

Biologically Inspired Grid Cell Representation for Object Detection in Radar Data



Technical University of Munich



Faculty of Informatics

Chair of Robotics, Artificial Intelligence and Embedded Systems

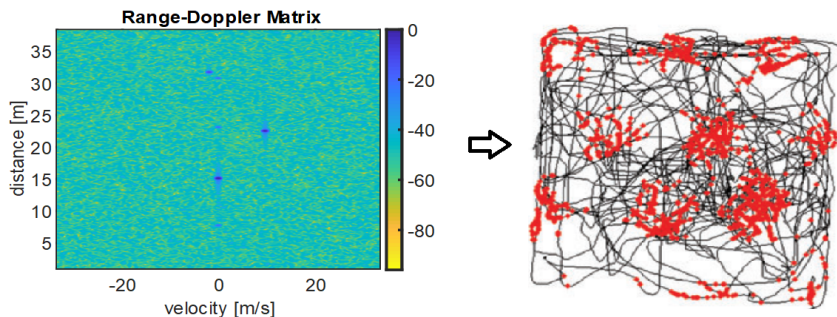
Background

Radar is an emerging sensor technology used in various fields. Some include target detection in aviation and marine applications, environment perception in cars and infrastructure (our focus), gesture recognition in mobile phones and light switches, and privacy protected indoor surveillance.

Modern solutions rely on both classical as well as neural network-based signal processing in order to cope with the demanding complexity. Often, the systems have to work under restricted power budgets and time frames, which in some cases forbids the utilisation of heavy neural networks and gives rise to alternative processing solutions.

Description

The objective of this thesis is to explore biologically inspired approaches for utilisation in the context of radar signal processing. In short, it should be examined to use the same mechanism to represent space and positions as our brain does: grid cells [1], [2].



Tasks

This student project consists of the following tasks:

- Getting familiar with the topics radar, spiking neural networks, and grid cells
- Designing toy examples which illustrate the underlying principles
- Designing and developing a network architecture and learning rule
- Testing the system on simulated and real-world data
- Documenting the results

References

- [1] E. I. Moser, E. Kropff, and M.-B. Moser, "Place cells, grid cells, and the brain's spatial representation system," *Annu. Rev. Neurosci.*, vol. 31, pp. 69–89, 2008.
- [2] J. Hawkins, M. Lewis, M. Klukas, S. Purdy, and S. Ahmad, "A Framework for Intelligence and Cortical Function Based on Grid Cells in the Neocortex," *Frontiers in Neural Circuits*, vol. 12, 2019.

Supervisor:

Prof. Dr.-Ing. Alois Knoll

Advisor:

Daniel Auge, M.Sc.

Research project:

-

Type:

Master Thesis

Research area:

Spiking Neural Networks, Signal Processing, Radar

Programming language:

Python/Matlab

Required skills:

Python, Machine Learning, Signal Processing

Language:

Englisch/German

Date of submission:

11. Mai 2020

For more information please contact us:

Phone: +49.89.289.18141

E-Mail: daniel.auge@tum.de

Internet:

<https://www6.in.tum.de/>