ITU KALEIDOSCOPE ONLINE 2021

6-10 December 2021

Exploring the Essence of Communication to Reach the Heart

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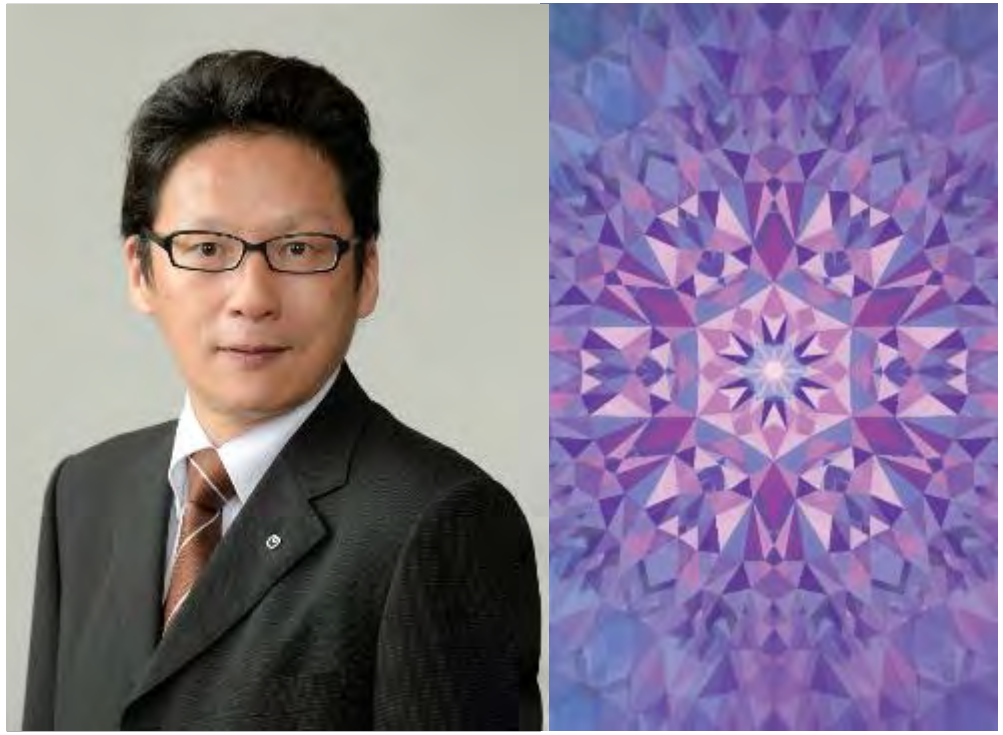

Day 4 – Thursday, 9 December 2021
(Time zone - UTC+1)

12:00-12:30

Keynote session

NTT R&D organization

2,300 researchers

$1.0 billion invested

18,000+ patents granted

10 consecutive years Received Derwent Top 100 Global Innovators by Clarivate Analytics

NTT IOWN Integrated Innovation Center	NTT Network Innovation Center
	NTT Software Innovation Center
	NTT Device Innovation Center
NTT Service Innovation Laboratory Group	NTT Human Informatics Laboratories
	NTT Social Informatics Laboratories
	NTT Computer and Data Science Laboratories
NTT Information Network Laboratory Group	NTT Network Service Systems Laboratories
	NTT Access Network Service Systems Laboratories
	NTT Space Environment and Energy Laboratories
NTT Science and Core Technology Laboratory Group	NTT Network Innovation Laboratories
	NTT Device Technology Laboratories
	NTT Communication Science Laboratories
	NTT Basic Research Laboratories

