ESTIMATION AND PREDICTION OF HOSPITALIZATION AND MEDICAL CARE COSTS

DATA ANALYTICS

IBM NAAN MUDHALVAN

PROJECT REPORT

Submitted By

GANESH VENKATESHWARAN S (611220106021)
DAMODHARAN M (611220106301)
SUBALAKSHMI V(611220106075)
SANTHIYA C (611220106065)

in partial fulfillment for the award of the degree of

BACHELOR OF ENGINEERING

in

ELECTRONICS AND COMMUNICATION ENGINEERING

KNOWLEDGE INSTITUTE OF TECHNOLOGY,
SALEM-637504

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BONAFIDE CERTIFICATE

Certified that this project report titled **"ESTIMATION AND PREDICTION OF HOSPITALIZATION AND MEDICAL CARE COSTS"** is the bonafide work of **"GANESH VENKATESHWARAN S (611220106012), DAMODHARAN M (611220106002), SUBALAKSHMI V (611220106003), SANTHIYA C Y(611220106011)"** who carried out the project work under my supervision.

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SPOC	**HEAD OF THE DEPARTMENT**

ACKNOWLEDGEMENT

At the outset, we express our heartfelt gratitude to **GOD,** who has been our strength to bring this project to light.

At this pleasing moment of having successfully completed our project, we wish to convey our sincere thanks and gratitude to our beloved president **Mr. C. Balakrishnan,** who has provided all the facilities to us.

We would like to convey our sincere thanks to our beloved Principal **Dr. PSS. Srinivasan,** for forwarding us to do our projected offering adequate duration in completing our project.

We express our sincere thanks to our Head of the Department **Dr. V. Kumar,** Department of Computer Science and Engineering for fostering the excellent academic climate in the Department.

We express our pronounced sense of thanks with deepest respect and gratitude to our faculty mentor **Mr. P. Sasikumar**, Assistant Professor Department of Computer Science and Engineering for his valuable and precious guidance and for having amicable relation.

With deep sense of gratitude, we extend our earnest and sincere thanks to our SPOC **Mr. T. Karthikeyan,** Assistant Professor, Department of Computer Science and Engineering for their guidance and encouragement during this project.

We would also like express our thanks to all the faculty members of our department, friends and students who helped us directly and indirectly in all aspects of the project work to get completed successfully.

ABSTRACT

Estimation and prediction of hospitalization and medical care costs play a crucial role in healthcare planning, resource allocation, and financial management. This abstract provides an overview of the key methods and approaches used for estimating and predicting these costs.

Accurate estimation and prediction of hospitalization and medical care costs are essential for healthcare providers, policymakers, and insurance companies. These estimates help in determining healthcare budgets, setting insurance premiums, and designing cost-effective interventions. Various factors contribute to the complexity of cost estimation and prediction, including patient characteristics, medical procedures, disease severity, treatment protocols, and healthcare system variations.

One commonly used approach for cost estimation is the analysis of retrospective data, which involves analyzing historical healthcare utilization and associated costs. Statistical techniques such as regression analysis, machine learning algorithms, and data mining methods can be employed to develop models that relate patient and treatment characteristics to costs. These models can then be used to predict costs for new patients or evaluate the impact of different interventions on healthcare expenditures.

Another approach is the use of prospective studies, where data is collected in real-time during the patient's treatment and hospitalization. This approach allows for more accurate estimation of costs but requires careful data collection and monitoring. Prospective studies can also incorporate clinical outcomes and quality of care measures to assess the cost-effectiveness of different treatment strategies.

Additionally, cost estimation and prediction can benefit from the integration of electronic health records (EHRs) and other healthcare data sources. EHRs provide a wealth of information on patient demographics, medical history, diagnoses, treatments,

and costs. By leveraging these data sources, predictive models can be developed to estimate future costs based on patient characteristics and treatment plans.

However, it is important to acknowledge the limitations and challenges associated with cost estimation and prediction. The complexity of healthcare systems, variations in healthcare practices, and changing reimbursement policies can introduce uncertainty into cost projections. Moreover, ethical considerations regarding patient privacy and data security must be addressed when utilizing sensitive healthcare data.

In conclusion, accurate estimation and prediction of hospitalization and medical care costs are vital for effective healthcare planning and management. By employing various statistical and machine learning techniques, leveraging prospective studies and integrating electronic health records, healthcare stakeholders can improve their understanding of cost drivers and make informed decisions regarding resource allocation and healthcare interventions.

LIST OF FIGURES

CHAPTER – 1

INTRODUCTION

1.1 PROJECT OVERVIEW

The evaluation and validation of cost estimation models are essential to ensure their reliability and generalizability. Researchers employ techniques such as cross-validation, bootstrapping, and external validation to assess the performance of predictive models. The use of appropriate evaluation metrics such as mean squared error, mean absolute error, and R-squared helps quantify the accuracy of predictions and compare different models.

In conclusion, estimating and predicting hospitalization and medical care costs is a complex task that requires sophisticated analytical approaches. Traditional regression models and machine learning techniques offer valuable tools for cost estimation, while the integration of EHRs and other healthcare data sources enhances the accuracy and applicability of these models. Further research and development in this field will contribute to improved cost management, healthcare planning, and decision support systems

1.2 PURPOSE

The regression analysis is performed to determine the relationship among two or more variables with cause-effect relationships and to make predictions for the topic using the relationships . If regression used one independent variable, then it is known as univariate regression analysis, or else if it used more than two independent variables then it is known as multivariate regression analysis. Linear regression involves initially uploading the data and then analysing the data. Subsequently, the data are cut, and then, the data are trained and separated to create the model. At last, it will evaluate the accuracy. The main aim of regression is to develop an efficient technique for predicting dependent properties from a set of characteristic variables. A regression problem is the actual or continuous value of the output variables, that is, area, salary, and weight. Regression can be defined as a statistical method used in applications such as predicting the healthcare costs. Regression is used to predict the relationship among the dependent variable and set of independent variables. There are various types of regression techniques available namely simple linear regression, multiple linear regression, polynomial regression, support vector regression, and random forest regression .

CHAPTER-2

2.1LITERATURE SURVEY

1.Hospital Management and Scheduling with Multi Agents Approach

Big data analytics has enabled healthcare practitioners and scientists to detect hidden patterns and derive insights from data for better decision making. A study utilizing breast cancer data collected from 1982-2010 aimed to statistically estimate incidence and mortality counts of breast cancer among females in Australia and to discover trends in breast cancer among the same. Results showed that breast cancer was the leading cause of cancer death among women in Australia, with middle-aged females being the most affected. The study highlights the need for innovative techniques and awareness programs to address every age group, reduce mortality rates, and increase timely diagnosis and treatment for a healthy and cancer-free population.

2.Big Data Analytics for Prediction Modelling in Healthcare Databases

The study aims to use big data analytics techniques to extract hidden knowledge from breast cancer databases for future diagnosis and prognosis. The data includes information on 356,507 patients from 1982-2010. The study acknowledges the complexity of healthcare data and the potential benefits of data mining in overcoming clinical limitations. The paper is divided into several sections, including methodology and results. Big data analytics benefits healthcare by detecting disease early, reducing costs, and improving patient care. However, challenges include data heterogeneity, volume, privacy, and ease of use. Healthcare organizations must overcome these challenges to improve decision making and patient outcomes. Cloud-based technology can provide services such as infrastructure, software, and data analytics to help manage and analyse healthcare data

The study utilized big data analytics to detect hidden patterns in breast cancer data from 1982-2010, consisting of 356,507 patient records. Linear regression and logistic regression were used for predictive analysis. Spectral plots were utilized for time series analysis, and the Kaplan-Meier method was used for survivability analysis. Results showed an increase in breast cancer incidence cases in young adults and those aged 50-54, with a decline in cases in those aged 85+. The highest number of incidence cases was found in the 25-29 age group, with a significant increase in cases as age increased. Mortality rates were also analysed for each age group. Overall, the study provided insights into the characteristic features of the data and generated statistical summaries and graphs. Breast cancer cases increased from 5,303 in 1982 to 14,181 in 2010. More females were diagnosed and mortality rates decreased from 37% in 1982 to 20% in 2010. Survivability rates varied in different age groups, with 100% in younger age groups and 56% in the 80-84 age group. Regression analysis was performed for incidence and mortality year-wise .The study analysed breast cancer in Australia, finding a higher incidence in middle-aged women, with increasing detection and decreasing mortality.

