Forgetful and Emotional: Recent Progress in Development of Dynamic Memory Management System for Conversational Agents

Michal Ptaszynski, Pawel Dybala, Rafal Rzepka, Kenji Araki
Introduction

• Who Are We?

Hokkaido University
Sapporo, Japan

Language Media Laboratory,
Graduate School of
Information Science and
Technology
Introduction

• What Do We Do?

- Genetic Algorithms
- Machine Ethics
- Affective Computing
- Humor Processing
Introduction

• What Do We Do?
Problem Description
Problem Description

“I’ve tried to tell Stuart he’s over-loading himself with too much information but.....”
Problem Description

• Expanding Database
• of Dialogue Agent
• Becomes a Problem:
  – Large space
  – Processing time
  – Which information is good...?
  – ...At the certain time?
Problem Description

• **Need to manage the database**

• How do humans do it?
  – Agent Database = Human Memory

• Memory:
  – Process of Forgetting (and Recalling)
Forgetting

• Definition: “Forgetting is a process in which parts of knowledge become rearranged, inaccessible or inactive.”[1,2]

• Usual attitude toward forgetting: BAD

• New findings:
  – “forgetting is not a defect, but helps organize memory and remember about important things.”[8]

Forgetting

- Definition: “Forgetting is a process in which parts of knowledge become rearranged, inaccessible or inactive.” [1,2]

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- New findings:
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If forgetting works positively for humans, it should be also applicable in dialogue agents.

Forgetting

• Forgetting is dependant on:
  – **Time** (chronological fading of memories) [4]
  – **Emotions** (Emotionally stronger memories fade slower) [5,6,7]

• **Recalling** is indivisible from Forgetting

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The idea of **chronological forgetting** has been applied in AI and related fields [2,10] (and at present is widely used: e.g., access history in your web browser).

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However the ideas of applying emotional weights in forgetting algorithms and adding the recalling ability has not been studied sufficiently yet.

*) Although this might change in the near future (see RWWA Symposium in the next room)

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- Dialogue Agent is trained on conversation sets
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• Each conversation set is one “context unit” (CU)

(different topics → different words used)
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- Dialogue Agent is trained on conversation sets
- Each conversation set is one “context unit” (CU)
- Agent database contains many CUs
- But not all of them have to be processed at all times → Some of them could be deactivated when not needed (forgetting) and reactivated again when needed (recalling)
System Description

Need to answer these questions:

1. On what basis should agent forget a CU?
2. What information could be extracted from a CU to fulfill this task?
3. How to recall a deactivated CU?
System Description

1. On what basis should an agent forget a CU?

Forgetting is a function of

- **Time** ($T$) and **Emotional value** ($E$): $V = f(T, E)$
System Description

2. What information could be extracted from a CU to fulfill this task?

Every CU has:

- a certain **time stamp**

- a certain **emotional level**

attached when created and renewed when information from a CU is used in other conversation

need to measure it
System Description

Measuring emotional level of a CU:

- Perform affect analysis [16] of all utterances in the training set to obtain emotive values.
- Approximation of all emotive values = emotional level of the conversation (CU).
- (perform continuously also on new CUs)

System Description

• Forgetting process:
  - Time
  - Emotions

• Recalling

  “Forget” by zipping parts of database and storing them using less space
System Description

Recalling

Unzip and reactivate the relevant CUs

Reactivate similar CU

Use DB in conversation

User input

Extract association lists from Internet [24]

Calculate similarity with deactivated CUs

Internet

System Description

✓ Forgetting process:
  ✓ Time
  ✓ Emotions
✓ Recalling
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System Description

- Construction of a CU
System Description

• Construction of a CU

Conclusions

• We presented the description of a dynamic database management system for dialogue agents.

• The system borrows from memory processes in humans: forgetting and recalling, based on:
  – Chronological fading of memories (CUs)
  – Emotional values attached to memories (CUs)

• We have developed sub-systems to implement the method
Further Work

• Implementation
• Evaluation
Thank you for your attention!