

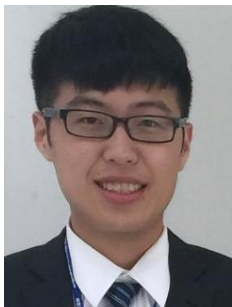
IMTKU Question Answering System for World History Exams at NTCIR-12 QA Lab2

Department of Information Management
Tamkang University, Taiwan

Sagacity Technology



Min-Yuh Day



Cheng-Chia Tsai



Wei-Chun Chung



Hsiu-Yuan Chang



Tzu-Jui Sun



Yuan-Jie Tsai



Jin-Kun Lin



Cheng-Hung Lee



Yu-Ming Guo



Yue-Da Lin



Wei-Ming Chen



Yun-Da Tsai



Cheng-Jhih Han



Yi-Jing Lin



Yi-Heng Chiang



Ching-Yuan Chien

myday@mail.tku.edu.tw



IMTKU

Question Answering System

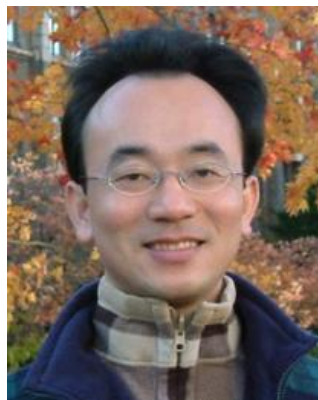
for

World History Exams

at NTCIR-12 QA Lab2

IMTKU Textual Entailment System for Recognizing Inference in Text at NTCIR-9 RITE

Department of Information Management
Tamkang University, Taiwan



Min-Yuh Day

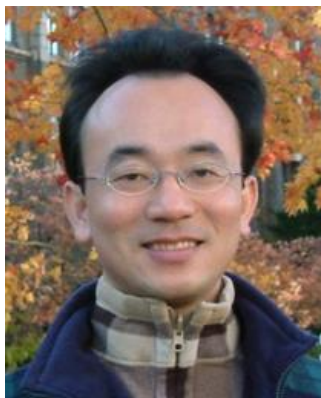


Chun Tu

myday@mail.tku.edu.tw

IMTKU Textual Entailment System for Recognizing Inference in Text at NTCIR-10 RITE-2

Department of Information Management
Tamkang University, Taiwan



Min-Yuh Day



Chun Tu



Hou-Cheng Vong



Shih-Wei Wu



Shih-Jhen Huang

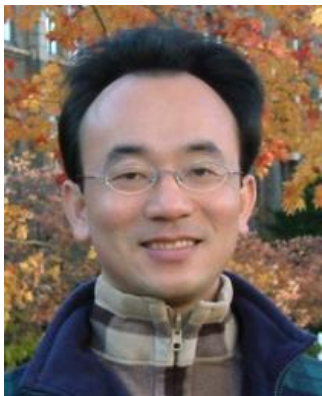
myday@mail.tku.edu.tw

IMTKU Textual Entailment System for Recognizing Inference in Text at NTCIR-11 RITE-VAL

Tamkang University

淡江大學

2014



Min-Yuh Day



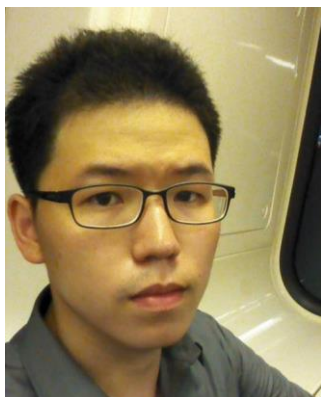
Ya-Jung Wang



Che-Wei Hsu



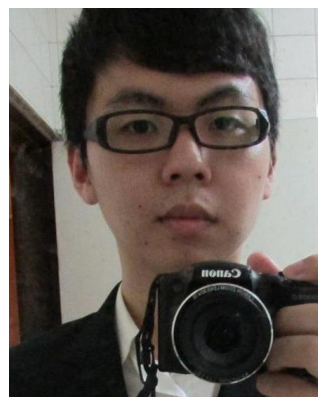
En-Chun Tu



Huai-Wen Hsu



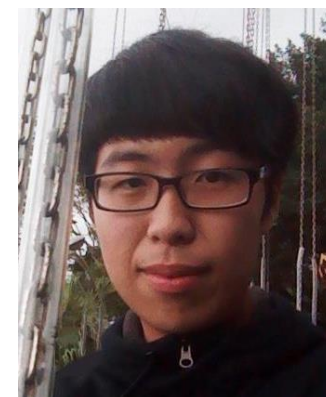
Yu-An Lin



Shang-Yu Wu



Yu-Hsuan Tai



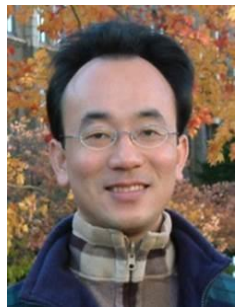
Cheng-Chia Tsai

2016

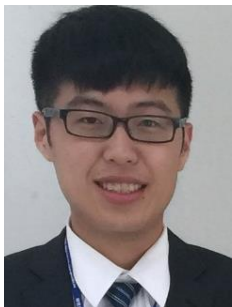
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Yuan-Jie Tsai



