Stage M2 Recherche

Laboratoire/équipe d'accueil :
TIMC-IMAG lab, PRETA team

Title :
Multiview Latent Models for extracting swallowing characteristics out of non-invasive respiratory signals

Description :
The internship is related to the ANR project « Déglutition & Respiration : Modélisation et e-Santé à domicile » (e-SwallHome, 2014-2018). The whole project aims at explaining the normal behavior of two coupled physiological functions, swallowing and breathing. In order to better understand the mechanisms responsible of pathologic disorders following a stroke.

One objective is to be able, from non-invasive measurements, to (1) differentiate phases of respiration, speech and swallowing, and (2) characterize the (physiological and pathological) deglutition, so as to consider the use of such measures for the monitoring of such patients at home.

Data acquisitions on healthy subjects have been carried out and a database of synchronous physiological signals in a multimodal context is now available. This allows the association of complementary modalities of the swallowing, by coupling various sensors.

Signals have now to be analyzed to raise relevant quantitative index to characterize the 3 functions and more particularly the swallowing function.

We will focus on standard physiological variables (cycle duration, tidal volume, inspiratory time….) but also on new parameters extracted from signals by spectral and/or time-frequency analysis. The developed model will be in line with the Latent Dirichlet Allocation (LDA).

Recently we have worked on the extension of LDA dedicated to the health domain and for real time analyses of evolution of discussions around aliments.

The line of research that we aim to pursue in the internshio related to this project is the development of a new multiview latent model operating on multiview signals. The main motivation is that an aliment can usually be detected by different health related signals (swallowing, breathing, heart beating, etc), and that the modalities presnet in the different affected signals reinforce the underlying disease-theme.

For this position, we are looking for highly motivated people, with a passion to work in health and machine learning areas and the skills to develop algorithms for prediction in real-life applications. We are looking for an inquisitive mind with the curiosity to use a new and challenging technology that requires a rethinking signal processing to achieve a high payoff in terms of speed and efficiency.

The internship will be divided in three mutually related parts (1) state-of the art reviewing, (2) implementation of state-of-the-art mono-view LDA model (3) developement of the multiview LDA model

References:
[1] D.-M. Blei, A.-Y. Ng, and M.-I. Jordan. "Latent Dirichlet Allocation", Journal of Machine Learning, 3:993–1022, 2003.
[1] A. Eberhard, P. Calabrese, P. Baconnier, and G. Benchetrit, "Comparison between the respiratory inductance plethysmography signal derivative and the airflow signal," Adv Exp Med Biol 499: 489–494, 2001.
[2] A. Moreau-Gaudry, A. Sabil, G. Benchetrit, A. Franco, "Use of Respiratory Inductance Plethysmography for the detection of swallowing in the Elderly", Dysphagia 20:297-302, 2005.

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Duration: 5-6 mois