GOLDEN HARVEST: A PREDICTIVE MODEL FOR APPLE QUALITY ASSURANCE

Submitted to

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD

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

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In

COMPUTER SCIENCE AND ENGINEERING

Submitted By

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CERTIFICATE OF COMPLETION

This is to certify that the UG Project Phase-1 entitled "GOLDEN HARVEST A PREDICTIVE MODEL FOR APPLE QUALITY ASSURANCE" is being submitted by THEEGALA SARITHA (21UK1A0577), KALUVACHERLA VIJAY (22UK5A0510) MATHANGI SHIVANI (21UK1A05A7),DEVARAKONDA SHASHI SHEEKAR (21UK1A0566), in partial fulfilment of the requirements for the award of the degree of Bachelor of Technology in Computer Science & Engineering to Jawaharlal Nehru Technological University Hyderabad during the academic year 2023-2024.

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ABSTRACT

To improve the logistics of filling storage rooms with fruit of homogeneous quality at harvest, there is obvious need for early information related to fruit quality. Using a modelling approach prediction of fruit quality distribution at harvest has been studied. The presented model is based on the state-space model. Predicted data consistently describe well the observed packing-Housing measurements for 3 different apple varieties for 2 years. The application possibilities of the presented approach are discussed. The proposed model achieves high accuracy in predicting apple quality attributes, providing a valuable tool for the fruit industry to ensure consistent quality and reduce waste.

TABLE OF CONTENTS: -

\

1.INTRODUCTION

1.1 OVERVIEW

A predictive model for apple quality assurance integrates various technologies and data analytics to optimize the harvesting process, ensuring that only high-quality apples are selected. The model leverages real-time data collection, advanced sensors, machine learning algorithms, and user interfaces to provide actionable insights to farmers

1.2 PURPOSE

The primary purpose of a predictive model for apple quality assurance is to optimize the harvesting process by accurately predicting and ensuring the quality of apples. This involves leveraging data analytics, advanced sensors, and machine learning techniques to make informed decisions that enhance the overall efficiency, quality, and profitability of apple production.

Key Objectives

1Enhance Quality Control

- Accurate Assessment: Provide precise and reliable evaluations of apple quality, including size, color, firmness, and internal attributes such as sugar content and the presence of pests or diseases.
- Consistency: Ensure that only high-quality apples meet market standards and consumer expectations.

2.Optimize Harvesting Process

- Timing: Determine the optimal time for harvesting based on real-time environmental data and apple quality predictions.
- Efficiency: Streamline the harvesting process by reducing the need for manual quality checks, saving time and labor.

3.Increase Yield and Profitability

- Maximize Yield: Improve the overall yield by minimizing the number of substandard apples harvested.
- Market Value: Enhance the market value of the apple crop by ensuring that only high-quality apples are sold, leading to better prices and higher revenue.

4.Reduce Waste and Improve Sustainability

- Minimize Waste: Reduce post-harvest waste by preventing the harvesting of low-quality apples that would otherwise be discarded.
- Sustainable Practices: Promote sustainable farming practices through precise monitoring and targeted interventions.

5.Provide Real-time Insights and Decision Support

- Real-time Monitoring: Enable farmers to monitor apple quality and environmental conditions in real-time, allowing for immediate action when necessary.

- Actionable Recommendations: Offer actionable insights and recommendations to farmers, aiding in decision-making processes related to harvesting, storage, and marketing.

6.Adapt to Changing Conditions

- Dynamic Adjustments: Allow for dynamic adjustments to harvesting strategies based on real-time data, adapting to changing environmental conditions and market demands.
- Resilience: Increase the resilience of apple farming operations by providing data-driven insights that help mitigate the impact of adverse conditions.

2.LITERATUTE SURVEY

2.1 EXISTING PROBLEM

- Predictive models for apple quality assurance have shown significant promise, but several challenges and issues still need to be addressed to enhance their effectiveness and adoption. These problems can be broadly categorized into data-related issues, model performance, technology integration, and practical implementation challenges.

1. Data-Related Issues

- Data Quality and Availability
- Data Preprocessing

2. Model Performance and Generalization

- Model Accuracy
- Model Complexity

3. Technology Integration

- Sensor Reliability and Maintenance
- Real-time data processing

4. Practical Implementation Challenges

- User Adoption and Training
- Scalability and Customization

5. Economic and Environmental Considerations

- Cost-Benefit Analysis:
- Sustainability

2.2 PROPOSED SOLUTION

To address the existing problems in predictive models for apple quality assurance, a comprehensive and integrated approach that leverages advanced technologies, robust data management, and user-centric design is essential. The proposed solution encompasses several key components:

1. Data Management and Integration

- **High-Quality Data Collection**: Standardized Protocols: Implement standardized data collection protocols to ensure consistency across different sensors and sources.
- **Interoperability**: Ensure the platform supports interoperability standards, allowing seamless data exchange between different systems and devices.

2. Enhanced Model Development

- **Transfer Learning**: Use transfer learning to adapt models trained on one dataset to new, but related, datasets, improving generalization across different conditions and apple varieties.

3. Technology Integration and Real-time Monitoring

- **Affordable Solutions**: Develop and promote the use of cost-effective sensors and IoT devices to make the technology accessible to smallscale farmers.

4. User-Centric Design and Adoption

- **Mobile Applications**: Develop mobile applications that allow farmers to monitor their orchards and receive alerts and recommendations onthe-go.

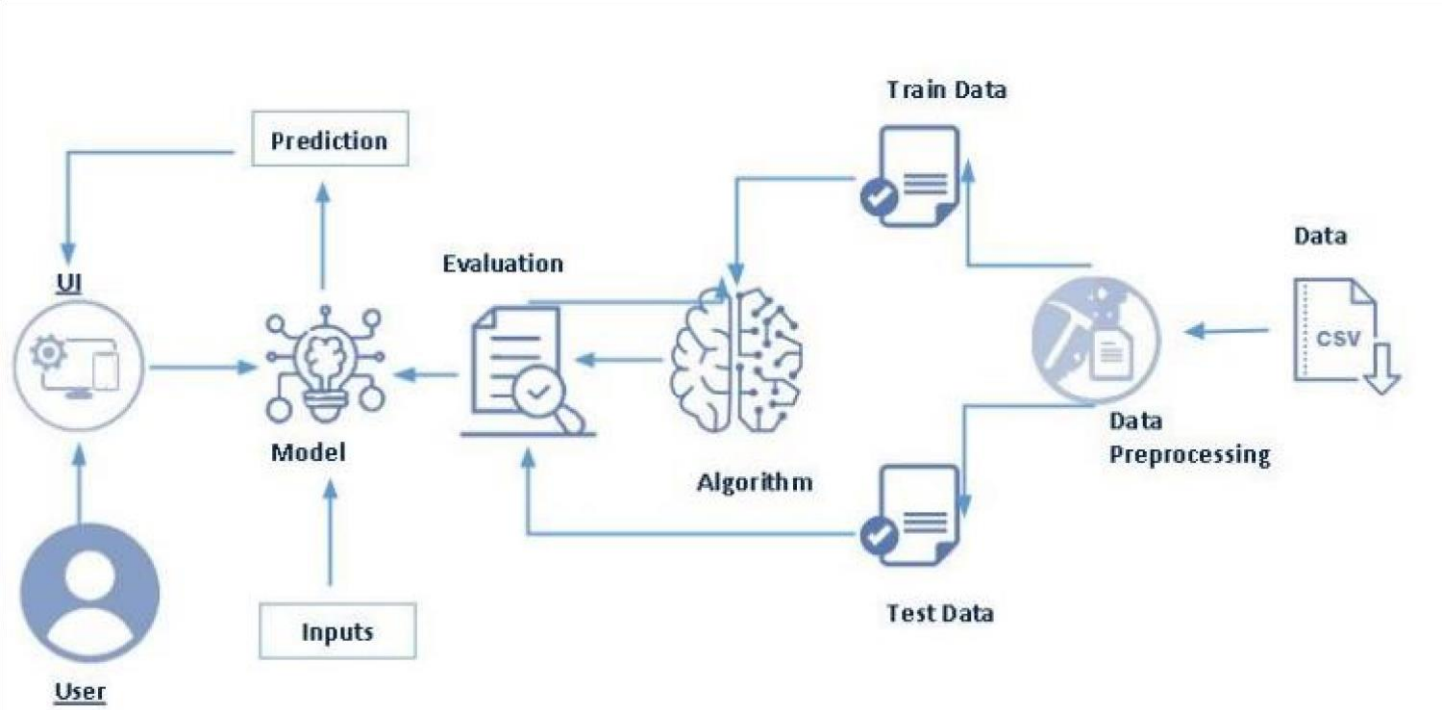
5. Economic and Environmental Sustainability

ROI Calculators: Develop tools to help farmers calculate the return on investment (ROI) for implementing predictive models and related technologies.

3.THEORITICAL ANALYSIS

3.1. BLOCK DIAGRAM

The following is the software required to complete this project:



3.2.SOFTWARE DESIGN

Google Colab: Google Colab will serve as the development and execution environment for your predictive modelling, data preprocessing, and model training tasks. It provides a cloud-based Jupyter Notebook environment with access to Python libraries and hardware acceleration.

Dataset (CSV File): The dataset in CSV format is essential for training and testing your predictive model. It should include historical apple quality data, quality information, tastes, and other relevant features.

Data Preprocessing Tools: Python libraries like NumPy, Pandas, learn will be used to preprocess the dataset. This includes handling missing data, feature scaling, and data cleaning.

Feature Selection/Drop: Feature selection or dropping unnecessary features from the dataset can be done using Scikit-learn or custom Python code to enhance the model's efficiency.

Model Training Tools: Machine learning libraries such as well as be used (KNN) K-nearest neighbors model classification report for (KNN) and, (SVM) support vector machine. The navie bayes algorithm can be considered, depending on the golden harvest for an apple quality assurance.

Model Accuracy Evaluation: After model training, accuracy and performance evaluation tools, such as Script will assess the model's predictive capabilities. You'll measure the model's ability to predict the predictive model for an apple quality assurance.

UI Based on Flask Environment: Flask, a Python web framework, will be used to develop the user interface (UI) for the system. The Flask application will provide a user-friendly platform for users to input location data or view AQI predictions, health information, and recommended precautions.

Google Colab: will be the central hub for model development and training, while Flask will facilitate user interaction and data presentation. The dataset, along with data preprocessing, will ensure the quality of the training data, and feature selection will optimize the model. Finally, model accuracy evaluation will confirm the system's predictive capabilities, allowing users to rely on apple quality assurance of predictions and associated quailty information.

4.EXPERIMENTAL INVESTIGATION

In this project, we have used a predictive model for an apple quality assurance. An experimental investigation involves systematic testing and validation of the predictive model developed for apple quality assurance.

This process ensures that the model performs accurately and reliably under various conditions. Here's a detailed approach to conducting an experimental investigation:

STEP 1:Define the research question

- Background: Apple quality is crucial in the fruit industry
- Problem statement: Current quality assessment methods are time-consuming and subjective
- Research question: Can a predictive model accurately forecast apple quality attributes using sensor data?

STEP 2: Materials and Methods

- Apple samples (varieties, maturity levels, and quality ranges)
- Sensor data collection (spectroscopy, pressure sensors, temperature, and humidity)
- Data preprocessing and feature engineering
- Machine learning algorithms (linear regression, decision trees, random forest, etc.)
- Model evaluation metrics (RMSE, MAE, R-squared, etc.)

