

ANALYTICS FOR HOSPITAL AND HEALTH-CARE DATA

A PROJECT REPORT

Submitted by

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ABSTRACT

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This paper is mainly streamered towards hospitals and their health-care data. Due to recent covid-19 pandemic has raised alarms over one of the most overlooked areas to focus. Healthcare management has various use cases for data science, patients health details and their past history with data records. Analyzing the data's with a module and exploring the visualization can improve the dataset. In order to discuss health data analytics and the role it plays in the health care sector, we must first understand the data that is being collected and analyzed. There is data being collected on the processes and procedures of the business side of health care, but there is also an enormous amount of health data being gathered, stored and analyzed. Health data is any data relating to the health of an individual patient or collective population. This information is gathered from a series of health information systems (HIS) and other technological tools utilized by health care professionals, insurance companies and government organizations. Consider the impact this has had on the COVID-19 pandemic. The data being collected is analyzed in real time to understand the effects of the virus better and predict future trends so we may slow the spread and prevent future outbreaks. Health care data management has the potential to lead to better care if used properly. With centralized datasets, there is immediate access to necessary information whenever and wherever it is needed. The addition of big data analytics improves efficiency on all fronts. Better data leads to better care.

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INTRODUCTION

CHAPTER 1

INTRODUCTION

The introduction about the analytics for hospital and health-care data with IBM-Cognos and analytics.

1.1 PROJECT OVERVIEW

Recent Covid-19 Pandemic has raised alarms over one of the most overlooked areas to focus on Healthcare. While Healthcare management has various use cases for using data science, patient length of stay is on critical parameter to observe and predict if one wants to improve the efficiency of the healthcare management in a hospital. This parameter helps hospitals to identify patients of high LOS-risk at the time of admission. Once identified, patients with high LOS risk can have their treatment plan optimized to minimize LOS and lower the chance of staff/visitor infection. Also, prior knowledge of LOS can aid in logistics such as room and bed allocation planning. Suppose you have been hired as Data Scientist of Health Man a not for profit organization dedicated to manage the functioning of Hospitals in a professional and optimal manner. The goal is to accurately predict the length of stay of 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.

1.2 PURPOSE

- a. This type of analysis is used to investigate why an event happened.
- b. This form of analysis is used to forecast something that will happen in the future. For example, a hospital might predict, based on trends observed over the past decade, that incoming cardiac patients will most likely increase by 20% this year.

- c. This is possibly the most important form of analysis in healthcare and the trend that is growing quickest. This form of analysis takes pre-existing data and implements treatment plans. For example, a healthcare provider might use a smart device to automatically analyze a patient's vital signs, preemptively alert them that they're at risk for developing a medical condition, and instruct them to visit their healthcare provider.
- d. While healthcare data analytics is highly advantageous, it can get pretty complicated, too. Whether the data was collected by assessing important real-time signs or through electronic health records (EHR), it needs to be derived from various sources by following proper government regulations, thus making the process precarious and complex.
- e. Anything from clinical data to patient behaviour, medical expenses, healthcare, or pharmaceuticals data analytics can be employed at the micro and macro level to evidently enhance operations, boost patient care, and even tackle the overall expenses.



Fig 1.1 Analytics for healthcare

LITERATURE SURVEY

CHAPTER 2

LITERATURE SURVEY

The introduction about the literature survey gone through for the project are briefly discussed in this chapter.

2.1 EXISTING PROBLEM

As we all know health care organisation will understand of big data analytics. Data mining offers novel information regarding health care helpful for making administrative as well as prediction disease, selection of treatment, health insurance policy. The novel corona virus pandemic outbreak is seriously threatening human health. Security optimization implementation and testing on real world patients Hospitalization cost and the insured population all show a trend of increasing year by year. The users to help to see understand the valuable information provided by data care visual analytics huge amount of structured and unstructured and semi structured data have been generated by various institutions around the world.

This research demonstrates to address lack, this study examines the historical development, architectural design and component functionalities of big data analytics. Data sets can gain unwanted attention from hackers and important information can be leaked to competitors. As each and every patient records are important to the hospital organisation and the data should be protected with security measures. The health industry sector has been confronted by the need to manage the big data being produced by various sources, which are well known for producing high volumes of heterogeneous data lack of standardisation methods and electronic tools. In recent years, there has been much research in medical big data, mainly targeting data collecting data, data analysis and visualisation.

2.2 REFERENCES

[1] Big data analytics for healthcare industry.

Authors: R Sunil Kumar, A Daniel

Published in: 2015 IEEE.

The user to help able to information provided by the healthcare data in any need with the help of system the is developed using the AI with chats analysis and visualization. Analysing the dats with the better understand and current practices, capabilities and challenges related to clinical data analytics. Multiview data analytics requires advanced machine learning techniques.

Merits: The data analysis will help to the hospital organisation with the structured data access at anytime through systems.

Demerits: Data should be maintained and protected as leakage of data could lead to unwanted issues to the organisation in privacy concerns.

[2] Intelligent and health care management.

Authors: Yinchuan Wang, .et.al, Zhihan Lv, .et.al,

Published in: 2017 IEEE.

Hospitalization cost and the insured and polulation all show a trend of increasing year by year. Data analytics become a future escalating tool of all industries including medicine, robotics, etc.,

Merits: As the population increases the productivity also increases so a system can manage this work loads.

Demerits: There is not mandatory to set a employee for data handling as system does it with AI build intelligence.

[3] IoT ENABLED SMART HEALTHCARE SYSTEM.

Authors: Syed Rooh Ullah, Divya Tomer, Imran Ahmed.

Published in: 2021 IEEE.

IoT enabled devices realtime, interoperability with prediction of disease real data set focusing on different pandemic symptoms. Unable to predict the data with the right chart and visualaization.

Merits: Data prediction will be viewed in the right visualization and chart with different kind of analysis.

Demerits: Accurate data is needed and analysis the pattern.

[4] A FRAMEWORK FOR DATA ANALYTICS BASED ON SYSTEMS.

Author: Alejandro Bal dominos .et.al.,

Published in: 2014 IEEE.

The visual analytics pattern is undertaken and the framework is designed based on the system with the data care information. The user to help the provided by healthcare and information is collected from the hospital organisation. Lack of oraganisational alignment and strategy for data analyticsad strandardized methods and report formation.

Merits: Data accessing is flexible with the designed framework.

Demerits: Maintainance of data fomate should be structured and grouped.

2.3 PROBLEM STATEMENT DEFINITION

There are multiple problems in the hospital health care organisation as some of the them are mentioned and solved though analysis of the various problem statements.

Who does the problem affect?	Covid-19 Patients
What are the boundaries of theproblem?	People who are affected by Covid19
What is the issue?	In medical aspects, if the patient is affected by Covid-19 and he is discharged before 100% recovery, he would be a transmitter of the disease. So, we must correctly predict the Length of Stay of the patient in the hospital
When does the issue occur?	It occurred during the current pandemic period and still in progress
Where does the issue occur?	The issue occurs in hospitals Providing treatment for Covid-19 patients
Why is it important that we fix the problem?	It is required for prevent the transmission of disease and reduce cost due to hospital readmission
What solution to solve this issue?	An automated system is introduced to identify different factors involved in finding the Length of Stay through various visualization.
What methodology used to solve the issue?	Machine learning techniques are used to predict the Length of Stay of a Covid-19 patient

Problem Statement (PS)	I am (Customer)	I'm trying to	But	Because	Which makes me feel
PS-1	Patient	Get treatment	Did not receive treatment	Pandemic situation	Frustrated
PS-2	Hospital Management	Allocating beds	Limit exceeded	Pandemic situation	Grievance

Fig 2.1 ProblemStatement Definition

IDEATION & PROPOSED
SOLUTION

CHAPTER 3

IDEATION & PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS

An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviors and attitudes. It is a useful tool to help teams better understand their users.

Creating an effective solution requires understanding the true problem and the person who is experiencing it. The exercise of creating the map helps participants consider things from the user's perspective along with his or her goals and challenge.

