

# UNIVERSITY OF SOUTH FLORIDA

## Defense of a Doctoral Dissertation

Adaptive Multi-scale Place Cell Representations and Replay for Spatial Navigation  
and Learning in Autonomous Robots

by

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For the Ph.D. degree in Computer Science and Engineering

Place cells are one of the most widely studied neurons in the brain hippocampus thought to play a vital role in spatial cognition. Studies show that place cell activity is highly correlated with the animal's location in an environment, forming "place fields" that are highly specific to the animal's location. This dissertation presents a novel multi-scale model of place cell representations and replay for spatial navigation and learning in autonomous robots. The model is implemented in a robot platform and evaluated in a series of experiments. The results show that the model is able to learn and navigate in a complex environment, and that it is able to replay its learned knowledge during periods of inactivity. The model is also able to learn and navigate in a dynamic environment, and that it is able to adapt to changes in the environment. The model is implemented in a robot platform and evaluated in a series of experiments. The results show that the model is able to learn and navigate in a complex environment, and that it is able to replay its learned knowledge during periods of inactivity. The model is also able to learn and navigate in a dynamic environment, and that it is able to adapt to changes in the environment.

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### Publications

- 1) **Scleidorovich, P.**, Weitzenfeld, A., Fellous, JM., and Dominey, P. Integration of velocity-dependent spatio-temporal structure of place cell activation during navigation in a reservoir model of prefrontal cortex. Biol Cybern (accepted).
- 2) **Scleidorovich, P.**, Llofriu, M., Fellous, JM. et al. A computational model for spatial cognition combining dorsal and ventral hippocampal place field maps: multiscale navigation. Biol Cybern 114, 187–