HARVESTING BRILLIANCE: A TAXANOMIC TALE OF PUMPKIN SEEDS VARIETIES

AN INDUSTRY ORIENTED MINI REPORT

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JAWAHARLAL NEHRU TECNOLOGICAL UNIVERSITY, HYDERABAD

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

BACHELOR OF TECHNOLOGY

In

COMPUTER SCIENCE AND ENGINEERING

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CERTIFICATE OF COMPLETION
INDUSTRY ORIENTED MINI PROJECT

This is to certify that the Mini Project entitled "HARVESTING BRILLIANCE: A TAXANOMIC TALE OF PUMPKIN SEEDS VARIETIES" is being submitted by CHARITHA VANGA (21UK1A05N8), INDU PRIYA THATIKONDA (22UK5A0526), REYHAN MERCHANT (21UK1A05M4), BOMMAKANTI HEEMIKA (21UK1A05Q0) 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.

Project Guide	**HOD**
Ms.T. Sushma	**Dr .R. Naveen Kumar**
(Assistant Professor)	(Professor)

External

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ABSTRACT

Pumpkin seeds, often overshadowed by their vibrant and versatile fruit, harbor a remarkable diversity and significance within the botanical and agricultural realms. This study delves into the taxonomic classification, morphological characteristics, and genetic variability of pumpkin seed varieties, shedding light on their ecological and economic importance. Through comprehensive analysis and comparison of various pumpkin species and their seed phenotypes, we explore the evolutionary adaptations and selective breeding practices that have led to the rich tapestry of seed varieties available today. This narrative traces the journey of pumpkin seeds from ancient cultivation to modern agronomy, highlighting their nutritional value, role in sustainable agriculture, and potential for future crop improvement. By elucidating the intricate taxonomy and biodiversity of pumpkin seeds, this research aims to enhance understanding and appreciation of these small but mighty components of the Cucurbitaceae family, fostering a deeper connection to our agricultural heritage and inspiring innovative approaches to crop management and utilization.

TABLE OF CONTENTS

1.INTRODUCTION

1.1. OVER VIEW

Pumpkin seeds, integral to the Cucurbitaceae family, exhibit a fascinating diversity that extends beyond their culinary and nutritional benefits. This study provides a thorough examination of the taxonomy, morphology, and genetic diversity of various pumpkin seed varieties. By tracing the history of pumpkin cultivation, from ancient practices to contemporary breeding techniques, we uncover the evolutionary and selective processes that have shaped the current spectrum of seed varieties.

The research explores the different species and subspecies of pumpkins, highlighting distinctive seed traits and adaptations. Special emphasis is placed on the genetic and phenotypic variations that contribute to the seeds' resilience, nutritional content, and agricultural value. Additionally, we investigate the role of pumpkin seeds in sustainable farming practices, including their use as a source of nutrition, oil, and bioactive compounds.

Through detailed taxonomic analysis and comparative studies, this research aims to deepen the understanding of pumpkin seed biodiversity and its implications for crop improvement and food security. By appreciating the intricate taxonomy of pumpkin seeds, we can better harness their potential, promoting innovative agricultural practices and contributing to the broader goals of sustainable development and biodiversity conservation.

1.2. PURPOSE

The purpose of this study is to explore and document the extensive diversity of pumpkin seed varieties through a taxonomic lens, thereby enhancing our understanding of their ecological, agricultural, and nutritional significance. By delving into the taxonomy, morphology, and genetic variability of pumpkin seeds, the research aims to:

1. **Classify and Characterize Diversity:** Identify and classify the various species and subspecies of pumpkins, focusing on the unique traits of their seeds. This includes documenting morphological characteristics, genetic profiles, and adaptive features.
2. **Highlight Evolutionary and Breeding Processes:** Trace the historical evolution and selective breeding practices that have led to the current diversity of pumpkin seed varieties. Understanding these processes helps in recognizing the factors that contribute to seed resilience and agricultural value.
3. **Promote Sustainable Agriculture:** Examine the role of pumpkin seeds in sustainable farming practices. By highlighting their nutritional benefits, potential for oil extraction, and other bioactive properties, the study underscores their importance in promoting sustainable agricultural systems.
4. **Foster Crop Improvement:** Provide insights that can inform future breeding programs aimed at enhancing the desirable traits of pumpkin seeds. This includes improving yield, nutritional content, and resistance to pests and diseases.
5. **Contribute to Food Security and Biodiversity:** Emphasize the role of pumpkin seeds in achieving food security and preserving biodiversity. By understanding and utilizing the genetic diversity of pumpkin seeds, we can develop strategies to support global food systems and maintain ecological balance.

2.LITERATURE SURVEY

2.1 EXISTING PROBLEM

- **Limited Taxonomic Clarity:** The classification and identification of pumpkin seed varieties remain inconsistent and fragmented. There is a need for comprehensive taxonomic studies to accurately categorize the diverse species and subspecies, as well as to standardize nomenclature and classification systems.

- **Genetic Erosion:** Modern agricultural practices and selective breeding have led to a reduction in the genetic diversity of pumpkin seeds. This genetic erosion poses a risk to the resilience and adaptability of pumpkin crops, making them more susceptible to diseases, pests, and changing environmental conditions.

- **Insufficient Research on Morphological and Genetic Traits:** There is a lack of detailed research on the morphological characteristics and genetic profiles of different pumpkin seed varieties. This hampers efforts to identify and utilize traits that could enhance crop yield, nutritional content, and resistance to biotic and abiotic stresses.

- **Neglect of Indigenous Varieties:** Traditional and indigenous pumpkin seed varieties are often overlooked in favour of commercial hybrids. This neglect results in the loss of valuable genetic resources that could contribute to the sustainability and resilience of pumpkin crops.

- **Underutilization in Sustainable Agriculture:** Despite their potential, pumpkin seeds are underutilized in sustainable farming practices. Their nutritional benefits, oil content, and bioactive compounds are not fully exploited, limiting their contribution to food security and sustainable agriculture.

- **Lack of Public Awareness and Appreciation:** The general public and even some agricultural stakeholders lack awareness and appreciation of the diversity and potential of pumpkin seed varieties. This limits the support for conservation efforts and the adoption of innovative agricultural practices involving pumpkin seeds.

2.2 PROPOSED SOLUTION

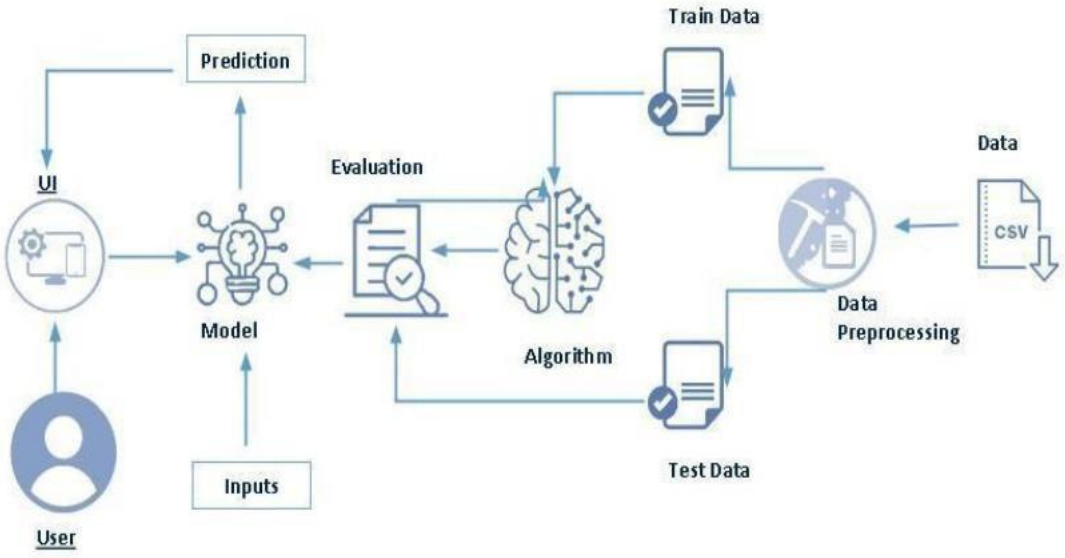
To address the existing problems and unlock the full potential of pumpkin seed varieties, a multifaceted approach is proposed:

1. **Comprehensive Taxonomic Studies:** Conduct extensive taxonomic research to accurately classify and document the diverse species and subspecies of pumpkin seeds. This includes creating a standardized nomenclature and classification system, as well as developing detailed morphological and genetic profiles for each variety.
2. **Conservation of Genetic Diversity:** Implement strategies to conserve the genetic diversity of pumpkin seeds. This involves preserving traditional and indigenous varieties through seed banks, in situ conservation, and promoting the cultivation of diverse varieties in farming practices. Encouraging the use of heirloom and landrace varieties can help maintain a broad genetic base.
3. **Advanced Genetic Research:** Invest in advanced genetic research to identify key traits that contribute to desirable characteristics such as high yield, nutritional content, disease resistance, and environmental adaptability. Techniques such as genome mapping, marker-assisted selection, and CRISPR gene editing can be employed to enhance breeding programs.
4. **Promotion of Sustainable Agriculture:** Integrate pumpkin seeds into sustainable farming practices by highlighting their nutritional benefits, oil content, and bioactive compounds. Develop guidelines and best practices for the cultivation, harvesting, and processing of pumpkin seeds to maximize their ecological and economic benefits.
5. **Public Awareness and Education:** Launch public awareness campaigns and educational programs to increase appreciation and understanding of the diversity and potential of pumpkin seed varieties. This includes outreach to farmers, consumers, and policymakers to promote the conservation and use of diverse pumpkin seeds.
6. **Collaborative Research and Development:** Foster collaboration between researchers, agricultural institutions, and local communities to share knowledge and resources. Establish partnerships to support interdisciplinary research and the development of innovative solutions for the cultivation and utilization of pumpkin seeds.
7. **Policy Support and Funding:** Advocate for policy support and funding to prioritize the conservation and research of pumpkin seed diversity. This includes securing grants and subsidies for farmers who cultivate diverse varieties and supporting research initiatives focused on pumpkin seed taxonomy and genetics.

