IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

Different Soil image classification using Fuzzy Rule Set and data mining

Dr.P.Manikandan[1], Dr.N.Vidhya[2], D.Lalitha[3]

1, 3-Assistant Professor, Department of Computer Science, Srinivasan College of Arts and Science, Perambalur, Tamil Nadu, India
2- Assistant Professor, Department of Computer Applications, Govt College of Arts and Science, Vepantattai, Perambalur, Tamil Nadu, India.

Abstract

An innovative method for classification discrete color images, such as map images, graphics, GIS, as well as binary images. In lossless compression techniques, the original image can be entirely recovered from the compressed image. The Soil image captures the environmental image that has the options of soil image like plant options, water particles, and soil patterns. Such models are applied to resolve several issues like agricultural growth. The fuzzy system is a fuzzy logic-based system. In this proposed method, Fuzzy logic provides innovative tools to handle the complex and ill-defined systems where traditional tools become unsuccessful. Fuzzy systems are universal approximates of nonlinear functions. Two aspects are essential in the fuzzy system one generating the best rule set and second tuning the membership functions.
Keywords: Soil classification; Fuzzy rule set; Data mining algorithms

1. Introduction

Data mining task can be classified into two categories: Descriptive data mining and Predictive data mining. Descriptive data mining tasks qualify the general properties of the database while predictive data mining is used to predict expressed values based on patterns determined from known results. Classification and prediction are two forms of data analysis that can be used to solution models describing essential data classes or to predict future data trends.

The classification of the image can be identified in different approaches according to different features like color, function, shape, object-oriented and so on. The color values based image classification uses the color features to perform image classification, and the configuration based method extracts the ways from the image and uses the forms to complete image classification.

2. Review of literature

Image segmentation by fuzzy c-means clustering algorithm with a novel penalty term young Yang, To overcome the noise sensitiveness of standard fuzzy c-means (FCM) clustering algorithm, a novel extended FCM algorithmic rule for image segmentation is bestowed during this study[1]. The algorithmic rule is developed by modifying the target perform of the quality FCM algorithmic rule with a penalty term that takes into consideration the influence of the neighboring pixels on the middle pixels.

Texture-Based Classification of Indian Soils Using Local Binary Pattern and Artificial Neural Networks Data mining techniques are playing the vital role in a significant number of fields. In this work, a ground classification methodology has been developed supported soil properties [3]. Within the study space, there's nice diversity concerning soil composition and occurrence.

Feature Extraction of Soil pictures for Retrieval supported Statistics In image process, applied math, geometrical and signal process options area unit accustomed describe the feel of a picture region[2]. The signal process ways involve enhancing original image exploitation filters and scheming the options of the remodeled pictures. In this study, Law mask, physicist Filter and color division area unit applied to the first images to extract the feel options of soil pictures for retrieval.

3. Methodology

The soil image has gray values, and the range of gray values can be used to perform classification. In case of color image, the color values of the model can be used to implement soil classification where each type of soil has different colors. Each soil has their plant which has more growth, and some of the facilities will grow in particular soil and others will not.

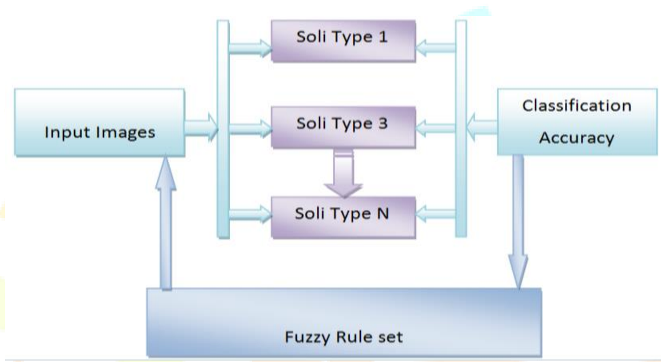


Figure 1: The proposed method for soil image classification

Figure 1: the proposed method of soil image classification. Soil is usually referred to as the naturally occurring organic materials found on the earth's surface. It is mainly composed of mineral, nutrients, water, other inorganic particles and some residues of plants and animals.

