
Term Project Guide

Chiehyeon Lim

2022. 11. 14

Last Term Project Proposal Presentation

Contents of Class Today

- Implications from several previous term projects
- Implications from your assignment outcomes
- Requirements and standards for your term projects
- Review of your term project proposals
- Feedback to your term project proposals
- Expected schedule of term project progress

Implications from several previous term projects

Previous Term Project Topics

Review-based food recommendation

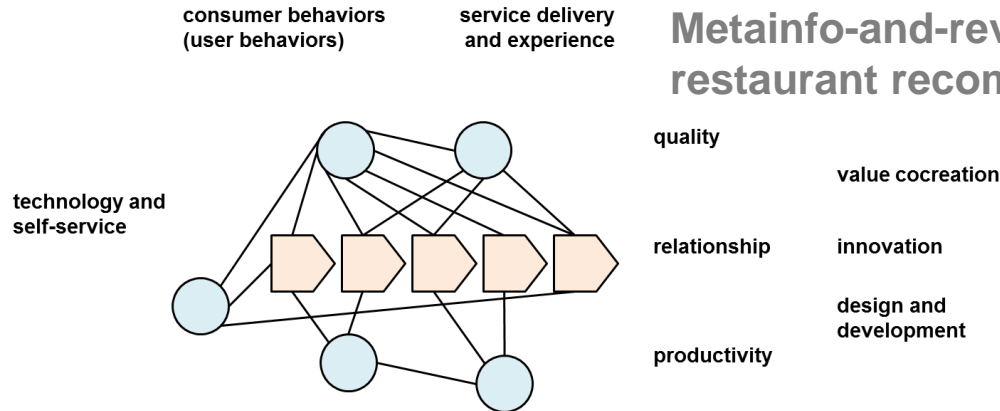
Animation recommender system
Book recommender system

Behavior-and-symptom
-based health diagnosis

Metainfo-and-review-based
restaurant recommendation

Customized
service design for
air conditioning
machine
users and clients

All
Projects



Allergy-free
diet planning for
children

Optimal routing for
COVID-19 vaccine
distribution

Industrial service solution development for
shale gas productivity prediction and investment

Previous Term Project Topics

Review-based food recommendation

Animation recommender system

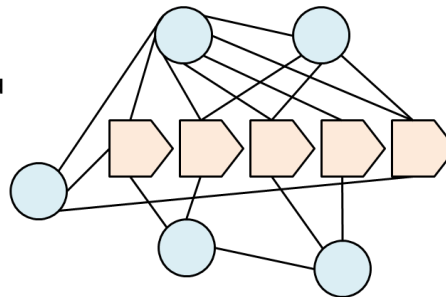
Book recommender system

Behavior-and-symptom
-based health diagnosis

Metainfo-and-review-based
restaurant recommendation

consumer behaviors
(user behaviors) service delivery
and experience

technology and
self-service



quality

value cocreation

relationship

innovation

productivity

design and
development

Customized
service design for
air conditioning
machine
users and clients

Allergy-free
diet planning for
children

knowledge and
employee
management

cost and pricing

service operations
and supply chain
management

Optimal routing for
COVID-19 vaccine
distribution

Industrial service solution development for
shale gas productivity prediction and investment



Animation Recommendation System

Previous Term Project Topics

Review-based food recommendation

Behavior-and-symptom
-based health diagnosis

Animation recommender system

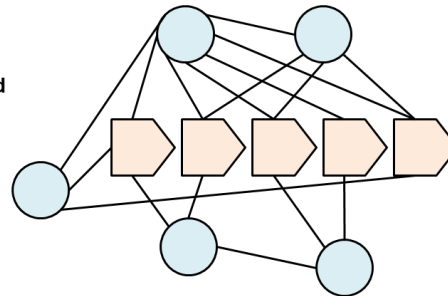
Book recommender system

Metainfo-and-review-based
restaurant recommendation

consumer behaviors
(user behaviors)

service delivery
and experience

technology and
self-service



quality

value cocreation

relationship

innovation

productivity

design and
development

Customized
service design for
air conditioning
machine
users and clients

Allergy-free
diet planning for
children

knowledge and
employee
management

cost and pricing

service operations
and supply chain
management

Optimal routing for
COVID-19 vaccine
distribution

Industrial service solution development for
shale gas productivity prediction and investment

