PROFILE

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Education

2020.03.01 ~ 2022.02.25	Computer Science Department, Hanyang University **[MS]** **한양대학교 컴퓨터소프트웨어학과**
2012.03.01 ~ 2018.08.31	Industrial Engineering Department, Kangwon University **[BS]** **강원대학교 산업공학과**

Work Experience

2023.02.13 ~ 현재	**AfreecaTV**	VOD데이터팀 추천 알고리즘 개발자
2022.06.20 ~ 2022.12.31	**Undefined**	개발팀 챗봇&추천 알고리즘 개발자
2019.12.26 ~ 2020.02.29	**Kakao**	추천팀 추천 알고리즘 개발자
2018.11.05 ~ 2019.04.22	**HanbiSoft**	인공지능 파트 텍스트/음성 챗봇 개발자

Publications

2022 BIB Journal
(Briefings in Bioinformatics)

RAMP: Response-Aware Multi-task Learning with Contrastive Regularization for Cancer Drug Response Prediction (link)

2022 ICEIC
(International Conference on Electronics, Information, and Communication)

Quantization training with two-level bit width (link)

PROJECTS

Undefined	[1] Match Result Recorder	1 month
	[2] Competition Rule Recommendation	2 months
	[3] FAQ Chatbot	3 months
Machine Learning System Lab., Hanyang Univ.	[1] Network Embedding Generation	2y 6m
	[2] DNN Model Quantization - 1	2 years
	[3] DNN Model Quantization - 2	3 months
	[4] Artificial Intelligence Assistant	2 months
Kakao	[1] Automobile Video Recommendation	2 months
	[2] Comics Recommendation	2 weeks
HanbitSoft	[1] (KR) Multi-speaker Speech Synthesis Model	4 months
	[2] (EN) Text Chatbot	2 months

