Predicting colon cancer in histopathological images

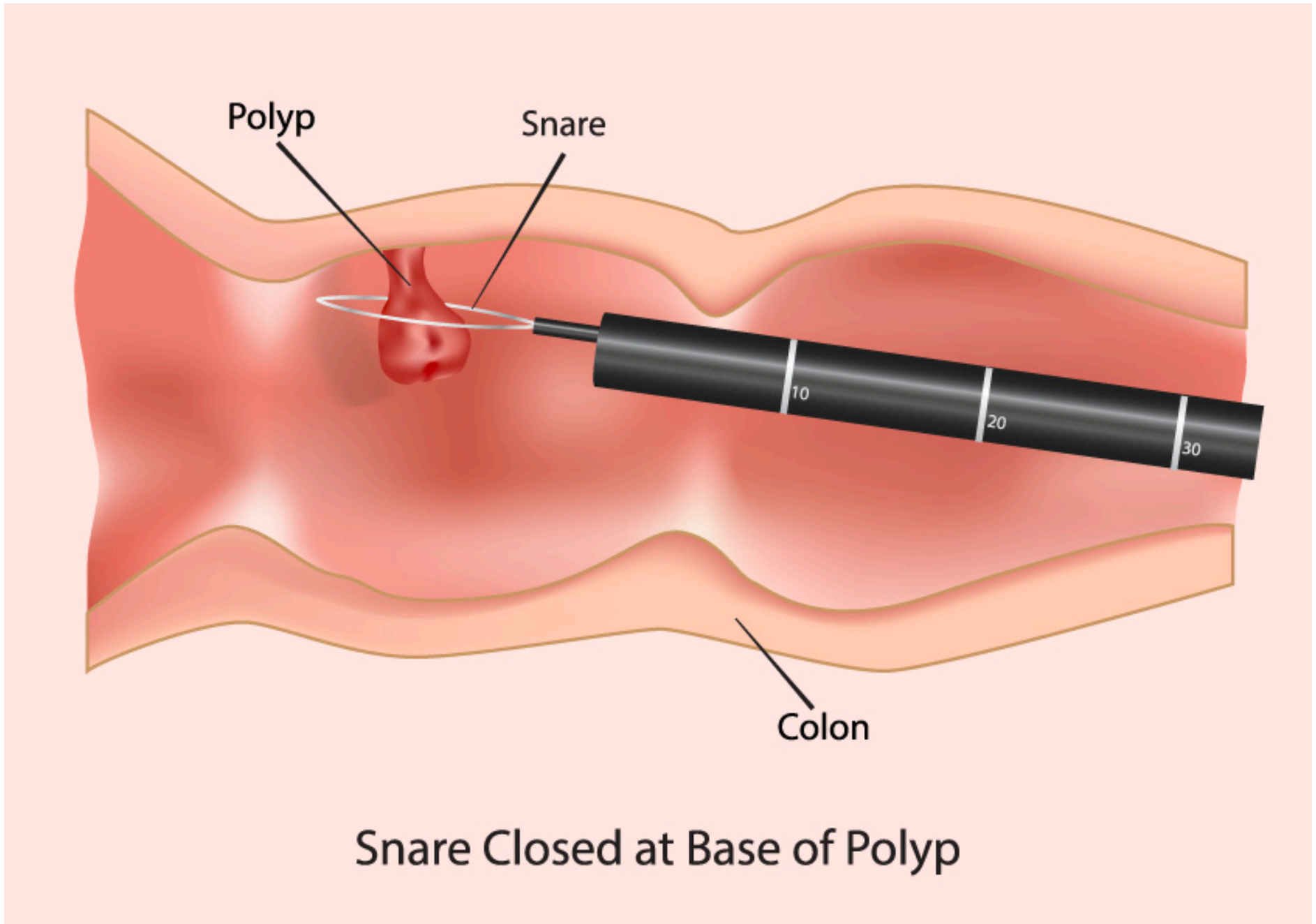
Ignasi Sols

Introduction

~149,500 americans
Will be diagnosed of
colorectal cancer in 2021

www.cancer.net

Introduction



Snare Closed at Base of Polyp

Business impact: Predict colorectal cancer in histopathological images will improve cancer diagnosis.