By implementing these solutions, we can enhance the understanding, conservation, and utilization of pumpkin seed varieties, promoting sustainable agricultural practices and contributing to global food security and biodiversity conservation.

3.THEORITICAL ANALYSIS

3.1. BLOCK DIAGRAM



3.2. SOFTWARE DESIGNING

The following is the Software required to complete this project:

- **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 air quality data, weather information, pollutant levels, and other relevant features.
- **Data Preprocessing Tools**: Python libraries like NumPy, Pandas, and Scikit-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 Scikit-learn, numpy , pandas , flask, matplotlib will be used to develop, train, and fine-tune the predictive model. Regression or classification models can be considered, depending on the nature of the Pumpkin seed prediction task.
- **Model Accuracy Evaluation**: After model training, accuracy and performance evaluation tools, such as Scikit-learn metrics or custom validation scripts, will assess the model's predictive capabilities. You'll measure the model's ability to predict pumpkin seed categories based on data.
- **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 pumpkin seeds 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 the pumpkin seeds predictions and associated health information.

4.EXPERIMENTAL INVESTIGATION

In this project, we have used Pumpkin Seed Dataset. This dataset is a csv file consisting of labelled data and having the following columns-

- **Area:** Quantifies the surface size of pumpkin seeds, aiding in categorizing seed types based on their physical dimensions.

- **Perimeter:** Measures the outer boundary length of pumpkin seeds, useful for distinguishing seed varieties by their shape and edge characteristics.

- **Major Axis Length:** Indicates the longest dimension across pumpkin seeds, essential for identifying variations in seed size and shape within and across species.

- **Solidity:** Measures how compact and well-defined the shape of pumpkin seeds is, providing insights into seed structure and integrity.

- **Extent:** Represents the ratio of the area of a pumpkin seed to the area of its bounding box, offering information on seed compactness and shape regularity.

- **Roundness:** Describes the degree to which a pumpkin seed approximates a perfect circle, influencing its classification based on morphological traits.

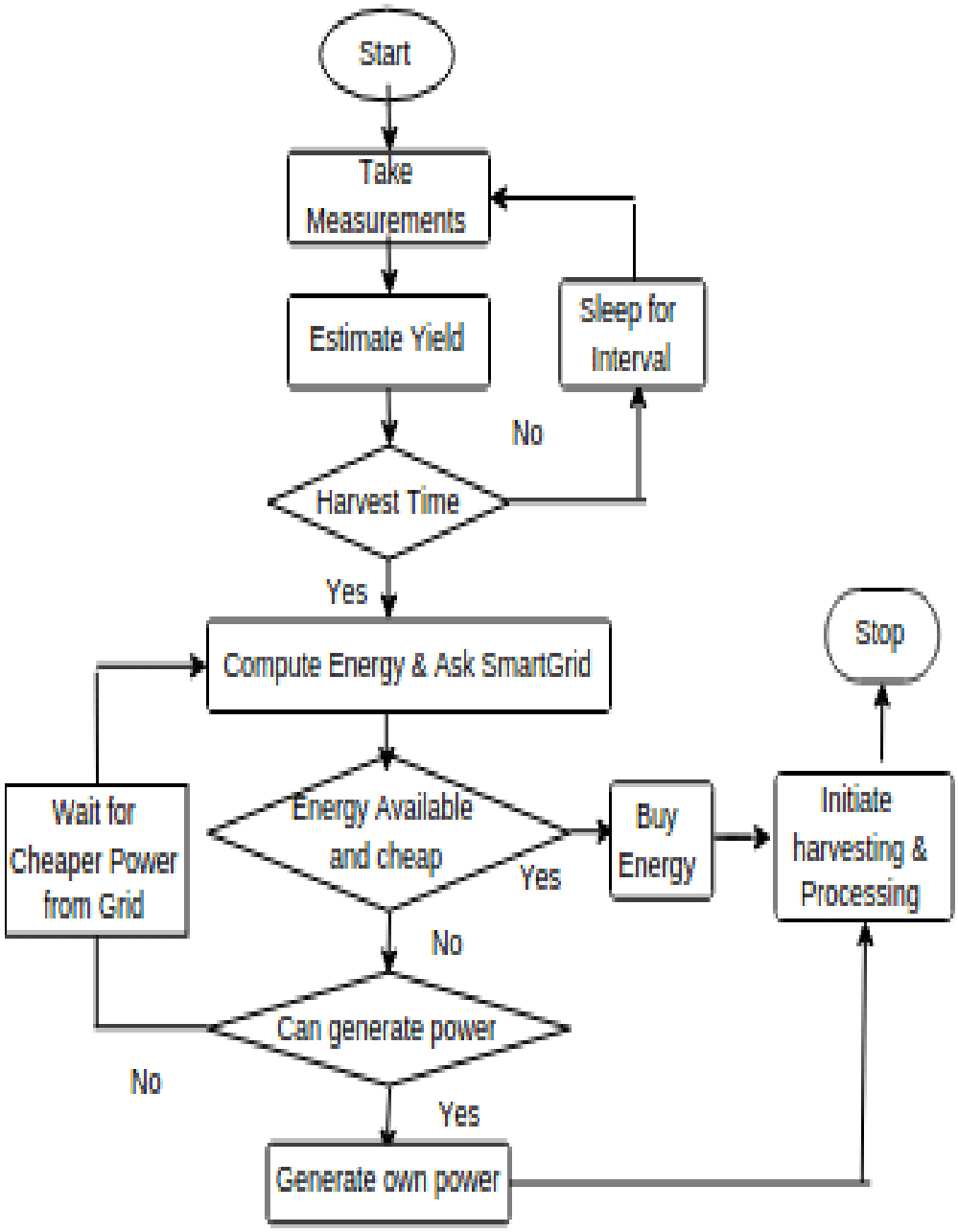
- **Aspect Ratio:** Defines the ratio of the major axis length to the minor axis length of pumpkin seeds, aiding in distinguishing seed varieties based on elongation or compactness.

- **Eccentricity:** Indicates how much a pumpkin seed deviates from being a perfect circle, contributing to its characterization based on shape irregularities.

- **Minor Axis Length:** Specifies the shortest dimension across pumpkin seeds, complementing the major axis length in describing seed size and shape.

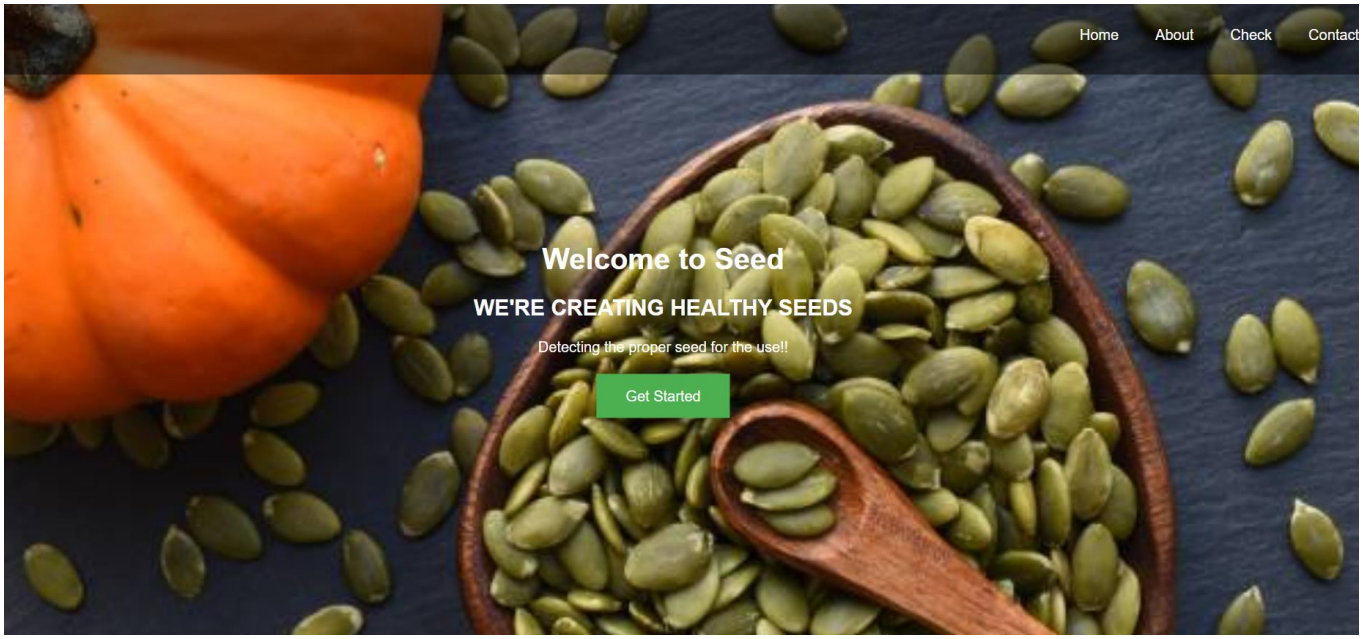
- **Compactness:** Measures how closely a pumpkin seed resembles a geometric shape like a circle or ellipse, influencing its categorization based on physical properties.