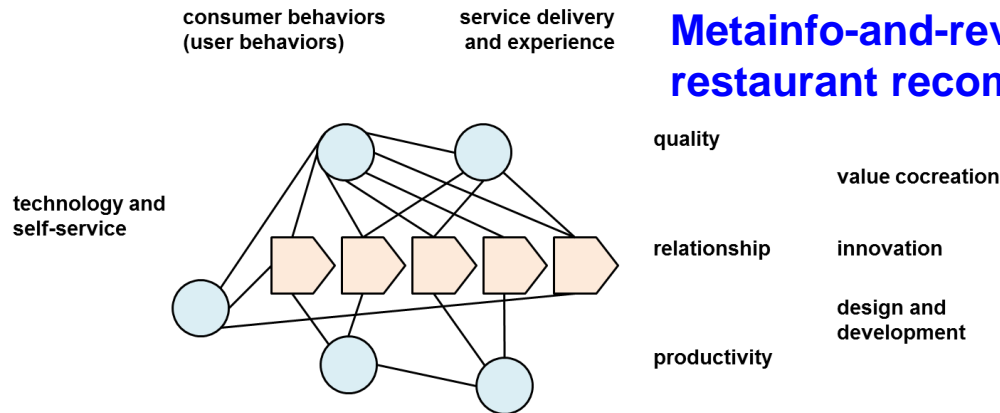
Service Intelligence Term Project

Food Recommendation



Previous Term Project Topics

Metainfo-and-review-based restaurant recommendation



Motivation



There are many restaurants in Ulsan. We thought of a service that recommends similar restaurants through reviews, ratings, and categories when customers who use our service choose one restaurant.

When we eat out, we always think about where to go. It is expected that this service will make it easier and faster to obtain information and find the restaurants you want.



Previous Term Project Topics

Review-based food recommendation

Animation recommender system

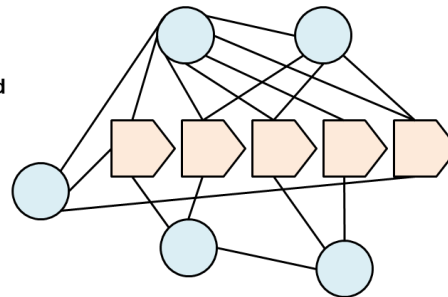
Book recommender system

Behavior-and-symptom
-based health diagnosis

Metainfo-and-review-based
restaurant recommendation

consumer behaviors
(user behaviors) service delivery
and experience

technology and
self-service



quality

value cocreation

relationship

innovation

productivity

design and
development

Customized
service design for
air conditioning
machine
users and clients

All
Projects

Allergy-free
diet planning for
children

knowledge and
employee
management

cost and pricing

service operations
and supply chain
management

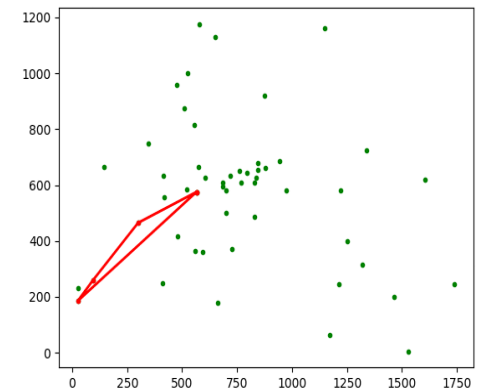
**Optimal routing for
COVID-19 vaccine
distribution**

Industrial service solution development for
shale gas productivity prediction and investment

Introduction

Therefore, we have come up with “**Vaccine Distribution Routing Service**” to solve both problems. We thought that if only **the amount of vaccines to be inoculated per day** could be delivered **in a short time**, both the spoilage and delivery problems could be solved.

Purpose of our research is to find optimal route (**time saving way**) for distributing vaccine to private hospitals using TSP (Traveling Salesman Problem).



Traveling salesman problem

Implications from several previous term projects

- Own creative “framework” of developing a novel service intelligence
- Performance evaluation of the intelligence developed
- Comparison of different methods
- Completeness of the “final solution” design
- Contribution of the term project outcome to the improvement of focal service

Implications from your assignment outcomes

Some of your interesting opinions

- ... I watch YouTube a lot. A major inconvenience when watching YouTube is that the recommendation system constantly recommends videos similar to the ones I've seen once the amount of YouTube usage is exceeded. ...
- ... So, if I study the recommender system, I will think about how to create an appropriate level of recommender system while saving diversity. ...
- ... The stock market is likely to be possible as a service that can improve existing services through a recommendation system. ...

