IMTKU Emotional Dialogue System for Short Text Conversation at NTCIR-14 STC-3 (CECG) Task

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Tamkang University, Taiwan
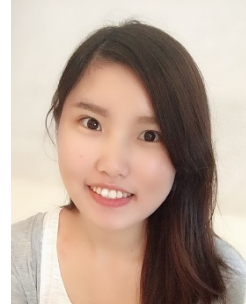
Min-Yuh Day   **Chi-Sheng Hung**   **Yi-Jun Xie**   **Jhih-Yi Chen**   **Yu-Ling Kuo**   **Jian-Ting Lin**

myday@mail.tku.edu.tw
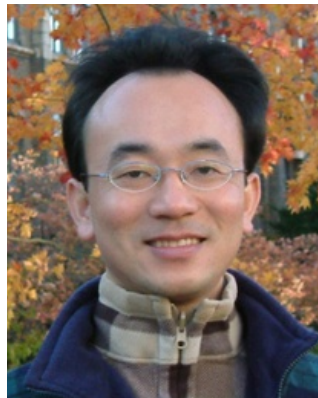
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Emotional Dialogue System for

Short Text Conversation at

NTCIR-14 STC-3 (CECG) Task

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

NTCIR-9 Workshop, December 6-9, 2011, Tokyo, Japan

Tamkang University

淡江大學

Tamkang University

2013

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

Department of Information Management
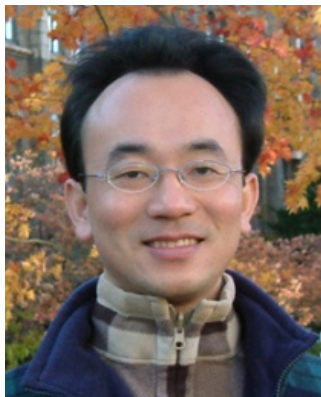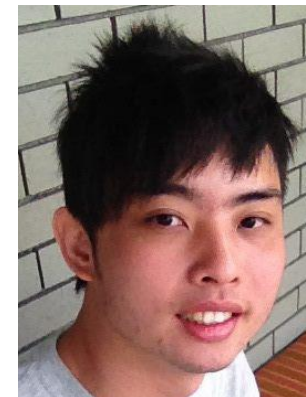## Tamkang University, Taiwan

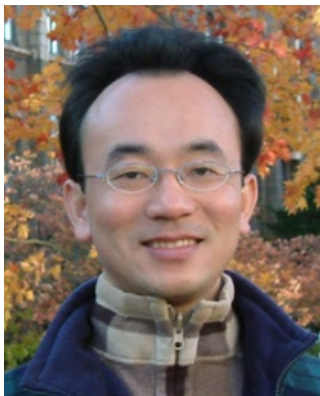**Min-Yuh Day**　　**Chun Tu**　　**Hou-Cheng Vong**　　**Shih-Wei Wu**　　**Shih-Jhen Huang**

myday@mail.tku.edu.tw

IMTKU Textual Entailment System for Recognizing Inference in Text at NTCIR-11 RITE-VAL
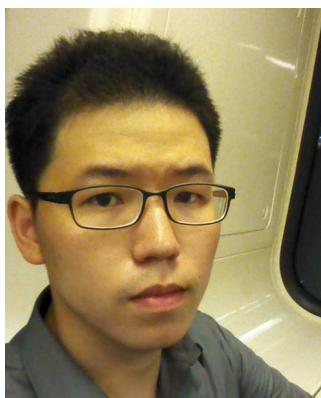
2014