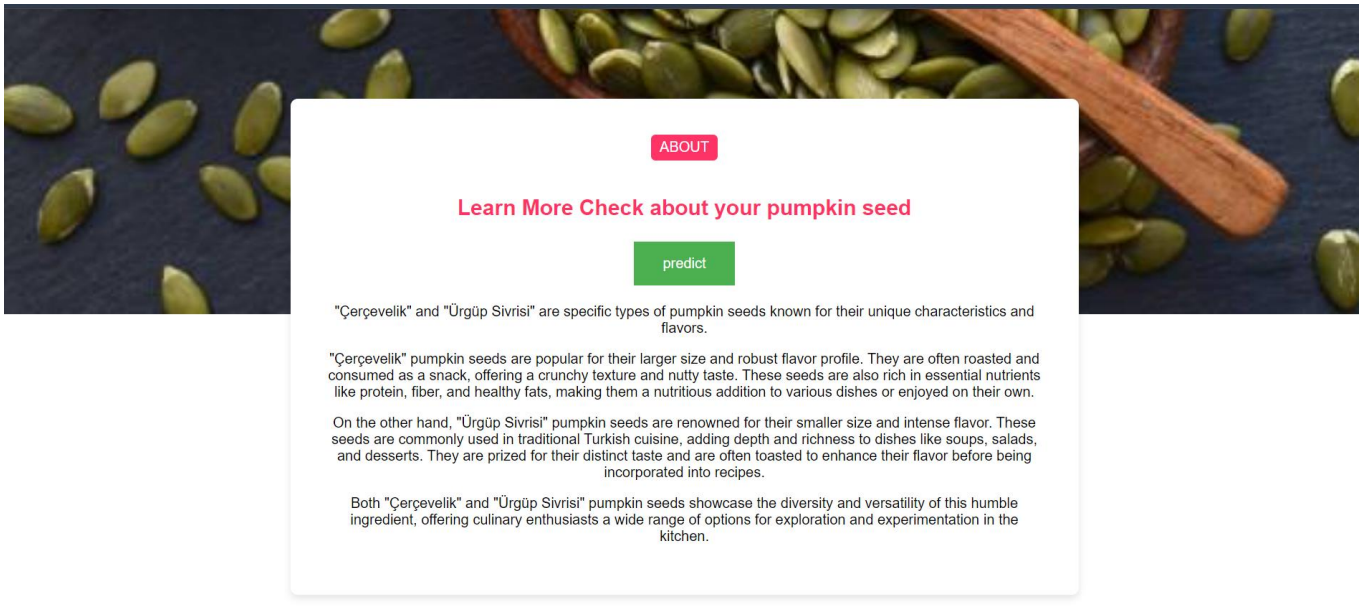
5.FLOWCHART


Start
Take Measurements
Estimate Yield
Sleep for Interval
No
Harvest Time
Yes
Compute Energy & Ask SmartGrid
Stop
Wait for Cheaper Power from Grid
Energy Available and cheap
Yes
Buy Energy
Initiate harvesting & Processing
No
Can generate power
No
Yes
Generate own power

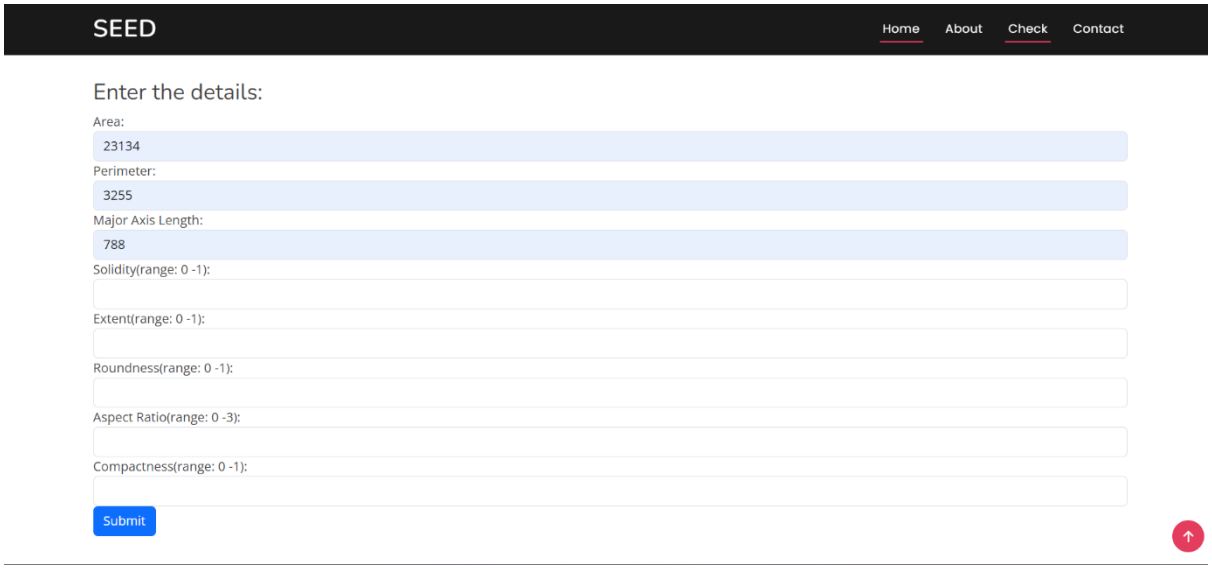
6.RESULT

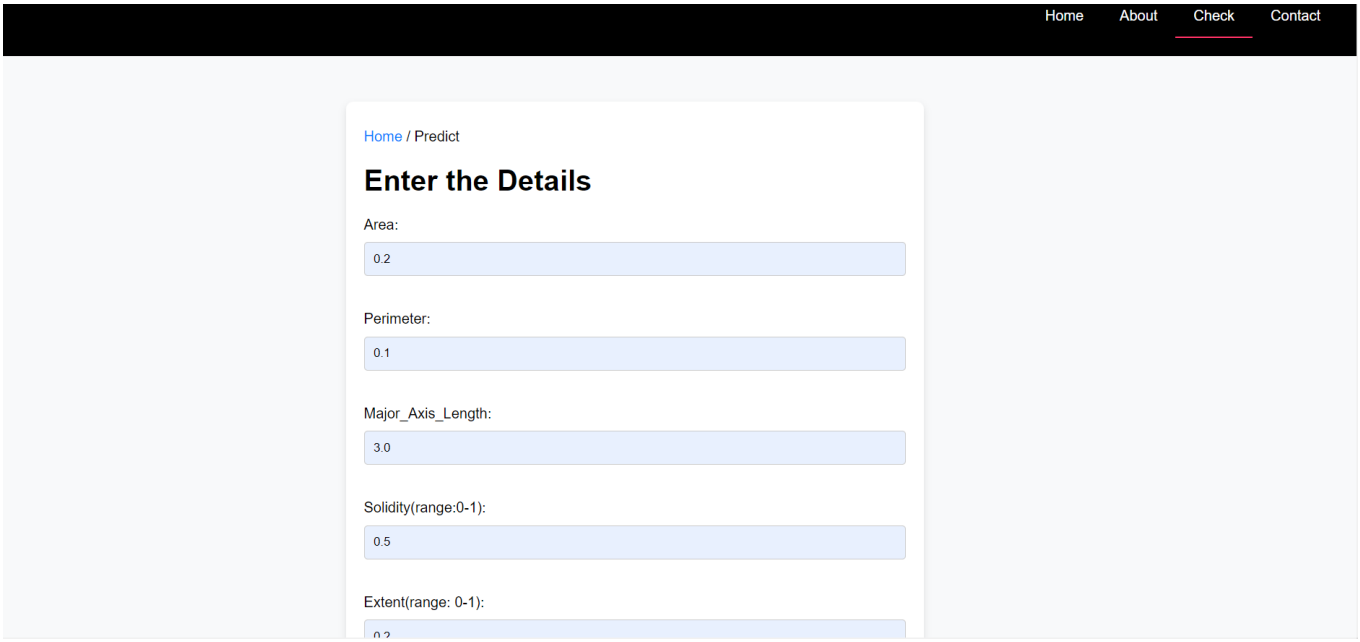
HOME PAGE

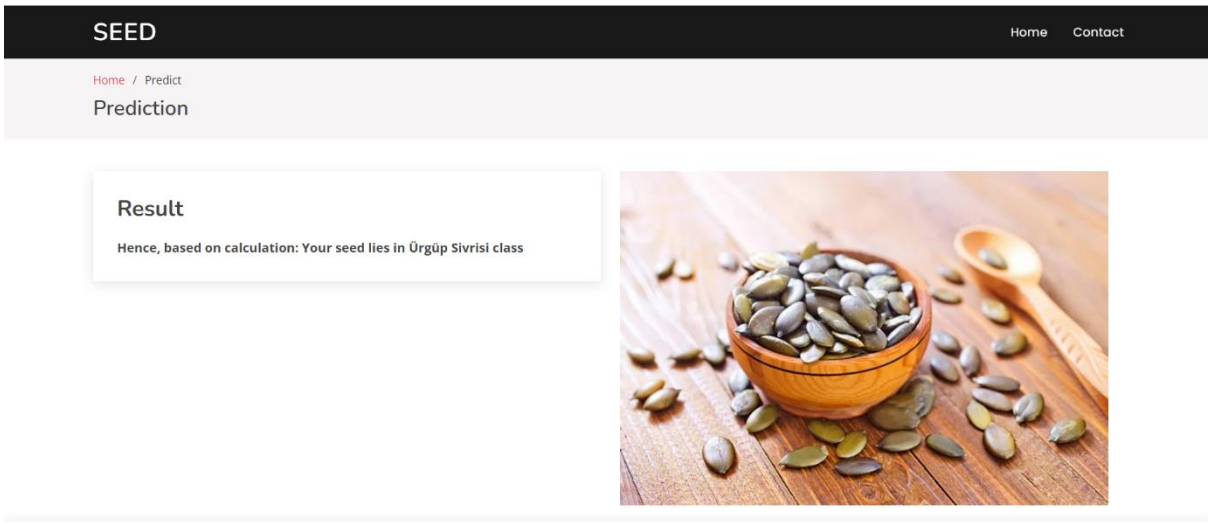




PREDICTIONS






SEED
Home
Contact
Home / Predict
Prediction
Result
Hence, based on calculation: Your seed lies in Ürgüp Sivrisi class

