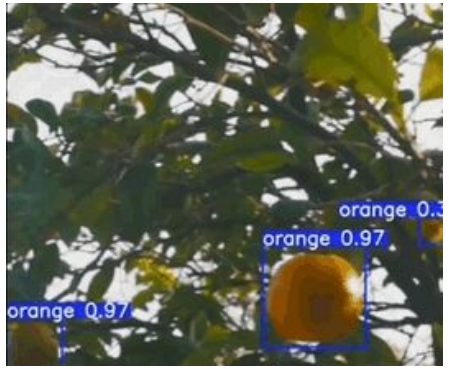
Università degli Studi di Palermo

TOELT RESEARCH

Toward the integration of ML in agriculture

An automated pipeline for Orange –in-the-field detection and maturity prediction



Participants:

TOELT LLC	UNIPA
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Orange-in-the-field: a novel dataset for orange detection under different conditions

Data collection

Weather conditions : R, C, S
Time of the day : M, A, E
Several resolutions
In the fields

Two data batches : 245 images, 620 images

Data annotation

STAGE 1

63 All Roboflow

Labelstudio Roboflow

49 24 111

Train 1

YOLO Label Studio

Train 2,3,4

STAGE 2

620 Roboflow check

Data pre-processing

CLIP check

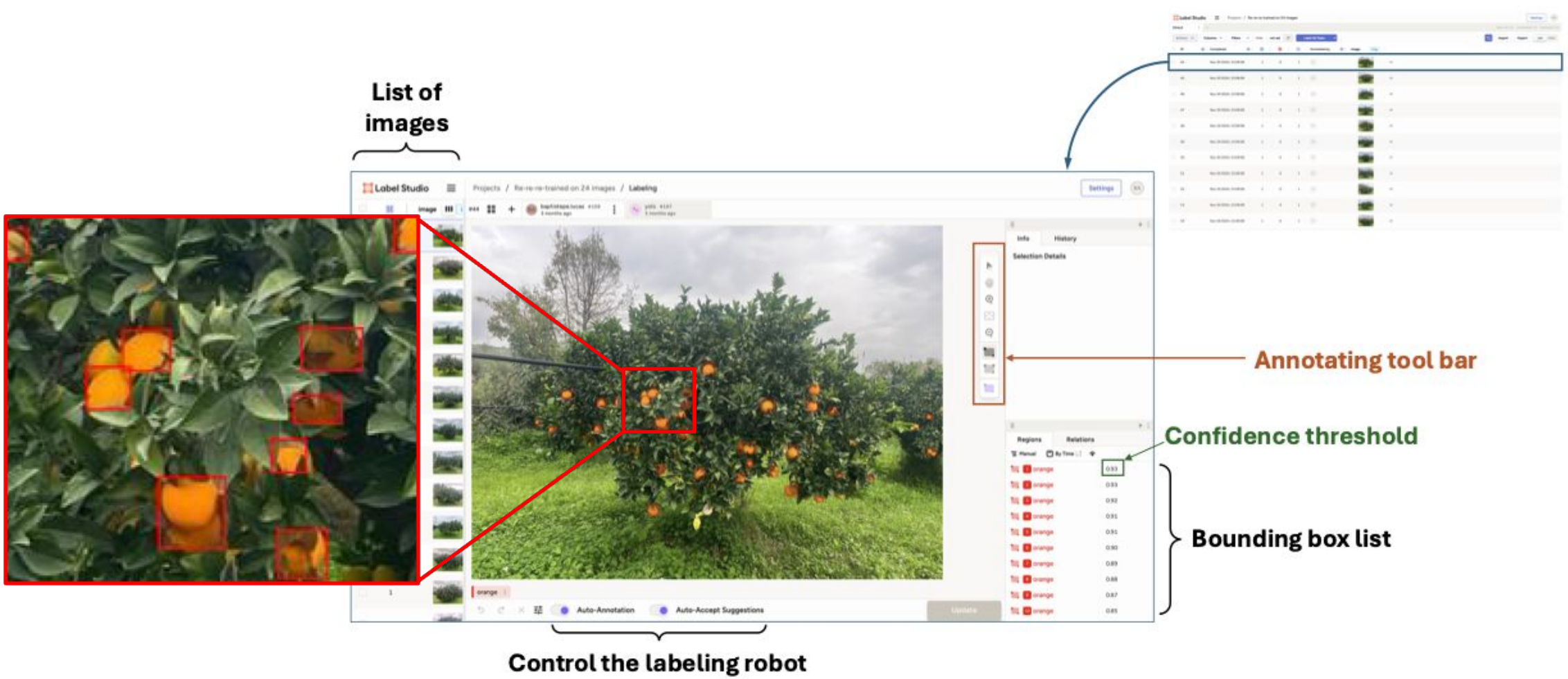
5,025 images
Final bounding boxes

CUT-IMG

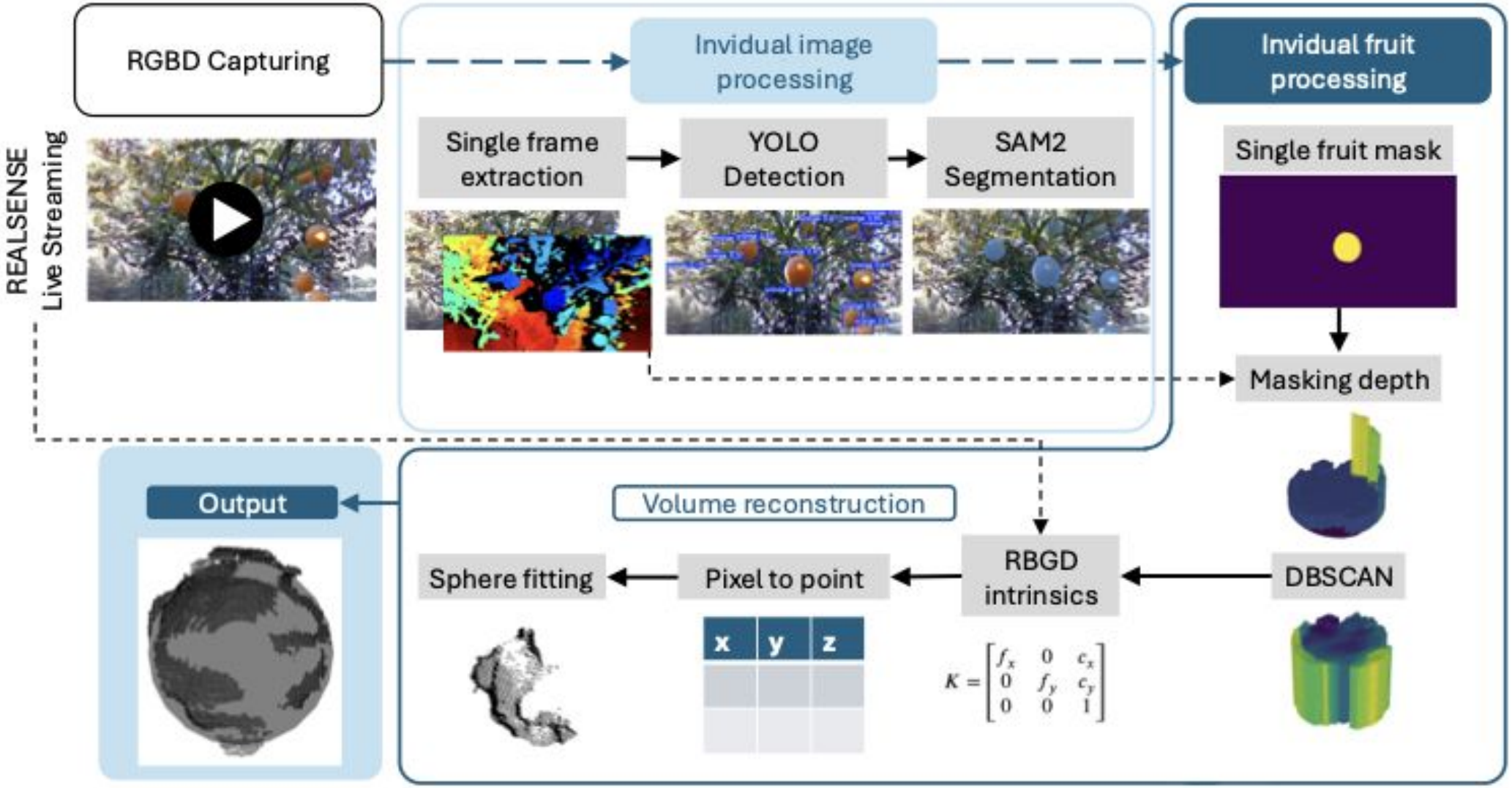
865 : 5,742 images
YOLO resolution: 640x640

