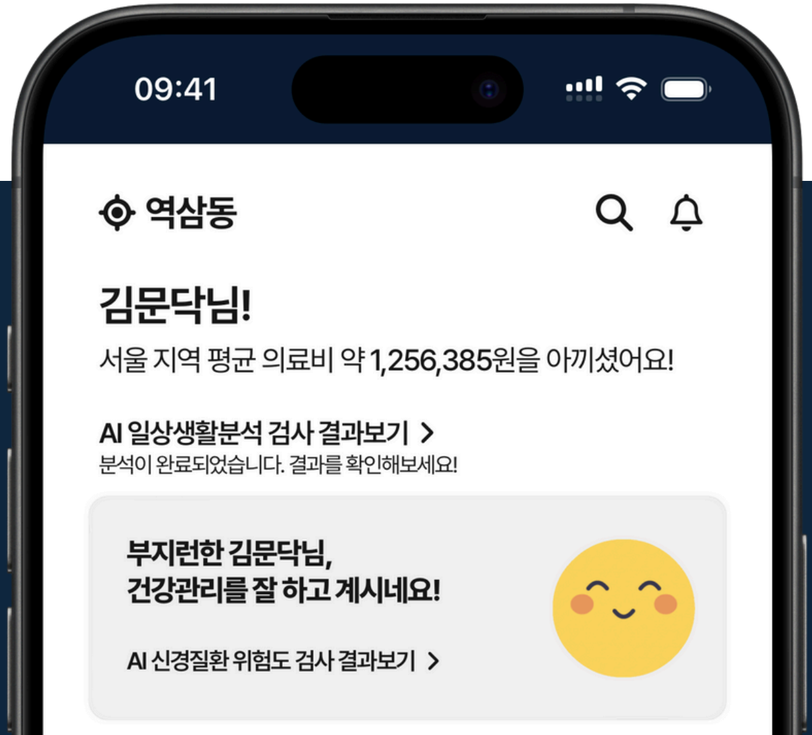
문밖의 닥터

Product Development Presentation

AI Health Risk Prediction and **Personalized Rehabilitation** Integration Solution for Neurological Patients



Doctors out the Door
정혜원 박지건 윤지훈 이상훈 임예원 황유진

2024-06-11

Index

Startup Competition using Healthcare Big Data

Hosted by: Ministry of Health and Welfare

Organized by: Health Insurance Review and Assessment Service, National Health Insurance Service

Competition Category: Product and Service Development

Project Period : 25.4.2024 ~ 5.31.2024

Team Members

Hyewon Jung
PM

Jigeon Park
Full-stack Developer

Jihoon Youn
Service Planner

Sanghoon Lee
Front-end Devloper

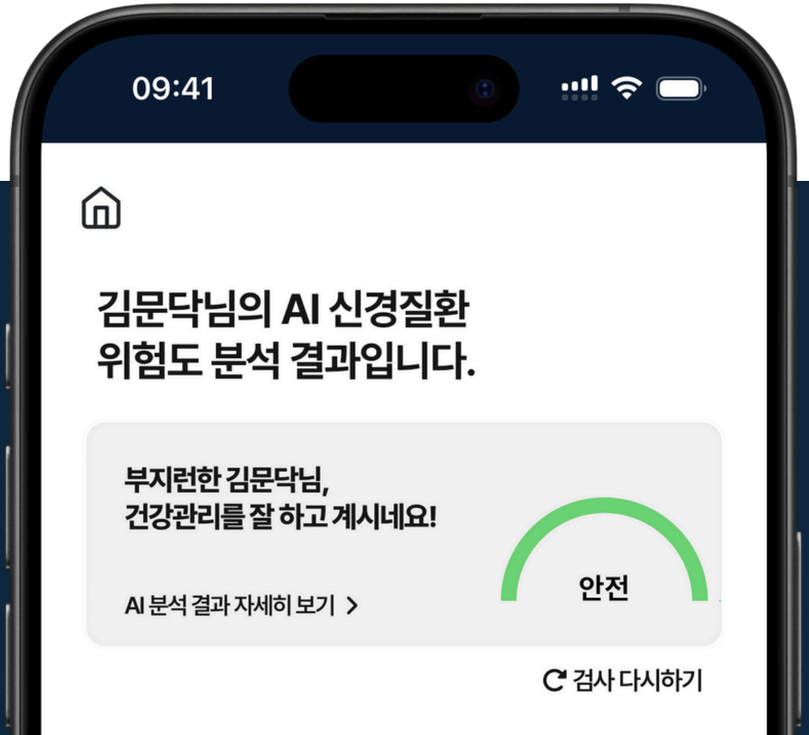
Yewon Lim
Data Analyst

YouJin Hwang
Data Scientist

문밖의 닥터

Background of Planning

Topic Selection / Core Features / Service Goals / Open Data



Planning Dept.
Hyewon Jung (PM)
Jihoon Youn (Planning))

Business Problem

뇌출혈 재활

블로그 카페 이미지 지식iN

파워링크 뇌출혈재활 관련광고

더건강연세재활센터 · 재활센터.com 광고

(주)더건강연세재활운동센터 · 가장 소중한 내 가족의 재활 · 진심을 다해 재활 하겠습니다

뇌출혈재활 전국18개 지점, 서울에서 제주까지 모든 지역 방문재활 가능 세상에서 가장 소중한 내 가족을 위해 정성을 다해 방문치료 & 재활치료 하겠습니다

첫 방문 무료평가

더건강연세 홍보영상

센터재활은 광교본점

myongji-sm.co.kr/ 광고

뇌혈관전문병원, 명지성모병원

뇌경색 재활

카페 블로그 이미지 지식iN

파워링크 뇌경색재활 관련광고

mjchoonhey.co.kr/ 광고 톡톡

재활전문병원 명지춘혜병원

보건복지부지정 재활전문병원, 첨단 로봇재활치료, 운동치료, 작업치료, 언어치료

진료시간안내 진료과 진료예약

heavenlyhospital.com 광고

사랑을 실천하는 해븐리병원

신경과 전문의 6인, 두통, 어지럼증, 이명, 불면증, 수면다원검사

의138261

lifeclinic.co.kr 광고

라이프의원 양재역 4번출구

서울대종양 내과전문의 김성군, 실장 경동맥 갑상선

뇌졸중 재활

블로그 카페 이미지 지식iN

파워링크 뇌졸중재활 관련광고

purunhospital.com 광고

청주 재활,씨엔씨푸른병원

회복기재활, 뇌졸중재활중심, 간호간병통합서비스, 건강증진센터

의166705

the-jain.co.kr 광고

재활치료는 더자인병원

근골격계 질환, 척추손상, 뇌졸중, 파킨스병, 외상성 뇌손상, 중추신경 손상

의157353

mjchoonhey.co.kr/ 광고 톡톡

재활전문병원 명지춘혜병원

보건복지부지정 재활전문병원, 첨단 로봇재활치료,

파킨슨 재활

블로그 카페 이미지 지식iN

파워링크 파킨슨재활 관련광고

hroboticsinc.com/ 광고 Npay

파킨슨재활 에이치로보틱스 · 홈 재활, 7일 무료 체험!

집에서 쉽게 뇌졸중 편마비, 근골격계 재활치료가 가능한 리블레스

렌탈신청 7일무료체험 리퍼브상품

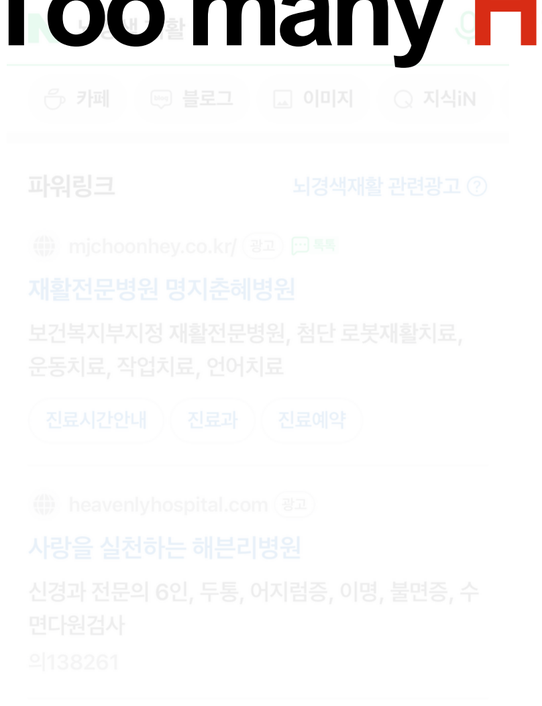
올바른재활.com 광고

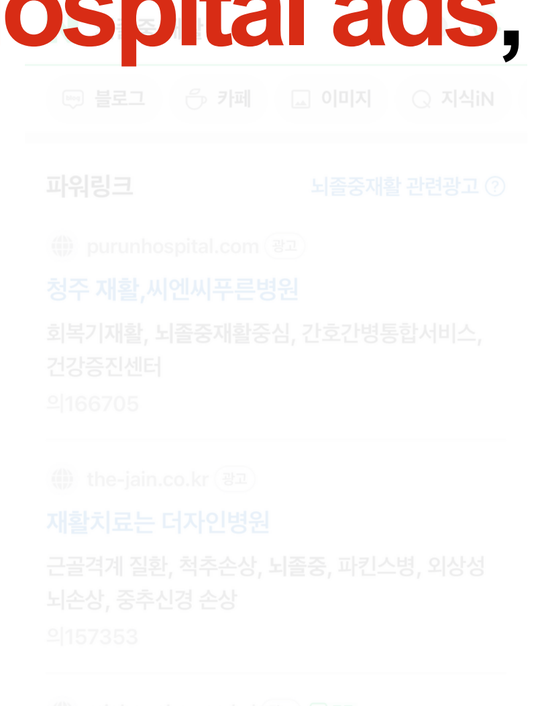
파킨슨재활은 올바른재활 · 365일 실시간 상담 가능

임상경력 10년이상 재활전문가들,1:1프리미엄 맞춤 재활,파킨슨재활,파킨슨재활

Business Problem

Too many Hospital ads,





Business Problem

Too many Hospital ads,

Hard to find reliable information,

Business Problem

Too many Hospital ads,

Hard to find reliable information,

Information available is scattered

Business Problem

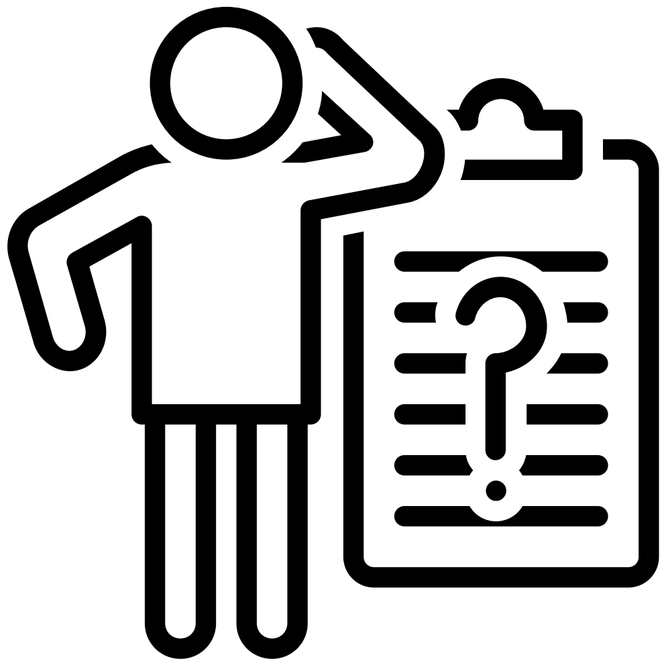
Too many Hospital ads,

Hard to find reliable information,

Information available is scattered,

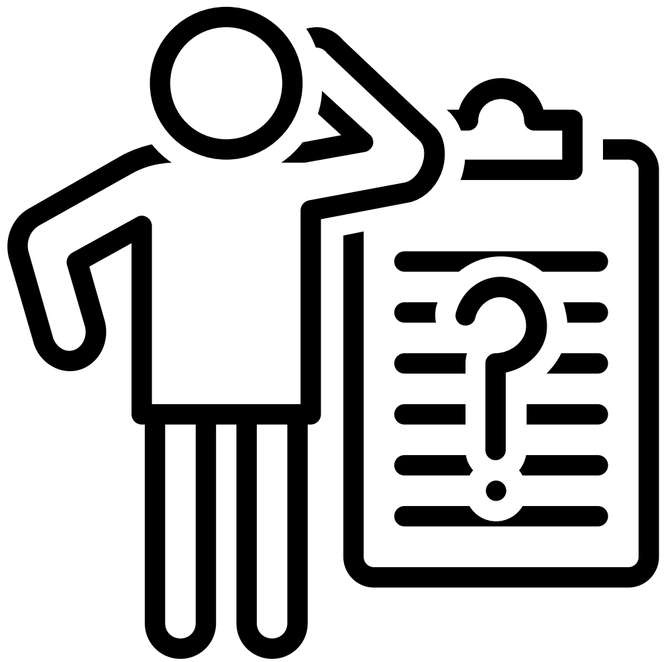
Rehabilitation is urgent

Business Problem



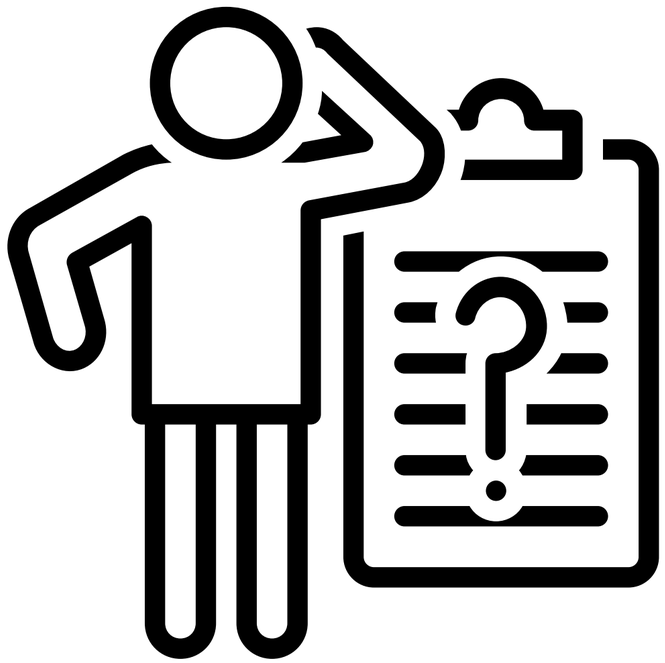
What's my current status?

Business Problem



What's my golden time?

Business Problem



What kind of

rehabilitation do I need?

Legislative Amendment

Policy > institutions and laws

'Visit rehabilitation treatment' will start next year...visiting rehabilitation fee up to 180,000 won

Reporter Lee Ji-hyun. | Issue date: 2022-11-23 18:40:08

Implementation of a pilot project in the third phase of rehabilitation medical institutions…Severe among discharged patients
Service for 90 days after discharge…Allow extension of 30 days for patient condition consideration
Incentives to activate links to medical institutions in the acute phase of cerebrovascular disease → palliative phase

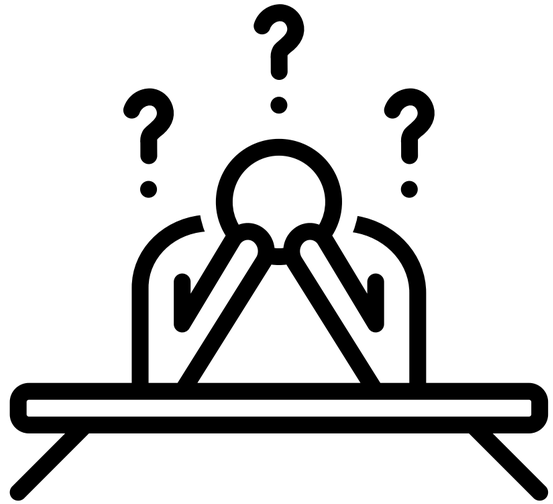
[Medical Times = Reporter Lee Ji-hyun] The Ministry of Health and Welfare will promote a two-year pilot project for visiting rehabilitation treatment from January next year (2023).

If the number of rehabilitation medical institutions has been targeted at inpatients as the next stage of the second phase of the pilot project, the third phase will be targeted at patients who need home rehabilitation among discharged patients.

On the 23rd, the Ministry of Health and Welfare held the 22nd Health Insurance Policy Review Committee (hereinafter referred to as the Health Insurance Review Committee) and reported on the third phase of the pilot project (visiting rehabilitation treatment pilot project).

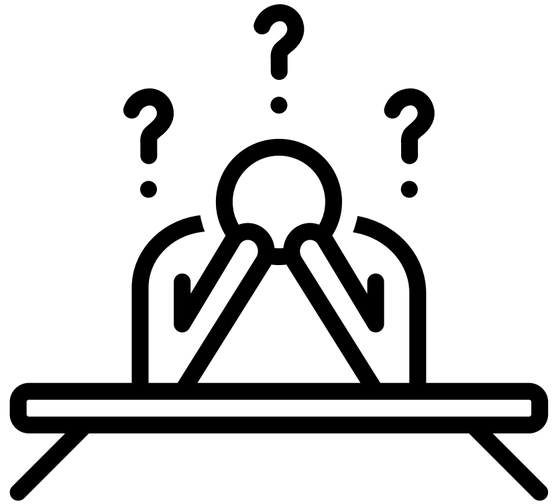
■ **How is the door-to-door rehabilitation treatment service conducted?**

Legislative Amendment



For patients with mobility difficulties

Legislative Amendment



Providing the first application service that connects home rehabilitation for patients with mobility difficulties.

Topic Selection

AI Health Risk Prediction and Personalized Rehabilitation Integration Solution for Neurological Patients

Core Features

AI Risk Prediction

Personalised Rehabilitation Integration

1:1 Home Rehabilitation Matching

Service Goals

Service Goals

Service Goals

Service Goals

Utilizing Open Data

HIRA Data 8

MIMIC Data 1

Kakao Real-time API 1

Utilizing Open Data

HIRA Data 8

MIMIC Data 1

Kakao Real-time API 1

A total of 10

Utilizing Open Data

건강보험심사평가원
HEALTH INSURANCE REVIEW & ASSESSMENT SERVICE

No	HIRA Open Data
1	Hospital Information Service (2024)
2	Hospital Medical Information Inquiry Service (2024)
3	Hospital Evaluation Information Service (2024)
4	Healthcare Institution Opening and Closing Information Inquiry Service (2024)
5	Outstanding Institution Hospital Evaluation Information Service (2024)
6	Detailed Information Service by Medical Institution (2024)
7	Special Treatment Hospital Information Service (2024)
8	Medical Expenses Statistics by Medical Department and Region for Hospitals and Higher (2021)

Utilizing Open Data

Database | Credentialed Access

MIMIC-IV

Alistair Johnson, Lucas Bulgarelli, Tom Pollard, Steven Horng, Leo Anthony Celi, Roge

Published: Jan. 6, 2023. Version: 2.2

Guidelines for creating datasets and models from MIMIC *(April 24, 2024, 10:12 a.m.)*

We recognize that there is value in creating datasets or models that are either derived from MIMIC or which augment MIMIC in some way (for example, by adding annotations). Here are some guidelines on creating these datasets and models:

- **Any derived datasets or models should be treated as containing sensitive information**. If you wish to share these resources, they should be shared on PhysioNet under the same agreement as the source data.
- **If you would like to use the MIMIC acronym in your project name**, please include the letters "Ext" (for example, MIMIC-IV-Ext-YOUR-DATASET"). Ext may either indicate "extracted" (e.g. a derived subset) or "extended" (e.g. annotations), depending on your use case.

