DEPI – FINAL PROJECT PROPOSAL

Project Title:
Image Classification and Object Detection System Submitted by:

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Team Leader:
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PROJECT DESCRIPTION

This project aims to develop a robust deep learning-based system capable of performing both image classification and object detection. By leveraging state-of-the-art models and cloud infrastructure, the system will classify entire images into predefined categories while simultaneously detecting and localizing multiple objects within them. The solution will be deployed on Microsoft Azure with a user-friendly web interface, enabling real-time predictions and scalable usage for practical applications such as smart surveillance, retail analytics, and automated quality control.

GROUP MEMBERS & ROLES

Members	Role Description
Basel Mohamed Mostafa	Object Classification Model Implementation & Evaluation
Zeyad Ahmed Samir	Data Collection, Preprocessing & EDA
Zeyad Gamal Mohamed	Team Leader, Azure Deployment & Retraining Strategy
Abdulrahman Kamal Saeed	MLOps & Monitoring

Members	Role Description

Mohamed Hamada Farghali	Object Detection Model Implementation & Evalutation
Omar Yasser Sayed	Web Interface (Frontend & API Integration)

OBJECTIVES

- **Collect and preprocess** high-quality, diverse datasets for both classification and object detection.
- **Develop and evaluate** high-performance deep learning models using CNNs, YOLO, and pre-trained architecture.
- **Enhance models** via transfer learning and fine-tuning for domain-specific tasks.
- **Deploy models** on Azure using containerized services and RESTful APIs.
- **Implement MLOps** practices for experiment tracking, versioning, and monitoring.
- **Deliver an intuitive web interface** for real-time image uploads and predictions.
- **Ensure system** reliability, scalability, and maintainability post-deployment.

TOOLS & TECHNOLOGIES

- **Frameworks:** TensorFlow, Keras, OpenCV
- **Pre-trained Models:** ResNet50, and YOLOv8
- **Cloud Platform:** Microsoft Azure (Azure Machine Learning, Azure Custom Vision, Azure Container Instances)
- **MLOps:** MLflow, Azure ML Pipelines
- **Backend/API:** FastAPI (or Django, flask)
- **Frontend:** HTML/CSS, JavaScript (or Streamlit for rapid prototyping)
- **Data Tools:** Pandas, NumPy, Matplotlib, Seaborn, Albumentations • **Monitoring:** Prometheus/Grafana (or Azure Application Insights)

MILESTONES

Milestones	Description	Deadline
Milestone 1	Data Collection, Preprocessing & EDA	12/10/2025
Milestone 2	Model Development (Classification & Detection)	19/10/2025
Milestone 3	Transfer Learning & Azure Cloud Deployment	26/10/2025
Milestone 4	MLOps, Web Interface & Monitoring Setup	2/11/2025
Milestone 5	Final Documentation & Presentation	18/11/2025

KPIS (KEY PERFORMANCE INDICATORS)

1. DATA QUALITY

- Percentage of missing values handled: **100%**
- Data accuracy after preprocessing: **98%**
- Dataset diversity (representation of different categories): **≥90%** (balanced across top 10–20 classes)

2. MODEL PERFORMANCE

- Model accuracy (**Accuracy/F1-Score**):
- Classification: **≥92%**
- Object Detection (mAP@0.5): **≥85%**
- Model prediction speed (Latency): **≤300 milliseconds per image**
- Error rate (False Positive/False Negative Rate): **≤5%**

3. DEPLOYMENT & SCALABILITY

- API uptime: **≥99%**
- Response time per request: **≤500 milliseconds**

- Real-time processing speed (for demo video): **≥10 FPS**

4. BUSINESS IMPACT & PRACTICAL USE

- Reduction in manual effort: **70%** (e.g., automating visual inspection tasks)
- Expected cost savings: **40%** (vs. manual labeling/analysis)
- User satisfaction: **≥4.5/5** (based on demo user feedback)