Analytics for Hospital 's Health-care Data

TEAM ID: PNT2022TMID23753

1.INTRODUCTION

1.1 PROJECT OVERVIEW

Data analytics in clinical settings attempts to reduce patient wait times via improved scheduling and staffing, give patients more options when scheduling appointments and receiving treatment, and reduce readmission rates by using population health data to predict which patients are at greatest risk.

The healthcare industry generates a tremendous amount of data but struggles to convert that data into insights that improve patient outcomes and operational efficiencies. Data analytics in healthcare is intended to help providers overcome obstacles to the widespread application of data-derived intelligence:

1. Making healthcare data easier to share among colleagues and external partners, and easier to visualize for public consumption
2. Providing accurate data-driven forecasts in real time to allow healthcare providers to respond more quickly to changing healthcare markets and environments
3. Enhancing data collaboration and innovation among healthcare organizations to convert analytics-ready data into business-ready information by automating low-impact data management tasks

1.2 PURPOSE

Data analytics in health care is vital. It helps health care organizations to evaluate and develop practitioners, detect anomalies in scans and predict outbreaks in illness, per the Harvard Business School. Data analytics can also lower costs for health care organizations and boost business intelligence. Most importantly, it helps health care companies to make better care decisions for patients.

2. LITERATURE SURVEY

2.1 EXISTING PROBLEM

When it comes to big data analytics, the healthcare industry faces numerous challenges. These challenges may include security, visualization, and a wide array of data integrity concerns. Over the years, big data analytics in healthcare has emerged as one of the most challenging undertakings for the healthcare industry. For instance, healthcare professionals, who may not be well-versed with managing electronic health records, now need to gather actionable insights as well. Also, they are expected to apply those learnings to complex initiatives that enhance their overall reimbursement rates.

2.2 REFERENCE

1)Mohammad Alkhatib , Amir Talaei-Khoei (University of Nevada,Reno)Amir Talaei-Khoei University of Nevada, Reno | UNR · Department of Accounting and Information Systems PhD of Information Systems-Amir Ghapanchi

2) From:"Book of Data Analytics" Chandank Reddy(Wayne State University) Charu C.Aggarwal(Watson Research Center)

3) From: Hoyt,RE,Yoshihashi,A,Eds.(2014).Health Informatics:Practical Guide for Healthcare and formation Technology Professionals,Sixth Edition.Pensacola,FL,Lulu.com

4) Panagiota Galetsia , Korina Katsaliakia , Sameer Kumarb,∗ a School of Economics, Business Administration & Legal Studies, International Hellenic University, 14th km Thessaloniki-N. Moudania, Thessaloniki, 57001, Greece b Opus College of Business, University of St. Thomas Minneapolis Campus, 1000 LaSalle Avenue, Schulze Hall 435, Minneapolis, MN 55403, USA

5) from"n book: Innovative Data Communication Technologies and Application (pp.83-96)"P. Nagaraj-Professor (Assistant) at Kalasalingam University

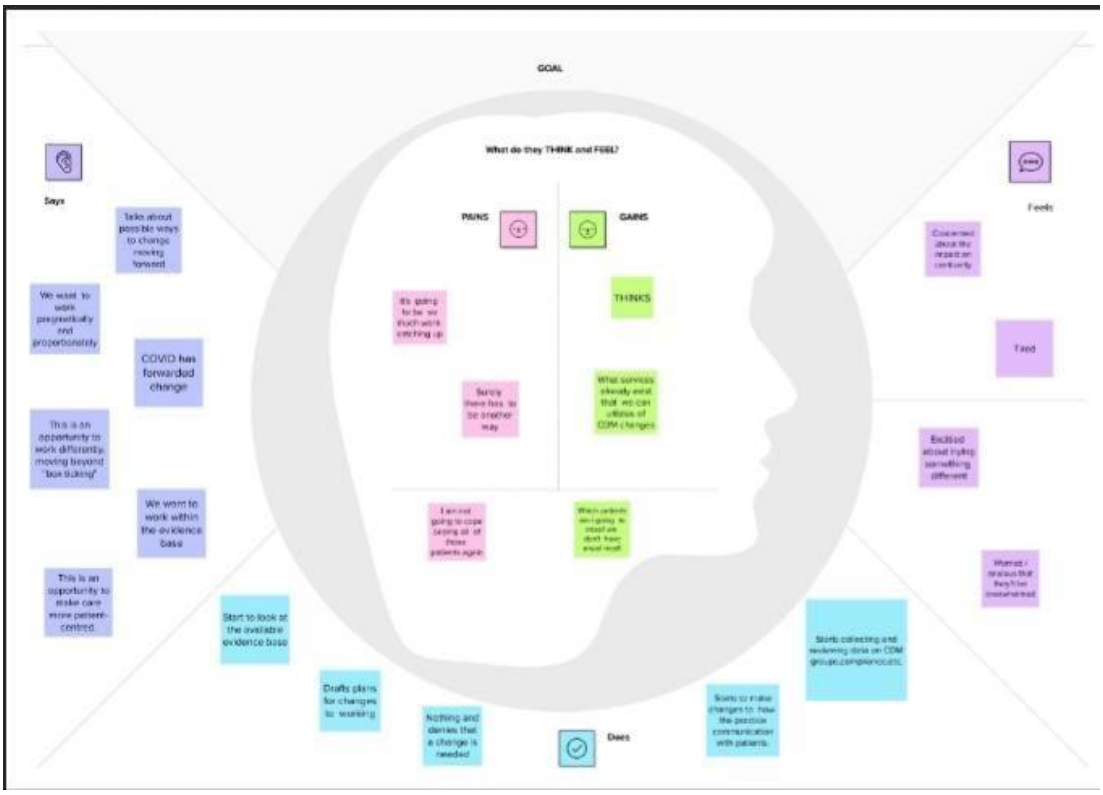
2.3 PROBLEM STATEMENT DEFINITION

Humanity today is suffering from one of the most dangerous pandemics in history, the Coronavirus Disease of 2019 (COVID-19). Although today there is immense advancement in the medical field with the latest technology, the COVID-19 pandemic has affected us severely. The virus is spreading rapidly, resulting in an escalation in the number of patients admitted. We propose a contextual patient classification system for better analysis of the data from the discharge summary available from the research hospital. The classification was done using the Knuth–Morris–Pratt algorithm. We have also analyzed the data of COVID-19 and nonCOVID-19 patients. During the analysis, studies on the medicines, medical services and tests, pulse count, body temperature, and the overall effect of age and gender was done. The death versus survival ratio for the COVID-19 positive patients has also been studied. The classification accuracy of the contextual patient classification system achieved was 97.4%. The combination of data analysis and contextual patient classification will be helpful to all the sectors to be better prepared for

any future waves of the COVID-19 pandemic. The goal is to accurately predict the Length of Stay for each patient on case by case basis so that the Hospitals can use this information for optimal resource allocation and better functioning. The length of stay is divided into 11 different classes ranging from 0-10 days to more than 100 days. The tools that we are using for data analytics is Cognos Analytics from IBM.

3. IDEATION AND PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS



3.2 IDEATION AND BRAINSTORMING

3.3 PROPOSED SOLUTION

S.No	Parameters	Description
1.	Problem Statement (Problem to be solved)	During the covid-19 pandemic, we have faced one of the difficult times of our life. Everyone seeks to survive from the great disaster. At the time of pandemic, noone get to know about which hospital has vacant beds(free beds) to admit themselves or others

		infected by covid. This situation made the death rate higher.
2.	Idea / Solution description	Predictive analytics can create patient journey dashboards and disease trajectories that helps us to know about the patient's period of stay. It improves effective allocation of beds and other resources, treatment delivery, improves efficiencies, and so on.
3.	Novelty / Uniqueness	Healthcare data frequently resides in several locations. The Collected data should be stored in central system(like centralized storage). This data becomes accessible and usable when it is combined into a single, central system, such as an enterprise datawarehouse (EDW). Uniqueness of our project is that we can able to use data for different things such as which medicine is more effective and for understanding behavioural pattern of particular disease.
4.	Social Impact / Customer Satisfaction	effective use of resource Enhanced diagnosis Improved Treatment enhancing the overall quality of treatment and life of patients

5.	Business Model (Revenue Model)	With the gathered data, redirecting the patients to particular hospital based on the vacancy, leading retailers used methods like market-basket analysis to discover insights about consumer purchase behaviour and used these insights to optimize the physical store experience, target relevant ads and streamline the supply chain, among other strategic initiatives.
6.	**Scalability of the Solution**	A variety of institutions must store, evaluate, and take action on the massive amounts of data being produced by the health care sector as it expands quickly. India is a vast, culturally varied nation with a sizable population that is increasingly able to access centralised healthcare services.

