

EEG-Signals Based Cognitive Workload Detection of Vehicle Driver using Deep Learning

Mohammad A. Almogbel*, Anh H. Dang**, Wataru Kameyama***

*Department. of Computer Science. and Communications Engineering
Graduate School of Fundamental Science and Engineering, Waseda University, Tokyo, Japan.

**GITS, Waseda University, Tokyo, Japan

***Faculty of Science and Engineering, Waseda University, Tokyo, Japan

almogbela@ruri.waseda.jp, danghoangnh@akane.waseda.jp, wataru@waseda.jp

Abstract— Vehicle driver’s ability to maintain optimal performance and attention is essential to ensure the safety of the traffic. Electroencephalography (EEG) signals have been proven to be effective in evaluating human’s cognitive state under specific tasks. In this paper, we propose the use of deep learning on EEG signals to detect the driver’s cognitive workload under high and low workload tasks. Data used in this research are collected throughout multiple driving sessions conducted on a high fidelity driving simulator. Preliminary experimental results conducted on only 4 channels of EEG show that the proposed system is capable of accurately detecting the cognitive workload of the driver with an enormous potential for improvement.

Keywords— Deep Learning, EEG, Neural Networks, Cognitive Workload, Driving, Stress



Mohammad A. Almogbel (S’14) received his bachelor’s degree in Information Systems from King Saud University, Riyadh, Saudi Arabia in 2009. He joined King Abdul-Aziz City for Science and Technology in Saudi Arabia as a researcher in 2009 and received a scholarship to complete his graduate school in 2010. He then received master’s degree in computer science from Waseda University in 2014 and he continued to pursue his Ph.D. since then. He is a member of IEEE, ITS and JSAE.



Anh H. Dang (S’09) received his bachelor degree in business administration, information & communication technology from Ritsumeikan Asia Pacific University (Beppu, Oita, Japan) in 2010. He then received the master degree in computer science from Waseda University (Shinjuku, Tokyo, Japan) in 2012. Since 2012, he is a Ph.D. candidate at Waseda University. He is a member of IEEE, ACM, and IEICE. His research interests are machine learning, artificial intelligence, and computer vision.



Wataru Kameyama (M’86) received the bachelor’s, master’s, and D.Eng. degrees from the School of Science and Engineering, Waseda University, in 1985, 1987, and 1990, respectively. He joined ASCII Corporation in 1992, and was transferred to France Telecom CCETT from 1994 to 1996 for his secondment. After joining Waseda University as an Associate Professor in 1999, he has been a Professor with the Department of Communications and Computer Engineering, School of Fundamental Science and Engineering, Waseda University, since 2014. He has been involved in MPEG, MHEG, DAVIC, and the TV-Anytime Forum activities. He was a Chairman of ISO/IECTC1/SC29/WG12, and a Secretariat and Vice Chairman of the TV-Anytime Forum. He is a member of IEICE, IPSJ, ITE, IIEEJ, and ACM. He received the Best Paper Award of Niwa-Takayanagi in 2006, the Best Author Award of Niwa-Takayanagi in 2009 from the Institute of Image Information and Television Engineers, and the International Cooperation Award from the ITU Association of Japan in 2012.