UNLOCK COMMUNITY AI MODELS FOR YOUR MICROSCOPY IMAGES

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Abstract: Lower the barrier for reusing pre-trained AI models from diverse repositories inside Web Image Processing Pipeline (WIPP) and save hours of computational time

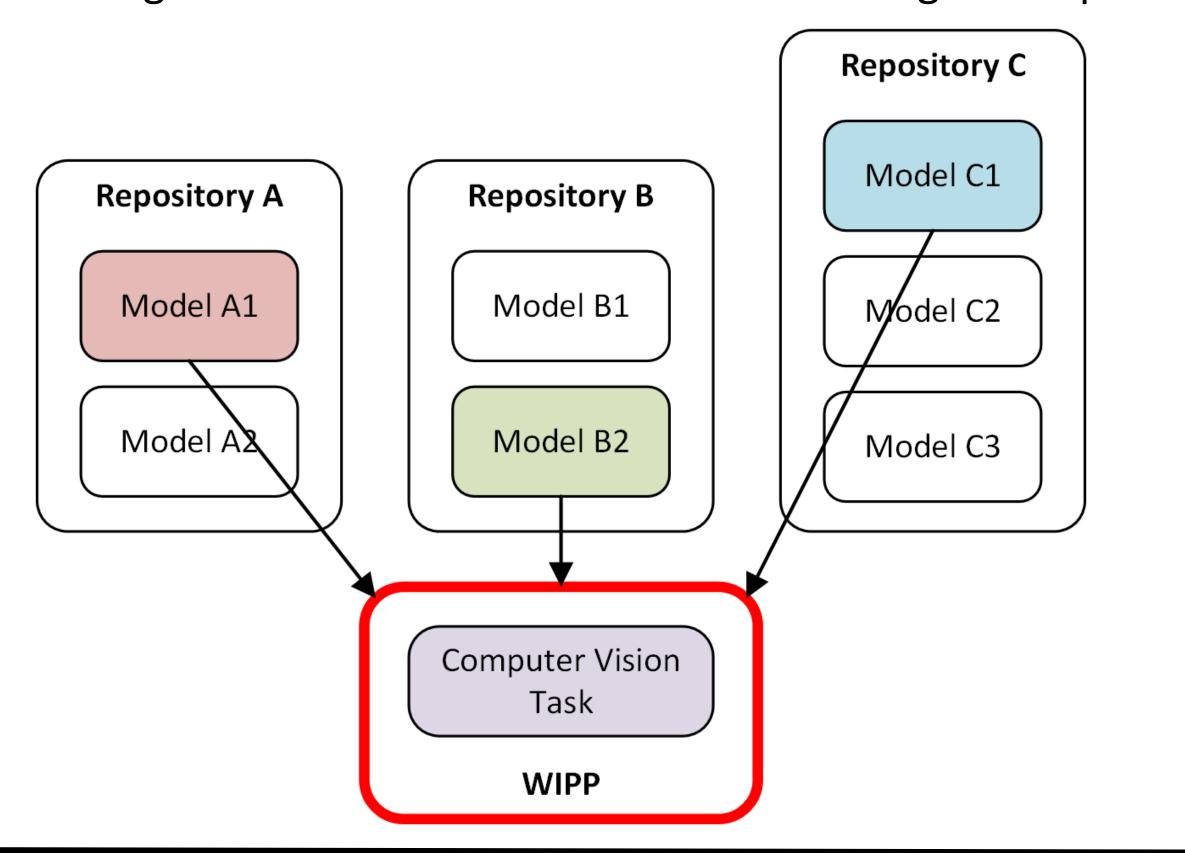
(1) Introduction

Observations

- a) There are a lot of potential models for your computer vision task
- b) Your data is in WIPP and you want to stay in this environment
- c) You want to experiment with a lot of models efficiently

Problems

- a) Models are spread across a lot of different repositories and formats
- b) WIPP cannot run pre-trained external models natively
- c) Re-training models from scratch is time-consuming and expensive