3.4 PROBLEM SOLUTION FIT

4. REQUIREMENTS ANALYSIS

4.1 FUNCTIONAL REQUIREMENTS

FR No	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR -1	User Registration	Registration through Form Registration through Gmail
FR-2	User Confirmation	Confirmation via Email Confirmation via Message
FR-3	Interoperability	Dashboard helps to share the patient's information interoperable to the hospitals in timely manner.
FR-4	Accuracy	Dashboard helps predict the patient's Health risks accurately based on LOS (Length of Stay).
FR-5	Compliance	The compliance of a dashboard is like to use very interactively in real time by the hospitals.
FR-6	Concise	These dashboards are clear, intuitive, and customizable and interactive in manner.

4.2 NON- FUNCTIONAL REQUIREMENTS

NFR NO	Non-Functional	Description

	Requirement	
NFR-1	**Usability**	This Dashboards are designed to offer a comprehensive overview of patient's LOS, and do so through the use of data visualization tools like charts and graphs.
NFR-2	**Security**	The Dashboard helps to indicate the current threat level to the Hospitals; an indication of events and incidents that have occurred; a record of authentication errors; unauthorized access
NFR-3	**Reliability**	This dashboard will be consistent and reliable to the users and helps the user to use in effective, efficient and reliable manner.
NFR-4	**Performance**	This dashboard can scan the backend users and analyzing the frequency in which they

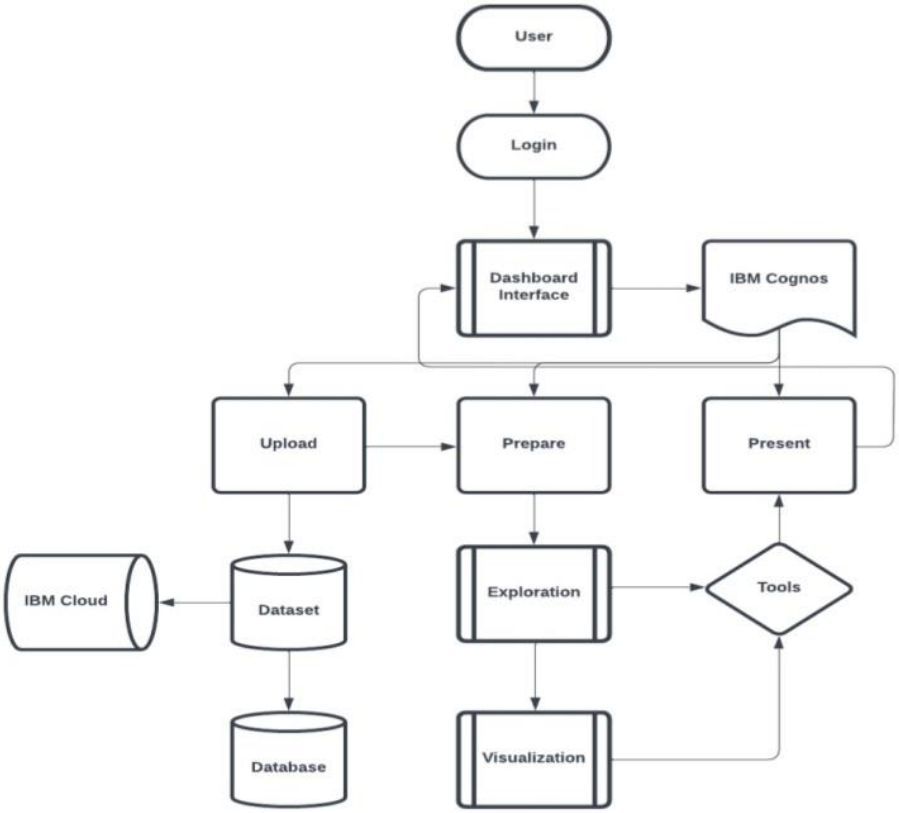
		visit the dashboard helps understand how useful and helpful the data displayed is for tasks.
NFR-5	**Availability**	The dashboard can available to meet user's demand in timely manner and it is also helps to provide necessary information to the user's dataset
NFR-6	**Scalability**	The layers used in the dashboard are a hosted feature layer, feature layer view, or hosted tile layer.

5. PROJECT DESIGN

5.1 DATA FLOW DIAGRAM

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can

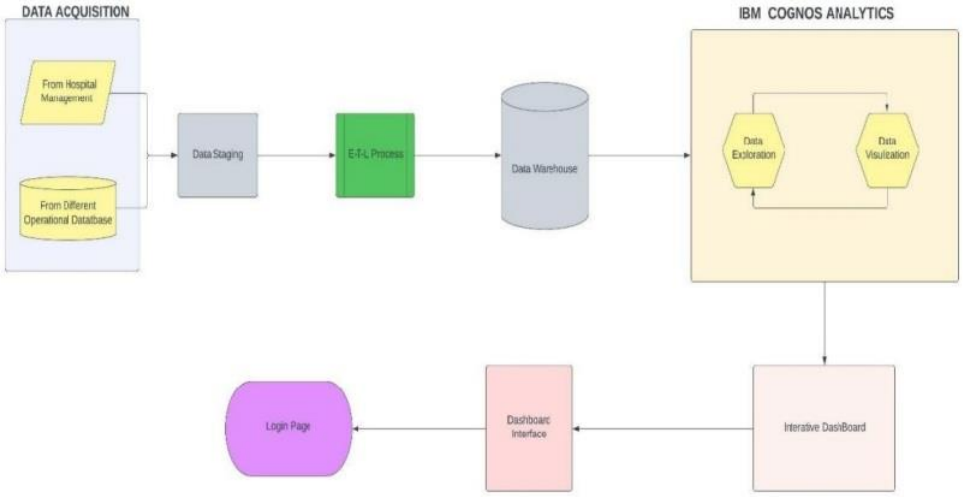
depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.