Some of your interesting opinions

- ... results. The photo attached next to it is the result of a survey on the conditions that we think when choose a movie. Based on the survey, it would be nice to have data on the genre, rating (average), and actor of the movie. ...

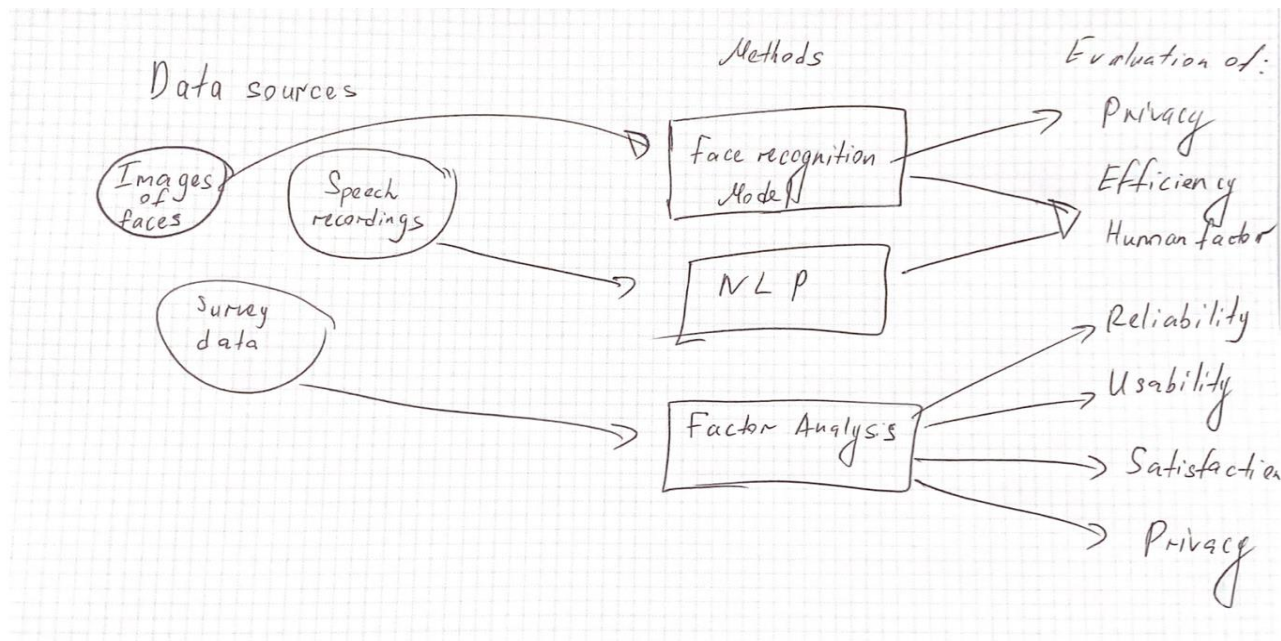
Data perspective) The data consists of four types: userid, movie title, rating, and year. Since it is difficult to fully understand consumer tastes with only Rate, I think we need more data to achieve good results. The photo attached next to it is the result of a survey on the conditions that we think when choose a movie. Based on the survey, it would be nice to have data on the genre, rating (average), and actor of the movie. Here, the rating should be weighted by the number of votes in order to make the difference between a movie with 5 points for one vote and a movie with 5 points for 100 votes. If it is not categorical data, such as movie review data, the contents

Q 영화를 선택할 때 가장 고려하는 사항?



Some of your interesting opinions

- ... Mainly 3 types of data will be collected, images of workers, their speech recordings and survey data. ...