When using this resource, please cite: (show more options)
Johnson, A., Bulgarelli, L., Pollard, T., Horng, S., Celi, L. A., & Mark, R. (2023). MIMIC-IV (version 2.2). *PhysioNet*. https://doi.org/10.13026/6mm1-ek67.

Additionally, please cite the original publication:
Johnson, A.E.W., Bulgarelli, L., Shen, L. et al. MIMIC-IV, a freely accessible electronic health record dataset. Sci Data 10, 1 (2023). https://doi.org/10.1038/s41597-022-01899-x

Please include the standard citation for PhysioNet: (show more options)
Goldberger, A., Amaral, L., Glass, L., Hausdorff, J., Ivanov, P. C., Mark, R., ... & Stanley, H. E. (2000). PhysioBank, PhysioToolkit, and PhysioNet: Components of a new research resource for complex physiologic signals. Circulation [Online]. 101 (23), pp. e215–e220.

Contents

Share

Access

Access Policy:
Only credentialed users who sign the DUA

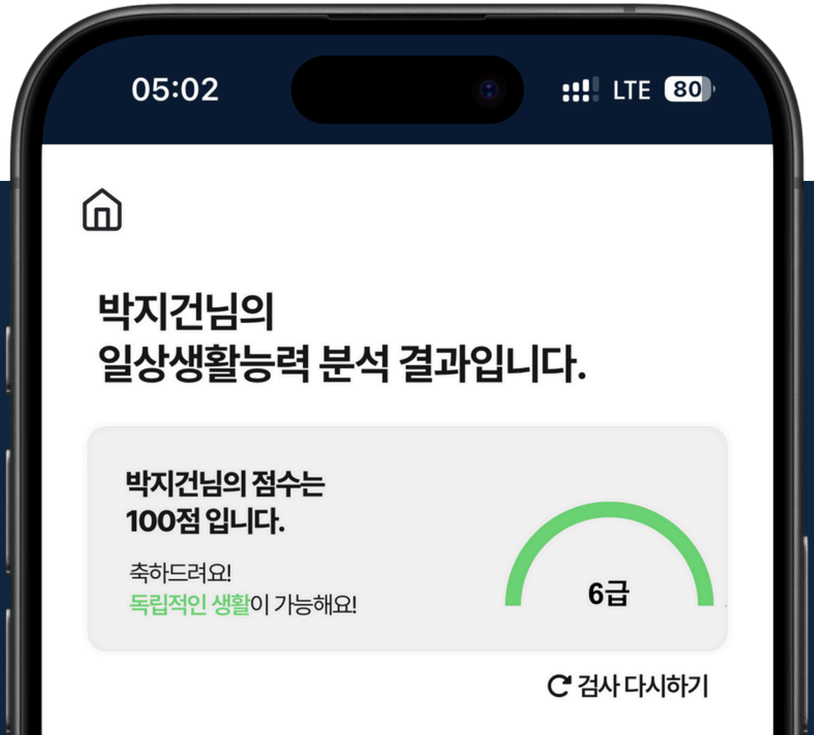
Utilizing Open Data

Kakao Postcode API

문밖의 닥터

Data Analysis

Data Collection / Variable Selection / ERD / EDA



Data Analysis Dept.
Yewon Lim (Data Analyst)

Data Collection

A large database for over 40,000 patients

Jointly developed by MIT Research Group & BIDMC

Applied in various fields such as medical data science and AI

Data Collection

CITI PROGRAM

Completion Date 01-May-2024
Expiration Date 01-May-2027
Record ID 62532200

This is to certify that:

JIGEON PARK

Not valid for renewal of certification through CME.

Has completed the following CITI Program course:

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(Curriculum Group)
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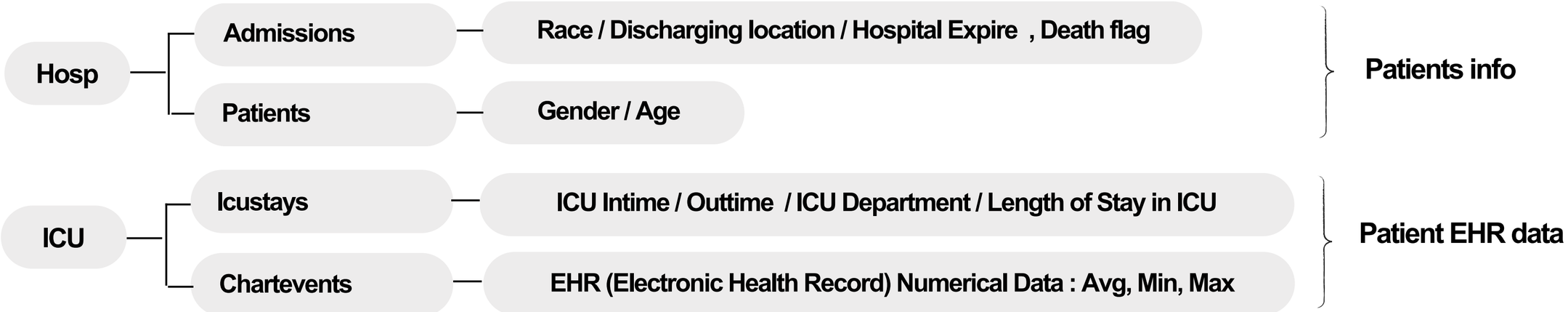
Connect to Google BigQuery

Variable Selection

Tables / Columns for Analysis



Variable Selection

Predictor variables / Target

X **Y**

No.	Chartevents		Race	Age	Gender	LOS	Death
	Numerical : 4	Categorical : 7					
Patient 1	. . .		. . .	. . .	. . .	. . .	Died : 1 Alive : 0
Patient 2							
. .							
Patient 1731							

Variable Selection

EHR Items

Chartevents

- GCS (Verbal Response, Eye Opening, Motor Response)
- Richmond RAS Scale
- Gait Transferring
- Mental Status
- Secondary Diagnosis
- Heart Rate
- Respiratory Rate
- Blood Pressure (Diastolic, Systolic)

Considering the counts of each item, user convenience, and the number of null values,

11 variables have been selected

Variable Selection

EHR Ordinal Variables

Variable	Details
GCS Verbal Response	• Glasgow Coma Scale (GCS) - Verbal Response Item • Purpose: Assesses the patient's level of consciousness. • Scoring: Ranges from 1 point (no response) to 5 points (normal response).
GCS Eye Opening	• Glasgow Coma Scale - Eye Opening Response Item • Scoring: Ranges from 1 point (no response) to 4 points (spontaneous eye opening)
GCS Motor Response	• Glasgow Coma Scale - Motor Response Item • Scoring: Ranges from 1 point (no response) to 6 points (obeys commands).
Richmond RAS Scale	• Assessment of Sedation and Agitation State • Purpose: Evaluates the patient's sedation and agitation levels. • Scoring: Ranges from -5 points (deep sedation) to +4 points (extreme agitation).

Variable Selection

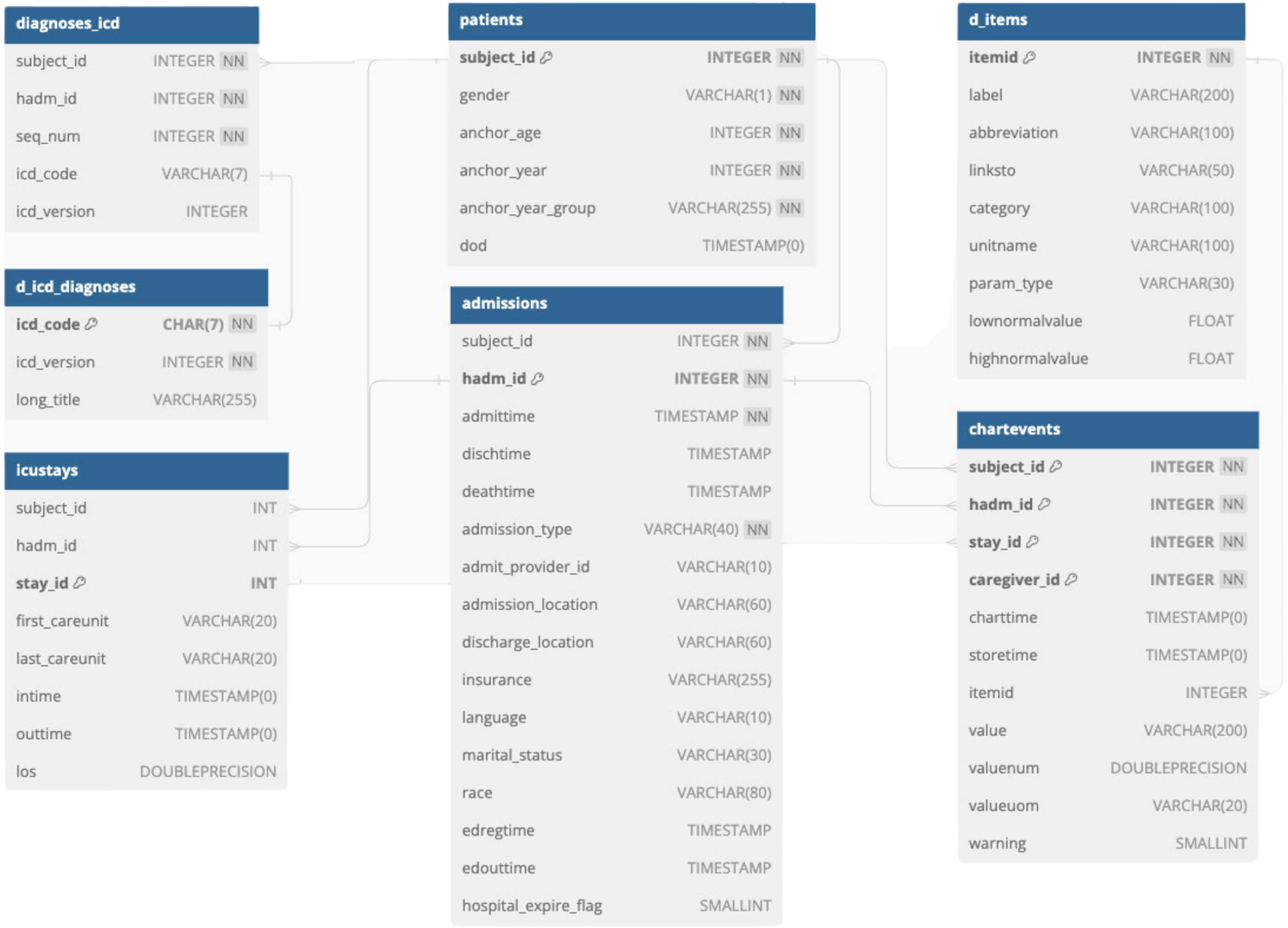
EHR Numerical Variables

Variable	Details
Heart Rate	• Assesses heart condition by measuring beats per minute (bpm). • Normal Range for Adults: 60-100 bpm
Respiratory Rate	• Assesses respiratory condition by counting breaths per minute. • Normal Range for Adults: 12-20 breaths per minute
Blood Pressure Diastolic	• Measurement: Measures the pressure in the blood vessels when the heart is at rest. • Normal Range: 60-80 mmHg
Blood Pressure Systolic	• Measures the pressure in the blood vessels when the heart contracts. • Normal Range: 90-120 mmHg

Variable Selection

EHR Categorical Variables

Variable	Details
Mental Status	• Purpose: Assesses the patient's cognitive state, including confusion, dementia, and level of consciousness. • Evaluation Criteria: Includes normal, confused, disoriented, and unresponsive states. • Scoring: Oriented to own ability (0.0) / Forgets limitations (15.0)
Secondary Diagnosis	• Purpose: Identifies other medical conditions or diseases the patient has in addition to the primary diagnosis. • Scoring: No (0.0) / Yes (15.0)



Creating Train Dataset by Joining

7 tables

Data Wrangling

Data Transformation

Filtering Neuro SICU

Pivoting EHR items from Chartevents

Creating Target column (death flag)

Data Wrangling

Data Cleaning

Removal of Null Values

Removal of Duplicates

Removing Columns with Inaccurate Original Data Encoding (Gate/Transfering)

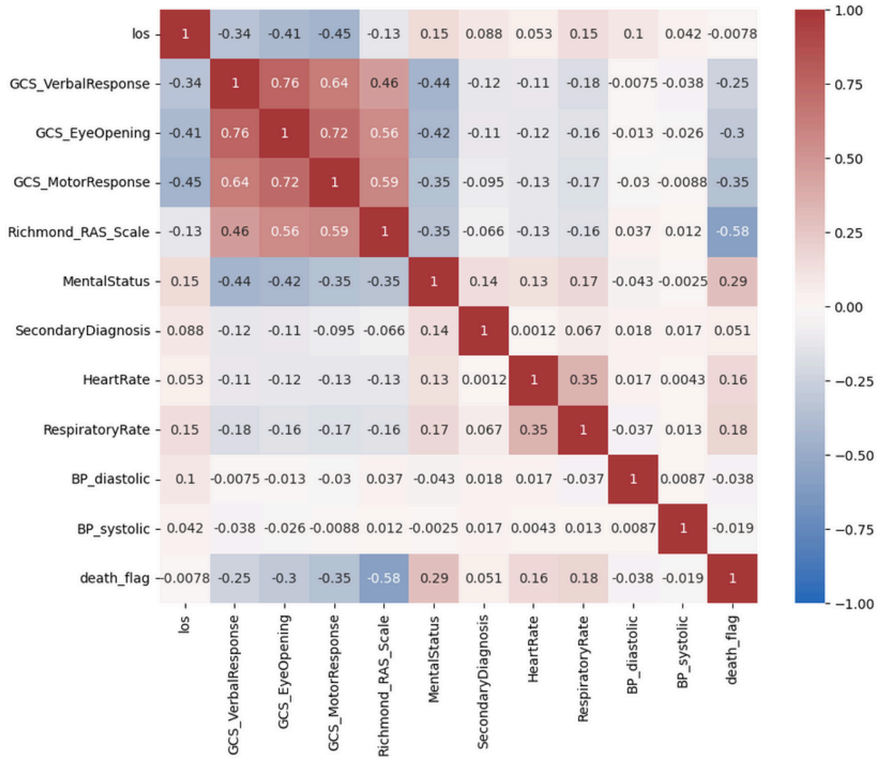
EDA

Statistical Analysis

Type	Method	Hypothesis	Result	Interpretation
Categorical (2)	**Chi-Square Test**	The two variables are not independent	gender, race p-value < 0.05	• Null Hypothesis Rejected • The two variables are not independent • There is a correlation with the dependent variable
Numerical (11)	**Independent T-Test**	There is a difference in the population means of two groups	all columns except LOS p-value < 0.05	• Null Hypothesis Rejected • There is a significant difference between the means of the two groups

EDA

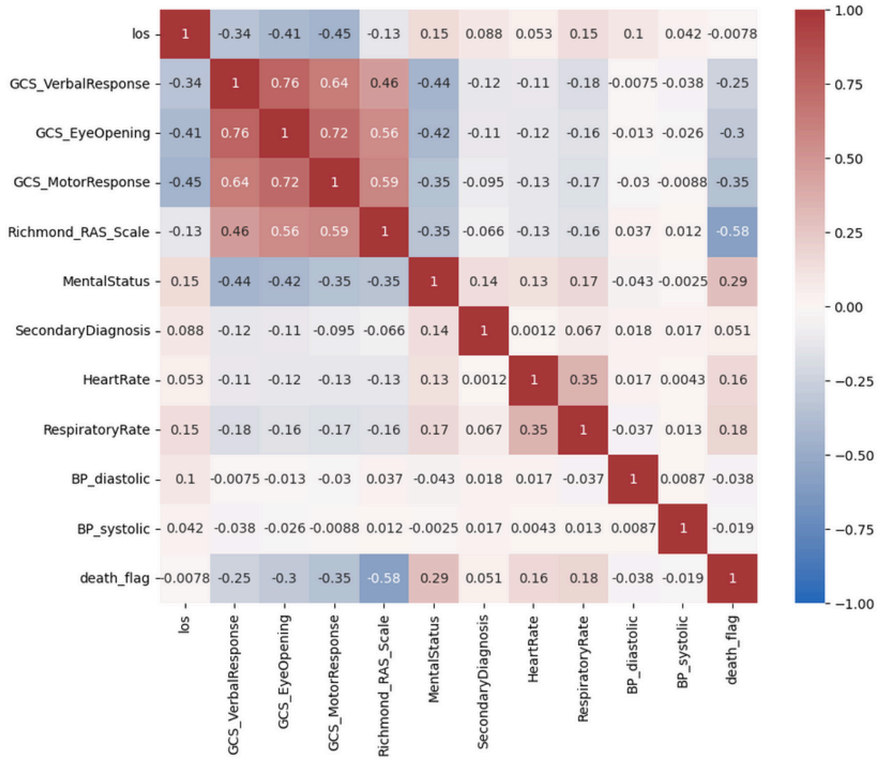
Correlation Analysis



Variable	Interpretation
GCS Related Variables	• Negative correlation with the dependent variable. • Lower GCS scores indicate a higher probability of mortality
Richmond RAS Scale	• Strong negative correlation • Lower scores indicate a higher probability of mortality.
Secondary Diagnosis	• Very weak positive correlation.
Heart Rate and Respiratory Rate	• Weak positive correlation. • Higher heart rate and respiratory rate may indicate an increased risk of mortality.
Blood Pressure	• Almost no correlation.

