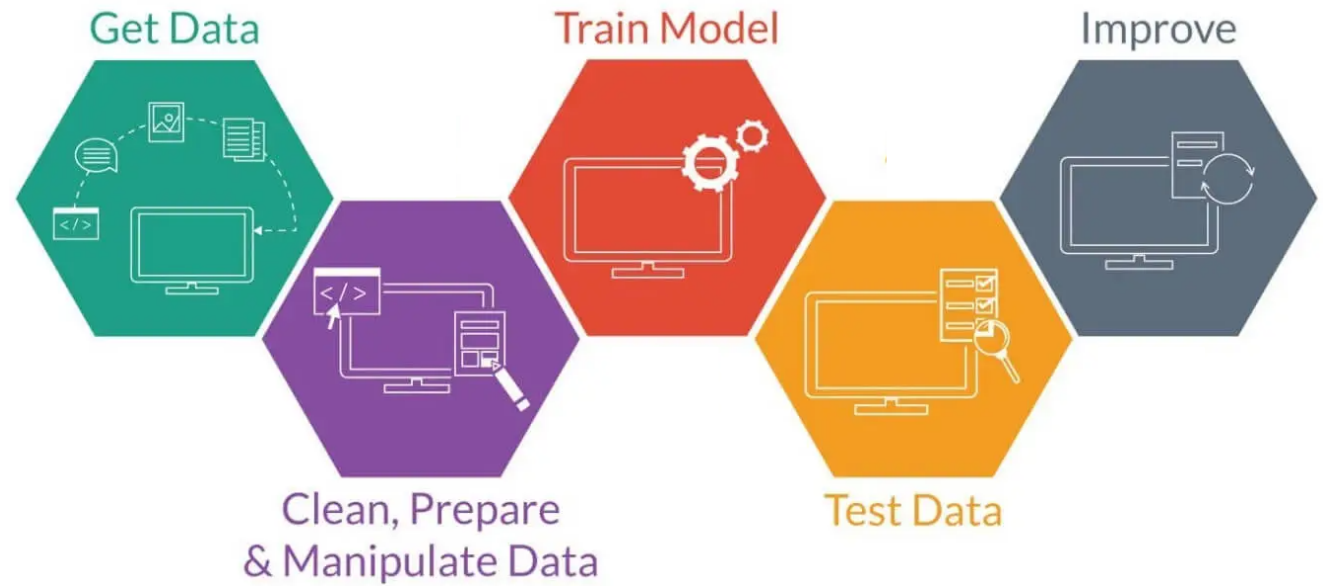


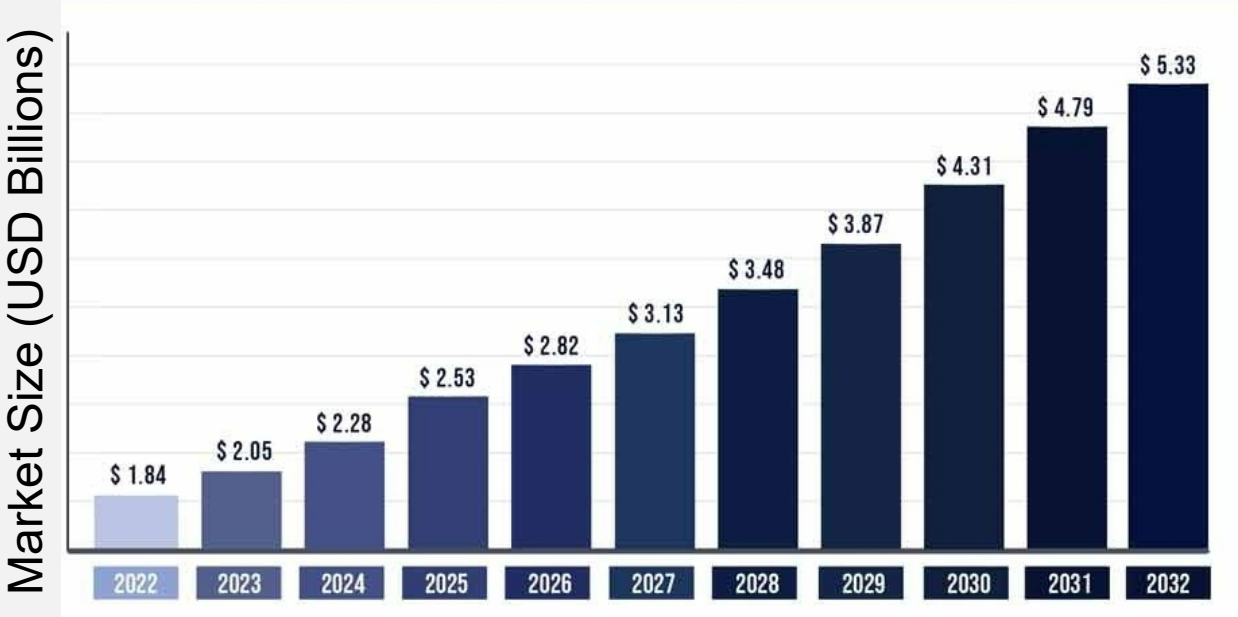
ML IN DIGITAL PATHOLOGY

Yuan Nghiem
Leo Grant Berman
Albert Bulik



PROBLEM STATEMENT

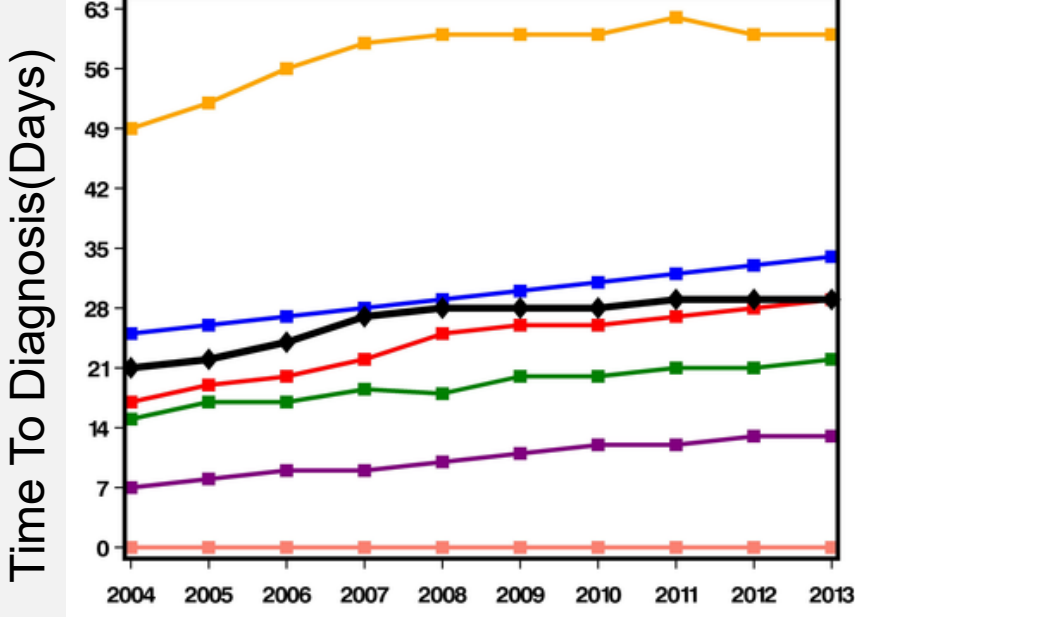
The demand for cancer diagnosis is increasing.



YEAR (2022 to 2032)

[SOURCE](#)

As a result, time to treatment is increasing.

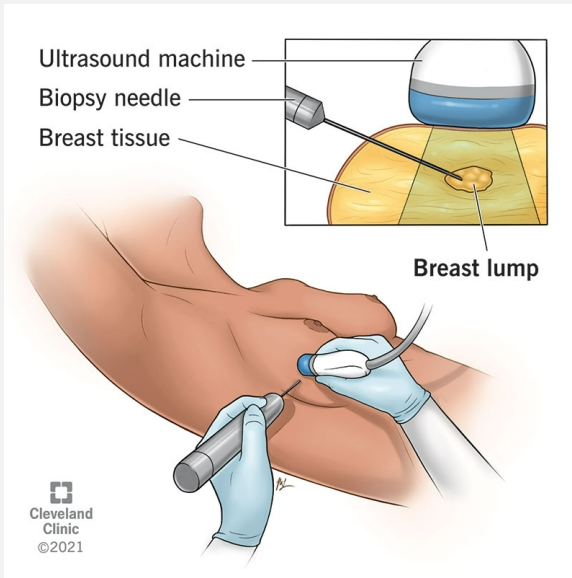


DIAGNOSIS YEAR (2004 to 2013)

[SOURCE](#)