3.Data Analytics Applications for Human Resource Management

Business success relies on HR department's skilled manpower, recruitment, training, performance analysis, and HR analytics.

Measuring the Employee Performance-Measuring employee performance is crucial for HRM. Data collection and statistical tools are used for evaluation

Informing Salary and promotion-Compensation and promotion are vital HR functions. Data analytics helps identify skill levels for salary and promotion eligibility.

Understanding Attrition and increasing Retention -Attrition and retention are important in HRM. Analytics help to design retention strategies for skilled employees.

Examining the Employee Engagement- Employee engagement using data analytics to identify motivation for organizational goals.

Measuring the Employee Development and Learning outcomes-Data analytics track employee training needs and predict training requirements of the organization

The ANOVA analysis showed a significant difference between managers in their use of data analytics in HR. This highlights the importance of informed decision-making in HR using predictive analytics.

4.Exploration of Big Data Analytics in Healthcare Analytics

Big data is characterized by five v's: variety, volume, value, velocity, and veracity. In healthcare, data can be inconsistent and multi-dimensional, requiring various tests for accuracy. The amount of healthcare data is massive and growing exponentially. Big data analytics involves ingesting and cleaning data, extracting valuable information, creating and validating models. Healthcare data collection and processing is challenging due to its size and complexity. Skilled workers and appropriate tools selection are crucial for successful data management. Incorporating new technologies is slow and costly.

SOURCES OF HEALTHCARE - Healthcare data comes in structured, semi-structured, and unstructured types. Sources include social media, genomics, clinical data, and external data from biometrics, insurance policies, and finances

CONCLUSION AND FUTUREWORK - Processing large and unstructured healthcare data is a challenge. Big data can help solve these problems, allowing for more efficient information extraction and analysis. This paper provides guidance for selecting tools and algorithms and encourages the incorporation of big data in healthcare organizations.

5.Cybersecurity and Data Privacy in the Cloudlet for Preliminary Healthcare Big Data Analytics

CPS are important for Industry 4.0, integrating computational algorithms and physical components. Health 4.0 refers to applying Industry 4.0 principles to healthcare, including cloud-based design and IoT. Healthcare data has big data characteristics, requiring big data analytics. Cloud computing and mobile edge computing are utilized for storage and complex computation. Big data analytics has five stages and can be implemented on cloud or cloudlets. Cybersecurity and data privacy remain a challenge for 4IR technologies.

Software-defined networking orchestrates security across networks. Hardware microelectronics protect information communication, storage, and processing. Distributed cloudlets attached to imaging sensors provide preliminary analytics for behaviour modification applications.

This paper addresses cyber security and data privacy challenges in healthcare industry's adoption of Industry 4.0, proposing cloudlet technology as a solution for preliminary big data analytics and reducing attack surface. Several potential applications are also suggested.

6.Analysis on Benefits and Costs of Machine Learning-Based Early Hospitalization Prediction

Emergency department overcrowding affects patient care and mortality rates. Boarding time, the time between decision to hospitalize and departure from the ED, contributes to overcrowding. Predicting hospitalization can help reduce boarding time and improve inpatient bed management. This paper reviews previous research and presents an algorithm for hospitalization prediction using machine learning. The study uses data from a single hospital, but the methods can be applied to other hospitals.

The study analysed data from 27,747 patients at a Korean hospital's emergency department over seven months. 220 variables were used, including demographics, disease status, and hospitalization, with no missing values. Patients in their 90s had the highest hospitalization rate. Predictive models can provide fast and accurate hospitalization predictions to reduce ED length of stay and alleviate overcrowding. More data is needed for convergence and further studies.

7.Estimation and Prediction of Hospitalization and Medical Care Costs Using Regression in Machine Learning

The increasing incidence of overweight and obesity has led to a rise in chronic diseases and healthcare costs. Regression analysis is commonly used for predicting these costs. However, advanced machine-learning approaches are also valuable, though not widely adopted due to lack of familiarity. This study compares penalty regression with linear regression in forecasting overall health costs.

Recent literature on estimating healthcare costs includes a study on predicting 30-day readmission for congestive heart failure patients. Another study used machine learning to predict critical results in heart failure patients, while a third study used natural language processing to forecast hospital costs based on diagnosis-related group codes. A study predicts 30-day readmissions for congestive heart failure patients, while others use ML and NLP to estimate healthcare costs. A K-nearest technique is used to optimize computing time for forecasting. The IEVREG framework is used for regulation writing.

We developed a new linear regression model to predict healthcare expenses for patients using devices such as smartphones. This supervised learning method performs accurately and reduces the risk of overfitting. It achieves a 97.89% accuracy rate and has been tested on real-world databases.

2.2 PROBLEM STATEMENT DEFINITION

Problem Statement (PS)	I am (Customer)	I'm trying to	But	Because	Which makes me feel
PS-1	A Patients	Estimate and prediction of Hospitalization and Medical Care Costs	Lack of transparency and Information sharing makes it difficult to estimate and predict costs	Healthcare industry is complex, making it difficult to predict costs	Difficult to pridect cost
PS-2	Healthcare providers	Estimate and prediction of Hospitalization and Medical Care Costs	Estimating and predicting Healthcare costs is challenging due to the complexity of medical procedures, patient needs and regulatory environment	Collaboration and coordination between healthcare providers. insurance companies, patients, and government agencies is needed to manage healthcare costs effectively	Unable to estimate cost
PS-3	Insurance companies	Estimate and prediction of Hospitalization and Medical Care Costs	Estimation and Prediction of Hospitalization and Medical Care Costs is challenging due to unpredictable healthcare costs.	Inaccurate estimates of healthcare costs can lead to financial strain and misallocation .	Challenging to assign insurance plans

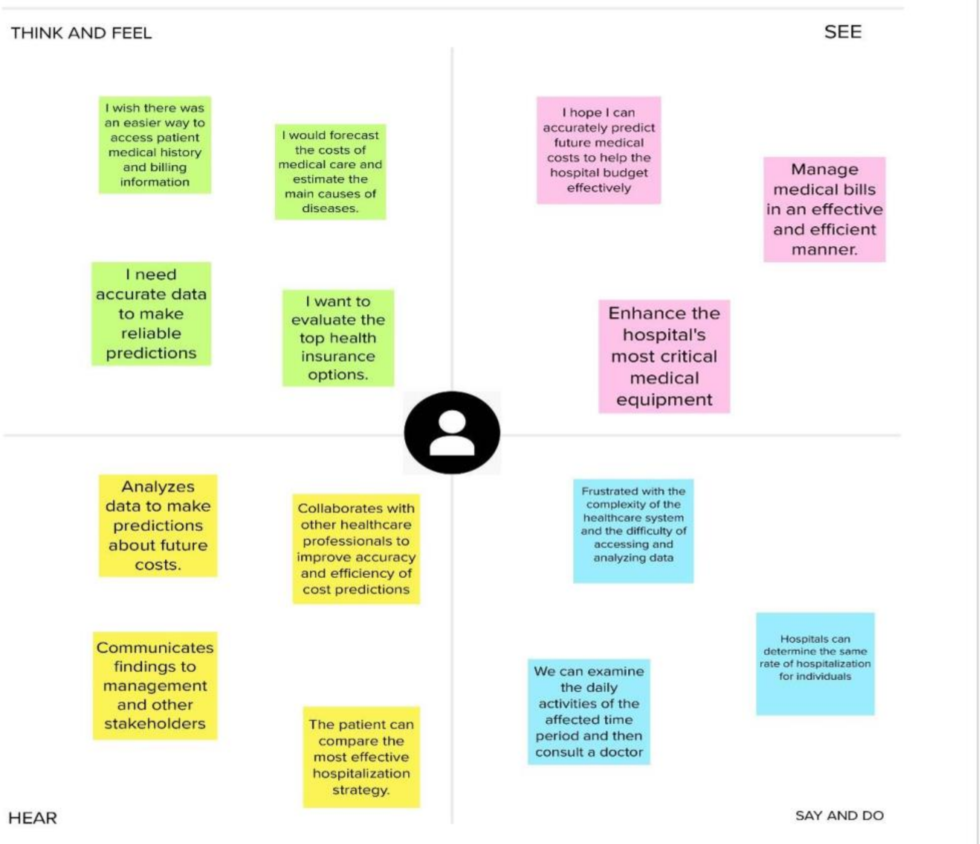
PS-4	Government agencies	Estimate and prediction of Hospitalization and Medical Care Costs	Healthcare costs are a major concern for all stakeholders in the healthcare system.	inaccurate estimates of hexincare costs can have serious consequences for patience providers and nurance	Unable to estimate the government healthcare schemes

