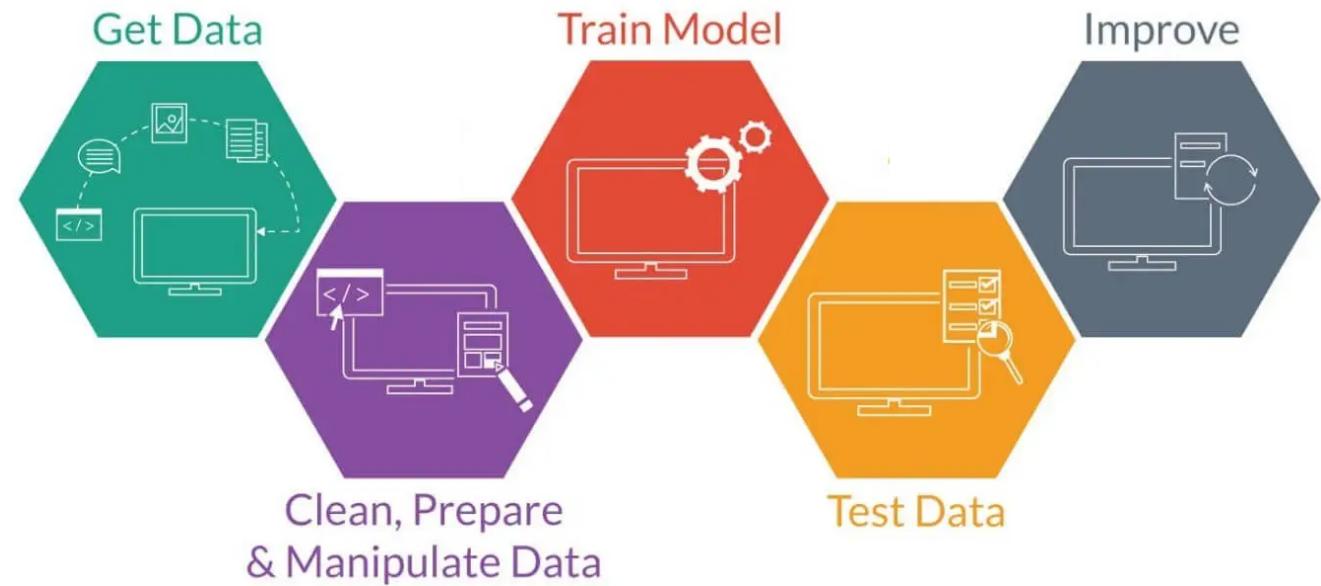


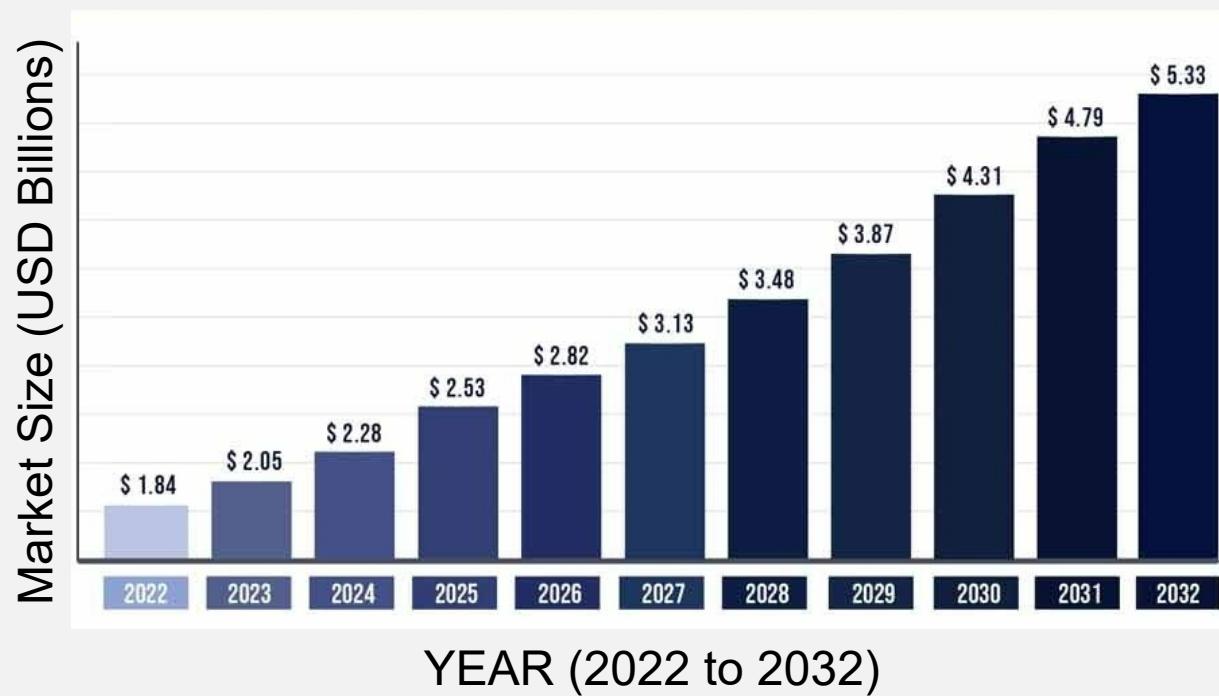
ML IN DIGITAL PATHOLOGY

Yuan Nghiem
Leo Grant Berman
Albert Bulik



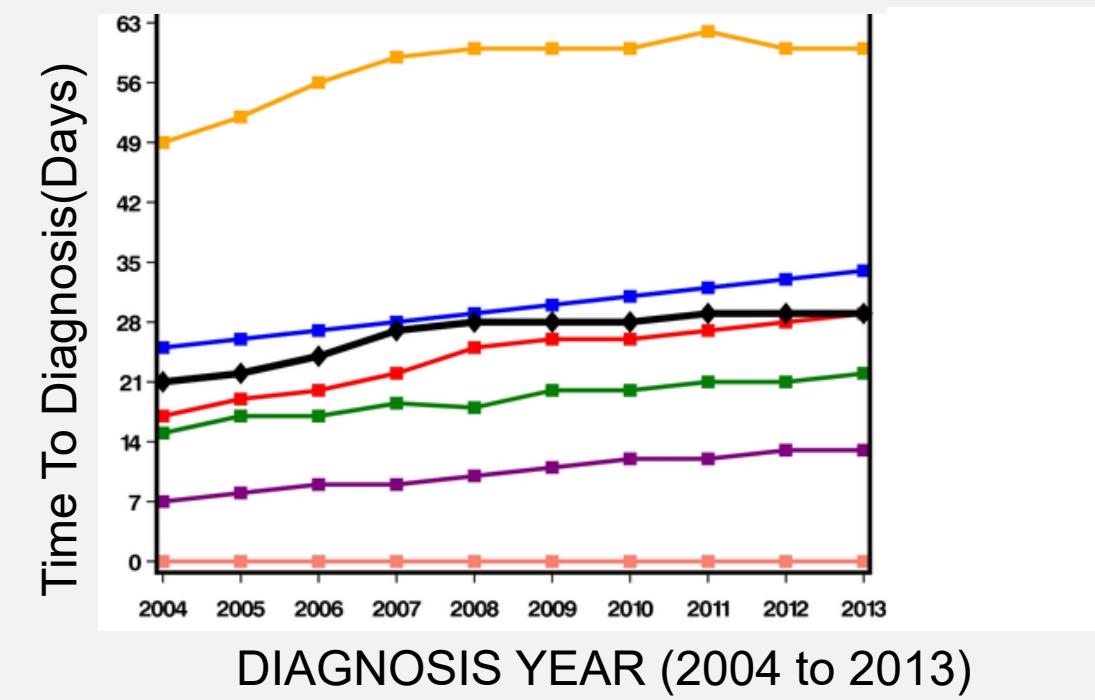
PROBLEM STATEMENT

The demand for cancer diagnosis is increasing.



[SOURCE](#)

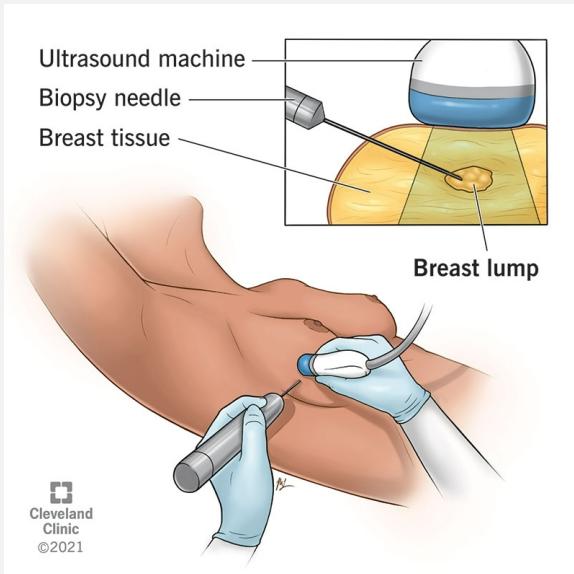
As a result, time to treatment is increasing.



[SOURCE](#)