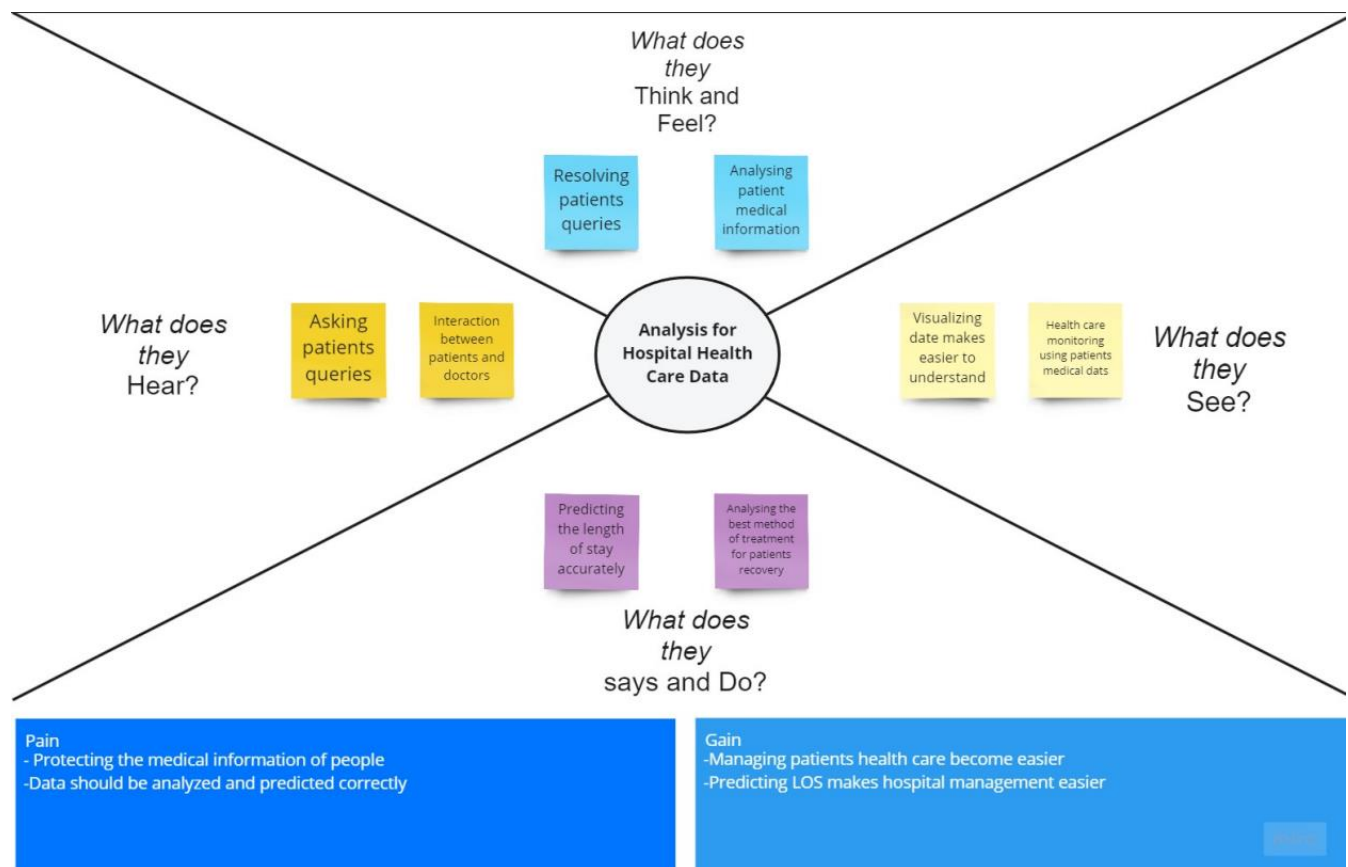


Fig 3.1 Empathy Map Canvas

3.2 IDEATION & BRAINSTORMING

Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon, and all participants are encouraged to collaborate, helping each other develop a rich amount of creative solutions.

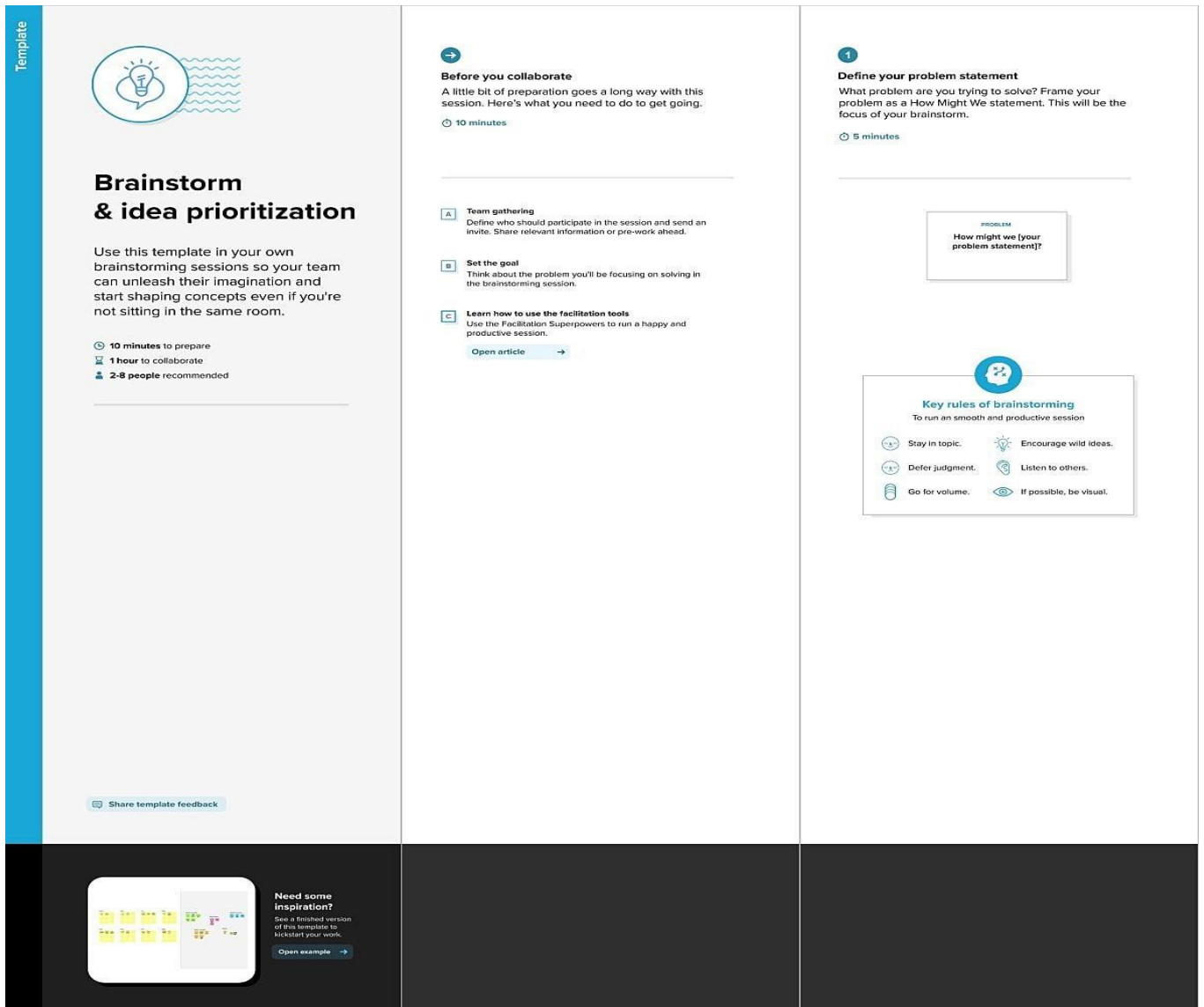


Fig 3.2 Brainstorming 1

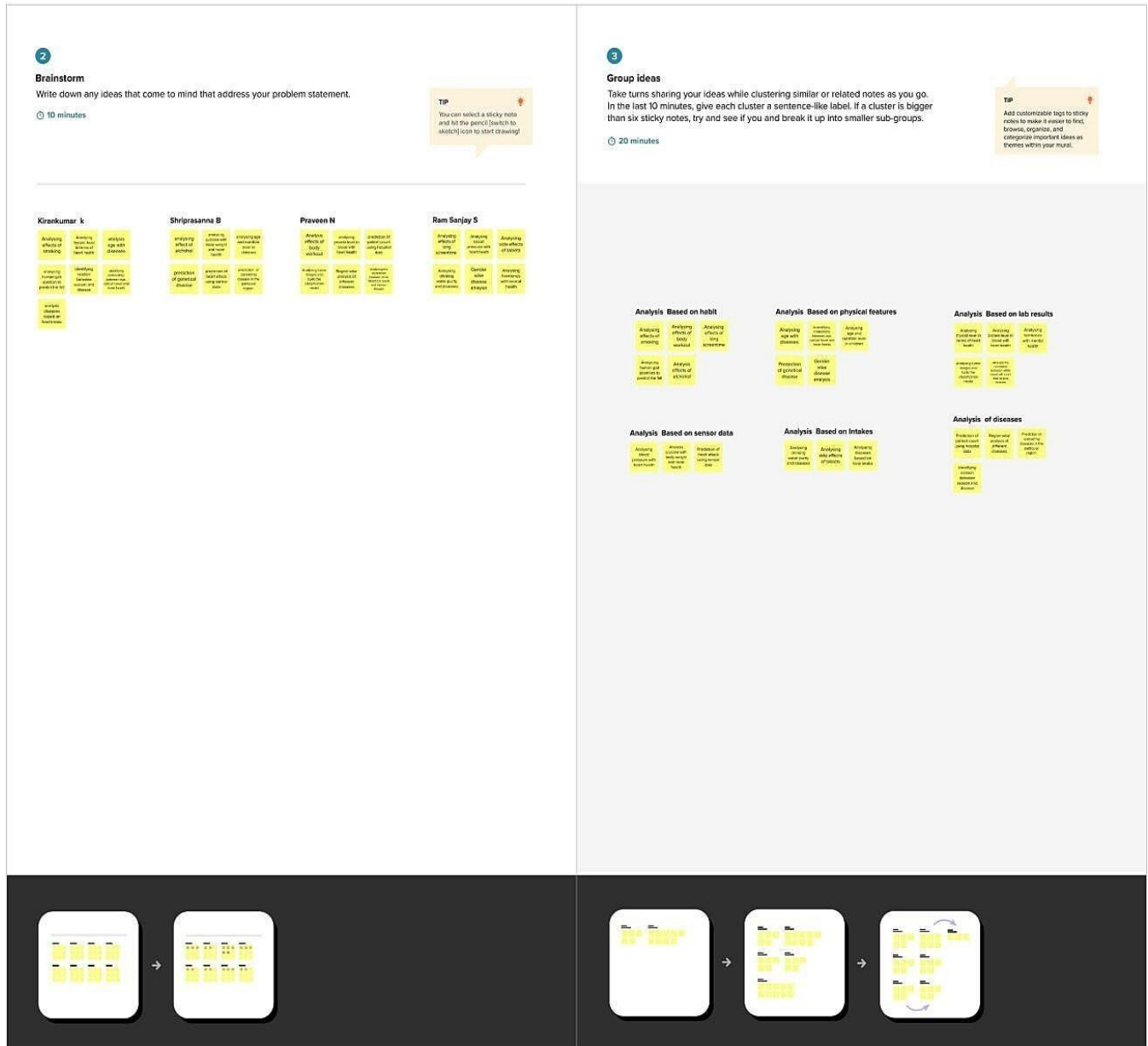


Fig 3.3 Brainstorming 2

4

Prioritize
 Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

20 minutes

Importance
 If each of these tasks could get done without any difficulty or cost, which would have the most positive impact?

Feasibility
 Regardless of their importance, which tasks are more feasible than others? (Cost, time, effort, complexity, etc.)

TIP
 Participants can use their cursors to point at where sticky notes should go on the grid. The facilitator can confirm the spot by using the laser pointer holding the H key on the keyboard.

