

A grayscale histopathological image of breast tissue, showing glandular structures and cellular details. The image is used as a background for the slide.

BREAST CANCER HISTOPATHOLOGICAL IMAGE CLASSIFICATION

AI Applications course – MSc in AI

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Signs of Breast Cancer



Retracted or inverted nipple



Breast or nipple pain



Lumps



Nipple discharge



Swelling



Redness/rash



Changes to skin texture

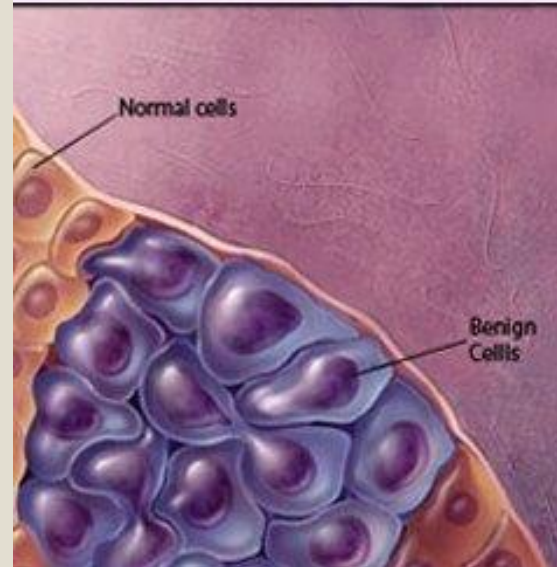


Lump around collar bone or underarm

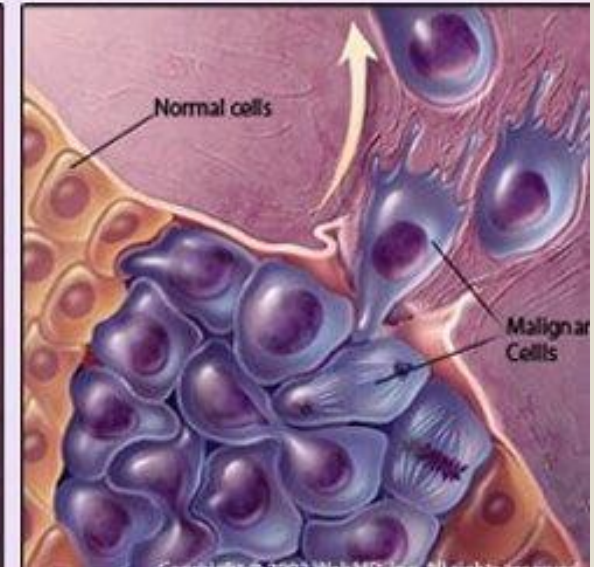
healthline

Benign vs. Malignant Tumors

Benign (not cancer) tumor cells grow only locally and cannot spread by invasion or metastasis



Malignant (cancer) cells invade neighboring tissues, enter blood vessels and metastasize to different sites



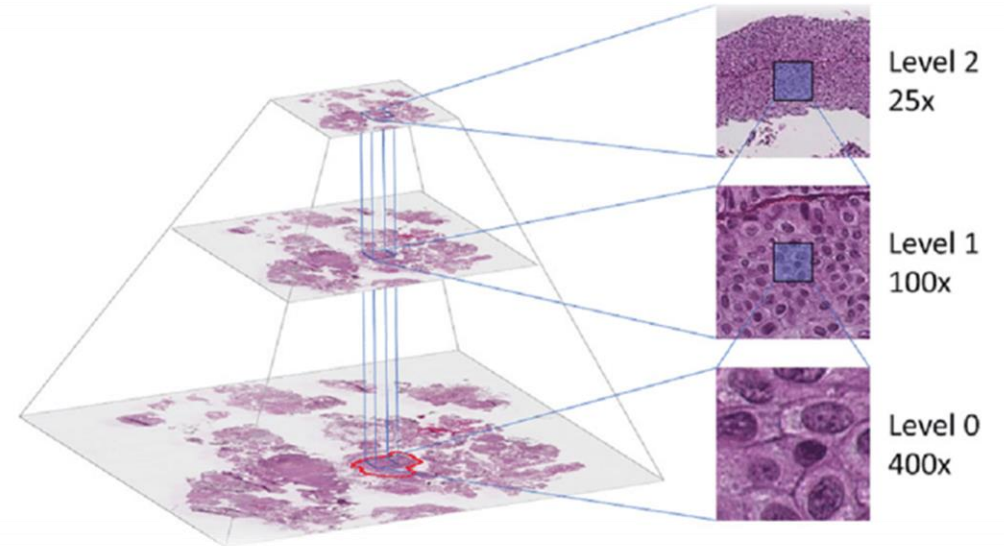
Breast exams – Detection/Diagnosis:

- **Mammogram**
- **Breast Ultrasound**
- **Breast Tomosynthesis (3D Mammography)**
- **Contrast-Enhanced Digital Mammography (CEDM)**
- **Breast MRI**

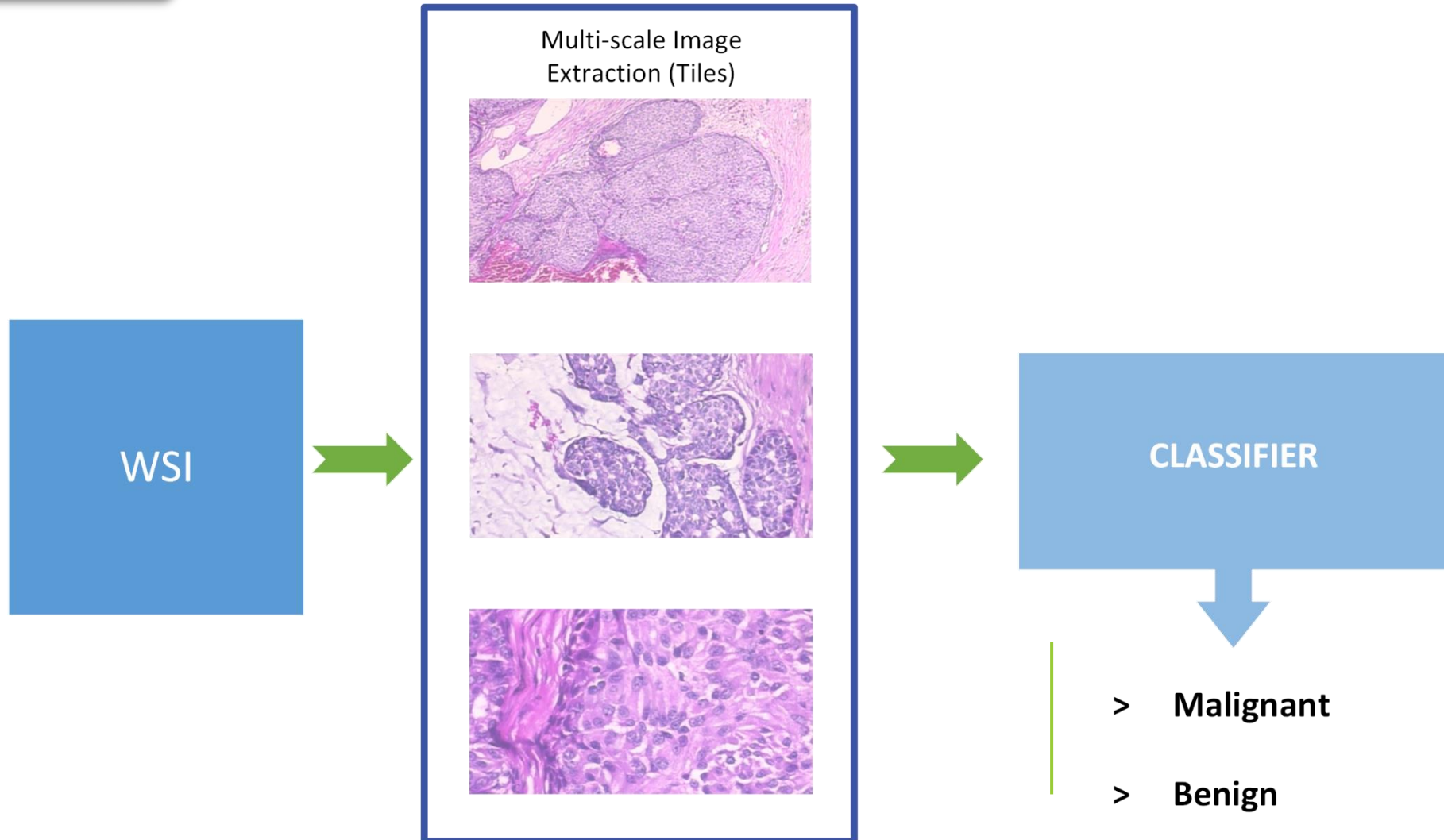
Tumor Screening:

Histopathological examination

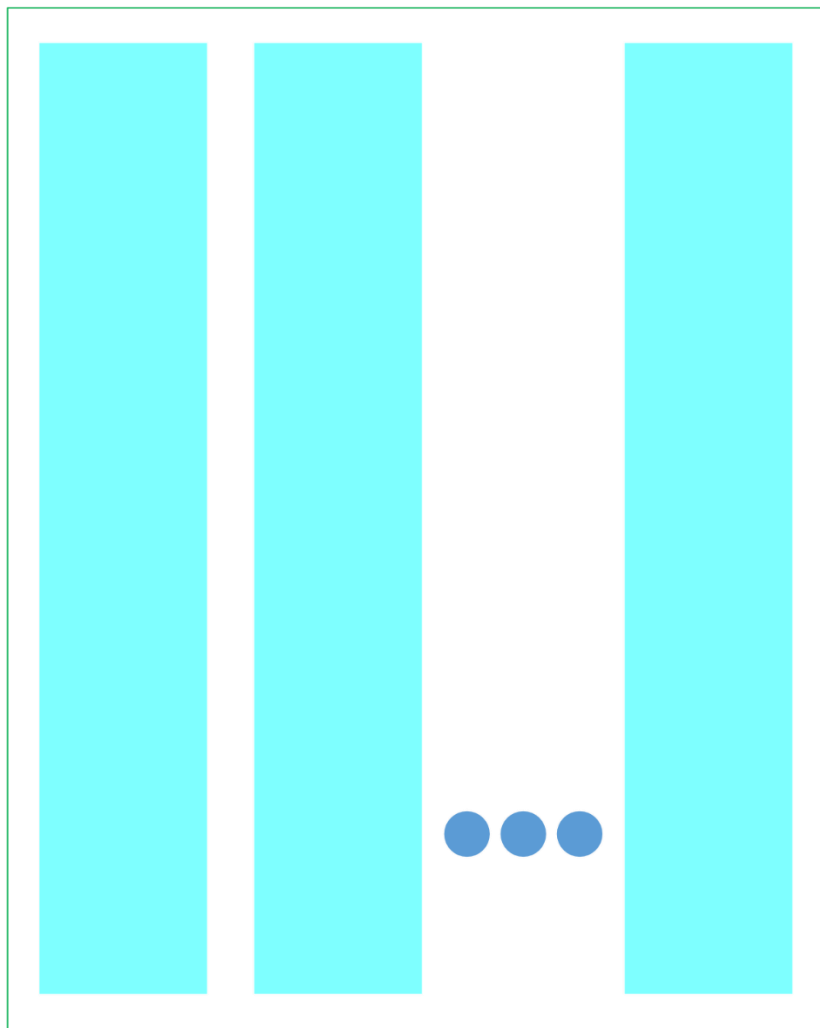
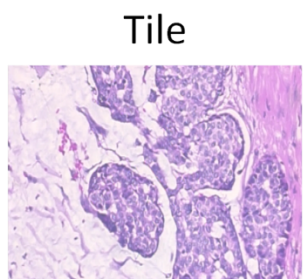
The study of the microscopic structure of cells and tissues of organisms. Pathologists examine the tissue under a microscope slide observing it at various levels of magnification to identify the morphological characteristics that indicate the presence of diseases, such as cancer.