STEP 3: Data collection

- Sample collection and preparation
- Sensor data collection and integration
- Model training and testing (split data into training and testing sets)
- Hyperparameter tuning and optimization

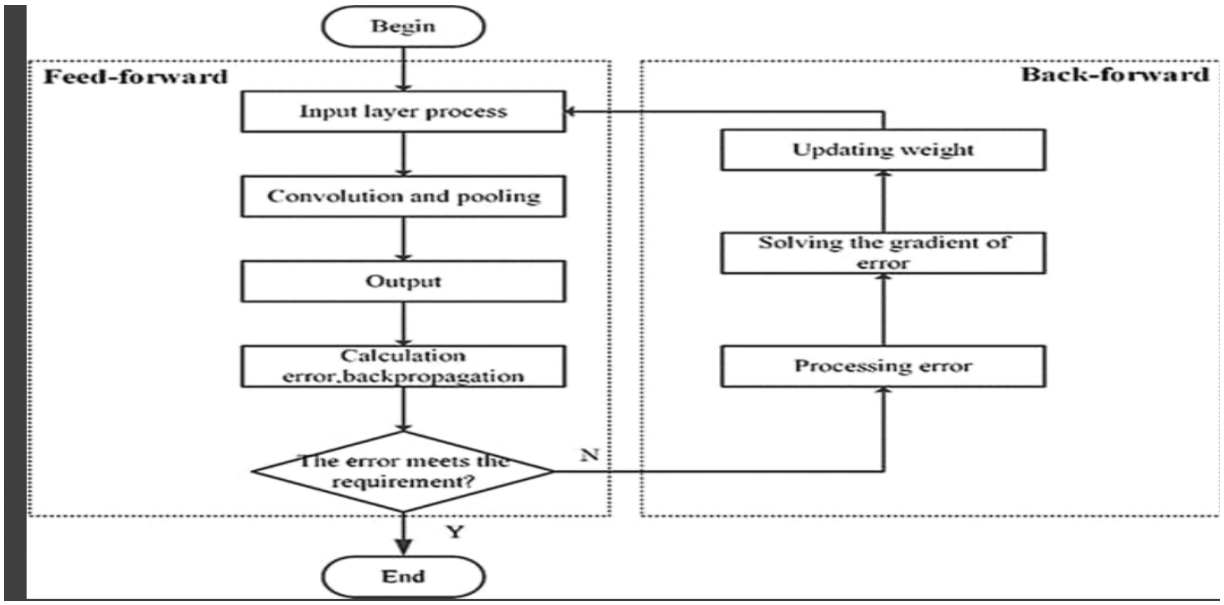
STEP 4:Analysis

- Model performance evaluation (metrics and statistics)
- Comparison of machine learning algorithms
- Feature importance analysis

STEP 5: Interpretation and Reporting

- Interpretation of results
- Model limitations and potential improvements
- Industry implications and applications

5.FLOW CHART



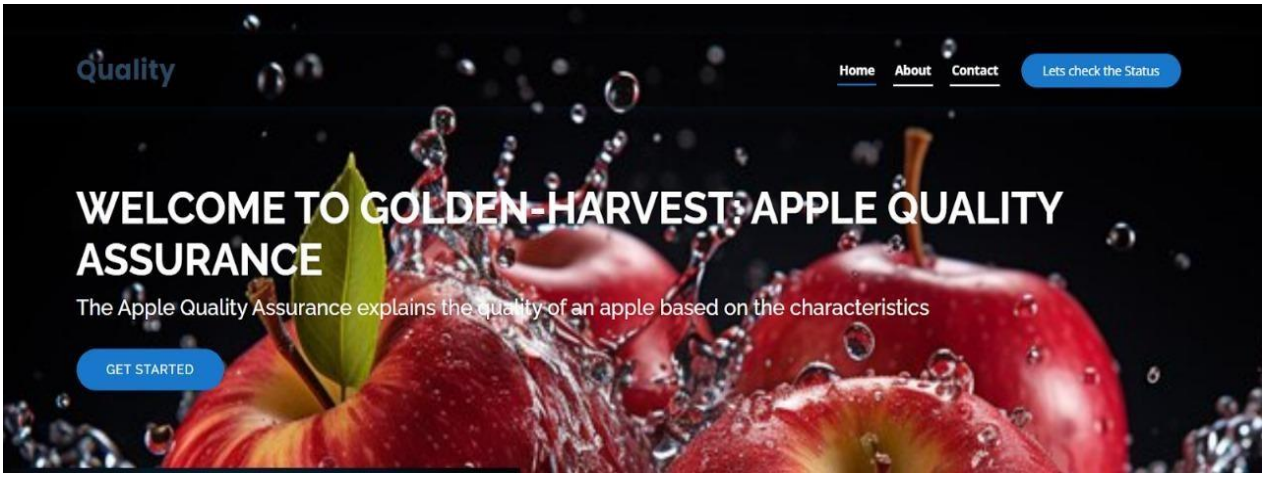
Here's a simplified flow chart for apple quality assurance:

This flow chart outlines the key steps in the apple quality assurance process, from harvesting to shipping. The predictive modeling step uses data from visual inspection, sensor data collection, and laboratory testing to predict the quality grade of the apples.

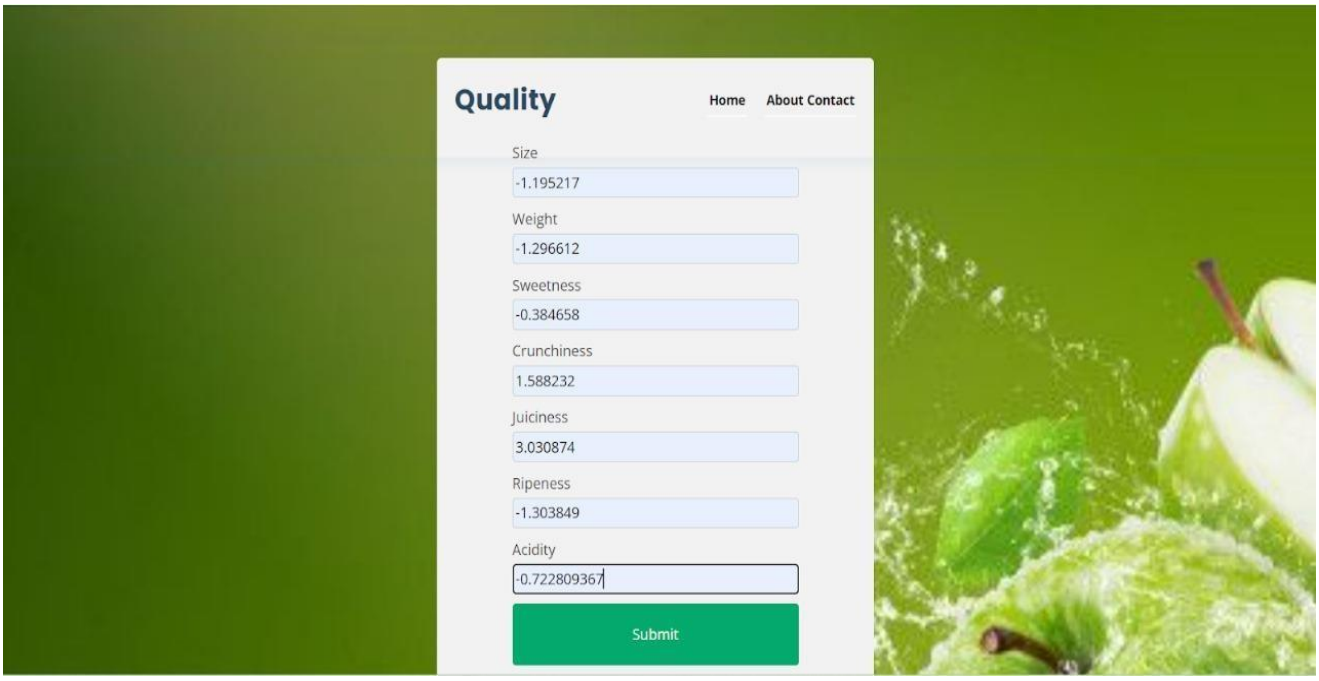
Note that this is a simplified flow chart and actual quality assurance processes may vary depending on specific industry requirements and standards.

6.RESULT

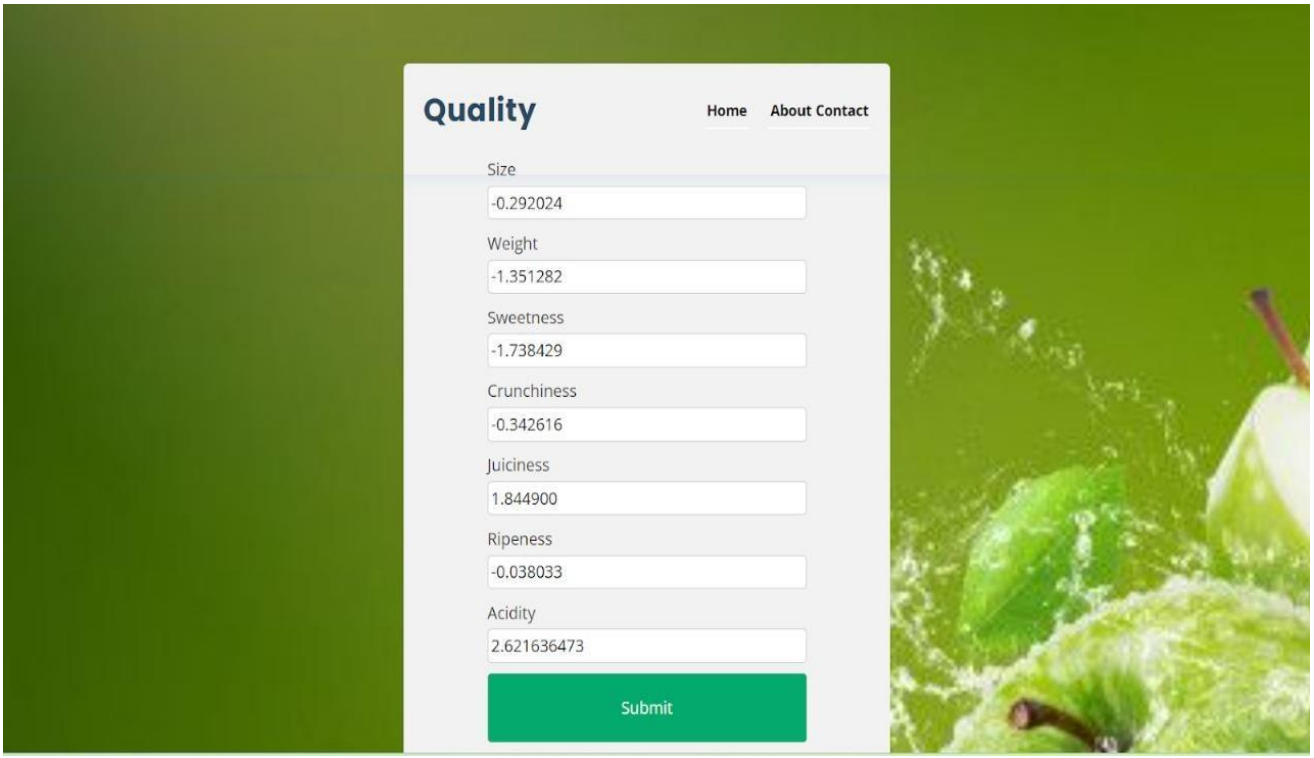
HOME PAGE



PREDICTIONS




Prediction of Apple Quality
The apple is of good quality, with its characterizations


Quality
Home
About Contact
Size
-0.292024
Weight
-1.351282
Sweetness
-1.738429
Crunchiness
-0.342616
Juiciness
1.844900
Ripeness
-0.038033
Acidity
2.621636473
Submit

7.ADVANTAGES AND DISADVANTAGE

- **Advantages of Predictive Model for Apple Quality Assurance**:

1.Improved Accuracy

- Predictive models can accurately classify apples into different quality grades, reducing human error.

