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엔디파인드 개발팀

챗봇 & 추천 알고리즘 개발

2019.12.26 ~ 2020.02.29

카카오 추천팀

추천 알고리즘 개발

2018.11.05 ~ 2019.04.22

한빛소프트 AR팀 인공지능파트

텍스트/음성 챗봇 개발

# PROJECTS

언디파인드	[1] FAQ Chatbot	2 개월
	[2] Competetion Rule Recommendation (Dev)	2 주
한양대학교 대학원 Machine Learning System Lab.	[1] DNN Model Quantization	1년 8개월
	[2] Network Embedding Generation	1년 8개월
	[3] Artificial Intelligence Assistant	2 개월
	[4] DNN Model Quantization	3 개월
카카오	[1] Automobile Video Recommendation	2 개월
	[2] Comics Recommendation	2 주
한빛소프트	[1] (EN) Text Chatbot	2 개월
	[2] (KR) Multi-speaker Speech Synthesis Model	4 개월



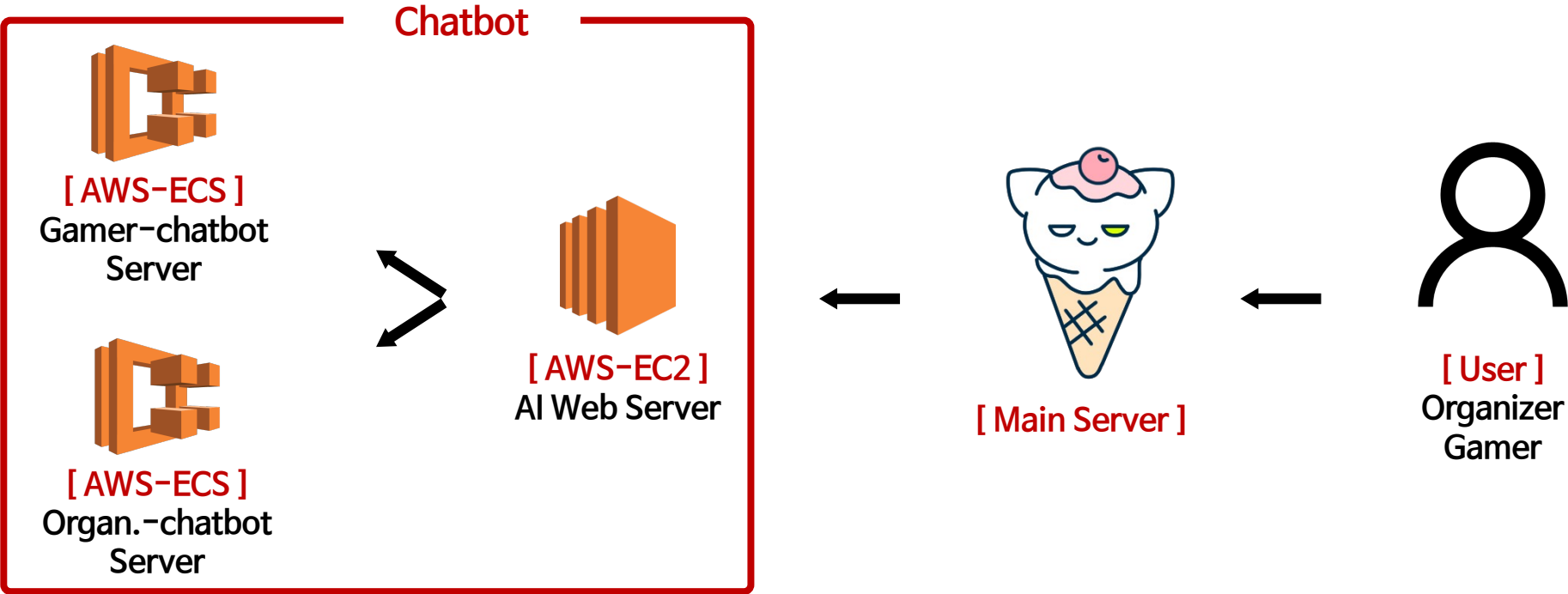
## 언디파인드

[1] FAQ Chatbot

[2] Competetion Rule Recommendation

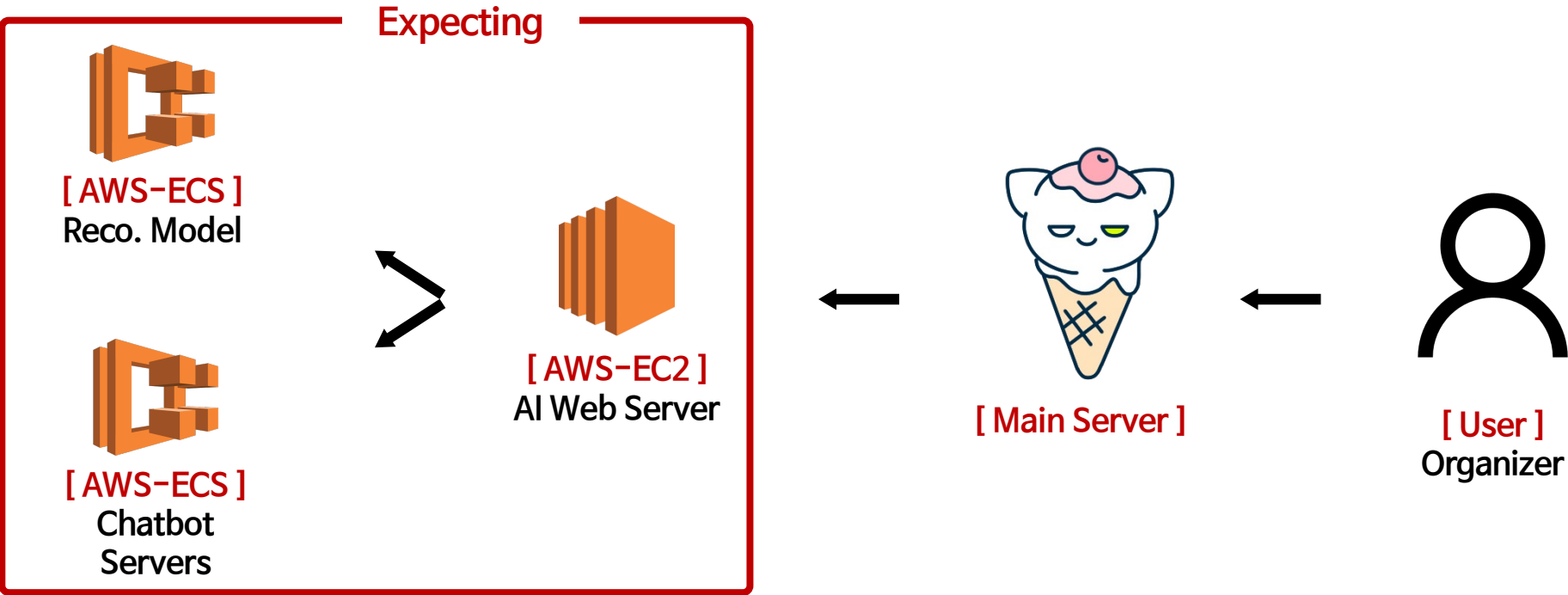
FAQ Chatbot (EN/KR)

RASA	Open Source	Open Source Chatbot Framework
	Utilized	Multi-lingual BERT, <a href="#">StarSpace</a>
	What I've Done	<ul style="list-style-type: none"><li>Dataset Preprocessing</li><li>Model Selection</li><li>Model Tuning</li><li>Model Serving</li></ul>



Competetion Rule Recommendation (Dev)

Alternating Least Square	Open Source	<a href="#">LibRecommender</a>
