A Topic Suggestion Method Based on the Interests of Each User by Analyzing Conversation Logs

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What should I talk about with someone I've never met before?

01 Purpose of this study

Analyze your daily conversation

↓

Extract topics of interest to you

↓

Suggest the best topic for you

when talking to someone you‘ve never met before !

01 Purpose

purpose - 1	Realization of topic provision **based on user interests**
purpose - 2	**Quantitative evaluation** of user interests
purpose - 3	**Liven up a conversation** with someone you've never met before by providing a topic of conversation

02 Data to be utilized

Utilizing Nagoya University Conversation Data
(Delete unnecessary information, Correction of blurring of notation)

@Data No. n (conversation time)
@Date of collection: xxxx year xxx date
@Location：Conversation location
@Participant No：Gender, Age, Hometown, Location
.
.
@ Participant Relationship: Relationship
articipant number: Conversation content
.
.

%com: Supplementary information
() Affecting words
<laughter or pause> My own laughter, some silence

Cleaning

One conversation / line

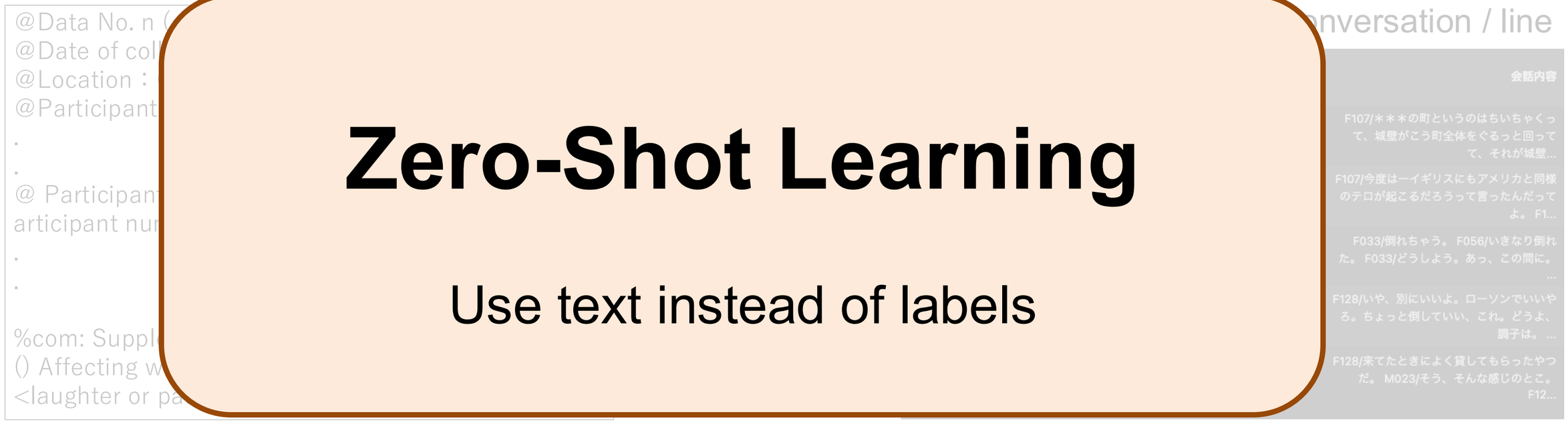
収集年月日	場所	追加	時間	参加者	会話内容
2001-10-16	ファミリーレストラン	None	35	M023/F107/F023/F128	F107/＊＊＊の町というのはちいちゃくって、城壁がこう町全体をぐるっと回ってて、それが城壁...
2001-10-16	ファミリーレストランガスト	None	60	F107/F023/F128	F107/今度はーイギリスにもアメリカと同様のテロが起こるだろうって言ったんだってよ。 F1...
2001-10-23	車中（某大から所属大学への帰り道。運転者F033）	None	43	F056/F033	F033/倒れちゃう。 F056/いきなり倒れた。 F033/どうしよう。あっ、この間に。...
2001-10-23	車中（知立駅より西尾市まで。運転者M018）	None	35	M018/F128	F128/いや、別にいいよ。ローソンでいいやろ。ちょっと倒していい、これ。どうよ、調子は。 ...
2001-10-23	M023の自宅	None	55	F116/M026/M023/F128	F128/来てたときによく貸してもらったやつだ。 M023/そう、そんな感じのとこ。 F12...

