Prototyping Preventive Maintenance Tools with R

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Machinery in factories is constantly monitored. A lot of data, like vibrations, is collected to track the machines' performance and condition. In this paper we present a method of timely analysis and visualization of these data. The representation derived from the data can be used to detect unusual behavior that could lead to malfunction if unnoticed, or for long-time monitoring to detect and track erosion or abrasion.

Our algorithm is based on John Chamber's algorithm for Incremental Quantile Estimation in univariate data. We adapted the method to cope with multivariate data.

As an example, we will use data collected from a coffee maker. The noise of the crushing mill of the coffee machine was recorded. Energy content of different frequency regions was used as the input to our multivariate algorithm. After applying the algorithm to this dataset, confidence intervals were calculated for each status. Now the grinding texture of the coffee machine can be evaluated based on its noise while running and the critical coffee bean charging level can be recognized early. The visualization and calculation was made using *R*.

Application to different and more complex machinery provides the possibility of preventive maintenance beyond the routine maintenance schedule and detection of erosion during periods of operation.

An important aspect of our algorithm is that we compute a condensed representation of the data in real time and therefore this algorithm works with relatively low storage requirements.

References

John M. Chambers (2006). Monitoring Networked Applications With Incremental Quantile Estimation. *Statistical Science,* 2006, Vol. 21, No. 4, 463-475.