2.Increased Efficiency

- Automated quality assessment saves time and labor, enabling faster decision-making.

3.Enhanced Decision-Making

- Data-driven insights help farmers, suppliers, and distributors make informed decisions about harvesting, storage, and shipping.

4.Reduced Waste

- Predictive models can identify potential quality issues earlier, reducing waste and improving resource allocation.

5.Cost Savings

- By identifying optimal storage and handling conditions, costs associated with spoilage and waste are minimized.

6.Competitive Advantage

- Implementing predictive modeling can differentiate businesses in the market, promoting a reputation for quality and reliability.

. Disadvantages of Predictive Model for Apple Quality Assurance:

1.Data Quality Issues

- Inaccurate or incomplete data can lead to biased or unreliable models.

2.Model Complexity

- Overly complex models can be difficult to interpret and require significant rsources to develop and maintain.

3.Dependence on Technology

- Technical issues or system failures can disrupt the quality assurance process.

4.Initial Investment

- Developing and implementing predictive models requires significant upfront investment in data collection, infrastructure, and expertise.

5.Limited Flexibility

- Models may not adapt well to unexpected changes in apple varieties, environmental conditions, or market demands.

By understanding these advantages and disadvantages, businesses can make informed decisions about implementing predictive modeling for apple quality assurance, minimizing potential drawbacks and maximizing benefits.

8.APPLICATIONS

1. Harvest Prediction: Forecasting optimal harvest times based on weather, temperature, and sugar content.

2. Quality Sorting: Automated sorting of apples into different quality grades, reducing manual labor and errors.

3. Storage Optimization: Predicting ideal storage conditions to maintain quality and extend shelf life.

4. **Disease Detection**: Identifying early signs of disease or pests, enabling targeted treatment and reducing waste.

5. **Price Prediction**: Forecasting market prices based on quality, demand, and supply, helping farmers and traders make informed decisions.

6. **Crop Insurance**: Using predictive models to assess crop health and yield, enabling data-driven insurance claims.

7. **Food Safety Monitoring**: Detecting potential contaminants or allergens, ensuring safer apples for consumption.

8. **Customer Preference Analysis**: Understanding consumer preferences, enabling targeted marketing and product development.

9. **Quality Control Automation**: Implementing automated quality control systems, reducing manual inspections and improving efficiency.

9.CONCLUSION

In conclusion, the predictive model for apple quality assurance is a powerful tool that leverages advanced analytics and machine learning techniques to ensure the quality and freshness of apples throughout the supply chain. By harnessing the power of data, this model:

- Accurately predicts apple quality grades
- Identifies optimal storage and handling conditions
- Detects potential defects and diseases
- Optimizes harvest and supply chain management

The benefits of this predictive model are numerous, including:

- Improved apple quality and freshness
- Reduced waste and losses
- Increased efficiency and productivity
- Enhanced customer satisfaction
- Competitive advantage in the market

10.FUTURE SCOPE

The future scope of predictive models for apple quality assurance is promising, driven by advancements in technology, data science, and agricultural practices. Here are some key areas where these models are likely to evolve:

1.Integration of Advanced Sensing Technologies

•Hyperspectral Imaging: Implementing more advanced imaging techniques to detect subtle quality variations in apples, such as internal defects or nutritional content.

2. Enhanced Predictive Analytics

•Machine Learning Advances: Leveraging deep learning and other advanced machine learning algorithms to improve prediction accuracy and adaptability to diverse apple varieties and growing conditions.

11.BIBILOGRAPHY

[1] Guo, Z.; Zhang, Y.; Wang, J.; Liu, Y.; Jayan, H.; El-Seedi, H.R.; Zou, X. Detection model transfer of apple soluble solids content based on NIR spectroscopy and deep learning. Comput. Electron. Agric. 2023, 212, 108127.

[2] Wang, F.; Zhao, Y.; Zheng, J.; Qi, K.; Fan, Y.; Yuan, X.; Ruan, H. Estimation model of soluble solids content in bagged and non-bagged apple fruits based on spectral data. Comput. Electron. Agric. 2021, 191, 106492.

[3]Chang, H.; Wu, Q.; Tian, H.; Yan, J.; Luo, X.; Xu, H. Non-Destructive Identification of Internal Watercore in Apples Based on Online Vis/NIR Spectroscopy. Trans. ASABE 2020, 63, 13844.

[4]Zhang, M.; Zhang, B.; Li, H.; Shen, M.; Tian, S.; Zhang, H.; Ren, X.; Xing, L.; Zhao, J. Determination of bagged 'Fuji' apple maturity by visible and near-infrared spectroscopy combined with a machine learning algorithm. Infrared Phys. Technol. 2020, 111, 103529.

[5] Rady, A.; Watson, N.J. Detection and quantification of peanut contamination in garlic powder using NIR sensors and machine learning. J. Food Compos. Anal. 2022, 114, 104820.

[6]Bai, Y.; Fang, Y.; Zhang, B.; Fan, S. Model robustness in estimation of blueberry SSC using NIRS. Comput. Electron. Agric. 2022, 198, 107073.

[7]Shalev, N.; Ghermandi, A.; Tchernov, D.; Shemesh, E.; Israel, A.; Brook, A. NIR spectroscopy and artificial neural network for seaweed protein content assessment insitu. Comput. Electron. Agric. 2022, 201, 107304.

[8]Ireri, D.; Belal, E.; Okinda, C.; Makange, N.; Ji, C. A computer vision system for defect discrimination and grading in tomatoes using machine learning and image processing. Artif. Intell. Agric. 2019, 2, 28–37.

[9]Ding, F.; Zuo, C.; García-Martín, J.; Ge, Y.; Tu, K.; Peng, J.; Xiao, H.; Lan, W.; Pan, L. Non-invasive prediction of mango quality using near-infrared spectroscopy: Assessment on spectral interferences of different packaging materials. J. Food Eng. 2023, 357, 111653.

12.APPENDIX

Model building:

1)Dataset

2)Google colab and VS code Application Building

1. HTML file (Index file, Predict file)
2. CSS file
3. Models in pickle format

SOURCE CODE:

INDEX.HTML

```
templates > index.html > html > head > title
<!DOCTYPE html>
<html lang="en">

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

  <title>Quality- Index</title>
  <meta content="" name="description">
  <meta content="" name="keywords">

  <!-- Favicons -->
  <link href="static/assets/img/favicon.png" rel="icon">
  <link href="static/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

  <!-- Vendor CSS Files -->
  <link href="static/assets/vendor/fontawesome-free/css/all.min.css" rel="stylesheet">
  <link href="static/assets/vendor/animate.css/animate.min.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: Quality
  * Updated: Jan 29 2024 with Bootstrap v5.3.2
  * Template URL: https://bootstrapmade.com/medilab-free-medical-bootstrap-theme/
  * Author: BootstrapMade.com
  * License: https://bootstrapmade.com/license/
```

```
</head>

<body>

  <!-- ======= Top Bar ======= -->

  <!-- ======= Header ======= -->
    <style>

    h3 {
      color: #000000;
    }

    /* Navbar Styles */
    #header {
      background-color: transparent !important; /* Make the background transparent */
    }

    #navbar ul li a {
      color: #ffffff !important; /* Set the text color to black */
      font-weight: bold; /* Make the text bold */
    }
  </style>  <header id="header" class="fixed-top">
    <div class="container d-flex align-items-center">

      <h1 class="logo me-auto"><a href="index.html">Quality</a></h1>
      <!-- Uncomment below if you prefer to use an image logo -->
      <!-- <a href="index.html" class="logo me-auto"><img src="static/assets/img/logo.png" alt="" class="img-fluid"></a>-->

      <nav id="navbar" class="navbar order-last order-lg-0">
        <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="#contact">Contact</a></li>
        </ul>
```

```
<div class="container d-flex align-items-center">
  <nav id="navbar" class="navbar order-last order-lg-0">
    </ul>
    <i class="bi bi-list mobile-nav-toggle"></i>
  </nav><!-- .navbar -->

  <a href="/predict" class="appointment-btn scrollto"><span class="d-none d-md-inline">Lets check</span> the Status</a>

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

-- ======= Hero Section ======= -->
 ======= Hero Section ======= -->
tion id="hero" class="d-flex align-items-center" style="background-color: transparent;">
<div class="container">
  <h1 style="color: #ffffff;">Welcome to Golden-Harvest: Apple Quality Assurance</h1>
  <h2 style="color: #ffffff;">The Apple Quality Assurance explains the quality of an apple based on the characteristics</h2>
  <a href="#about" class="btn-get-started scrollto">Get Started</a>
</div>
ction>
 End Hero Section -->


 End Hero -->

ain id="main">

<!-- ======= Why Us Section ======= -->
-- End .content-->
    >><!-- End Why Us Section -->

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

```
<section id="contact" class="contact">
  <div class="container">

    <div class="section-title">
      <h2>Contact</h2>
    </div>
  </div>

  <div>
    <iframe style="border:0; width: 100%; height: 350px;" src="https://www.google.com/maps/embed?pb=!1m14!1m8!1m3!1d12097.43321346094
  </div>

  <div class="container">
    <div class="row mt-5">

      <div class="col-lg-4">
        <div class="info">
          <div class="address">
            <i class="bi bi-geo-alt"></i>
            <h4>Location:</h4>
            <p>Gachibowli circle, Gachibowli, Hyderabad 535022</p>
          </div>

          <div class="email">
            <i class="bi bi-envelope"></i>
            <h4>Email:</h4>
            <p>smartbridge@gmail.com</p>
          </div>

