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Machine Learning Method for Improving Obsolescence Detection

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Abstract: *Driven by the frequent technological changes and innovation, obsolescence has become a major challenge that cannot be ignored in which the life cycle of the components is often shorter than that of their systems. Basically, obsolescence problems are often sudden and not planned which causes delays and extra costs. On the other side forecasting appears to be one of the most efficient solutions to solve this problem. This paper aims to provide new light and help industries to generate different solutions to the problems of obsolescence. Specifically it presents a framework for forecasting the obsolescence based on random forest (RF) algorithm which has proven as the best predictor for forecasting obsolescence risk based on a previous comparative study with a high degree of accuracy.*

I. INTRODUCTION

The rapidly evolving technologies have aggravated the obsolescence problem, which is a major issue that is noticed when an alternative component is no longer in stock or the supplier no longer produces it [1, 2]. Or because demand has dropped, OEMs are obliged to abandon manufacturing. As defined by Moore's law, the rapid evolution of electronic components continues to grow, which stipulates that semiconductor density doubles approximately every 18 months [3-5]. In fact, when we talk about technological obsolescence, we immediately think of electronics. This evolution creates new electronic components every year with short lifetimes. In USA, the industry has grown at a rapid rate since the 1990s. New technologies are introduced in the market with increased speed. Today, the short life cycle of technology and the lack of forecasting represent a challenge for several companies which need to take into account the risk of obsolescence. Moreover the modeling of obsolescence is considered as a complex problem that requires a good knowledge about the components affected by obsolescence. In the same way, it is necessary to know the lifetime of the components and their technological evolutions and therefore know all the factors that influence the obsolescence of components. On the other side, forecasting appears to be one of the most efficient solutions. Obsolescence forecasting is one of the best solutions in the management obsolescence approach that assists manufacturers in identifying part obsolescence before it occurs and helping companies to enhance forecasting in order to ensure support for part/system in service. In the literature, the majority of the works are based on the life cycle forecasting for a single type part. Moreover, it is based on human knowledge to estimate obsolescence. To resolve this problem, machine learning appears as an optimal method for forecasting. In fact, machine learning is a data analysis method that automates the recognition of data models without human manipulation [6, 7]. It is forecast a large sample of electronic components with a high degree of accuracy. In previous work, we have presented a comparison of the different algorithms which are: artificial neural network (ANN), AdaBoost, support vector machine (SVM), random forest (RF) and decision tree that are capable of forecasting obsolescence risk of a large sample of electronic components to estimate the best predictor based on confusion matrix. However, Random Forest has appeared as the best predictor to forecast the obsolescence risk. Therefore, this paper presents a model to predict obsolescence based on Random Forest algorithm, which can help manufacturers to make the best decision on their components and thus, increase the profit.

II. MOTIVATION

Driven by the frequent technological changes and innovation, obsolescence has become a major challenge that cannot be ignored in which the life cycle of the components is often shorter than that of their systems. Basically, obsolescence problems are often sudden and not planned which causes delays and extra costs. On the other side forecasting appears to be one of the most efficient solutions to solve this problem. This work aims to provide new light and help industries to generate different solutions to the problems of obsolescence. Specifically it presents a framework for forecasting the obsolescence based on random forest (RF) algorithm which has proven as the best predictor for forecasting obsolescence risk based on a previous comparative study with a high degree of accuracy.

III. METHODOLOGY

Initially, we will be performing Collection of obsolescence datasets then, Pre-processing on the dataset will be done in order to remove outliers. After outlier removal, the application of feature reduction on the datasets to select most optimum features will

be done. Then the development of classification engine on the dataset will be performed in order to get the classes from the data and then finally the result evaluation and comparison will be done. This can be expressed in the following modules,

Collection of obsolescence datasets (1 Month)

Pre-processing on the dataset in order to remove outliers (2 Months)

Application of feature reduction on the datasets to select most optimum features (2 Months)

Development of classification engine on the dataset in order to get the from the data (2 Months)

Result evaluation and comparison (1 Month)

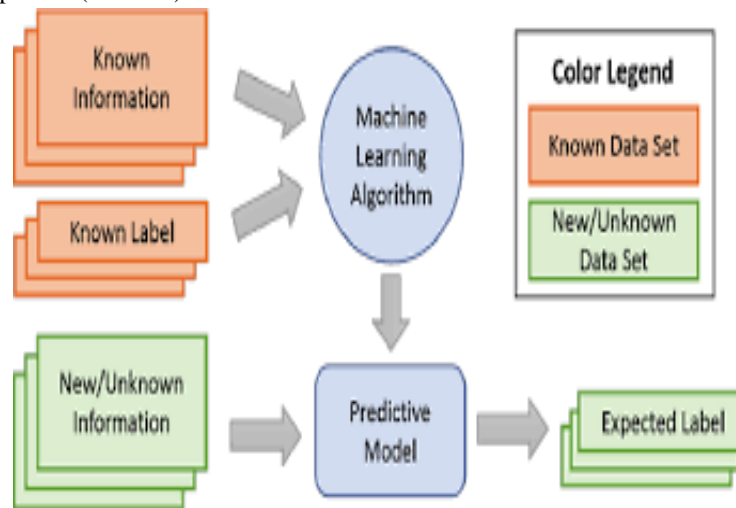


Figure 1. Data flow diagram

IV. OBJECTIVE

- A. To find proper datasets
- B. To implement the existing obsolescence detection algorithm
- C. To improve the accuracy of the current algorithm with machine learning

V. CONCLUSION

This work presents a new random forest approach for predicting obsolescence. Compare to a benchmark model, RF was more accurate model with a high degree of accuracy presented by a reduced estimate error. However, this model can help manufacturers especially for electronic industries that evolution has created new electronic components every year with short. Moreover, the exploitation of this model can be carried out on new data. To improve RF algorithm, features that do not have a correlation can be removed from the training and the same optimal parameters can be repeated in order to obtain more accuracy rate of forecast. Naïve Bayes is widely used for probabilistic forecasting, characterized by its robustness and efficiency. In fact, no works have been done before regarding obsolescence forecasting using naive Bayes up till now. Therefore we intend to include it in the future work by comparing its performance with RF.

VI. FUTURE SCOPE

In future, we can apply artificial intelligence in order to improve the overall accuracy of the algorithm and reduce the delay needed in prediction of obsolescence

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