TEMPLE UNIVERSITY HEALTH DIGITAL PATHOLOGY (TUHDP) CORPUS

Biopsy



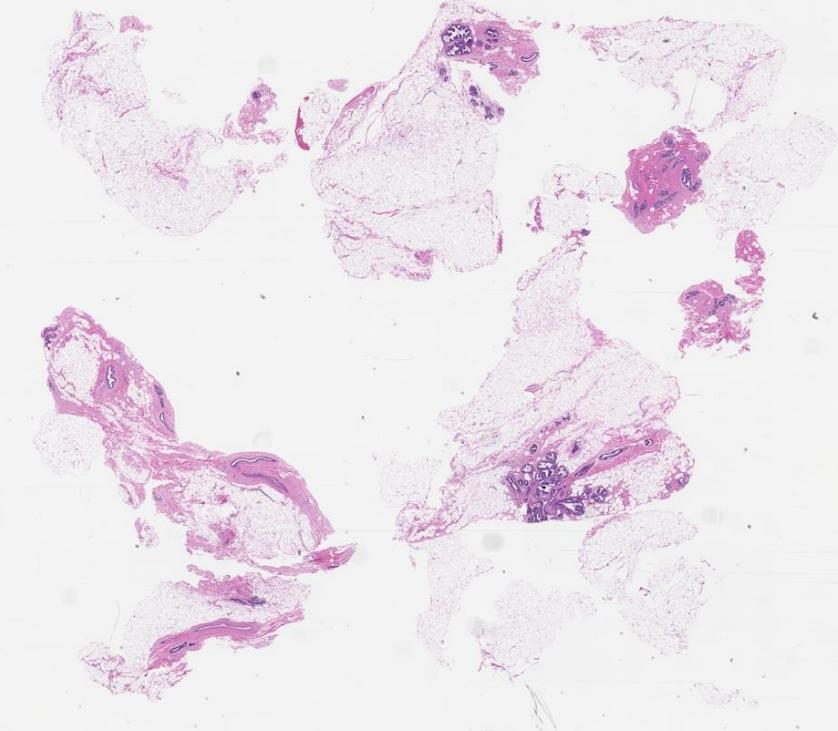
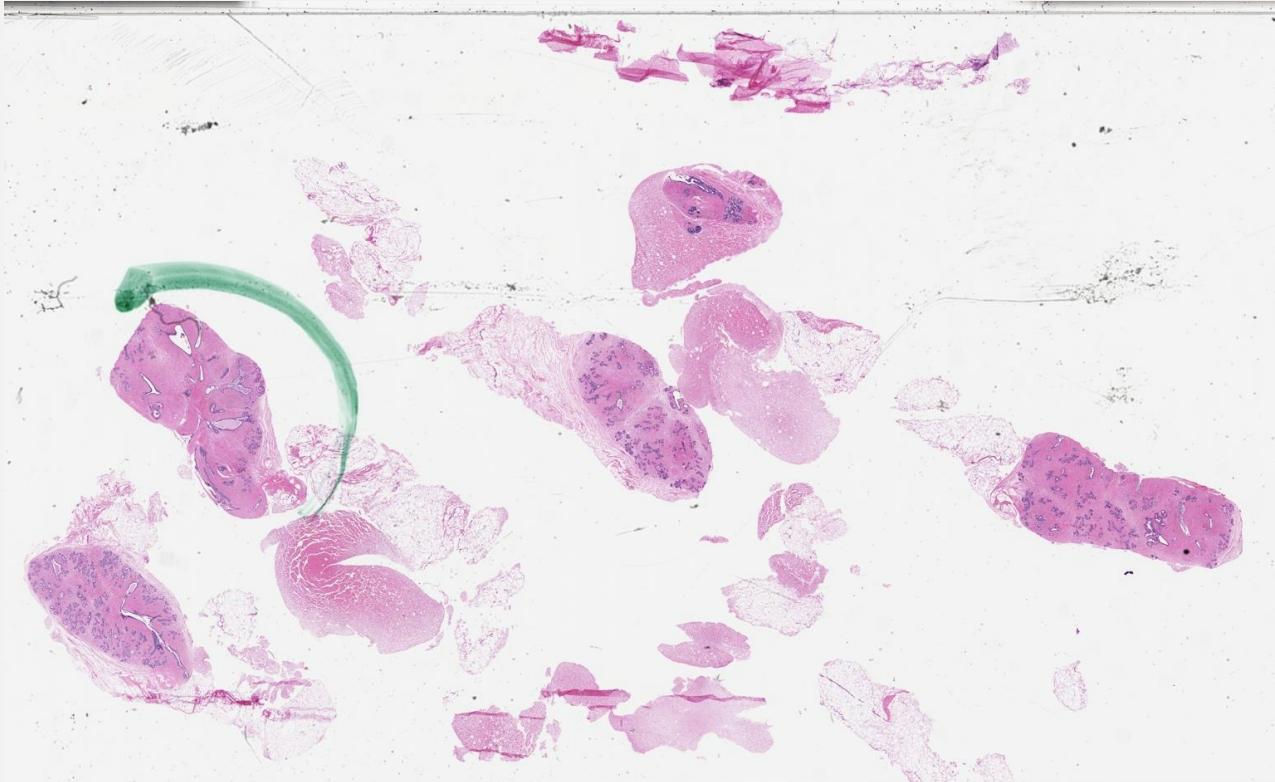
Staining



Scanning

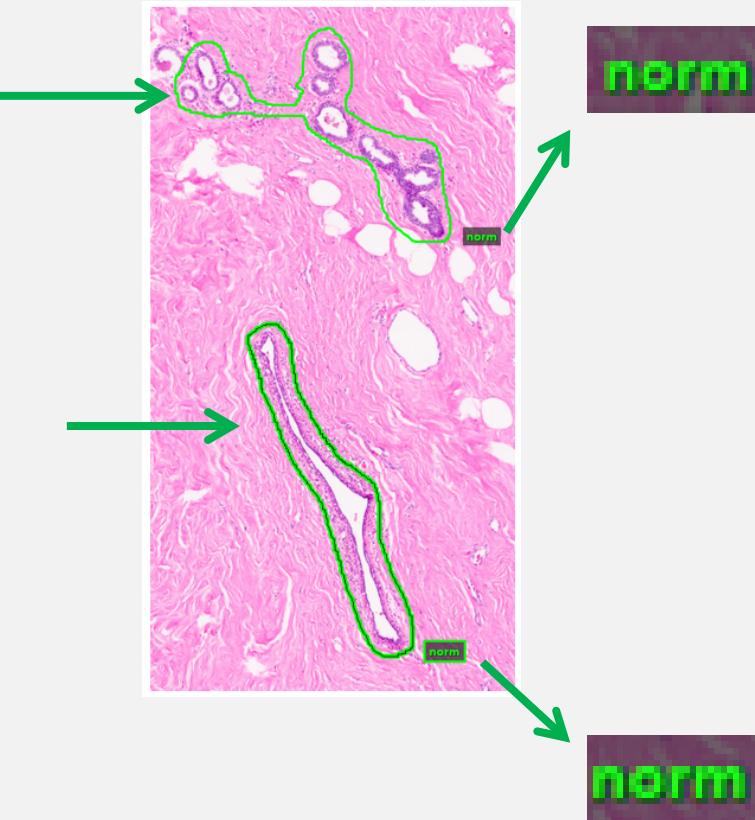


TUHDP BIOPSY SLIDE SAMPLE

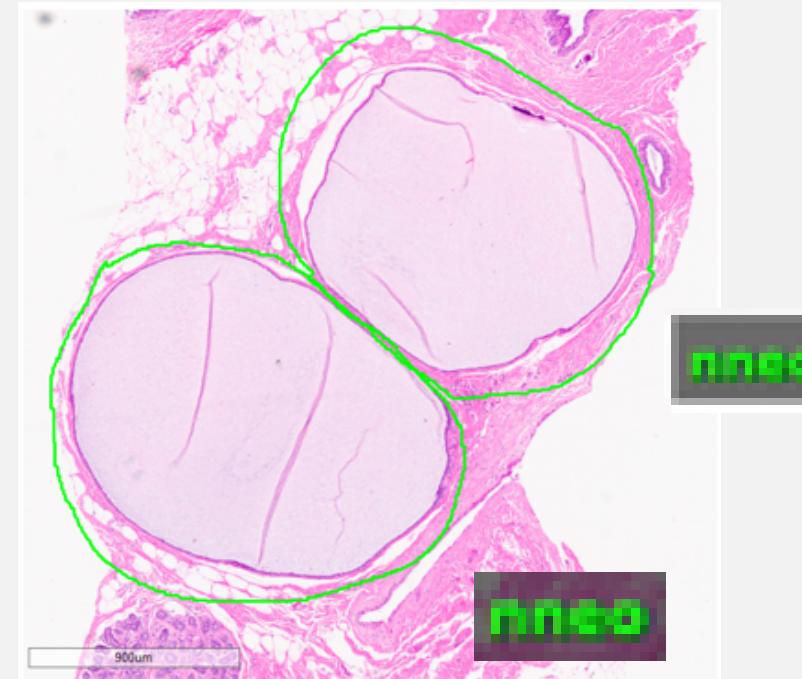


LABELED DATA TYPES

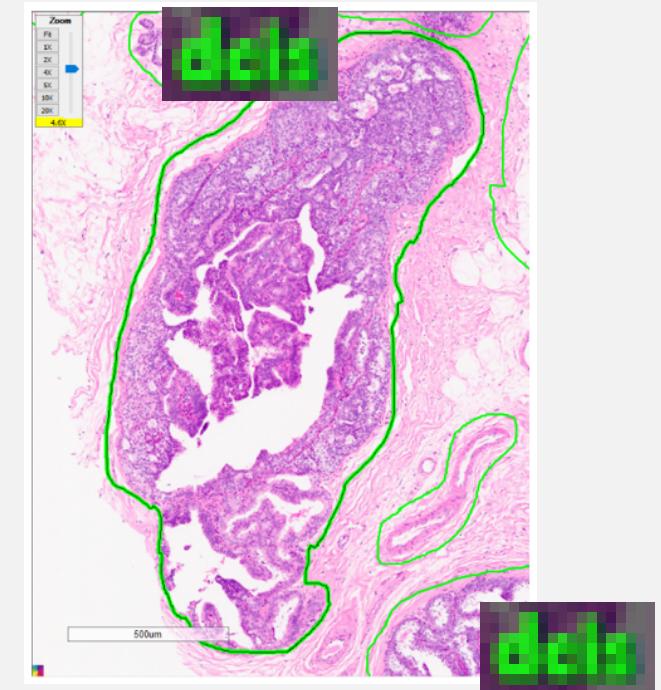
Non-Cancerous Types



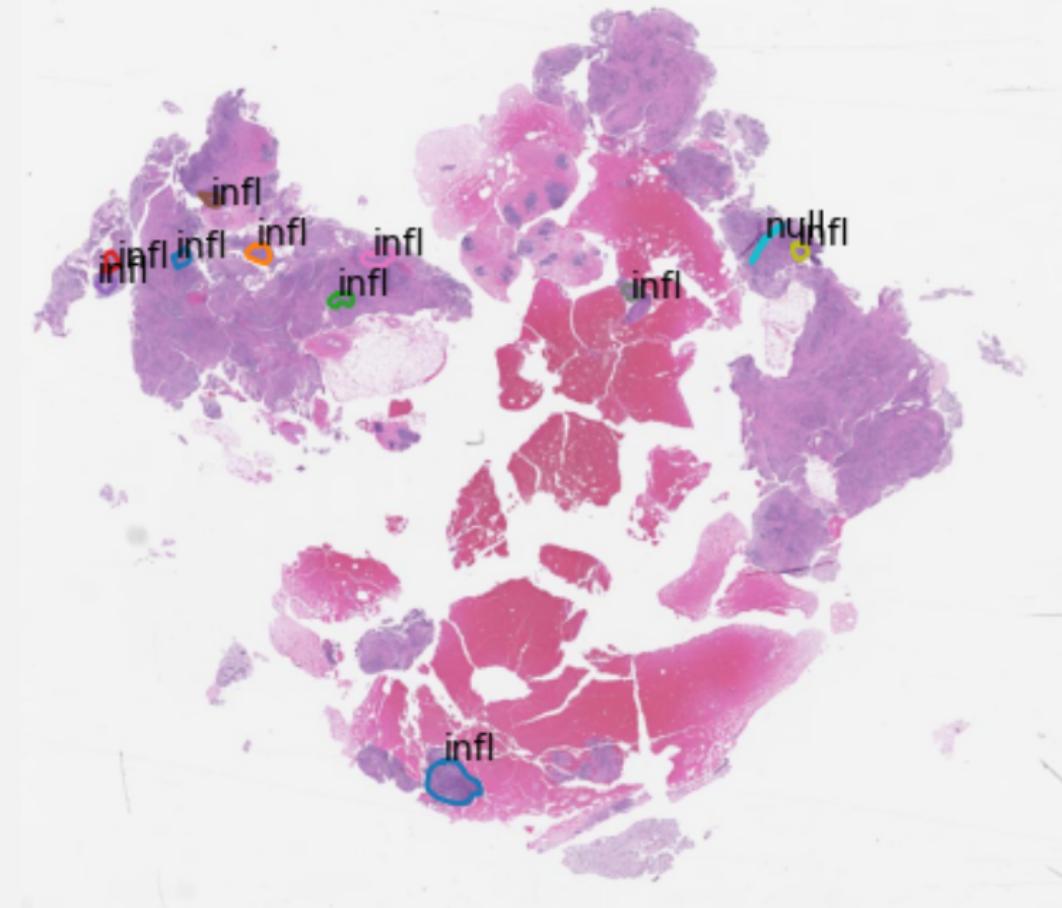
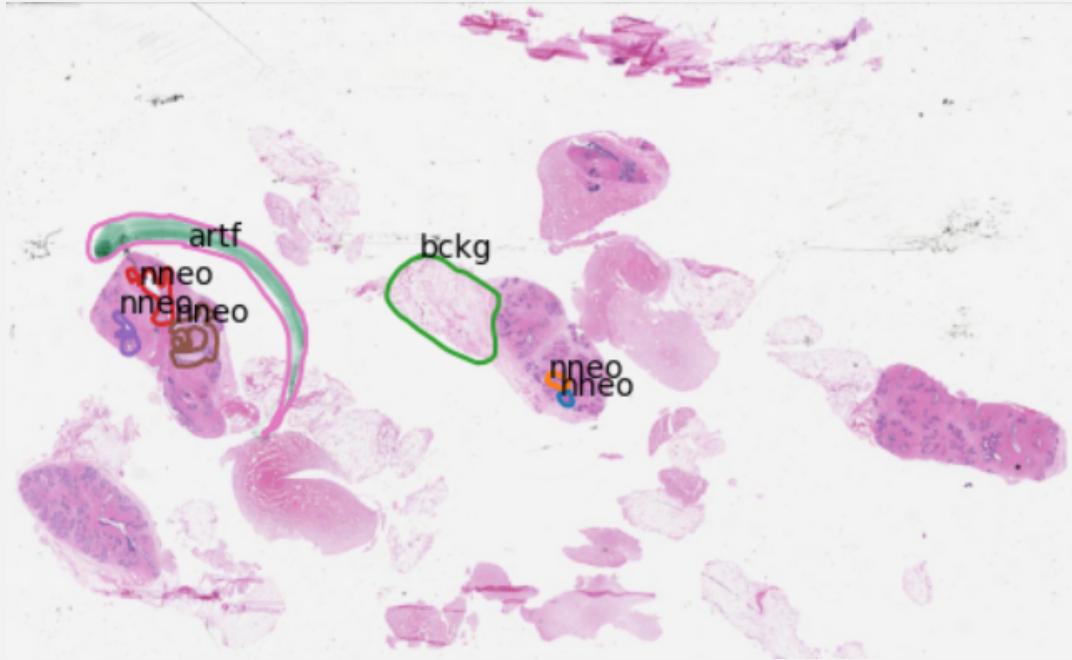
Carcinogenic-Signs Type



