School of Electrical Engineering
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Aalto University
School of Electrical
Engineering

Dissertation press release **15.09.2020**

Analyzing Human Behavior by detecting complex 3D body movements using Wireless Technology

Title of the dissertation	Toward Complex 3D Movement Detection to Analyze Human Behavior via Radio-Frequency Signals
Contents of the dissertation	This thesis project exploited multiple wireless technologies (1.8GHz, WiFi, mm-Wave), and their combinations to detect complex 3D movements of a driver in a car. The upper body movements are vital indicators of driver's behavior in car, which could be used as a source to generate appropriate feedback, warnings or undergo actions to prevent any safety threatening incidence. Existing wireless-based solutions primarily focus on either big or small movements or well-defined activities. They do not consider separating large movements from small movements along with their directions within a single system. This brings the need to cater to complex natural behavioral situations, such as in a car, where we need not only to separate these movements but to classify them. To materialize these contributions, we exploit numerous physical properties of RF signals, different hardware-software combinations and build algorithms to process and detect simple to complex body movements and introduce distinctive feature sets for machine learning techniques to find patterns in data and predict states. We evaluate our systems by performing extensive real-world studies and demonstrate how they can be utilized for in-vehicle sensing. Our process includes wireless data collection from devices such as USRP, WLAN card and VNA, data pre-processing, signal feature extraction and human state classification. From basic to complex, we have performed several studies to prove the potential of body movements as a powerful indicator of human behavior.
Field of the dissertation	"Wireless sensing, behavior analysis, signal processing and machine learning"
Doctoral candidate	Muneeba Raja, M.Sc. (tech.)
Time of the defence	15.09.2020 time18:00 EEST
Place of the defence	Remote Technology https://aalto.zoom.us/j/6549167529 Meeting ID: 654 916 7529
Opponent	Professor Matthias Pätzold, University of Agder, Norway
Custos	Associate Professor Stephan Sigg, Aalto University, Finland, School of Electrical Engineering, COMNET
Electronic dissertation	http://urn.fi/URN:ISBN:978-952-60-3988-6 *(will be available on Aalto website 10 days prior to the defense)*

A doctoral dissertation is a public document and shall be available at Aalto University, School of Electrical Engineering, Maarintie 8, main hall at the latest 10 days prior to public defence.

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Tekstirivi 1 Aalto-yliopisto Tekstirivi 1

Tekstirivi 2 Teknillinen Tekstirivi 2