Flower Species Classification Using Machine Learning

Leveraging Fast.ai and Gradio for Botanical Applications

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Introduction

In recent years, machine learning has significantly advanced the field of image recognition, offering new possibilities for automated classification tasks. This project focuses on the development of a flower species classification system using machine learning techniques, specifically leveraging the Fast.ai library. The primary objective is to create an efficient and accurate model capable of identifying various flower species from images, thereby assisting botanical researchers, educators, and enthusiasts. By automating the identification process, we aim to save time, reduce human error, and contribute to more effective botanical research and education.

Dataset

Dataset Source (Kaggle "Flowers" dataset)

Image Categories: Rose, Daisy, Sunflower, Tulip, Dandelion

Problem Statement

STAKEHOLDER: Botanical researchers
The stakeholder aims to solve the problem of accurately identifying different flower species from images. This is a significant challenge due to the vast number of species and the variations in appearance due to factors like lighting, angle, and background.

Model Selection

ResNet 34:

Transfer learning from ImageNet

Efficient Net:

Advanced architecture for improved performance

Reasons & Pro's & Con's

Reasons:

1. **Transfer Learning**
2. **Model Complexity**

Pro's n Con's

1. **Pros of ResNet 34 include its proven effectiveness and simplicity, while Efficient Net is highlighted for its potential performance gains.**
2. **Cons may include increased computational complexity for Efficient Net compared to ResNet 34.**

Feature Engineering

Input Features:

- Raw Pixel Data (RGB values)

Feature Engineering Techniques:

- Data Augmentation (resizing, flipping, random crops)

Importance of Feature Selection and Engineering

Evaluation Metrics

- Training Loss
- Validation Loss
- Error Rate

Deployment Process

Deployment Tools:

- Gradio for user interface

Steps in Deployment:

- Package Installation
- Loading Trained Model
- Prediction Function Definition
- Gradio Interface Creation
- Launching the Gradio Interface

Interface Accessibility

User-Friendly Gradio Interface:

- Upload flower images
- Real-time predictions

Demo

Future Work

1. Potential Enhancements
2. Hyperparameter Tuning
3. Advanced Architectures (Transformers)
4. Ensemble Methods
5. Model Interpretability Techniques

Conclusion

Flower species classification project harnesses the power of machine learning to automate and improve the accuracy of flower identification. By leveraging state-of-the-art models and data augmentation techniques, we've developed a robust system that can benefit researchers, educators, and enthusiasts alike. The successful deployment of our model via an intuitive interface marks a significant step forward in making AI accessible for botanical applications.

Thank You