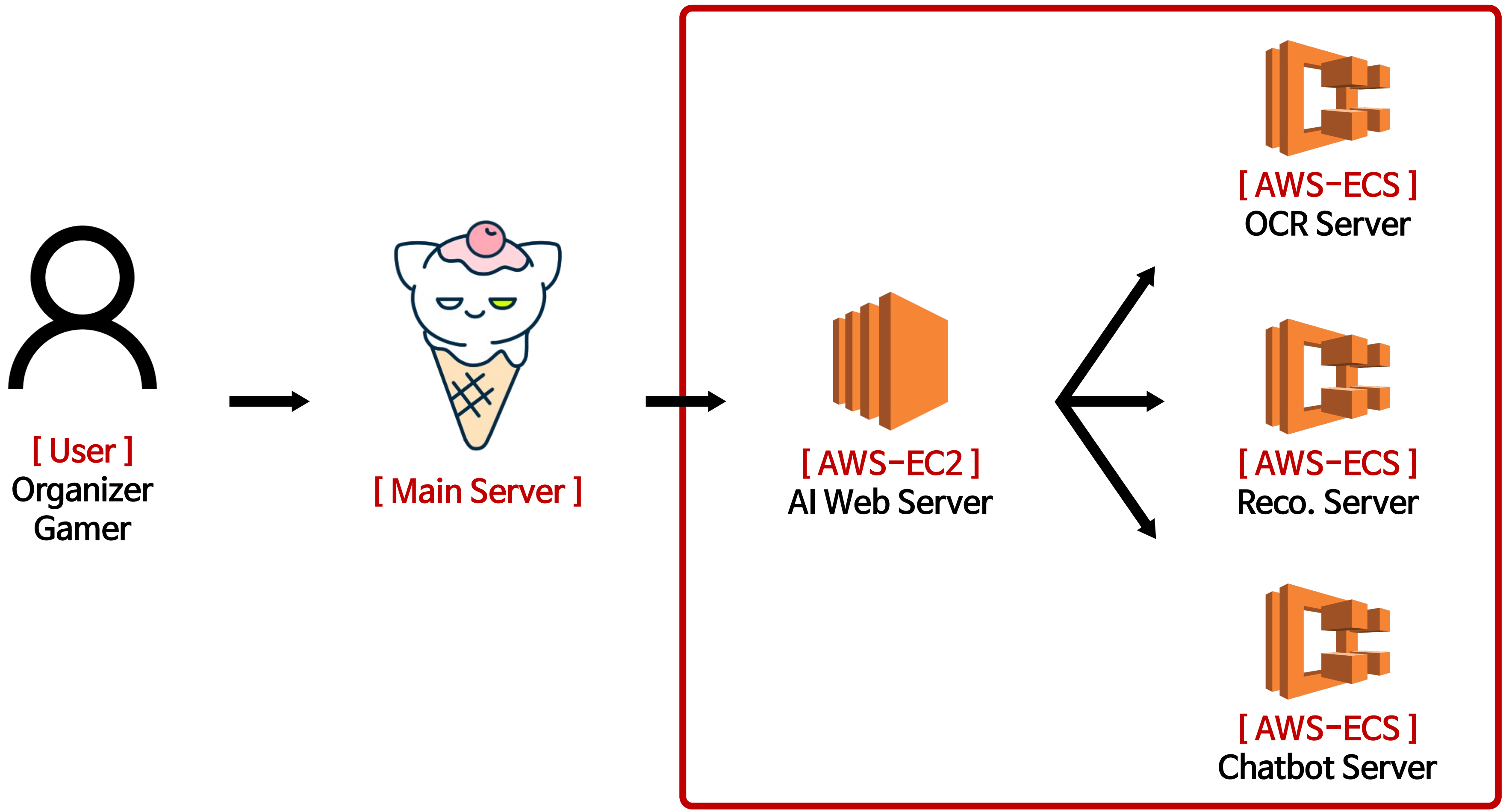
Undefined

[1] Match Result Recorder

[2] Competition Rule Recommendation

[3] FAQ Chatbot

AI Server Pipeline



Match Result Recorder (OCR)	Model	Tesseract (Google, LSTM-based)

	Works	• Define Problem
		• Define Pipeline
		    • Our Tesseract Model
		    • Cloud API (in case of poor confidence)
		    • Finetuning
		• Model Serving

Competition Rule Recommendation	Model	Matrix Factorization (Alternative Least Squares)
	Works	• Define Problem • EDA and Feature Selection (via Correlations) • Model Selection/Tuning • Model Optimization (remove operations) • Model Serving
Chatbot	Model	Multi-lingual BERT, StarSpace (Facebook)
	Works	• Dataset Preprocessing • Model Selection/Tuning • Model Serving

Machine Learning System Lab.

