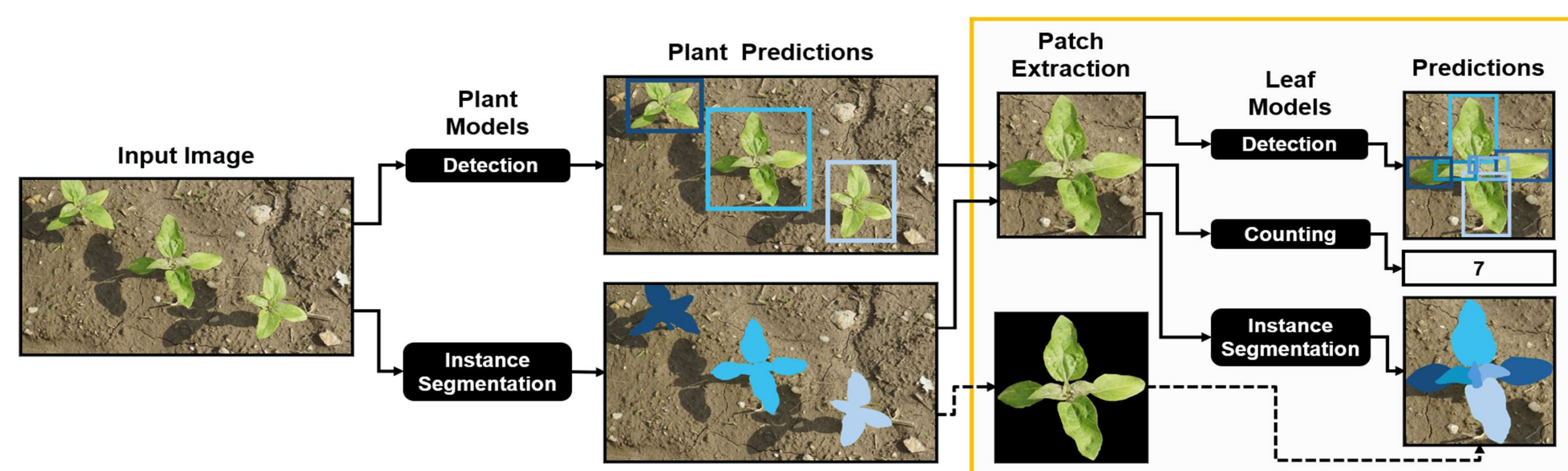




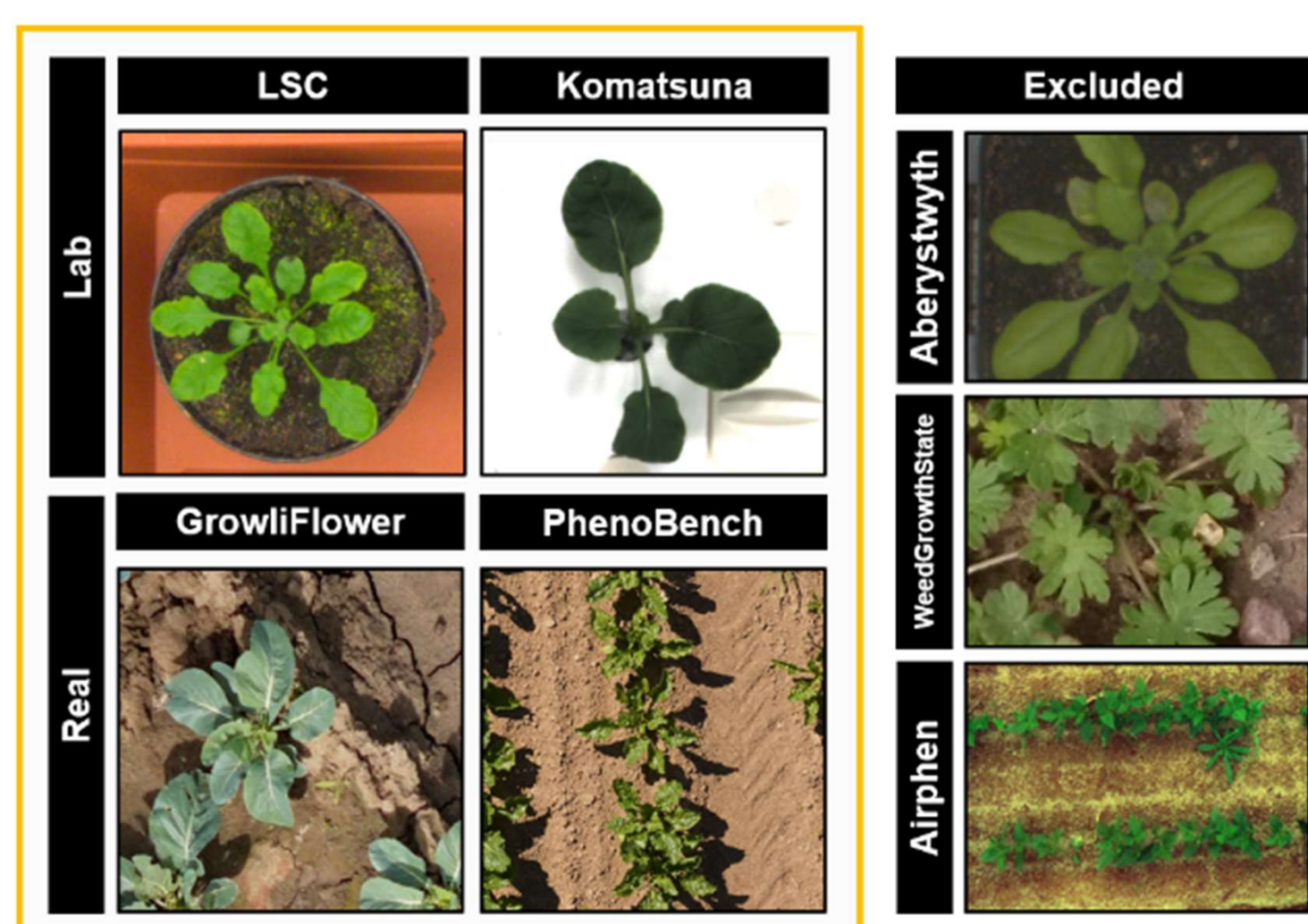
Exploring Leaf Segmentation

- Enables **precise analysis** of health, growth stage and yield potential
- Requires robust **domain** and **species generalization**
 - Limited by **data scarcity** due to complex annotation



Data Analysis

- Four available datasets providing **per-plant leaf annotations**
 - Covering four species in **lab** and **field** settings



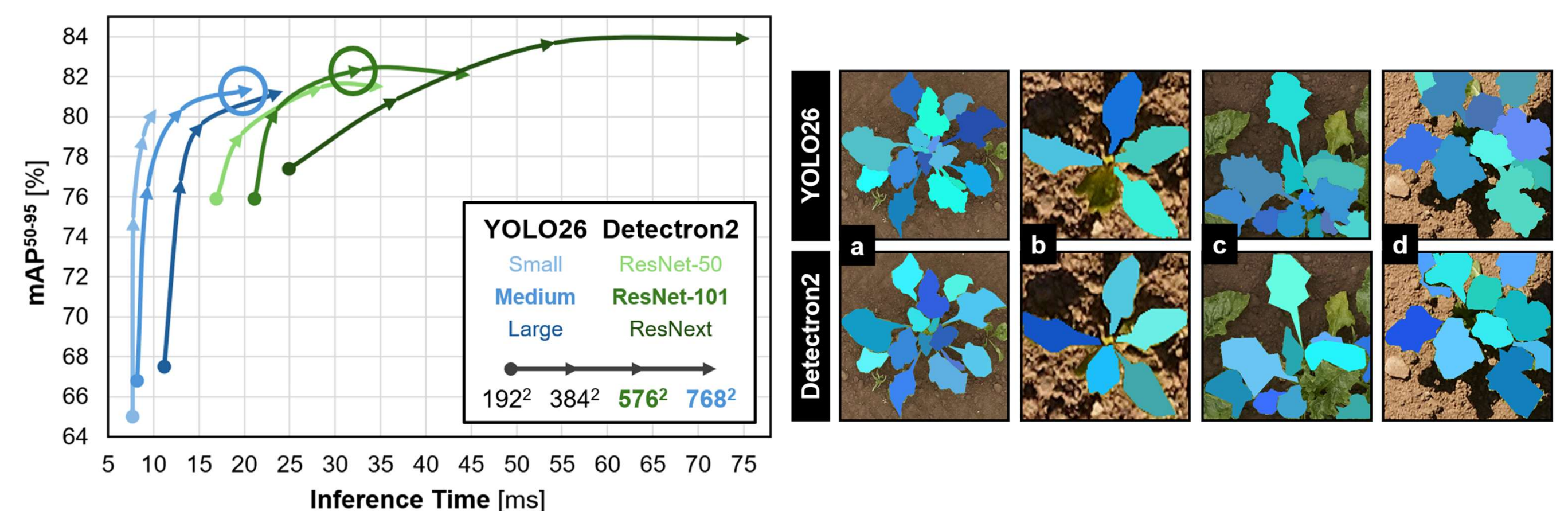
Dataset	Plants (Selected)	Species	Image size	Patch size	Sensors	Setting
LSC [30]	810 (707)	2	441×441	274×241	RGB	Lab
Komatsuna [34]	1,200 (1,055)	1	480×480	176×142	RGB-D	Lab
GrowliFlower [18]	2,587 (2,432)	1	448×368	154×151	RGB	Real
PhenoBench [40]	23,062 (13,752)	1	1,024×1,024	152×141	RGB	Real
CropAndWeedAndLeaf (Ours)	8,819 (345)	23	1,920×1,088	286×201	RGB	Real

CropAndWeedAndLeaf Benchmark

- **Leaf-level annotations** for CropAndWeed dataset
 - 345 images evenly sampled from **23 species**
 - **Semi-supervised annotation** approach
- Focus on **high variability**
 - Leaf appearances and environmental conditions