Implications from your assignment outcomes

- Collection, analysis, and learning of well-structured datasets are basic
- Identification of a significant problem based on the basic practice
- Identification of an idea to solve the problem
- Identification or design of service contents to be delivered to the customers/users
- Own creative “framework” of developing a novel service intelligence

Requirements and standards for your term projects

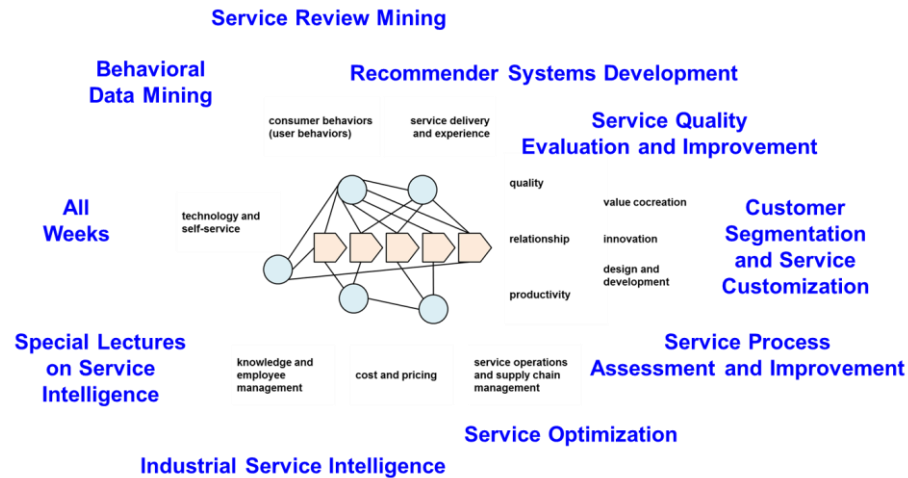
Requirements and standards for your term projects

- Definition of a significant service problem and an idea to solve the problem
- Identification or design of service contents to be delivered to the customers/users
- Own creative “framework” of developing a novel service intelligence
- Collection, analysis, and learning of well-structured datasets
- Experiment: Performance verification of the intelligence developed
- Experiment: Comparison with different methods of the intelligence development
- Validity and completeness of the final service solution design
- Contribution of your term project outcome to the improvement of focal service

Requirements and standards for your term projects

- Definition of a significant service problem and an idea to solve the problem (10)
- Identification or design of service contents to be delivered to the customers/users (10)
- Own creative “framework” of developing a novel service intelligence (30)
- Collection, analysis, and learning of well-structured datasets (20)
- Experiment: Performance verification of the intelligence developed (10)
- Experiment: Comparison with different methods of the intelligence development (10)
- Validity and completeness of the final service solution design (5)
- Contribution of your term project outcome to the improvement of focal service (5)

Examples of the framework of developing a service intelligence



Review of your term project proposals

Previous Term Project Topics

Musical review mining

Spotify review mining **for what/whom?**

Skin care item recommendation

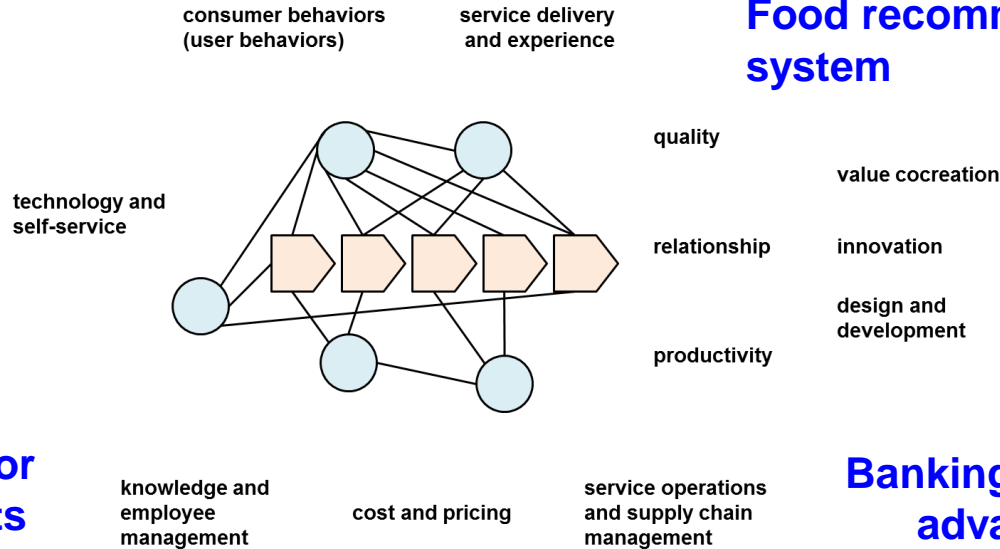
Customer language understanding?
for search engine improvement

Music recommender system
Restaurant recommender system

**how much
scope and
which
methods?**

Food recommender
system

**All
Projects**



Healthy
diet planning for
UNIST students
which dataset?

