Implementation of neuroadaptive technology to optimize humanS-machineS teaming.

Advisor (s):

Caroline Chanel, caroline.chanel@isae.fr; https://personnel.isae-supaero.fr/caroline-chanel/

Frédéric Dehais, frederic.dehais@isae.fr; https://personnel.isae-supaero.fr/frederic-dehais/

Nicolas Drougard, nicolas.drougard@isae.fr

Net salary: 2700€ per month with some teaching

Duration: 2 years

DESCRIPTION

The development of autonomous systems (e.g.: aircraft, highly automated cars, robots) are becoming increasingly present in a wide variety of operational context and in everyday life situations. Most of scientific and technical efforts have focused on the implementation of AI and smart sensors. However, these developments are generally achieved without questioning the integration of the human in the control/decision loop: the human operator is considered as a providential agent that will be able to take over when sensors or automations fails. Accidents analysis in many critical domains (eg. aviation, nuclear power plant, high frequency trading) highlight that human-artificial agent interactions breakdown represent one major contributive factors to recent industrial disasters. A promising avenue to deal with these issues is to consider that artificial and human agents have complementary skill/abilities and are likely to provide better performance when joined efficiently than when used separately. This approach, known as mixed-initiative, defines the role of the human and artificial agents according to their recognized skills. The implementation of such an interaction presuppose 1) to develop passive Brain Computer Interface (pBCI) also known as Neuro-adaptive technology to "sense" human performance and 2) to implement a decision system dedicated to dynamically adapt human-machine interactions.

The objectives of this post-doctoral position are:

- To design Neuro-adaptive technology to measure multiple users' brains while interacting with each other and several artificial agents. This recent approach, referred as Hyperscanning, consists of the continuous and synchronous monitoring of at least two brains with portable brain imaging sensor.
- To develop a decision-making unit that considers uncertainties on actions, or potentially non-deterministic behavior of the humans, and partial observable states (e.g. degraded mental states, artificial agent perception). This mixed-initiative driving system will be

governed by a policy or a strategy that would maximize the overall man-machine teaming performance.

The candidate is expected to design an experimental protocol with at least two humans interacting with two artificial agents and to drive the interactions between natural and artificial entities in an-online fashion.

The ideal candidate will have a background in Neurosciences and Artificial Intelligence for automated learning and planning. She/he will have to work in strong collaboration with the three other researchers (2 PhD students, 1 post doc) funded by the ANITI program. This research will be conducted within the stimulating environment of Neuroergonomics lab at ISAE-SUPAERO (25 researchers), the Artificial and Natural Intelligence Toulouse Institute.

References

- De Souza, P. E. U., Chanel, C. P. C., & Dehais, F. (2015, November). MOMDP-based target search mission taking into account the human operator's cognitive state. In 2015 IEEE 27th International Conference on Tools with Artificial Intelligence (ICTAI) (pp. 729-736). IEEE.
- Babiloni, F., & Astolfi, L. (2014). Social neuroscience and hyperscanning techniques: past, present and future. Neuroscience & Biobehavioral Reviews, 44, 76-93.
- Zhang, D., Lin, Y., Jing, Y., Feng, C., & Gu, R. (2019). The Dynamics of Belief Updating in Human Cooperation: Findings from inter-brain ERP hyperscanning. NeuroImage, 198, 1-12.
- Charles, J. A., Chanel, C. P., Chauffaut, C., Chauvin, P., & Drougard, N. (2018, December). Human-Agent Interaction Model Learning based on Crowdsourcing. In Proceedings of the 6th International Conference on Human-Agent Interaction (pp. 20-28). ACM.

APPLICATION PROCEDURE
Formal applications should include detailed cv, a motivation letter and transcripts of bachelors' degree.
Samples of published research by the candidate and reference letters will be a plus.
> applications should be sent by email to: advisor email
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