EDA

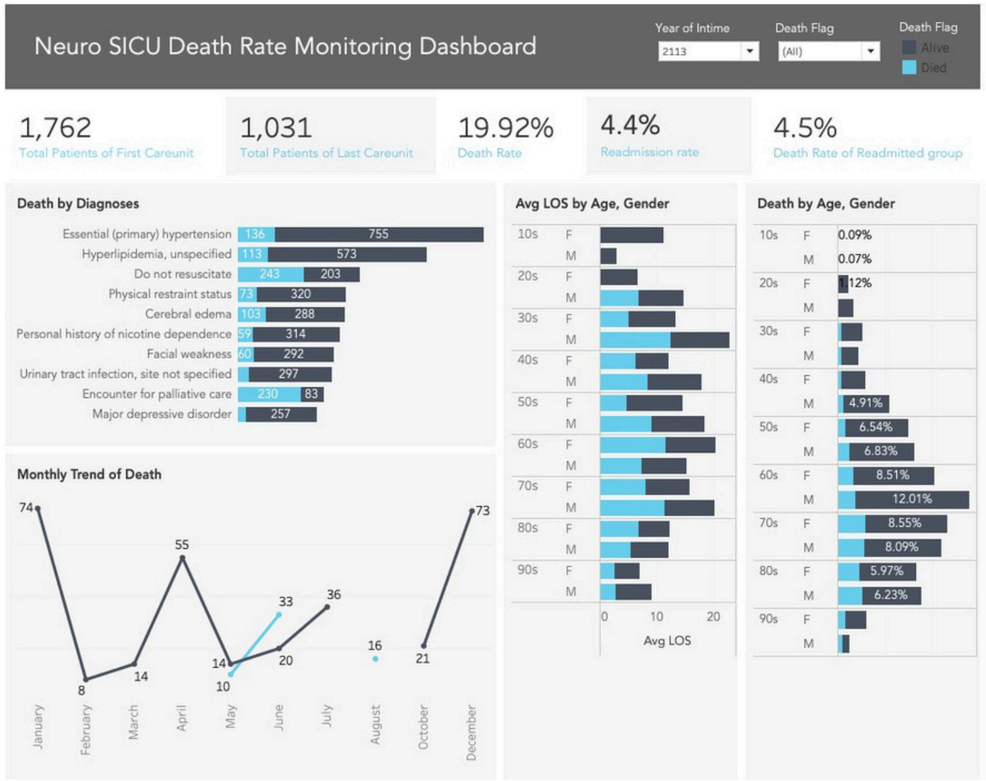
Correlation Analysis



Indicators of consciousness (GCS score, Richmond scale) and vital signs (heart rate, respiratory rate) have a stronger correlation with mortality rates

EDA

Tableau Dashboard Development



Objective

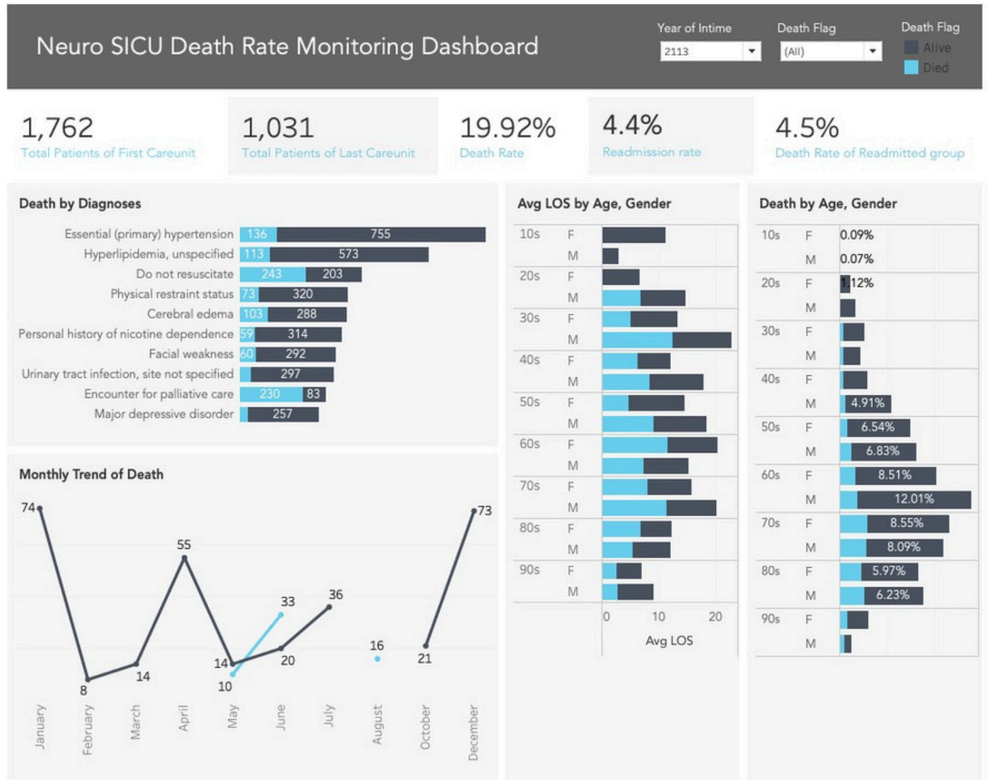
Monitoring the death rate in Neuro SICU

Type

KPI Dashboard

EDA

Tableau Dashboard Development



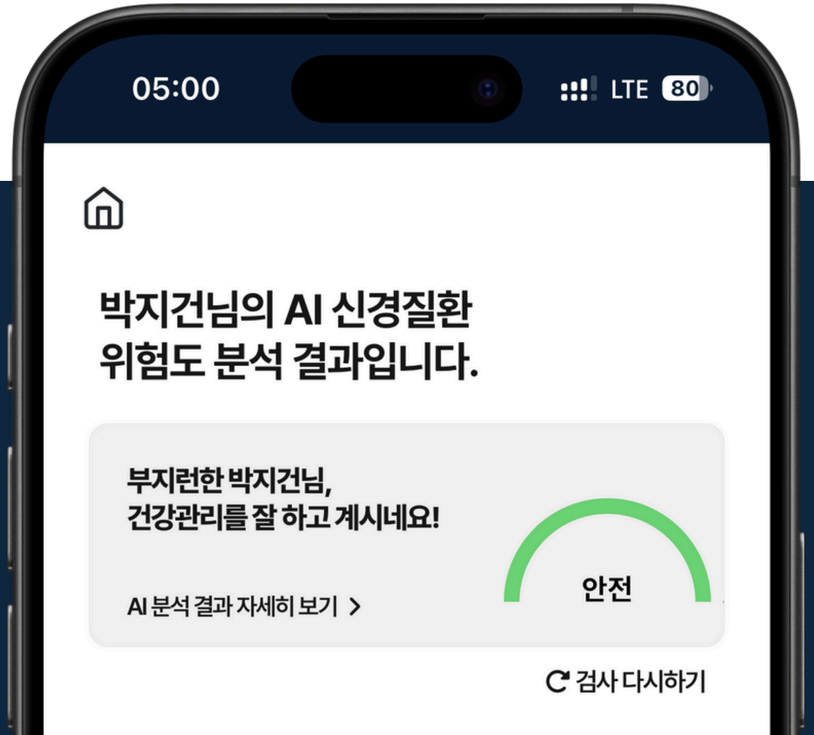
KPI

- Number of Patients by First and Last Care Unit
- Mortality and Readmission Rates
- Mortality Rate of the Readmission Group
- Number of Patients and Mortality Rate for Each Top 10 Diagnosis
- Monthly Mortality Trend
- Average Length of Stay by Age Group and Gender
- Mortality Rate by Age Group and Gender

문밖의 닥터

Machine Learning

Preprocessing / Modeling / Evaluation / Interpretation



ML Dept
Youjin Hwang (ML)

Data Preprocessing

Variable Selection

Modeling

Evaluation

Interpretation

Data Preprocessing

Problem	Reason	Result
Categorical variables (e.g., secondary conditions) are incorrectly entered as numerical data	Assigning size and proportion to each numerical category	This does not learn the actual structure of the data, ignores nonlinear relationships -> Applied normalization and standardization

Data Preprocessing

Round according to each category

Data Preprocessing

Convert to categorical variables

Data Preprocessing

Identify columns for label encoding and one- hot encoding.

Data Preprocessing

Round according to thresholds

Data Preprocessing

Convert to categorical variables

Data Preprocessing

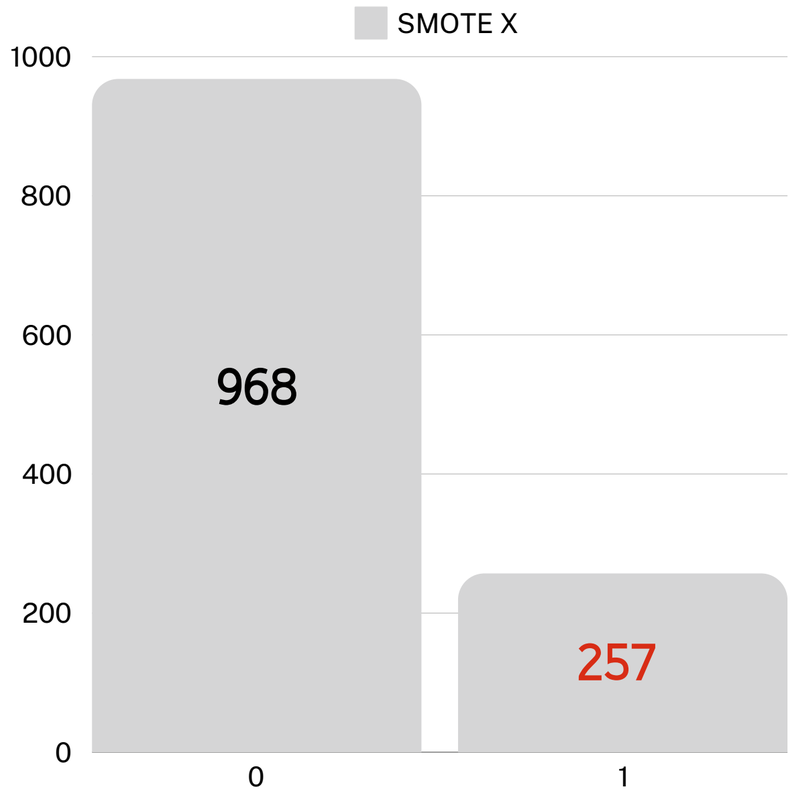
Add to columns for one-hot encoding.

Data Preprocessing

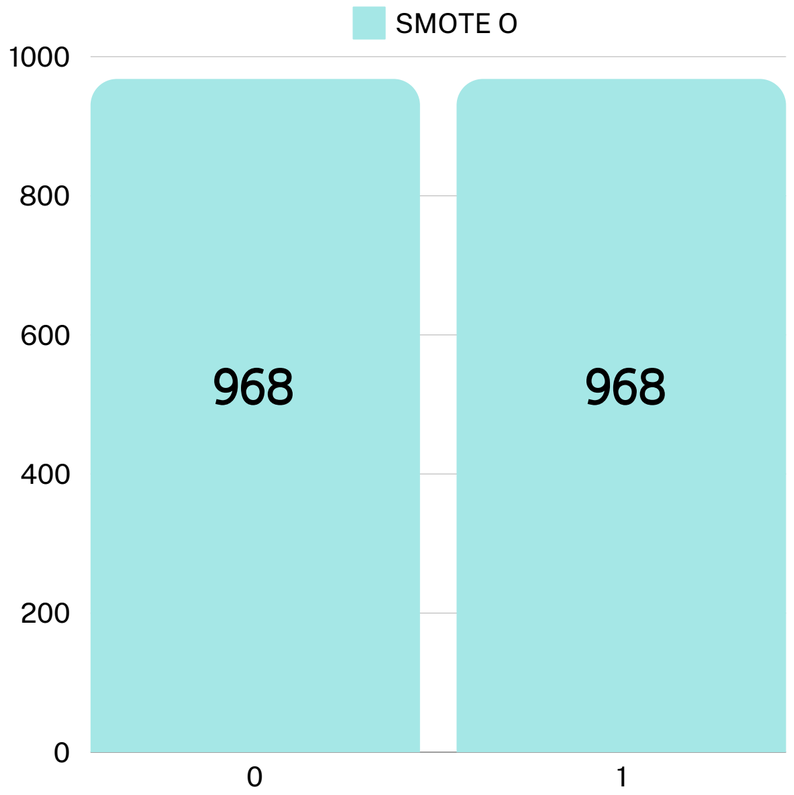
Numerical Variables
Standard Scaler

Categorical Variables
Label & One-Hot Encoding

Data Preprocessing



Data Preprocessing



Modeling

LightGBM

Ensemble (Soft Voting)
RF+LGBM
...

Stacking
RF+LGBM
RF+LGBM+GBDT
RF+GBDT
...

Ensemble (Weighted Voting)
RF+LGBM
RF+XGB
....

PCA

Logistic Regression

Modeling

LightGBM

Ensemble (Soft Voting)
RF+LGBM
...

Stacking
RF+LGBM
RF+LGBM+GBDT
RF+GBDT
...

Ensemble (Weighted Voting)
RF+LGBM
RF+XGB
....

PCA

Logistic Regression

Modeling

LightGBM

Ensemble (Soft Voting)
RF+LGBM
...

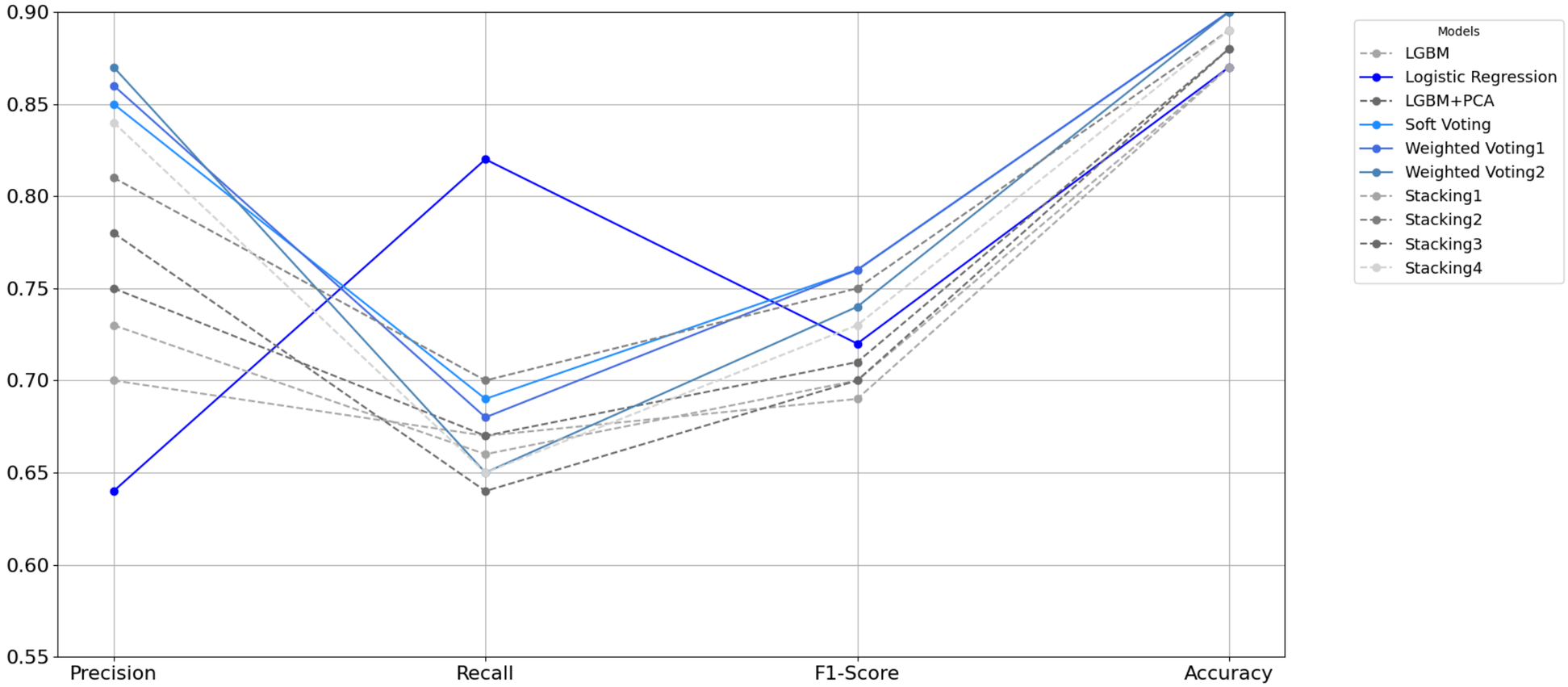
Stacking
RF+LGBM
RF+LGBM+GBDT
RF+GBDT
...

Ensemble (Weighted Voting)
RF+LGBM
RF+XGB
....

PCA

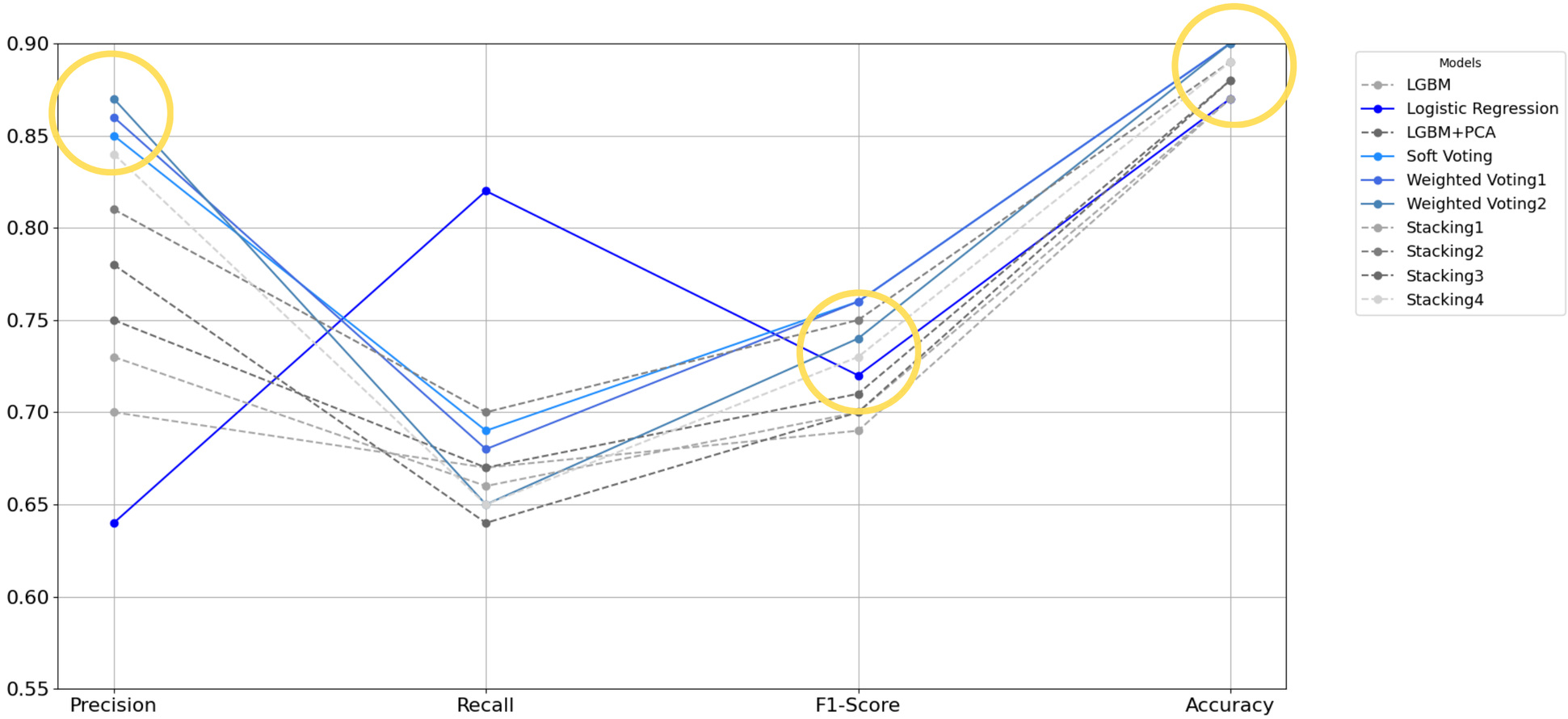
Logistic Regression

Evaluation

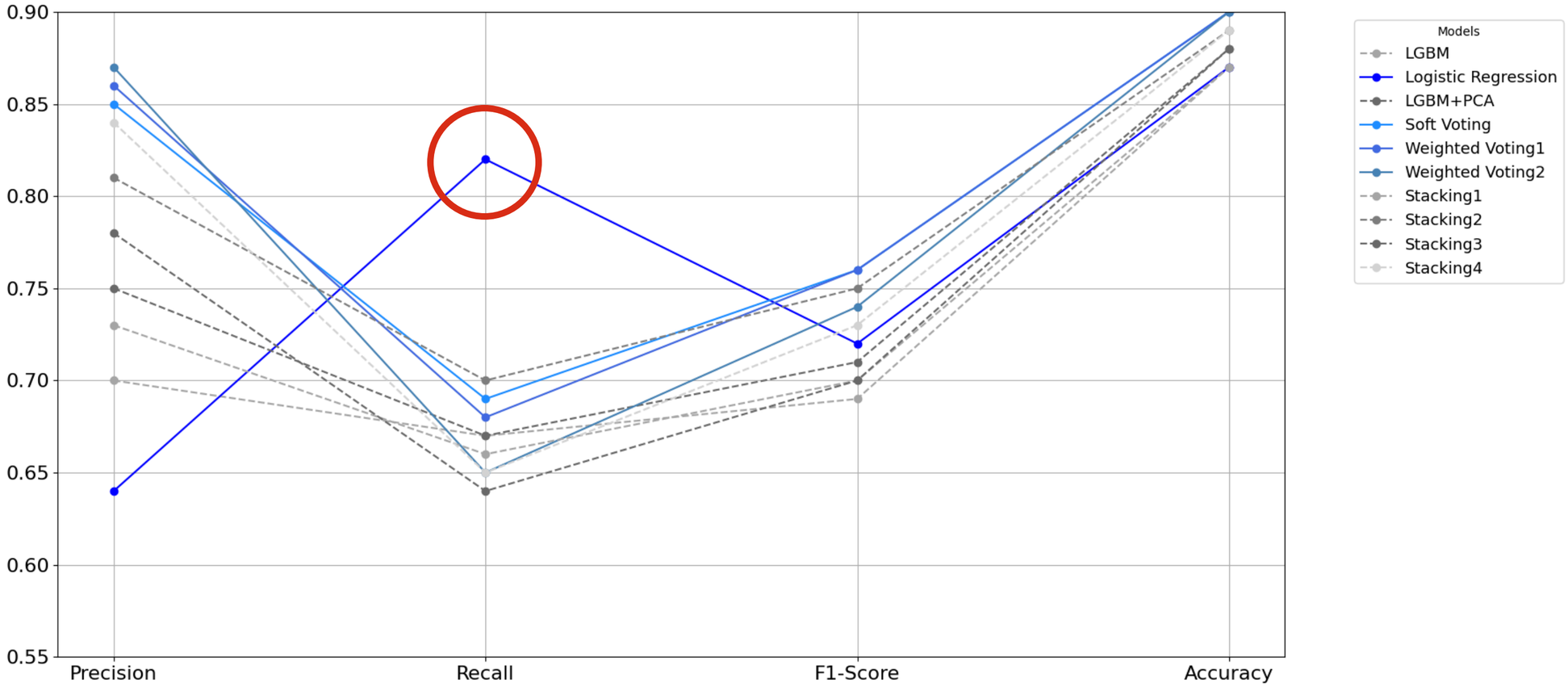

0.90
0.85
0.80
0.75
0.70
0.65
0.60
0.55
Precision
Recall
F1-Score
Accuracy
Models
LGBM
Logistic Regression
LGBM+PCA
Soft Voting
Weighted Voting1
Weighted Voting2
Stacking1
Stacking2
Stacking3
Stacking4

Comparison by Model

Evaluation



Evaluation


0.90
0.85
0.80
0.75
0.70
0.65
0.60
0.55
Precision
Recall
F1-Score
Accuracy
Models
LGBM
Logistic Regression
LGBM+PCA
Soft Voting
Weighted Voting1
Weighted Voting2
Stacking1
Stacking2
Stacking3
Stacking4

Comparison by Model

Logistic Regression

The **Highest Recall**

Ensemble

(Soft Voting / Weighted Voting)

The **Highest Precision, F1-Score, Accuracy**

So, what problems should we focus on?

