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Artificial Intelligence and Machine Learning Technique for Soil Classification System

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A B S T R A C T

Growing interest in Artificial Intelligence (AI) and associated technologies be employed for efficient analysis and sorting machine learning algorithms can process large data sets, including soil properties and quality, to identity patterns and make predictions. The four-phase development involved a comprehensive literature review, to accurately classify different types of soil based on specific property. This study proposes a solution to increase order and accuracy in soil classification processes and gives better land management and agricultural applications. This paper explores the beneficial combination of AI and lean methodologies for increasing efficiency by automating the classification process, reducing the time and effort compared to manual methods. The study contributes search into existing soil classification techniques, highlighting their control and the growing need for advanced technologies. The paper highlights the challenges faced by discharge light on the complex challenges encountered during its implementation. Paper establishes a linkage between cutting-edge machine learning techniques and the improvement of soil identity. Finally, a systematic literature review identifies hot topics in scientific studies related to artificial intelligence in supporting soil classification, relevant literature into the advancements, challenges, and potential future directions in advantage artificial intelligence for more effective and accurate soil classification process.

Keywords: Deep learning Image recognition Machine learning Neural network Soil classification

INTRODUCTION

- Artificial Intelligence (AI) is a system designed for classification supports advanced algorithms to analyze multiple soil data. By using machine learning techniques, it skillfully processes soil characteristics, such as texture, composition, and moisture content, providing accurate and timely classifications. This intelligent system increases the exactness of soil classification, helping agricultural and environmental advantages with penetrating data for informed decision-making.
- It customizes for soil classification – a cutting-edge solution designed to transform the way we understand and classify soil. By control the power of advanced algorithms and machine learning, this system analyzes complex into properties like texture, composition, and moisture levels. Absolute integrating technology into the principality of soil science, it provides an advanced tool for improved accuracy and efficiency in soil classification, supporting various application in agriculture, environmental science, and later than.
- It can play a crucial role in supporting soil classification. By harnessing the power of advanced technologies like deep learning and machine learning algorithms, AI can provide valuable assistance in accurately classifying different types of soil. Deep learning is a subset of machine learning, involves training neural networks to recognize patterns and make predictions based on large datasets. In the context of soil classification, deep learning models can be created to analyze soil samples and identify their specific characteristics.
- By inputting data such as chemical features, physical properties, and even images of soil samples, the AI system can learn to differentiate between various soil types, such as clay, sand, and gravel. This enables the system to provide insights into the structure, fertility, and other important qualities of the soil.

Literature Review

- Hameed, I. A Et Al (2017); In Proceedings of the International Conference on Data Engineering (ICDE). The authors propose the application of artificial neural networks (ANNs) in the classification of soil. They aim to investigate the effectiveness and appropriateness of using ANNs compared to other empirical formulas or methods described in the literature for soil classification. To focuses on analysing the performance and accuracy of ANNs in classifying different types of soil based on various input parameters. By comparing the results obtained from the ANN model with those from other existing methods, the authors aim to evaluate the suitability of ANNs for soil classification tasks. the main objective is to assess the effectiveness and appropriateness of artificial neural networks for soil classification and compare their performance with other existing methods in the literature.

- Samui, P Et Al (2013): The study is to provide a comprehensive review and comparison of two machine learning techniques for soil classification. The authors propose to evaluate and compare the performance of two specific machine learning techniques in the context of soil classification. It focuses on analyzing the effectiveness and accuracy of these techniques in categorizing different types of soil based on various input parameters. By conducting a thorough review of the literature and comparing the results obtained from the two machine learning techniques, to assess their suitability and potential for soil classification tasks. then also to identify the strengths and limitations of each technique and provide insights into their practical applications in the field of engineering geology. The main objective is to review and compare two machine learning techniques for soil classification, with the aim of evaluating their performance and providing insights into their practical applications in engineering geology.

- Mohanty Et Al (2016); Studied the application of deep learning techniques for the of plant diseases using images of plant leaves. The authors objective to train a deep convolutional neural network (CNN) model on a dataset of images of diseased and healthy plant leaves. And to develop a model that can accurately classify and distinguish between different crop species and identify the presence of diseases in plants based on the visual characteristics captured in the images. By utilizing deep learning algorithms and training the model on a large dataset of plant leaf images, to evaluate the performance and effectiveness of the CNN model in detecting and classifying plant diseases. the researched is to contribute to the field of plant pathology and agricultural sciences by leveraging the capabilities of deep learning and image-based analysis for plant disease detection. The findings of the study can have practical implications in improving crop health monitoring and disease management practices. the main objective of the research is to investigate the use of deep learning techniques, specifically CNN models, for image-based plant disease detection, with the aim of developing an accurate and efficient tool for early diagnosis and management of plant diseases.

- Haghverdi Et Al (2018); The study is to propose and evaluate a hybrid model that combines fuzzy logic and multilayer perceptron (MLP) for soil classification. The authors purpose to develop a model that can effectively classify different types of soil based on various input parameters. They propose a hybrid approach that combines the interpretability of fuzzy logic with the learning capabilities of MLP, a type of artificial neural network. to leverage the of both fuzzy logic and MLP to improve the accuracy and robustness of soil classification models. And the Fuzzy logic allows for the representation of uncertainty and imprecision in the classification process, while MLP can learn complex patterns and relationships from the data. they to assess its performance in accurately classifying soil types. is to provide a reliable and efficient tool for soil classification that can be applied in various engineering and environmental applications. The main goal is to contribute to the field of soil science and engineering by proposing a hybrid model that combines fuzzy logic and MLP for soil classification. The findings of the study can have practical implications in improving soil mapping, land management, and decision-making processes.

