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Crop Yield Prediction Using Machine Learning Algorithms

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Abstract
We all know that India has the second-highest population and that the vast majority of its citizens work in agriculture. Farmers are spreading fertilizer in haphazard amounts without understanding the deficient composition or quantity, and they are planting the same crops over and over again without trying other varieties. Because of this, crop output is negatively impacted, and the soil becomes acidic and the top layer is damaged. In order to help farmers, we built the system employing techniques for machine learning.

Introduction
Machine learning is also being used in agriculture for several years(McQueen et al., 1995). Crop yield prediction is one of the challenging problems in precision agriculture, and many models have been pro-posed and validated so far. This problem requires the use of several datasets since crop yield depends on many different factors such as climate, weather, soil, use of fertilizer, and seed variety (Xu et al.,2019). This indicates that crop yield prediction is not a trivial task;instead, it consists of several complicated steps. Nowadays, crop yield prediction models can estimate the actual yield reasonably, but a better performance in yield prediction is still desirable (Filippi et al., 2019a).Machine learning, which is a branch of Artificial Intelligence (AI)focusing on learning, is a practical approach that can provide better yield prediction based on several features. Machine learning (ML) can determine patterns and correlations and discover knowledge from da-tasets. The models need to be trained using datasets, where the out-comes are represented based on past experience. The predictive modelis built using several features, and as such, parameters of the models are determined using historical data during the training phase. For the testing phase, part of the historical data that has not been used for training is used for the performance evaluation purpose.An ML model can be descriptive or predictive, depending on the research problem and research questions. While descriptive models are used to gain knowledge from the collected data and explain what hash appened, predictive models are used to make predictions in the future(Alpaydin, 2010). ML studies consist of different challenges when aiming to build a high-performance predictive model. It is crucial to select the right algorithms to solve the problem at hand, and in addi-tion, the algorithms and the underlying platforms need to be capable of handling the volume of data.To get an overview of what has been done on the application of ML in crop yield prediction, we performed a systematic literature review(SLR). A Systematic Literature Review (SLR) shows the potential gaps in research on a particular area of problem and guides both practitioners and researchers who wish to do a new research study on that problem area. By following a methodology in SLR, all relevant studies are ac-cessed from electronic databases, synthesized, and presented to respond to research questions defined in the study. An SLR study leads to new perspectives and helps new researchers in the field to understand the state-of-the-art .

An SLR study is expected to be replicable, which means that all the steps taken need to be explained clearly, and the results should be transparent for other researchers. The critical factors for a successful SLR study are objectivity and transparency (Kitchenham et al., 2007). As itsname indicates, an SLR needs to be systematic and cover all the literature published so far. This study presents all the available literature published so far on the application of machine learning in crop

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yield prediction problem. In this study, we present our empirical results and responses tothe research questions defined as part of this review article.

Literature Survey

A MACHINES LEARNING ALGORITHM FOR PROJECTING CULTIVATION
Priya, Uthaiah, and Balamurugan are the authors.

A country's economic prosperity is heavily dependent on its agricultural sector. However, climate change and other environmental factors pose a serious danger to the agricultural sector. Finding workable and efficient solutions to this issue requires a strategy that incorporates machine learning (ML). In this study, we use the Random Forest method to forecast future crop yields using historical data on variables such as weather, soil, and previous harvests. This process is known as crop yield prediction.

Machine learning methodologies for agricultural crop production: a comprehensive overview
This work is authored by Mishra, D., and Santra, G. H.

Before relying on these figures, nevertheless, keep in mind that they are not objective estimates but rather the product of extensive descriptive evaluation based on a wide range of qualitative characteristics. Therefore, it is necessary to create objective crop production predictions that are based on solid statistics. Thanks to advancements in computers and data storage, a plethora of data has been available. Results: Since deriving complex insights from such raw data has proven challenging, new methods like machine learning have emerged to bridge this gap and integrate data expertise with agricultural yield assessment. The goal of this study has been to assess these new methods so that we may discover meaningful relationships between the variables in the database by using them.

A System for Forecasting Harvest Success.

Published by Manjula.E.