Cancerous Types



TUHDP BIOPSY SLIDE SAMPLE

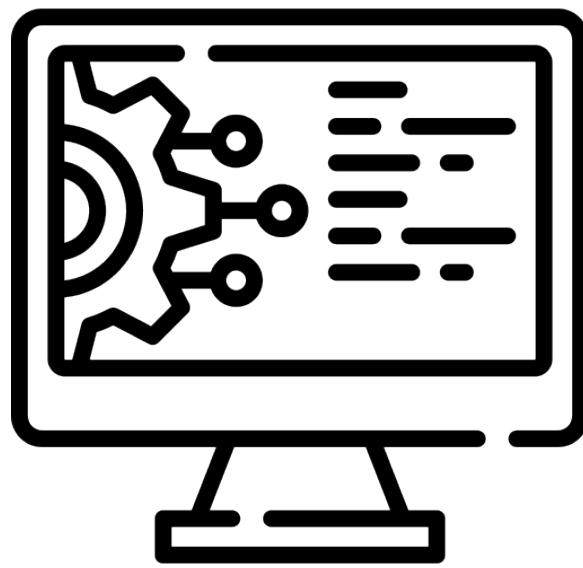


OUR PRODUCT

Scanning



System



Prediction Report



HOW THIS FITS



DESIGN CRITERIA / REQUIREMENTS

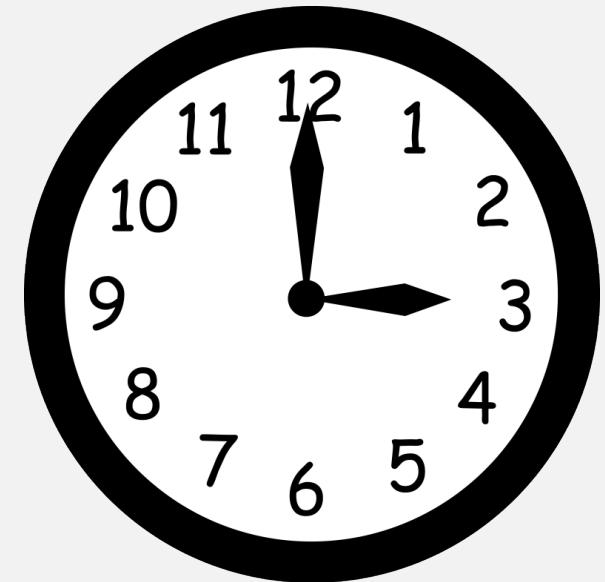
Image Classification

n



Whole Slide Image
Classification

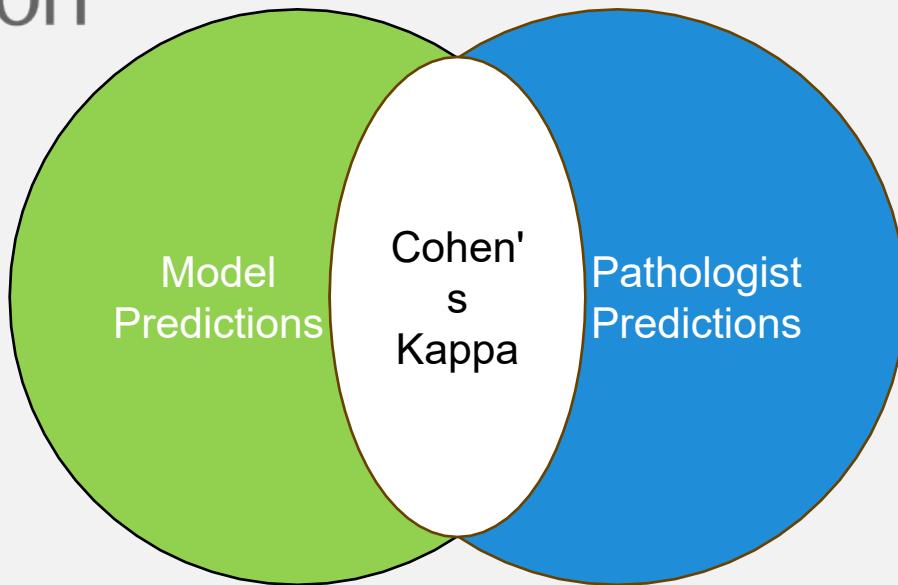
[Source](#)



Functional GUI

- Show location of areas
- Show area's probability of malignancy

DESIGN CRITERIA / REQUIREMENTS



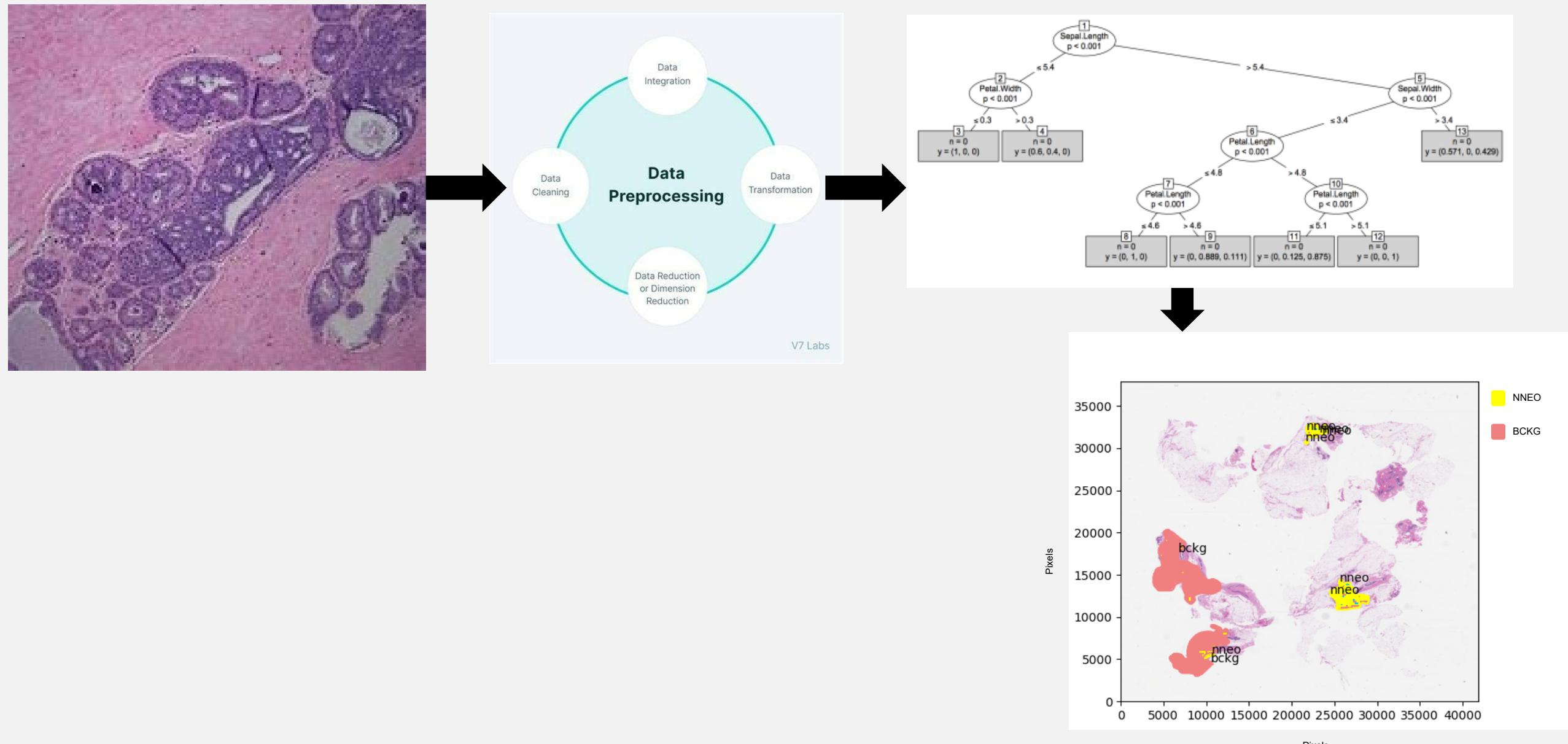
Cohen's Kappa > 80%
[Source](#)

