HAIRFALL PREDICTION

AN INDUSTRY ORIENTED MINI REPORT

Submitted to

JAWAHARLAL NEHRU TECNOLOGICAL UNIVERSITY, HYDERABAD

In partial fulfillment of the requirements for the award of the degree of

BACHELOR OF TECHNOLOGY

In

COMPUTER SCIENCE AND ENGINEERING

Submitted By

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CERTIFICATE OF COMPLETION INDUSTRY ORIENTED MINI PROJECT

This is to certify that the UG Project Phase-1 entitled "HAIRFALL PREDICTION" is being submitted by **VAISHNAVI PALADUGU(21UK1A05M5), PUJITHA BETHI(21UK1A05M1), UDAY RAO PERLA(21UK1A05N1)** in partial fulfillment of the requirements for the award of the degree of Bachelor of Technology in Computer Science & Engineering toJawaharlal Nehru Technological University Hyderabad during the academic year2024- 2025.

Project Guide

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(Professor)

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We wish to take this opportunity to express our sincere gratitude and deep sense of respect to our beloved **Dr Syed Musthak Ahmed,** Principal, Vaagdevi Engineering College for making us available all the required assistance and forhis support and inspiration to carry out this UG Project Phase-1 in the institute.

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ABSTRACT

Using a classification technique, this dataset is curated to investigate the predicted characteristics that lead to baldness. It has thorough records of people that capture different aspects of baldness. The following variables are present in the dataset:

Genetics: Shows whether or not baldness runs in the family.

Hormonal Changes: Selects "Yes" or "No" to indicate whether the person has had hormonal changes.

Medical Conditions: Includes a list of ailments like psoriasis, ringworm, dermatosis, and eczema.

Medication and Treatments: Includes a list of treatments such as Accutane, Antifungal Cream, and Antibiotics.

Nutritional deficits: Lists deficits in iron, calcium, protein, selenium, and other nutrients.

Stress: There are three levels of stress: low, moderate, and high.

Age: The person's actual age.

Bad Hair Care Habits: Selects whether or not to indicate bad hair care habits.

Environmental Factors: Shows exposure to elements in the environment that affect hair

TABLE OF CONTENTS:-

1.INTRODUCTION

Baldness, or alopecia, is a common condition that affects millions of individuals worldwide, impacting not only physical appearance but also psychological well-being and quality of life. Understanding the underlying causes of baldness is crucial for developing effective prevention and treatment strategies. Baldness can result from a complex interplay of genetic, hormonal, medical, environmental, and lifestyle factors. Identifying these factors and their relative contributions can provide valuable insights for both individuals and healthcare professionals.

Advancements in data science and machine learning offer new opportunities to analyze large datasets and uncover patterns that may not be immediately apparent through traditional methods. By leveraging these technologies, we can develop predictive models to identify individuals at higher risk of developing baldness and understand the contributing factors.

This project aims to predict the likelihood of baldness in individuals based on a comprehensive dataset that includes various potential predictors such as genetic predisposition, hormonal changes, medical conditions, medications, nutritional deficiencies, stress levels, age, hair care habits, environmental exposures, smoking habits, and weight loss. By applying a classification model to this dataset, we seek to identify the most significant predictors of baldness and quantify their impact.

1.1. OBJECTIVES

1. To explore and preprocess the dataset to ensure its suitability for predictive modeling.
2. To develop and train a classification model to predict the presence or absence of baldness.
3. To evaluate the performance of the model and interpret the results to identify key factors contributing to baldness.
4. To provide actionable insights that can inform prevention and treatment strategies for individuals at risk of baldness.

Through this project, we aim to contribute to the growing body of knowledge on the etiology of baldness and demonstrate the potential of data-driven approaches in medical research and personalized healthcare.

1.2 OVERVIEW

Overview

The dataset used for this project comprises detailed records of various factors that may influence hair loss. Each record represents an individual and includes data on genetic predispositions, hormonal changes, medical conditions, medications and treatments, nutritional deficiencies, stress levels, age, hair care habits, environmental factors, smoking habits, weight loss, and the presence or absence of baldness. By analyzing these factors, we can identify patterns and correlations that contribute to baldness.

The project involves several key steps:

1. **Data Collection and Preprocessing:** Gathering and cleaning the dataset to ensure it is suitable for analysis.
2. **Exploratory Data Analysis (EDA):** Understanding the distribution and relationships within the data.
3. **Feature Selection and Engineering:** Identifying and creating relevant features that can improve the model's predictive power.

4. **Model Building and Training:** Applying various machine learning algorithms to train predictive models.
5. **Model Evaluation:** Assessing the performance of the models using appropriate metrics to ensure accuracy and reliability.
6. **Interpretation and Insights:** Interpreting the results to derive meaningful insights that can inform prevention and treatment strategies for baldness.

2. LITERATURE SURVEY

The exploration of baldness, or alopecia, has been a significant area of research within dermatology and medical sciences for decades. Numerous studies have investigated the genetic, medical, and environmental factors contributing to this condition. This literature survey reviews key research findings related to the factors influencing baldness, methodologies for studying these factors, and the application of machine learning in predicting hair loss.

Genetic Factors:

Research has consistently shown that genetics play a crucial role in the development of baldness. A study by Hillmer et al. (2008) identified significant genetic loci associated with androgenetic alopecia, the most common form of hair loss in men and women. Their findings indicated that variations in the AR gene, which codes for the androgen receptor, are strongly linked to male pattern baldness. Other studies have corroborated these findings, highlighting the hereditary nature of baldness and its complex genetic architecture (Richards et al., 2009; Hagenaars et al., 2017).

Hormonal and Medical Conditions:

Hormonal changes, particularly those involving androgens, have been implicated in hair loss. Androgenetic alopecia, for example, is characterized by the miniaturization of hair follicles in response to dihydrotestosterone (DHT) (Hamilton, 1951). Additionally, medical conditions such as alopecia areata, thyroid disorders, and scalp infections have been identified as significant contributors to hair loss (Gilhar et al., 2012; Shapiro et al., 2000). These conditions can disrupt the normal hair growth cycle, leading to temporary or permanent hair loss.

Nutritional Deficiencies and Lifestyle Factors:

Nutritional deficiencies, particularly in vitamins and minerals essential for hair growth, are well-documented causes of hair loss. Studies have shown that deficiencies in iron, zinc, biotin, and vitamin D can lead to diffuse hair thinning and shedding (Rushton et al., 2002; Almohanna et al., 2019). Lifestyle factors such as stress, smoking, and poor hair care practices have also been associated with hair loss. High stress levels can trigger telogen effluvium, a condition where hair prematurely enters the resting phase and falls out (Arck et al., 2006).

Environmental Factors:

Exposure to environmental pollutants and harsh weather conditions can exacerbate hair loss. Research has indicated that pollutants such as particulate matter and polycyclic aromatic hydrocarbons can damage hair follicles and contribute to hair thinning (Seethapathy et al., 2017). Understanding these environmental impacts is crucial for developing comprehensive prevention strategies.

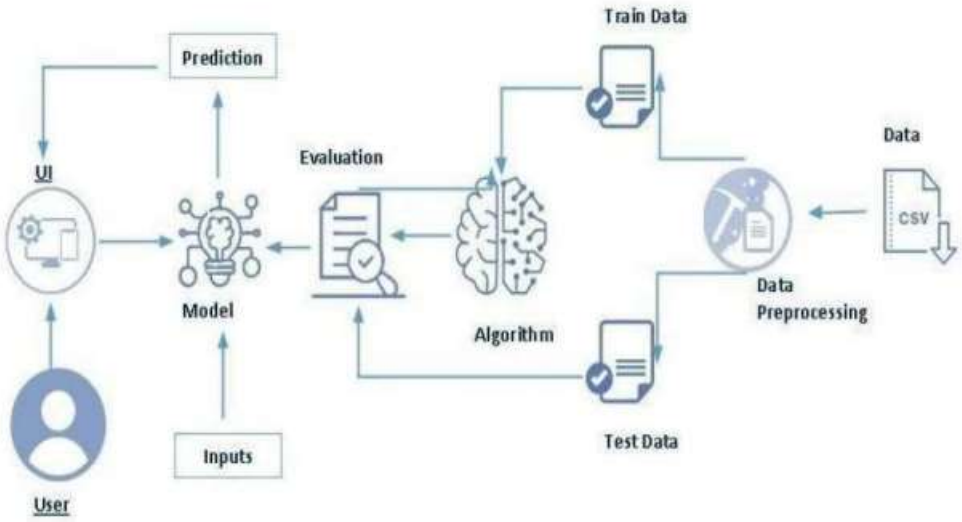
Machine Learning Applications:

The application of machine learning in medical research has seen substantial growth, providing new opportunities for predictive modeling in dermatology. Machine learning algorithms, such as decision trees, support vector machines, and neural networks, have been successfully used to predict the onset of various medical conditions, including alopecia (Esteva et al., 2017). These models can analyze complex datasets, identify patterns, and predict outcomes with high accuracy, making them invaluable tools in clinical settings.

Summary:

The literature highlights the multifactorial nature of baldness, encompassing genetic predispositions, hormonal changes, medical conditions, nutritional deficiencies, lifestyle factors, and environmental exposures. While significant progress has been made in identifying these factors, there is a growing need for predictive models that can integrate this diverse information to forecast the likelihood of baldness accurately.

3.1 BLOCK DIAGRAM



3.1 HARDWARE/SOFTWARE DESIGNING

The following is the Software required to complete this project:

Google Colab: This platform will be used for your model training, data preprocessing, and predictive modelling jobs, both in terms of development and execution. It offers hardware acceleration and access to Python libraries in a cloud-based Jupyter Notebook environment.

