ASQA2 – Academia Sinica Question Answering System on C-C and E-C Subtasks

Cheng-Wei Lee, Min-Yuh Day, Cheng-Lung Sung, Yi-Hsun Lee, Tian-Jian Jiang, Chia-Wei Wu, Cheng-Wei Shih, Yu-Ren Chen, Wen-Lian Hsu

Academia Sinica, Taiwan

aska@iis.sinica.edu.tw

Outline
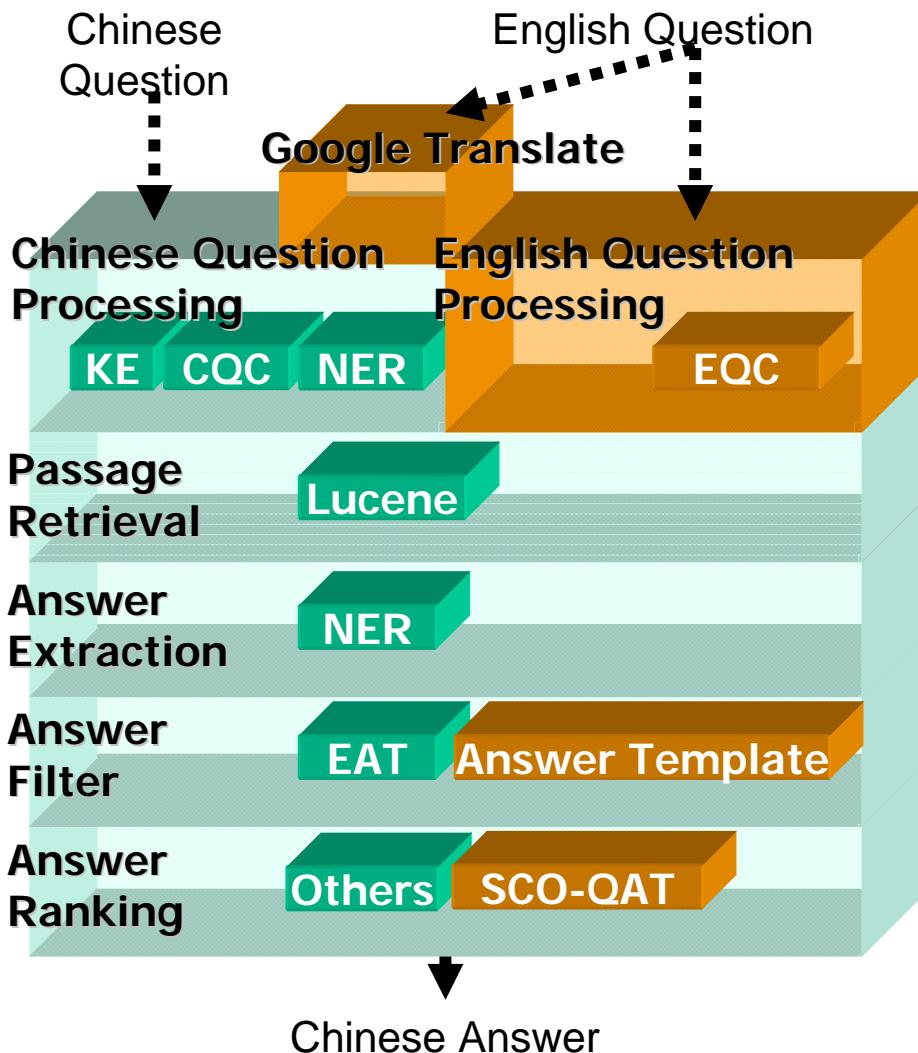
- **Overview**
- Major Extensions
  - English Question Classification
  - Answer Filtering with Answer Template
  - Answer Ranking with SCO-QAT Feature
- Error Analysis
- Conclusion

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Overview

- ASQA1 System (NTCIR5)
- ASQA2 System (NTCIR6) participated in C-C and E-C subtasks
- ASQA2 focuses on
  - Cross-lingual QA (EC)
  - Syntactic information
  - Global information
- Post-hoc evaluation of ASQA2 on NTCIR5 test set
  - C-C RU-Accuracy: 0.445 → 0.555
  - C-C R-Accuracy: 0.375 → 0.395