Jin-Kun Lin



Cheng-Hung Lee



Yu-Ming Guo



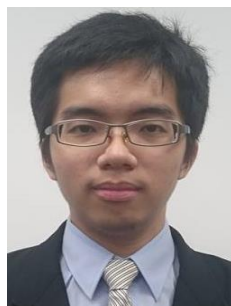
Yue-Da Lin



Wei-Ming Chen



Yun-Da Tsai



Cheng-Jhih Han



Yi-Jing Lin



Yi-Heng Chiang



Ching-Yuan Chien

myday@mail.tku.edu.tw



Outline

- **IMTKU Question Answering System Architecture**
- **IMTKU System Description**
- **Performance**
- **Discussions**
- **Conclusions**



Motivation

Question Answering System

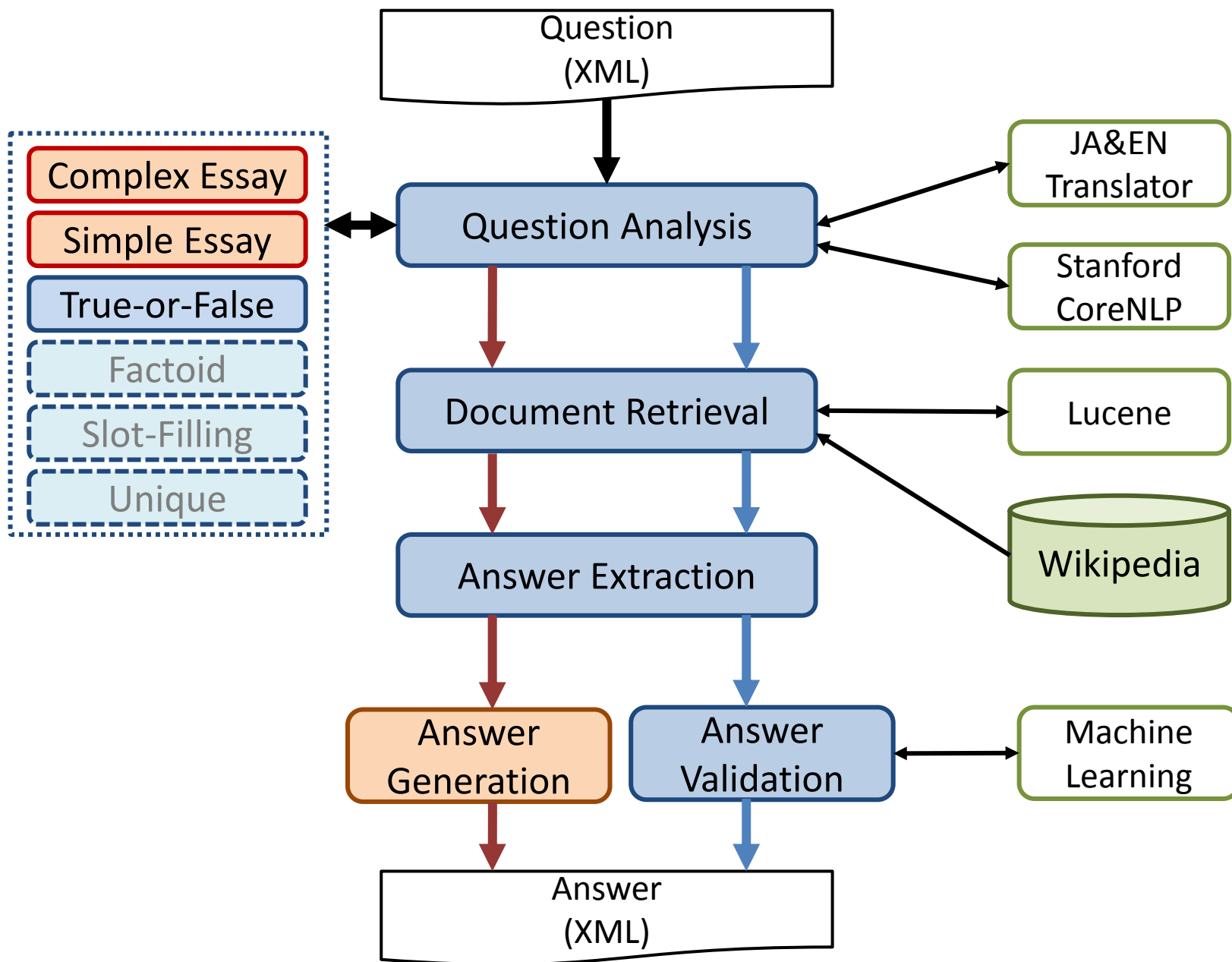
Who was the U.S. president in 2012?

Barack Obama

Highlights

- **IMTKU (Information Management at TamKang University) Question Answering System for World History Exams at NTCIR-12 QA Lab2**
- **Phase-1**
 - 6 End-to-End QA runs results for **English subtask** for National Center Test for University Admissions and Secondary exams subtask.
- **Phase-3**
 - 7 End-to-End QA run results for **English and Japanese subtask** for Nation Center Exams and Secondary exams subtask.

