SUMMARY
The BIO-BAYES PREDICTIONS project is welcoming applications for a 3-year, fully funded PhD scholarship
starting October, 1st, 2019 at Laboratoire de Psychologie et NeuroCognition (Grenoble, France)
TOPIC: Bayesian modeling of predictive, hierarchical coding in speech processing
PROFILE: Computer Science, Artificial Intelligence, Probabilistic modeling, Cognitive Sciences
SUPERVISION: J. Diard (LPNC); J.-L. Schwartz (GIPSA-Lab); intl collab with A.-L. Giraud (Univ. Geneva, Switzerland)

MANDATORY REFERENCES:
IDEX PROJECT TITLE: IDEX ISP19-BIO-BAYES
SUBJECT TITLE: Bio-Bayes Predictions -- Coupling Biological and Bayesian Predictive Models in Neurocognitive Speech Processing
RESEARCH FIELD: Computer science, Cognitive Science, Psychological sciences, Neurosciences
SCIENTIFIC DEPARTMENT (LABORATORY'S NAME): LPNC -- Laboratoire de Psychologie et NeuroCognition
DOCTORAL SCHOOL'S: MSTII -- Mathématiques, Sciences et technologies de l'information, Informatique
SUPERVISOR'S NAME: Julien Diard, PhD

SUBJECT DESCRIPTION:

The issue of the relationship between perception and production mechanisms is central to many domains in cognitive science. In speech communication for instance, where predictions from speech production simulation interact in various ways with perceptual processes. In this context, we have developed COSMO (Communicating about Objects using SensoriMotor Operations), a family of Bayesian algorithmic models of communicating agents. We have previously used such models to study the evolution of phonological systems (Moulin-Frier et al., 2015), speech perception and learning (Laurent et al., 2017; Barnaud et al., 2017; 2018), and speech production and adaptation (Patri et al., 2015; 2018).

However, so far, these models consider greatly simplified temporal dimensions. For instance, syllable perception was restricted to consonant-vowel syllables, assuming that the key points of speech trajectories, respectively at the center of the consonant and the vowel, were previously identified. This, of course, contrasts with natural speech processing, where sensory inputs and motor controls continuously unfold over time. Indeed, the neuronal substrates, in the brain, that deal with auditory input are well described in terms of their oscillatory nature, since they intrinsically have to deal with temporal properties of speech, and their predictive nature, since they aim at anticipating events.

In this PhD project, we aim at extending the COSMO framework to define the first Bayesian perceptuo-motor model of continuous speech communication. In previous work, in the domain of Bayesian visual word recognition modeling (Phénix et al., 2018; Ginestet et al., 2019), we have developed mathematical tools to describe the temporal dynamics of perceptual evidence accumulation across layers of hierarchical representations. Probability distributions at each layer (letters and words) evolve continuously over time, as a function of bottom-up sensory evidence and top-down lexical constraints, to predict upcoming events. Crucially, we have developed mathematical tools to model, on the one hand, attentional control of these information flows, and, on the other hand, asynchronous and asymmetric information transfer. Applying these mathematical constructs to speech communication modeling would yield a novel class of Bayesian hierarchical and predictive models, able to account for observations of neuronal oscillatory systems in the brain.

This PhD project is part of an international collaboration with Anne-Lise Giraud and Itsaso Olasagasti of the "Auditory, Speech and Language Neuroscience" group at UNIGE (Université de Genève, Switzerland), with regular meetings and visits to Geneva planned. This international collaboration with Geneva will provide a unique framework for mixing the Bayesian approach with neuroscience constraints and data, providing a valuable multidisciplinary environment for the PhD project. The PhD candidate will integrate the "Language" research team at LPNC (Laboratoire de Psychologie et NeuroCognition, Grenoble), will be supervised by Julien Diard (CR CNRS, LPNC) and Jean-Luc Schwartz (DR CNRS, Gipsa-Lab), and will be registered in the MSTII (Mathématiques, Sciences et technologies de l'information, Informatique) doctoral school of Univ. Grenoble Alpes.