Dataset(xlsx File): Included should be Specialisation, Annual Income, Survey Respondents by Specialty: Feel Fairly Compensated, Overall Carrer Satisfaction, Satisfied Income, Would Choose Medicine Again

Tools for Preprocessing Data: The dataset will be preprocessed using Python tools such as NumPy, Pandas, and Scikit-learn. This covers feature scaling, data cleaning, and handling missing data.

Feature Selection/Drop: To improve the model's performance, more features can be dropped from the dataset or selected using custom Python code or Scikit-learn.

Tools for Model Training: To create, train, and optimise the predictive model, machine learning libraries like Scikit-learn, TensorFlow, or PyTorch will be utilised. Depending on how the annual salary prediction task is structured, regression or classification models may be taken into consideration.

Model Accuracy Evaluation: Following training, the model's predictive power will be evaluated using accuracy and performance evaluation techniques, like custom validation scripts or Scikit-learn metrics. The model's capacity to forecast pay categories from past data will be evaluated.

UI Based on Flask Environment: The system's user interface (UI) will be created using Flask, a Python web framework. Users will have an easy-to-use platform to enter location data or check the annual income of doctors with the Flask application.

Flask will enable user interaction and data presentation, while Google Colab will serve as the main focus for model building and training. The model will be optimised by feature selection and the dataset, in conjunction with data preparation to guarantee the quality of the training data. Ultimately, an assessment of the model's accuracy will validate the system's forecasting skills, enabling customers to depend on the physician's yearly income projection.

4.EXPERIMENTAL INVESTIGATION

1. Data Preprocessing

1.1 Data Cleaning

- Missing values in the dataset are handled by either imputing with the most frequent values or using techniques such as mean/mode imputation for numerical data and 'No Data' for categorical data.
- Data types are converted to appropriate formats (e.g., categorical to numerical encoding for machine learning models).

1.2 Feature Encoding

- Categorical variables such as "Genetics", "Hormonal Changes", "Medical Conditions", "Medications & Treatments", "Nutritional Deficiencies", "Poor Hair Care Habits", "Environmental Factors", "Smoking", and "Weight Loss" are encoded using techniques like one-hot encoding or label encoding.

1.3 Feature Scaling

- Numerical variables such as "Age" and "Stress" are scaled using standardization or normalization techniques to ensure all features contribute equally to the model.

2. Exploratory Data Analysis (EDA)

2.1 Descriptive Statistics

- Summary statistics are calculated for each feature to understand the distribution and central tendency.
- Frequency distributions for categorical variables are analyzed to identify common categories.

2.2 Correlation Analysis

- Correlation coefficients between features and the target variable "Hair Loss" are calculated to identify potential predictors.

2.3 Visualization

- Visualizations such as histograms, box plots, and bar charts are created to explore the distributions of numerical and categorical variables.
- Heatmaps are used to visualize the correlation matrix.

3. Model Building

3.1 Model Selection

- Several machine learning classification algorithms are considered, including Logistic Regression, Decision Trees, Random Forest, Support Vector Machine (SVM), and Gradient Boosting.

3.2 Model Training

- The dataset is split into training and testing sets (e.g., 80% training and 20% testing).
- Each model is trained on the training set using cross-validation to ensure robustness.

3.3 Hyperparameter Tuning

- Hyperparameters for each model are optimized using techniques such as Grid Search or Random Search.

4. Model Evaluation

4.1 Performance Metrics

- Models are evaluated using performance metrics such as Accuracy, Precision, Recall, F1-Score, and Area Under the Receiver Operating Characteristic Curve (ROC-AUC).
- Confusion matrices are analyzed to understand the distribution of true positives, true negatives, false positives, and false negatives.

4.2 Model Comparison

- The performance of different models is compared to identify the best-performing model.

5. Results

5.1 Feature Importance

- The importance of each feature is analyzed using techniques like feature importance scores from tree-based models or coefficients from linear models.

5.2 Predictive Performance

- The best-performing model is selected based on evaluation metrics.
- The model's predictions on the test set are analyzed to understand its predictive performance.

6. Discussion

6.1 Key Predictors

- Significant predictors of baldness are discussed, providing insights into the factors most strongly associated with hair loss.

6.2 Implications for Prevention and Treatment

- The findings are interpreted to suggest potential preventive measures and treatment strategies for individuals at risk of baldness.

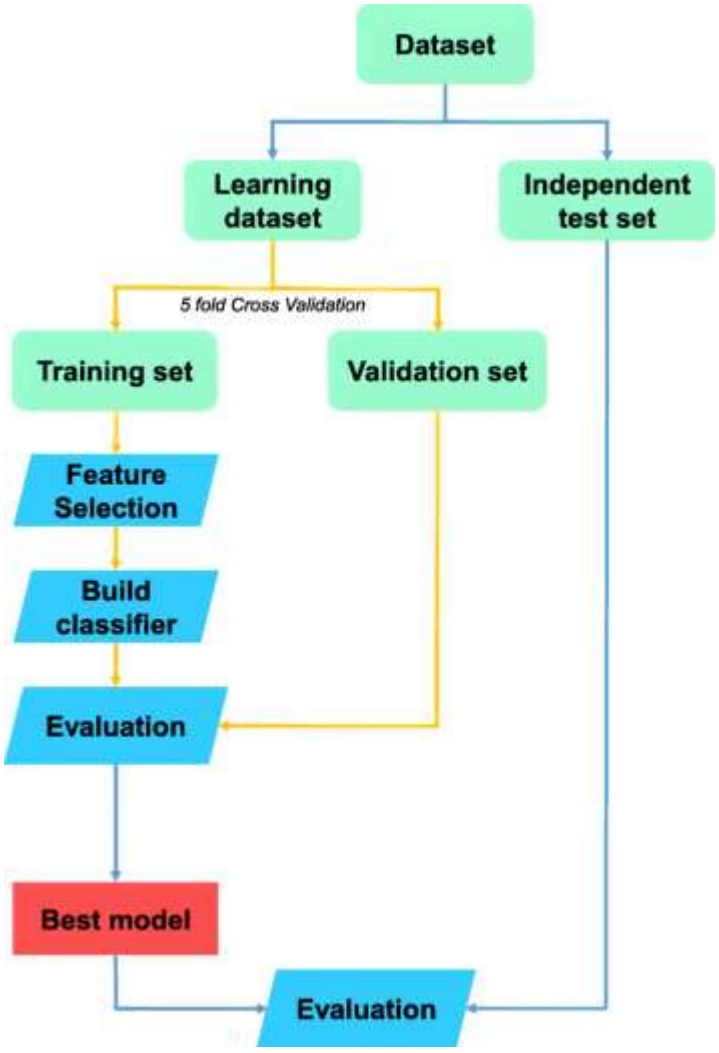
6.3 Limitations and Future Work

- Limitations of the study, such as sample size and potential biases, are discussed.
- Suggestions for future research, including the incorporation of additional variables and the use of advanced modeling techniques, are provided.

7. Conclusion

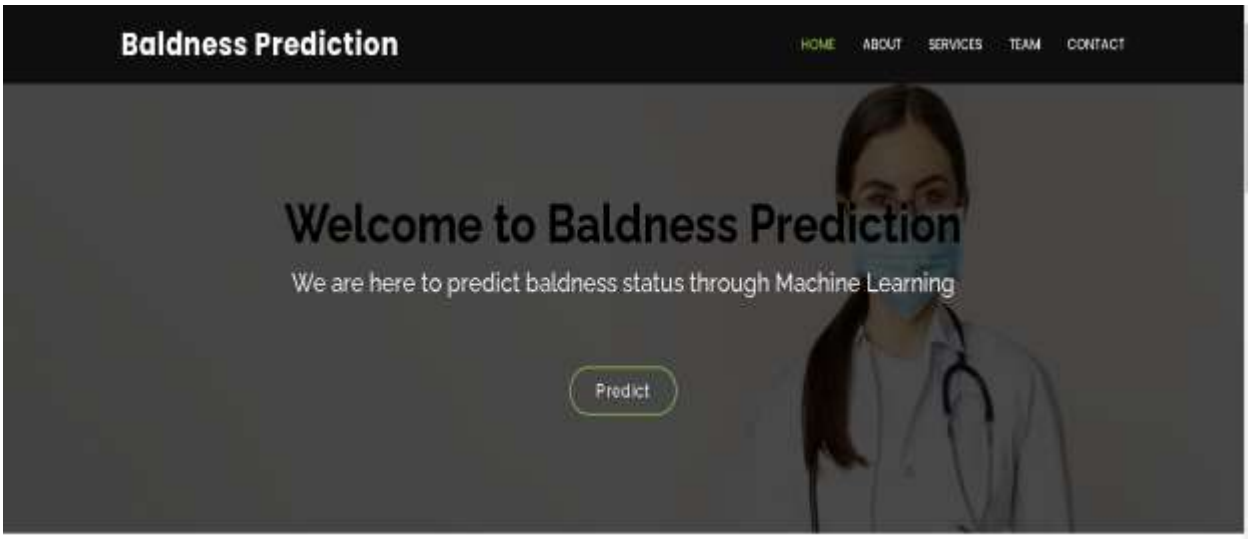
The experimental investigation demonstrates the feasibility of using machine learning models to predict baldness based on a variety of contributing factors. By identifying key predictors, the study provides valuable insights that can inform preventive and therapeutic approaches to manage and mitigate hair loss.