Methodology



Neural Network



Pretrained MobileNet v2

$1280 * 7 * 7$



1: 2048
2: 512
3: Sigmoid Activation



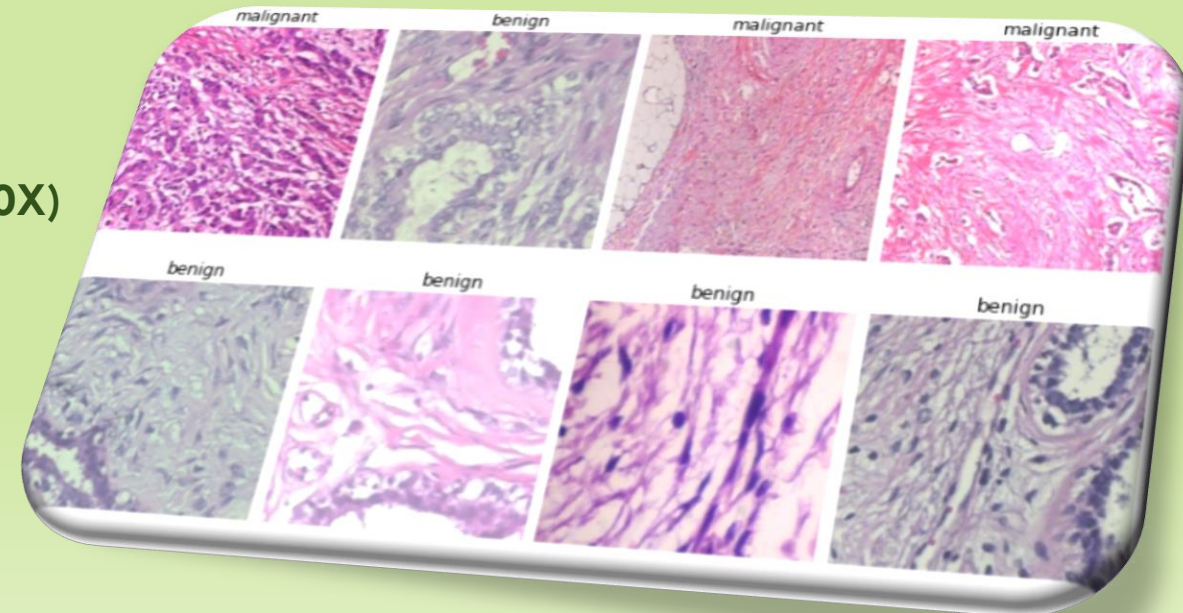
> Malignant

> Benign

Dataset

Breast Cancer Histopathological Database (BreakHis)

- Collected from 82 patients
- Different magnifying factors (40X, 100X, 200X & 400X)
- 2,480 benign and 5,429 malignant samples



Pre-processing

- Image resize → Network requirements
- Normalization of pixel values
- Patient-level train/validation/test split
- Data Augmentation on random samples of training dataset (Horizontal Flip and Rotation)

Model Development

- 100 Epoch with 4 epoch patience for early stopping
- Adam Optimizer
- Binary Cross Entropy as Loss Function
- F1 Score as metric
- Pytorch Framework
- Development using Kaggle Notebooks