	What I've Done	<ul style="list-style-type: none"><li>• Define Problem</li><li>• Dataset Preprocessing</li><li>• Feature Selection</li><li>• Model Selection</li><li>• Model Tuning</li></ul>





## 한양대학교 대학원 · Machine Learning System Lab.

- [1] DNN Model Quantization
- [2] Network Embedding Generation
- [3] Artificial Intelligence Assistant
- [4] DNN Model Quantization

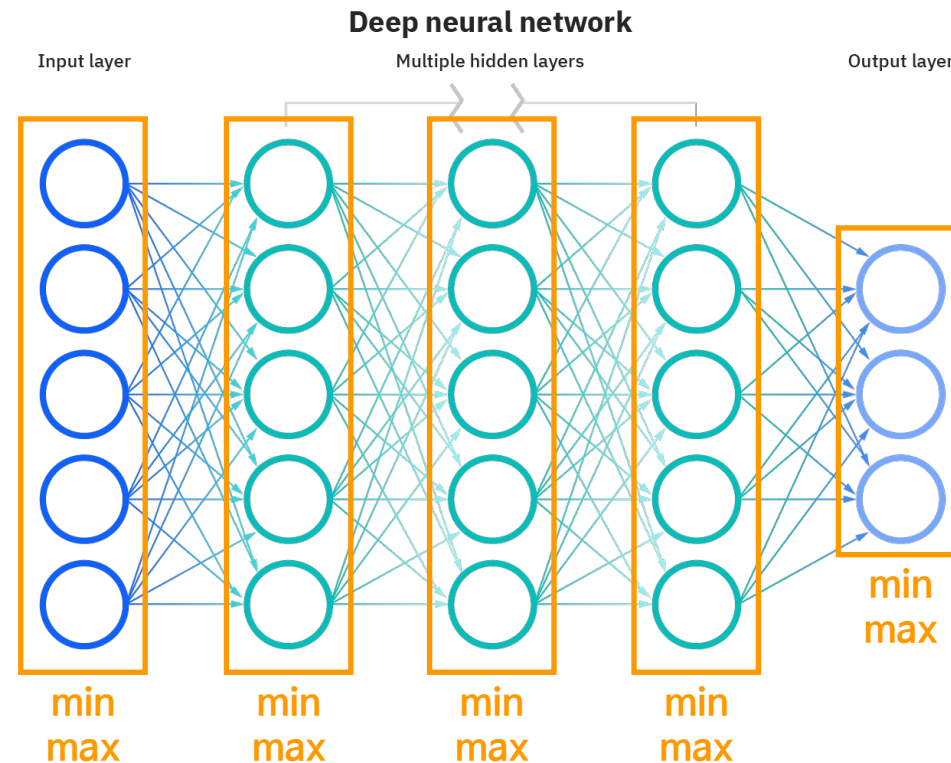


## DNN Model Quantization

Definition	What is	General DNN models use Float32 type variables
		Quantized models use low-bit INT types at inference
	What for	<ul style="list-style-type: none"><li>• Model storage</li><li>• In memory load</li><li>• Matrix multiplication</li></ul> with Float32 type cause bottleneck/unusability in low performance H/W

## [1] DNN Model Quantization

Problem	Problem	Quantized models' performance (e.g., accuracy) drops catastrophically when using sub-8bit INT type
	Why legacy tech. suffers	Too generalized Quantization parameters <ul style="list-style-type: none"><li>Quantization parameters require: <b>Per layer avg-ed min/max range</b> of intermediate outputs across datasets</li></ul>
		Averaged min/max values include outliers