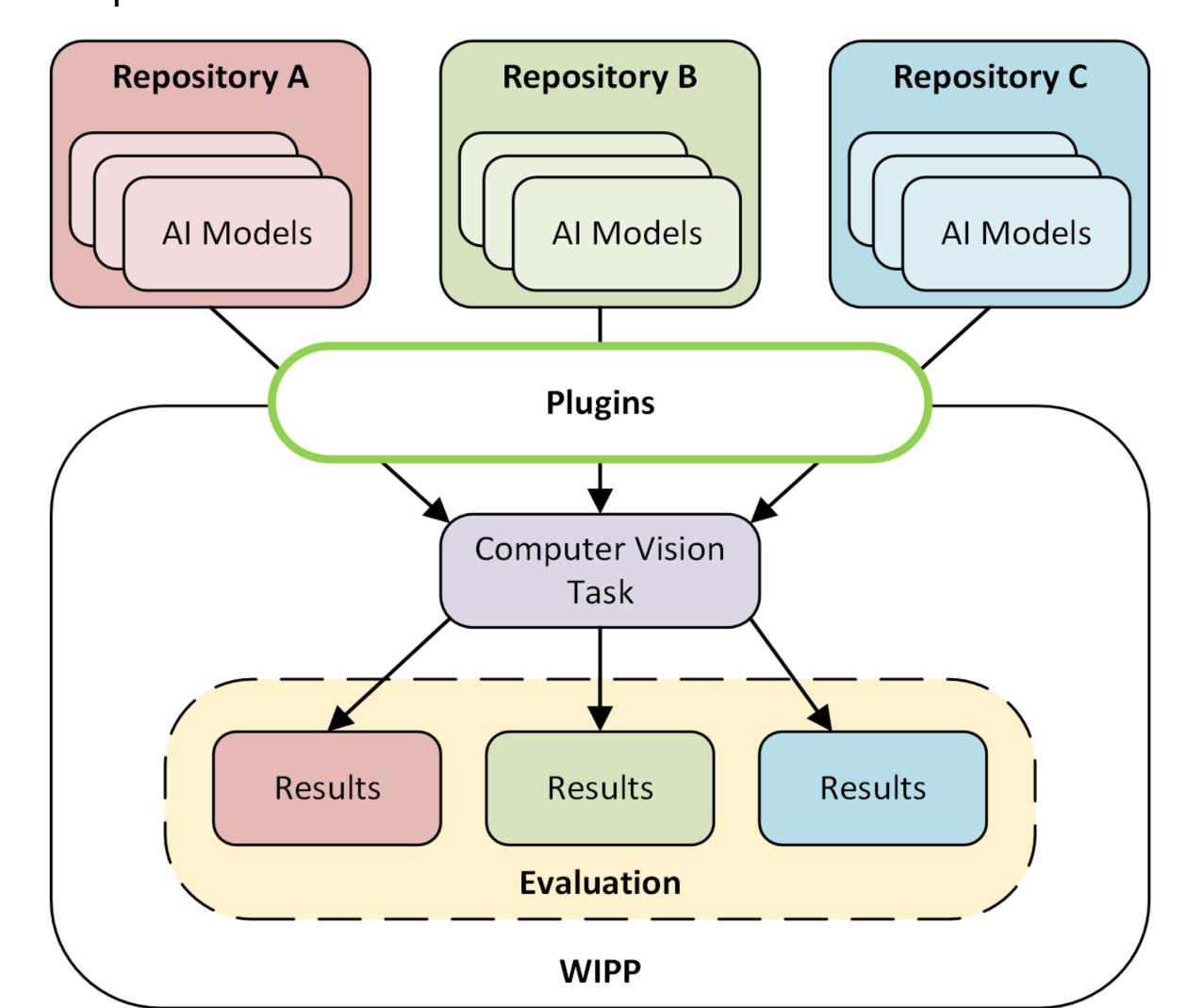
(2) Approach

Objectives

- a) Infer models from different repositories
- b) Evaluate accuracy of models for your specific task

Technical solutions

- a) Creation of new WIPP inference plugins
- b) Compute Dice-Sorensen coefficient and execution time



(3) Experimental results

Data

- Images: 256x256 Retinal Pigment Epithelium (RPE) cell microscopy images
- AI Models: Five models from WIPP, HuggingFace and BioImage.IO repositories

Method

Run inference for each model on a set of test images and compare accuracy and execution time

