

# 02

## Presenting a quick solution to system failures

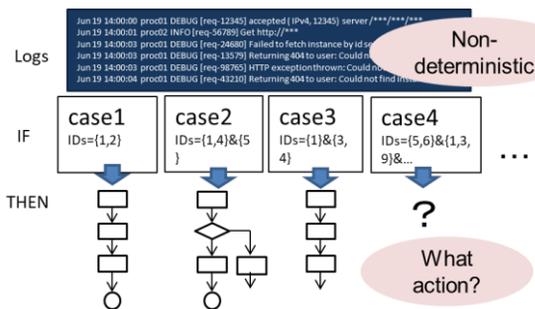
### Generating recovery-command sequences by neural networks

#### Abstract

We propose a method for **automatically generating recovery-command sequences**, which is intended to support quick recovery actions by system operators and to achieve **automatic recovery** from ICT (information and communication technology)-system failures. Our method is based on **Seq2Seq** (sequence-to-sequence), a neural network model usually used to solve translation tasks in the field of natural language processing. This model can learn complex relationships between **logs** obtained from equipment and **recovery commands** that operators executed in the past. When a new failure occurs, our method estimates plausible commands that recover from the failure on the basis of collected logs. Our method also evaluates **the confidence score** of the estimated recovery-command sequences. Operators can use this confidence score as a criterion to determine whether the estimated recovery-command sequence should be executed.

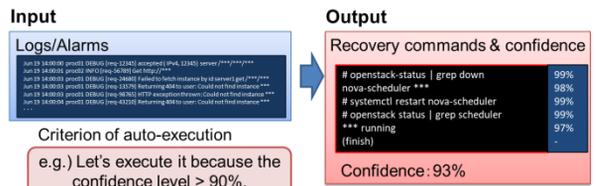
#### Problem: Construction of Recovery rules

- Automated recovery requires **predefined rules** associating logs/alarms with recovery actions.
- Operators **spend a lot of time** making rules and action sequences



#### Technology: Automatic generation of recovery commands

- Input: Logs/Alarms, Output: Recovery commands**  
→ Reducing operation cost
- Confidence score** of estimated commands  
→ Supporting operators' judgement of command execution



#### Method: Log-Command transformation by Seq2Seq

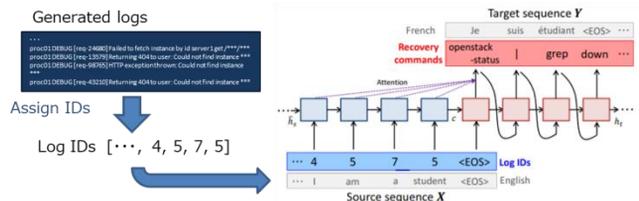
We constructed a neural network model that converts **log/alarm sequences into the corresponding recovery-command sequences** on the basis of historical data by using **Seq2Seq**, which can learn the relationship between multiple sequences.

#### Input: Log IDs

- Using a log templater [2] to assign IDs to logs

#### Output: Words included in recovery commands

- Considering an action such as "Pressing Enter key" as a word
- Evaluating the likelihood of the output sequence as the confidence score of estimation



#### References

- [1] H. Ikeuchi, A. Watanabe, T. Hirao, M. Morishita, M. Nishino, Y. Matsuo, K. Watanabe, "Recovery command generation towards automatic recovery in ICT systems by Seq2Seq learning," *Proc. of IEEE/IFIP Network Operations and Management Symposium (NOMS)*, 2020, to appear.
- [2] T. Kimura, A. Watanabe, T. Toyono, K. Ishibashi, "Proactive failure detection learning generation patterns of large-scale network logs," *IEICE Transactions on Communications*, Vol. E102-B, No2, pp. 306–316, 2019.

#### Contact

**Hiroki Ikeuchi** Email: cs-openhouse-ml@hco.ntt.co.jp  
NTT Network technology laboratories

