

Analysis of physiological responses induced by motion sickness and its detection based on ocular parameters

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Analysis of physiological responses induced by motion sickness and its detection based on ocular parameters

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Under the supervision of Clémentine François, PhD, and
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One of the promises of autonomous cars is that these will allow drivers to become passengers, and therefore to be engaged in many tasks other than driving such as working, reading or relaxing. However, there exists an increased risk of motion sickness incidence in self-driving cars, thus preventing people suffering from this state from devoting themselves to these tasks. As a consequence, the user acceptance and uptake of autonomous cars could be negatively affected, limiting the benefits this emerging technology may provide. To avoid the negative impact motion sickness could have on autonomous car adoption, this problem has to be investigated and appropriate countermeasures have to be developed.

A first step in the development of a solution consists in detecting early signs of motion sickness, allowing so to initiate the triggering of various processes intended to alleviate the symptoms associated with motion sickness. The aim of this thesis is to identify physiological parameters that are indicative of motion sickness, and to determine the relevance of ocular parameters for predicting this state. Indeed, ocular data could be easily recorded in autonomous cars through integrated high precision cameras.

A protocol to acquire data in context is first designed. This protocol aims at inducing motion sickness in 2 different ways. The first one consists in driving in a fixed-base driving simulator. The second one consists in performing some tasks on paper while being a passenger in a moving car. Twenty subjects took part to the protocol. Severe motion sickness was reported by 3 and 9 participants, during the session in simulator and the session in car respectively. The analysis of the collected data shows that heart rate, electrodermal and gastric activities increase with motion sickness. Machine learning models are then trained with ocular data as inputs, and a 3-level score, reflecting the severity of motion sickness, as ground truth. The results suggest that ocular data alone cannot predict motion sickness, but that it may be appropriate to combine it with other physiological data in order to predict motion sickness.