Results: Training Curves

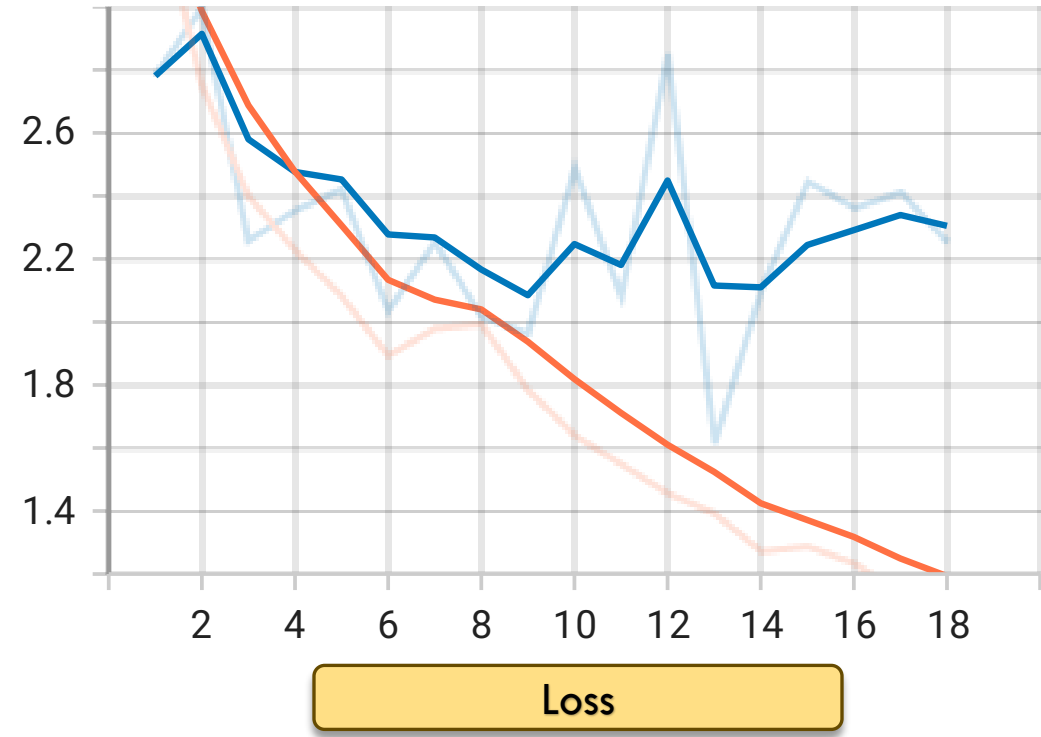
