

Groundwater Potential Delineation Using Geodetector Based Convolutional Neural Network in the Gunabay Watershed of Ethiopia

Authors : Asnakew Mulualem Tegegne, Tarun Kumar Lohani, Abunu Atlabachew Eshete

Abstract : Groundwater potential delineation is essential for efficient water resource utilization and long-term development. The scarcity of potable and irrigation water has become a critical issue due to natural and anthropogenic activities in meeting the demands of human survival and productivity. With these constraints, groundwater resources are now being used extensively in Ethiopia. Therefore, an innovative convolutional neural network (CNN) is successfully applied in the Gunabay watershed to delineate groundwater potential based on the selected major influencing factors. Groundwater recharge, lithology, drainage density, lineament density, transmissivity, and geomorphology were selected as major influencing factors during the groundwater potential of the study area. For dataset training, 70% of samples were selected and 30% were used for serving out of the total 128 samples. The spatial distribution of groundwater potential has been classified into five groups: very low (10.72%), low (25.67%), moderate (31.62%), high (19.93%), and very high (12.06%). The area obtains high rainfall but has a very low amount of recharge due to a lack of proper soil and water conservation structures. The major outcome of the study showed that moderate and low potential is dominant. Geodetector results revealed that the magnitude influences on groundwater potential have been ranked as transmissivity (0.48), recharge (0.26), lineament density (0.26), lithology (0.13), drainage density (0.12), and geomorphology (0.06). The model results showed that using a convolutional neural network (CNN), groundwater potentiality can be delineated with higher predictive capability and accuracy. CNN-based AUC validation platform showed that 81.58% and 86.84% were accrued from the accuracy of training and testing values, respectively. Based on the findings, the local government can receive technical assistance for groundwater exploration and sustainable water resource development in the Gunabay watershed. Finally, the use of a detector-based deep learning algorithm can provide a new platform for industrial sectors, groundwater experts, scholars, and decision-makers.

Keywords : CNN, geodetector, groundwater influencing factors, Groundwater potential, Gunabay watershed

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