Title of Project : Deployment of Robot Audition Toward Understanding Real World

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Research Area : Informatics, Intelligent Robotics
Keyword : Robot Audition, Computational Auditory Scene Analysis, Prince Shotoku Robot

【Purpose and Background of the Research】

Robot audition is mandatory for symbiosis between humans and robots because our main sensors are vision and audition in our daily life. We are developing robot audition software that can listen to several things at once. The resulting software called HARK is open-sourced for academia and has been applied to a robot that can listen to three simultaneous meal orders and to a musical robot that can play ensemble by cancelling its own playing sounds and improving the beat-tracking of human performance. For further applications, robot audition should be more robust against more realistic environments, e.g., in-door and out-door, moving sound sources, and moving robots (Fig.1).
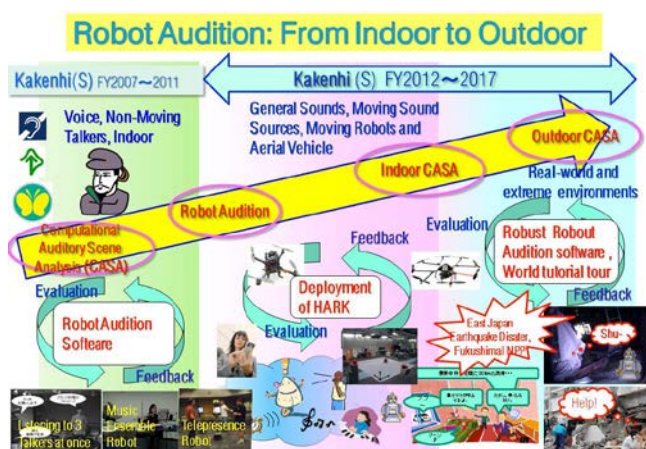

Fig. 1 Deployment of Robot Audition

【Research Methods】

The project consists of four work packages (WPs).
【 WP1 】 Deployment to various microphone configuration: e.g., synchronization of distributed microphone arrays, fewer microphones with less performance degradation.
【WP2】 Deployment from in-door to out-door: e.g., capturing sounds and localization by unmanned aerial vehicle (UAV), ego-noise cancelation for moving robots and UAV.
【WP3】 Deployment from voice to music and environmental sounds: e.g., non-parametric Bayesian signal processing, bioacoustics with sound-to-light conversion devices, real-time separation of musical instrumental sounds, automatic onomatopoeia recognition of environmental sounds.
【 WP4 】 Deployment to real and extreme environments: e.g., fiberscope with microphones and visualization of auditory scene

By these 4 WPs, various kinds of software including enhanced HARK will be released and robot audition will be made as popular as vision through worldwide tour of HARK tutorials.

【Expected Research Achievements and Scientific Significance】

The main expected results include robot audition software HARK that will enable robots all over the world to "Prince Shotoku Robots" that can listen to several things at once. Since HARK will cover various configuration and auditory environemnts, it is expected to improve hearing capabilities of various systems including life innovation for supporting elderly and hearing-weak and impaired people and safe and secure societies for audio-visual surveillance.

【Publications Relevant to the Project】

1) Nakadai, K., Takahashi, T., Okuno, H.G., Nakajima, H., Hasegawa, Y., and Tsujino, H.: Design and Implementation of Robot Audition System "HARK", Advanced Robotics, **24**:5-6 (2010) 739-761. doi:10.1163/016918610X493561
2) Nakadai, K. Miyashita T., and Okuno, H.G. (Eds.) Special Issue on Robot Audition, Journal of Robotic Society of Japan, **28**:1 (Jan. 2010) p.1~42 doi:10.7210/jrsj.28.6

【Term of Project】 FY2012-2016

【Budget Allocation】 167,800 Thousand Yen

【Homepage Address and Other Contact Information】

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