TEMPLE UNIVERSITY HEALTH DIGITAL PATHOLOGY (TUHDP) CORPUS

Biopsy



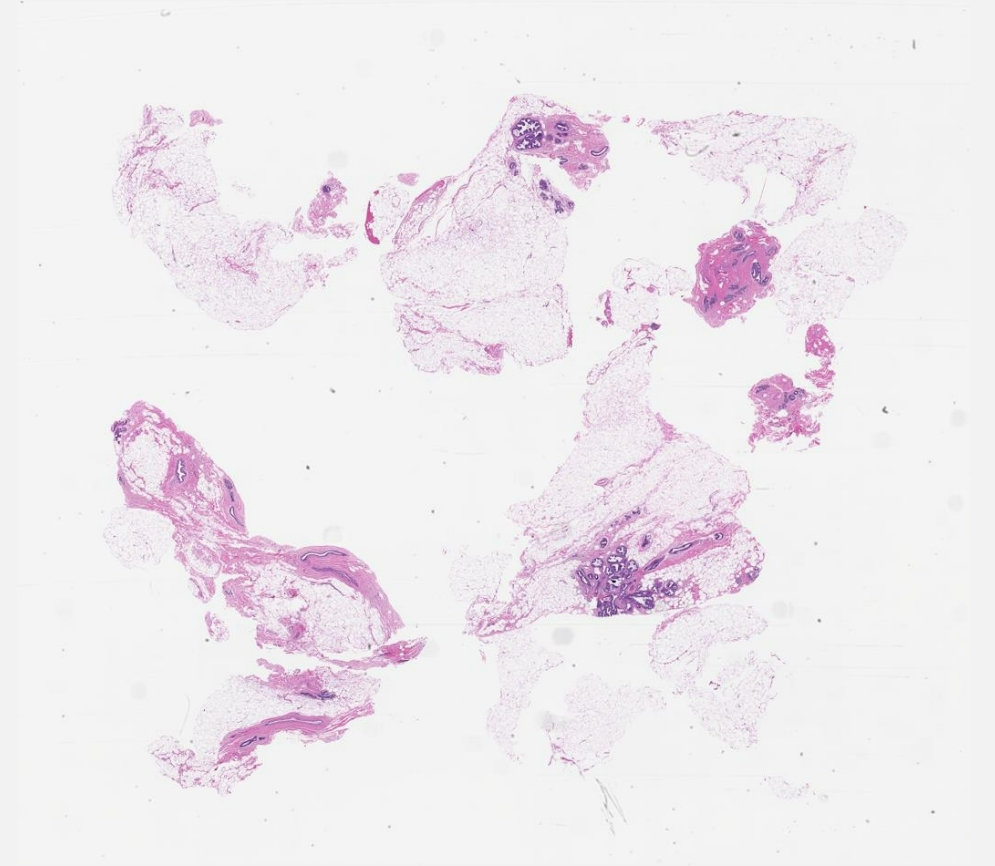
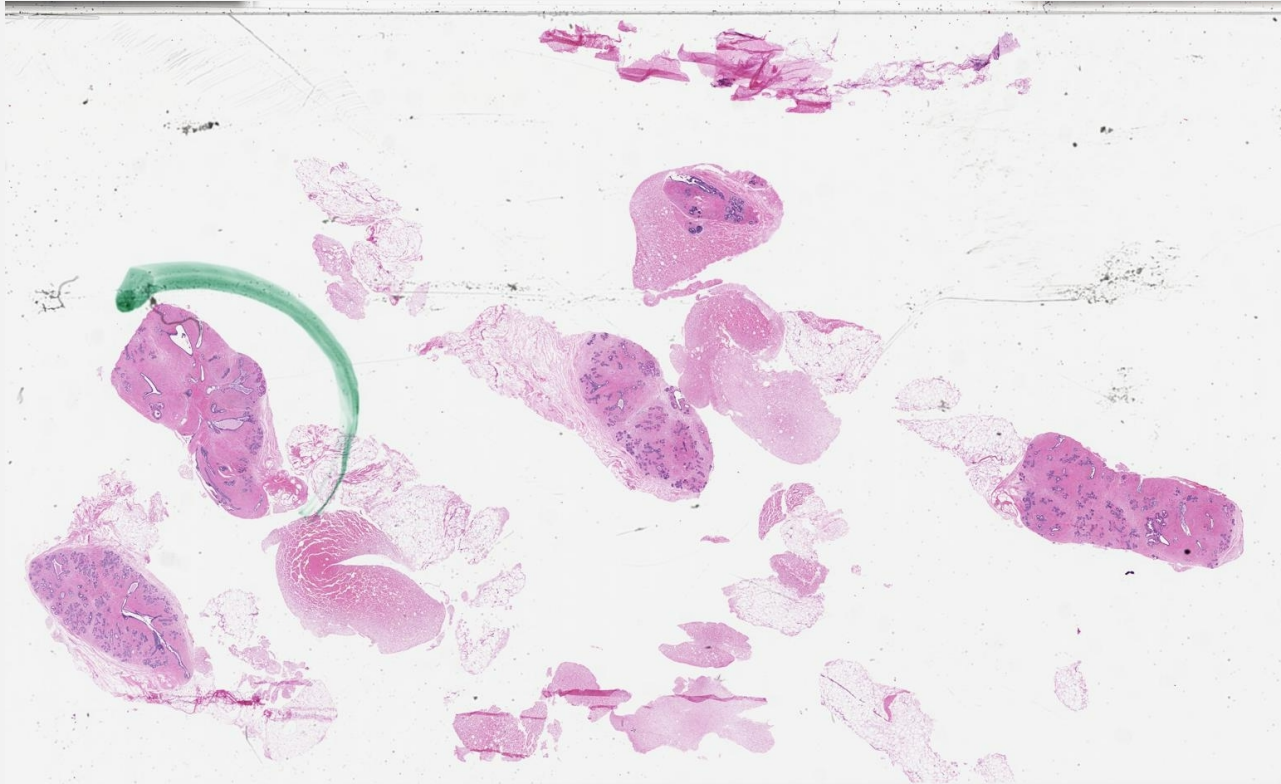
Staining



Scanning

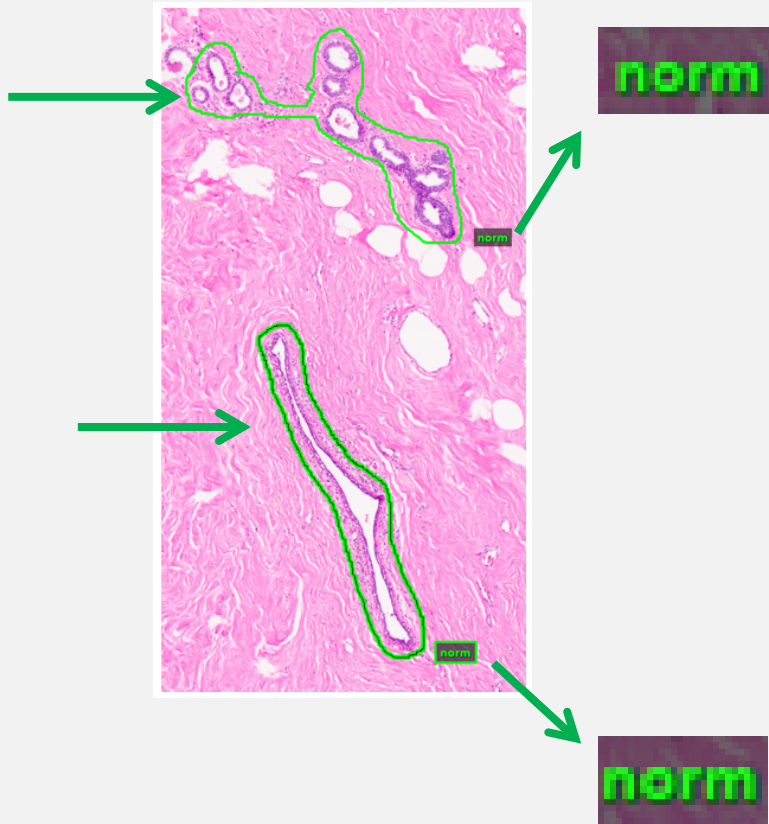


TUHDP BIOPSY SLIDE SAMPLE

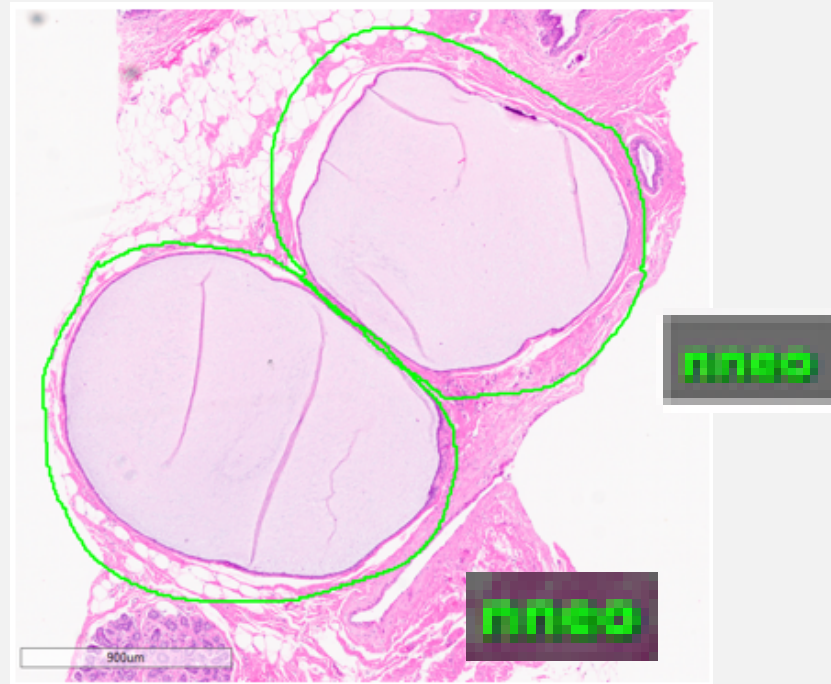


LABELED DATA TYPES

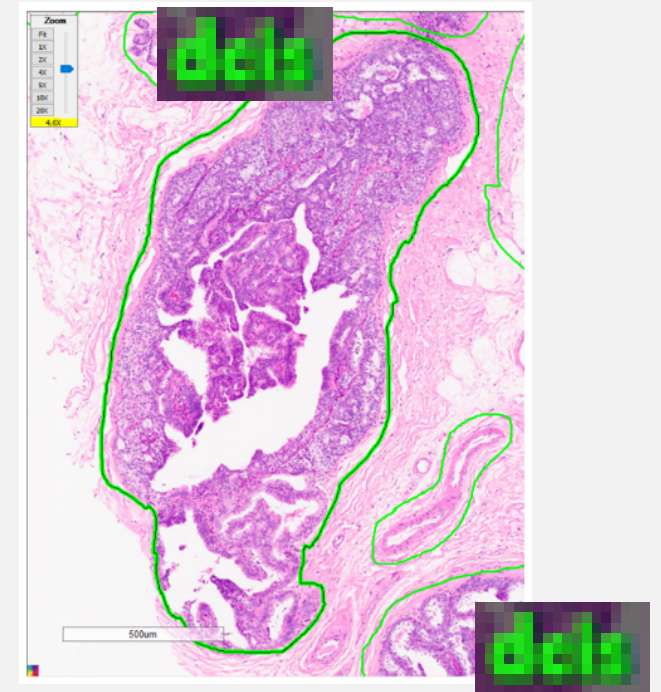
Non-Cancerous Types



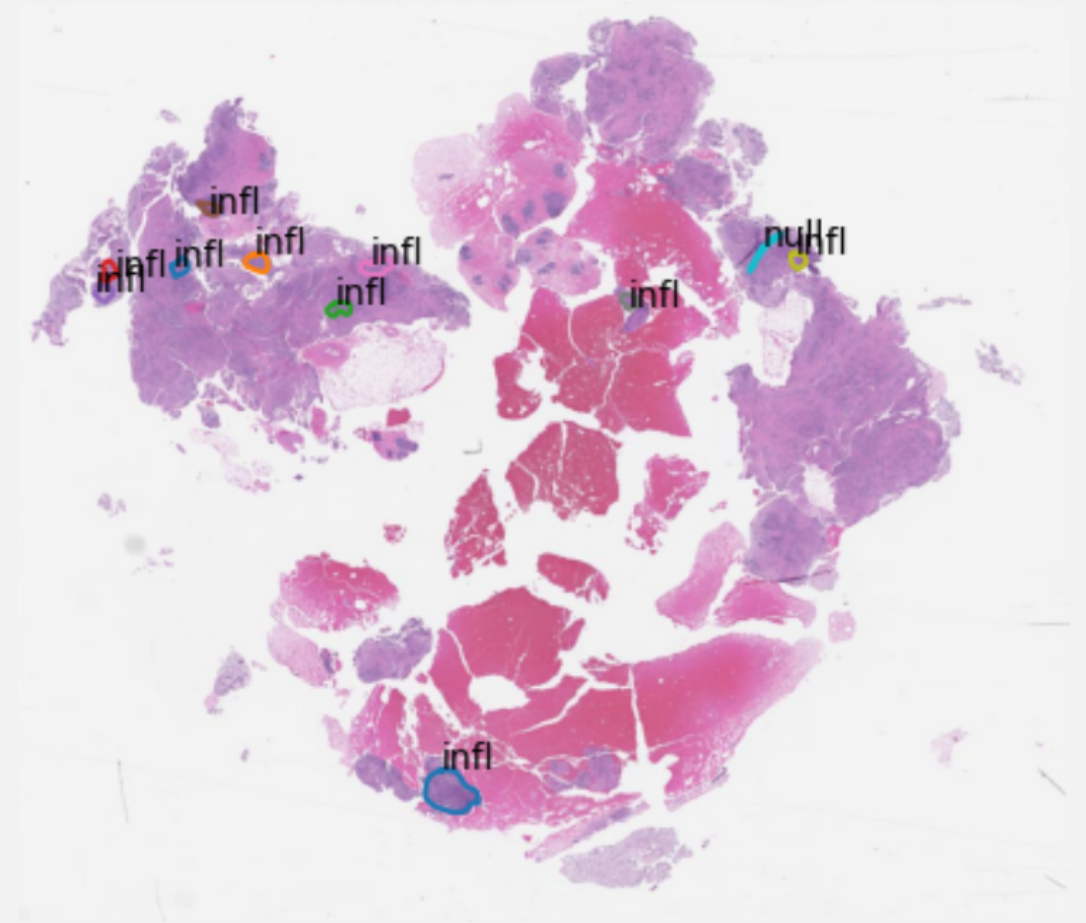
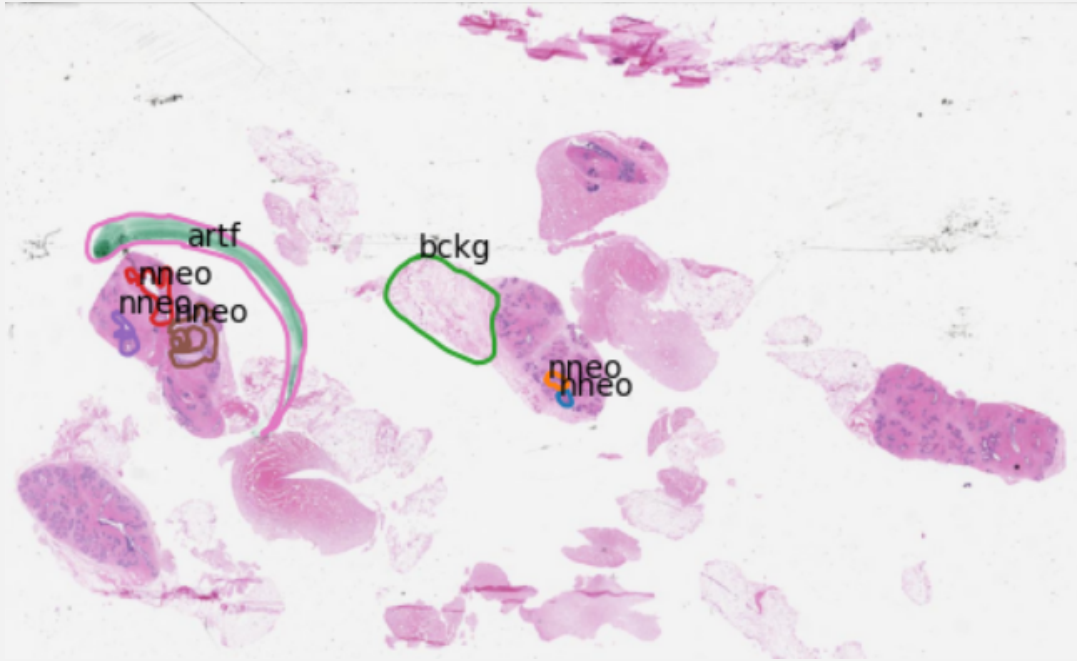
Carcinogenic-Signs Type



