AI AND DISASTER

DISASTER SEEN IN WATSON

IBM Japan, Ltd.
Akiko Murakami
Masayasu Muraoka
Hideyuki Mizuta
Kaori Namba

AGENDA

An actualization of operational risks using text analytics approach in Fukushima power plant disaster

Akiko Murakami, Tokyo Software Development Laboratory

Use case introduction: Twitter analysis towards indirect support for Kumamoto Earthquake

Masayasu Muraoka, IBM Research AI

Large-scale agent-based social simulation for traffic and pedestrian in a city

Hideyuki Mizuta, IBM Research AI

AN ACTUALIZATION OF OPERATIONAL RISKS USING TEXT ANALYTICS APPROACH IN FUKUSHIMA POWER PLANT DISASTER

2017-11-28

Akiko Murakami, Kaori Namba, Teruki Tauchi, Hiroya Matsubara (IBM Corp.)
Akio Suzuki (NHK: Japan Broadcasting Corporation)
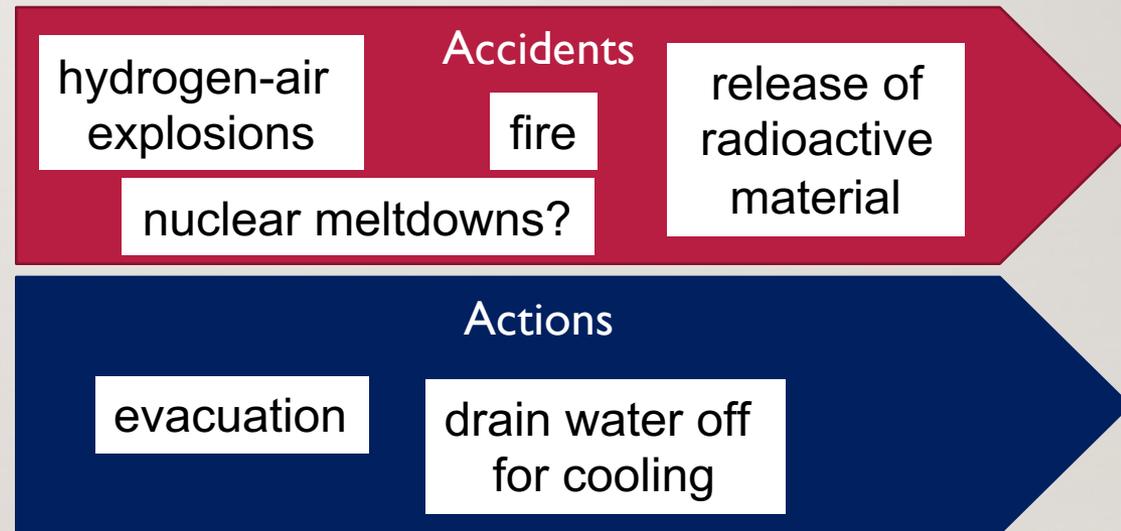Michinori Hatayama (Kyoto University)

LEADERSHIP AT THE DISASTER TIMES

- String leadership is needed at the disaster time

- However, it contains some risks: Health concern of the leader and the missing ideas from others

- Analyzing the documents (Reports, transcript of decision making) at the disaster time might be useful for the future disasters