Data mining is a relatively new area of study for analyzing agricultural yields. The ability to forecast crop yields is crucial in the agriculture sector. The amount of harvest a farmer may anticipate is of paramount importance to him. In the past, farmers would use their knowledge of a certain area and crop to make predictions about future yields. One of the most pressing problems with the current data set is the yield prediction. The most appropriate method for this task would be data mining. This study provides a concise examination of agricultural production prediction in the chosen area, namely the district of Tamil Nadu in India, utilizing a data mining approach based on association rules. It is clear from the experiments that the suggested method accurately predicts the generation of crop yields.
Predicting agricultural crop yields using an artificial neural network method (2.4)

Machine learning approaches' predictive abilities for large-scale agricultural yield forecasting.
Writers: González Sánchez. Hello, Frausto Sols. Ojeda Bustamante and Herjavec J. W
Accurately estimating yields for the many crops included in agricultural planning is a critical challenge. Finding workable and efficient solutions to this issue requires a strategy that incorporates machine learning (ML). The most accurate approach for yield prediction has been the subject of several evaluations of ML techniques. When it comes to agricultural planning, the number of examined crops and methods is often insufficient. This study examines 10 different agricultural datasets and compares the predictive ability of linear regression and ML methods for predicting crop production. In order to construct the models, actual data from a Mexican irrigation zone was used. Data from two consecutive years were used to test the models. With respect to average RMSE errors, RRSE errors, MAE errors, correlation factors, and other metrics, the findings demonstrate

