



thesis:



Sensitive connected objects to measure autism sensory disorders: a path towards an augmented musical instrument

Beginning: 2019 (autumn – winter)

Keywords: Machine learning, connected object, Internet of Things - IoT, sensory disorders, autism

Place: Computer Science, Systems, Information and Knowledge Processing Laboratory (LISTIC) labeled as a Research Team by the Ministry of Research (EA3703)
Université Savoie Mont-Blanc
Annecy - University Campus, France.

Partners: - The Laboratory of Psychology and NeuroCognition (LPNC),
Grenoble - Chambéry, France
a Cognitive Science Research Unit affiliated to the CNRS (National Institute of Biological Sciences, section 26) and to two universities (University Grenoble-Alpes, Grenoble and University of Savoie Mont Blanc, Chambéry)
- Conservatoire à Rayonnement Régional (music, dance and theater conservatory), Annecy, France

Thesis subject:

Several kinds of research use connected objects to improve quality of human life, to facilitate it, or also to interact with physical world around user. Internet of things facilitating inter-connection and interoperability, we propose to take advantage of physical objects, like musical instruments, in order to measure the sensitive sensory disorders especially in autism case consideration (Autism Sensory Disorder - ASD).

The originality of the proposed approach is to use sensitive objects to measure the hypo and hypersensitivity on several modalities: vision, hearing, tactile, proprioception and vestibular. The goal of the proposed study is to automate the production of sensory profiles given by individual evaluations of persons with ASD. A special interest of this approach is that the system to be developed will deliver information periodically; thus, we can observe evolution of sensory disorders for each person with ASD.

In the field of Psychology, the measurement approach is based on the clinical observation of the behavior's manifestations of the hypo/hyper sensitivity. For example, approaching a noisy object to the ear could be a manifestation of a hyposensitivity on the hearing modality. The measurement process of the proposed study will include to improve objects by making them sensitive by the way of embedded sensors. A first study ongoing work within our university in association with the conservatory of Annecy has already validated that autism sensory disorders could be measured using sensors embedded into objects. Indeed, according to the studies related to the sensory processing of children with ASD, the characterization of sensory features is performed by identification of the intensity of hypo and of hyper-responsiveness to stimulation respectively related to a hypo and a hypersensitivity.

The scientific problem raised in this proposition of thesis is the measurement of sensory disorders from the data output by sensors. These non-wearable sensors placed on or into objects, which are only manipulated by persons with ASD, are able to deliver several but classical kinds of measurement: frequency of checking, approach, touch, etc.... By combining and fusing data of sensors outputs, the system would be able to evaluate the sensory profile of person which ASD. The system to be developed during thesis will require machine learning methods using eventually symbolic representation information and managing uncertainty.

The experimentation stage will take place at the music, dance and theater conservatory of Annecy, where music workshop with children with ASD.



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Note that three computer science researchers and psychological researcher will supervise this thesis. And this project includes other students with different levels of qualification, who could contribute by studying the stage of instrumentation of objects.

Adequate and required skills:

- Ideally, the candidate followed engineering classes or master classes in the field of computer science or in the field of applied mathematics with facilities with IoT or embedded systems.
- Good knowledge and experience in data analysis, classification and machine learning. Big data experience will be appreciated.
- Knowledge of at least one data analysis tool (For ex. Matlab, R, numpy, knime).
- Enjoying implementing prototypes.
- Has an interest for the social and medical impact around autism.

Funding for thesis: **the candidate must find the grant.**

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You can ask for video meeting by sending an email.

Additional information:

LISTIC : <https://www.listic.univ-smb.fr/>

Annecy – tourism information: <https://en.lac-annecy.com/>