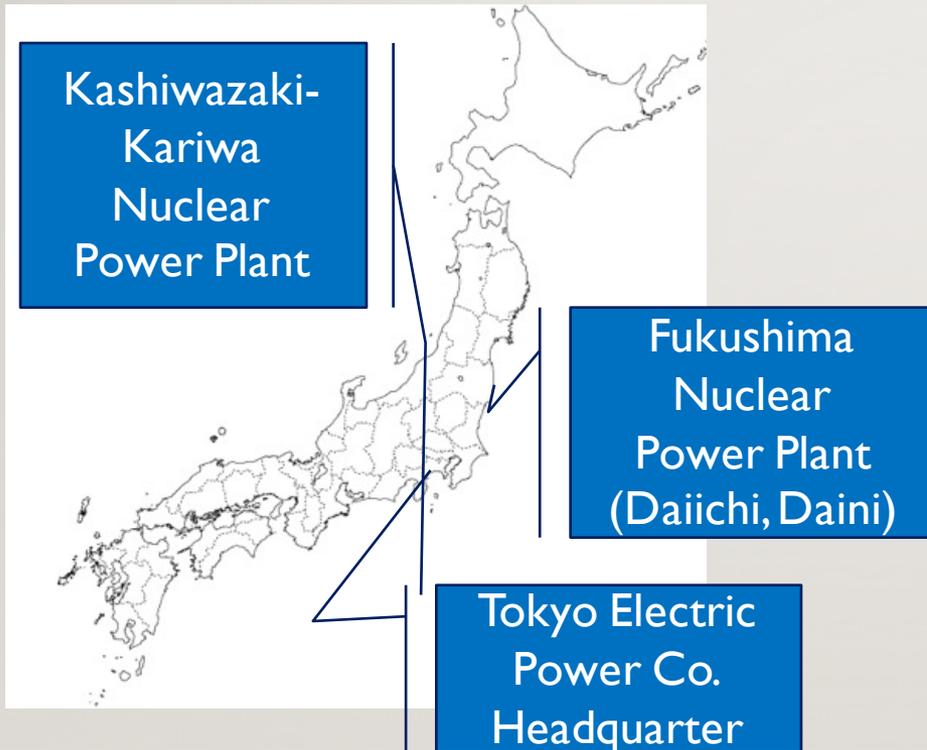# OVERVIEW OF THE FUKUSHIMA DAIICHI NUCLEAR POWER PLANT ACCIDENT

- Initiated primarily by the tsunami following the Tohoku Great Earthquake on 11 March 2011

- The accidents occurred by insufficient cooling

2011
March 11

Accidents

hydrogen-air explosions

fire

release of radioactive material

nuclear meltdowns?

Actions

evacuation

drain water off for cooling

3

RESPONSE TEAM FOR THE ACCIDENT

Kashiwazaki-Kariwa Nuclear Power Plant

Fukushima Nuclear Power Plant (Daiichi, Daini)

Tokyo Electric Power Co. Headquarter

- The owner of the plant, Tokyo Electric Power Company (TEPCO), had three teams for the disaster response
  - Headquarter in Tokyo
  - Fukushima (Daiichi and Daini) and Kashiwazaki-Kariwa Nuclear Power Plants
- The plants and HQ are located different locations, several hundreds kilometers away

VIDEO CONFERENCE SYSTEMS FOR TEAM COMMUNICATIONS

http://photo.tepco.co.jp/date/2013/201303-j/130029-01j.html

- TEPCO used a video conference system for teams' communication

- After March 15, the government decided that consolidated team including TEPCO, Government and Nuclear and Industrial Safety Agency use the system for communication

- Almost all recorded video are available in public

Can we utilize the data for future disasters?

TRANSCRIPTION DATA OF THE ACCIDENT

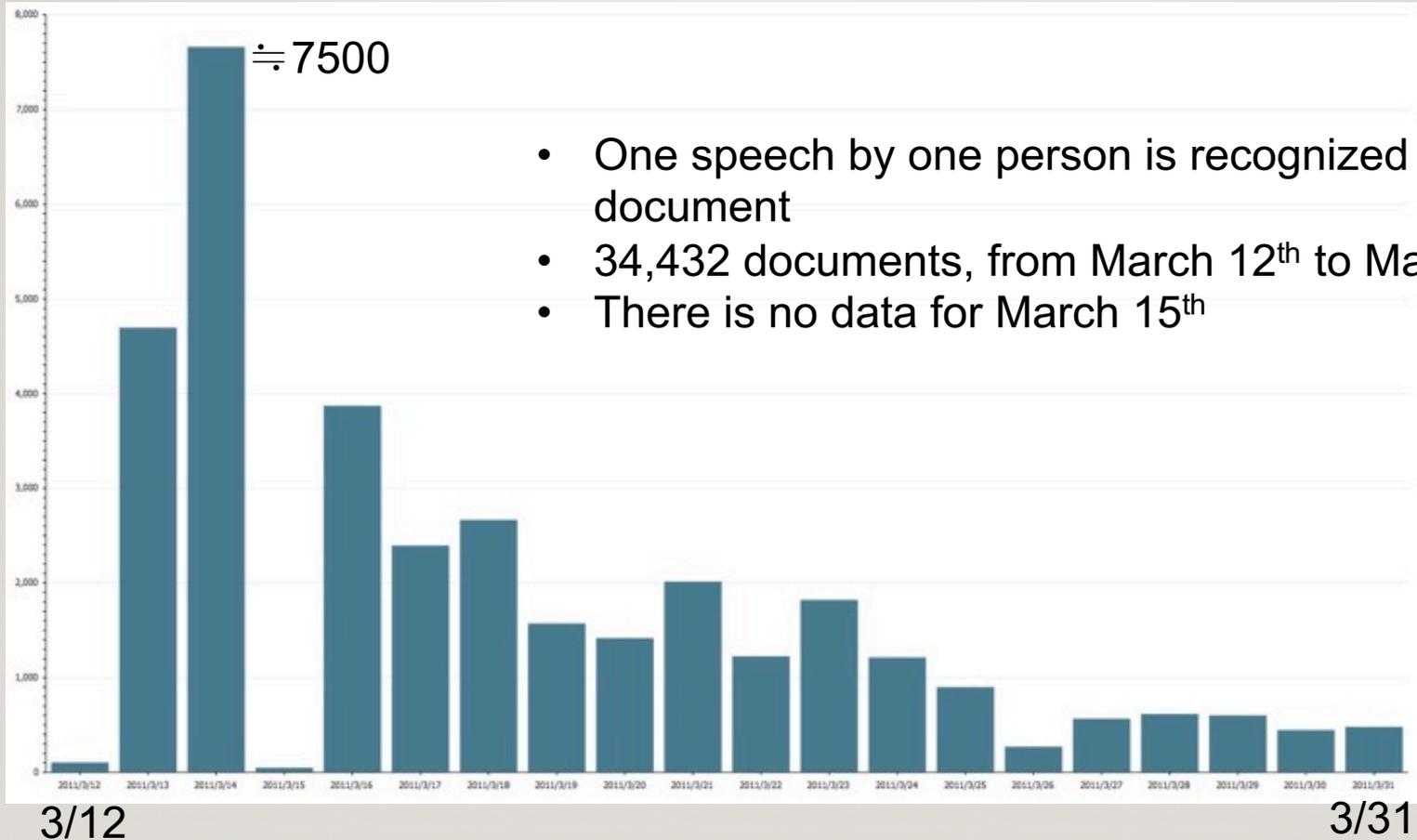| 時刻	場所	発言者	発言内容
23:07	本店	小森常務	吉田所長、どうぞ。
	1 F	吉田所長	あのーちょっと、いま、我々プラントのほうに力いっているし、もちろんNISAだ、官邸というところにあるんですけども。いま、避難している人たちの中から、やっぱりものすごく不満があって、東京電力が説明しに来ないというかですね、いつまでこんな生活が続くんだと、こういうようなご不満が多々出ているようで、なかなかそれにですねえ、ちょっとその応え切れてないなと。今後のことを考えると多分ものすごい我々今回のことで鼻つまみ者になっちゃうわけですけども。このタイミングでやっぱり手を打っておかないとですね、ますますそういう感じがしてて、ただあまりそこにあまり人が割けないというところが、いま非常に今日も困ったなあ、とこう思ってるんで、というところがある。
	本店	高橋フェロー	それもちょっと考えてはいるんですが、ちょっと立地地域部のほうとそれからサイトの広報のほうと…
23:08	1 F	吉田所長	ええ、ただサイトの広報は…実態なものですから。
	本店	高橋フェロー	まぁ行くのは本店で行くにしても…聞かないと、と思うんだけどもね。
	1 F	吉田所長	もちろんそれぐらいのことはやりますけども、とてもじゃないけど今のこのメンバーでなかなかできないというところ…
	本店	高橋フェロー	じゃあ立地地域部と相談しますよ。