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NTT CS Labs. 30th 30th ANNIVERSARY

founded on July 4, 1991

The mission of NTT Communication Science Laboratories

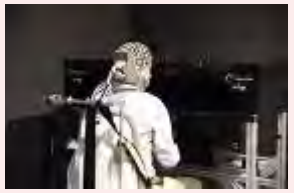
NTT

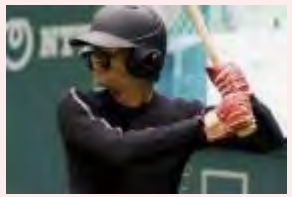
NTT CS Labs. 30th 30th ANNIVERSARY

Human

deep understanding of humans

Brain



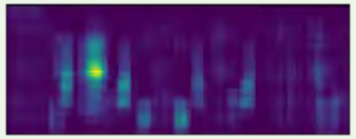


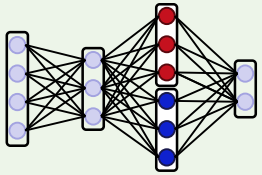
SBS

Communication that reaches the heart

approaching human abilities

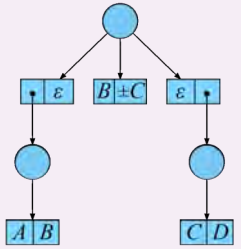
Media





Knowledge

MLC



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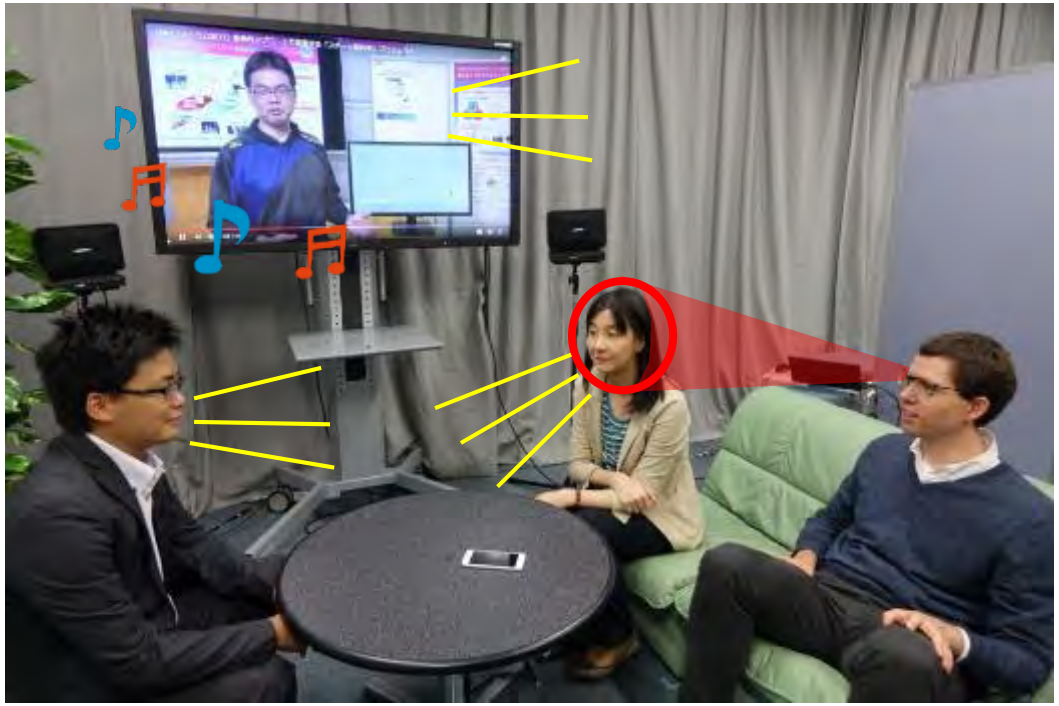
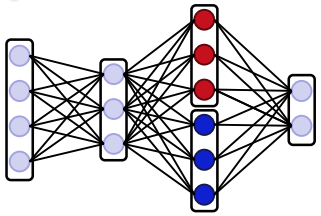
ITU

SpeakerBeam: Computational selective listening based on deep learning



Humans are good at selective listening.

SpeakerBeam



The voice of the target speaker can be extracted simply by teaching the characteristics of the voice.

Voice Conversion: Converting impression and intelligibility of speech

Sender

Voice conversion modifies speech signals to one's desired form of expression without changing the content

Receiver

It not only makes communication smoother but also creates new forms of communication that extend human vocal and auditory functions.

