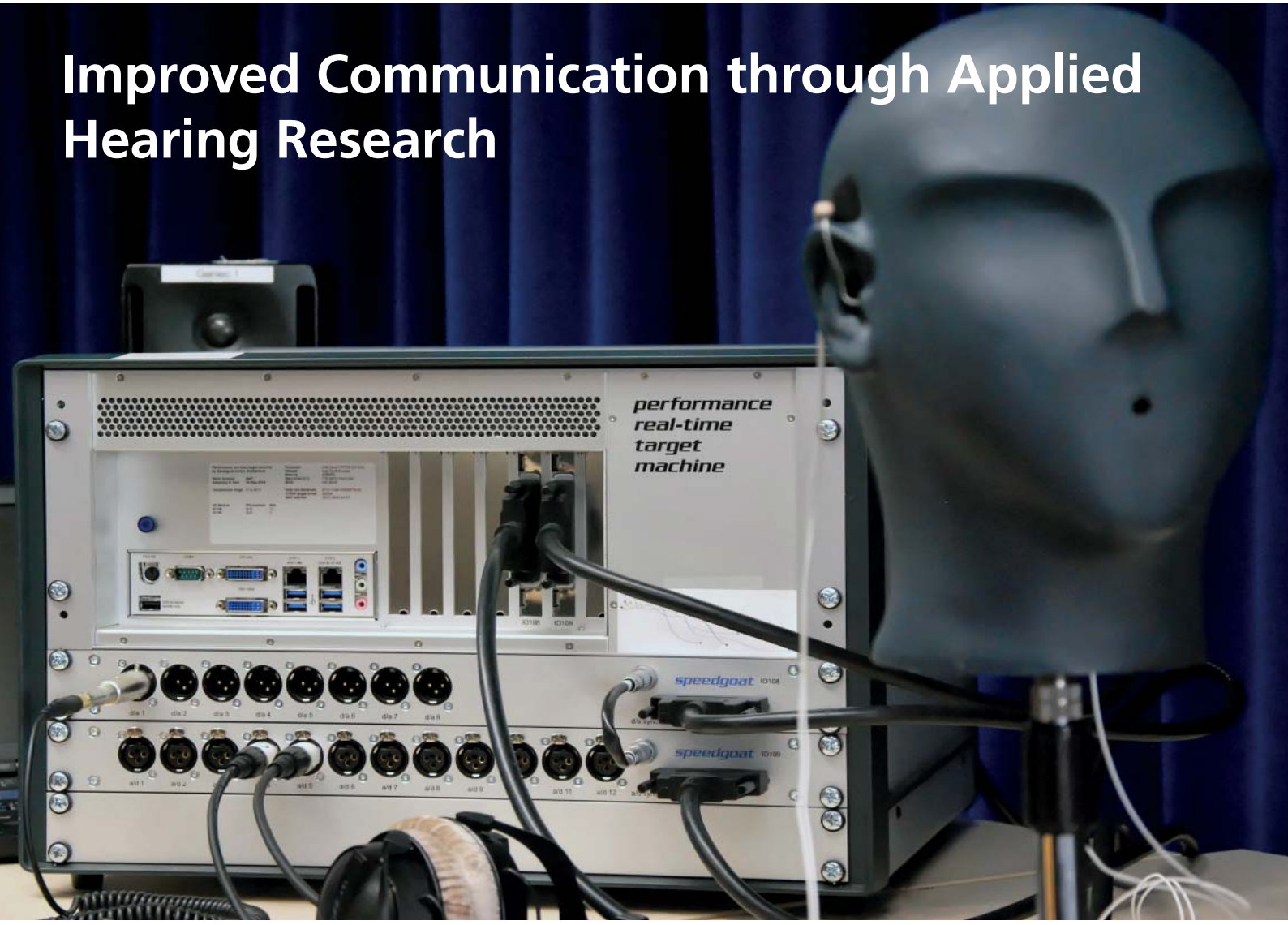
ICanHear

Improved Communication through Applied Hearing Research



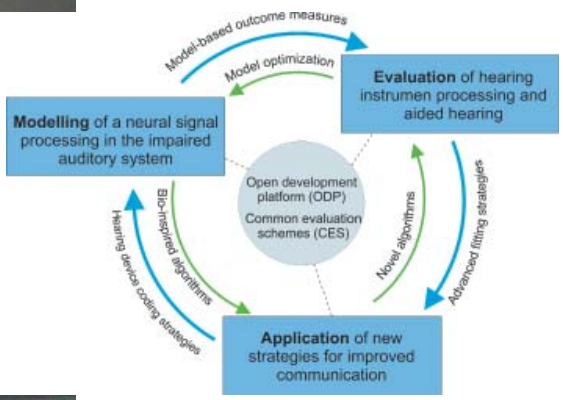
speedgoat
real-time simulation and testing

ICanHear

EU funded project ICanHear is using Speedgoat products to develop creative new signal processing solutions that will improve the performance of hearing instruments in adverse acoustic environments

ICanHear ("Improved Communication through Applied Hearing Research") is a European Union funded research and training project, designed to push frontiers of knowledge in hearing research, digital signal processing, and hearing instrument technology. The project aims at paving the way towards the next generation of hearing aids and cochlear implants (CIs) with improved user experience in complex acoustic environments. In an interdisciplinary network, young researchers at five academic and two industrial institutions across Europe are jointly working towards this goal.

Their research is structured around the three themes: Modelling, Evaluation and Application. The Modelling theme is focused on the description of neural processing in the impaired auditory system. One of its objectives is to improve sound coding strategies for CIs. The Evaluation theme looks at the consequences of hearing impairment and benefits from signal processing. Here, one of the objectives is to improve the evaluation of auditory models in adverse acoustic environments. The Applications theme works on innovative solutions for communication – for example by feeding environmental and additional sensors' information into speech enhancement algorithms.



ICanHear project research structure

Open Development Platform

A central component to all three themes is the Open Development Platform for Signal Processing in Hearing Devices (ODP). This platform is jointly developed by the participating partner institutions. It is programmed in MATLAB & Simulink and implemented on a Speedgoat Performance real-time target machine. The ODP enables the researchers to develop and evaluate real-time algorithms and to share algorithms and building blocks across the network. It also offers a common communication platform between researchers and industry.