CHAPTER- 3

IDEATION & PROPOSED SOLUTION

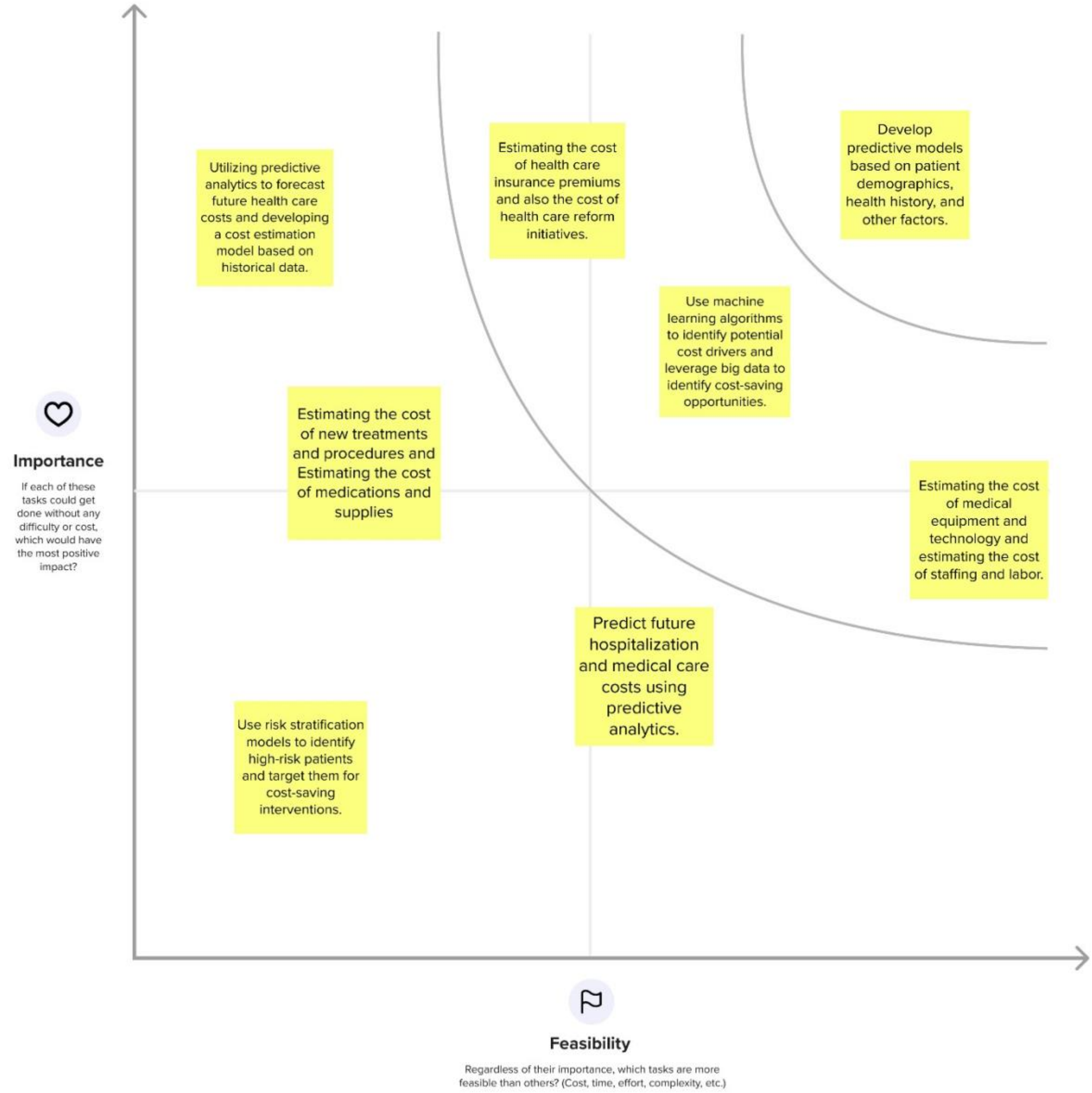
3.1 EMPATHY MAP CANVAS

An empathy map is a collaborative tool teams can use to gain a deeper insight into their customers. Much like a user persona, an empathy map can represent a group of users, such as a customer segment. The empathy map was originally created by Dave Gray and has gained much popularity within the agile community. Have the team members speak about the sticky notes as they place them on the empathy map. Ask questions to reach deeper insights so that they can be elaborated for the rest of the team. To help bring the user to life, you may even wish to sketch out the characteristics this person may have on the center of the face.



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.



Utilizing predictive analytics to forecast future health care costs and developing a cost estimation model based on historical data.
Estimating the cost of health care insurance premiums and also the cost of health care reform initiatives.
Develop predictive models based on patient demographics, health history, and other factors.
Use machine learning algorithms to identify potential cost drivers and leverage big data to identify cost-saving opportunities.
Estimating the cost of new treatments and procedures and Estimating the cost of medications and supplies
Importance
If each of these tasks could get done without any difficulty or cost, which would have the most positive impact?
Estimating the cost of medical equipment and technology and estimating the cost of staffing and labor.
Predict future hospitalization and medical care costs using predictive analytics.
Use risk stratification models to identify high-risk patients and target them for cost-saving interventions.
Feasibility
Regardless of their importance, which tasks are more feasible than others? (Cost, time, effort, complexity, etc.)

3.3 PROPOSED SOLUTION

S.No	Parameter	Description
1.	Problem Statement (Problem to be solved)	The problem statement asks for an estimation and forecast of patients' hospital and medical care costs. Patients, insurance companies, and healthcare providers all need to pay attention to this issue.
2.	Idea/Solution description	Using machine learning algorithms to analyze patient data and forecast the expenses of their medical care is one way to estimate and anticipate hospitalization and medical care costs. To put this solution into practise, complete the following actions: ● Data collection is the initial step, which entails gathering information about the patient's demographics, medical background, diagnosis, courses of treatment, and procedures. Electronic health records (EHRs), insurance claims, and other pertinent sources can all be used to acquire this information.
3.	Novelty / Uniqueness	However, the following features of this solution are novel and distinctive: ● Data Integration from Multiple Sources: Our system combines information from various databases, such as electronic health records, insurance claims, and other pertinent sources.
4.	Social Impact / Customer Satisfaction	Better Resource Allocation: Healthcare providers can more effectively manage their resources, such as personnel, facilities, and equipment, by precisely forecasting

		hospitalization and medical care expenses. Better patient health outcomes may result from more effective and efficient healthcare delivery.

5.	Business Model (Revenue Model)	Healthcare providers, insurers, and other stakeholders may subscribe to the cost prediction service under this model and pay a monthly or yearly charge. The cost may vary depending on the quantity of clients served, the quality of care needed, or other elements. With this approach, the service provider can have a steady and regular revenue stream, and the pricing can be changed to suit various consumer groups.
6.	Scalability of the Solution	• Including electronic health records in the integration • Infrastructure based in the cloud • Collaborations with Insurance Companies and Healthcare Providers

CHAPTER-4

REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENTS

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Input	Allow user to enter the input in GUI and recognize the input.
FR-2	Model	A file that has been trained to recognize certain types of patterns.
FR-3	Prediction	Train and test the model and predict the user input.
FR-4	Evaluation	Checking the model whether the prediction is correct.

4.2 NON-FUNCTIONAL REQUIREMENTS

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	Can predict digits correctly. Our model can be used in postal mail sorting, bank check processing, data entry, etc.