**Price comparison
service? for
supermarket and
zakh users
in Ulaanbaatar**

Banking app service
advancement

**what
methods?
and why?**

Machine predictive maintenance for e-coating system
Anomaly detection for industrial services

**what contents
for whom?**

Feedback to your term project proposals

Review of your term project proposals

Term project proposal
04. Analysis Plan

Task 2. Personalized recommendation from sequential data of food diet

Alice

Chris

Recommend food

- Higher Protein
- Lower Calories food
- Lower Sodium food
- Need Mineral food

- Use Sequential Recommendation methods to predict the next Food for the users to be prefer.
- With the given sequential food data, estimate the deficient nutrient for each users.
- Recommend the next food with the **satisfied nutrients** and **preferred food** from the recommendation model.
- Recommendation models such as BERT4Rec, SASRec will be used to predict the next food.
- To solve **Cold start problem**, the model will consider the side information of each users while training.

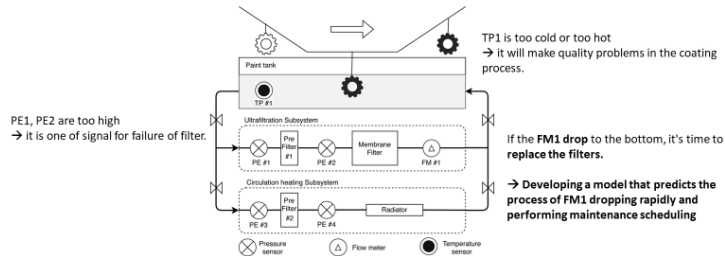
UNIST FIRST IN CHANGE 07

Requirements and standards for your term projects

- Definition of a significant service problem and an idea to solve the problem
- Identification or design of service contents to be delivered to the customers/users
- Own creative "framework" of developing a novel service intelligence
- Collection, analysis, and learning of well-structured datasets
- Experiment: Performance verification of the intelligence developed
- Experiment: Comparison with different methods of the intelligence development
- Validity and completeness of the final service solution design
- Contribution of your term project outcome to the improvement of focal service

Review of your term project proposals

What service?



3

Requirements and standards for your term projects

- Definition of a significant service problem and an idea to solve the problem
- Identification or design of service contents to be delivered to the customers/users
- Own creative "framework" of developing a novel service intelligence
- Collection, analysis, and learning of well-structured datasets
- Experiment: Performance verification of the intelligence developed
- Experiment: Comparison with different methods of the intelligence development
- Validity and completeness of the final service solution design
- Contribution of your term project outcome to the improvement of focal service

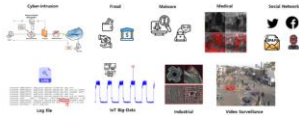
Review of your term project proposals

Anomaly Detection

Anomaly Detection

- The problem of distinguishing between 'Normal' and 'Abnormal' samples

Applications



- Model type: Statistical models, Probabilistic models, Clustering-based, Nearest-neighbors-based, Density-based, Deep learning based, etc

Anomaly Detection model



- Train the model with the threshold that can distinguish the abnormal points
- Final anomaly score of test data (online data) is distinguished normal or abnormal by threshold

UNIST

FIRST IN CHANGE

Requirements and standards for your term projects

- Definition of a significant service problem and an idea to solve the problem
- Identification or design of service contents to be delivered to the customers/users
- Own creative "framework" of developing a novel service intelligence
- Collection, analysis, and learning of well-structured datasets
- Experiment: Performance verification of the intelligence developed
- Experiment: Comparison with different methods of the intelligence development
- Validity and completeness of the final service solution design
- Contribution of your term project outcome to the improvement of focal service

Service & Knowledge Lab

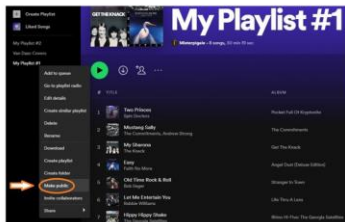
49

UNIST

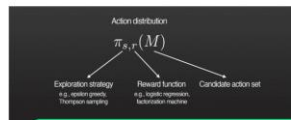
Review of your term project proposals

3) How to collect data & build intelligence

6



Multi-armed bandit algorithms



Explore vs Exploit

Flip a coin with given probability of fail
If head, pick best card in M according to predicted reward r → EXPLOIT
If tail, pick card from M at random → EXPLORE

UNIST

FIRST IN CHANGE

Requirements and standards for your term projects

- Definition of a significant service problem and an idea to solve the problem
- Identification or design of service contents to be delivered to the customers/users
- Own creative "framework" of developing a novel service intelligence
- Collection, analysis, and learning of well-structured datasets
- Experiment: Performance verification of the intelligence developed
- Experiment: Comparison with different methods of the intelligence development
- Validity and completeness of the final service solution design
- Contribution of your term project outcome to the improvement of focal service

Service & Knowledge Lab

49

UNIST

Review of your term project proposals

WHAT SERVICE?