Assign the best matching label from the label set to each conversation
Need to learn a lot of conversation data, but only 129 conversations

Use a method that allows classification even if **train and test data do not match**

03 Data to be utilized

Utilizing Nagoya University Conversation Data
(Delete unnecessary information, Correction of blurring of notation)



Zero-Shot Learning

Use text instead of labels

Assign the best matching label from the label set to each conversation.
Need to learn a lot of conversation data, but only 129 conversations.

Use a method that allows classification even if **train and test data do not match**

03 Zero-shot learning summary

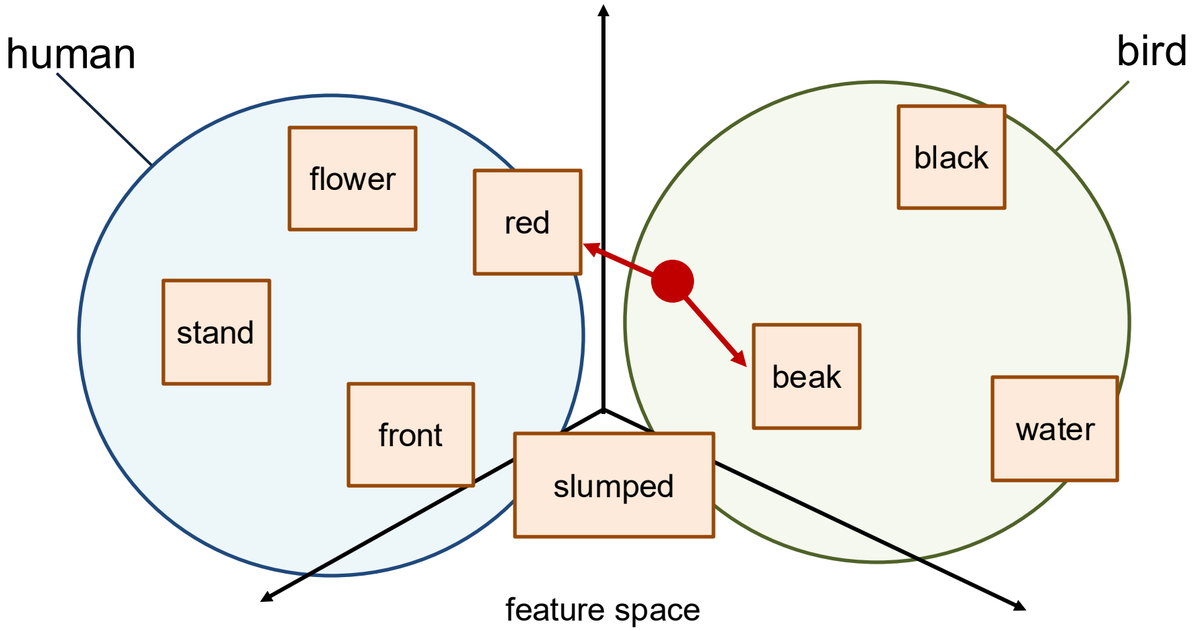
train data

Woman standing in front of flowers with red fan.

Woman slumped in front of yellow flowers.

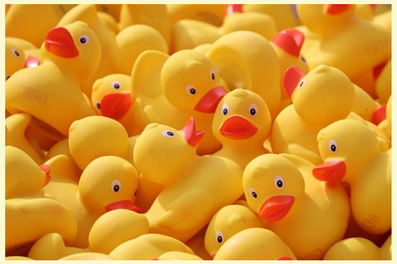
Bird with red feathers and black eyes slumped over.

Black bird playing on the water.