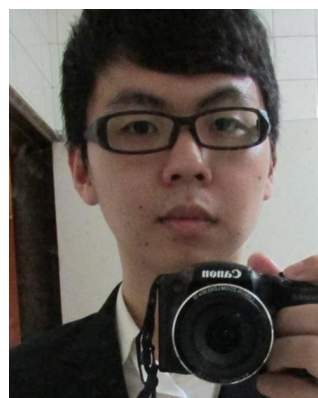**Tamkang University**

淡江大學

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

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

Department of Information Management
Tamkang University, Taiwan

Tamkang University

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
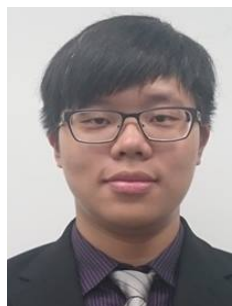
Yu-Ming Guo Yue-Da Lin Wei-Ming Chen Yun-Da Tsai Cheng-Jhih Han Yi-Jing Lin Yi-Heng Chiang Ching-Yuan Chien
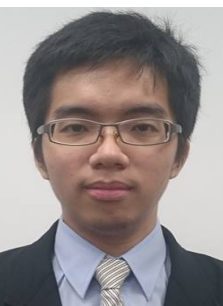
myday@mail.tku.edu.tw

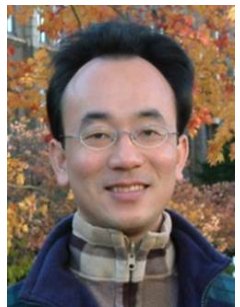NTCIR-12 Conference, June 7-10, 2016, Tokyo, Japan
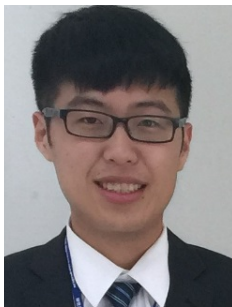
2017

Tamkang University
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IMTKU Question Answering System for World History Exams at NTCIR-13 QALab-3

Department of Information Management
Tamkang University, Taiwan
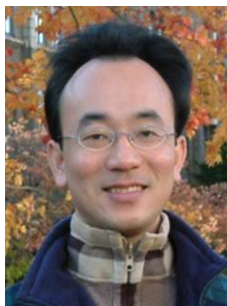
Min-Yuh Day   Chao-Yu Chen
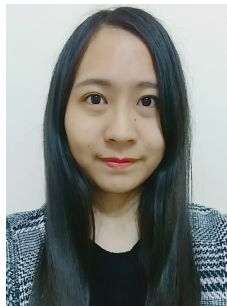
Wanchu Huang   **Shi-Ya Zheng**   **I-Hsuan Huang**   **Tz-Rung Chen**   **Min-Chun Kuo**   **Yue-Da Lin**   **Yi-Jing Lin**

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2019

IMTKU Emotional Dialogue System for Short Text Conversation at NTCIR-14 STC-3 (CECG) Task

Department of Information Management
Tamkang University, Taiwan

Min-Yuh Day   **Chi-Sheng Hung**   **Yi-Jun Xie**   **Jhih-Yi Chen**   **Yu-Ling Kuo**   **Jian-Ting Lin**

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Outline

- **IMTKU Emotional Dialogue System Architecture**

- **IMTKU System Description**

- **Performance**

- **Discussions and Conclusions**

Highlights

- **IMTKU
(Information Management at TamKang University)
Emotional Dialogue System for Short Text
Conversation at NTCIR-14 STC-3 (CECG) Task**

- **IMTKU Submitted two runs for NTCIR-14 STC-3
(CECG)**
  - **IMTKU1: Retrieval-based model**
  - **IMTKU2: Generation-based model**