## Solution

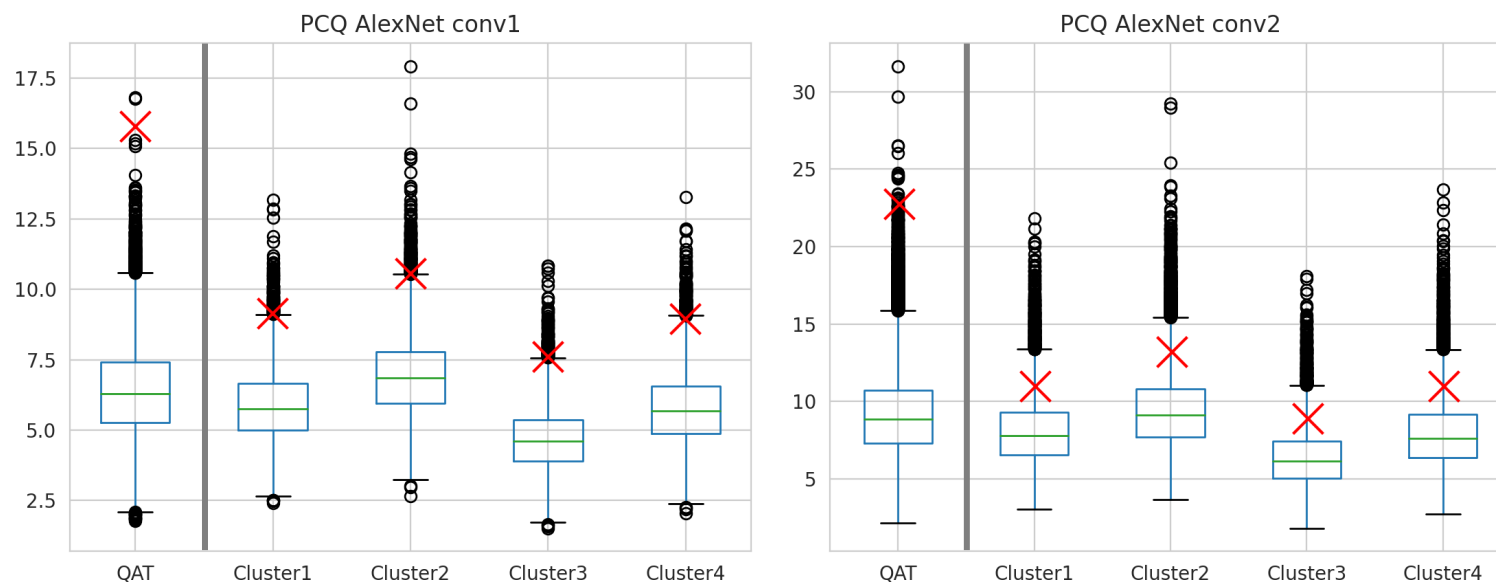
### Granular Exponential Moving Average (Granular EMA)

Train Quantization Parameters while **excluding outliers**

### Neural Network Aware Clustering (NNAC)

Train Quantization Parameters separately **across clusters** of input images

- Some data might need **shorter min/max range**
- Shorter range means **less information loss**



## Figures' Description

- Shows that our method
  - how efficiently exclude outliers
  - how to work with clusters
- QAT : Baseline (Google)
- Cluster\* : Ours
- X : Trained maximum value
- Box-plots : Actual max values per image

## Network Embedding Generation

\* Currently submitted to BIB (Briefings in Bioinformatics)

### Project description

[Human Cell lines – Cancer Drugs] Response Prediction

Network(graph) dataset consist of

- **Cell line** nodes
- **Drug** nodes
- Protein nodes (connected to Cell lines)

My Task: **Train embedding vectors of Cell lines and Drugs**

### Problem

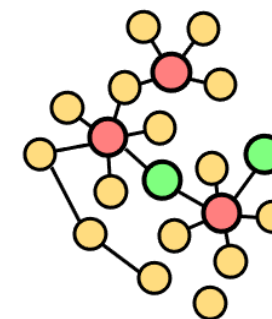
Extremely unbalanced dataset

- About **20,000 Protein nodes**
- About 900 Cell line nodes
- About 300 Drug nodes