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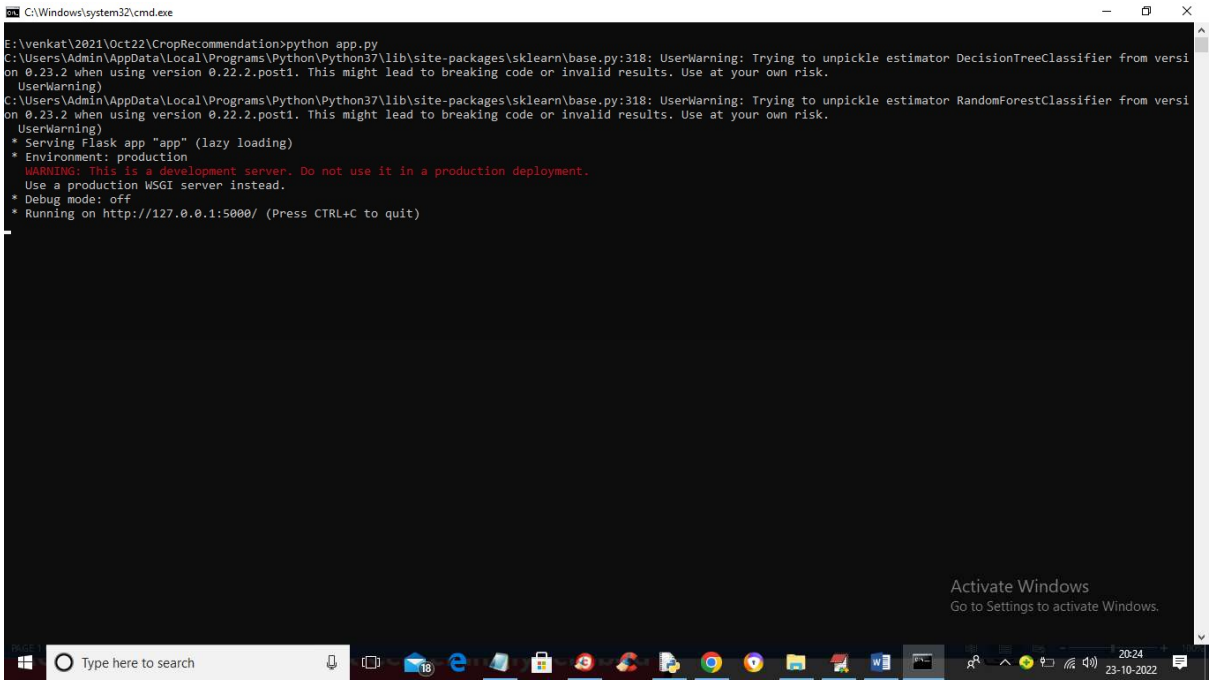
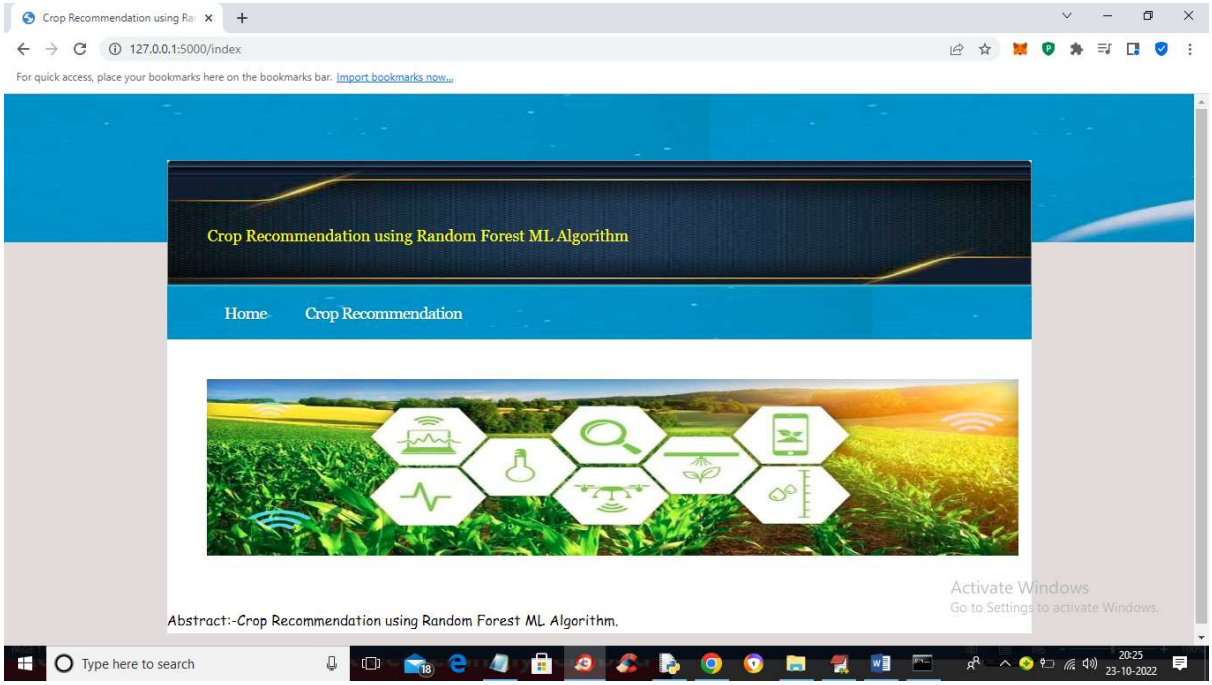
that k-nearest neighbor and M5-Prime approaches provide the best outcomes, with respective averages of 4.91 and 79.46%.

Results

To start the Python Flask server and execute the project, double-click the run.bat file. The result will be as follows.



In above screen python FLASK server started and now open browser and enter URL as http://127.0.0.1:5000/index and press enter key to get below page