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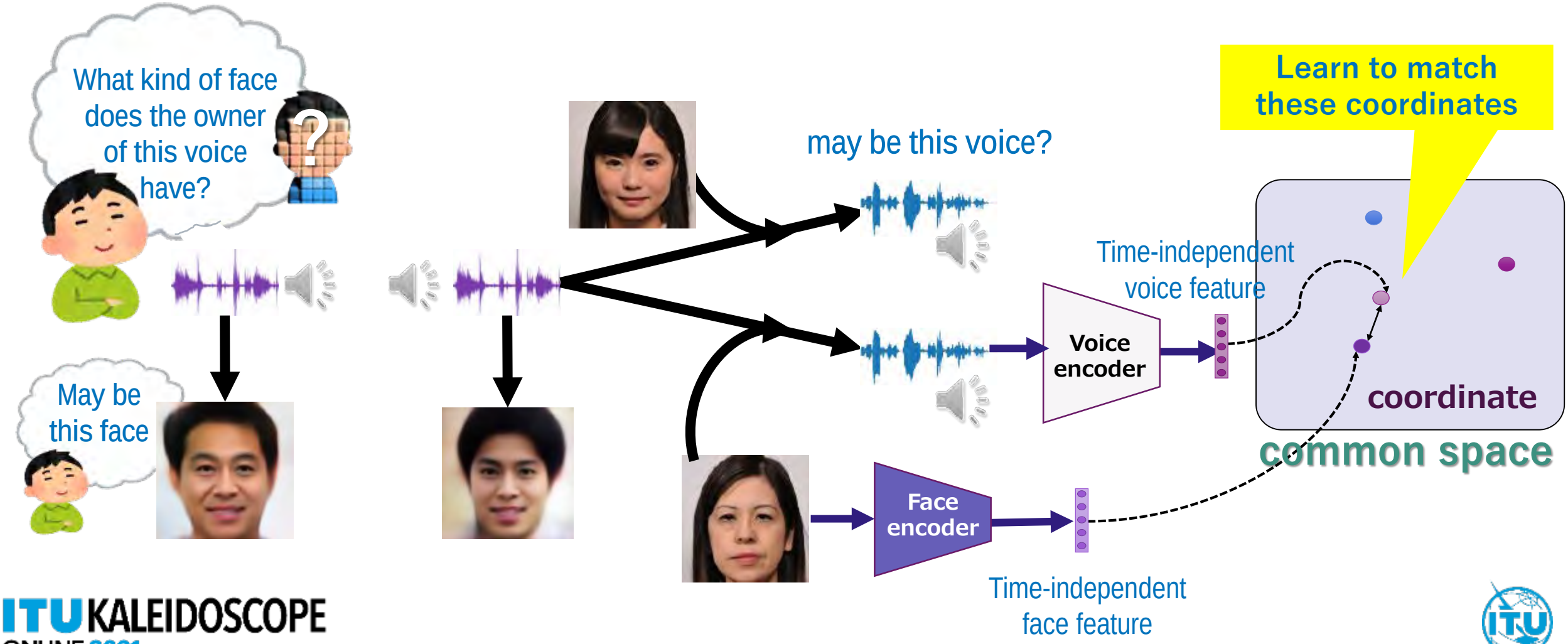
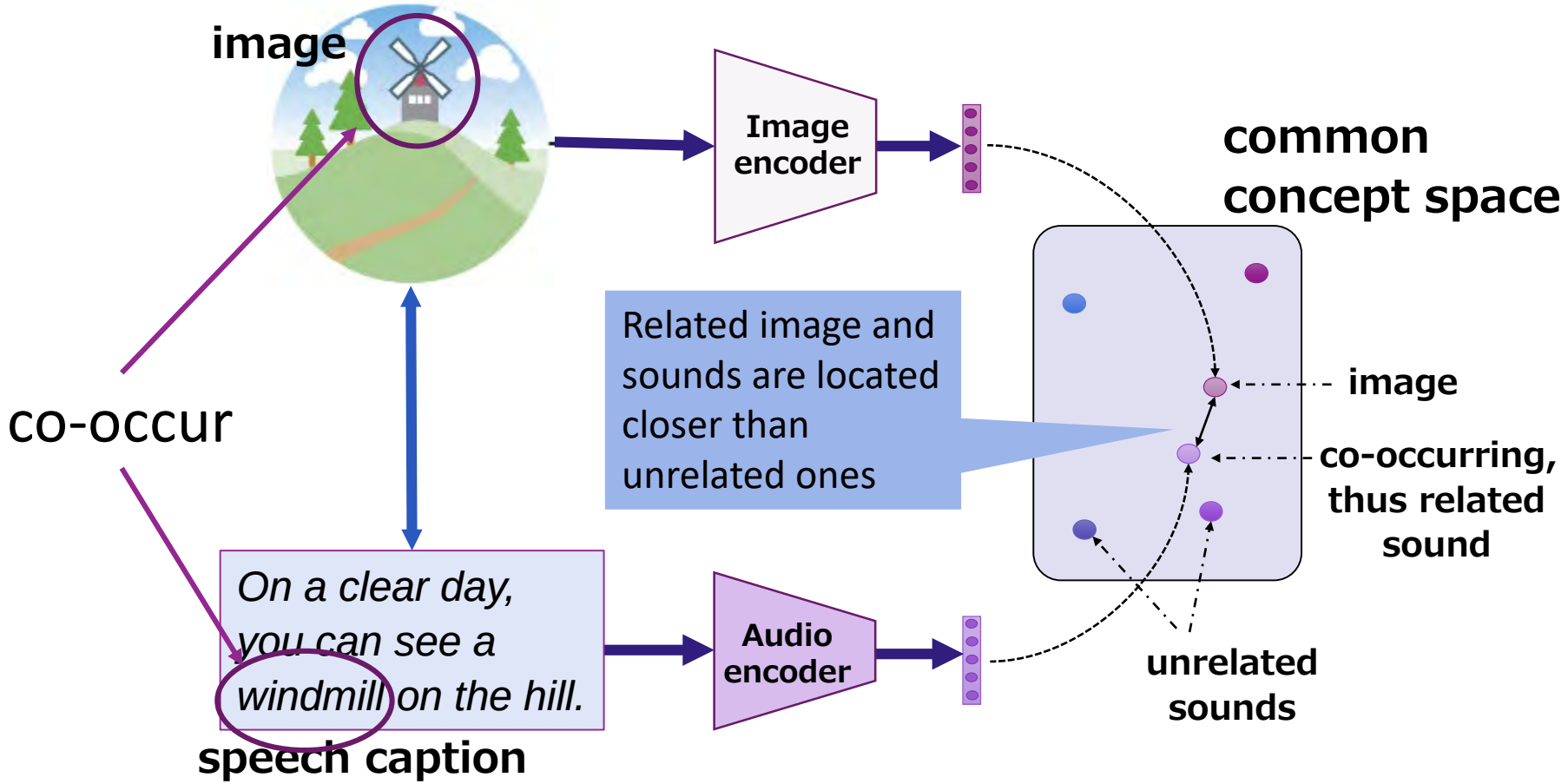
Cross-modal voice conversion