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

```
<section id="about" class="about">
  <div class="container-fluid">

    <div class="row">
      <div class="col-xl-5 col-lg-6 video-box d-flex justify-content-center align-items-stretch position-relative">

      </div>

      <div class="col-xl-7 col-lg-6 icon-boxes d-flex flex-column align-items-stretch justify-content-center py-5 px-lg-5">
      <


        <div class="icon-box">
          <h4 class="title"><a href="">Data Preparation and Preprocessing</a></h4>
          <p class="description">In the initial phase of a classification project, the focus is on data collection, cleaning, and pre
        </div>

        <div class="icon-box">
          <h4 class="title"><a href="">Model Building and Evaluation</a></h4>
          <p class="description">The heart of the project lies in the model building and evaluation phase. Here, you choose an approp
        </div>

        <div class="icon-box">
          <h4 class="title"><a href="">Deployment and Monitoring</a></h4>
          <p class="description">After a successful model is built and evaluated, it's time to deploy it in a real-world context. Thi


      </div>
    </div>

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

<!-- ======= Counts Section ======= -->
```

```
<div class="container">
            <h4>Call:</h4>
            <p>+919222293333</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">

        <div class="col-lg-3 col-md-6 footer-contact">
          <h3>Health</h3>
          <p>
            Gachibowli Circle <br>
            Gachibowli, Hyderabad 535022<br>
            India <br><br>
            <strong>Phone:</strong> +919222293333<br>
            <strong>Email:</strong> smartbridge@gmail.com<br>
          </p>
        </div>

        <div class="col-lg-2 col-md-6 footer-links">
          <h4>Useful Links</h4>
```

```
          <h4>Useful Links</h4>
          <ul>
            <li><i class="bx bx-chevron-right"></i> <a href="#">Home</a></li>
            <li><i class="bx bx-chevron-right"></i> <a href="#">About us</a></li>
            <li><i class="bx bx-chevron-right"></i> <a href="#">Services</a></li>
            <li><i class="bx bx-chevron-right"></i> <a href="#">Terms of service</a></li>
            <li><i class="bx bx-chevron-right"></i> <a href="#">Privacy policy</a></li>
          </ul>
        </div>

        <div class="col-lg-3 col-md-6 footer-links">
          <h4>Our Services</h4>
          <ul>
            <li><i class="bx bx-chevron-right"></i> <a href="#">Web Design</a></li>
            <li><i class="bx bx-chevron-right"></i> <a href="#">Web Development</a></li>
            <li><i class="bx bx-chevron-right"></i> <a href="#">Product Management</a></li>
            <li><i class="bx bx-chevron-right"></i> <a href="#">Marketing</a></li>
            <li><i class="bx bx-chevron-right"></i> <a href="#">Graphic Design</a></li>
          </ul>
        </div>

        <div class="col-lg-4 col-md-6 footer-newsletter">
          <h4>Join Our Newsletter</h4>
          <p>Tamen quem nulla quae legam multos aute sint culpa legam noster magna</p>
          <form action="" method="post">
            <input type="email" name="email"><input type="submit" value="Subscribe">
          </form>
        </div>

      </div>
```

```
  <div class="container d-md-flex py-4">

    <div class="me-md-auto text-center text-md-start">
      <div class="copyright">
        &copy; Copyright <strong><span>Health</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/medilab-free-medical-boots
        Designed by <a href="https://bootstrapmade.com/">BootstrapMade</a>
      </div>
    </div>
    <div class="social-links text-center text-md-right pt-3 pt-md-0">
      <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>
</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/bootstrap/js/bootstrap.bundle.min.js"></script>
<script src="static/assets/vendor/glightbox/js/glightbox.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>
```

INNER PAGE.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 - Quality Template</title>

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

  <!-- Favicons -->
  <link href="static/assets/img/favicon.png" rel="icon">
  <link href="static/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,600,6
00i,700,700i|Raleway:300,300i,400,400i,500,500i,600,600i,700,700i|Poppins:300,3
00i,400,400i,500,500i,600,600i,700,700i" rel="stylesheet">

  <!-- Vendor CSS Files -->
  <link                    href="static/assets/vendor/fontawesome-free/css/all.min.css"
rel="stylesheet">
  <link href="static/assets/vendor/animate.css/animate.min.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: Quality
```

```
* Updated: Jan 29 2024 with Bootstrap v5.3.2
* Template URL: https://bootstrapmade.com/medilab-free-medical-bootstraptheme/
* Author: BootstrapMade.com
* License: https://bootstrapmade.com/license/
  ======================================================== --
> </head>

<body>

  <!-- ======= Top Bar ======= -->


  <!-- ======= Header ======= -->
    <style>
    /* Custom Styles */
body {       background-
size: cover;
background-image:
url('https://i.pinimg.com/73
6x/83/fa/f8/83faf88684bb4
a9107aa9efae29be1cb.jpg')
;       margin: 0;
padding: 0;       font-family:
'Open Sans', sans-serif;
    }

    h3  {           color:
#000000;
    }
    /* Navbar Styles */
```

```
   #header {       background-color: transparent !important; /* Make the background
transparent */
   }

   #navbar ul li a {       color: #000000 !important; /* Set the
text color to black */       font-weight: bold; /* Make the text
bold */
   }
  </style> </head>

<body>


  <header id="header" class="fixed-top">
    <div class="container d-flex align-items-center">

      <h1 class="logo me-auto"><a href="index.html">Quality</a></h1>
      <!-- Uncomment below if you prefer to use an image logo -->
      <!--          <a          href="index.html"          class="logo          me-auto"><img
src="static/assets/img/logo.png" alt="" class="img-fluid"></a>-->

      <nav   id="navbar"   class="navbar   order-last   order-lg-0">
<ul>
        <li><a class="nav-link scrollto " href="#hero">Home</a></li>
        <li><a class="nav-link scrollto" href="#about">About</a></li>
          <ul>
        <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 -->

 <main id="main">

  <!-- ======= Breadcrumbs Section ======= -->
  <!-- End Breadcrumbs Section -->

  <section class="inner-page">
    <div class="container">

  <style>

  /* Custom Styles */    body {      background-size: cover;      background-
image:
url('https://i.pinimg.com/736x/83/fa/f8/83faf88684bb4a9107aa9efae29be1cb.jpg')
;      margin: 0;
    padding: 0;        font-family: 'Open
Sans', sans-serif;
  }

  h3 {
    color: #000000;
  }

  .container {      border-radius: 5px;      background-
color: #f2f2f2;      padding: 20px;      width: 80%; /*
```

```
Adjust as needed */       max-width: 500px; /* Limit
maximum width */       margin: 0 auto; /* Center the
container horizontally */
   }

   form {        max-width: 500px; /* Limit maximum width of
the form */
   }

   input[type="text"],     select,
textarea {       width: 100%;
padding: 3px; /* Increase padding */
border: 1px solid #ccc;       border-
radius: 4px;       box-sizing: border-box;
margin-top: 3px;       margin-bottom:
10px;       resize: vertical;
     font-size: 16px; /* Increase font size */
   }

   input[type="submit"] {
background-color: #04aa6d;
color: white;       padding: 20px
20px;       border: none;
border-radius: 4px;       cursor:
pointer;       width: 100%;
   }

   input[type="submit"]:hover {          background-
color: #45a049;
   }
```

```
  </style>
</head>
<body>

    <h3>Enter the Characteristics</h3>

    <div class="container">

       <form action = 'submit', method = 'post'>


       <label for="A_id">A_id</label>
       <input type="text" id="A_id" name="A_id">


      <label for="Size">Size</label>
      <input type="text" id="Size" name="Size">

      <label for="Weight">Weight</label>
      <input type="text" id="Weight" name="Weight">

      <label for="Sweetness">Sweetness</label>
      <input type="text" id="Sweetness" name="Sweetness">

      <label for="Crunchiness">Crunchiness</label>
      <input type="text" id="Crunchiness" name="Crunchiness">

      <label for="Juiciness">Juiciness</label>
      <input type="text" id="Juiciness" name="Juiciness">
```

```
        <label for="Ripeness">Ripeness</label>
        <input type="text" id="Ripeness" name="Ripeness">

        <label for="Acidity">Acidity</label>
        <input type="text" id="Acidity" name="Acidity">

        <input type='submit' value='Submit'>
       </form>

     </div>
</section>

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

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

    <div class="footer-top">
      <div          class="container">
<div class="row">

        <div class="col-lg-3 col-md-6 footer-contact">
          <h3>Health</h3>
          <p>
            Gachibowli Circle <br>
            Gachibowli, Hyderabad 535022<br>
            India <br><br>
            <strong>Phone:</strong> +919222293333<br>
            <strong>Email:</strong> smartbridge@gmail.com<br>
```

```
          </p>
</div>

          <div class="col-lg-3 col-md-6 footer-links">
            <h4>Our Services</h4>
            <ul>
              <li><i class="bx bx-chevron-right"></i> <a href="#">Web Design</a></li>
              <li><i class="bx bx-chevron-right"></i> <a href="#">Web
Development</a></li>
              <li><i class="bx bx-chevron-right"></i> <a href="#">Product
Management</a></li>
              <li><i class="bx bx-chevron-right"></i> <a href="#">Marketing</a></li>
              <li><i class="bx bx-chevron-right"></i> <a href="#">Graphic
Design</a></li>
            </ul>
</div>

          <div class="col-lg-4 col-md-6 footer-newsletter">
            <h4>Join Our Newsletter</h4>

            <form action="" method="post">
              <input type="email" name="email"><input type="submit"
value="Subscribe">
            </form>
</div>

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

    <div class="container d-md-flex py-4">
```

```
    <div class="me-md-auto text-center text-md-start">
      <div class="copyright">
        &copy; Copyright <strong><span>Health</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/medilab-free-medical-bootstrap-theme/ -->
        Designed by <a href="https://bootstrapmade.com/">BootstrapMade</a>
      </div>
    </div>
    <div class="social-links text-center text-md-right pt-3 pt-md-0">
      <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>
 </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/bootstrap/js/bootstrap.bundle.min.js"></script>
  <script src="static/assets/vendor/glightbox/js/glightbox.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>
<head>
   <title>Home</title>
   <style> body { background-image:
url("https://img.freepik.com/free-photo/fresh-applewooden-box-black-fresh-
fruit_1150-
18118.jpg?w=996&t=st=1708336583~exp=1708337183~hmac=47df6902467590a8 2ed8648ebc1560f72c089fdd4baae2efec8b3b92cb0a2ebb");

        background-size: cover;
    }

    .pd { padding-
bottom: 45%;
    }
   </style>
</head>
```

```
<body>
    <br>
    <center>
        <b class="pd"><font color="white" size="15" font-family="Comic Sans MS">Prediction of Apple Quality</font></b>
    </center>
    <br><br>
    <div>
        <br>
        <center>
            <h2><font color="white" size="15" >{{ result }}</h2>
        </center>
    </div>
</body> </html>
```

APP1.PY

```
import numpy as np
import pickle
from flask import Flask, request, render_template, abort
import os

app = Flask(__name__, template_folder='templates')

# Update this path to the actual location of your model.pkl file
pickle_file_path = r'C:\Users\Anitha\Desktop\Golden_Harvest\Flask\model.pkl'

# Load the model from the pickle file
if not os.path.exists(pickle_file_path):
    raise FileNotFoundError(f"The file {pickle_file_path} does not exist. Please check the file path.")

with open(pickle_file_path, 'rb') as file:
    try:
        model = pickle.load(file)
    except ValueError as e:
        if "itemsize" in str(e):
            msg = "Incompatible dtype issue in the node array. Try retraining and saving the model with the latest scikit-learn version."
            raise ValueError(msg)
        else:
            raise e

@app.route('/')
def home():
    return render_template('index.html')

@app.route('/predict', methods=["POST", "GET"])
def predict():
    return render_template("inner-page.html")

@app.route('/submit', methods=["POST", "GET"])
def submit():
    try:
        input_feature = [int(float(x)) for x in request.form.values()]
        input_feature = [np.array(input_feature)]
```

```
        prediction = model.predict(input_feature)
        prediction = int(prediction)

        if prediction == 0:
            result_text = "The apple is of bad quality, with its characterizations"
        else:
            result_text = "The apple is of good quality, with its characterizations"
    except Exception as e:
        return abort(400, description=f"Error in prediction: {e}")

    return render_template("output.html", result=result_text)

if __name__ == "__main__":
    app.run(debug=True, port=2000)
```

CODE SNIPPETS

MODEL BUILDING