In above screen click on 'Crop Recommendation' link to get below screen

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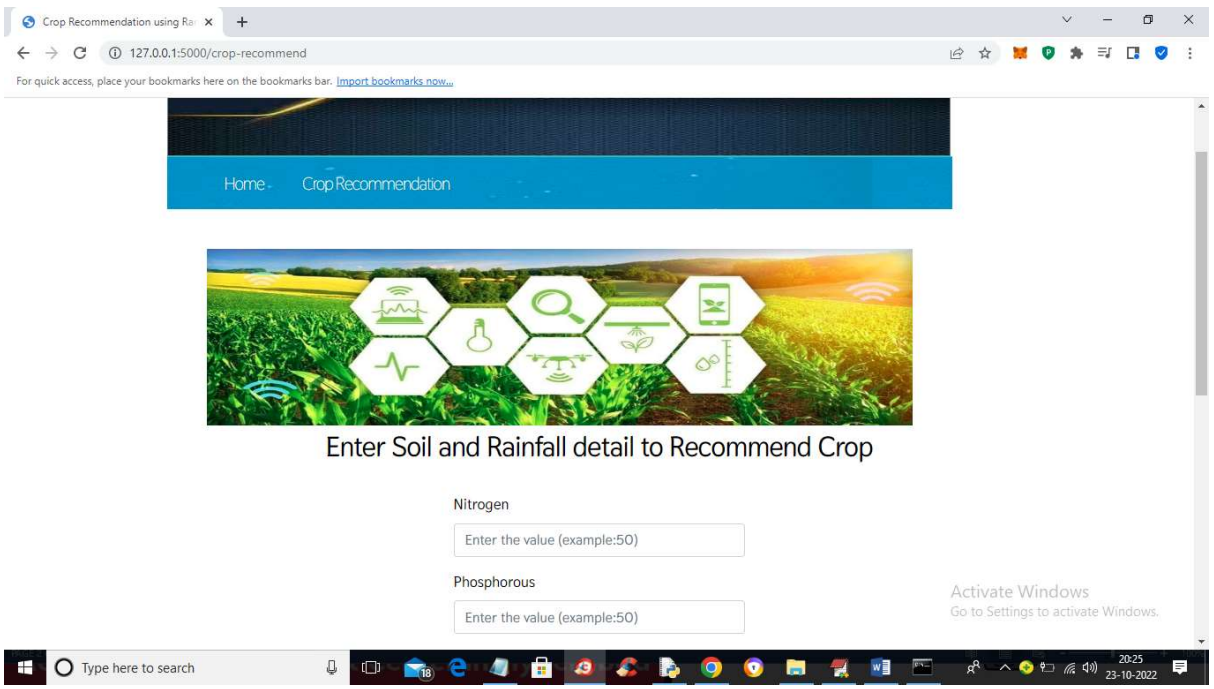
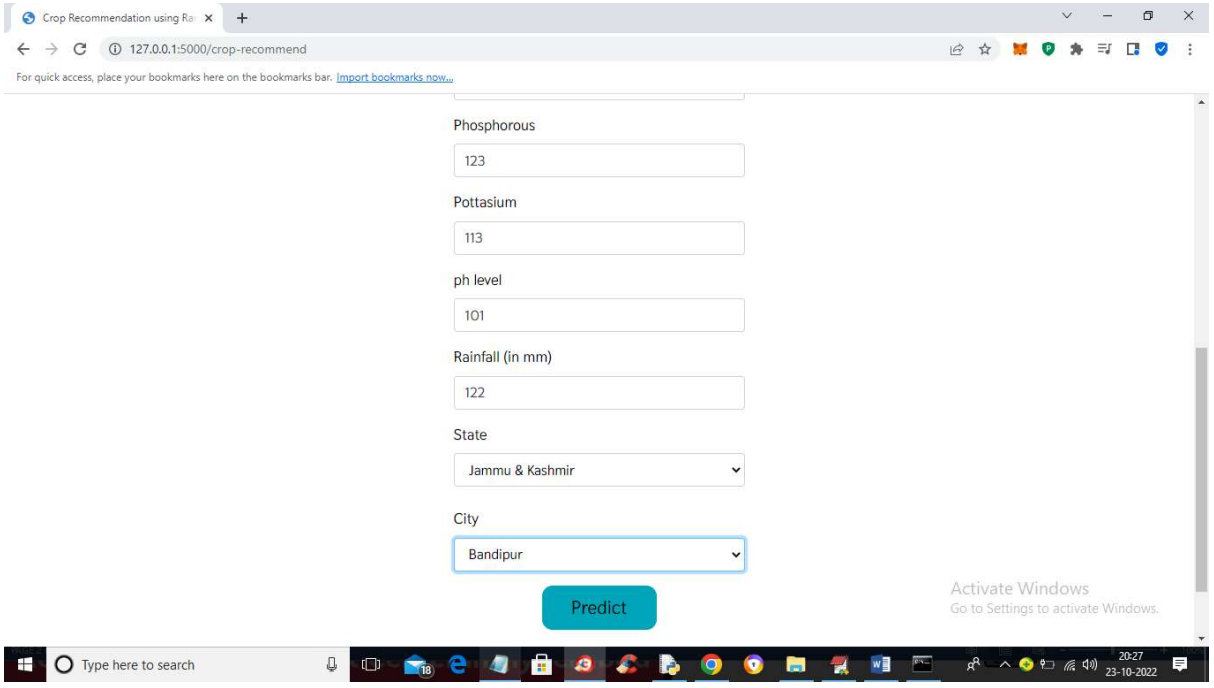