IMTKU System Architecture for NTCIR-12 QALab2

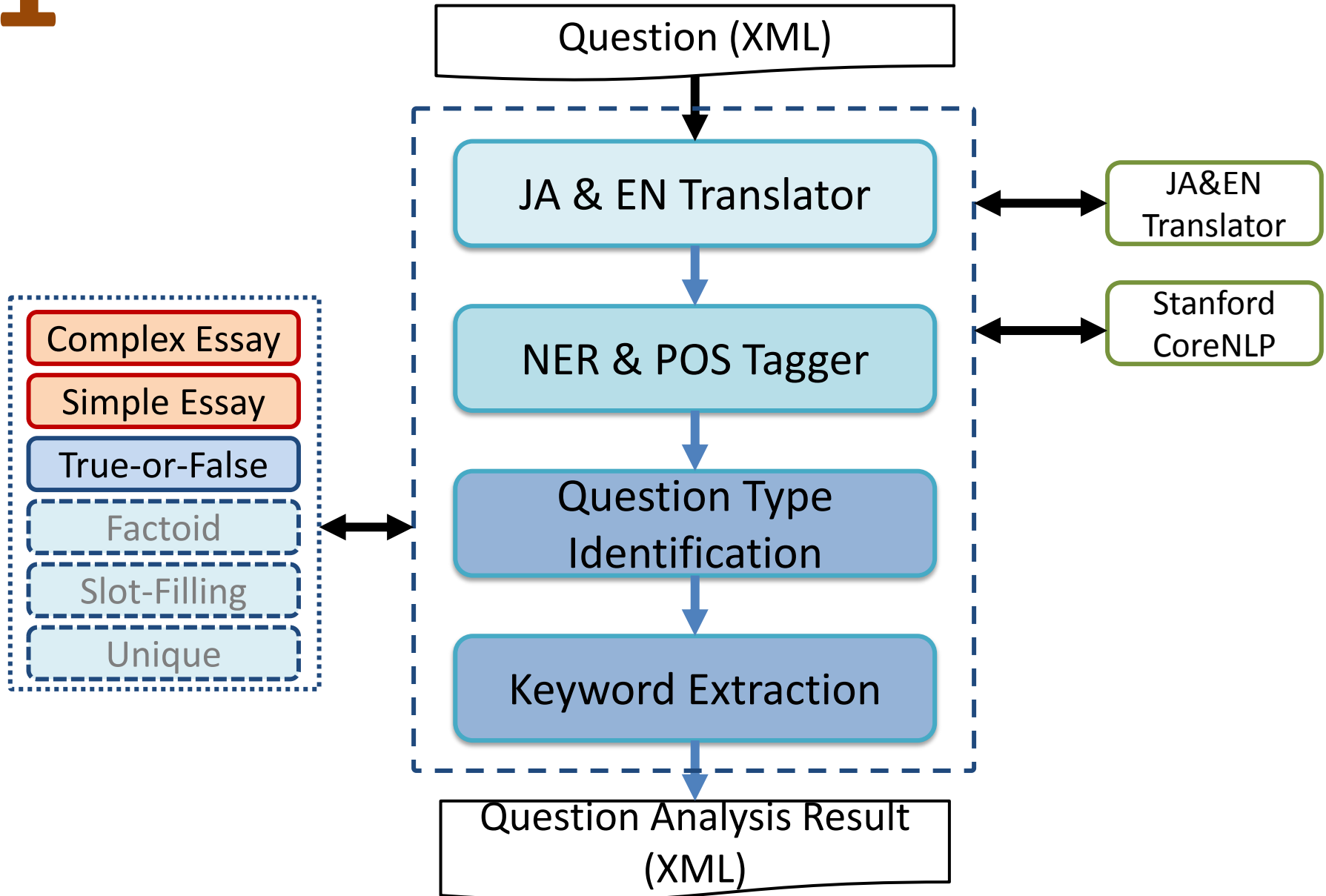




IMTKU

System Description

Question Analysis



JA & EN Translator

JA&EN
Translator

Japanese:

欧陽脩や蘇軾は，唐代を代表する文筆家である。

English (provided by organizer):

Ouyang Xiu and Su Shi are writers representative of the Tang period.

English (JA & EN Translator by Google Translate):

Ouyang Xiu and Su Shi is a writer representative of the Tang Dynasty.



NER & POS tagger

Stanford
CoreNLP

Raw Data:

Wang Anshi, who lived during the Song period, carried out reforms called the New Policies (xin fa).

POS tagger and NER:

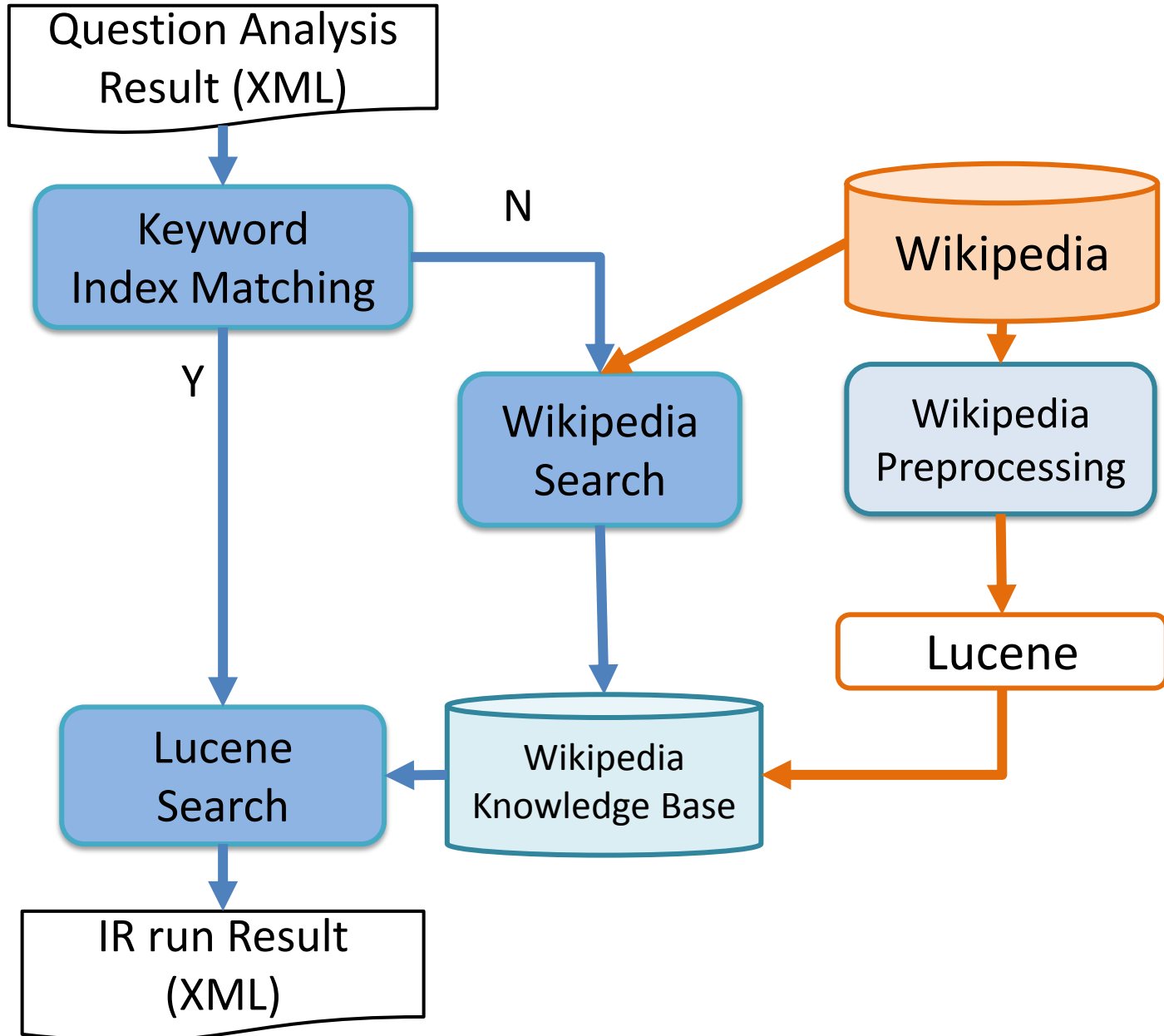
Wang/PERSON/NNP Anshi/PERSON/NNP ,/O/, who/O/WP
lived/O/VBD during/O/IN the/O/DT Song/O/NN
period/O/NN ,/O/, carried/O/VBD out/O/RP
reforms/O/NNS called/O/VBD the/O/DT New/O/JJ
Policies/O/NNS -LRB-/O/-LRB- xin/O/FW fa/O/FW -RRB-
/O/-RRB- ./O/.

Question Analysis Result

```
<KEY_TERM_SET LANGUAGE="EN">
  <KEY_TERM RANK="1" SCORE="1">time</KEY_TERM>
  <KEY_TERM RANK="2" SCORE="0.95">Tsuda</KEY_TERM>
  <KEY_TERM RANK="3" SCORE="0.9">Umeko</KEY_TERM>
  <KEY_TERM RANK="4" SCORE="0.85">journey</KEY_TERM>
  <KEY_TERM RANK="5" SCORE="0.8">USA</KEY_TERM>
  <KEY_TERM RANK="6" SCORE="0.75">China</KEY_TERM>
  <KEY_TERM RANK="7" SCORE="0.7">language</KEY_TERM>
  <KEY_TERM RANK="8" SCORE="0.65">schools</KEY_TERM>
  <KEY_TERM RANK="9" SCORE="0.6">students</KEY_TERM>
  <KEY_TERM RANK="10" SCORE="0.55">modernization</KEY_TERM>
  <KEY_TERM RANK="11" SCORE="0.5">policy</KEY_TERM>
  <KEY_TERM RANK="12" SCORE="0.45">foreign</KEY_TERM>
  <KEY_TERM RANK="13" SCORE="0.4">government-funded</KEY_TERM>
  <KEY_TERM RANK="14" SCORE="0.35">Tsuda</KEY_TERM>
  <KEY_TERM RANK="15" SCORE="0.3">Umeko</KEY_TERM>
</KEY_TERM_SET>
```