Orange-in-the-field: a novel dataset for orange detection under different conditions

Data capture in the field -> Annotated via Label Studio



FruitVision: RGBD-based pipeline for orange detection and size prediction

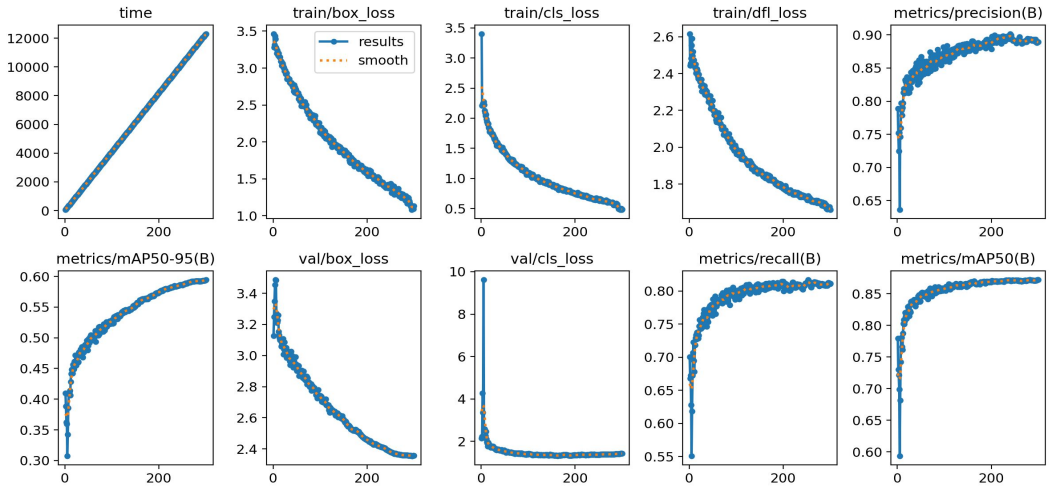


FruitVision: RGBD-based pipeline for orange detection and size prediction

STEP 1: Train the model on orange class

Train Yolov10 Model

Infer the model on real-world images

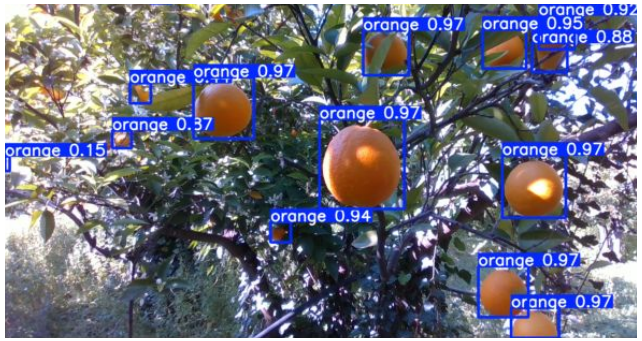


FruitVision: RGBD-based pipeline for orange detection and size prediction