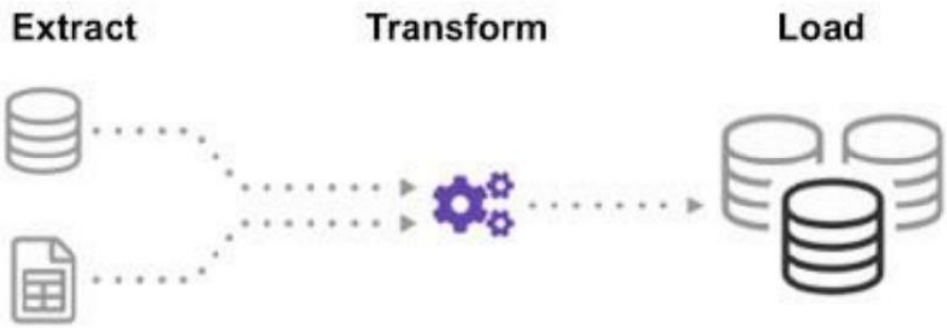
5.2 SOLUTION &TECHNICAL ARCHITECTURE

SOLUTION ARCHITECTURE

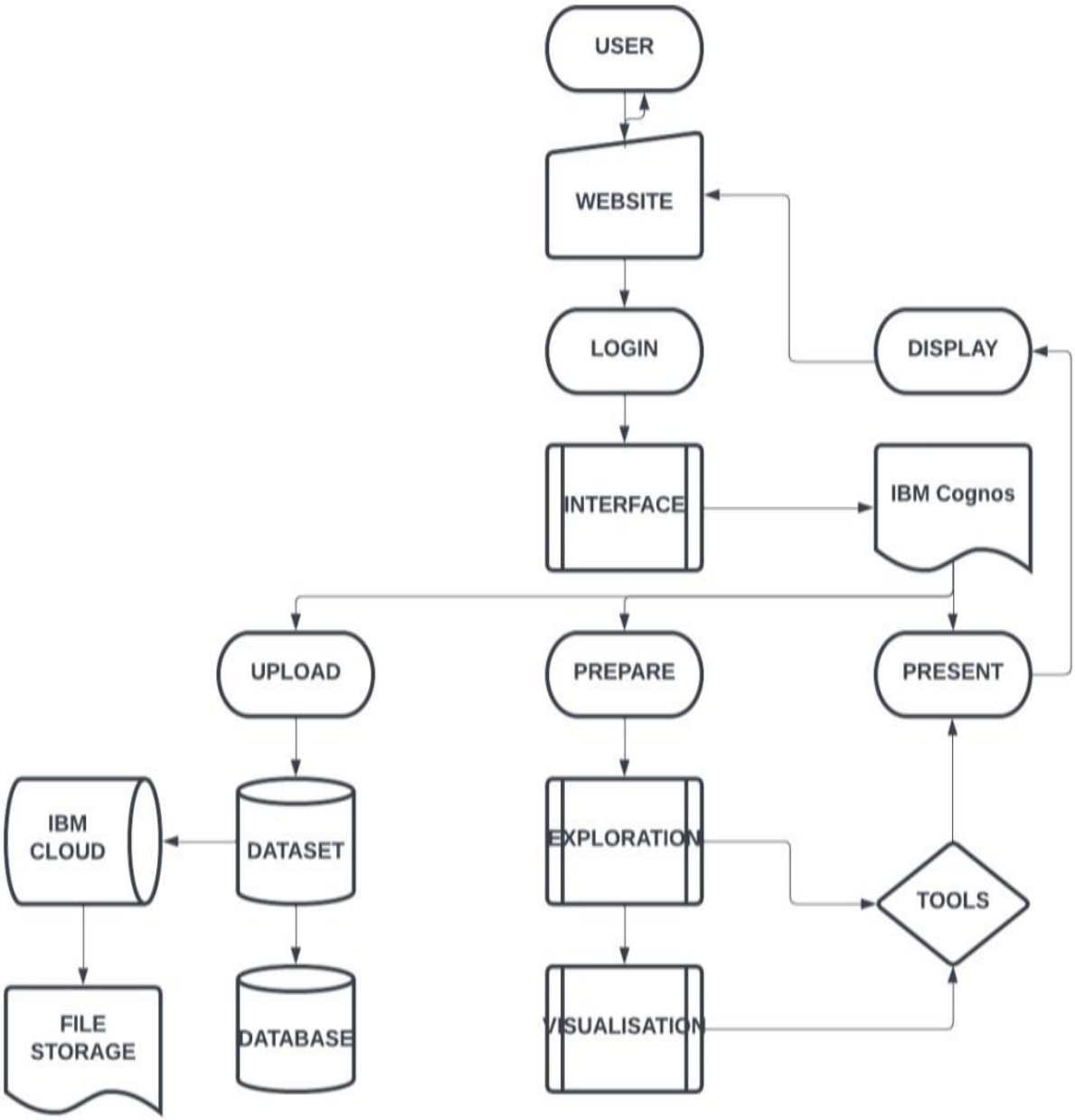
SYSTEM ARCHITECTURE:



ETL PROCESS (DATA INTEGRATION PROCESS):



TECHNICAL ARCHITECTURE



5.3 USER STORIES

Use the below template to list all the user stories for the product.

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Pricrity	Release
Customer (Mobile user)	Registration	USN-1	As a user, I can register for the dashboard by entering my email, and password, and confirming my password.	I can access my account in the dashboard	High	Sprint-1
		USN-2	As a user, I will receive a confirmation email once I have registered for the dashboard	I can receive a confirmation email & click confirm	High	Sprint-1
		USN-3	As a user, I can register for the dashboard through Social Media	I can register & access the dashboard with Social Media Login	Low	Sprint-2
		USN-4	As a user, I can register for the dashboard through Gmail	I can register and access dashboard with Gmail	Medium	Sprint-2
	Login	USN-5	As a user, I can log into the application by entering email & password	I can login to the account in my email login.	High	Sprint-2
	Dashboard	USN-6	As a user ,I can use my account in my dashboard for uploading dataset.	I can login to the account for uploading dataset.	Medium	Sprint-3
Customer (Web user)	Website	USN-7	As a user ,I can use my dashboard in website	I can login into the dashboard by visiting website.	Medium	Sprint-3
Customer Care Executive		USN-8	As a user ,I can contact Customer care Executive for my login.	I can contact customer executive for my login.	High	Sprint-4
Administrator		USN-9	As a user ,I can contact administrator for my queries.	I can contact admin strator for so ving my queries.	High	Sprint-4
Exploration	Dashboard	USN-10	As a user, I can prepare data by using Exploration Techniques.	I can prepare data by using Exploration Techniques.	High	Sprint-3
Presentation	Dashboard	USN-11	As a user, I can Present data in my dashboard.	I can present data by using my account in dashboard.	High	Sprint-4
Visualization	Dashboard	USN-12	As a user, I can Prepare Data by using Visualization Techniques	I can prepare data by using Visualization Techniques.	High	Sprint-3

6.PROJECT PLANNING AND SCHEDULING

6.1 SPRINT PLANNING AND ESTIMATION

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password	2	High	Priyadharshini D, Narmadha Varshini N
Sprint-1		USN-2	As a user, I will receive confirmation email once I have registered for the application	1	High	Priyadharshini D, Yasotha S
Sprint-2		USN-3	As a user, I can register for the application through Facebook	2	Low	Priyadharshini D, Yasotha S
Sprint-1		USN-4	As a user, I can register for the application through Gmail	2	Medium	Yamuna Devi V,Priyadharshini D
Sprint-1	Login	USN-5	As a user, I can log into the	1	High	Yamuna Devi V,Priyadharshini D

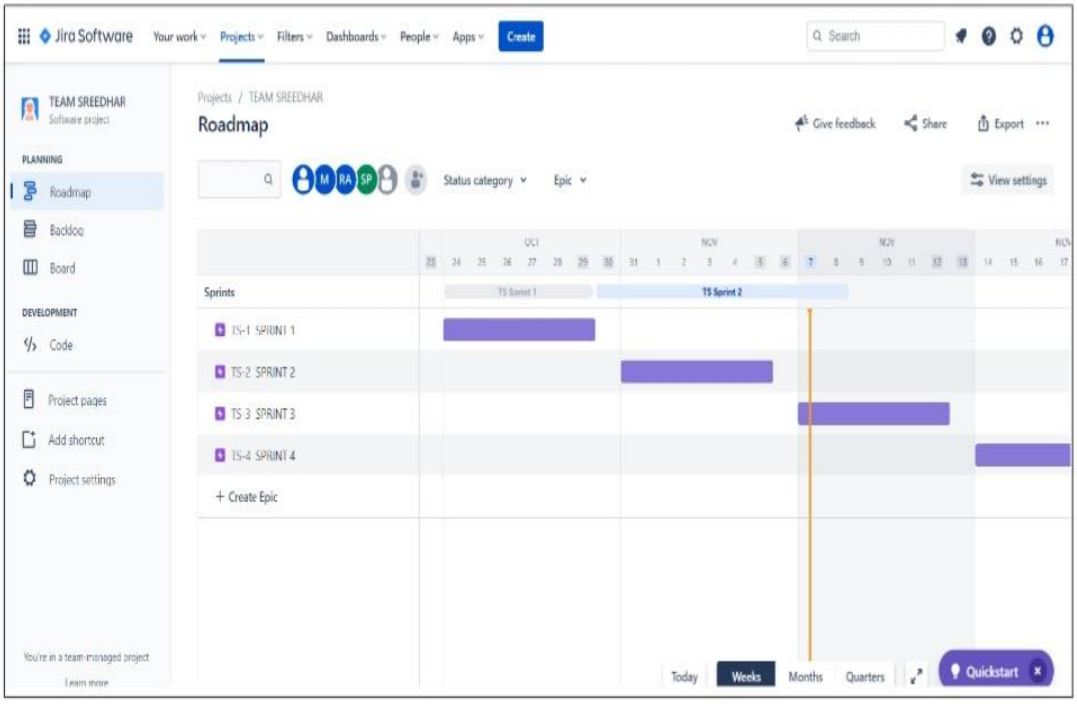
			application by entering email & password			
	Dashboard					