Architecture Ablation

- **Speed-accuracy trade-off** for leaf-level instance segmentation
 - Multiple model capacities and input resolutions
- Focus on **broad applicability** and **reproducibility** with **accessible hardware**
- Selected architecture with suitable **real-time performance**
 - **YOLO26** Medium model at 768² pixels



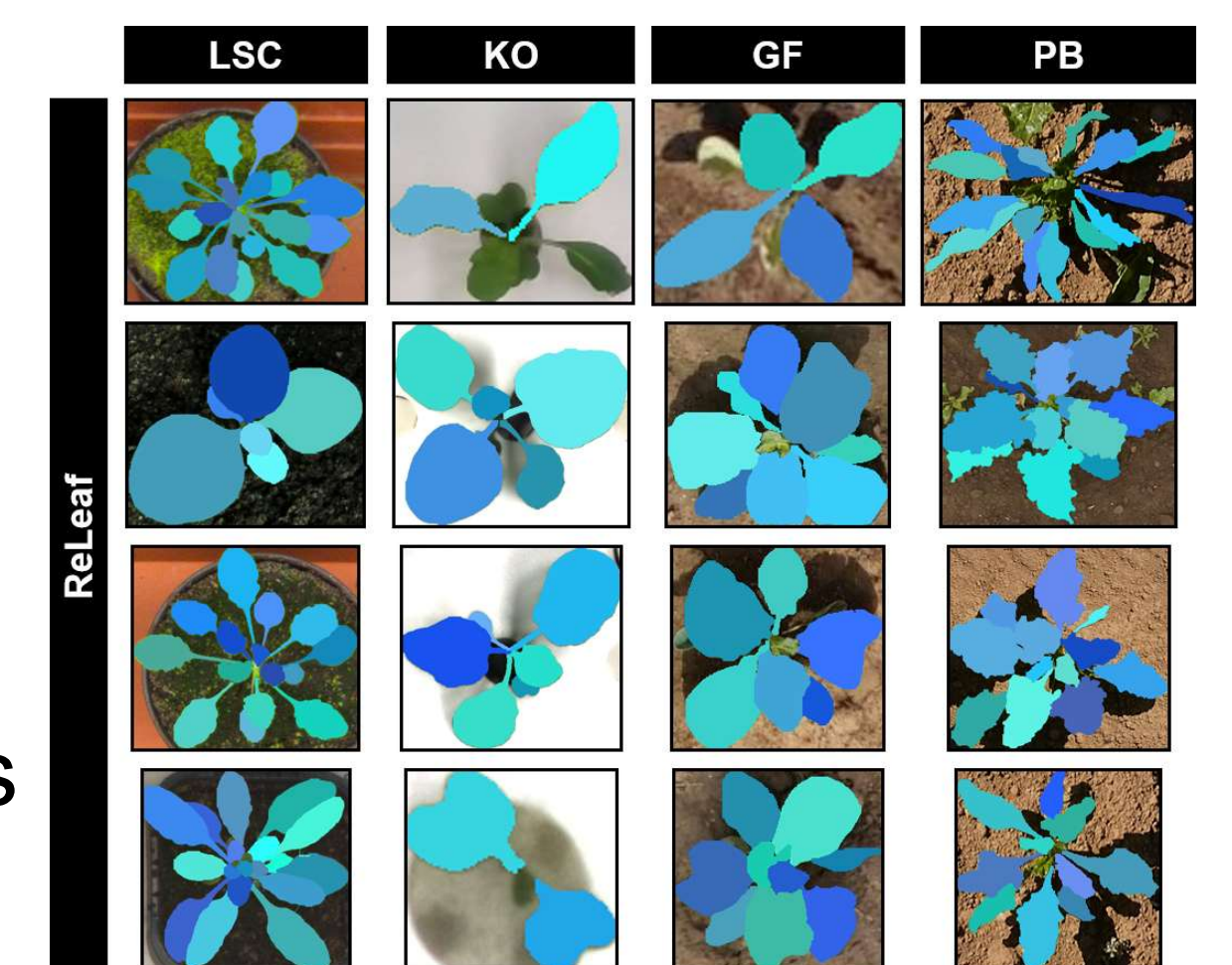
Domain and Species Generalization

- **Cross-dataset evaluation** with models trained on each dataset
 - Strong **variations in complexity** between datasets
 - Solid **cross-species generalization** between field datasets
 - Pronounced **lab-to-real gap**

	LSC	KO	Lab	GF	PB	CWL	Real
LSC	79.2	49.1	44.7	26.8	10.5	17.4	17.7
KO	40.2	90.7		22.7	12.3	16.3	
GF	30.2	42.5	29.8	76.4	38.4	31.5	38.6
PB	40.0	6.6		49.1	81.4	35.4	
RL	79.4	90.1	84.8	82.2	83.8	40.2	83.3

ReLeaf Model

- Combining all training sets
- **Robust performance** on all test sets
- **Superior generalization** to CropAndWeedAndLeaf species



Outlook

- Extending the **CropAndWeedAndLeaf** dataset
 - Including other data sources
 - Using ReLeaf model for annotation
- Bridging the **lab-to-real gap**
 - Architecture optimizations
 - Exploring few-shot learning techniques

Generalization to Novel Species