- Rajan Et Al (2018); The study is to explore the application of machine learning algorithms for soil classification using hyperspectral data. The authors goal to evaluate the performance of different machine learning algorithms in classifying soil types based on hyperspectral data. Hyperspectral data refers to the measurements of reflectance across a wide range of wavelengths, providing detailed information about the spectral characteristics of different materials, including soil. The objective is to assess the effectiveness and accuracy of machine learning algorithms, such as artificial neural network (ANN), random forest (RF), and support vector machine (SVM), in classifying soil types using hyperspectral data. By comparing the performance of these algorithms, to identify the most suitable algorithm for soil classification tasks. The main goal of the research is to contribute to the field of remote sensing and soil science by demonstrating the potential of machine learning algorithms in soil classification using hyperspectral data. The findings of the study can have practical implications in improving soil mapping and land management practices, as well as supporting decision-making processes in various applications such as agriculture, environmental monitoring, and land-use planning.

- Parihar Et Al (2018); The study is to conduct a comparative analysis of different machine learning algorithms for soil classification. to evaluate and compare the performance of four commonly used machine learning algorithms: artificial neural network (ANN), random forest (RF), support vector machine (SVM), and k-nearest neighbors (KNN). The objective is to assess the effectiveness and accuracy of these algorithms in classifying soil types. By conducting this comparative study, to identify the most suitable machine learning algorithm for soil classification tasks. They evaluate the algorithms based on various performance metrics such as accuracy, precision, recall, and F1 score. The main goal is to contribute to the field of soil science and agriculture by providing insights into the performance of different machine learning algorithms for soil classification. The findings of the study can have practical implications in improving soil mapping, crop suitability assessment, and precision agriculture practices.

- Vapnik Et Al (1995); discussed and describe the fundamental ideas and principles that underlie the statistical theory of learning and generalization. The author aims to explore the nature of statistical learning theory and its implications in the field of machine learning and data analysis. The book delves into the concept of learning as a process of generalization from empirical data, considering it from a general perspective of function estimation. is to provide a comprehensive understanding of the theoretical foundations of statistical learning and how they relate to practical algorithms and methods. The author aims to demonstrate how abstract reasoning leads to the development of new algorithms and approaches in statistical learning. And to focuses on the fundamental concepts and principles of statistical learning theory, omitting detailed proofs and technicalities.

- P. Idziaszek Et Al; Developed an IT system for the identification and classification of soil valuation classes using AI methods. The aim of the study was likely to create suitable models and implement an IT system that could effectively identify and classify different soil valuation classes. This research likely aimed to contribute to soil quality assessment by utilizing IT methods, algorithms, and artificial intelligence tools

to improve the accuracy and efficiency of soil classification. Unfortunately, I couldn't find the specific details of the main objective in the web search results provided.

- T.A. Tang Et Al (2016): Proposed a deep learning approach for network intrusion detection in Software Defined Networking (SDN). The aim of the study was likely to develop a model or system that utilizes deep learning techniques, such as convolutional neural networks (CNN) or deep neural networks (DNN), to effectively detect and classify network intrusions in SDN environments. By leveraging the power of deep learning, the researchers likely aimed to enhance the security of SDN networks by accurately identifying and responding to potential intrusions or attacks.

CONCLUSION:

Deep learning playing a pivotal role in models, such as neural networks, convolutional neural network (CNNs), and recurrent neural network (RNNs), have shown amazing potential in catch complex patterns and relationships within soil data. It was shown that this AI model can be applied to make judgments on soil classification. As a result, a high recall rate of 1 was obtained for sand. The ability of deep learning to automatically take out relevant features from complex datasets contributes to improved accuracy in soil classification. Including the need for large and various datasets, model understandable, and addressing potential cross. In spite of these challenges, the step made in advantage deep learning for soil classification are interesting. The further research and alteration are pivotal to purify deep learning models, increase their understandable, and make sure their relevance across various soil types and environmental conditions.

The integration of Artificial intelligence (AI) for supporting soil classification, highlight the combination of various AI techniques. The union of machine learning algorithms, data analysis through the use of deep learning techniques and neural networks, AI models have been developed to accurately classify different types of soil, such as clay, sand, and gravel soil classification offers several benefits. Firstly, it allows for more efficient and automated analysis of soil samples, saving time and resources. AI models can process large amounts of data quickly and provide accurate results AI can enhance the accuracy and reliability of soil classification by minimizing human error. The use of deep learning algorithms enables the AI model to learn from a vast amount of training data, improving its ability to classify soils accurately.

Through the utilization of deep learning techniques and AI algorithms, researchers have verified that AI can be effectively applied to soil classification determination. By performing simple deep learning with large datasets, AI models have been able to accurately classify different types of soil. use of AI technology in soil analysis offers numerous advantages. It enables more efficient and automated analysis of soil samples, saving time and resources. Additionally, AI models can process vast amounts of data quickly and provide accurate results, minimizing human error. It is an AI-based tool for soil classification holds a promising future for workable agriculture and environmental management. It can contribute to better decision-making processes by providing consistent besides consistent results.

The investigation into the application of artificial intelligence (AI) for supporting soil classification has shown promising results. Through the utilization of deep learning techniques and neural networks, AI models have been developed to accurately classify different types of soil, such as clay, and gravel to the findings indicate that AI, combined with deep learning algorithms, can effectively be applied to classification determination. It enables more efficient and automated analysis of soil samples, reducing time and resources required for manual classification methods. These technologies offer a promising approach to improving our understanding of soils and optimizing agricultural practices.

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