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Design of Early Warning Model based on Time Series Data for Production Safety

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Abstract: Chemical equipment failure, toxic leaks and other abnormal conditions often have significant impact on the production line and moreover there is a risk of life safety. Therefore, detection of early warning for abnormal states and stifling the risks are of prime importance. In this context, time series prediction method is the commonly used one for building models for early warning. The early warning forecasting problem in petrochemical industry could be a very complicated one because the large number of multi-nature processes takes place in the industry. This work presents a methodology to predict the alarms of catalytic reforming unit in a petrochemical industry. Based on the refinery time series data obtained by monitoring production status, a complete ensemble empirical mode decomposition with adaptive noise (CEEMDAN) is used to decompose the complex nonlinear time series. The best parameters for classification model were explored for the effective prediction. The results show that, the early warning model for production safety based on the AI7005 in the catalytic reforming unit, have a reasonable correlation and accuracy under the proper data preprocess, features extraction and parameters selection. The experimental validation shows the forecasting accuracy of 75.9%, which is acceptable and valuable for the practice of enterprise's production and management. This study not only provides effective and feasible path for practical application, but also gives a complete program and valuable reference for other similar studies based on time series data analysis.

Keywords: Refinery time series; Petrochemical; Early warning; Ensemble empirical mode decomposition; Monitoring system

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