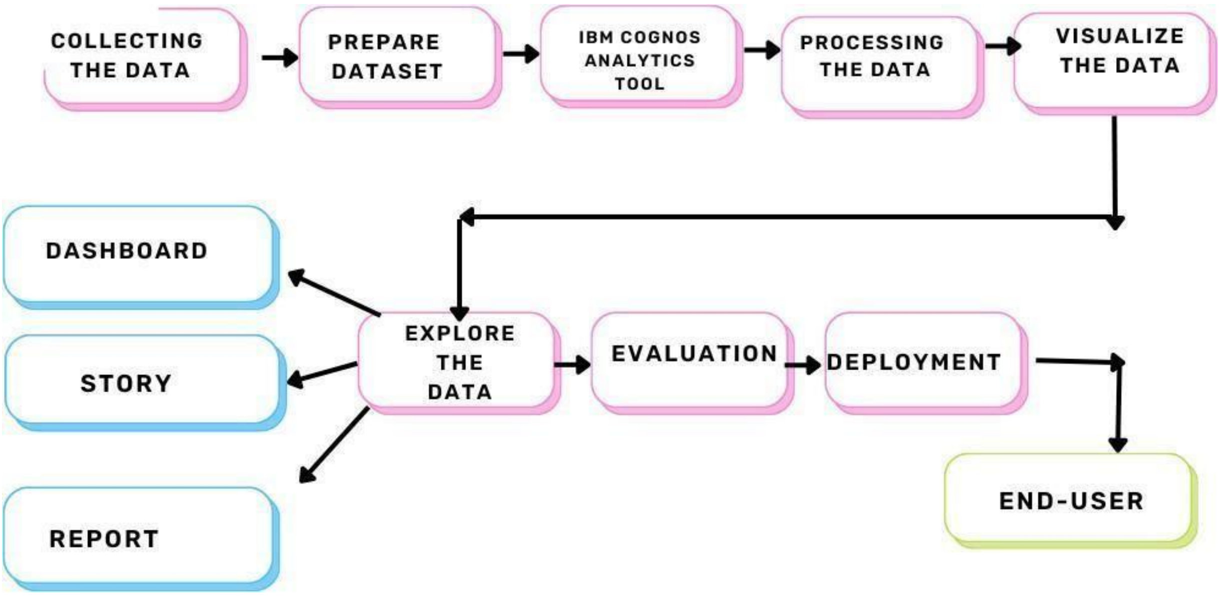
NFR-2	Security	User data is secured. It ensures security in a way that the images uploaded for
NFR-3	Reliability	Can process confidential information. Recognize digits without interruption.
NFR-4	Performance	Improvement in fast prediction. We use CNN algorithm for accurate prediction.
NFR-5	Availability	Available as software for both common and professional use.

CHAPTER-5

PROJECT DESIGN

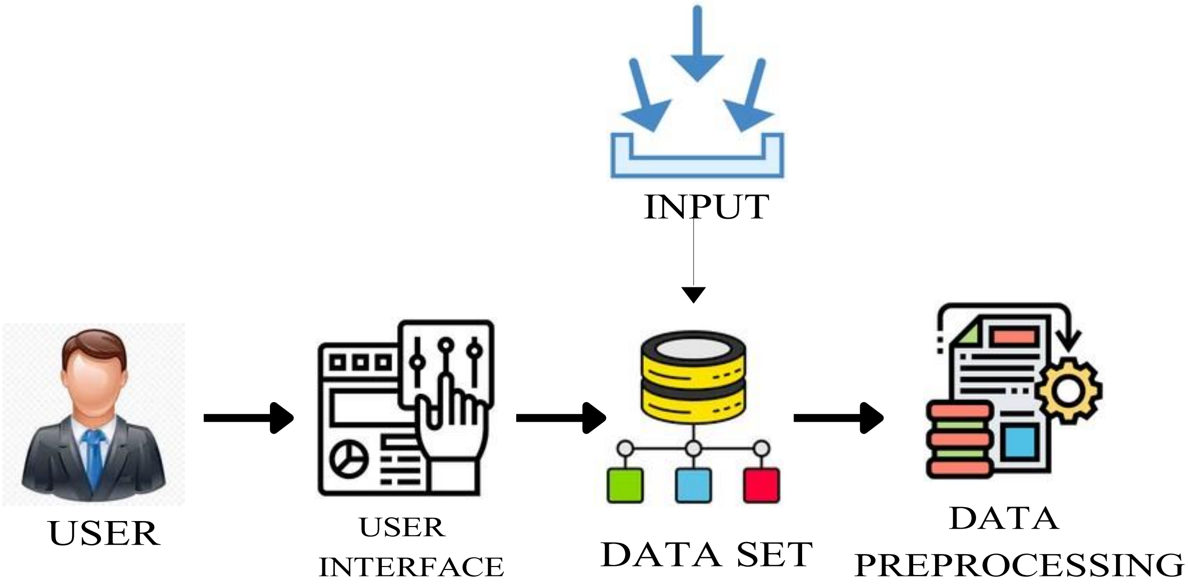
5.1 DATA FLOW DIAGRAMS

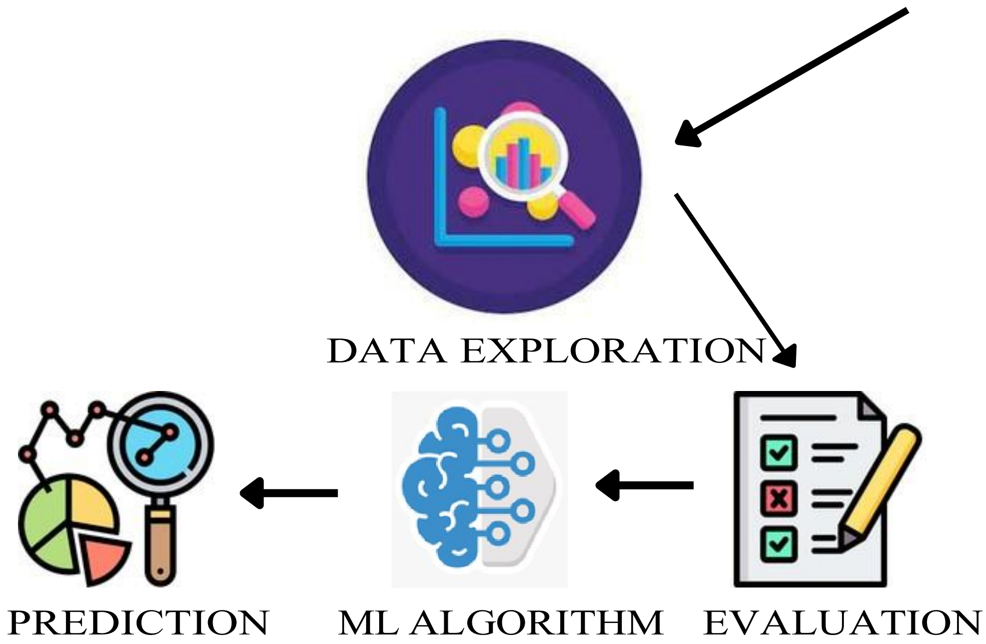
A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It can be manual, automated, or a combination of both. It shows how data enters and leaves the system, what changes the information, and where data is stored. The objective of a DFD is to show the scope and boundaries of a system as a whole. It may be used as a communication tool between a system analyst and any person who plays a part in the order that acts as a starting point for redesigning a system.



5.2 SOLUTION & TECHNICAL ARCHITECTURE

Solution architecture (SA) is an architectural description of a specific solution. SAs combine guidance from different enterprise architecture viewpoints (business, information and technical), as well as from the enterprise solution architecture (ESA).




DATA EXPLORATION
PREDICTION
ML ALGORITHM
EVALUATION

5.3 USER STORIES

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

	Functional Requirement	**User Story Number**	**User Story / Task**	**Acceptance criteria**	**Priority**	**Team Member**
Customer	Dashboard	USN-1	As a user, I can upload the datasets to the dashboard	I can access various operations	Medium	Sprint-4
	View	USN-2	As a user, I can view the patient details	I can view the visual data and the result after the prediction	Medium	Sprint-3
Admin	Analyze	USN-3	As an admin, I will analyze the given dataset	I can analyze the dataset	High	Sprint-2
	Predict	USN-4	As an admin, will predict the length of stay	I can predict the length of stay	High	Sprint-1