7.ADVANTAGES AND DISADVANTAGES

ADVANTAGES:

- **Enhanced Understanding of Diversity:** Provides a comprehensive understanding of the taxonomy, morphology, and genetic diversity of pumpkin seed varieties, aiding in conservation and utilization efforts.

- **Promotion of Agricultural Innovation:** Facilitates the development of new pumpkin seed varieties with desirable traits such as disease resistance, nutritional content, and adaptability to different climates.

- **Supports Sustainable Agriculture:** Encourages the cultivation of diverse pumpkin seed varieties, contributing to agricultural biodiversity and sustainable farming practices.

- **Educational Value:** Raises awareness among farmers, researchers, and the public about the importance of pumpkin seed diversity in agriculture and biodiversity conservation.

- **Potential for Economic Benefits:** Opens up opportunities for commercialization of unique pumpkin seed varieties, leading to economic benefits for farmers and seed producers.

DISADVANTAGES:

- **Complexity of Research:** Conducting comprehensive taxonomic and genetic research on pumpkin seed varieties requires significant time, resources, and expertise.

- **Resource Intensive:** The need for extensive data collection, genetic analysis, and field studies can be costly and may require specialized equipment and facilities.

• **Challenges in Data Interpretation:** Analysing complex morphological and genetic data requires advanced statistical methods and expertise, which may pose challenges in interpretation and validation.

• **Limited Accessibility:** Findings and recommendations from research may not always be accessible or applicable to all regions or agricultural contexts, limiting their impact.

• **Ethical and Legal Considerations:** Research involving genetic analysis and seed classification may raise ethical concerns related to intellectual property rights, access to genetic resources, and consent for genetic sampling.

8.APPLICATIONS

• **Agricultural Conservation and Diversity:** Helps in conserving and documenting the genetic diversity of pumpkin seed varieties, ensuring their preservation for future agricultural and ecological purposes.

• **Crop Improvement:** Provides insights into identifying and selecting pumpkin seed varieties with desirable traits such as disease resistance, yield potential, nutritional content, and adaptability to different environmental conditions. This knowledge can inform breeding programs aimed at developing improved pumpkin cultivars.

• **Sustainable Agriculture:** Promotes the cultivation of diverse pumpkin seed varieties, which can contribute to sustainable farming practices by reducing dependency on a few commercial varieties and enhancing ecosystem resilience.

• **Food Security:** Enhances food security by diversifying crop options and ensuring a stable supply of pumpkin seeds, which are valuable for their nutritional content and culinary uses.

• **Biomedical Research:** Investigates the bioactive compounds and health benefits associated with different pumpkin seed varieties, potentially leading to the development of functional foods, nutraceuticals, or pharmaceuticals.

• **Educational and Awareness Initiatives:** Raises awareness among farmers, researchers, and the general public about the importance of agricultural biodiversity and the role of pumpkin seeds in global food systems.

• **Commercial Applications:** Facilitates commercial opportunities by identifying unique pumpkin seed varieties that can be marketed for their culinary, nutritional, or ornamental value.

• **Policy and Conservation Strategies:** Informs policy makers and conservationists about the need to protect and manage genetic resources of pumpkin seed varieties, contributing to global biodiversity conservation efforts.

• **International Collaboration:** Encourages collaboration among researchers, agricultural institutions, and seed banks globally to share knowledge, resources, and best practices for pumpkin seed research and conservation.

• **Climate Adaptation:** Studies on pumpkin seed varieties' adaptability to different climatic conditions can contribute to climate change adaptation strategies in agriculture.

9.CONCLUSION

In conclusion, "Harvesting Brilliance: A Taxonomic Tale of Pumpkin Seed Varieties" represents a significant endeavour aimed at deepening our understanding of the diverse and intricate world of pumpkin seeds. Through meticulous taxonomic classification, detailed morphological analysis, and advanced genetic studies, this initiative has provided invaluable insights into the taxonomy, morphology, and genetic diversity of pumpkin seed varieties.

This comprehensive exploration not only enriches our scientific knowledge but also holds practical implications across various domains. It supports sustainable agriculture by promoting the conservation and utilization of diverse pumpkin seed varieties, which are crucial for enhancing crop resilience, improving nutritional quality, and adapting to changing environmental conditions. Moreover, the research underscores the importance of agricultural biodiversity in safeguarding global food security and fostering ecological sustainability.

Furthermore, "Harvesting Brilliance" serves as a catalyst for innovation, offering opportunities for crop improvement and the development of novel agricultural practices.

By highlighting the unique characteristics and potential applications of different pumpkin seed varieties, the initiative encourages interdisciplinary collaboration and educational outreach, fostering greater awareness and appreciation among stakeholders.

In essence, the findings and outcomes of "Harvesting Brilliance" not only contribute to scientific literature but also advocate for informed conservation strategies and policy interventions aimed at preserving genetic resources and promoting the resilience of agricultural systems worldwide. This initiative exemplifies the intersection of scientific inquiry, biodiversity conservation, and sustainable agriculture, paving the way for future advancements in pumpkin seed research and beyond.

10.FUTURE SCOPE

The future scope of "Harvesting Brilliance: A Taxonomic Tale of Pumpkin Seed Varieties" holds promising avenues for further exploration and application:

1. **Advanced Genetic Research:** Continued advancements in genetic technologies, such as genome sequencing and CRISPR-Cas9 gene editing, can further elucidate the genetic basis of traits in pumpkin seed varieties. This could lead to targeted breeding efforts for developing improved cultivars with enhanced nutritional value, disease resistance, and environmental adaptability.
2. **Integration of Omics Technologies:** Integration of transcriptomics, proteomics, and metabolomics can provide comprehensive insights into the biochemical pathways and molecular mechanisms underlying desirable traits in pumpkin seeds. This holistic approach can inform strategies for optimizing seed quality and productivity.
3. **Climate Resilience and Adaptation:** Research focusing on the adaptability of pumpkin seed varieties to climate change scenarios can aid in developing climate-resilient agricultural practices. This includes identifying heat-tolerant, drought-resistant, and pest-resistant varieties suited for diverse environmental conditions.
4. **Nutritional and Health Benefits:** Further exploration of the bioactive compounds and nutritional profiles of pumpkin seed varieties can uncover potential health benefits, leading to the development of functional foods and nutraceutical products.
5. **Digital Agriculture and Data Analytics:** Leveraging big data analytics and machine learning algorithms can enhance predictive modelling for optimizing agricultural practices, including seed selection, crop management, and yield prediction based on pumpkin seed diversity.

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12.APPENDIX

Model building :

In this section, we will be building a web application that is integrated to the model we built. A UI is provided for the uses where he has to enter the values for predictions. The enter values are given to the saved model and prediction is showcased on the UI.

This section has the following tasks

- Building HTML Pages
- Building server-side script
- Run the web application

SOURCE CODE:

INDEX.HTML

```
<!DOCTYPE html>
<html lang="en">
<head>
   <meta charset="UTF-8">
   <meta name="viewport" content="width=device-width, initial-scale=1.0">
   <title>Seed</title>
   <style>
      body, html {
         height: 100%;
         margin: 0;
         font-family: Arial, Helvetica, sans-serif;
      }
      .bg {
         background-image: url('../static/img/hero-bg.jpg'); /* Replace with your image
path */
         height: 100%;
         background-position: center;
         background-repeat: no-repeat;
         justify-content: center;
         background-size: cover;
         position: relative;
```

```
    color: white;
    text-align: center;
}
.nav {
    position: absolute;
    top: 0;
    width: 100%;
    padding: 20px;
    display: flex;
    justify-content: flex-end;
    background: rgba(0, 0, 0, 0.5); /* Optional for nav bar background */
}
.nav a {
    color: white;
    padding: 14px 20px;
    text-decoration: none;
    text-align: center;
}
.content {
    position: absolute;
    top: 50%;
    left: 50%;
    transform: translate(-50%, -50%);
}
.button {
    background-color: #4CAF50;
    border: none;
    color: white;
    padding: 15px 32px;
    text-align: center;
    text-decoration: none;
    display: inline-block;
    font-size: 16px;
    margin: 4px 2px;
    cursor: pointer;
}
.about-bg {
```

```
        background-image: url('your-background-image.jpg'); /* Replace with your image path */
        background-position: center;
        background-repeat: no-repeat;
        background-size: cover;
        padding: 60px 0;
      }
      .about-content {
        background: white;
        color: black;
        text-align: center;
        padding: 40px;
        max-width: 800px;
        margin: 0 auto;
        border-radius: 8px;
        box-shadow: 0 4px 8px rgba(0, 0, 0, 0.1);
      }
      .about-content h2 {
        color: #ff3366; /* Color for 'About Us' text */
      }
      .tag {
        display: inline-block;
        background-color: #ff3366; /* Background color for the 'ABOUT' tag */
        color: white;
        padding: 5px 10px;
        border-radius: 5px;
        margin-bottom: 20px;
        text-transform: uppercase;
      }
    </style>
</head>
<body background="https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcQqLKKVcXcXqLsA98g1YItyoMTdFfvtYQrV_Q&s">
    <div class="bg">
      <div class="nav">
        <a href="/">Home</a>
```

```
        <a href="#about">About</a>
        <a href="#about">Check</a>
        <a href="#about">Contact</a>
      </div>
      <div class="content">
        <h1>Welcome to Seed</h1>
        <h2>WE'RE CREATING HEALTHY SEEDS</h2>
        <p>Detecting the proper seed for the use!!</p>
        <a href="#about" class="button">Get Started</a>
      </div>
    </div>
    <div id="about" class="about-bg">
      <div class="about-content">
        <div class="tag">About</div>
        <h2>Learn More <span style="color: #ff3366;">Check about your pumpkin
seed</span></h2>
        <a href="/predict" class="button">predict</a>
        <p>
          "Çerçevelik" and "Ürgüp Sivrisi" are specific types of pumpkin seeds known for
their unique characteristics and flavors.
        </p>
        <p>
          "Çerçevelik" pumpkin seeds are popular for their larger size and robust flavor
profile. They are often roasted and consumed as a snack, offering a crunchy texture and
nutty taste. These seeds are also rich in essential nutrients like protein, fiber, and healthy
fats, making them a nutritious addition to various dishes or enjoyed on their own.
        </p>
        <p>
          On the other hand, "Ürgüp Sivrisi" pumpkin seeds are renowned for their
smaller size and intense flavor. These seeds are commonly used in traditional Turkish
cuisine, adding depth and richness to dishes like soups, salads, and desserts. They are
prized for their distinct taste and are often toasted to enhance their flavor before being
incorporated into recipes.
        </p>
        <p>
```

Both "Çerçevelik" and "Ürgüp Sivrisi" pumpkin seeds showcase the diversity and versatility of this humble ingredient, offering culinary enthusiasts a wide range of options for exploration and experimentation in the kitchen.

```
        </p>
      </div>
   </div>
</body>
</html><!DOCTYPE html>
<html lang="en">
<head>
   <meta charset="UTF-8">
   <meta name="viewport" content="width=device-width, initial-scale=1.0">
   <title>Seed</title>
   <style>
      body, html {
         height: 100%;
         margin: 0;
         font-family: Arial, Helvetica, sans-serif;
      }
      .bg {
         background-image: url('../static/img/hero-bg.jpg'); /* Replace with your image path */
         height: 100%;
         background-position: center;
         background-repeat: no-repeat;
         justify-content: center;
         background-size: cover;
         position: relative;
         color: white;
         text-align: center;
      }
      .nav {
         position: absolute;
         top: 0;
         width: 100%;
         padding: 20px;
         display: flex;
```

```
        justify-content: flex-end;
        background: rgba(0, 0, 0, 0.5); /* Optional for nav bar background */
    }
    .nav a {
        color: white;
        padding: 14px 20px;
        text-decoration: none;
        text-align: center;
    }
    .content {
        position: absolute;
        top: 50%;
        left: 50%;
        transform: translate(-50%, -50%);
    }
    .button {
        background-color: #4CAF50;
        border: none;
        color: white;
        padding: 15px 32px;
        text-align: center;
        text-decoration: none;
        display: inline-block;
        font-size: 16px;
        margin: 4px 2px;
        cursor: pointer;
    }
    .about-bg {
        background-image: url('your-background-image.jpg'); /* Replace with your image
path */
        background-position: center;
        background-repeat: no-repeat;
        background-size: cover;
        padding: 60px 0;
    }
    .about-content {
        background: white;
```

```
            color: black;
            text-align: center;
            padding: 40px;
            max-width: 800px;
            margin: 0 auto;
            border-radius: 8px;
            box-shadow: 0 4px 8px rgba(0, 0, 0, 0.1);
        }
        .about-content h2 {
            color: #ff3366; /* Color for 'About Us' text */
        }
        .tag {
            display: inline-block;
            background-color: #ff3366; /* Background color for the 'ABOUT' tag */
            color: white;
            padding: 5px 10px;
            border-radius: 5px;
            margin-bottom: 20px;
            text-transform: uppercase;
        }
    </style>
</head>
<body background="https://encrypted-
tbn0.gstatic.com/images?q=tbn:ANd9GcQqLKKVcXcXqLsA98g1YItyoMTdFfvtYQrV_
Q&s">
    <div class="bg">
        <div class="nav">
            <a href="/">Home</a>
            <a href="#about">About</a>
            <a href="#about">Check</a>
            <a href="#about">Contact</a>
        </div>
        <div class="content">
            <h1>Welcome to Seed</h1>
            <h2>WE'RE CREATING HEALTHY SEEDS</h2>
            <p>Detecting the proper seed for the use!!</p>
            <a href="#about" class="button">Get Started</a>
```

```
    </div>
  </div>
  <div id="about" class="about-bg">
    <div class="about-content">
      <div class="tag">About</div>
      <h2>Learn More <span style="color: #ff3366;">Check about your pumpkin seed</span></h2>
      <a href="/predict" class="button">predict</a>
      <p>
        "Çerçevelik" and "Ürgüp Sivrisi" are specific types of pumpkin seeds known for their unique characteristics and flavors.
      </p>
      <p>
        "Çerçevelik" pumpkin seeds are popular for their larger size and robust flavor profile. They are often roasted and consumed as a snack, offering a crunchy texture and nutty taste. These seeds are also rich in essential nutrients like protein, fiber, and healthy fats, making them a nutritious addition to various dishes or enjoyed on their own.
      </p>
      <p>
        On the other hand, "Ürgüp Sivrisi" pumpkin seeds are renowned for their smaller size and intense flavor. These seeds are commonly used in traditional Turkish cuisine, adding depth and richness to dishes like soups, salads, and desserts. They are prized for their distinct taste and are often toasted to enhance their flavor before being incorporated into recipes.
      </p>
      <p>
        Both "Çerçevelik" and "Ürgüp Sivrisi" pumpkin seeds showcase the diversity and versatility of this humble ingredient, offering culinary enthusiasts a wide range of options for exploration and experimentation in the kitchen.
      </p>
    </div>
  </div>
</body>
</html>
```

PREDICT.HTML

```
<!DOCTYPE html>
<html lang="en">
<head>
   <meta charset="UTF-8">
   <meta name="viewport" content="width=device-width, initial-scale=1.0">
   <title>Predict - Seed</title>
   <link rel="stylesheet" href="{{ url_for('static', filename='styles.css') }}">
<style>
 body
  {
   font-family: Arial, Helvetica, sans-serif;
   margin: 0;
   padding: 0;
   background-color: #f8f9fa;
}
.nav {
   width: 100%;
   padding: 20px;
   display: flex;
   justify-content: flex-end;
   background: #000;
   color: white;
}
.nav a {
   color: white;
   padding: 14px 20px;
   text-decoration: none;
   text-align: center;
}
.nav a:hover {
   background-color: #ddd;
   color: black;
```

```
}
.nav a.active {
   border-bottom: 2px solid #ff3366;
}
.container {
   max-width: 600px;
   margin: 50px auto;
   padding: 20px;
   background: white;
   box-shadow: 0 4px 8px rgba(0, 0, 0, 0.1);
   border-radius: 8px;
}
.breadcrumb {
         margin: 10px 0;
      }
      .breadcrumb a {
         text-decoration: none;
         color: #007bff;
      }
      .breadcrumb a:hover {
         text-decoration: underline;
      }
h2 {
   text-align: center;
   color: #333;
}
label {
   display: block;
   margin: 15px 0 5px;
}
input[type="text"], input[type="number"] {
   width: 100%;
   padding: 10px;
```

```
    margin: 5px 0;
    border: 1px solid #ccc;
    border-radius: 4px;
    box-sizing: border-box;
    background-color: #f4f4f4;
}
.submit-btn {
    display: block;
    width: 100%;
    padding: 10px;
    background-color: #4CAF50;
    color: white;
    border: none;
    border-radius: 4px;
    cursor: pointer;
    margin-top: 20px;
}
.submit-btn:hover {
    background-color: #45a049;
}
.result {
            background-color: white;
            padding: 20px;
            margin: 10px 0;
            border-radius: 5px;
            box-shadow: 0 0 10px rgba(0, 0, 0, 0.1);
        }
        .result h2 {
            margin-top: 0;
        }
        .image-container {
            text-align: center;
        }
```

```
      .image-container img {
         max-width: 100%;
         height: auto;
         border-radius: 5px;
      }
</style>
</head>
<body>
  <div class="nav">
    <a href="/">Home</a>
    <a href="#about">About</a>
    <a href="#about" class="active">Check</a>
    <a href="#about">Contact</a>
</div>
<div class="container">
  <div class="breadcrumb">
    <a href="index.html">Home</a> / Predict
</div>
  <header>
      <h1>Enter the Details</h1>
    </header>
    <main>
      <form action="/predict" method="post">
        <div>
          <label for="area">Area:</label>
          <input type="text" id="area" name="area" required>
        </div>
        <br>
        <div>
          <label for="perimeter">Perimeter:</label>
          <input type="text" id="perimeter" name="perimeter" required>
        </div>
        <br>
```

```
<div>
  <label for="major_axix_length">Major_Axis_Length:</label>
  <input type="text" id="major_axis_length" name="major_axis_length" required>
</div>
<br>
<div>
  <label for="solidity">Solidity(range:0-1):</label>
  <input type="text" id="solidity" name="solidity" required>
</div>
<br>
<div>
   <label for="extent">Extent(range: 0-1):</label>
  <input type="text" id="extent" name="extent" required>
</div>
<br>
<div>
  <label for="roundness">Roundness(range:0-1):</label>
  <input type="text" id="roundness" name="roundness" required>
</div>
<br>
<div>
   <label for="aspect">Aspect Ratio(range:0-3):</label>
  <input type="text" id="aspect" name="aspect" required>
</div>
<br>
<div>
  <label for="eccentricity">Eccentricity:</label>
 <input type="text" id="eccentricity" name="eccentricity" required>
</div>
<br>
<div>
 <label for="minor_axis_length">Minor_Axis_Length:</label>
<input type="text" id="minor_axis_length" name="minor_axis_length" required>
```

```
      </div>
      <br>
        <div>
          <label for="compactness">Compactness(range:0-1):</label>
         <input type="text" id="compactness" name="compactness" required>
        </div>
        <br>
          <button type="submit">Submit</button>
       </form>
       <div class="result">
         <h2>Result</h2>
         <p> {{prediction_text}}</p>
      </div>
      <div class="image-container">
        <!--img src="../static/img/hero-bg.jpg" alt="Seeds"-->
      </div>
    </main>
    </div>
   </body>
</html>
```