Data Science Goal:

Predict colorectal cancer in data biopsy slices

Dataset: Kaggle dataset 'Lung and Colon Cancer Histopathological Images', https://www.kaggle.com/andrewmvd/lung-and-colon-cancer-histopathological-images/code

10,000 images - already augmented

Tools: Pandas, sklearn, Keras.

Data Science path:

Build a Deep Learning model that predicts colorectal cancer in biopsy slices.

-The target had two classes:
Positive class: adenocarcinoma (TUMOR)
Negative class: benign tissue

-The data was **balanced: 5000 augmented images for each class**

Recall: 0.69

-Images were re-scaled to 128x128

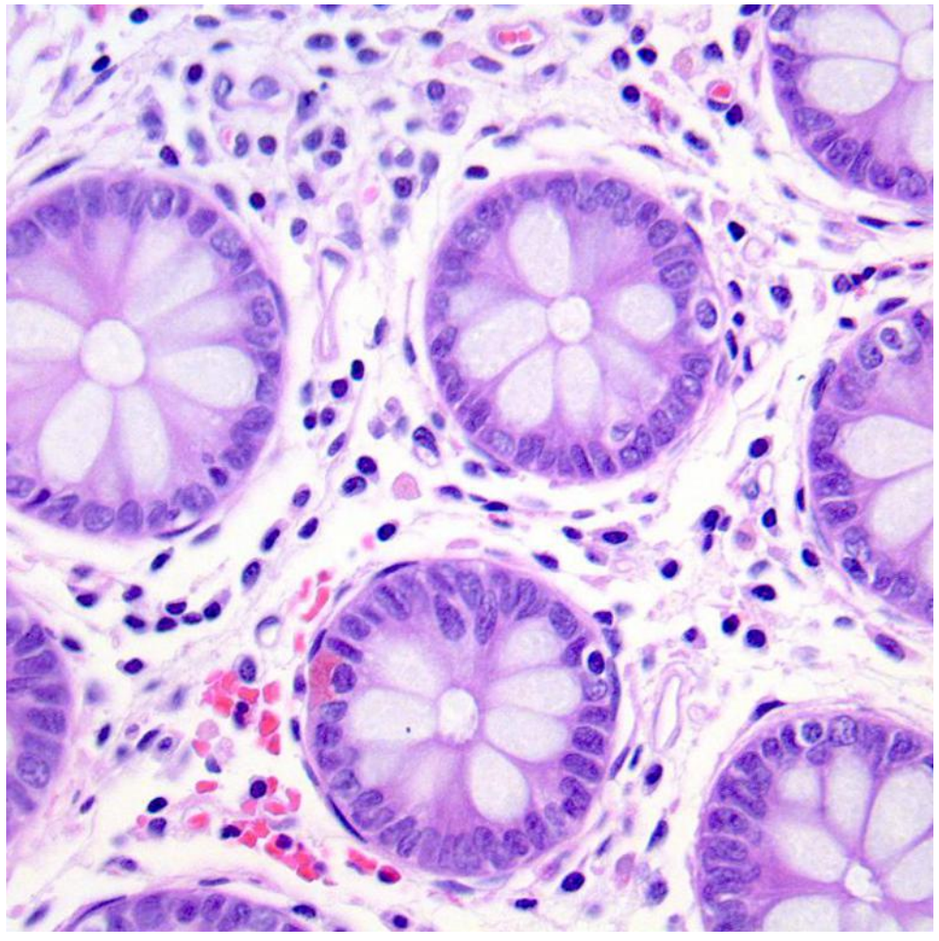
-Trained *Logistic Regression* and *Random forest* **baseline** models.

-Simple CNN.
-CNN with transfer learning (mobileNet V2)