IMTKU Emotional Dialogue System Architecture

1

Retrieval-Based Model

2

Generation-Based Model

3

Emotion Classification Model

4

Response Ranking
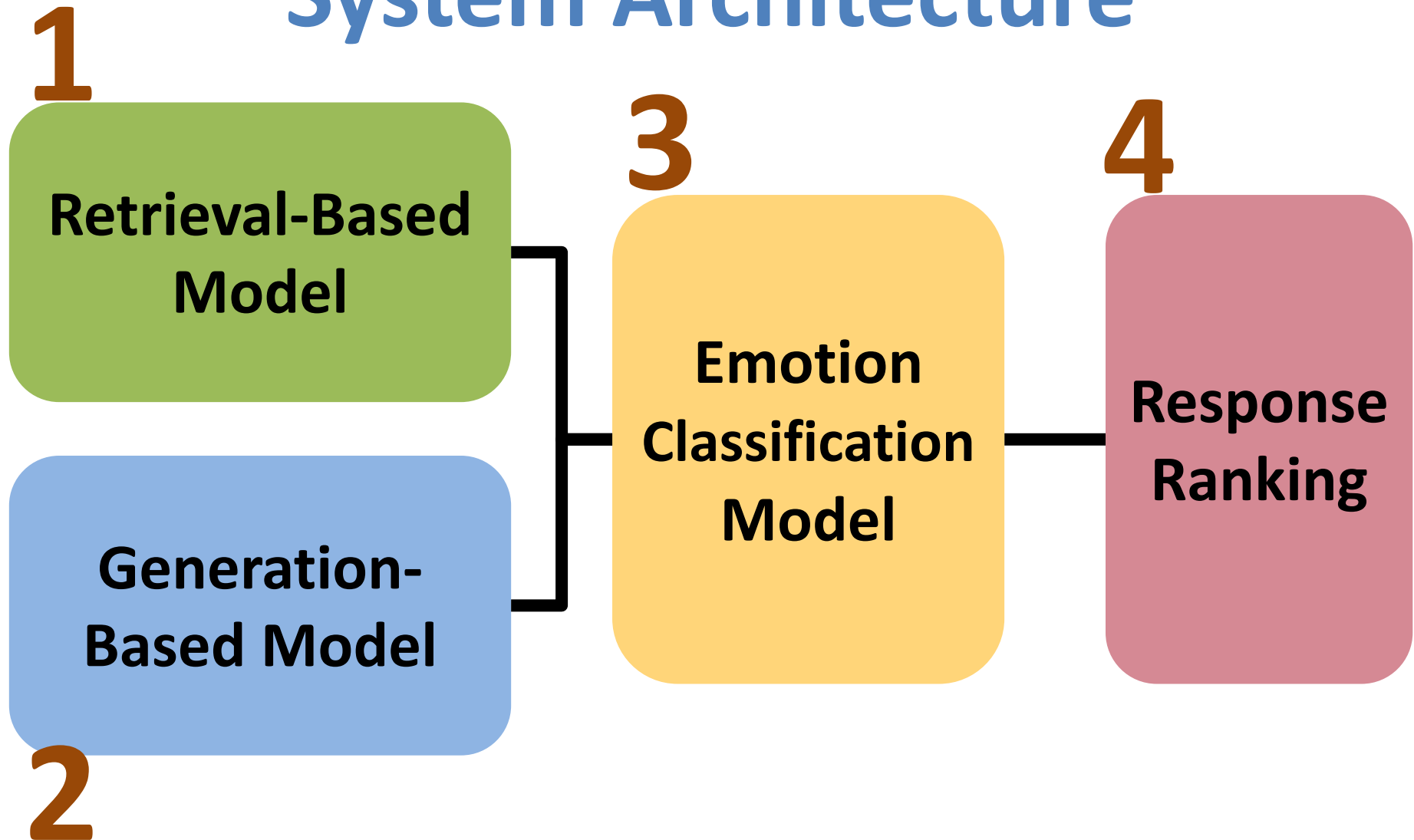
The system architecture of
IMTKU retrieval-based model for NTCIR-14 STC-3