Predicted survival but resulted in death

Predicted death but survived

Comparison by Model

Logistic Regression

The **Highest Recall**

Ensemble

(Soft Voting / Weighted Voting)

The **Highest Precision, F1-Score, Accuracy**

Comparison by Model

Logistic Regression

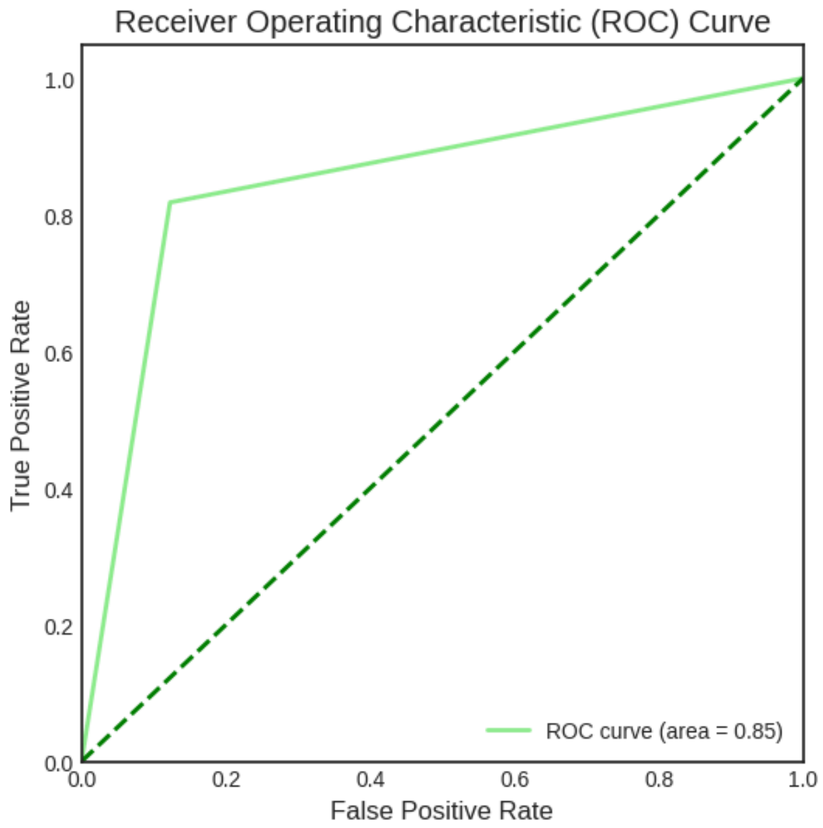
The Highest Recall

Ensemble

(Soft Voting / Weighted Voting)

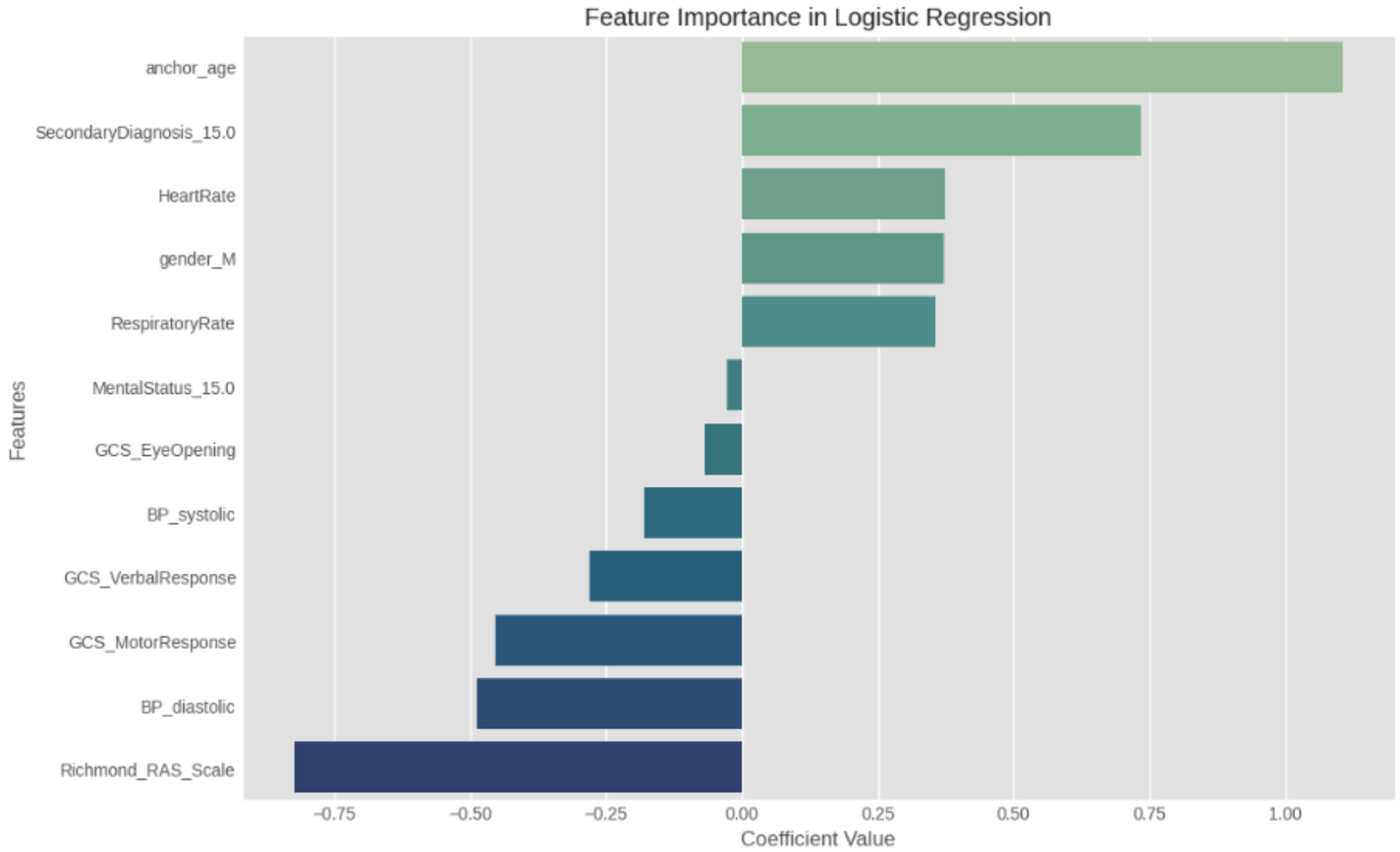
가장 높은 Precision, F1-Score, Accuracy

Interpretation



AUROC : 0.85

Interpretation



\+

Age, Secondary Diagnosis

−

RASS Scale, BP systolic,

GCS scores

Interpretation

SHAP (SHapley Additive exPlanation)

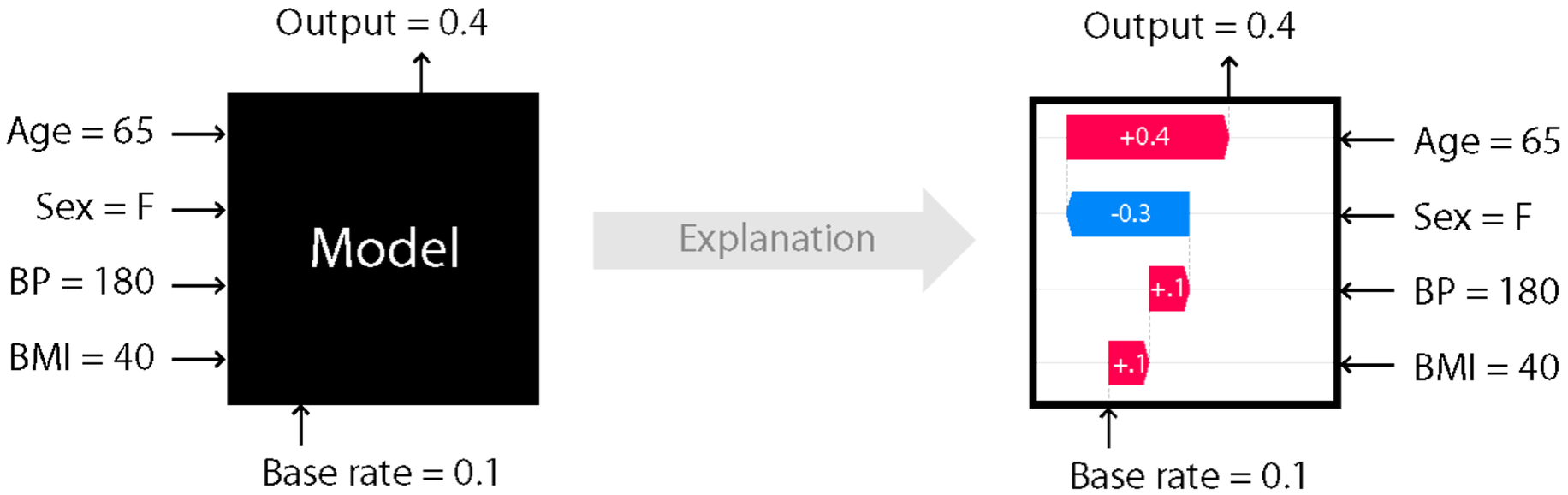
SHAP

eXplainable AI, XAI

: SHAP (SHapley Additive exPlanation)

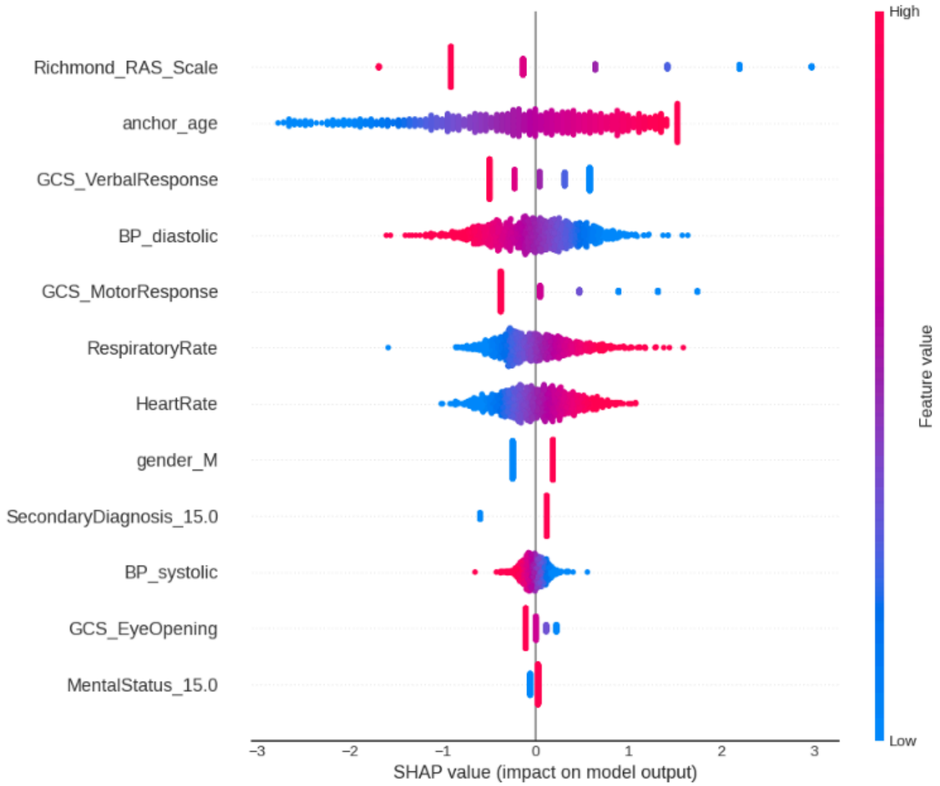
Interpretation

SHAP (SHapley Additive exPlanation)



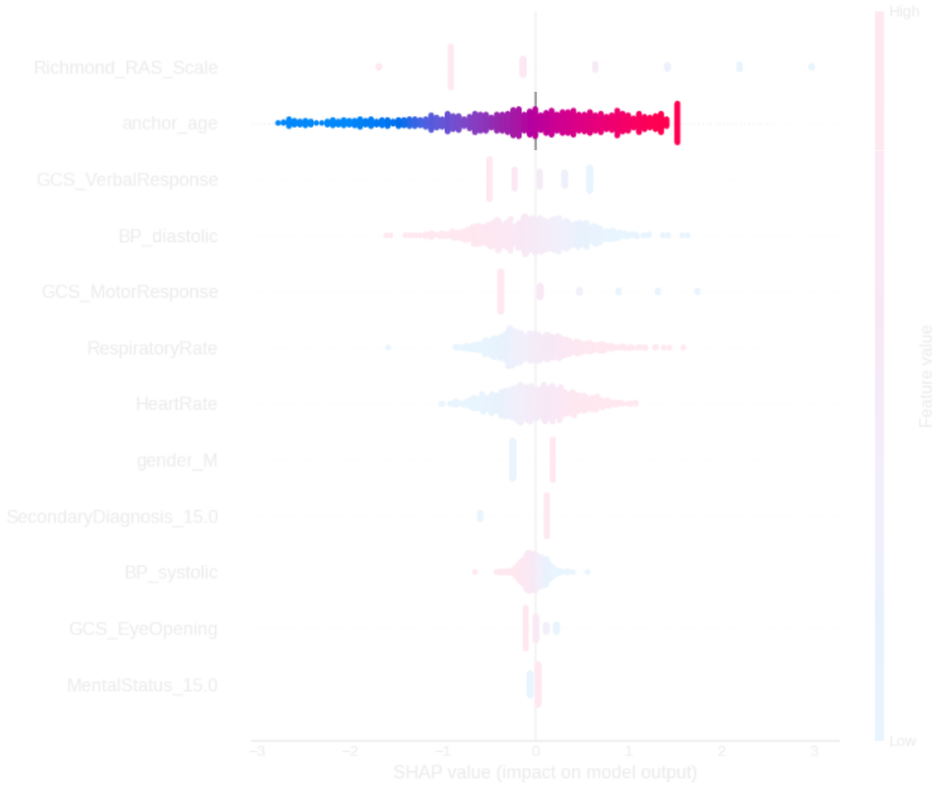
Interpretation

SHAP (SHapley Additive exPlanation)



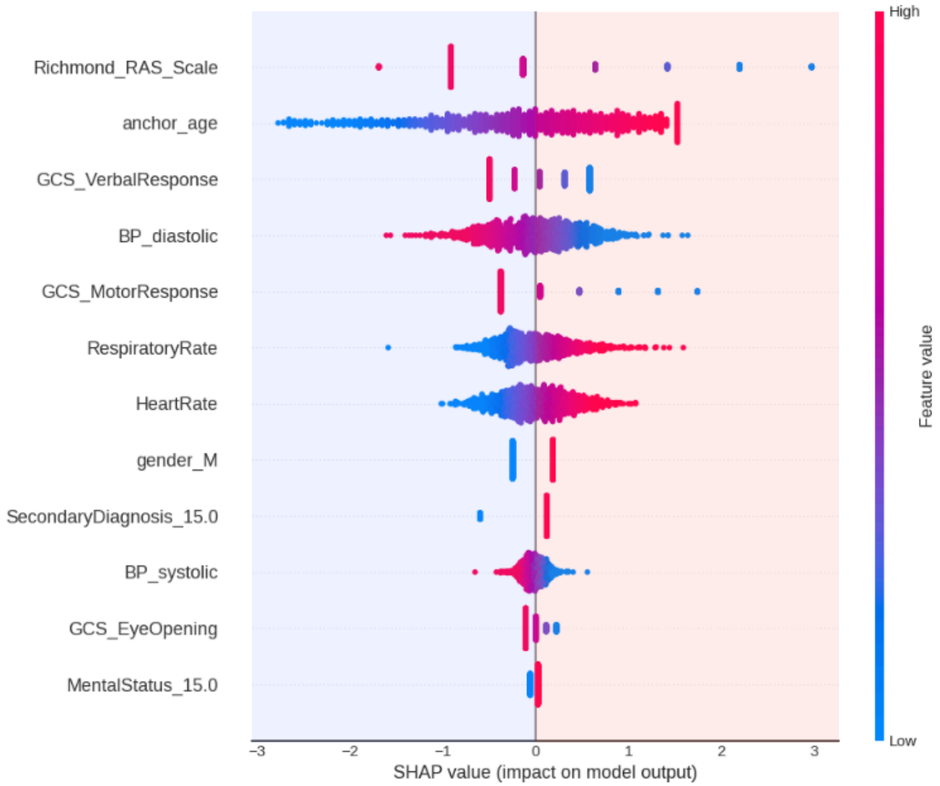
Interpretation

SHAP (SHapley Additive exPlanation)