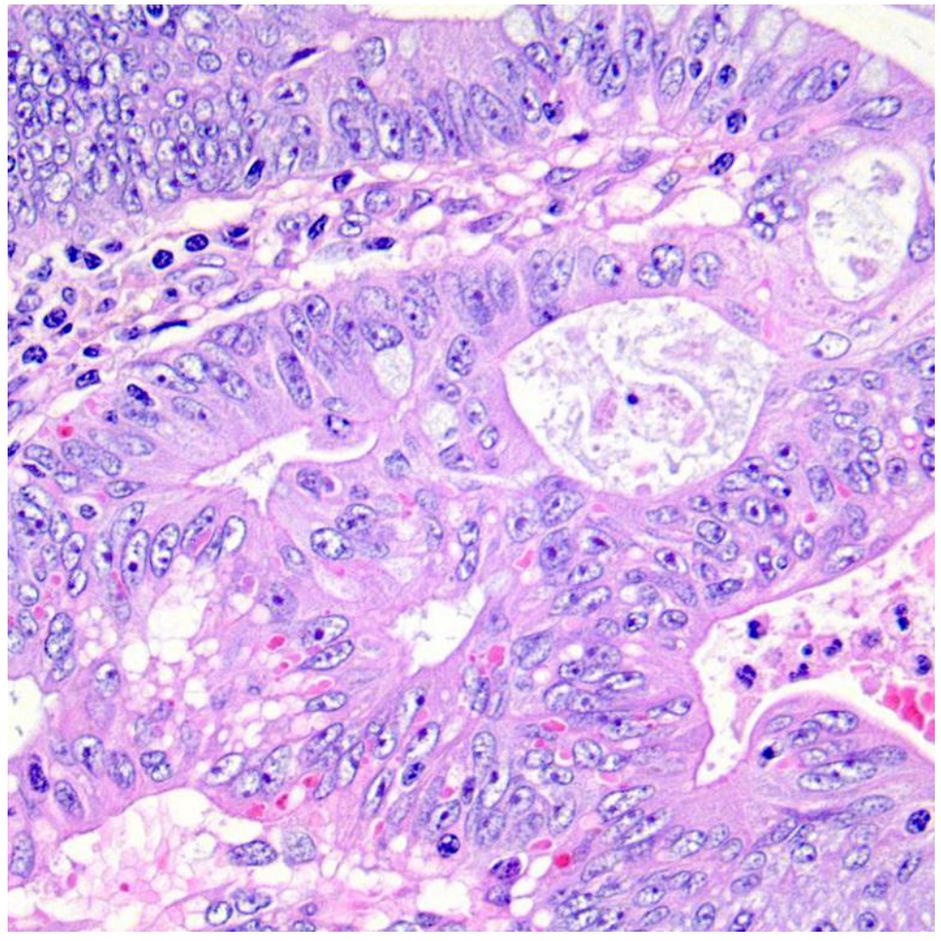
Assumptions/Risks

-The dataset images were already augmented and were in a unique folder, with no information regarding to which original images did they belong. Therefore, data bleeding is to be expected.
-The cancer stage of the tumors was not provided, and this might hinder how the model generalizes to data outside this data set.