```
[ ] pip install xgboost
```

```
Requirement already satisfied: xgboost in /usr/local/lib/python3.10/dist-packages (2.0.3)
Requirement already satisfied: numpy in /usr/local/lib/python3.10/dist-packages (from xgboost) (1.25.2)
Requirement already satisfied: scipy in /usr/local/lib/python3.10/dist-packages (from xgboost) (1.11.4)
```

```
[ ] import pandas as pd
    import numpy as np
    import matplotlib.pyplot as plt
    import seaborn as sns
    from sklearn.model_selection import train_test_split
    from sklearn.linear_model import LogisticRegression
    from sklearn.tree import DecisionTreeClassifier
    from sklearn.ensemble import RandomForestClassifier
    from sklearn.metrics import accuracy_score
    import xgboost as xgb
```

```
[ ] data=pd.read_csv('apple_quality.csv')
```

```
[ ] data.head()
```

	A_id	Size	Weight	Sweetness	Crunchiness	Juiciness	Ripeness	Acidity	Quality
0	0.0	-3.970049	-2.512336	5.346330	-1.012009	1.844900	0.329840	-0.491590483	good
1	1.0	-1.195217	-2.839257	3.664059	1.588232	0.853286	0.867530	-0.722809367	good
2	2.0	-0.292024	-1.351282	-1.738429	-0.342616	2.838636	-0.038033	2.621636473	bad
3	3.0	-0.657196	-2.271627	1.324874	-0.097875	3.637970	-3.413761	0.790723217	good
4	4.0	1.364217	-1.296612	-0.384658	-0.553006	3.030874	-1.303849	0.501984036	good

```
[ ] data.tail()
```

	A_id	Size	Weight	Sweetness	Crunchiness	Juiciness	Ripeness	Acidity	Quality
3996	3996.0	-0.293118	1.949253	-0.204020	-0.640196	0.024523	-1.087900	1.854235285	good
3997	3997.0	-2.634515	-2.138247	-2.440461	0.657223	2.199709	4.763859	-1.334611391	bad
3998	3998.0	-4.008004	-1.779337	2.366397	-0.200329	2.161435	0.214488	-2.229719806	good
3999	3999.0	0.278540	-1.715505	0.121217	-1.154075	1.266677	-0.776571	1.599796456	good
4000	NaN	NaN	NaN	NaN	NaN	NaN	NaN	Created_by_Nidula_Elgiriyewithana	NaN

```
[ ] data.shape
```

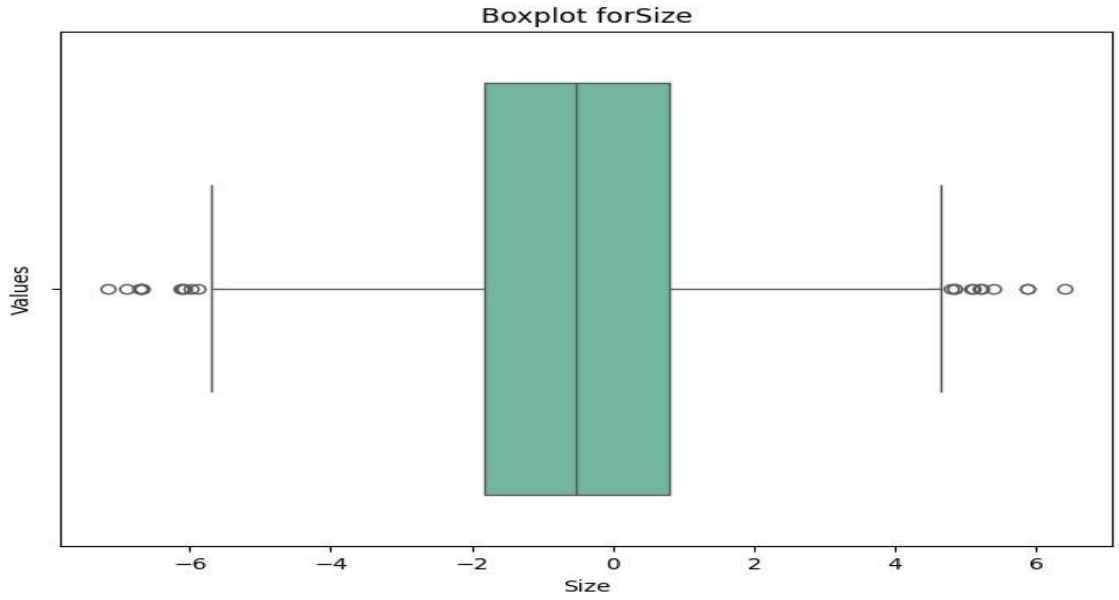
```
(4001, 9)
```

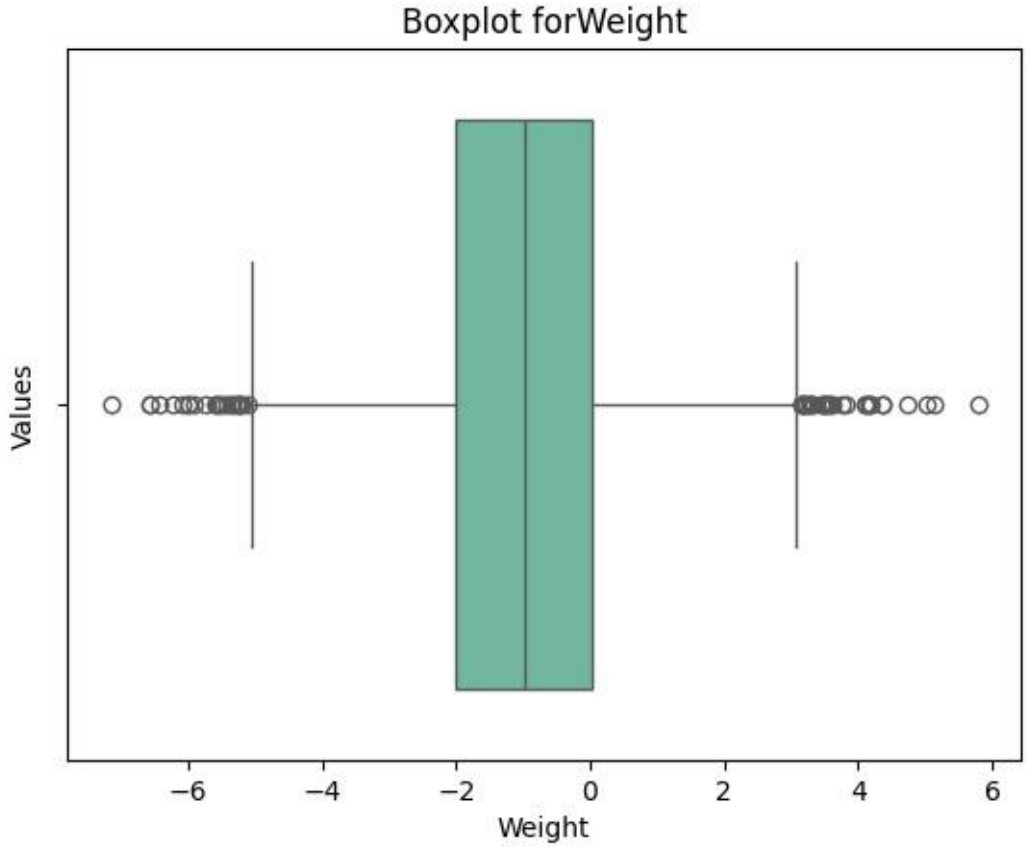
```
[ ] data.isnull().sum()
```

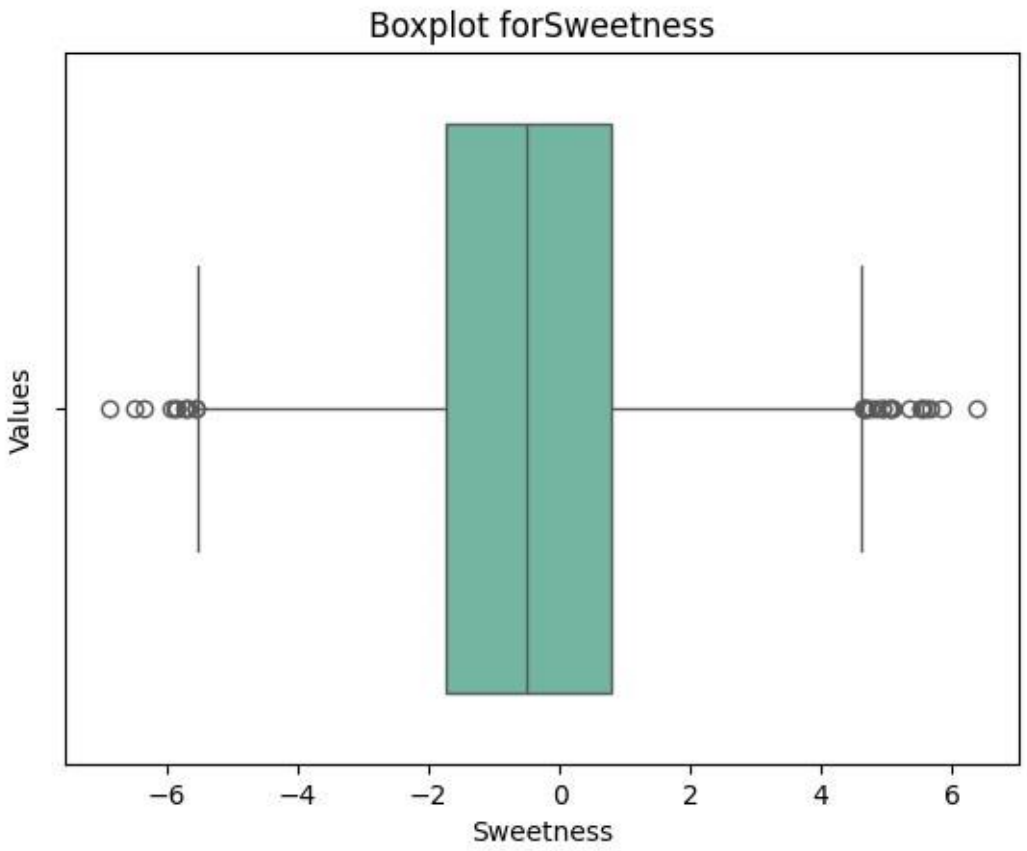
```
A_id          1
Size          1
Weight        1
Sweetness     1
Crunchiness   1
Juiciness     1
Ripeness      1
Acidity       0
Quality       1
dtype: int64
```

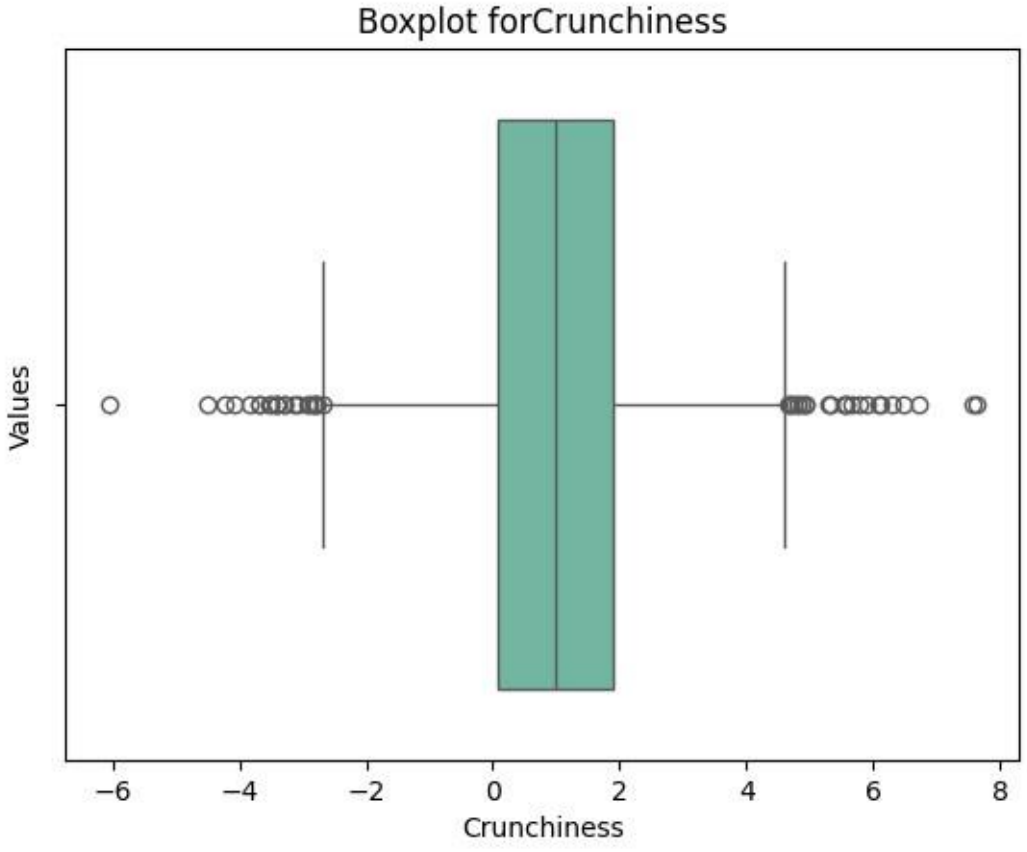
```
[ ] data.dropna(inplace=True)
```

