Automatic Speech Acquisition and Recognition for Spacesuit Audio Systems

Enables voice recognition technology in noisy and reverberant environments

NASA has a widely recognized but unmet need for novel human-machine interface technologies that can facilitate communication during astronaut extravehicular activities (EVAs), when loud noises and strong reverberations inside spacesuits make communication challenging. WeVoice, Inc., has developed a multichannel signal-processing method for speech acquisition in noisy and reverberant environments that enables automatic speech recognition (ASR) technology inside spacesuits. The technology reduces noise by exploiting differences between the statistical nature of signals (i.e., speech) and noise that exists in the spatial and temporal domains. As a result, ASR accuracy can be improved to the level at which crewmembers will find the speech interface useful.

System components and features include beam forming/multichannel noise reduction, single-channel noise reduction, speech feature extraction, feature transformation and normalization, feature compression, and ASR decoding. Arithmetic complexity models were developed and will help designers of real-time ASR systems select proper tasks when confronted with constraints in computational resources. In Phase I of the project, WeVoice validated the technology. The company further refined the technology in Phase II and developed a prototype for testing and use by suited astronauts.

Applications

NASA

- Voice command rover navigation systems
- Voice-controlled robots
- Voice entry for information search and retrieval
- Dictation systems
- Data entry systems
- In-helmet voice communications

Commercial

- Mobile phones
- Automotive devices
- Home electronics and appliances
- Video games and toys
- Information and computer systems used by disabled persons
- Speech-driven intelligent systems used in military environments

Phase II Objectives

- Collect multichannel speech data from inside spacesuits under various working conditions
- Analyze and minimize scientific and engineering uncertainties regarding in-suit speech recognition
- Gain knowledge about next-generation spacesuit processing systems to define a more intuitive and easy-to-memorize set of dialog commands
- Study the architecture of the proposed speech-command interface for spacesuit processing systems and design a prototype
- Explore and suggest appropriate computer processing devices that can implement the developed in-suit speech-command interface
- Implement the interface with a real-time system and demonstrate its performance

Benefits

- Efficient
- Compact
- Lightweight
- High performance

Firm Contact

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