Cancerous Types



TUHDP BIOPSY SLIDE SAMPLE

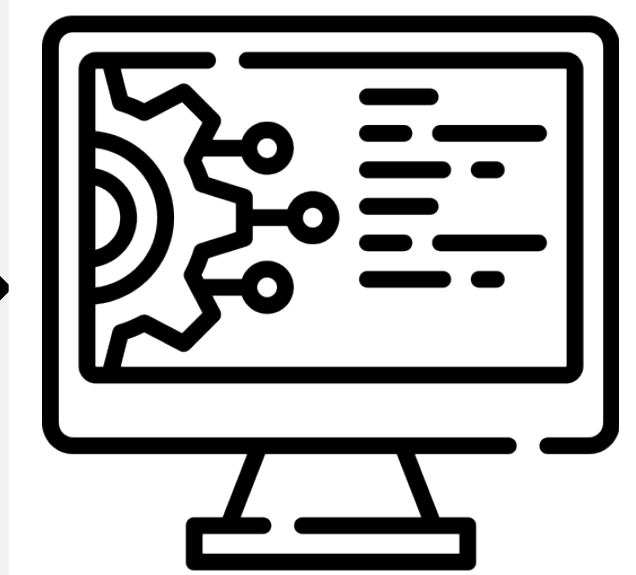


OUR PRODUCT

Scanning



System



Prediction Report

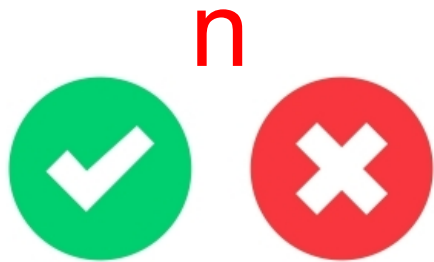


HOW THIS FITS



DESIGN CRITERIA / REQUIREMENTS

Image Classificatio



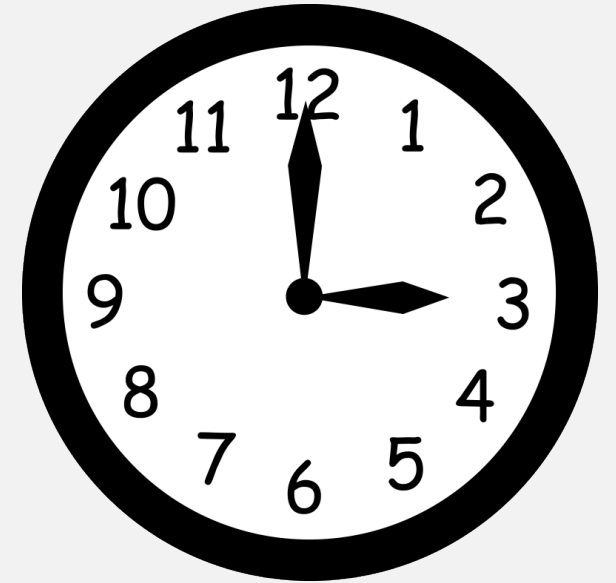
Whole Slide Image
Classification

[Source](#)



