A Project Report on

SOIL MOISTURE PREDICTION

Submitted in partial ful llment of the requirements for the award

of the degree of

Bachelor of Engineering

in

COMPUTER SCIENCE

by

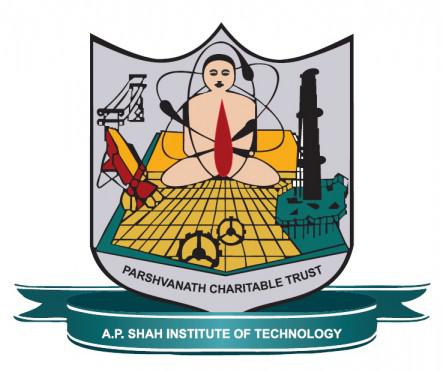
SHUBHAM PADTE(16102058)

PRADIPT KALAMKAR(16102028)

PANKIT KHIMASIYA(16102034)

Under the Guidance of

ARCHANA KOTANGALE



Department of Branch Name A.P. Shah Institute of Technology G.B.Road,Kasarvadavli, Thane(W), Mumbai-400615 UNIVERSITY OF MUMBAI

Academic Year 2017-2018

Approval Sheet

This Project Report entitled SOIL MOISTURE PREDICTION Submitted by SHUBHAM PADTE(16102058),PRADIPT KALAMKAR (16102028),PANKIT KHIMASIYA (16102034), is approved for the par-tial ful llment of the requirenment for the award of the degree of Bachelor of Engineering in Branch Name from University of Mumbai.

ARCHANA KOTANGALE

Guide

Prof. Sachin Malve

Head Department of Computer

A.P. Shah Institute of Technology,

Place: Thane

CERTIFICATE

This is to certify that the project entitled \Title of project" submitted by SHUBHAM PADTE (16102058), PRADIPT KALAMKAR (16102028),PANKIT KHIMASIYA (16102034) for the partial ful llment of the requirement for award of a degree Bachelor of Engineering in Branch Name.,to the University of Mumbai,is a bona de work carried out during academic year 2017-2018.

ARCHANA KOTANGALE

Guide

Prof. Sachin Malve

Head Department of Computer

Place: A.P. Shah Institute of Technology, Thane

Date:

Declaration

We declare that this written submission represents our ideas in our own words and where others' ideas or words have been included, We have adequately cited and referenced the orig-inal sources. We also declare that We have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsi ed any idea/data/fact/source in our submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

|||||||||||||||

(Signature)

|||||||||||||||

(SHUBHAM PADTE 16102058)

(PRADIPT KALAMKAR 16102028)

(PANKIT KHIMASIYA 16102034)

Date:

ABSTRACT

Prediction of soil moisture in advance is useful to the farmers in the field of agriculture. In this paper we have used machine learning techniques such as multiple linear regression, support vector regression and recurrent neural networks for prediction of soil

moisture. These techniques were applied on datasets collected from different online repositories.

Contents

|  |  |  |  |
| --- | --- | --- | --- |
| 1 | Introduction | | 1 |
|  | 1.1 Regression Techniques . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | | 1 |
|  | 1.1.1 Multiple Linear Regression. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | | 1 |
|  | 1.1.2 Support Vector Regression . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | | 2 |
|  |  |
| 2 | Literature Review | | 3 |
| 3 | Methodology | | 6 |
| 4 | Result | | 7 |
| 5 Conclusions and Future Scope  Bibliography | | | 8 |
| Appendices | | | 9 |
|  | Appendix-A . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . | | 9 |
| Publication | | | 12 |

List of Abbreviations

SVR: SUPPORT VECTOR REGRESSION

RNN: RECURRENT NEURAL NETWORK

MLR: MULTIPLE LINEAR REGRESSION

ANN: ARTIFICIAL NEURAL NETWORK

iv

1

Chapter 1

Introduction

India is a country where majority of the population is dependent on agriculture for their livelihood. Indian soils are less fertile especially in case of micronutrients . In recent years, it has been seen that soil health is somehow related with the sustainability in the field of agriculture and also the current crop yield levels can be improved by maintaining the fertility of the soil. Agriculture needs decision support system in variety of ways such as type of crop to be cultivated .By monitoring soil moisture, water usage can be optimized to a large extent as the water table is lowering day by day.

Recurrent neural network (RNN) :-

These are neural networks which are suitable for

modeling sequence of inputs, like speech data, natural language dataetc. They have the same structure as that of a feed-forward neural network or artificial neural network (ANN), but unlike the acyclic nature of ANN, RNN has cyclic connections also. The neurons in a layer can be connected to one another and can even be connected to itself which was not allowed in ANN. Because of this cyclic

nature, previous inputs are used to compute outputs at each step and thus, RNNs have a memory of previous events by using which it can make further

predictions.

Support Vector Regression(SVR):-

The support vector regression is based on the concept of vectors and since it depends on some data points it is less prone to outliners. For regression task, the loss function is defined such that it ignores the error for the data points which are within a certain distance from the true values

*Multiple linear regression*

It is a commonly used regression technique in a wide variety of problems. Multiple linear regression assumes linear relationship between the variables and

tries to fit all the given data points with a straight line minimizing the residual error. Itis an extended version of the linear regression. As it takes all the data points into account while finding the optimal line, it is more prone to outliers.