CHAPTER – 6

CODING & SOLUTIONING

6.1 FEATURE 1

```
/**
* Template Name: iPortfolio
* Updated: Mar 10 2023 with Bootstrap v5.2.3
* Template URL: https://bootstrapmade.com/iportfolio-bootstrap-portfolio-websites-template/
* Author: BootstrapMade.com
* License: https://bootstrapmade.com/license/
*/
(function() {
  "use strict";

  /**
   * Easy selector helper function
   */
  const select = (el, all = false) => {
    el = el.trim()
    if (all) {
      return [...document.querySelectorAll(el)]
    } else {
      return document.querySelector(el)
    }
  }

  /**
   * Easy event listener function
   */
  const on = (type, el, listener, all = false) => {
```

```
    let selectEl = select(el, all)
    if (selectEl) {
      if (all) {
        selectEl.forEach(e => e.addEventListener(type, listener))
      } else {
        selectEl.addEventListener(type, listener)
      }
    }
  }

  /**
   * Easy on scroll event listener
   */
  const onscroll = (el, listener) => {
    el.addEventListener('scroll', listener)
  }

  /**
   * Navbar links active state on scroll
   */
  let navbarlinks = select('#navbar .scrollto', true)
  const navbarlinksActive = () => {
    let position = window.scrollY + 200
    navbarlinks.forEach(navbarlink => {
      if (!navbarlink.hash) return
      let section = select(navbarlink.hash)
      if (!section) return
      if (position >= section.offsetTop && position <= (section.offsetTop +
section.offsetHeight)) {
        navbarlink.classList.add('active')
      } else {
        navbarlink.classList.remove('active')
      }
    })
  }
  window.addEventListener('load', navbarlinksActive)
  onscroll(document, navbarlinksActive)
```

```
/**
 * Scrolls to an element with header offset
 */
const scrollto = (el) => {
  let elementPos = select(el).offsetTop
  window.scrollTo({
    top: elementPos,
    behavior: 'smooth'
  })
}

/**
 * Back to top button
 */
let backtotop = select('.back-to-top')
if (backtotop) {
  const toggleBacktotop = () => {
    if (window.scrollY > 100) {
      backtotop.classList.add('active')
    } else {
      backtotop.classList.remove('active')
    }
  }
  window.addEventListener('load', toggleBacktotop)
  onscroll(document, toggleBacktotop)
}

/**
 * Mobile nav toggle
 */
on('click', '.mobile-nav-toggle', function(e) {
  select('body').classList.toggle('mobile-nav-active')
  this.classList.toggle('bi-list')
  this.classList.toggle('bi-x')
})
```

```
/**
 * Scrool with ofset on links with a class name .scrollto
 */
on('click', '.scrollto', function(e) {
  if (select(this.hash)) {
    e.preventDefault()

    let body = select('body')
    if (body.classList.contains('mobile-nav-active')) {
      body.classList.remove('mobile-nav-active')
      let navbarToggle = select('.mobile-nav-toggle')
      navbarToggle.classList.toggle('bi-list')
      navbarToggle.classList.toggle('bi-x')
    }
    scrollto(this.hash)
  }
}, true)

/**
 * Scroll with ofset on page load with hash links in the url
 */
window.addEventListener('load', () => {
  if (window.location.hash) {
    if (select(window.location.hash)) {
      scrollto(window.location.hash)
    }
  }
});

/**
 * Hero type effect
 */
const typed = select('.typed')
if (typed) {
  let typed_strings = typed.getAttribute('data-typed-items')
  typed_strings = typed_strings.split(',')
```

```
  new Typed('.typed', {
    strings: typed_strings,
    loop: true,
    typeSpeed: 100,
    backSpeed: 50,
    backDelay: 2000
  });
}

/**
 * Skills animation
 */
let skilsContent = select('.skills-content');
if (skilsContent) {
  new Waypoint({
    element: skilsContent,
    offset: '80%',
    handler: function(direction) {
      let progress = select('.progress .progress-bar', true);
      progress.forEach((el) => {
        el.style.width = el.getAttribute('aria-valuenow') + '%'
      });
    }
  })
}

/**
 * Porfolio isotope and filter
 */
window.addEventListener('load', () => {
  let portfolioContainer = select('.portfolio-container');
  if (portfolioContainer) {
    let portfolioIsotope = new Isotope(portfolioContainer, {
      itemSelector: '.portfolio-item'
    });
```

```
    let portfolioFilters = select('#portfolio-flters li', true);

    on('click', '#portfolio-flters li', function(e) {
      e.preventDefault();
      portfolioFilters.forEach(function(el) {
        el.classList.remove('filter-active');
      });
      this.classList.add('filter-active');

      portfolioIsotope.arrange({
        filter: this.getAttribute('data-filter')
      });
      portfolioIsotope.on('arrangeComplete', function() {
        AOS.refresh()
      });
    }, true);
  }

});

/**
 * Initiate portfolio lightbox
 */
const portfolioLightbox = GLightbox({
  selector: '.portfolio-lightbox'
});

/**
 * Portfolio details slider
 */
new Swiper('.portfolio-details-slider', {
  speed: 400,
  loop: true,
  autoplay: {
    delay: 5000,
    disableOnInteraction: false
  },
```

```
  pagination: {
    el: '.swiper-pagination',
    type: 'bullets',
    clickable: true
  }
});

/**
 * Testimonials slider
 */
new Swiper('.testimonials-slider', {
  speed: 600,
  loop: true,
  autoplay: {
    delay: 5000,
    disableOnInteraction: false
  },
  slidesPerView: 'auto',
  pagination: {
    el: '.swiper-pagination',
    type: 'bullets',
    clickable: true
  },
  breakpoints: {
    320: {
      slidesPerView: 1,
      spaceBetween: 20
    },

    1200: {
      slidesPerView: 3,
      spaceBetween: 20
    }
  }
});
```

```
  /**
   * Animation on scroll
   */
  window.addEventListener('load', () => {
    AOS.init({
      duration: 1000,
      easing: 'ease-in-out',
      once: true,
      mirror: false
    })
  });

  /**
   * Initiate Pure Counter
   */
  new PureCounter();

})()
```

CHAPTER – 7

RESULTS

7.1Performance Matrix

1. Dashboard design

No of Tabs : 3

No of Visualizations : 12

Fig 7.2.1 Home Page

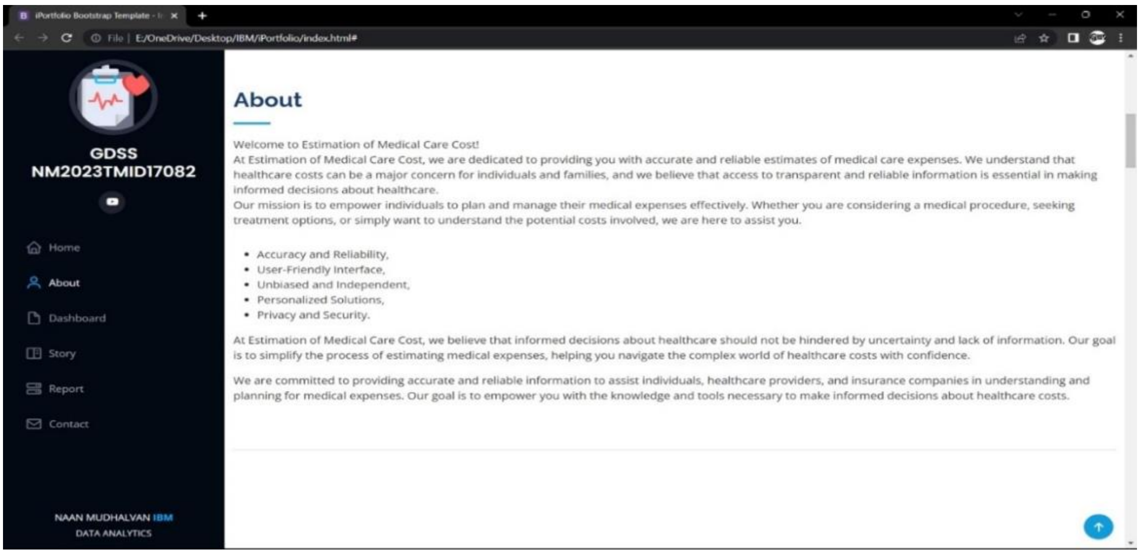


Fig 7.2.2 About

DASHBOARD

https://eu2.ca.analytics.ibm.com/bi/?perspective=dashboard&pathRef=.my_folders%2FMedical_cost_dashboard&action=view&mode=dashboard

