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

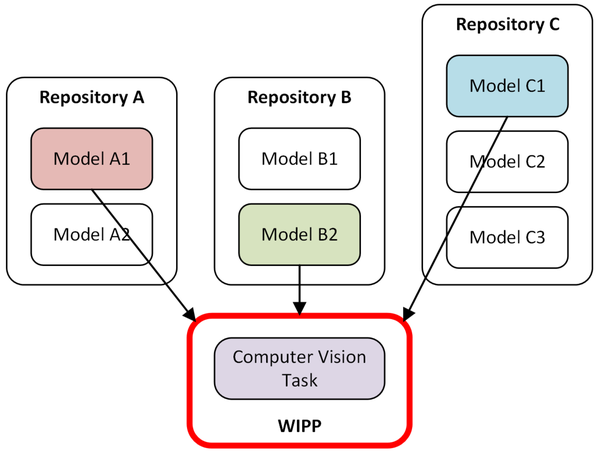
(1) Introduction

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



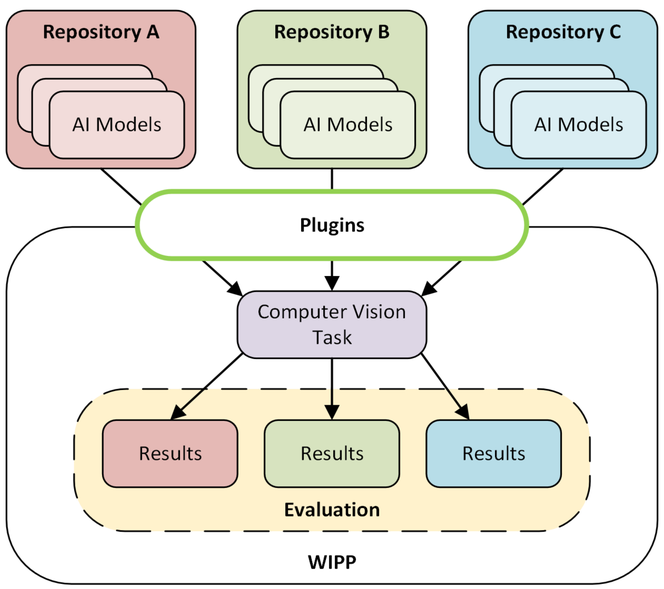
(2) Approach

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

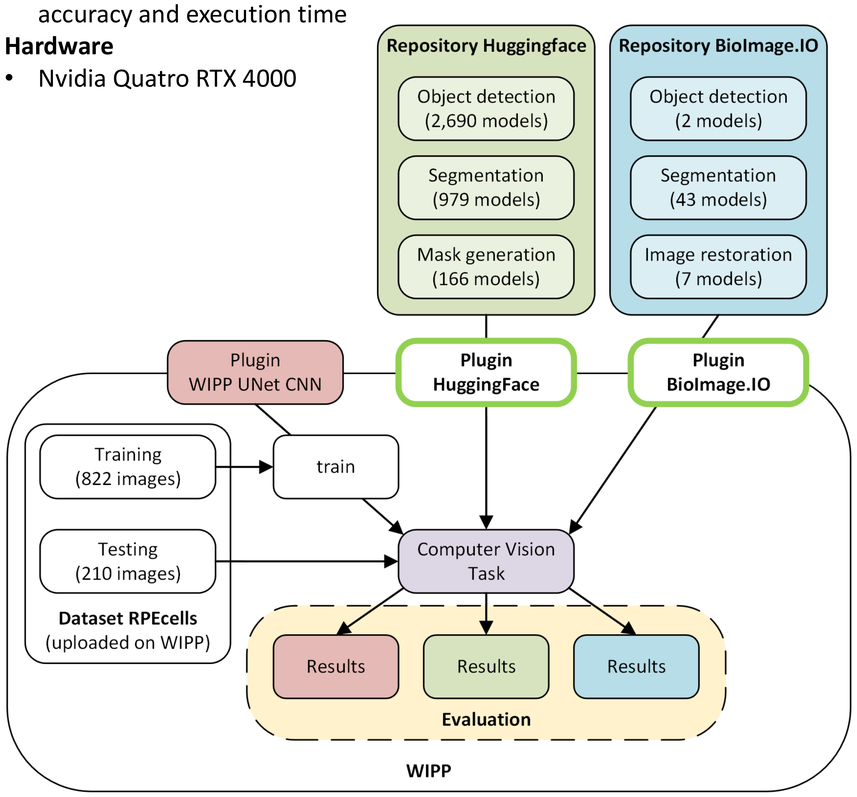
- Images: 256x256 Retinal Pigment Epithelium (RPE) cell microscopy images
- AI Models: Five models from WIPP, HuggingFace and BioImage.IO repositories

Method

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

Hardware

- Nvidia Quatro RTX 4000



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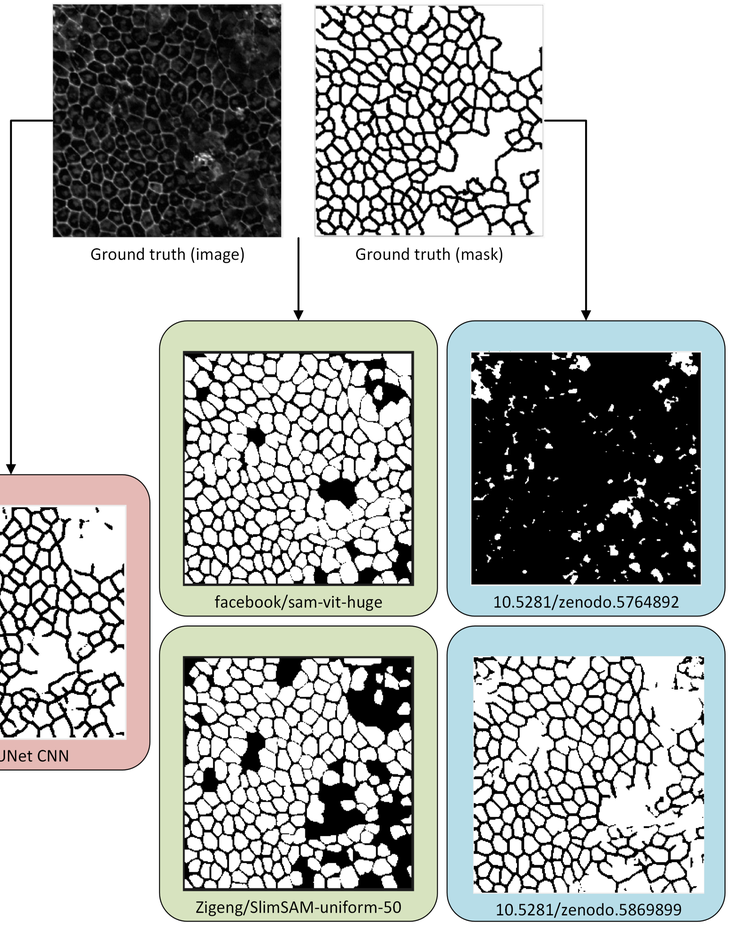

(4) Conclusion

	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 BioImage.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:
  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