Microscopic Images Binary Classification

 *SeeGene Project Report* 

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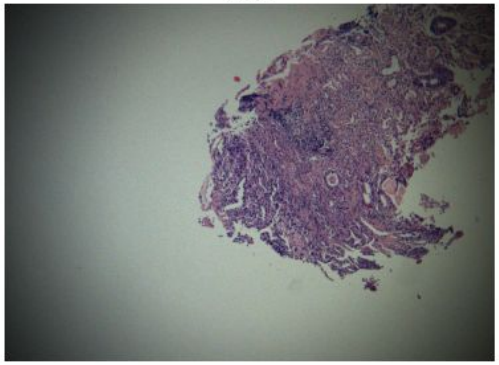
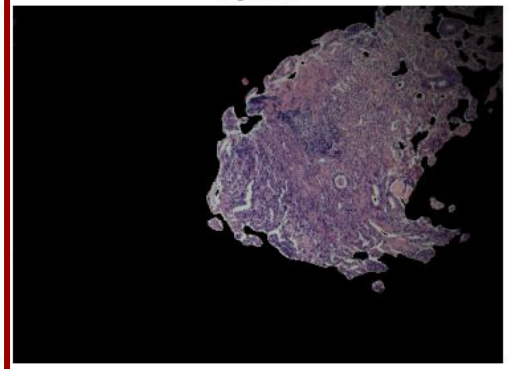
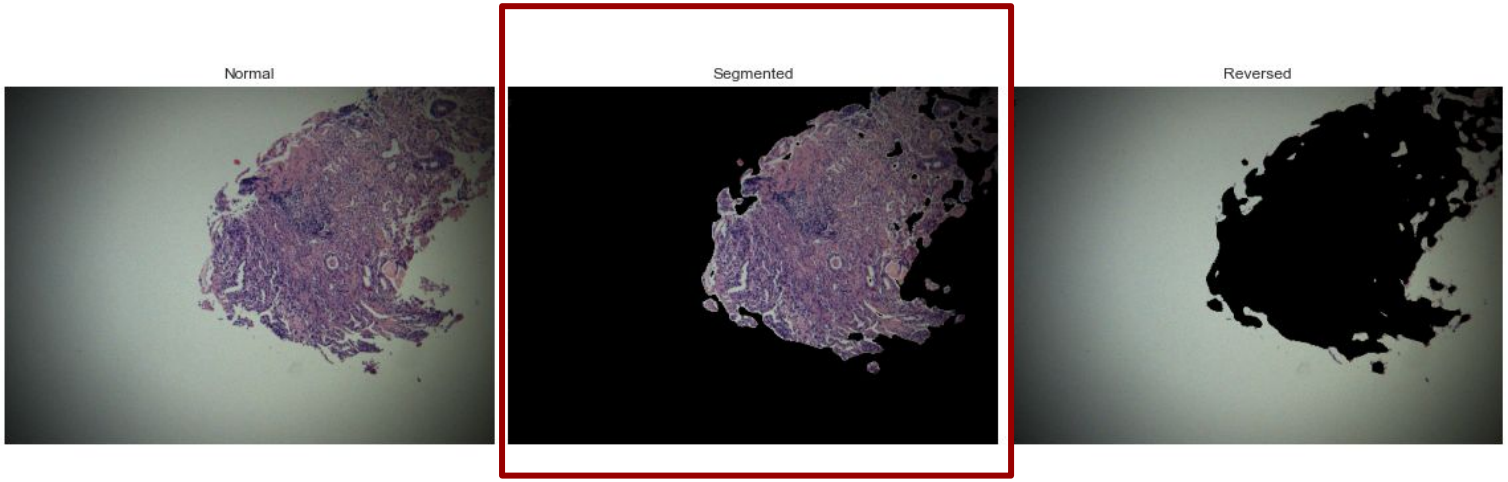
> Segmented Data





Accuracy	0.971 ± 0.015	**0.888 ± 0.011**	0.969 ± 0.022
TPR	0.948 ± 0.051	**0.854 ± 0.020**	0.943 ± 0.063
TNR	0.981 ± 0.001	**0.900 ± 0.009**	0.979 ± 0.007

> Data Extraction



SEGMENTED: IMG * MASK

MASK:

RGB → HSV

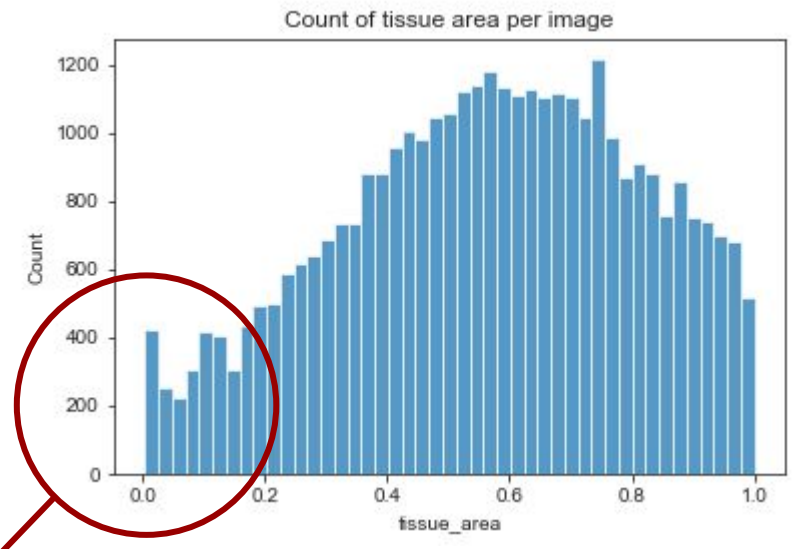
HUE: 110 - 255 (purple, pink, ...)

```
hsv_img = cv2.cvtColor(temp, cv2.COLOR_RGB2HSV)
mask = cv2.inRange(hsv_img, (0,0,0), (110, 250, 255))
mask = np.invert(mask)
segmented = cv2.bitwise_and(img, img, mask=mask)
```

> Data Extraction

```
Tissue_area:     non-zeroes pixels
Noise:           tissue_area < 0.05

Discard:         695/35638 = 1.95%
Used:            34,943/35,638
```



> Data Extraction

Subset	Class	Sample	# Images
train	M	130	8574
	N	130	9208
test	M	58	5256
	N	146	11905

* From *train*, 30 samples (for each class) are extracted for validation

> Model Selection

ResNet18
batch_size: 64
max_epochs: 15
training_size: 100%

Overall Accuracy: 0.822

Confusion Matrix:

	Pred M	Pred N
True M	4468	788
True N	2272	9633

ResNet50
batch_size: 128
max_epochs: 15
training_size: 100%

Overall Accuracy: 0.859

Confusion Matrix:

	Pred M	Pred N
True M	4696	560
True N	1860	10045

ResNet101
batch_size: 128
max_epochs: 15
training_size: 100%

Overall Accuracy: 0.860

Confusion Matrix:

	Pred M	Pred N
True M	4533	723
True N	1670	10235

ResNet158
batch_size: 128
max_epochs: 15
training_size: 100%

Overall Accuracy: 0.851

Confusion Matrix:

	Pred M	Pred N
True M	4684	572
True N	1985	9920

> Model Selection

ResNet50
batch_size: 128
max_epochs: 15
training_size: **50%**

Overall Accuracy: 0.8562

Confusion Matrix:

	Pred M	Pred N
True M	4693	563
True N	1904	10001

ResNet50
batch_size: 128
max_epochs: 15
training_size: **75%**

Overall Accuracy: 0.8594

Confusion Matrix:

	Pred M	Pred N
True M	4700	556
True N	1856	10049

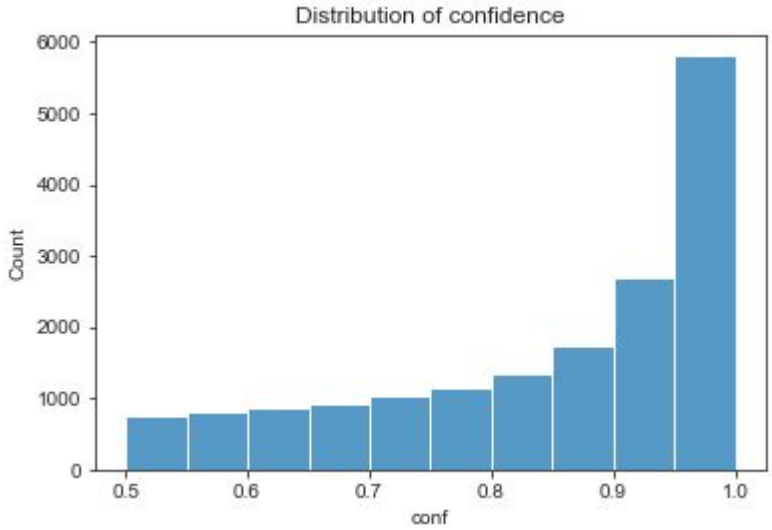
ResNet50
batch_size: 128
max_epochs: 15
training_size: **100%**

Overall Accuracy: 0.859

Confusion Matrix:

	Pred M	Pred N
True M	4696	560
True N	1860	10045

> Confidence Analysis



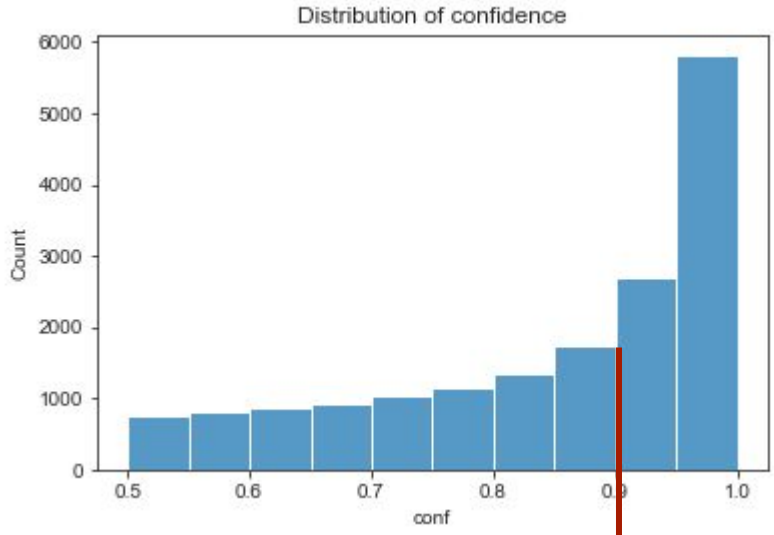
ResNet50

Overall Accuracy: 0.859

Confusion Matrix:

	Pred M	Pred N
True M	4696	560
True N	1860	10045

> Confidence Analysis



ResNet50

Overall Accuracy: 0.859

Confusion Matrix:	Pred M	Pred N
True M	4696	560
True N	1860	10045

50.48% of test set

Overall Accuracy: 0.755

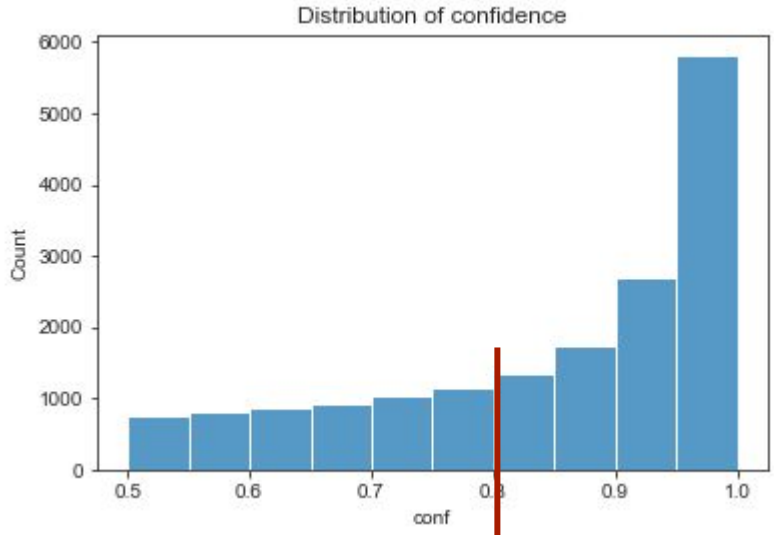
Confusion Matrix:	Pred M	Pred N
True M	2128	522
True N	1603	4410

49.52% of test set

Overall Accuracy: 0.965

Confusion Matrix:	Pred M	Pred N
True M	2568	38
True N	257	5635

> Confidence Analysis



ResNet50

Overall Accuracy: 0.859

Confusion Matrix:	Pred M	Pred N
True M	4696	560
True N	1860	10045

32.34% of test set

Overall Accuracy: 0.692

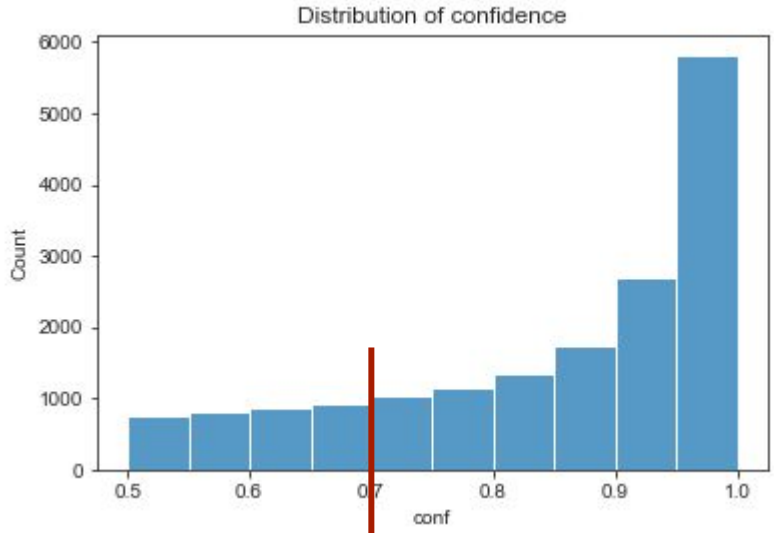
Confusion Matrix:	Pred M	Pred N
True M	1186	449
True N	1262	2653