5. Flow Chart

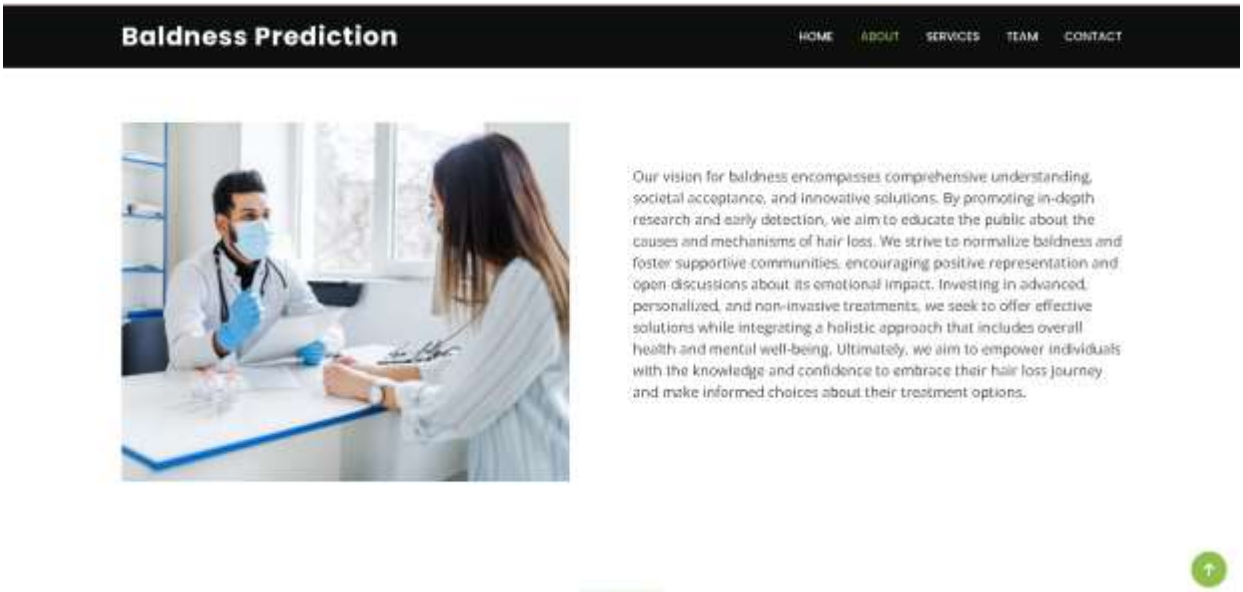

Dataset
Learning dataset
Independent test set
5 fold Cross Validation
Training set
Validation set
Feature Selection
Build classifier
Evaluation
Best model
Evaluation

6. Results

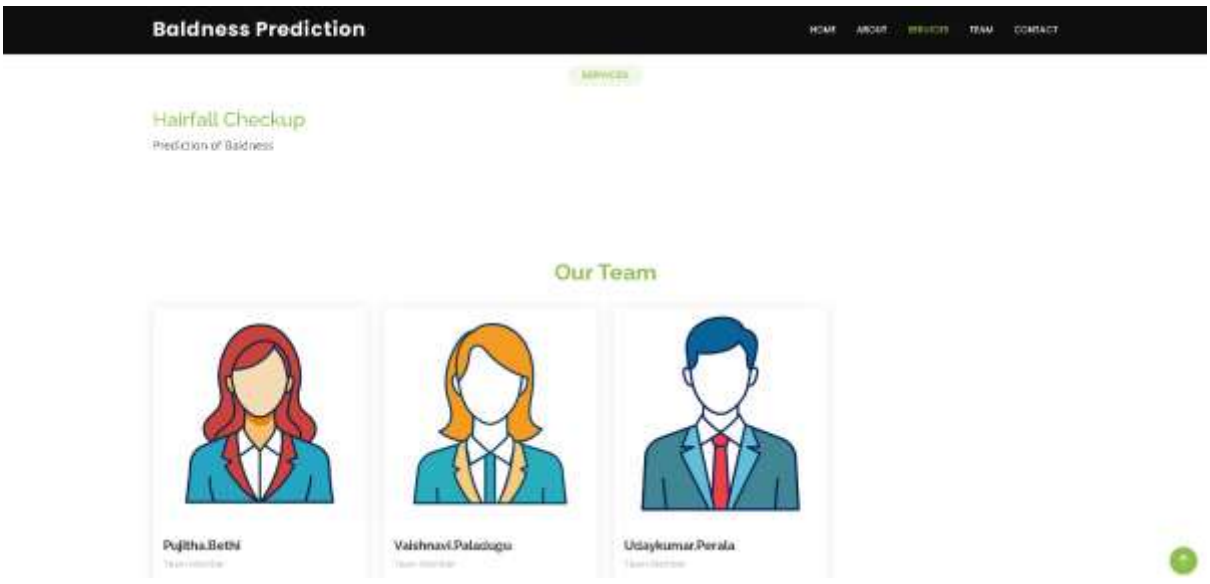
Home Page



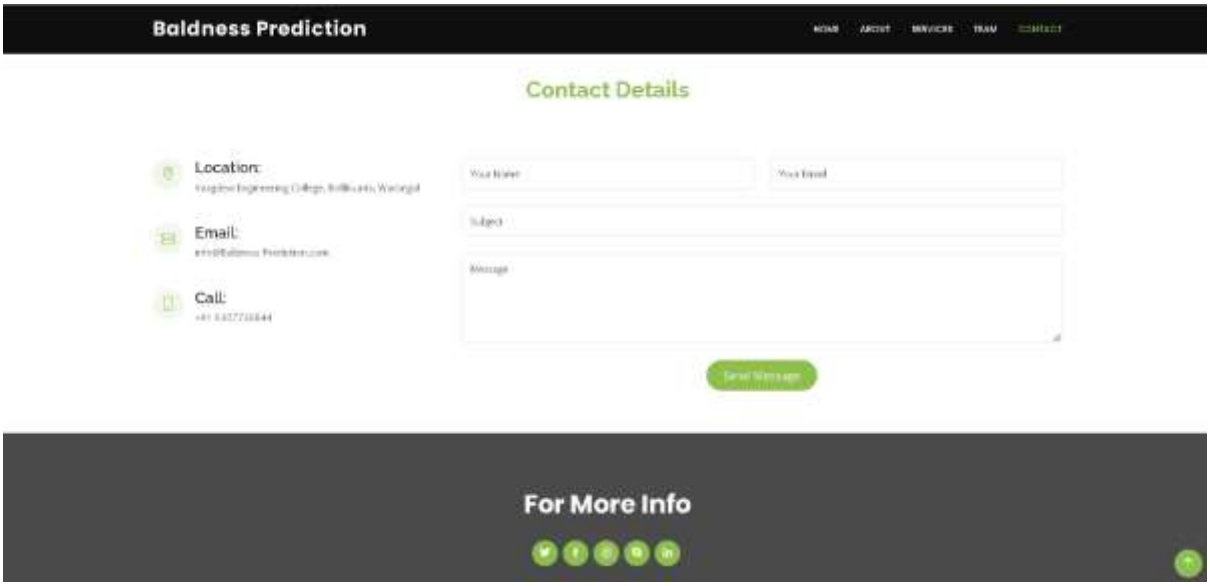
About Page



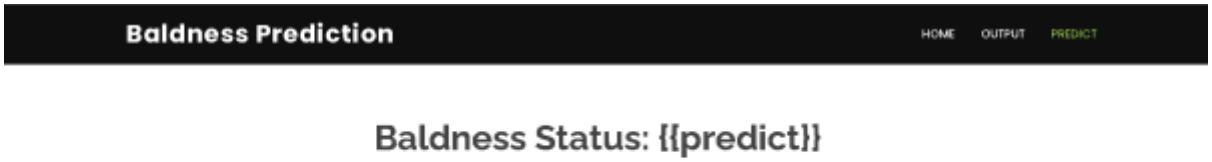
Service Page



Contact Page



Result



Conclusion

The project aimed at predicting baldness using a multifactorial dataset encompassing genetics, medical conditions, lifestyle habits, and environmental exposures demonstrates significant potential for advancing

the understanding and management of hair loss. By leveraging machine learning models, the study provides a robust framework for identifying key predictors of baldness, thereby facilitating early intervention and personalized treatment strategies.

Key Takeaways:

1. **Comprehensive Insights:**
    - The integration of diverse factors offers a holistic perspective on the causes of baldness, highlighting the complex interplay between genetic predispositions and environmental influences. This comprehensive analysis helps in identifying both primary and contributing factors to hair loss.
2. **Predictive Accuracy:**
    - The use of advanced machine learning techniques enables the creation of predictive models that can effectively estimate an individual's risk of developing baldness. These models, with their data-driven approach, offer higher accuracy and objectivity compared to traditional diagnostic methods.
3. **Personalization in Medicine:**
    - The ability to predict baldness risk on an individual basis allows for tailored preventive measures and treatment plans. Personalized recommendations can significantly improve patient outcomes by addressing specific risk factors relevant to each individual.
4. **Innovation and Research Contributions:**
    - This project contributes to the field of dermatology by introducing a novel dataset and demonstrating the applicability of machine learning in medical research. The insights gained can inform future studies and drive innovation in the diagnosis and treatment of other dermatological conditions.

Challenges and Future Directions:

Despite the promising results, the project also faces several challenges, such as data quality, model interpretability, and generalizability. Addressing these challenges will be crucial for the practical implementation of the predictive models. Future research should focus on:

- Enhancing data quality by incorporating more comprehensive and high-resolution data, including detailed genetic markers and environmental exposures.
- Improving model interpretability to ensure that the predictions are understandable and actionable for healthcare providers and patients.
- Ensuring the generalizability of the models across diverse populations and over time by continuously updating the models with new data.

Moreover, ethical considerations related to data privacy and bias must be diligently addressed to maintain the integrity and fairness of the predictive models.