Retrieval-Based Model

1

Post

Word Segmentation

Corpus

Building Index

Retrieval Model

Keyword Boolean Query

Solr Matching

Distinct Result Data

Emotion Matching

Word2Vec Similarity Ranking

Emotion Classification

Retrieval-Based Response
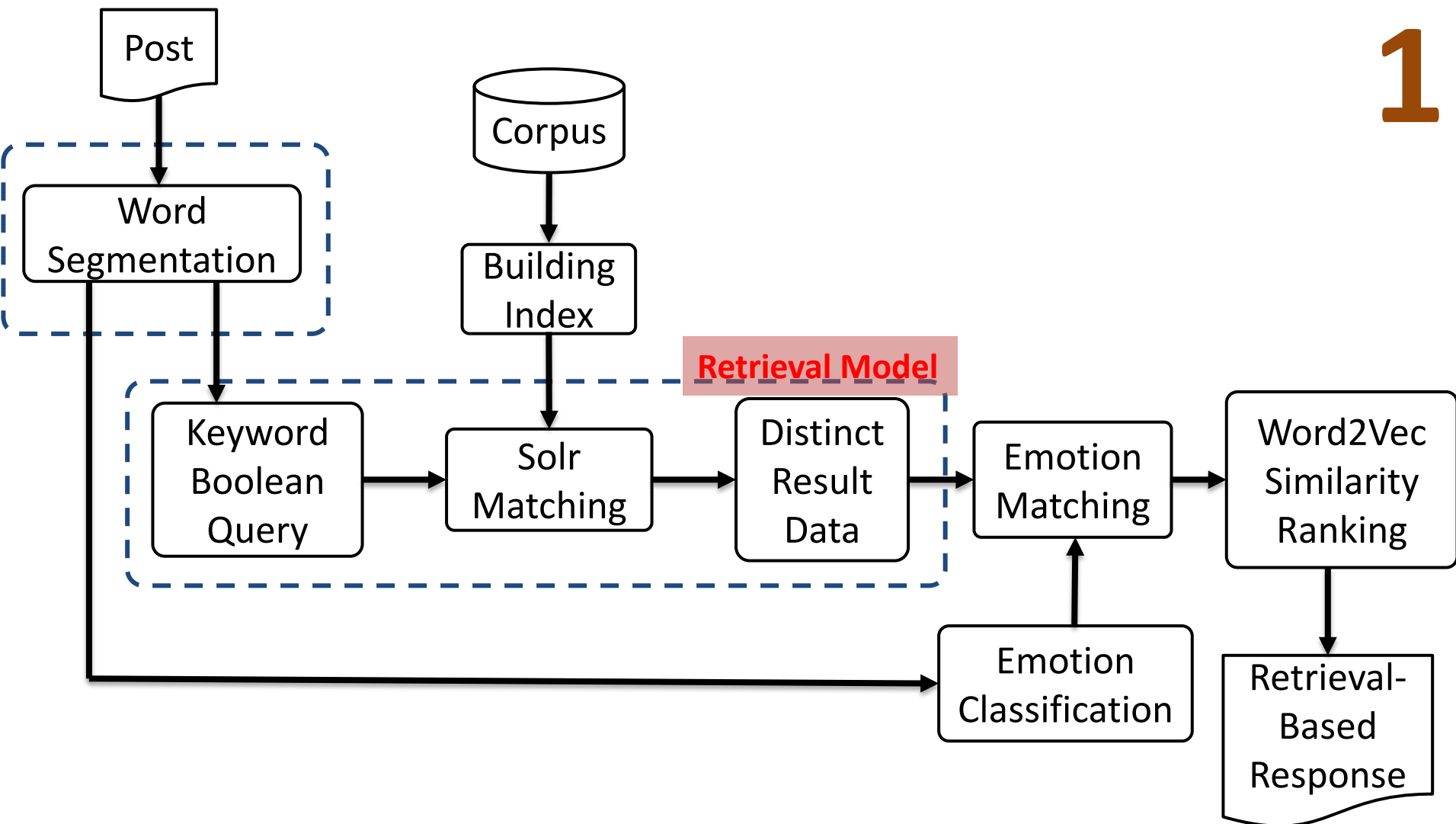
The system architecture of
IMTKU generation-based model for NTCIR-14 STC-3

