

NICT Projects on Networked Robots

National Institute of Information and Communications Technology



Multimodal dialogues with robots: Language processing using non-linguistic information is challenging

Smartphone and other consumer devices

Language processing using non-linguistic information gives benefit

cf. Market size of speech recognition
 ¥88B@2013 → **¥170B@2018 (£ 1B)***

Show me today's schedule

Sushi restaurants around here



Benefit for QA/search

GPS

Contacts

Other context info.

* Estimation by NEDO, TSC Foresight Vol.8, 2015

Current communication with robots

Limited multi-modality and scalability in robot intelligence

Is there any milk in the fridge?

Throw them away.



??

??



cf. [Steels 2003, Roy 2005, Iwahashi 2007, Kollar+ 2010, Yu+ 2013]

Key Question:

How can we make robot intelligence scalable and multimodal ?

Major speech recognition engines are trained with large-scale corpora (>1000 hours $\hat{=}$ 100M utterances), and **continuously improved** as cloud services



Can we make such innovations in robotics?

- Training with large-scale datasets and continuous improvements in e.g. dialogues, object recognition, grasping, simulation, ...



RoboCup@Home: Target user scenario with service robots



XIMERA 3
(by NICT)

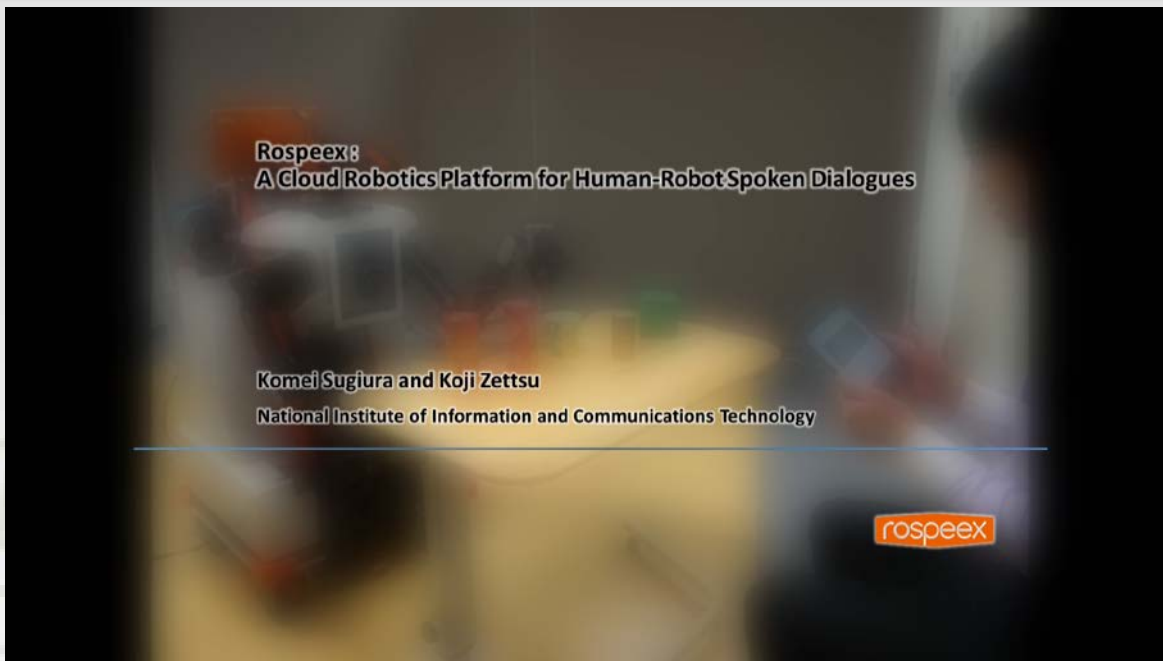


Voice talent

cf. [Sugiura+ ICRA2014]

(1) Rospeex:

