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# PROJECT

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# DESCRIPTION

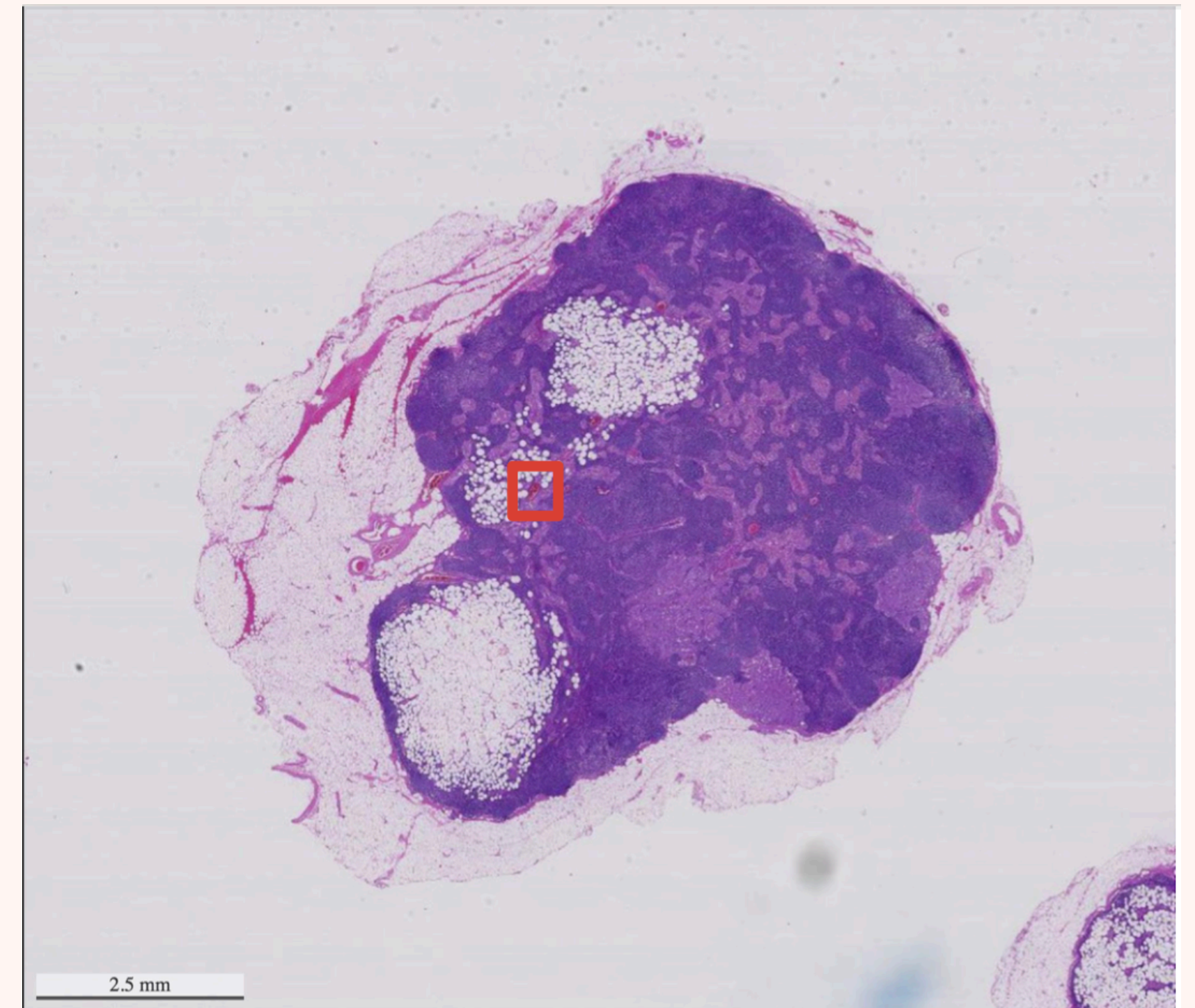
- **Background:** It is really hard to detect cancer metastases in a high resolution pathology image by visual inspection which can be tedious and error prone. Thus, we hope to develop a tool to assist pathologists by showing regions of the given image likely to contain cancer to decrease pathologists' workload and increase the diagnosis accuracy.

