is cultivated in that piece of land, then automatically, the yield of the crop will increase.

Hence, crop recommendation systems can be very beneficial for farmers. Recommendation systems need to be very accurate and explicit. If not, it may result in vast amount of loss on the monetary and materialistic front. Various machine learning methods can be used to create recommendation systems. However, this paper proposes a system, which uses neural networks to build a powerful, accurate and an unambiguous recommendation system.

In this specific model of recommendation system, certain climatic parameters will be taken into consideration. These parameters would be temperature, soil moisture content and humidity. These mentioned parameters

would help the recommendation system to give an accurate prediction regarding the most suitable crop to be cultivated.

2. LITERATURE SURVEY

2.1 Crop Suitability and Fertilizers Recommendation Using DataMining Techniques

AUTHORS: Vijay Kumar Jha,Debajyoti Mukhopadhyay

ABSTRACT: Economy of India highly depends on agriculture. Still traditional ways of recommendations are used for agriculture. Currently, agriculture is done based on various approximations of fertilizers quantity and the type of crop to be grown or planted. Agriculture highly depends on the nature of soil and climate. Therefore, it becomes important to make advancement in this field. The paper proposes development of an ontology-based recommendation system for crop suitability and fertilizers recommendation. It bridges the gap between farmers and technology. The system predicts suitable crop for the field under consideration based on region in Maharashtra state of India and type of soil. It provides proper recommendation of fertilizers to the farmers. Fertilizer recommendation is done based on nitrogen, phosphorus, and potassium (NPK) contents of soil and using past years research data that is stored in ontology. Along with fertilizer recommendation system also provides suggestions about crop suitability in particular region. Recommendation system uses random forest algorithm and k-means clustering algorithm.

2.2 Crop Yield Prediction and Efficient use of Fertilizers

AUTHORS: S. Bhanumathi,M. Vineeth and N. Rohit

ABSTRACT: India being an agriculture country, its economy predominantly depends on agriculture yield growth and agro-industry products. Data Mining is an emerging research field in crop yield analysis. Yield prediction is a very important issue in agricultural. Any farmer is interested in knowing how much yield he is about to expect. Analyze the various related attributes like location, pH value from which alkalinity of the soil is determined.

Along with it, percentage of nutrients like Nitrogen (N), Phosphorous (P), and Potassium (K) Location is used along with the use of third-party applications like APIs for weather and temperature, type of soil, nutrient value of the soil in that region, amount of rainfall in the region, soil composition can be determined. All these attributes of data will be analyzed, train the data with various suitable machine learning algorithms for creating a model. The system comes with a model to be precise and accurate in predicting crop yield and deliver the end user with proper recommendations about required fertilizer ratio based on atmospheric and soil parameters of the land which enhance to increase the crop yield and increase farmer revenue.

2.3 Real time Data Analysis For Crop Prediction Using IOT

AUTHORS: Chandla Ellis,Vishal J, Saravannan L S, Vignesh B

ABSTRACT: This paper helps the users to choose their own crop or plant according to their soil type and the climate, where the soil is present. It also deals with some other factors like the current market price of the crop or plant. These details are used to predict the best crop to be grown, economical methods, and an innovative farmer collaboration method. This paper is also used to predict the climatic hazard and helps to

prevent it or reduce is hazards. We help to improvise the agricultural system with regular data analysis to create and maintain a predictable and sustainable crop growth and enrich its development.

2.4 Paddy Crop Production Analysis Based on SVM and KNN classifier

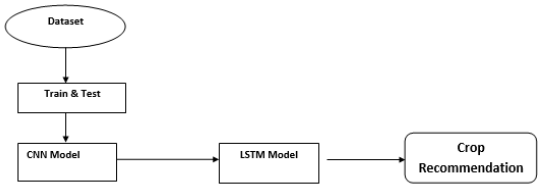
AUTHORS: Pankaj Bhambri,Inderjit Singh Dhanoa,Vijay Kumar Sinha and Jasmine Kaur

ABSTRACT: In earlier times, the people used to fulfil their own requirements by cultivating the crops in their own land regions. In the economy of a nation, an important role is played by the farming sector. A variety of fungal and bacterial infections infect various crops. Reducing the use of insect killers is a prominent demand of sustainable development.