After you collaborate
 You can export the mural as an image or pdf to share with members of your company who might find it helpful.

Quick add-ons

A Share the mural
 Share a view link to the mural with stakeholders to keep them in the loop about the outcomes of the session.

B Export the mural
 Export a copy of the mural as a PNG or PDF to attach to emails, include in slides, or save in your drive.

Keep moving forward

Strategy blueprint
 Define the components of a new idea or strategy.
[Open the template →](#)

Customer experience journey map
 Understand customer needs, motivations, and obstacles for an experience.
[Open the template →](#)

Strengths, weaknesses, opportunities & threats
 Identify strengths, weaknesses, opportunities, and threats (SWOT) to develop a plan.
[Open the template →](#)

[Share template feedback](#)

Fig 3.4 Brainstorming 3

3.3 PROPOSED SOLUTION

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	1. Using cognos display the data graphical format. 2. Clean the data using cognos 3. Display the data in days like 1-10 or 11-20 etc.,
2.	Idea / Solution description	1. If numeric value is null perform average or mid value or repeated value. 2. If String value is null perform repeated value.
3.	Novelty / Uniqueness	Getting real time data to find out the high accuracy.It help to find out the result eassy
4.	Social Impact / Customer Satisfaction	Depend upon the Analytic patient is get teatment .Easily find out the patient health level
5.	Business Model (Revenue Model)	In low cost we Find out the result and eassly get the result
6.	Scalability of the Solution	We Can use this solution for any type of age peoples

PROBLEM SOLUTION FIT

<p><u>1. Customer Segments</u></p> <p>Health care center and patient with high LOS risk</p>	<p><u>6. Customer CONSTRAINTS</u></p> <p>Lack of effective data governance procedure, data must be clean, Data Collection, resource management</p>	<p><u>5. Available Solution</u></p> <p>Creating dashboard for tracking ratio of doctors to patients can ensure that hospitals are adequately staffed.</p> <p>PROS: provide visual reference CONS: data security, better design</p>
<p><u>2. JOBS-TO-BE-DONE / PROBLEMS</u></p> <p>Visualize the following, Length of Stay, Severity of illness, Age and Department Wise Patient Room Availability</p>	<p><u>9. Problem ROOT CAUSE</u></p> <p>Capturing Accurate Data, Data Visualization, Unstructured data</p>	<p><u>7. Behaviour</u></p> <p>Analyzing the data and get solutions from the visualization</p>
<p><u>3. Triggers to Act Prevailing</u></p> <p>New technology to monitor their health</p>	<p><u>10. Your Solution</u></p> <p>Clean, scaled, formatted, and quality data must be used. Using infographic dashboard to represent ideas and data</p>	<p><u>8. Channels of Behaviour</u></p> <ol style="list-style-type: none"> 1. Online: Compare the data with other data with other 2. Offline: Share data with other

Fig 3.5 Problem Solution Fit

REQUIREMENT ANALYSIS

CHAPTER 4

REQUIREMENT ANALYSIS

In this chapter, the requirement analysis of the proposed system has been discussed along with the brief explanation about its advantages.

4.1 FUNCTIONAL REQUIREMENT

Following are the functional requirements of the proposed solution.

S.NO	Functional Requirements	Story
1	Data Gathering	Gathering data From kaagle
2	DB	Upload data in DB2
3	Connect DB with Cognos	Cleaning Data
4	Data Exploration	Explore the data in graphical format
5	Dashboard	Create Dashboard interactively
6	Report	Create report for various fields
7	Story	Create story and animation

4.2 NON-FUNCTIONAL REQUIREMENT

Following are the non-functional requirements of the proposed solution.

Working with open source platform	GitHub
Prepare Step by Step process Doc	Project Documents

This chapter dealt with the functional and non-functional requirement analysis of proposed system.

PROJECT DESIGN

CHAPTER 5

PROJECT DESIGN

5.1 DATA FLOW DIAGRAMS

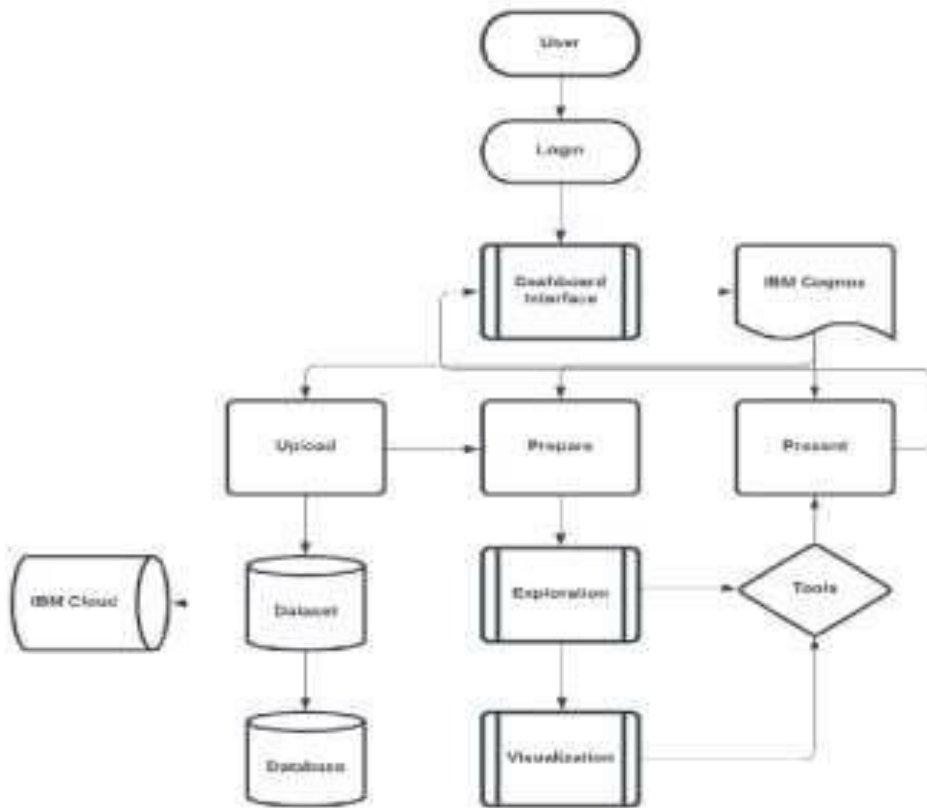


Fig 5.1 Dataflow Diagram

5.2 SOLUTION & TECHNICAL ARCHITECTURE

5.2.1 SOLUTION ARCHITECTURE

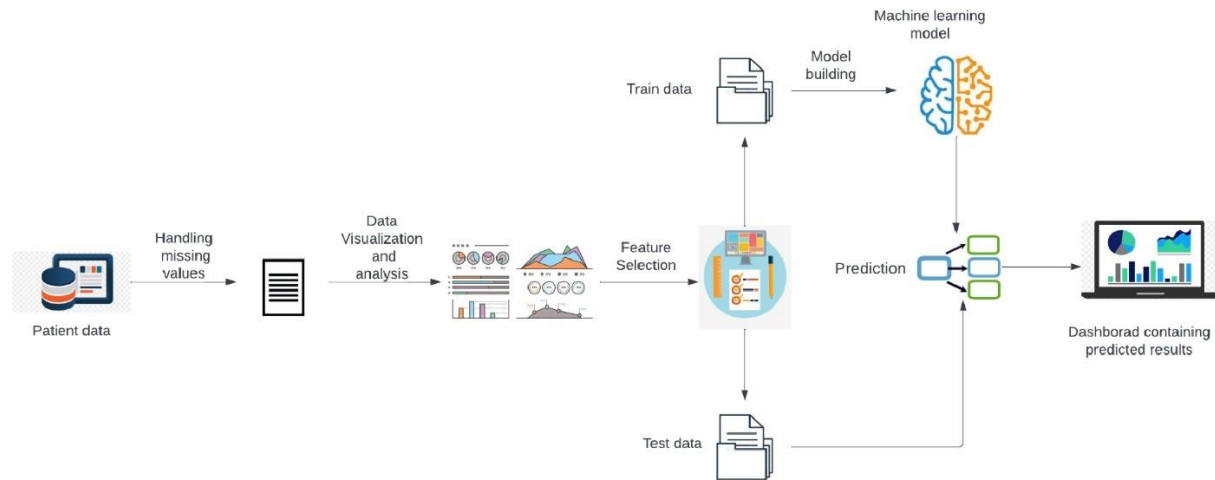


Fig 5.2 Solution Architecture Diagram

5.2.2 TECHNICAL ARCHITECTURE

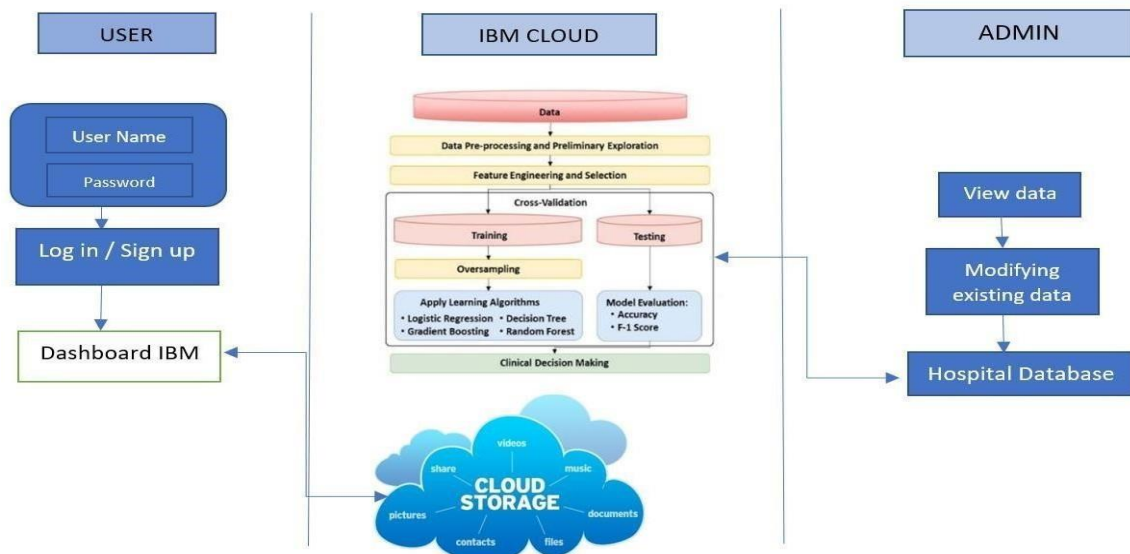


Fig 5.3 Technical Architecture Diagram

5.3 USER STORIES

S.NO	Funnnctional Requirements	User Story Number	Tasks	Acceptance Criteria	Priority	Release
1	Data Gathering	1	Gathering Data	Using API	High	Sprint1
2	Pre- processing	2	Cleaning the data inproper format	Cleaned Data	High	Sprint 1
3	Data Exploration	3	Explore the data	Display data in graph	High	Sprint1
4	Dashboard	4	Creating various chart	Intractive Dashboard	High	Sprint 2
5	Reports	5	Creating report for various field	Intractive Report	High	Sprint 3
6	Story	6	Creating Animation Using picture	Various animation and slides	High	Sprint 4
7	Web Application	7	Cognos Embedded Web application	Intractive Web Application	High	Sprint 4

