

Predicting location of suitable groundwater for brewing coffee using tree-based ensemble machine learning

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Recently, groundwater is used as a source of drinking purposes such as water, coffee, beer and other beverages. The range of water quality for producing high-quality of beverages is different from each usage, so it is important to find suitable groundwater location for each purpose in the aspect of water industry. This study was conducted to predict the suitable location for brewing coffee in Gangwon Province, South Korea using tree-based ensemble machine learning. Appropriate water quality standard for brewing coffee is known as TDS of 75-250 mg/L and calcium hardness of 17-85 mg/L from recent research. Boosted Regression Trees (BRT), Random Forests (RF) and Extremely Randomized Trees (ERT) were used as tree-based ensemble method. Response indicating suitable or unsuitable groundwater for brewing coffee was determined by 254 wells' water quality data, and predictor variables were composed of slope, altitude, drainage grade, effective soil depth, soil composition, land use, and hydrogeology based on GIS data. Applying models to the test data, all three models showed the area under a curve (AUC) and accuracy more than 0.85 and 0.80, respectively, which indicates high reliability in prediction. Threshold of dividing suitable or unsuitable for brewing coffee is found from Receiver Operating Characteristic (ROC) curve. The BRT showed the highest AUC and accuracy among the three models, therefore, potential map of suitable groundwater location for brewing coffee was suggested by the BRT model. In the condition of lack of water quality data, this research can help to determine location of suitable groundwater for several usages.

Keyword: potable groundwater · boosted regression tree · random forest · extremely randomized tree

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Primary author: Ms LEE, Hye-Lim (School of Earth and Environmental Sciences, Seoul National University)

Co-authors: Dr KAOWN, Dugin (School of Earth and Environmental Sciences, Seoul National University); Dr KOH, Eun-Hee (School of Earth and Environmental Sciences, Seoul National University); Prof. LEE, Kang-Kun (School of Earth and Environmental Sciences, Seoul National University); Mr LEE, Sanghoon (School of Earth and Environmental Sciences, Seoul National University)

Presenter: Ms LEE, Hye-Lim (School of Earth and Environmental Sciences, Seoul National University)

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