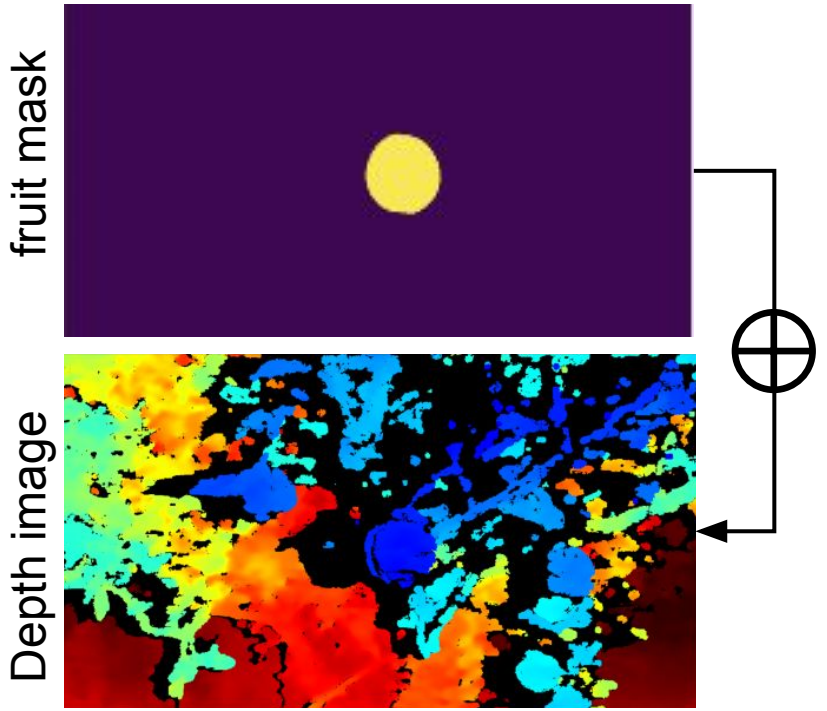
STEP 2: Predict mask and translate to Depth channel

YOLO prediction → SAM2 → Individual mask extraction and merging with depth

RGB - YOLO

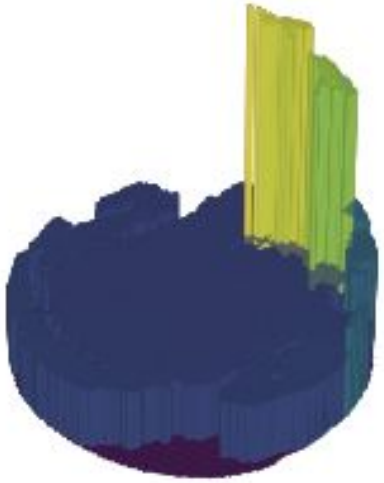


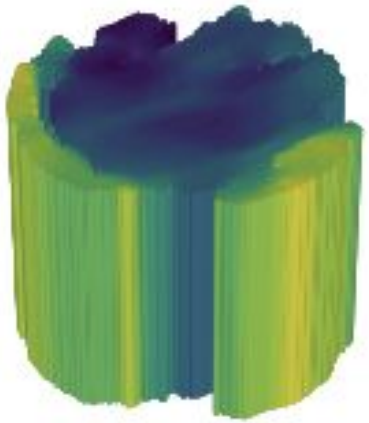
RGB –SAM 2



STEP 3: Single orange shape prediction

Raw filtered depth array → DBSCAN output (real depth) + Camera intrinsics → Fruit 3D point-cloud → Shape prediction least square fitting





$$K = \begin{bmatrix} f_x & 0 & c_x \\ 0 & f_y & c_y \\ 0 & 0 & 1 \end{bmatrix}$$