67.66% of test set

Overall Accuracy: 0.939

Confusion Matrix:	Pred M	Pred N
True M	3510	111
True N	598	7392

> Confidence Analysis



ResNet50

Overall Accuracy: 0.859

Confusion Matrix:	Pred M	Pred N
True M	4696	560
True N	1860	10045

19.59% of test set

Overall Accuracy: 0.627

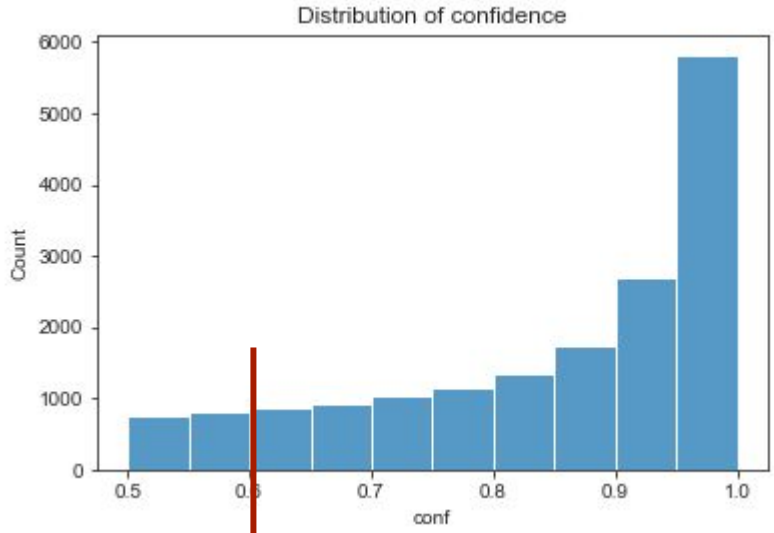
Confusion Matrix:	Pred M	Pred N
True M	603	333
True N	921	1504

80.41% of test set

Overall Accuracy: 0.916

Confusion Matrix:	Pred M	Pred N
True M	4093	227
True N	939	8541

> Confidence Analysis



ResNet50

```
Overall Accuracy: 0.859
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Confusion Matrix:
         Pred M  Pred N
True M    4696     560
True N    1860   10045
```

9.21% of test set

```
Overall Accuracy: 0.5481
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Confusion Matrix:
         Pred M  Pred N
True M     239     191
True N     523     627
```