Table 5.1 User Stories

PROJECT PLANNING & **SCHEDULING**

CHAPTER 6

PROJECT PLANNING & SCHEDULING

6.1 SPRINT PLANNING & ESTIMATION

MILESTONES	ACTIVITY LIST
MILESTONE-1	Data collection
MILESTONE-2	Uploading the data on IBM Cognos
MILESTONE-3	Data exploration in IBM COGNO
MILESTONE-4	Data Visualization in IBM COGNOS
MILESTONE-5	Creating an interactive dashboard
MILESTONE-6	Displaying data in dashboard
MILESTONE-7	Filtering the dataset with optimal attributes
MILESTONE-8	Applying various ML algorithm and getting more accurate results
MILESTONE-9	Displaying the results as per the required format
MILESTONE-10	Deploying in GitHub

Table 6.1 Sprint Planning and Estimation

6.2 SPRINT DELIVERY SCHEDULE

Use the below template to create product backlog and sprint schedule

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Register	USN-1	As a Admin, I can register users and provide username and password.	10	Medium	Arunkumar V R
Sprint-1	Login	USN-1	As a user, I can login into the website/ application using username and password	20	High	Ajith S
Sprint-2	Dashboard	USN-2	As a user, I can add Patient Details like Patient name, contact number, age etc.	10	High	Madhan kumar
Sprint-2	Dashboard	USN-3	As a user, I can add bed details, Doctor details and other hospital detail.	10	High	Abishake A M
Sprint-3	Dashboard	USN-4	As a user, I can upload patient medical reports.	20	High	Arun kumar V R
Sprint-4	Virtualize	USN-5	As a user, I can virtualize the data which are analyzed	20	High	Abishake AM