Fig 7.2.3 Dashboard Tab1

Fig 7.2.4 Dashboard Tab2

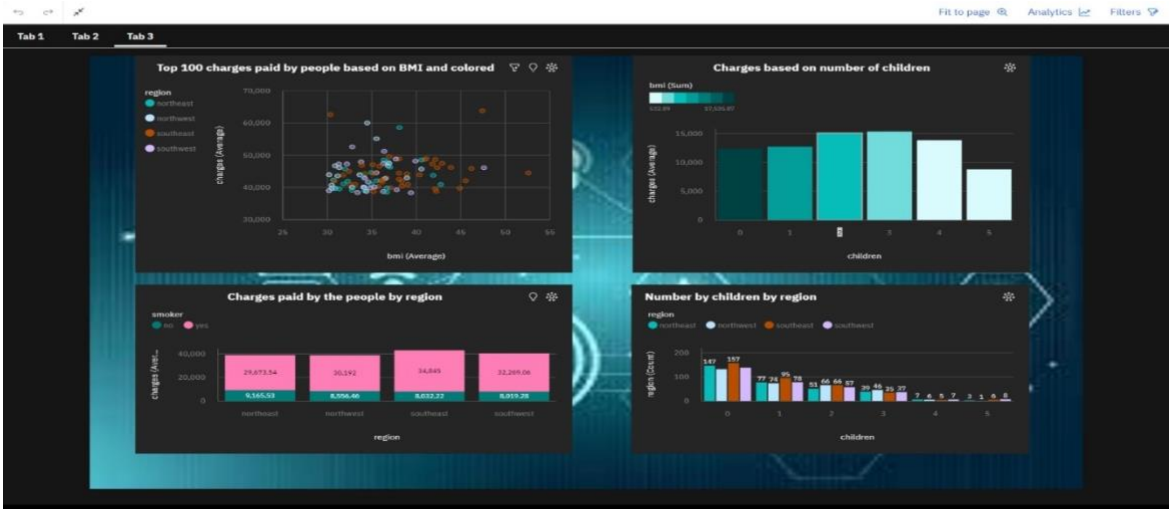
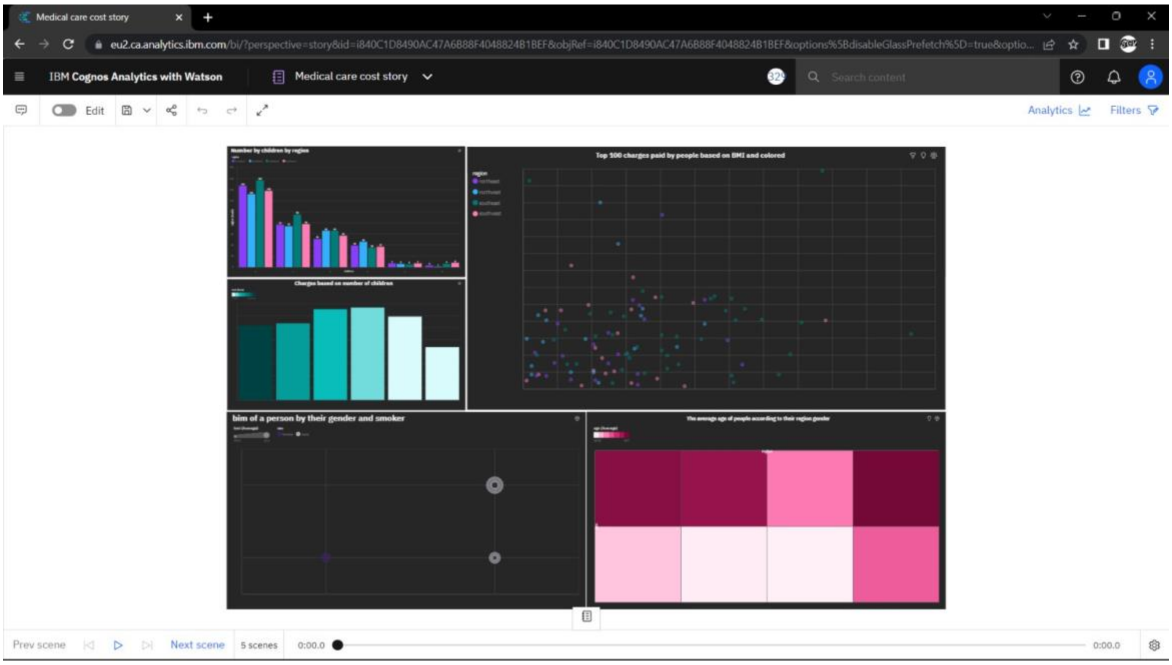


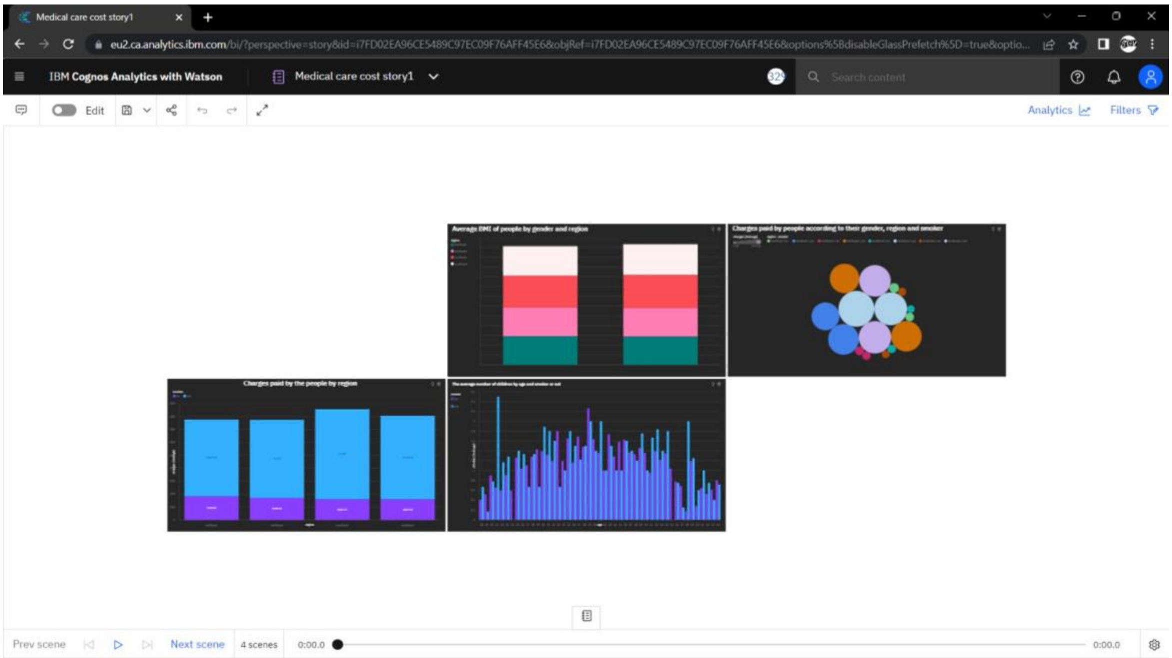
Fig 7.2.5 Dashboard Tab3

STORY

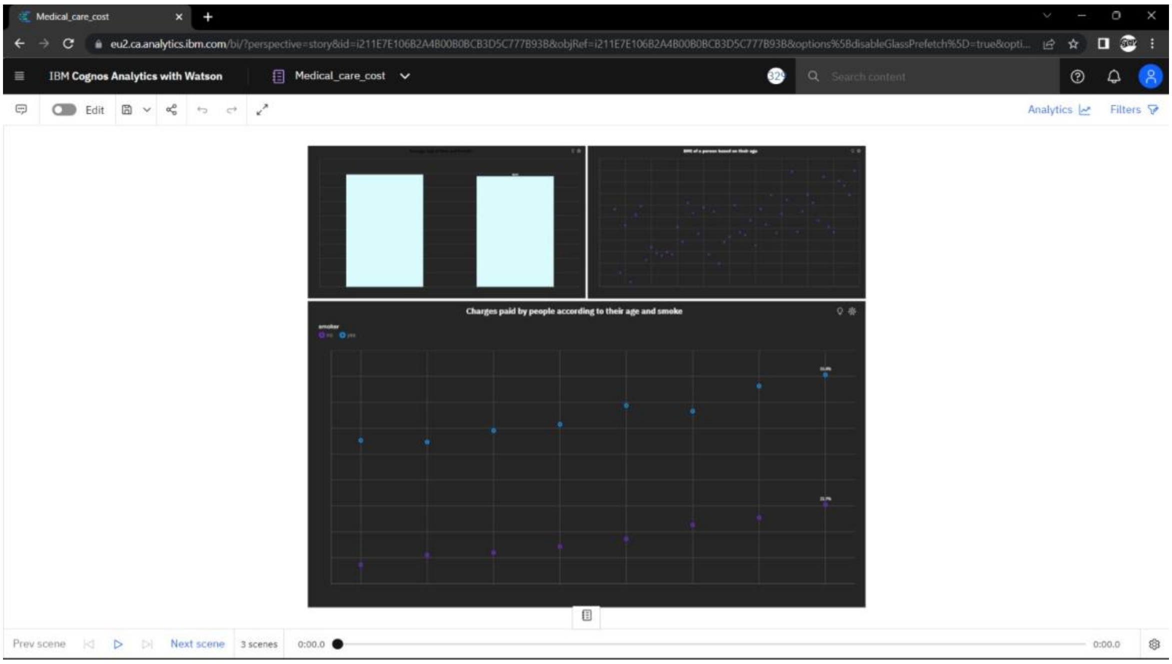
https://eu2.ca.analytics.ibm.com/bi/?perspective=story&pathRef=.my_folders%2FMedical%2Bcare%2Bcost%2Bstory&action=view&mode=dashboard



https://eu2.ca.analytics.ibm.com/bi/?perspective=story&pathRef=.my_folders%2FMedical%2Bcare%2Bcost%2Bstory1&action=view&mode=dashboard



https://eu2.ca.analytics.ibm.com/bi/?perspective=dashboard&pathRef=.my_folders%2FMedical_cost_dashboard&action=view&mode=dashboard