90.79% of test set

```
Overall Accuracy: 0.891
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Confusion Matrix:
         Pred M  Pred N
True M    4457     369
True N    1337    9418
```
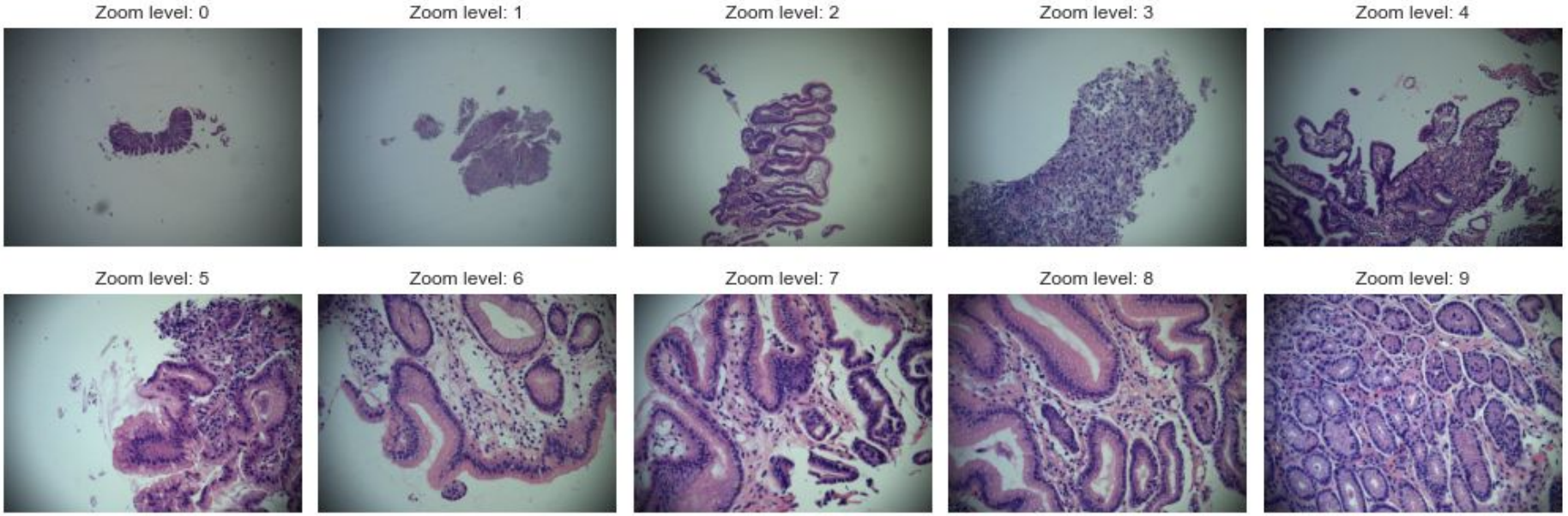
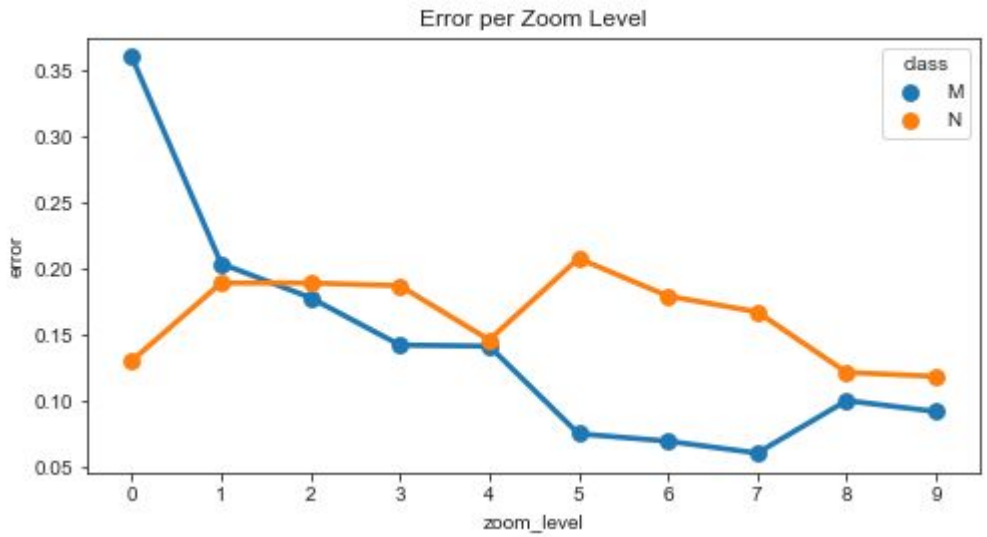