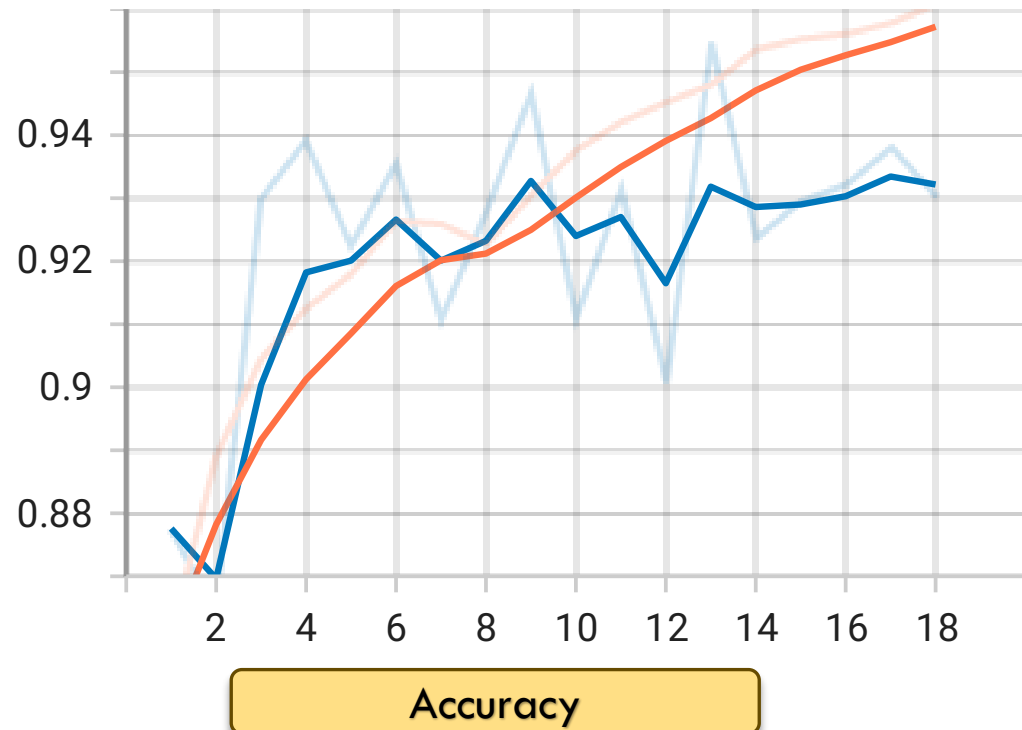
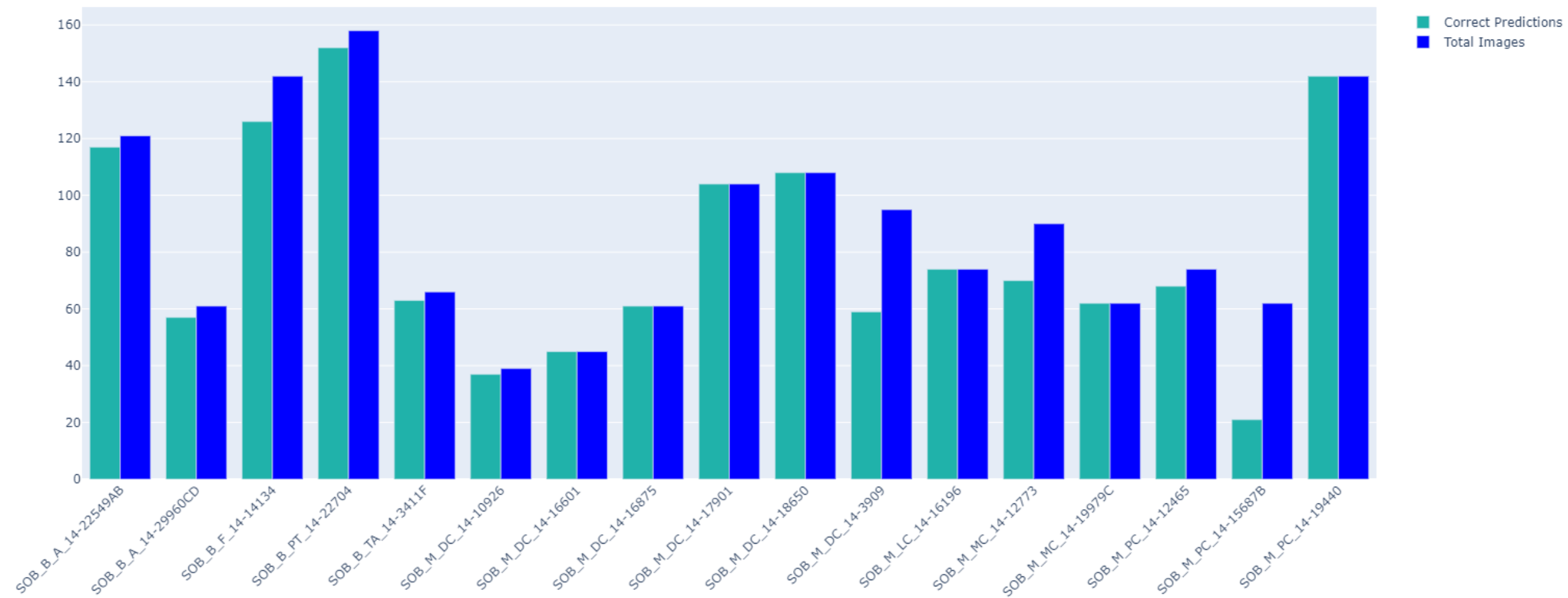