In above screen enter all values and press button (as your reference application contains all states and cities names so we have used same code for this screen)



In above screen we entered some values and then click on ‘Predict’ button to get below output

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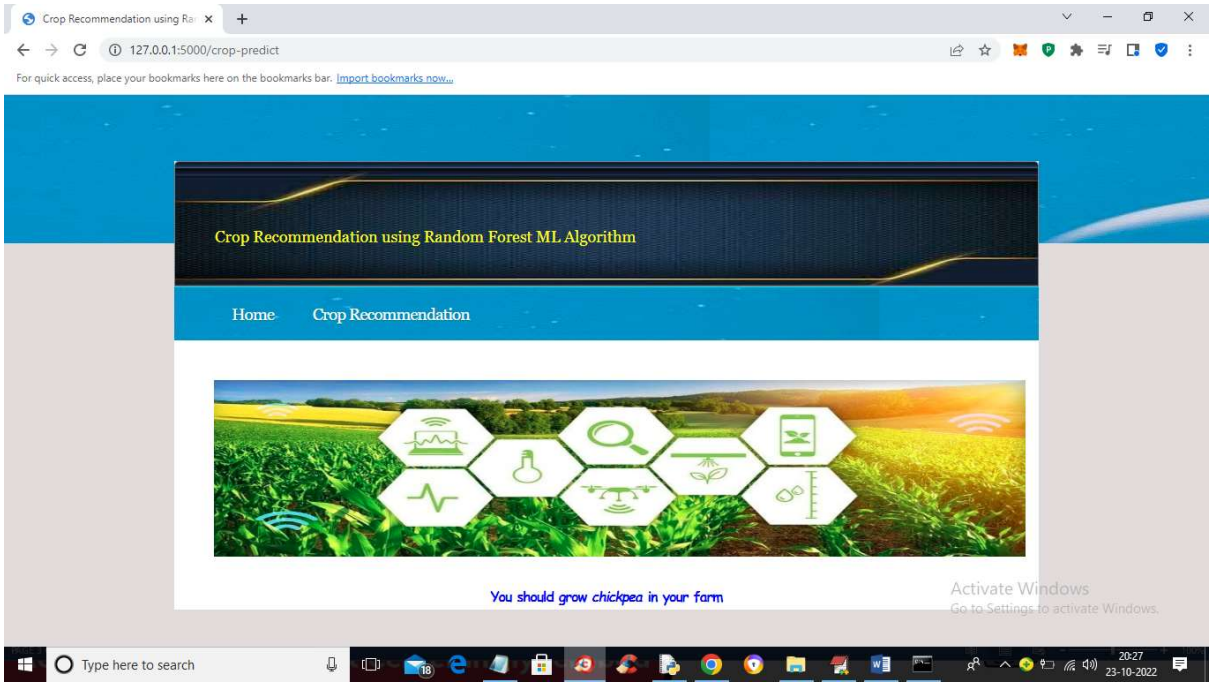
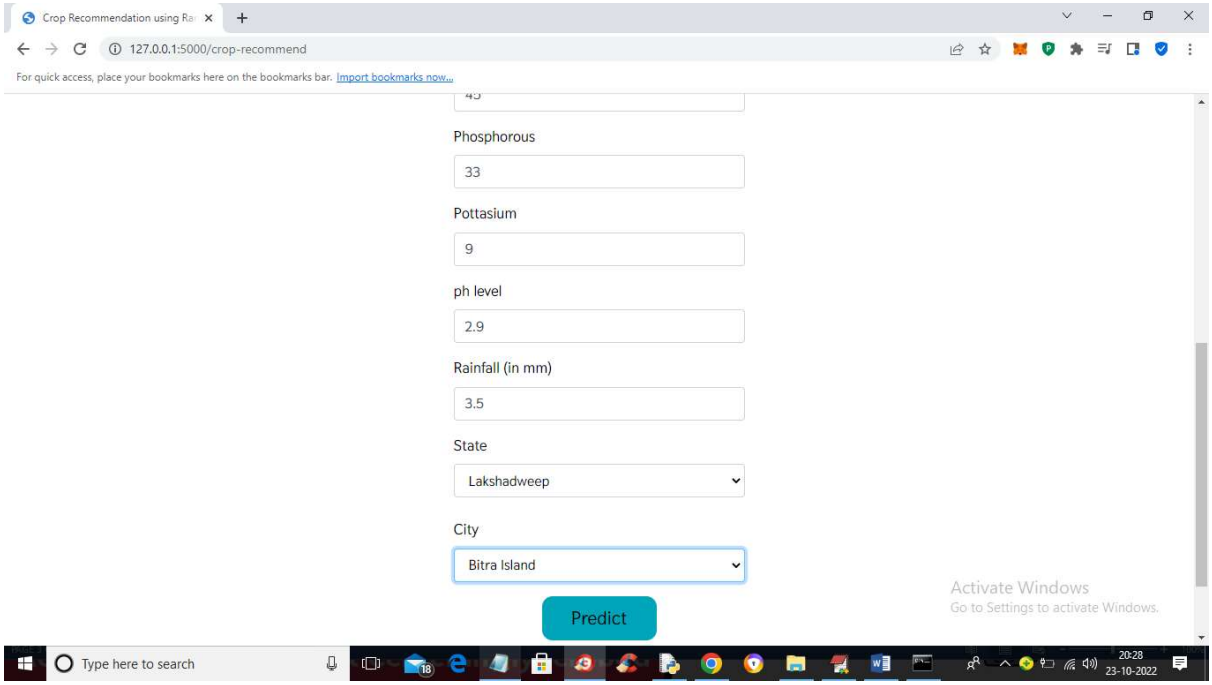