- Dictation by human, with any filler words and/or hesitations
- One speech by one person is recognized as one document
- Each speech (document) has metadata: time and day, speech location, speaker, speech contents (text)
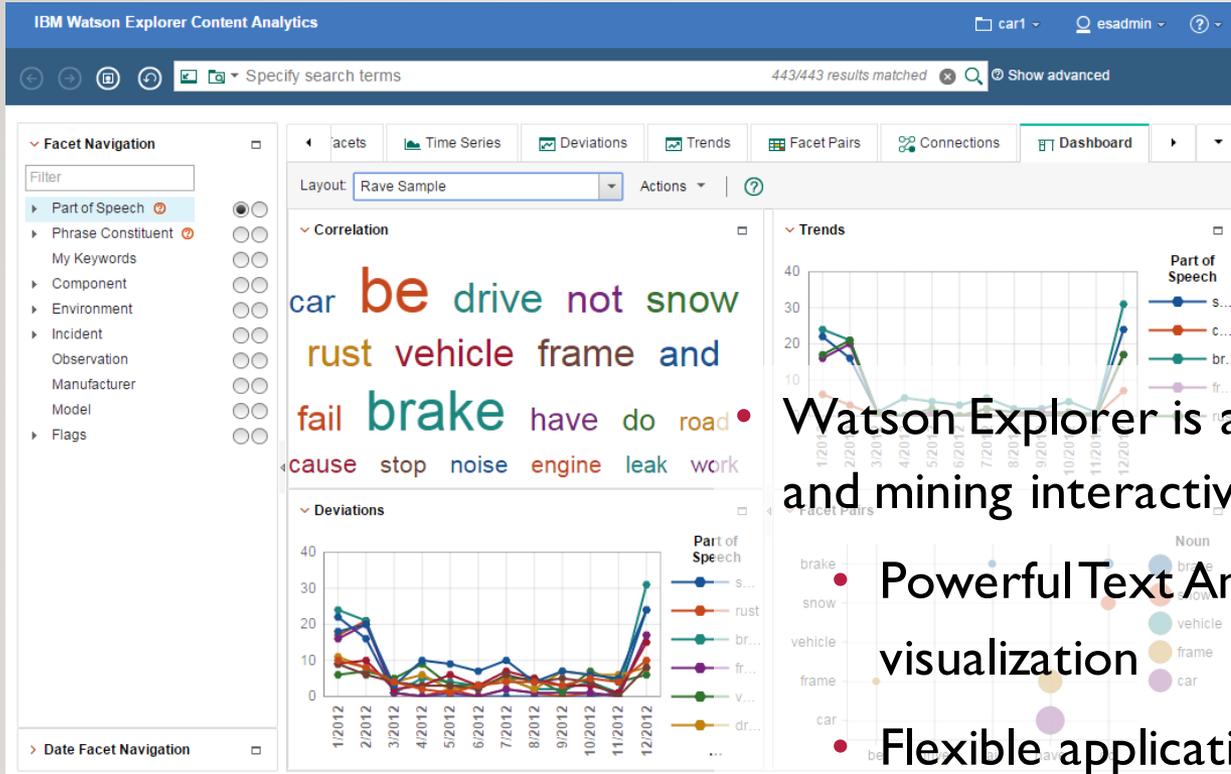
EXAMPLE OF THE DATA

