Multivariate Statistical Approach for Estimating QoE of Real-Time Multimedia Applications in Vehicular ITS Network

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Multivariate Statistical Approach for Estimating QoE of Real-Time Multimedia Applications in Vehicular ITS Network

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ABSTRACT

Though absolute QoE assessment, requires a subjective approach, performing a subjective test to assess real-time multimedia quality is expensive in terms of time and resources. The process involved in subjective approach is not suited for assessing real-time multimedia services such as IPTV over a dynamic network such as VANETs. Thus, the only practical solution during service operation is to apply an objective quality assessment model, which produces an estimate of the perceived quality. Hence, in this paper, we propose a novel objective QoE prediction model that estimates the QoE of real-time multimedia services over VANETs. Our proposed model is based on a multivariate statistical approach, in conjunction with ordinal regression analysis, that estimates perceived multimedia service quality as a function of aggregated QoE influencing parameters. We assume that each parameter has a different weight depending on the application used. Therefore, to create a standardized QoE model, we develop a correlation model where we estimate the QoE as a weighted sum of the QoE influencing parameters. To validate the effectiveness of our proposed model, Monte Carlo simulation was carried out to investigate the model predicting capabilities. The results attest to be very promising as the proposed model exhibits good predictive ability coherent with the observed data.

1. Introduction

Intelligent Transport System (ITS) is the term used to describe the application of information and communication technology to improve and ease the transportation problem. ITS is an integrated, flexible and scalable technology that leverage the transformative abilities of wireless technology to advance transportation safety, mobility and environmental sustainability [1-3]. The primary objective of ITS is to improve transportation outcome by offering modern services that connect with diverse ways of transit and traffic management. To provide different users with better information that will ensure safer, more coordinated, 'smarter' use of transportation networks and to make transportation more efficient, green, safe, and seamless. As exemplified in Fig. 1, ITS envelops the whole scope of information technology as apply in transportation (transportation here refers to any of land, ocean and air means of transportation). These include control, communication and computation model, human interface, algorithms and database models. ITS advantages can be assessed in terms of crash reduction, traffic congestion reduction, delays and travelling time reduction, air contamination and fuel consumption reduction.

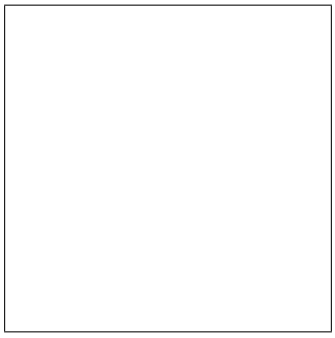

Fig. 1. An illustration of intelligent transportation system [4]

A substantial part of ITS is based on the concept of vehicular networks [5, 6], where moving vehicles act as nodes in a network to create a mobile vehicular communication that include vehicle-to-infrastructure (V2I) and vehicle-to-vehicle (V2V) communications [7-9]Vehicles with these capabilities form an ad hoc network communication, referred to as vehicular ad hoc networks (VANETs) [10]. In V2I communications, vehicles communicate with a fixed

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