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FRUIT DISEASE DETECTION

Mrs.P.Laxmi, B.Ramesh, K.Amith, L.Parashuram Associate Professor, Student/Research Scholar,
Student/Research Scholar, Student/Research Scholar
Department of Artificial Intelligence and Machine Learning,
Vignana Bharathi Institute of Technology, Hyderabad
Aushapur(V), Ghatkesar(M), Medchal Dist 501301, Telangana, India

This abstract highlights strides in agriculture through computer vision and machine learning integration, focusing on fruit detection and disease identification. Emphasizing the efficacy of convolutional neural networks (CNNs) and transfer learning for versatile fruit identification, it addresses variations in size and orientation. In disease detection, image processing, and machine learning, employing segmentation, feature extraction, and models like SVMs and deep neural networks ensure precise identification. The paper discusses challenges like dataset diversity, model interpretability, and scalability in real-world implementation. Additionally, it explores edge computing and IoT integration for real-time monitoring in precision agriculture. Overall, these advancements promise efficient crop management.

Objectives:

- Identify diseases in fruits at the earliest possible stage to prevent further spread and minimize damage.
- Develop algorithms or systems that can accurately classify different types of diseases affecting fruits to ensure appropriate treatment measures are taken.
- Create detection methods that are highly sensitive to even minor symptoms or signs of diseases, ensuring no infections go unnoticed.
- Enable real-time monitoring of fruit health to provide timely interventions and prevent widespread outbreaks.
- Develop automated systems for disease detection to streamline the process and reduce the need for manual inspection, thereby increasing efficiency and scalability.

INTRODUCTION

The realm of agricultural technology has witnessed a paradigm shift with the advent of machine learning and computer vision, revolutionizing the way we approach fruit classification and quality assessment. This paper presents a comprehensive study on the application of these cutting-edge technologies to classify a diverse array of fruits, transcending the limitations of traditional methods. We introduce a robust machine learning framework that employs Convolutional Neural Networks (CNNs) to discern subtle differences and identify various fruit types, ranging from the common apple and banana to the more exotic dragon fruit and lychee.

Our methodology is grounded in the creation of a vast and varied dataset that encapsulates the rich spectrum of fruit characteristics, including color, shape, texture, and size. This dataset serves as the foundation for training our CNN models, enabling them to learn and predict with high accuracy. The paper further explores the challenges of multi-class fruit classification, such as handling imbalanced datasets and ensuring model generalizability across different fruit categories.

Through this introduction, we set the stage for a detailed exploration of our data-driven approach, which promises to enhance the efficiency of fruit sorting processes and contribute to the reduction of food waste. By harnessing the power of machine learning, we aim to provide valuable insights into the nuances of fruit classification and pave the way for smarter, more sustainable agricultural practices.

LITERATURE SURVEY

Research explores AI and image processing for fruit disease detection. Methods include deep learning for banana and citrus diseases, and texture analysis with artificial neural networks (ANN). These technologies offer efficient surveillance and early intervention for farmers, potentially minimizing crop losses. Additionally, image processing techniques aid in symptom-based disease detection, crucial for timely agricultural management. These advancements signify a shift towards precision agriculture, enhancing productivity and sustainability in fruit crop production.

METHODOLOGY

The methodology begins with data collection from a directory containing images of fresh and rotten bananas. Each image undergoes preprocessing using the prepare function, which converts them to grayscale, resizes them to 50x50 pixels, and normalizes their pixel values. TensorFlow's Keras API loads a pre-trained CNN model trained on banana images stored in a specific directory. Predictions are made on fresh banana images, and the results are printed as "Fresh" or "Rotten" based on the model's output. Testing data is generated by iterating through each category and storing image arrays along with their corresponding labels in a list. The data is shuffled to ensure balanced distribution, and features and labels are extracted for evaluation. The model's performance is assessed by evaluating test loss and accuracy. Visualization techniques are used to plot training and validation loss curves if available, and a random sample image is displayed with its actual and predicted labels, along with test loss and accuracy. The methodology concludes by emphasizing the importance of consuming fresh fruits for health benefits. Future enhancements such as data augmentation, hyperparameter tuning, and model deployment are suggested for further system improvement.