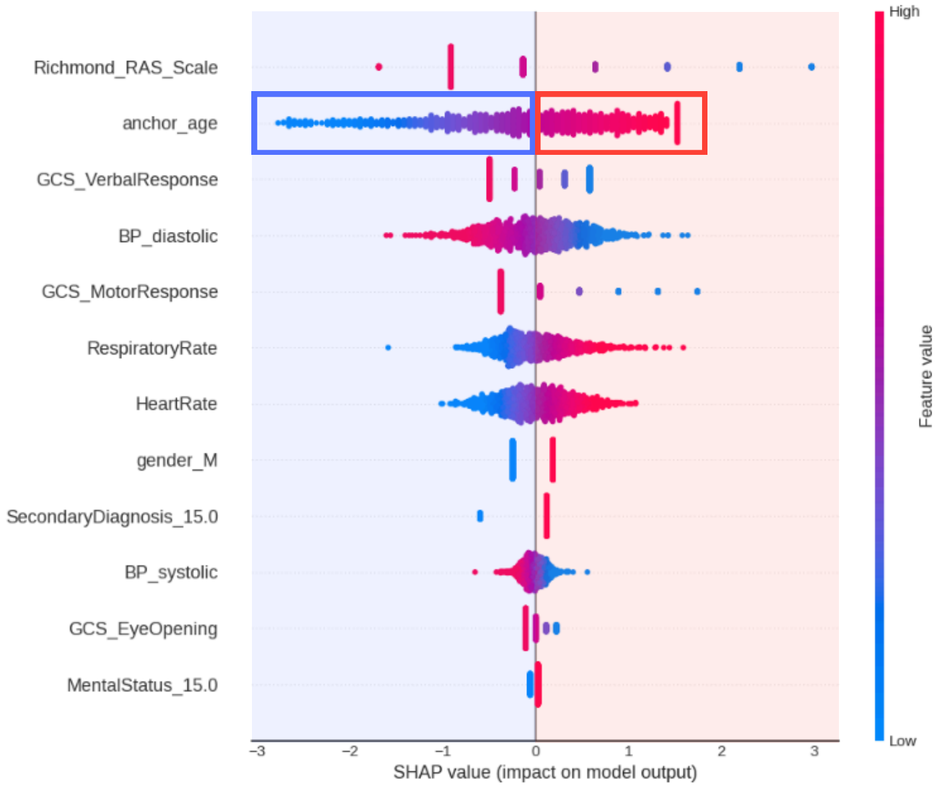
Interpretation

SHAP (SHapley Additive exPlanation)



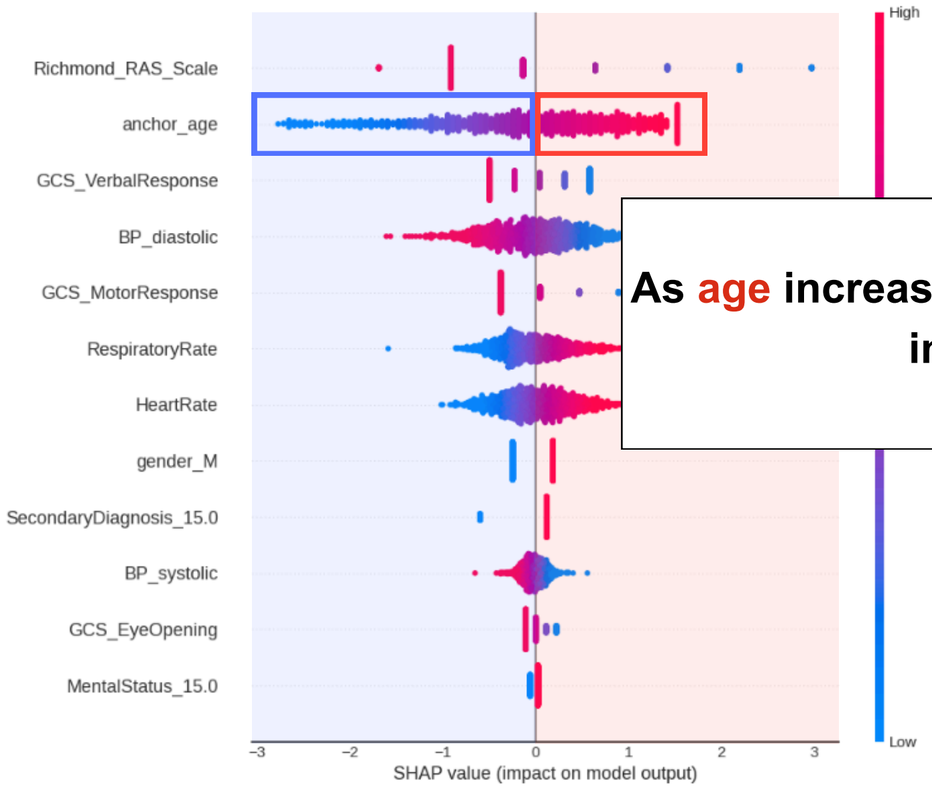
Interpretation

SHAP (SHapley Additive exPlanation)



Interpretation

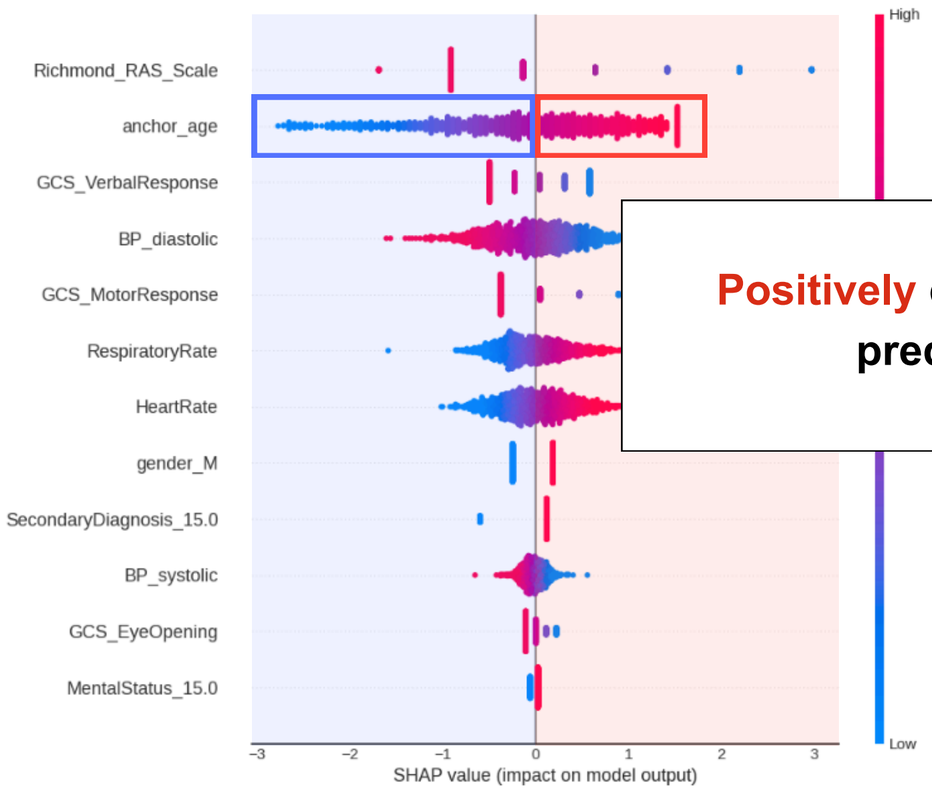
SHAP (SHapley Additive exPlanation)



As age increases, the predicted value increases.

Interpretation

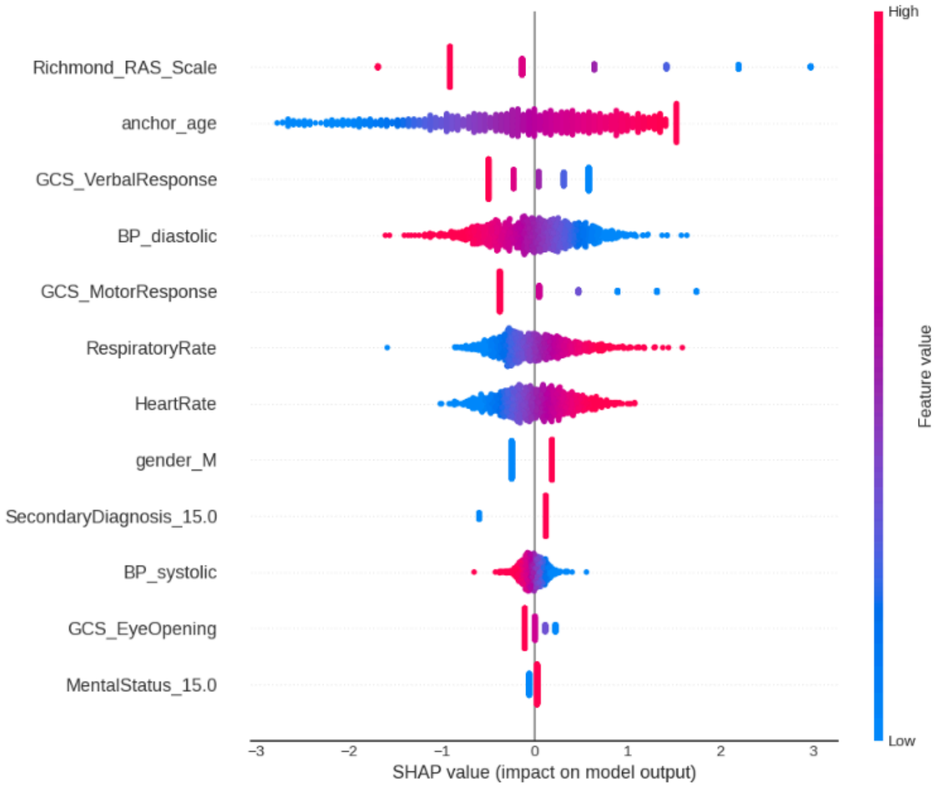
SHAP (SHapley Additive exPlanation)



Positively correlated with the predicted value

Interpretation

SHAP (SHapley Additive exPlanation)



Positive(+) correlation

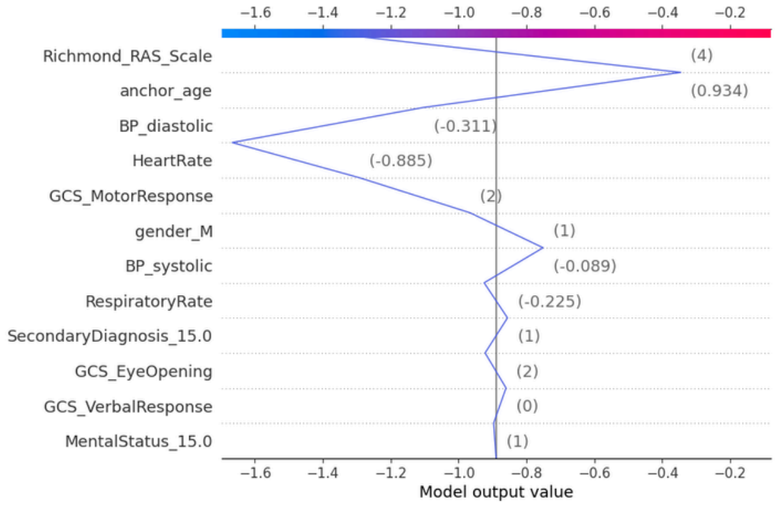
Age, Respiratory rate, Heart Rate, Gender(M), Secondary diagnosis, Mental Status

Negative(-) correlation

RASS, GCS, Blood pressure

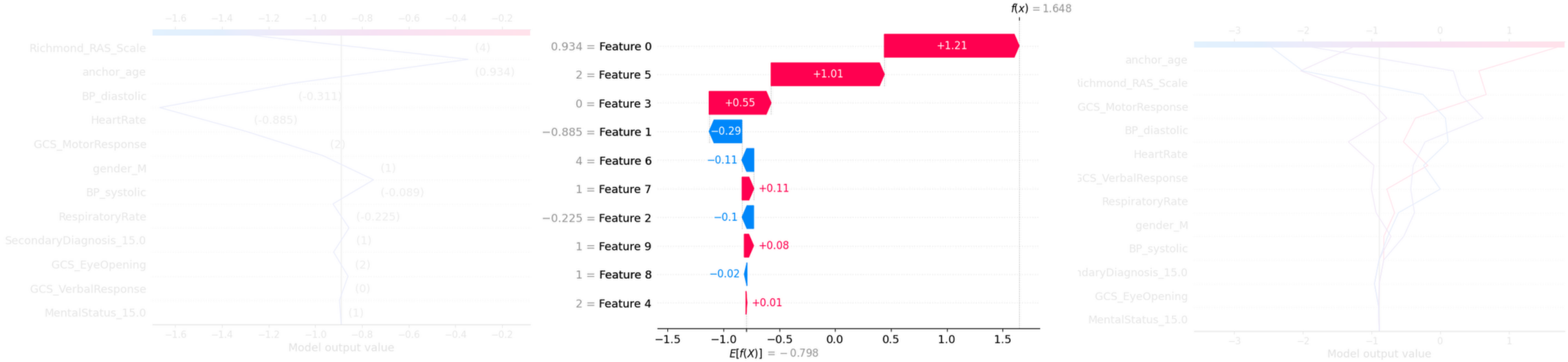
모델 해석

SHAP (SHapley Additive exPlanation)



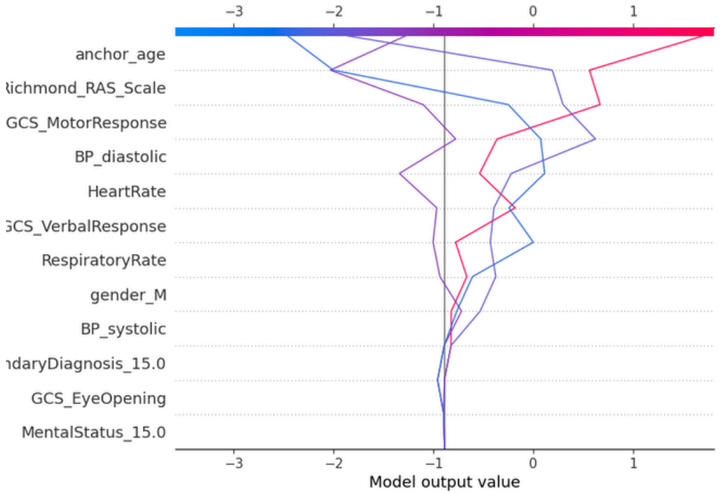
Interpretation

SHAP (SHapley Additive exPlanation)



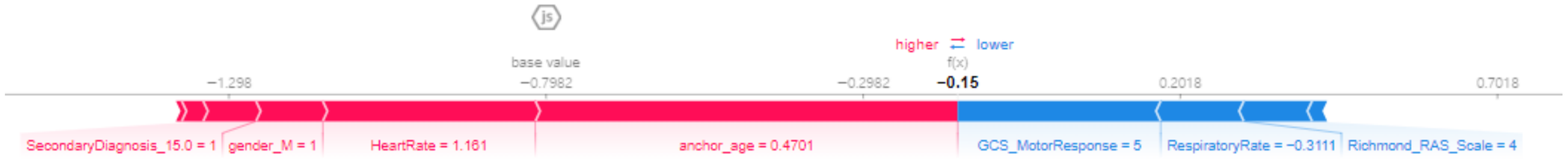
Interpretation

SHAP (SHapley Additive exPlanation)



Interpretation

SHAP (SHapley Additive exPlanation)



Interpretation

SHAP (SHapley Additive exPlanation)

Statistical Analysis

Feature Importance

SHAP

Interpretation

Nonlinear relationships

Complex interactions between data

Interpretation

Using multiple tools organically together

→ Enhancing model performance and interpretability through multi-faceted analysis

Interpretation

Insignificant variables

→ When combined,

there is a potential for improved predictive power

Interpretation

Avoid creating derived variables unconditionally

→ Consider combinations with and without derived variables

Limitations / Solutions

Not enough samples

Difficulty in collecting death samples

Limitations / Solutions

Not enough samples

사망 데이터 수집 어려움

Limitations / Solutions

Accumulation of user data in the database

데이터 축적에 따라
새로운 모델 개발

Limitations / Solutions

데이터 수 부족

Difficulty in collecting death samples

Limitations / Solutions

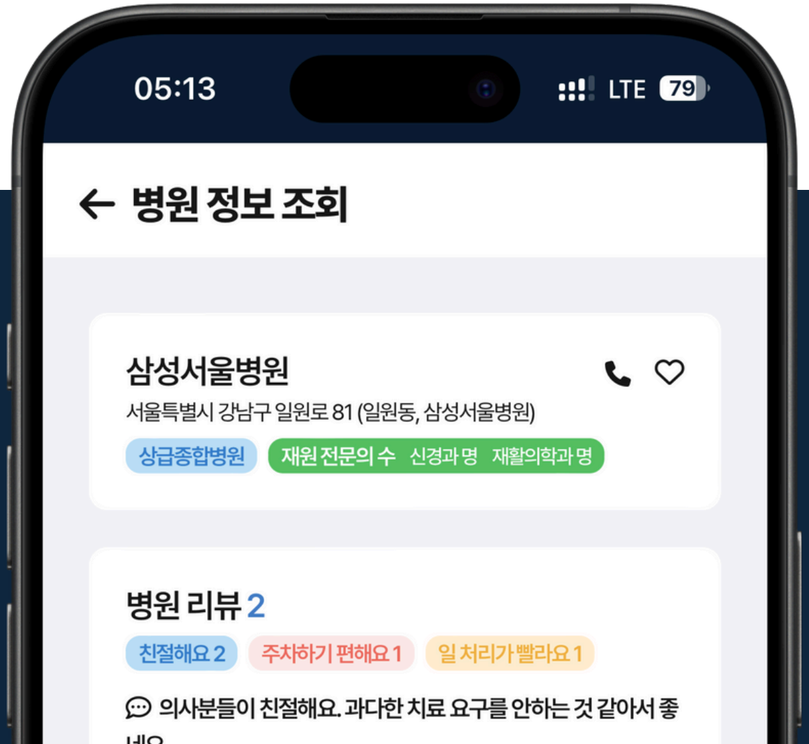
사용자 데이터 DB 축적

Develop new models as data accumulates

문방의 닥터

Multi Platform Development

From responsive web/app implementation to final deployment



Development Dept

Jigeon Park (Full-stack dev))

Overview

The development team's goal is to enhance user experience by optimizing the stability and performance of the product.

Overview

Agile Methodology

: A flexible approach that involves releasing products quickly in regular cycles, allowing for the addition and modification of requirements to meet customer needs and adapt to changing environments.

