AN INTEGRATED DECISION-MAKING MODEL FOR CONSTRUCTION EQUIPMENT REPLACEMENT

By

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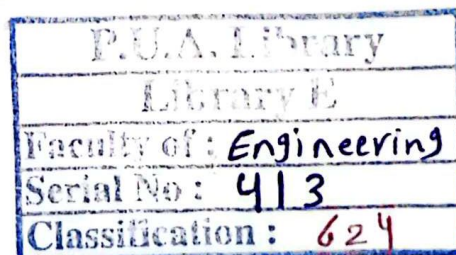
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ABSTRACT

A successful equipment replacement plan depends on identifying the proper time to sell the used equipment within its profitable life. The equipment resale price plays an important role in calculating the optimum time for equipment replacement. Some of the existing models that predict the equipment resale price do not take many of the influencing factors into account; other models consider more factors that influence the equipment resale price, but they still have low accuracy because of the modeling techniques that were used. An easy tool is required to help forecast the resale price and support efficient decisions for equipment replacement. This research presents a machine learning resale price model that helps in accurately forecasting the equipment resale price as a step towards developing a complete framework system to help in making the equipment replacement decision. A measuring scale for the influencing factors that have impacts on the equipment resale price was developed. The values of those factors were measured for 1700 pieces of equipment and their corresponding resale prices. The data were used to develop a machine learning (ML) model that covers three types of equipment (loaders, excavators, and bulldozers). The methodology used to develop the model applied three ML algorithms: (1) the random forest regressor, (2) the extra trees regressor, and (3) the decision tree regressor), to find an accurate model for the equipment resale price. The three algorithms were verified and tested with data from 340 pieces of equipment. Using a large amount of data to train the ML model resulted in a high-accuracy prediction model. The accuracy of the extra trees regressor algorithm was the highest among the three algorithms used to develop the ML model. The accuracy of the model is ± 98%. The computer interface is designed to make the use of the model easy.

Keywords: Machine replacement; Construction equipment; Resale price; Machine Learning; Random Forest regressor; Decision tree; Extra trees regressor; Decision making; Economic life; and Egypt.