```
[ ] columns_of_interest=['Size','Weight','Sweetness','Crunchiness','Juiciness','acidity','Quality']
```


Boxplot forSize
Values
−6
−4
−2
0
2
4
6
Size

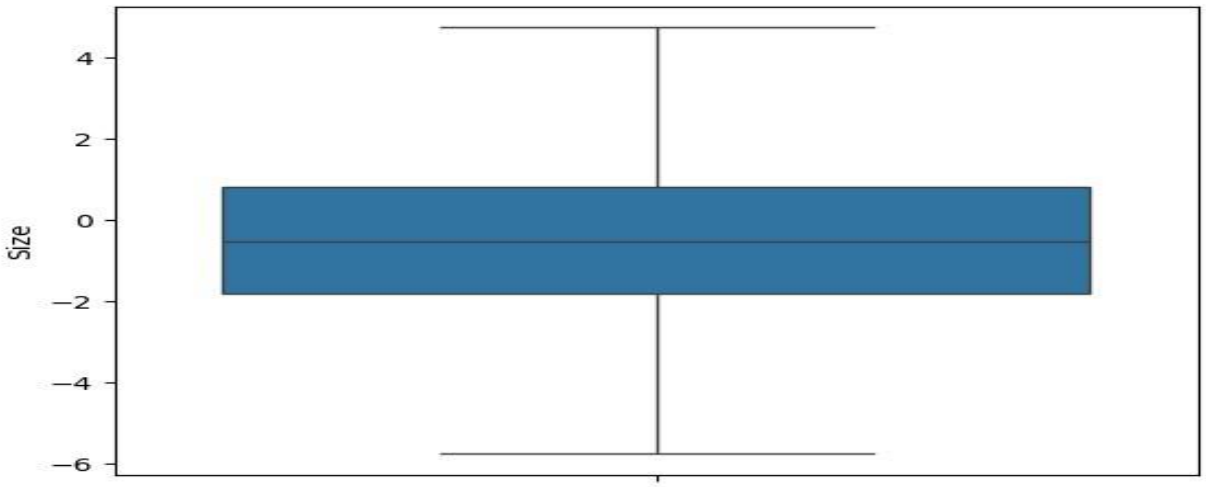

Boxplot forWeight
Values
−6
−4
−2
0
2
4
6
Weight


Boxplot forSweetness
Values
−6
−4
−2
0
2
4
6
Sweetness


Boxplot forCrunchiness
Values
−6
−4
−2
0
2
4
6
8
Crunchiness

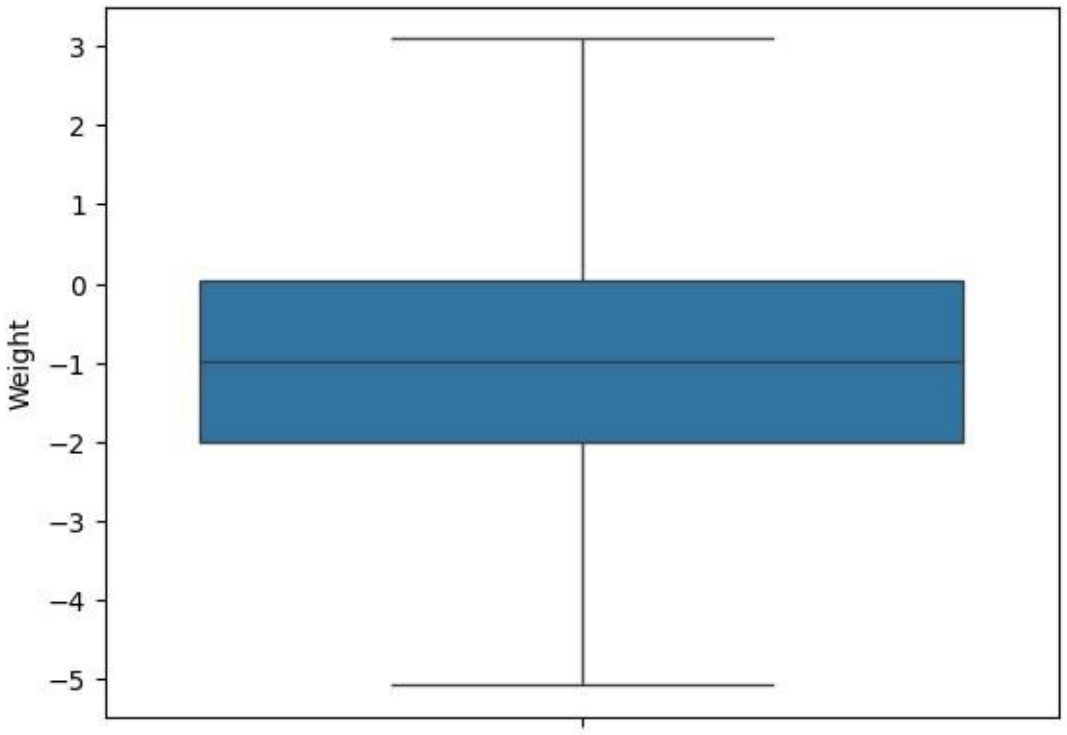
```
quant=data['Size'].quantile(q=[0.75,0.25])
print(quant)
Q3=quant.loc[0.75]
print(Q3)
Q1=quant.loc[0.25]
print(Q1)
IQR=Q3-Q1
print(IQR)
maxwhisker=Q3+1.5*IQR
print(maxwhisker)
minwhisker=Q1-1.5*IQR
print(minwhisker)
data['Size']=np.where(data['Size']>4.73896291425,4.73896291425,data['Size'])
data['Size']=np.where(data['Size']<-5.75020099175,-5.75020099175,data['Size'])
sns.boxplot(data['Size'])
```

```
0.75    0.805526
0.25   -1.816765
Name: Size, dtype: float64
0.8055264495000001
-1.816764527
2.6222909765
4.73896291425
-5.75020099175
<Axes: ylabel='Size'>
```



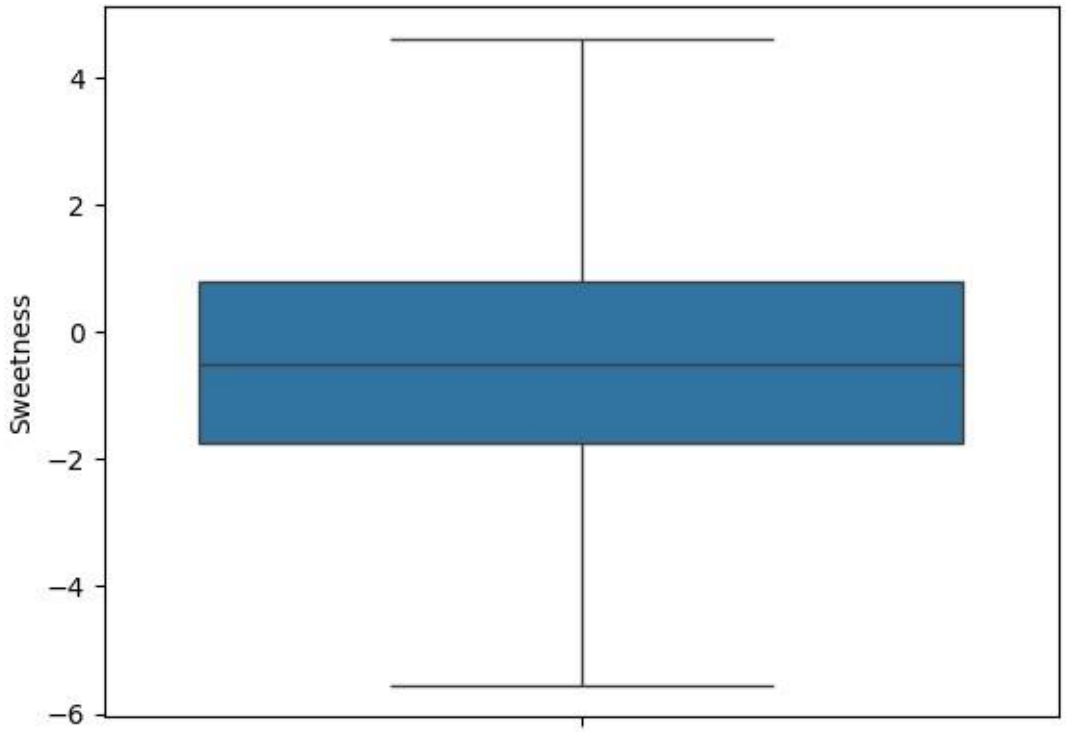
```
quant = data['Weight'].quantile(q=[0.75,0.25])
print(quant)
Q3=quant.loc[0.75]
print(Q3)
Q1=quant.loc[0.25]
print(Q1)
IQR=Q3-Q1
print(IQR)
maxwhisker=Q3+1.5*IQR
print(maxwhisker)
minwhisker=Q1-1.5*IQR
print(minwhisker)
data['Weight']=np.where(data['Weight']>3.0950965391249996,3.0950965391249996,data['Weight'])
data['Weight']=np.where(data['Weight']<-5.075890391874999,-5.075890391874999,data['Weight'])
sns.boxplot(data['Weight'])
```