Dev Lang. / Frameworks

python django

Database / Manage

MariaDB phpMyAdmin

CI/CD

git GitHub

Web Server, Proxy

NGINX

Dev environment, IDE

mac OS PyCharm VSCode

ML Pipeline

JobLib

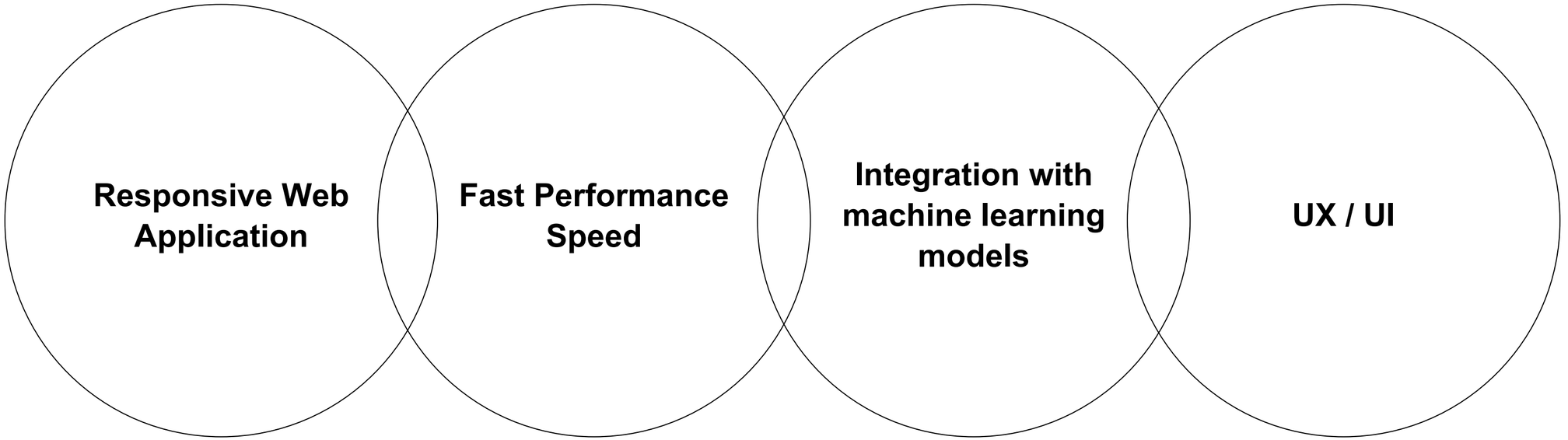
Server Protection, DNS

Server

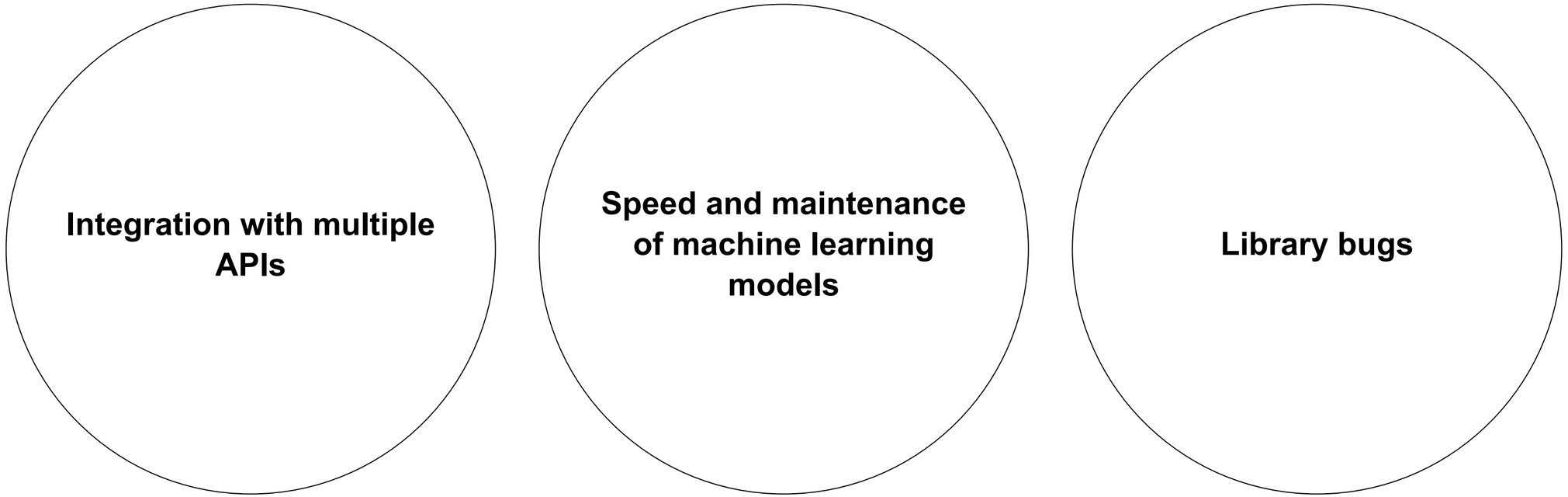
Route

Container Orchestration

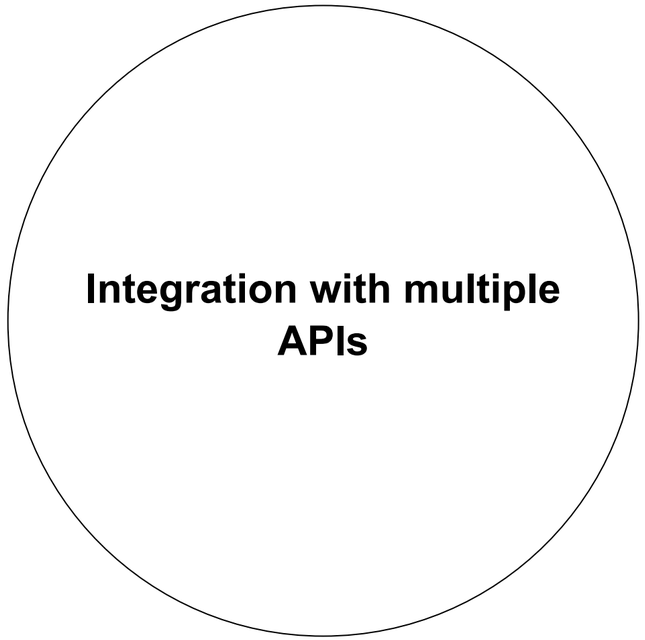
Goals


Responsive Web Application
Fast Performance Speed
Integration with machine learning models
UX / UI

Tasks


Integration with multiple APIs
Speed and maintenance of machine learning models
Library bugs

Tasks



Tasks

Integration with multiple APIs

When querying the hospital information list and detailed information,

30 to 180 API calls occur

Tasks

Integration with multiple APIs

Causing an unusable level of speed reduction

***Each query requires at least 130 seconds**

Tasks

Integration with multiple APIs

After applying caching technology,

speed improves by at least 130 to 1,200 times

Tasks

다중 API 연동문제

Speed and maintenance of ML models

라이브러리 버그

Tasks

Speed and maintenance of ML models

다중 API 연동문제

라이브러리 버그

Operating and integrating ML models on a service server with lower performance compared to GCP

Tasks

Speed and maintenance of ML models

다중 API 연동문제

라이브러리 버그

Continuously maintaining the improved version of the new ML models

Tasks

Speed and maintenance of ML models

다중

Using the Joblib library,

to integrate the built ML model pipeline, solving both speed and maintenance issues

Tasks

다중 API 연동문제

머신러닝 모델의
속도 및 유지보수

Library bugs

Tasks

Library bugs

When predicting using DB data instead of a CSV file, the same values result in completely different predictions

Tasks

Library bugs

다중

Export to CSV, then reload it

Manage the CSV files using unique user codes, and configure the system to delete the CSV file immediately after loading is complete

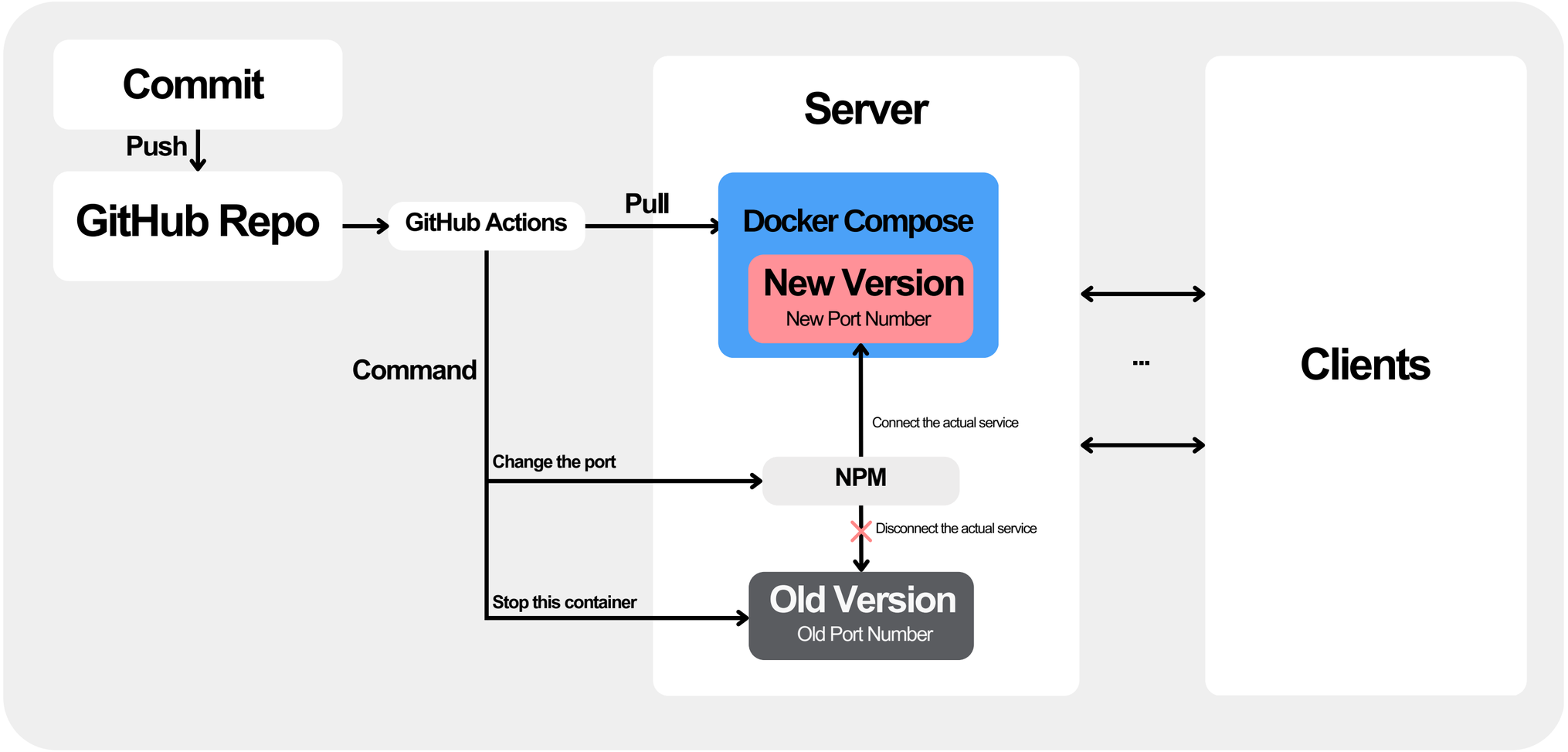
Considerations

Handling Frequent Changes

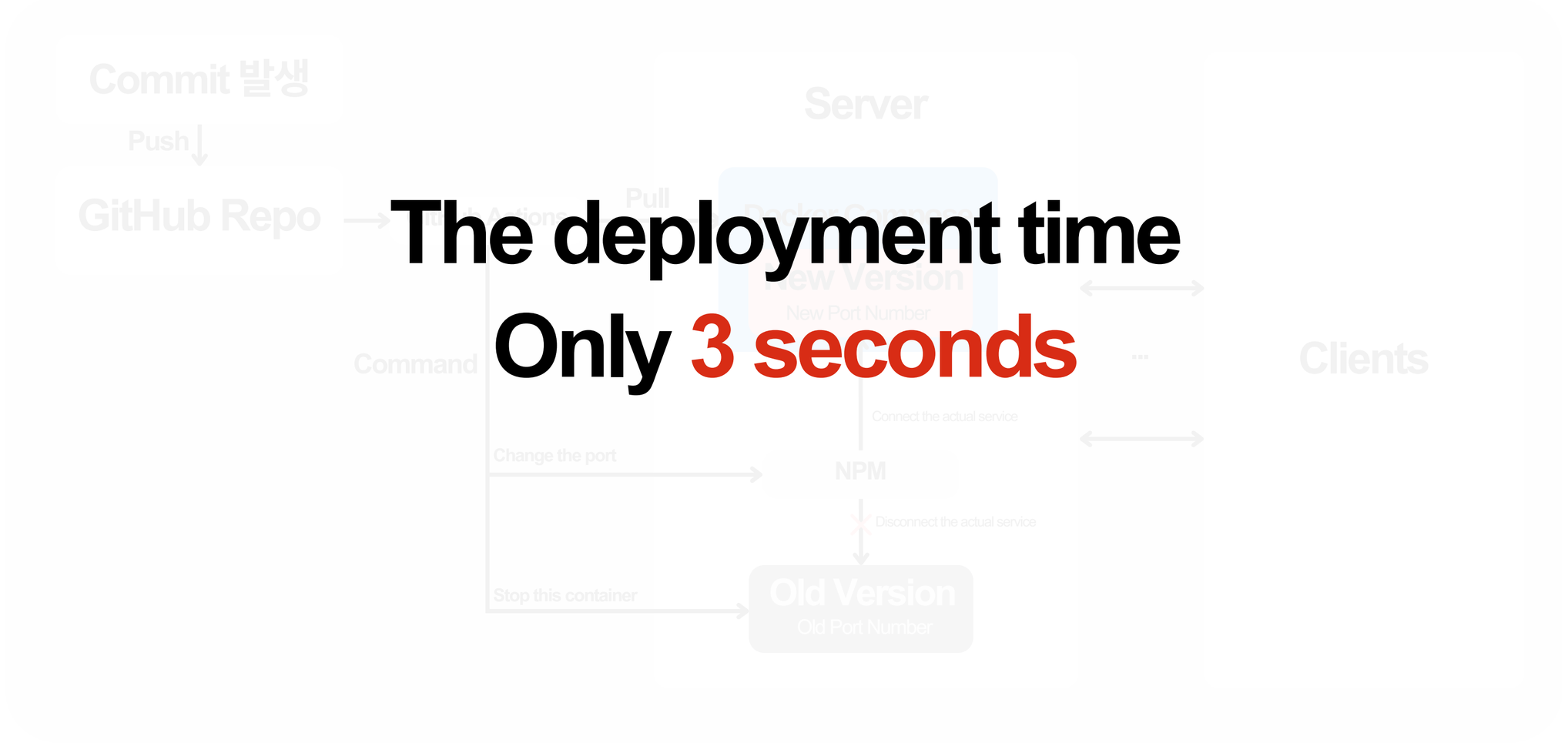
Full automation of the entire process

Uninterrupted deployment and quick speed

Flow chart

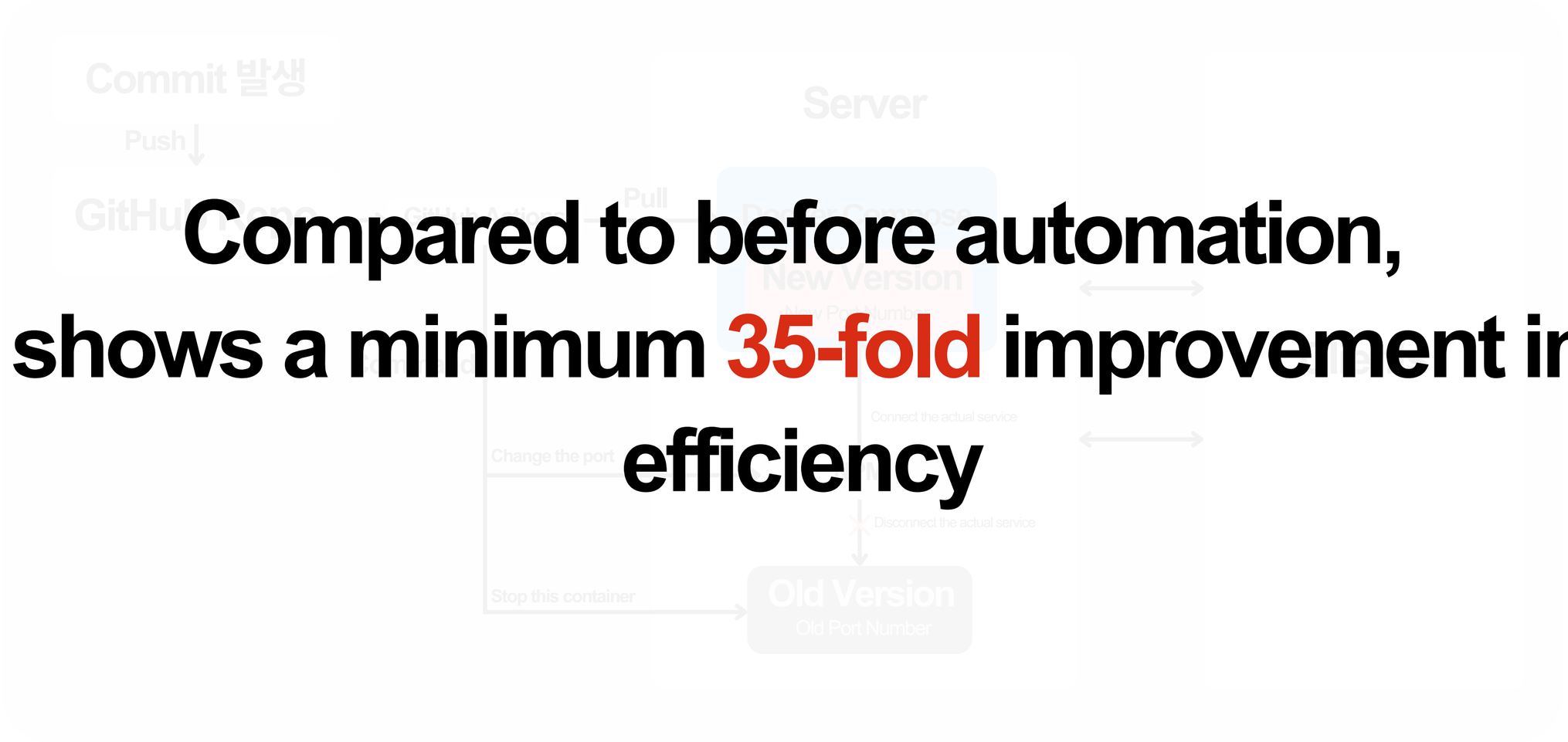

Commit
Push
GitHub Repo
GitHub Actions
Pull
Server
Docker Compose
New Version
New Port Number
Command
Connect the actual service
Change the port
NPM
Disconnect the actual service
Stop this container
Old Version
Old Port Number
...
Clients

