

Discovering Event Outliers for Drug as Commercial Products

Arunas Burinskas, Aurelija Burinskiene

Abstract— On average, ten percent of drugs - commercial products are not available in pharmacies due to shortage. The shortage event disbalance sales and requires a recovery period, which is too long. Therefore, one of the critical issues that pharmacies do not record potential sales transactions during shortage and recovery periods. The authors suggest estimating outliers during shortage and recovery periods. To shorten the recovery period, the authors suggest using average sales per sales day prediction, which helps to protect the data from being downwards or upwards. Authors use the outlier's visualization method across different drugs and apply the Grubbs test for significance evaluation. The researched sample is 100 drugs in a one-month time frame. The authors detected that high demand variability products had outliers. Among analyzed drugs, which are commercial products i) High demand variability drugs have a one-week shortage period, and the probability of facing a shortage is equal to 69.23%. ii) Mid demand variability drugs have three days shortage period, and the likelihood to fall into deficit is equal to 34.62%. To avoid shortage events and minimize the recovery period, real data must be set up. Even though there are some outlier detection methods for drug data cleaning, they have not been used for the minimization of recovery period once a shortage has occurred. The authors use Grubbs' test real-life data cleaning method for outliers' adjustment. In the paper, the outliers' adjustment method is applied with a confidence level of 99%. In practice, the Grubbs' test was used to detect outliers for cancer drugs and reported positive results. The application of the Grubbs' test is used to detect outliers which exceed boundaries of normal distribution. The result is a probability that indicates the core data of actual sales. The application of the outliers' test method helps to represent the difference of the mean of the sample and the most extreme data considering the standard deviation. The test detects one outlier at a time with different probabilities from a data set with an assumed normal distribution. Based on approximation data, the authors constructed a framework for scaling potential sales and estimating outliers with Grubbs' test method. The suggested framework is applicable during the shortage event and recovery periods. The proposed framework has practical value and could be used for the minimization of the recovery period required after the shortage of event occurrence.

Keywords— drugs, Grubbs' test, outlier, shortage event.