Table 6.2 Sprint Delivery Schedule

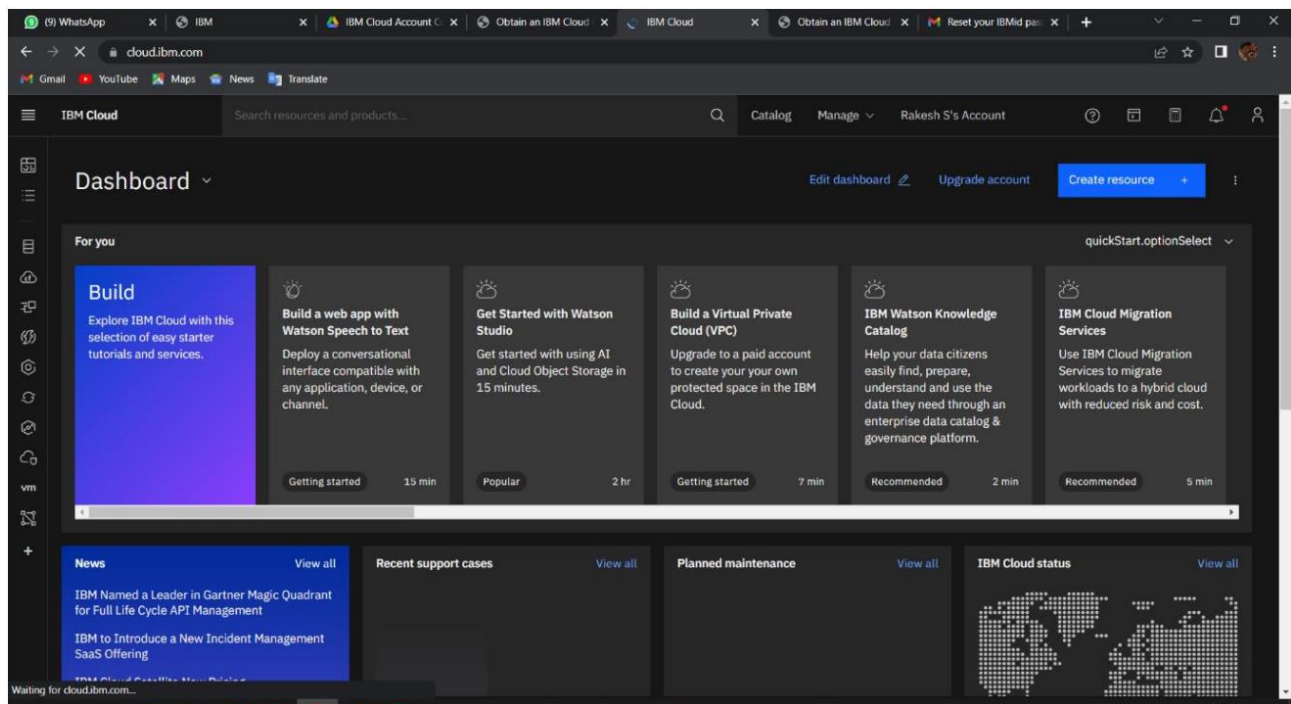
CODING AND SOLUTIONING

CHAPTER 7

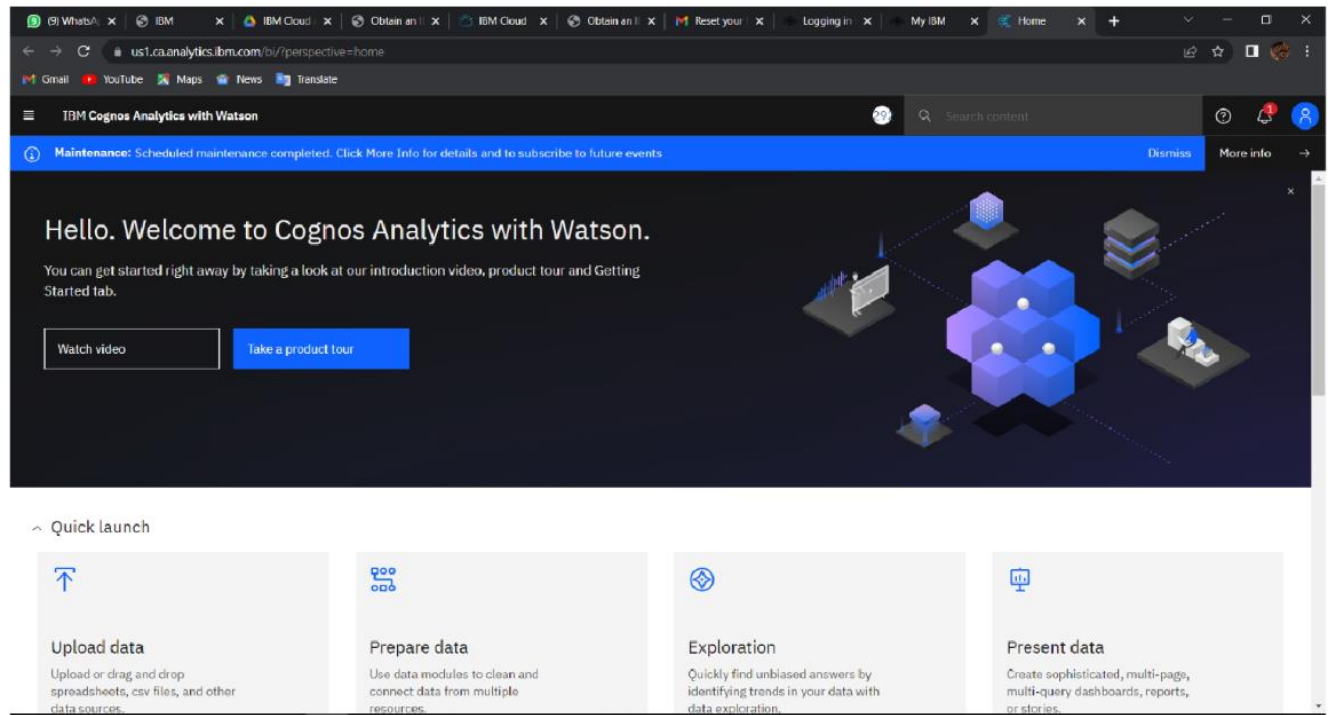
CODING AND SOLUTIONING

7.1 CREATE AND CONFIGURE IBM CLOUD SERVICES

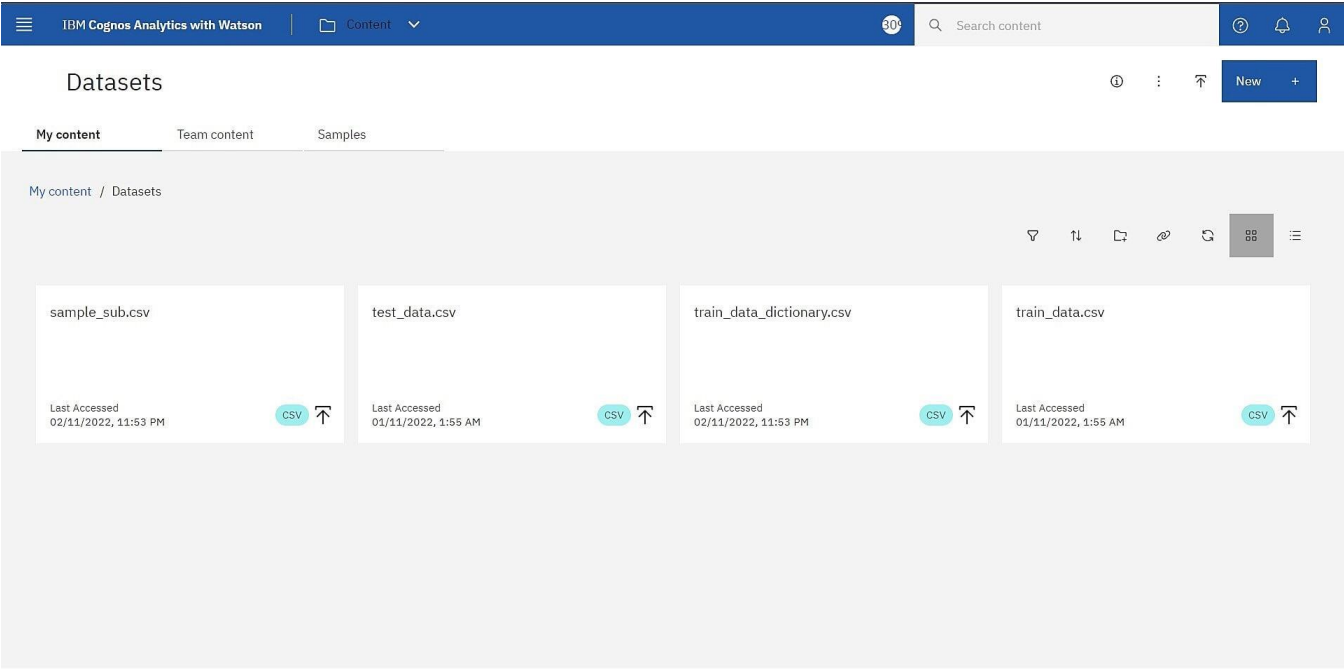
USN 1: As a user, I will create IBM cloud account.



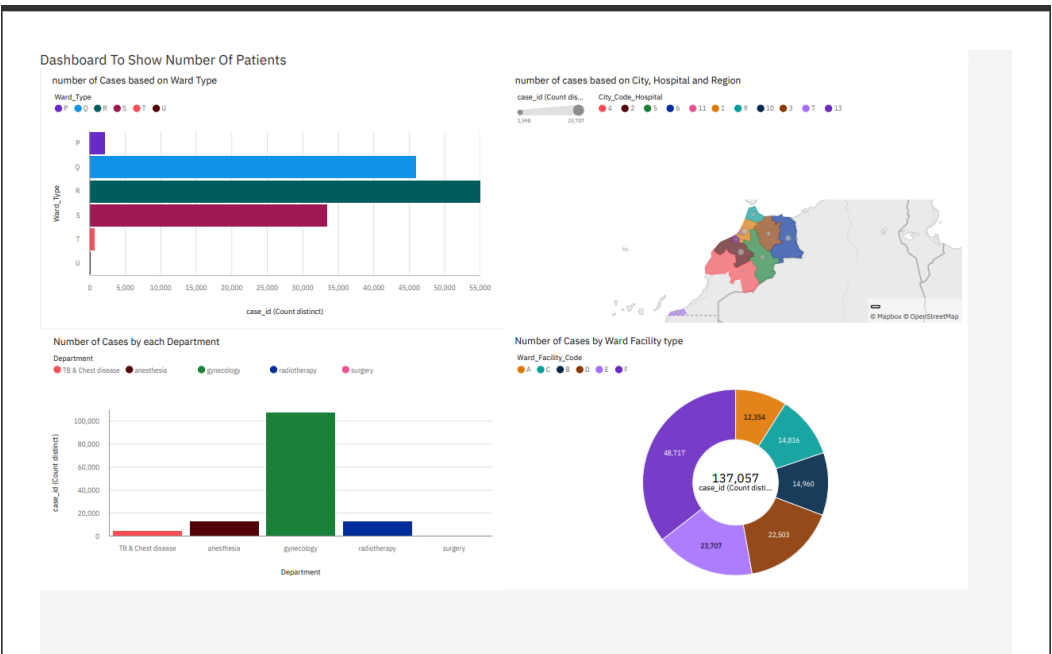
USN 2: As a user, I will create IBM cognos account.



USN 3: Loading the datasets

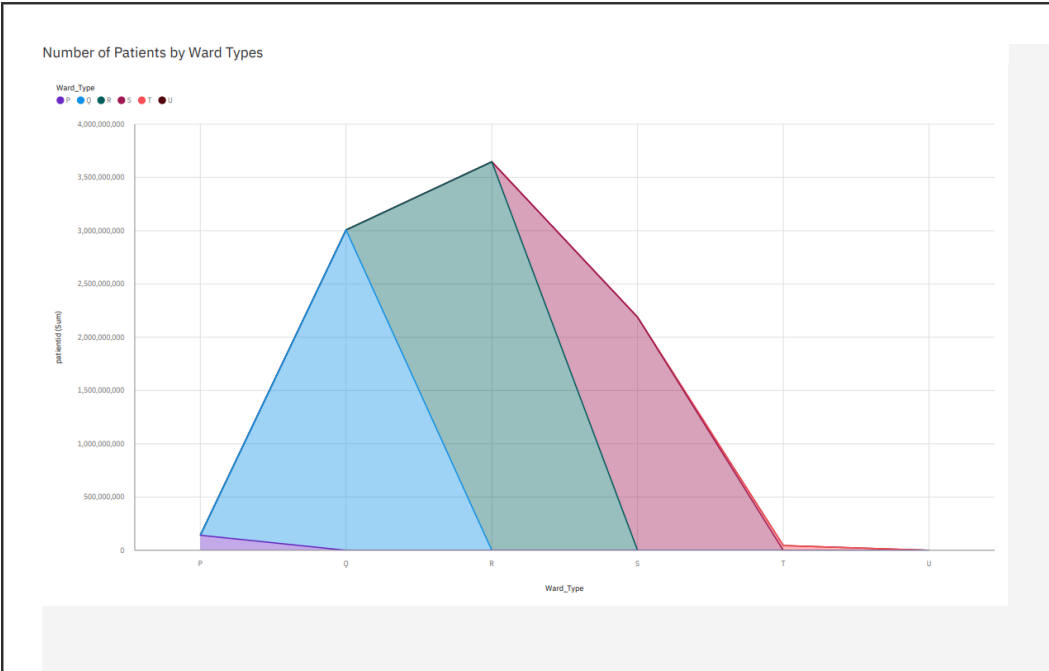


USN 4: Data analysing with different visualisation chart

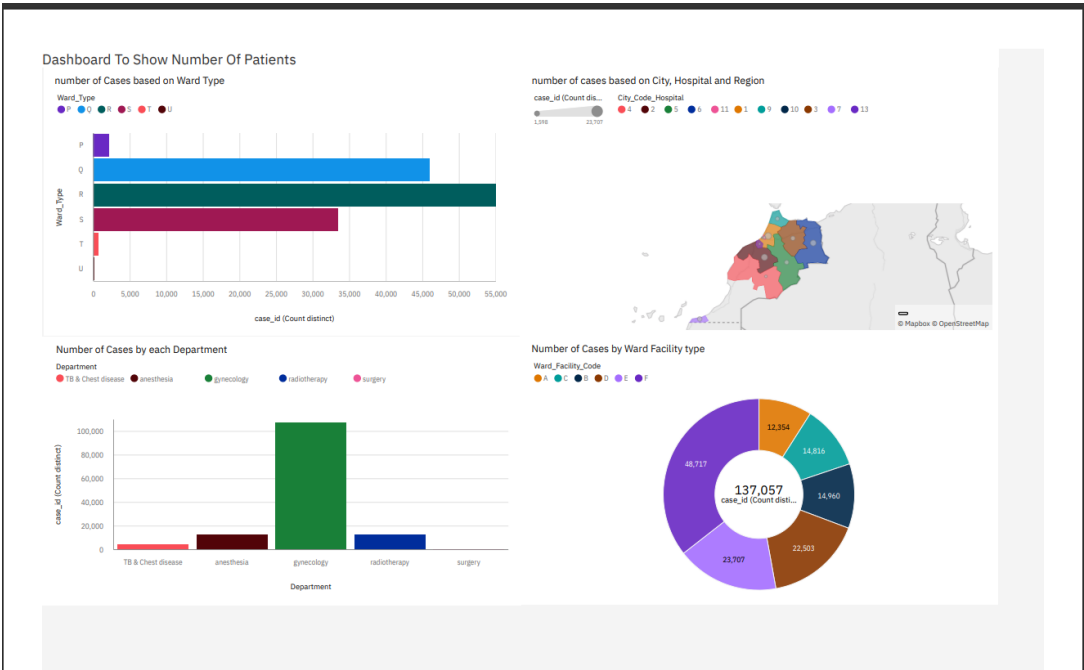


7.2 Data Visualizations

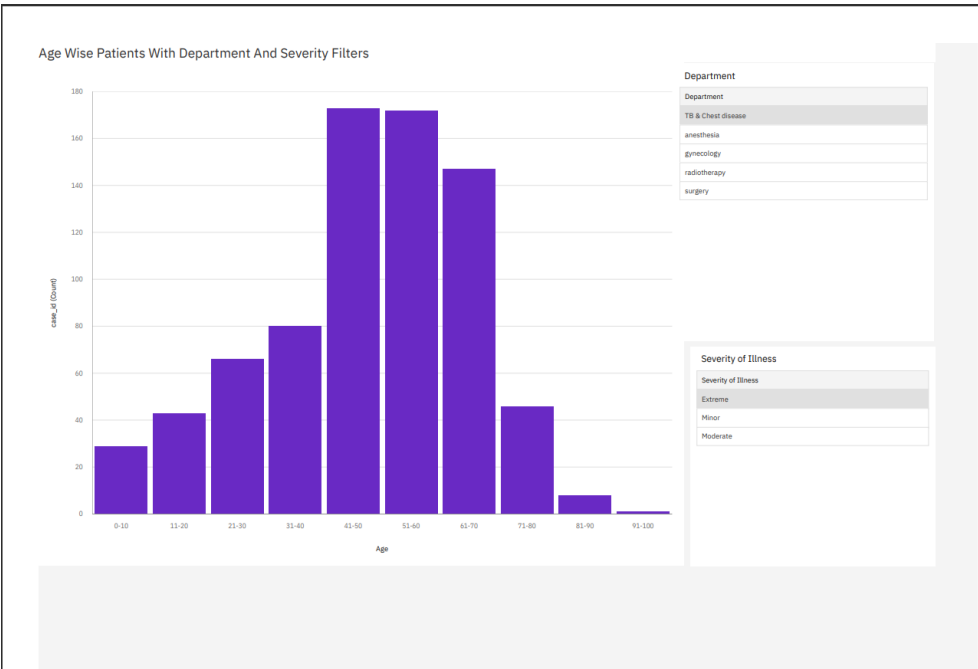
USN 5: Number of Patients By ward types.