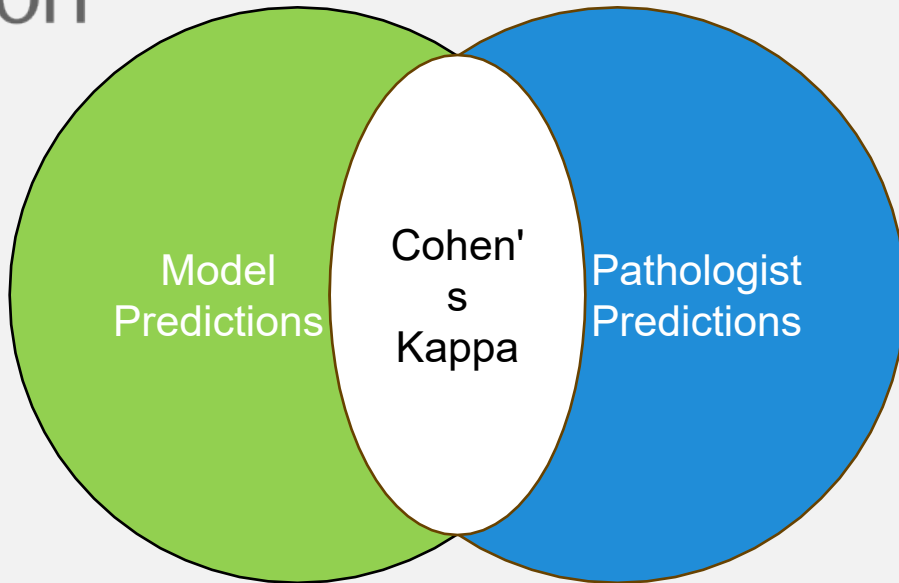
Functional GUI

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

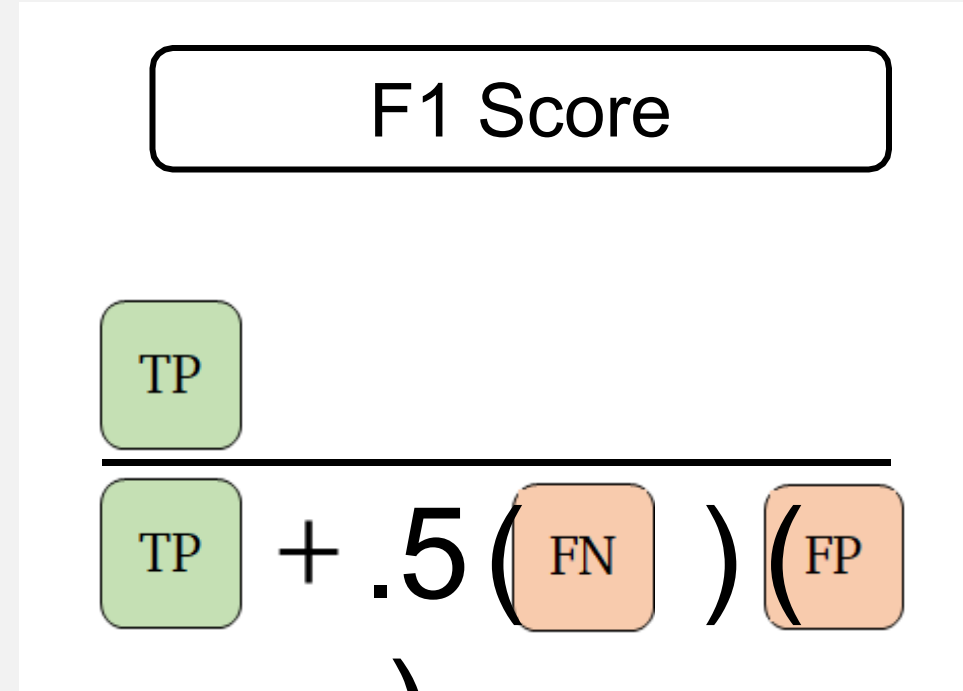


Train Time < 3 Days

DESIGN CRITERIA / REQUIREMENTS

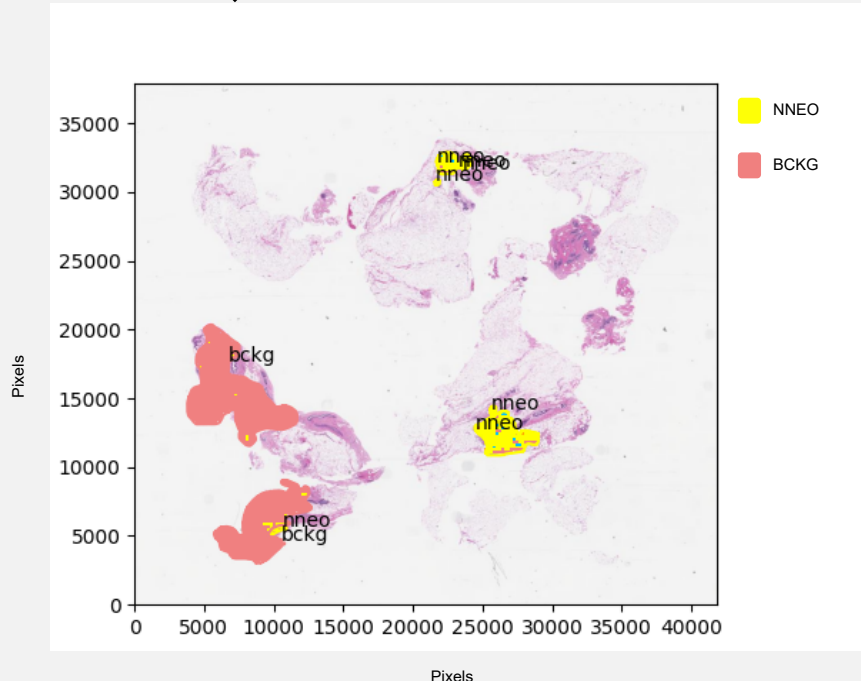
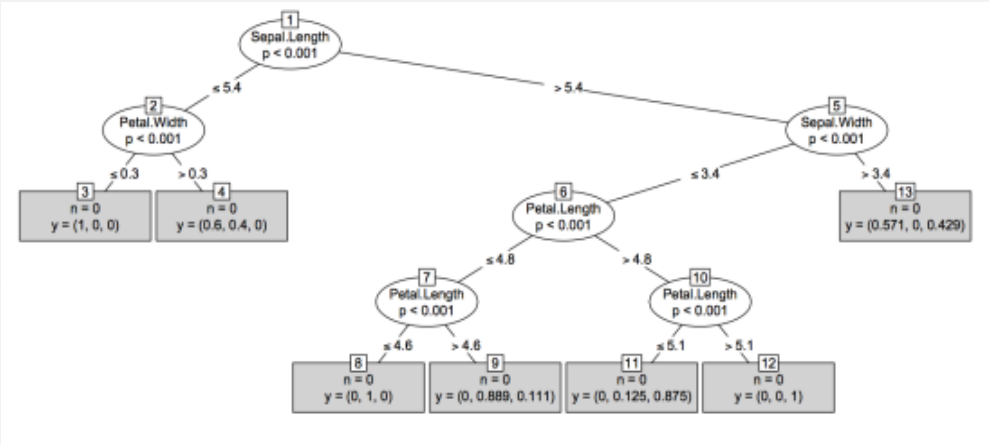
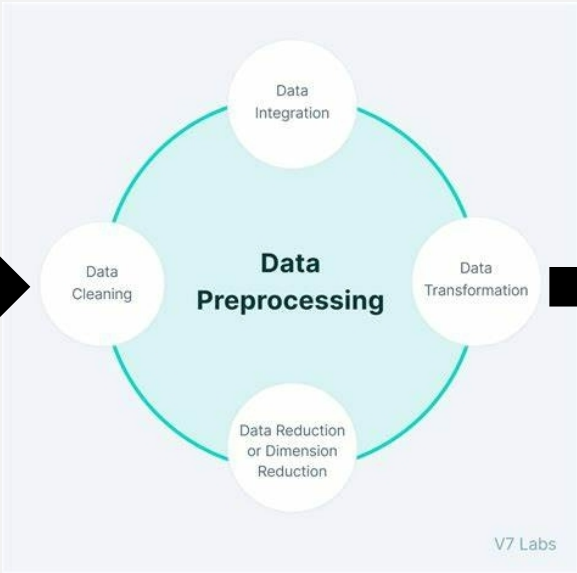
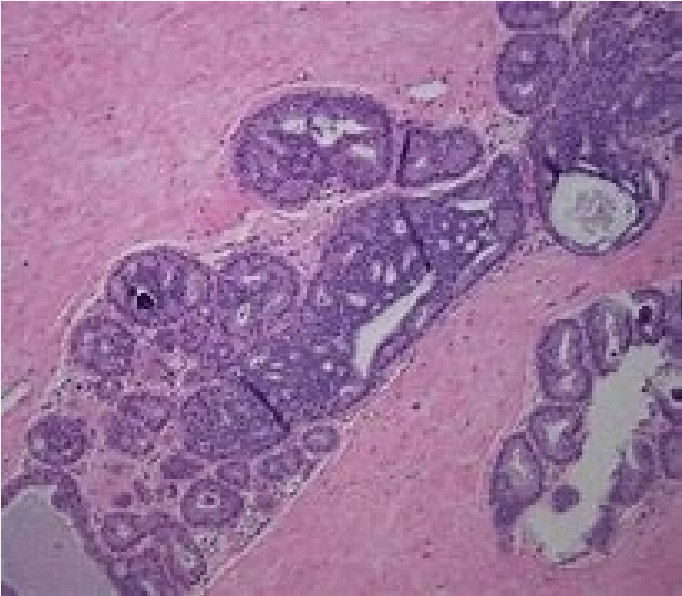


Cohen's Kappa > 80%
[Source](#)



F1 Score > 95%
[Source](#)

