



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

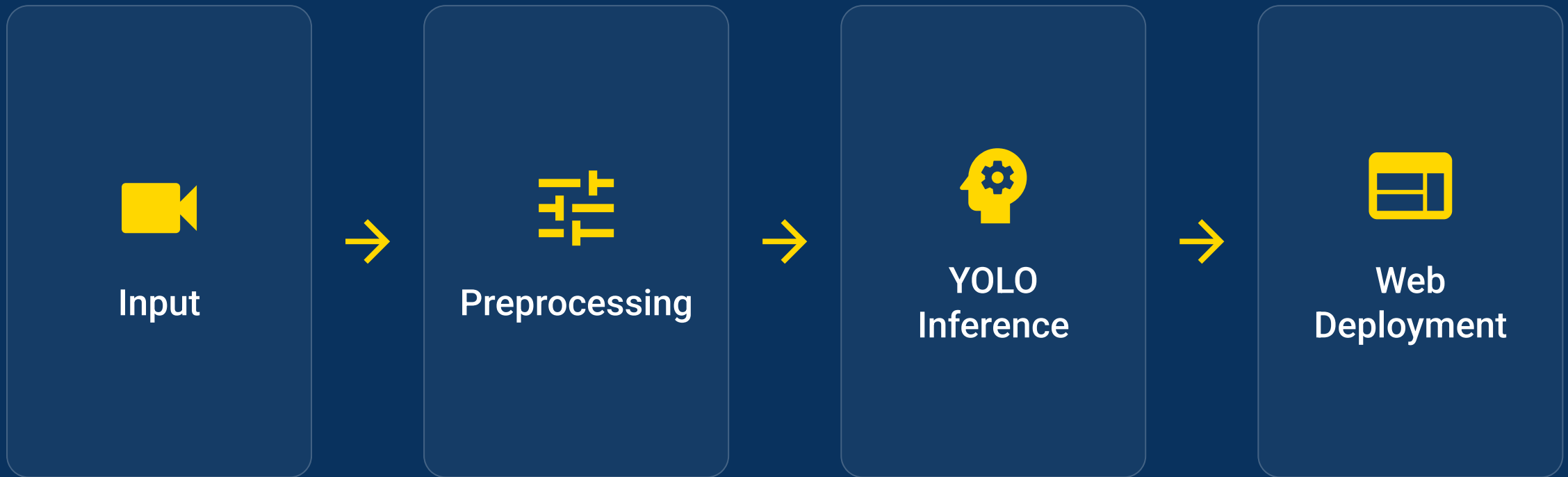
PROBLEM

-  Real-time deployment challenges
-  Computational costs
-  Limited web accessibility

GOALS

-  High FPS performance
-  User-friendly web interface

⚙️ METHODOLOGY



DATASET

Source

 Pre-labeled fruit dataset from Roboflow

 9 fruit classes

Split

2,697

Training

187

Validation

90

Test

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

|| 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