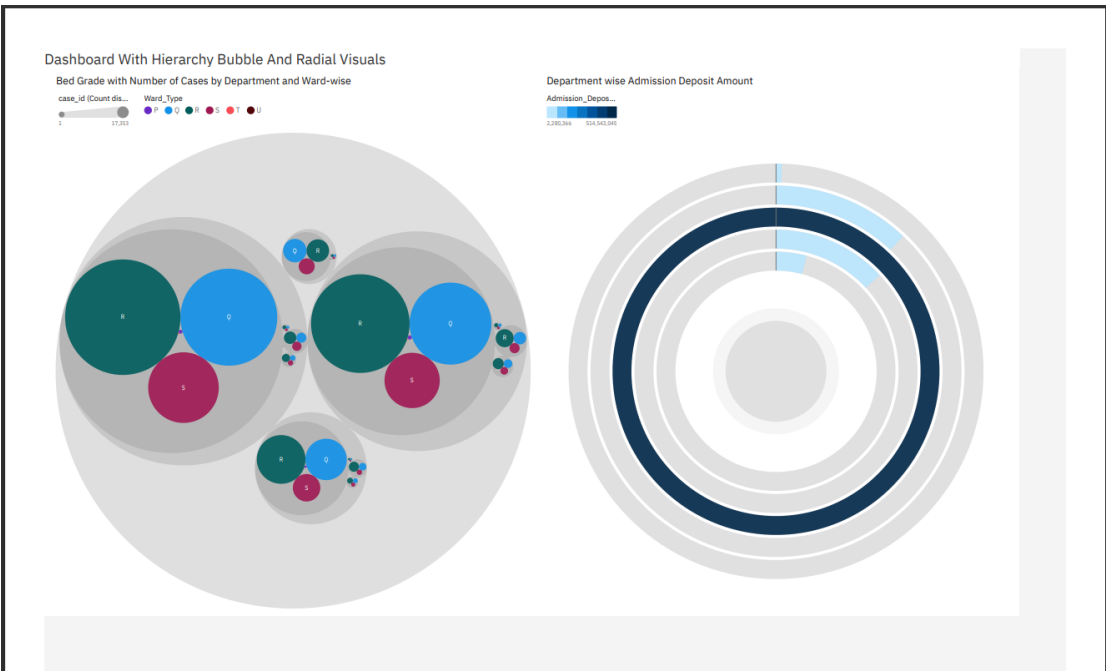
USN 6: Dashboard to show number of patients.



USN 7 : Age wise patients with department and severity filters.



USN 8: Dashboard with Hierarchy bubble and radial visuals.



USN 9: Select the dataset.

us3.ca.analytics.ibm.com/bi/?perspective=content&tab=myContent&folder=IFF358348157B4A5E8ADEDE64CBD98C17

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<input type="checkbox"/>	dataset	Folder	21/09/2022, 7:53 AM

USN 10: Prepare the dataset.

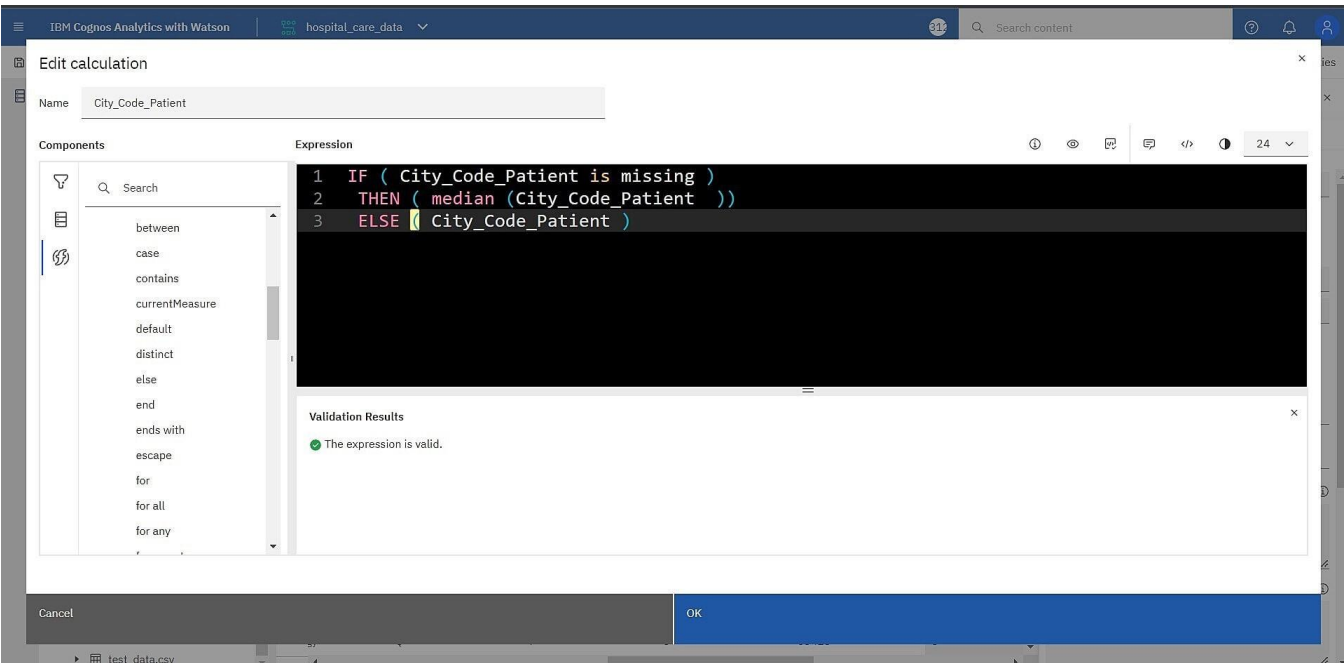
IBM Cognos Analytics with Watson · hospital_care_data · Search content · ? · ? · ?

Grid · Relationships · Custom tables

Search · hospital_care_data · Navigation paths · train_data.csv · test_data.csv

Row Id	case_id	Hospital_code	Hospital_type_code	City_Code_Hospital	Hospital_region_code	Available E...in Hospital	Department
1	1	8	c	3	Z	3	radiotherapy
2	2	2	c	5	Z	2	radiotherapy
3	3	10	e	1	X	2	anesthesia
4	4	26	b	2	Y	2	radiotherapy
5	5	26	b	2	Y	2	radiotherapy
6	6	23	a	6	X	2	anesthesia
7	7	32	f	9	Y	1	radiotherapy
8	8	23	a	6	X	4	radiotherapy
9	9	1	d	10	Y	2	gynecology
10	10	10	e	1	X	2	gynecology
11	11	22	g	9	Y	2	radiotherapy
12	12	26	b	2	Y	4	radiotherapy
13	13	16	c	3	Z	2	radiotherapy
14	14	9	d	5	Z	3	radiotherapy
15	15	6	a	6	X	4	gynecology
16	16	6	a	6	X	3	gynecology

USN 11: Null values cleaning process.



The screenshot shows the 'Data module' in IBM Cognos Analytics. The 'Data module' list on the left includes 'train_data.csv' and 'test_data.csv'. The 'Grid' view is selected, showing a table with 16 rows and 9 columns. The columns are: Row Id, case_id, Hospital_code, Hospital_type_code, City_Code_Hospital, Hospital_region_code, Available E...in Hospital, and Department. The data is as follows:

Row Id	case_id	Hospital_code	Hospital_type_code	City_Code_Hospital	Hospital_region_code	Available E...in Hospital	Department
1	1	8	c	3	Z	3	radiotherapy
2	2	2	c	5	Z	2	radiotherapy
3	3	10	e	1	X	2	anesthesia
4	4	26	b	2	Y	2	radiotherapy
5	5	26	b	2	Y	2	radiotherapy
6	6	23	a	6	X	2	anesthesia
7	7	32	f	9	Y	1	radiotherapy
8	8	23	a	6	X	4	radiotherapy
9	9	1	d	10	Y	2	gynecology
10	10	10	e	1	X	2	gynecology
11	11	22	g	9	Y	2	radiotherapy
12	12	26	b	2	Y	4	radiotherapy
13	13	16	c	3	Z	2	radiotherapy
14	14	9	d	5	Z	3	radiotherapy
15	15	6	a	6	X	4	gynecology
16	16	6	a	6	X	3	gynecology