Benign

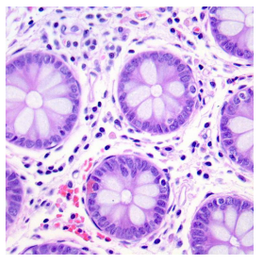


Tumor



Deep Learning network Architecture

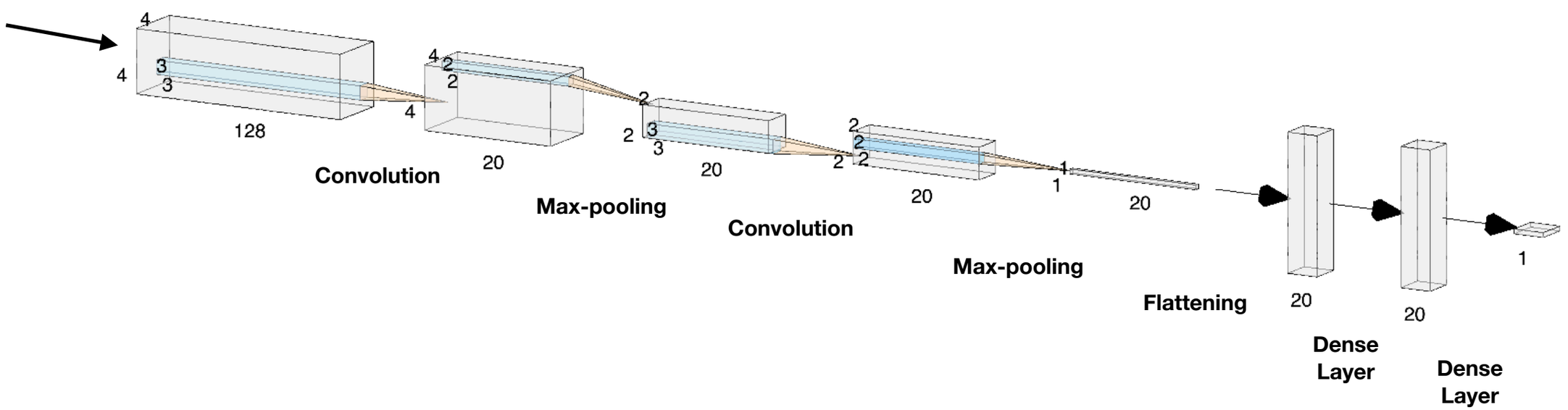
Benign



128 x **128** x **3**

MobileNet V2

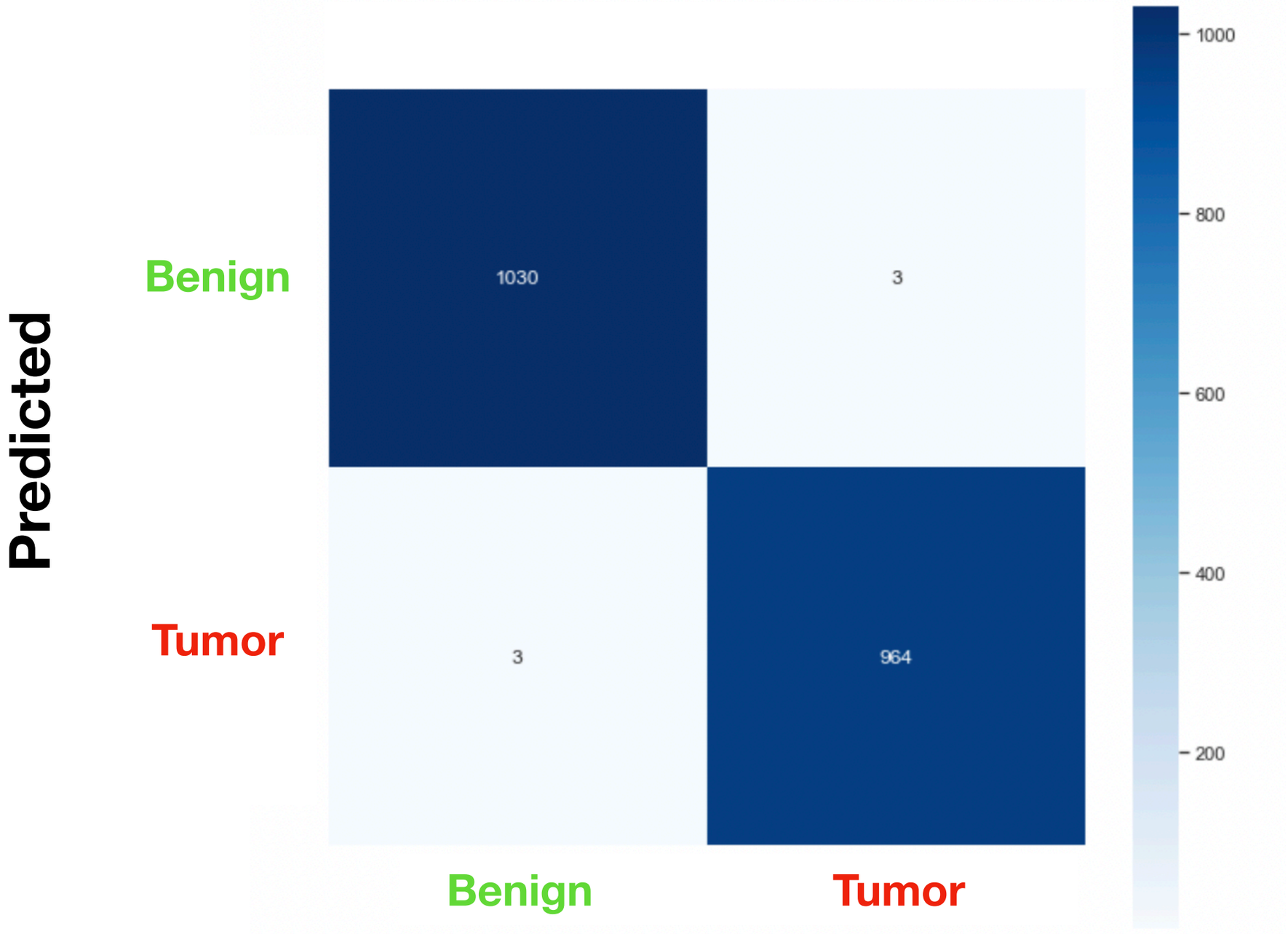
Top layers
Excluded,
All layers included
Are frozen)



