

## GaussianProcessDipoleSimulation

The project of sensor array simulation and Gaussian Processes for angle predictions on simulation datasets starts in

### May 06. 2019

with IEEE paper by Thorben Schüthe which is a base investigation of "Two-Dimensional Characterization and Simplified Simulation Procedure for Tunnel Magnetoresistive Angle Sensors". What produces characterization datasets of different current available angular sensors on the market.

### June 11. 2019

Thorben Schüthe came up with a high experimental scripting for abstracting sensor characterization fields to an array of sensor fields which was stimulated by magnetic dipole field equations to approximate a spherical magnet.

### November 06. 2019

Prof. Dr. Klaus Jünemann supports the team around Prof. Dr.-Ing. Karl-Ragmar Riemschneider and Thorben Schüthe with an apply of Gaussian Process learning to investigate on angle predictions for sensor array simulation results. The attempt of the solution was working for tight set of parameter and was highly experimental with rare documentation and few set of functions and script. The math of this very solution based the standard book for Gaussian Process by Williams and Rasmussen. The algorithm is related to the guideline for linear regression model which worked fine for a setup of standard use cases but needed further investigation for a wider set of parameters and functions to identify general and relevant parameter settings to provide an applicable angular prediction.

### September 21. 2020

Tobias Wulf establish a Matlab project structure and programming guidance and flows to document the source code integrated in the Matlab project architecture. That includes templating for scripts and functions and general descriptions of project structure and guidance for testing and documenting project results or new source code including automation for publishing html in Matlab integrated fashion.

### October 22. 2020

Tobias Wulf added TDK TAS2141 TMR characterization to the project. Thorben Schüthe provided a raw dataset which was manually modified by Tobias Wulf to dataset which is plotable and reconstructable in stimulus and characterization field investigations.

### October 31. 2020

Tobias Wulf establish a general configuration flow to control part of software via config file which is part loaded as needed into workspace.

### November 29. 2020

Tobias Wulf finished the implementation of sensor array simulation which uses TDK TAS2141 as base of simulation. The software includes now simulation for stimulus magnet (dipole sphere) and automated way fast generate training and test datasets by set configuration. Various plots and animation for datasets and a best practice workflow for simulation. Also included are unittest and Matlab integrated documentation in html files. A full description of generated datasets is included too.

### December 05. 2020

Tobias Wulf integrated a second characterization dataset for NXP KMZ60 into the sensor array simulation software. The

dataset was manually modified in the same way as the TDK TAS2141 dataset. The KMZ60 raw data was provided from Thorben Schütte. The simulation software was adjusted to run with both datasets now. Additional plots for transfer curves are included for both and same plots for characterization view of KMZ60 as for TAS2141 too.

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