The minimum use of pesticides saves environment and increases the quality of crops. To improve the accuracy of paddy production prediction the KNN is implemented for the paddy production prediction in data mining. The SVM classifiers also implemented which is compared with the KNNclassifier. The presented and earlier classifier will be applied in python, and it is expected that accuracy will be improved, and execution time will be reduced. It is analysed that KNN performs well as compared to SVM classifier for the paddy production prediction as per the obtained analytic results.

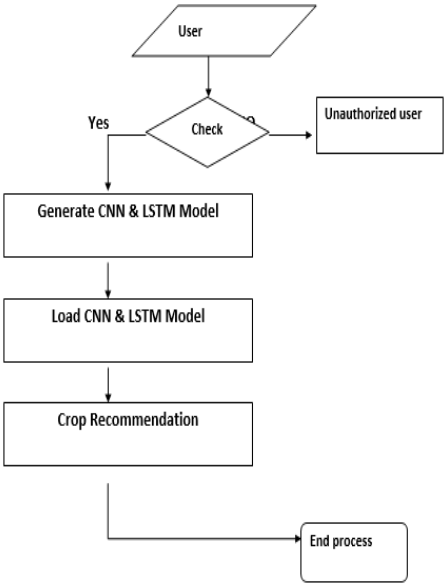
4. SYSTEM DESIGN

4.1 SYSTEM ARCHITECTURE:



4.2 DATA FLOW DIAGRAM:

1. The DFD is also called as bubble chart. It is a simple graphical formalism that can be used to represent a system in terms of input data to the system, various processing carried out on this data, and the output data is generated by this system.
2. The data flow diagram (DFD) is one of the most important modeling tools. It is used to model the system components. These components are the system process, the data used by the process, an external entity that interacts with the system and the information flows in the system.
3. DFD shows how the information moves through the system and how it is modified by a series of transformations. It is a graphical technique that depicts information flow and the transformations that are applied as data moves from input to output.
4. DFD is also known as bubble chart. A DFD may be used to represent a system at any level of abstraction. DFD may be partitioned into levels that represent increasing information flow and functional detail.



4.3 UML DIAGRAMS

UML stands for Unified Modeling Language. UML is a standardized general-purpose modeling language in the field of object-oriented software engineering. The standard is managed, and was created by, the Object Management Group.

The goal is for UML to become a common language for creating models of object-oriented computer software. In its current form UML is comprised of two major components: a Meta-model and a notation. In the future, some form of method or process may also be added to; or associated with, UML.

The Unified Modeling Language is a standard language for specifying, Visualization, Constructing and documenting the artifacts of software system, as well as for business modeling and other non-software systems.

The UML represents a collection of best engineering practices that have proven successful in the modeling of large and complex systems.

The UML is a very important part of developing objects-oriented software and the software development process. The UML uses mostly graphical notations to express the design of software projects.

GOALS:

The Primary goals in the design of the UML are as follows:

1. Provide users a ready-to-use, expressive visual modeling Language so that they can develop and exchange meaningful models.
2. Provide extendibility and specialization mechanisms to extend the core concepts.
3. Be independent of particular programming languages and development process.
4. Provide a formal basis for understanding the modeling language.
5. Encourage the growth of OO tools market.
6. Support higher level development concepts such as collaborations, frameworks, patterns and components.

7. Integrate best practices.

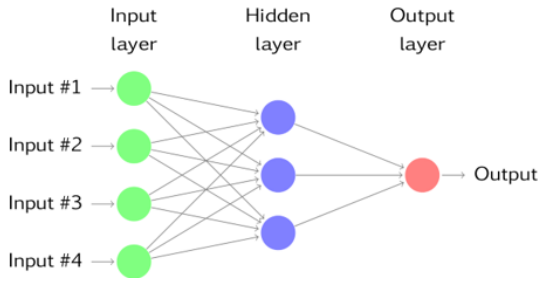
4.4 Algorithms:

convolutional neural network:

To demonstrate how to build a convolutional neural network based image classifier, we shall build a 6 layer neural network that will identify and separate one image from other. This network that we shall build is a very small network that we can run on a CPU as well. Traditional neural networks that are very good at doing image classification have many more parameters and take a lot of time if trained on normal CPU. However, our objective is to show how to build a real-world convolutional neural network using TENSORFLOW.