6.2 SPRINT DELIVERY SCHEDULE

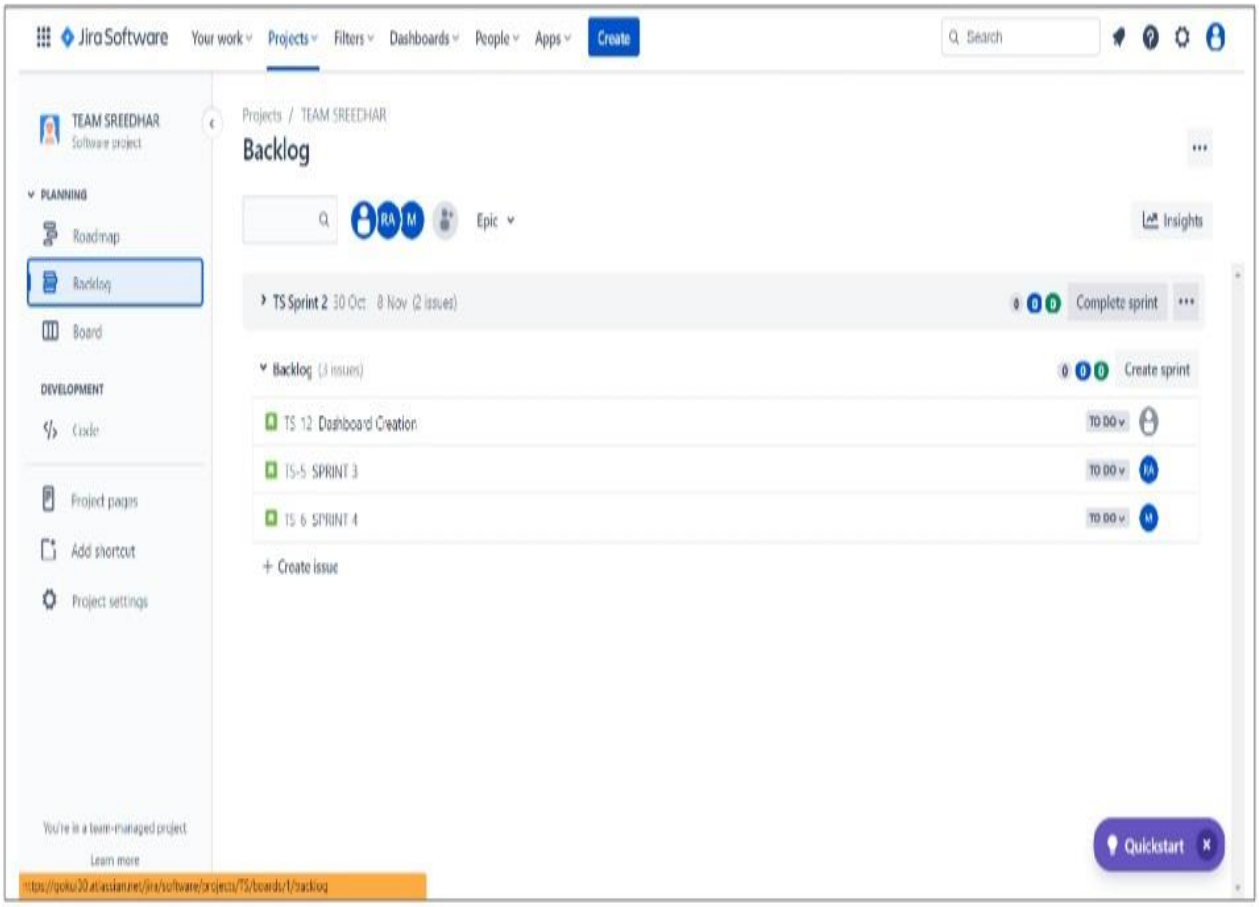
Sprints	**Total Story Points**	**Duration**	**Sprint Start Date**	**Sprint End Date (Planned)**	**Story Points Completed (as on Planned End Date)**	**Sprint Release Date (Actual)**
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	11 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	15 Nov 2022

6.3 REPORTS FROM JIRA

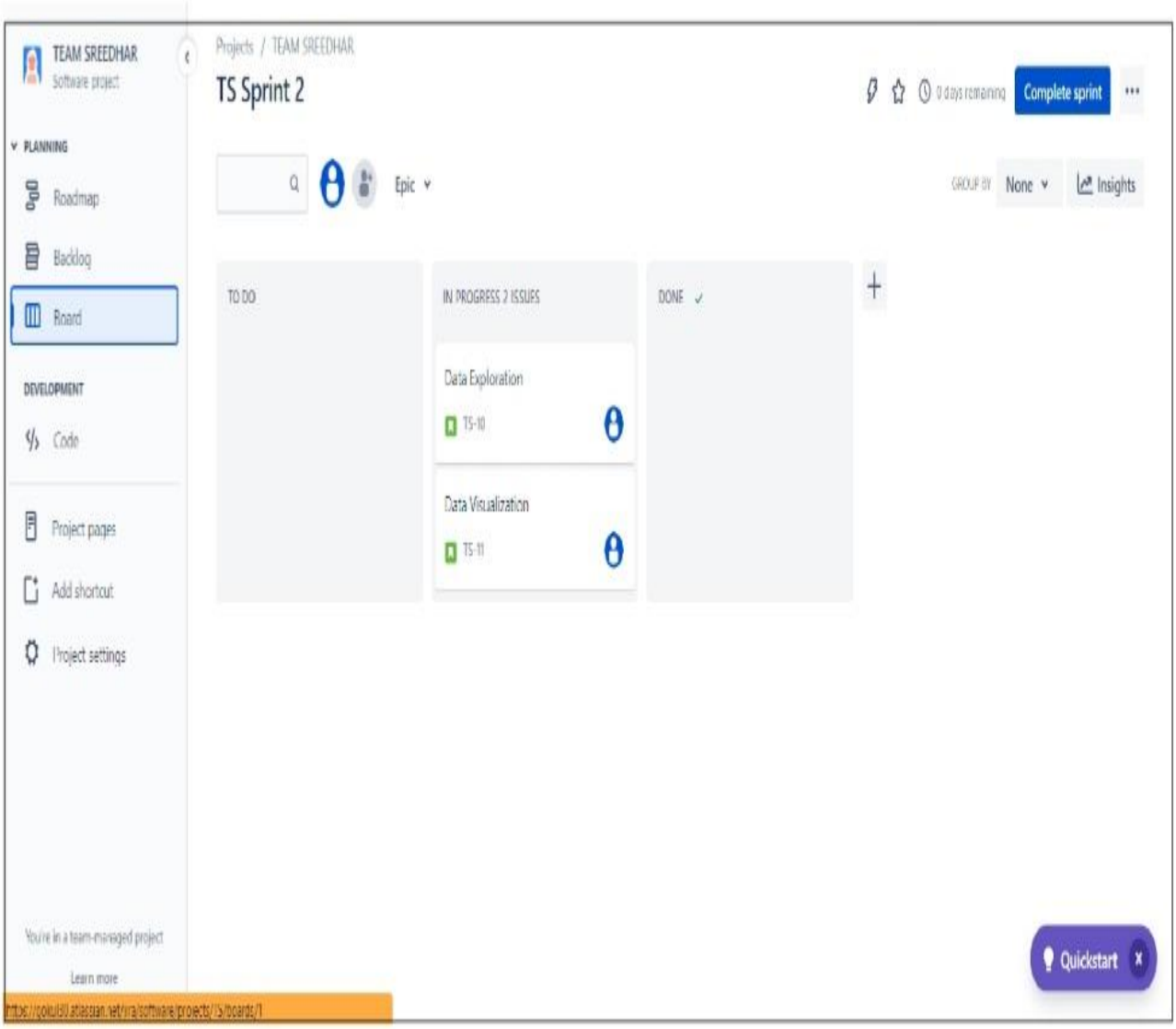
ROADMAP


Jira Software
Your work
Projects
Filters
Dashboards
People
Apps
Create
Search
TEAM SREEDHAR
Software project
PLANNING
Roadmap
Backlog
Board
DEVELOPMENT
Code
Project pages
Add shortcut
Project settings
You're in a team-managed project
Learn more
Projects / TEAM SREEDHAR
Roadmap
Give feedback
Share
Export
Status category
Epic
View settings
OCT
NOV
NOV
Sprints
TS Sprint 1
TS Sprint 2
TS-1 SPRINT 1
TS-2 SPRINT 2
TS-3 SPRINT 3
TS-4 SPRINT 4
+ Create Epic
Today
Weeks
Months
Quarters
Quickstart

BACKLOGS


Jira Software
Your work
Projects
Filters
Dashboards
People
Apps
Create
Search
TEAM SREEDHAR
Software project
PLANNING
Roadmap
Backlog
Board
DEVELOPMENT
Code
Project pages
Add shortcut
Project settings
You're in a team-managed project
Learn more
Projects / TEAM SREEDHAR
Backlog
Epic
Insights
TS Sprint 2 30 Oct - 8 Nov (2 issues)
Complete sprint
Backlog (3 issues)
Create sprint
TS-12 Dashboard Creation
TS-5 SPRINT 3
TS-6 SPRINT 4
TO DO
+ Create issue
Quickstart

BOARD



7. CODING AND SOLUTIONING

7.1 FEATURE 1

Data Collection

Download the dataset here

```
[ ]  from google.colab import drive
     drive.mount('/content/drive')
```

```
Mounted at /content/drive
```

```
[ ]  cd/content/drive/MyDrive/Colab Notebooks
```

```
/content/drive/MyDrive/Colab Notebooks
```

```
[ ]  # Unzipping the dataset
     !unzip 'Dataset.zip'
```

Image Preprocessing

```
[ ]  from keras.preprocessing.image import ImageDataGenerator
```

Image Data Augmentation

```
[ ]  train_datagen = ImageDataGenerator(rescale=1./255,shear_range=0.2,zoom_range=0.2,horizontal_flip=True)
     test_datagen=ImageDataGenerator(rescale=1./255)
```