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ASQA2 System
(NTCIR6)

Chinese Question → Chinese Question Processing

English Question → Google Translate → English Question Processing

Chinese Question Processing: KE | CQC | NER

English Question Processing: EQC

Passage Retrieval: Lucene

Answer Extraction: NER

Answer Filter: EAT | Answer Template

Answer Ranking: Others | SCO-QAT

→ Chinese Answer

NTCIR-6 CLQA CC subtask:
• R-Accuracy: 0.52
• RU-Accuracy: 0.553
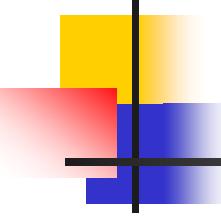
NTCIR-6 CLQA EC subtask:
• R-Accuracy: 0.253
• RU-Accuracy: 0.34

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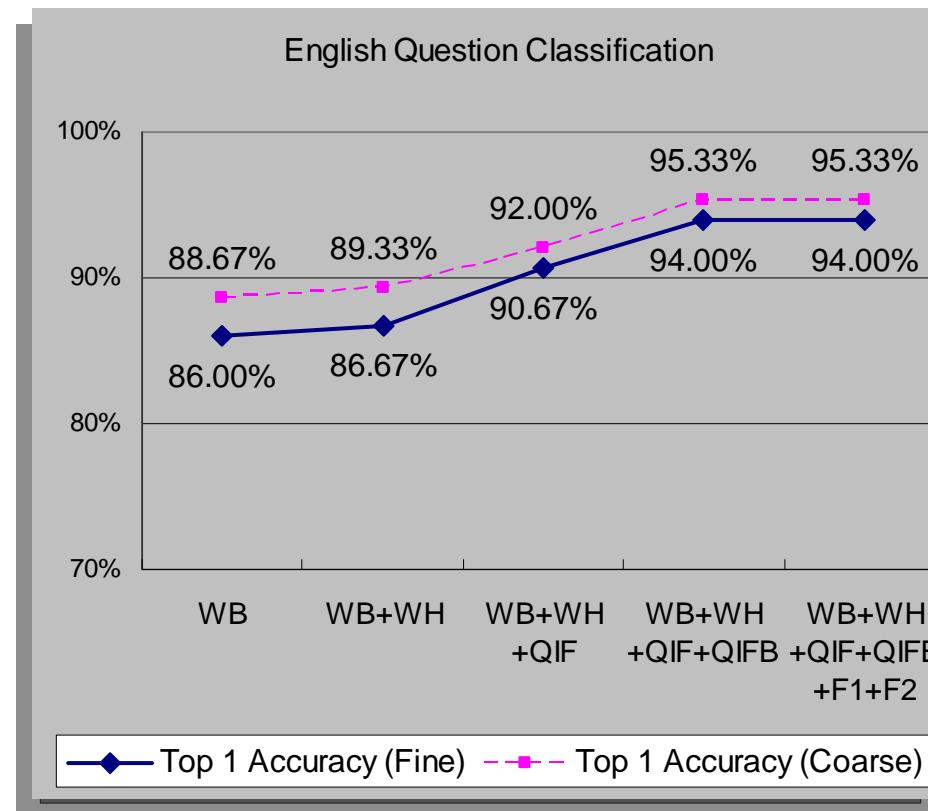
English Question Classification
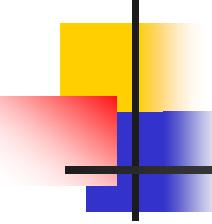
- SVM
- Features for SVM EQC model
  - word bi-gram
  - first word
  - first two words
  - question wh-word
  - **question informer**
  - **question informer** bi-gram

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Question Informer for English Questions

- Answer type informer span (Krishnan et al. 2005)
    - *a short (typically 1–3 word) subsequence of question tokens that are adequate clues for question classification*
    - How much does an adult elephant weigh?