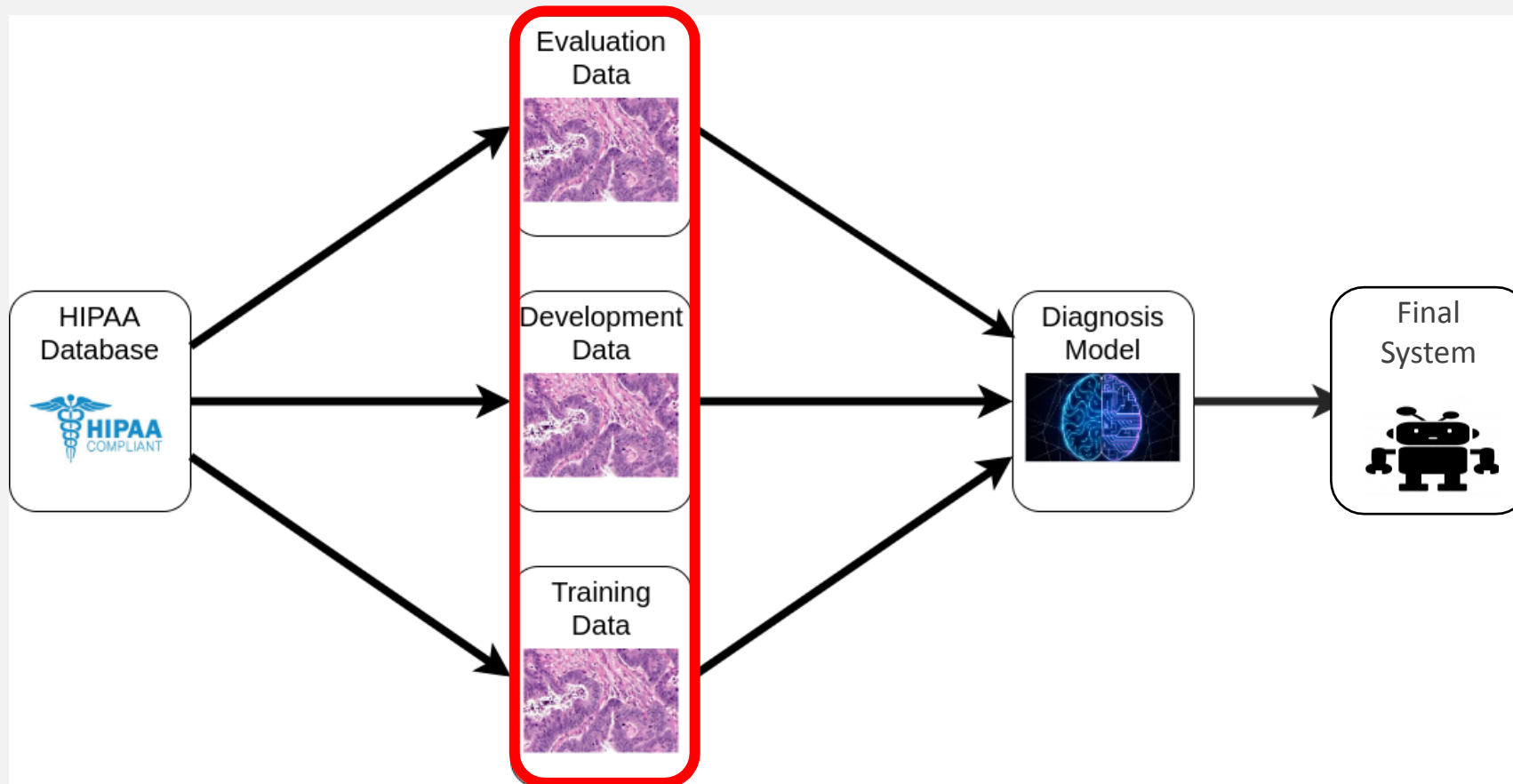
DEEPER LOOK AT PROGRAM I/O



PRELIMINARY DESIGN



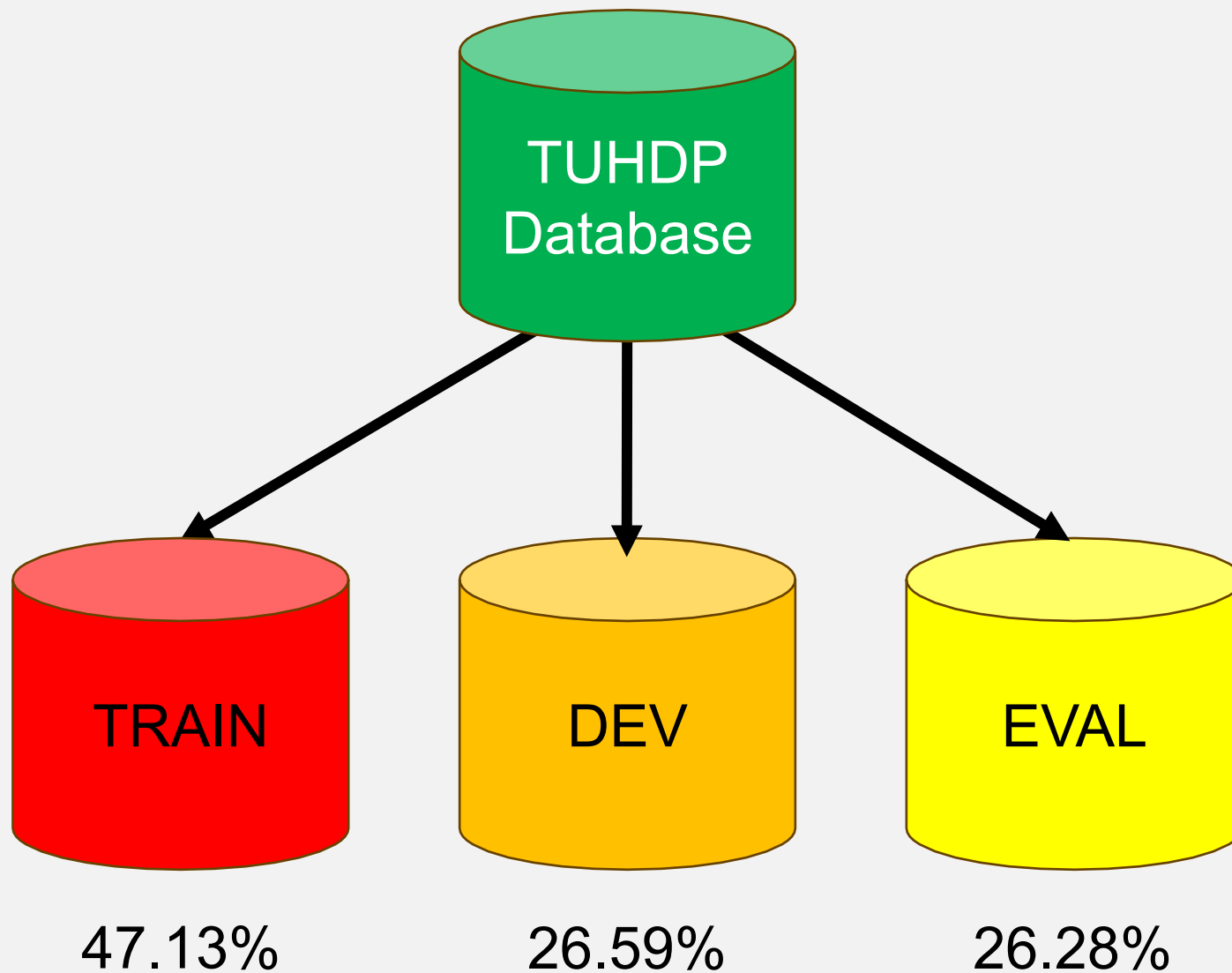
PRELIMINARY DESIGN



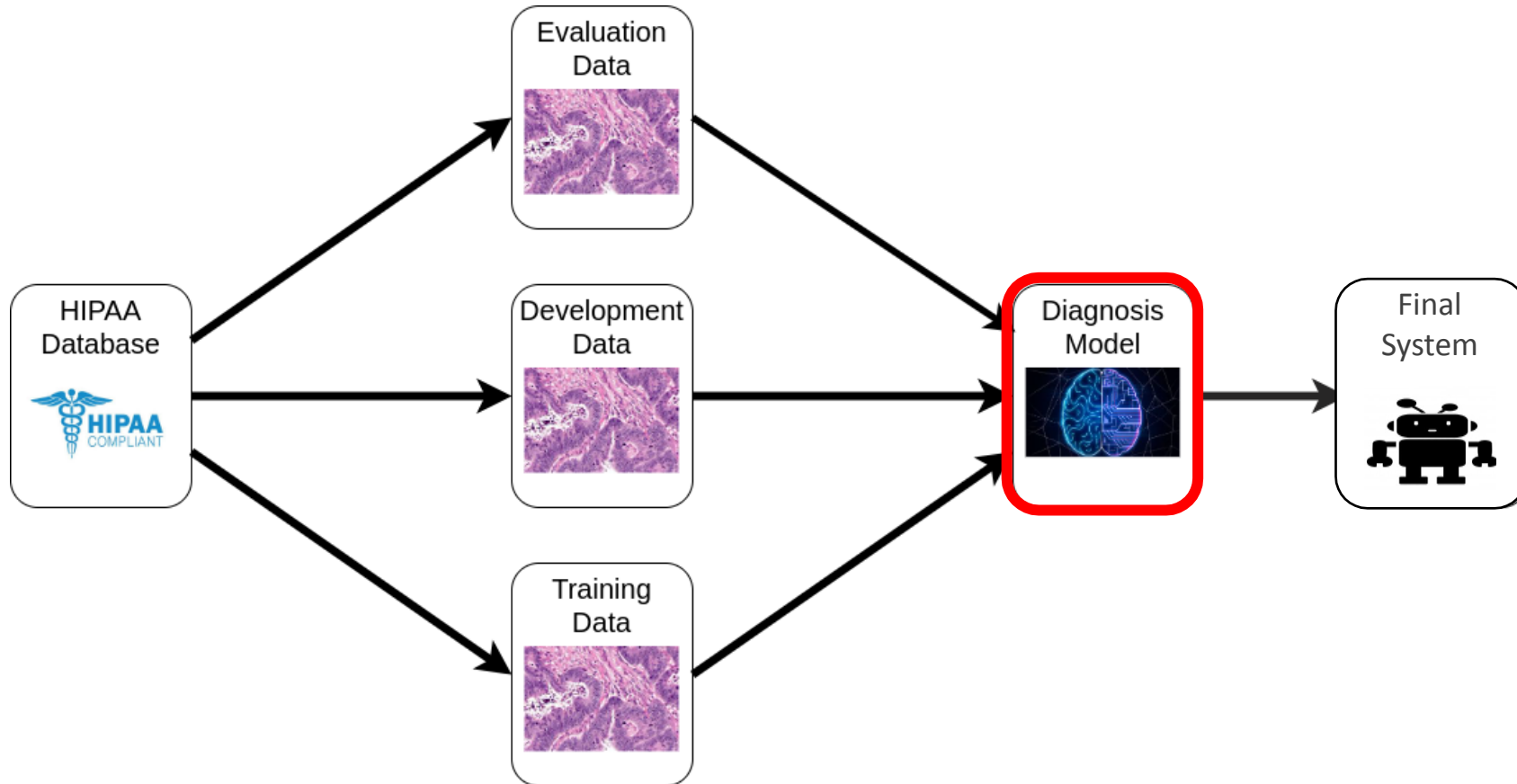
TEMPLE UNIVERSITY HEALTH DIGITAL PATHOLOGY CORPUS

3,505 Tissue Images

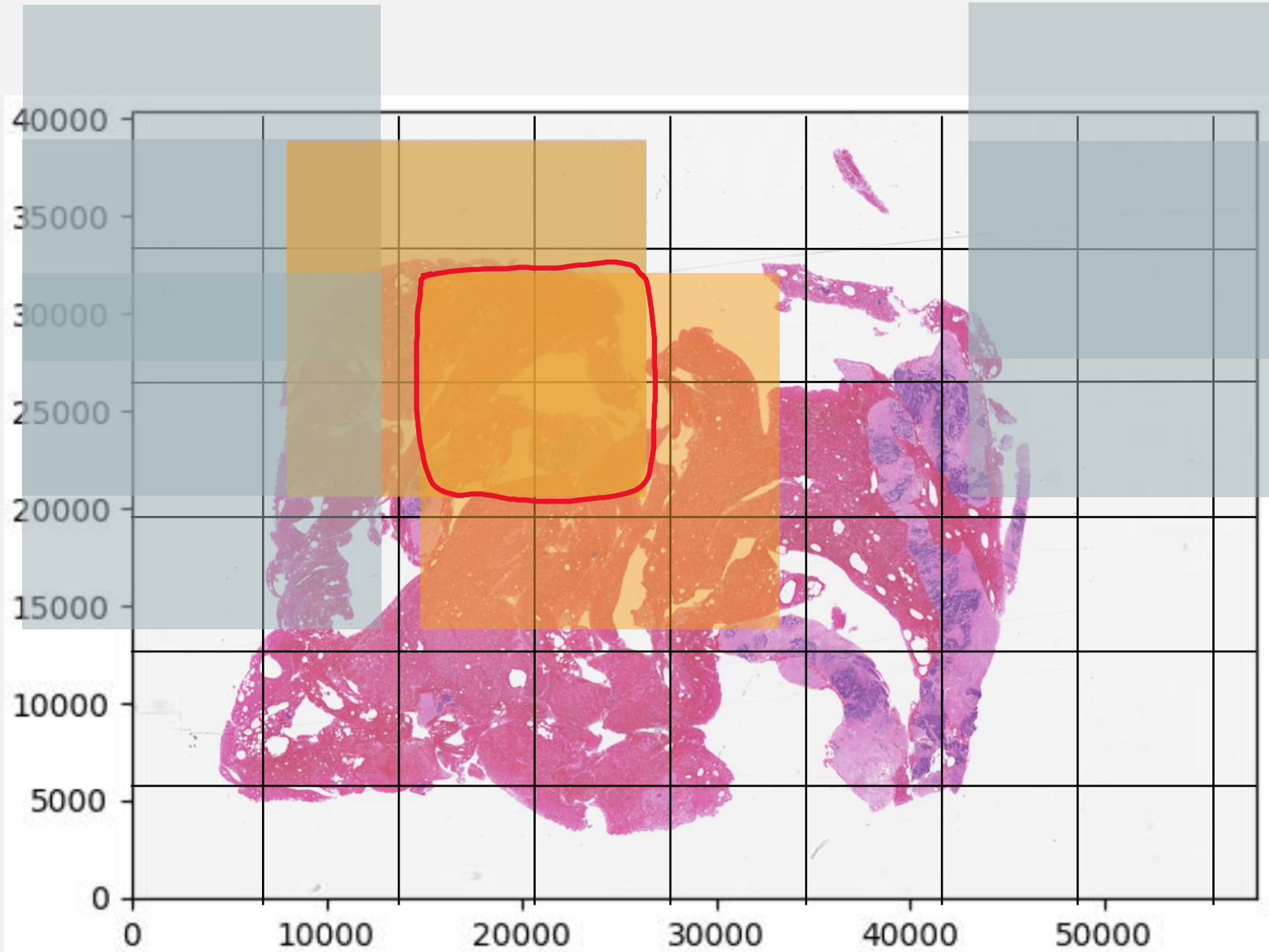
1.23 Terabytes



PROTOTYPE

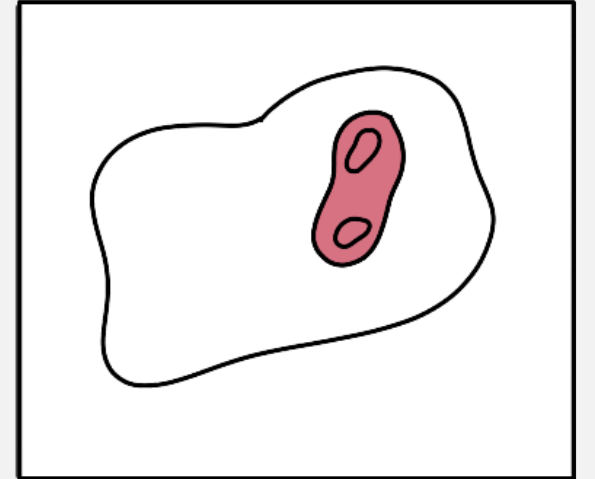
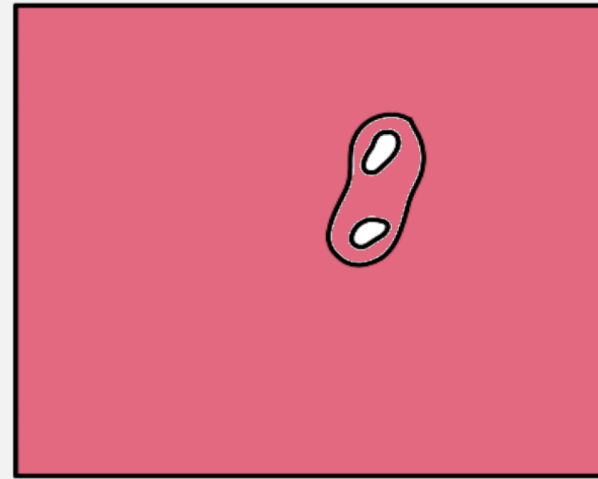
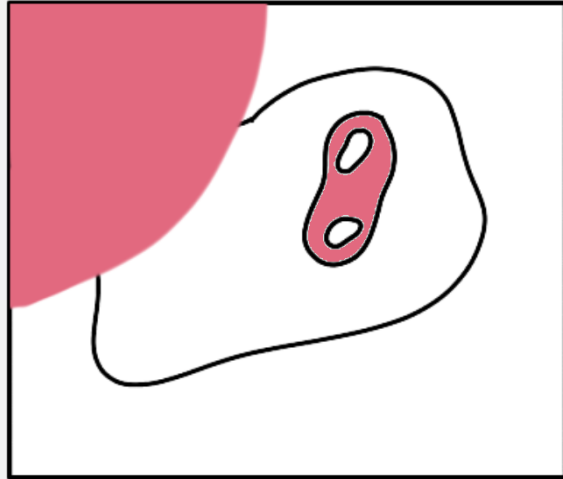
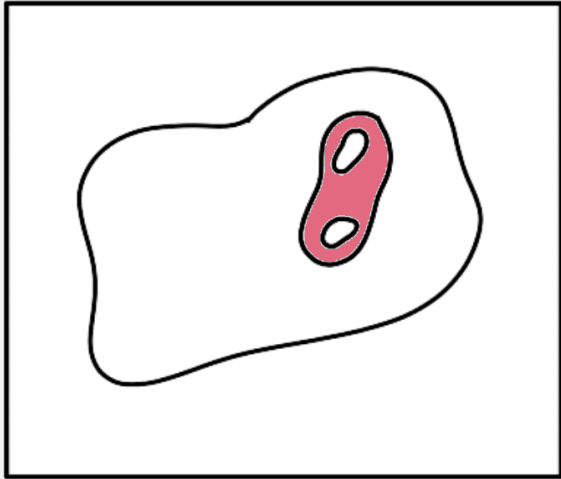