Neural Networks are essentially mathematical models to solve an optimization problem. They are made of neurons, the basic computation unit of neural networks. A neuron takes an input (say x), do some computation on it (say: multiply it with a variable w and adds another variable b) to produce a value (say; z= wx+b). This value is passed to a non-linear function called activation function (f) to produce the final output(activation) of a neuron. There are many kinds of activation functions. One of the popular activation function is Sigmoid. The neuron which uses sigmoid function as an activation function will be called sigmoid neuron. Depending on the activation functions, neurons are named and there are many kinds of them like RELU, TanH.

If you stack neurons in a single line, it's called a layer; which is the next building block of neural networks. See below image with layers



To predict image class multiple layers operate on each other to get best match layer and this process continues till no more improvement left.

Long short-term memory (**LSTM**) is an artificial recurrent neural network (RNN) architecture[1] used in the field of deep learning. Unlike standard feedforward neural networks, LSTM has feedback connections. It can not only process single data points (such as images), but also entire sequences of data (such as speech or video). For example, LSTM is applicable to tasks such as unsegmented, connected handwriting recognition, speech recognition and anomaly detection in network traffic or IDSs (intrusion detection systems).

A common LSTM unit is composed of a **cell**, an **input gate**, an **output gate** and a **forget gate**. The cell remembers values over arbitrary time intervals and the three *gates* regulate the flow of information into and out of the cell.

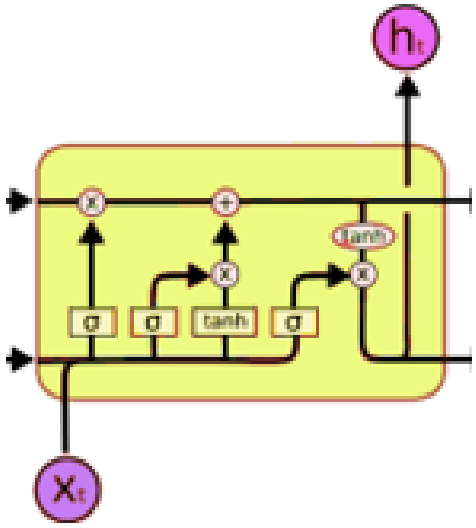
LSTM networks are well-suited to classifying, processing and making predictions based on time series data, since there can be lags of unknown duration between important events in a time series. LSTMs were developed to deal with the vanishing gradient problem that can be encountered when training traditional RNNs. Relative

insensitivity to gap length is an advantage of LSTM over RNNs, hidden Markov models and other sequence learning methods in numerous applications

Training:

An RNN using LSTM units can be trained in a supervised fashion, on a set of training sequences, using an optimization algorithm, like gradient descent, combined with backpropagation through time to compute the gradients needed during the optimization process, in order to change each weight of the LSTM network in proportion to the derivative of the error (at the output layer of the LSTM network) with respect to corresponding weight.

A problem with using gradient descent for standard RNNs is that error gradients vanish exponentially quickly with the size of the time lag between important events. However, with LSTM units, when error values are back-propagated from the output layer, the error remains in the LSTM unit's cell. This "error carousel" continuously feeds error back to each of the LSTM unit's gates, until they learn to cut off the value.



5 CONCLUSIONS

Nowadays, it has become a necessity, for farmers to leave the traditional methods of farming behind and accept the modern scientific and technological ways of agriculture. This paper focused on the prototype of a recommendation system, which worked on a relatively dataset. This same prototype can be worked upon and can be made compatible for datasets. India is a nation in which agriculture plays a prime role. In prosperity of the farmers, prospers the nation. Thus, our work would help farmers in sowing the right seed based on soil requirements to increase productivity of the nation.

Future Enhancement

Our future work is aimed at an improved data set with large number of attributes and also implements yield prediction.

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