A service that:

- notifies you the price of products in different supermarket chains
- alerts you when a product is on sale

Requirements and standards for your term projects

- Definition of a significant service problem and an idea to solve the problem
- Identification or design of service contents to be delivered to the customers/users
- Own creative "framework" of developing a novel service intelligence
- Collection, analysis, and learning of well-structured datasets
- Experiment: Performance verification of the intelligence developed
- Experiment: Comparison with different methods of the intelligence development
- Validity and completeness of the final service solution design
- Contribution of your term project outcome to the improvement of focal service

Review of your term project proposals

Topic introduction

- Topic : Analyze the review of Spotify application

- 1) Find the strengthen and weakness of Spotify application
- 2) Find the “thumbs-up” points in reviews

- Selected Reason

: The open space for writing reviews is a community where consumers share their views on the service. It is important to analyze reviews and create a better review writing platform for active interaction with consumers



Requirements and standards for your term projects

- Definition of a significant service problem and an idea to solve the problem
- Identification or design of service contents to be delivered to the customers/users
- Own creative “framework” of developing a novel service intelligence
- Collection, analysis, and learning of well-structured datasets
- Experiment: Performance verification of the intelligence developed
- Experiment: Comparison with different methods of the intelligence development
- Validity and completeness of the final service solution design
- Contribution of your term project outcome to the improvement of focal service

Review of your term project proposals

Plan

Sorting reviews by Word embedding algorithm and get the necessary data(Review mining).

Organize them into csv file as customer and his review

Using algorithm we used in recommendations to get the ranking of the products as most liked and least liked products.

We focus mainly on matrix factorization to get the ranking of the products(Collaborative Filtering)



Requirements and standards for your term projects

- Definition of a significant service problem and an idea to solve the problem
- Identification or design of service contents to be delivered to the customers/users
- Own creative "framework" of developing a novel service intelligence
- Collection, analysis, and learning of well-structured datasets
- Experiment: Performance verification of the intelligence developed
- Experiment: Comparison with different methods of the intelligence development
- Validity and completeness of the final service solution design
- Contribution of your term project outcome to the improvement of focal service

Review of your term project proposals

Project plan

- 1. Collect data with all reviews, ratings and etc.
- 2. Preprocess and transform the data (removing missing values, duplicates)
- 3. Text preprocessing and cleaning
- 4. Doing EDA on top 10 rated restaurants in Ulsan, types of restaurants and etc.
- 5. Applying content based algorithms
- 6. Evaluating the results.

Recommender system for restaurants in Ulsan

- In Ulsan, there are plenty of different cuisines, and people have different food preference. For instance, many international students prefer halal food, some people are vegetarians and etc. Based on it, we want to create content - based recommender system of restaurants. So that, if the person have visited and liked food in some restaurant in Ulsan, we would recommend to him the same type of restaurants with same reviews.
- Once, we came to Ulsan, we knew only several places to eat, as we do not explore the city, and do not know Korean language well. So, the recommender system created will solve this problem, as it will provide more variety of restaurants to visit based on our preferences.



Requirements and standards for your term projects

- Definition of a significant service problem and an idea to solve the problem
- Identification or design of service contents to be delivered to the customers/users
- Own creative "framework" of developing a novel service intelligence
- Collection, analysis, and learning of well-structured datasets
- Experiment: Performance verification of the intelligence developed
- Experiment: Comparison with different methods of the intelligence development
- Validity and completeness of the final service solution design
- Contribution of your term project outcome to the improvement of focal service

Review of your term project proposals

Expected Outcome



- We can identify the factors that customers consider important in the musical industry.
- Through regression analysis, the most influential elements among the factors can be derived.
- By checking whether the elements that are important to customers are well included or not in the planning stage or production stage of a musical, it is possible to provide musicals with higher satisfaction to customers