Even detailed information can be expressed in the feature space

test data



Output sentences using features close to inference data

bird with red beak

04 Zero-shot learning formulation

2 classes to utilize

Y^s ： Visible class for learning (In this study, Japanese SNLI Data.548,014 pairs)
Y^u ： Invisible class for prediction (In this study, Nagoya University Conversation Data, NOTE Categories)

$$Y^s \cap Y^u = \emptyset$$
$$Y^s \cup Y^u = Y$$

$$Y^s: \quad D^s = \{(x_i^s, y_i^s)\}_{i=1}^N$$
$$Y^u: \quad D^u = \{(x_i^u, y_i^u)\}_{i=1}^M$$

x_i ： i th text
y_i ： label corresponding to
※ In the invisible class, Labels that can be assumed to be the best match

Goal of the Framework

Learning a matching model $f(x, y; \theta)$ from D^s and making predictions about D^u.

$$\hat{y} = \underset{y \in Y}{\operatorname{argmax}}(x, y; \theta)$$

θ ： parameters of f

Learning a base matching model from Y^s and predicting Y^u from that model

04 Zero-shot learning building a matching model

Example of $(x_i^s,\ y_i^s)$: (I eat strawberries, Strawberry is food)

Converts input format to BERT-encoder
[CLS] I eat strawberries [SEP] Strawberry is food [SEP]

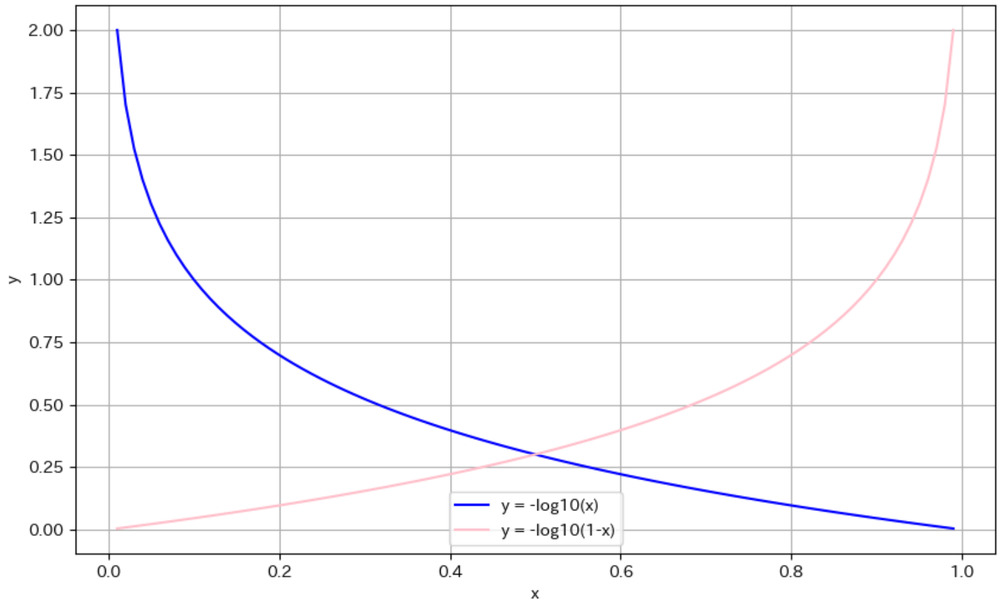
Do “I eat strawberries” and “strawberry is food” have the same meaning?

Overlap the linear layer (1) as follows, Calculate loss (2).

$$p_{x,y'} = \sigma(W^T c_{x,y'} + b) \qquad (1)$$

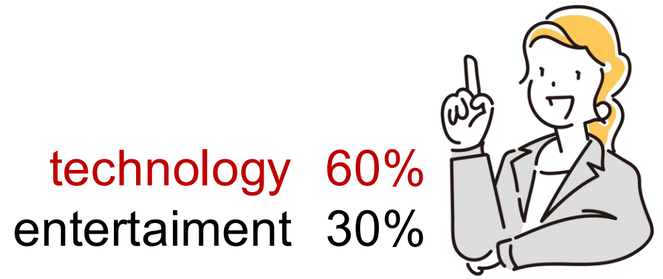
$$\mathcal{L} = \begin{cases} -\log(p_{x,y'}),\ y' = y, \\ -\log(1 - p_{x,y'}),\ y' \neq y. \end{cases} \qquad (2)$$