Building common space by multiple encoders for concept acquisition



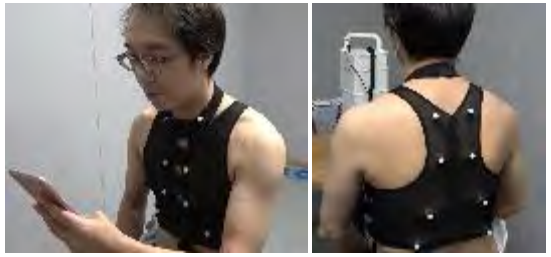
a big windmill

Image object and word originating from the same 'thing' tend to co-occur in many samples.

Tele-stethoscope

conventional stethoscope

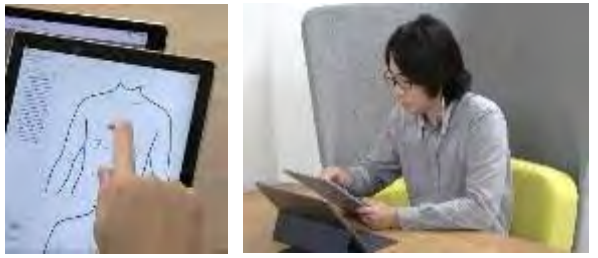
Patient



network

A doctor can listen to sounds coming from various parts of the patient's body.