3.1 **Soil classification types:**

- Sandy Soil

The first type of soil is sand. It consists of small particles of weathered rock. Sandy soils are one of the poorest types of soil for growing plants because it has very low nutrients and poor water holding capacity, which makes it hard for the plant's roots to absorb water. This type of soil is very good for the drainage system. Sandy soil is usually formed by the breakdown or fragmentation of rocks like granite, limestone and quartz.

- Silt Soil

Silt, which is known to have much lesser particles compared to sandy soil and is made up of rock and other mineral particles, which are smaller than sand and larger than clay. It is the flat and fine quality of the soil that holds water better than sand. Silt is easily transported by moving currents and it is mainly found near the river, lake and other water bodies. The silt soil is more fertile compared to the other three types of soil.

- Clay Soil

Clay is the smallest particle amongst the other two types of soil. The particles in this soil are tightly packed together with each other with very little or no airspace. This soil has very good water storage qualities and makes it hard for moisture and air to penetrate into it. It is very sticky to the touch when wet, but smooth when dried. Clay is the densest and heaviest type of soil which does not drain well or provide space for plant roots to flourish.

- **Loamy Soil**

Loam is the fourth type of soil. It is a combination of sand, silt and clay such that the beneficial properties from each are included. For instance, it has the ability to retain moisture and nutrients; hence, it is more suitable for farming. This soil is also referred to as agricultural soil as it includes an equilibrium of all three types of soil materials being sandy, clay, and silt and it also happens to have humus. Apart from these, it also has higher calcium and pH levels because of its inorganic origins.

3.2 Fuzzy Rule Set

The fuzzy rules are a unit regarding creating a collection of variable values for every attribute being thought-about from the results of feature extraction part. First, the plan of action makes the small-scale footage through the feature extraction section then for every feature vector obtained the tactic computes the various values for every attribute or live to be thought about. In training phase, the process generates such rules with the benefits of plant growth which is also an input for the system. By creating range values, the method makes some regulations which will be used to perform plant growth estimation [4].

Algorithm:

Input: Feature Vector Set Favs.
Output: Rule R
Step1: Start
Step2: Compute range value for Humidity factor
Min, Max = Compute Minimum and Max values of humidity.
Step3: For each feature Fi from Fvs

Min = $\int_{i=1}^{size(Fvs)} \mathrm{Min}(\min, \mathrm{Fvs}(\mathrm{Hv}))$

Max = $\int_{i=1}^{size(Fvs)} \mathrm{Max}(\max, \mathrm{Fvs}(\mathrm{Hv}))$

End

Step4: For each feature Fi from Fvs

Compute WMin = $\int_{i=1}^{size(Fvs)} \mathrm{Min}(\min, \mathrm{Fvs}(\mathrm{Wsf}))$

Compute WMax = $\int_{i=1}^{size(Fvs)} \mathrm{Max}(\max, \mathrm{Fvs}(\mathrm{wsf}))$

End

Where Wmin=min value of water source factor and Wmax = max value of water source factor

Step5: For each feature Fi from Fvs

Compute PMin = $\int_{i=1}^{size(Fvs)} \mathrm{Min}(\min, \mathrm{Fvs}(\mathrm{Pf}))$

Compute PMax = $\int_{i=1}^{size(Fvs)} \mathrm{Max}(\max, \mathrm{Fvs}(\mathrm{Pf}))$

End

Where Pmin= minimum value of Plant factor and Pmax= max value of Plant factor

Step6: For each feature Fi from Fvs

Compute GMin = $\int_{i=1}^{size(Fvs)} \mathrm{Min}(\min, \mathrm{Fvs}(\mathrm{Gv}))$

Compute GMax = $\int_{i=1}^{size(Fvs)} \mathrm{Max}(\max, \mathrm{Fvs}(\mathrm{Gv}))$

End

Where GMin=minimum value of Grindness and GMax=max value of Grindness

Step7: For each attribute Ai of feature vector
Split the range into N ranges.

