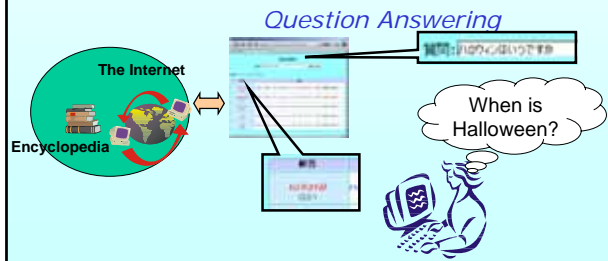# Question Answering system for NTCIR QAC2

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COE technical presentation 2004/5/27

Background

- **Efficient Information Access** to huge amount of text data on the www or in encyclopedias.

Question Answering

The Internet

Encyclopedia

When is Halloween?

What is QA

- Question Answering

> To obtain appropriate answers for a given question written in natural language

Q: Who killed Abraham Lincoln?
A: John Wilkes Booth.

NTCIR

- The NTCIR Workshop
  - A series of evaluation workshops
  - Designed to enhance research in Information Access technologies

- participants of NTCIR-4(2003-2004)
  - 74 groups
  - From 10 countries

NTCIR

- Tasks
  - Cross-Lingual Information Retrieval Task
  - Patent Retrieval Task
  - Question Answering Challenge
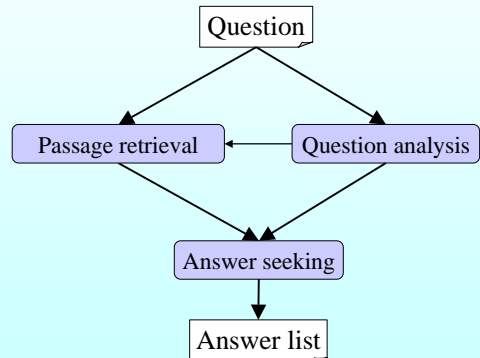 - Text Summarization Challenge
  - WEB Task

NTCIR QAC

- Question Answering Challenge
  - The required answers are short answers consisting of a noun or noun phrase.
  - Target documents: Four years Japanese newspaper articles.
  - Subtask1
    - Returns five possible exact answers or no-answer.
  - Subtask2
    - Returns only one set of answers or no-answer.
  - Subtask3
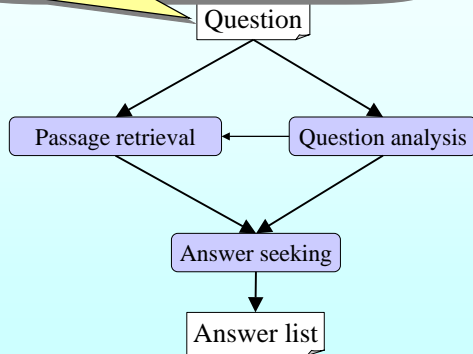   - Returns all the possible answers for a series of questions.

System Overview

- Three stages
  - Question analysis
  - Passage retrieval
  - Answer selection

- Two characteristics
  - Mediates the difference of expression using paraphrasing.
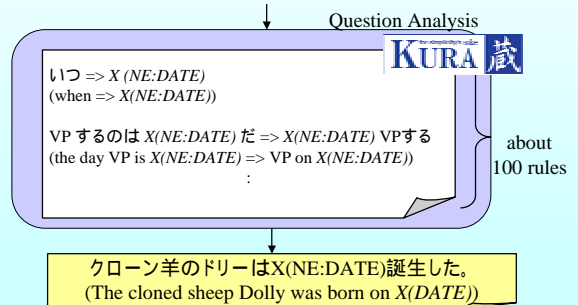 - Re-ranks answer candidates by structural matching.

System Overview

Question

Passage retrieval ← Question analysis

Answer seeking

Answer list

(When was the cloned sheep Dolly born?)

Question

Passage retrieval ← Question analysis

Answer seeking

Answer list

Question analysis

(When was the cloned sheep Dolly born?)

Question Analysis

KURA 蔵

=> X (NE:DATE)
(when => X(NE:DATE))

VP   X(NE:DATE)   => X(NE:DATE) VP
(the day VP is X(NE:DATE) => VP on X(NE:DATE))
:

about 100 rules

X(NE:DATE)
(The cloned sheep Dolly was born on X(DATE))

(When was the cloned sheep Dolly born?)