REPORT

https://eu2.ca.analytics.ibm.com/bi/?pathRef=.my_folder

CHAPTER-8

ADVANTAGES & DISADVANTAGES

8.1 Advantages

Estimation and prediction of hospitalization and medical care costs offer several benefits. They enable individuals and families to plan their healthcare expenses, make informed decisions about insurance coverage, and budget accordingly. Healthcare providers and policymakers can use cost estimation to allocate resources effectively, ensuring that staffing, equipment, and infrastructure investments align with expected costs. Cost estimation also promotes pricing transparency, empowering patients to make informed choices and encouraging competition in the healthcare industry. Insurance companies can develop tailored coverage plans and set appropriate premiums based on predicted costs, providing individuals with coverage options that suit their needs

8.2 Disadvantages

Estimating and predicting hospitalization and medical care costs come with challenges. The complexity and variability of healthcare services make it difficult to accurately forecast costs, as they can vary widely based on numerous factors. Uncertainties surrounding future healthcare utilization and evolving medical guidelines can impact the reliability of cost predictions. Accessibility and user-friendliness of cost estimation tools may be limited, hindering practical application for individuals and healthcare providers. Ethical considerations arise regarding the potential influence of cost estimates on patient care, ensuring that financial concerns do not compromise the quality of care or result in disparities in access to necessary treatments.

CHAPTER-9

9.1 CONCLUSION

We provided a new linear regression that can easily demonstrate the reasons for producing a certain forecast regarding potential healthcare expenses, which is a useful capacity in the healthcare area. The linear regression algorithm is used to estimate the healthcare costs of the patients such as obesity (BMI) using certain devices such as smartphones and smart devices. For estimation, by the use of linear regression, supervised learning performs more accurately. By providing comprehensive evidence, regression methodology can be effectively used for prognosis in conjunction with the dataset. The domain and time accuracy will determine the prediction model and the estimation of healthcare expenses. The proposed method reduces the risk of overfitting, and also, training time is less. This method is effective in estimating the healthcare costs of patients with an accuracy rate of 97.89%. The extensive tests on a real-time world database have confirmed the efficiency of our method.

9.2 FUTURE SCOPE

The estimation and prediction of hospitalisation and medical care costs have significant potential for future development and applications. Here are some future scopes and possibilities for this field: Advanced Data Analytics: With the increasing availability of electronic health records (EHRs), wearable devices, and health monitoring systems, there is a vast amount of data that can be leveraged to improve cost estimation and prediction models. Advanced data analytics techniques, such as machine learning and artificial intelligence, can be applied to these datasets to identify patterns, risk factors, and predictive models for hospitalisation and medical care costs. Predictive Modelling: Future efforts can focus on developing more accurate and precise predictive models for hospitalisation and medical care costs. These models can incorporate a wide range of factors, including patient demographics, medical history, disease severity, treatment plans, and environmental factors, to provide personalised cost estimations. By considering a comprehensive set of variables, these models can help healthcare providers, insurers, and policymakers anticipate costs more effectively. Cost Containment Strategies: Cost containment is a critical concern in healthcare systems worldwide. The future scope for estimating and predicting hospitalisation and medical care costs lies in developing models and strategies to identify cost-saving measures and optimise resource allocation. By analysing historical cost data and incorporating outcome measures, healthcare organisations can identify areas where costs can be minimised without compromising patient care. Patient-Centric Approaches: As healthcare becomes more patient-centric, future efforts in cost estimation and prediction should focus on empowering patients to make informed decisions about their healthcare. Personalised cost estimation tools can provide patients with insights into the potential costs associated with different treatment options, allowing them to make cost-conscious decisions while considering their financial circumstances. Policy and Planning: Estimation and prediction of hospitalisation and medical care costs can inform healthcare policy and planning. By leveraging cost data, policymakers can identify trends, predict future healthcare costs, and develop strategies to allocate resources efficiently. This information can aid in designing public health initiatives, insurance policies, and reimbursement models that promote affordability and sustainability in healthcare systems.

CHAPTER - 10

A.1 SOURCE CODE

```
<!DOCTYPE html>
<html lang="en">

<head>
  <meta charset="utf-8">
  <meta content="width=device-width, initial-scale=1.0"
name="viewport">

  <title>iPortfolio Bootstrap Template - Index</title>
  <meta content="" name="description">
  <meta content="" name="keywords">

  <!-- Favicons -->
  <link href="{{ url_for('static', filename='assets/img/favicon.png')
}}" rel="icon">
  <link href="{{ url_for('static', filename='assets/img/apple-touch-
icon.png') }}" rel="apple-touch-icon">

  <!-- Google Fonts -->
```

```
  <link
href="https://fonts.googleapis.com/css?family=Open+Sans:300,300i,400,400i,600,600i,700,700i|Raleway:300,300i,400,400i,500,500i,600,600i,700,700i|Poppins:300,300i,400,400i,500,500i,600,600i,700,700i" rel="stylesheet">

  <!-- Vendor CSS Files -->
  <link href="{{ url_for('static', filename='assets/vendor/aos/aos.css') }}" rel="stylesheet">
  <link href="{{ url_for('static', filename='assets/vendor/bootstrap/css/bootstrap.min.css') }}" rel="stylesheet">
  <link href="{{ url_for('static', filename='assets/vendor/bootstrap-icons/bootstrap-icons.css') }}" rel="stylesheet">
  <link href="{{ url_for('static', filename='assets/vendor/boxicons/css/boxicons.min.css') }}" rel="stylesheet">
  <link href="{{ url_for('static', filename='assets/vendor/glightbox/css/glightbox.min.css') }}" rel="stylesheet">
  <link href="{{ url_for('static', filename='assets/vendor/swiper/swiper-bundle.min.css') }}" rel="stylesheet">

  <!-- Template Main CSS File -->
```

```
  <link href="{{ url_for('static', filename='assets/css/style.css') }}"
rel="stylesheet">

</head>

<body>

  <!-- ======= Mobile nav toggle button ======= -->
  <i class="bi bi-list mobile-nav-toggle d-xl-none"></i>

  <!-- ======= Header ======= -->
  <header id="header">
    <div class="d-flex flex-column">

      <div class="profile">
        <img src="{{ url_for('static', filename='assets/img/bg6.png')
}}" alt="" class="img-fluid rounded-circle">
        <h1 class="text-light"><a
href="index.html">GDSS</a></h1>
        <h1 class="text-light"><a
href="index.html">NM2023TMID17082</a></h1>
        <div class="social-links mt-3 text-center">
          <a href="#" class="youtube"><i class="bx bxl-
youtube"></i></a>
```

```html
      </div>
    </div>

    <nav id="navbar" class="nav-menu navbar">
      <ul>
        <li><a href="#hero" class="nav-link scrollto active"><i class="bx bx-home"></i> <span>Home</span></a></li>
        <li><a href="#about" class="nav-link scrollto"><i class="bx bx-user"></i> <span>About</span></a></li>
        <li><a href="#resume" class="nav-link scrollto"><i class="bx bx-file-blank"></i> <span>Dashboard</span></a></li>
        <li><a href="#portfolio" class="nav-link scrollto"><i class="bx bx-book-content"></i> <span>Story</span></a></li>
        <li><a href="#services" class="nav-link scrollto"><i class="bx bx-server"></i> <span>Report</span></a></li>
        <li><a href="#contact" class="nav-link scrollto"><i class="bx bx-envelope"></i> <span>Contact</span></a></li>
      </ul>
    </nav><!-- .nav-menu -->
  </div>
</header><!-- End Header -->

<!-- ======= Hero Section ======= -->
```

```
  <section id="hero" class="d-flex flex-column justify-content-center align-items-center">
    <div class="hero-container" data-aos="fade-in">
      <center>
      <h1>DATA ANALYTICS</h1>
      <center>
      <p>ESTIMATION & PREDICTION OF HOSPITALISATION & MEDICAL CARE COST</p></center></center>
    </div>
  </section><!-- End Hero -->



  <main id="main">

    <!-- ======= About Section ======= -->
    <section id="about" class="about">
      <div class="container">

        <div class="section-title">
         <h2>About</h2>
          <p>Welcome to Estimation of Medical Care Cost!</p>

          <p>       At Estimation of Medical Care Cost, we are dedicated to providing you with accurate and reliable estimates of medical
```

care expenses. We understand that healthcare costs can be a major concern for individuals and families, and we believe that access to transparent and reliable information is essential in making informed decisions about healthcare.</p>

