

Drone AI

AI-Driven Drone Navigation and Object Detection

(Group Project)



High-Level Explanation

In *Drone AI*, you and your team will explore the world of autonomous drones, programming a Tello drone to navigate, detect obstacles, and identify objects on its own. Inspired by real-world AI applications in robotics, this project will have you applying computer vision techniques to help your drone make intelligent decisions in-flight. You'll learn to create algorithms that process visual data and adjust the drone's movements in response to its surroundings.

Using Python along with libraries like OpenCV and PyTorch, you'll develop AI models that make the drone more responsive and adaptable to its environment. This project provides a unique opportunity to see how AI and computer vision can turn a standard drone into a dynamic, intelligent device capable of making real-time decisions.

Success Criteria

Each team will aim to achieve the following milestones:

1. **Autonomous Navigation:** Create a functioning navigation algorithm that allows the drone to avoid obstacles and navigate through a course.
2. **Computer Vision Implementation:** Apply at least one computer vision method (such as object detection or edge detection) to guide the drone's actions.
3. **Testing and Refinement:** Trial your navigation algorithm with real-world tests, improving performance based on feedback and observation.
4. **Present your algorithm and results**, discussing how well it performed and how you'd improve it - this entails making a small YouTube video going over your project as a team and what you achieved (maker portfolio video).

Resources Required

1. **Tech Stack:**
 - **Python:** Your primary coding tool for controlling the drone and implementing AI.
 - **OpenCV and PyTorch:** For building vision-based algorithms that allow the drone to detect objects and respond to its environment.
 - **DJI Tello SDK:** This library enables you to control the drone's movements and capture data from the camera for processing.

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2. Hardware:

- **DJI Tello Drone:** This drone will serve as the primary platform, providing a straightforward and affordable means of testing AI in a real-world setting.
- **Laptop with Python & Jupyter Notebook:** For writing and testing code, developing models, and processing the drone's video feed.

3. Supporting Materials:

- Documentation and guides on using the Tello SDK, setting up OpenCV, and implementing basic AI for object detection.
- Tutorials and sample code on OpenCV, TensorFlow, and using Python for computer vision tasks.

Proposed Architecture

Here's the technical structure each team will follow to create a functional drone AI:

1. **Video Stream Input:** Capture live video feed from the Tello drone.
2. **Image Processing and Feature Extraction:** Use OpenCV to identify features in the video feed (e.g., detecting objects or edges).
3. **Decision Logic:** Develop decision rules for the drone's navigation based on detected features, guiding it to move, avoid obstacles, or follow specific objects.
4. **Testing and Iteration:** Deploy the algorithm on the drone, test in real scenarios, and refine based on observed performance.

Alternatives Considered

1. **Simpler Rule-Based Navigation:** Instead of AI, simple rule-based logic could be used, but it lacks the adaptability of computer vision.
2. **More Advanced Drones:** Higher-end drones like the DJI Phantom could have been considered, but the Tello is a more accessible choice for educational purposes.
3. **Stretch Goals:**
 - For those interested, reinforcement learning can be explored to create an adaptive navigation strategy.
 - Additional features, such as gesture recognition, could be attempted if time and resources allow.

Training Resources

To help you get started, here are some resources tailored for beginners:

1. **Books and Documents:**
 - *"Deep Learning for Computer Vision with Python"* by Adrian Rosebrock.
 - *DJI Tello SDK Documentation* for using Python to control the Tello.
2. **Video Tutorials:**
 - *OpenCV for Computer Vision:* Video tutorials on YouTube.
 - *Tello-Python GitHub Repository:* A helpful example of how to control the Tello with Python.

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Conclusion

Drone AI will give you the chance to dive into the fast-growing field of AI for robotics, turning your Tello drone into an intelligent, autonomous device. You'll gain hands-on experience with computer vision, learn how to apply AI models to real-time decision-making, and see how an everyday drone can take on real-world challenges with AI. Good luck, and enjoy making your drone smarter than ever!

Resources

- [Tello SDK 2.0 User Guide.pdf](#)
- [Download Deep Learning for Computer Vision with Python by Adrian Rosebrock](#)
- [dji-sdk/Tello-Python: This is a collection of python modules that interact with the Ryze Tello drone.](#)
-  DroneAI - Getting Started.ipynb

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