

# Abstract

The purpose of the thesis was to propose and develop, following a thorough study of radar processing methods, an algorithm that can improve a radar image obtained from real targets, with good precision and reduced processing time compared to conventional methods.

The radar imaging software has two main objectives: (1) improving the radar image and detecting the target of interest and (2) classifying the target.

While developing the imaging software, we've assumed that information regarding the measurements (distance to target, clutter or target shape and size) are not available. The decisions referring to estimating the values of significant parameters are taken entirely by the unsupervised software, usually as a result of an iterative process. For comparison, a supervised version of the software was also developed, where the user can set the values of certain parameters, based on observations regarding the radar measurements.

Regarding the unsupervised version of the processing software, multiple methods were implemented and compared. These algorithms have advantages and disadvantages, based on the analysed scenario, regarding both the quality of the focused radar images and the total processing time.

Some of the methods used for developing the software are conventional to radar imaging: beamforming and adaptive filtering. We've also implemented and adapted a number of algorithms used in statistical processing, based on independent and principal component analysis (ICA and PCA). The FastICA variant was developed to work as an adaptive filtering algorithm that can be used to focus radar images and detect any targets of interest. These methods can also be used to classify the detected targets.

Finally, the thesis presents a case study for testing and evaluating the performances of the proposed processing algorithm. Using radar data generated to emulate SFCW measurements, the algorithm is used to focus the radar images and classify the detected targets. The processing stages and significant parameters are presented, as well as the advantages and disadvantages for the different variants of the proposed algorithm.