本店　　　武藤副社長　　　えっと、吉田所長。
1F　　　　吉田所長　　　　はい、吉田です。
本店　　　武藤副社長　　　機動隊の消防隊がオペレーターも含めて小名浜で

え一準備が
とになりまし

1F　　　　吉

本店　　　武
時頃行ける
準備をして頂
えて下さい。

1F　　　　吉
せて下さい。
ね、あの、今

本店　　　武
る為のガラス
によりますけ

HQ	Muto SVP	Hello, Director Yoshida.
1F	Director Yoshida	Yes sir, this is Yoshida.
HQ	Muto SVP	Fire prevention team in the mobile unit including operators in Onahama, now are ready, well, yea, they can go your site anytime.
1F	Director Yoshida	Yes, sir.
HQ	Muto SVP	Then, we will confirm that when we can do remove heaps of rubble, when the condition is ready to go the disaster place, and would like to ask you to prepare for it, please estimate the time for removing the rubbles.
1F	Director Yoshida	Yes, I understand your request, would you mind if I ask you two question? Did you mean the place is that heaps of rubble in the side of Unit4, align to the mountain side road?
HQ	Muto SVP	I meant that the way to Unit4's pool with glass rubbles – removing rubbles, it depends on the situation, mountain or sea side.

DATA DETAILS

$\doteqdot 7500$

- One speech by one person is recognized as one document
- 34,432 documents, from March 12th to March 31st
- There is no data for March 15th

3/12 3/31

WATSON EXPLORER: A TEXT MINING TOOL WITH COGNITIVE TECHNOLOGIES

Watson Explorer is a tool to do text analysis and mining interactively

- Powerful Text Analysis features with rich visualization

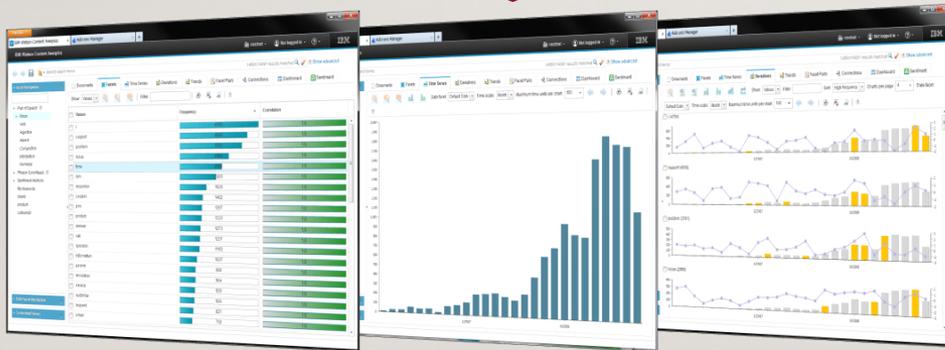- Flexible application customization capability with True WYSIWYG editor

TEXT ANALYTICS
"MINING INSIGHTS FROM TEXT"

Structured Data

- Semantics of information is explicitly defined by the structure of data
- e.g. Tables in RDB