Fails to reflect the relationships between Cell lines & Drugs

As a result, we got poor response prediction performance

● Cell line ● Drug ● Protein



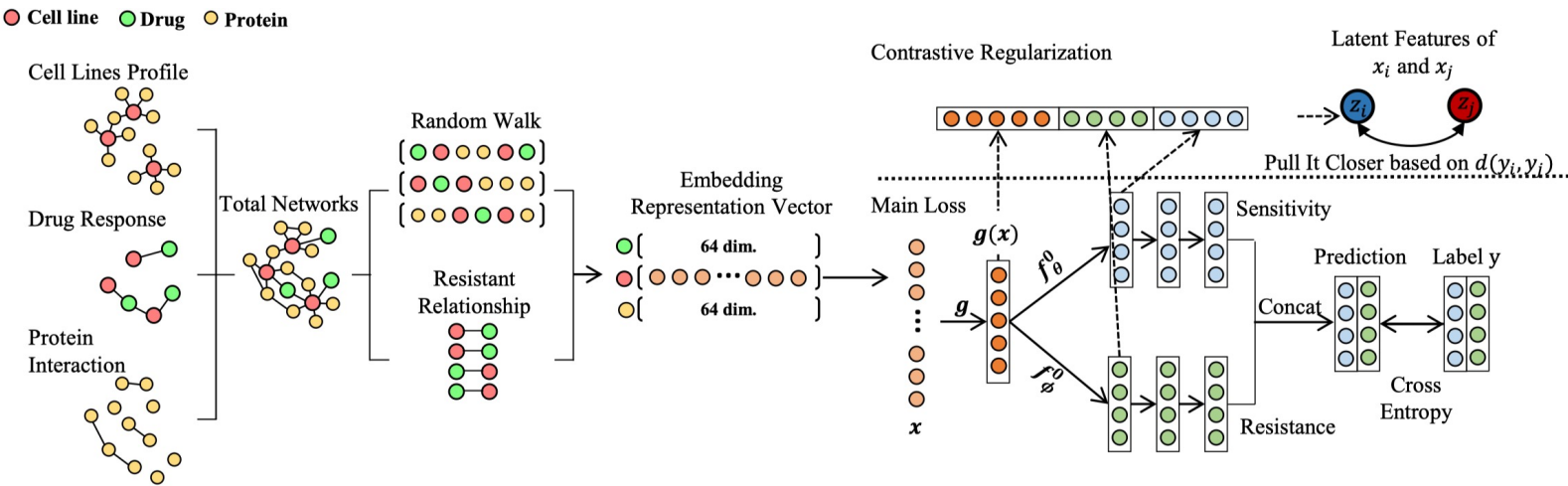
Solution

Make training process to focus on relationships between Cell lines & Drugs

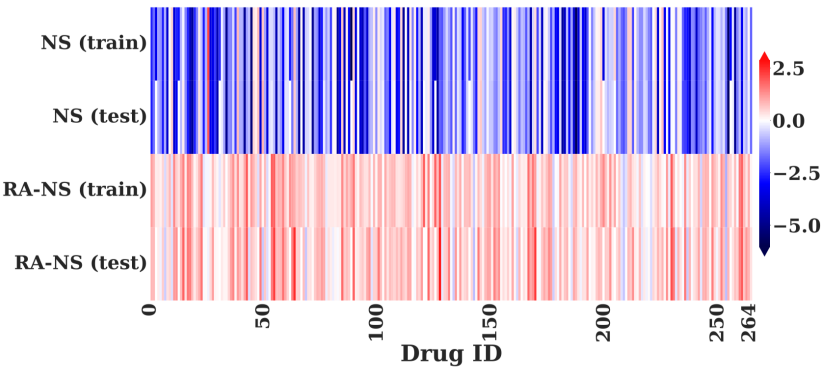
Response-aware Negative Sampling (RA-NS)

- Cell line & Drug nodes use resistant Drug & Cell line nodes as their negative samples

\* Tested Models: Node2Vec, Graph Convolutional Network, Graph Transformer Network



**Fig. 1.** The framework of RAMP. RAMP consists of two main stages. First, representation vectors are extracted from heterogeneous networks with RA-NS. Second, the multitask architecture of a Bayesian neural network is trained by representation vectors with contrastive regularization.



**Fig. 2.** Embedding similarities among drug and cellines. We subtract the similarity of a drug and its resistant cell lines from the similarity of the drug and its responsive cell lines. The results are normalized and plotted in a heatmap format. The higher (or redder) the value is, the better the embedding reflects the network structure.

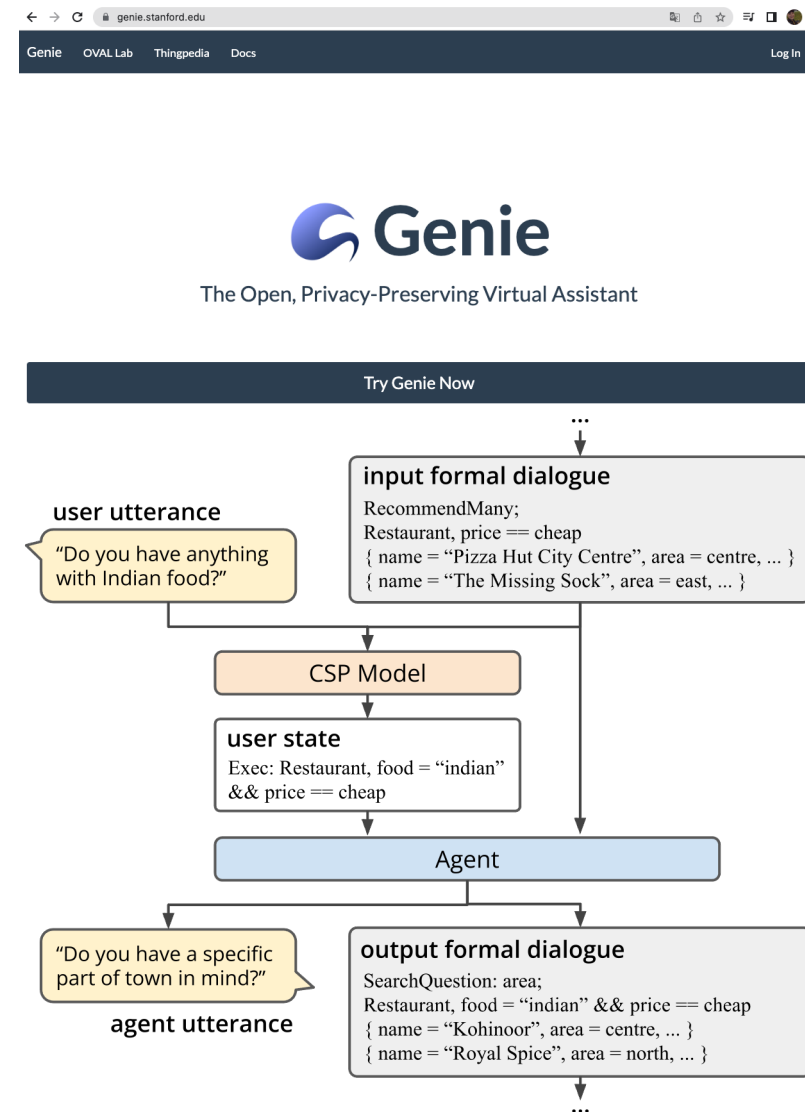
## Artificial Intelligence Assistant

- AI Assistant App, Almond

- Currently, the service name has been modified to [Genie](#)
- Developed by Stanford OVAL Lab