Question

Passage retrieval ← Question analysis

X(NE:DATE)
(The cloned sheep Dolly was born on X(DATE))

Answer seeking

Answer list
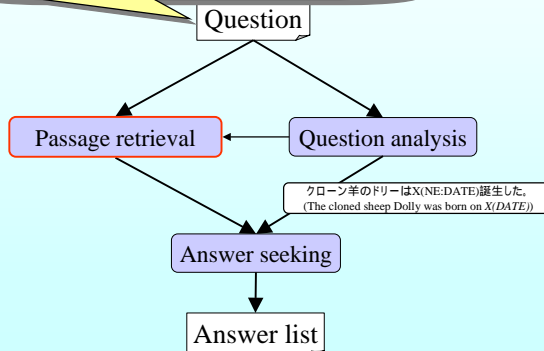
Passage retrieval

(When was the cloned sheep Dolly born?)

Keyword extraction
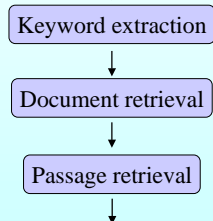
Document retrieval

Passage retrieval

Passage retrieval

(When was the cloned sheep Dolly born?)

Keyword extraction → keywords

cloned, sheep, Dolly, born

Document retrieval

Passage retrieval

Passage retrieval

(When was the cloned sheep Dolly born?)

20-best documents

Keyword extraction

cloned, sheep, Dolly, born

Document retrieval ← Newspaper articles

Passage retrieval

Passage retrieval

(When was the cloned sheep Dolly born?)

Keyword extraction

Document retrieval

Passage retrieval

cloned, sheep, Dolly, born
DATE

Passage retrieval

cloned, sheep, Dolly, born, *DATE*

Retrieved document

Dolly the **sheep clone** dies young .
Dolly the **sheep**, who became famous as the first mammal to be **cloned** from an adult cell, has died.
The news was confirmed on Friday by the Roslin Institute, the Scottish research center which created her.
A decision was taken to "euthanase" six-year-old **Dolly** after a veterinary examination showed that she had a progressive lung disease, the institute said in a statement.
Dolly became the first mammal **clone** when she was **born** on **5 July 1996**. She was revealed to the public the following year.
Dr Harry Griffin, from the institute, said: "**Sheep** can live to 11 or 12 years of age and lung infections are common in older **sheep**, particularly those housed inside.
Speaking to BBC News 24 on **Friday**, Prof Wilmut said **Dolly's** birth should be the important issue.

Passage retrieval

cloned, sheep, Dolly, born, *DATE*

Retrieved document

Dolly the **sheep clone** dies young .
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Passage retrieval

(When was the cloned sheep Dolly born?)

Keyword extraction
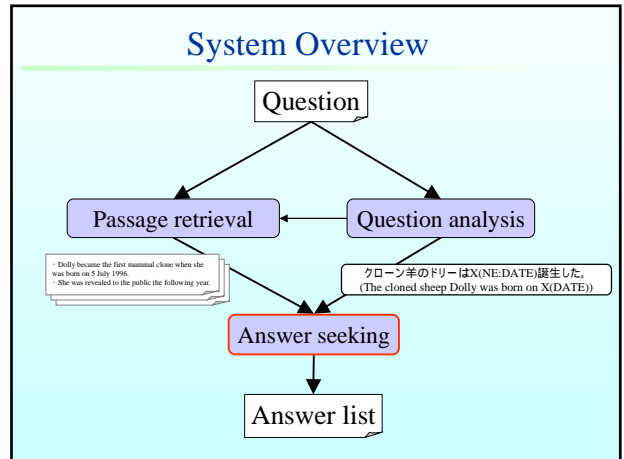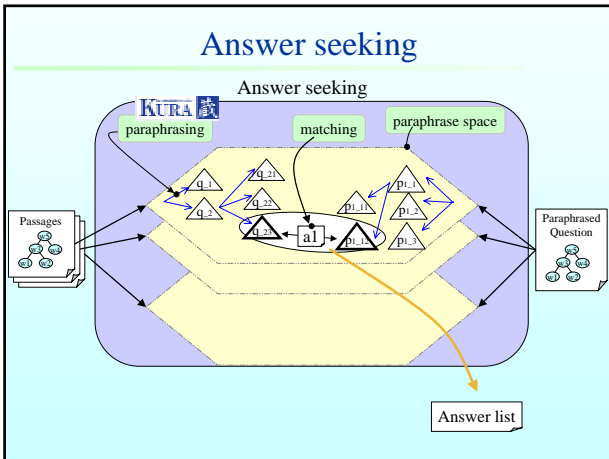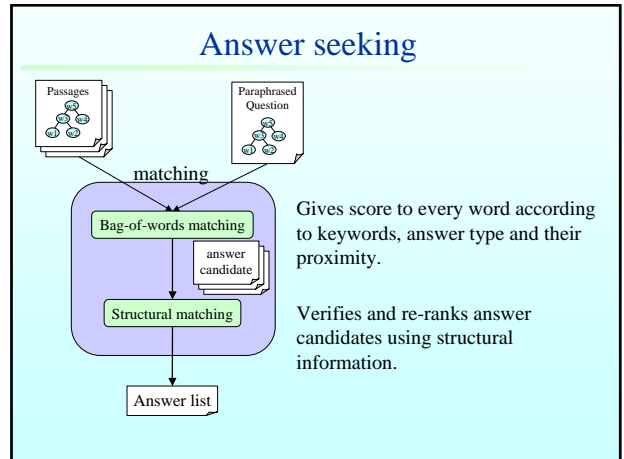
cloned, sheep, Dolly, born, *DATE*