Applying Image DataGenerator Functionality To Trainset And Testset

```
x_train = train_datagen.flow_from_directory(
    r'/content/drive/MyDrive/Colab Notebooks/Dataset/TRAIN_SET',
    target_size=(64, 64),batch_size=5,color_mode='rgb',class_mode='sparse')
x_test = test_datagen.flow_from_directory(
    r'/content/drive/MyDrive/Colab Notebooks/Dataset/TEST_SET',
    target_size=(64, 64),batch_size=5,color_mode='rgb',class_mode='sparse')
```

Model Building

1. Importing The Model Building Libraries

```
[ ]  import numpy as np
     import tensorflow as tf
     from tensorflow.keras.models import Sequential
     from tensorflow.keras import layers
     from tensorflow.keras.layers import Dense,Flatten
     from tensorflow.keras.layers import Conv2D,MaxPooling2D,Dropout
```

2. Initializing The Model

```
[ ]  classifier = Sequential()
```

3. Adding CNN Layers

```
[ ]  classifier = Sequential()
     classifier.add(Conv2D(32, (3, 3), input_shape=(64, 64, 3), activation='relu'))
     classifier.add(MaxPooling2D(pool_size=(2, 2)))
     classifier.add(Conv2D(32, (3, 3), activation='relu'))
     classifier.add(MaxPooling2D(pool_size=(2, 2)))
     classifier.add(Flatten())
```

4. Adding Dense Layers

```
[ ]  classifier.add(Dense(units=128, activation='relu'))
     classifier.add(Dense(units=5, activation='softmax'))
```

```
classifier.summary()
```

```
Model: "sequential_1"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv2d (Conv2D)             (None, 62, 62, 32)        896
```

5. Configure The Learning Process

```
[ ]  classifier.compile(optimizer='adam', loss='sparse_categorical_crossentropy', metrics=['accuracy'])
```

6. Train The Model

```
[ ]  classifier.fit_generator(generator=x_train,steps_per_epoch = len(x_train),epochs=20, validation_data=x_test,validation_steps = len(x_test))
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:2: UserWarning: `Model.fit_generator` is deprecated and will be removed in a future version. Pl

Epoch 1/20
494/824 [==========>.....] - ETA: 6:52 - loss: 0.7194 - accuracy: 0.7174
```

7. Saving The Model

```
[ ]  classifier.save('nutrition.h5')
```

8. Testing The Model

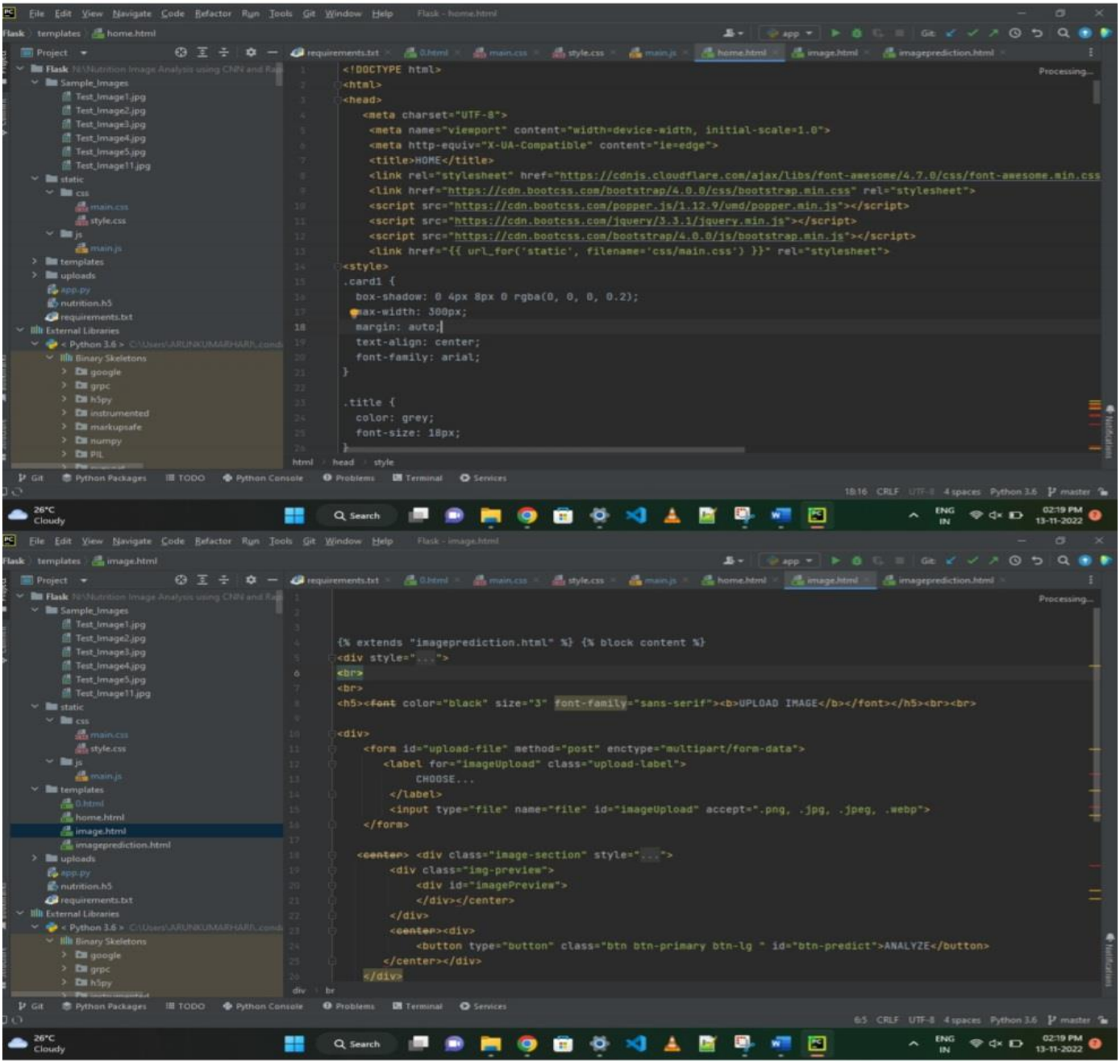
```
[ ]  from tensorflow.keras.models import load_model
     from keras.preprocessing import image
     model = load_model("nutrition.h5")
```

```
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image
model = load_model("nutrition.h5")
img = image.load_img(r'/content/drive/MyDrive/Colab Notebooks/Sample_Images/Test_Image1.jpg',grayscale=False,target_size= (64,64))
x = img_to_array(img)
x = np.expand_dims(x,axis = 0)
predict_x=model.predict(x)
classes_x=np.argmax(predict_x,axis=-1)
classes_x
```

```
1/1 [==============================] - 0s 62ms/step
array([0])
```

```
[ ]  index=['APPLES', 'BANANA', 'ORANGE','PINEAPPLE','WATERMELON']
     result=str(index[classes_x[0]])
     result
```