F1 Score

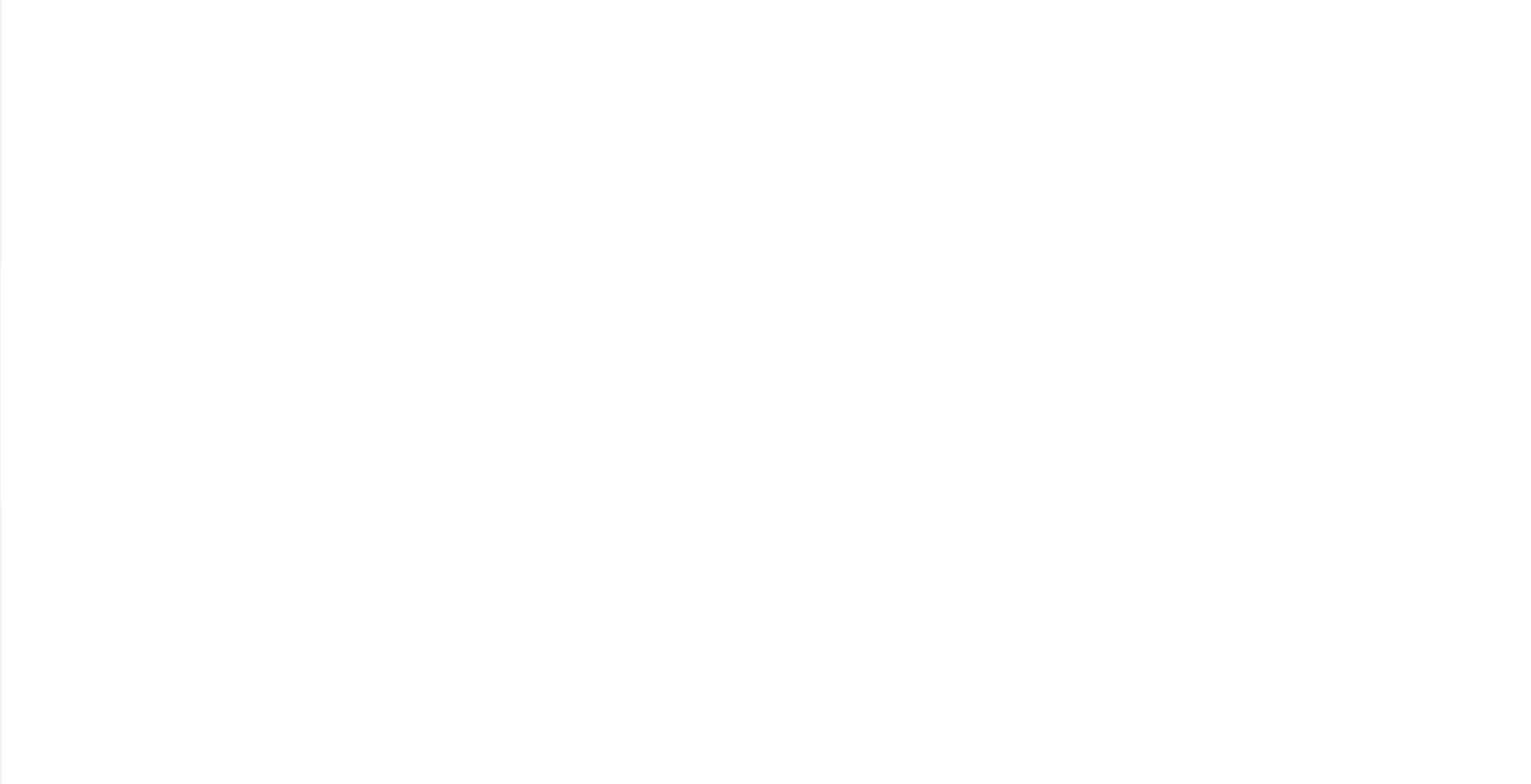
$$\frac{\text{TP}}{\frac{\text{TP}}{\text{TP}} + .5 (\text{FN}) (\text{FP})}$$

)
F1 Score > 95%
[Source](#)