pixels



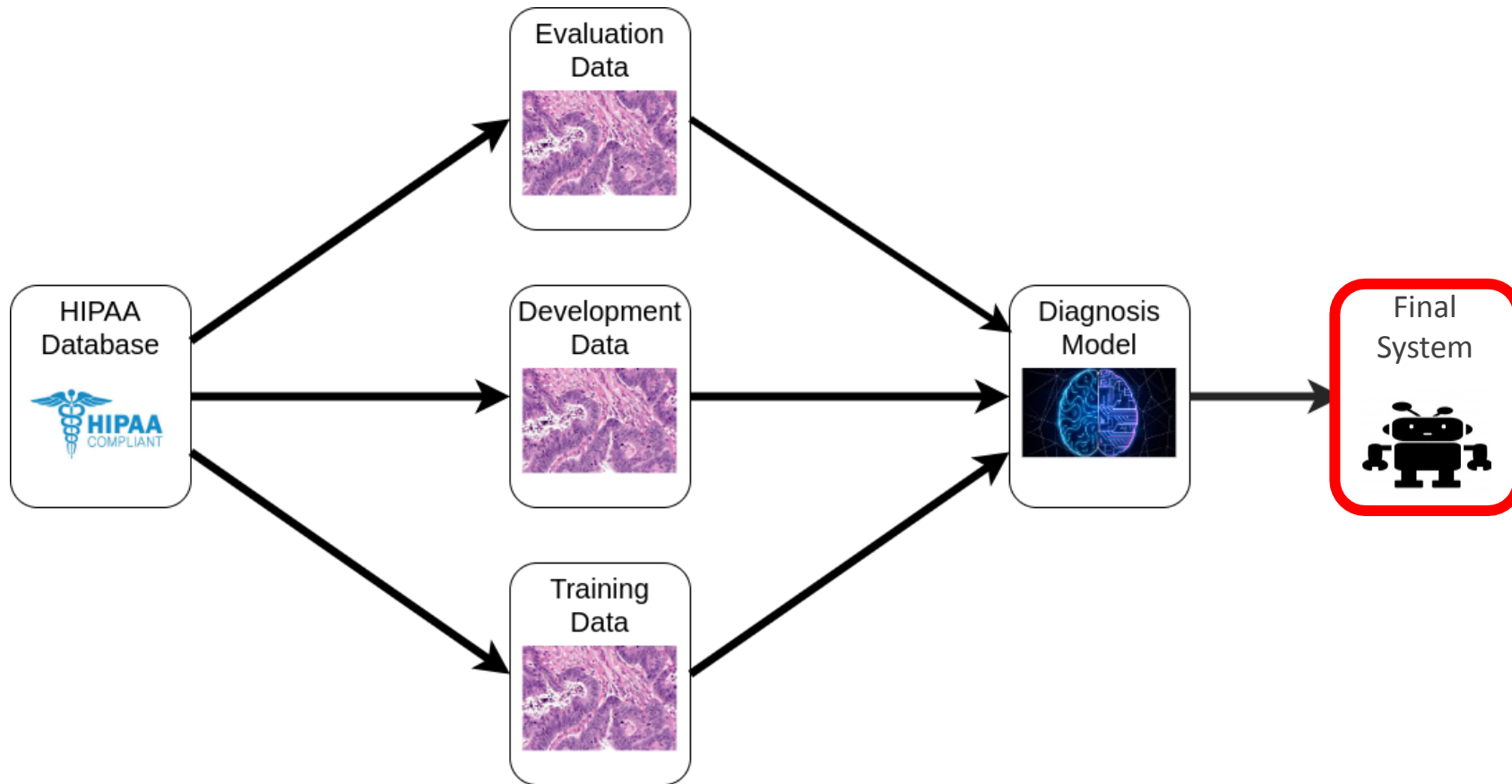
pixels

WINDOW TO PATCH



PATCH TO IMAGE LEVEL

PROTOTYPE



TESTING GOALS

FUTURE WORK

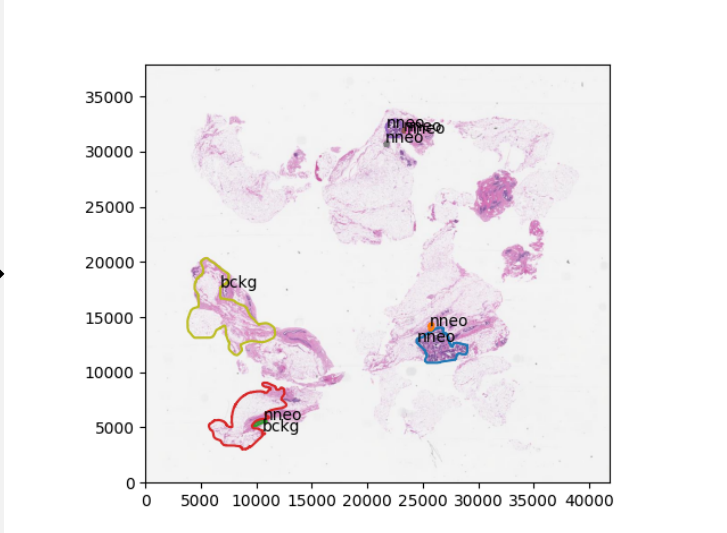
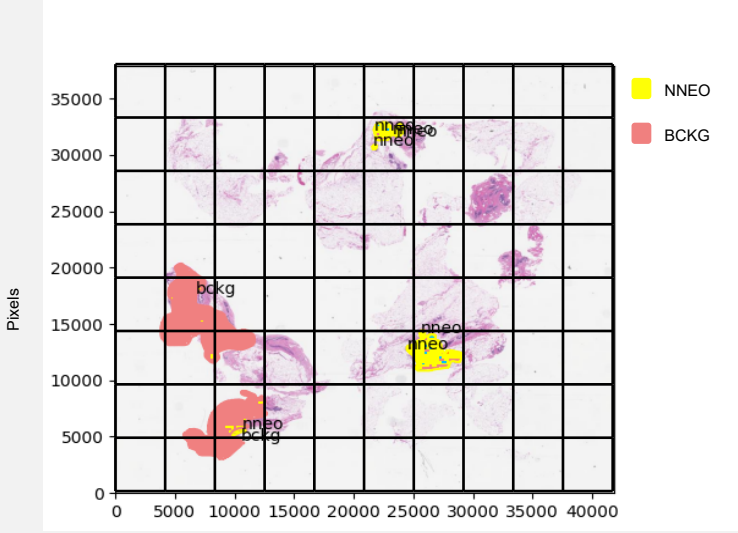


Image Classification

n

The third figure shows the text 'Image Classification' in red. Below it is a red 'n'. At the bottom are two circular icons: a green circle with a white checkmark and a red circle with a white X.

FILTERS

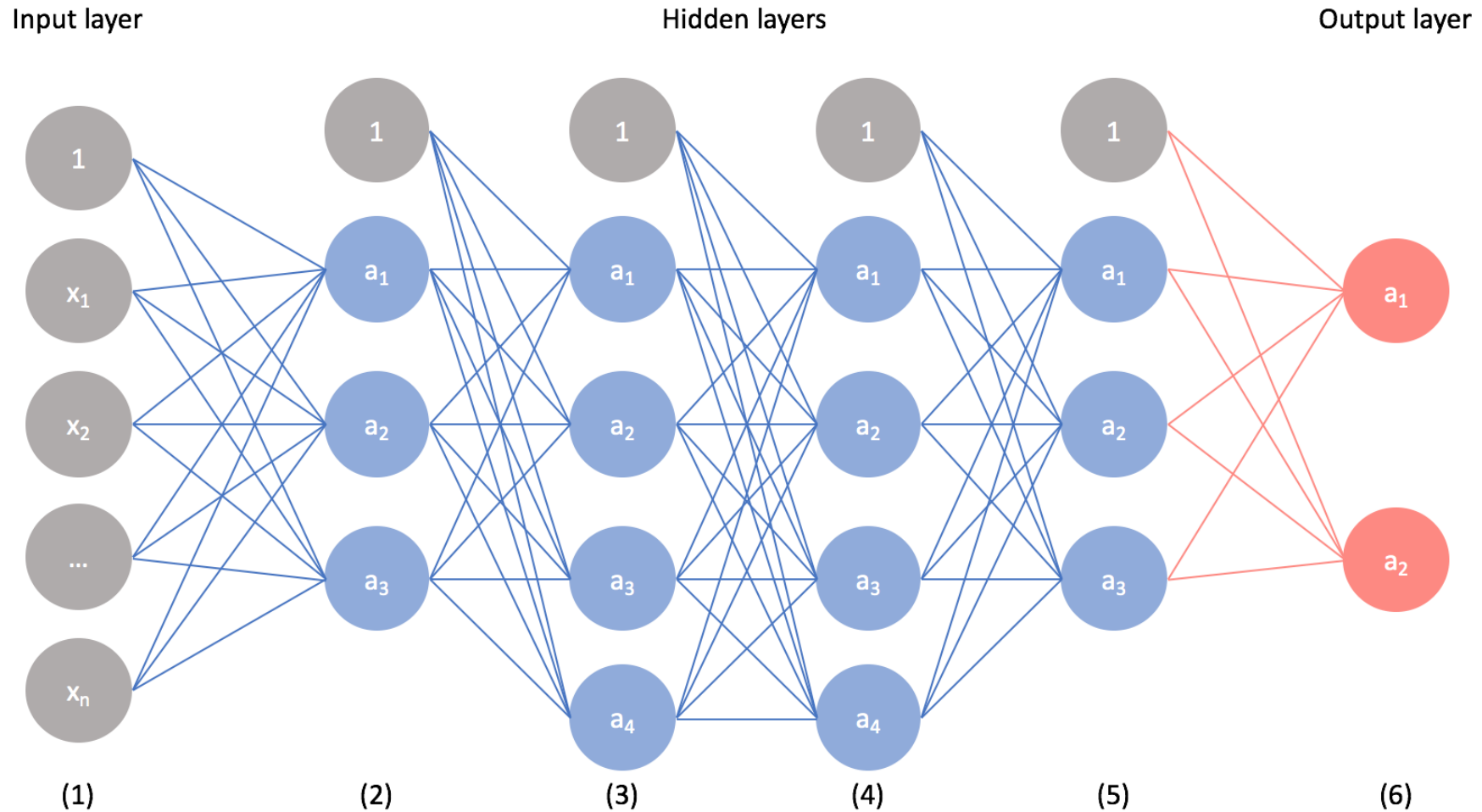


Original image



Filter "Laplace" applied

CONVOLUTIONAL NEURAL NETWORK



QUESTIONS?