Flow chart



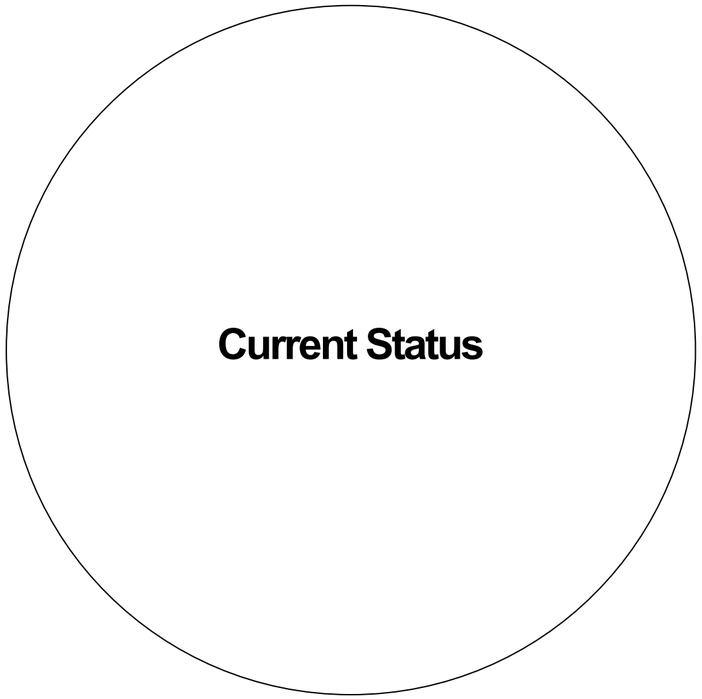
The deployment time
Only 3 seconds

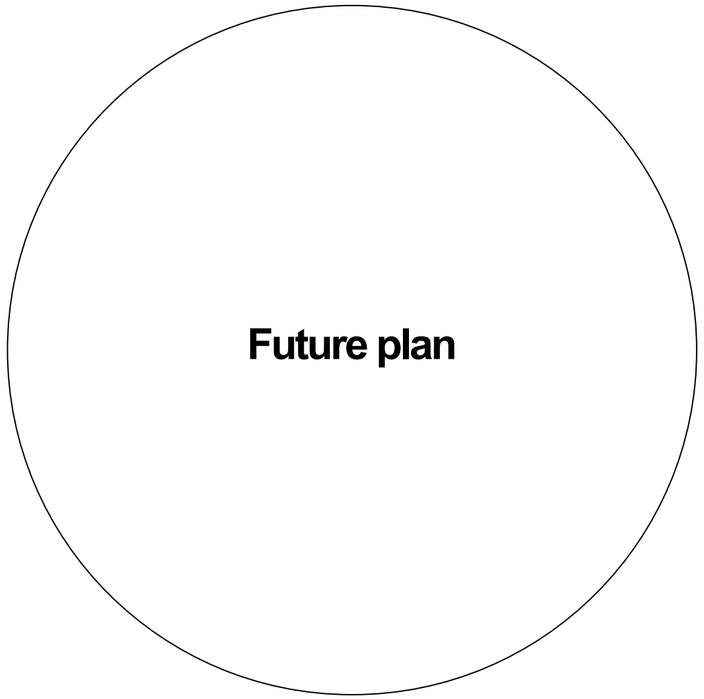
Flow chart



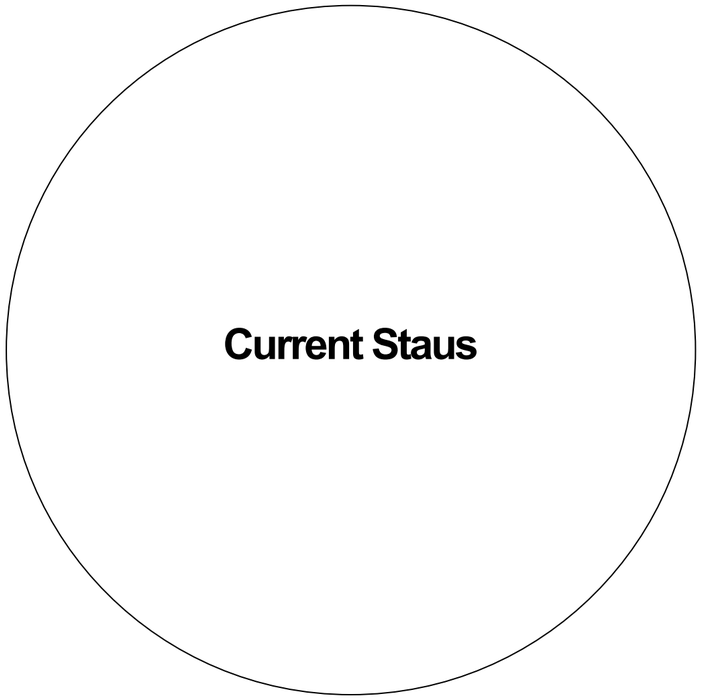
Compared to before automation, shows a minimum 35-fold improvement in efficiency

Maintenance plan





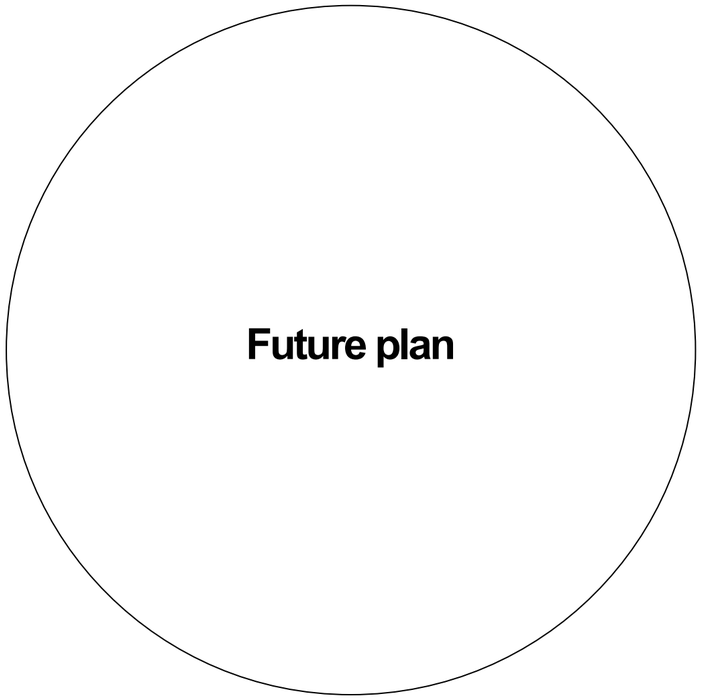
Maintenance plan



Integration with Google Analytics

Track the volume of incoming traffic/simultaneous users
Analyse user trends and behaviors

Maintenance plan



Prometheus Grafana

Utilize Advanced Monitoring tool

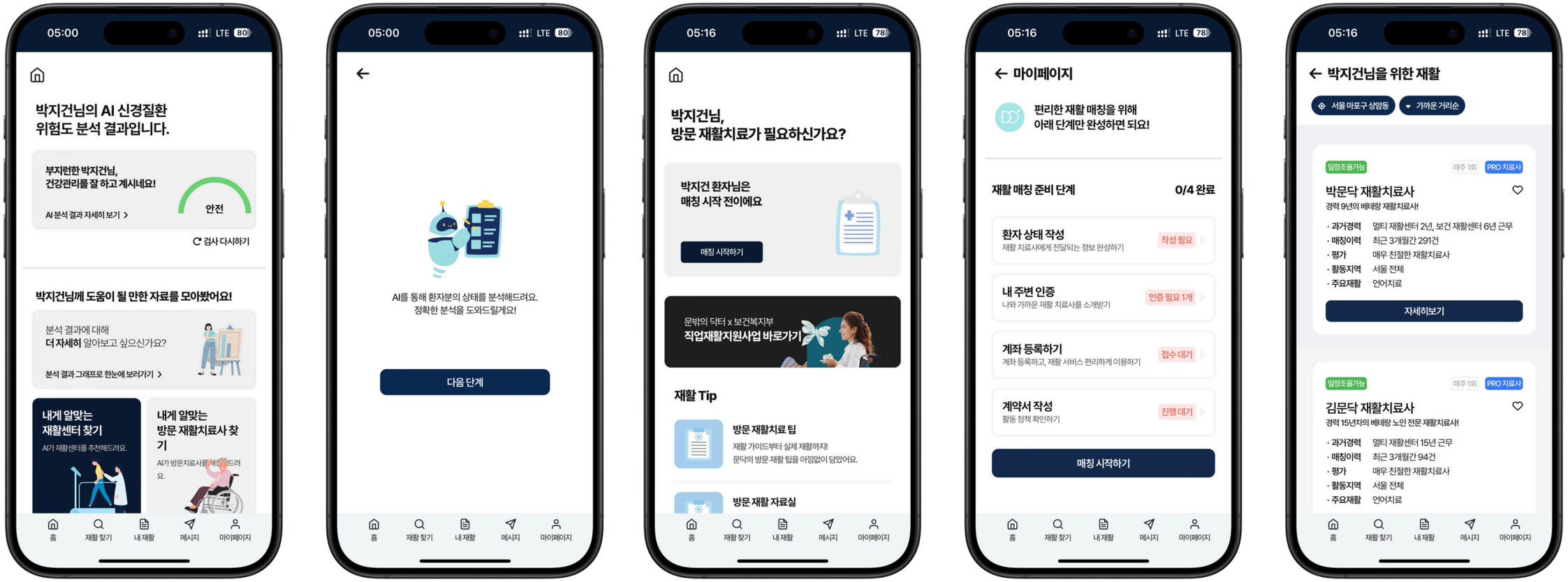
For advanced user behavior analysis

Maintenance plan

Migration to Cloud service

Enhance service stability through cloud migration to AWS, Google Cloud Platform

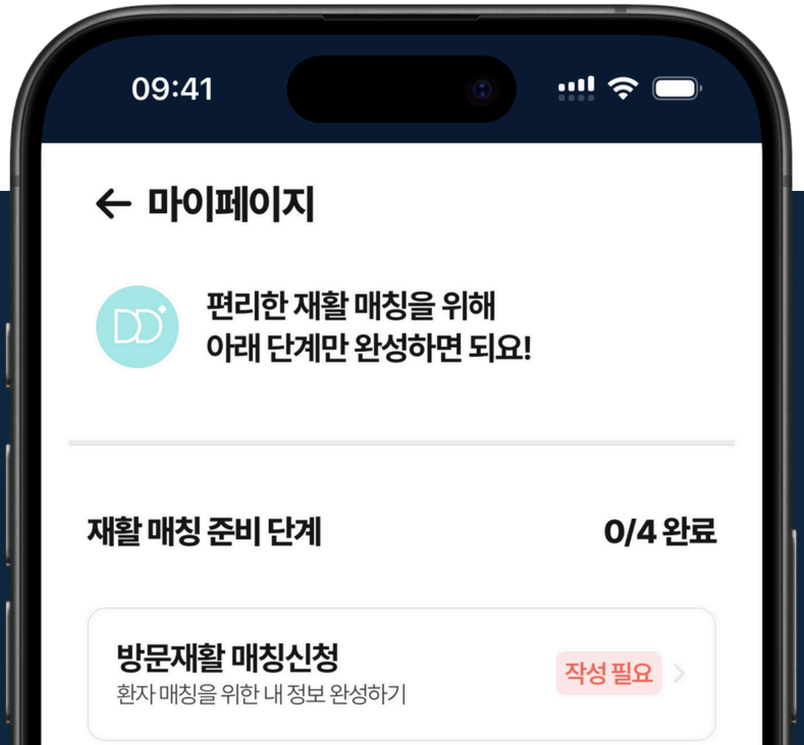
Multi Platform Demo



문밖의 닥터

Business Model

Market & Target Analysis / Expected Outcomes



Business Planning Dept
Hyewon Jung
Jihoon Youn

Market/Target Analysis

Neurological disease patients and their caregivers

Rehabilitation therapists and centers

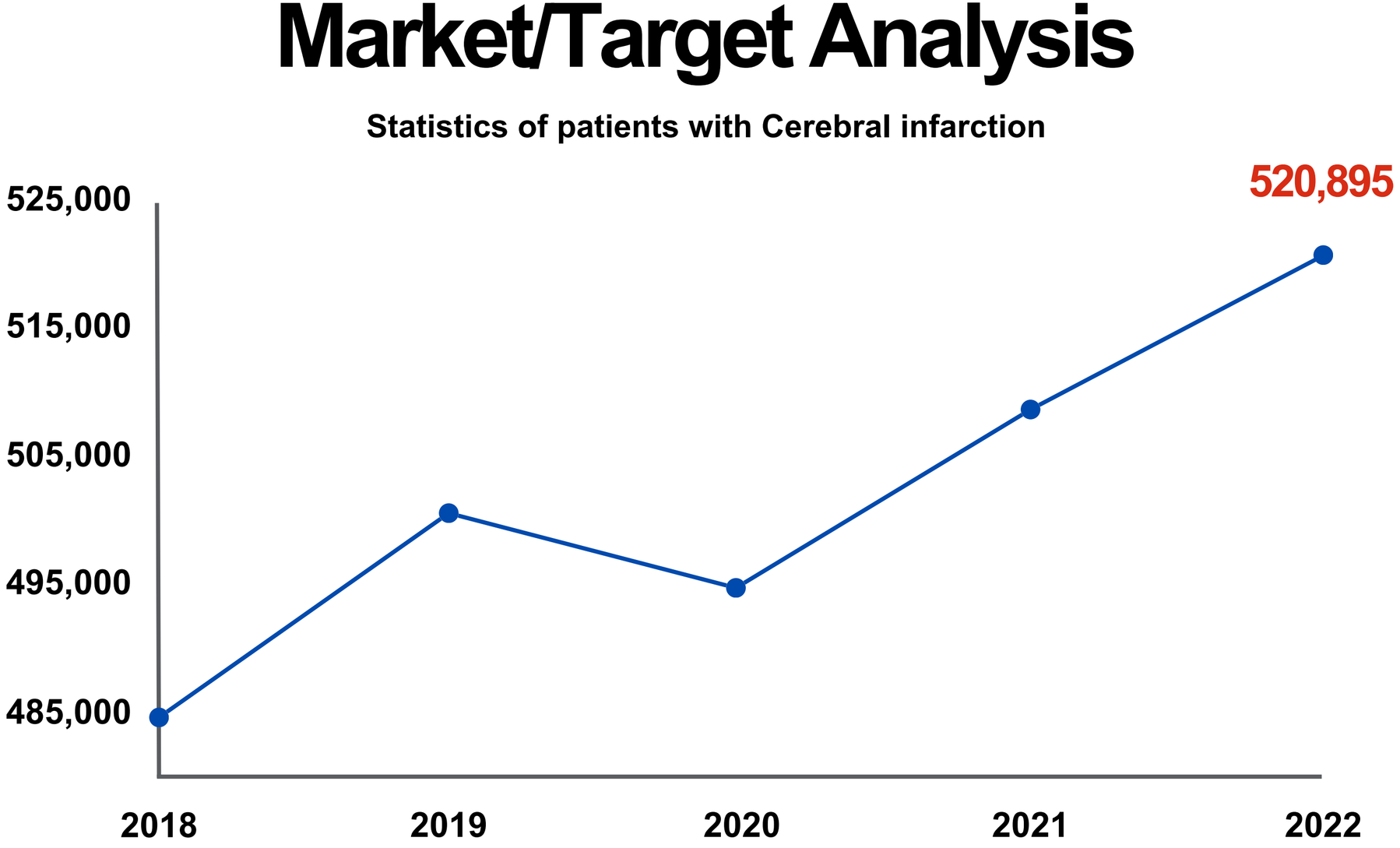
Market/Target Analysis

Neurological disease patients
and their caregivers

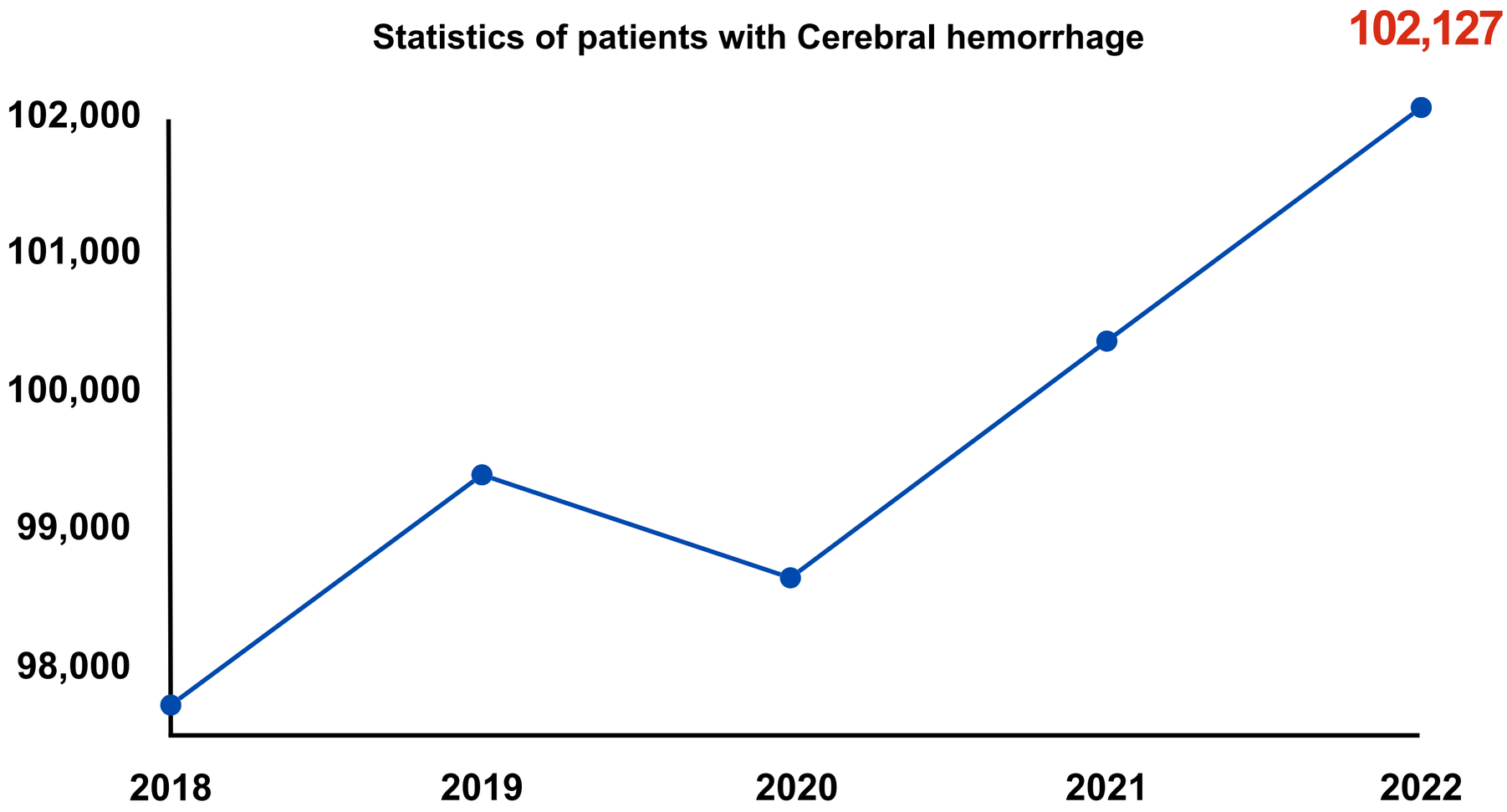
Population size : Approx. 128 milion

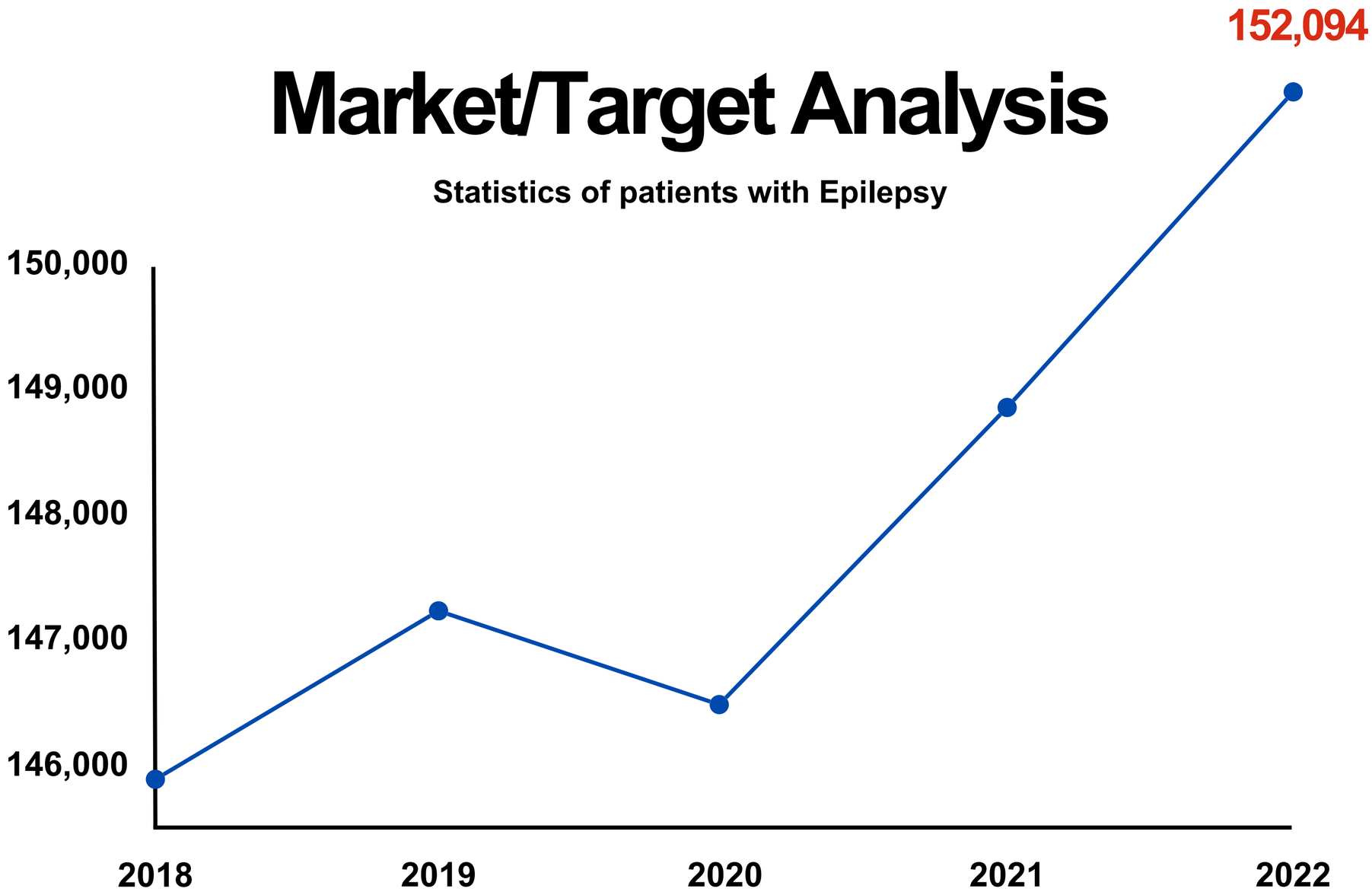
Market size : 5.26 billion dollars

Market/Target Analysis



Market/Target Analysis




152,094
Market/Target Analysis
Statistics of patients with Epilepsy
150,000
149,000
148,000
147,000
146,000
2018
2019
2020
2021
2022