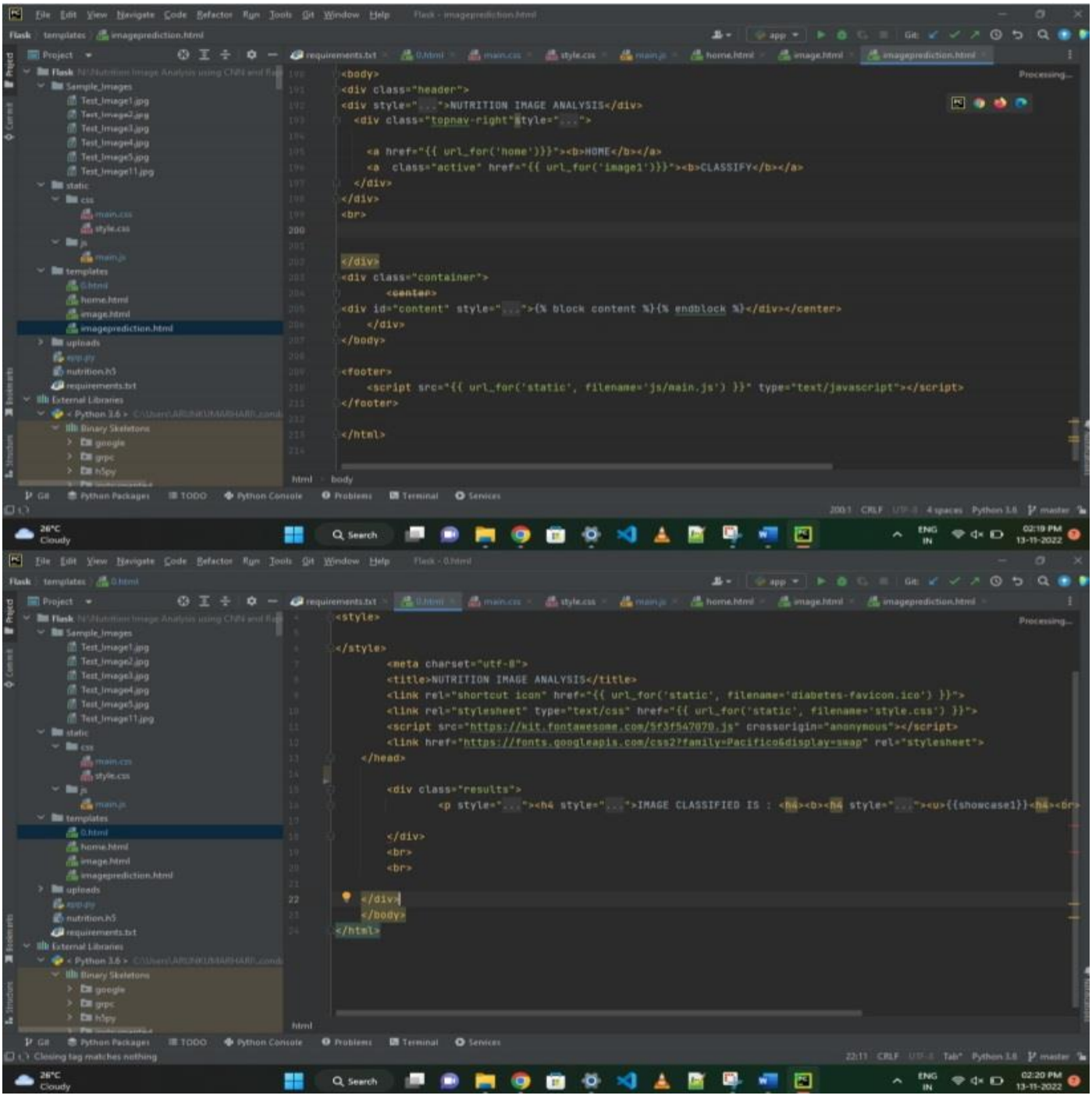
7.2 FEATURE 2

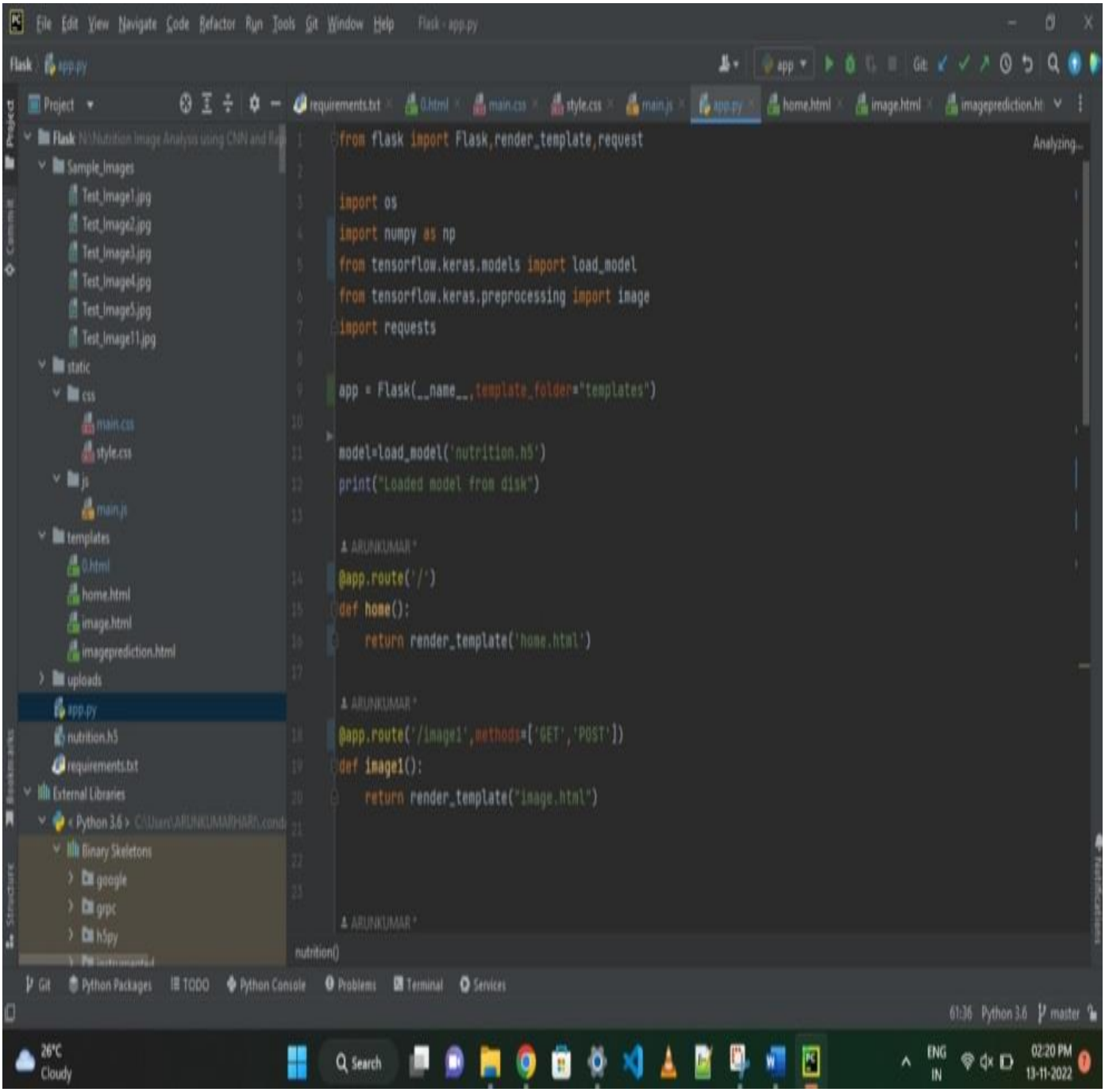

home.html
<!DOCTYPE html>
<html>
<head>
<meta charset="UTF-8">
<meta name="viewport" content="width=device-width, initial-scale=1.0">
<meta http-equiv="X-UA-Compatible" content="ie=edge">
<title>HOME</title>
<link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/4.7.0/css/font-awesome.min.css
<link href="https://cdn.bootcss.com/bootstrap/4.0.0/css/bootstrap.min.css" rel="stylesheet">
<script src="https://cdn.bootcss.com/popper.js/1.12.9/umd/popper.min.js"></script>
<script src="https://cdn.bootcss.com/jquery/3.3.1/jquery.min.js"></script>
<script src="https://cdn.bootcss.com/bootstrap/4.0.0/js/bootstrap.min.js"></script>
<link href="{{ url_for('static', filename='css/main.css') }}" rel="stylesheet">
<style>
.card1 {
box-shadow: 0 4px 8px 0 rgba(0, 0, 0, 0.2);
max-width: 300px;
margin: auto;
text-align: center;
font-family: arial;
}
.title {
color: grey;
font-size: 18px;
}
image.html
{% extends "imageprediction.html" %} {% block content %}

<h5>UPLOAD IMAGE</h5>

<form id="upload-file" method="post" enctype="multipart/form-data">
<label for="imageUpload" class="upload-label">
CHOOSE...
</label>
<input type="file" name="file" id="imageUpload" accept=".png, .jpg, .jpeg, .webp">
</form>

