

Personal Programming Project Report

Title:

YOLO Model Training Google Colab Project for Drones

1. (5pts) Honor Code and LLM Usage for this Report.

I have neither given nor received unauthorized assistance on this assignment.

During the preparation of this assignment, Carter Hawkins used ChatGPT in research for my project and to help write code in all my Python files. After using this tool, I/we reviewed and edited the content as needed to ensure its accuracy and take full responsibility for the content in relation to grading.

2. (15pts) Learning Objectives:

List the learning objectives from your proposal. In your own words explain whether you met those objectives and how (50-100 words each objective). Also describe if you learned something different than expected or anything additional.

My learning objectives were to understand machine learning concepts with YOLO (conceptual learning) and to use Python code to generate training images and train the YOLO model (skill development). I met both these objectives and definitely improved my understanding of machine learning, especially when I could connect what we learned in class to an actual project. I also learned how much the input images provided to the model influence its accuracy. Finally, I was able to use my programming skills to create the Python script that generates the images for training.

3. (15pts) Timeline:

Outline how you spent time on your project. Break down the time into specific tasks or milestones. Here is an adjustable schedule to get you started. Actual Details should be 50-100 words each and should compare or reflect on differences from your proposal.

Time	Task	Expected Details from Proposal	Actual Details
Hour 1-2	Research and gather resources	I will spend this time researching potential solutions to create the project. I will use a combination of ChatGPT and	This step took much longer than I thought it would take. I didn't know how Google Colab worked or how vision recognition works in general before this project, so I had to spend a lot of time just watching YouTube videos and

Time	Task	Expected Details from Proposal	Actual Details
		Google searches to find resources for my project. I will be looking at other Google Colab projects to see how I can structure my own project. I will also look for existing example code to adapt for my own project.	looking at other Google Colab projects as inspiration. One thing I had to research was how to get files to be put into the Google Colab project.
Hour 3-4	Design the project structure and plan	I will first create a list of all the tasks I will need to complete. I will then set up the folder structure in Google Colab and create Python files with an outline of the code I need to write. I will also create the main layout of the main Jupiter Notebook within Google Colab.	This step didn't take as long as I thought it would. I basically just created all the different folders I needed within my GitHub repo and then also created a basic outline of all the steps within the Jupiter Notebook. I didn't actually create the Python files in this step, but just did it during the next phase.
Hour 5-7	Start coding functionalities	I will write the Python code needed to train the YOLO model. I will need to split the code's logic into multiple files so it is easier to adapt and understand later. I will also figure out	In this phase, I created all the Python files and wrote all the Python code that was needed. ChatGPT was super helpful in this part, but I ended up facing a lot of issues and errors while coding. I also was able to figure out how to get the webcam to work in the Google Colab project by using a combination

Time	Task	Expected Details from Proposal	Actual Details
		how to integrate advanced features, such as running code and testing the model with a webcam, in Google Colab.	of Python code and JavaScript code.
Hour 8-9	Test and debug the initial version	I will test out the code that I have written. I will test the code in phases to ensure each step of the Yolo training process works as intended. I will then fix the bugs that I will inevitably run into. I will also add safety checks within the Python code to help prevent errors.	I ended up facing a lot of issues during this phase. My code had a lot of bugs that I had to troubleshoot and fix. I was also having a lot of issues with file paths, which were causing more trouble than they should have. I also had to adapt the code a little to accomplish the tasks I needed it to perform.
Hour 10	Documentation	I will spend the final hour commenting out the code so it is easy to understand. I will also make the Jupiter Notebook easy to follow. The idea is that someone with no experience could still use the software that I have made. I also need to make sure everything makes	In this step, I had to fully comment out my code and also make the descriptions and steps within the Jupiter notebook easy to follow and understand. My goal was someone with no idea how this project works could still easily train the Yolo model. This didn't take super long because I had been documenting everything in other phases as I was working on this project.

Time	Task	Expected Details from Proposal	Actual Details
		sense so my design team can use this project.	
Additional			

4. **(55pts) Final Product Description:**

Include your proposed MVP, Target, and Reach versions.

i. **Minimum Viable Product (MVP):**

Create a Google Colab project that can be used for training a YOLO model for vision recognition on a drone. The project could handle everything needed to train the YOLO model, including generating a dataset of images, training and testing the model, and letting the user try it out with their webcam. The target audience will be members of my design team who can use this project for our upcoming competition.

For this level:

The YOLO model will be able to detect a single object.

ii. **Target Product:**

Create a Google Colab project that can be used for training a YOLO model for vision recognition on a drone. The project could handle everything needed to train the YOLO model, including generating a dataset of images, training and testing the model, and letting the user try it out with their webcam. The target audience will be members of my design team who can use this project for our upcoming competition.