Single-microphone binaural hearing

An example for the use of the ODP is a project in the Application theme, where a new algorithm has been developed to enhance the signal of single-microphone binaural hearing aids by using the additional microphones of a smartphone*. In this project ICanHear research fellow Dianna Yee (hosted by Sivantos GmbH) aims at improving speech intelligibility in difficult acoustic environments by attenuating the background noise, while preserving the signal of the target source. In such noisy environments, single microphone hearing aids suffer from a front-back ambiguity - the algorithm that processes their signal cannot differentiate between the front and back hemispheres. Therefore there is no attenuation of interfering audio sources coming from the back of the listener. The idea behind the project is to take advantage of the widespread availability of smartphones and utilize their microphone signals as a wealthy source of audio data that describe its surrounding environment and helps to disambiguate the acoustic information picked up by the hearing aid microphones.

The communication device can be strategically placed in front of the listener, where its microphone signal benefits from the shielding effect the body has on noise coming from the back. This signal can thereby be used to address the front-back ambiguity of the single microphone binaural hearing aids and lead to an improved frontal target source.

Test setup

The figure on the right shows the Open Development Platform test setup. It includes one listener (artificial head (3)), wearing a pair of single-microphone binaural microphones and two sources of speech sound (2),

one of them located in front and the other at the back of the listener. The smartphone with the external microphone (4) is located in front of the listener. The Speedgoat target machine (6) programmed with the proposed audio processing algorithm using a laptop (1), receives the preamplified hearing aid signals (5) as well as the signal of the external microphone of the smartphone (4) and processes them. The processed signals are played live via a soundcard (7) or can be stored on the laptop computer (1).