2

Document Retrieval



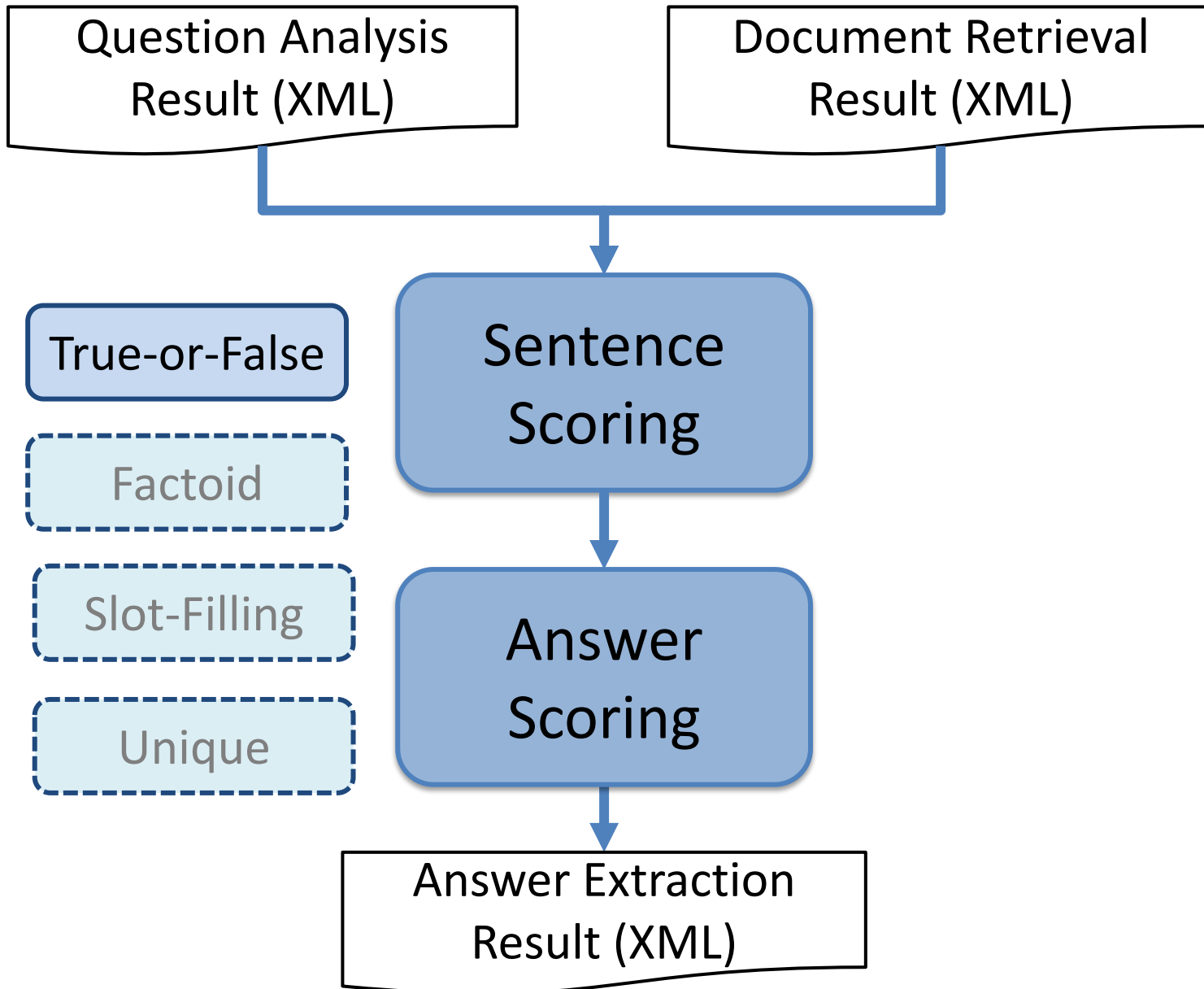


Document Retrieval Result

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<DOCUMENT_SET>
  <DOCUMENT RANK="1" SCORE="0.4393864"
SOURCE_ID="https://en.wikipedia.org/wiki/Buddha-nature"
SOURCE_ID_TYPE="WEB">Zen in the USA</DOCUMENT>
  <DOCUMENT RANK="2" SCORE="0.3515091"
SOURCE_ID="https://en.wikipedia.org/wiki/Robert_Smithson"
SOURCE_ID_TYPE="WEB">Spiral Jetty, Utah, USA</DOCUMENT>
  <DOCUMENT RANK="3" SCORE="0.2636318"
SOURCE_ID="https://en.wikipedia.org/wiki/Buddhism_in_China"
SOURCE_ID_TYPE="WEB">Sheng Yen also founded dharma centers in the
USA</DOCUMENT>
  <DOCUMENT RANK="4" SCORE="0.2515581"
SOURCE_ID="https://en.wikipedia.org/wiki/Chinese_language"
SOURCE_ID_TYPE="WEB">Numbers of first-language speakers</DOCUMENT>
  <DOCUMENT RANK="5" SCORE="0.2500338"
SOURCE_ID="https://en.wikipedia.org/wiki/Gloucester,_Massachusetts"
SOURCE_ID_TYPE="WEB">The following schools are located within the Gloucester Public
Schools District:</DOCUMENT>
</DOCUMENT_SET>
```

3

Answer Extraction



Answer Extraction Result



<question anscol="A1" target="time">

<keyList>

<mainKey>Imperial</mainKey>

<mainKey>Tang</mainKey>

<mainKey>Song</mainKey>

<mainKey>onwards</mainKey>

