

## SOIL TESTING PROCESS USING DATA MINING TECHNIQUES

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### ABSTRACT

“Data-Mining”, process of finding out unrevealed patterns & interconnection within large amount of data-sets. “Data-Mining” also called as KDD, data/pattern examination, information gathering, etc. In current paper, we propose a restful web service form of automated system, which uses data-mining technique to analyze category of uploaded soil data-sets & provide multiple suggestions such as crops, fertilizers, quantity of water, etc. to achieve better profit. “Naive Bayes” & “K-Nearest Neighbor” algorithms used to predict yield is formalized by classification rule. Collection of soil sample from agricultural field is first step of our implementation. Furthermore tested, multiple nutrients levels are calculated and provided as input to application. After that they provide multiple suggestions such as crops, fertilizers, quantity of water, etc.

**KEYWORDS:** Soil Data Mining, Pattern Mining, Information Archeology & Information Dredging

### 1. INTRODUCTION

Soil-testing improves soil-fertility & increases growing capacity of soil for better cultivation. 1st level soil-testing is very critical to decide contaminants, nutrients & other attributes such as “Acidity” & “pH” level of soil. Soil data-sets can be collected from different soil-testing research centers and data-segregation is done depending on different localities and imported as input data set to our proposed approach. In order to improve effectiveness and accuracy of classification of large soil data-sets we need to solve complex soil data sets. Advanced literature on various aspects of soil-testing is provided to all soil-testing laboratory members & different methodology for soil-testing also provided to them as practical’s. Guide lines to farmers for better yield and recommendation of fertilizer provided to them after soil-testing the corresponding soil from particular agricultural land. Farmers should periodically test their own soil; know their soil nutrient levels and other attributes such as “Acidity” and “pH” level of soil for better yield.

Current paper had established an approach called “Novel Based Soil Classification Technique” to improve fertilizer-quality, fertilizer-quantity & fertilizer-efficiency depending upon mineral-deficiency in soil. Process of predicting mineral-deficiency in soil & provide necessary fertilizers to improve quality of soil for better yield called as “Predict-Def”.

The efficiency of data-mining algorithms such as “K-Nearest Neighbor” and “Naive Bayes” algorithms is used to classify minerals in soil & estimate deficiency level of it. Agriculture is back bone of each and every country’s economy, various researches has been under going to develop short period crops for better yield and to increase productivity. Factors which affects cultivation is wrong quantity of fertilizer provided, less watering for crops and cultivation of non suitable crops for that particular soil type. These all are done, due to lack of information and expert advice. Most of the farmers failed to get good yield and slowly they are migrating from farming to some other business.

In our proposed approach, we have developed a restful web service form of automated system for soil classification providing various suggestions such as crops, fertilizers, quantity of water, etc. The outcome of this research

will result into substantial decrease in price of these testing methods and save a lot of time and efforts of soil testing laboratories of all nations.

## 2. MATERIALS AND METHODS

We had developed a restful web service form of automated system, which uses data-mining techniques to analyze category of uploaded soil data-sets. After classifying soil category from soil data-sets with help of automated system using restful API's, we had carried out various soil classification techniques with help of data mining tool known as "WEKA". Dataset used in soil classification techniques, was collected from one of soil testing laboratories in India. The approach carried out for soil testing process has very sound practical knowledge of soil testing methodologies. The outcome of this research will reduce the testing time of the soil testing laboratories. Restful Web Service API's can be published as an open source, which can be consumed by many other soil-testing laboratories. The published API's can be integrated to other soil testing application with help of integration document to provide accurate results.

### 2.1. Collection of Data Set

Data-sets are collected from different areas by conducting survey which is being carried out regularly. Data-sets which are acquired by field sampling is packed and sent to soil-testing laboratories which are located nearby for further analysis. Analyzed soil-nutrient levels are uploaded to restful web service based automated system, nutrients are considered as attributes for soil classification techniques. Table: 1 describes data-set attributes (i.e. minerals or nutrients) for each soil sample.

