

Thesis Proposal

Title	Emotion recognition in Hand-Object Interaction with iCube device
Supervisors	Radoslaw Niewiadomski (DIBRIS, UNIGE) Alessandra Sciutti (Contact Unit, IIT)
Team/Company	Contact Unit, IIT
Research field	Affective Computing / HCI
Motivations and general objectives:	<p>Significant effort was made in last two decades in the field of automatic emotion recognition from nonverbal signals. The focus is on visual (e.g., full body movements, facial expressions) and audio (e.g., prosody) cues while other modalities such as touch are very rarely considered.</p> <p>The aim of this thesis is to develop an emotion classification model for the data is collected with a novel multimodal interface [1], which has a form of a small cube covered with tactile sensors and embedded with accelerometer. It generates combination of tactile (i.e., 2D tactile maps) and kinematic (i.e., angle rotations) data.</p> <p>The aim of this thesis is the development of a model for emotion detection and recognition of touch gestures. The research challenges include the creation of experimental protocols for data collection and model validation, as well as the development of detection and recognition models.</p> <p>An example of interaction with iCube can see seen in this video: https://youtu.be/6bof8KTy6Mc?si=znJMMNW-IKIHwLD</p> <p>The work will consist of two main stages: 1) data collection in an ecological setting, 2) development of machine learning algorithms for emotion classification from mono- and multimodal data.</p> <p>Regarding item 1, the particular focus will be given to elicit spontaneous emotional reactions in participants that result in a combination of emotion specific touch patterns and movements, while avoiding collecting conventional touch gestures. Several techniques of emotion induction in the lab settings will be considered including both passive (e.g., emotion elicitation videos) and active (e.g., interaction with other human, social games) ones.</p> <p>Regarding item 2, the preference will be given to using deep learning techniques that can deal with spatiotemporal information. It is also</p>

expected that the student will carry out a set of experiments to compare the mono- (e.g., tactile only) and multimodal models.

The student will have the opportunity to develop innovative solutions and, consequently, be involved in scientific publications. Most of the activities will be held at the CONTACT Unit, directed by ERC winner Alessandra Sciutti. The student will have the chance to work with an interdisciplinary and international team of researchers.

Required skills

- Programming skills (Python, C++)
- Notions of machine learning

Proposed work plan and expected results

The student is expected to carry out the following tasks:

- design of the data collection session with the use of iCube,
- delivery of a new dataset of human-object interaction (with the use of iCube),
- development of new emotion recognition model for iCube.

Place of activity

The primary location of activity is the Contact Unit at IIT (Erzelli), where iCube was designed and developed.

References

[1] R. Niewiadomski, C. Beyan and A. Sciutti, "Affect Recognition in Hand-Object Interaction Using Object-Sensed Tactile and Kinematic Data," in *IEEE Transactions on Haptics*, vol. 16, no. 1, pp. 112-117, 1 Jan.-March 2023, doi: 10.1109/TOH.2022.3230643.

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