W, b : parameters of linear layer ($W \in R^H,\ b \in R$)
$c_{x,y'}$: hidden vectors corresponding to each sentence(H-dimension)
$p_{x,y'}$: matching score of x and y'
$\sigma(\cdot)$: sigmoid function



Build the model so that $\mathcal{L}$ is small.
Through these processes, **each conversation(=test data) is given the best possible label**

05 Provides topic and matching score



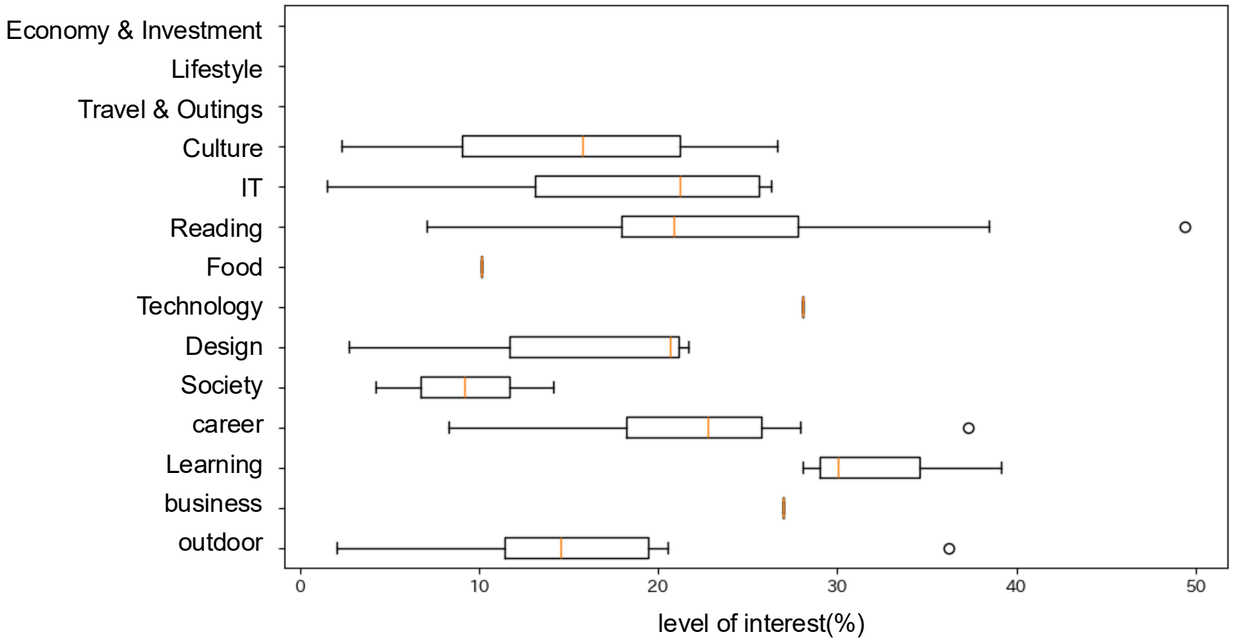
technology 60%
entertaiment 30%

technology
Matching score : 70%

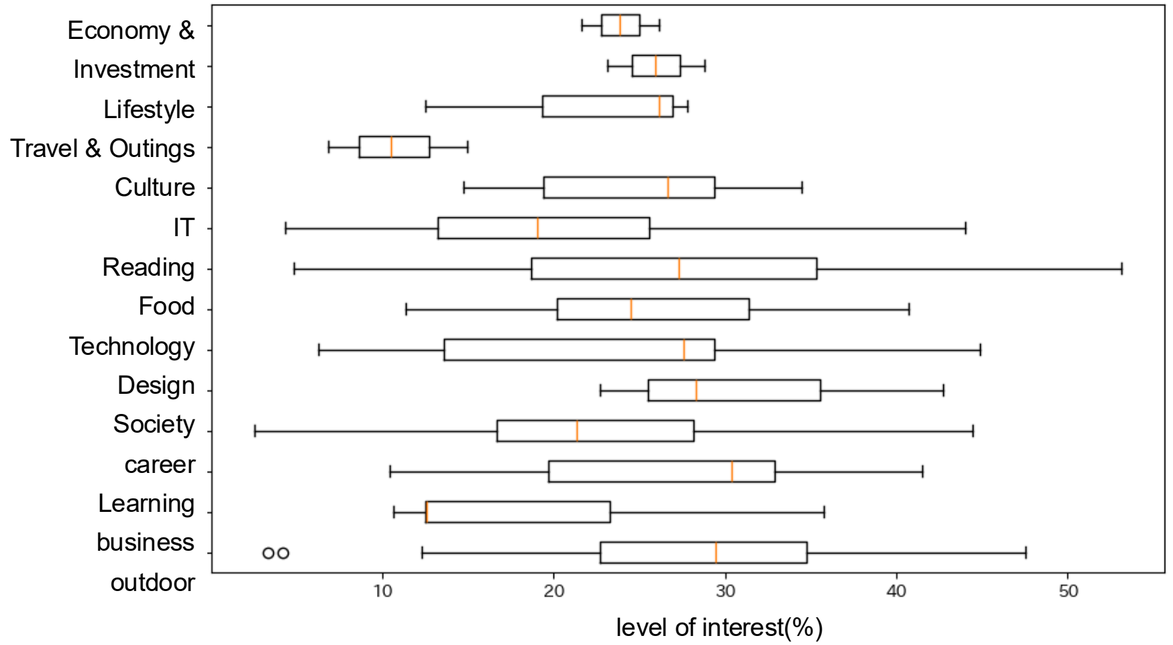
technology 80%
outdoor 40%

