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Abstract

Title	Study on Robust Inattentive Driving Detection System with Driver Model and Dynamic Relational Network

(800 words)

Inattentive driving is an important safety problem. More than 25% of crashes are attributed to this aspect. Apart from the driver situation, the increased use of in-vehicle infotainment systems (IVIS) such as navigation systems, entertainment devices, real-time information systems and communications equipment in modern automobiles along with personal typical tasks such as eating and talking to passengers has further aggravated this problem. One promising solution for this problem can be realized by detection and estimation of driver inattention in real-time and then using the information together with advanced driver support systems (ADSS) to compensate the effects of the inattention or re-direct back the focus of the driver to the primary driving tasks. Therefore, the main purpose of this dissertation is to study a new robust method capable of detecting inattentive driving in real driving situation.

In the first part of this dissertation, a new method for the analysis of driver inattention using the driving operation signals is discussed. The proposed method involved with constructing a Nonlinear Autoregressive Exogenous (NARX) model as a driver-dependent modeling framework to capture the nominal behavior of the drivers. The models are then trained using the experimental data, validated, and used to predict the hypothetical nominal action of the drivers when they are actually driving with secondary tasks. The differences between the predicted nominal and actual distracted actions are analyzed to gain insights into how the secondary tasks affect the driver attention. Through assessment of the model residuals, the results demonstrate that the proposed method can differentiate and classify clearly between neutral and inattentive driving.

In the second part, a novel method to detect inattentive driving automatically and systematically is proposed. Next, a comprehensive robust system for inattentive driving detection is developed. Here, the term 'robust' means that the system still could execute the detection process even though one of its inputs is absent (faulty sensor). In the studies of other researchers, the proposed models are usually dependent on the input, where the model cannot predict the output correctly, if one of the inputs is not available and hence the overall system is suspended. To realize the robust detection system, inputs (sensors) diagnosis method is proposed using Dynamical Relational Network (DRN) to verify the state of the inputs (sensors). Based on the input available (healthy sensor), an appropriate model is chose to evaluate the driver inattention. Through this method the overall system reliability is enhanced and high-accuracy detection of inattentive driving is achieved even though one of the sensors in the system is malfunction. In the last part of this dissertation, the relation between individual driver characteristics and inattentive driving is discussed.

In conclusion, this study has proposed a robust system for inattentive driving detection. The results demonstrate that this system can detect driver inattention in real driving environment and can change its behavior based on available inputs.