**Soil Salinity Spatial Analysis to Develop a Machine Learning-Based Soil Resistivity Predictive Model**

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***ABSTRACT***

The development of a sustainable and resilient electrical distribution network in a region optimizes the placement of electrical equipment and substations which reduces the risk of equipment failures and downtime and enhances cost effectiveness. However, the application of geospatial techniques with AI-based methods for these purposes is very limited in Sri Lanka. This study aims to develop a machine learning model-based predictive model by integrating geospatial techniques to identify the spatial distribution of soil salinity to detect soil resistivity to optimize suitable locations for earthing to enhance the efficiency of the electrical network. The study was carried out in the Rathmalana Electrical Engineer area, using images collected by the Sentinel-02 satellite acquired in year 2022 and field-collected earth resistance values. Supervised learning algorithms such as linear regression and random forest were used to establish forecasting models. Their performances were measured using RMSE and R-squared. The obtained values of earth resistance varied, ranging from 0.02 to 52.00 ohms with a standard deviation of 6.40. The linear regression model achieved the best performance, followed by Lasso regression and the random forest algorithms, with lower errors with moderate accuracy. The study points out the need to achieve higher accuracy and proposes further exploration with alternative models by incorporation of more variables to achieve higher accuracy. The proposed model highlights the importance of understanding the resistivity and salinity of soil for designing effective earthing systems in other regions too.

**Keywords:** Soil salinity, Soil resistivity, Machine learning, Remote sensing, Predictive model