Final Thoughts

In conclusion, the project successfully demonstrates the potential of using a multifactorial approach combined with machine learning to predict baldness. The insights derived from this study can lead to improved preventive measures and personalized treatment strategies, ultimately enhancing the quality of life for individuals at risk of or experiencing hair loss. By continuing to refine and expand upon this research, we can pave the way for more effective and personalized healthcare solutions in the field of dermatology and beyond.

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These references provide a solid foundation for understanding the multifactorial aspects of baldness and the application of machine learning in predictive modeling within dermatology.

11. APPENDIX

Model building :

1. Dataset
2. Google colab and VS code Application Building
    2.1 HTML file (Home file, About file, Service file, Result file)
    2.2 CSS File
3. Classification Models

Source Code

Index.html

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

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

  <title>Baldness Prediction</title>
```

```
  <meta content="" name="description">
  <meta content="" name="keywords">

  <!-- Favicons -->
  <link href="../static/assets/img/b.jpg" rel="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,400,40
0i,500,500i,600,600i,700,700i" rel="stylesheet">

  <!-- Vendor CSS Files -->
  <link href="../static/assets/vendor/aos/aos.css" rel="stylesheet">
  <link href="../static/assets/vendor/bootstrap/css/bootstrap.min.css" rel="stylesheet">
  <link href="../static/assets/vendor/bootstrap-icons/bootstrap-icons.css"
rel="stylesheet">
  <link href="../static/assets/vendor/boxicons/css/boxicons.min.css" rel="stylesheet">
  <link href="../static/assets/vendor/glightbox/css/glightbox.min.css" rel="stylesheet">
  <link href="../static/assets/vendor/swiper/swiper-bundle.min.css" rel="stylesheet">

  <!-- Template Main CSS File -->
  <link href="../static/assets/css/style.css" rel="stylesheet">

  <!-- =======================================================
  * Template Name: Remember
  * Template URL: https://bootstrapmade.com/remember-free-multipurpose-
bootstrap-template/
  * Updated: Mar 17 2024 with Bootstrap v5.3.3
  * Author: BootstrapMade.com
  * License: https://bootstrapmade.com/license/
  ======================================================= -->
</head>

<body>
```

```
  <!-- ======= Header ======= -->
  <header id="header" class="d-flex align-items-center">
    <div class="container d-flex justify-content-between">

      <div class="logo">
        <h1 class="text-light"><a href="index.html">Baldness Prediction</a></h1>
        <!-- Uncomment below if you prefer to use an image logo -->
        <!-- <a href="index.html"><img src="assets/img/logo.png" alt="" class="img-fluid"></a>-->
      </div>

      <nav id="navbar" class="navbar">
        <ul>
          <li><a class="nav-link scrollto active" href="#hero">Home</a></li>
          <li><a class="nav-link scrollto" href="#about">About</a></li>
          <li><a class="nav-link scrollto" href="#services">Services</a></li>
          <li><a class="nav-link scrollto" href="#team">Team</a></li>
          <li><a class="nav-link scrollto" href="#contact">Contact</a></li>
        </ul>
        <i class="bi bi-list mobile-nav-toggle"></i>
      </nav><!-- .navbar -->

    </div>
  </header><!-- End Header -->

  <!-- ======= Hero Section ======= -->
  <section id="hero">
    <div class="hero-container" data-aos="fade-up">
      <h1>Welcome to Baldness Prediction</h1>
      <h2>We are here to predict baldness status through Machine Learning</h2>
      <a href="{{url_for('inner')}}" class="btn-get-started scrollto">Predict</a>
    </div>
  </section><!-- End Hero -->

  <main id="main">

    <!-- ======= About Section ======= -->
```

```
    <section id="about" class="about">
      <div class="container" data-aos="fade-up">

        <div class="row">
          <div class="features-image col-lg-6" data-aos="fade-up" data-aos-
delay="100"><img src="../static/assets/img/doctor.jpg" alt=""></div>
          <div class="col-lg-6">
          <br>
          <br>
         Our vision for baldness encompasses comprehensive understanding, societal
acceptance, and innovative solutions. By promoting in-depth research and early
detection, we aim to educate the public about the causes and mechanisms of hair loss.
We strive to normalize baldness and foster supportive communities, encouraging
positive representation and open discussions about its emotional impact. Investing in
advanced, personalized, and non-invasive treatments, we seek to offer effective
solutions while integrating a holistic approach that includes overall health and mental
well-being. Ultimately, we aim to empower individuals with the knowledge and
confidence to embrace their hair loss journey and make informed choices about their
treatment options.
          </div>
        </div>
      </div>

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


    <!-- ======= Services Section ======= -->
  <section id="services" class="services">
    <!-- Section Title -->
    <div class="container section-title" data-aos="fade-up">
      <h2>Services</h2>
    </div><!-- End Section Title -->

    <div class="container">

      <div class="row gy-4">
        <div class="col-lg-4 col-md-6" data-aos="fade-up" data-aos-delay="400">
```

```
        <div class="service-item position-relative">
          </div>
          <a href="/inner-page" class="stretched-link">
            <h3>Hairfall Checkup</h3>
          </a>
          <p>Prediction of Baldness</p>
        </div>
      </div><!-- End Service Item -->
    </div>
  </div>
</section> <!-- End Services Section -->



  <!-- ======= Team Section ======= -->
  <section id="team" class="team">
    <div class="container">

      <div class="section-title" data-aos="zoom-in">
        <h3><span>Our Team</span></h3>
      </div>

      <div class="row">

        <div class="col-lg-3 col-md-6 d-flex align-items-stretch">
          <div class="member" data-aos="fade-up">
            <div class="member-img">
              <img src="../static/assets/img/team/1.jpg" class="img-fluid" alt="">
              <div class="social">
                <a href=""><i class="bi bi-twitter"></i></a>
                <a href=""><i class="bi bi-facebook"></i></a>
                <a href=""><i class="bi bi-instagram"></i></a>
                <a href=""><i class="bi bi-linkedin"></i></a>
              </div>
            </div>
            <div class="member-info">
              <h4>Pujitha.Bethi</h4>
```

```
      <span>Team Member</span>
    </div>
  </div>
</div>

<div class="col-lg-3 col-md-6 d-flex align-items-stretch">
  <div class="member" data-aos="fade-up">
    <div class="member-img">
      <img src="../static/assets/img/team/2.jpg" class="img-fluid" alt="">
      <div class="social">
        <a href=""><i class="bi bi-twitter"></i></a>
        <a href=""><i class="bi bi-facebook"></i></a>
        <a href=""><i class="bi bi-instagram"></i></a>
        <a href=""><i class="bi bi-linkedin"></i></a>
      </div>
    </div>
    <div class="member-info">
      <h4>Vaishnavi.Paladugu</h4>
      <span>Team Member</span>
    </div>
  </div>
</div>

<div class="col-lg-3 col-md-6 d-flex align-items-stretch">
  <div class="member" data-aos="fade-up">
    <div class="member-img">
      <img src="../static/assets/img/team/3.jpg" class="img-fluid" alt="">
      <div class="social">
        <a href=""><i class="bi bi-twitter"></i></a>
        <a href=""><i class="bi bi-facebook"></i></a>
        <a href=""><i class="bi bi-instagram"></i></a>
        <a href=""><i class="bi bi-linkedin"></i></a>
      </div>
    </div>
    <div class="member-info">
      <h4>Udaykumar.Perala</h4>
      <span>Team Member</span>
```

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

    </div>

  </div>
</section><!-- End Team Section -->


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

      <div class="section-title" data-aos="zoom-in">
        <h3><span>Contact Details</span></h3>
      </div>

      <div class="row mt-5">

        <div class="col-lg-4" data-aos="fade-right">
          <div class="info">
            <div class="address">
              <i class="bi bi-geo-alt"></i>
              <h4>Location:</h4>
              <p>Vaagdevi Engineering College, Bollikunta, Warangal</p>
            </div>

            <div class="email">
              <i class="bi bi-envelope"></i>
              <h4>Email:</h4>
              <p>info@Baldness Prediction.com</p>
            </div>

            <div class="phone">
              <i class="bi bi-phone"></i>
              <h4>Call:</h4>
```

```
            <p>+91 6307736844</p>
          </div>

        </div>

      </div>
        <div class="col-lg-8 mt-5 mt-lg-0">

          <form action="forms/contact.php" method="post" role="form" class="php-email-form">
            <div class="row">
              <div class="col-md-6 form-group">
                <input type="text" name="name" class="form-control" id="name" placeholder="Your Name" required>
              </div>
              <div class="col-md-6 form-group mt-3 mt-md-0">
                <input type="email" class="form-control" name="email" id="email" placeholder="Your Email" required>
              </div>
            </div>
            <div class="form-group mt-3">
              <input type="text" class="form-control" name="subject" id="subject" placeholder="Subject" required>
            </div>
            <div class="form-group mt-3">
              <textarea class="form-control" name="message" rows="5" placeholder="Message" required></textarea>
            </div>
            <div class="my-3">
              <div class="loading">Loading</div>
              <div class="error-message"></div>
              <div class="sent-message">Your message has been sent. Thank you!</div>
            </div>
            <div class="text-center"><button type="submit">Send Message</button></div>
          </form>
```

```
          </div>
        </div>

      </div>
    </section><!-- End Contact Section -->

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

  <!-- ======= Footer ======= -->
  <footer id="footer">

    <div class="footer-top">

      <div class="container">

        <div class="row  justify-content-center">
          <div class="col-lg-6">
            <h3>For More Info</h3>
          </div>
        </div>

        <div class="social-links">
          <a href="#" class="twitter"><i class="bx bxl-twitter"></i></a>
          <a href="#" class="facebook"><i class="bx bxl-facebook"></i></a>
          <a href="#" class="instagram"><i class="bx bxl-instagram"></i></a>
          <a href="#" class="google-plus"><i class="bx bxl-skype"></i></a>
          <a href="#" class="linkedin"><i class="bx bxl-linkedin"></i></a>
        </div>

      </div>
    </div>

    <div class="container footer-bottom clearfix">
      <div class="copyright">
        &copy; Copyright <strong><span>Baldness Prediction</span></strong>. All Rights Reserved
      </div>
```

```
      <div class="credits">
        <!-- All the links in the footer should remain intact. -->
        <!-- You can delete the links only if you purchased the pro version. -->
        <!-- Licensing information: https://bootstrapmade.com/license/ -->
        <!-- Purchase the pro version with working PHP/AJAX contact form: https://bootstrapmade.com/remember-free-multipurpose-bootstrap-template/ -->
      </div>
    </div>
  </footer><!-- End Footer -->
  <div id="preloader"></div>
  <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="../static/assets/vendor/purecounter/purecounter_vanilla.js"></script>
  <script src="../static/assets/vendor/aos/aos.js"></script>
  <script src="../static/assets/vendor/bootstrap/js/bootstrap.bundle.min.js"></script>
  <script src="../static/assets/vendor/glightbox/js/glightbox.min.js"></script>
  <script src="../static/assets/vendor/isotope-layout/isotope.pkgd.min.js"></script>
  <script src="../static/assets/vendor/swiper/swiper-bundle.min.js"></script>
  <script src="../static/assets/vendor/php-email-form/validate.js"></script>

  <!-- Template Main JS File -->
  <script src="../static/assets/js/main.js"></script>

</body>

</html>
```