USN 12: Python pandas with numpy.

```
import pandas as pd

import numpy as np

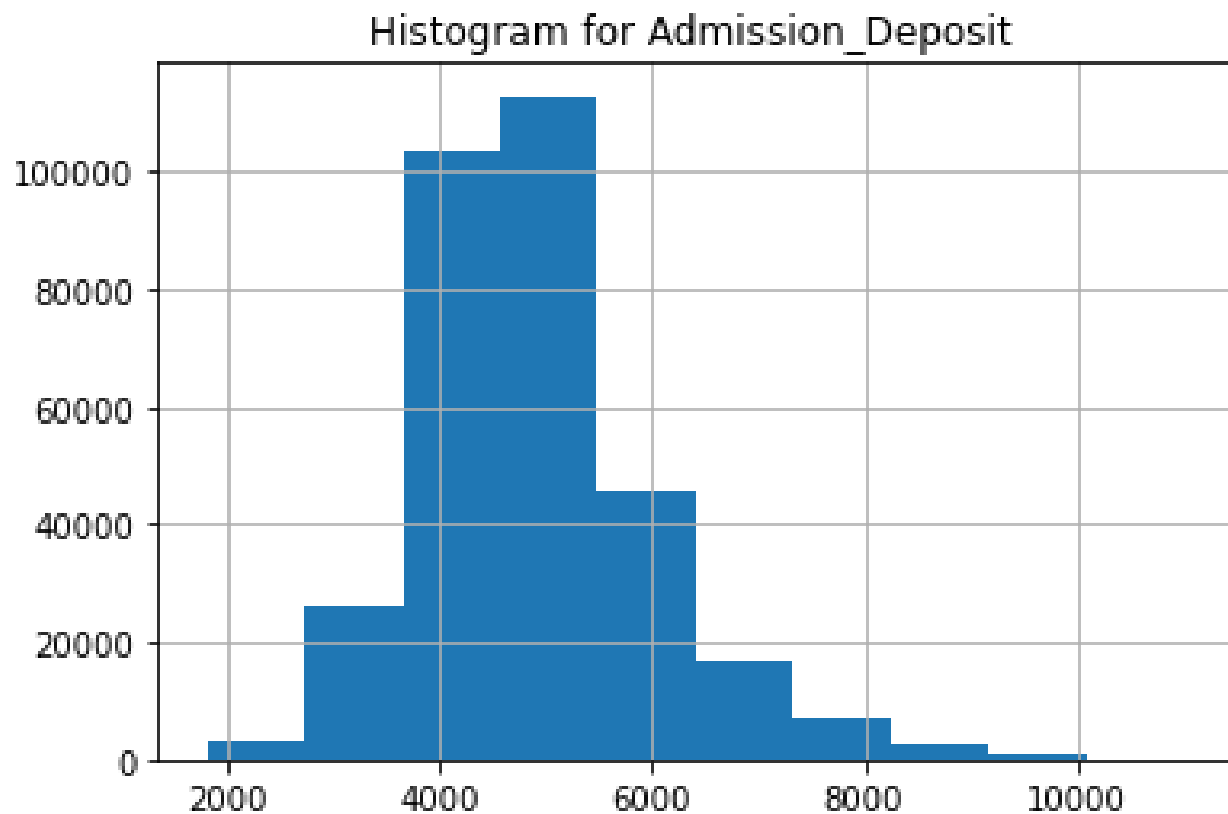
import matplotlib.pyplot as plt

import seaborn as sns

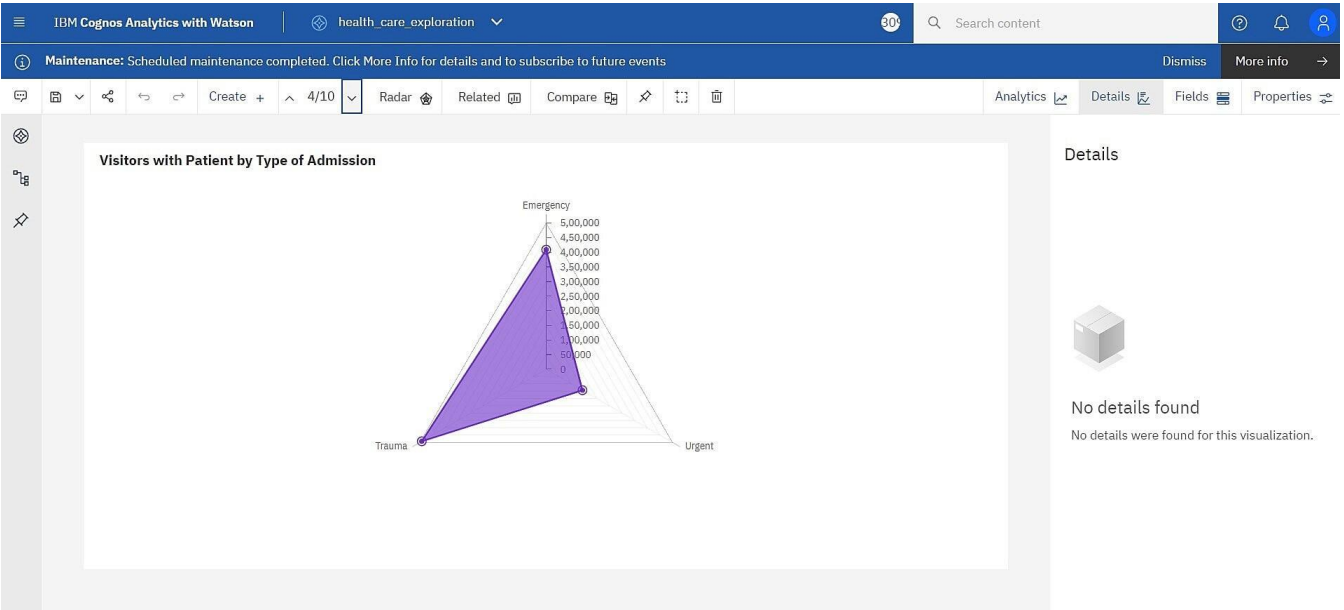
%matplotlib inline

df= pd.read_csv("C:/Users/nprav/OneDrive/Desktop/Healthcare_Data/train_data.csv")
```

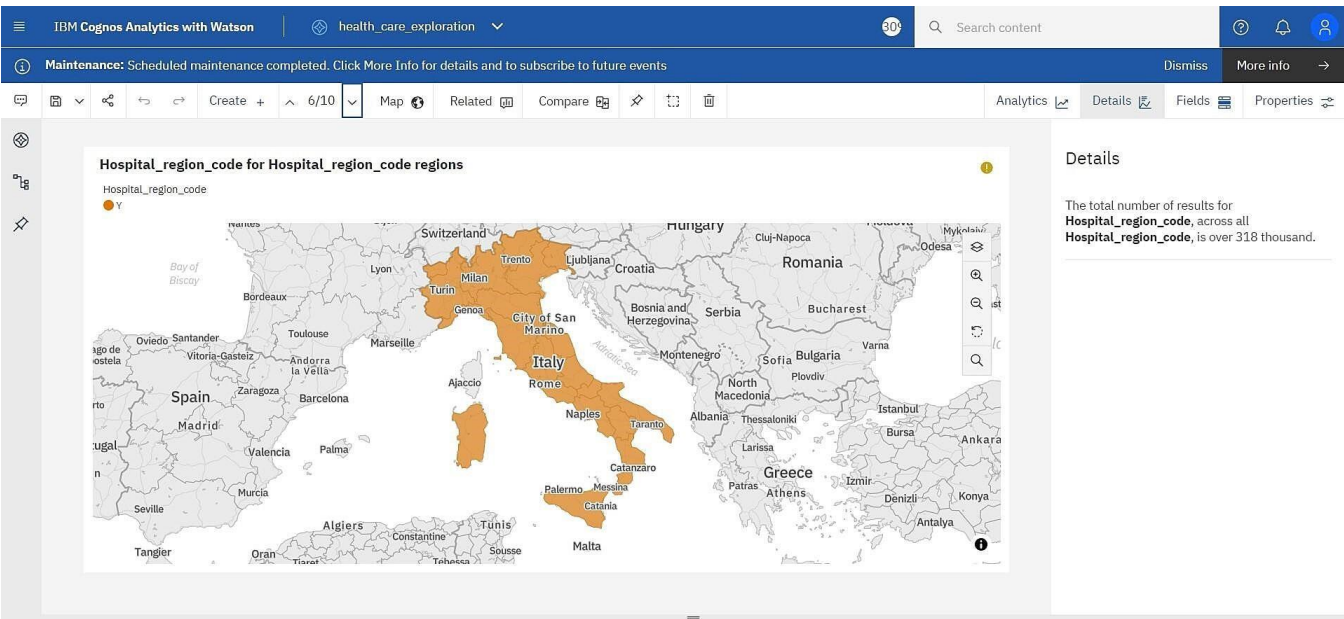
df



USN 13: Visitors with patient by type of admission.



