

Polytech network form for PhD Research Grants from the China Scholarship Council

This document describes the PhD subject and supervisor proposed by the French Polytech network of 14 university engineering schools. Please contact the PhD supervisor by email or Skype for further information regarding your application.

Supervisor information	
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University name	University of Tours
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PhD information	
Title	Multimodal Analysis for Affective Computing
Main topics regards to CSC list (3 topics at maximum)	I-12. Understanding models and intelligent systems

Required skills in science and engineering	Programming, Image Processing, Machine Learning, Probabilistic Graphical Models
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Subject description (two pages maximum)

Understanding affective signals from others is crucial for both human-human and human-agent interaction. Interacting with humans requires understanding emotions [1] and emotions are based on a person's state of mind and partially regulated by personality, context and conditioning. Emotion is a language for communicating by feelings and it includes approval and disapproval. The research field aimed at emotion recognition is called Affective Computing.

Affective computing is an emerging interdisciplinary research field bringing together researchers and practitioners from various fields, ranging from artificial intelligence, natural language processing, to cognitive and social sciences.

As stated in [2], most of the emotion recognition systems in the scientific literature are limited to the integration of:

- 1) Facial expressions,
- 2) The limited amount of speech commands and emotional phrases, and
- 3) Gesture analysis of the upper body part involving head, hand, fingers, eyes, and lips.

Recently, more and more papers study the contribution of other modalities, especially physiological modalities, to model the affective state of a human in some interaction contexts.

Within this field, we have proposed [3] a simulationist approach to the analysis of displayed emotions - e.g., in the course of a face-to-face interaction between an expresser and an observer. At the heart of such perspective lies the enactment of the perceived emotion in the observer. We proposed a probabilistic framework based on a deep Gaussian Process Latent Variable Model representation of a continuous affect space, which can be exploited for both the estimation and the generation of affective states in a multimodal space. Namely, we consider the observed facial expression together with heart rate and skin conductance driven by autonomic activity.

The goal of this Ph.D. proposition is to extend the existing model to other important modalities, such as saliency and eye movements, pupil dilatation analysis, and so on. In introducing these new modalities, there are two main challenges: the first is to cope with some computer vision problems like, for example, video super-resolution problem (to deal with small size of pupil), detection of eye movements with high accuracy, etc.; the second major challenge is to integrate such spatio-temporal signals to the general existing probabilistic framework.

References

- [1] J. M. Fellous and M.A. Arbib, "Who needs emotions? The brain meets the robots", Oxford press, 2005.
- [2] Ghayoumi, M., Thafar, M., & Bansal, A. K. (2016). Towards Formal Multimodal Analysis of Emotions for Affective Computing. In DMS (pp. 48-54).
- [3] Boccignone, G., Conte, D., Cuculo, V., D'Amelio, A., Grossi, G., & Lanzarotti, R. (2018). Deep construction of an affective latent space via multimodal enactment. IEEE Transactions on Cognitive and Developmental Systems.