Proposal for Master's Thesis
Master Thesis in cooperation with Fraunhofer IISB (Modeling and Artificial Intelligence Group) and FAU (Pattern Recognition Lab)

Supervisor: Rodrigo Coelho, Mathias Zinnen, Prof. Andreas Maier

Working Title: Pre-processing and synthetic data generation techniques for defect detection in SiC and AlN wafers.

Research Question: Can an object detection model trained from synthetic data identify defects in real wafer measurements?

Description:
This thesis topic aims to build an end-to-end pipeline to identify different types of defects in faulty SiC and AlN wafers that could contribute to introducing a reliable defect detection system for wafer manufacturers.

Aluminium Nitride (AlN) and Silicon Carbide (SiC) materials are crucial for power electronics applications where devices are relied on for their high frequency. However, during the manufacturing process, various unwanted defects occur, which reduce the quality of the wafers. To build a defect detection pipeline, we need labeled training data and a suitable object detection model. Our research will focus on synthetic wafer data generation and pre-processing strategies to improve an object detection model to detect defects in the wafer measurements. This improved algorithm would allow the manufacturers to localize the different types of defects on the wafers, improving the quality control of the manufacturing process and providing necessary information regarding possible improvements.

Our research objectives and outcomes will be:

- Train and evaluate the baseline model with real wafer measurements.
- Develop a resilient mechanism for synthetic data generation and data augmentation.
- Evaluate the effects of pre-processing and synthetic data generation techniques on the performance of the baseline model on the real wafer measurements.
- Apply different training strategies, such as combining synthetic and real data. (Optional)
- Evaluate additional established object detection algorithms using the developed strategies. (Optional)