For this level:

The YOLO model will be able to support detecting as many objects as the user would like.

iii. **Reach Version:**

Create a Google Colab project that can be used for training a YOLO model for vision recognition on a drone. The project could handle everything needed to train the YOLO model, including generating a dataset of images, training and testing the model, and letting the user try it out with their webcam. The target audience will be members of my design team who can use this project for our upcoming competition.

For this level:

The YOLO model will be able to support detecting advanced features like numbers and text.

- iv. (20pts) Description of final product including target audience, user story, problem statement, key features, technical details and technologies used. (100 – 150 words)

My final product was a Google Colab project that can train a YOLO model for vision recognition on a drone. This project was created to help my design team, as we currently don't have any system for training YOLO models, which we need for our competition. A team member can simply follow all the steps within the Jupyter notebook and upload their own images to easily train a YOLO model. The project uses Python code to process images of objects and overlay them onto a set of background images. These create the training set images used to train the YOLO model. I also built in features to test the YOLO model, such as allowing users to test it with their webcam.

- v. (20pts) Provide a YouTube link to your video demonstration (1–2 minutes, narrated). **Important Note:** Do not upload your video file directly. Instead, upload your video to YouTube and include the video link clearly here in your report. The level of difficulty and detail of the project should be reasonable for 10 hours of work with LLM support. The project should not be something an LLM can solve without significant effort by the developer.
(Be sure to have someone else test that your link is working.)

YouTube Video:

<https://www.youtube.com/watch?v=yAnrAhluk4E>

- vi. (15pts) Any input files, coding files, and test files should be uploaded. Provide a list here of file names and purposes, or any links to live sites or artifacts. Remember code should also be commented. A README file should be created and uploaded so that we have the option to follow your instructions to run your project.

Files:

Basemodel folder

yolo11n.pt

The base model that the yolo training uses

Test folder

Test_model.py

Tests the yolo model using the validation data set

Code folder

`generate.py`

Creates the images that the yolo model will train on

`Train_val_split.py`

Splits the generated images into two groups (training and validation)

Input folder

Backgrounds

The different backgrounds the user wants the objects to be placed on

Objects

The different images of objects the user wants the yolo model to recognize

Output

Contains the generated images for the yolo model to train on

WebcamPreview

Contains the code to allow the user to try out the yolo model with their webcam inside Google Colab

Project Repo:

<https://code.vt.edu/carterhawkins/yolotrainingfordrone>

Project Repository & Code Submission Details:

Project Repository (code.vt: You <https://code.vt.edu/> or (Git-hub only if you are part of virtual global collaboration)): r repository should be well-organized, documented, and easy to navigate. At a minimum, include the following structure:

- **code/** – All source code files for your project (organized by component or module if applicable).
- **data/** – Any input files, datasets, or configuration files used by your program.
- **tests/** – Test scripts or files demonstrating how your code was verified.
- **docs/** – Supporting materials such as screenshots, reports, or documentation.
- **report/** – This final report document.
- **README.md** – A detailed file describing:
 - Project overview and purpose
 - Video link of your project
 - Installation and setup instructions
 - How to run the program and reproduce results
 - Technologies or libraries used

- Author(s) and contribution summary

Required:

- Maintain a logical directory structure, do not store all files at the root level.
- Include comments in your code to explain logic and design decisions.
- Keep your repository **private** until grades are released, then you may make it public.

Share access with the following personnel (Add them as collaborators):

GTA Name	Section	Professor
Mona Moghadampanah	83484	P. Sullivan
Yue Shen	83485	O. Emebo
Abdullah Al Noman	83486	O. Emebo
Suraj Vishwanath	83487	P. Sullivan
Juno Bartsch	91578	S. Nizamani

5. **(10pts) Consultation and Use of LLMs:**

Each student must create a unique project but is allowed to consult with other people and use Large Language Models (LLMs). Describe how you incorporated these resources into your project:

• **Consultation Description:**

Describe how you ended up seeking advice or feedback from peers, mentors, or online communities.

I talked with a member of my design team who has experience with training YOLO models. He gave me a high-level overview of how a YOLO model could be trained for a drone. This is where the idea to generate our own images for training by overlaying images of objects onto different backgrounds came from. He basically said to do these steps:

1. Generate the images for training (with Python code)
2. Separate into a training and validation set
3. Train the model
4. Test the model using the validation data set

• **Use of LLMs:**

Explain how you ended up utilizing LLMs to assist with coding, debugging, learning technologies and concepts, or generating ideas.

I heavily used ChatGPT to help me with writing the Python code. It was especially used for creating the Python code to generate our custom images. It also helped with the other helper Python files and debugging issues I had.