Analysis Method for One-to-one Discussion Process for Research Progress using Transition Probability of Utterance Types

Seiya Tsuji, Yoko Nishihara (Ritsumeikan Univ., Japan)
Wataru Sunayama (The Univ. of Shiga Prefecture, Japan)
Ryosuke Yamanishi (Kansai Univ., Japan)
Shiho Imashiro (Recruit Management Solutions Co., Ltd., Japan)

Contact: Dr. Yoko Nishihara
(nisihara at fc.ritsumei.ac.jp)

Discussion for each research progress by a student and his/her supervisor

- For each research progress, discussions between a student and his/her supervisor are held.

- Problem to be tackled
  - Due to the time limitation, they often do not come to the common understanding and agreement.
  - It is tough for some of the students to obtaine the skills of discussion and communication.
  - The quality of each discussion is not evaluated.

- **As the quality of each discussion is evaluated**, **they might look back on their discussion** and make a plan to have an improved discussion next time.

Contribution of this paper

- This paper proposes **an evaluation method for one-to-one discussions** between a student and his/her corresponding supervisor.

- The method makes **a model of the discussion process with transition probability of utterance types** to evaluate discussions.

  - Given transcripts of discussions, the method makes a model of discussion process.

Assumption of a good discussion and hypothesis for a good discussion

- We assume **a good discussion to be a discussion in which both the student and the supervisor understand their research progress**.

- We hypothesize that **a good discussion should have characteristic transitions of utterance types**.

Outline of the proposed analysis method

1. Making transcripts of discussions

2. Labelling utterance types to utterances

3. Making a matrix of transition probabilities of labels

4. Making a model of discussion process

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1. Making transcripts of discussions

○ Recorded discussions are written down to transcripts manually.

○ One line has one utterance by one speaker.

Speaker	Utterance
Teacher	Well, let's start the meeting.
Teacher	I'm sure that you have not made a transcription. Did you get recording data?
Student	Yes.
Teacher	Who did you get it from?
Student	From Riko.
Teacher	You got it from Riko. OK.
	(To be continued)

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2. Labelling utterance types to utterances

○ Each utterance is labelled with utterance types manually.

○ One utterance may be labelled with more than two types.

○ We prepared 62 labels of the utterance types for labelling.

○ Table 1 shows 31 labels. The utterances from a student and a supervisor will be distinguished. In total, we use 62 labels.

Table 1 Labels for utterance types.

Greeting, Confirmation, Question, Answer, Agreement, Repetition, Explanation, Opinion, Admiration, Suggestion, Understanding, Topic Shifting, Report, Degression, Soliloquy, Nodding, Request, Planning, Denial, Filler, Consultation, Response, Comment, Advice, Indication, Correction, Wondering, Surprise, Acknowledgement, Chatting, Additional Comment

2. Labelling utterance types to utterances

○ Each utterance is labelled with utterance types manually.

○ We prepared 62 labels of the utterance types for labelling.

Suffixes (T and S) denote speakers.

Speaker	Utterance	Labels
Teacher	Well, let's start the meeting.	Greeting_T
Teacher	I'm sure that you have not made a transcription. Did you get recording data?	Question_T
Student	Yes.	Answer_S
Teacher	Who did you get it from?	Question_T
Student	From Riko.	Answer_S
Teacher	You got it from Riko. OK.	Understanding_T
	(To be continued)	

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3. Making a matrix of transition probabilities of labels (1/2)

○ Suppose that i_{th} utterance has a vector of labels *L(i)* and j_{th} utterance has a vector *L(j)* *(j=i+1)*.

○ $L(i) = \{ln|0 \leq n \leq 61\}$, where $ln = 0$ or 1. ln is a label

○ The transition probability $p_{n,m}$ from the label l_n to l_m is calculated by the equation:

○ $p_{n,m} = \frac{f_{n,m}}{NL-1}$, where *NL* is the number of lines of the transcripts.

3. Making a matrix of transition probabilities of labels (2/2)

○ Example of a part of matrix of transition probabilities of labels

/	Greeting_T	Question_T	Understanding_T	Suggestion_T	Confirmation_T	Answer_S	Repetition_S	Agreement_S	Question_S
Greeting_T	0	0	0	0	0	0	0	0	0
Question_T	0	0	0	0	0	0.082	0	3	0
Understanding_T	0	0	0	0	0	0	0	0	0
Suggestion_T	0	0	0	0	0	0	0	0.014	0.014
Confirmation_T	0	0	0	0	0	0.031	0	5	0
Answer_S	0	0.054	0	0.003	0	0	0	0	0
Repetition_S	0	0	0	0	0	0	0	0	0
Agreement_S	0	3	0	0.008	0.007	0	0	0	0
Question_S	0	0	0	0	0	0	0	0	0

4. Making a model of discussion process

- From the matrix of transition probabilities, transitions with high probabilities are extracted.

- The extracted transitions are connected if the same labels are included in two different transitions.

