**During the third semester** this project information sheet and a project description have to be added to your study plan for **both of your projects separately**!

Project Information

# Project Information

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| □ Minor Project (10 ECTS, 300 hours)  □ Major Project (15 ECTS, 450 hours) (*Please fill all data into the right column!)* | |
| Expected number of hours per week: | 40 |
| Composition of project hours:  *(ECTS Lecture, ECTS Project Work)* | 460 |
| Project start date: | 16/12/2019 |
| Project end date: | 13/03/2020 |

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| **Student Data** | |
| Last name, first name: | Figueiredo Miller, Gabriel |
| e-mail: | [Gabriel.f.miller@fau.de](mailto:Gabriel.f.miller@fau.de) |
| Matriculation/Student-No.: | 22589864 |

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| **Involved Professors** | |
| Mentor: | Prof. Walter Kellermann |
| SIGNATURE MENTOR |  |
| Supervising professor: | Prof. Sharon Gannot |
| SIGNATURE SUPERVISING PROFESSOR |  |
| Additional supervisor: |  |
| Professor(s) teaching included lecture(s): | Professors Elmar Nöth, Andreas Maier, Christian Riess |

# Description of □ Minor Project □ Major Project

Project Description

(Please insert your description text here or attach a description if you have a printout in another design already. The summary should span about half a page of continuous text with at least 200 words.)

Topic

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|  | Sensor Localization Using Manifold Learning Techniques |

Summary

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|  | Scenario: We assume that we have a manifold learning scenario, where a set of distributed arrays, i.e., an acoustic sensor network observes a single acoustic source. By using a set of labeled and unlabeled high-dimensional feature vectors which are dependent on the source position, we have trained regression functions which yield estimates of the source coordinates. Such a scenario may occur, e.g., in a smart home scenario. Now, one of the arrays is displaced w.r.t. its initial position, e.g., due to rearrangement by the inhabitant of the smart home. We do neither assume any information about the identity of the displaced node nor the distance the node is displace by. Problem description: The problem to be solved is the detection of the displaced node (here already some results are available from Sharon Gannot’s group), the investigation of the effects of the displacement on the regression function and the re-adaptation of the regression function corresponding to the displaced node.  Work plan: 1. Investigation of methods for the detection of the displaced node, e.g., cross-validation. 2. Investigation of the effect of varying node positions on the regression function. The eigen-analysis of the kernel matrices corresponding to the regression functions associated with different training points may serve as a starting point for this analysis. 3. Investigation of methods for the adaption of the regression function of the displaced node, e.g., Gaussian process online learning including forgetting mechanisms.  Skills to be acquired: • Overview over manifold learning techniques with a special focus on the design of kernels for Gaussian process regression. • Insights into mathematical methods for data analysis, e.g., (Kernel-)PCA. • Development of simulation software and handling of measurement hardware. |

Literature

|  |  |
| --- | --- |
|  | Bracha Laufer-Goldshtein, Ronen Talmon, Sharon Gannot, “Semi-Supervised Source Localization on Multiple Manifolds With Distributed Microphones”.  Carl Edward Rasmussen, “Gaussian Processes in Machine Learning”  Bracha Laufer-Goldshtein, Ronen Talmon, Sharon Gannot, “Speaker Tracking on Multiple-Manifolds with Distributed Microphones” |

Included Lectures

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| --- | --- |
|  | Deep Learning  Pattern Analysis  Pattern Recognition |

Further Notes

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