- Predicted by a Conditional Random Field (CRF) model
- Training data set (5,500 questions)
    - UIUC QC dataset (Li and Roth, 2002)
    - Question informer dataset (Krishnan et al., 2005)
- Features: Word, POS, heuristic informer, Parser Information, Question wh-word, length, position.
- 0.939 F-score

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Accuracy of English Question Classification by SVM
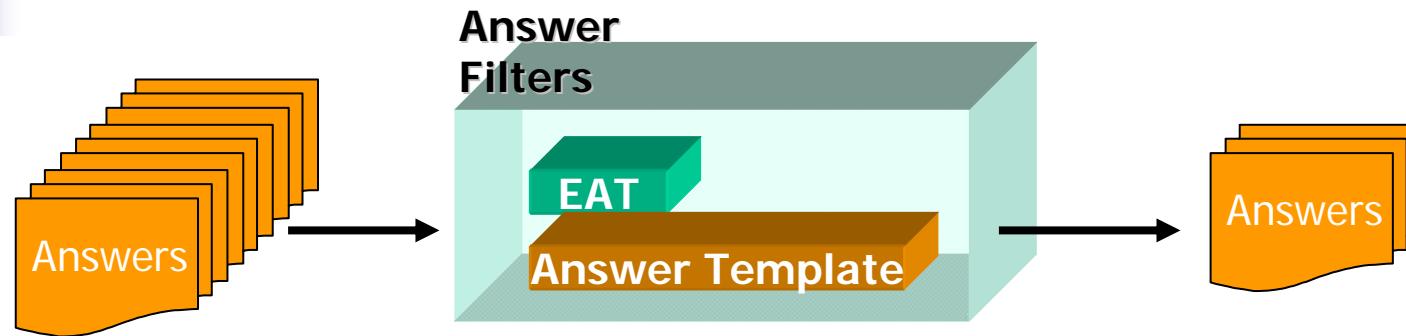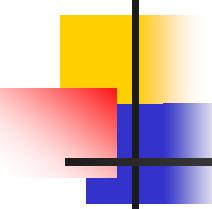
English Question Classification

