On the proper and optimal use of manufacturing process data in predictions and realtime decision-making

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Abstract

This paper will explain how to optimally use manufacturing process data by taking into account the information on where in the process data was measured. Manufacturing data often is in the form of multisource timeseries. That means that data comes from multiple sources (i.e., machines) and measurements on an item are done over a period of time, as opposed to cross-sectional data, where each measurement provides a single data point. Analyzing relation between timeseries is difficult as correlations between such variables a (nearly) meaningless and only evaluate similar trajectories. To date there are no models available that can find relations between features of multivariate timeseries, as the number of possible cross-correlations explodes rapidly.

Incorporating expert knowledge into the data analysis allows for predicting data in subsequent machines at every point in time. The paper will show how to organize the data to optimally extract information and value from the data and how transposing that data structure will enable classification of produced items based on similar observed data observed during their production. This ideas put forth in this paper will increase the potential of data to improve manufacturing processes, for example for building digital twins that allow for predictive discarding or realtime process optimization.