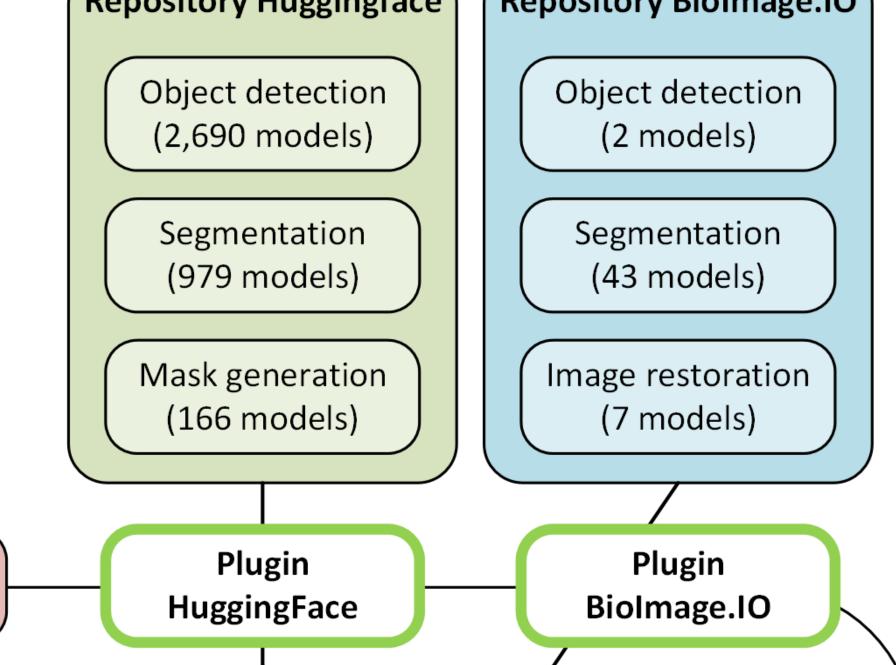
Repository Huggingface Hardware **Repository BioImage.IO** Nvidia Quatro RTX 4000 Object detection (2,690 models) Segmentation (979 models) Mask generation (166 models)