Innerpage.html

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

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

```
  <title>Inner Page</title>
  <meta content="" name="description">
  <meta content="" name="keywords">

  <!-- Favicons -->
   <link href="../static/assets/img/b.jpg" rel="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,400,40
0i,500,500i,600,600i,700,700i" rel="stylesheet">

  <!-- Vendor CSS Files -->
  <link href="../static/assets/vendor/aos/aos.css" rel="stylesheet">
  <link href="../static/assets/vendor/bootstrap/css/bootstrap.min.css" rel="stylesheet">
  <link href="../static/assets/vendor/bootstrap-icons/bootstrap-icons.css"
rel="stylesheet">
  <link href="../static/assets/vendor/boxicons/css/boxicons.min.css" rel="stylesheet">
  <link href="../static/assets/vendor/glightbox/css/glightbox.min.css" rel="stylesheet">
  <link href="../static/assets/vendor/swiper/swiper-bundle.min.css" rel="stylesheet">

  <!-- Template Main CSS File -->
  <link href="../static/assets/css/style.css" rel="stylesheet">

  <!-- =======================================================
  * Template Name: Remember
  * Template URL: https://bootstrapmade.com/remember-free-multipurpose-
bootstrap-template/
  * Updated: Mar 17 2024 with Bootstrap v5.3.3
  * Author: BootstrapMade.com
  * License: https://bootstrapmade.com/license/
  ======================================================= -->
</head>

<body>

  <!-- ======= Header ======= -->
```

```
  <header id="header" class="d-flex align-items-center">
    <div class="container d-flex justify-content-between">

      <div class="logo">
        <h1 class="text-light"><a href="inner-page.html">Baldness
Prediction</a></h1>
        <!-- Uncomment below if you prefer to use an image logo -->
        <!-- <a href="index.html"><img src="assets/img/logo.png" alt="" class="img-
fluid"></a>-->
      </div>

      <nav id="navbar" class="navbar">
        <ul>
          <li><a class="nav-link scrollto" href="/">Home</a></li>
          <li><a class="nav-link scrollto" href="#hero">About</a></li>
         <li><a class="nav-link scrollto" href="#predict">Predict</a></li>
        </ul>
        <i class="bi bi-list mobile-nav-toggle"></i>
      </nav><!-- .navbar -->

    </div>
  </header><!-- End Header -->

  <!-- ======= Hero Section ======= -->
  <section id="hero">
    <div class="hero-container" data-aos="fade-up">
      <h1> Predict Baldness</h1>
    </div>
  </section><!-- End Hero -->

  <main id="main">
  <!-- ======= About Section ======= -->
  <section id="predict" class="predict">
    <center>
        <h3>Enter Your Details Here</h3>
        <br>
        <p class="fst-italic"
```

```
        <div class="container" >
          <form method="post" action="/predict">
            <div class="row">
              <div class="col-sm">
                <label for="Genetics"><b>Genetics</b></label><br>
                <input type="text" name="feature1"><br>
                <br>

                <label for="Harmonal Changes"><b>Harmonal
Changes</b></label><br>
                <input type="text" name="feature2"><br>
                <br>

                <label for="Medical Conditions"><b>Medical
Conditions</b></label><br>
                <input type="text" name="feature3"><br>
                <br>

                 <label for="Medications & Treatments "><b>Medications &
Treatments</b></label><br>
                 <input type="text" name="feature4"><br>
                 <br>

                 <label for="Nutritional deficiencies"><b>Nutritional
deficiencies</b></label><br>
                 <input type="text" name="feature5"><br>
                 <br>
               </div>
               <div class="col-sm">
                 <label for="Age "><b>Age</b></label><br>
                 <input type="text" name="feature6"><br>
                 <br>

                 <label for="Poor Hair Care Habits"><b>Poor Hair Care
Habits</b></label><br>
                 <input type="text" name="feature7"><br>
                 <br>
```

```
            <label for="Environmental Factors"><b>Environmental
Factors</b></label><br>
            <input type="text" name="feature8"><br>
            <br>

            <label for="Smoking"><b>Smoking</b></label><br>
            <input type="text" name="feature9"><br>
            <br>

           <label for="Weight Loss"><b>Weight Loss</b></label><br>
           <input type="text" name="feature10"><br>
           <br>
          </div>

          <div class="col-sm">
           <label for="Stress_level"><b>Stress_level</b></label><br>
           <input type="text" name="feature11"><br>
           <br>

         <label for="Hair_Loss"><b>Hair Loss</b></label><br>
        <input type="text" name="feature12"><br>
        <br>
         </div>
         <br>
         <br>
         <br>
        </div>
        <button type="submit" class="btn btn-success" >Submit</button>
      </form>
     </div>
   </p>
  </Center>

 </div>
</div>
```

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


 </main>
 <div id="preloader"></div>
  <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="../static/assets/vendor/purecounter/purecounter_vanilla.js"></script>
  <script src="../static/assets/vendor/aos/aos.js"></script>
  <script src="../static/assets/vendor/bootstrap/js/bootstrap.bundle.min.js"></script>
  <script src="../static/assets/vendor/glightbox/js/glightbox.min.js"></script>
  <script src="../static/assets/vendor/isotope-layout/isotope.pkgd.min.js"></script>
  <script src="../static/assets/vendor/swiper/swiper-bundle.min.js"></script>
  <script src="../static/assets/vendor/php-email-form/validate.js"></script>

  <!-- Template Main JS File -->
  <script src="../static/assets/js/main.js"></script>

</body>

</html>
```

Output.html

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

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

  <title>Bladness Prediction Output</title>
  <meta content="" name="description">
  <meta content="" name="keywords">
```

```
  <!-- Favicons -->
  <link href="../static/assets/img/b.jpg" rel="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,400,40
0i,500,500i,600,600i,700,700i" rel="stylesheet">

  <!-- Vendor CSS Files -->
  <link href="../static/assets/vendor/aos/aos.css" rel="stylesheet">
  <link href="../static/assets/vendor/bootstrap/css/bootstrap.min.css" rel="stylesheet">
  <link href="../static/assets/vendor/bootstrap-icons/bootstrap-icons.css"
rel="stylesheet">
  <link href="../static/assets/vendor/boxicons/css/boxicons.min.css" rel="stylesheet">
  <link href="../static/assets/vendor/glightbox/css/glightbox.min.css" rel="stylesheet">
  <link href="../static/assets/vendor/remixicon/remixicon.css" rel="stylesheet">
  <link href="../static/assets/vendor/swiper/swiper-bundle.min.css" rel="stylesheet">

  <!-- Template Main CSS File -->
  <link href="../static/assets/css/style.css" rel="stylesheet">

  <!-- =======================================================
  * Template Name: Gp - v4.10.0
  * Template URL: https://bootstrapmade.com/gp-free-multipurpose-html-bootstrap-
template/
  * Author: BootstrapMade.com
  * License: https://bootstrapmade.com/license/
  ======================================================== -->
</head>

<body>

  <!-- ======= Header ======= -->
  <header id="header" class="d-flex align-items-center">
    <div class="container d-flex justify-content-between">

      <div class="logo">
```

```
      <h1 class="text-light"><a href="output.html">Baldness Prediction</a></h1>
      <!-- Uncomment below if you prefer to use an image logo -->
      <!-- <a href="index.html"><img src="assets/img/logo.png" alt="" class="img-fluid"></a>-->
    </div>
    <nav id="navbar" class="navbar">
      <ul>
        <li><a class="nav-link scrollto" href="/">Home</a></li>
        <li><a class="nav-link scrollto" href="#hero">Output</a></li>
        <li><a class="nav-link scrollto" href="#predict">Predict</a></li>
      </ul>
      <i class="bi bi-list mobile-nav-toggle"></i>
    </nav><!-- .navbar -->
  </div>
</header><!-- End Header -->

<!-- ======= Output Section ======= -->
<section id="predict" class="d-flex align-items-center justify-content-center">
  <div class="container" data-aos="fade-up">

    <div class="row justify-content-center" data-aos="fade-up" data-aos-delay="150">
      <div class="col-xl-6 col-lg-8">
      <form id="predict" data-form onsubmit="return calculatebaldness()">

          </form>
        <h1> <b style="rgb(234, 30, 180)">Baldness Status: {{output}} </b></h1>
      </div>
    </div>

  </div>

</section><!-- End Output -->


  <main id="main">
```

