Web Information Analysis for Open-domain Decision Support: System Design and User Evaluation

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Background

• A large amount of information on the Web
  – Everyone can send information
• Decision making based on the Web information becomes usual.
  – Job hunting
  – Purchasing
• However, the quality of the Web information is not assured because the cost of sending information becomes lower.
  – Generally search engine (such as Google) is main way for decision making on the Web.
  – Information literacy is required for selecting useful and credible Web information.
Goal and proposal

• Our goal
  – To support wide range of decision making on the Web.

• Proposal
  – To clarify the process of decision making
  – To develop a supporting system in accord with the process of decision making
    • To develop information analysis system “WISDOM”
  – To verify whether the system contribute people’s decision making
    • Users evaluation
Decision making

• Decision making is regarded as the following process:
  1. Searching the environment for conditions calling for a decision.
  2. Analyzing alternative courses
  3. Selecting a particular course of action

(Simon 1977)

• The same process for the decision on the Web

I am worried about my tooth, especially, gum disease.
Process of decision making

(0) Desire/Demand/Interests
"I want to prevent from gum disease."

(1) Searching the candidate of solution for the desire
"Electric toothbrush"

(2) Gathering information that is necessary for judging value of the solution
Is it useful? What is the benefit and defect?
Process of decision making

(0) Desire/Demand/Interests

“I want to prevent from gum disease.”

(1) Searching the candidate of solution for the desire

“Electric toothbrush”

(2) Gathering information that is necessary for judging value of the solution

a) Needs no special technique and easy to use
b) Cleans more effectively than by hand

(3) Judging whether gathered information is true or not

(a) Is sent by a doctor.
(b) Is asserted by many people.

Decision making

I decide to buy a toothbrush!
Supporting decision making

1. To clarify user’s undefined desires
   - Providing official page or encyclopedic Info.
     - It seems that Gum disease is dangerous
       • Plaque is one of the factor of gum disease.

2. Searching for the candidate of solution
   - Presenting candidates for solution
     - I want to remove plaque easily
       • Electric toothbrush
       • Fluorinated water

3. Gathering information necessary for judging value
   - Presenting various opinions about the candidate
     - Electric toothbrush
       • Needs no special technique and easy to use
       • Cleans more effectively than by hand
     - (a) is sent from a newspaper
     - (b) is asserted by many people.

- Decision making
Outline of WISDOM
http://wisdom-nict.jp/

Definition of the topic

- Professional’s page
- A page which contains various opinions

Visualizing bias of the stance by different senders

- Showing major/ minor information

Presenting the list of various opinions
User evaluation

• Purpose
  – To verify whether the information analysis with WISDOM is achieved through information extraction and aggregation
  – Whether the information presented by WISDOM is easily understandable for general users

• Outline
  – 100 participants use WISDOM and answer the questionnaire
Contents of the questionnaire

1. Selected (given) topics
   - Analyzing about 2 topics which we gave and comparing with the result of Google.

2. Free topics
   - Analyzing about 2 topics which participants came up with and comparing with the result of Google.

3. Overall evaluation
   - Evaluating WISDOM itself, such as usefulness of WISDOM or disadvantages of WISDOM.
Selected topics
The procedure

1. Selecting 2 topics from the given list and analyzing the topics with WISDOM and Google

- Divided into two groups:
  - Starting from WISDOM/Google
- Given topics are controversial things/issues in Japan

- The effects of homeopathy
- Merit-based wage system
- Resident registry network
- Hybrid car
- Coffee is good for health
- Anti-cancer drug
- Generic medicine
- Negative ion
- Construction of Dam in Japan
- Baby hatches
Selected topics
The procedure

2. Analyzing the topics and answering the following questions (at the same time).
   i. Write your motivation to analyze the topic
   ii. Did you find a wide range of opinions?
   iii. Did you find any bias in opinions from the different stances of the senders?
   iv. Did you receive any surprising or new information?
   v. Did you confirm the information you expected?
   vi. Were you able to analyze the information efficiently?
Selected topics
The procedure

3. Analyzing another search/analysis engine.
4. Analyzing second topic with the same way of the first topic.
Free topics

• The procedure
  – Analyzing two topics which participants came up with.
  – The procedure is common with selected topics

• The items of questionnaire
  – Common with selected topics
Examples of free topics

• Grant for eco-car
  – I do not have car and even license, so I do not know this topic in detail.
• How to reduce CO2
  – Because I want to prevent from global warming.
• Senkaku island chain issue
  – Because I watched TV on this
• Utility value of iPad
  – Because I am interested in iPad.
• Drinking milk before bedtime is good for health.
  – Because I am interested in this topic.
• High-rise apartment building
  – I want to know merit and demerit.
• “Japan human space flight”
  – I am interested in this topic.
• Diatom earth
  – I heard diatom earth is used for water-absorbing coaster.
Comparison with Google

• Counted the scores of selected topic and free topic (Horizontal axis: mean of the scores)

p < .05 (Mann-Whitney U test)

Cmp.1: Find various opinions
Cmp.2: Find any bias in opinions
Cmp.3: Get new/surprising information
Cmp.4: Get expected information
Cmp.5: Analyze efficiently

WISDOM is useful for getting information which is required for decision making
Overall evaluation
Advantage of WISDOM

