

# KSU Team's QA System for World History Exams at the NTCIR-13 QA Lab-3 Task

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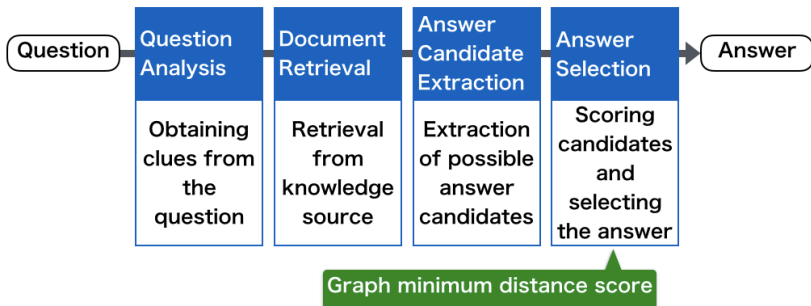
NTCIR-13 DAY-3: Dec 7 (Thu)

15:40 - 15:50

# Abstract

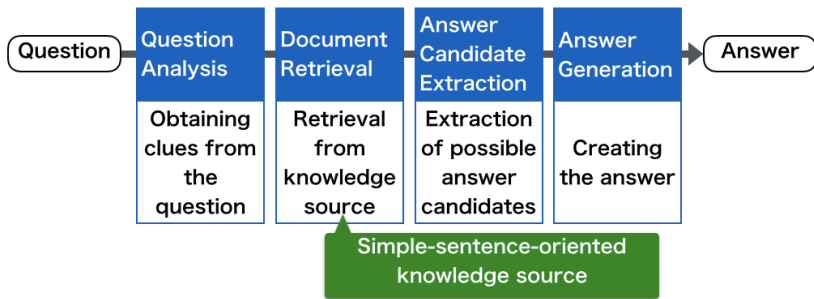
## Basic system configuration for the factoid type questions

The automatic answering system based on document retrieval for the factoid questions.



## Basic system configuration for the essay type questions

The automatic answering system based on document retrieval for the essay questions.



## The problem of the factoid type questions

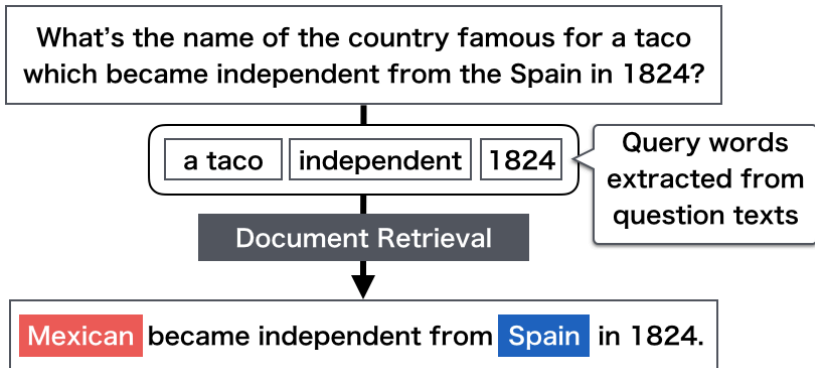
### The problem

Multiple candidates with the same score value can be obtained, even if the score is calculated based on the estimated answer categories.

## The problem of the factoid type questions

In what case are the answer candidates with the same score value be obtained?

For example, if the answer candidates share the same answer category and are obtained from the same document.



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Mexican became independent from Spain in 1824.

