Refined Methodology for Accurately Detecting Objects from Digitized Herbarium Specimen

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#1 BACKGROUND

- Huge amount of digitized herbarium specimens.
- Providing valuable information on functional traits.
- Deploying computer vision techniques to automatically extract functional trait data from digitized specimen images.
- Recognizing objects present on the specimen images which may appear in any positions and have different sizes (Figure 1).
- Developing a refined methodology RefYOLO, which is based on the pioneer object recognition system called You Only Look Once (YOLO).
- RefYOLO is darknet based framework for recognizing objects from digitized herbarium specimens.
- RefYOLO is one of the main outcomes of the Managing Multimedia Data for Science (MAMUDS) project.

#2 OBJECTIVES

- Recognizing efficiently all object classes of specimen images in order to extract automatically measurements of plant leaves.
- Batch processing of large specimen image data sets.

#3 ACHIEVEMENTS

- Achieve an accuracy better than two-stage object detectors (Figure 2) (Table 1).
- Achieve a fast recognition of objects within digitized herbarium specimens (0,06 s) (Table 2).
- Encoding contextual feature information about classes such as shape, contours and their appearance.
- Independent of object positions, orientation, size and shape.
- Recognize perfectly all object classes within the digitized herbarium specimens (7 classes).
- Optimizing complexity of the model in term of number of parameters.
- Introducing the Average-Max pooling method (AM-PM) to increase the recognition accuracy.

#4 SPECIMEN IMAGES

Figure 1. *An example of a typical digitized herbarium specimens*

#5 RefYOLO ARCHITECTURE

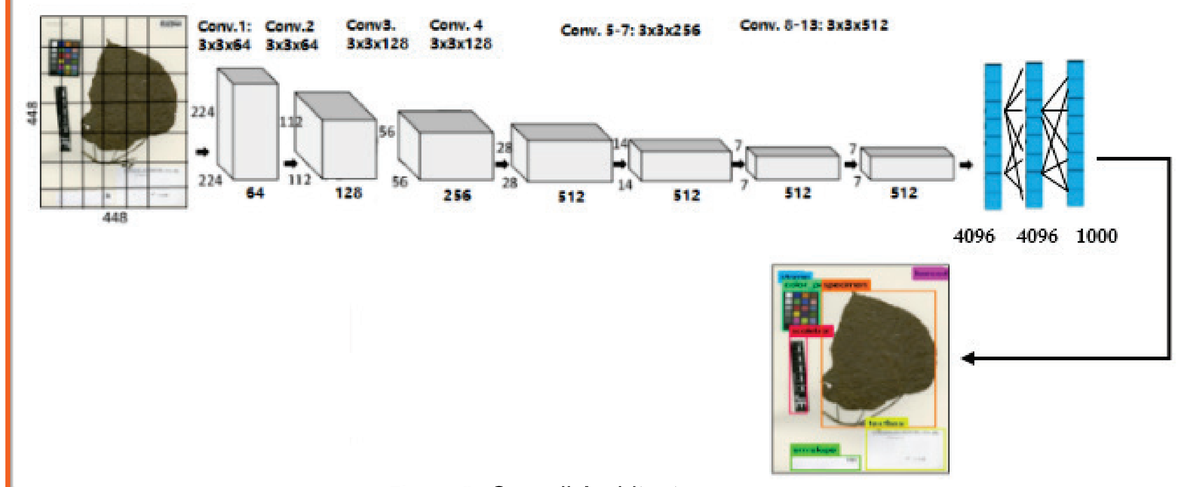

Figure 2. *Overall Architecture*

#6 EXPERIMENTS

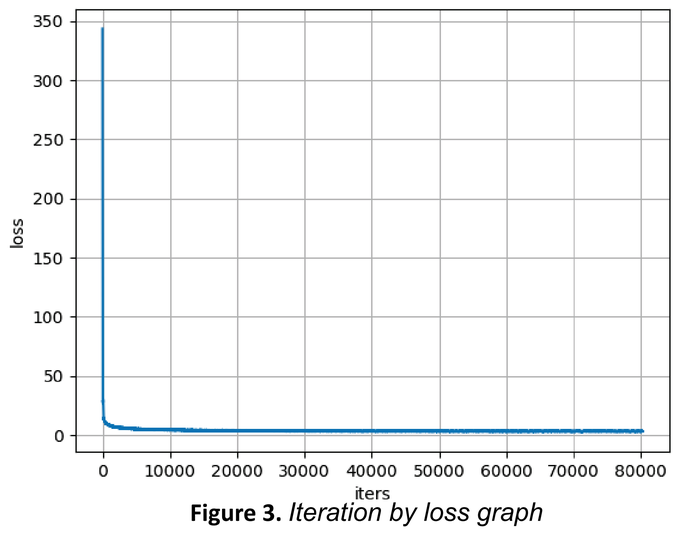

Figure 3. *Iteration by loss graph*

Table 1. mAP Measurements.

	RefYOLO	YOLO	Faster RCNN	SSD	OverFeat
mAP	89%	77%	84%	76%	79%

Table 2. mIoU Measurements.

Objects	RefYOLO	Faster RCNN	SSD	OverFeat
Stamp	80%	84%	76%	71%
Barcode	86%	81%	85%	87%
ScaleBar	88%	87%	80%	78%
Color-Pallet	92%	90%	87%	70%
Specimen label	91%	78%	82%	81%
Envelope	92%	89%	77%	82%
Specimen	94%	90%	88%	79%
Time(s/image)	0.06	0,14	0,2	0,6

#7 CONCLUSION and FURTHER WORK

- Proposed a new Deep Learning based Model for recognizing efficiently all object classes of specimen images
- Operate on batch processing of large specimen image data sets.
- Next step will be focused on fine segmentation of herb regions.

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