PYTHON APP.PY

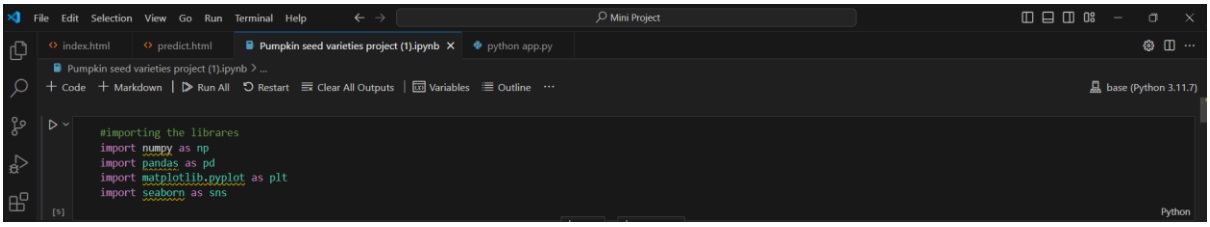
```
import numpy as np
import pandas as pd
import pickle
import os
from flask import Flask, request, render_template

app=Flask(_name_,static_url_path='/Flask/static')
model=pickle.load(open('model.pkl','rb'))
```

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


@app.route('/predict',methods=["POST","GET"])
def predict():
   if request.method=="POST":
      Area=float(request.form["area"])
      Perimeter=float(request.form["perimeter"])
      Major_Axis_Length=float(request.form["major_axis_length"])
      Solidity=float(request.form["solidity"])
      Extent=float(request.form["extent"])
      Roundness=float(request.form["roundness"])
      Aspect_Ration=float(request.form["aspect"])
      Compactness=float(request.form["compactness"])
      Eccentricity =float(request.form["eccentricity"])
      Minor_Axis_Length=float(request.form["minor_axis_length"])



features_values=np.array([[Area,Perimeter,Major_Axis_Length,Minor_Axis_Length,Eccen
tricity,Solidity,Extent,Roundness,Aspect_Ration,Compactness]])

df=pd.DataFrame(features_values,columns=['Area','Perimeter','Major_Axis_Length','Min
or_Axis_Length','Eccentricity','Solidity','Extent','Roundness','Aspect_Ration','Compactnes
s'])
       print(df)


      prediction=model.predict(df)
```

```
        print(prediction[0])
        result=prediction[0]

        if prediction[0]==0:
            result="Your seed lies in cercevelik class"
        elif prediction[0]==1:
            result="Your seed lies in Urgup Sivrisi class"

        text="Hence,based on calculation:"
        return render_template("predict.html",prediction_text=text+str(result))
    else:
        return render_template("predict.html")

if _name=="main_":
    app.run(debug=True,port=5000)
```

CODE SNIPPETS

MODEL BUILDING



```
df=pd.read_csv("Pumpkin_Seeds_Dataset.xlsx - Pumpkin_Seeds_Dataset.csv",sep=",")
df
```

	Area	Perimeter	Major_Axis_Length	Minor_Axis_Length	Convex_Area	Equiv_Diameter	Eccentricity	Solidity	Extent	Roundness	Aspect_Ration	Compactness	Class
0	56276	888.242	326.1485	220.2388	56831	267.6805	0.7376	0.9902	0.7453	0.8963	1.4809	0.8207	Çerçevelik
1	76631	1068.146	417.1932	234.2289	77280	312.3614	0.8275	0.9916	0.7151	0.8440	1.7811	0.7487	Çerçevelik
2	71623	1082.987	435.8328	211.0457	72663	301.9822	0.8749	0.9857	0.7400	0.7674	2.0651	0.6929	Çerçevelik
3	66458	992.051	381.5638	222.5322	67118	290.8899	0.8123	0.9902	0.7396	0.8486	1.7146	0.7624	Çerçevelik
4	66107	998.146	383.8883	220.4545	67117	290.1207	0.8187	0.9850	0.6752	0.8338	1.7413	0.7557	Çerçevelik
...	...	...	...	...	...	...	...	...	...	...	...	...	...
2495	79637	1224.710	533.1513	190.4367	80381	318.4289	0.9340	0.9907	0.4888	0.6672	2.7996	0.5973	Ürgüp Sivrisi
2496	69647	1084.318	462.9416	191.8210	70216	297.7874	0.9101	0.9919	0.6002	0.7444	2.4134	0.6433	Ürgüp Sivrisi
2497	87994	1210.314	507.2200	222.1872	88702	334.7199	0.8990	0.9920	0.7643	0.7549	2.2828	0.6599	Ürgüp Sivrisi
2498	80011	1182.947	501.9065	204.7531	80902	319.1758	0.9130	0.9890	0.7374	0.7185	2.4513	0.6359	Ürgüp Sivrisi
2499	84934	1159.933	462.8951	234.5597	85781	328.8485	0.8621	0.9901	0.7360	0.7933	1.9735	0.7104	Ürgüp Sivrisi

2500 rows × 13 columns

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2500 entries, 0 to 2499
Data columns (total 13 columns):
 #   Column             Non-Null Count  Dtype  
---  ------             --------------  -----  
 0   Area               2500 non-null   int64  
 1   Perimeter          2500 non-null   float64
 2   Major_Axis_Length  2500 non-null   float64
 3   Minor_Axis_Length  2500 non-null   float64
 4   Convex_Area        2500 non-null   int64  
 5   Equiv_Diameter     2500 non-null   float64
 6   Eccentricity       2500 non-null   float64
 7   Solidity           2500 non-null   float64
 8   Extent             2500 non-null   float64
 9   Roundness          2500 non-null   float64
 10  Aspect_Ration      2500 non-null   float64
 11  Compactness        2500 non-null   float64
 12  Class              2500 non-null   object 
dtypes: float64(10), int64(2), object(1)
memory usage: 254.0+ KB
```

```
df.shape
```

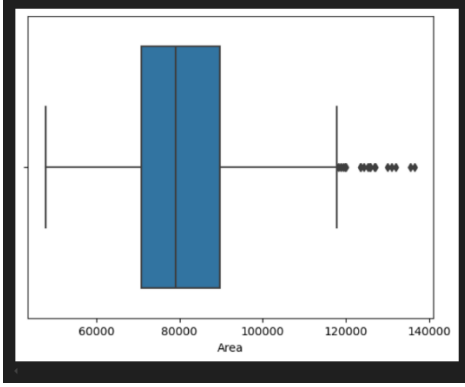
```
(2500, 13)
```

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

```
Area                0
Perimeter           0
Major_Axis_Length   0
Minor_Axis_Length   0
Convex_Area         0
Equiv_Diameter      0
Eccentricity        0
Solidity            0
Extent              0
Roundness           0
Aspect_Ration       0
Compactness         0
Class               0
dtype: int64
```

```
sns.boxplot(x = df['Area'])
```

```
<Axes: xlabel='Area'>
```