Requirements and standards for your term projects

- Definition of a significant service problem and an idea to solve the problem
- Identification or design of service contents to be delivered to the customers/users
- Own creative "framework" of developing a novel service intelligence
- Collection, analysis, and learning of well-structured datasets
- Experiment: Performance verification of the intelligence developed
- Experiment: Comparison with different methods of the intelligence development
- Validity and completeness of the final service solution design
- Contribution of your term project outcome to the improvement of focal service

Review of your term project proposals



Goal

Re-making SEO with new perspective

Kind of predictive intelligence



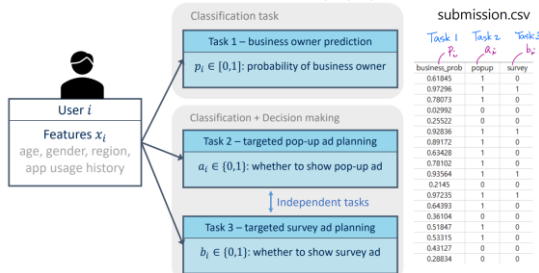
Requirements and standards for your term projects

- Definition of a significant service problem and an idea to solve the problem
- Identification or design of service contents to be delivered to the customers/users
- Own creative "framework" of developing a novel service intelligence
- Collection, analysis, and learning of well-structured datasets
- Experiment: Performance verification of the intelligence developed
- Experiment: Comparison with different methods of the intelligence development
- Validity and completeness of the final service solution design
- Contribution of your term project outcome to the improvement of focal service

Review of your term project proposals



- For each user i in the exam dataset (200,000 users), you have to submit three numbers p_i, a_i, b_i



Dataset: Overview

- Provided by Hana Bank
 - Usage record of Hana 1Q App (mobile banking app)
 - for 8 months (2022.01.01 ~ 2022.08.26, 238 days)



- Data description
 - Input features (raw) : 3 + 238*3 = 717 columns per user

feature name	meaning	remark
gender	Male(0) or female(1)	binary
age_code	age band (1:<20, 2:13:20~79, 14:>=80)	
region_code	region code (1~18)	categorical
c20220101~ c20220826	Number of logins for each day	time series (cardinal)
t20220101~ t20220826	Number of logins with money transfer	time series (cardinal)
s20220101~ s20220826	Duration of staying with the app	time series (cardinal)

- Label = {1: small business owner, 0: general (non-business)}
 - The proportion of the small business owner (label=1) is approximately 6.55%

Requirements and standards for your term projects

- Definition of a significant service problem and an idea to solve the problem
- Identification or design of service contents to be delivered to the customers/users
- Own creative "framework" of developing a novel service intelligence
- Collection, analysis, and learning of well-structured datasets
- Experiment: Performance verification of the intelligence developed
- Experiment: Comparison with different methods of the intelligence development
- Validity and completeness of the final service solution design
- Contribution of your term project outcome to the improvement of focal service

Expected schedule of term project progress

The remaining schedule of the term project is as follows

- November 16: Special lectures on offline interactive recommendation and metaheuristic algorithm to motivate and guide your term projects further (see the next pages)
- November 21/23: Term project progress presentation (see the next pages); The submission in BB will be due by November 20, but present with the latest file at your presentation
- November 28/30: Individual team meetings; The submission section in BB will be open by November 27, but discuss with the latest file at your meeting
- December 5/7: Project outcome presentation; The submission section in BB will be open by December 4, but present with the latest file at your presentation
- Final paper submission due by December 23 (the paper should address the final comments; maximum 6 pages for the main article template and unlimited pages for the appendix)

예선작 중간 제출 마감 : 11.26 (토)
예선작 중간 평가 : 12.1 (목)
예선작 최종 제출 마감 : 12.17 (토)

Think carefully about the following components and ask due questions on 11/16
You must be clear about the components and complete some of them by 11/23

- Definition of a significant service problem and an idea to solve the problem (10)
- Identification or design of service contents to be delivered to the customers/users (10)
- Own creative “framework” of developing a novel service intelligence (30)
- Collection, analysis, and learning of well-structured datasets (20)
- Experiment: Performance verification of the intelligence developed (10)
- Experiment: Comparison with different methods of the intelligence development (10)
- Validity and completeness of the final service solution design (5)
- Contribution of your term project outcome to the improvement of focal service (5)