Generation-Based Model

2

Training Data

Post

Building Word Index → **Word Embedding** → **Training Data Seq2seq model**

Generative Model

Word Segmentation → Short Text Emotion Classifier → Trained Model

Emotion Matching → Word2Vec Similarity Ranking → Generation-Based Response
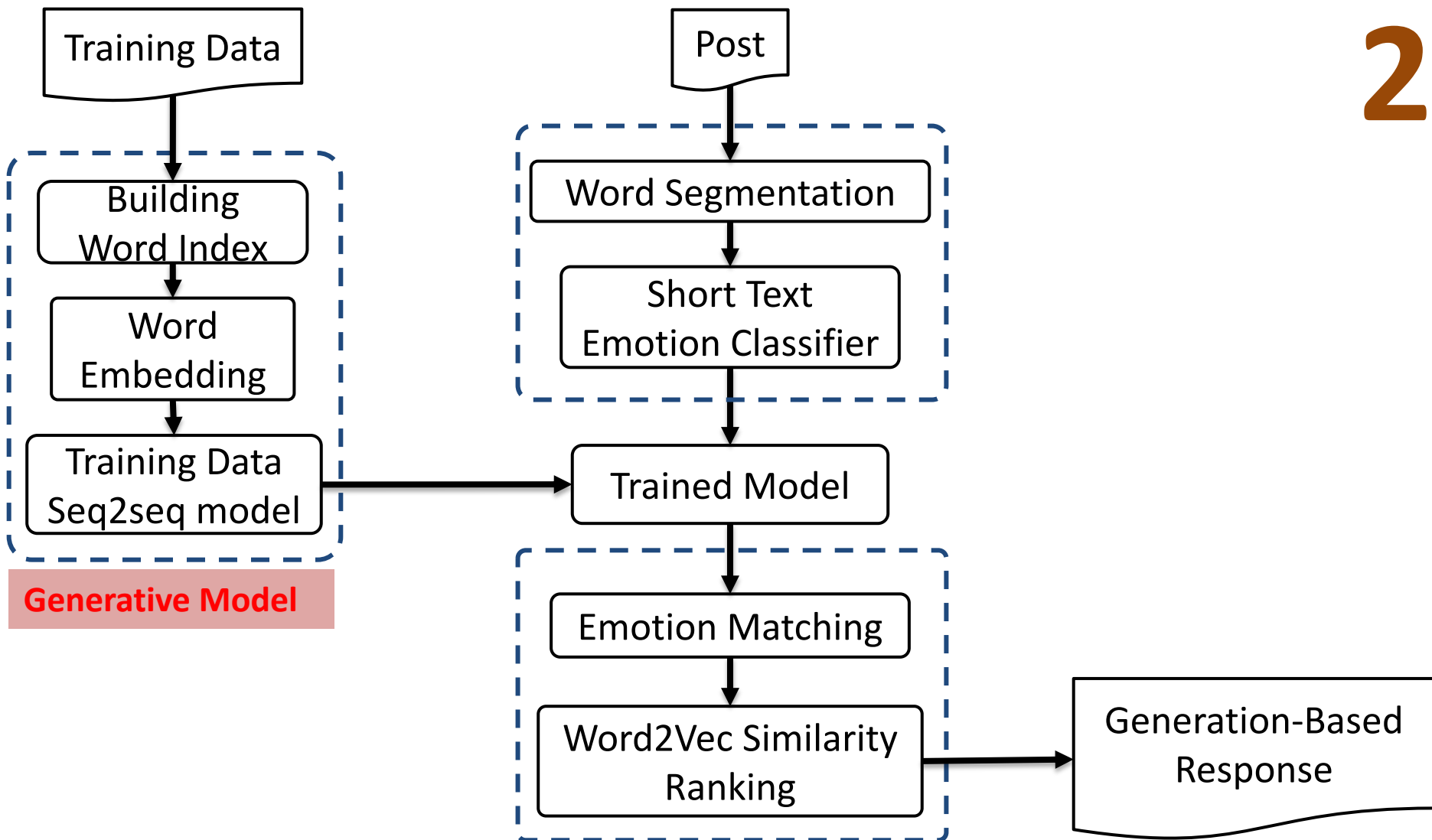
The system architecture of
IMTKU emotion classification model for NTCIR-14 STC-3