06 Evaluation Label distribution of data

male



famale



- The variation in values is greater for women.
  →**Women participate in that conversation even if they are less knowledgeable about the topic.**

- Men's data distribution concentrates on the least interesting,
  but has more upswing outliers than women’s.
  → **Men have a higher degree of expertise in each of these areas.**

07 Evaluation Experimental Setup

test subject 11 (7 men, 4 women)

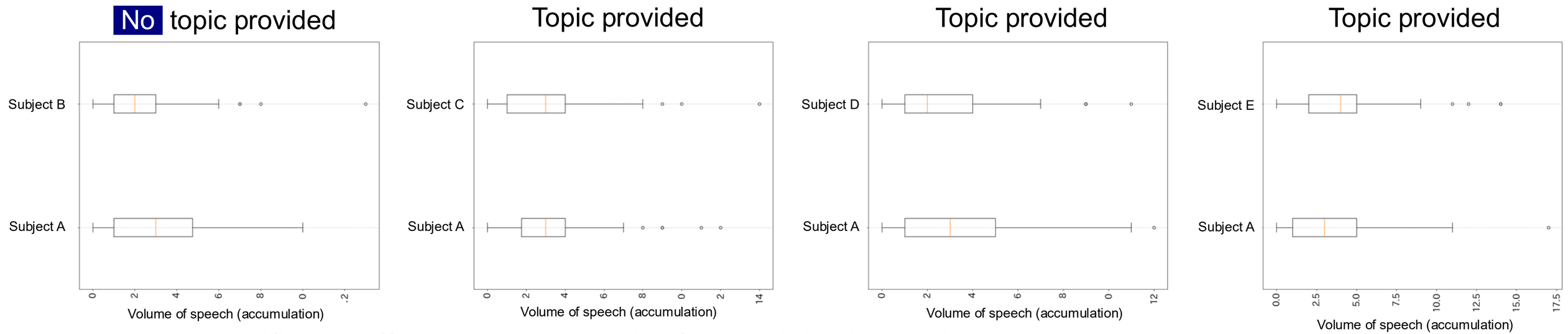
Subject Combination Acquaintance conversations : 7 conversations
Conversation with a new acquaintance