Must and optional components of your progress presentation

- Definition of a significant service problem and an idea to solve the problem (10)
- Identification or design of service contents to be delivered to the customers/users (10)
- Own creative “framework” of developing a novel service intelligence (30)
- Collection, analysis, and learning of well-structured datasets (20)
- Experiment: Performance verification of the intelligence developed (10)
- Experiment: Comparison with different methods of the intelligence development (10)
- Validity and completeness of the final service solution design (5)
- Contribution of your term project outcome to the improvement of focal service (5)

Reminder: Assignment 6 (by 11.18 11:59 pm)

- Based on the practice demonstration by TA Cho, (1) complete the development of a yield prediction model for the sugar manufacturer by yourself. Through trials and tests, develop your own best prediction model. You should compare and interpret multiple prediction models.
- (2) In the prediction model development, think carefully about the controllable variables. You should analyze the variables around the process based on your own descriptive and predictive analyses. For example, interpret the analytics outcomes (e.g., describe the controllable variables you identified significant, interpret their coefficient/importance values in your yield prediction models). As a result, describe what controllable variables should be prioritized in the optimization of the process.
- (3) Optimize the production process and describe the results (e.g., a set of optimal control values). First, based on a linear regression model, use the scipy package for the mathematical optimization. Second, based on a non-linear regression model (e.g., tree-based models, neural network models), complete the provided GA code and use it for the optimization through simulation (refer to the next week practice); of course you can develop your own heuristic optimization algorithm if you want.
- (4) Assume you actually need to use your machine for the sugar manufacturer. Using the finally selected prediction model and your optimizer, think how to manage effectively and improve the sugar production process. Design and develop your own industrial service intelligence solution for this manufacturer (e.g., develop an automated prediction-optimization code package). You must provide visualization contents (e.g., visualization of the predicted values of yield flow, visualization of suggested optimal control values for specific controllable variables) Describe your service intelligence solution in detail. Think beyond the class examples in your own creative, unique way!
- (5) Think about your concerned industrial/business service around UNIST, in Ulsan, in your hometown, or any other interested service that require a machine for its management and improvement. Describe the specific tasks of the service that require the support of a machine. Discuss the requirements of developing such a machine for the service in detail.
- (6) If you would actually conduct a study on developing a machine for the industrial/business service, how would you conduct the research in your own creative, unique way? What kinds of data are you going to collect, analyze, and learn, and what methods are you going to use? Describe your service intelligence development plan in detail. If possible, visualize your plan clearly (e.g., draw an image, construct a mathematical model). To facilitate your thinking, you may want to identify and review a paper or any other reference in the Internet, related to the service you are interested or concerned.
- Upload your code and a several paragraph essay on the tasks (1)~(6) in the Blackboard.

Reminder: Assignment 7 (by 11.18 11:59 pm)

- (0) Based on the practice demonstration by TA Yoon, complete the Assignment 6 (i.e., Optimize the production process and describe the results - identify a set of optimal control values). First, based on a linear regression model, use the scipy package for the mathematical optimization. Second, based on a non-linear regression model (e.g., tree-based models, neural network models), complete the provided GA code and use it for the optimization through simulation (refer to the next week practice); of course you can develop your own heuristic optimization algorithm if you want.
- (1) Select more than 9 nodes in the UNIST map you would like to introduce to a visitor. Connect the nodes, estimate the distance between nodes, and represent the network similar to the case introduced in the class. Find the optimal route, using a genetic algorithm or your own heuristic.
- (2) Identify a real-world service optimization problem that you are interested or concerned, and develop a mathematical model of this problem, based on existing reference models and your own creativity. Describe the importance of your problem and model in detail. [You may want to connect your Assignment 5 outcome with this question \(i.e., optimize the driving process for fuel-efficient driving\)](#). Then, what should be the constraints and objective in your optimization model?
- (3) Develop your own heuristic algorithm to solve a type of optimization problems (e.g., the problem of above question (2) or any other problems in general). Your algorithm should reflect a mechanism “how we, humans make decisions”. An idea level is fine. Try to think long and propose your new algorithm concisely. Describe in detail the algorithm in a format of flow chart, pseudocode, or your own visualization. If possible, try to identify and use a good mathematical model for your conceptual basis. For your reference, you may want to study a metaheuristic algorithm besides GA that is most interesting to you.