The title (العنوان):

Analysis of Dam Behavior by Statistical Models: Application of the Random Forest Approach

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ABSTRACT: Dams are singular infrastructures whose safety assessment requires mathematical models for predicting its behavior and detecting anomalies. Here, we develop an approach based on random forest regression for dam displacement prediction. Random forest regression is a non-parametric statistical technique that can deal with non-linearities and does not need assumptions regarding relationship between predictors. Inputs to the model are the water level in the reservoir, time, and concrete temperature, and the outputs –predicted variables– are movements at the desired points. Since concrete temperature is only available at those points where thermometers are placed, we compute the thermal field at any point of the dam through a one-dimensional deterministic model. Our thermal model accounts for solar radiation, shading, night and evaporative cooling, convection with the air, and long wave radiation exchange. We assess the performance of our model by comparing its estimates with recorded data at a case study, an arch dam located in Algeria, and with outputs computed by two widely used statistical models and an artificial neural network model. Our model provides satisfactory predictions and improves the results of the other models. Our approach is a powerful tool for analyzing dam displacements and incorporates a rigorous evaluation of thermal loads. It emerges as a good alternative for practitioners and stakeholders.

Keywords: Arch dam, Thermal analysis, Displacements, Solar radiation, Random forest

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