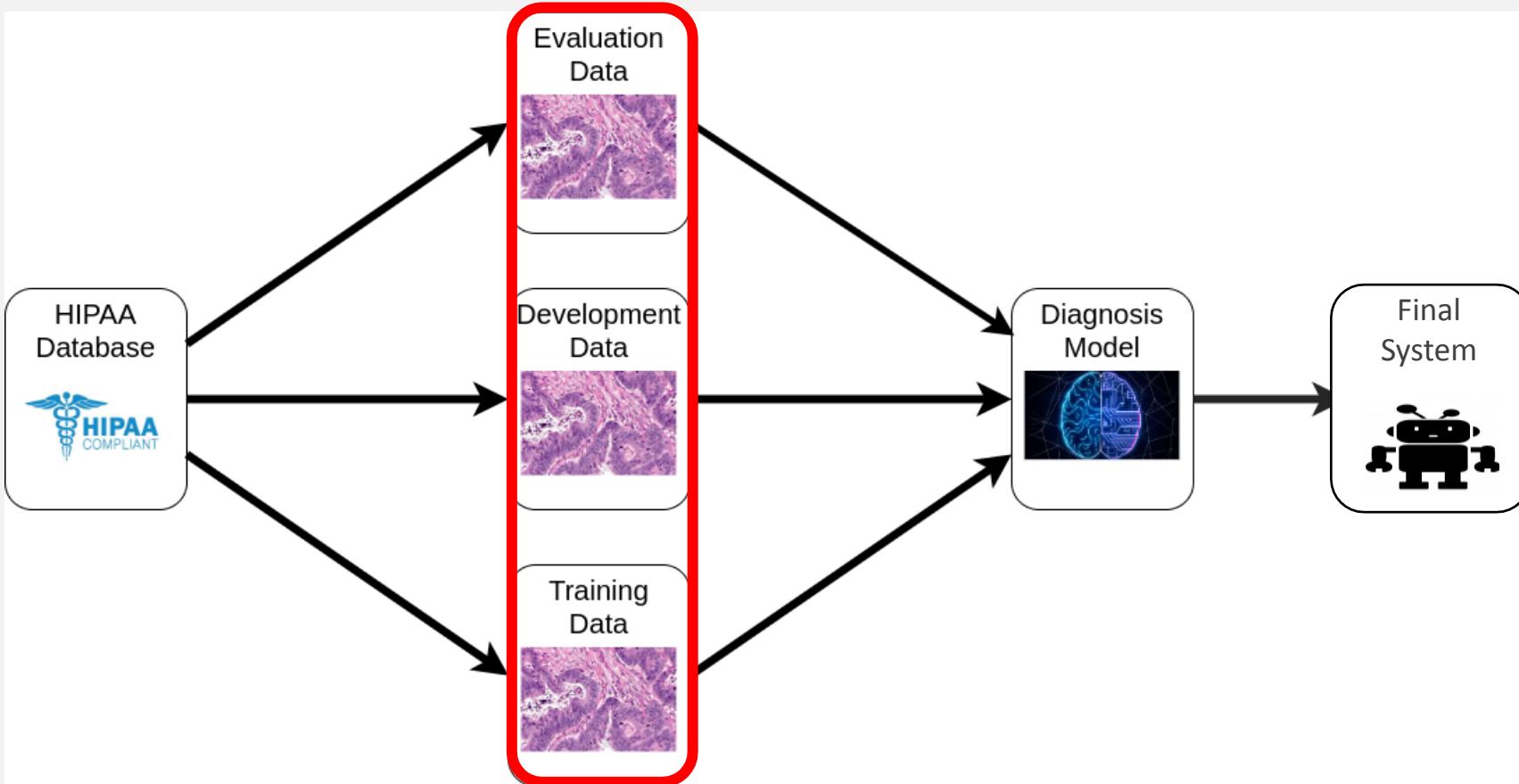
DEEPER LOOK AT PROGRAM I/O



PRELIMINARY DESIGN

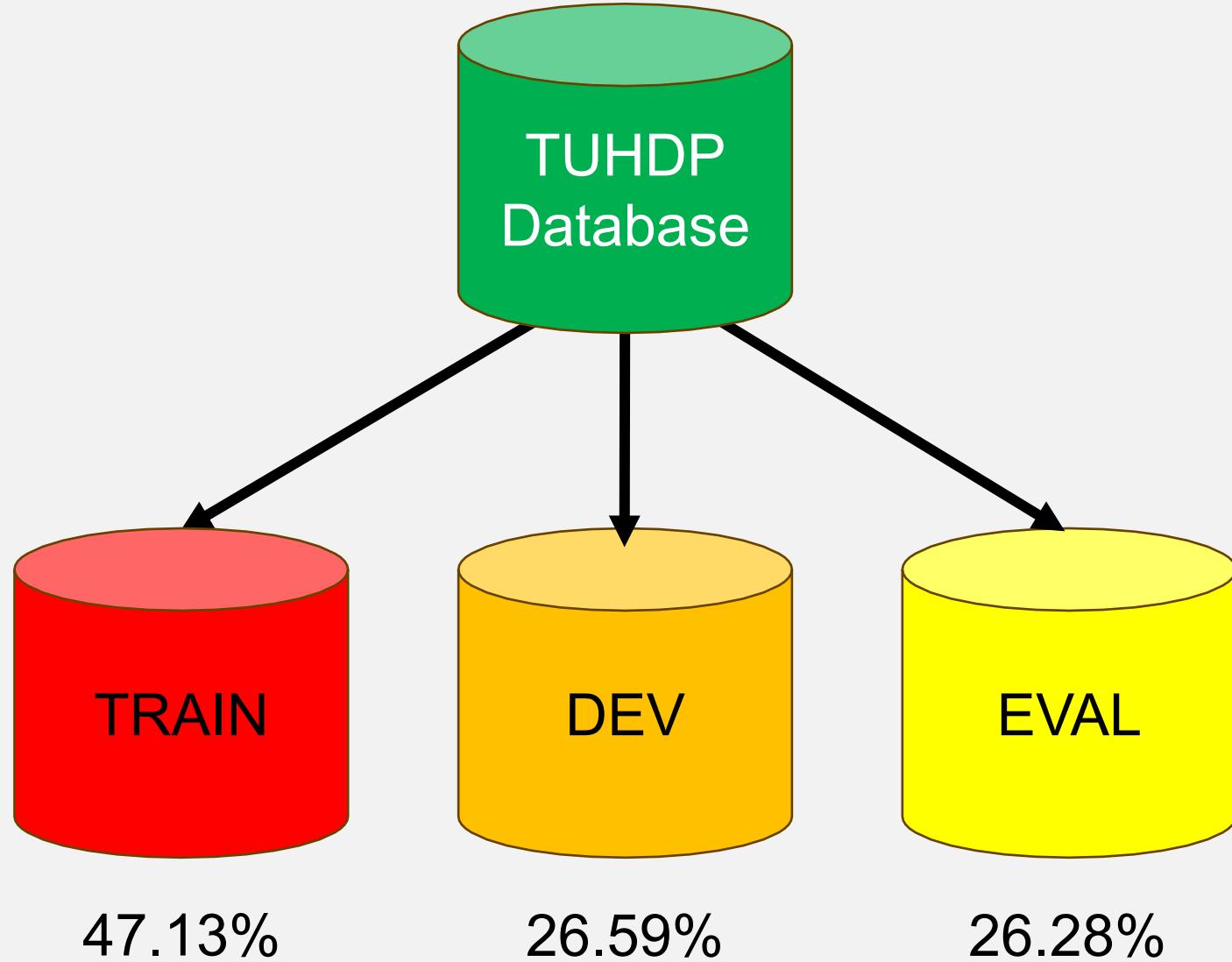


PRELIMINARY DESIGN

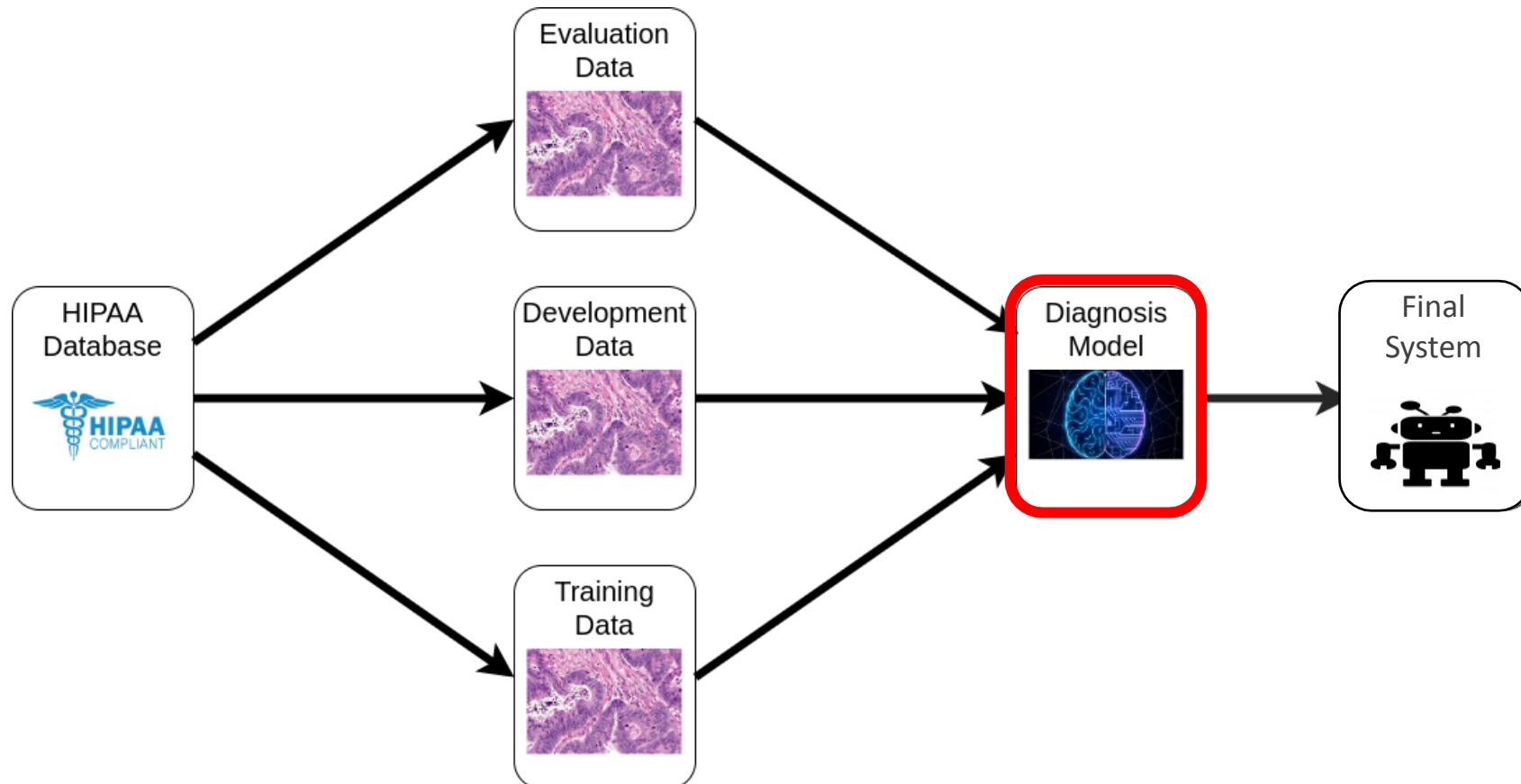


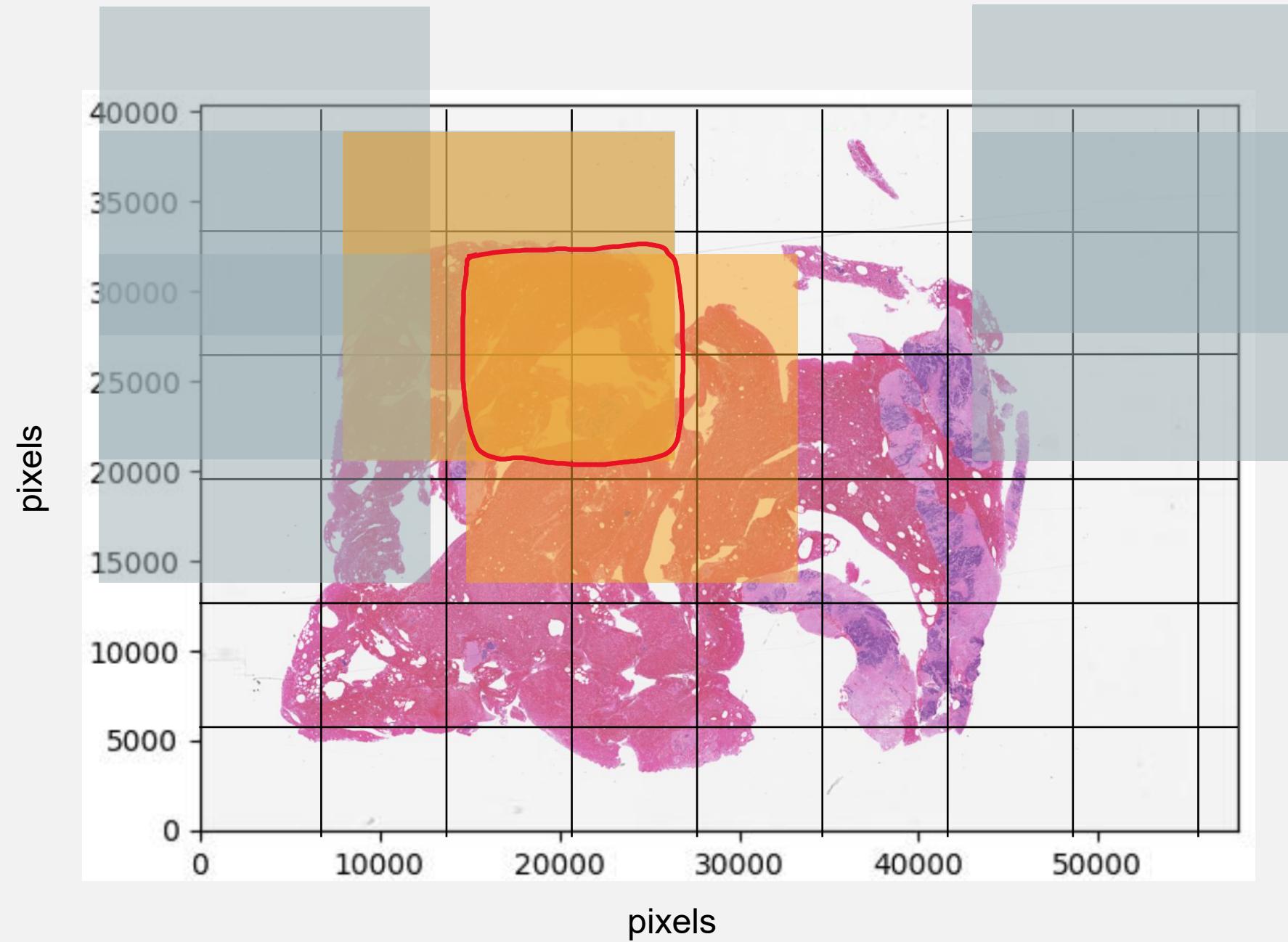
TEMPLE UNIVERSITY HEALTH DIGITAL PATHOLOGY CORPUS

3,505 Tissue Images 1.23 Terabytes

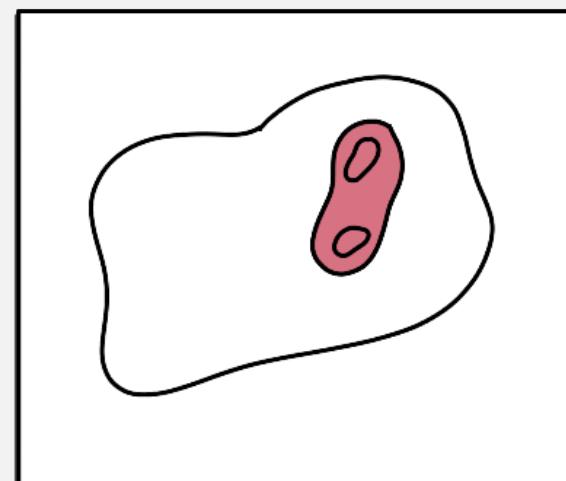
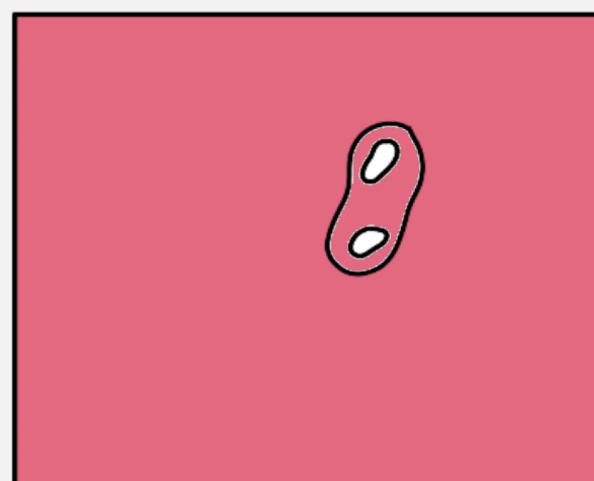
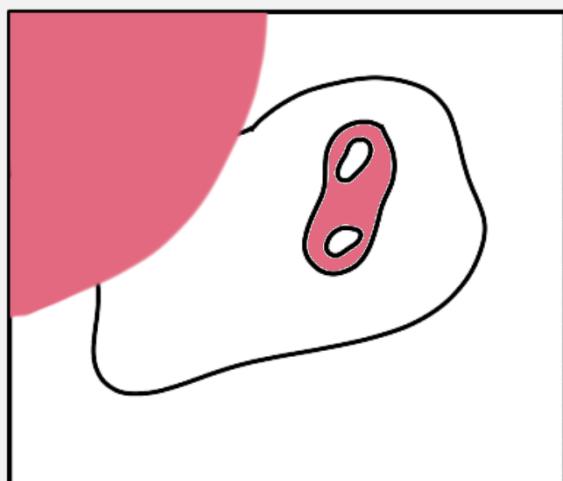
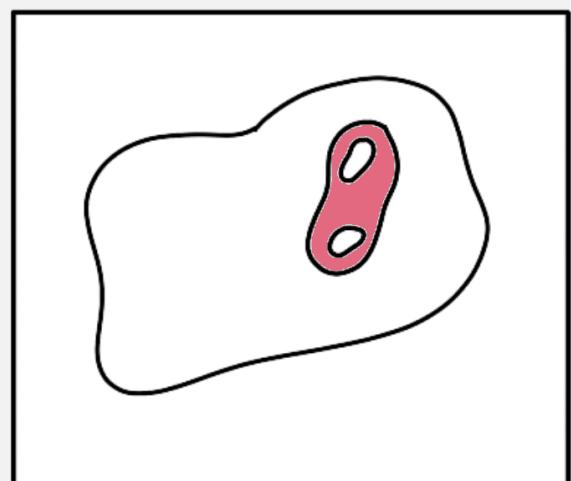