2

Chapter 2

Literature Review

Data mining techniques plays a significant role in the field of agriculture .Good crop yield prediction results have been achieved by many researchers after applying data mining techniques under different climatic scenario .Data mining techniques were used in order to estimate tea yield analysis of four regions of Assam using the multiple linear regression .Nowadays machine learning is

one of the state of art techniques for predicting unknown values. This paper deals with the prediction of soil moisture using machine learning. RNN is a powerful tool for learning sequential data, like time series data, natural language data, etc. It predicts the output not just on the basis of present inputs but also remembers previous inputs and outputs to better learn the interdependence of inputs .In recurrent neural network an echo state network for the prediction of seed moisture content is used and compared with Elman network .Other neural network techniques can also be used for the prediction purpose

3

Chapter 3

METHODOLOGY:



The regression techniques used for predicting of soil moisture were MLR (multiple linear regression),SVR(support vector regression) and RNN(recurrent neural network). For the measurement of soil moisture and soil temperature a hydra probe soil sensor (2.5 volt) having an accuracy of +/− 0.03 wfv (m3∙m−3) and +/− 0.6 degrees celsius (from −10˚C to 36˚C) respectively[10].More details can be seen

fromhttps://soilmoisture.tamu.edu The samples contain the daily recorded soil

moisture a depth of two inches for complete day.





4

Result

Mean Squared Error (MSE) is the mean of square of errors, i.e. the difference between the true values and the predicted values. It is one of the most commonly

used prediction parameter to compare various regression models It can be observed that the MLR has MSE of 0.15 for one day ahead, 0.40 MSE for two days ahead and 1.2 MSE for seven days ahead. Similarly the R2 for one day ahead is 0.96, for two days ahead is 0.90 and for seven days ahead is 0.713.In the same way SVR has the MSE 0.14 for one day ahead,0.42 for two days and 1.3 for seven days ahead and for r2 of 0.96 for one day ahead,0.90 for two days ahead and 0.68 for seven days ahead. In RNN the MSE for one day ahead is 1.26, for two days ahead is 1.8 and for seven days ahead is 3.2 for R2 it is 0.96, 0.922 and 0.76 respectively. Hence it is observed from the tabulated results that multiple linear regression shows better predictive capability in comparison to the other two methods. It is also observed that recurrent neural network is not a good predictive model as its results are inferior to both multiple linear regression and support vector regression.

5

Conclusions and Future Scope

In this paper, we introduced machine learning techniques for prediction of soil moisture in advance. We have used multiple linear regression, support vector regression and recurrent neural network for the prediction. From the results it is concluded that multiple linear regression is superior to the support vector regression and recurrent neural network. The prediction results are pretty good for 1 day ahead. This will help the farmers to adjust their management strategy beforehand. refers to the amount of water within pore spaces found in a volume of soil. Water is essential for photosynthesis, the process essential for plant growth and, therefore, soil moisture is an important agricultural consideration. The data provided by our prediction can provide farmers with useful information to help maximise crop productivity and yield. are a tool used to estimate crop yield by inputting relevant data, and so soil moisture measures provided by our predicted moisture can be entered into these models. It reduces the rate of root proliferation as well as air and water mobility in the soil. This means less water is available to the plant, and therefore growth rate decreases. High soil moisture increases the potential for compaction, so the data provided by can be vital in determining when farmers can use heavy machinery on their fields without soil degradation.

6

Bibliography

https://scikit-learn.org/stable/modules/generated/sklearn.kernel\_ridge.KernelRidge.html#sklearn.kernel\_ridge.KernelRidge

https://scikit-learn.org/stable/modules/generated/sklearn.linear\_model.Lasso.html#sklearn.linear\_model.Lasso

https://www.analyticsvidhya.com/blog/2016/01/complete-tutorial-ridge-lasso-regression-python

7

Appendices

DATASET:

http://nationalsoilmoisture.com/test/VWC\_QAQC/Daily%20soil%20moisture%20percentile/

REFERENCES:

https://www.analyticsvidhya.com/blog/2016/01/complete-tutorial-ridge-lasso-regression-python/

https://datatofish.com/multiple-linear-regression-python/

https://github.com/mahesh147/Multiple-Linear-Regression

http://www.thejavageek.com/2018/02/14/multiple-linear-regression/

8

Acknowledgement

We have great pleasure in presenting the report on SOIL MOISTURE PREDICTION. We take this opportunity to express our sincere thanks towards our guide ARCHANA KOTANGALE Department of COMPUTER, APSIT thane for providing the technical guidelines and suggestions regarding line of work. We would like to express our gratitude towards his constant encouragement, support and guidance through the development of project.

We thank Prof. SACHIN MALVE Head of Department ,COMPUTER, APSIT for his encouragement during progress meeting and providing guidelines to write this report.

We also thank the entire sta of APSIT for their invaluable help rendered during the course of this work. We wish to express our deep gratitude towards all our colleagues of APSIT for their encouragement.

SHUBHAM PADTE

16102058

PRADIPT KALAMKAR

16102028

PANKIT KHIMASIYA

16102034