Candidate Extraction

Mexican Spain

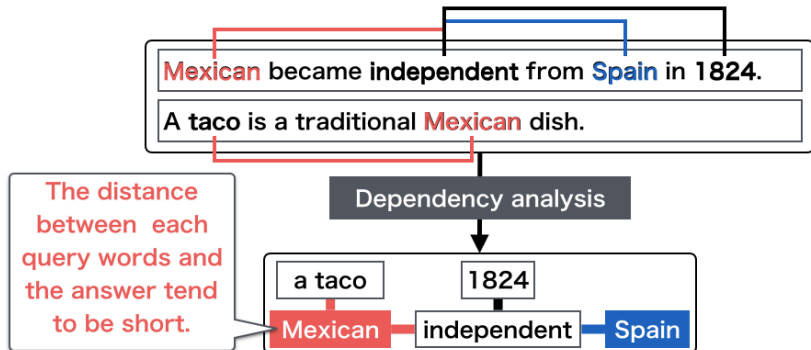
Answer candidates  
obtained from  
documents

These two answer candidates have the same score value,  
because they share the same category  
and they are obtained from the same document.

## The problem of the factoid type questions

### Our approach

Introduction of the score based on the dependency structure between the answer candidate words and the query words in the knowledge source.





## The problem of the essay type questions

### The problem

It is difficult to generate the summary satisfying the requested length and containing as many key points with concise expressions as possible.

## The problem of the essay type questions

Why is it difficult to include many key points with concise expressions in the summary?

Normal sentences often take the composition of complex sentences or compound sentences, and may be too redundant to be included in the summary as key points with concise expressions.

**Simple Sentence** contains only one independent clause.

Subject    Predicate    Modifier

A dog    walks    on the street.

Clauses : A dog - walks

**Compound Sentence** contains two or more independent clauses.

Subject    Predicate                      Subject    Predicate

A dog    walks , and a cat    sleeps.

Clauses : A dog - walks  
a cat - sleeps

**Complex Sentence** contains at least one subordinate clause.

Subject    Subordinate Clause    Predicate

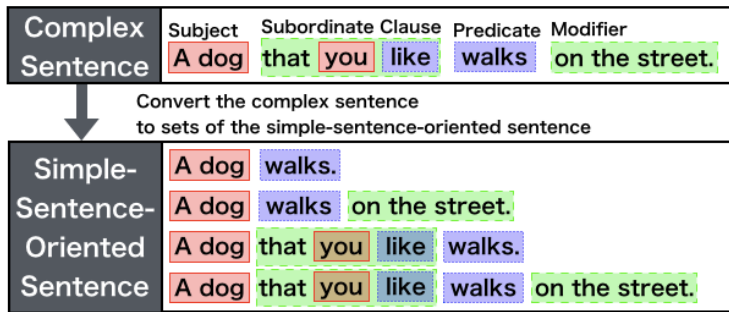
A dog    that you like    walks.

Clauses : A dog - walks  
you - like

## The problem of the essay type questions

### Our approach

Construct knowledge source by extracting sentences with more concise expressions from the original sentence.



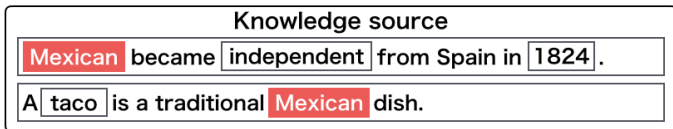
# Approach

## The indicator score based on the dependency graph

### Hypothesis

The correct word and each named entity in the question sentence tends to appear nearer in terms of dependency relations in the sentences in the knowledge source.

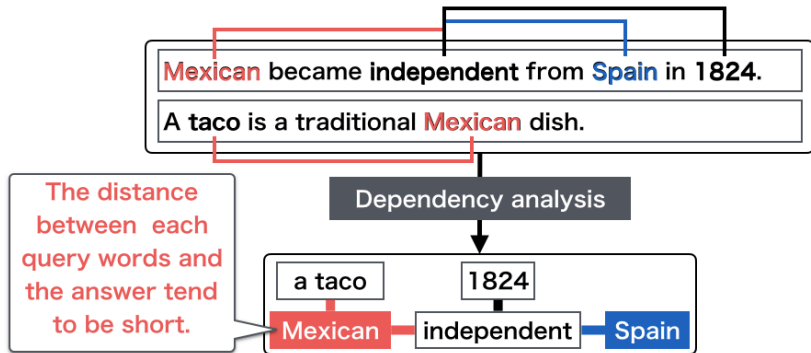
Question	Answer
What's the name of the country famous for a taco which became independent from the Spain in 1824?	Mexican



## The indicator score based on the dependency graph

### Introduction of the graph minimum distance score

Generate dependency graph from sentences in knowledge source, and score each answer candidate  $c$  by the distance between the query words  $q_k$  and the candidate.