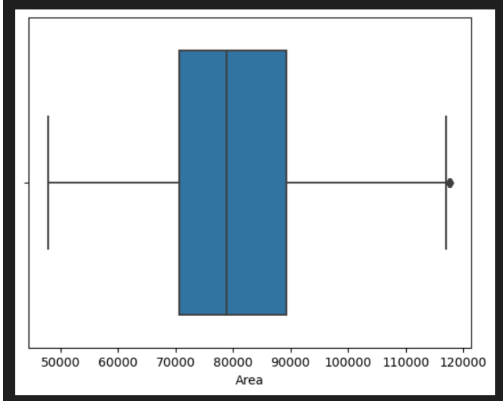



```
# removing the outlier
# calculate the first and third quartiles
Q1 = df["Area"].quantile(0.25)
Q3 = df["Area"].quantile(0.75)

#calculate the interquartile range(IQR)
IQR = Q3 - Q1

#Define the lower and upper bounds
lower_bound = Q1 - 1.5 * IQR
upper_bound = Q3 + 1.5 * IQR

#filter out outliers
df = df[(df["Area"] >= lower_bound) & (df["Area"] <= upper_bound)]
```

```python
# removing the outlier
# calculate the first and third quartiles
Q1 = df["Area"].quantile(0.25)
Q3 = df["Area"].quantile(0.75)

#calculate the interquartile range(IQR)
IQR = Q3 - Q1

#Define the lower and upper bounds
lower_bound = Q1 - 1.5 * IQR
upper_bound = Q3 + 1.5 * IQR

#filter out outliers
df = df[(df["Area"] >= lower_bound) & (df["Area"] <= upper_bound)]
```

```python
sns.boxplot(x = df['Area'])
```

```
<Axes: xlabel='Area'>
```




```python
from sklearn.preprocessing import MinMaxScaler
columns_to_scale= ['Area','Perimeter','Major_Axis_Length']
```

```python
# Apply MinMaxScaler only to selected columns
scaler = MinMaxScaler()
df[columns_to_scale] = scaler.fit_transform(df[columns_to_scale])
```

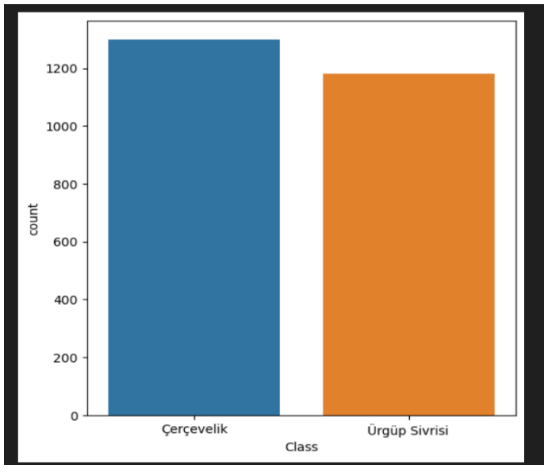
```
# Display the resulting DataFrame
print(df)
```

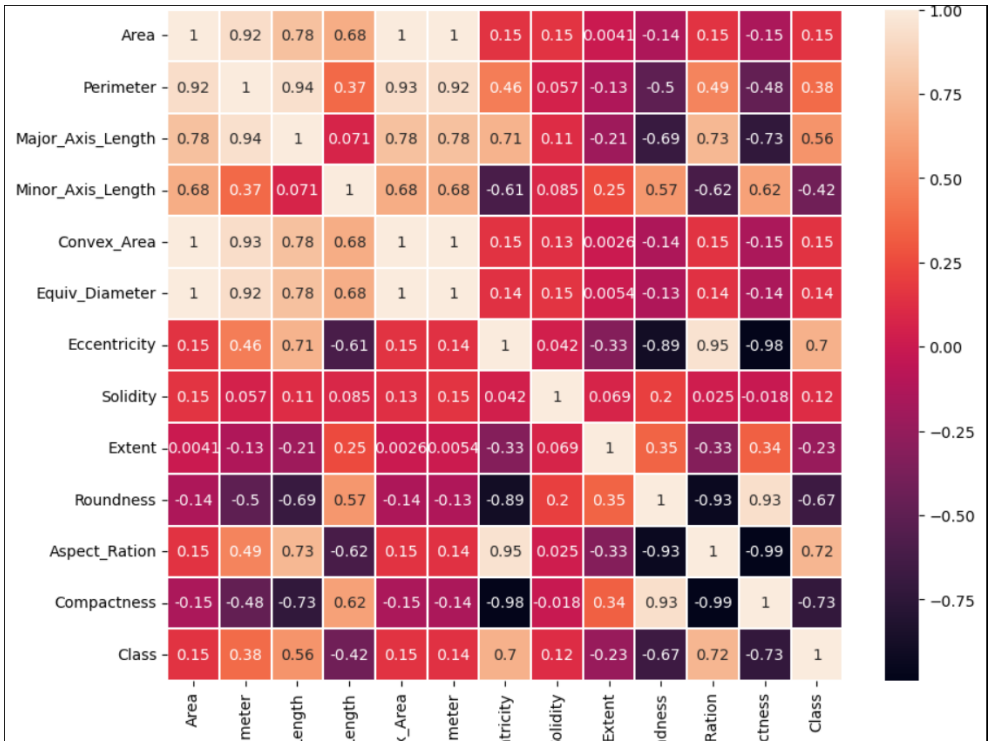
```
          Area  Perimeter  Major_Axis_Length  Minor_Axis_Length  Convex_Area  \
0     0.119284   0.033709           0.016192           220.2388        56831
1     0.410519   0.340661           0.294143           234.2289        77280
2     0.338866   0.365983           0.351048           211.0457        72663
3     0.264966   0.210828           0.185170           222.5322        67118
4     0.259944   0.221228           0.192467           220.4545        67117
...        ...        ...                ...                ...          ...
2495  0.453528   0.607791           0.648153           190.4367        80381
2496  0.310593   0.368254           0.433809           191.8210        70216
2497  0.573098   0.583228           0.568987           222.1872        88702
2498  0.458879   0.536535           0.552765           204.7531        80002
2499  0.529317   0.497268           0.433667           234.5597        85781

      Equiv_Diameter  Eccentricity  Solidity  Extent  Roundness  \
0           267.6805        0.7376    0.9902  0.7453     0.8963
1           312.3614        0.8275    0.9916  0.7151     0.8440
2           301.9822        0.8749    0.9857  0.7400     0.7674
3           290.8899        0.8123    0.9902  0.7396     0.8486
4           290.1207        0.8187    0.9850  0.6752     0.8338
...              ...           ...       ...     ...        ...
2495        318.4289        0.9140    0.9907  0.4888     0.6672
2496        297.7874        0.9101    0.9919  0.6002     0.7444
2497        334.7199        0.8990    0.9920  0.7641     0.7549
2498        319.1758        0.9130    0.9890  0.7374     0.7185
2499        328.8485        0.8621    0.9901  0.7360     0.7933
...
2408         2.4513       0.6359  Ürgüp Sivrisi
2499         1.9735       0.7104  Ürgüp Sivrisi

[2482 rows x 13 columns]
Output is truncated. View as a scrollable element or open in a text editor. Adjust cell output settings...
```

```
df.describe()
```

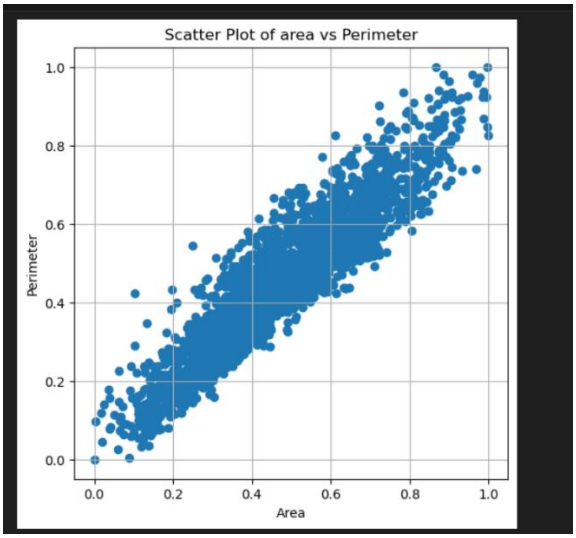
	Area	Perimeter	Major_Axis_Length	Minor_Axis_Length	Convex_Area	Equiv_Diameter	Eccentricity	Solidity	Extent	Roundness	Aspect_Ration	Compactness
count	2482.000000	2482.000000	2482.000000	2482.000000	2482.000000	2482.000000	2482.000000	2482.000000	2482.000000	2482.000000	2482.000000	2482.000000
mean	0.463459	0.442677	0.411127	225.505553	81179.048751	318.748695	0.860620	0.989479	0.693502	0.791838	2.039858	0.704435
std	0.188186	0.180938	0.167586	23.094748	13249.936542	26.081716	0.045183	0.003499	0.060676	0.055916	0.315819	0.053053
min	0.000000	0.000000	0.000000	152.171800	48366.000000	247.058400	0.492100	0.918600	0.468000	0.554600	1.148700	0.560800
25%	0.325145	0.307016	0.285968	211.110100	71449.500000	299.953675	0.831525	0.988300	0.659300	0.752325	1.800325	0.663900
50%	0.443448	0.433898	0.391094	224.478400	79802.500000	317.017300	0.863500	0.990300	0.713250	0.798200	1.982850	0.707900
75%	0.592092	0.567014	0.522056	240.022600	90430.250000	337.235300	0.896675	0.991500	0.740275	0.834575	2.258775	0.743700
max	1.000000	1.000000	1.000000	305.818000	118597.000000	387.333300	0.948100	0.994400	0.829600	0.939600	3.144400	0.904900

```
#counting the class values
plt.figure(figsize=(6,6))
sns.countplot(data=df,x='Class')
plt.show()
```






```
plt.figure(figsize=(6,6))
plt.scatter(df['Area'],df['Perimeter'])
plt.title(f'Scatter Plot of area vs Perimeter')
plt.xlabel("Area")
plt.ylabel("Perimeter")
plt.grid(True)
plt.show()
```



```
numeric_df = df.select_dtypes(include=[np.number])
sns.heatmap(numeric_df.corr(), annot=True, linewidths=0.2)
fig = plt.gcf()
fig.set_size_inches(10, 8)
plt.show()
```

```
#dropping columns
df=df.drop(['Convex_Area','Equiv_Diameter'],axis=1)
```

```
df.head()
```