> Error Analysis

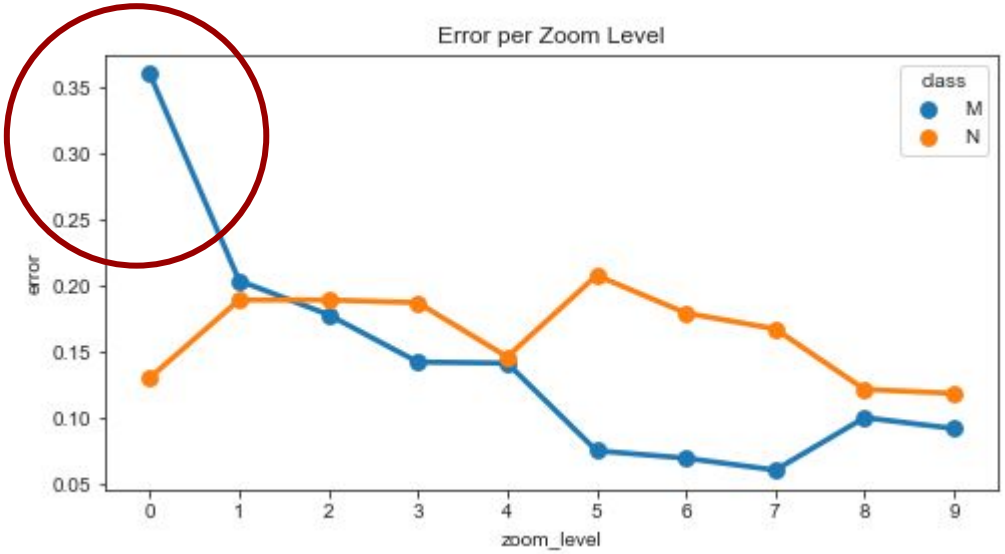


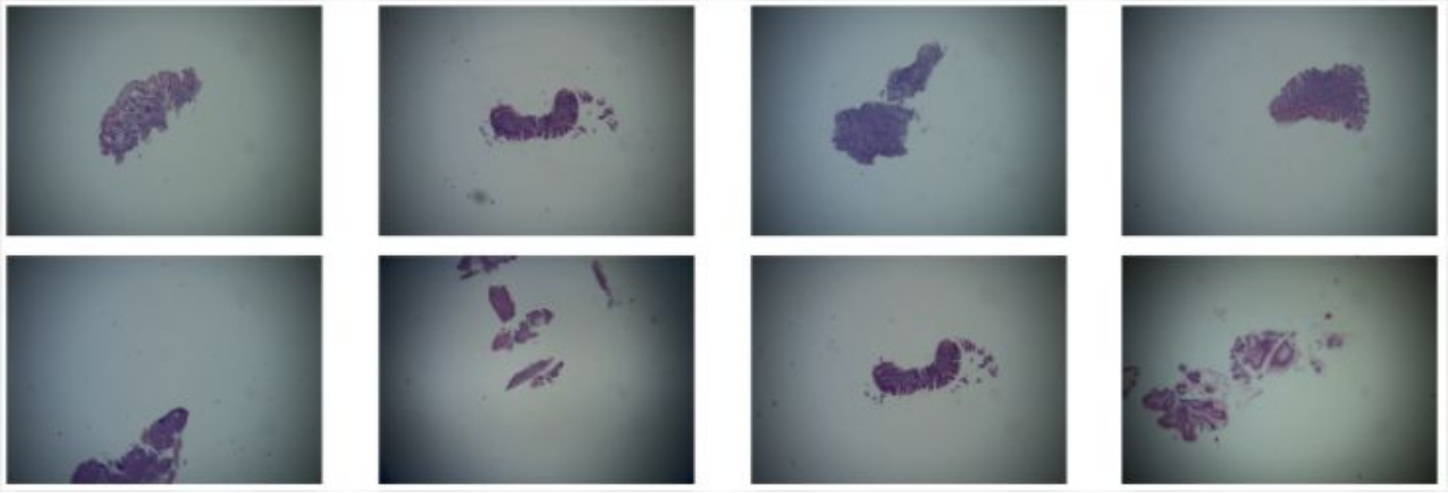
* based on the amount of ‘tissue’ in the image