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# DESCRIPTION

➤ **Goal:** Successfully detect cancer in gigapixel pathology images

➤ **Database:** CAMELYON16



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# PROCESS

➤ **Preprocessing Data**

➤ **Building Models**

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# PREPROCESSING

- **Read Image**
  - **Get Patch**
  - **Detect Tissue and Tumor**
  - **Save Patch**
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# MODEL

## Model 1

- Model: InceptionV3
- Data: Tumor\_091, Tumor\_101, Tumor\_110
- Zoom level: 3
- Patch size: 299\*299
- Train/Val/Test Ratio: 4:1:1

## Model 2

- Model: InceptionV3 + data augmentation + a few layers
- Data: Tumor\_091, Tumor\_101, Tumor\_110
- Zoom level: 3
- Patch size: 299\*299
- Train/Val/Test Ratio: 4:1:1

## Model 3

- Model: Three InceptionV3 models
  - Data: Tumor\_091, Tumor\_101, Tumor\_110
  - Zoom level: 3, 4, 5
  - Patch size: 299\*299
  - Train/Val/Test Ratio: 4:1:1
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**CODE**

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# MODEL 1 PERFORMANCE

➤ Patch size: 299\* 299

➤ Evaluate on test set: loss is 0.237 and accuracy is 87.5 %

```
Confusion matrix is:
```

```
[[42 22]
```

```
 [46 18]]
```

```
Classification report is:
```

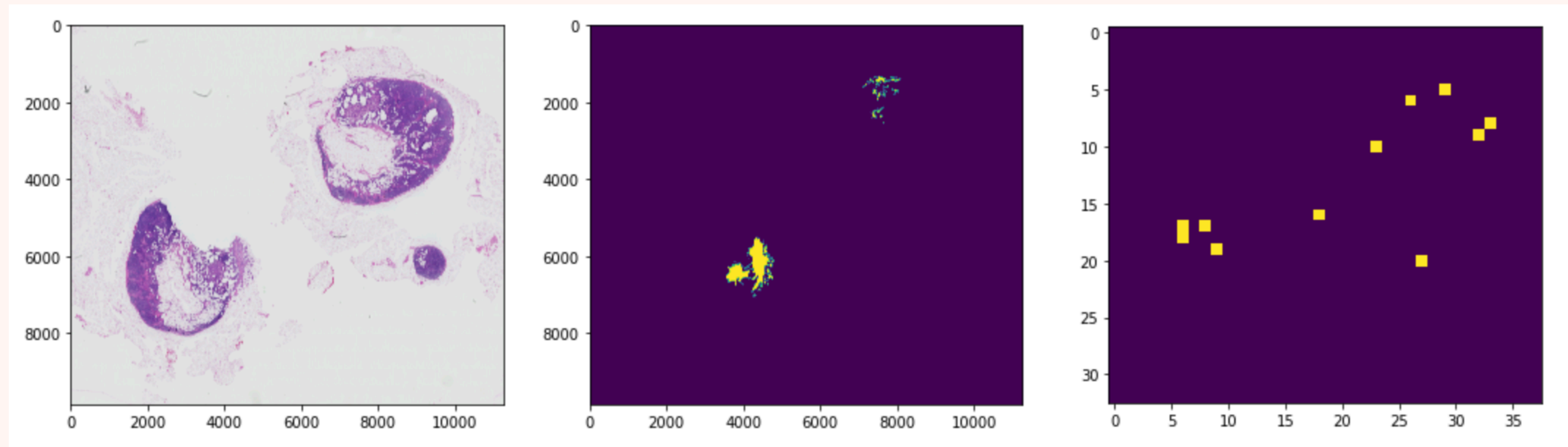
	precision	recall	f1-score	support
0	0.48	0.66	0.55	64
1	0.45	0.28	0.35	64
accuracy			0.47	128
macro avg	0.46	0.47	0.45	128
weighted avg	0.46	0.47	0.45	128



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# MODEL 1 PREDICTION

➤ Predict on a new slide "tumor\_075.tif" patch by patch



Slide

Actual Tumor Mask

Model Prediction

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# MODEL 1 PERFORMANCE

➤ Patch size: 75\*75

➤ Evaluate on test set: loss is 0.213 and accuracy is 91.4 %

Confusion matrix is:

```
[[480 239]
```

```
[474 245]]
```

Classification report is:

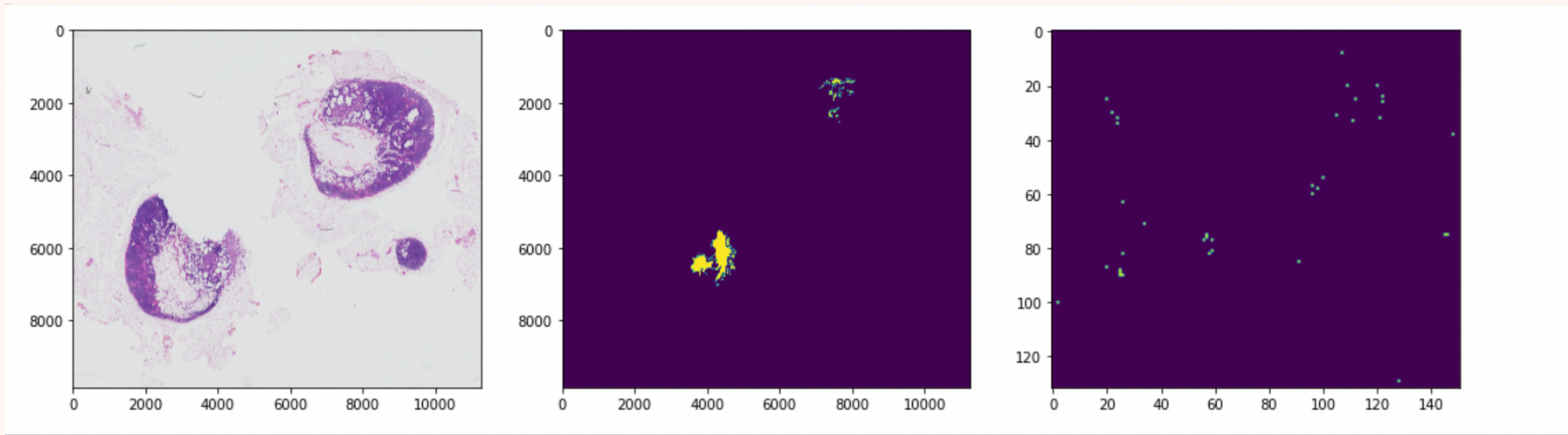
	precision	recall	f1-score	support
0	0.50	0.67	0.57	719
1	0.51	0.34	0.41	719
accuracy			0.50	1438
macro avg	0.50	0.50	0.49	1438
weighted avg	0.50	0.50	0.49	1438