Acknowledgements:

Dr. Joseph Picone – Mentor & Data Coordinator

Claudia Dumitrescu – AI Expert

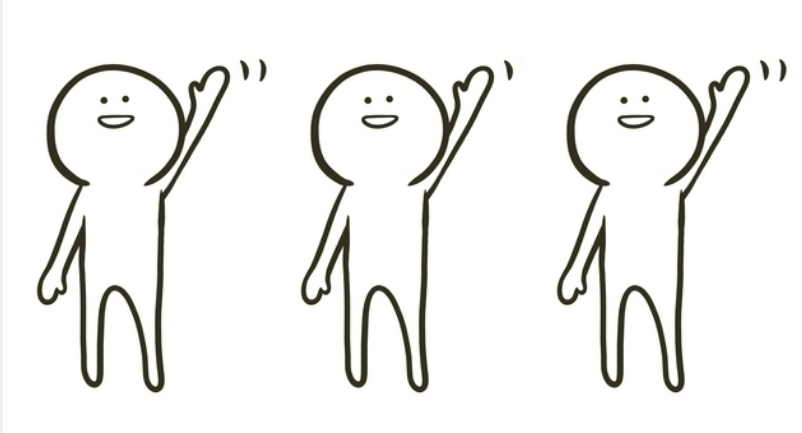
Phuykong Meng – Image Segmentation & GUI Planning

Hemanth Kamana – Model Scoring & Evaluation

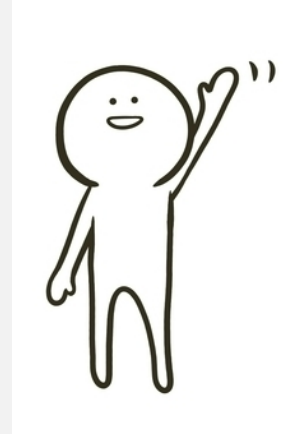
For the curious

- [*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*](#)

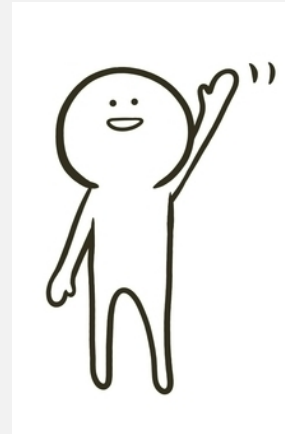
The Team



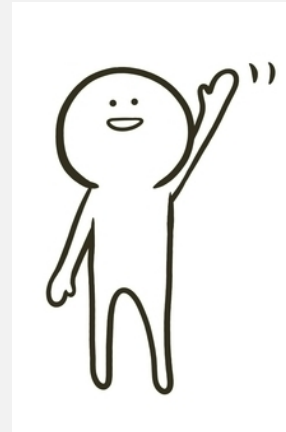
The SD
Team



The ML Expert



The "Other?" Guy
Idrk know what he does but he's good at python



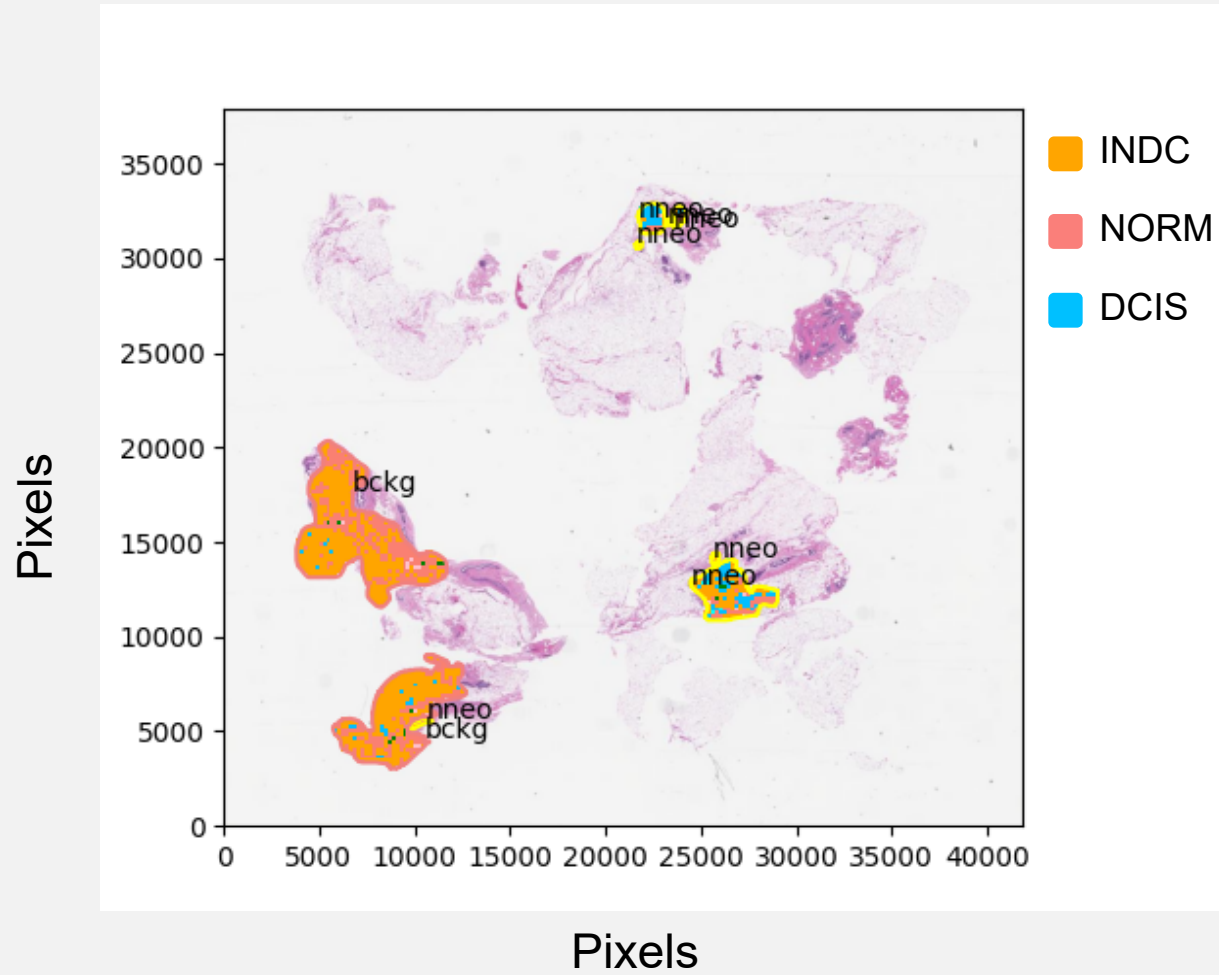
The
Tester



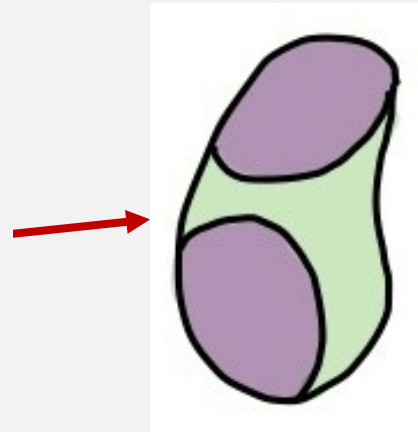
FRAME LEVEL EVALUATION RESULTS

	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

data
training data
development data
evaluation data

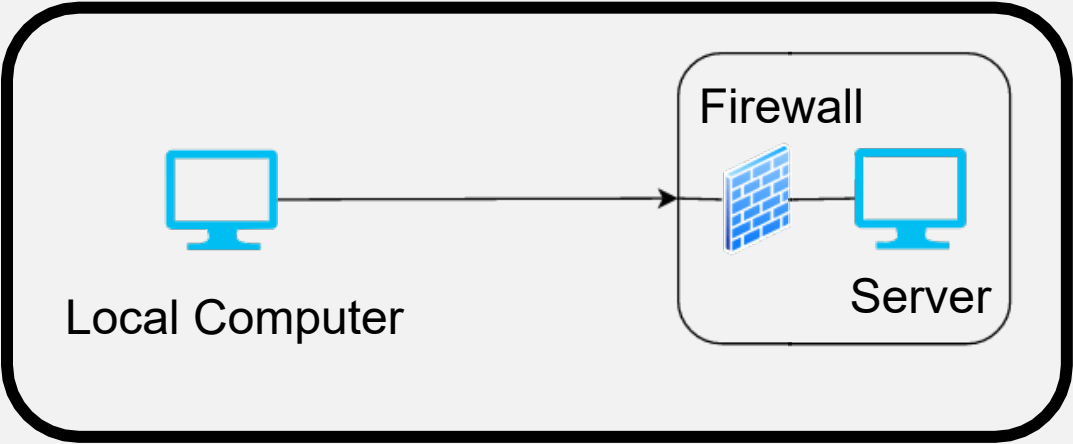
lib
training functions
evaluation functions
imaging functions