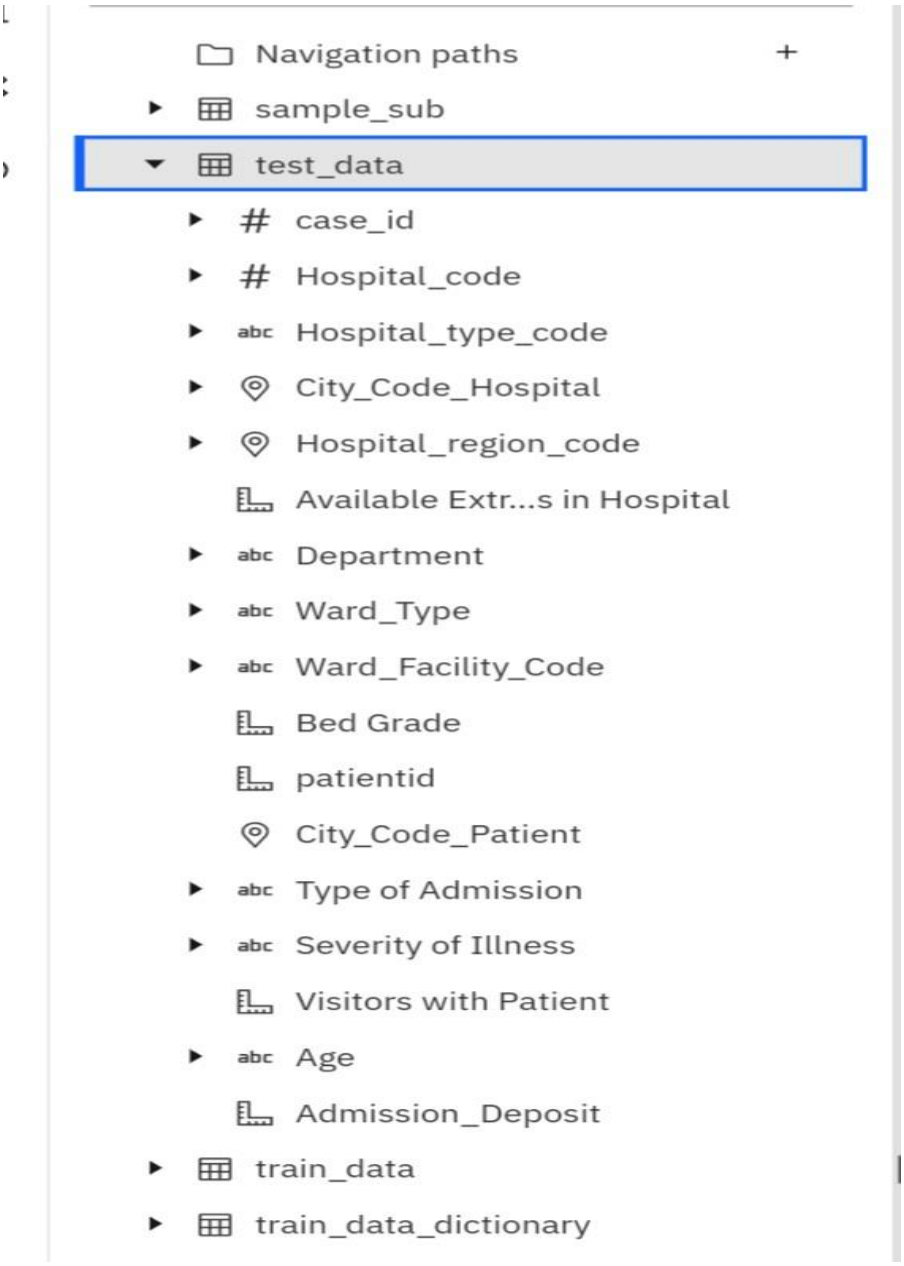
<button type="button" class="btn btn-primary btn-lg " id="btn-predict">ANALYZE</button>