PROTOTYPE



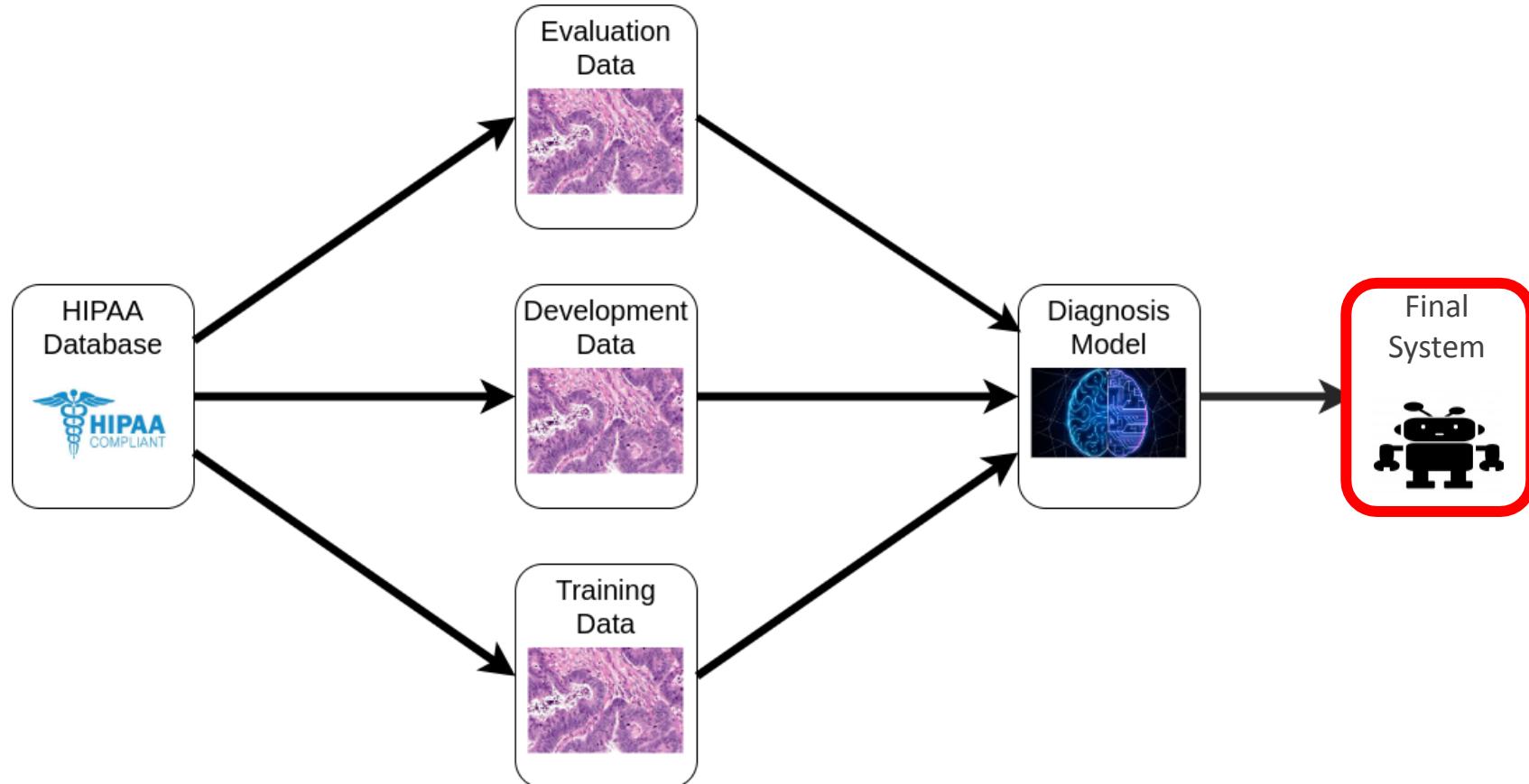


WINDOW TO PATCH



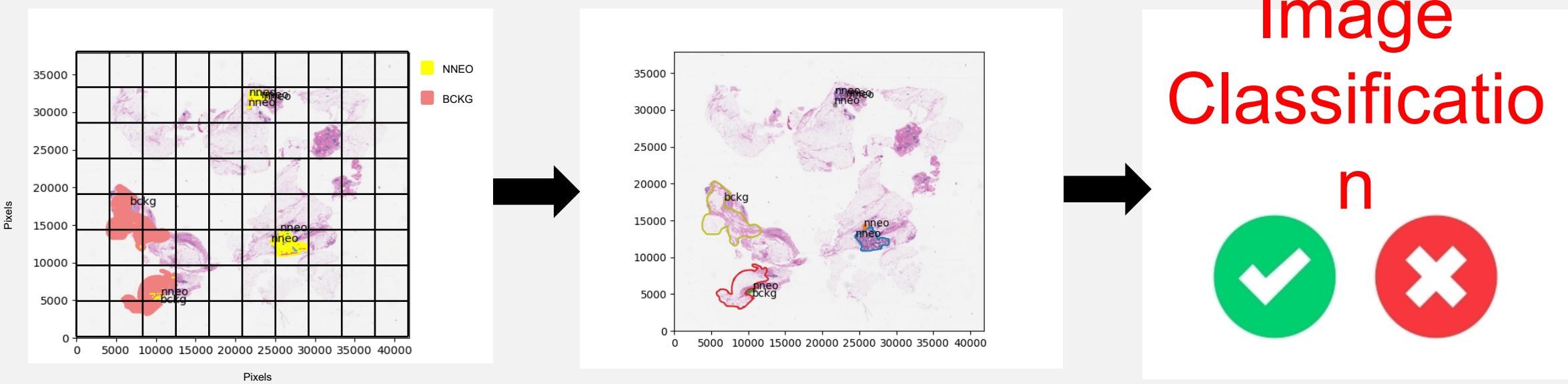
PATCH TO IMAGE LEVEL

PROTOTYPE



TESTING GOALS

FUTURE WORK



FILTERS

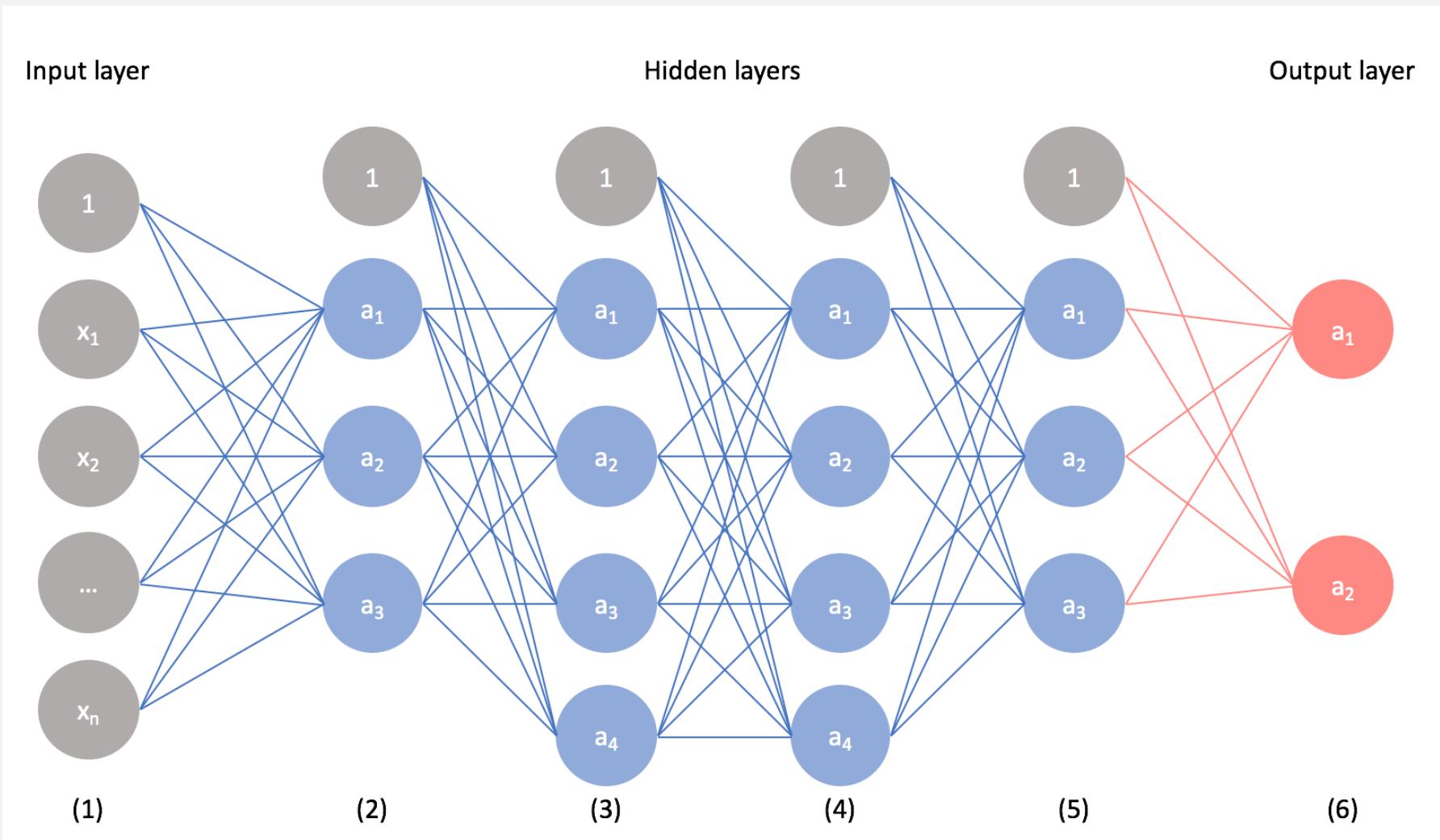


Original image



Filter “Laplace” applied

CONVOLUTIONAL NEURAL NETWORK



QUESTIONS?

Acknowledgements:

Dr. Joseph Picone – Mentor & Data Coordinator

Claudia Dumitrescu – AI Expert

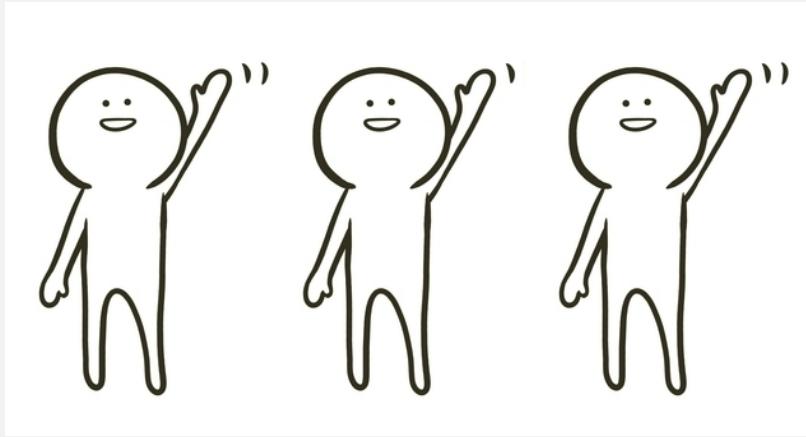
Phuykong Meng – Image Segmentation & GUI Planning

Hemanth Kamana – Model Scoring & Evaluation

For the curious

- [Benefits of Machine Learning in Healthcare](#)
- [Machine Learning in Healthcare](#)
- [What is Machine Learning in Healthcare?](#)
- [Significance of Machine Learning in Healthcare](#)
- [The Potential for Artificial Intelligence in Healthcare](#)