	Area	Perimeter	Major_Axis_Length	Minor_Axis_Length	Eccentricity	Solidity	Extent	Roundness	Aspect_Ration	Compactness	Class
0	0.119284	0.033709	0.016192	220.2388	0.7376	0.9902	0.7453	0.8963	1.4809	0.8207	Çerçevelik
1	0.410519	0.340661	0.294143	234.2289	0.8275	0.9916	0.7151	0.8440	1.7811	0.7487	Çerçevelik
2	0.338866	0.365983	0.351048	211.0457	0.8749	0.9857	0.7400	0.7674	2.0651	0.6929	Çerçevelik
3	0.264966	0.210828	0.185370	222.5322	0.8123	0.9902	0.7396	0.8486	1.7146	0.7624	Çerçevelik
4	0.259944	0.221228	0.192467	220.4545	0.8187	0.9850	0.6752	0.8338	1.7413	0.7557	Çerçevelik

```
#splitting the data into X and Y
x=df.drop('Class',axis = 1)
x
```

	Area	Perimeter	Major_Axis_Length	Minor_Axis_Length	Eccentricity	Solidity	Extent	Roundness	Aspect_Ration	Compactness
0	0.119284	0.033709	0.016192	220.2388	0.7376	0.9902	0.7453	0.8963	1.4809	0.8207
1	0.410519	0.340661	0.294143	234.2289	0.8275	0.9916	0.7151	0.8440	1.7811	0.7487
2	0.338866	0.365983	0.351048	211.0457	0.8749	0.9857	0.7400	0.7674	2.0651	0.6929
3	0.264966	0.210828	0.185370	222.5322	0.8123	0.9902	0.7396	0.8486	1.7146	0.7624
4	0.259944	0.221228	0.192467	220.4545	0.8187	0.9850	0.6752	0.8338	1.7413	0.7557
...	...	...	...	...	...	...	...	...	...	...
2495	0.453528	0.607791	0.648153	190.4367	0.9340	0.9907	0.4888	0.6672	2.7996	0.5973
2496	0.310593	0.368254	0.433809	191.8210	0.9101	0.9919	0.6002	0.7444	2.4134	0.6433
2497	0.573098	0.583228	0.568987	222.1872	0.8990	0.9920	0.7643	0.7549	2.2828	0.6599
2498	0.458879	0.536535	0.552765	204.7531	0.9130	0.9890	0.7374	0.7185	2.4513	0.6359
2499	0.529317	0.497268	0.433667	234.5597	0.8621	0.9901	0.7360	0.7933	1.9735	0.7104

2482 rows × 10 columns

```
Y=df['Class']
Y
```

```
0          Çerçevelik
1          Çerçevelik
2          Çerçevelik
3          Çerçevelik
4          Çerçevelik
            ...
2495    Ürgüp Sivrisi
2496    Ürgüp Sivrisi
2497    Ürgüp Sivrisi
2498    Ürgüp Sivrisi
2499    Ürgüp Sivrisi
Name: Class, Length: 2482, dtype: object
```

```python
#splitting into training and testing dataset
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=30)
```

```python
print(X_train.shape)
print(X_test.shape)
print(Y_train.shape)
print(Y_test.shape)
```

```
(1985, 10)
(497, 10)
(1985,)
(497,)
```

```python
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import accuracy_score
from sklearn.metrics import classification_report
```

```python
logistic_regression=LogisticRegression()
logistic_regression.fit(X_train,Y_train)
Y_pred=logistic_regression.predict(X_test)
```

```python
acc_lr=accuracy_score(Y_test,Y_pred)
c_lr=classification_report(Y_test,Y_pred)
```

```python
print('Accuracy Score:',acc_lr)
print(c_lr)
```

```
Accuracy Score: 0.869215291750503
              precision    recall  f1-score   support

  Çerçevelik       0.85      0.91      0.88       257
Ürgüp Sivrisi      0.89      0.83      0.86       240

    accuracy                           0.87       497
   macro avg       0.87      0.87      0.87       497
weighted avg       0.87      0.87      0.87       497
```

```python
from sklearn.ensemble import RandomForestClassifier
```

```python
random_forest=RandomForestClassifier()
random_forest.fit(X_train,Y_train)
Y_pred=random_forest.predict(X_test)
```

```python
acc_rf=accuracy_score(Y_test,Y_pred)
c_rf=classification_report(Y_test,Y_pred)
```

```python
print('Accuracy Score:',acc_rf)
print(c_rf)
```

```
Accuracy Score: 0.8752515090543259
              precision    recall  f1-score   support

  Çerçevelik       0.86      0.91      0.88       257
Ürgüp Sivrisi      0.90      0.84      0.87       240

    accuracy                           0.88       497
   macro avg       0.88      0.87      0.87       497
weighted avg       0.88      0.88      0.87       497
```

```
from sklearn.tree import DecisionTreeClassifier


decision_tree_model=DecisionTreeClassifier()
decision_tree_model.fit(X_train,Y_train)
Y_pred=decision_tree_model.predict(X_test)


acc_dt=accuracy_score(Y_test,Y_pred)
c_dt=classification_report(Y_test,Y_pred)


print('Accuracy Score:',acc_dt)
print(c_dt)
```

```
Accuracy Score: 0.8289738430583501
              precision    recall  f1-score   support

   Çerçevelik       0.81      0.87      0.84       257
Ürgüp Sivrisi       0.85      0.78      0.82       240

    accuracy                           0.83       497
   macro avg       0.83      0.83      0.83       497
weighted avg       0.83      0.83      0.83       497
```

```
from sklearn.naive_bayes import MultinomialNB


NB=MultinomialNB()
NB.fit(X_train,Y_train)
Y_pred=NB.predict(X_test)


acc_nb=accuracy_score(Y_test,Y_pred)
c_nb=classification_report(Y_test,Y_pred)


print('Accuracy Score:',acc_nb)
print(c_nb)
```

```
Accuracy Score: 0.8148893360160966
              precision    recall  f1-score   support

   Çerçevelik       0.75      0.95      0.84       257
Ürgüp Sivrisi       0.93      0.67      0.78       240

    accuracy                           0.81       497
   macro avg       0.84      0.81      0.81       497
weighted avg       0.84      0.81      0.81       497
```

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

```
support_vector=SVC()
support_vector.fit(X_train,Y_train)
Y_pred=support_vector.predict(X_test)
```

```
acc_svc=accuracy_score(Y_test,Y_pred)
c_svc=classification_report(Y_test,Y_pred)
```

```
print('Accuracy Score:',acc_svc)
print(c_svc)
```

```
Accuracy Score: 0.6680080482897385
              precision    recall  f1-score   support

   Çerçevelik       0.64      0.80      0.71       257
Ürgüp Sivrisi       0.71      0.53      0.60       240

     accuracy                           0.67       497
    macro avg       0.68      0.66      0.66       497
 weighted avg       0.68      0.67      0.66       497
```

```
from sklearn.ensemble import GradientBoostingClassifier
```

```
GBC=GradientBoostingClassifier()
GBC.fit(X_train,Y_train)
Y_pred=GBC.predict(X_test)
```

```
acc_gbc=accuracy_score(Y_test,Y_pred)
c_gbc=classification_report(Y_test,Y_pred)
```

```
print('Accuracy Score:',acc_gbc)
print(c_gbc)
```

```
Accuracy Score: 0.8832997987927566
              precision    recall  f1-score   support

   Çerçevelik       0.86      0.92      0.89       257
Ürgüp Sivrisi       0.91      0.85      0.88       240

     accuracy                           0.88       497
    macro avg       0.89      0.88      0.88       497
 weighted avg       0.88      0.88      0.88       497
```

```
prediction=random_forest.predict([[ 0.410519,0.340661,0.294143,234.2289,77280,312.3614,0.8275,0.9916,0.7151,0.8440]])
```

```
c:\Users\LENOVO\anaconda3\Lib\site-packages\sklearn\base.py:439: UserWarning: X does not have valid feature names, but RandomForestClassifier was fitted with feature names
  warnings.warn(
```

```
prediction[0]
```

```
'Ürgüp Sivrisi'
```

```python
if prediction[0]==0:
  print("Your seed lies in cercevelik class")
elif prediction[0]==1:
  print("Your seed lies in Urgup Sivrisi class")
```

```python
model = pd.DataFrame({'Model':['Linear Regression','Decision Tree Classifier','RandomForest Classifier',
                               'Multinomial Navie Bayes','Support Vector Classifier', 'Gradient Boost Classifier'],
                      'Score':[acc_lr,acc_dt,acc_rf,acc_nb,acc_svc,acc_gbc],})
```

```python
model
```

	Model	Score
0	Linear Regression	0.869215
1	Decision Tree Classifier	0.828974
2	RandomForest Classifier	0.875252
3	Multinomial Navie Bayes	0.814889
4	Support Vector Classifier	0.668008
5	Gradient Boost Classifier	0.883300

```python
import pickle
import warnings
pickle.dump(random_forest,open("model.pkl","wb"))
```