Emotion Classification Model

3

```
Corpus → Emotion Classification
                ├→ Training Dataset → MLP LSTM BiLSTM
                └→ Testing Dataset → Emotion Classification Model → Emotion Prediction
```

MLP LSTM BiLSTM → Emotion Classification Model
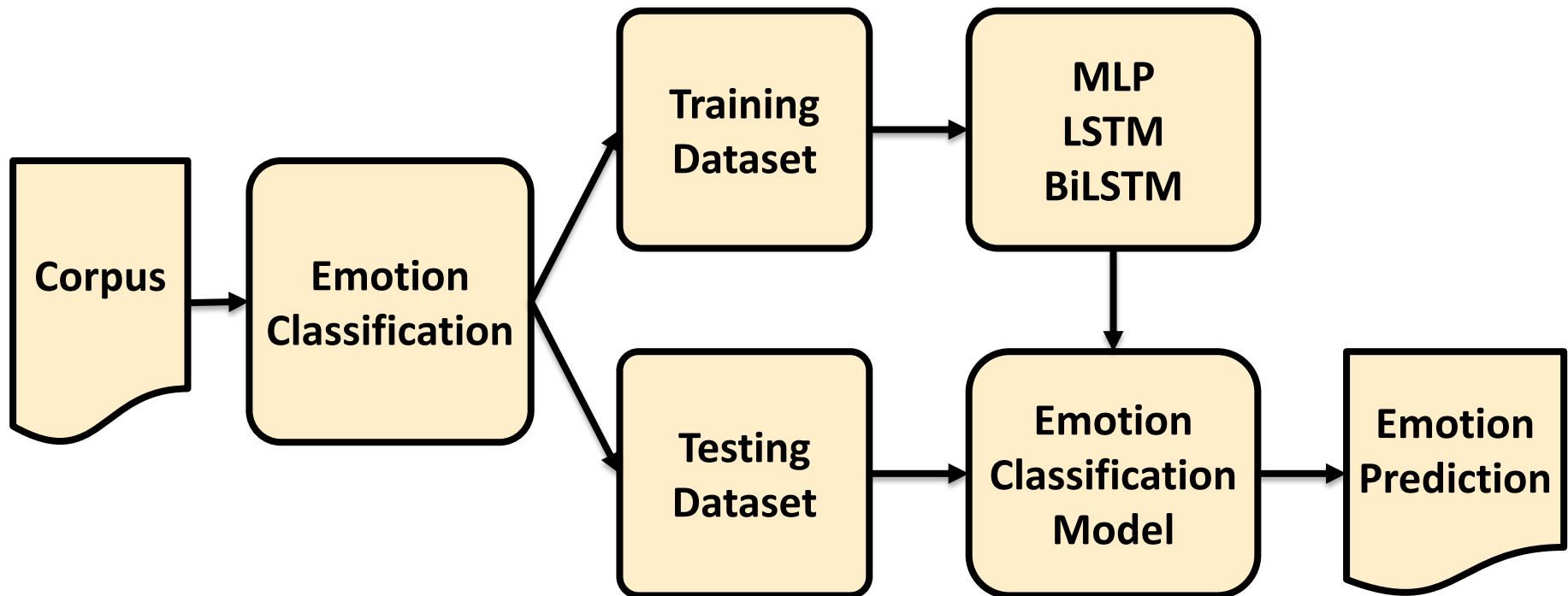
The system architecture of
IMTKU Response Ranking for NTCIR-14 STC-3

