AI AND DISASTER

DISASTER SEEN IN WATSON

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

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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

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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 on 11 March 2011

Accidents
- hydrogen-air explosions
- nuclear meltdowns?
- fire

Actions
- evacuation
- drain water off for cooling

Release of radioactive material
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.
• 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

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

Can we utilize the data for future disasters?
### TRANSCRIPTION DATA OF THE ACCIDENT

<table>
<thead>
<tr>
<th>時刻</th>
<th>場所</th>
<th>発言者</th>
<th>発言内容</th>
</tr>
</thead>
<tbody>
<tr>
<td>23:07</td>
<td>本店</td>
<td>小森常務</td>
<td>吉田所長、どうぞ。</td>
</tr>
<tr>
<td></td>
<td>1 F</td>
<td>吉田所長</td>
<td>あのちょっと、いま、我々プラントのほうに力いているし、もちろんNISAだ、官邸とかいうところにあるんですけれども、いま、避難している人たちの中から、やっぱりもののすごく不満があって、東京電力を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か、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、ちょっとその応え切れてないなんですね。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とまみれ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る人が割れないというところが、いま非常に今も困ったり、ところだと思っていますんで、というところがある。</td>
</tr>
<tr>
<td></td>
<td>本店</td>
<td>高橋フェロー</td>
<td>それちょっと考えてはいるんですですが、ちょっと立地地帯のほうとそれからサイトの広報のほうとちょっとこちらもございまして、そうした方たちも含めて、</td>
</tr>
<tr>
<td>23:08</td>
<td>1 F</td>
<td>吉田所長</td>
<td>ええ、ただサイトの方のはごちょっというと、もう少しは、帰るタイムのということはプレス文対応でもう毛もまたしないんです、これはどこもここも、そしていかなる欠点があるというののが実態なものですから。</td>
</tr>
<tr>
<td></td>
<td>本店</td>
<td>高橋フェロー</td>
<td>まあ行方は本庁で行こうと申し上げて行っているかなだから、やっぱりそれは指標にして聞くことも、これからも考えていきたい。</td>
</tr>
<tr>
<td></td>
<td>1 F</td>
<td>吉田所長</td>
<td>もちろんそれくらいのことではありますけども、とてもじゃないけど今のこのメンバーでなかなか</td>
</tr>
<tr>
<td></td>
<td>本店</td>
<td>高橋フェロー</td>
<td>じゃあ立地地帯をと相談しようよ。</td>
</tr>
</tbody>
</table>

- 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
1F 吉田所長 はい。

本店 武藤副社長 えー準備が出来ていて、あー準備が出来ていて小名浜で
1F 吉田所長 はい。

本店 武藤副社長 えー準備が出来ていて、あー準備が出来ていて小名浜で
1F 吉田所長 はい。

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.
• 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
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 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.
WHAT WE UNDERSTAND FROM THE DATA

1. Visualize the Rotation of the leadership
2. The risk of keeping leadership by single person
3. Visualize the Conversation Ratio Between Organizations
WHAT WE UNDERSTAND FROM THE DATA: LEADERS ROTATION OF THE TEAMS

Speech frequency per day

Director Yoshida
Komori VP
Muto SVP
Takeguro Fellow

Fukushima team was led by the single leader
WHAT WE UNDERSTAND FROM THE DATA: DIR. YOSHIDA KEPT HIS LEADERSHIP

- Director Yoshida did not sleep well (3-4 hours per 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

Can we predict this risk based on the data?
STAMMER EXPRESSIONS IN THE SPEECH REPRESENT THE PERSON’S TIREDNESS

- 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

あの、まあ、そうですね。
はい、はい、そうですね。
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?
The frequency and the ratio of repeating expressions in the speech for Director Yoshida are slightly higher than others’.

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: THE RATIO BY ORGANIZATION

- Most of the conversation occupied by HQ and 1F (Fukushima-daiichi)
- Assumption: Kashiwazaki-Kariwa and Fukushima-daini did not perform their knowledge effectively
WHAT WE UNDERSTAND FROM THE DATA: NEXT SPEAKER OF DIR. YOSHIDA

- 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?

• 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