Unstructured Data

- Semantics of information is hidden in character (or binary) streams
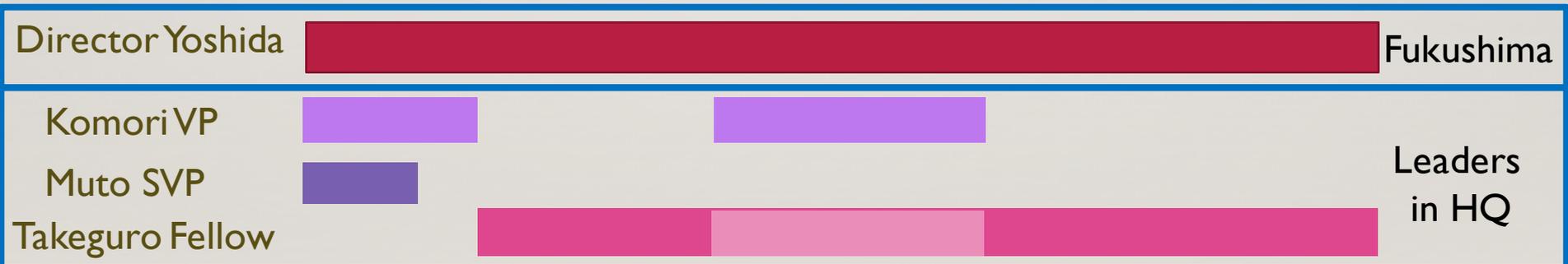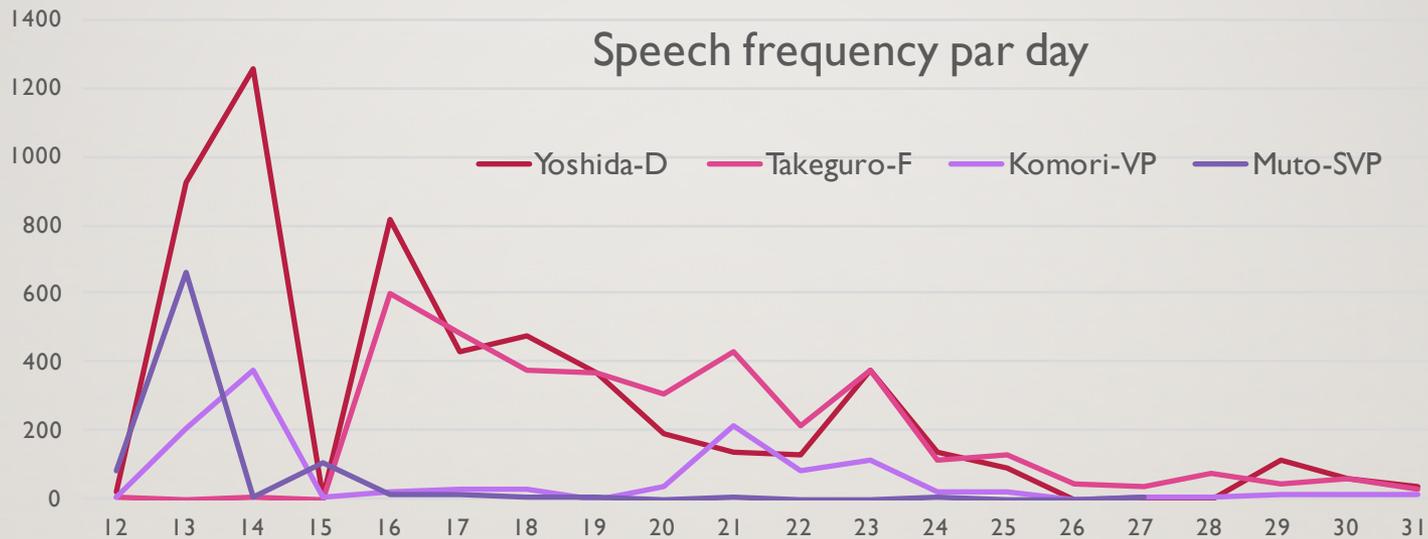- e.g. Text, Graphics, Voice

- Text mining is a technology combining structured and unstructured data and showing their statistics with graphical interface to find out "insight"

- Information extraction technology enables us to extract information as structured data from textual document using Natural Language Technologies

…

Graphical Interface

WHAT WE UNDERSTAND FROM THE DATA: DIR. YOSHIDA KEPT HIS LEADERSHIP

Speech Frequency of Yoshida Director / Ratio of the speech

No data

Sick leave

He was in Gov. to report the accident
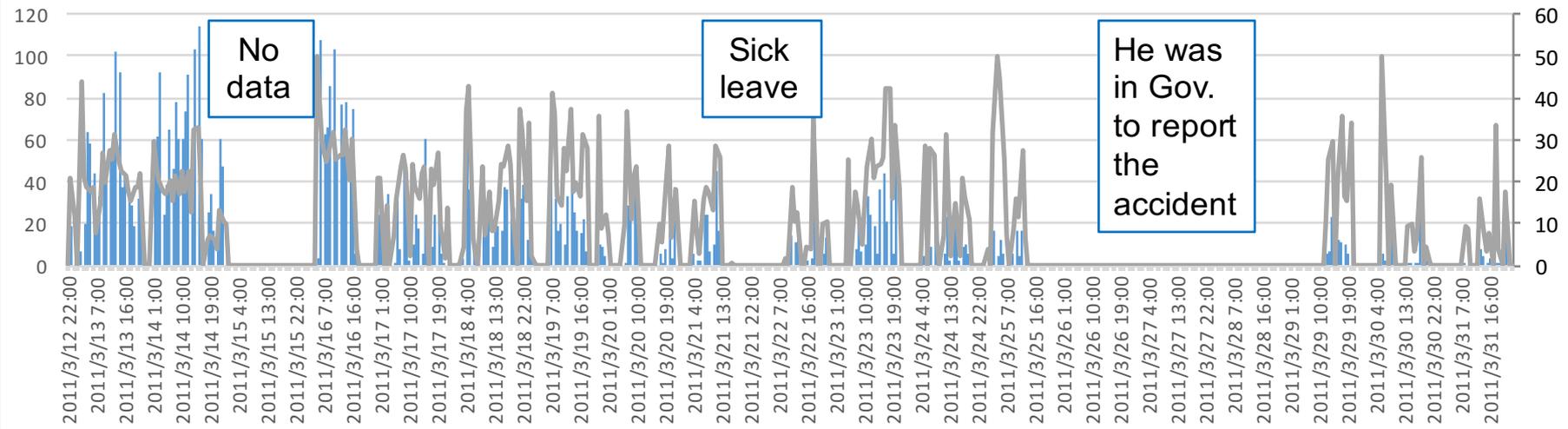
- Director Yoshida did not sleep well (3-4 hours par day)