Rvs = $\int_{i=1}^{4} \mathrm{Split}(\mathrm{Min}, \mathrm{Max})\mathrm{or}4$

Where Rvs= Range of vectors

End

Step8: For each range values

Generate Ri = {Range(A_1), Range(A2), Range(A3), Range(A4), GF}

Where Ri= Rule
Add to Rule set.
End
Step9: Stop.

The above-presented algorithm computes range values from the feature vector given and based on the values the method generates the rule to perform plant growth estimation.

3.3 Soil Classification

The method computes the multi-feature support factor for each class with the given input feature vectors. Based on the multi-feature support factor computed the method decides the class of image to perform soil classification.

Algorithm:
Input: Soil Feature Fv, Rule Set Rs.
Output: Class C.
Step1: Start
Step2: For each class Ci from Soil Class Sc
Step3: Compute Multi-Feature Support Factor.
Step4: End
Step5: Choose the most valued support factor and class Ci = Max(MFSF).
Step6: Stop

The above pseudo code computes the multi-feature support factor for each class to select the type with the maximum comfort factor.

4. SIMULATED RESULT

This study is used to compare that soil classification techniques using its accuracy, and they are used for finding the best soil classification technique. The improvement of agriculture research has been improved by technical advances in computation, automation and data mining. Data mining is being used in vast areas. The products of data mining system and domain-specific data mining application software's are available for tailor-made use, but data mining in agriculture on soil data sets is a relatively a new and useful research domain.

Symbol	Soil Type
S	Sand
Sick	Silt Clay Loam
Sic	Silt Clay
C	Clay
Sl	Sandy Loam
Cl	Clay loam
Sil	Silt Loam
L	Loam
LS	Loamy Sand
SCL	Sand Clay Loam

Table 1: List of soil types considered

Table 1: Parameters used for multi-variant soil pattern-based classification

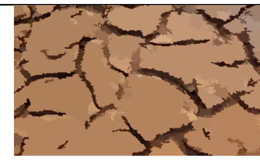
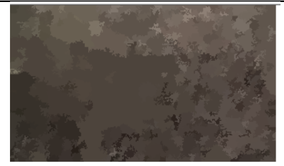
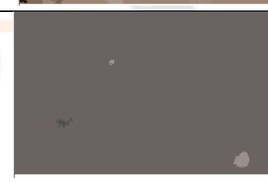
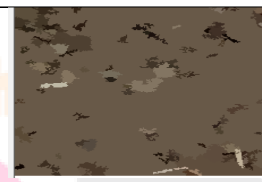
Soil Type	**Original Image**	**Filter image**	**Processed image**
Clay			
Loam			
sand			
Silt Loam			
Clay Loam			
Sandy Loam			
Silt Clay Loam			

Figure 2: fuzzy rule set Implement and processed Image of different soil images

Figure 2: shows the proposed method of result of soil properties is produced by the fuzzy rule set. The processed images are the way toward partitioning an advanced image into different sections (sets of pixels, otherwise called super-pixels. The consequence of image segmentation is an arrangement of sections that by a large cover the whole image, or an arrangement of forms separated from the image see edge location. Each of the pixels in a district are comparative concerning some trademark or processed property, for example, shading, power, or surface. The fuzzy rule set method has been implemented using following parameters and the efficiency of the soil classification have been evaluated using some data sets of special pictures. The result shows that the projected methodology has made sensible cause soil classification with more accurate results.

Soil type And Algorithm	**Sand**	**Silt Clay Loam**	**Silt Clay**	**Sandy Loam**	**Silt Loam**	**Loam**
fuzzy rules	87.56	89.52	92.65	95.88	98.65	94.45

