Traffic Speed Limit Modeling Using Support Vector Regression and Firefly Algorithm

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Abstract

Setting traffic speed limits using engineering approaches is highly desirable, however, spot studies required for such approaches are tedious, subjective and time consuming. In the present study, 85th percentile speeds were modeled using two machine learning approaches a) Support Vector Regression, and b) Support Vector Regression (SVR) coupled with the Firefly Algorithm (FA). The objective of the study is to model traffic speed limits using artificial intelligence tools and quantify the efficiency of metaheuristic evolutionary algorithms for optimization. Input parameters, namely, physical characteristics of road, traffic and pavement condition were used for modeling. Physical characteristics of road included shoulder width, shoulder type and surface width. The traffic parameters consisted of average daily traffic and posted speed. Skid number and international roughness index were covered in pavement condition parameters. Two statistical models (Model 1 and Model 2) were developed for the prediction of 85th percentile speed. Model 1 consisted of physical characteristics of road, pavement condition parameters and traffic parameters including posted speed. Model 2 consisted of all the parameters of Model 1 except posted speed. Statistical performance evaluators like mean absolute relative error, mean square error, coefficient of determination and over-fitting ratio were used to compare the models. It was observed that the Model 1 outperformed Model 2, conveying the importance of posted speed for accurate prediction of operating speed. Application of firefly algorithm resulted in improved prediction accuracy with reduced computational time and manual work, highlighting the need to explore its application for civil engineering problems.

Keywords: 85th percentile speed, Support Vector Regression, Firefly Algorithm

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