Plugin

WIPP UNet CNN

train

Results



Results

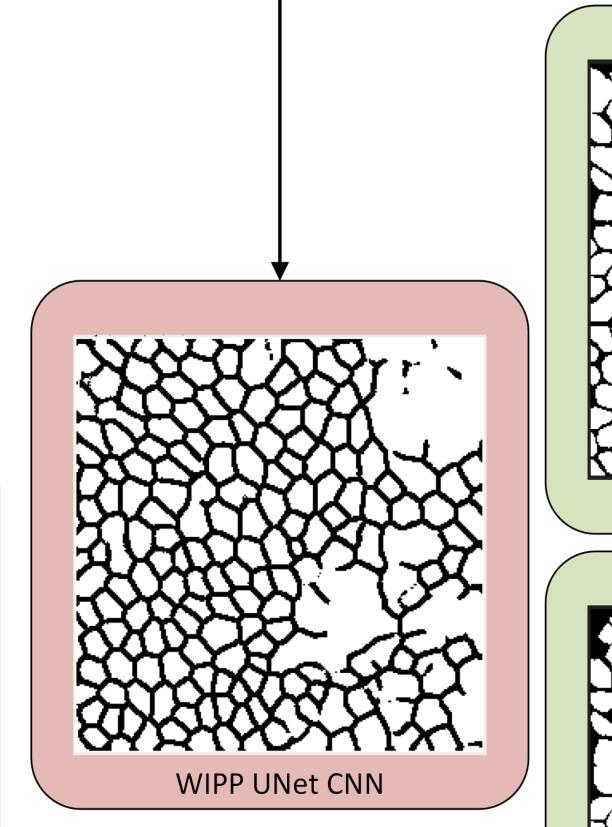
Computer Vision

Task

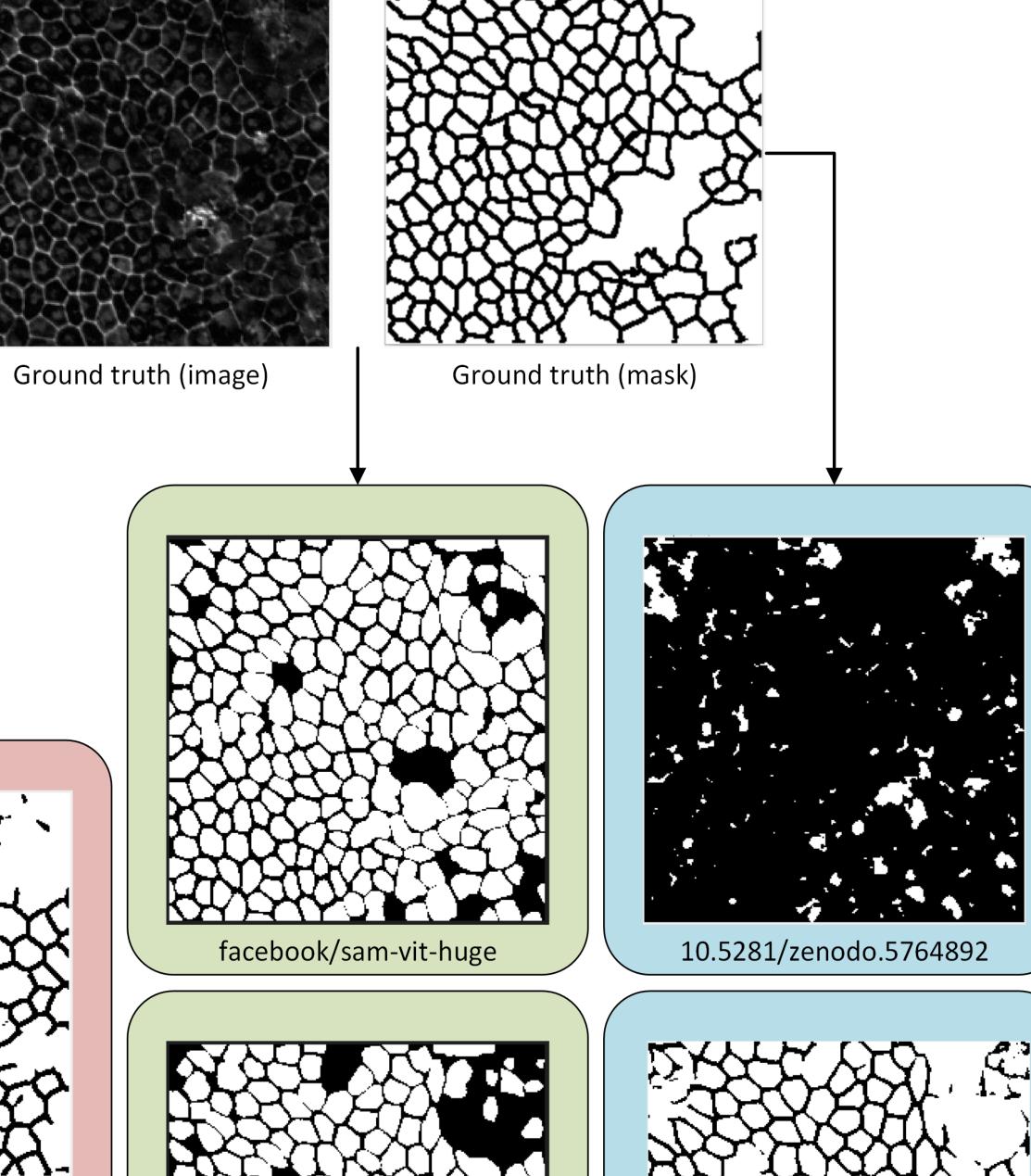
Results

Evaluation

WIPP



https://doi.org/doi:10.18434/T4/1503229



(4) Conclusion

Training

(822 images)

Testing

(210 images)

Dataset RPEcells

(uploaded on WIPP)

			1
	WIPP plugins	Execution time per image [s]	Accuracy with Dice- Sorensen coefficient
UNet CNN	WIPP UNet CNN Inference Plugin	10.91	95.11% ± 0.78%
SAM - ViT Huge version (facebook/sam-vit-huge)	*NEW* WIPP HuggingFace Inference Plugin	4.16	85.87% ± 3.98%
SlimSAM (Zigeng/SlimSAM-uniform-50)		2.81	79.78% ± 5.31%
U-Net for Nucleurs Seg. (10.5281/zenodo.5764892)	*NEW* WIPP Biolmage.IO Inference Plugin	0.38	10.44% ± 3.20%
U-Net for Livecell Seg. (10.5281/zenodo.5869899)		0.31	89.30% ± 0.84%

Details

- Results are the metrics average for 20 images
- Training done on GPU and inference done on CPU
- WIPP UNet CNN model training time: 46 minutes

Key results

WIPP now supports inference for:

Zigeng/SlimSAM-uniform-50

- 1. HuggingFace models
- 2. BioImage.IO models
- Plethora of AI models are now usable in WIPP
- Hours of computation time and resources saved
- Improved reusability of pre-trained AI models

Link

https://github.com/usnistgov/WIPP

DISCLAIMER: Certain commercial products or company names are identified here to describe our study adequately. Such identification is not intended to imply that the products or names identified are necessarily the best available for the purpose.