Intelligent Data Analysis

Laser (Project 7)

This project is part of the exam *Intelligent Data Analysis*. Each project assignment is to be resovled by a single student on his/her own. The student is supposed to present the solution as part of the oral exam. The student is required to present a printed version of the Python code together with diagrams, tables, etc. that summarize the results. The specific way of how the project is presented is up to the student's choice.

Problem setting

For the purpose of quality assurance, a manufacturer of medical lasers wants to introduce a system which recognizes defective products. For the lasers produced, a constant light output with a frequency as constant as possible is desired. Certain fluctuations are acceptable; Lasers in which the power fluctuates to an intolerable extent should be sorted out. For this purpose, the intensity of each laser is measured for one minute – one measurement per second. For 200 lasers, it is known whether they are suitable for sale or not (see Figure 1). The respective measurements thus describe which type of fluctuations are or are not tolerable. You have been asked to develop a predictive model from the given data with which the correct functioning of a laser can be predicted.

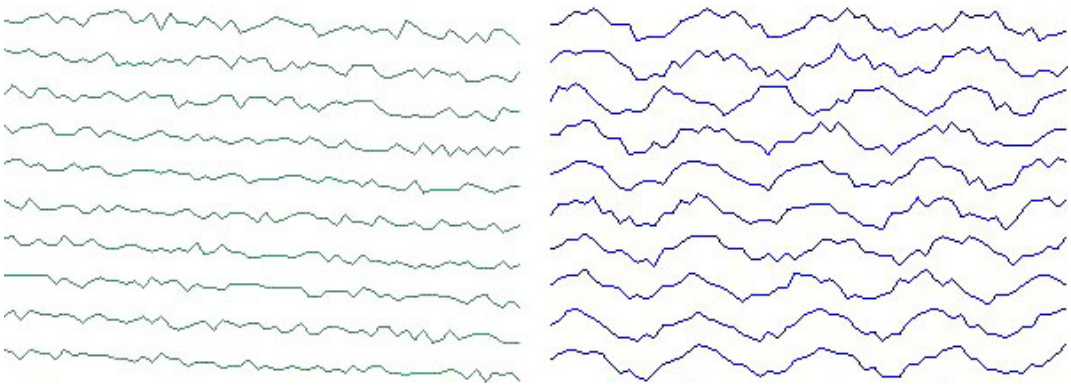

Abbildung 1: Examples of measurement series of correctly working lasers (left) and faulty lasers (right).

Exercise

Load the file "laser.mat" into Python and present the data appropriately. If necessary, perform data preprocessing. Identify three different models — for example, kernel methods with different kernel functions — which are suitable for solving the prediction problem. Implement these methods in Python. Train the models and compare them with respect to their predictive power. Briefly motivate and document all the steps you have taken.