

## A Hidden Markov Models-based approach for stochastic time-series signal modeling and framing

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Modeling of stochastic time-series signals is needed in various domains, including data mining, speech recognition, fault detection, and advanced control. A hidden Markov model (HMM) is a general modeling technique that can be used not only to extract features but also to cluster the time-series data into frames of distinct statistical behavior. Moreover, HMMs add some beneficial structural and parametric assumptions such as Markov properties and hidden state variables, which prove to be very useful for clustering. In this study, we proposed a hidden Markov model-based approach for modeling multivariate stochastic data sequences from batch plant operations and for framing the time-series data into windows of distinct stochastic behavior. We apply the technique to data from semi-conductor manufacturing operations to facilitate data storage. We then go on to show the possibility of using the proposed framework for advanced control and fault detection in various industrial manufacturing operations.