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

  <div id="preloader"></div>
  <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="../static/assets/vendor/purecounter/purecounter_vanilla.js"></script>
  <script src="../static/assets/vendor/aos/aos.js"></script>
  <script src="../static/assets/vendor/bootstrap/js/bootstrap.bundle.min.js"></script>
  <script src="../static/assets/vendor/glightbox/js/glightbox.min.js"></script>
  <script src="../static/assets/vendor/isotope-layout/isotope.pkgd.min.js"></script>
  <script src="../static/assets/vendor/swiper/swiper-bundle.min.js"></script>
  <script src="../static/assets/vendor/php-email-form/validate.js"></script>

  <!-- Template Main JS File -->
  <script src="../static/assets/js/main.js"></script>

</body>

</html>
```

Code Snippets:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import warnings
warnings.filterwarnings("ignore")
```

```
import pandas as pd
from google.colab import drive
drive.mount('/content/drive')
df = pd.read_csv("/content/drive/MyDrive/Colab Notebooks/Predict Hair Fall.csv")
```

```
df
```

	Id	Genetics	Hormonal Changes	Medical Conditions	Medications & Treatments	Nutritional Deficiencies	Stress	Age	Poor Hair Care Habits	Environmental Factors	Smoking	Weight Loss	Hair Loss
0	133992	Yes	No	No Data	No Data	Magnesium deficiency	Moderate	19	Yes	Yes	No	No	0
1	148393	No	No	Eczema	Antibiotics	Magnesium deficiency	High	43	Yes	Yes	No	No	0
2	155074	No	No	Dermatosis	Antifungal Cream	Protein deficiency	Moderate	26	Yes	Yes	No	Yes	0
3	118281	Yes	Yes	Ringworm	Antibiotics	Biotin Deficiency	Moderate	46	Yes	Yes	No	No	0
4	111915	No	No	Psoriasis	Accutane	Iron deficiency	Moderate	30	No	Yes	Yes	No	1
...	...	...	...	...	...	...	...	...	...	...	...	...	...
994	184367	Yes	No	Seborrheic Dermatitis	Rogaine	Vitamin A Deficiency	Low	33	Yes	Yes	Yes	Yes	1
995	164777	Yes	Yes	No Data	Accutane	Protein deficiency	Low	47	No	No	No	Yes	0
996	143273	No	Yes	Androgenetic Alopecia	Antidepressants	Protein deficiency	Moderate	20	Yes	No	Yes	Yes	1
997	169123	No	Yes	Dermatitis	Immunomodulators	Biotin Deficiency	Moderate	32	Yes	Yes	Yes	Yes	1
998	127183	Yes	Yes	Psoriasis	Blood Pressure Medication	Vitamin D Deficiency	Low	34	No	Yes	No	No	1

999 rows × 13 columns

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 999 entries, 0 to 998
Data columns (total 13 columns):
 #   Column                    Non-Null Count  Dtype 
---  ------                    --------------  ----- 
 0   Id                        999 non-null    int64 
 1   Genetics                  999 non-null    object
 2   Hormonal Changes          999 non-null    object
 3   Medical Conditions        999 non-null    object
 4   Medications & Treatments  999 non-null    object
 5   Nutritional Deficiencies  999 non-null    object
 6   Stress                    999 non-null    object
 7   Age                       999 non-null    int64 
 8   Poor Hair Care Habits     999 non-null    object
 9   Environmental Factors     999 non-null    object
 10  Smoking                   999 non-null    object
 11  Weight Loss               999 non-null    object
 12  Hair Loss                 999 non-null    int64 
dtypes: int64(3), object(10)
memory usage: 101.6+ KB
```

```
df.isnull().sum()
```

```
Id                              0
Genetics                        0
Hormonal Changes                0
Medical Conditions              0
Medications & Treatments        0
Nutritional Deficiencies        0
Stress                          0
Age                             0
Poor Hair Care Habits           0
Environmental Factors           0
Smoking                         0
Weight Loss                     0
Hair Loss                       0
dtype: int64
```

```
df.describe()
```

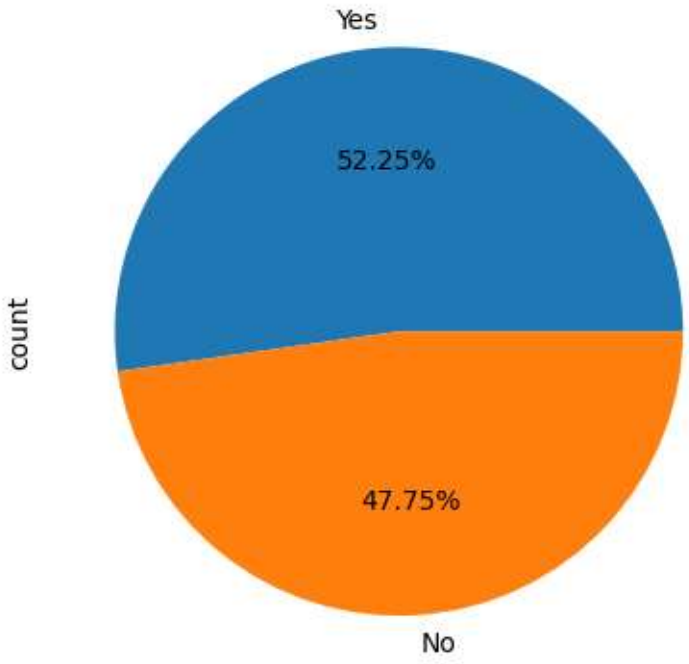
	Id	Age	Hair Loss
count	999.000000	999.000000	999.000000
mean	153354.673674	34.188188	0.497497
std	25516.041985	9.377980	0.500244
min	110003.000000	18.000000	0.000000
25%	131867.500000	26.000000	0.000000
50%	152951.000000	34.000000	0.000000
75%	174969.000000	42.000000	1.000000
max	199949.000000	50.000000	1.000000

```
gen=df["Genetics"].value_counts()
```

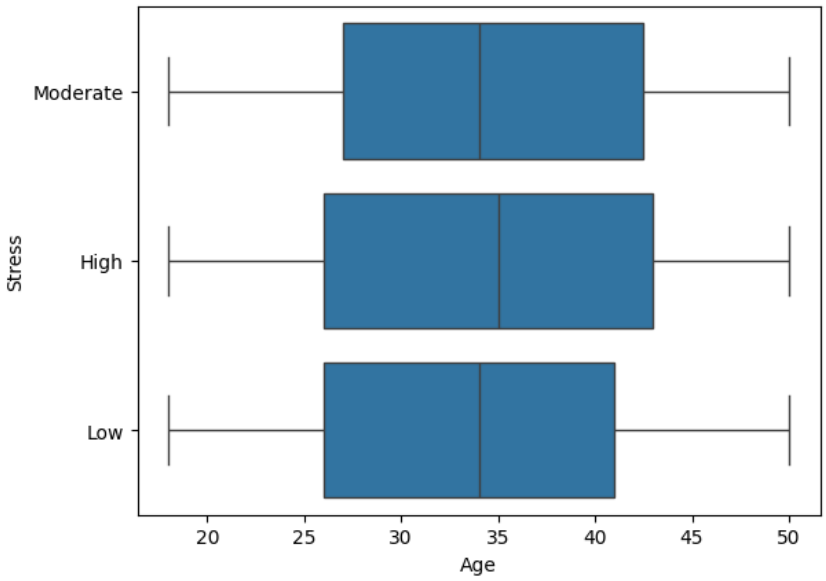
```
gen
```