<mainKey>culture</mainKey>

<viceKey>song</viceKey>

<viceKey>tang</viceKey>

</keyList>

<sentenceList>

<sentence>During this time, the Song court retreated south of the Yangtze River and established their capital at Lin'an. Although the Song Dynasty had lost control of the traditional birthplace of Chinese civilization along the Yellow River, the Song economy was not in ruins, as the Southern Song Empire contained 60 percent of China's population and a majority of the most productive agricultural land</sentence>

<sentence>Southern Tang was conquered in 976 by the Northern Song Dynasty</sentence>

</sentenceList>

<answerList>

<A><answer>Ouyang Xiu and Su Shi are writers representative of the Tang period.</answer>

<answer>Yan Zhenqing is a calligrapher representative of the Song period.</answer>

<C><answer>Wang Anshi, who lived during the Song period, carried out reforms called the New Policies (xin fa).</answer></C>

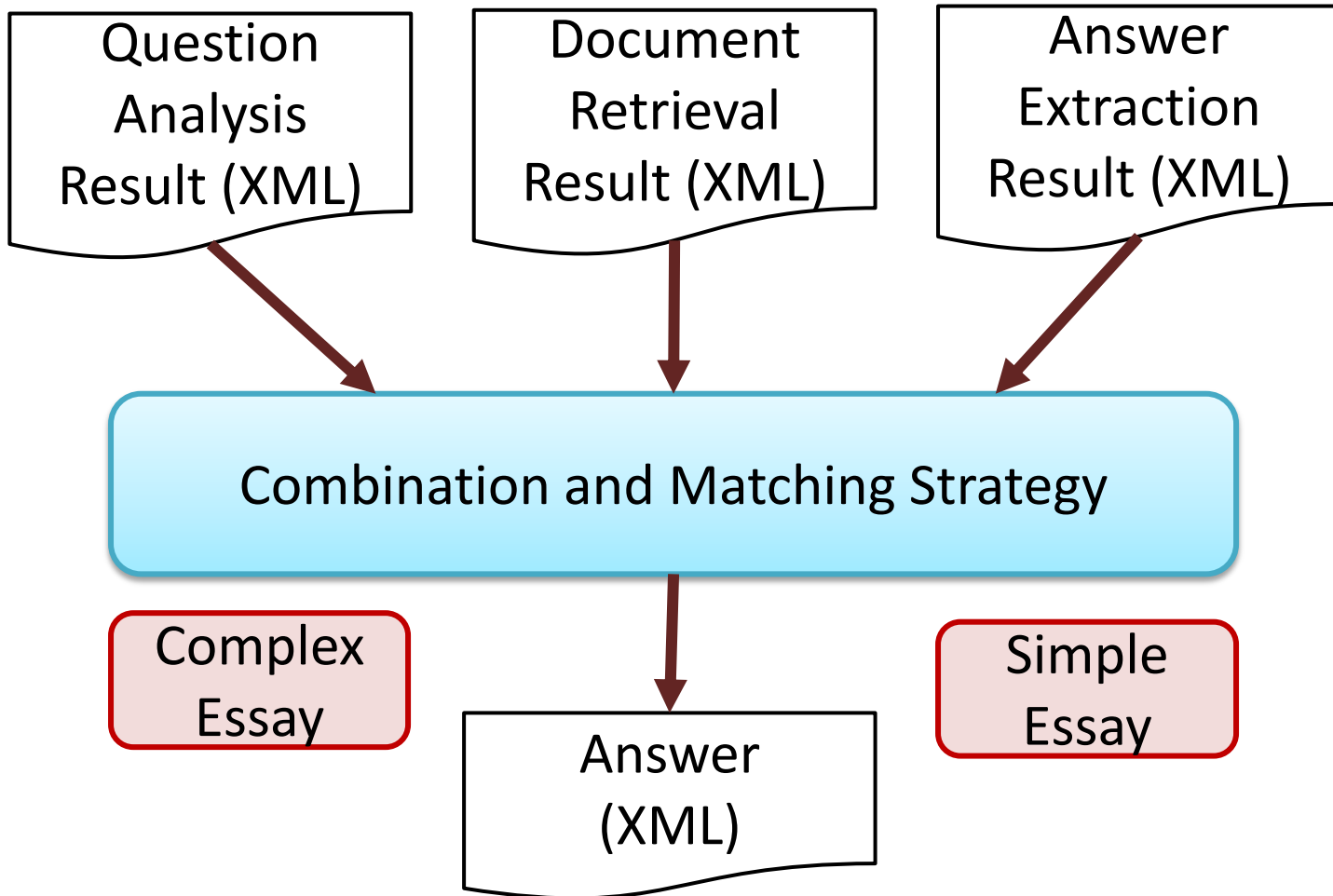
<D><answer>Qin Hui came into conflict with the party in favor of war, concerning the relationship with the Yuan.</answer></D>

</answerList>

</question>

4

Answer Generation

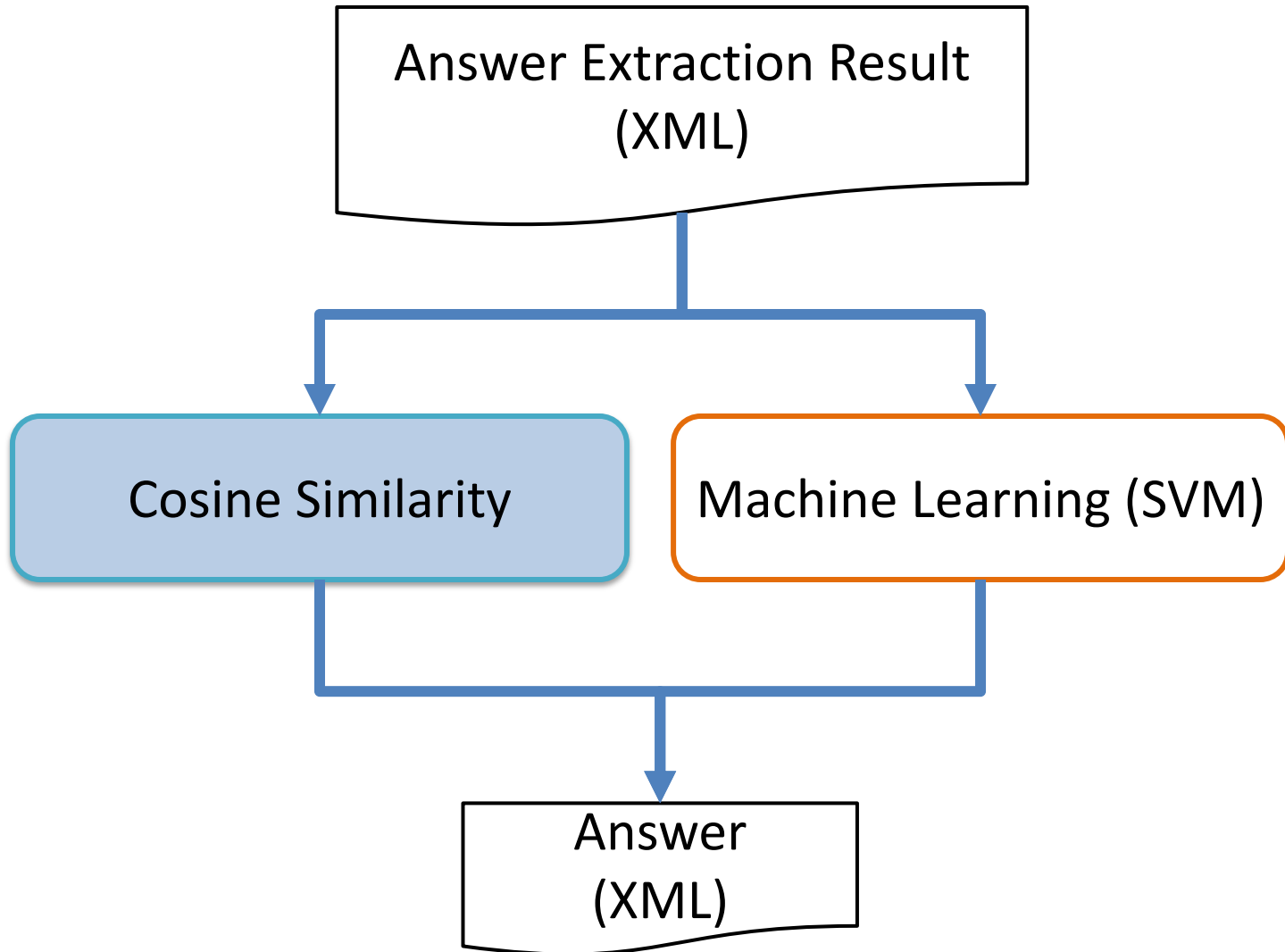


Answer Generation Result