The Team



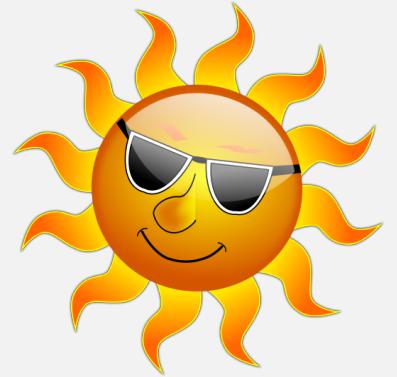
The SD
Team



The ML Expert



The
Tester



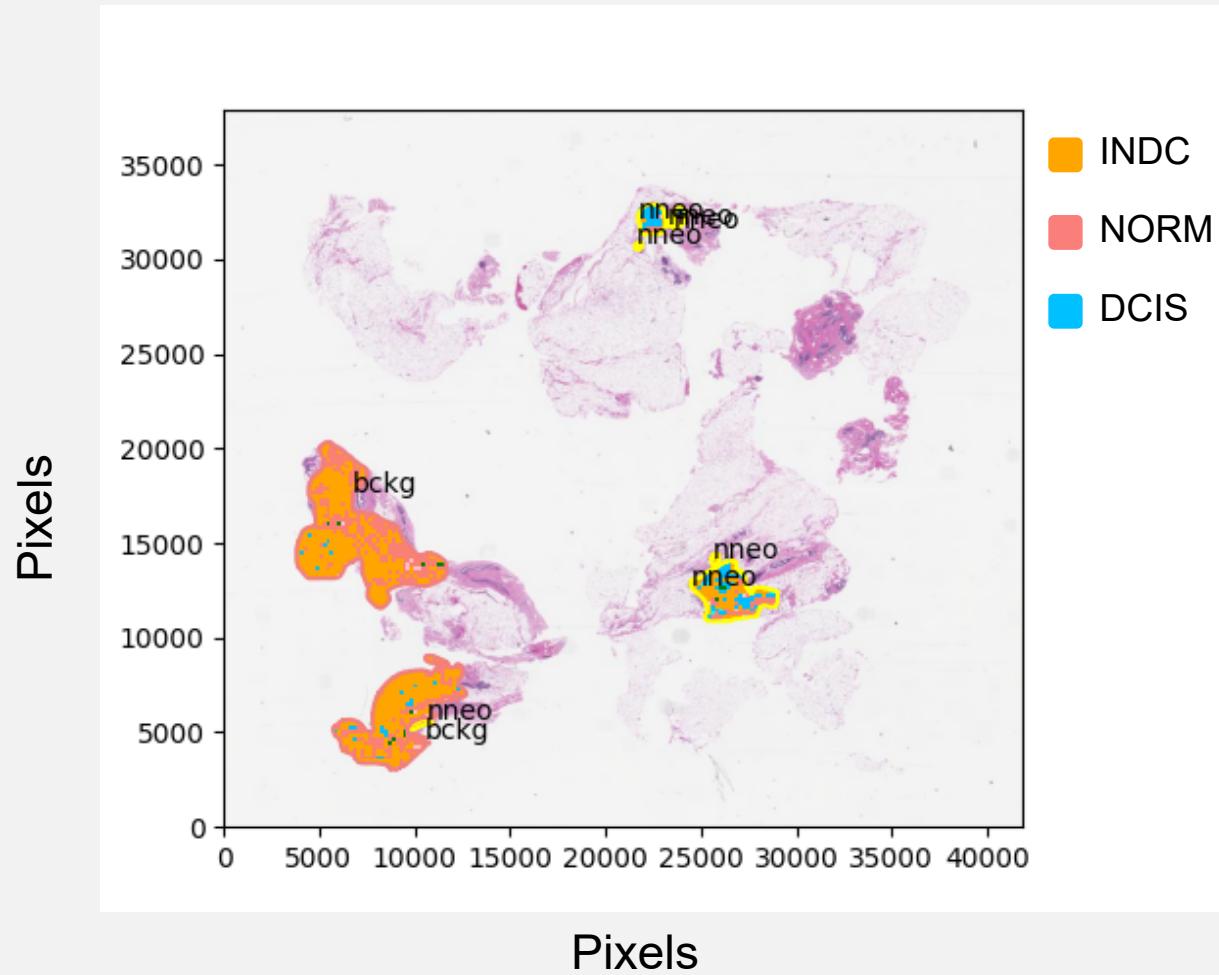
The "Other?" Guy

I don't know what he does but he's good at python

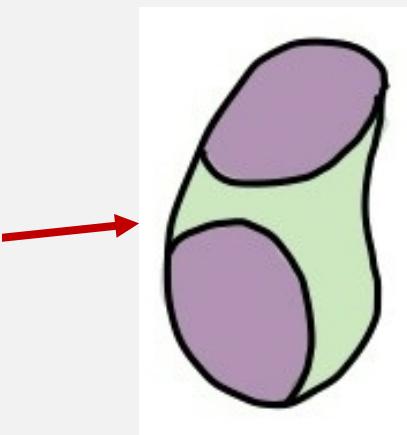
FRAME LEVEL EVALUATION RESULTS

	Dataset	Accuracy Rate [%]
Random Forest	TRAIN	100.00
	DEV	86.33
	EVAL	85.87

QDA DECISION SURFACES



EXPLAIN WINDOW TO PATCH

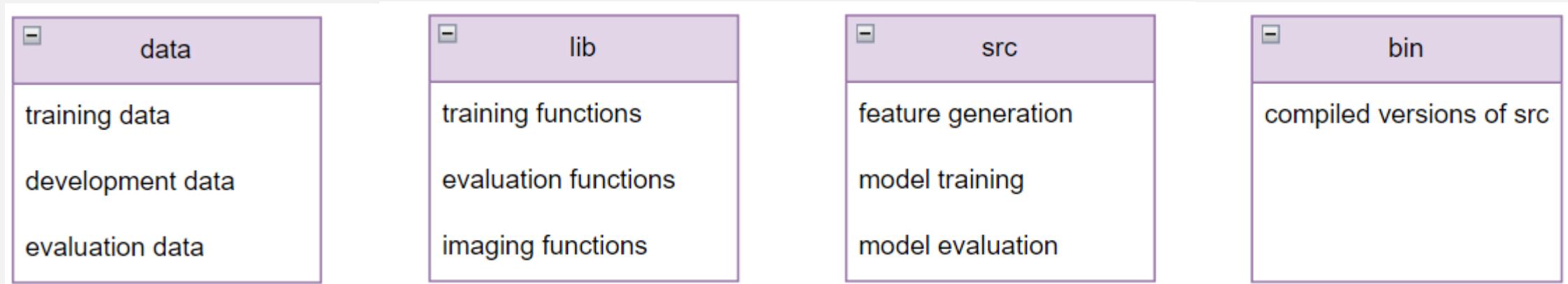


$\geq 30\%$ cancerous
then patch is a cancerous type

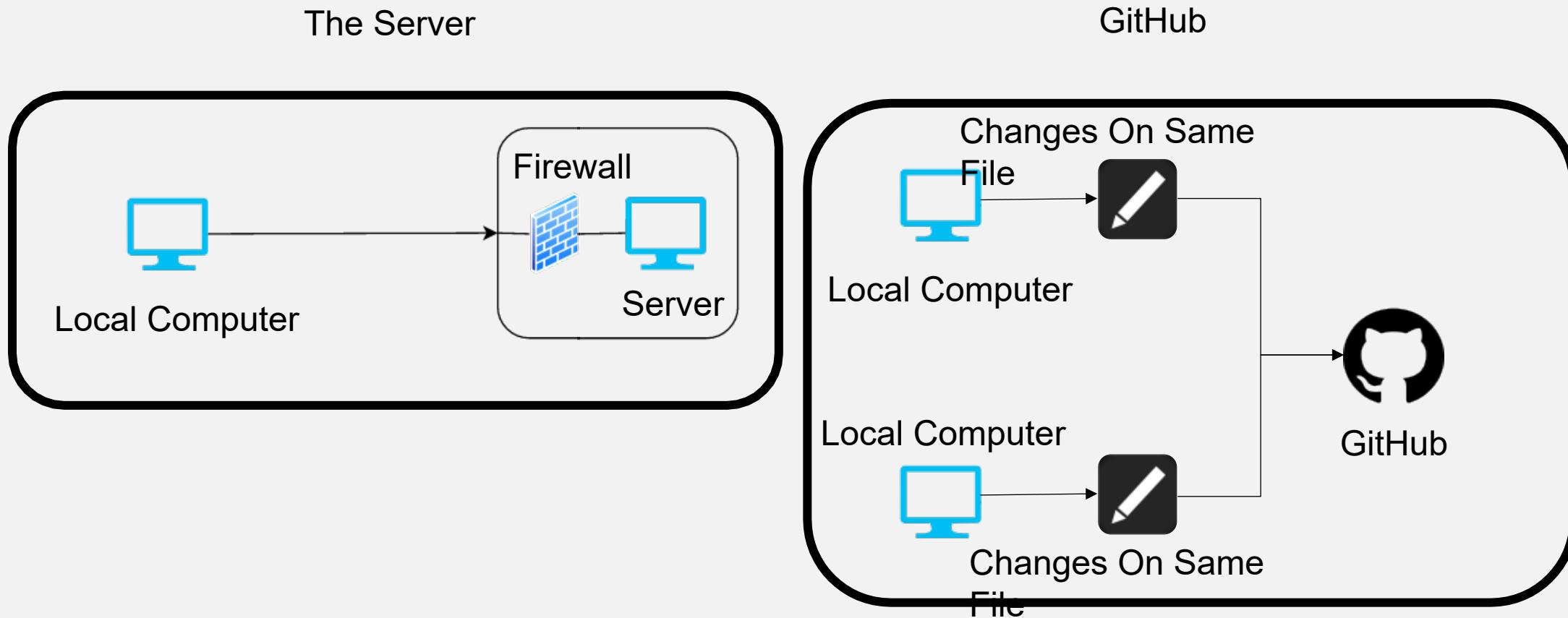
$\geq 50\%$ carcinogenic signs
then patch indicates concern