[1] Network Embedding Generation

[2] DNN Model Quantization – 1

[3] DNN Model Quantization – 2

[4] Artificial Intelligence Assistant

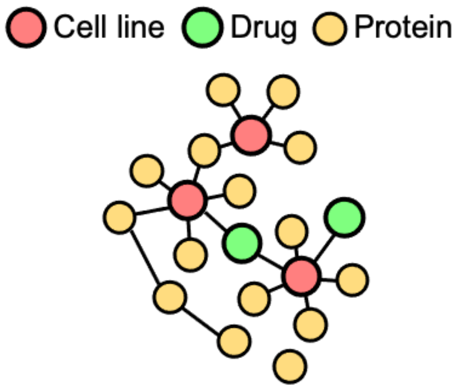
Network Embedding Generation

Paper link

Github Code link

* **Published in 2022 BIB** (Briefings in Bioinformatics) **Journal**

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



[1] Network Embedding Generation

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

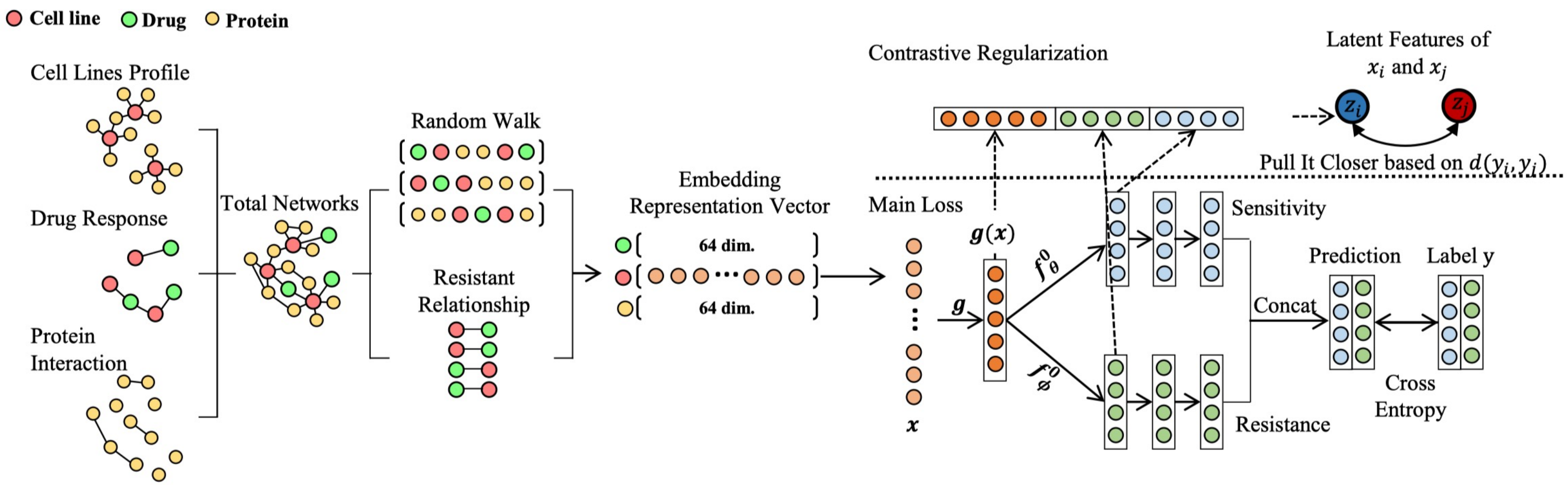


Fig. 1. The framework of RAMP. RAMP consists of two main stages. First, representation vectors are extracted from heterogeneous networks with RA-NS. Second, the multitask architecture of a Bayesian neural network is trained by representation vectors with contrastive regularization.