Response Ranking

4

STC3 Corpus → Chinese Segmentation using Jieba → Stop Words Removal → Word2Vec → 1.2 million data (300 dimensions) → Vector of Corpus
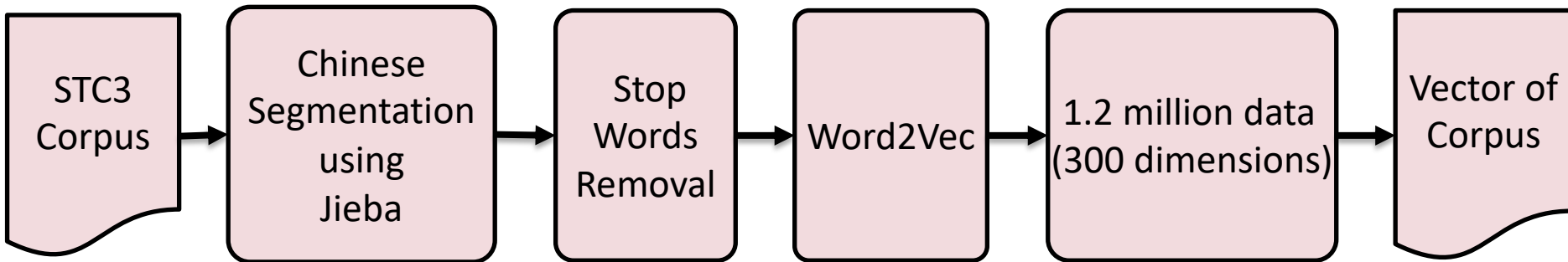
Word2Vec Similarity Ranking

$$x = (S_p * \alpha + S_r * \beta)/2$$

S_p : The similarity score of the new post and the corpus post
S_r : The similarity score of the new post and the corpus response
α : Weight = 0.2
β : Weight = 0.8

STC-3 CECG Evaluation:
Total Score and Average Score

$$Total\ Score = \sum_{i=0}^{2} i * num_i$$

i : score corresponding to Label

num_i : total number of questions marked with Label i

$$\textbf{Average Score} = \frac{\sum_{i=0}^{2} i * num_i}{\textbf{Nt}}$$

i : score corresponding to Label,

num_i : total number of questions marked with Label i

Nt: total number of all questions

Affective Conversational Robot Index (ACR Index)
for
Evaluating Emotional Dialogue System

$$\text{ACR Index} = \frac{\sum_{i=0}^{2} i * num_i}{Nt * \max(i)}$$

i : score corresponding to Label

num_i : total number of questions marked with Label i

Nt : total number of all questions

$max(i)$: maximum value of i.

Emotion Classification Model

Emotion Classification Model	Accuracy
Multi-Layer Perceptron (MLP)	73.9%
Long Short Term Memory (LSTM)	86.4%
Bi-directional Long Short Term Memory (Bi-LSTM)	**87.6%**

* Five Emotion Classes
1: Like, 2: Sadness, 3: Disgust, 4: Anger, 5: Happiness

IMTKU at NTCIR-14 STC-3 Performance (Formal Run)

Run	The Result		Like		Sad	
	Overall Score	Average Score	Overall Score	Average Score	Overall Score	Average Score
IMTKU-1	592	**0.592**	127	0.635	120	0.6
IMTKU-2	60	0.06	8	0.04	17	0.085

Run	Disgust		Anger		Happy	
	Overall Score	Average Score	Overall Score	Average Score	Overall Score	Average Score
IMTKU-1	97	0.485	88	0.44	160	**0.8**
IMTKU-2	7	0.035	11	0.055	17	0.085

IMTKU at NTCIR-14 STC-3 Evaluators Consistency (Self-Evaluation)

Evaluators	All agree	Two agree	All disagree
# Pairs	1366	603	31
Percentage (%)	68.3%	30.2%	1.5%

98.5%

IMTKU at NTCIR-14 STC-3 Performance (Self-Evaluation)