```
Genetics
Yes    522
No     477
Name: count, dtype: int64
```

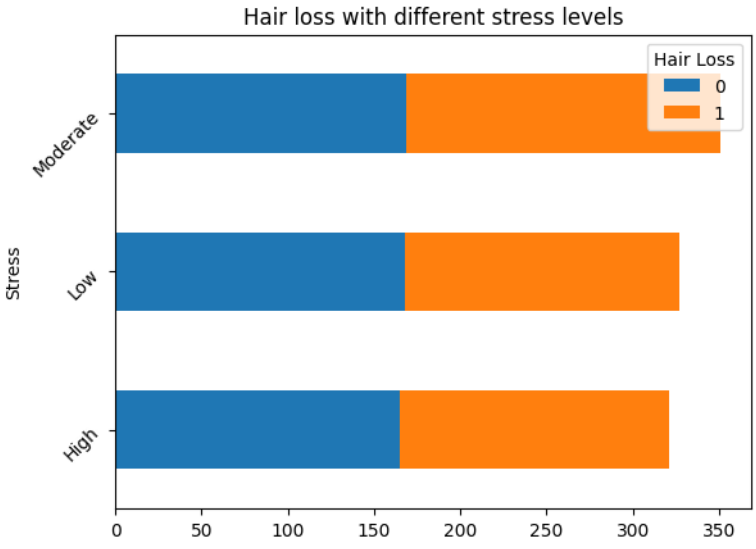
```
gen.plot(kind="pie",subplots=True,autopct="%1.2f%%")
plt.show()
```



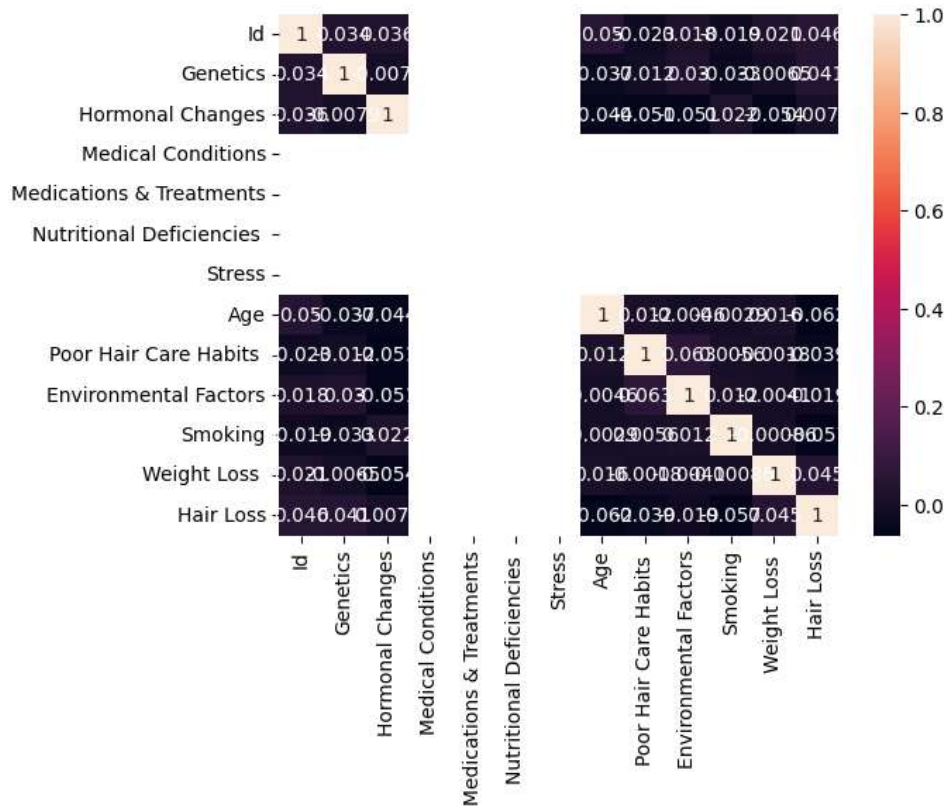

```
sns.boxplot(x="Age",y="Stress",data=df)
```




```
df.groupby('Stress')['Hair Loss'].value_counts(normalize= False).unstack('Hair Loss').plot.barh(stacked=True)
plt.title('Hair loss with different stress levels')
plt.yticks(rotation=45)
plt.show()
```



```
for col in df.columns:
    if df[col].dtype == 'object':  # Check if column is of object type
(likely string)
        df[col] = df[col].map({'Yes': 1, 'No': 0})  # Replace 'Yes'
with 1, 'No' with 0

sns.heatmap(df.corr(),annot=True)
plt.show()
```

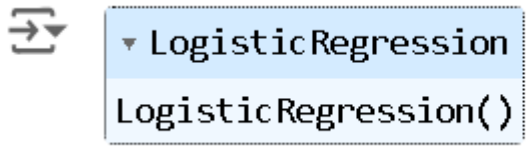



```
from sklearn.model_selection import train_test_split
x=df.drop(["Hair Loss","Id"],axis=1)
y=df["Hair Loss"]
xtrain,xtest,ytrain,ytest=train_test_split(x,y,test_size=0.20,random_st
ate=0)
```

```
from sklearn.linear_model import LogisticRegression
lo=LogisticRegression()
```

```
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LogisticRegression
from sklearn.impute import SimpleImputer

imputer = SimpleImputer(strategy='most_frequent')
x = imputer.fit_transform(x)
```

```
xtrain,xtest,ytrain,ytest=train_test_split(x,y,test_size=0.20,random_st
ate=0)

lo = LogisticRegression()
lo.fit(xtrain, ytrain)
```




```
ypred=lo.predict(xtest)
ypred
```

```
array([1, 0, 1, 1, 0, 0, 0, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 0, 0, 0, 1,
       1, 0, 0, 1, 1, 1, 0, 1, 0, 0, 0, 0, 0, 0, 1, 0, 1, 1, 0, 1, 0, 1,
       1, 1, 1, 1, 0, 0, 0, 0, 1, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 1, 0, 1,
       1, 0, 1, 1, 0, 0, 1, 0, 1, 0, 1, 0, 1, 1, 1, 1, 0, 1, 1, 1, 0, 0,
       0, 1, 1, 1, 1, 0, 1, 1, 1, 1, 0, 1, 0, 1, 1, 1, 0, 0, 1, 0, 1, 0,
       1, 0, 0, 1, 1, 0, 1, 0, 0, 1, 0, 1, 0, 0, 0, 0, 1, 1, 0, 1, 0, 0,
       0, 0, 1, 1, 0, 1, 1, 0, 1, 1, 0, 1, 1, 0, 0, 0, 0, 1, 1, 0, 0, 0,
       1, 0, 1, 0, 0, 0, 1, 0, 1, 0, 0, 0, 1, 0, 1, 0, 1, 0, 0, 0, 0, 0,
       0, 0, 0, 1, 1, 0, 1, 0, 1, 1, 0, 0, 0, 1, 1, 1, 0, 1, 1, 0, 1, 1,
       0, 1])
```

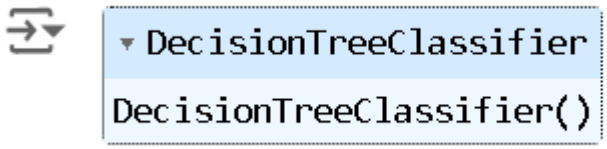
```
y_train_pred = lo.predict(xtrain)
ypred = lo.predict(xtest)

from sklearn.metrics import
accuracy_score,classification_report,confusion_matrix
accuracy_lr = accuracy_score(ytest,ypred)
cla=classification_report(ytest,ypred)
con=confusion_matrix(ytest,ypred)
print("Train
Result:\n================================================")
print(accuracy_score(ytrain,y_train_pred)*100)
print("")

print("Test
Result:\n================================================")
print(accuracy_score(ytest,  ypred)*100)
print("")

print("_____________________________________________________________")
print("Classification Report")
print(cla)
```

```
print("_____________________________________________________________")
print("")
print("confussion_matrix:")
print(con)
```

```
Train Result:
================================================
53.066332916145186

Test Result:
================================================
57.49999999999999

_____________________________________________________________
Classification Report
              precision    recall  f1-score   support

           0       0.58      0.58      0.58       102
           1       0.57      0.57      0.57        98

    accuracy                           0.57       200
   macro avg       0.57      0.57      0.57       200
weighted avg       0.58      0.57      0.58       200

_____________________________________________________________

confussion_matrix:
[[59 43]
 [42 56]]
```

```
from sklearn.tree import DecisionTreeClassifier
dic=DecisionTreeClassifier()
```

```
dic.fit(xtrain,ytrain)
```




```
y_train_pred1 = dic.predict(xtrain)
ypred1 = dic.predict(xtest)

from sklearn.metrics import
accuracy_score,classification_report,confusion_matrix
accuracy_lr = accuracy_score(ytest,ypred1)
cla=classification_report(ytest,ypred1)
con=confusion_matrix(ytest,ypred1)
print("Train
Result:\n================================================")
print(accuracy_score(ytrain,y_train_pred1)*100)
```

```
print("")

print("Test Result:\n================================================")
print(accuracy_score(ytest,ypred1)*100)
print("")

print("_____________________________________________")
print("Classification Report:")
print(cla)
print("_____________________________________________")
print("")

print("confusion_matrix:")
print(con)
```

```
Train Result:
================================================
92.86608260325406

Test Result:
================================================
53.0

_____________________________________________
Classification Report:
              precision    recall  f1-score   support

           0       0.54      0.49      0.52       102
           1       0.52      0.57      0.54        98

    accuracy                           0.53       200
   macro avg       0.53      0.53      0.53       200
weighted avg       0.53      0.53      0.53       200

_____________________________________________

confusion_matrix:
[[50 52]
 [42 56]]
```

```
from sklearn.neighbors import KNeighborsClassifier

knn=KNeighborsClassifier()

knn.fit(xtrain,ytrain)
```

```
KNeighborsClassifier
KNeighborsClassifier()
```

```
kypre=knn.predict(xtest)
kypre
```

```
array([0, 0, 0, 1, 0, 1, 1, 0, 0, 1, 1, 0, 1, 0, 1, 1, 0, 0, 1, 0, 1, 1,
       1, 0, 0, 1, 0, 1, 0, 0, 0, 0, 0, 0, 0, 1, 0, 1, 1, 0, 0, 1, 0, 1,
       0, 1, 1, 1, 0, 1, 1, 1, 0, 0, 0, 0, 0, 0, 1, 1, 0, 1, 1, 1, 0, 1,
       1, 1, 0, 1, 0, 1, 1, 0, 1, 0, 1, 0, 1, 0, 1, 1, 0, 1, 0, 0, 0, 0,
       1, 1, 0, 0, 1, 0, 1, 0, 0, 1, 0, 0, 1, 1, 0, 0, 1, 1, 1, 0, 0, 1,
       1, 0, 0, 1, 1, 0, 0, 1, 0, 1, 0, 1, 0, 1, 1, 0, 0, 0, 1, 1, 1, 1,
       1, 1, 0, 1, 0, 0, 1, 1, 1, 1, 0, 1, 0, 1, 1, 0, 1, 0, 1, 1, 0, 0,
       1, 0, 1, 1, 0, 1, 0, 0, 1, 0, 0, 0, 1, 0, 1, 0, 1, 0, 1, 1, 0, 0,
       0, 0, 1, 1, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 1, 1, 1,
       1, 1])
```

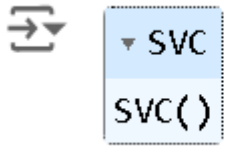
```
kac=accuracy_score(ytest,kypre)*100
kac
```