We built a cloud robotics platform for multilingual dialogues*

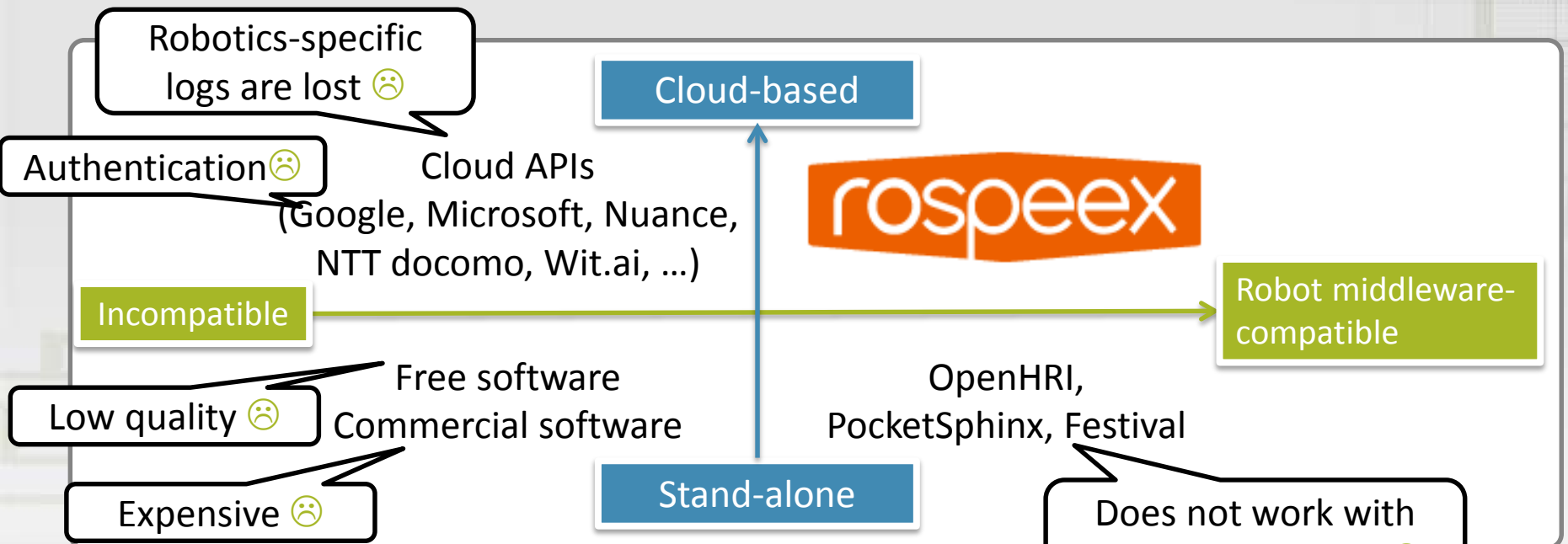


Python & C++ samples
are available

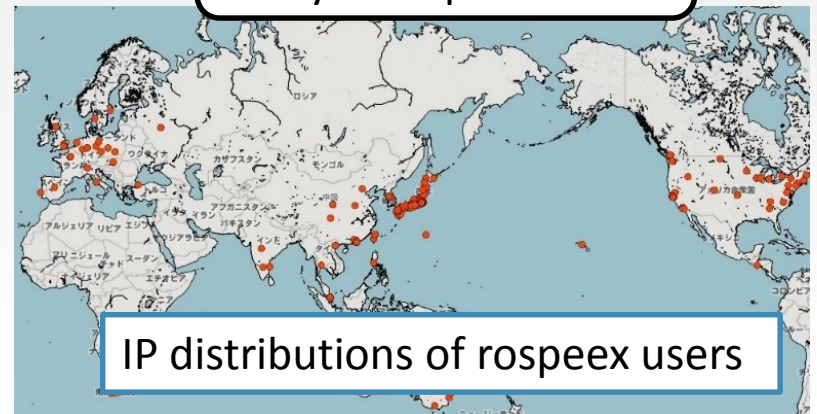
- **30,000 unique users** since Sep. 2013
- **Non-monologue speech synthesis designed for robots** [Sugiura+ 2014]
- **Multilingual speech recognition and synthesis**

* Research/development-use only

Rospeex's positioning in robot dialogue quadrants



Rospeex has been applied to:
Humanoids, web agents, conversational robots with elderly people, automotive navigation systems, smart-home interface



(2) Building domestic service robots (1st places in 2008 & 2010, 2nd places in 2009 & 2012)

- **RoboCup@Home: The largest competition for domestic service robots**
 - Focuses on **human-robot interaction** and mobile manipulation
- **Challenges**
 - Navigation in unknown environments (e.g. real shop), handling everyday objects, spoken dialogues in very noisy environments (75dBA), ...
- **cf. Social impacts of other RoboCup leagues**
 - RoboCupRescue: Fukushima Power plant investigation
 - Aldebaran sold >1000 NAO robots and bought by Softbank @US\$ 100M, ...