Early-stopping
11 Epochs

Total parameters: 2,492,465. Trainable parameters: 234,481

Results



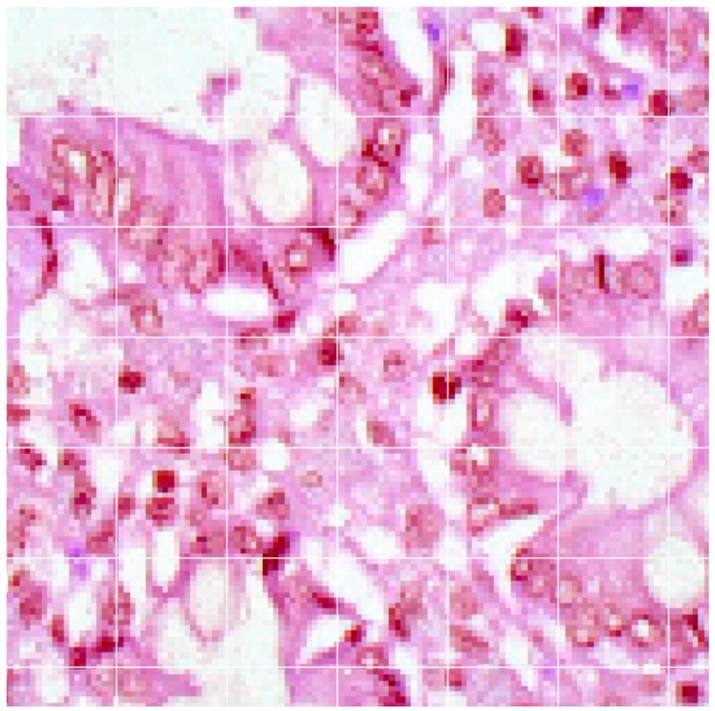
accuracy: 0.9970

recall: 0.9969

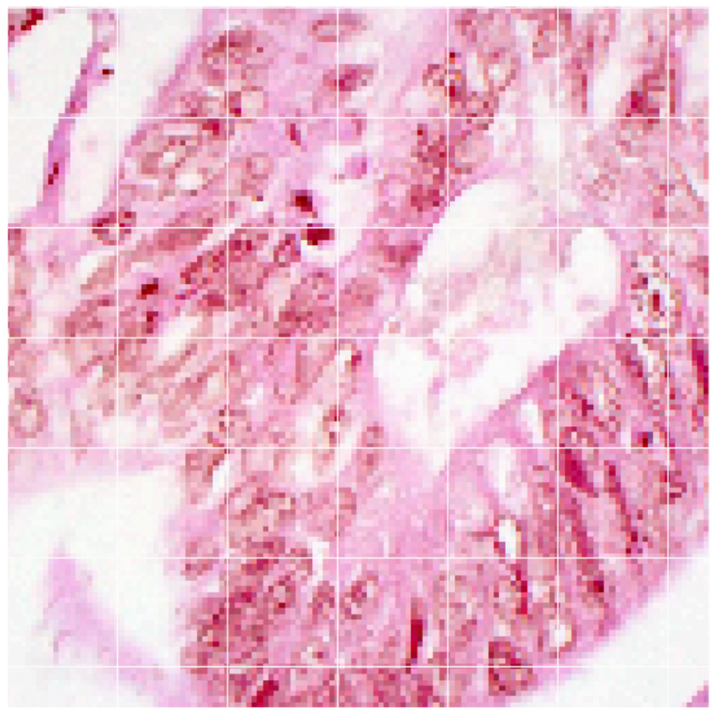
precision: 0.9969

Misclassifications

False Positive



False Negative



Future directions:

-Use another dataset that allows to avoid data bleeding (e.g., NCT-CRC-HE-100K).
-Consider transforming it into a multi-class problem (NCT-CRC-HE-100K has different classes for non-cancerous tissue).

Thanks!

