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Predict energy consumption for land leveling using Integrating Artificial Neural Network and PSO algorithm (PSO-ANN), Artificial Neural Networks (ANNs) and regression

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Land leveling is one of the most important steps of soil preparation for consequent objectives. It requires considerable amount of energy by heavy machines and equipment. Creating the desired slope for surface of the area with minimal degradation of the ground causes least damage to plant and animal organisms in the soil, and it protects the environment. On the other hand, reducing fossil fuel consumption for land leveling reduces air pollution and improves the environment. In the recent years, new techniques such as Integrating artificial neural network and particle swarm optimization algorithm (PSO-ANN), ANNs and regression have been employed for developing of the predictive models to estimate the desired parameters. In this study, several soil properties such as soil cut/fill volume, soil compressibility factor, specific gravity, moisture content, slope, % sand, and soil swelling index in energy consumption were investigated. In this study, total of 90 samples were collected from 3 land areas. The grid size was (20 m × 20 m) in Karaj, Iran. The aim of this work was to develop PSO-ANN and ANN and regression models to predict the energy consumption for land leveling and analyze the sensitivity of using these models. According to the results, by using sensitivity analysis method only three parameters of soil slope, soil compressibility, % Sand and soil cut/fill volume showed the significant effects. The results showed that using PSO-ANN for prediction of energy consumption of labour energy, fuel energy, total machinery cost, and total machinery energy can be successfully demonstrated. Overall, the results revealed that PSO-ANN models have better accuracy and ability to predict targets according to their higher R2 value and lower RMSE value.

Key words: Energy, particle swarm optimization (PSO) algorithm, regression, artificial neural networks (ANN), land levelling.

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