ETH AI CENTER

Wise-Vision

End-to-end scalable pipeline for Integrating traditional knowledge by segmenting drone images, performing tree species classification and enriching traditional knowledge about the species to the drone images.

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1. Introduction

For the preservation of the Amazon Rainforest, gaining critical information about the different varieties of tree species and the flora-fauna around them is critical to counter climate change's impact.

There exists deep treasure of the traditional knowledge from various amazon tribes about these trees, collected over centuries which is unused. Moreover, it is also difficult to understand the terrain beneath these dense forests.Drone & satellite imagery are often lacking such rich information.

The solution not only aids in biodiversity studies but also supports environmental monitoring and management efforts.

2. Method overview

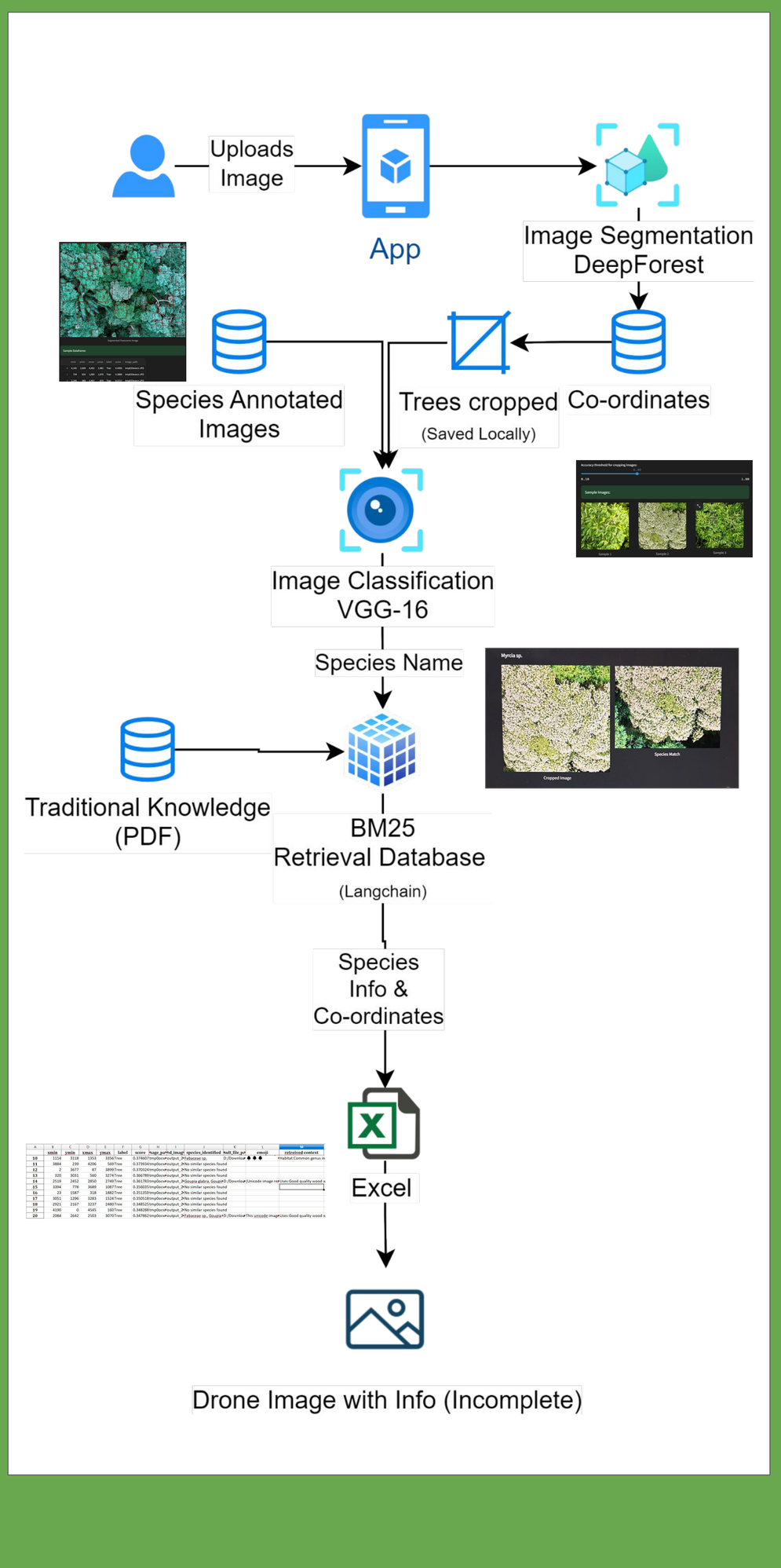
1. **Image Upload and Segmentation**:
   - Users upload a panoramic image in streamlit app environment
   - The image is automatically segmented to identify and extract individual trees using pretrained models: DeepForest (Weinstein, 2019) or DetectTree2, (Ball, 2023)
   - Individual trees are cropped according to co-oridinates and saved.
   - The output is an Excel file containing the coordinates of each segmented tree on the image. Intermediate sample results are shown at each step, like 3 cropped images for human verification.

2. **Species Identification**:
   - The segmented tree images are compared with known species images annotated by experts.
   - Classification is executed using the VGG-16 model, ensuring high accuracy based on extensive pretraining.
- Classified tree images and cropped images are shown next to each other.

3.**Knowledge Integration**
- PDF containing the traditional knowledge is translated into english using apis.
- Then it is integrated into a BM25 retrieval database from Langchain which uses BM25 algorithm to fetch results matching the identified species name from the document.:

4. **Dataset and Testing**:
   - A custom dataset was created specifically for this project, which is available at [segments.ai] (https://segments.ai/r/drone-panoramic/).
   - This dataset includes species annotations in panoramic images, facilitating rigorous testing and validation of the pretrained model used for classification.

3. Interaction Workflow



4. Contribution & Conclusion

1. Major contribution as result of this project was creation of the annotated dataset for the drone-panoramic images. This dataset contains 25 annotated images with species names, bitmap images and their co–ordinates
2. Second contribution was the development of an end-to-end scalable and customisable pipeline which help in biodiversity studies.
3. Third would be a simple yet effective way of adding traditional knowledge to drone images. Using and training a Vision transformer would be a computationally and data heavy tasks. This method allows to add new and different sources for classification and also adding/integrating new knowledge sources

Dataset:

IBM **Research** | Zurich

JÜLICH Forschungszentrum