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# Machine Learning Based Link Stability Prediction for Routing in Software Defined Vehicular Networks

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**Abstract**

Vehicular Adhoc networks (VANETs) are a key component of the Intelligent Transportation System (ITS) which necessarily consists of a wireless network of mobile vehicles. SDVN (Software Defined Vehicular Network) is a new paradigm that enables programmability and flexibility in vehicular networks formed by applying Software Defined Networking (SDN) in VANETs. Due to dynamic network topology in vehicular networks, routing is challenging. However, in SDVNs, global network awareness by the centralized controller can be used in taking routing decisions. Among different techniques used for overcoming challenging routing in SDVN, we focus on the approach of finding the highest stable path for routing using the data collected by the controller about the dynamics of the network, which has higher reliability compared to other approaches. Even though Machine Learning (ML) has been applied for different applications in vehicular networks, its application to predict link stability in vehicular networks can be hardly found in the literature. In this paper, we propose a novel Deep Neural Network (DNN) based machine learning model to fit an eighth-order polynomial to predict link lifetimes as DNN has better regression performance according to literature. Differential position, velocity, and acceleration of the link should be preprocessed to compute the 1-8th order terms, then normalized and provided to the polynomial regression model to obtain the link stability output. We used an optimization-based approach to generate the first part of the link lifetime data set using raw data collected from a real SDVN simulated network environment. Then, we combined the first part of the data set with status data generated using a uniform random number generator to eliminate dataset bias to train and test the regression model. The proposed method is validated by computing the training and testing losses (mean squared error) which are proved to be very low. Furthermore, results show that the proposed DNN-based ML model has a lower computational time compared to the optimization-based link lifetime prediction.

Keywords*:* *Deep Neural Network, Link Stability, Optimization, Software-Defined Vehicular Network, Vehicular Adhoc Networks.*

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