INSECTIGATOR

A team consisting of , M Hammad 21L-5388, M Abdullah Asim 21L-5365, and Mohsin Arif 21L-1763, have come together to tackle the pressing issue of insect infestations that harm crops and endanger field workers. The project, aptly named "INSECTIGATOR", aims to develop an AI-powered solution to detect and identify various insect species, providing farmers and workers with the knowledge to mitigate these cha

Problem Statement

1 **Crop Damage**

Insects can eat crops or kill the plant itself, causing up to 40% of global crop loss.

2 **Plant Health Impacts**

Insects like aphids and weevils suck sap from plants, affecting their growth and making them more susceptible to disease.

3 **Climate Change Exacerbation**

Climate change is leading to increased pest activity, further escalating these challenges.

4 **Health Risks for Workers**

Exposure to pests and pesticides used to control them can pose significant health risks for field workers.

Working on Dataset

Training-Testing Split

The dataset was divided into training and testing sets with a 75:25 ratio, ensuring a balance between training sufficiency and model validation.

Class Balancing

The training set was curated to equalize the number of images for each insect class to 70, eliminating potential imbalances that could skew the model's learning process.

Data Curation

Useless images were identified and replaced with relevant, high-quality images from reputable sources to ensure the model is trained on useful and relevant data.

Working on Dataset (Contd.)

Image Resizing

All images were resized to 224 x 224 pixels to accommodate the ResNet50 model architecture and ensure optimal performance during the training process.

Background Removal

The Rembg library was used to remove background noise from the images, minimizing distractions and allowing the model to focus on the insects.

Data Augmentation

Various random transformations, such as rotations, flips, and zooms, were applied to each image, generating four augmented versions per image to expand the dataset and enhance the AI's ability to recognize insects in different scenarios.

Model

1 **Model Selection**

The ResNet50 model was chosen for training due to its proven performance in image classification tasks.

2 **Hyperparameter Tuning**

Various parameters, such as the number of epochs, batch sizes, and optimizers, were experimented with to optimize the model's accuracy.

3 **Custom Layer Addition**

A custom layer incorporating a SoftMax function was added to the ResNet50 model, tailoring it to the specific task and improving its performance.

Final Model

Bounding Boxes + Confidence

S x S Grid on Input

Final Detection

Class Probability Map

Model Performance

The custom ResNet50 model achieved a mean precision value of approximately 0.80, indicating a high accuracy in identifying the insect classes.
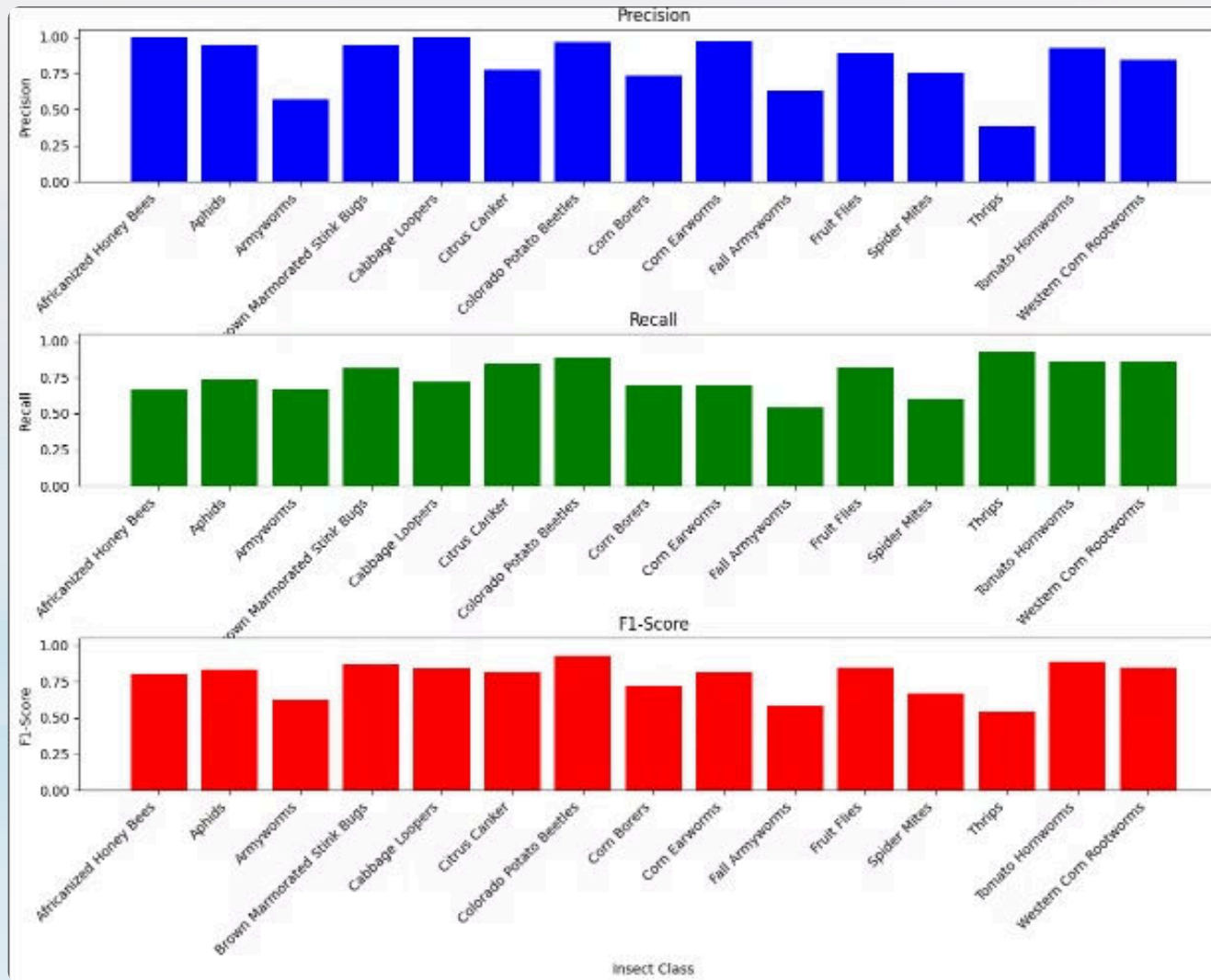
Flask App

1	2	3	4
Image Input	**Preprocessing**	**Model Inference**	**Result Presentation**
The user's image input is received by the system.	The image is resized, background is removed, and 20 augmented versions are generated.	Each augmented image is tested with the trained model, and the class with the highest number of successful detections is selected.	The identified insect is promptly presented to the user, ensuring accurate and reliable detection.

Made with Gamma

Conclusion

Collaborative Effort

The INSECTIGATOR project is the result of a collaborative effort by a team of M Hammad, M Abdullah Asim , and Mohsin Arif .

Innovative Solution

The team has developed an AI-powered solution to detect and identify various insect species, providing a valuable tool to mitigate the challenges faced by farmers and field workers.

Positive Impact

The INSECTIGATOR project aims to have a significant positive impact on crop protection and worker safety, addressing the escalating issues caused by insect infestations and climate change.

Thank You!

The INSECTIGATOR team would like to express their gratitude for your time and attention. They welcome any questions you may have regarding their work and the presented solution.