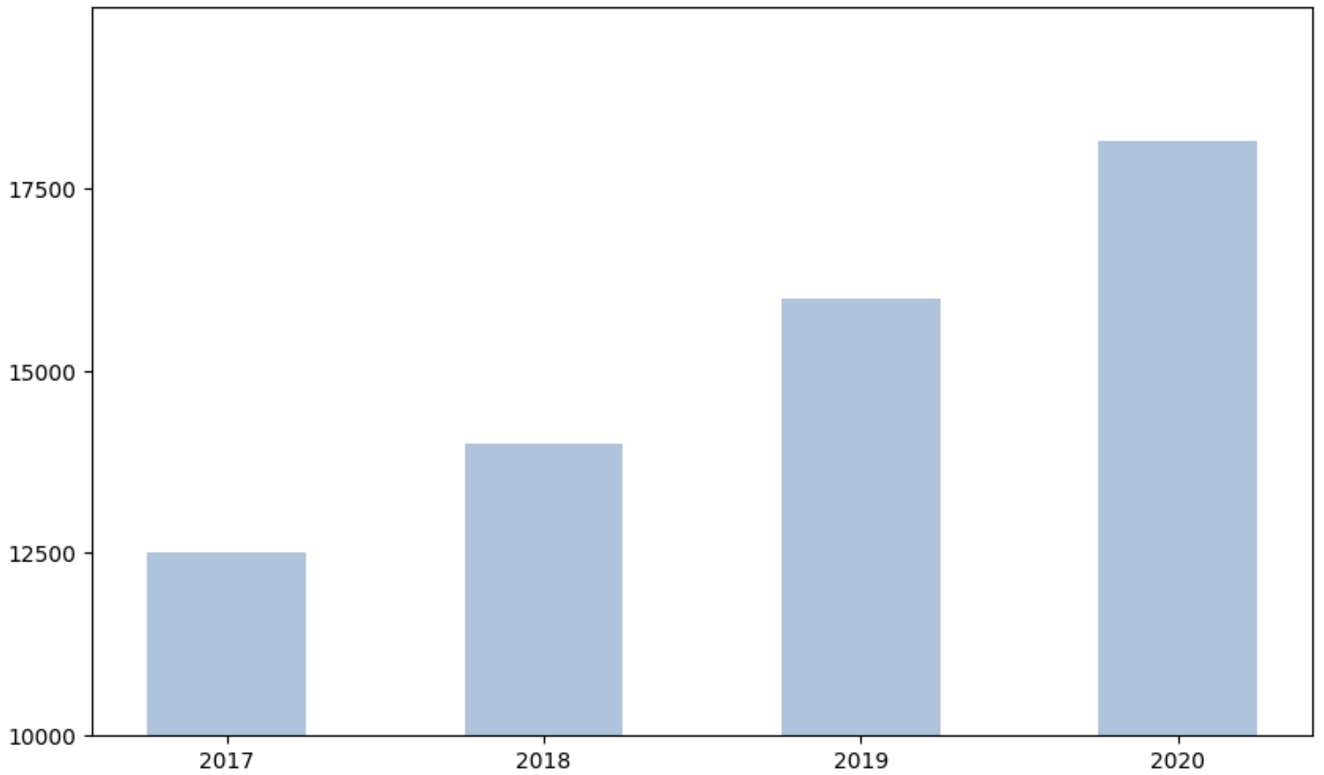
Market/Target Analysis

Population size : approx. 21,000, 430 centers

Market size : approx. 1.56 billion dollars

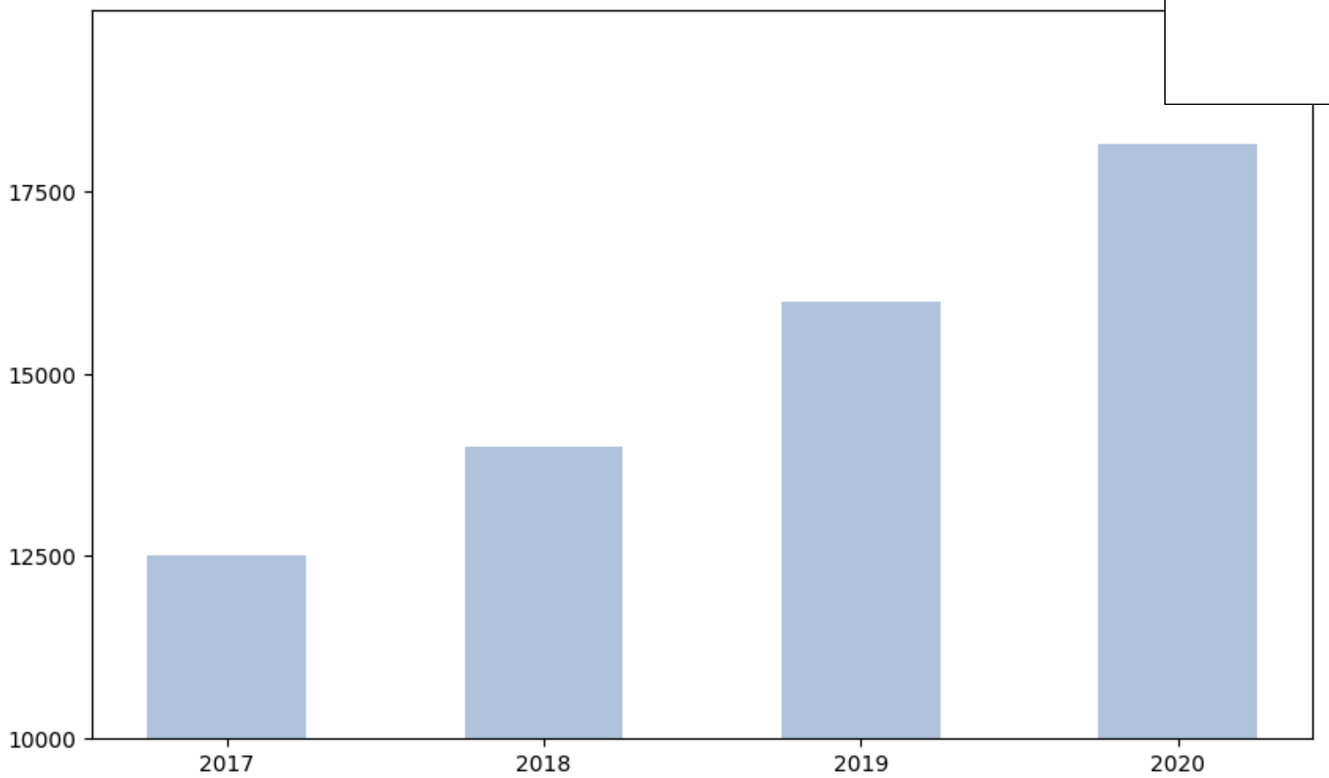
Market/Target Analysis

Numbers of Occupational therapist



Market/Target Analysis

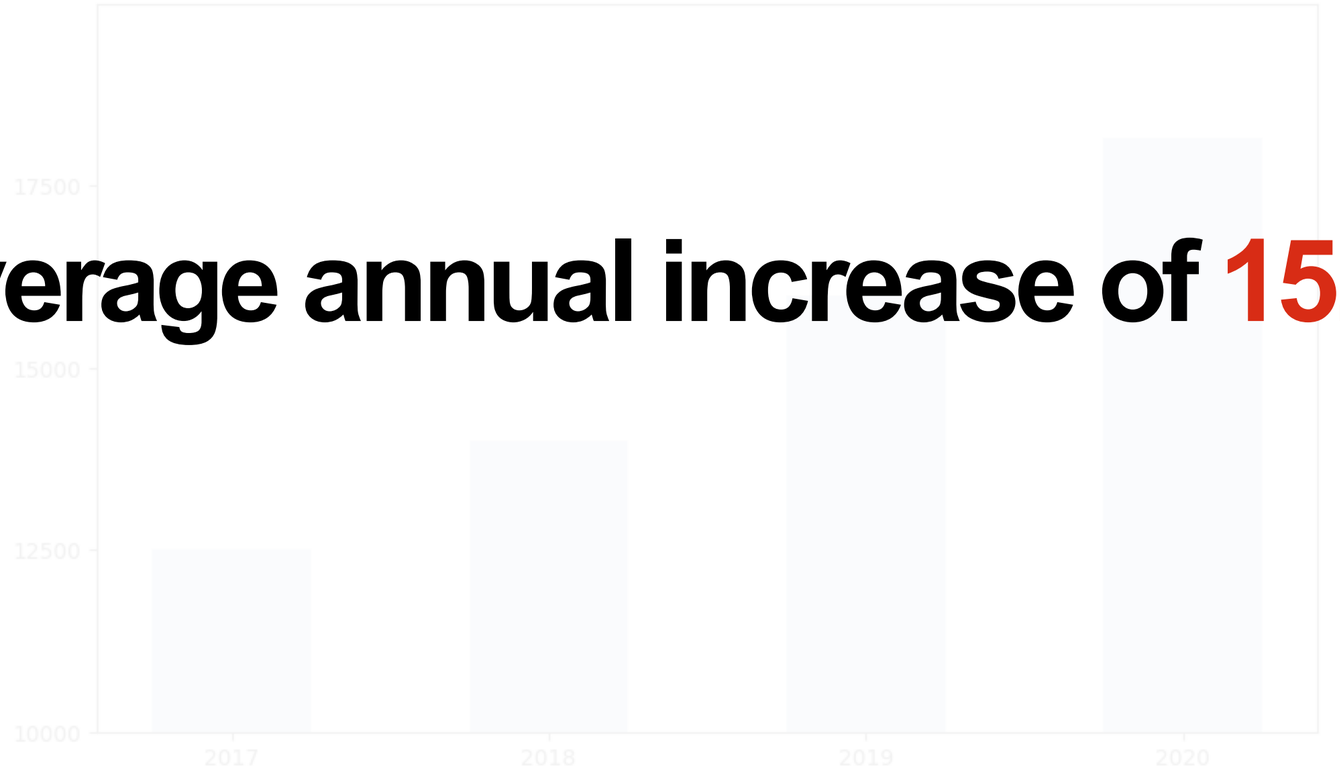
Numbers of Occupational therapist



Over 18,000 in year 2020

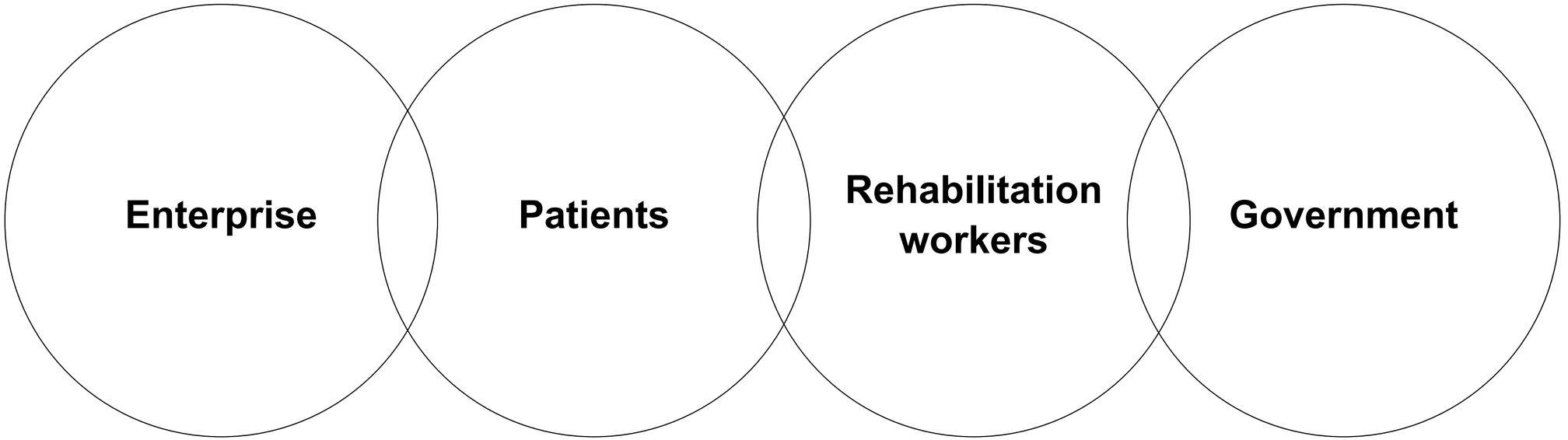
Market/Target Analysis

Numbers of Occupational therapist



Average annual increase of 15.4%

Expected Outcomes



Expected Outcomes

Enterprise

By leveraging accumulated data, enterprises can improve the accuracy of AI models and enhance the quality of analytical results

Expected Outcomes

Enterprise

Providing a developed welfare infrastructure can improve the quality of life for citizens

Expected Outcomes

Patients

Enables quick access to necessary information and the design of optimal rehabilitation plans

Expected Outcomes

Patients

Maximizes the effectiveness of rehabilitation and reduces medical expenses

Expected Outcomes

Rehabilitation workers

Flexible work is possible with segmented time blocks, additionally generating **extra revenue**

Expected Outcomes

Government

Creates 21,000 new rehabilitation therapy jobs and stimulates economic activity amounting to 1.12 billion dollars annually

Expected Outcomes

Government

Achieves economic stimulation amounting to 1.12 billion dollars annually

References

<□thesis>
MINYOUNG LEE. (2022). Machine learning based models for readmission to intensive care units. Graduate School of Management of Technology Korea University

<statistics>
e- index. https://www.index.go.kr/unity/potal/main/EachDtlPageDetail.do?idx_cd=2766
Hospital newspaper. https://www.khanews.com/news/articleView.html?idxno=221749
HIRA. https://www.hira.or.kr/bbsDummy.do?
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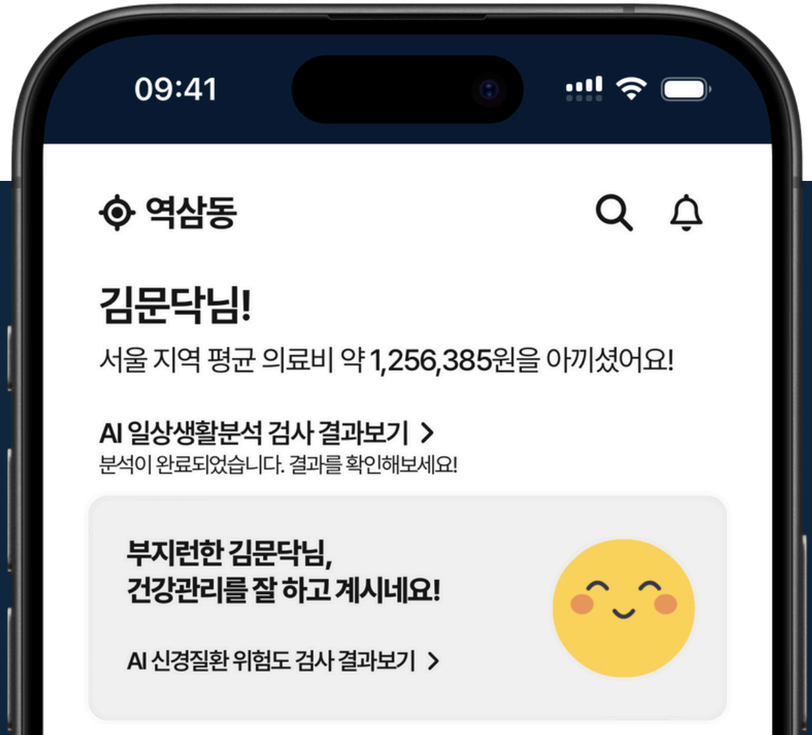
문밖의 닥터

QnA

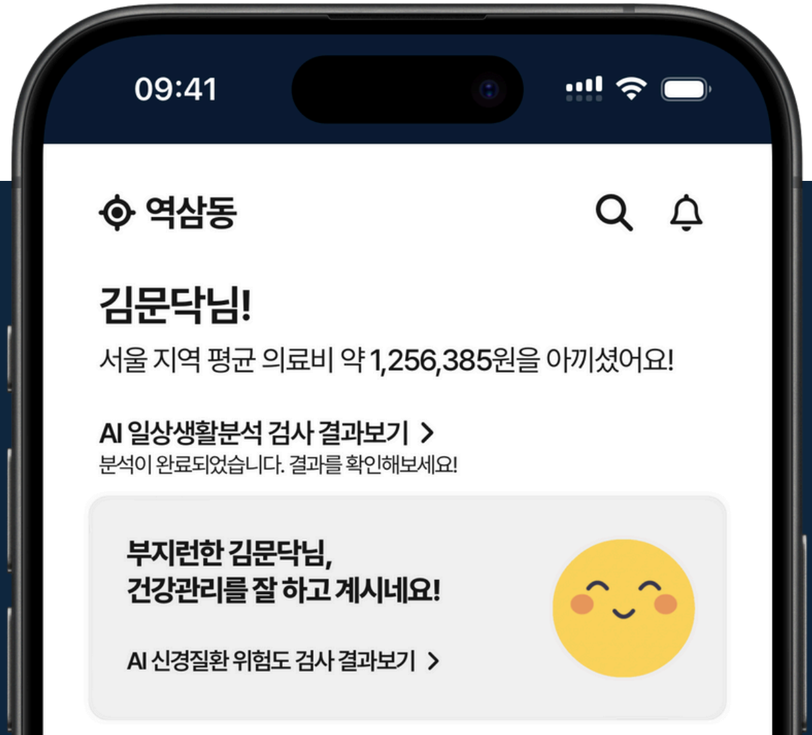


Doctors out the Door
정혜원 박지건 윤지훈 이상훈 임예원 황유진

2024-06-11

문밖의 닥터

Thank you for listening!



Doctors out the Door
정혜원 박지건 윤지훈 이상훈 임예원 황유진

2024-06-11