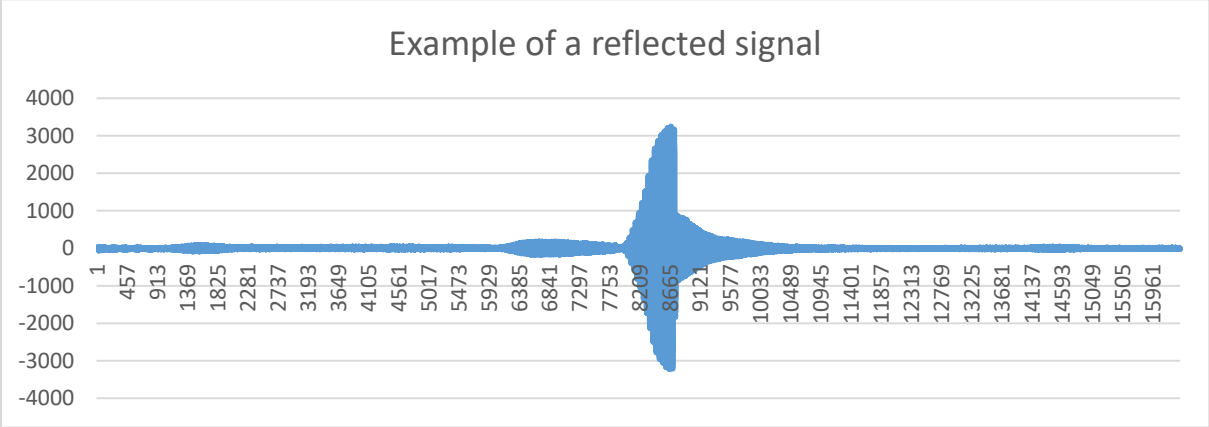
Project task: „Discrimination of reflected sound signals"

The surface of an object reflects a sound signal. Recording the reflected signal provides a time signal. This time signal results from the convolution of the incident acoustic wave with the surface properties of the reflecting object. Knowing the incident acoustic signal one can conclude on the reflecting object by analyzing the reflected signal.

Your task: Use reflected time signals to conclude on the reflecting object. As the number of objects is limited in our experimental setup, solving the task means discriminating the time signals.



Apply machine learning (ML) to the time signal. Download the measuring signals from the Moodle page.

Your task in detail:

1) to create a GUI,
2) to read time signals from given Excel files, one time signal per row, starting column and signal length (number of scan points) adjustable,
3) to distinguish between two classes, namely "Object #1" and "Object #2",
4) to use data labels given in the Excel file or to create new labels and complete the data files,
5) to create a time-frequency representation (TFR) of the signal using discrete Gabor-transformation,
6) to create a binary classifier (discriminator) by applying machine learning using labeled data,
7) to use the binary classifier for discriminating new data,
8) to assess the classifier (at least all of the following measures: TP, TN, FP, FN, FDR, NPV, TPR, TNR, F1, ROC), see Sensitivity and specificity - Wikipedia
9) to discuss the results,
10) to write a report using the given WORD-template. Use the title of the task as paper title.

Exact procedure very important. Being precise is much more important than achieving high classification rates. The GUI should be easy to use.
The problem has to be solved either using MATLAB, Python, C, C++ or C#.
You must submit a report (.pdf-file) of your work containing a detailed description of your solution according to the steps 1 to 10 at the upload portal of the examination office of the faculty by 31 March 2021. No maximum size given. Additionally upload the source code files, the report file (Word file) and the all the training data files on Moodle, same deadline.

After submission, I will invite you to a Zoom conference for result presentation. Every participating team has to prepare a Power-Point file. Upload it on Moodle before the presentation date. After

Power-Point presentation, you will present your program. New data (Excel file), information about the starting column and the signal length will be given in the conference.

Processing hints: You may work on the project individually or in a team. The maximum number of participants in a work team are three persons. If you're working in a team the individual contribution must be identified in the report.
Provide all necessary technical information needed to rebuild the solution. Please note that even if the technical task solved to 100%, the individual grade could be "5" (NOT passed) in case of a poor report.

I wish you success!
A. Pech