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Answer Filters

Answer Filters

Answers → [EAT / Answer Template] → Answers
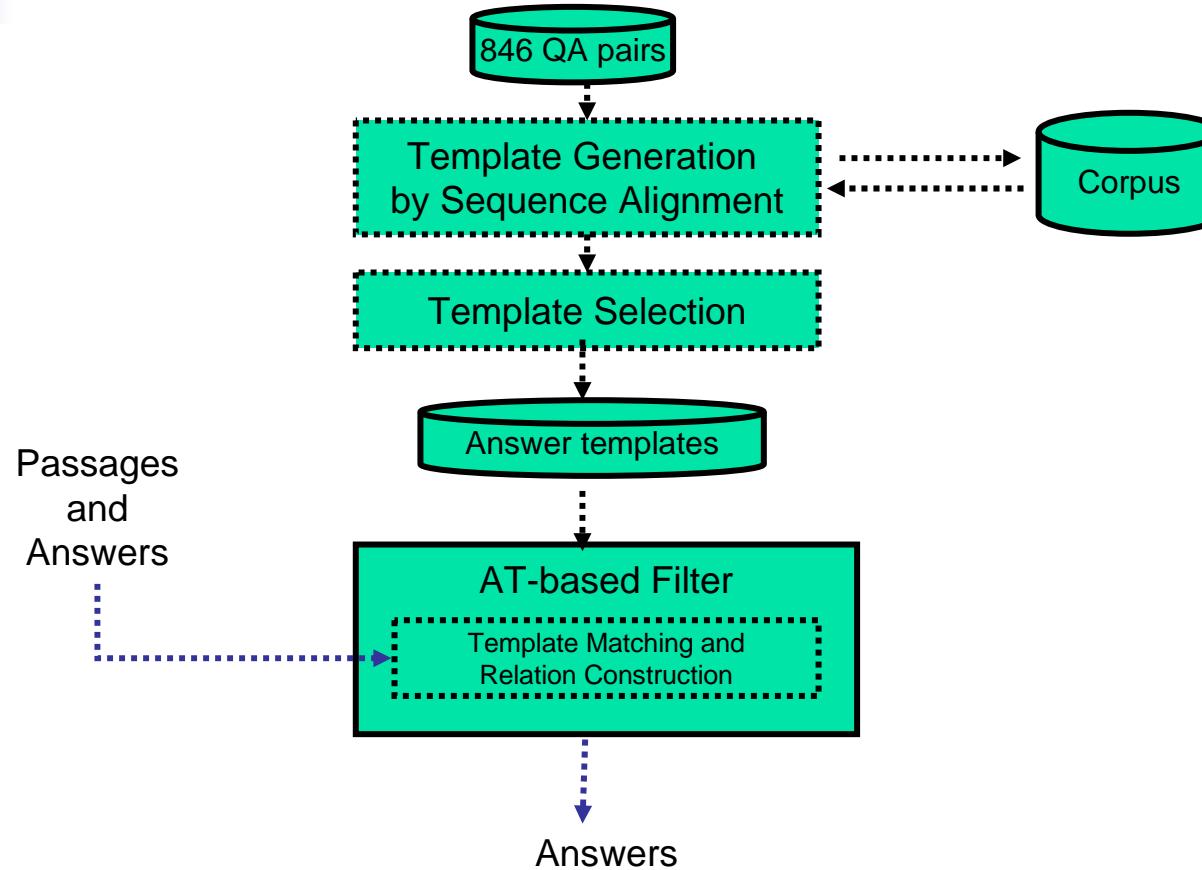
- Goal
  - Reducing the number of answers without damaging the upper bound of answer accuracy
  - Improving the performance of answer ranking since unrelated answers are removed

- EAT (Expected Answer Type) Filter
- AT-based Filter

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Answer Templates

- **Syntactic patterns for capturing relations between question terms and answers**

- **Similar to Surface Patterns used in some QA researches**
  - Trained from Question-Answer pairs
  - Gather passages by sending question keywords and the answer
- **But different in some ways:**
  - Generated by local sequence alignment
  - Not targeting to a specific question type
  - No bootstrapping

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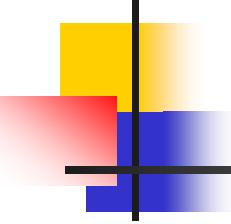
Generate and Apply Answer Templates

846 QA pairs

Template Generation
by Sequence Alignment

Corpus

Template Selection

Answer templates

Passages
and
Answers

AT-based Filter

Template Matching and
Relation Construction

Answers

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Templates generated by local alignment

- ..因/Cbb/O 台中縣/Nc/LOC 議長/Na/OCC 顏清標/Nb/PER 涉嫌/VK/O..
  .. 清朝/Nd/O 台灣/Nc/LOC 巡撫/Na/OCC 劉銘傳/Nb/PER 所/D/O..
  → LOC OCC PER　　　　　(contains only Semantic-tag)

- 　　被/P/O 大陸/Nc/LOC 國家/Na/O 主席/Na/OCC　　江民/Nb/O 形容為/VG/O..
  /COMMA/O 香港/Nc/LOC 行政/Na/O 長官/Na/OCC　　董建華/Nb/PER 近日..
  　　俄羅斯/Nc/LOC 男子/Na/O 選手/Na/OCC 史莫契柯夫/Nb/O 在/P/O..
  → LOC Na OCC Nb　　　(template contains POS-tag)

- 由/P/O 建業/Nc/O 所長/Na/OCC 張龍憲/Nb/PER 擔任/VG/O
  由/P/O 安侯/Nb/O 所長/Na/OCC 魏忠華/Nb/PER 擔任/VG/O
  → 由 N 所長 PER 擔任　　(template contains parital POS-tag, word)

- 在/P/O　卡達首都/Nc/LOC　多哈/D/PER,LOC 舉行/VC/O
  於/P/O 國父紀念館/Nc/ORG -　　　　　　舉行/VC/O
  在/P/O 國父紀念館/Nc/ORG 廣場/Nc/O　　　舉行/VC/O
  → P Nc – 舉行　　　　(template with don't care '-')

Priority of template tag types
Word > Semantic-tag > POS-tag

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Template Selection

- Apply the generated templates to the retrieved passages of training questions

- If there is a passage of which the matched parts contains the answer and some question key terms (with semantic-tag, Nb, or verb), the template will be retained.