- Training Korean Seq2SQL Model

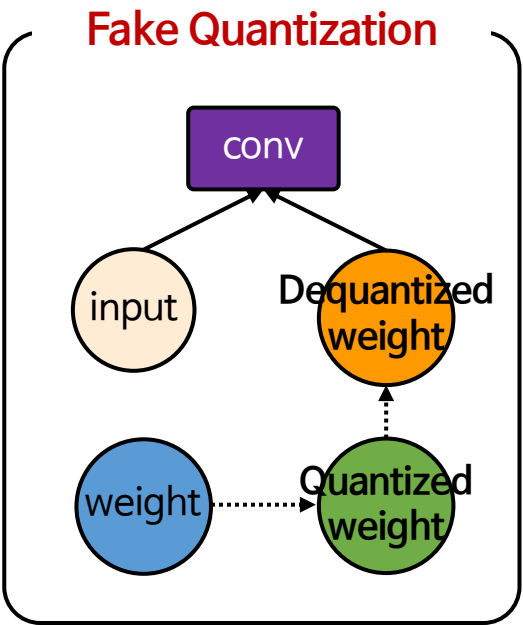
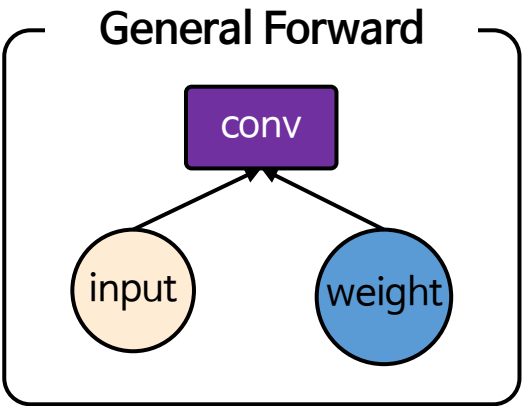
- Dataset preparation
  - Web Crawling
  - Construct templates of sentences (example of sentences)
  - Augment sentences based on templates
- Train & serve model



# DNN Model Quantization

\* Published in 2022 ICEIC (International Conference on Electronics, Information, and Communication)

Problem	<p>Quantization Aware Training (Google)</p> <ul style="list-style-type: none"><li>• Fake-quantize all of the weight matrices with a single low-bit type</li><li>• Too much quantization errors occur and the trained model gets ruined</li></ul> <p>QuantNoise (Facebook)</p> <ul style="list-style-type: none"><li>• Fake-quantize probabilistically selected subsets of matrices (a subset per matrix)</li><li>• Trained models <b>under-prepared</b> for Quantization</li></ul>
Solution	<p>Fake Single Precision Training (FST)</p> <ul style="list-style-type: none"><li>• Probabilistically select subsets of weight matrices as QuantNoise</li><li>• Fake-quantize <b>selected subsets</b> with <b>low-bit type</b></li><li>• Fake-quantize <b>the rests</b> with <b>higher bit type</b> than the selected</li></ul>





## 카카오

[1] Automobile Video Recommendation

[2] Comics Recommendation


## Automobile Video Recommendation

Exp 1, 2	Thomson Sampling h-params tuning	Purpose	Adjustment of trade-off between exploration & exploitation
		Reason	[Exp-1] High <b>matrix sparsity</b>
			[Exp-2] Considering <b>time bias</b> enhanced by low traffic
Exp 3, 4	Ranking algorithm's h-params tuning	Purpose	Searching the key model among ensembled models
		Reason	Other well performing services had been used <b>similar pipelines</b> <ul style="list-style-type: none"><li>• Therefore, assumed that the composition of used models are good enough</li></ul>
Exp 5	Item2Vec instead of Matrix Factorization	Purpose	Overcome Matrix Factorization model's limitation
		Reason	Needed to generate reco. results <b>within limited item list</b> <ul style="list-style-type: none"><li>• The limited items rated 30~40th on avg., if we force the limitation off</li></ul>
			Needed some models which <b>capture information</b> which MF can't

# Automobile Video Recommendation

Exp 1, 2	Thomson Sampling h-params tuning	Purpose	Adjustment of trade-off between exploration & exploitation
		Reason	<div>[Exp-1] High matrix sparsity</div> <div>[Exp-2] Considering time bias enhanced by low traffic</div>

Target Item (Bandit)




제네시스보다 저렴한 5천만원대 전기차 BMW i4 edrive 40

02:38 / 14:59

제네시스보다 저렴한 5천만원대 전기차 BMW i4 edrive 40

Reco. Result ( Selected Arms )




테슬라도? 저라면 이거 삽니다

29:15

BMW i4 시승기, 날마다 비싸지는 테슬라 보단 이 전기차를 사겠습니다


(Arm #13)



우리나라 소비자들에게 최고의 전기차 물었더니 보인 반응

05:00


최고의 전기차는?



6,900만원! 미국에서도 대박난 '포드 브롱코 아우터뱅크스' 국내 출시 실물 직...