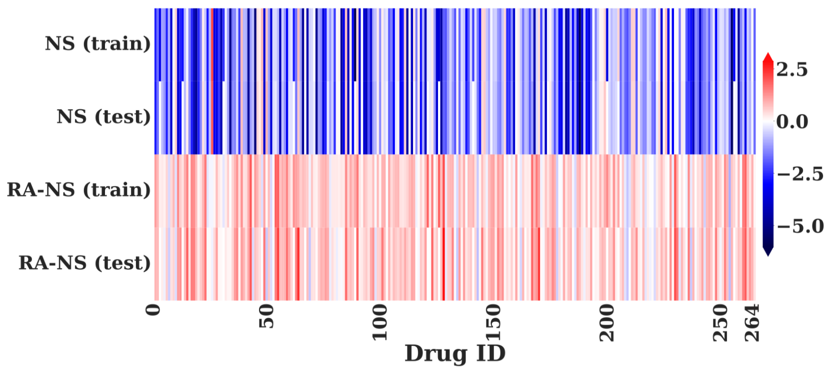


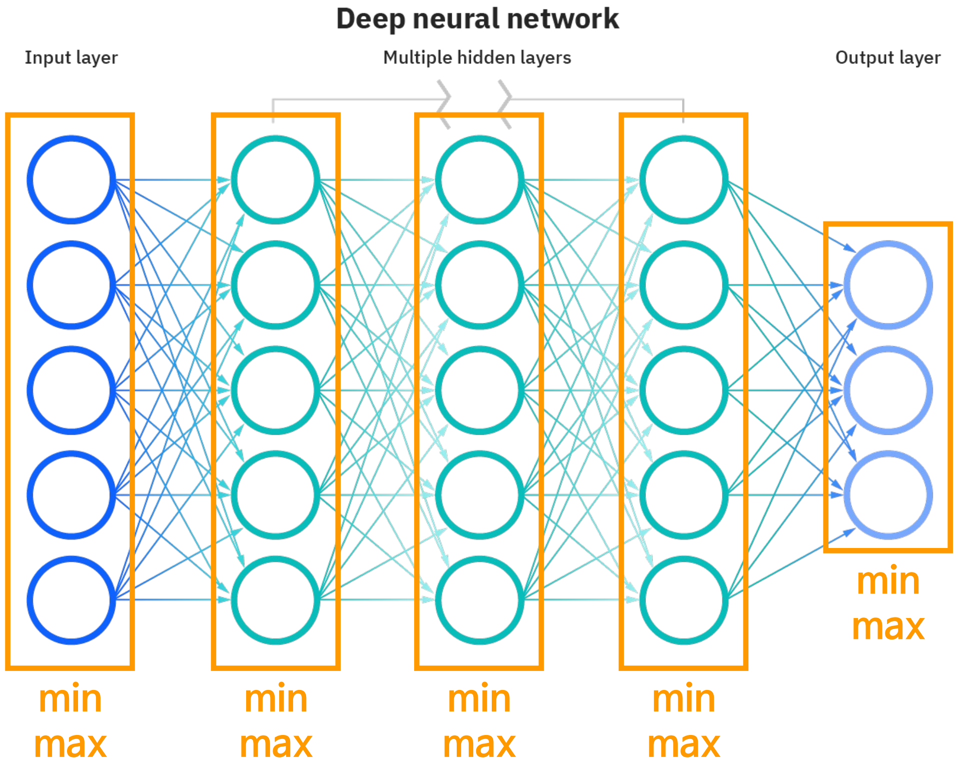
Fig. 2. Embedding similarities among drug and cellines. We subtract the similarity of a drug and its resistant cell lines from the similarity of the drug and its responsive cell lines. The results are normalized and plotted in a heatmap format. The higher (or redder) the value is, the better the embedding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

Github Code [link]

DNN Model Quantization – 1

Definition	What is Quantization	General DNN models use Float32 type variables
		Quantized models use low-bit INT types at inference
	What for	• Model storage • In memory load • Matrix multiplication with Float32 type cause bottleneck/unusability in low performance H/W

Problem	Poor Performance	Quantized models' **performance (e.g., accuracy) drops catastrophically when using sub-8bit INT type**
	Why	**Too generalized Quantization parameters** • Quantization parameters require: Per layer avg-ed min/max range of intermediate outputs across datasets
		Averaged min/max values include outliers



Solution

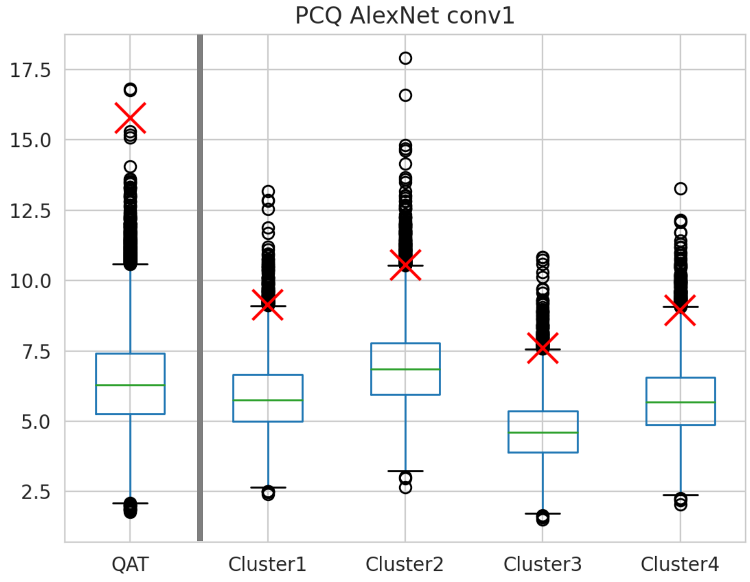
Granular Exponential Moving Average (Granular EMA)