- 126 answer templates are selected

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Use Answer Templates to Filter Answers
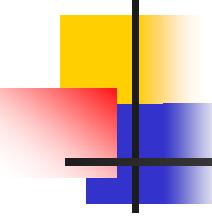
Question:	女演員/OCC 蜜拉索維諾/PER 獲得/VJ 奧斯卡/Nb/ORG 最佳/A 女配角/OCC 獎/Na 是/SHI 因/Cbb 哪/Nep 部/Nf 電影/Na

Passage₁	...... 而/Cbb 奪得/VC 一九九五/Neu 奧斯卡/Nb 最佳/A 女配角/OCC 的/DE 殊榮/Na ...
Template₁:	VC Neu Nb A OCC - Na
Relation₁:	{奪得/VC, 奧斯卡/Nb, 女配角/OCC}

Passage₂	... 蜜拉索維諾/PER 在/O/P/O 「/O/PAR 非強力春藥/ART 」/PAR 中/Ncd ...... 獲/VJ 奧斯卡/Nb 獎/Na ...
Template₂:	PER P PAR ART PAR − DE Na X VJ Nb
Relation₂:	{蜜拉索維諾/PER, 非強力春藥/ART, 獲/VJ, 奧斯卡/Nb}
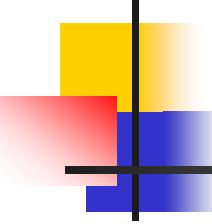
Relation₃:	{ 奪得/VC, 奧斯卡/Nb, 女配角/OCC, 蜜拉索維諾/PER, 非強力春藥/ART, 獲/VJ }

- Only answers found in final relations are retained
- If there is no answer found in the relations, retain all the answers
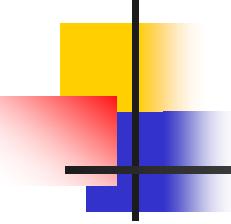
Answer Template Performance

- **NTCIR6 CLQA C-C**
  - Question Coverage: 37.3%
  - RU-Accuracy: 0.911
- **NTCIR6 CLQA E-C**
  - Question Coverage: 25.3%
  - RU-Accuracy: 0.632

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Answer Ranking

- ## Answer score

$$AnswerScore(ans) = \sum_i w_i \cdot feature_i$$

- ## Local features: only use the information in the containing passage
- ## Global features: use information from all the returned passages

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SCO-QAT (Sum of Co-occurrence of Question and Answer Terms)