## The indicator score based on the dependency graph

### Introduction of the graph minimum distance score

Generate dependency graph from sentences in knowledge source, and score each answer candidate  $c$  by the distance between the query words  $q_k$  and the candidate.

$$Score(c, Q) = \sum_{k=1}^n distance(c, q_k), \forall c \in C \quad (1)$$

$C$ : a set of candidate words  $Q$ : a set of query words

$$distance(x, y) = \begin{cases} \text{The minimum number of edges between the nodes} \\ \text{(if one or more paths exist between } x \text{ and } y\text{)} \\ \text{The large penalty score (otherwise)} \end{cases} \quad (2)$$

## Creating the simple-sentence-oriented sentence

### Hypothesis

“One meaning is basically represented by a pair of a subject and its predicate.”

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Subject    Predicate    Modifier

A dog    walks    on the street.

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**Complex Sentence** contains at least one subordinate clause.

Subject    Subordinate Clause    Predicate

A dog    that you like    walks.

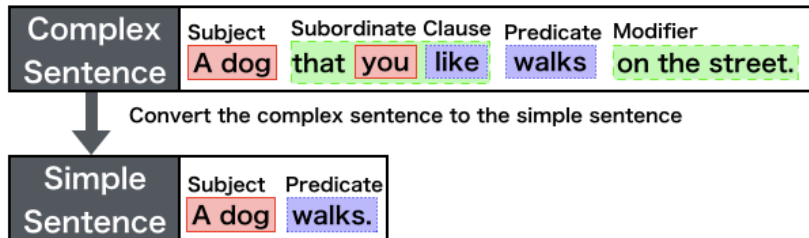
Clauses : A dog - walks  
you - like



## Creating the simple-sentence-oriented sentence

### What is the simple-sentence-oriented sentence?

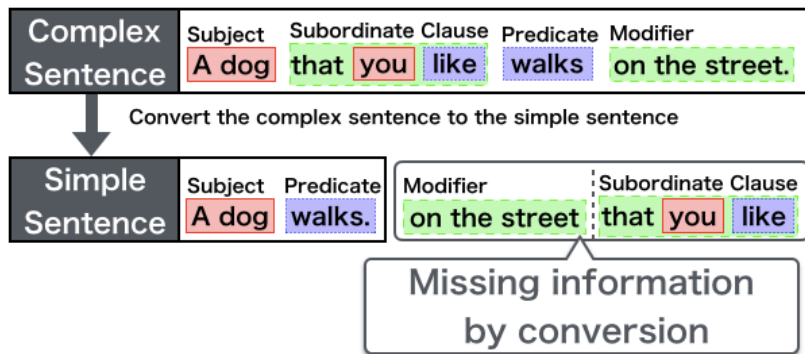
The simple-sentence-oriented sentence is a simple sentence composed only of a subject and its predicate, added by zero or more components other than the subject and the predicate.