```
55.00000000000001
```

```
from sklearn.svm import SVC
```

```
sv=SVC(max_iter=-1)
```

```
sv.fit(xtrain,ytrain)
```




```
yp=sv.predict(xtest)
yp
```

```
array([1, 0, 0, 1, 1, 0, 1, 0, 0, 1, 1, 1, 1, 1, 1, 0, 1, 0, 1, 1, 1, 1,
       1, 0, 1, 1, 1, 1, 0, 1, 1, 0, 1, 0, 0, 1, 0, 1, 1, 1, 1, 1, 0, 1,
       1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 0, 1, 1,
       1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 0, 1, 1, 0, 1, 1, 0, 1, 1,
       1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 0, 1, 1,
       1, 1, 0, 0, 1, 1, 1, 0, 1, 1, 0, 1, 0, 1, 0, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 0, 1, 1, 1, 0, 1, 1, 1, 0, 1, 1, 0, 1, 1, 1, 1, 1, 0,
       1, 1, 1, 1, 0, 0, 1, 1, 1, 1, 0, 1, 1, 0, 1, 1, 1, 1, 0, 1, 1, 0,
       0, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1,
       1, 0])
```

```
ac7=accuracy_score(ytest,yp)*100
print("The Accuracy score for sv:",ac7)
```

```
The Accuracy score for sv: 52.5
```

```
from sklearn.ensemble import AdaBoostClassifier
```

```
ad=AdaBoostClassifier(n_estimators=100,random_state=0)
```

```
ad.fit(xtrain,ytrain)
```

```
AdaBoostClassifier(n_estimators=100, random_state=0)
```

```
yy=ad.predict(xtest)
yy
```

```
array([0, 0, 1, 1, 0, 0, 1, 0, 1, 1, 1, 0, 1, 0, 1, 1, 1, 0, 1, 0, 1, 1,
       1, 0, 1, 1, 1, 1, 1, 0, 1, 0, 0, 0, 0, 1, 0, 0, 1, 1, 0, 1, 0, 1,
       0, 1, 0, 0, 0, 0, 1, 0, 1, 0, 1, 0, 1, 1, 1, 0, 1, 0, 0, 0, 1, 1,
       1, 0, 1, 1, 1, 0, 1, 1, 1, 1, 1, 0, 1, 0, 0, 1, 0, 1, 1, 0, 1, 0,
       0, 0, 0, 0, 1, 0, 0, 1, 1, 1, 1, 0, 0, 1, 1, 1, 1, 1, 1, 0, 0, 1,
       1, 0, 0, 1, 1, 1, 0, 0, 0, 1, 0, 1, 0, 1, 1, 0, 0, 1, 1, 1, 0, 1,
       1, 0, 1, 1, 0, 1, 1, 0, 1, 1, 0, 1, 0, 1, 1, 0, 0, 1, 1, 0, 1, 0,
       1, 0, 1, 1, 0, 1, 1, 0, 1, 1, 0, 0, 1, 0, 1, 1, 0, 0, 0, 0, 0, 0,
       0, 0, 1, 1, 0, 0, 1, 1, 1, 0, 0, 0, 0, 1, 1, 1, 0, 1, 1, 1, 1, 0,
       1, 1])
```

```
a8=accuracy_score(ytest,yy)*100
a8
```

```
52.0
```

```
from keras.models import Sequential
from keras.layers import Dense
!pip install tensorflow
import tensorflow as tf
```

```
model=Sequential()
model.add(Dense(units=13,activation="tanh"))
model.add(Dense(units=160,activation="tanh"))
model.add(Dense(units=90,activation="tanh"))
model.add(Dense(units=45,activation="tanh"))
model.add(Dense(units=1,activation="sigmoid"))
```

```
opt =tf.keras.optimizers.Adam(learning_rate=0.001)
```

```
model.compile(loss="binary_crosstropy",optimizer=opt,metrics=["accuracy
"])
```

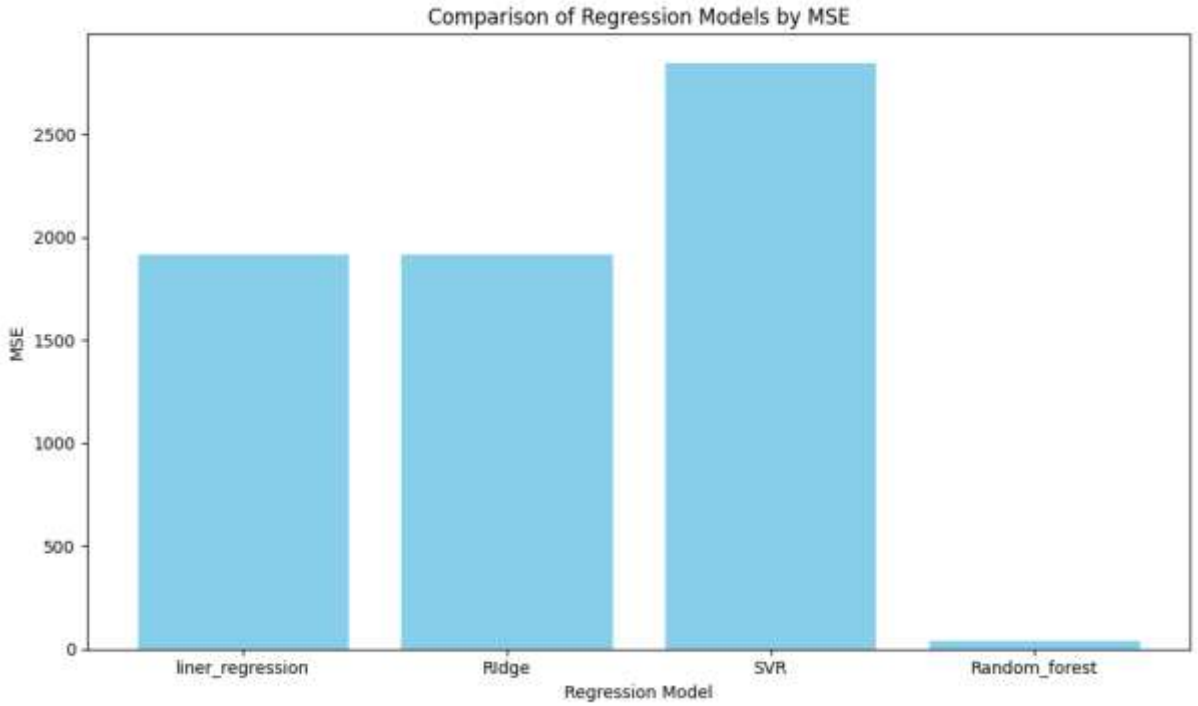
```
model.fit(xtrain,ytrain,epochs=500,batch_size=10)
```

```
model.summary()
```

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 dense (Dense)               (None, 13)                104

 dense_1 (Dense)             (None, 160)               2240

 dense_2 (Dense)             (None, 90)                14490

 dense_3 (Dense)             (None, 45)                4095

 dense_4 (Dense)             (None, 1)                 46

=================================================================
Total params: 20975 (81.93 KB)
Trainable params: 20975 (81.93 KB)
Non-trainable params: 0 (0.00 Byte)
_________________________________________________________________
```

```
mse_values ={'liner_regression': 1912.4072205848418,'RIdge':
1912.4002330743629,'SVR': 2842.6338000438527,'Random_forest':37}

models=list(mse_values.keys())
mse_scores = (mse_values.values())
```

```
import matplotlib.pyplot as plt

plt.figure(figsize=(10, 6))
plt.bar(models, mse_scores, color='skyblue')
plt.xlabel('Regression Model')
plt.ylabel('MSE')
plt.title('Comparison of Regression Models by MSE')
plt.tight_layout()
plt.show()
```




```
X_input=[[0.133218,0.2333390,0.20606,0.758036,0.136519,2017,217]]
prediction = model.predict(X_input)
print(prediction)
```

```
1/1 [==============================] - 0s 35ms/step
[[1.33218e-01 2.33339e-01 2.06060e-01 7.58036e-01 1.36519e-01 2.01700e+03
  2.17000e+02]]
```

```
_input=[[-0.054981, 0.885919, 0.019357, 0.42204, -0.819113, 1974, 0]]
prediction = model.predict(X_input)
print(prediction)
```

```
1/1 [==============================] - 0s 46ms/step
[[1.33218e-01 2.33339e-01 2.06060e-01 7.58036e-01 1.36519e-01 2.01700e+03
  2.17000e+02]]
```

```
import pickle
pickle.dump(model,open("model.pkl","wb"))
from tensorflow.keras.models import save_model
save_model(model, "model.h5")
```

```
(13,)
```

```
input_data = input_data.reshape(1,-1)
print(input_data.shape)
```

```
(1, 13)
```

```
import numpy as np
from tensorflow.keras.models import load_model
model1 = load_model('model.h5')

input_data = np.array([0,1,9,1,5,31,1,1,1,0,0,0,1])
input_data = input_data.reshape(1,-1)

model1.predict(input_data)
```

```
1/1 [==============================] - 0s 38ms/step
array([[ 0,  1,  9,  1,  5, 31,  1,  1,  1,  0,  0,  0,  1]])
```

```
import pickle
from sklearn.svm import SVR

svr_model = SVR()

X_train = [[0, 1], [1, 1], [1, 0]]
y_train = [0, 1, 1]
svr_model.fit(X_train, y_train)

pickle.dump(svr_model, open('model.pkl', 'wb'))
```