$$SCOQAT(ans) = \sum_{c \subset QTermCombination} \frac{Freq(c, ans)}{Freq(c)}$$

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SCO-QAT Example

Input Question Q：誰是泰國總理 (Who is the prime minister of Thailand?)
Question Terms: 泰國　總理
2 Candidate Answers：乃川, 史柏柴
4 Retrieved Passages =
　　泰國副總理史柏柴也指責避險基金及投機客加重亞洲金融危機。
　　泰國總理乃川計畫在未來十年中將軍方將領減少四分之三
　　泰國總理乃川今天諭令泰國駐印尼大使館，若印尼局勢惡化，應準備撤回泰僑事宜
　　泰國總理乃川已指示駐印尼大使館預先準備撤僑事宜，並爲泰國僑民設立廿四小時
不….
➔
　　SCO-QAT(乃川) = F(乃川,泰國)/F(泰國)+ F(乃川,總理)/F(總理) + F(乃川,泰國,總理)/F(泰國,總理) = ¾ + ¾ + ¾ = 2.25
　　SCO-QAT(史柏柴)= ¼+ ¼+ ¼ = 0.75
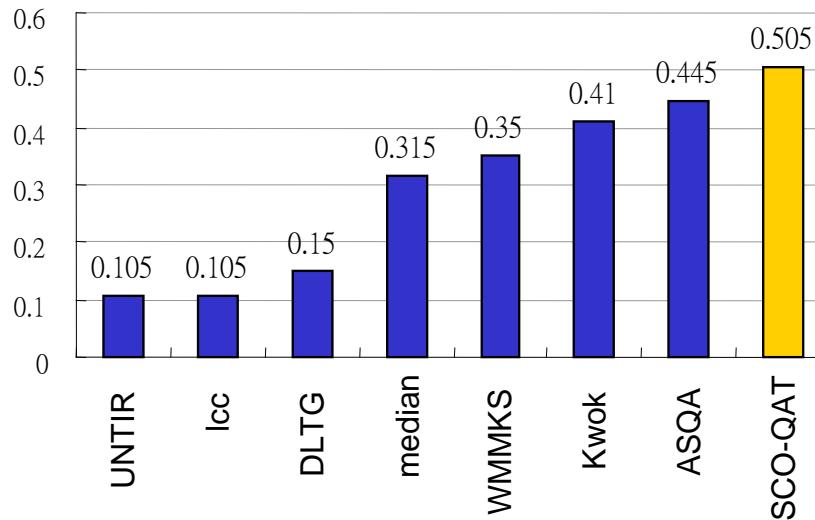
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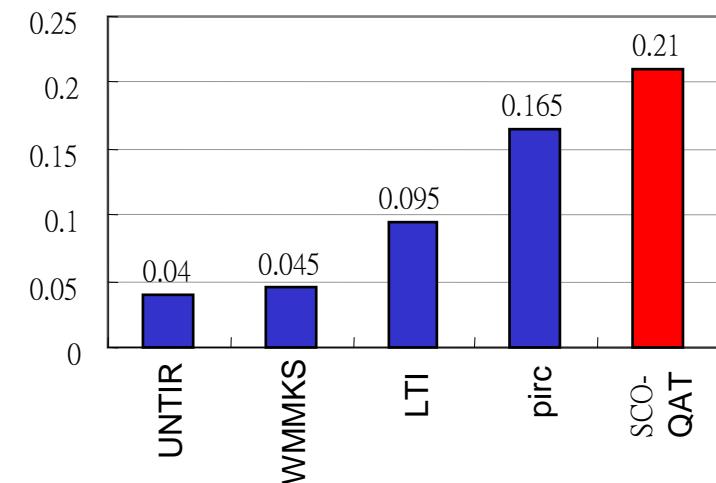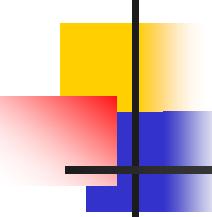
SCO-QAT RU-Accuracy on NTCIR-5 test data

NTCIR-5 C-C

NTCIR-5 E-C
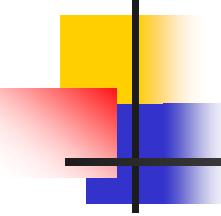
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Error Analysis of ASQA2 at NTCIR-6

- C-C
  - Answer Ranking (28.6%)
  - Question Classification (19.0%)
  - Time Constraint (15.9%)
  - Others
- E-C
  - Wrong Translation (37.9%)
  - Answer Ranking (20.4%)
  - Synonym (10.7%)
  - Others

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Conclusion

- We have successfully built an EC QA system by enhancing the CC version with *Google translate* and EQC

- In both C-C and E-C subtasks
  - Syntactic information is helpful (Answer Template)
  - Global information is helpful (SCO-QAT)

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Demo Site
http://asqa.iis.sinica.edu.tw/

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Thank You

智慧型代理人系統實驗室 i@SL   中央研究院 ACADEMIA SINICA

Intelligent Agent Systems Lab (IASL),
Academia Sinica, Taiwan

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