Enjoyable Conversation System

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2016.7.15
1973 WABOT-1

The First Conv. RT

1984 WABOT-2

1997 Hadaly-2

1998 R

1999 ROBITA

Group Convers

Eye-contact

Body expression

History of CONV. RT

1970

1980

1990

July. 15, 2016
I’d like to talk about:

1. Be **Talkative**:  
   - Framework to add one more comment to the usual answer.

2. Be **Attentive**:  
   - Framework to balance the engagement density of group communication.
Robot Vision
Subjects

EXTERNAL TRIGGER: "TSUGI"
BEHAVIOR: REACT TO LEVEL

2006-09 @Care Town KODAIRA
What elderly people enjoyed

1. Unexpected/surprising utterances
   Oh! Robot speaks such things !!

2. Addressing to him/her
   Oh! Robot talked to me !!
Add ONE MORE comment
Unexpected/surprising utterances

Enjoyable system should be Talkative !!
Chaining of Episodes

Tedious guy replies to only what he was asked.

Proposal: Add “+α” comment

Q: Which actor/actress do you like best, Robisuke?
A: I like Audrey Hepburn, best.
   Roman Holiday is my favorite. (+α)
   I love the scene of “Mouth of Truth” (+α)
   Liar will lose his hand when he XXXXX (+α)
   ....
Chaining Episodes

- Roman Holidays
  - Main actor: Gregory Peck
  - Main actress: Audrey Hepburn
  - Director: William Wyler

- Breakfast at Tiffany's
  - Main actress: Audrey Hepburn

Factoid information
Chaining Episodes

... Joe and Anya on a scooter ride through Rome ...

... pretending to have lost his hand to the Mouth of Truth...

Gregory Peck

Roman Holidays

Main actor

Representative movie

Director

Episode

Episode

Audrey Hepburn

Main actress

Representative movie

Main actress

Breakfast at Tiffany's

Episode

... she is awakened by new neighbor Paul Varjak ...

William Wyler

... pretending to have lost his hand to the Mouth of Truth...

Non-factoid information

Factoid information
Automatic Sentence Generation

1. Collect sentences from review sites.
2. Extract the subjectively informative parts (using Conditional Random Fields).
3. Change style from written to spoken
4. Ranking & select
   • Sentence length (not so long = easy to speak)
   • TF-IDF of nouns (high = topic related)
   • Number of adjectives
     (many = quantitatively more informative)
   • Frequency of adjectives
     (low = qualitatively more informative)

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Enjoyable conversation system @ interACT
Facilitation: balance maintenance of ENGAGEMENT DENSITY Addressing to everyone

Enjoyable system should be Attentive/thoughtful !!
What is engagement density

Frequently speaking Participants
= High engagement density

Silent participant
= Low engagement density
= feel difficulty to join in the conversation

Harmonic Party

in group conversation situation,

Non-Harmonic
Problem: imbalance of engagement density

- Silent participant need help to join in the conversation.
- Harmonic party may not recognize the situation.
Theme:
make an agent to balance engagement density.

Harmonic Party

System

Silent participant = left behind
Speaking to silent participant directly...

Harmonic Party

System

Silent participant = left behind
... cause another problem

Harmonic Party

System

Silent participant = left behind

Direct action disturb the total harmony.

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Enjoyable conversation system @ interACT
Speak to harmonic party, first

Harmonic Party

Silent participant = left behind

System
Join in the harmonic party

Harmonic Party

System

Silent participant = left behind
Then, speak to silent participant

Harmonic Party

System

Silent participant = left behind
Then, all participants are in a big HP System Haro

mic Party

System
Rules to interrupt

Did you see “FROZEN”?  

Silent participant = left behind

System
Rules to interrupt

Did you see "FROZEN"?

Do you see Action movie?

Silent participant = left behind

Enjoyable conversation system @ interACT
Rules to interrupt

Did you see “FROZEN”?

Yah, I’ve enjoyed.

Silent participant = left behind

System
Rules to interrupt

Did you see "FROZEN"?

Yah, I’ve enjoyed.

Disney is always Good.

Silent participant = left behind

System
Did you see “FROZEN”? 

Yah, I’ve enjoyed.

Disney is always Good

By the way, Do you see Action Movie?

Silent participant = left behind

A

B

C

Enjoyable conversation system @ interACT
Rules to interrupt

Did you see “FROZEN”? 

Yah, I’ve enjoyed Disney is always Good

By the way, Do you see Action Movie? 

I don’t like it
Rules to interrupt

Did you see “FROZEN”? 

Yah, I’ve enjoyed it.
I don’t like it.

Disney is always Good.

By the way, Do you see Action Movie?

Recognizing CONVERSATIONAL MOVE

Do you like Action movie?

