PhD Thesis

COOPERATIVE RAMP METERING FOR URBAN MOTORWAYS BASED ON MACHINE LEARNING

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Abstract

To cope with today's problems with congestions in urban motorways and the inability to expand their capacity in an urban environment, new solutions in the form of advanced control methods on the existing road infrastructure are applied. Such solutions are part of Intelligent Transportation Systems (ITS). ITS essentially integrates information and communication technologies in order to resolve mentioned congestion problems. Often used ITS based traffic control methods on urban motorways are ramp metering (RM) and variable speed limit control (VSLC).

A dedicated algorithm for RM or VSLC uses sensed data form urban motorway to compute actions that will make a positive impact on traffic flows. This study will place focus on cooperative approach between RM and VSLC, and integration of several different RM algorithms into the one algorithm – INTEGRA. Mentioned algorithm is created by using adaptive neuro-fuzzy inference system (ANFIS) as the one of machine learning techniques. INTGERA is furthermore expanded in other to integrate its original functionality with recurrent neural network for traffic demand prediction. As the final step, evaluation of different criteria function setups for learning data set design based on which ANFIS neural network of INTEGRA is learned, is presented and compared with previously mentioned approaches. Results of all mentioned approaches will be compared and discussed in relation with other commonly used urban motorway control methods.

Key words:

Cooperative control, ramp metering, variable speed limit control, urban motorways, adaptive neuro fuzzy inference systems, recurrent neural network, learning dataset

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