Semi-automated Estimation of Reliability Measures from MaintenanceWork Order Records

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Determining mean-time-between-failure (MTBF) estimation for in-service assets is an essential process. Statistical distributions of end-of-life values are used to assess asset reliability performance and the effectiveness of maintenance strategy. However, identifying the end-of-life event for each instance of functional failure is an arduous, manual process dependent on structured and unstructured fields in the maintenance management system and rules used by individual reliability engineers. We emulate the process of end-of-life event detection using a natural language processing pipeline followed by statistical parameter estimation to produce MTBF values for in-service assets from maintenance work order data. Using this pipeline we test how alternate mappings of words in unstructured text and the use, or not, of structured data can impact the identification of end-of-life events. We demonstrate the pipeline on data sets from two industrial users with 14,508 and 89,259 maintenance work orders, respectively. We find that resulting MTBF estimates can vary from, for example, 97 to 226 days for a single asset depending on the mappings and rules used. The main contributions of this paper are a) a demonstration of the impact of undocumented decisions made by reliability engineers in identifying end-of-life events on MTBF estimates, and b) an end to end pipeline for MTBF estimation from raw maintenance work order texts. In addition, we provide open-source code for the pipeline that can be used by asset owning organisations to semi-automate the MTBF estimation process in a manner that is fast and scalable, and ensures the rules used for end of life determination are documented and hence the process is transparent and repeatable.

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