09:17

(Arm #7)




6천만원에 모하비 풀옵션 선택? 모하비가 달라졌다? 2023 모하비

10:02



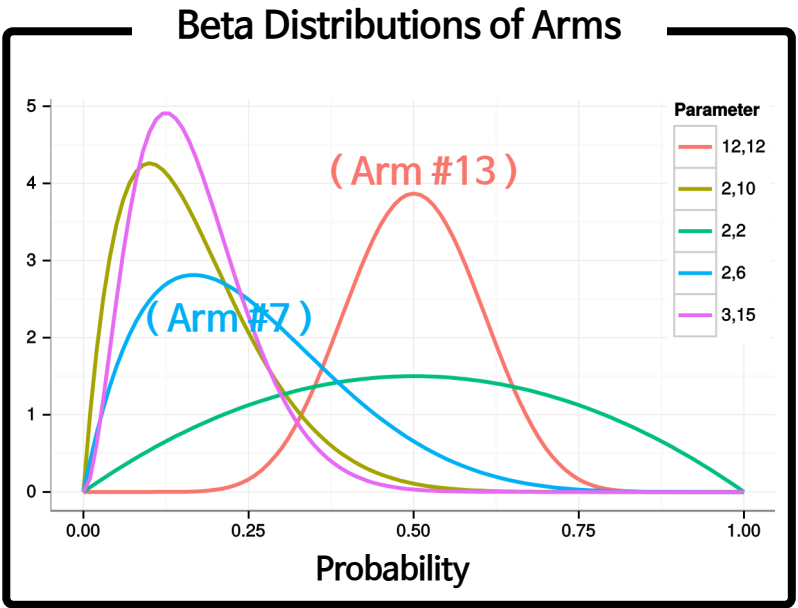
아우디 Q7 45 TDI, 이 차가 답답하면 성격이 급하신 겁니다?

22:27



싼타페 쏘렌토 저격가능? 신형 QM6 미리보기? 르노 오스트랄 완전공개!

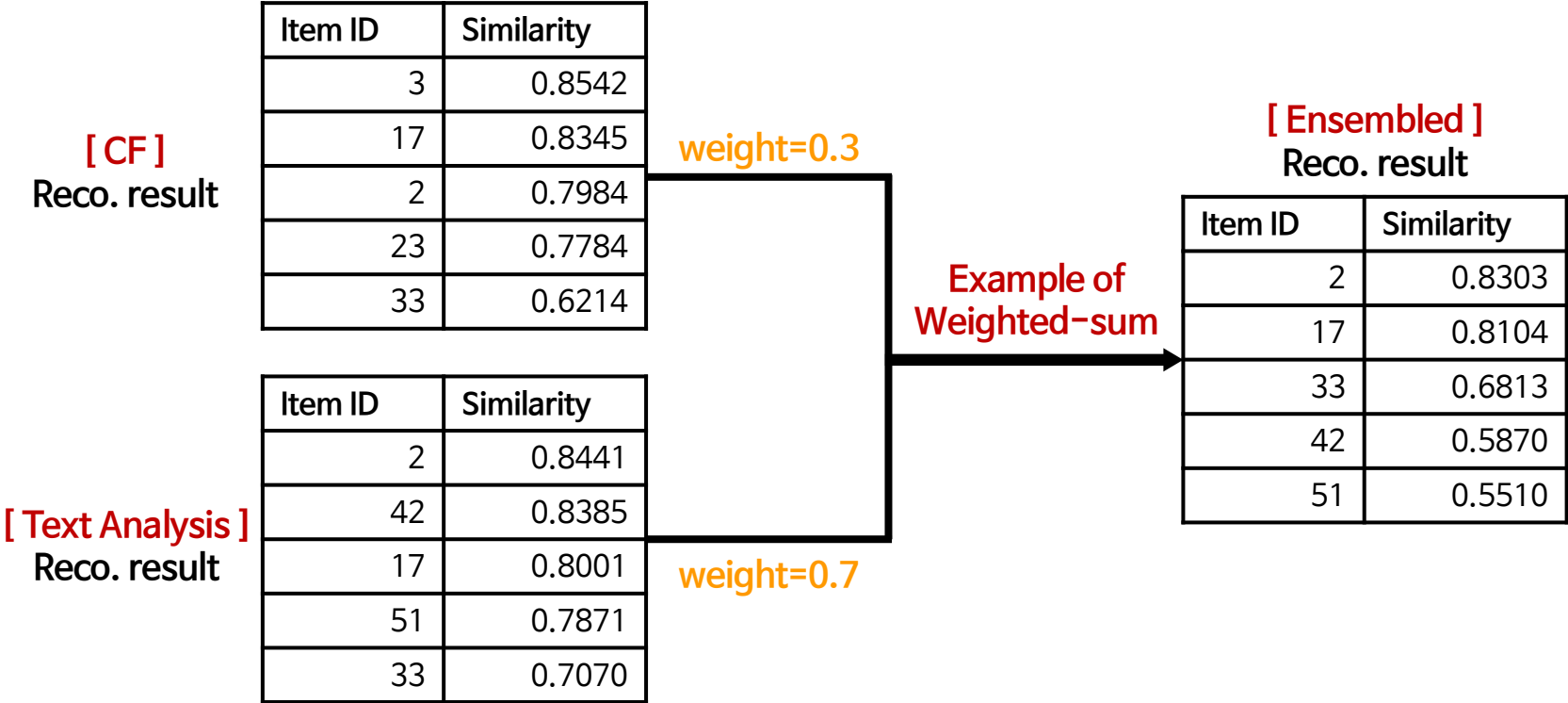
05:45





Automobile Video Recommendation

Exp 3, 4	Ranking algorithm's h-params tuning	Purpose	Searching the key model among ensembled models
		Reason	Other well performing services had been used <b>similar pipelines</b> <ul style="list-style-type: none"><li>• Therefore, assumed that the composition of used models are good enough</li></ul>