System

Silent participant = left behind
State transition to get initiative

Non-Harmonic

Closed

Open

RT has right to speak to HP

Non-Initiative

Harmonic

Initiative (own the right to speak anyone)

State of the Robot

HP: Harmonic Party

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Enjoyable conversation system @ interACT
State transition to get initiative

HP: Harmonic Party

- Non-Harmonic
  - Closed
  - Open
  - Non-Initiative
    - (own the right to speak anyone)
  - Harmonic
    - Initiative
State transition to get initiative

Non-Harmonic

Closed

Eliciting
from HP to HP

Open

Non-Initiative

Harmonic

Initiative

(own the right to speak anyone)

HP: Harmonic Party

Enjoyable conversation system @ interACT
State transition to get initiative

HP: Harmonic Party

Non-Harmonic

Closed

Eliciting from HP to HP

Open

Response from HP to HP

Non-Initiative

Harmonic (own the right to speak anyone)

Initiative
State transition to get initiative

HP: Harmonic Party

Non-Harmonic

Closed

Eliciting from HP to HP

Response from HP to HP

Open

Non-Initiative

Harmonic

(own the right to speak anyone)

Initiative

Enjoyable conversation system @ interACT
State transition to get initiative

HP: Harmonic Party

Non-Harmonic

Closed

Eliciting from HP to HP

Response from HP to HP

Open

Non-Initiative

Harmonic

Initiative

(own the right to speak anyone)
State transition to get initiative

Non-Harmonic

Closed

Response from HP to HP

Eliciting from HP to HP

Open

Eliciting/Initiation from RT to HP

Harmonic

Non-Initiative

(own the right to speak anyone)

Initiative

Harmonic Party

Enjoyable conversation system @ interACT
State transition to get initiative

- **Non-Harmonic**
  - Closed
- **Open**
- **Eliciting**
  - from HP to HP
- **Eliciting/Initiation**
  - from RT to HP
- **Response**
  - from HP to HP
- **Non-Initiative**
- **Initiative**
  - (own the right to speak anyone)

- **Ignored**

HP: Harmonic Party
State transition to get initiative

Closed

Open

Non-Harmonic

Response/Follow up from HP to RT

Response/Follow up from HP to RT

Eliciting/Initiation from RT to HP

Non-Initiative

Ignored

Eliciting from HP to HP

Response from HP to HP

Harmonic

Initiative (own the right to speak anyone)

HP: Harmonic Party

Enjoyable conversation system @ interACT
Control Strategies

POMDP: Partially Observable Markov Decision Process

States of a Target Person

Participants' Actions

Timestamp t

R(Sh, Sm, Ap, As)

Timestamp t + 1

R' (S'h, S'm, A'p, A's)

R

S

Sh

Sm

Ap

O

States of Harmony

O'
Belief State Update

\[ b'(s'_m, a'_m) = \eta \cdot P(o'|s'_m, a'_p, a_s) \cdot P(s'_m | a_s) \cdot \sum_{a_p} P(a'_p | s'_h, a_p, a_s) \]

\[ \cdot \sum_{s_h} P(s'_h | s_h, a_p, a_s) \cdot b(s_m, a_m) \]

**Observation model**

**Motivation model**

**Participants’ action model**

**Harmony model**

- \( s_h \): State of harmony
- \( s_m \): State of a target participant
- \( a_s \): System action
- \( a_p \): Participants’ action

Enjoyable conversation system @ interACT
All participants be “HARMONIC”
All participants be “HARMONIC”
Why Robot?

Role of Body
Role of eye gaze
Role of para-linguistic information
Group conversation

Human-Machine Conversation in a group situation

MULTI node communication with PUBLIC NETWORK

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Enjoyable conversation system @ interACT
Conversation is COMMUNICATION

Conversational Communication in a group

Data Communication in a network

Linguistic Info.

Message

Facilitation:
Is situation good?

Turn control:
Who has right to speak?

Reliable & speedy transmission:
Did transmission succeed/not?

Participation structure:
Who join in the conversation? Who is speaker? Who is addressee?

Application
Session
Protocol
Transport
Data link

Enjoyable conversation system @ interACT
Conversation is COMMUNICATION

Conversational Communication in a group

Data Communication in a network

Linguistic Info.

Visual Information of BODY is important to keep PROTOCOL

Conversation needs human-like BODY as the physical-layer protocol

Facilitation:
Is situation good?

Turn control:
Eye gaze

Reliability:
Body & Face directions

Participation structure:
Who join in the conversation? Who is speaker? Who is addressee?

Data link

Relyable & speedy transmission:
Did transmission succeed/not?
Visit our facebook page at
https://www.facebook.com/
PerceptualComputingLab

... and push “like it”

REFERENCES:
<Overall>
<Day care center domo>

<Enjoyable conversation>

<4 people conv.>
Did you watch movies recently?
Use of Eye Gaze