- Except reporting the accident to the government, he kept his leadership though the accident

- He left his leadership for few hours because of his sickness

13   ➡ Can we predict this risk based on the data?

STAMMER EXPRESSIONS IN THE SPEECH REPRESENT THE PERSON'S TIREDNESS

あの、まあ、そうですね。

はい、はい、そうです。

やら、やらざるを得ないんだから。

消防、消防団はまだいないの。

Well, yaa, I got it.

Yea, yea, that's right.

We have to do, do.

Do we have fire, firemen?

- This is a record of conversations, not a formal speech, so it contains some filler, stammer and some expressions with hesitations
  - Filler
  - Repeating same words/phrases
- Extracting these kinds of expressions automatically using NLP technologies

TIME SERIES OF REPEATING EXPRESSIONS IN DIRECTOR YOSHIDA'S SPEECH

- The frequency and the ratio of repeating expressions in the speech for Director Yoshida are slightly higher than others'
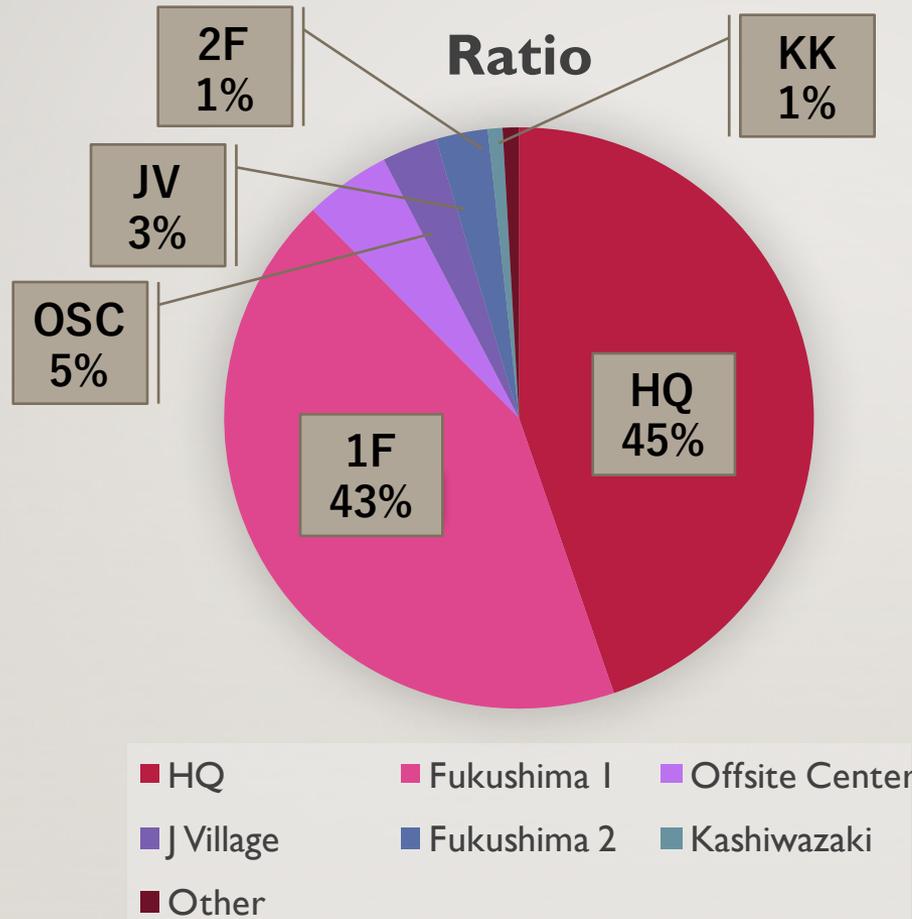
TIME SERIES OF REPEATING EXPRESSIONS
FREQUENCY & TREND VALUE