Topic provided : 3 Conversations
No topic provided : 1 conversation

	age	gender	birthplace
Subject A	Early 20s	female	Saitama
Subject B	Early 20s	female	Tokyo
Subject C	Early 50s	male	Nara
Subject D	Early 20s	male	Chiba
Subject E	Early 60s	male	Niigata

experimental example

07 evaluation volume of speech at first meeting



- No significant difference between the first and third quartile ranges.
  →There is **no significant difference in the trend of speech volume** in any of the conversations.

- About outliers
  Downside outliers : none
  Upside Outlier
  Focusing on subject A, it only occurs in all of the conversations where **the topic is provided**.
  → **Suggests that people may be more likely to vividly voice their opinions and experiences if they are provided with a topic of discussion**

07 Evaluation emotional changes

Emotion : POSITIVE, NEGATIVE, NEUTRAL

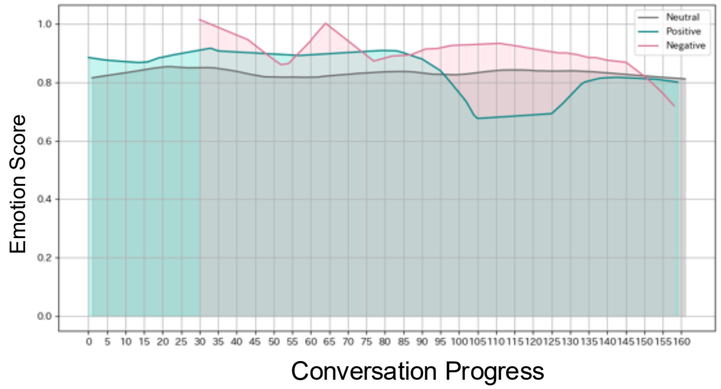
NEUTRAL

Score values are stable at 0.8~1.0

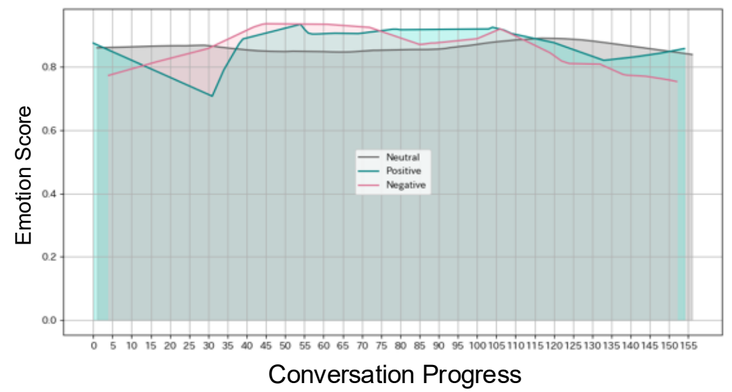
POSITIVE, NEGATIVE

Value change is greater than neutral.
positive : 0.65~1.0
negative : 0.6~1.0

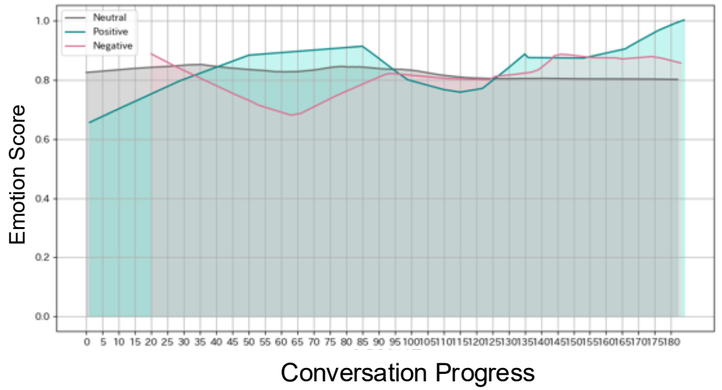
No topic provided



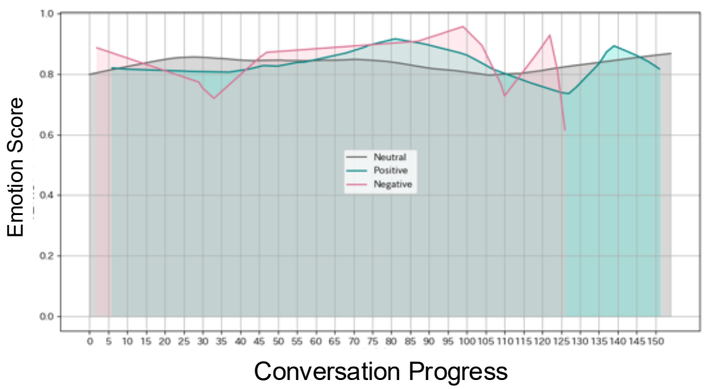
Topic provided



Topic provided



Topic provided



Emotional swings are high when the topic is provided

→ More intimate conversations are achieved with someone I've never met before

08 Did I achieve our goals?

purpose - 1

Realization of topic provision based on user interests
→ From conversation logs,
extract interests and select topics

purpose - 2

Quantitative evaluation of user interests
→ **Calculate an interest score** for each conversation label

purpose - 3

Liven up a conversation with someone you've never met before by providing a topic of conversation
→ **Conversations are lively and full of emotional ups and downs.**

10 Future works

works - 1

Creating a **evaluation function of conversation excitement**

works - 2

Implementation of **Speech to Text**