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# MODEL 1 PREDICTION

➤ Patch size: 75 \* 75



Slide

Actual Tumor Mask

Model Prediction

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# IMPROVED MODEL 2

➤ **Apply random data augmentation and more layers**

➤ **Patch size: 299\*299      Testing accuracy: 90.6%**

```
Confusion matrix is:
```

```
[[36 28]
```

```
 [40 24]]
```

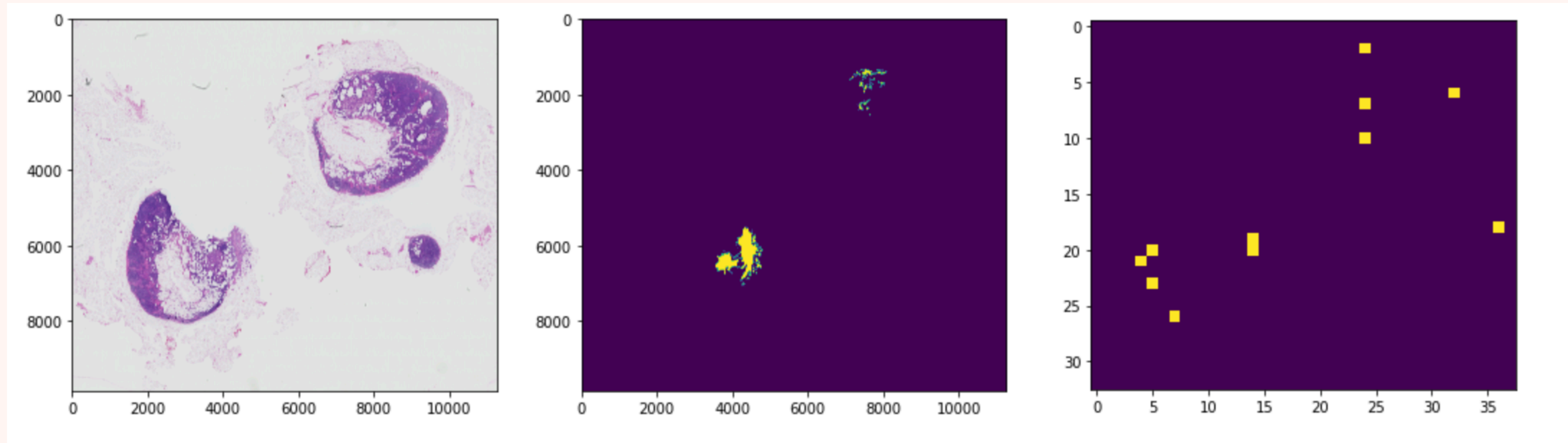
```
Classification report is:
```

	precision	recall	f1-score	support
0	0.47	0.56	0.51	64
1	0.46	0.38	0.41	64
accuracy			0.47	128
macro avg	0.47	0.47	0.46	128
weighted avg	0.47	0.47	0.46	128

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# MODEL 2 PREDICTION

➤ Predict on a new slide "tumor\_075.tif" patch by patch



Slide

Actual Tumor Mask

Model Prediction

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# MODEL 3: STACKING MODEL

- **Patch size: 299\*299**
  - **Stacking three InceptionV3 models, each with a zoom level of 3, 4 and 5 respectively. Then add a concatenating layer and a few layers on top.**
  - **Achieves training loss of 0.0081 and training accuracy of 99.75%**
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# LIMITATION AND FUTURE DIRECTION

- **Overfitting:** The size of training set is quite small. Though we have a high training accuracy, the prediction result on a new slide is not very ideal. Improve by including more training images, and use a smaller zoom level such as two in the future to improve the performance.
  - **Limiting computation power to train a stacking model:** The model is too big for Colab to train. We can use model parallelism or data parallelism to speed up.
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