IMPLEMENTATION

The implementation of the code is as follows:

1. **Mount Google Drive and Import Libraries:**
   - Mounts Google Drive to access files and imports necessary libraries including cv2, tensorflow, os, tqdm, and matplotlib.pyplot.
2. **Image Preparation and Model Loading:**
   - Defines a function to preprocess images for model input.
   - Loads a pre-trained CNN model stored in Google Drive.
3. **Data Preparation and Prediction:**
   - Prepares testing data by iterating through fresh and rotten banana directories, reading and preprocessing images, and storing them along with their labels.
   - Makes predictions for each image using the loaded model and displays the predicted labels.
4. **Evaluation and Visualization:**
   - Evaluates the model's performance on the testing dataset and prints the test loss and accuracy.
   - Plots training and validation loss curves if available.
5. **Data Analysis and Presentation:**
   - Analyzes and presents the results by generating a confusion matrix, displaying randomly selected images with predicted labels, and printing statements based on the predictions.
6. **Final Statement:**
   - Prints a common statement encouraging the consumption of fresh fruit.

Overall, the code demonstrates the process of loading a pre-trained CNN model, preparing testing data, making predictions, evaluating model performance, visualizing results, and presenting the findings in a structured manner. It serves as a practical example of using deep learning for fruit classification tasks.

EXPERIMENTAL RESULTS

Fig 4. Training the Data Set

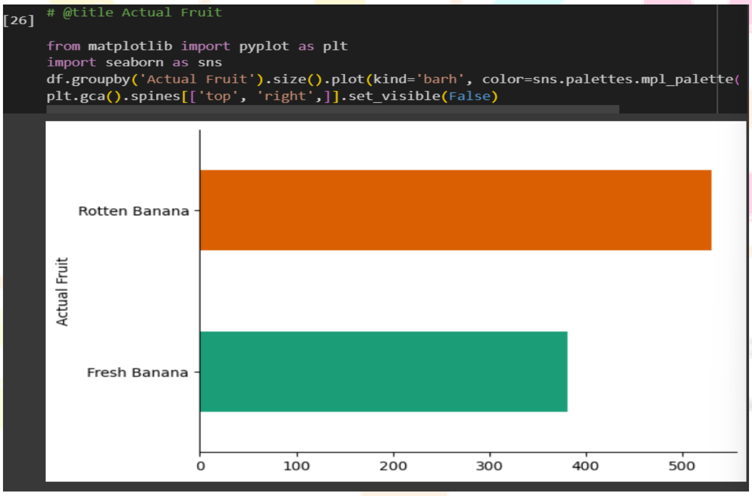

Fig 5. Summary of the Actual Data Set

Fig 6&7. Displaying the actual & Predicted label along with suggestions

Fig 8. displaying the actual and Predicted label for randomly selected image

CONCLUSION

The provided code employs a pre-trained convolutional neural network (CNN) to classify fresh and rotten bananas effectively. It begins by preparing the test data, ensuring consistency by resizing and normalizing the images. Once the data is ready, the loaded CNN model is utilized to predict labels for each image, leveraging its learned features to distinguish between fresh and rotten bananas accurately. Furthermore, the code includes an evaluation step to assess the model's performance, typically measuring metrics like test loss and accuracy. Additionally, it offers visualization capabilities to present predictions visually, potentially incorporating loss curves to provide insights into the training process. Finally, the results are displayed in a clear format, often in a tabular or graphical manner, making it easy to interpret the model's predictions. Beyond classification, the code aims to promote healthy eating habits by emphasizing the importance of consuming fresh fruits, highlighting the significance of nutrition and wellness.

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