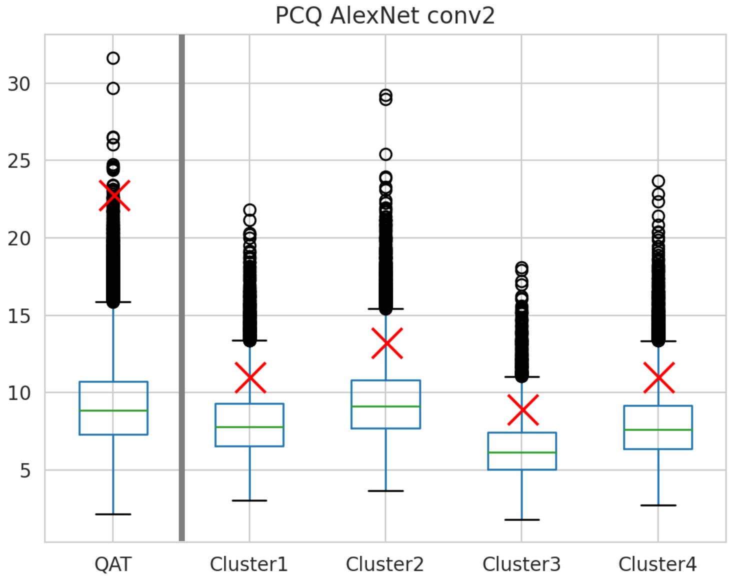
Train Quantization Parameters while **excluding outliers**

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

Paper link

DNN Model Quantization – 2

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

Problem

Quantization Aware Training (Google)

- Fake-quantize all of the weight matrices with a single low-bit type
- **Too much quantization errors** occur and the trained model gets ruined

QuantNoise (Facebook)

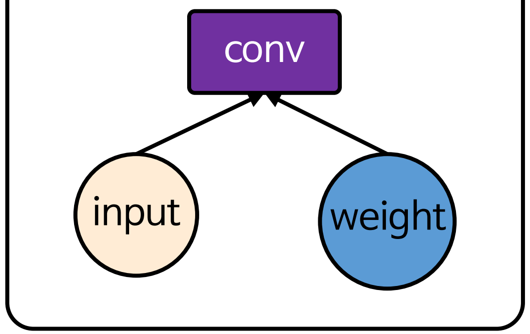
- Fake-quantize probabilistically selected subsets of matrices (a subset per matrix)
- Trained models **under-prepared** for Quantization

Solution

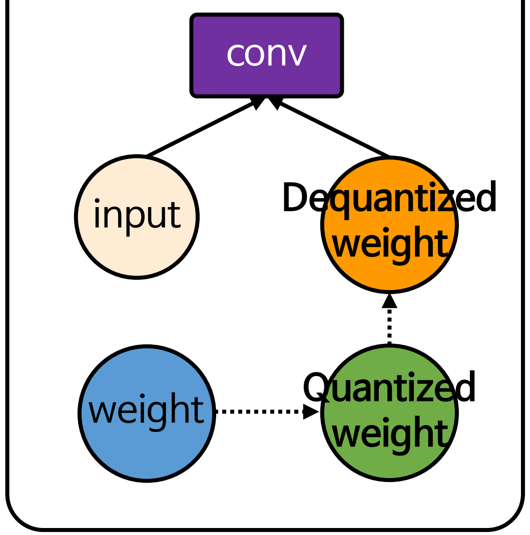
Fake Single Precision Training (FST)

- Probabilistically select subsets of weight matrices as QuantNoise
- Fake-quantize **selected subsets** with **low-bit type**
- Fake-quantize **the rests** with **higher bit type** than the selected