Speedgoat's value contribution

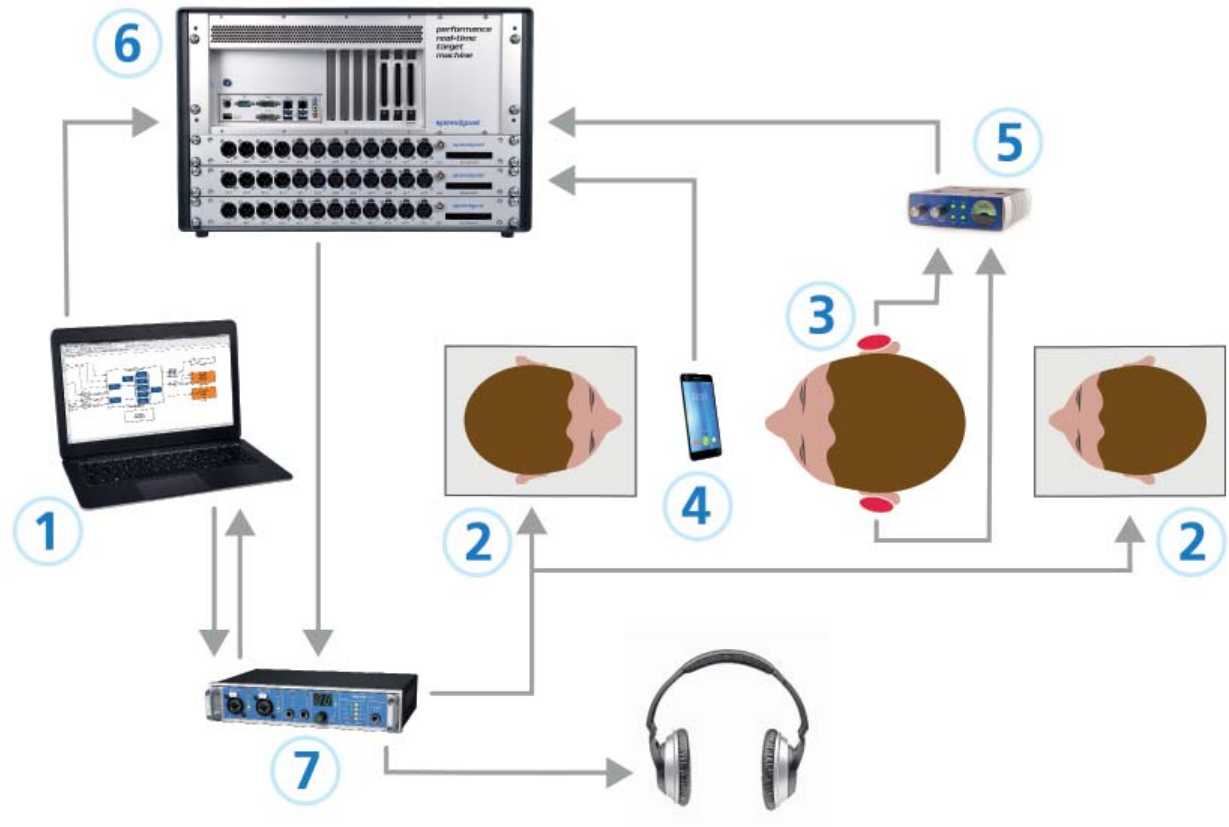
"The Speedgoat real-time target machine was selected because of its widespread use in the hearing instruments industry.

I am impressed by the relatively short time required to convert the MATLAB code into a running real-time implementation.

Being able to demonstrate algorithms in real-time adds a lot of credibility to our research endeavour."

- Prof. Dr.-Ing. Rainer Martin, ICanHear Coordinator

Prof. Dr.-Ing. Rainer Martin, Institute of Communication Acoustics, Ruhr-Universität Bochum



ICanHear Open Development Platform test setup

*D. Yee, H. Kamkar-Parsi, H. Puder and R. Martin, "A speech enhancement system using binaural hearing aids and an external microphone," 2016 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), Shanghai, 2016, pp. 246-250.

ICanHear

www.icanhear.eu

Partners
Ruhr-Universität Bochum
Katholieke Universiteit Leuven
University of Southampton
Universität Zürich
Danmarks Tekniske Universitet
Sivantos GmbH
Cochlear Research & Development Ltd

Speedgoat products used

- Performance real-time target machine
- IO108 analog output module with XLR panel
- IO109 high-resolution analog input module with XLR panel

MathWorks software used

- MATLAB®
- Simulink®
- MATLAB Coder™
- Simulink Coder™
- Simulink Real-Time™

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