src
feature generation
model training
model evaluation

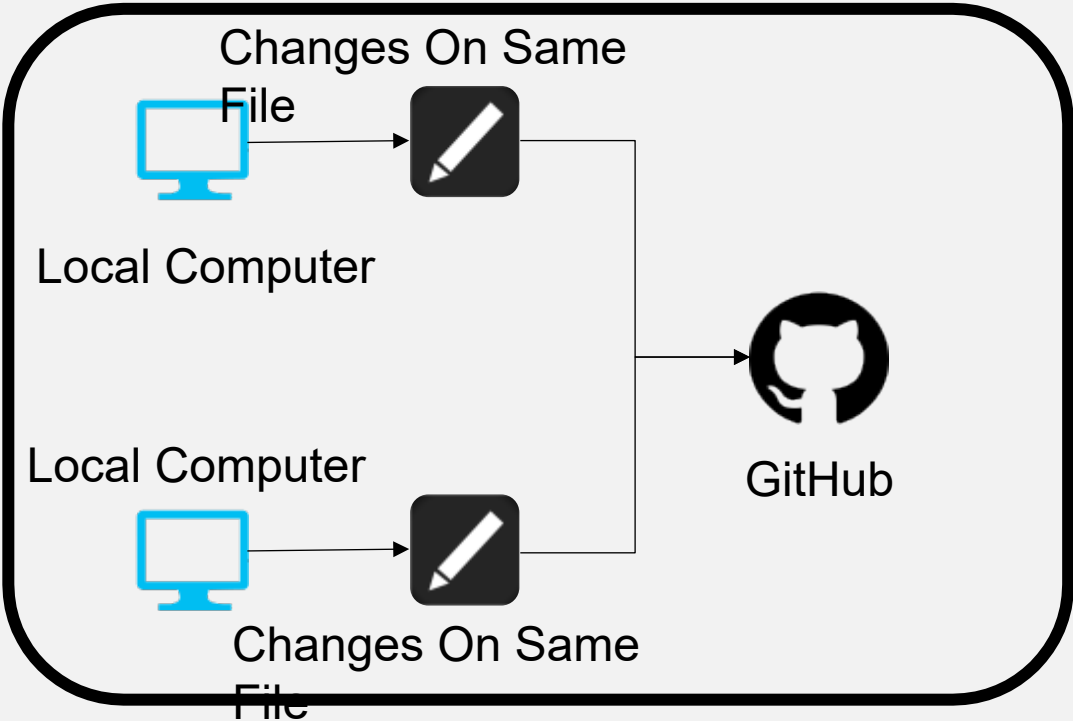
bin
compiled versions of src

GITHUB AND THE SERVER

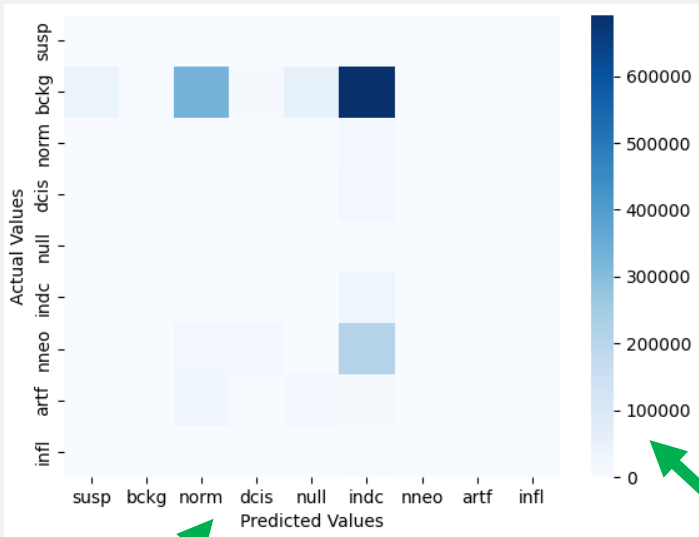
The Server



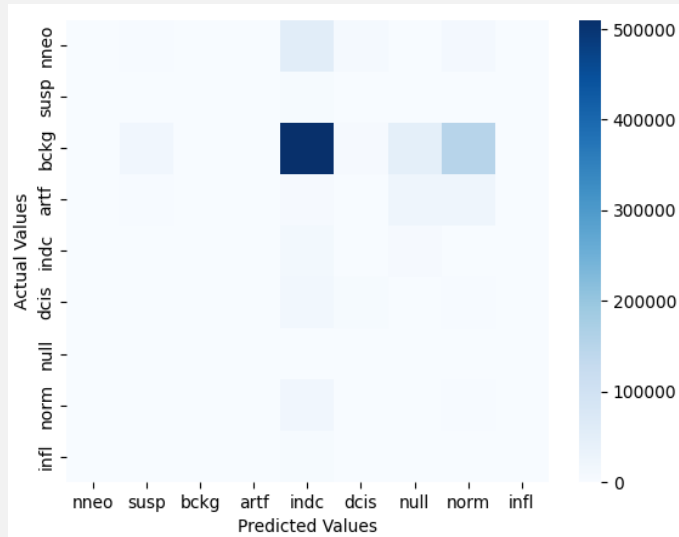
GitHub



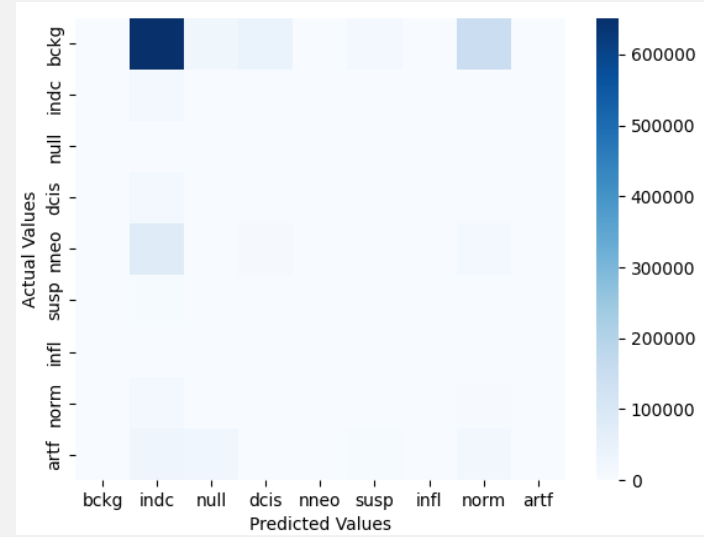
QDA CONFUSION MATRIX



TRAIN

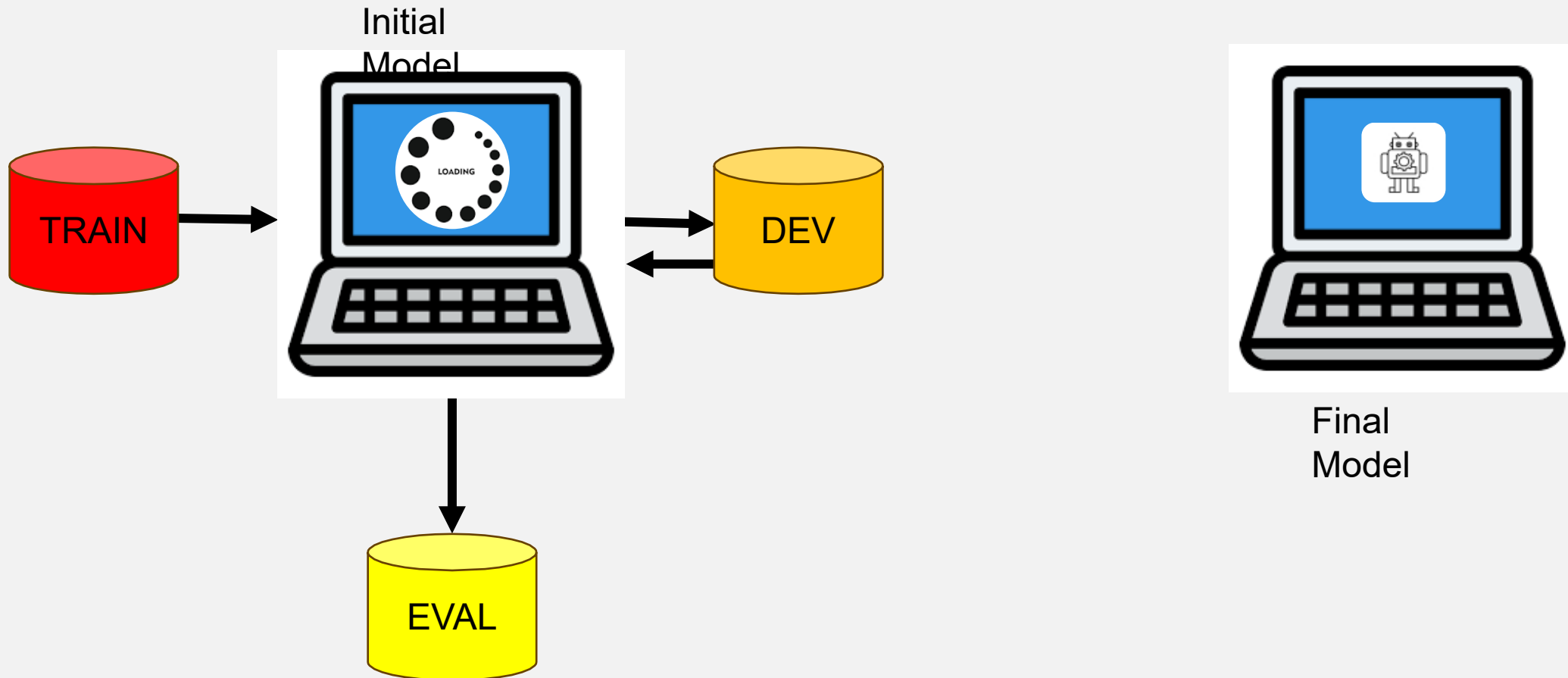


DEV

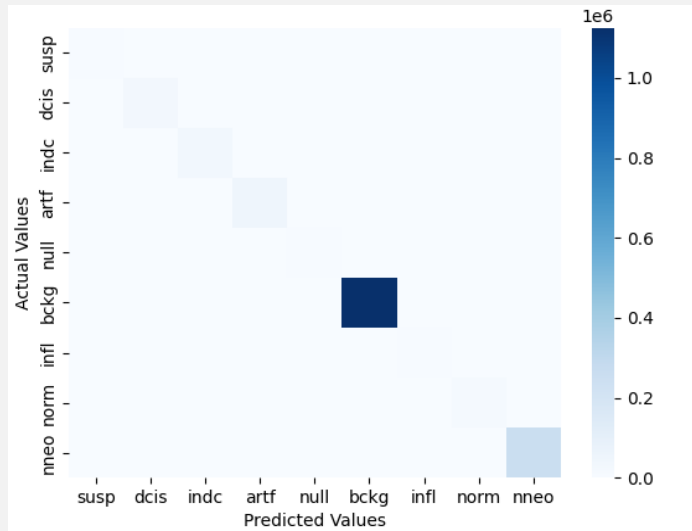


EVAL

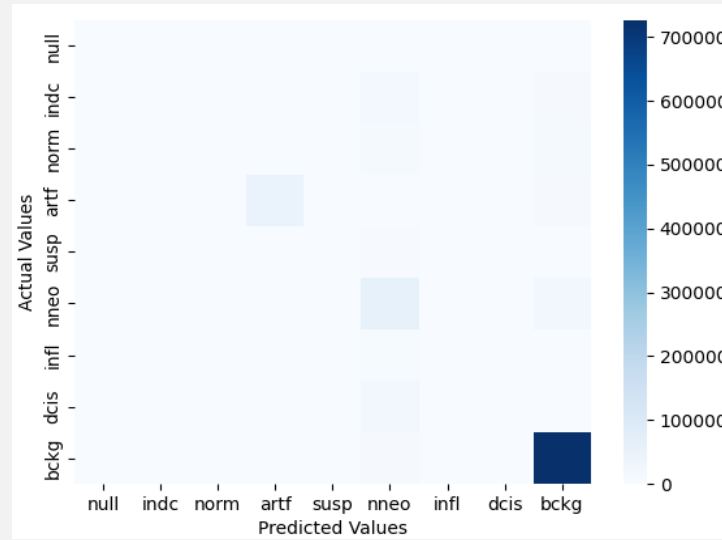
EXPLAIN TRAIN, DEV, AND EVAL IN THE PROCESS



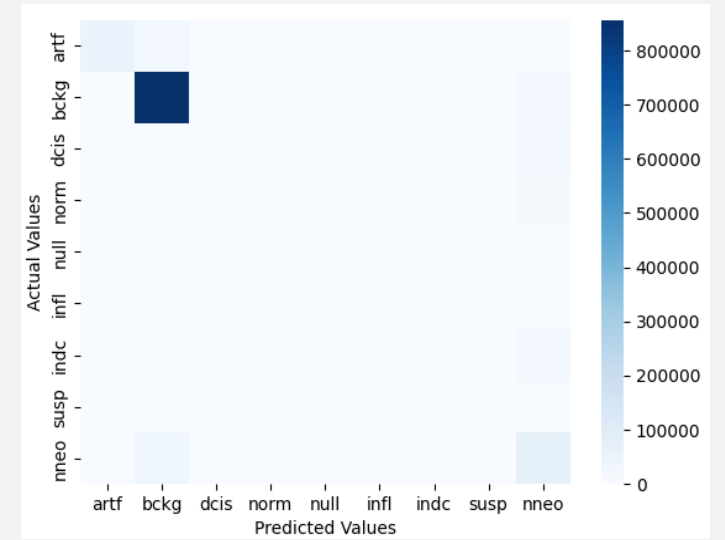
RNF CONFUSION MATRIX



TRAIN



DEV



EVAL

END

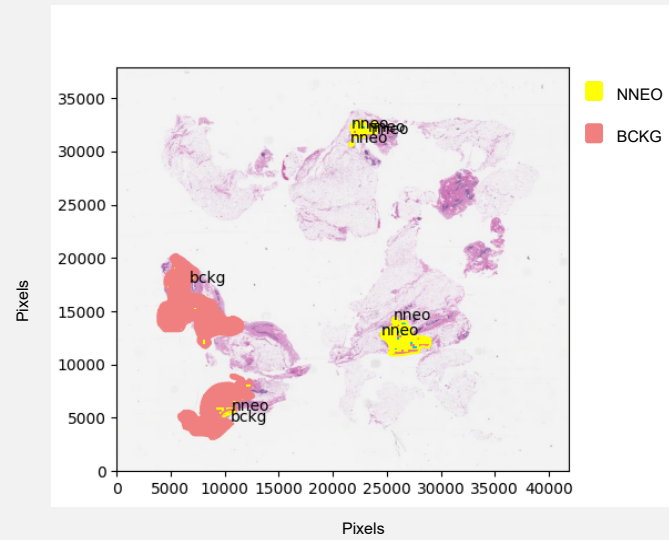
PLANNING AND PROTOTYPING

generate features

train model
based on features

evaluate with
different data

RNF DECISION SURFACES



CONVERT IMAGES TO FEATURES

parse parameters



extract image files
and label files from
list of files



segment images and
classify windows as
labeled



generate RGBA
values and apply
DCT

LIBRARIES USED

Python Libraries

scipy

shapely

joblib

sklearn

Nedc Library

cmdl_parser

image_tools

ann_dpath_tools

nedc_file_tools

TESTING

breast
tissue

