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Fraunhofer Institute for Digital Media Technology IDMT

Project Group for Hearing, Speech and Audio Technology of the Fraunhofer IDMT

The Project Group for Hearing, Speech and Audio Technology of the Fraunhofer IDMT was founded in Oldenburg in August 2008 and combines the globally recognized Oldenburg hearing research with the competencies and technologies in the area of digital media developed at the Fraunhofer IDMT. As a partner in the cluster of excellence "Hearing4all", it is the goal of the project group to implement the scientific findings from university fundamental research in new technologies. With their research specialities, the scientists address the needs of customers in the fields of telecommunications, multimedia, health, transport and security technology.

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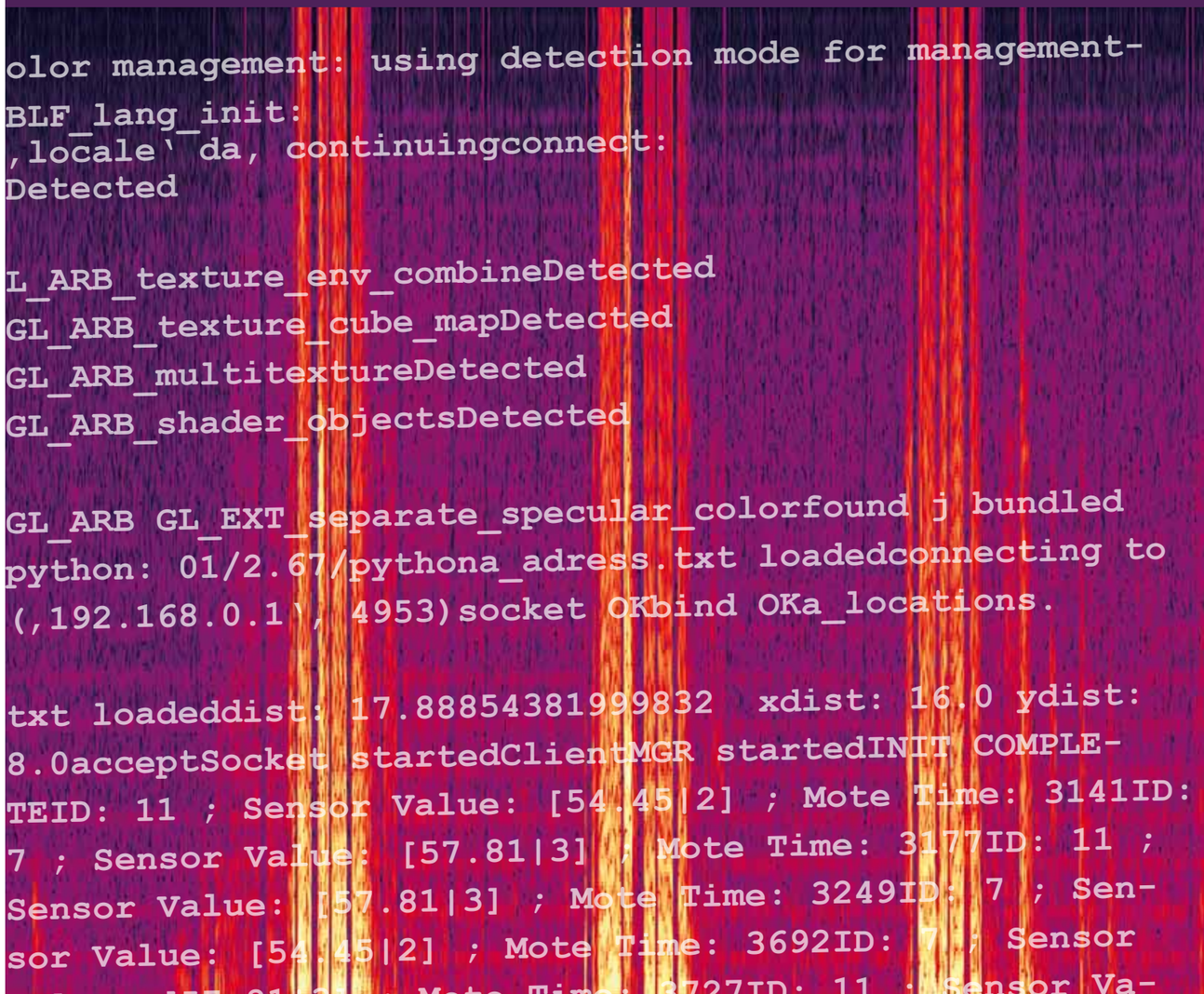
Acoustic Event Detection