Doctor



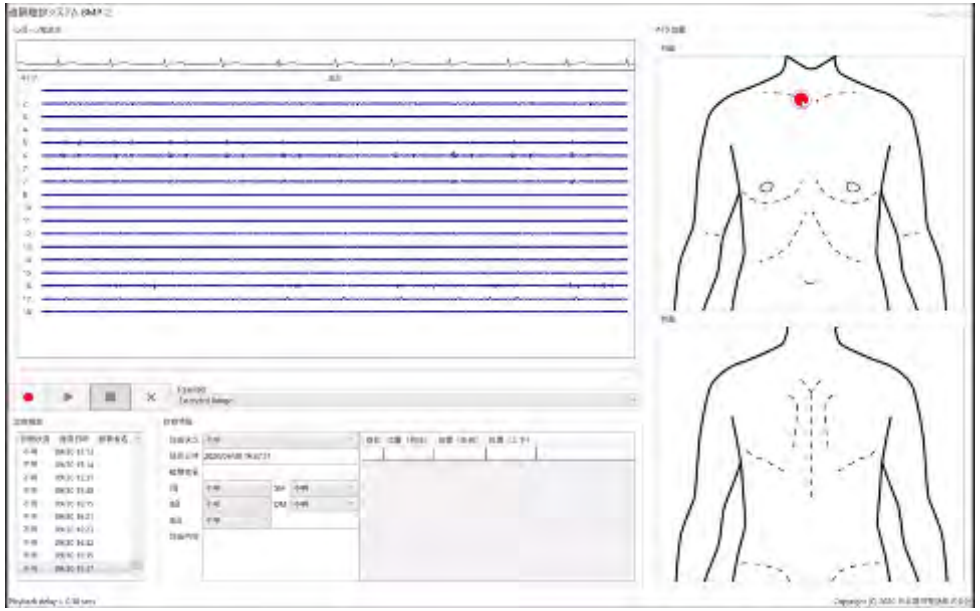
no direct physical contact with the patient

An examination vest is equipped with multi-channel* acoustic sensors.

