



TITLE

Cognitive Maps - modeling and artificial implementation

LAB & PEOPLE

- Name of the hosting lab: Smart Grids and Mobility Lab. (ISE-UAlg)
General activities of the lab: Smart Grids and Intelligent Systems
Website: <https://ise.ualg.pt/>
Number of staff / PhD: 3
- Supervisor name and contact: Jânio Monteiro (jmmonte@ualg.pt), António Silva (asilva@ualg.pt)

TOPIC OF THE INTERSHIP

- Scientific context of the internship:
At our lab we are currently exploring the possibility of modelling the hippocampal formation of the brain namely its capability to perform simultaneous localization and mapping (SLAM). Our work is driven by the most recent neuroscience observations of the brain namely the head-direction, grid and place cells behaviour and operation, with the objective of implementing artificial cognitive maps. Moreover, we are exploring the possibility of applying those artificial cognitive maps to daily life problems, including SLAM, smart grids, and others, which require artificial intelligence. The long-term objective is the possibility of developing “brain twins” of small animals.

Keywords: hippocampal formation, head direction cells, grid cells, place cells, cognitive maps, simultaneous localization and mapping

Bibliography:

- Pedro, A., Monteiro, J., & João Silva, A. (2023). Role of the Hippocampal Formation in Navigation from a Simultaneous Location and Mapping Perspective. *IntechOpen*. doi: 10.5772/intechopen.110450
- Monteiro J, Pedro A, Silva AJ. A gray code model for the encoding of grid cells in the entorhinal cortex. *Neural Computing and Applications*. 2022;34(3):2287-2306
- Tomás Mendes, Pedro J.S. Cardoso, Jânio Monteiro, João Raposo, "Anomaly Detection System for Consumptions of Hotel Units: A comparison between Isolation Forest and Variational Autoencoder Algorithms", *Journal of Applied Sciences*, MDPI. <https://www.mdpi.com/2076-3417/13/1/314>
- André Pacheco, Jânio Monteiro, Joni Santos, Cláudia Sequeira, José Nunes, "Energy transition process and community engagement: the case of Culatra Island (Ria Formosa, Portugal)", *Renewable Energy Journal*, Elsevier, January 2022. <http://dx.doi.org/10.1016/j.renene.2021.11.115> (Impact Factor 8.39 in 2021).



2023 Master internship at University of Algarve



- Tasks and duties entrusted to the student: Studying current neuroscience observations towards the implementation of digital models; Writing of reports and scientific papers;
- Skills to be acquired or developed: ability to model the hippocampal formation, foreseeing the implementation of “brain twins”.

PROFILE OF THE DESIRED STUDENT

- Minimum level of study required: Graduation
- Field(s) of study: neuroscience, digital processing,
- Scientific skills: Matlab and/or Python, basic C-language, basic signal processing
- Language skills required: English

THE INTERNSHIP ASSIGNMENT:

Desired duration of the internship (in months): 4 to 12 months

Desired Starting date of the mission: at any time

Indicative weekly schedule: 35h / week

Remuneration: Not Available

Erasmus grant: Application should be made by the student at the sending institution

Internship agreement: *an internship agreement will be signed.*

To SEA-EU students:

If you're interested please send your CV and letter of motivation to the scientist in charge, Jânio Monteiro, jmmonte@ualg.pt.