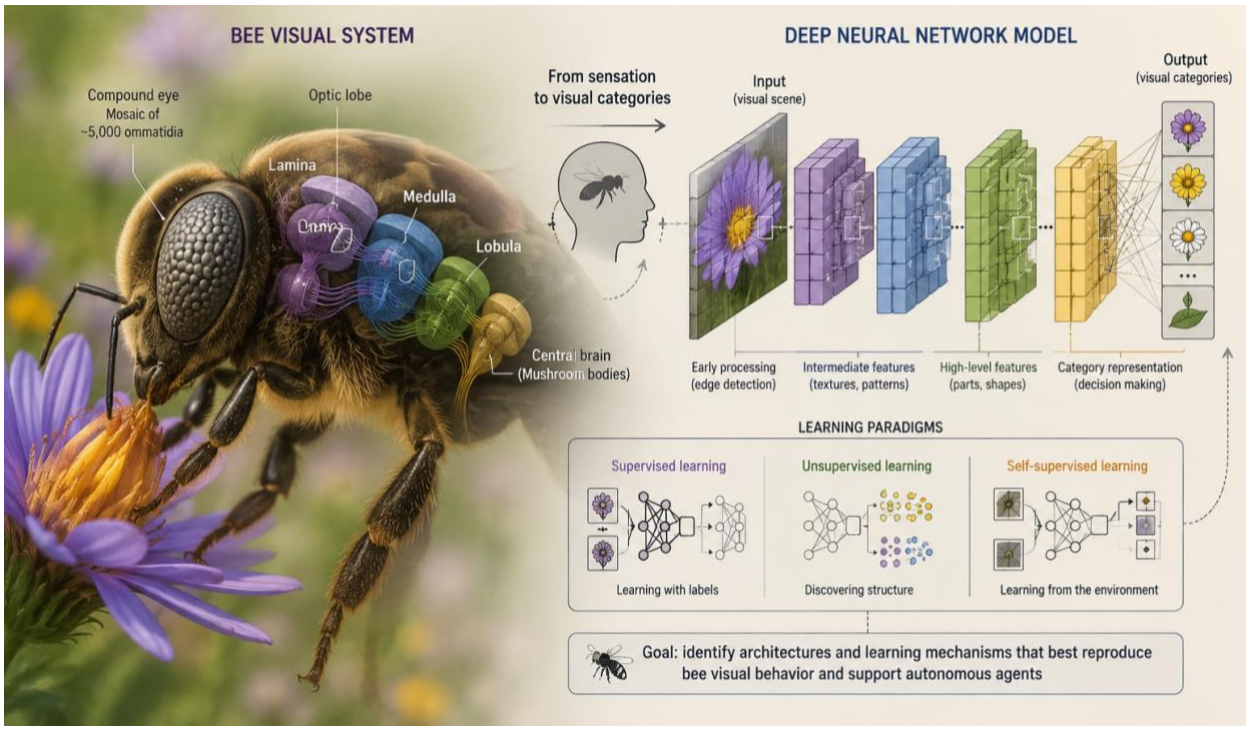
Master 2 Research Internship + PhD

Modeling visual learning in bees with deep neural networks



Can artificial neural networks learn to see the world in ways that resemble bees? Bees display remarkable visual categorization abilities: they can rapidly form visual categories from observation alone, without explicit supervision. Understanding how these abilities emerge could provide new insights into biological intelligence and inspire more autonomous artificial agents.

We are looking for a motivated student to investigate these questions at the intersection of deep learning, computational neuroscience, and animal cognition.

KEYWORDS: artificial intelligence (AI), deep learning, computational neuroscience, vision.

RESEARCH PROJECT

The overall goal of the ANR-funded Bees project is to develop an autonomous cognitive agent inspired by bees that can learn and operate in an open environment. The project brings together three complementary research teams working on animal cognition (Aurore Avarguès-Weber at CRCA), computational neuroscience of vision (Timothée Masquelier and Benoît Cottereau at CERCO), and artificial intelligence (Dominique Longin at IRIT).

Our role at CERCO is to develop neural network models of the visual cognitive abilities experimentally characterized at CRCA that will subsequently contribute to the autonomous cognitive agent developed at

IRIT. The central research question is: Which neural architectures and learning paradigms best reproduce the visual categorization abilities observed in bees?

The successful candidate will investigate supervised, unsupervised, and self-supervised learning approaches and compare their ability to reproduce experimentally observed behavioral patterns. Since bees do not have access to explicit category labels, we hypothesize that unsupervised and self-supervised approaches may provide a better account of their behavior. These approaches are also particularly relevant to autonomous agents that must learn from their environment without explicit supervision.

RESEARCH ENVIRONMENT

The project will be conducted at the Centre de Recherche Cerveau et Cognition (CERCO) in Toulouse, France, at the interface between the NeuroAI and SV3M teams. The successful candidate will benefit from close collaboration with Aurore Avarguès-Weber at the Centre de Recherches sur la Cognition Animale (CRCA) and Dominique Longin at the Institut de Recherche en Informatique de Toulouse (IRIT).

The Bees project is funded by an ANR PRC grant. Funding covers the position as well as research-related expenses, including computing resources, GPUs, conference travel, and publication fees.

Toulouse is a major university city in southwestern France, offering a high quality of life and easy access to the Pyrenees, the Mediterranean coast, and Spain.

CANDIDATE PROFILE

We are looking for a candidate who is enthusiastic about interdisciplinary research and interested in understanding biological intelligence through computational modeling.

Essential qualifications:

- Strong quantitative training (e.g., physics, mathematics, engineering)
- A solid background in deep learning & computer vision.
- Strong programming skills, particularly in Python.
- Motivation to work in a multidisciplinary research environment.
- An interest in understanding biological intelligence and reverse-engineering the brain.
- Fluency in English.

Desirable qualifications:

- Experience with deep learning frameworks such as PyTorch.
- Experience with AI-based coding assistants, such as Claude.
- Knowledge of visual neuroscience or computational neuroscience.

French is not required.

POSITION DETAILS

Type of positions: M2 internship, M2 internship followed by a PhD, or PhD directly.
Duration: 5-6 months (M2) – 3 years (PhD).
Stipend: 682.51€/month (M2) – 2300€/month gross (PhD).
Start date: early 2027.
Supervisors: Timothée Masquelier (DR2 CNRS at CERCO, NeuroAI team leader) & Benoît Cottereau (DR2 CNRS at CERCO, SV3M co-team leader)
Location: Centre de Recherche Cerveau et Cognition (CERCO), UMR 5549 (CNRS – Univ Toulouse 3), Pavillon Baudot CHU Purpan, Toulouse, France.

HOW TO APPLY

Send a CV and a short motivational letter to timothee.masquelier@cnrs.fr and benoit.cottereau@cnrs.fr
Informal enquiries are welcome.