Document retrieval ← Newspaper articles

Passage retrieval

10-beset passages

3

System Overview

Question

Passage retrieval ← → Question analysis

Dolly became the first mammal clone when she was born on 5 July 1996.
She was revealed to the public the following year.

X(NE:DATE)
(The cloned sheep Dolly was born on X(DATE))

Answer seeking

Answer list

Answer seeking

Passages

Paraphrased Question

matching

Bag-of-words matching

answer candidate

Structural matching

Answer list

Gives score to every word according to keywords, answer type and their proximity.

Verifies and re-ranks answer candidates using structural information.

Answer seeking

Answer seeking

KURA蔵

paraphrasing   matching   paraphrase space

q_1
q_2
q_3

p1_1
p1_2
p1_3

a1

p1_1
p1_2
p1_3

Passages

Paraphrased Question

Answer list

System Overview

Question

Passage retrieval ← Question analysis

Dolly became the first mammal clone when she was born on 5 July 1996.
She was revealed to the public the following year.

X(NE:DATE)
(The cloned sheep Dolly was born on X(DATE))

Answer seeking

Answer list

Evaluation and Result

⬤ Subtask 1 (200 questions)

MRR

	re-ranking	re-ranking
paraphrasing	0.340	0.311
paraphrasing	0.341	0.310

$$RR_i = \frac{1}{Rank_i}$$

$$MRR = \frac{\sum_{i=1}^{n} RR_i}{n}$$

1: 2002
2: 5 July 1996
3: Friday
4: 1996
5: 2 years ago

Evaluation and Result

⬤ Subtask 1 (200 questions)

MRR

	re-ranking	re-ranking
paraphrasing	0.340	0.311
paraphrasing	0.341	0.310

$$RR_i = \frac{1}{Rank_i}$$

$$MRR = \frac{\sum_{i=1}^{n} RR_i}{n}$$

1: 2002
2: 5 July 1996
3: Friday
4: 1996
5: 2 years ago

$$RR_i = \frac{1}{2}$$

Evaluation and Result

- Subtask 2 (200 questions)

Mean F-value

	re-ranking	re-ranking
paraphrasing	0.219	0.185
paraphrasing	0.220	0.185

$$F-value_i = \frac{2 \times Recall_i \times Precision_i}{Recall_i + Precision_i}$$

$$Mean\ F-value = \frac{\sum_{i=1}^{n} F\text{-}value_i}{n}$$

Evaluation and Result

- Re-ranking had a negative effect.
  - Other way to combine structural information.

- Effect of paraphrasing was extremely small.
  - Investigation of paraphrasing rules for question answering

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Related work

- Structural matching
  - Ittycheriah 2001, Kiyota 2002
    - used information of syntactic structure as a score to be appended

    ⇕

    as a penalty

    - The penalty was too strict, since question key words appeared in positions isolated from the answer in many passages.

Conclusion

- Question answering system
  - Mediates the difference of expression using paraphrasing.
  - Re-ranks answer candidates by structural matching.
- Evaluation
  - Re-ranking had a negative effect.
  - Effect of paraphrasing was extremely small.
- Future work
  - Investigation of paraphrasing rules for question answering.