



PERFORMANCE BENCHMARKING OF YOLO ARCHITECTURES

FOR REAL-TIME OBJECT DETECTION



TEAM MEMBERS

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📄 ABSTRACT

- ⌚ Real-time object detection using YOLO models (v5, v8, v11)
- 💻 Streamlit web deployment
- 📊 Pre-labeled fruit dataset from Roboflow (9 classes)

TEAM & ROLES

Beyza GÜLER

YOLOv11 Specialist &
Reporting

- Trained YOLOv11
- Analyzed Metrics
- Technical Docs
- Slides Design

Ramazan YILDIZ

AI Project Planning & AI
Research

- Project Init
- Dataset Prep
- Trained YOLOv8m &
YOLOv8n
- Model Comparison

Abdelrahman MOHAMED

YOLOv5 Specialist & Web
Developer

- Trained YOLOv5
- Web Interface
- Front-end Integration

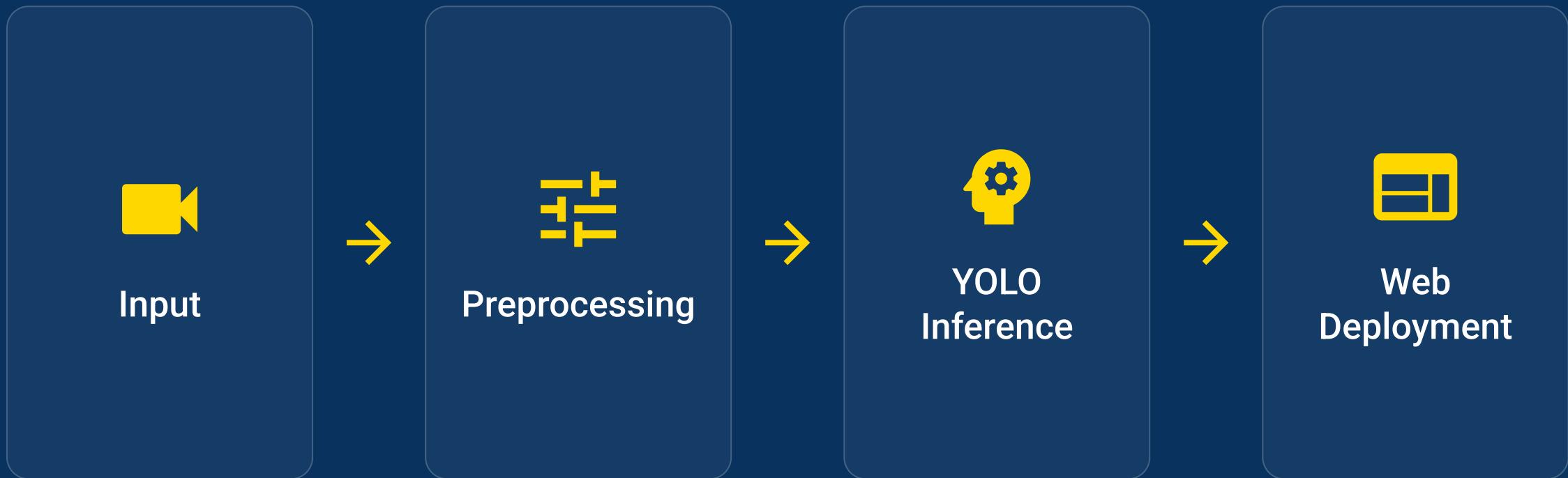
⚠ PROBLEM

- ⌚ Real-time deployment challenges
- ⚡ Computational costs
- 🌐 Limited web accessibility

🏁 GOALS

- ⌚ High FPS performance
- 💻 User-friendly web interface

⚙️ METHODOLOGY



📁 DATASET

➊ Source

- ◆ Pre-labeled fruit dataset from Roboflow
- # 9 fruit classes

➋ Split

2,697
Training

187
Validation

90
Test

➌ Training Split Ratio

70% Train

20% Validation

10% Test

YOLO ARCHITECTURE



BACKBONE

Feature extraction



NECK

Feature aggregation



HEAD

Bounding box & class
prediction





TRAINING PHASE

Data.yaml

- Dataset paths defined
- Class names listed
- Train/Val/Test splits

Normalization

- **class_id** - Object category
- **x_center** - Horizontal position
- **y_center** - Vertical position
- **width / height** - Box dimensions

📊 RESULTS: GRAPHS & MATRICES



Training graphs show steadily decreasing loss



Confusion matrices confirm strong diagonal concentration



Consistent learning demonstrated



Strong class identification achieved

- ⓘ All models showed stable training patterns with measurable improvement across epochs

III. BENCHMARK COMPARISON



YOLOv11m achieved
the highest detection
accuracy



YOLOv5m provided
the fastest inference
time



Performance: ~30
FPS achieved

→ Key Insight

YOLOv11 excels in accuracy while YOLOv5 leads in speed – all models meet real-time targets

SYSTEM DEMO



Webcam detection with bounding
boxes



Class labels displayed



Confidence scores shown



Real-time performance



Live Detection

Streamlit web interface with webcam integration

~30 FPS

Real-time

✓ CONCLUSION



Developed a working real-time prototype



Stable performance achieved



Integration of YOLO + OpenCV + Streamlit



Successful deployment



Project Success

Fully functional real-time detection system ready for production deployment

↗ FUTURE WORK



Train with a bigger
custom dataset



Implement 3D
Localization



Deploy a Mobile
App



Performance Optimization

Continue improving inference speed and accuracy for production-ready deployment