Image – Level Results

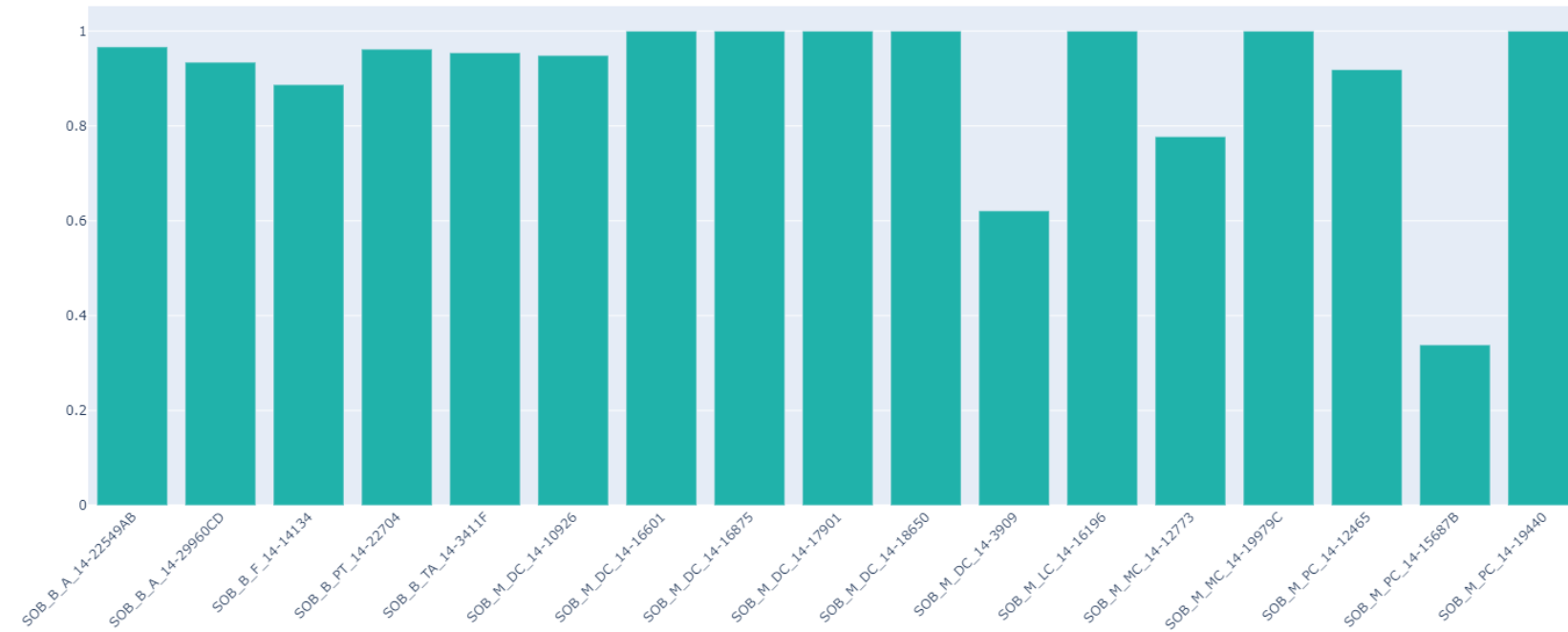
	precision	recall	f1-score	support
0	0.83	0.94	0.88	548
1	0.96	0.89	0.93	956
accuracy			0.91	1504
macro avg	0.90	0.91	0.90	1504
weighted avg	0.91	0.91	0.91	1504

<i>True\Predicted</i>	Benign	Malignant
Benign	515	33
Malignant	105	851

Patient – Level Results



Patient – Level Results



$$\text{Patient Score} = \frac{N_{rec}}{N_P}$$

$$\text{Recognition Rate} = \frac{\sum \text{Patient score}}{\text{Total number of patients}}$$



90 %