Automobile Video Recommendation

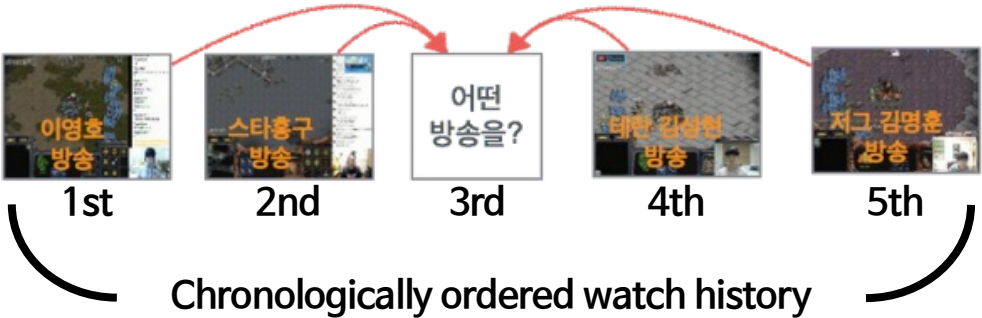
Exp 5	Item2Vec instead of Matrix Factorization	Purpose	Overcome Matrix Factorization model's limitation
		Reason	Needed to generate reco. results <b>within limited item list</b> <ul style="list-style-type: none"><li>• The limited items rated 30~40th on avg., if we force the limitation off</li></ul>
			Needed some models which <b>capture information</b> which MF can't

〈 MF Model's Reward Matrix 〉

				
John	5	1	3	5
Tom	?	?	?	2
Alice	4	?	3	?



〈 Item2Vec Model's Input Sequence 〉

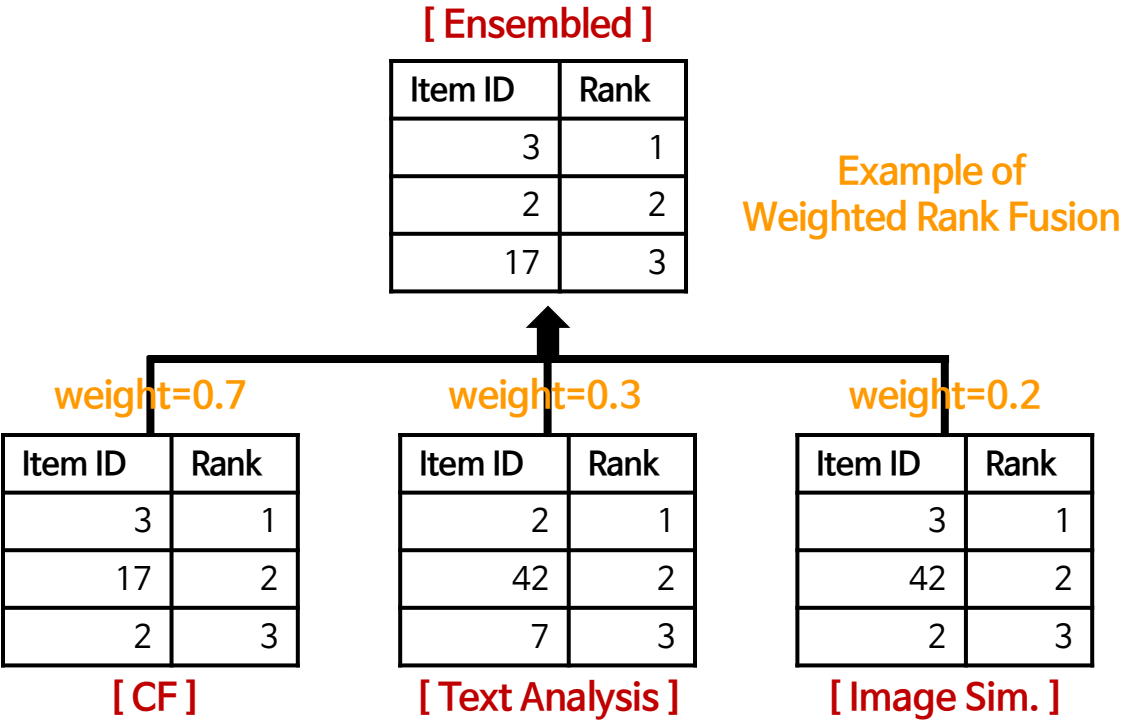


Comics Recommendation

Exp 6	Word2Vec input dataset reconstruction	Purpose	Better reflection of Japanese characteristics
		Reason	Previously, model used <b>nouns</b> and <b>pronouns</b> only
			According to past researches, <b>verbs</b> and <b>adjectives</b> are also important for JP
Exp 7	Modified ranking algorithm (RRF to WRF)	Purpose	Strengthen the key model
		Reason	By previous experiment logs, the only MF used reco. pipeline without ensemble method outperformed ensembled pipeline
			But the ranking algorithm the system was using weakened MF's power

Comics Recommendation

Exp 7	Modified ranking algorithm to Weighted Rank Fusion	Purpose	Strengthen the key by giving weight to rank values
		Reason	By previous experiment logs, the only MF used reco. pipeline without ensemble method outperformed ensembled pipeline
			But the the Weighted-sum Ranking Algorithm weakened MF's power