Otherwise, noncancerous type

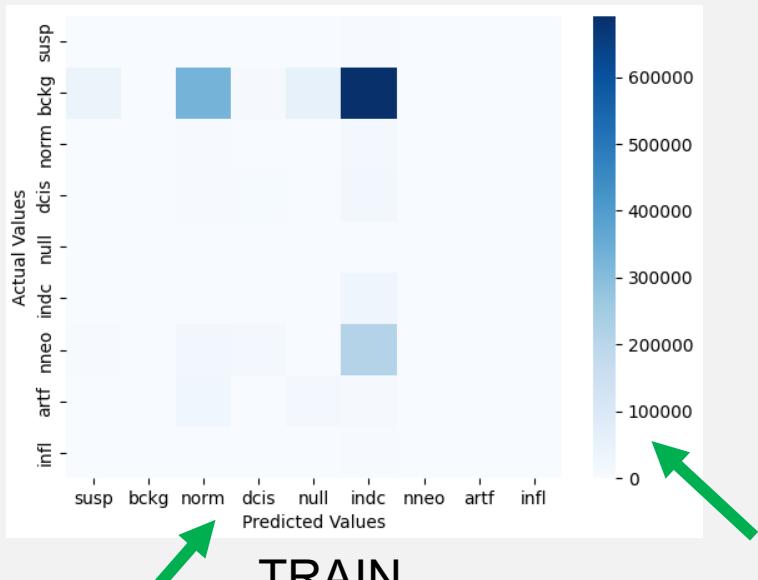
SOFTWARE ARCHITECTURE



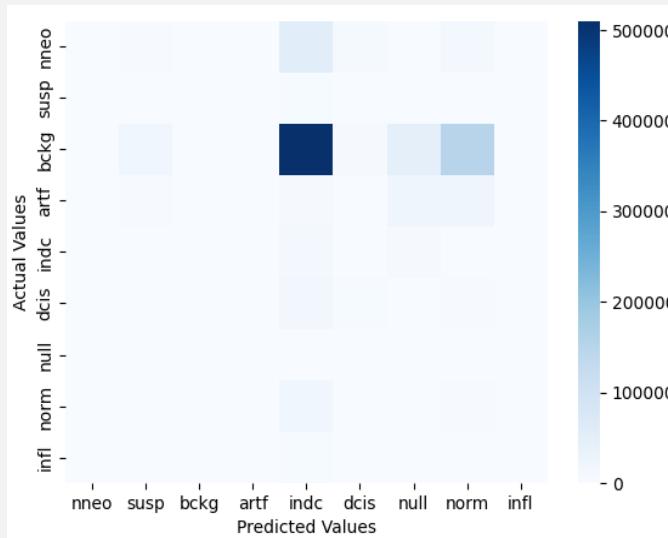
GITHUB AND THE SERVER



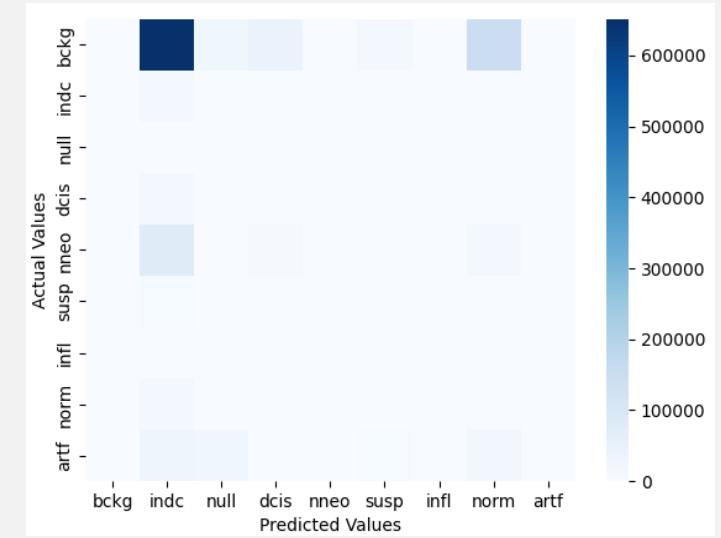
QDA CONFUSION MATRIX



TRAIN

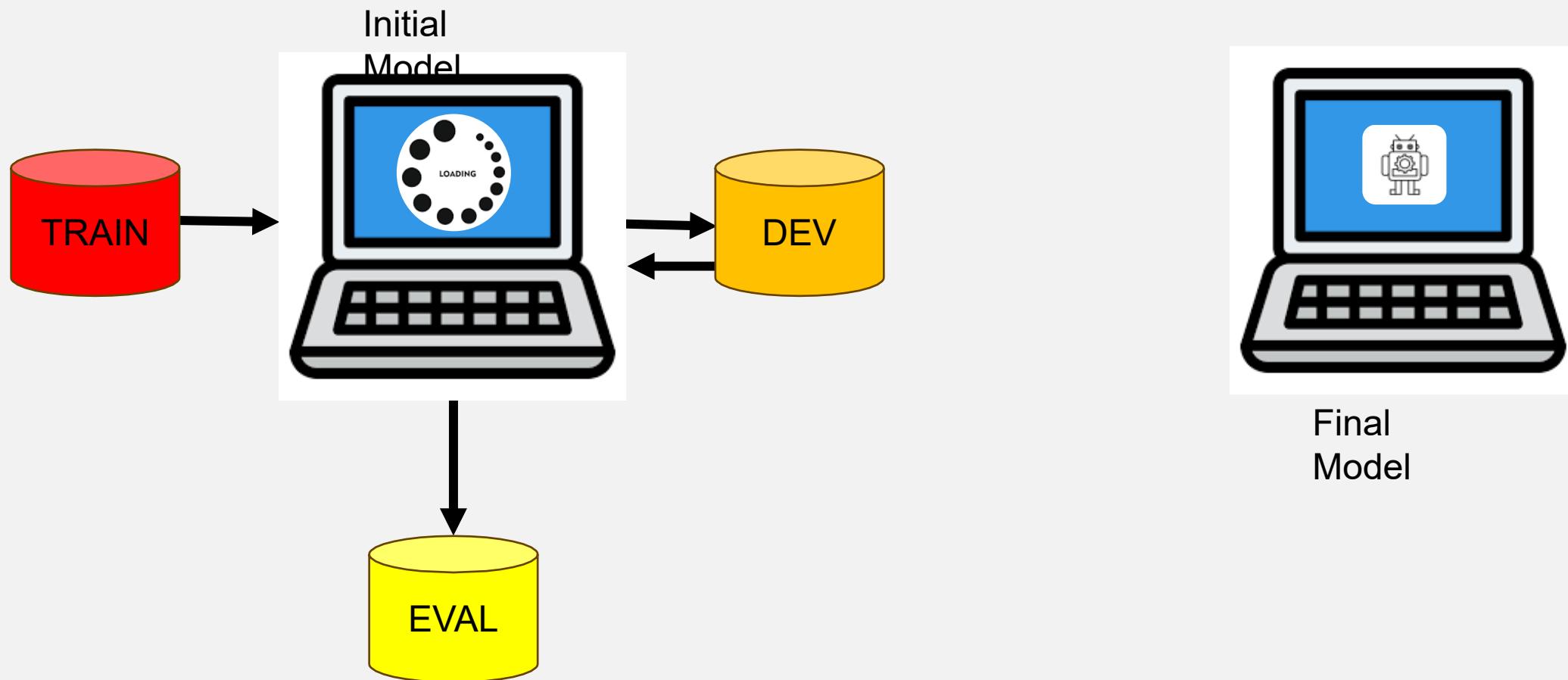


DEV

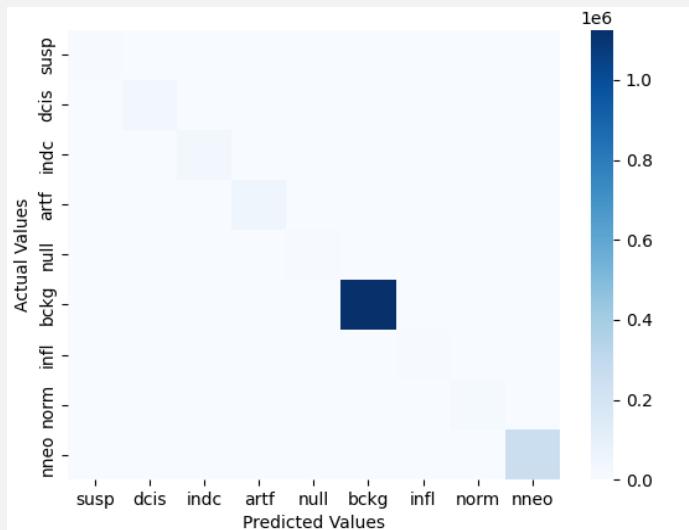


EVAL

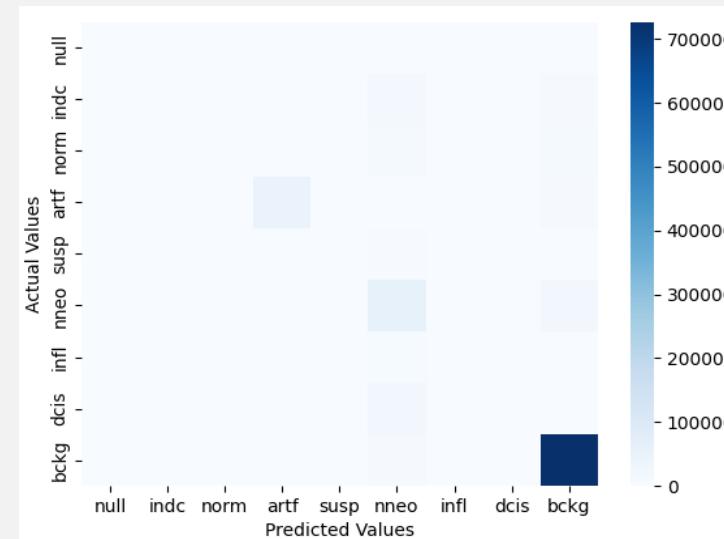
EXPLAIN TRAIN, DEV, AND EVAL IN THE PROCESS



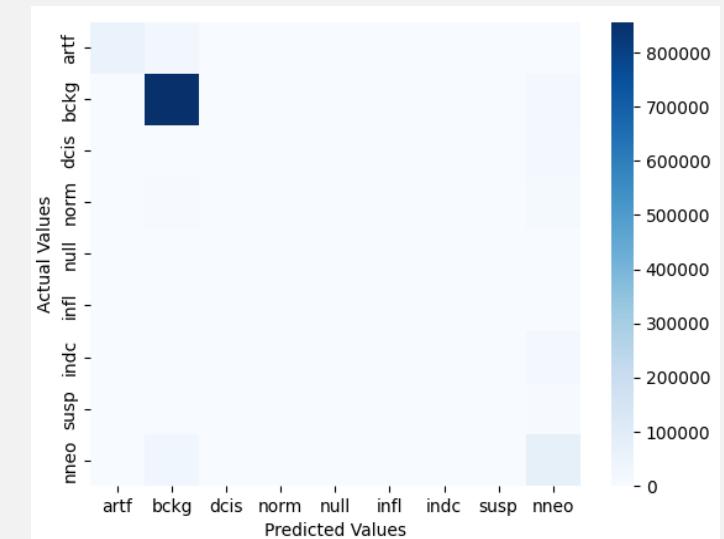
RNF CONFUSION MATRIX



TRAIN



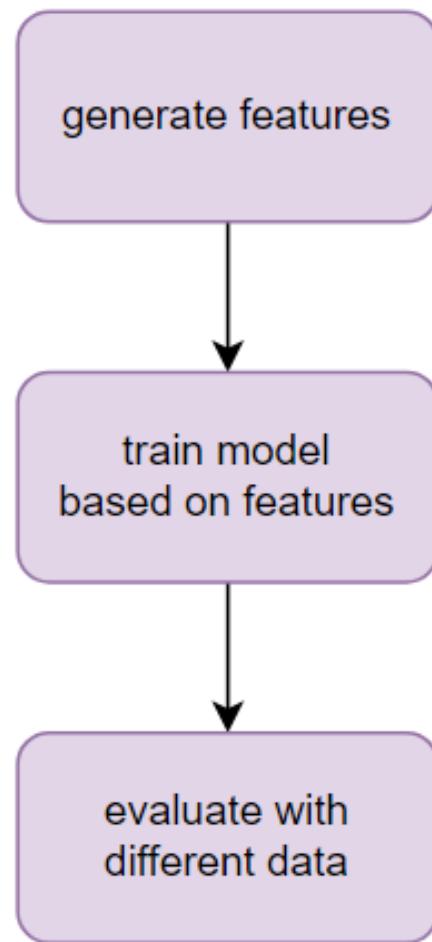
DEV



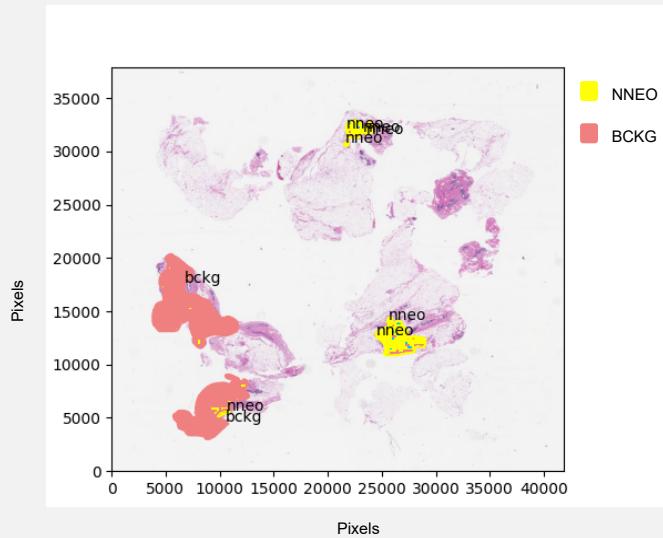
EVAL

END

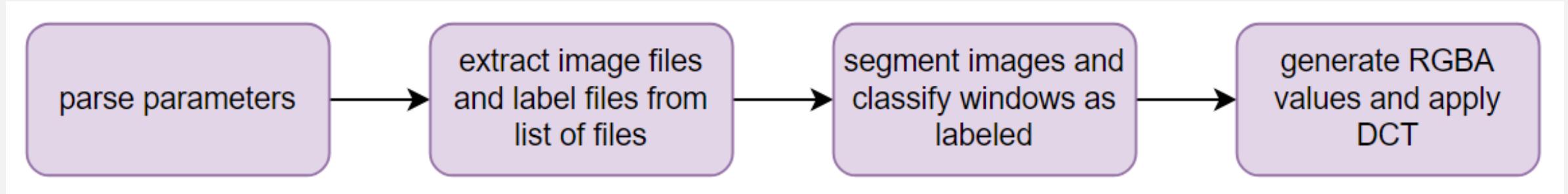
PLANNING AND PROTOTYPING



RNF DECISION SURFACES



CONVERT IMAGES TO FEATURES



LIBRARIES USED

Python Libraries

scipy

shapely

joblib

sklearn

Nedc Library

cmdl_parser

image_tools

ann_dpath_tools

nedc_file_tools

TESTING

