

Localization and Classification of Sounds around an Electronic Device

Students



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Introduction: Today's electronic devices offer more and more functionalities. Often the users are unaware of the device's capabilities.

In order to simplify the usage, the device should detect which device mode is the best for a given situation.

To accomplish this in our case, the device needs to localize and classify sounds, for which we had four air-borne and four structure-borne sound microphones.

Approach: For the localization we detect the time-delays between the measured sounds of the four air-borne sound microphones. These time-delays are used to calculate the position of the sound source. To find the best time-delay estimates a global optimization problem is solved with a Branch and Bound (BB) algorithm.

Additionally, a Linear Discriminant Analysis (LDA) model was trained to predict the region where the sound originated.

The sound classification was done using Linear Discriminant Analysis for which audio features were extracted from the data.

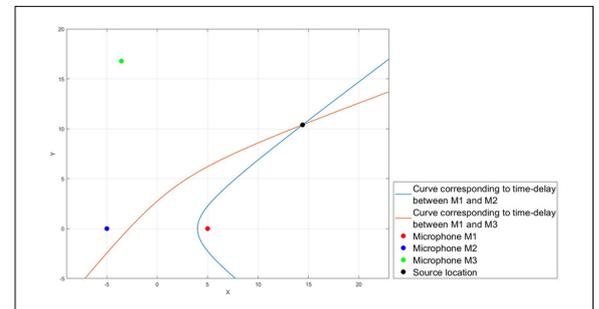
Interfering sounds were in both applications a huge problem and hindered us getting accurate predictions. With Independent Component Analysis (ICA) however, this problem could be solved.

Conclusion: The localization with the LDA worked well with an accuracy of over 90 percent in contrast to the time-delay based method which had problems finding the real position in the true environment. We suspect this was caused by disturbances from other parts of the device.

The classification got a test accuracy of over 93

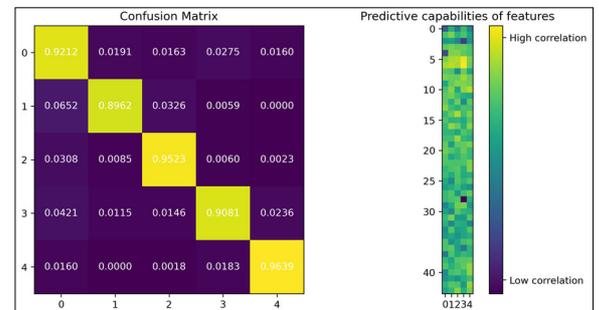
percent and even in the true environment, with interfering sounds, nine out of ten sounds were on average classified correctly.

Localisation of a sound source in a two-dimensional plane with three microphones
Own presentation



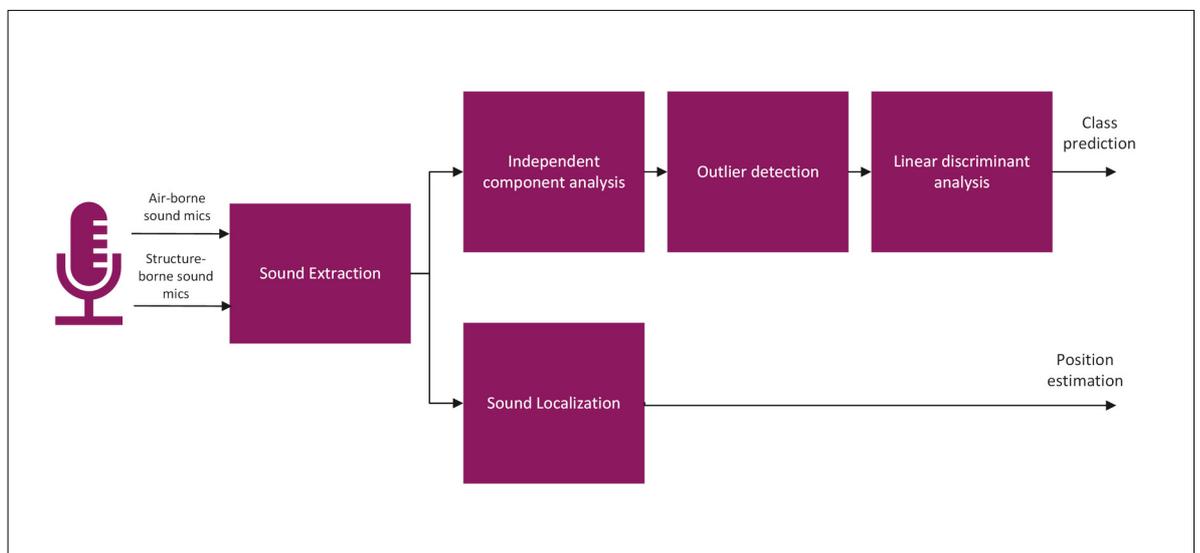
Results of the classification

Own presentation



Processing steps

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Examiner
Hannes Badertscher

Subject Area
Digital Signal
Processing, Artificial
Intelligence