### 2.2. Automated System using Restful Web Service

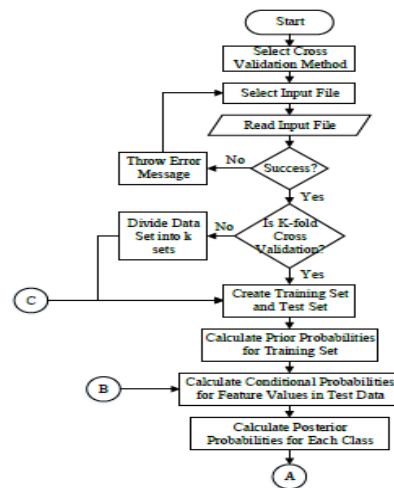
Soil classification is very essential for identifying soil nutrient's level and to find out amount of fertilizer to be provided to enrich soil nutrient's level. Restful Web Service form of automated system is very powerful in identifying different types of soil categories very efficiently by providing required inputs. Traditional classification methods are very time consuming process and hence it is not reliable automated system for soil-classification. A traditional method for soil-classification done manually in laboratories and hence it will be a time consuming process, because of this many farmers will not follow soil testing process. Hence yield obtained by farmers will be very poor and they struggle a lot to obtain better yield.

Current paper had proposed an automated system for soil-classification using Restful Web Service to determine nutrient level of soil, such as Ph, EC, OC, P, K, Fe, Zn, Mn, Cu, etc. It's very difficult to implement automated soil-testing system without data-mining techniques such as classification, feature extraction & combined mining. Rules & regulations which followed out for soil-classification technique collected from soil-testing laboratories & embedded "Novel Based Soil-Classification Technique".

**Table 1: Data Set Attributes Description**

Field	Description
Ph	pH value of soil
EC	Electrical conductivity, decisiemen per meter
OC	Organic Carbon, %
P	Phosphorous, ppm
K	Potassium, ppm
Fe	Iron, ppm
Zn	Zinc, ppm
Mn	Manganese, ppm
Cu	Copper, ppm

### 3. A COMPARATIVE STUDY OF SOIL CLASSIFICATION TECHNIQUES



**Figure 1: Flow of Soil Testing Process.**

The first & foremost process is soil-classification, which very critical one for every researcher, because depending on soil categories; we have to find out various nutrients level and to define fertilizer quantity improving nutrients level & obtain better yield. Earlier days, our ancestor determines which crops can be cultivated on particular soil on particular season and which fertilizer should be used for better profit. Beyond this very small amount of farmers will perform soil -testing & utilize advanced techniques of cultivation & get better profit, which in turn will improve economy of family and country too.

### 4. RESULTS AND DISCUSSIONS

The purpose of study is to examine most effective techniques to predict minerals deficiency in soil and providing necessary fertilizers to improve quality of soil for better yield. Few techniques which are discussed here are “Novel Based Soil-Classification Technique” to improve fertilizer-quality, fertilizer-quantity and fertilizer-efficiency to corresponding crops depending upon minerals deficiency in soil. Comparative study of “Naive Bayes” and “K Nearest Neighbor” Algorithm is used to find out classification of soil categories. “Naive Bayes” Algorithm is very strong assumption that most unlikely in real data, i.e. that attributes do not interact with each other. Nevertheless, this methodology performs surprisingly well on data where this assumption does not hold and “K Nearest Neighbor” Algorithm is used to classify soil-testing attributes & categories different kind of soil for better yield of crops.

### 5. CONCLUSIONS

In this proposed work, we had used “Novel Based Soil-Classification Technique” to improve fertilizer-quality, fertilizer-quantity and fertilizer-efficiency to corresponding crops depending upon minerals deficiency in soil. “Data-Mining” techniques such as combined mining & pattern recognition are used for soil-testing studied. Major aim of this research work is to predict minerals deficiency in soil and provide necessary fertilizers to improve quality of soil for better yield. A comparison of different data-mining classification algorithm will be very helpful to provide an efficient solution for soil-classification problem. Better understanding of soil-testing process improves productivity in farming and maintains biodiversity.

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