Table 2: Different soil image classification accuracy

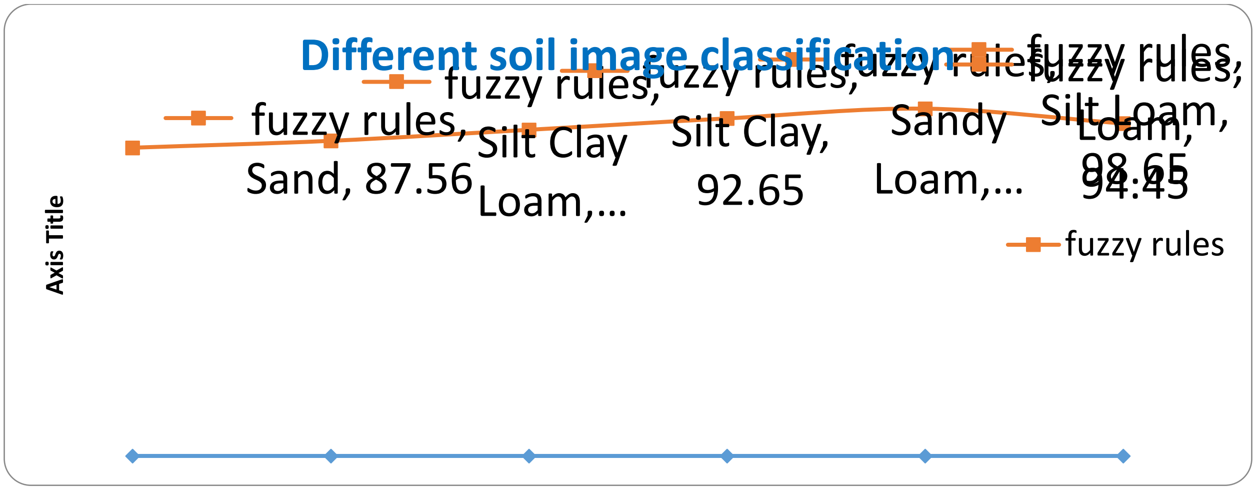


Figure 3: Different soil image classifiaction

Figure 3: shows the comparative result on different soil classification produced by fuzzy rule set methods and the result shows that the proposed method has produced more classification accuracy. The different soil image classification using fuzzy rule sets to enhance soil simulation analysis results had the better performance to overcome the problem strategies produced higher processed results as well as multi soil classification.

5. Conclusion

In this study, analysis of various soils like sand, silt, Loam, sandy Loam and Silt clay has been studied and analysis successfully. Depends up on the algorithm each and every soil produced the different accuracy and result. All the soil has tested in different parameter depends on the parameter result in concluded. The presents a fuzzy rule set measure soil image classification approach. The method improves the image quality using multi-level filter technique and extracts the features. Using the features extracted the method computes the fuzzy rule set for each class. This result compares different soil silt loam is more accuracy for other soil.

6. References

1. R.shenbagavalli, k.ramar, "feature extraction of soil images for retrieval based on statistics", international journal of computer applications (0975 – 8887) vol 88 – no.14, 2014.
2. Myint, S.W.; Gober, P.; Brazel, A.; Grossman-Clarke, S.;Weng, Q. "Per-pixel vs. object-based classification of urban land cover extraction using high spatial resolution imagery". Remote Sens. Environ. 2011.
3. Charlotte baey, anne Didier, Evaluation of the Predictive Capacity of Five Plant Growth Models for Sugar Beet, published in "plant growth modeling, simulation, visualization and applications, 2012.
4. P. Manikandan, Dr.C.Jothi Venkateswaran "Multi Variant Soil Pattern Based Classification Of Geospatial Soil Images For Agricultural Plant Growth Estimation Using Data Mining" International Journal of Applied Engineering Research ISSN 0973-4562 Volume 10, Number 24 (2015)
5. Satvir Singh, Inderjeet Singh Gill, Sarabjeet Singh and Gaurav Dhawan, "Application of Type-2 Fuzzy Logic – A Review", International Conference on Communication, Computing & Systems (ICCCS–2014)
6. Mahalakshmi P, Ganesan K, " Mamdani fuzzy rule based model to classify sites for aquaculture development", Indian Journal of Fish., 62 (1): 110-115, 2015
7. Maher Ibrahim Sameen, Biswajeet Pradhan,"A Two-Stage Optimization Strategy for Fuzzy Object-Based Analysis Using Airborne LiDAR and High-Resolution Orthophotos for Urban Road Extraction", Journal of Sensors Volume, 2017.