INPhINIT
"la Caixa" Fellowship Programme

IBEC
Institute for Bioengineering of Catalonia

EXCELENCIA SEVERO OCHOA

IBEC participates in INPhINIT, "la Caixa" Doctoral Fellowship Programme with a set of stimulating PhD projects and excellent research groups to host the fellows

Synthetic, Perceptive, Emotive and Cognitive Systems (SPECS)

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Understanding embodied social behavior in humans and robots

Social behavior is an evolutionarily adaptive trait that many animal species possess and that is key to survival at the group and individual level.

What we want to address in this project is the following:

- How is a social behavior acquired in real-time via embodied interaction between individuals.

- What are the specific brain structures that underlie the emergence of such high-level functions in human and non-human animals?

- What are the human brain features that account for the complexity of our social behavior repertoire? To answer these questions, this research will aim to develop a functional computational model that will be integrated within a complete and biologically grounded cognitive architecture in order to study the formation of social behavior in multi-agent environments. In order to achieve this, first, we will extend the actual model proposed in DAC-X, the latest computational implementation of the Distributed Adaptive Control cognitive architecture. This framework already incorporates biologically constrained computational models of different regions of the mammalian brain and was capable of matching animal behavior on a benchmark foraging task. Second, we will apply this architecture on multi-agent coordination tasks to understand how the coupling of cognitive agents evolving in shared environments shapes the emergence of social behaviors (e.g. cooperation, competition). We will attempt at reproducing behavioral data observed in experiments that require a certain level of coordination between two or more participants. With the results of this work, we will then be able to provide new experimental predictions that later could be tested in human or non-human animal benchmark tasks. A particular emphasis will be put on modeling and studying the self-organization of macro properties at the population level from the local interactions between embodied agents.

SPECS_lab: one of our goals is to understand human behavior in a mixed-reality context. In this context we build mixed-reality applications based on neurobiological understanding and methodologies. We Test neurobiological models by deploying them in control of mixed-reality systems. see brainx3.com, and Rehabilitation Gaming System.

Job position description

The PhD candidate will investigate the neurobiology of social behavior, focusing on identifying those brain structures, and their functions, that are involved in social behavior as well as review in depth the literature on animal cooperation (including humans) and linking it to the framework of evolutionary game theory.
Propose a suitable human or non-human experimental paradigm for benchmarking.
A special effort will be put in finding experimental setups where game theoretical tasks are designed in a more ecologically valid real-time format where behavioral data is available.
Develop a biologically grounded computational model of these functions, trying to capture the underlying features of each one and the interactions between them.
Integrate the model into the Distributed Adaptive Control cognitive architecture, DAC-X developed by SPECS_lab
Validate the full model by integrating it into biologically and environmentally constrained agents and applying the model to various robotic platforms (mobile robot population or a humanoid robot (iCub) interacting with a human).
SPECS_lab: our group wants to "understand" the brain from an embodied and systemic perspective and to do that we resort to principles derived from brain and behavior, robots and AI. At the center of 'understand' is the Distributed Adaptive Control theory (DAC). DAC is a theory of mind and brain advanced to explain fundamental aspects of neuroscience and psychology, predict novel phenomena and generate biologically grounded control principles underlying innovative technologies.