

Drone Surveillance & Object Detection

- Implement computer vision models to analyze drone footage and detect enemy movements.
- Use anomaly detection to identify unusual activities in sensitive areas.

1. Data Collection & Preprocessing

- **Drone Footage Acquisition:** Collect or use publicly available drone videos/images from military exercises, surveillance, or open datasets.
 - **Data Annotation:** Use tools like **Labellmg** or **Roboflow** to label objects (vehicles, humans, weapons, suspicious movements).
 - **Preprocessing:** Convert videos to frames, resize images, normalize pixel values, and augment data to improve model generalization.
 - Location, Distance, Object_name, Date, Time,
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2. Object Detection Model

You need a deep learning model capable of detecting objects in real-time. Common approaches:

- **YOLO (You Only Look Once)** – Fast and efficient for real-time detection.
- **Faster R-CNN** – High accuracy but slower than YOLO.
- **SSD (Single Shot Multibox Detector)** – A balance between YOLO and Faster R-CNN.

Implementation Steps:

1. Train a **YOLOv8/Faster R-CNN** model on military drone footage.
 2. Fine-tune the model with custom labels (e.g., tanks, people, unauthorized vehicles).
 3. Deploy the trained model using **OpenCV + TensorFlow/PyTorch** for real-time detection.
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3. Anomaly Detection

Once objects are detected, use **Anomaly Detection** to flag unusual activity.

- **Approach 1: Behavior Analysis**
 - Track movement patterns using **Optical Flow** or **DeepSORT (Object Tracking)**.
 - Identify suspicious behavior like people running, vehicles moving in restricted zones.
- **Approach 2: Machine Learning-based Anomaly Detection**
 - Train an **autoencoder** or use **Isolation Forest** to detect unusual movements.

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- Use **Spatiotemporal CNNs or LSTMs** for motion pattern recognition over time.
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4. Real-Time Deployment

- **Edge Computing:** Deploy on **NVIDIA Jetson Nano/Xavier** for real-time drone processing.
 - **Cloud Processing:** Use AWS, Google Cloud, or Azure for scalable analysis.
 - **Alert System:** Set up automatic alerts to security teams via SMS, email, or IoT-based alarm systems.
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5. Visualization & Dashboard

- Display real-time drone footage and detections using **Dash, Streamlit, or Flask**.
 - Store detected anomalies in a database (PostgreSQL/MongoDB) for later analysis.
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6. Advanced Enhancements

- Integrate **Thermal Imaging** for night vision detection.
 - Use **LiDAR + AI Fusion** for 3D object detection.
 - Combine **Satellite Data + Drone Data** for better situational awareness.
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Tools & Technologies

- ✓ Python, OpenCV, TensorFlow, PyTorch, FastAPI
- ✓ YOLO, Faster R-CNN, DeepSORT, Autoencoders
- ✓ AWS S3, GCP, Azure for cloud processing
- ✓ Jetson Nano, Raspberry Pi for edge computing