In above screen we got output as ‘chickpea’ can be grown and now try some other values



For above input will get below output

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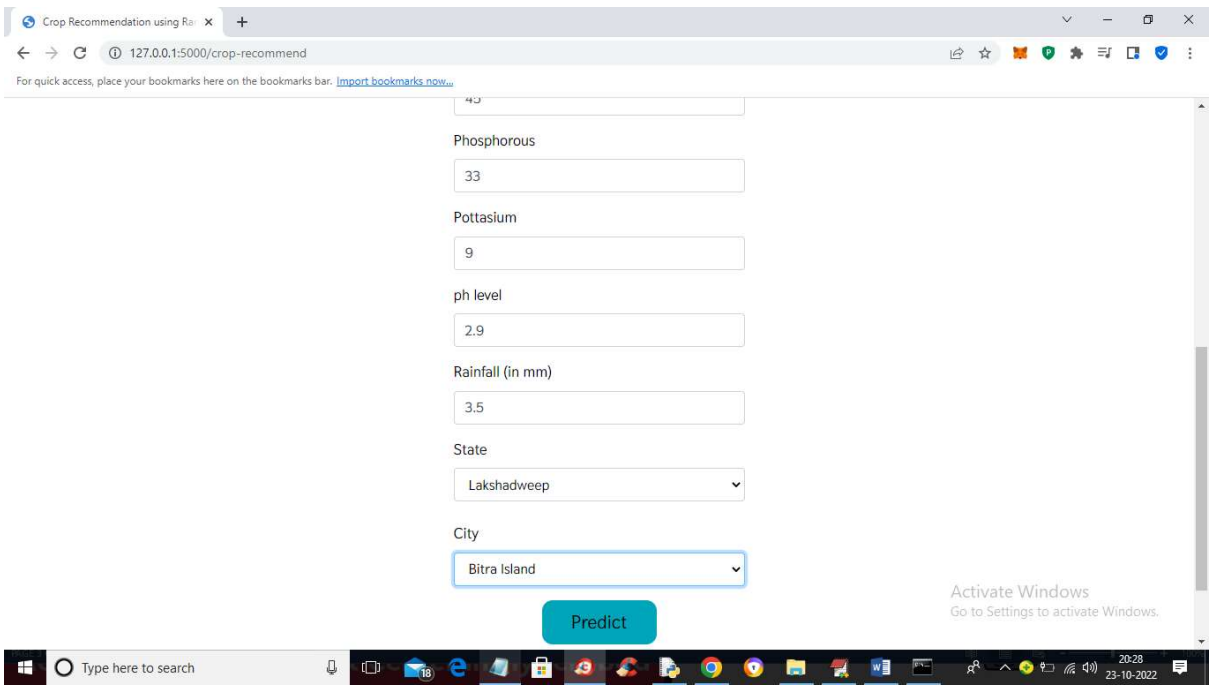
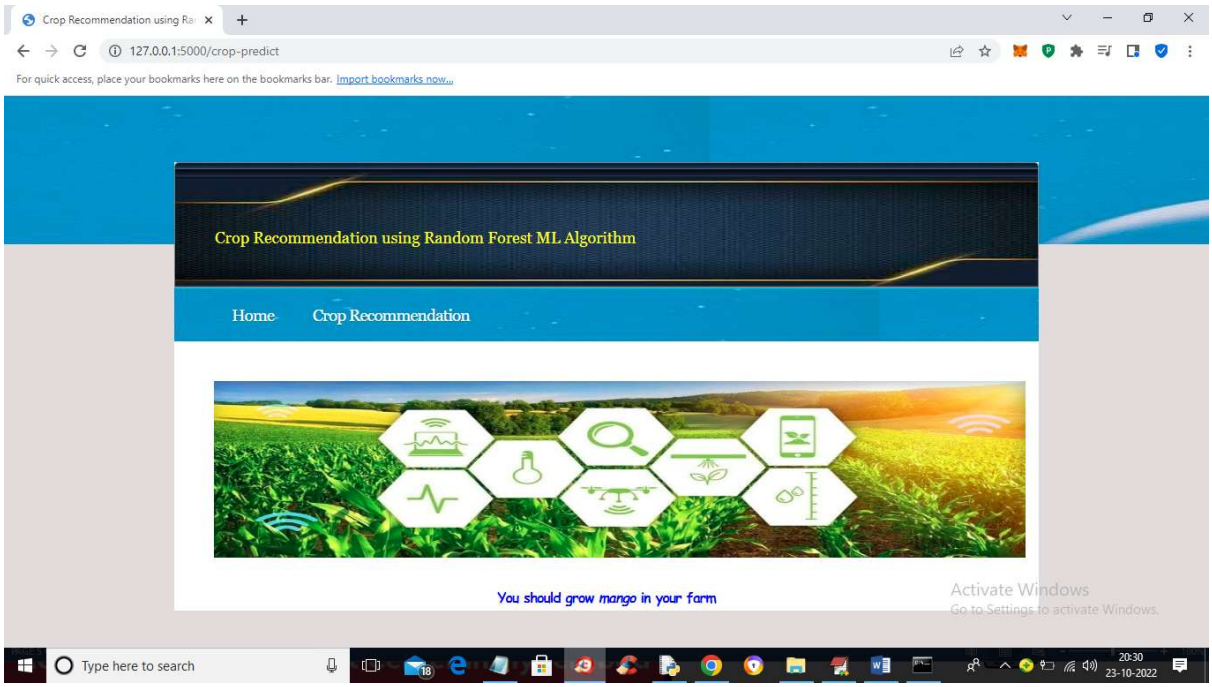


For above input will get below prediction



In above screen we got prediction as ‘mango’ to grow

Similarly you can use any values to get prediction or you can copy values from test.txt file

CONCLUSION

Predicting agricultural production from weather, region, season, and precipitation was the focus of this paper's machine learning techniques. After doing experiments on a dataset provided by the Indian government, researchers determined that the Random Forest Regressor provided the most

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accurate yield predictions. While Long Short-Term Memory (LSTM) models are effective in predicting temperatures, Sequential Models—specifically, Simple Recurrent Neural Networks—do better when it comes to rainfall. Yield prediction for a certain district may be achieved by integrating rainfall, temperature, and other characteristics such as season and area. After considering all of the factors, Random Forest emerged as the top classifier.

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