Applying two-stage neural network based classifiers to the identification of mixture control chart patterns for an SPC-EPC process.

Summary: The effective controlling and monitoring of an industrial process through the integration of Statistical Process Control (SPC) and Engineering Process Control (EPC) has been widely addressed in recent years. However, because the mixture types of disturbances are often embedded in underlying processes, Mixture Control Chart Patterns (MCCPs) are very difficult for an SPC-EPC process to identify. This can result in problems when attempting to determine the underlying root causes of process faults. Additionally, a large number of categories of disturbances may be present in a process, but typical single-stage classifiers have difficulty in identifying large numbers of categories of disturbances in an SPC-EPC process. Therefore, we propose a two-stage Neural Network (NN) based scheme to enhance the Accurate Identification Rate (AIR) for MCCPs by performing dimension reduction on disturbance categories. The two-stage scheme includes a combination of a NN, Support Vector Machine (SVM), and Multivariate Adaptive Regression Splines (MARS). Experimental results reveal that the proposed scheme achieves a satisfactory AIR for identifying MCCPs in an SPC-EPC system.

MSC:
93E12 Identification in stochastic control theory
92B20 Neural networks for/in biological studies, artificial life and related topics
90B30 Production models

Keywords:
statistical process control (SPC); engineering process control (EPC); two-stage neural network; multivariate adaptive regression splines (MARS); support vector machine (SVM)

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