<p>Our mission is to empower individuals to plan and manage their medical expenses effectively. Whether you are considering a medical procedure, seeking treatment options, or simply want to understand the potential costs involved, we are here to assist you.</p>

</div>

<ul>

**
<i class="ri-check-double-line"></i>Accuracy and Reliability,
**

**
<i class="ri-check-double-line"></i>User-Friendly Interface,
**

**
<i class="ri-check-double-line"></i>Unbiased and Independent,
**

**
<i class="ri-check-double-line"></i>Personalized Solutions,
**

**
<i class="ri-check-double-line"></i>Privacy and Security.
**

**
**

<p>

At Estimation of Medical Care Cost, we believe that informed decisions about healthcare should not be hindered by uncertainty and lack of information. Our goal is to simplify the process of estimating medical expenses, helping you navigate the complex world of healthcare costs with confidence.

</p>

<p>We are committed to providing accurate and reliable information to assist individuals, healthcare providers, and insurance companies in understanding and planning for medical expenses. Our goal is to empower you with the knowledge and tools necessary to make informed decisions about healthcare costs.

<pre>

<hr>

</pre>

</p>

</div>

</div>

</div>

</section><!-- End About Section -->

<!-- ======= Resume Section ======= -->

<section id="resume" class="resume">

<div class="container">

```
        <div class="section-title">
          <h2>Dashboard</h2>
          <iframe
src="https://eu2.ca.analytics.ibm.com/bi/?perspective=dashboard
&amp;pathRef=.my_folders%2FMedical_cost_dashboard&amp;c
loseWindowOnLastView=true&amp;ui_appbar=false&amp;ui_na
vbar=false&amp;shareMode=embedded&amp;action=view&amp
;mode=dashboard" width="1200" height="800"
frameborder="0" gesture="media" allow="encrypted-media"
allowfullscreen=""></iframe>

    <!-- ======= Portfolio Section ======= -->
    <section id="portfolio" class="portfolio section-bg">
      <div class="container">

        <div class="section-title">
          <h2>Story</h2>
          <iframe
src="https://eu2.ca.analytics.ibm.com/bi/?perspective=story&amp
;pathRef=.my_folders%2FMedical%2Bcare%2Bcost%2Bstory&a
mp;closeWindowOnLastView=true&amp;ui_appbar=false&amp;
ui_navbar=false&amp;shareMode=embedded&amp;action=view
&amp;mode=dashboard" width="1200" height="750"
frameborder="0" gesture="media" allow="encrypted-media"
allowfullscreen=""></iframe>
```

```
      <iframe src="https://eu2.ca.analytics.ibm.com/bi/?perspective=story&amp;pathRef=.my_folders%2FMedical%2Bcare%2Bcost%2Bstory1&amp;closeWindowOnLastView=true&amp;ui_appbar=false&amp;ui_navbar=false&amp;shareMode=embedded&amp;action=view&amp;mode=dashboard" width="1200" height="750" frameborder="0" gesture="media" allow="encrypted-media" allowfullscreen=""></iframe>
      <iframe src="https://eu2.ca.analytics.ibm.com/bi/?perspective=story&amp;pathRef=.my_folders%2FMedical_care_cost&amp;closeWindowOnLastView=true&amp;ui_appbar=false&amp;ui_navbar=false&amp;shareMode=embedded&amp;action=view&amp;mode=dashboard" width="1200" height="750" frameborder="0" gesture="media" allow="encrypted-media" allowfullscreen=""></iframe>
      <!-- End Portfolio Section -->

  <!-- ======= Services Section ======= -->
  <section id="services" class="services">
    <div class="container">

      <div class="section-title">
      <h2>Report</h2>
```

```
        <iframe
src="https://eu2.ca.analytics.ibm.com/bi/?pathRef=.my_folders%2FReport_final_1&amp;closeWindowOnLastView=true&amp;ui_appbar=false&amp;ui_navbar=false&amp;shareMode=embedded" width="1200" height="800" frameborder="0" gesture="media" allow="encrypted-media" allowfullscreen=""></iframe>
        <!-- End Services Section -->

    <!-- ======= Contact Section ======= -->
    <section id="contact" class="contact">
      <div class="container">

        <div class="section-title">
          <h2>Contact</h2>
          <p>We value your interest in our estimation and prediction services for medical care costs. Should you have any questions, feedback, or inquiries, please don't hesitate to reach out to us. Our dedicated team is here to assist you and provide the information you need.</p>
        </div>

        <div class="row" data-aos="fade-in">

          <div class="col-lg-5 d-flex align-items-stretch">
            <div class="info">
```

```
<div class="address">
  <i class="bi bi-geo-alt"></i>
  <h4>Location:</h4>
  <p>KNOWLEDGE INSTITUTE OF TECHNOLOGY, SALEM</p>
</div>

<div class="email">
  <i class="bi bi-envelope"></i>
  <h4>Email:</h4>
  <pre>    GANESH VENKATESHWARAN S
  2k20ece020@kiot.ac.in</pre>
  <pre>             SUBALAKSHMI V
  2k20ece075@kiot.ac.in</pre>
  <pre>             SANTHIYA C
  2k20ece061@kiot.ac.in</pre>
  <pre>             DAMODHARAN M
  2k20ece090@kiot.ac.in</pre>
</div>

<!-- End Contact Section -->

</main><!-- End #main -->
```

```
<!-- ======= Footer ======= -->
<footer id="footer">
  <div class="container">
    <div class="copyright">
      NAAN MUDHALVAN <strong><span><a href=" https://nmcareereducation.smartinternz.com/college/knowledge-institute-of-technology-269/">IBM</span></strong></a>
    </div>
    <div class="credits">

      DATA ANALYTICS
    </div>
  </div>
</footer><!-- End  Footer -->

<a href="#" class="back-to-top d-flex align-items-center justify-content-center"><i class="bi bi-arrow-up-short"></i></a>

 <!-- Vendor JS Files -->
 <script src="{{ url_for('static', filename='assets/vendor/purecounter/purecounter_vanilla.js') }}"></script>
 <script src="{{ url_for('static', filename='assets/vendor/aos/aos.js') }}"></script>
```

```
  <script src="{{ url_for('static',
filename='assets/vendor/bootstrap/js/bootstrap.bundle.min.js')
}}"></script>
  <script src="{{ url_for('static',
filename='assets/vendor/glightbox/js/glightbox.min.js')
}}"></script>
  <script src="{{ url_for('static', filename='assets/vendor/isotope-
layout/isotope.pkgd.min.js') }}"></script>
  <script src="{{ url_for('static',
filename='assets/vendor/swiper/swiper-bundle.min.js')
}}"></script>
  <script src="{{ url_for('static',
filename='assets/vendor/typed.js/typed.min.js') }}"></script>
  <script src="{{ url_for('static',
filename='assets/vendor/waypoints/noframework.waypoints.js')
}}"></script>
  <script src="{{ url_for('static', filename='assets/vendor/php-
email-form/validate.js') }}"></script>

  <!-- Template Main JS File -->
  <script src="{{ url_for('static',
filename='assets/js/main.js')}}"></script>

</body>
```

</html>

A.2 GITHUB & PROJECT DEMO LINK

10.2.1 GITHUB LINK:
https://github.com/naanmudhalvan-SI/PBL-NT-GP--3102-1680670544

10.2.2 PROJECT DEMO VIDEO LINK:
https://drive.google.com/file/d/1ZqlrGtIgDvzh0Lw5tAcB41CJ2aM3GrzZ/view?usp=share_link