Examination Vest

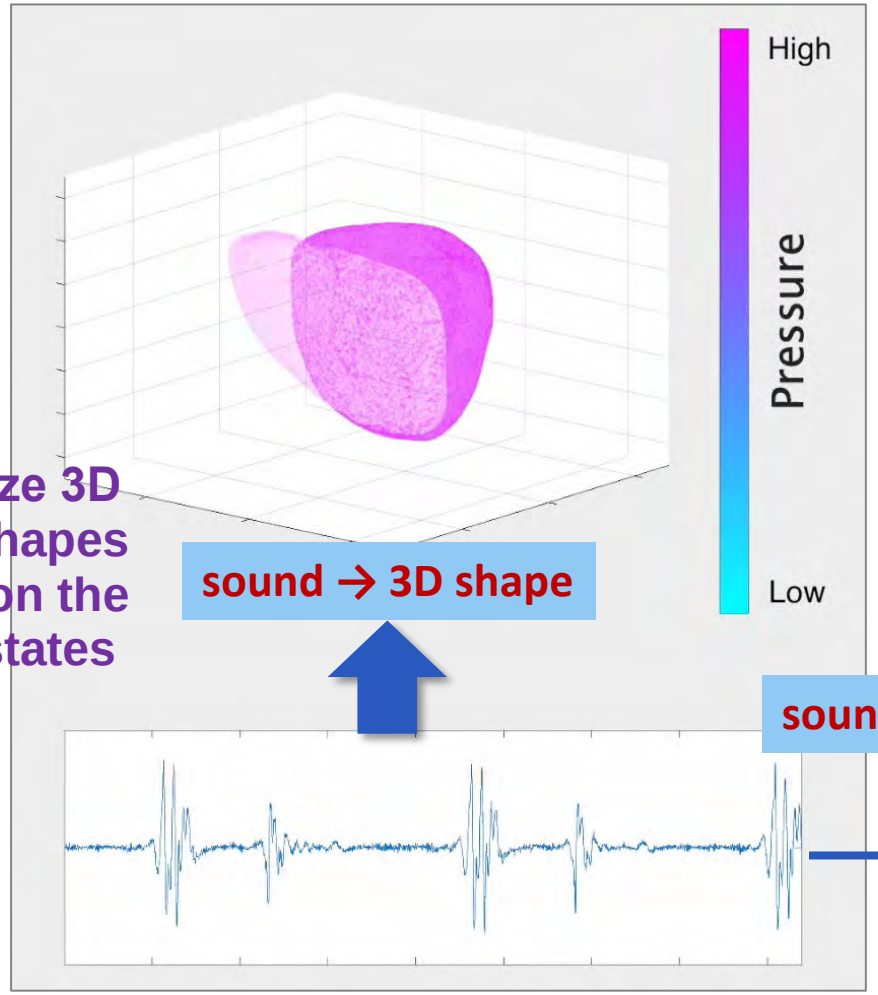
front back

sensor



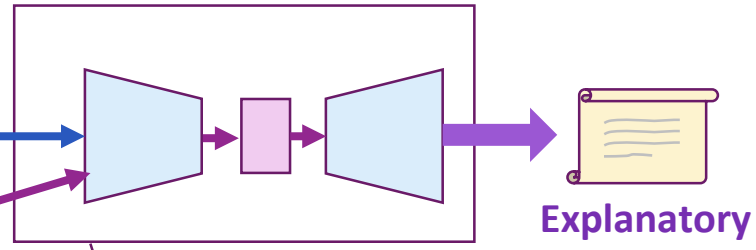
*18 acoustic channels and 1 electrocardiogram (ECG) channel

From tele-stethoscope to AI stethoscope



Visualize 3D heart shapes based on the heart states

Explain the meaning of the sounds in text



Specificity
controls amount of information in the output sentences

Explanatory sentences

Conditional sequence-to-sequence caption generator (sound-to-sentence translator)

Examples

- Low specificity: The heart sounds are abnormal.
- High specificity: The heart sounds are abnormal. There may be a problem with one of the heart valves. The 1st sound is normal, and the 2nd sound is split.

Remote Haptic Communication

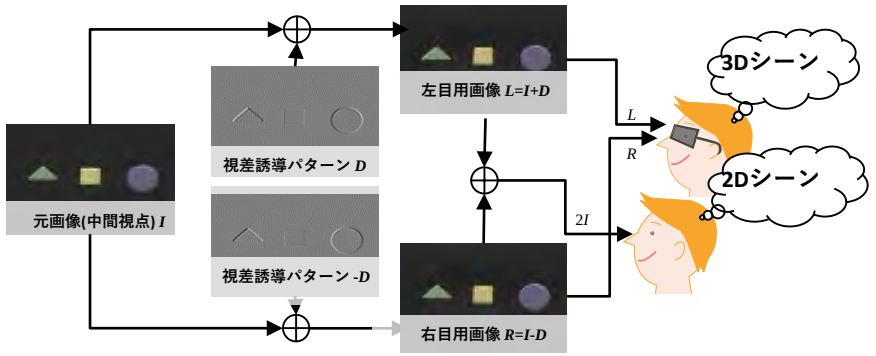
Vibrotactile Telephone Lite

Ultra-Future Sensory Public Phone

Implementing perceptual illusions into the real world

変幻灯 Hengento (2015)

HiddenStereo (2017)

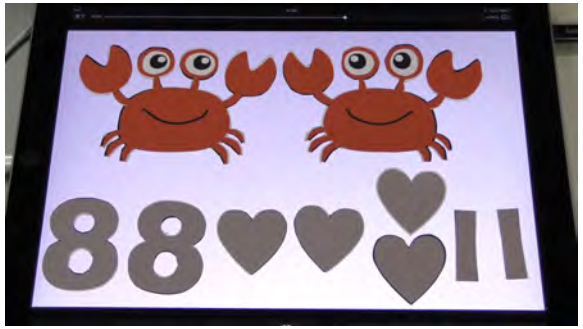


ぶるなび 1 Buru-Navi 1 (2007)

ぶるなび 4 Buru-Navi 4 (2017)

浮像 Ukuzo(2018)