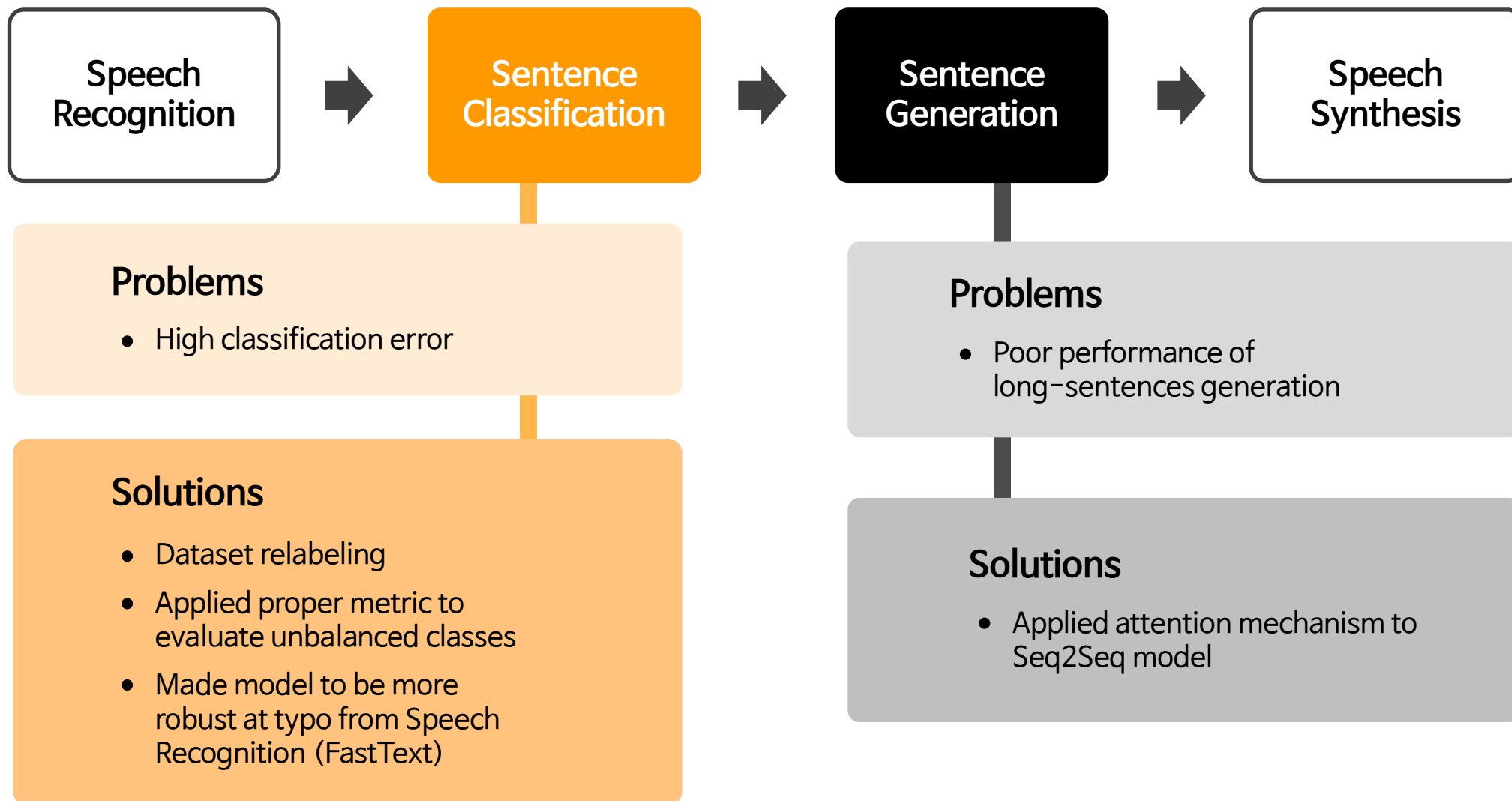


## 한빛소프트

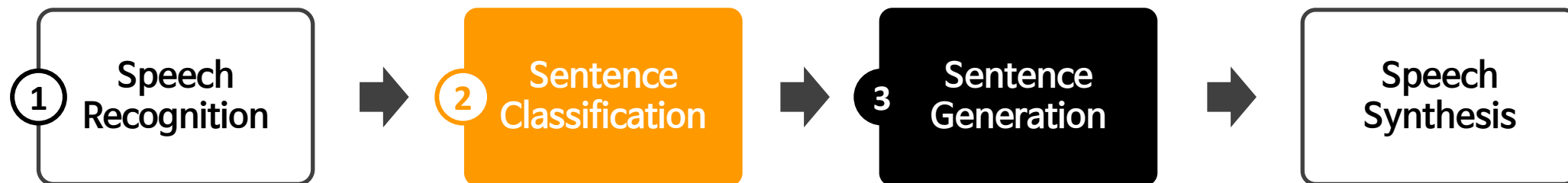
[1] (EN) Text/Audio Chatbot

[2] (KR) Multi-speaker Speech Synthesis Model

## (EN) Text/Audio Chatbot



## (EN) Text/Audio Chatbot



```
>>>>> 2 OhEnglish Conversation - Domain [ MainTopic 1 : 일반 생활 ] <<<<<<<<<<
----- Say something! -----
----- HBS STT ( his table was dirty can you clean it. ) -----
1 User >> this table is dirty can you clean it
3 OE_Bot >> Sure, sorry about the mess.
<< TTS(Request)
```

## (KR) Multi-speaker Speech Synthesis Model

- Dataset preparation

Web Crawling	Audio files
	Script files
Preprocessing	Cut audio files into files of sentences
	Cut script files into sentences (by comparing STT results)

- H-params optimization

- Demo [https://jarvis08.github.io/pjt\\_hbs\\_multi.html](https://jarvis08.github.io/pjt_hbs_multi.html)