## Creating the simple-sentence-oriented sentence

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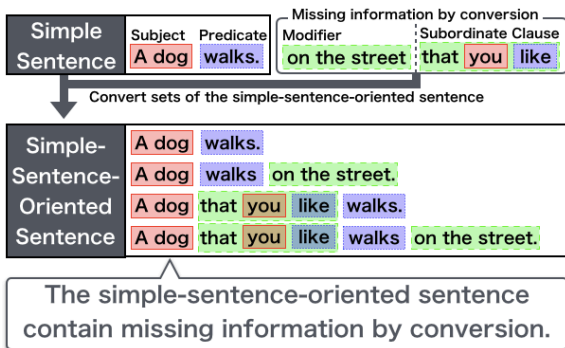
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## Creating the simple-sentence-oriented sentence

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# Result and discussion

## The effect of the graph minimum distance score

**Table:** Results of our runs in named-entity end-to-end task

<b>Phase</b>	<b>System Id</b>	<b>Using graph score?</b>	<b>Accuracy</b>
Phase-1	KSU-TERM-01@PH1	No	0.29(20/68)
	KSU-TERM-02@PH1	No	0.26(18/68)
Phase-2	KSU-TERM-01@PH2	No	0.30(23/77)
	KSU-TERM-02@PH2	Yes	0.29(22/77)
	KSU-TERM-03@PH2	Yes	0.31(24/77)

## The effect of the graph minimum distance score

The graph minimum distance score improved the accuracy slightly. It was confirmed that the distance between each named entity and the correct word tends to be short.

**Table:** Results of our runs in the factoid type questions of named-entity end-to-end task

<b>System Id</b>	<b>Using graph score?</b>	<b>Accuracy</b>
KSU-TERM-03@PH2	Yes	0.32(23/73)
KSU-TERM-04@PH2 <sup>1</sup>	No	0.29(21/73)

<sup>1</sup> An informal RUN for comparison, where the system was composed of KSU-TERM-03@PH2 without the graph minimum score.

## The effect of the graph minimum distance score

The graph minimum distance score improved the accuracy slightly. It was confirmed that the distance between each named entity and the correct word tends to be short.

**Table:** Result of the correct answer rate with and without the graph score

System Id	Single <sup>2</sup>	Same rate <sup>3</sup>
KSU-TERM-03@PH2	0.27(20/73)	0.03(2/73)
KSU-TERM-04@PH2	0.15(11/73)	0.32(23/73)

<sup>2</sup> The word with the highest score is the correct word and other words with the same score do not exist.

<sup>3</sup> The word with the highest score is the correct word but other words with the same score exist.

## The effect of the graph minimum distance score

It was also confirmed that the system tends to give incorrect answers in the following cases:

- When there were few named entities in the question,
- when the named entity in the question does not exist on the knowledge source in the first place, or
- when the distance between the named entities on the graph happens to be long.



## The effect of the simple-sentence-oriented sentence

The sentences with concise expressions including the correct answer were successfully selected by converting the original sentences into the simpler sentences.

**Table:** Results of our runs for Phase-2 in essay end-to-end task

System Id	Using proposed method?	ROUGE-1	ROUGE-2
KSU-ESSAY-01	No	0.0517	0.0040
KSU-ESSAY-02	Yes	0.0548	0.0037

## The effect of the simple-sentence-oriented sentence

Some simple-sentence-oriented sentences were unnatural due to the lack of necessary semantic components.

The diagram shows a Japanese sentence: "ローマは、勢力を拡大した。しかし、市民権をもつものは少数で、みなされなかった。ローマがなった。ローマに移った。" The word "しかし" is underlined. A red box labeled "Inappropriate conjunction" points to "しかし". Another red box labeled "Transitive verb without the object" points to "みなされなかった".

**Inappropriate conjunction**

ローマは、勢力を拡大した。しかし、市民権をもつものは少数で、みなされなかった。ローマがなった。ローマに移った。

**Transitive verb without the object**

Figure: Example the unnatural sentence

# Conclusion

## Approach and result

- Factoid type
    - The introduction of graph minimum distance score contributes to improve the correct answer rate.
- 
- Essay type
    - The knowledge source composed of the simple-sentence-oriented sentences contributes to improve ROUGE-N.

## Future works

- Factoid type
    - More comprehensive correspondence for spelling variations of words.
- 
- Essay type
    - Generating simple-sentence-oriented sentences more carefully to avoid the shortage of necessary semantic components.