- The graph of connected transitions is the model of discussion process in this paper.
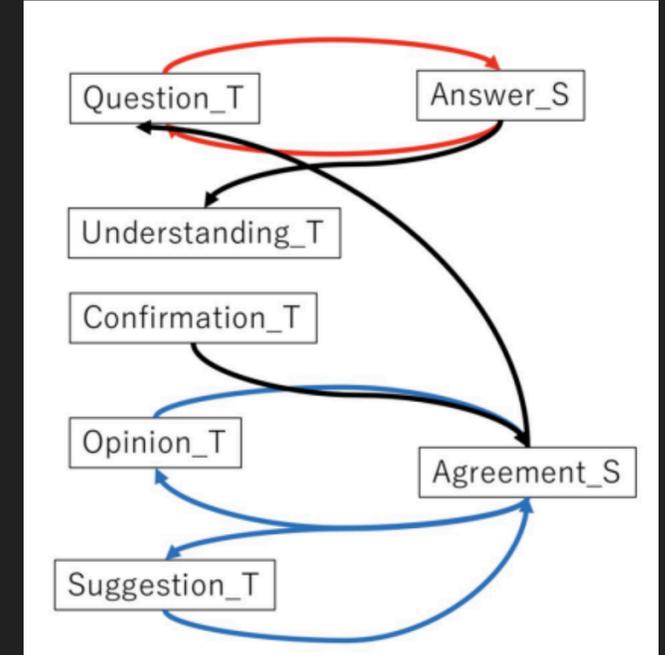
Experiment for our hypothesis

- **We evaluated the hypothesis by the experiment.**
  - In the slide #4, we hypothesized that a good discussion should have characteristic transitions of utterance types.
- Procedures:
  - We made transcripts of discussions.
    - 8 discussions held in spring, 2019
    - 8 students and 2 supervisors. Each discussion was held one-on-one.
    - The students and supervisors belonged to the College of Information Science and Engineering.
  - The transcripts were classified into a good/bad discussion classes.
- Evaluated items:
  - **1. Difference of transitions between good/bad discussions (corresponding to the hypothesis)**
  - 2. Difference of processes between good/bad discussions

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Result 1: Difference of label transitions between good/bad discussions

- **Good discussions had characteristic transitiosns.**
  - Answer_S → Question_T, Agreement_S → Opinion_T, Answer_S → Understanding_T
- Bad discussions also had characteristic transitions.
  - Question_S → Answer_T, Agreement_S → Explanation_T

| Transitions from **high-evaluated** (Prob.)	Transitions from **low-evaluated** (Prob.)
Question_T → Answer_S(0.125)	Question_T → Answer_S(0.083)
Answer_S → Question_T(0.058)	Suggestion_T → Agreement_S(0.044)
Opinion_T → Agreement_S(0.038)	Agreement_S → Suggestion_T(0.039)
Agreement_S → Opinion_T(0.037)	Question_S → Answer_T(0.035)
Suggestion_T → Agreement_S(0.027)	Answer_S → Question_T(0.031)
Confirmation_T → Agreement_S(0.022)	Explanation_T → Understanding_S(0.023)
Agreement_S → Question_T(0.020)	Understanding_S → Opinion_T(0.019)
Answer_S → Understanding_T(0.017)	Answer_S → Suggestion_T(0.017)
Agreement_S → Suggestion_T(0.017)	Agreement_S → Explanation_T(0.017)

We found that good discussions had characteristic transitions of utterance labels.

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Result 2: Difference of discussion process between good/bad discussions

- The model of **good** discussions process showed that **most of the transitions were connected**.

- The model of **bad** discussions process showed that s**ome of the transitions had dead-end paths**.
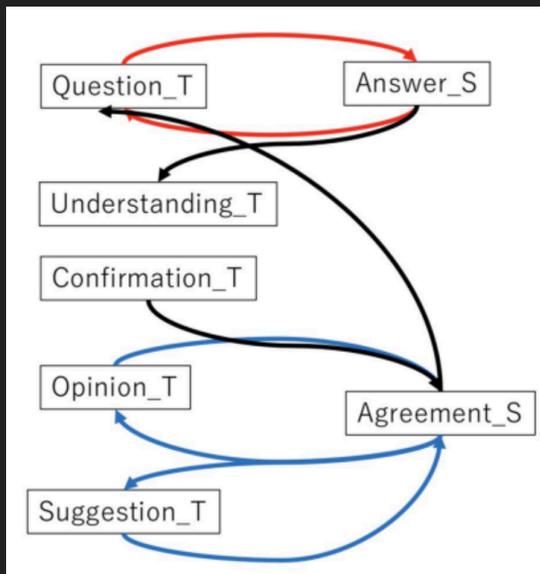
process model of good discussions
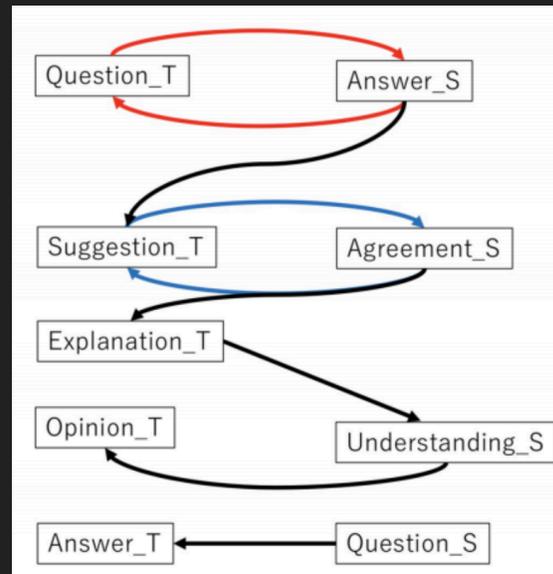
process model of bad discussions

We found that the process model could show the differences of good/bad discussions.

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Conclusions and future work

○ We proposed an evaluation method of one-to-one discussions between students and their corresponding supervisors.

  ○ The proposed method obtain a discussion process model from discussion transcripts by using the labels of utterance types.

○ We found that **good discussions had characteristic transitions of utterance labels.**

  ○ We also found that the process model could show the differences of good/bad discussions.

○ As the future work, we will try to evaluate the growth of discussion skill of a student by using the proposed method.

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