General Forward



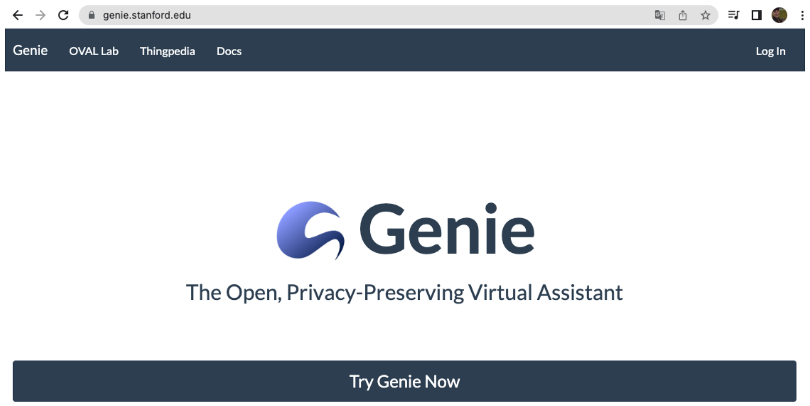
Fake Quantization

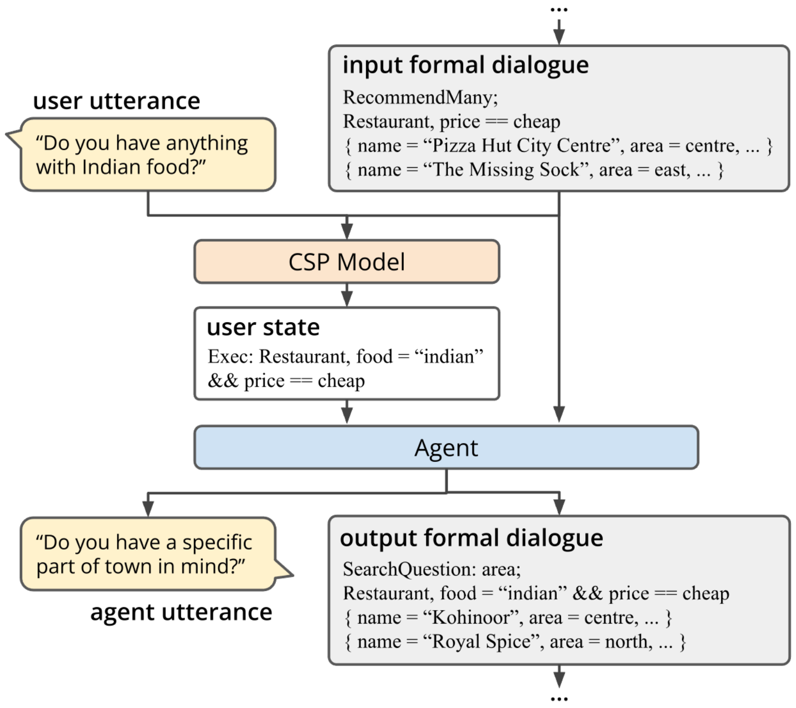


Artificial Intelligence Assistant

- 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





Kakao

[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 **matrix sparsity**
			[Exp-2] Considering **time bias** enhanced by low traffic
Exp 3, 4	**Ranking Algorithm** (RRF to Weighted-sum)	Purpose	Searching the key model among ensembled models
		Reason	Other well performing services had been used **similar model combination** • Therefore, assumed that the composition of used models are good enough
Exp 5	**Item2Vec** instead of Matrix Factorization	Purpose	Overcome Matrix Factorization model's limitation
		Reason	Needed to generate reco. results **within limited item list** • The limited items rated 30~40th on avg., if we force the limitation off
			Needed some models which **capture information** which MF can't