• Following questions about advantages of WISDOM
  – 5 scale [disagree:0 - agree: 5]
  1. WISDOM is useful for decision making.
     • (decision making)
  2. WISDOM is useful for finding credible information with WISDOM?
     • (finding credible information)
  3. WISDOM is useful for searching reviews.
     • (word-of-mouth)
  4. WISDOM is useful for finding people who share your experience?
     • (share experience)
  5. WISDOM is useful for finding opinions from various viewpoints?
     • (opinion from various viewpoints)
  6. WISDOM is useful for grasp organized wide variety of information
     • (organized information)
The average point of each item

Advantages related to the process of decision making are highly evaluated.
Analysis of free topics

• It is possible that participants’ motivation and the characteristics of the topics affects evaluation
  – Investigating the relationship between free topic and evaluation of WISDOM

• To compare high evaluated topics and low evaluated topics
Analysis of WISDOM
Highly evaluated topics

- Products and controversial social issues are highly evaluated.
## Analysis of WISDOM

### Low evaluated topics

<table>
<thead>
<tr>
<th>WISDOM: Low Google: High</th>
<th>Motivation/reason</th>
<th>Opinion results</th>
</tr>
</thead>
<tbody>
<tr>
<td>coron</td>
<td>I research about this topic</td>
<td>61</td>
</tr>
<tr>
<td>recently it is buzz-word</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Coron robot</td>
<td>Second trial.</td>
<td>2</td>
</tr>
<tr>
<td>How about S. Shimada</td>
<td>I am interested in the result of WISDOM in case of person name.</td>
<td>22</td>
</tr>
<tr>
<td>(Japanese comedian)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ranking of good restaurant</td>
<td>I want to find the different liking by the different stance</td>
<td>8</td>
</tr>
<tr>
<td>Autumn in Tokyo at night</td>
<td>I want to go to Tokyo to enjoy the autumn color at night.</td>
<td>21</td>
</tr>
<tr>
<td>Akunin movie</td>
<td>I wonder if I go to the movie “Akunin”</td>
<td>231</td>
</tr>
<tr>
<td>Smartphone</td>
<td>Smartphone becomes more and more popular</td>
<td>1040</td>
</tr>
<tr>
<td>CSS Technique</td>
<td>I usually search this topic</td>
<td>5</td>
</tr>
<tr>
<td>Solar panel</td>
<td>I want to know merit and demerit of this topic</td>
<td>517</td>
</tr>
</tbody>
</table>

- The topics where WISDOM does not return much information are low evaluated.
- When users require a specific method or option, such as “technique” or “good restaurant”, WISDOM is not.
Analysis of WISDOM
Low evaluated topics

<table>
<thead>
<tr>
<th>WISDOM: Low</th>
<th>Motivation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar panel</td>
<td>I want to know merit and demerit comparing with current electric generation method</td>
</tr>
<tr>
<td>Smartphone</td>
<td>Smartphone is popular now.</td>
</tr>
<tr>
<td>Cutting tax for eco car</td>
<td>I frequently see this topic on TV.</td>
</tr>
<tr>
<td>Tokyo Disney Resort</td>
<td>I want to go to Disney Resort!</td>
</tr>
<tr>
<td>Animal therapy</td>
<td>I heard the effect of animal therapy and want to confirm the effect.</td>
</tr>
<tr>
<td>Is CO2 cause of global warming</td>
<td>I feel uneasy about global warming.</td>
</tr>
<tr>
<td>Education for gifted children</td>
<td>I have a child, so I am interested in this topic.</td>
</tr>
<tr>
<td>Thin client</td>
<td>I am interested vaguely in this topic</td>
</tr>
<tr>
<td>Senkaku</td>
<td>I wonder which country, Japan or China has ownership of this island.</td>
</tr>
<tr>
<td>Abolition of capital punishment</td>
<td>I feel this topic is controversial and get various opinions.</td>
</tr>
</tbody>
</table>

- Selecting topics where WISDOM returned much information but low evaluated.
- In case of “Disney Resort”, official page rather than various opinions is required.
- When the motivation is vague, such as, “popular now”, “feel uneasy”, the evaluation is low.
Results

• Compared with Google, WISDOM is
  – Equal when getting surprising or expected information
  – Superior when finding various opinions and bias of the different stance of senders.
    → WISDOM can mainly support the phase of collecting various opinions and verifying the quality on the decision making process.

• We attempt to support the users’ vague motivation and a specific method by presenting definition of the topic and key words.
  → For the future, integrated evaluation including all phases of decision making process is required.
Related Work

• Web information analysis system
  – Organization of information based on keywords
    • Yippy (http://search.yippy.com/)
  – Extracting dispute on the Web
    • Dispute Finder(Ennals et al., 2010)
  – Credibility Judgement
    • Wassmer et al. (2005), Weerkamp et al(2008)
      – Judging credibility based on the surface information of the text.

→ WISDOM is characteristic on presenting and organizing information which is required for decision making.
Conclusion

• We proposed the model of open-domain decision making on the Web information.
• WISDOM analyzes Web information from various viewpoints and assist user’s credibility judgment for decision making by the following ways.
  i. Uncovering biases
  ii. Showing various opinions from multiple viewpoints
  iii. Revealing information sources
References