ELIGIBILITY CRITERIA

Applicants must hold a Master's degree (or be about to earn one) or have a university degree equivalent to a European Master's (5-year duration),

Applicants will have to send an application letter in English and attach:
- their last diploma;
- their CV;
- letters of recommendation are welcome.

Address to send their application: *Julien.Diard@univ-grenoble-alpes.fr*

SELECTION PROCESS

Application deadline: **June, 21, 2019** at 17:00 (CET)
Applications will be evaluated through a three-step process:

1. Eligibility check of applications before June, 24, 2019
2. 1st round of selection: the applications will be evaluated by a Review Board between June, 24, and June, 28, 2019. Results will be given June, 28, 2019.
3. 2nd round of selection: shortlisted candidates will be invited for an interview session in Grenoble on July, 5, 2019 (in Grenoble or by Skype).

TYPE of CONTRACT: temporary-3 years of doctoral contract
JOB STATUS: Full time
HOURS PER WEEK: 35
OFFER STARTING DATE: October, 1st, 2019
APPLICATION DEADLINE: June, 21, 2019

Salary: between 1768.55 € and 2100 € brut per month (depending on complementary activity or not)

PROFILE SUMMARY:

The candidate must have a background in computer science, applied mathematics or signal processing, with a strong affinity for cognitive sciences, or instead a background in cognitive science or computational neuroscience, with a strong affinity for mathematical modelling. This training must be validated, or be validated soon (before Summer 2019), by a Masters level diploma (or equivalent).

The candidate must have previous experience in scientific research in a laboratory. Mastery of a scientific calculus language, or of a general-purpose programming language is required (R, Python, Matlab, etc.). The candidate must also have a good command of scientific English, both spoken and written.

Previous experience in probabilistic modeling, dynamic systems modeling, or connectionist modeling are a plus but are not required. Previous knowledge of the field of perception modeling or speech production is also a plus.

Informal enquiries to *Julien.Diard@univ-grenoble-alpes.fr* before preparing a complete application are welcome!

More about the Univ. Grenoble Alpes, University of Innovation

SECTOR**:** Higher Education Institution

LOCATION: France, Grenoble

RESEARCHER PROFILE:
□ *First stage researcher*

INSTITUTION: Univ. Grenoble Alpes, University of Innovation

One of the major research-intensive French universities, Univ. Grenoble Alpes enjoys an international reputation in many scientific fields, as confirmed by international rankings. It benefits from the implementation of major European instruments (ESRF, ILL, EMBL, IRAM, EMFL*1). The dynamic ecosystem, grounded on a close interaction between research, education and companies, has earned Grenoble to be ranked as the 5th most innovative city in the world. Surrounded by mountains, the campus benefits from a natural environment and a high quality of life and work environment. With 7000 foreign students and the annual visit of more than 8000 researchers from all over the world, Univ. Grenoble Alps is an internationally engaged university.

A personalized Welcome Center for international students, PhDs and researchers facilitates your arrival and installation.

In 2016, Univ. Grenoble Alpes was labeled «Initiative of Excellence ". This label aims at the emergence of around ten French world class research universities. By joining Univ. Grenoble Alpes, you have the opportunity to conduct world-class research, and to contribute to the social and economic challenges of the 21st century ("sustainable planet and society", "health, well-being and technology", "understanding and supporting innovation: culture, technology, organizations" "Digital technology").

* ESRF (European Synchrotron Radiation Facility), ILL (Institut Laue-Langevin), IRAM (International Institute for Radio Astronomy), EMBL (European Molecular Biology Laboratory), EMFL (European Magnetic Field Laboratory)

Key figures:

- + 50,000 students including 7,000 international students
- 3,700 PhD students, 45% international
- 5,500 faculty members
- 180 different nationalities
- 1st city in France where it feels good to study and 5th city where it feels good to work
- ISSO: International Students & Scholars Office affiliated to EURAXESS