Automobile Video Recommendation

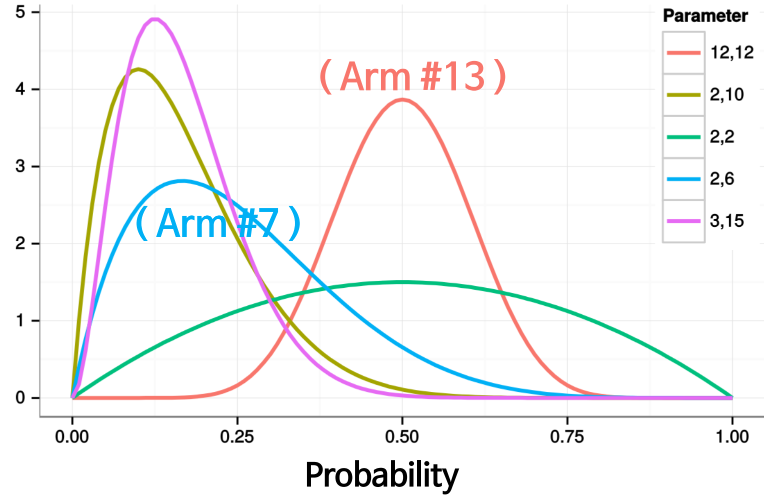
Exp 1, 2	**Thomson Sampling** h-params tuning	Purpose	Adjustment of trade-off between exploration & exploitation
		Reason	[Exp-1] High **matrix sparsity**
			[Exp-2] Considering **time bias** enhanced by low traffic

Target Item (Bandit)

제네시스보다 저렴한 5천만원대 전기차 BMW i4 edrive 40

Reco. Result (Selected Arms)

Beta Distributions of Arms



Automobile Video Recommendation

Exp 3, 4	Ranking Algorithm (RRF to Weighted-sum)	Purpose	Searching the key model among ensembled models
		Reason	Other well performing services had been used **similar model combination** • Therefore, assumed that the composition of used models are good enough

[CF]
Reco. result

Item ID	Similarity
3	0.8542
17	0.8345
2	0.7984
23	0.7784
33	0.6214

weight=0.3

[Text Analysis]
Reco. result

Item ID	Similarity
2	0.8441
42	0.8385
17	0.8001
51	0.7871
33	0.7070

weight=0.7

Example of Weighted-sum

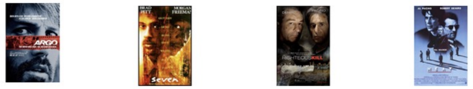
[Ensembled]
Reco. result

Item ID	Similarity
2	0.8303
17	0.8104
33	0.6813
42	0.5870
51	0.5510

Automobile Video Recommendation

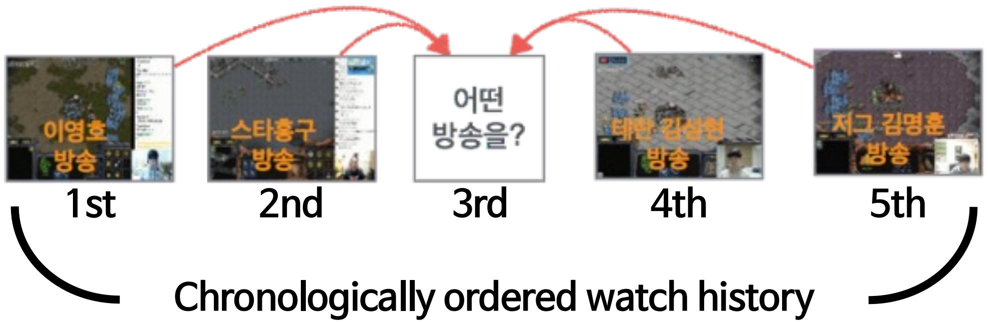
Exp 5	**Item2Vec** instead of Matrix Factorization	Purpose	Overcome Matrix Factorization model's limitation
		Reason	Needed to generate reco. results **within limited item list** • The limited items rated 30~40th on avg., if we force the limitation off
			Needed some models which **capture information** 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 **nouns** and **pronouns** only
			According to past researches, **verbs** and **adjectives** 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

Example of Weighted Rank Fusion

[Ensembled]

Item ID	Rank
3	1
2	2
17	3

weight=0.7

Item ID	Rank
3	1
17	2
2	3

[CF]

weight=0.3

Item ID	Rank
2	1
42	2
7	3

[Text Analysis]

weight=0.2

Item ID	Rank
3	1
42	2
2	3

[Image Sim.]

