Initial Plan: Design and Implementation of an Accessible Image-Based Insect Detection and Classification System in a Web Browser

Author: **Jakub Brydak**

Supervisor: **Jonas Beuchart**

Project Description

Insects are a big part of our world and this project focuses on building a fully functional optamised web-based insect detection and classification system using image based technique trained model. The goal is to create a website which has a browser-based tool where users can either upload images or capture them using a connected camera to snap a picture.This project explores loads of different ideas such as web development user experience wit the emphasis is on performance optimisation, accessibility, and ease of use. Due to the complexity of developing such model I will be using a pre trained object detection model but might explore retrain if time remaining.I wanted to complete this project as I feel its very interesting and something that im curious about as the system will focus on using bounding boxes to highlight the insects from an image.

the potential approach will be as followed:

- Developing a custom web application that operates entirely in the browser.
- Using an existing pre-trained model for object detection and classification [removing the need for training a new one]
- Implementing a multi-step user process, involving image input, detection (bounding boxes), and classification.
- Assessing performance across different hardware (desktop, smartphone, single-board computers)
- Optimisation – key as its running on the browser needs to be efficient
- Refining the user experience to ensure the system is accessible and user-friendly.
- Ensuring the entire detection pipeline runs in the browser
- avoiding server-based processing

the project is a challenging task to implement an environment while maintaining usability and performance.Due to it solely working on browser only I feel theres less room for error and clean code Is needed. I will try to implement the structure in the best possible way

Aims and Objreectives

Overall Aim - To design and implement a responsive and efficient browser based insect detection and classification system that is accessible for a range of users.

Specific Objectives:

Develop a web application – front end framework

add a pretrained model – Implement and adapt a pre-trained object detection model to use for identification and classifying insects within the web environment.

Optimise system performance – Ensure the website runs efficiently across multiple platforms testing and refining it for many devices

Minimise latency and computation load

user experience – have a system well designed and simple to use that allows user to use an image or capture on in the moment.

User experience – have a aesthetic website that aligns with insects as key focus

Show the results efficiently after processing

testing on different device to make sure works on multiple devices – laptop , phone etc

complete documentation covering the app and design / features

Risk Assessment:

Model Integration Risk – can run into issues adapting so potentially change for another model

Browser Performance - a system may be used to speed up inference.

Device Issues – Testing across a range of devices could identify and have problems.

Feasibility

Ethical Issues- none

Legal & Licensing: look into the model used and make sure terms are ensured

Risk Mitigation

Develop a website which is compatible on multiple devices .

Ensure that insect image search models are open-source or have access to licenses.

Integrate the tool to be efficient

Work Plan

Weeks 1- Research and Initial Setup

Define project scope and key objectives.

Weeks 2-3

Review and test pre-trained models for insect detection.

Outline system architecture and identify necessary web technologies.

Set up the dev environment.

Weeks 4-6: Core Implementation - Detection & Classification

Develop the core web application framework.

Implement image upload and camera capture functionalities.

Integrate the object detection model to identify insects and overlay bounding boxes.

Week 7-8: Performance Optimisation

Test model inference speed across different hardware.

Optimise execution time, memory usage, and browser compatibility.

Implement acceleration if needed.

Weeks 9 : design and user experience

Improve interface for a smooth user experience

Implement nice ui design graphics

Design around bugs

Weeks 10: last checks and bug fixing

tweak detection accuracy and performance.

Make sure program works on various platforms and devices.

add any final usability improvements.

Weeks 11-12: Documentation & Finalisation

Prepare and finalise project documentation.

Conduct final tests to ensure functionality and performance goals are met.

Submit the final report and application.

Week 2 milestone setup complete and project scope done – deliverable= defined objectives , a pre trained object detection model selected and start to the website complete

Week 4 milestone – web app structure implemenetation **–** deliverable=basic web app done and basic task features like handling image input from the user

Week6 milestone – bounding box implementation- bounding box detection implemented and operational on the browser , finding and identifying insects from users input.

Week 8 milestone – performance optimisation applied – some increase in performance on browser showing difference in performance being faster and more efficient

Week 10 milestone – system testing complete and documented – try finding any bugs ensure system Is all complete and further optimisation – system testing complete and documented resolving bugs and maintenance

Week 12 project finalised and submitted – documentation completed and app completed and functional allowing user to upload image which taken into the model otputs and identifies and insects using box.

Reference: Kim Bjerge, Henrik Karstoft, Hjalte M.R. Mann, Toke T. Høye, A deep learning pipeline for time-lapse camera monitoring of insects and their floral environments, Ecological Informatics, Volume 84, 2024, 102861, ISSN 1574-9541, https://doi.org/10.1016/j.ecoinf.2024.102861. (Note: This example focuses on an edge device pipeline rather than a browser-based approach.)

Submission Details:

The final version of this document will be submitted asPDF via PATS before the deadline. Also Weekly progress meetings with the supervisor will take place every Friday and provide a structured way for progress and receive guidance.

Note – wasn’t available to meet supervisor due to varied schedule .