Open community platform for hearing aid research

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The large incidence rate of hearing loss (about 13% of the US population), its high economic costs and the limitations of technical rehabilitative solutions call for an effort towards improving the rehabilitation of hearing impairment. The major aim of the envisaged project is therefore to facilitate research and development towards new technical solutions that improve rehabilitative devices. To achieve this, a large group of researchers will be provided with the means to efficiently develop and evaluate, in collaborative multi-center environments, novel signal processing schemes, individualized fitting procedures, technical solutions and services for hearing devices such as hearing aids and assistive listening devices. This approach leads to more integrated, sustainable and focused research towards improving hearing devices in general.

This open-source platform will comprise

1. a software development kit (C/C++ SDK) including an extensive signal processing library for algorithm development and a set of Matlab and Octave tools to support development and offline testing.
2. real-time runtime environments for standard PC platforms with standard sound hardware (Windows and Linux operating systems) as well as ARM platforms (Beaglebone black with 2/2- and 6/2-ch AD/DA (Linux)). To be able to start collaborations with hardware manufacturers at an early stage and thus to increase impact, ARM-M4 microcontroller support will be also included, on the basis of which manufacturers can design wearable earpieces for the community.
3. and a set of baseline reference algorithms that forms a complete hearing system (multi-band dynamic compression and amplification, directional microphones, binaural beamformers and coherence filters, single-channel noise reduction, feedback control).

The project will provide distributions of the platform to the community every year with increasing software and hardware functionality. The first version after year one will already be a fully functional version that allows algorithm development under Linux on PC platforms, provides Linux realtime runtime support for PC and Beaglebone black ARM platforms, and includes a set of realtime algorithms that is based on the latest set of Master Hearing Aid algorithms (Ref 1-4), which is competitive with current commercial algorithms, e.g., algorithms running on OnSemi Ezairo Audiology DSP systems. The second version after year 2 will include Windows operating system support for algorithm development, extended support for multichannel AD/DA-converters on the Beaglebone black and runtime support for the ARM-M4 microcontroller platform. The third version after year 3 will includes an extended set of algorithms for extensive subjective evaluations by the community. The fourth and fifth version will include development kit updates based on the feedback of the community as well as updated versions of the algorithms and new experimental algorithms. The software deliverables will be

underpinned by scientific publications on the design of the platform as well as on the algorithms and evaluation results.

The project would take 5 years to complete and will be organized towards completing relevant milestones listed in Table 1.

Time table and milestones	Year 1	Year 2	Year 3	Year 4	Year 5
M1: First version of community platform (SD,R) Fully functional version that allows algorithm development under Linux on PC platforms, provides Linux realtime runtime support for PC and Beaglebone black ARM platforms, and includes a set of realtime algorithms that is based on the latest set of Master Hearing Aid algorithms [1-4]	▲				
M2: Second version of community platform (SD,TP) Additional Windows operating system support for algorithm development, extended support for multichannel (6/4 channel) AD/DA-converters on the Beaglebone black and runtime support for the ARM-		▲			
M3: Third version of community platform (SD,2xP) Final version including an extended set of algorithms for extensive subjective evaluations by the community			▲		
M4: Fourth version of community platform (SD,P) Development kit updates based on the feedback of the community as well as updated versions of the algorithms and new experimental algorithms				▲	
M5: Fifth version of community platform (SD,P) Development kit updates based on the feedback of the community as well as updated versions of the algorithms and new experimental algorithms					▲

Table 1: Time line, list of milestones and specification of deliverables. SD: Software deliverable; R: Report, P: Publication, TP: Technical Paper.

References

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