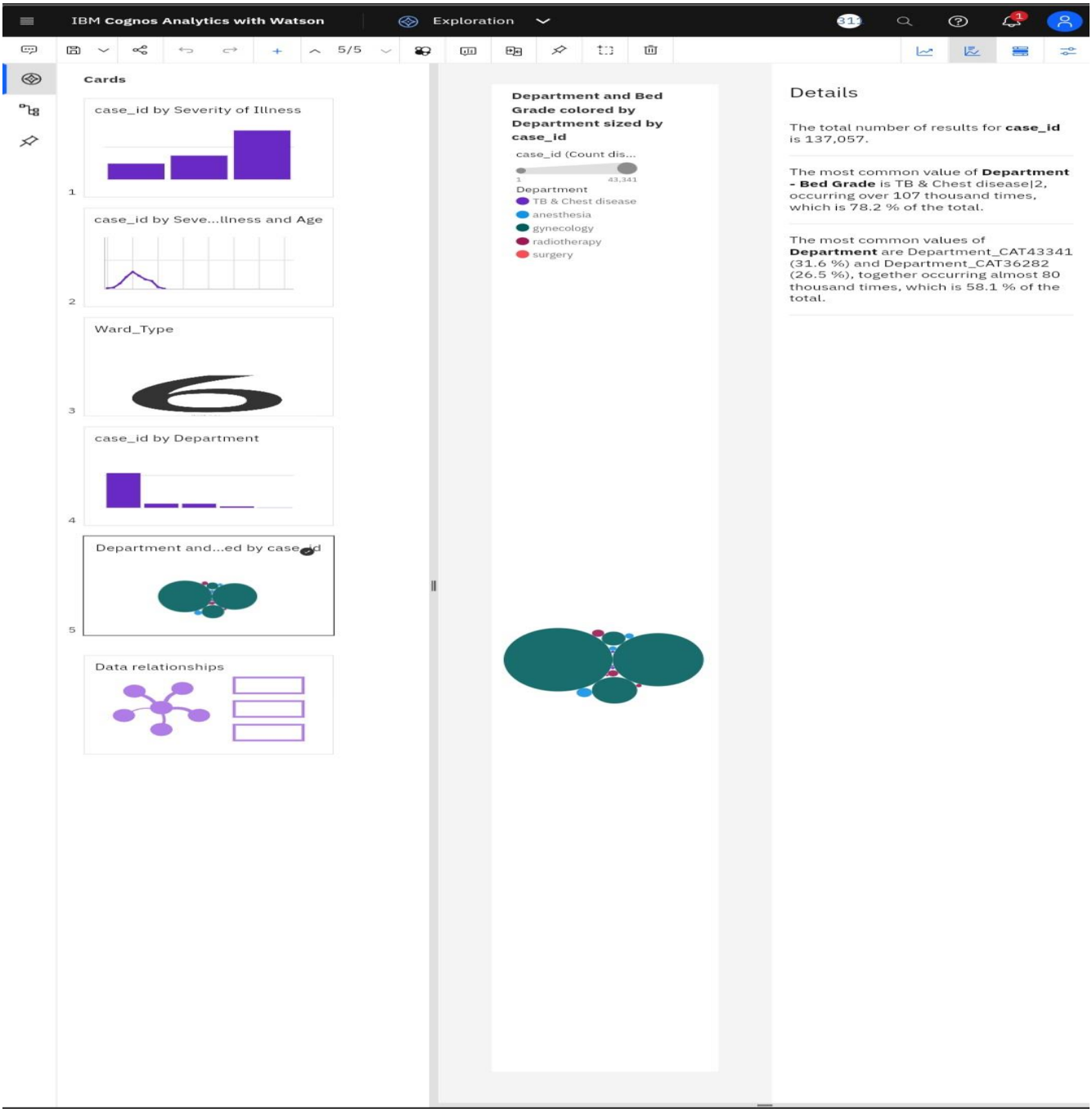


8. TESTING

8.1 TEST CASES



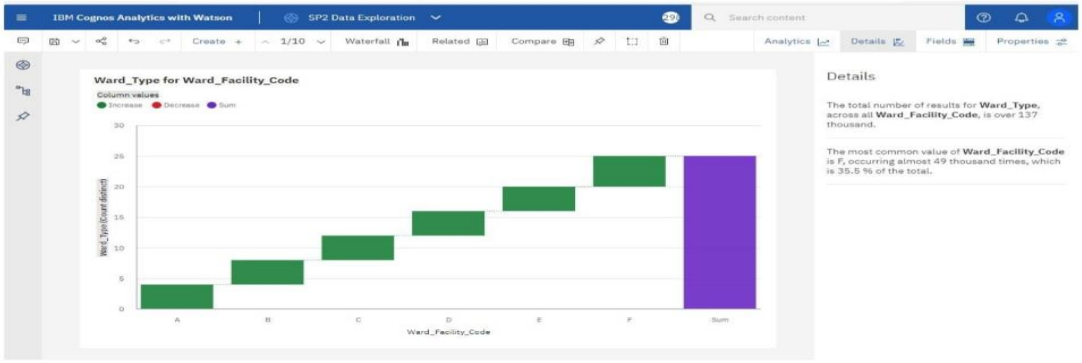
8.2 USER ACCEPTANCE TESTING



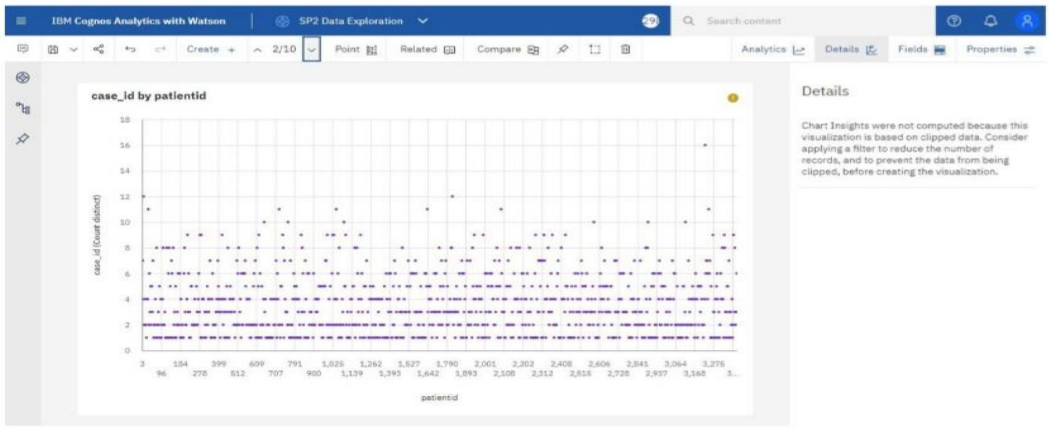
9.RESULTS

9.1 PERFORMANCE TESTING

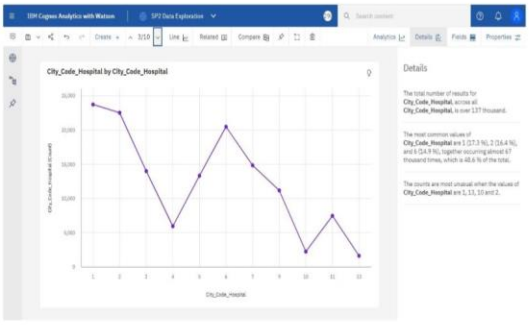
1.Ward_Type for Ward_Facility_Code



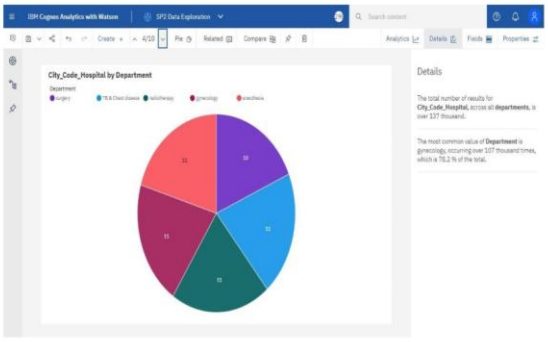
2. case_id by patient_id



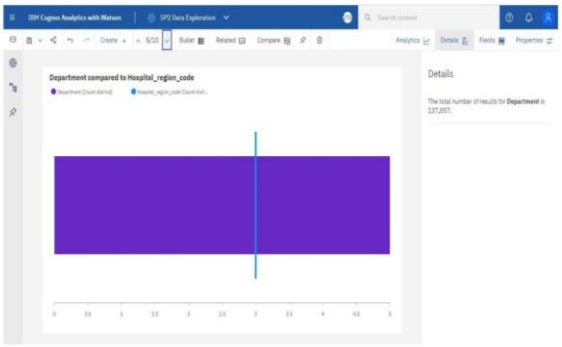
3. City_Code_Hospital by City_Code_Hospital



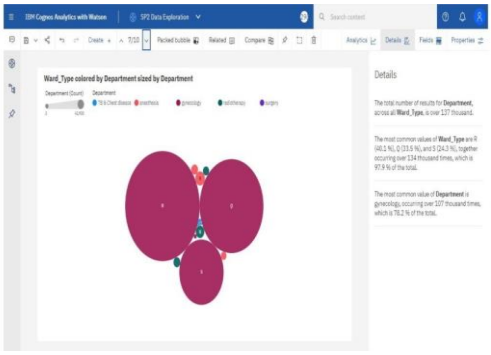
4. City_Code_Hospital by Department

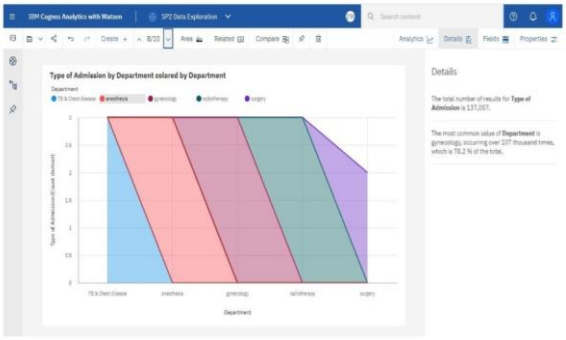


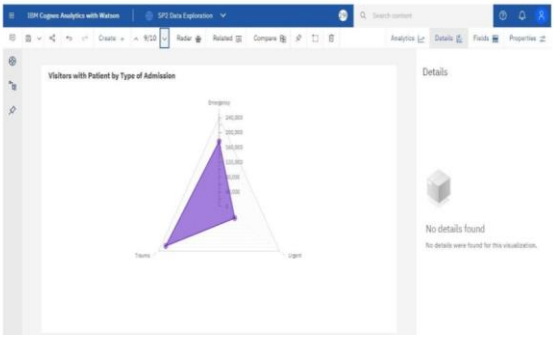
5. **Department compared to Hospital_region_code**

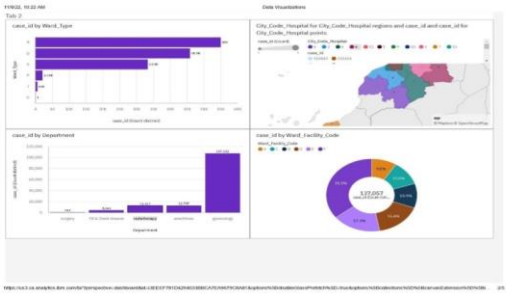


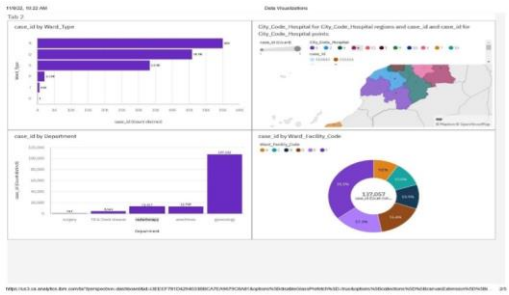
b

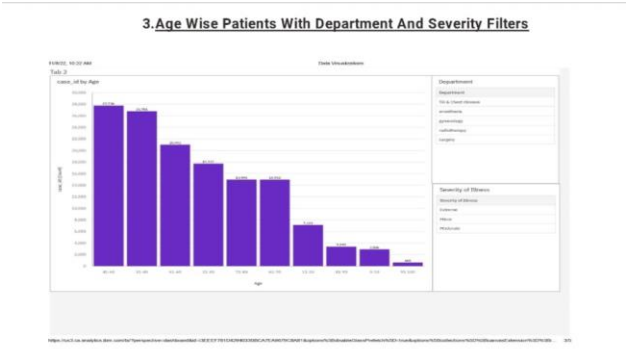


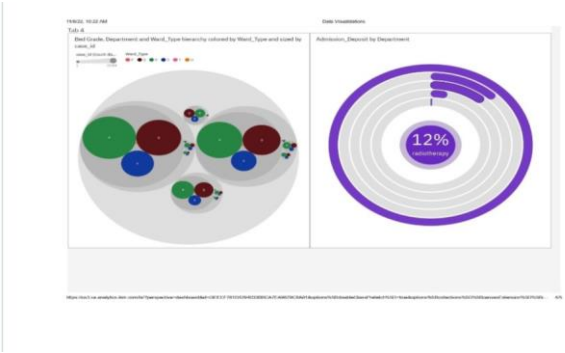


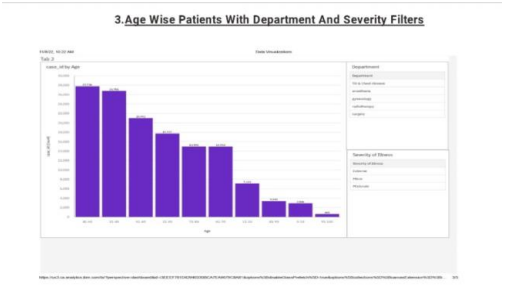












10. ADVANTAGES &DISADVANTAGES

10.1 ADVANTAGES

1. Improved research efforts
2. Improved health outcomes
3. Obtain operational insights
4. Improved staffing
5. Informed strategic planning

10.2 DISADVANTAGES

1. Lack of alignment within teams
2. Lack of commitment and patience
3. Low quality of data
4. Privacy concerns
5. Complexity & Bias

11.CONCLUSION

Data analytics has the potential to transform the way healthcare providers use sophisticated technologies to gain insight from their clinical and other data repositories and make informed decisions. In the future we'll see the rapid, widespread implementation and use of big data analytics across the healthcare organization and the healthcare industry.

12. FUTURE SCOPE

Data analysts can develop software to automatically inform patients about recommended lifestyle changes to prevent certain conditions. This helps improve performance by delivering data-based quality patient care which, in turn, improves patient satisfaction.