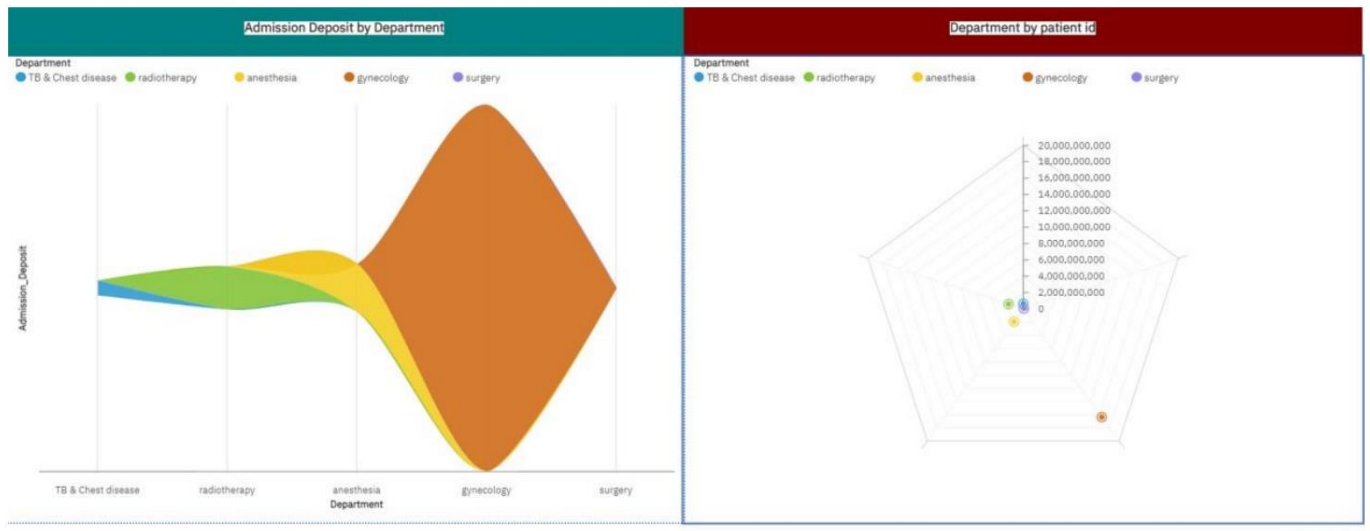
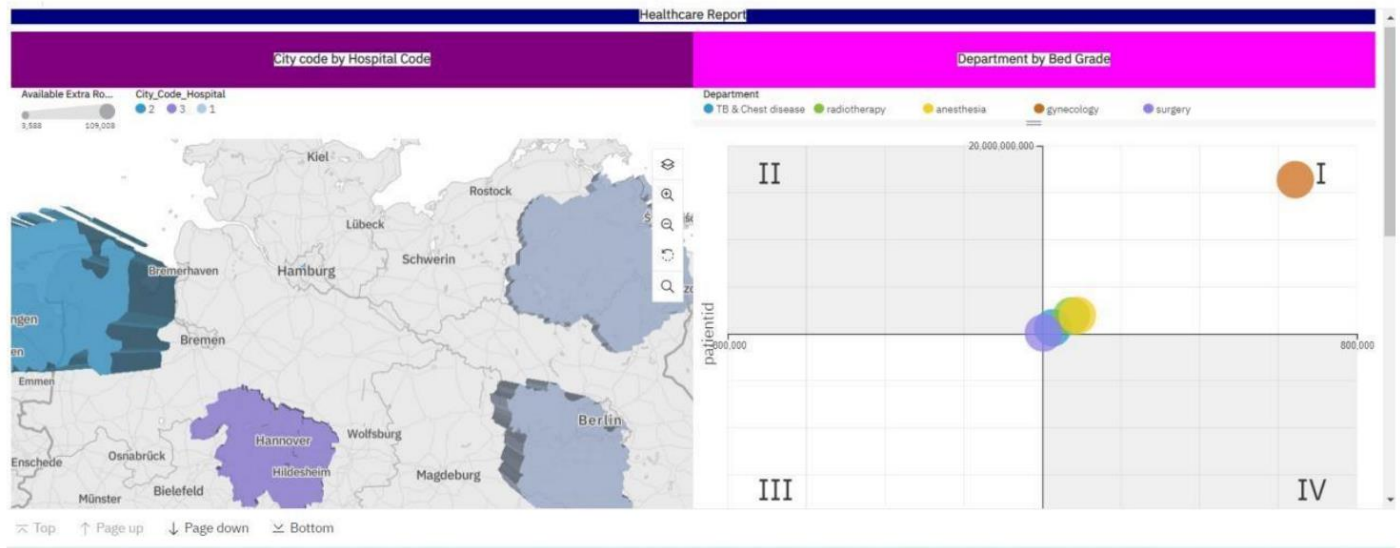
USN 14: Hospital region code for hospital region code regions.



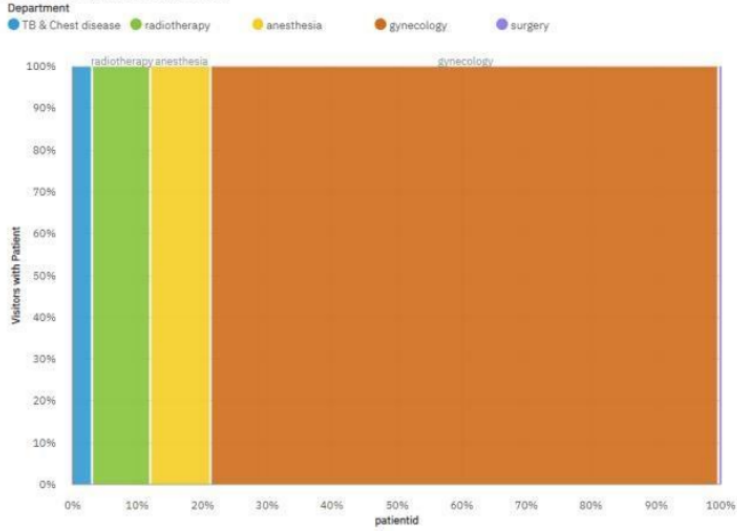
RESULTS

CHAPTER 8

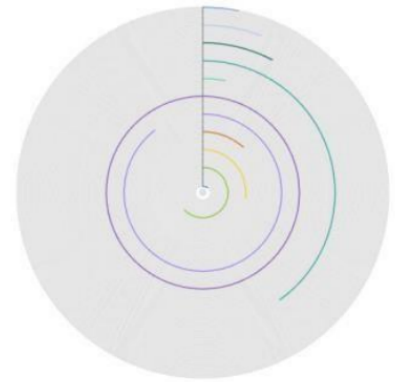
RESULT



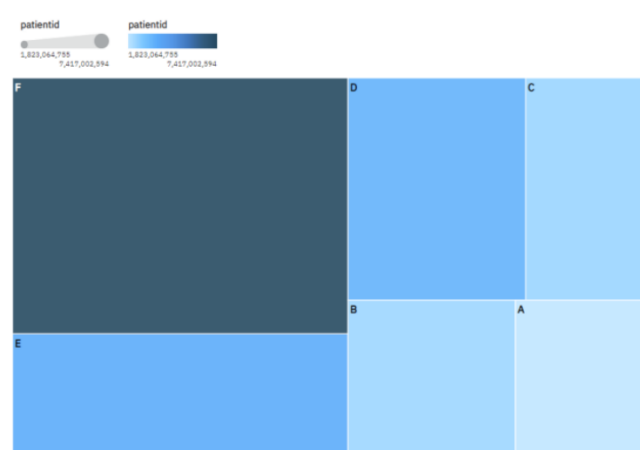
Department by visitors with patient



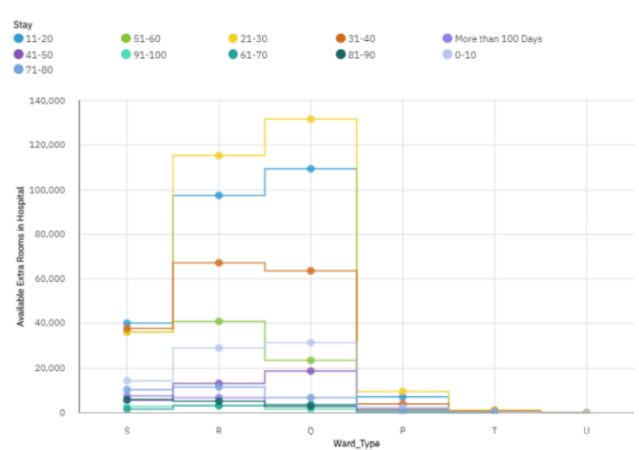
Patient by Stay



Ward_Facility_code by Patientid



Ward Type by Available Extra Room in Hospital



ADVANTAGES AND DISADVANTAGES

CHAPTER 9

ADVANTAGES AND DISADVANTAGES

9.1 ADVANTAGES

- As the internet reaches the far ends of our world, so does digital health. With a simple internet connection, anyone can access **patient health records** online without visiting the medical center.
- Gone are those days of securely storing all the handwritten prescriptions and test reports. With **electronic health record** apps, you can store all the relevant health data in one place without worrying about losing one.
- Personal digital health tools like fitness bands let you know your health-related data on a real-time basis.
- Those technological marvels constantly track your vitals and auto-dial emergency numbers in case anything wrong happens to you.

9.2 DISADVANTAGES

- Adapting to new technologies has always been a challenge for senior citizens.
- Adapting to new technologies has always been a challenge for senior citizens. Some of them prefer the old-school treatment methods instead of getting used to digital health facilitators.
- If not done properly, these apps can often crash, resulting in an inconvenience.

CONCLUSION

CHAPTER 10

CONCLUSION

This research demonstrates Analytics for hospital and health care data with data visualization and analytics. This information is gathered from a series of health information systems (HIS) and other technological tools utilized by health care professionals, insurance companies and government organizations. Consider the impact this has had on the COVID-19 pandemic. The data being collected is analyzed in real time to understand the effects of the virus better and predict future trends so we may slow the spread and prevent future outbreaks. Health care data management has the potential to lead to better care if used properly.

Healthcare analytics can be understood as the gathering and analysis of healthcare sector data with the purpose of deriving insights and prompting decision-making. Ranging from main areas like medical expenses, clinical data, patient behavior, or pharmaceuticals, healthcare data analytics can be employed at both the macro and micro level to sufficiently boost operations, enhance patient care, and curtail overall expenses.

Nevertheless this data, while being highly advantageous is also pretty complicated. Be it the data from electronic health records (EHR) or the data gained by assessing real-time vital signs, the data is not only derived from a number of varying sources, but it is also required to follow government regulations, making it a complex and precarious process.

FUTURE SCOPE

CHAPTER 11

FUTURE SCOPE

The data analytics market in the healthcare space has only increased over the last few years. Considering the rising costs of medical treatments globally, a proper body of knowledge was needed to reduce the costs at the business-level as well as the professional-level. McKinsey, in one of its reports, states that healthcare expenses constitute 17.6 percent of the GDP in the USA, which is approximately US\$600 billion, more than what is the set benchmark for the ideal size of population in the country. This is a serious indicator of bigger trouble. Hence, the usage of healthcare data analytics is being promoted these days.

To some, the domain of healthcare data analytics may look new, but it has a lot of potential, especially if you wish to engage in challenging job roles and build a strong data analytics profile in the upcoming years. In this blog, we have covered some of the major topics such as what is healthcare data analytics, its applications, scope, and benefits, etc. We hope it helps you in your decision-making as a healthcare data analytics professional.