> Error Analysis

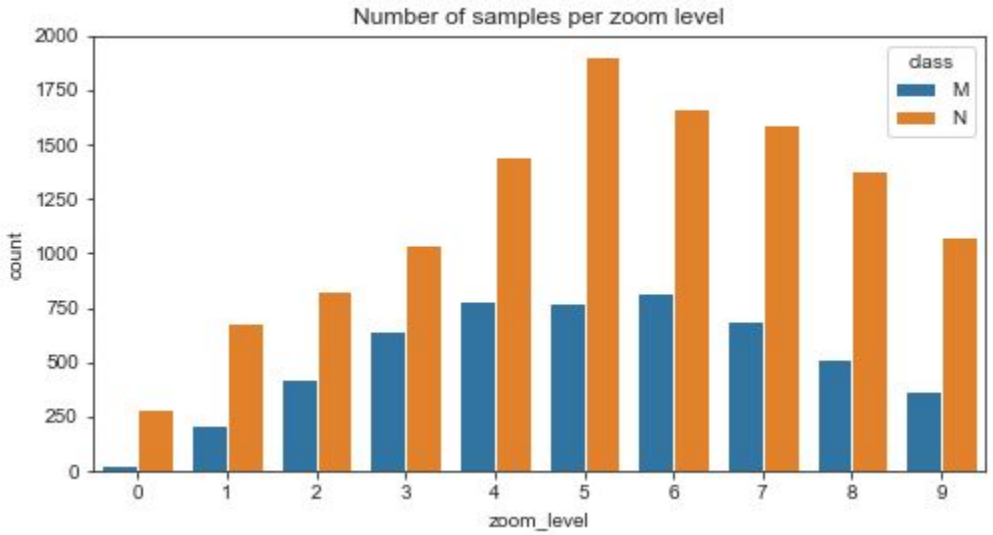


> Error Analysis

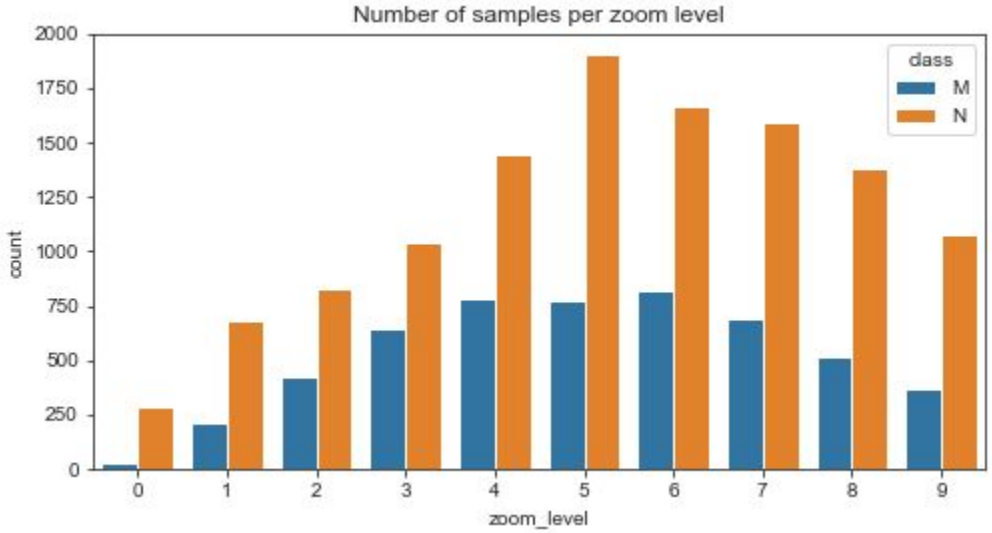


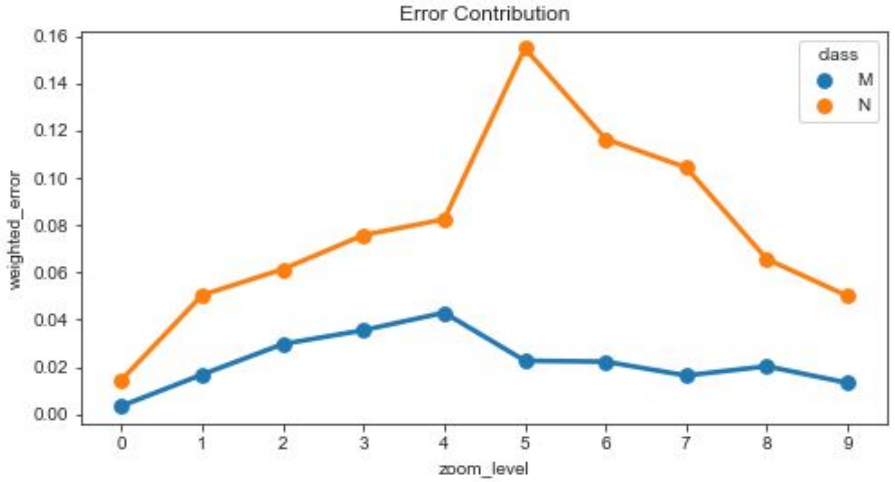


> Error Analysis

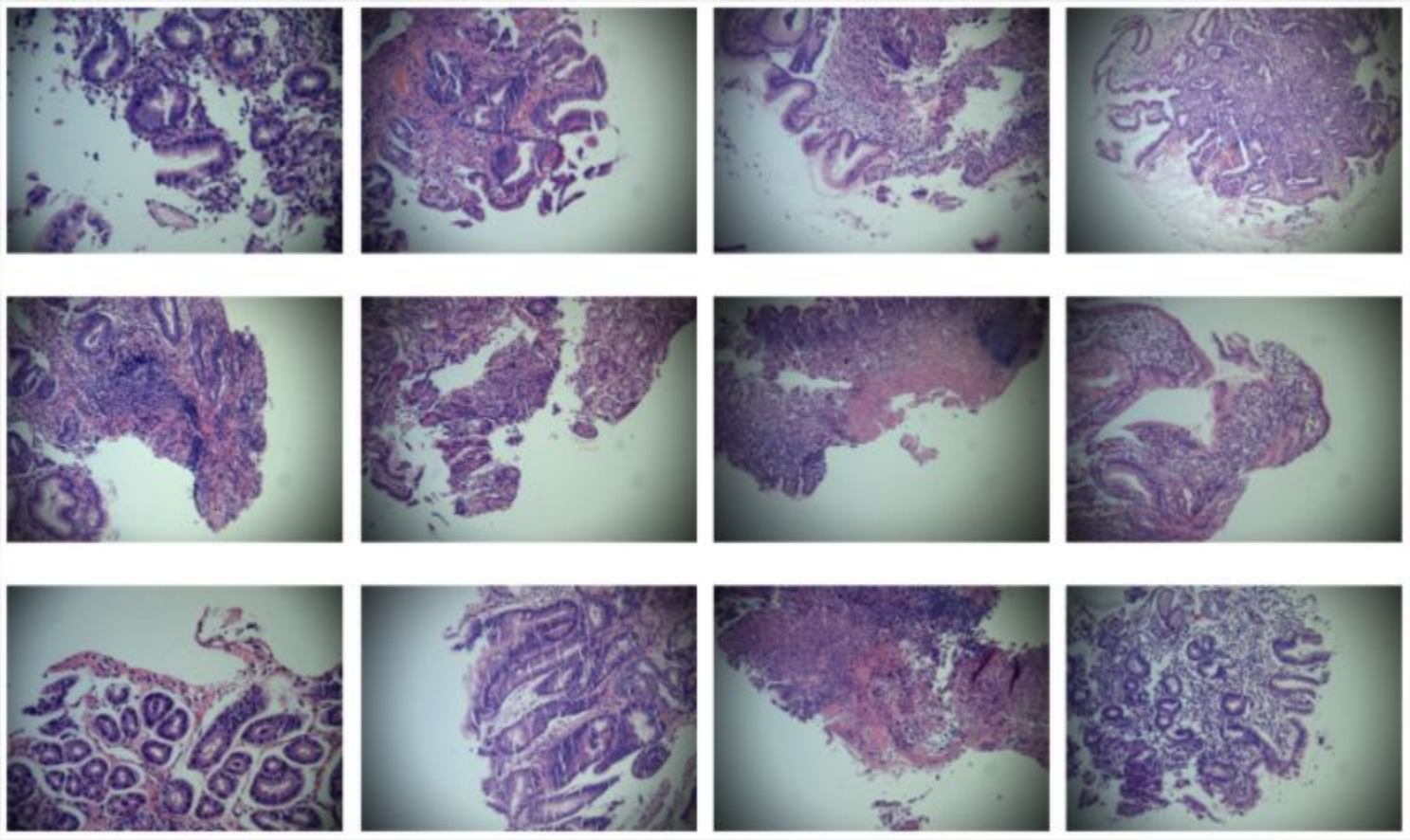


> Error Analysis





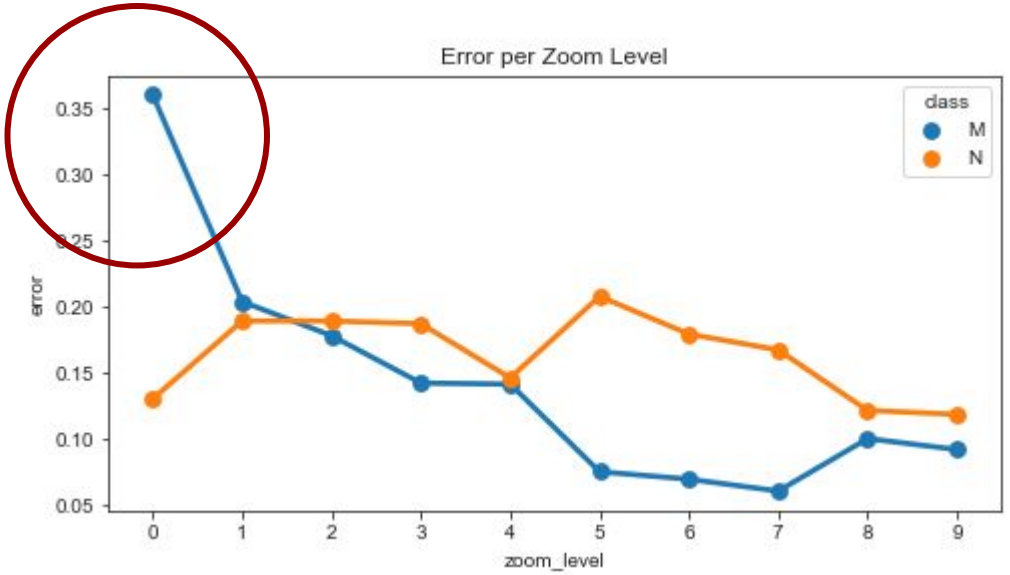
> Error Analysis



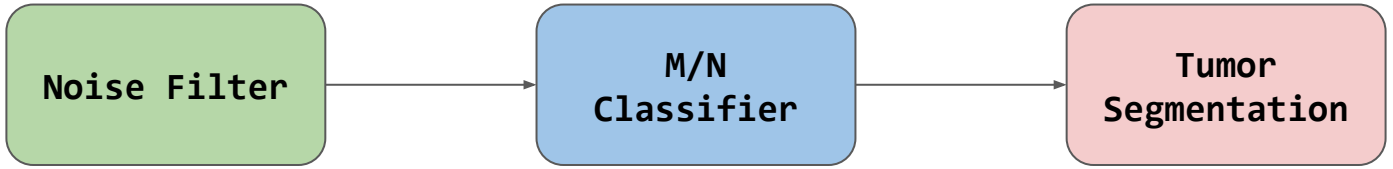
Normal images predicted as Malignant

> Requirements?

Do zoom-out images matter?



> Requirements?



Model A (resnet50)

Acc: 0.859
TPR: **0.894**
TNR: 0.844

Confusion Matrix:	Pred M	Pred N
True M	4696	560
True N	1860	10045

vs.

Model B (resnet101)

Acc: 0.860
TPR: 0.862
TNR: **0.860**

Confusion Matrix:	Pred M	Pred N
True M	4533	723
True N	1670	10235

~ THANK YOU ~