```
<answer match_type="exact" order="-1" choices="" format_string=""
length_limit="-1">
  <expression_set>
    <expression>
      Jessica Motaung
    </expression>
  </expression_set>
</answer>
```

5

Answer Validation



Answer Validation Result

<combine>

<sentence>China is the largest trading nation in the world and plays a vital role in international trade, and has increasingly engaged in trade organizations and treaties in recent years</sentence>

<answer>Song is to manage maritime trade, established a Maritime Affairs.</answer>

<option>1</option>

<dict>0.177122977108019</dict>

</combine>

<combine>

<sentence>China is the largest trading nation in the world and plays a vital role in international trade, and has increasingly engaged in trade organizations and treaties in recent years</sentence>

<answer>In the Middle Ages of the Champagne region, large-scale regular city is opened.</answer>

<option>2</option>

<dict>0.180775381515547</dict>

</combine>

<combine>

IMTKU Phase-1 Official Runs



IMTKU Official Runs	Question Analysis results(QA)	IR run results(RS)	End-to-End QA run results(FA)
National Center Test	Center-1999--Main-WorldHistoryB_IMTKU_EN_QA_01	Center-1999-Main-WorldHistoryB_IMTKU_EN_RS_01	Center-1999-Main-WorldHistoryB_IMTKU_EN_FA_01
	Center-1999--Main-WorldHistoryB_IMTKU_EN_QA_02	Center-1999-Main-WorldHistoryB_IMTKU_EN_RS_02	Center-1999-Main-WorldHistoryB_IMTKU_EN_FA_02
	Center-1999--Main-WorldHistoryB_IMTKU_EN_QA_03	Center-1999-Main-WorldHistoryB_IMTKU_EN_RS_03	Center-1999-Main-WorldHistoryB_IMTKU_EN_FA_03
	question_format_type_set_def		
	answer_type_set_def		
Second Stage Examination	D792W10_IMTKU_EN_QA_01	D792W10_IMTKU_EN_RS_01	D792W10_IMTKU_EN_FA_01
	D792W10_IMTKU_EN_QA_02	D792W10_IMTKU_EN_RS_02	D792W10_IMTKU_EN_FA_02
	D792W10_IMTKU_EN_QA_03	D792W10_IMTKU_EN_RS_03	D792W10_IMTKU_EN_FA_03

IMTKU at NTCIR-12 QA-Lab2

Phase-1 Performance

RUN	Correct rate	Total score	Average score
1	0.293	31	0.756
2	0.244	27	0.659
3	0.000	0	0.000

IMTKU at result of multiple choice questions

RUN	Correct rate	ROUGE-1 score	ROUGE-2 score
1	0	0.032	0.005
2	0	0.008	0.000
3	0	0.032	0.005

IMTKU at result of free description questions



IMTKU at NTCIR-12 QA-Lab2

Phase-1 Performance

RUN	CORRECT	INCORRECT	UNANSWERED	Total	SCORE
1	12	19	10	12/41	31
2	10	21	10	10/41	27
3	0	0	41	0/41	0

Correct, Incorrect, Unanswered and score of IMTKU National Center Test 3 runs

RUN	CORRECT	INCORRECT	UNANSWERED	WITHHOLDING	SCORE
1	0	8	22	1	0
2	0	8	22	1	0
3	0	8	22	1	0

Correct, Incorrect, Unanswered and score of IMTKU Second-stage Examination 3 runs

IMTKU Phase-3 Official Runs

IMTKU Official Runs	Question Analysis results(QA)	IR run results(RS)	End-to-End QA run results(FA)
National Center Test	Center-2011--Main-WorldHistoryB_IMTKU_EN_QA_01	Center-2011-Main-WorldHistoryB_IMTKU_EN_RS_01	Center-2011-Main-WorldHistoryB_IMTKU_EN_FA_01
	Center-2011--Main-WorldHistoryB_IMTKU_EN_QA_02	Center-2011-Main-WorldHistoryB_IMTKU_EN_RS_02	Center-2011-Main-WorldHistoryB_IMTKU_EN_FA_02
	Center-2011--Main-WorldHistoryB_IMTKU_EN_QA_03	Center-2011-Main-WorldHistoryB_IMTKU_EN_RS_03	Center-2011-Main-WorldHistoryB_IMTKU_EN_FA_03
