An Analysis of Quality Monitoring and Control System using Real-Time, Integrated Cost Effectiveness and Support Vector Machine

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ABSTRACT

The quality monitoring and control (QMC) has been an essential process in the manufacturing industries to ensure product reliability. With the advancements in big-data analytics, machine-learning based QMC has become more and more popular in various manufacturing industries, such as automotive and electronic companies. At the same time, the cost effectiveness (CE) of the QMC is perceived as a main decision criterion that explicitly accounts for inspection efforts and has a direct relationship with the QMC capability. In this paper, the integrated support vector machine (SVM)-based automated QMC system with the adjusted CE, CE_{adj}, model is proposed. Unlike existing models, the proposed model explicitly incorporates inspection-related expenses (i.e., warranty cost, rework cost, inspection cost) and error types (i.e., type-I and -II errors) in the CE_{adj} framework to guide the SVM algorithm. The proposed automated QMC system is verified and validated using a door-trim manufacturing process of an automotive industry. Next, a designed experiment is performed to assess the sensitivity analysis of the proposed framework. The proposed model is found to be effective and could be exploited as an alternative or complementary tool for the traditional quality inspection system.