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Abstract

INTEGRATED MACHINE LEARNING TECHNIQUES WITH APPLICATION TO ADAPTIVE DECISION SUPPORT SYSTEM FOR AUTOMOTIVE ENGINEERING

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The field of machine learning is concerned with the question of how to construct computer programs that automatically improve with experience. Basically, the machine learning techniques used in all applications can be categorized into three classes: modelling (for classification and prediction), optimization, and adaptation. The techniques in these classes are reviewed in the research. Some selected techniques from these classes are integrated to build an ADSS (*Adaptive Decision Support System*) for an application domain of automotive engineering.

In the research, a more sophisticated modelling technique – *Least Squares Support Vector Machines* (*LS-SVM*) is employed because the traditional modelling techniques such as multivariate nonlinear regression or multilayer feedforward networks may not produce satisfactory results for the applications where the number of data is extremely limited. Due to the inability of the existing DSS framework (modelling and optimization only), a new ADSS framework is proposed that includes modelling, optimization, and adaptation techniques. The new part *adaptation* is used for generating solutions for similar problem domains, which can solve the problems of not only the target application domain, but also its similar domains. This eliminates the expensive procedure of data acquisition for those domains having limited amount of data.

Automotive engineering is chosen as the test bed of the research. Different experiments in modelling and optimization have been done to build the necessary parts of the ADSS. In addition, a prototype program utilizing *Case-Based Reasoning* (*CBR*) has been built for the part of adaptation to verify the usefulness and correctness of the proposed ADSS framework.