Freqency   Trend Value

The day of the sick leave
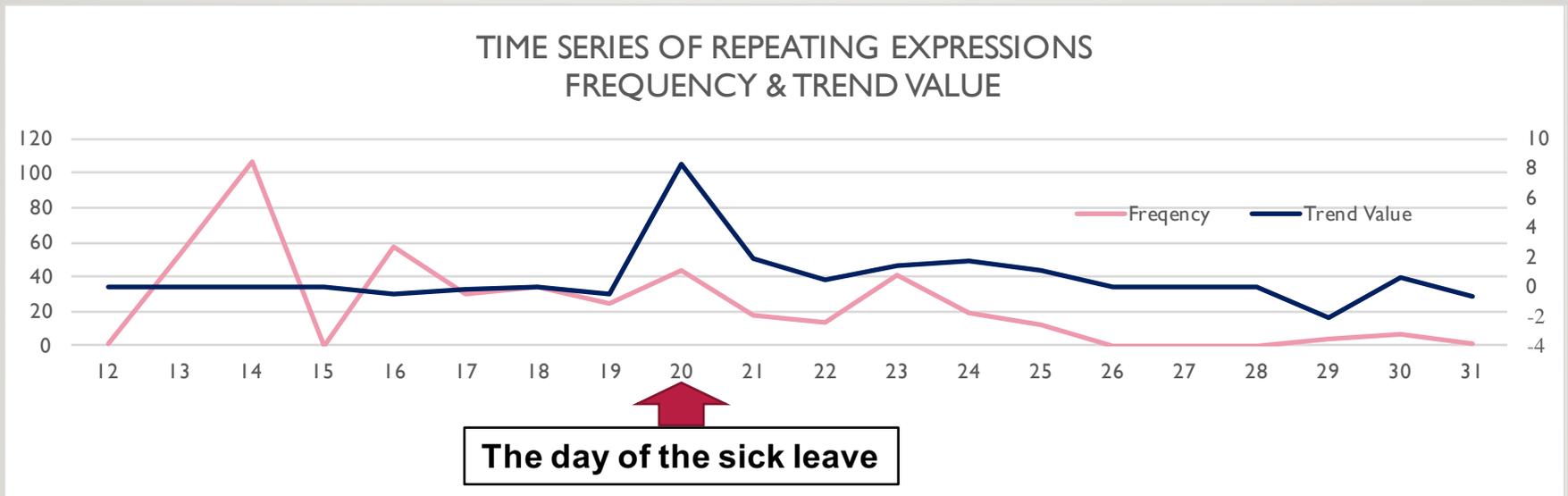
- Statistics shows that the expressions increase irregularly at the day of his sick leave

DISCUSSION:
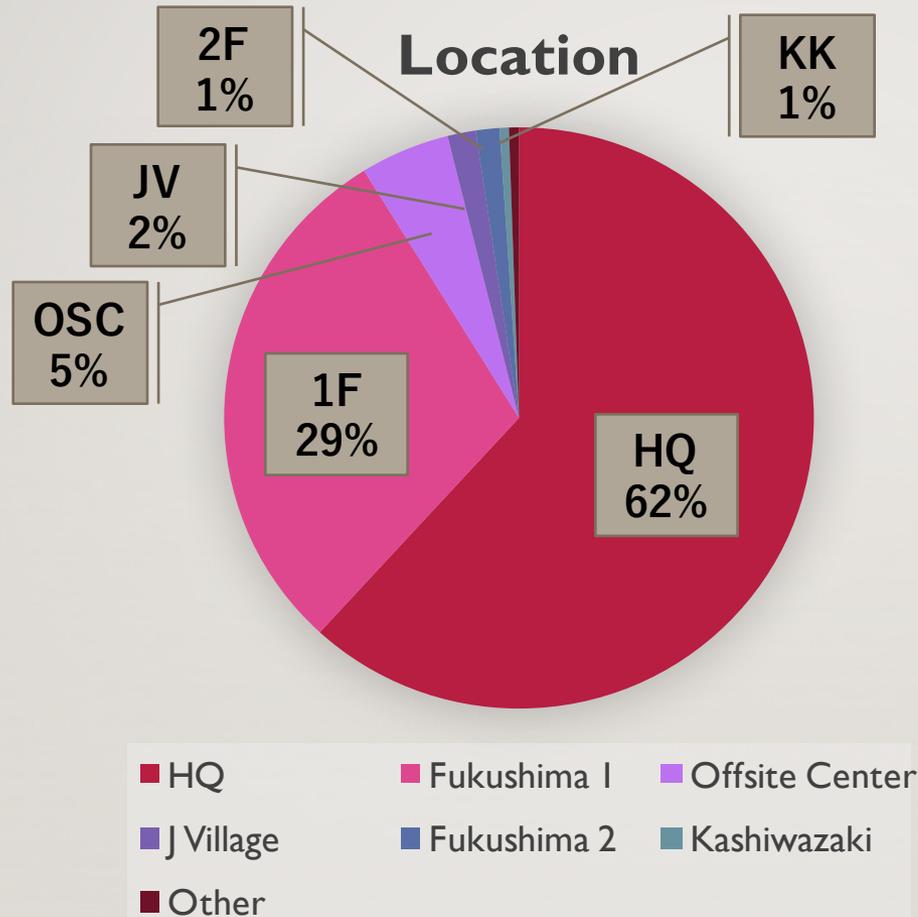# SINGLE-LEADERSHIP VS. MULTI-LEADERSHIP

- The Fukushima team had a risk for loosing their leader

  - The text analytics result shows that he had some trouble with physical or mental health

- Why was the Fukushima team led by the single leader?