	Center-2011--Main-WorldHistoryB_IMTKU_JA_QA_01	Center-2011-Main-WorldHistoryB_IMTKU_JA_RS_01	Center-2011-Main-WorldHistoryB_IMTKU_JP_FA_01
	Center-2011--Main-WorldHistoryB_IMTKU_JA_QA_02	Center-2011-Main-WorldHistoryB_IMTKU_JA_RS_02	Center-2011-Main-WorldHistoryB_IMTKU_JP_FA_02
	Center-2011--Main-WorldHistoryB_IMTKU_JA_QA_03	Center-2011-Main-WorldHistoryB_IMTKU_JA_RS_03	Center-2011-Main-WorldHistoryB_IMTKU_JP_FA_03



IMTKU Phase-3 Official Runs

IMTKU Official Runs	IR run results(RS)	
Second Stage Examination	M792W10_IMTKU_EN_RS_01	M792W10_IMTKU_JP_RS_01
	M792W10_IMTKU_EN_RS_02	M792W10_IMTKU_JP_RS_02
	M792W10_IMTKU_EN_RS_03	M792W10_IMTKU_JP_RS_03

IMTKU Official Runs	Combination Run
National Center Test	Center-2011-Main-WorldHistoryB_KitAi_IMTKU_EN_FA_01

IMTKU at NTCIR-12 QA-Lab2 Phase-3 Performance



Run	Lang.	Correct rate	Total score	Average score
RUN01	EN	0.194	20	0.556
RUN02	EN	0.194	20	0.556
RUN03	EN	0.139	14	0.389
RUN01	JA	0.222	24	0.667
RUN02	JA	0.083	8	0.222
RUN03	JA	0.222	24	0.667

IMTKU at result of multiple choice questions in Phase-3



IMTKU at NTCIR-12 QA-Lab2

Phase-3 Performance

EN	CORRECT	INCORRECT	SCORE
RUN01	7	29	20
RUN02	7	29	20
RUN03	5	31	14

Correct, Incorrect and score of IMTKU National Center Test English 3 run

JA	CORRECT	INCORRECT	SCORE
RUN01	4	32	12
RUN02	3	33	8
RUN03	8	28	24

Correct, Incorrect and score of IMTKU National Center Test Japanese 3 runs

IMTKU at NTCIR-12 QA-Lab2 Phase-3 Performance



TeamID	Comb	Correct rate	Total score	Average score
IMTKU	KitAi	0.333	34	0.944

IMTKU at result of multiple choice questions for combination run in Phase-3

Combination	CORRECT	INCORRECT	Total	SCORE
RUN with KitAi	12	24	12/36	34

**Correct, Incorrect and score of IMTKU with KitAi National
Center Test English Combination run**

Discussions

- Systematic Error of XML output (IMTKU FA run03 on Phase-1)
- Limitations of the IMTKU System

o(symbol-symbol-symbol):

(1) $a \rightarrow b \rightarrow c$ (2) $a \rightarrow c \rightarrow b$ (3) $b \rightarrow a \rightarrow c$ (4) $b \rightarrow c \rightarrow a$

symbol-symbol:

(1)(A) — a (2)(A) — b (3)(B) — a (4)(B) — b

(symbol-TF)*2

(1)a- Correct b- Correct (2)a- Correct b- Incorrect

(3)a- Incorrect b- Correct (4)a- Incorrect b- Incorrect

(symbol-term_other)*2:

(1)(A)- Huguang (B)- Gongsuo (guild)

(2)(A)- Huguang (B)- Zujie (concession)

(3)(A)- Suhu (Jiangzhe) (B)- Gongsuo (guild)

(4)(A)- Suhu (Jiangzhe) (B)- Zujie (concession)

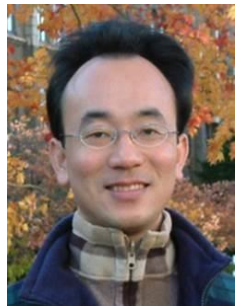
Conclusions

- **IMTKU Question Answering System for World History Exams at NTCIR-12 QA Lab2**
- **Phase-1**
 - **6 End-to-End QA runs results for English subtask for National Center Test for University Admissions and Secondary exams subtask.**
- **Phase-3**
 - **7 End-to-End QA run results for English and Japanese subtask for Nation Center Exams and Secondary exams subtask.**
- **IMTKU with KitAi for National Center Test English Combination run**

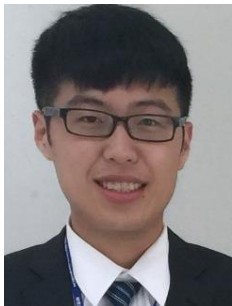
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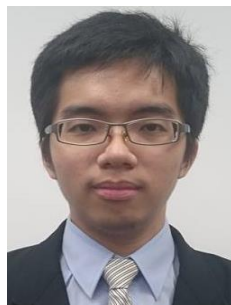
Yue-Da Lin



Wei-Ming Chen



Yun-Da Tsai



Cheng-Jhih Han



Yi-Jing Lin



Yi-Heng Chiang



Ching-Yuan Chien

myday@mail.tku.edu.tw