Appendix:

Logistic Regression

accuracy: 0.74

recall: 0.69

F beta score (beta = 2) : 0.70

Precision : 0.74

Random Forests (BASELINE)

accuracy: 0.80

recall: 0.77

F beta score (beta = 2) : 0.78

Precision : 0.81

CNN

accuracy: 0.92

recall: 0.99

Precision: 0.87

CNN - MobileNet V2

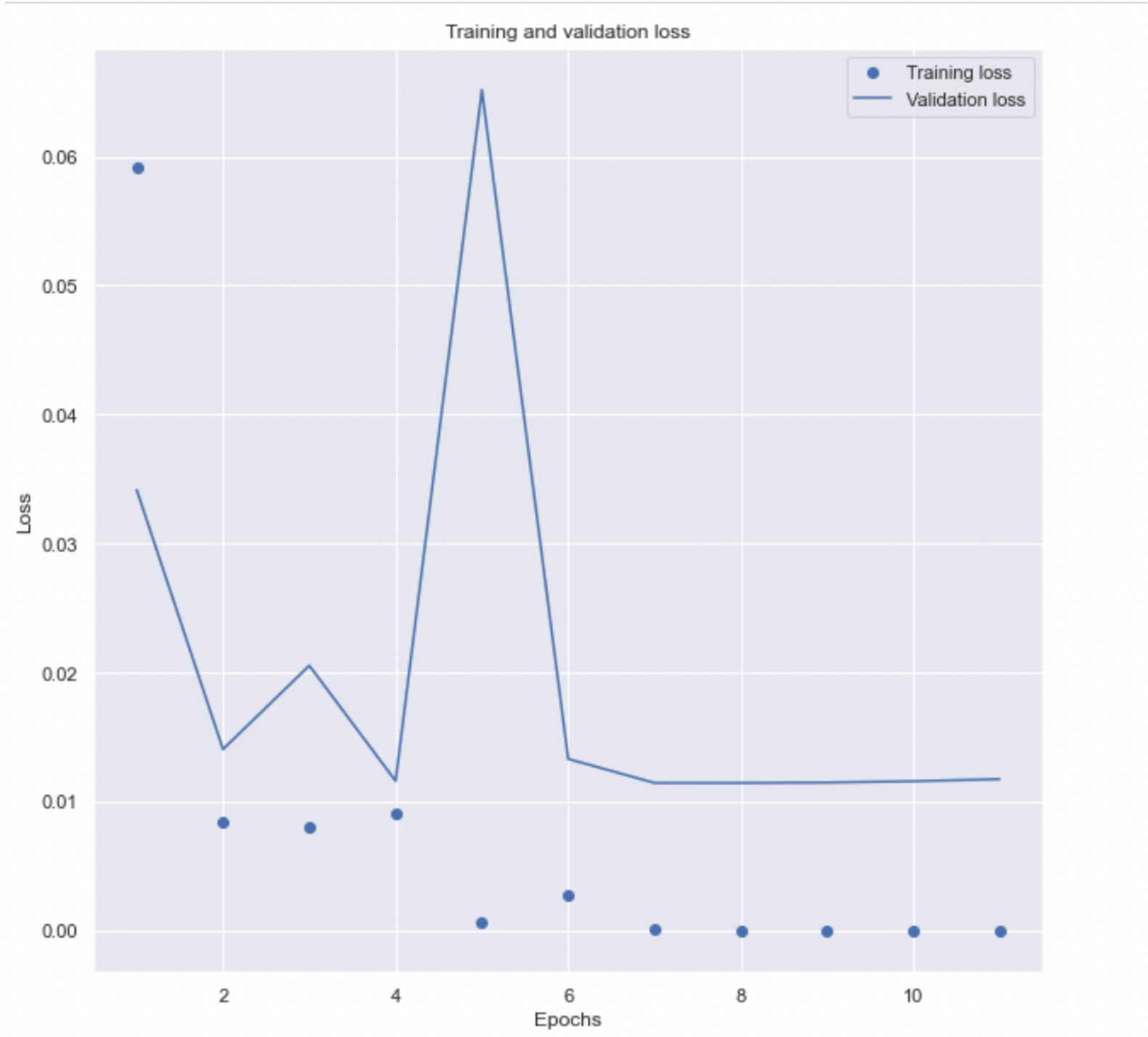
accuracy: 0.9970

recall: 0.9969

precision: 0.9969

Appendix:

CNN - with Transfer Learning (mobileNet V2)



Appendix:

Baseline (PCA: 2 principal components)