Run	Label0	Label1	Label2	Total Score	Average Score	ACR Index
Retrieval-based Model	304	209	487	1183	**1.183**	**0.591**
Generation-based Model	875	90	35	160	0.16	0.08

Conclusions

- **IMTKU Submitted two runs for STC-3 (CECG)**
  - **IMTKU-1: Retrieval-based model**
  - **IMTKU-2: Generation-based model**

- **The performance of retrieval-based model is superior to the generation-based model.**

Contributions

- **We have developed an emotional dialogue system that integrates retrieval-based model, generation-based model, and emotion classification model with deep learning approach for short text conversation.**

- **We have proposed an Affective Conversational Robot Index (ACR Index) for evaluating emotional dialogue system.**

IEEE EM-RITE 2019

The 8th IEEE International Workshop on Empirical Methods for Recognizing Inference in TExt

(IEEE EM-RITE 2019)

In conjunction with IEEE IRI 2019

Los Angeles, California, USA

July 30 - August 1, 2019

https://sites.google.com/view/emrite2019

MSNDS 2019

The 10th International Workshop on Mining and Analyzing Social Networks for Decision Support
(MSNDS 2019)

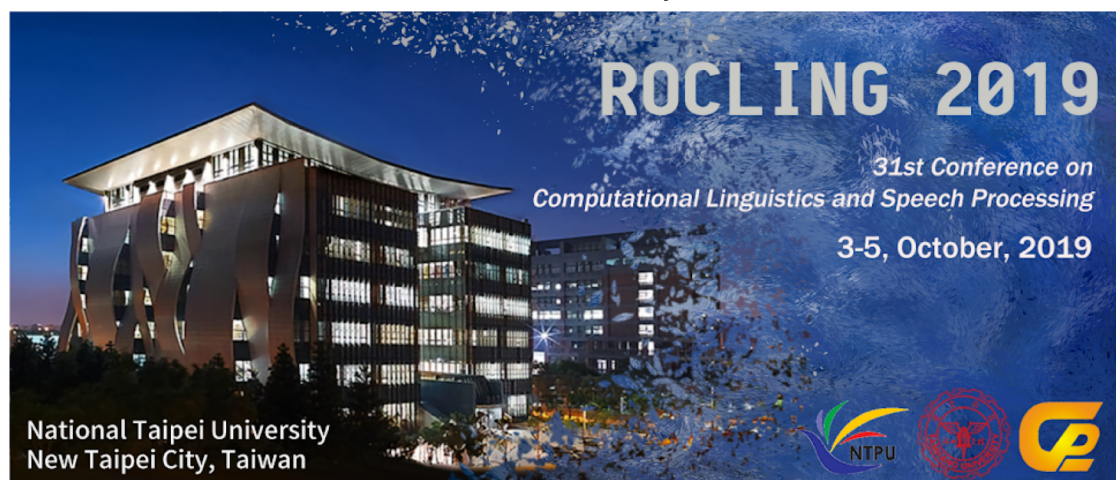In conjunction with IEEE/ACM ASONAM 2019

Vancouver, Canada

27-30 August, 2019

https://sites.google.com/view/msnds2019/

ROCLING 2019

The 31st Annual Conference on Computational Linguistics and Speech Processing
(ROCLING 2019)

New Taipei City, Taiwan,
October 3-5, 2019

https://sites.google.com/view/rocling2019/

Q&A

IMTKU Emotional Dialogue System for Short Text Conversation at NTCIR-14 STC-3 (CECG) Task

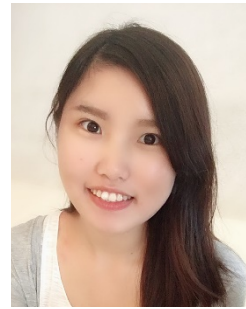## Department of Information Management
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Min-Yuh Day **Chi-Sheng Hung** **Yi-Jun Xie** **Jhih-Yi Chen** **Yu-Ling Kuo** **Jian-Ting Lin**

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