```
0.75    0.030976
0.25   -2.011770
Name: Weight, dtype: float64
0.03097644
-2.01177029275
2.04274673275
3.0950965391249996
-5.075890391874999
<Axes: ylabel='Weight'>
```



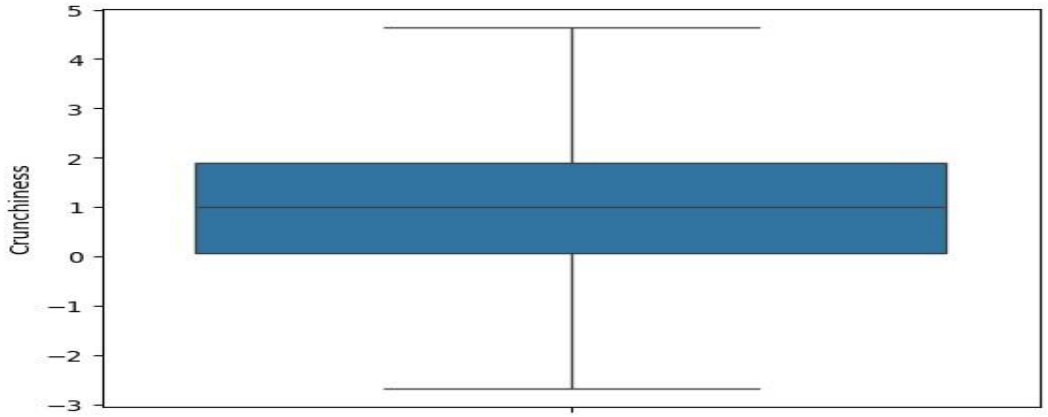
```
quant=data['Sweetness'].quantile(q=[0.75,0.25])
print(quant)
Q3=quant.loc[0.75]
print(Q3)
Q1=quant.loc[0.25]
print(Q1)
IQR=Q3-Q1
print(IQR)
maxwhisker=Q3+1.5*IQR
print(maxwhisker)
minwhisker=Q1-1.5*IQR
print(minwhisker)
data['Sweetness']=np.where(data['Sweetness']>4.61244239625,4.61244239625,data['Sweetness'])
data['Sweetness']=np.where(data['Sweetness']<-5.54894553775,-5.54894553775,data['Sweetness'])
sns.boxplot(data['Sweetness'])
```

```
0.75    0.801922
0.25   -1.738425
Name: Sweetness, dtype: float64
0.8019219209999999
-1.7384250625
2.5403469835
4.61244239625
-5.54894553775
<Axes: ylabel='Sweetness'>
```



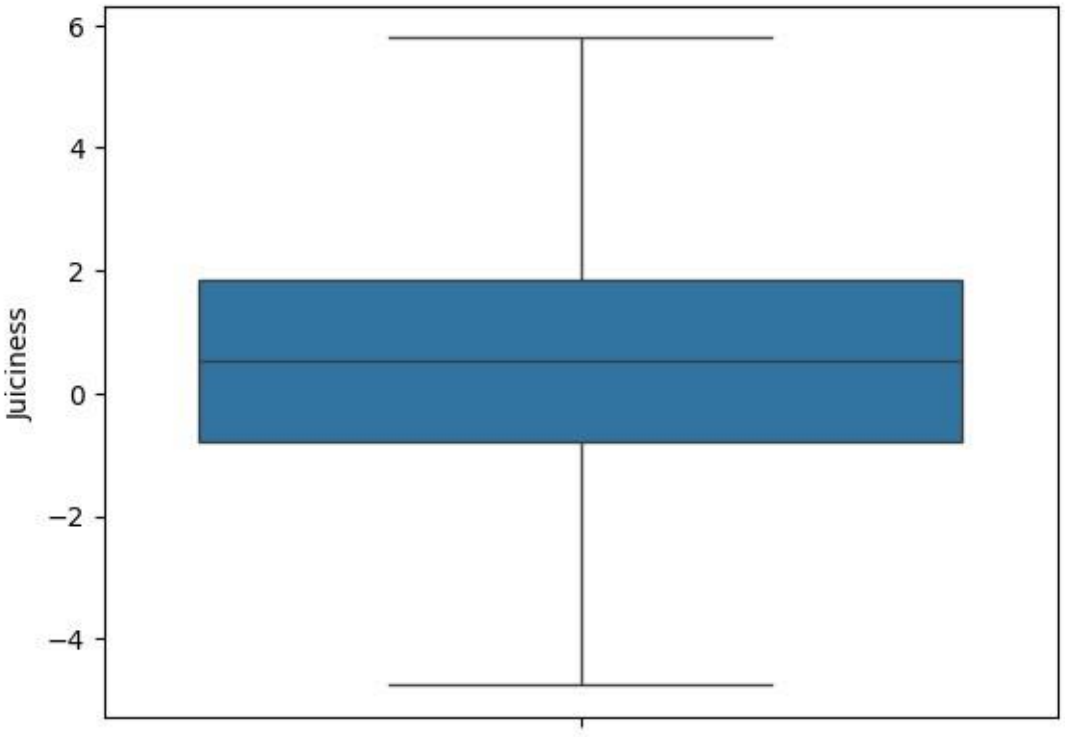
```
quant=data['Crunchiness'].quantile(q=[0.75,0.25])
print(quant)
Q3=quant.loc[0.75]
print(Q3)
Q1=quant.loc[0.25]
print(Q1)
IQR=Q3-Q1
print(IQR)
maxwhisker=Q3+1.5*IQR
print(maxwhisker)
minwhisker=Q1-1.5*IQR
print(minwhisker)
data['Crunchiness']=np.where(data['Crunchiness']>4.641438949625,4.641438949625,data['Crunchiness'])
data['Crunchiness']=np.where(data['Crunchiness']<-2.6844403373750003,-2.6844403373750003,data['Crunchiness'])
sns.boxplot(data['Crunchiness'])
```

```
0.75    1.894234
0.25    0.062764
Name: Crunchiness, dtype: float64
1.8942342170000002
0.06276439525000001
1.83146982175
4.641438949625
-2.6844403373750003
<Axes: ylabel='Crunchiness'>
```



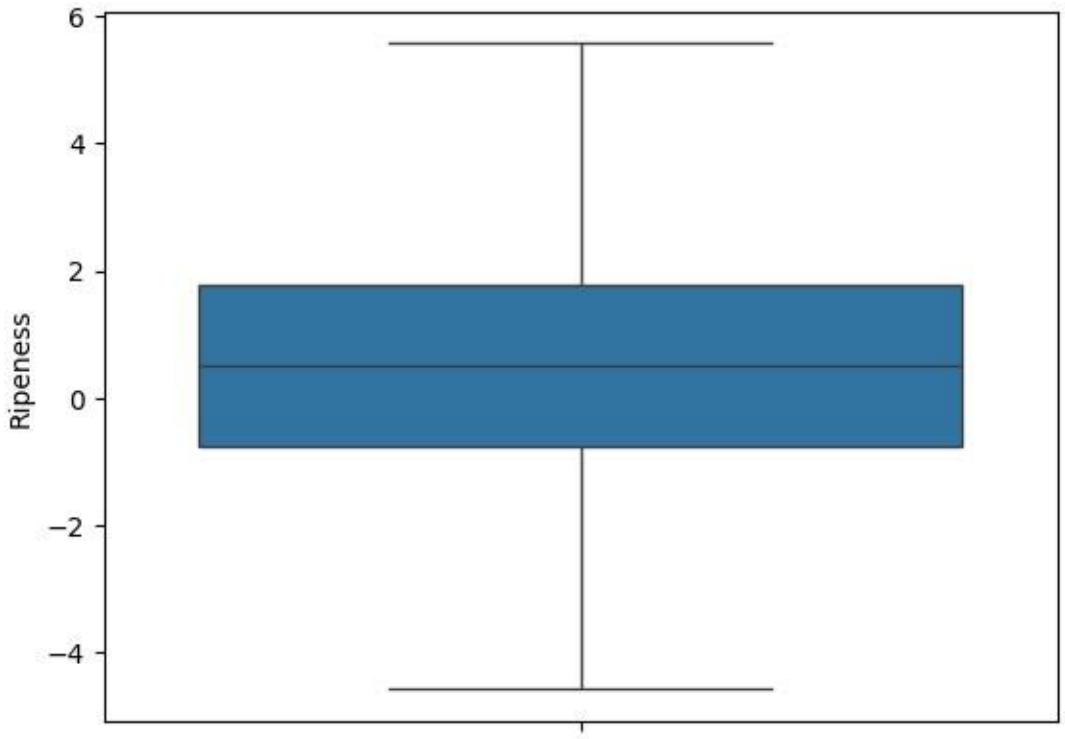

```
[ ]  quant=data['Juiciness'].quantile(q=[0.75,0.25])
     print(quant)
     Q3=quant.loc[0.75]
     print(Q3)
     Q1=quant.loc[0.25]
     print(Q1)
     IQR=Q3-Q1
     print(IQR)
     maxwhisker=Q3+1.5*IQR
     print(maxwhisker)
     minwhisker=Q1-1.5*IQR
     print(minwhisker)
     data['Juiciness']=np.where(data['Juiciness']>5.7918691624999,5.791869691624999,data['Juiciness'])
     data['Juiciness']=np.where(data['Juiciness']<-4.7571791193749995,-4.7571791193749995,data['Juiciness'])
     sns.boxplot(data['Juiciness'])
```

```
0.75    1.835976
0.25   -0.801286
Name: Juiciness, dtype: float64
1.8359763875
-0.80128581525
2.6372622027499997
5.791869691624999
-4.7571791193749995
<Axes: ylabel='Juiciness'>
```



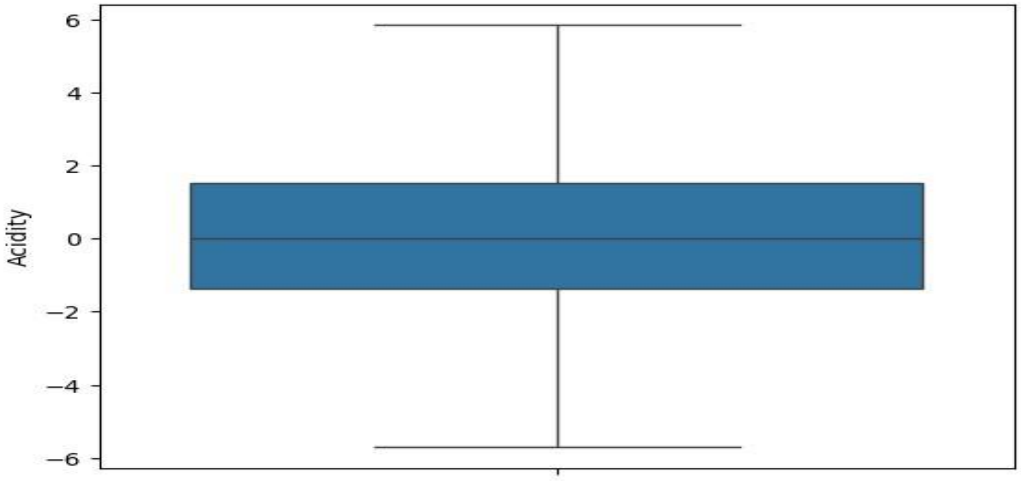
```
[ ] quant=data['Ripeness'].quantile(q=[0.75,0.25])
    print(quant)
    Q3=quant.loc[0.75]
    print(Q3)
    Q1=quant.loc[0.25]
    print(Q1)
    IQR=Q3-Q1
    print(IQR)
    maxwhisker=Q3+1.5*IQR
    print(maxwhisker)
    minwhisker=Q1-1.5*IQR
    print(minwhisker)
    data['Ripeness']=np.where(data['Ripeness']>5.573044401624999,5.573044401624999,data['Ripeness'])
    data['Ripeness']=np.where(data['Ripeness']<-4.578509627375,-4.578509627357,data['Ripeness'])
    sns.boxplot(data['Ripeness'])
```