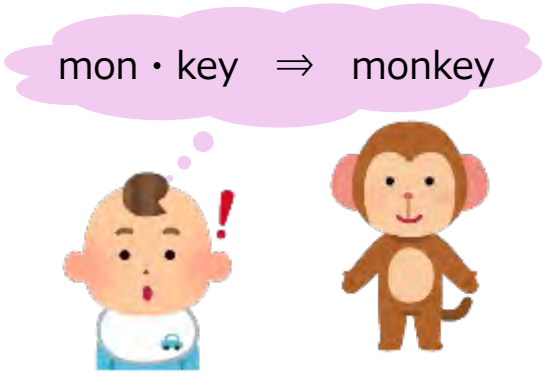
Danswing Papers (2019)



Velvet hand illusion (2021)

Language development of infants

Picture books supervised by NTT CSL have achieved 280,000 copies in total.



Do human infants autonomously learn from the co-occurrence of phenomena in the natural world?

理解		
順位	項目	月齢
1	自分の名前	6.95
2	バイバイ	8.69
3	いないいないばー	9.20
4	おいで	9.42
5	ママ	9.76
6	まんま	9.94
7	ちょうだい	10.19
8	どうぞ	10.22
9	おっぱい	10.38
10	あーん	10.42
11	いただきます	10.51
12	パパ	10.85
13	抱っこ	11.17
14	ごちそうさま	11.26
15	ごはん(食事)	11.30

発話		
順位	項目	月齢
1	いないいないばー	14.15
2	まんま	14.34
3	ママ	15.38
4	わんわん(犬)	15.49
5	はい	16.34
6	パパ	16.54
7	あっ	16.80
8	バイバイ	16.83
9	あーあ	16.93
10	アンパンマン	17.83
11	イヤ	18.10
12	ねんね	18.17
13	ぶっぶー(車)	18.32
14	にゃんにゃん	18.46
15	あーん	18.78

2017

2017

2018

2018

2018

2019

child vocabulary development database

Printed books stimulate five senses

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Personalized Picture Book

Designed by Akio Kashiwara
and NTT Print Corp.

Target Age: 1-2 years of age

Enter information about a child at:
https://ehon.nttprint.com

- **child's name and gender**
- **favorite objects**
- **vocabulary checklist**

Child Vocabulary Development Database

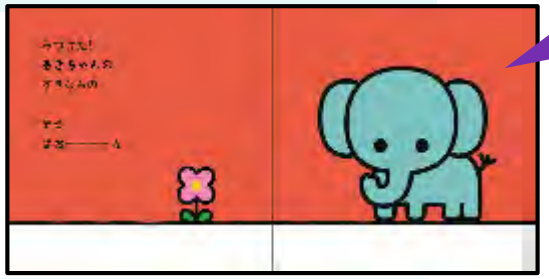
1. A main character is set to match the child's name and gender

Hiro-kun (boy)

Aki-chan (girl)

2. The story is customized to match the child's interests

Dog story



Elephant story

3. Words with pictures that the child is just about to learn are selected

elephant **ant** **ladybug**

butterfly **cat** **monkey**

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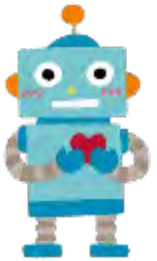
Conclusion

What it means to be a human? is an ultimate question



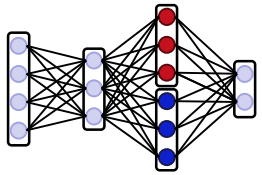
Study illusions provide important clues to understanding the brain functions of humans

The way we interact with other people is changing

COVID-19

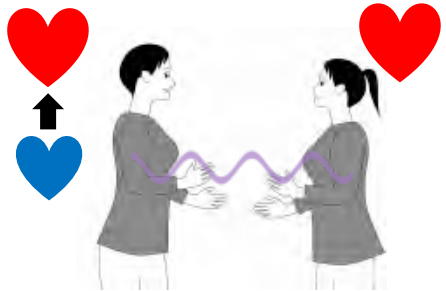
Pursue the possibilities of new communication media

Technologies are approaching toward human intelligence



Challenge the technical limits toward approaching human intelligence

Reach out and touch someone's heart



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Thank you!