  - At the first stage of the disaster, TEPCO considered that Fukushima team should have multiple leaders

  - They had several sub-leaders, but the leadership of Director Yoshida is very strong so that the team relied on his leadership
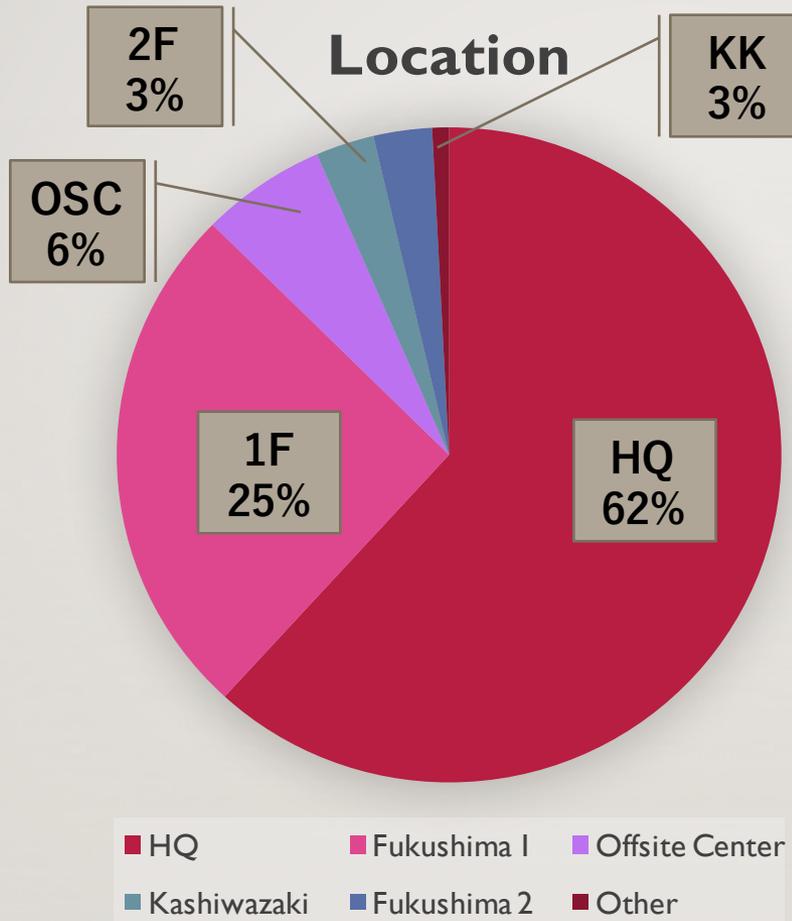
WHAT WE UNDERSTAND FROM THE DATA: NEXT SPEAKER OF DIR. YOSHIDA

Location

2F 1%

KK 1%

JV 2%

OSC 5%

1F 29%

HQ 62%

Legend:
- HQ
- Fukushima 1
- Offsite Center
- J Village
- Fukushima 2
- Kashiwazaki
- Other

- After Dir. Yoshida's reports, HQ reacted these reports and make decisions
  - Sometimes other person in 1F reported continuously

- Kashiwazaki-Kariwa and Fukushima-daini did not react to Dir. Yoshida's reports

WHO TALKED AFTER KASHIWAZAKI-KARIWA?

Location

2F
3%

KK
3%

OSC
6%

1F
25%

HQ
62%

■ HQ   ■ Fukushima 1   ■ Offsite Center
■ Kashiwazaki   ■ Fukushima 2   ■ Other

- After Kashiwazaki-kariwa's speech, HQ reacted to them first

- 1F and KK and 2F did not communicate directly – all conversation though HQ

DISCUSSION: HOW TO UTILIZE THE DATA AND ANALYTICS RESULT

- How can we get the data?
  - This time the disaster area and the headquarters are located in different places so that almost all conversation are stored as recoded video
  - However recognizing the conversation in real time is difficult due to the sound quality, etc.

- How can we recognize the types of risk?
  - We observed several types of risks in the data

➡ With analytics technology we can retrospect the disaster and the operation for it

CONCLUSION

- We show the text analytics results with the conversational data at the disaster time

- The results show the risks of operation: single leadership and the lack of leadership

- From these experiences, we might be able to learn how to better organize and lead disaster response teams

END OF THE PRESENTATION