that converts conversation into text data

works - 3

Servicing this research

11 References

[1]R&G Inc. "Ranking of Conversation Difficulties! How to overcome it is also solved" (2024,11,24).
https://r-andg.jp/blog/4733
[2]Techtale, LLC, "Talk theme gacha that provides topics in seconds!"
https://talkgacha.com/
[3] Mamoru Komachi (2024) "Textbook of Natural Language Processing" Gijutsu Hyoron Co.
[4] Kiyoaki Shirai (2006) "Natural Language Processing I 7. Morphological Analysis (Word Segmentation in Japanese)"
[5] Itsuko Fujimura, Mie Ohso, Yoshikazu Oshima David (2011)
"Communication Research by Building a Conversation Corpus".
In Itsuko Fujimura and Naohiro Takizawa (eds.), Techniques of Language Research: Data Collection and Analysis, p.43-72, Hitsuji Shobo.
[6]PythonDocs "re --- Regular Expression Manipulation "Python3.13.1Document
https://docs.python.org/ja/3.13/library/re.html
[7] Zhiquan Ye, Yuxia Geng, Jiaoyan Chen, Xiaoxiao Xu, Suhang Zheng, Feng Wang, Jingmin Chen, Jun Zhang, Huajun Chen" Zero-shot Text Classification via Reinforced Self-training" Proceedings of the 58th Annual Meeting of the Association for Computational Linguistics, pages 3014-3024 July 5 pages 3014-3024 July 5 - 10, 2020. c2020 Association for Computational Linguistics
[8]Department of Language and Media, Course in Intelligent Informatics, Graduate School of Informatics, Kyoto University
"Japanese SNLI(JSNLI) Dataset"(2020,07,15).
[9]NOTE Corporation "NOTE"
https://note.com/
[10]National Institute for Japanese Language and Linguistics "Modern Spoken Language UniDic "UniDic(2023,03,24)
https://clrd.ninjal.ac.jp/unidic/download.html#unidic_csj
[11]HuggingaFace "SentenceTransformers Documentation".
https://sbert.net/
[12] Kyoto University Graduate School of Informatics-Nippon Telegraph and Telephone Corporation Communication Science Laboratories Joint Research Unit Project
"MeCab: Yet Another Part-of-Speech and Morphological Analyzer".
(2013,02,18)
[13]oVice Corporation, "oVice".
https://www.ovice.com/ja