PhD Thesis Topics Proposals 2021

Title: Emotion Recognition for Positive Computing

Proposer: Francesco Masulli, Stefano Rovetta

Research area: Machine Learning, Computational Intelligence

Curriculum: Computer Science

Description: Interpersonal interaction is oftentimes intricate and nuanced, and its success is often predicated upon a variety of factors. These factors range widely and can include the context, mood, and timing of the interaction, as well as the expectations of the participants. For one to be a successful participant, her/he must perceive a counterpart's disposition as the interaction progresses and adjust accordingly. People vary widely in their accuracy at recognizing the emotions of others.
This project is aimed at exploiting multiple sensorial sources for emotion recognition, including video of subject faces, audio of speech, written texts, and physiological signals as measured by wearables. The data processing methods used include signal analysis, fuzzy logic and machine learning, with particular focus on deep neural networks. The main aim of this activity is the development of a set of tools supporting the design of positive computing systems, that is systems supporting the well-being.

Link to the group or personal webpage: https://person.dibris.unige.it/masulli-francesco/

References:

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Title: Computational Intelligence Methods for Flow Induction

Proposer: Francesco Masulli, Stefano Rovetta

Research area: Machine Learning, Computational Intelligence

Curriculum: Computer Science

Description: In positive psychology, the flow is a state of consciousness in which the person is fully immersed in an activity, such as chess playing, partner dancing, education, music, sports practicing, and gaming. To induce flow the undertaken activity's challenges and the person's skills must increase in balanced way over time. At the cortical level the experience of flow is linked to dopamine release. The duration of the time spent in flow experiences induces positive effects, such as raising self-esteem, lowering anxiety, leading to better performance in artistic and scientific creativity, teaching, learning, sports, etc.
This project is aimed at exploiting multiple sensorial sources for flow monitoring in natural and controlled (e.g., gaming) contexts. Considered biometric signals include heart rate, blood pressure, facial expression, eye movements, pupil dilation, and skin conductivity obtained from consumer's market devices. The data processing methods used include signal analysis and machine learning, with particular focus on deep neural networks. Moreover, a fuzzy control of game challenges levels will be implemented in order to optimize the flow experience and accelerate the achievement of high skills by the player.

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References:

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Title: Computational Intelligence Tools for Noninvasive Dysphagia Diagnosis

Proposer: Francesco Masulli, Stefano Rovetta

Research area: Machine Learning, Computational Intelligence

Curriculum: Computer Science

Description: The term Dysphagia means "difficulty swallowing." It is the inability of food or liquids to pass easily from the mouth, into the throat, and down into the esophagus to the stomach during the process of swallow. Dysphagia can occur in all age groups, resulting from congenital abnormalities, structural damage, and/or medical conditions.
This project is aimed at exploiting Computational Intelligence methods in noninvasive tests for the diagnosis of the dysphagia and for the evaluation of its grade based on the analysis of vocal traits. The considered methods include Fuzzy Systems and Convolutionary Neural Networks, and Deep Autoencoders.

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Title: Edge AI -based Real-Time Object Detection and Tracking

Proposer: Francesco Masulli, Stefano Rovetta

Research area: Machine Learning, Computational Intelligence

Curriculum: Computer Science

Description: Many Artificial Intelligence and Computer Vision application domains, including video surveillance, industrial control, urban traffic monitoring, robotics, require the implementation of advanced machine learning algorithms on the edge, for reasons real-time reaction, communication workload, and privacy.
This project is aimed at exploring the edge implementation of deep learning algorithms for real-time video object detection and tracking on low impact SWAP (Size, Weight and Power) platforms such as NVIDIA Jetson.

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[1] Ho GTS, Tsang YP, Wu CH, Wong WH, Choy KL. A Computer Vision-Based Roadside Occupation Surveillance System for Intelligent Transport in Smart Cities. Sensors (Basel). 2019;19(8):1796. Published 2019 Apr 15.

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