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Modelling an Optimized Warranty Analysis methodology for fleet industry using data mining clustering methodologies

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Abstract

As the industrial revolution started, the complexity of new products in manufacturing as well as fleet industry has improved to meet the ever increasing needs and expectations of successful business. Degradation of Products due to age and/or operational usage and failures when they are unable to carry out their normal functions. The product had a n-year warranty and these warranty data is available for all applicable units in an organization. Data on essentially all failures was available for the initial level of operation on all units. A large set of data on Warranty among operational units contains useful information about product quality and reliability. They are available as coarse data because most often they are aggregated values, delayed reports, filtered, missing or vague and more importantly erroneous due to human mistakes. They are only forms of warranty data an organization has. Analyzing such data is therefore needed and can also be of benefit to organization and in identifying early warnings of abnormalities in their products, providing useful information about failures, nature of failure modes to aid design modification, finding out product reliability for warranty policy and predicting future warranty claims needed for preparing warranty reserves plans.

Keywords: Data Analysis, Optimization, Warranty, Manufacturing, Fleet Industry, Predictive Analysis

1. Introduction

Product users or an organization (consumers) need assurance that the product will perform satisfactorily over its lifetime. The legislations are getting stricter to protect consumers. Manufacturer of the products have responded to these challenges by offering warranties and extended warranties. Warranty is a legal contract that requires the manufacturer to either rectify or provide replacement for all failures occurring within the stipulated warranty period. Warranty have different aspects and these have been studied by researchers from many different disciplines. Additional costs are applicable for offering a warranty (warranty servicing costs or simply warranty costs) to the producer as all failures that are covered under warranty need to be either rectified or replaced by the manufacturer. Warranty costs depends on the reliability performance of the product. It includes several factors some under the control of the manufacturer (based on the decisions made while designing and development of the product) and others under the control of the consumer (depends on the usage levels, operating styles, environment and maintenance methodologies). Warranty servicing costs may vary from 2-10% of the sale price depending on the product and the manufacturer as well. We have predicted for sample datasets using Minitab.

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2. Warranty – An Overview

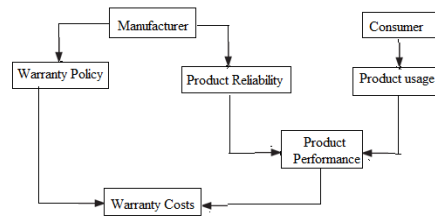


Figure 1: Characterization of warranty costs analysis

2.2. Issues in Warranty

Because of the diversity of purpose and application of a product, warranty has received the attention of researchers from many diverse disciplines such as Historical, Legal, Economic, Behavioral, Consumerist, Engineering, Statistics, Operations Research, Accounting, Marketing, Management, Societal

3. Collection, Mining and Analysis of Warranty data

3.1 Data Mining:

Data mining, popularly known as Knowledge Discovery in Databases (KDD), it is the non-trivial extraction of implicit, unknown and potentially useful information from available data in databases. It is actually the process of finding the hidden information or data pattern from the data repositories.

3.2 Data Analysis:

Data analysis by Web-scale information extraction or the problem of creating structured tables using extraction from the entire web, is gathering lots of research interest. We perform a study to understand and quantify the value of web-based survey on educational institutions. We believe this is the first study of its kind, and gives us new insights for information extraction over the Web.

3.3 Warranty Data:

Warranty data are presented in terms of claims data and supplementary data that are available with respect to manufacturer and the product. Warranty claims data are the data collected during the servicing of items under warranty and supplementary data are additional data (that includes production and marketing related, goods with no claims, etc.,) that are needed for effective warranty management essential for every organization. Warranty data provide valuable information to indicate product quality and reliability. Karim et al. [2] is an excellent review paper that summarizes the different statistical models and methods used to analyse warranty claims data. Wu [3] presents a new approach on warranty data analysis.

3.4 Warranty Data Collection:

Unlike data collected from laboratories which gives guaranteed high quality data, "Coarse" warranty data collected from the field such as individuals or organizations usually have low quality for a variety of reasons (as they can be aggregated, delayed, censored, missing, vague, etc.,)

Whereas, warranty claims data are lifetime data collected during the servicing of items over of warranty period. Performing analysis over such lifetime data requires good quality data. The data collected under controlled conditions during pre-launch which includes failure and censoring times properly recorded. When all items are tested to failure then the data are said to be complete (i.e.: as all items have failed). Else, these data may be supplied with some censored data in addition to failure data. To do proper analysis, one need to collect data such as amounts and dates with a typical sequence of events leading to warranty data are characterized by six time points (h) – (m), as indicated in Figure 2.

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