Short Communication

Prediction of environmental indicators in land leveling using artificial intelligence techniques

Dr Isham Alzoubi
University of Tehran, Iran

Abstract

Land leveling is one of the most significant strides in soil planning and development. Despite the fact that land leveling with machines requires significant measure of vitality, it conveys a reasonable surface incline with negligible decay of the dirt and harm to plants and different living beings in the dirt. In any case, specialists during late years have attempted to decrease petroleum derivative utilization and its pernicious symptoms utilizing new procedures, for example, Artificial Neural Network (ANN),Imperialist Competitive Algorithm – ANN (ICA-ANN), and relapse and Adaptive Neuro-Fuzzy Inference System (ANFIS) and Sensitivity Analysis that will prompt a perceptible improvement in the earth. In this examination impacts of different soil properties, for example, Embankment Volume, Soil Compressibility Factor, Specific Gravity, Moisture Content, Slope, Sand Percent, and Soil Swelling Index in vitality utilization were researched. The examination was comprised of 90 examples were gathered from 3 unique areas. The lattice size was set 20 m in 20 m (20*20) from a farmland in Karaj territory of Iran. The point of this work was to decide best direct model Adaptive Neuro-Fuzzy Inference System (ANFIS) and Sensitivity Analysis so as to anticipate the vitality utilization for land leveling. Methods New techniques such as ANN, ICA, GWO–ANN, PSO–ANN, sensitivity analysis, regression, and ANFIS that using them for optimizing energy consumption will lead to a noticeable improvement in the environment. In this research, effects of various soil properties such as embankment volume, soil compressibility factor, specific gravity, moisture content, slope, sand percent, and soil swelling index in energy consumption were investigated. The study was consisted of 350 samples which were collected from 175 regions in two depths. The grid size was set 20 m × 20 m from a 70-ha farmland in Karaj province of Iran. Results The models that reveals the relationship between the land parameters and the energy indicators were extracted. As it was expected three parameters; density, soil compressibility factor and, embankment volume index had significant effect on fuel consumption. In comparison with ANN, all ICA–ANN models had higher accuracy in prediction according to their higher R^2 value and lower RMSE value. Statistical factors of RMSE and R^2 illustrate the superiority of ICA–ANN over other methods by values about 0.02 and 0.99, respectively. Results also revealed the superiority of integrated techniques over other methods for prediction of complicated problems such as land leveling energy estimation. Conclusion Results were extracted and statistical analysis was performed, and RMSE as well as coefficient of determination, R^2, of the models were determined as a criterion to compare selected models. According to the results, 10-8-3-1, 10-8-2-5-1, 10-5-8-10-1, and 10-6-4-1 MLP network structures were chosen as the best arrangements and were trained using Levenberg–Marquardt as NTF. Integrating ANN and imperialist competitive algorithm (ICA–ANN) had the best performance in prediction of output parameters, i.e., energy indicators. New techniques based on artificial intelligence, such as Artificial Neural Network, integrating Artificial Neural Network and Imperialist Competitive Algorithm (ICAANN), or Genetic Algorithms (GA-ANN), or Particle Swarm Optimization (PSO-ANN) have been employed for developing predictive models to estimate the energy related parameters and the results were compared to SPSS and Sensitivity Analysis results. In this study, several soil properties such as cut/fill volume, compressibility factor, specific gravity, moisture content, slope of the area, sand percent, and swelling index were measured and their effects on energy consumption were investigated. Totally 90 samples were collected from 3 land areas by grid size of 20m×20m. The aim of this work was to develop predictive models based on artificial intelligence techniques to predict the environmental indicators of land levelling. Results of sensitivity analysis illustrated that only three parameters consist of soil density, soil compressibility, and soil cut/fill volume had meaningful effects on energy consumption. In this research effects of various soil properties such as embankment volume, soil compressibility factor, specific gravity, moisture content, slope, sand percent, and soil swelling index in energy consumption were investigated. The study was consisted of 90 samples were collected from 3 different regions. The grid size was set 20 m in 20 m (20 x 20) from a farmland in Karaj province of Iran. Results According to the results of sensitivity analysis, only three parameters; density, soil compressibility factor and, embankment volume index had significant effect on fuel consumption. In comparison with ANN, all ICA-ANN models had higher accuracy in prediction according to their higher R.sup.2 value and lower RMSE value. Statistical factors of RMSE and R.sup.2 illustrate the superiority of ICA-ANN over other methods by values about 0.02 and 0.99, respectively. Conclusion Results extracted and statistical analysis was performed and RMSE as well as coefficient of determination, R.sup.2, of the models were determined as a criterion to compare selected models. According to the results, 10-8-3-1, 10-8-2-5-1, 10-5-8-10-1, and 10-6-4-1 MLP network structures were chosen as the best arrangements and were trained using Levenberg-Marquet as NTF.