HanbitSoft

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

[2] (EN) Text/Audio Chatbot

(KR) Multi-speaker Speech Synthesis Model

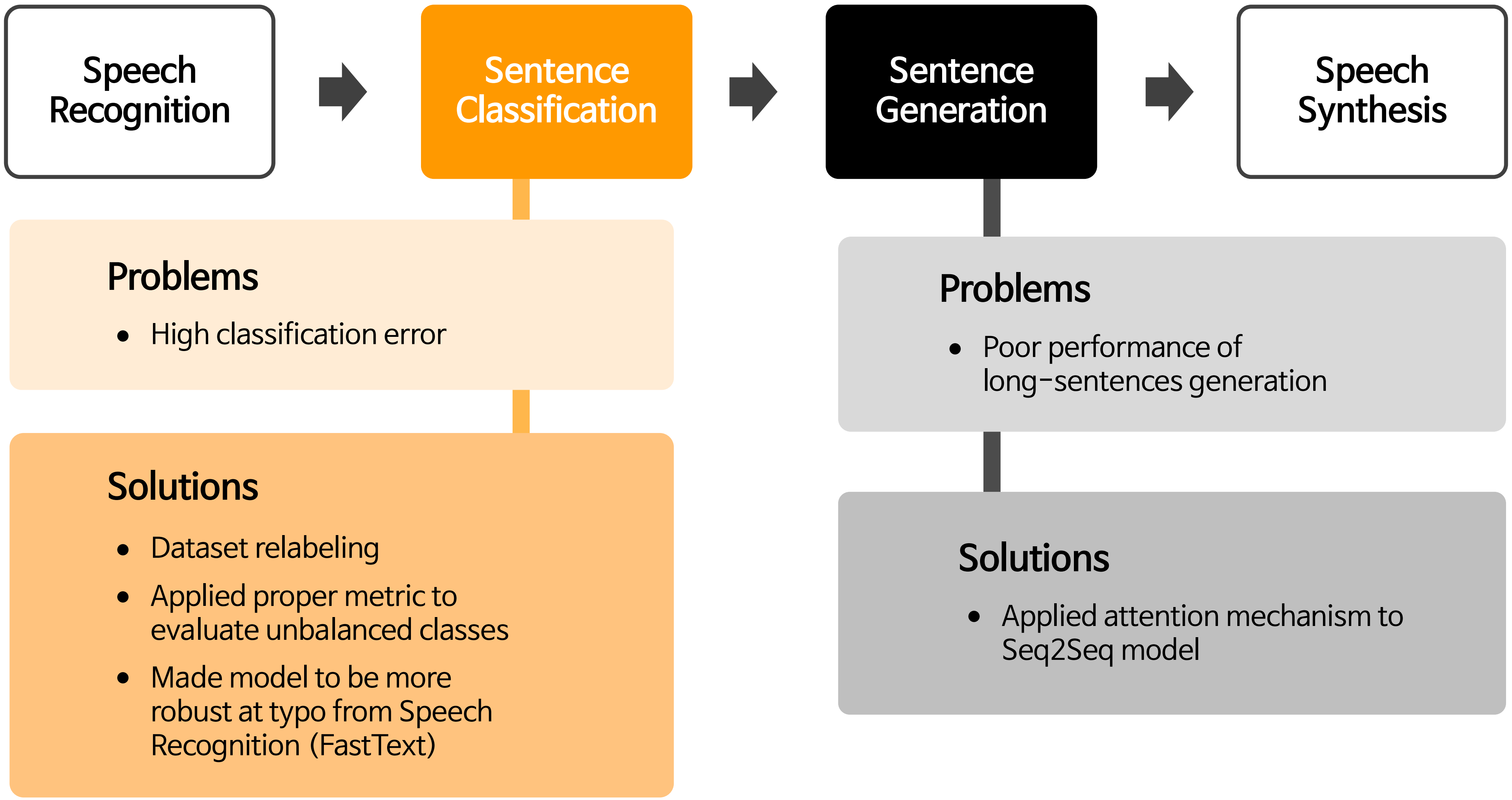
- **Dataset preparation**

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

(EN) Text/Audio Chatbot



(EN) Text/Audio Chatbot