The Project Group for Hearing, Speech and Audio Technology develops methods for acoustic event detection on different platforms – ranging from OEM solutions in embedded systems to acoustic monitoring in sensor networks.

Greater safety: Systems for acoustic event recognition are used in inpatient and home care for acoustic monitoring of persons who require assistance. Intelligent sound monitors can recognize dangerous situations such as breaking glass, frequent coughing, falls and cries for help and automatically initiate an emergency call. photo: MEV Verlag GmbH

Acoustic event detection

The Project Group for Hearing, Speech and Audio Technology of the Fraunhofer IDMT develops computer-based methods for acoustic event recognition – from recognition of individual acoustic events to analysis of complex scenarios. One main focus of research is safety systems in the care field. These systems automatically recognize emergency situations on the basis of calls for help, crying, whimpering or falls. New technological application fields are opened up through the use of acoustic monitoring in industrial production, buildings and public spaces. As part of corresponding research projects, scientists investigate the potential solutions and methods that will allow use of acoustic data in networked buildings and cities for applications in the fields of security, traffic management and energy efficiency.

Auditory models

The research scientists work on event recognizers, which separate and classify acoustic events from background noise in real time. Preprocessing of the audio signal is modeled here on the auditory processing of human hearing. Current scientific findings from psychoacoustic and psychophysical fundamental research are used to develop algorithms with a minimum false recognition rate. The detection methods are characterized by high reliability and robustness towards interference noise and environmental influences even with ambient installation of microphones in a room or when there is a large distance between the event and microphone.

Scalable recognizer systems

On the basis of a wide portfolio of characteristics that describe acoustic signals, the scientists are able to adapt the recognizer systems to application-specific requirements even with a small amount of training data. The applications extend from recognition of characteristic individual events or person recognition through to analysis of whole scenarios. The inaudible, low-frequency range from 3 - 50 Hz can also be used for event detection, such as rumbling or impacts in technical applications.

Optimized signal acquisition

The project group develops different technologies for signal acquisition and enhancement. Depending on the acoustic requirements, either simple microphones or ambient arrays with a large number of different microphone types are used. The signal is first optimized for processing in the event recognizer by single- or multi-channel signal preprocessing such as direction filtering (beamforming), echo reduction, reverberation suppression or signal equalization. FPGA-based hardware components permit practically latency-free transmission via internet protocol even for multi-channel signals and over long distances, e.g. for isosynchronous transmission for localization in sensor networks.

Signal processing in embedded systems

The recognition algorithms developed by the project group are capable of running on different platforms, so that integration in existing applications and terminal devices is easily possible. If recognizer systems are implemented on DSP or ARM processors, all processing tasks can be performed in the device and an internet connection is not required. This means that the systems can also be used in areas with high requirements with respect to data security and privacy.

Contract research

- Development of application-specific recognizer technologies
- Adaptation of the signal characteristic portfolio
- Microphoning and adaptation to acoustic influences
- Signal preprocessing methods
- Implementation in embedded systems

Greater energy efficiency: In public buildings such as shopping malls or airports, acoustic data can be used to determine the number of people present and correspondingly adjust the air conditioning, heating and lighting. Recognition of security-critical situations or traffic management are further application scenarios for acoustic sensor networks in public spaces. photo: Thinkstock.de