```
0.75    1.766212
0.25   -0.771677
Name: Ripeness, dtype: float64
1.76621164075
-0.7716768665
2.53788850725
5.573044401624999
-4.578509627375
<Axes: ylabel='Ripeness'>
```



```
data['Acidity']=pd.to_numeric(data['Acidity'],errors='coerce')
print(quant)
Q3=quant.loc[0.75]
print(Q3)
Q1=quant.loc[0.25]
print(Q1)
IQR=Q3-Q1
print(IQR)
maxwhisker=Q3+1.5*IQR
print(maxwhisker)
minwhisker=Q1-1.5*IQR
print(minwhisker)
data['Acidity']=np.where(data['Acidity']>5.84236800775,5.84236800775,data['Acidity'])
data['Acidity']=np.where(data['Acidity']<-5.7092993302499995,-5.7092993302499995,data['Acidity'])
sns.boxplot(data['Acidity'])
```

```
0.75    1.766212
0.25   -0.771677
Name: Ripeness, dtype: float64
1.76621164075
-0.7716768665
2.53788850725
5.573044401624999
-4.578509627375
<Axes: ylabel='Acidity'>
```



Descriptive Statistics

```
data.describe()
```

	A_id	Size	Weight	Sweetness	Crunchiness	Juiciness	Ripeness	Acidity
count	4000.000000	4000.000000	4000.000000	4000.000000	4000.000000	4000.000000	4000.000000	4000.000000
mean	1999.500000	-0.502695	-0.991229	-0.472248	0.984194	0.513127	0.498102	0.076639
std	1154.844867	1.917446	1.574517	1.931684	1.369437	1.917024	1.866614	2.101441
min	0.000000	-5.750201	-5.075890	-5.548946	-2.684440	-4.757179	-4.578510	-5.709299
25%	999.750000	-1.816765	-2.011770	-1.738425	0.062764	-0.801286	-0.771677	-1.377424
50%	1999.500000	-0.513703	-0.984736	-0.504758	0.998249	0.534219	0.503445	0.022609
75%	2999.250000	0.805526	0.030976	0.801922	1.894234	1.835976	1.766212	1.510493
max	3999.000000	4.738963	3.095097	4.612442	4.641439	5.791870	5.573044	5.842368

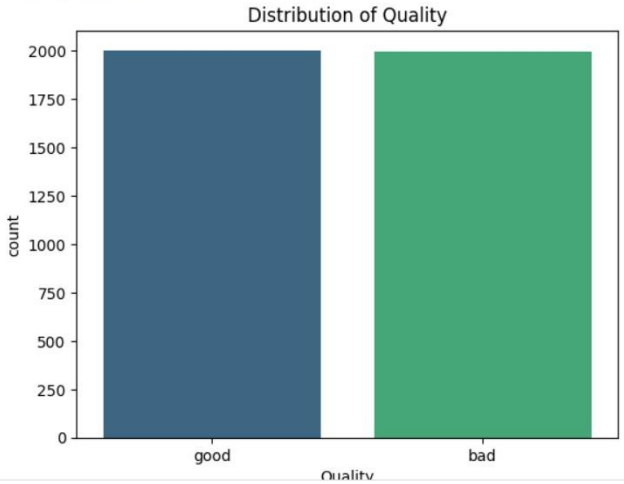
Visual Analysis

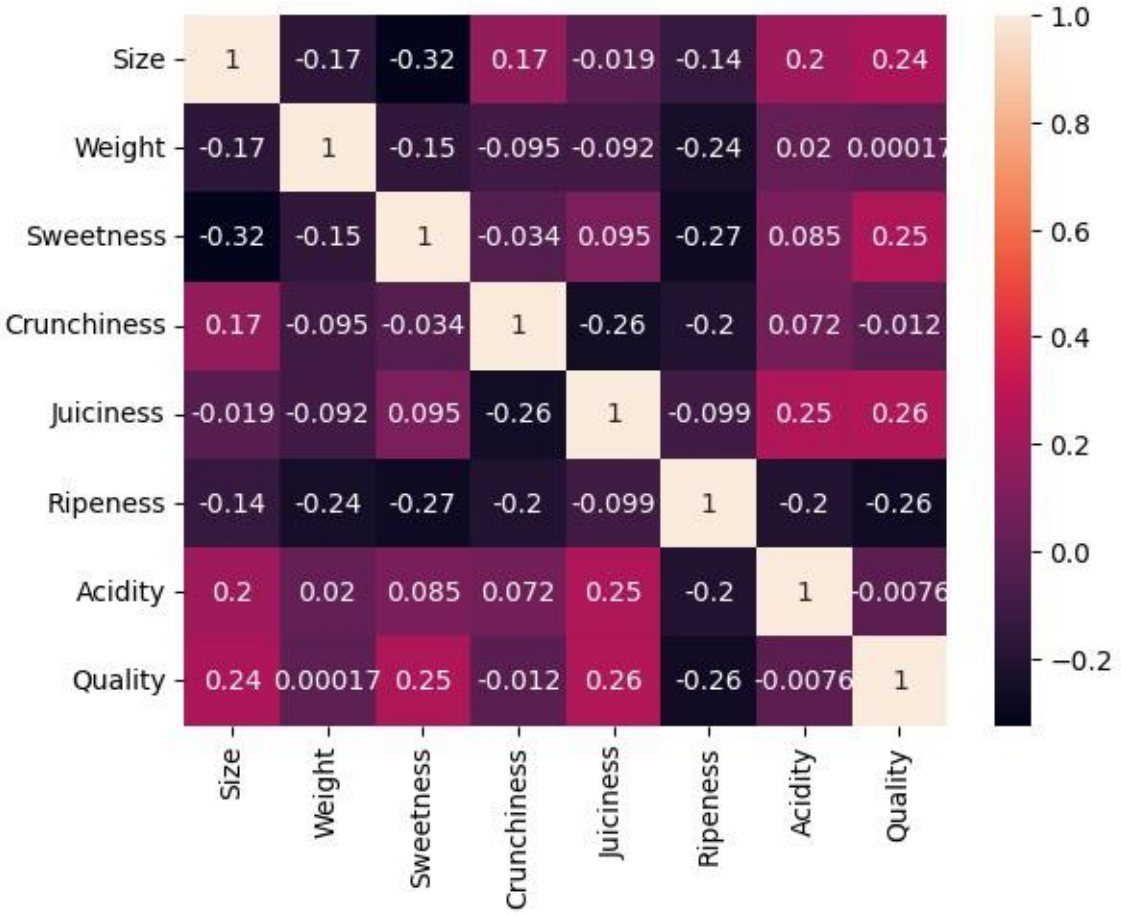
```
[ ] sns.countplot(x='Quality',data=data,palette='viridis')
    plt.title('Distribution of Quality')
```

```
<ipython-input-74-596555e9703b>:1: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `x` variable to `hue` and set `legend=False` for the same effect

  sns.countplot(x='Quality',data=data,palette='viridis')
Text(0.5, 1.0, 'Distribution of Quality')
```





```
[ ] x=data.iloc[:,:-1]
    y=data['Quality']
    from sklearn.preprocessing import StandardScaler
    scaler=StandardScaler()
    X=scaler.fit_transform(x)
    x_train,x_test,y_train,y_test=train_test_split(X,y,test_size=0.2,random_state=42)
```

```
[ ] model_=DecisionTreeClassifier()
    model_.fit(x_train,y_train)
    dt_pred=model_.predict(x_test)
    acc_score=accuracy_score=(y_test,dt_pred)
    from sklearn.metrics import accuracy_score
    acc_score=accuracy_score(y_test,dt_pred)
    print("acc_score of decision tree model %.2f" % acc_score)
```

```
acc_score of decision tree model 0.80
```

Model Building

Multiple Algorithms

```
[ ]  model=RandomForestClassifier(n_estimators=100)
     model.fit(x_train,y_train)
     forest=model.predict(x_test)
     accuracy=accuracy_score(y_test,forest)
     print("acc_score of randomForest model %.2f"%accuracy)
```

```
acc_score of randomForest model 0.91
0.915
```

```
[ ]  model.score(x_test,y_test)
```

```
0.9
```

```
[ ]  model1=xgb.XGBClassifier().fit(x_train,y_train)
     y_pred=model1.predict(x_test)
     model1.score(x_test,y_test)
```

```
0.915
```

```
[ ]  print("acc_score of model %.2f"%accuracy_score(y_test,forest))
```

```
acc_score of model 0.90
```

Testing The Model

```
[ ] print(model1.predict([[-0.292024,-1.351282,-1.738429,-0.342616,2.838636,-0.038033,2.621636473,0]]))
```

```
[0]
```

Performance Testing & Multiple Evaluation Metrics

Compare The Model

```
[ ] from sklearn.metrics import classification_report
    print(classification_report(dt_pred,y_test))
```

```
              precision    recall  f1-score   support

           0       0.82      0.81      0.81       406
           1       0.80      0.81      0.81       394

    accuracy                           0.81       800
   macro avg       0.81      0.81      0.81       800
weighted avg       0.81      0.81      0.81       800
```

```
[ ] from sklearn.metrics import classification_report
```

```
[ ] print(classification_report(forest,y_test))
```

```
[ ] from sklearn.metrics import classification_report
```

```
[ ] print(classification_report(forest,y_test))
```

```
              precision    recall  f1-score   support

           0       0.91      0.90      0.90       405
           1       0.89      0.90      0.90       395

    accuracy                           0.90       800
   macro avg       0.90      0.90      0.90       800
weighted avg       0.90      0.90      0.90       800
```

```
[ ] print(classification_report(y_pred,y_test))
```

```
              precision    recall  f1-score   support

           0       0.90      0.91      0.90       400
           1       0.90      0.90      0.90       400

    accuracy                           0.90       800
   macro avg       0.90      0.90      0.90       800
weighted avg       0.90      0.90      0.90       800
```

```
[ ] print(classification_report(reg_pred,y_test))
```

```
              precision    recall  f1-score   support

           0       0.75      0.76      0.75       400
           1       0.75      0.75      0.75       400

    accuracy                           0.75       800
   macro avg       0.75      0.75      0.75       800
weighted avg       0.75      0.75      0.75       800
```

```
[ ] from sklearn.model_selection import train_test_split
    X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)
    if not isinstance(X_test, pd.DataFrame):
     X_test = pd.DataFrame(X_test)
     single_test_instance=X_test.iloc[[0]]
    print(model1.predict(single_test_instance))
```

```
[1]
```

```
[ ] print(model1.predict([[-0.292024,-1.351282,-1.738429,0,-0.342616,2.838636,-0.038033,2.621636473]]))
```

```
[0]
```

```
[ ] print(model1.predict([[1.364217,-1.296612,-0.384658,-0.553006,3.030874,-1.303849,0.501984036,0]]))
```

```
[0]
```

```
[ ] print(model1.predict([[1.364217,1.296612,0.384658,0.553006,3.030874,1.303849,0.501984036,0]]))
```

Model Deployment

Save The Best Model

```
[ ] import pickle
```

```
[ ] pickle.dump(model1,open("model.pkl","wb"))
```