Topcoder Konica Minolta

Pathological Image Segmentation Challenge

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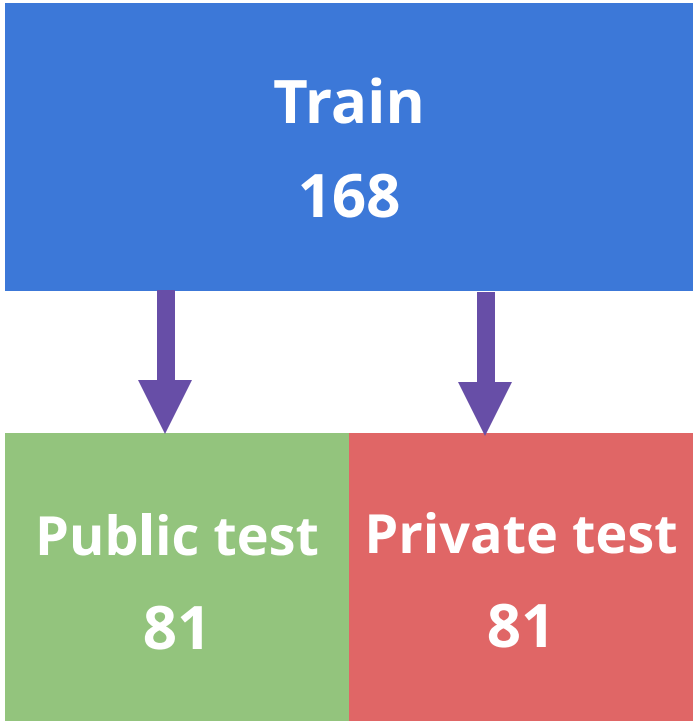
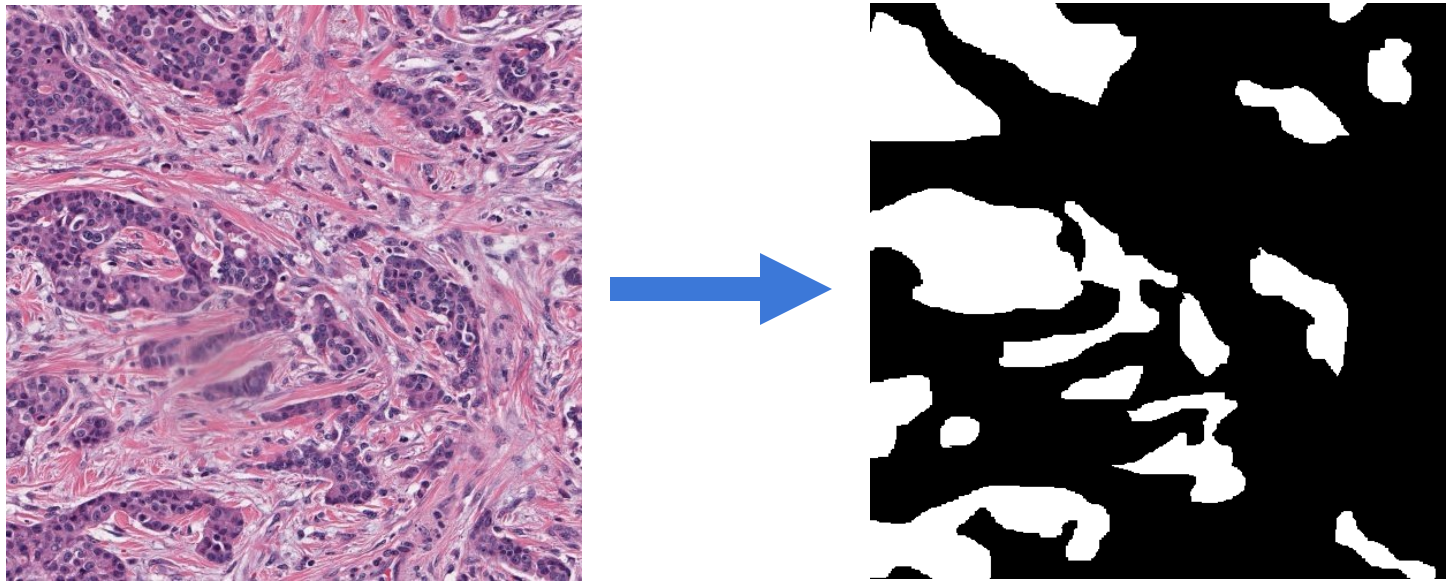
Kaggle top 100

Problem description



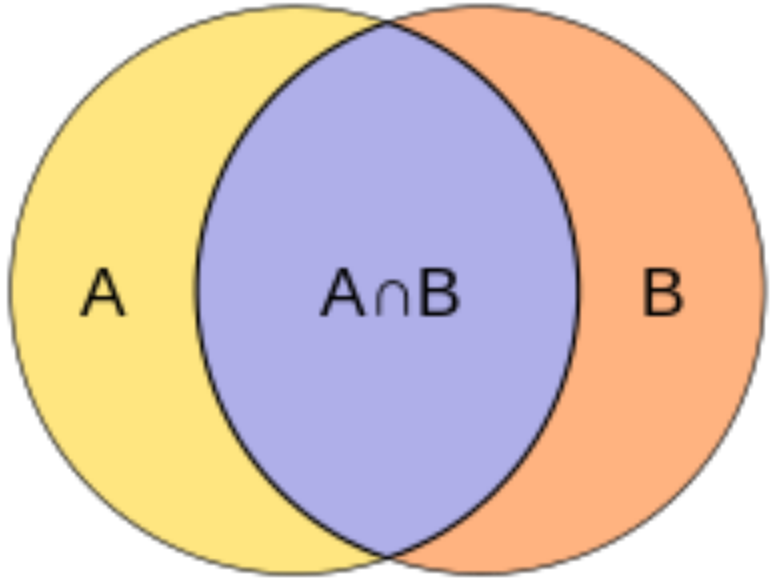


Metric

$$Score = 100000 \times \frac{F1_{micro} + Dice_{instance-wise}}{2}$$

$$F1 = 2\frac{P \cdot R}{P + R} \qquad P = \frac{TP}{TP + FP} \qquad R = \frac{TP}{TP + FN}$$

$$DICE = \frac{2TP}{(TP + FP) + (TP + FN)}$$



Platform description

- TopCoder
- The hardest part was to deal with the website.
- Submissions once in two hours.
- Last submission at the Leaderboard.
- The last submission is your final submission.
- Private LB realized week+ after the end.

Submission

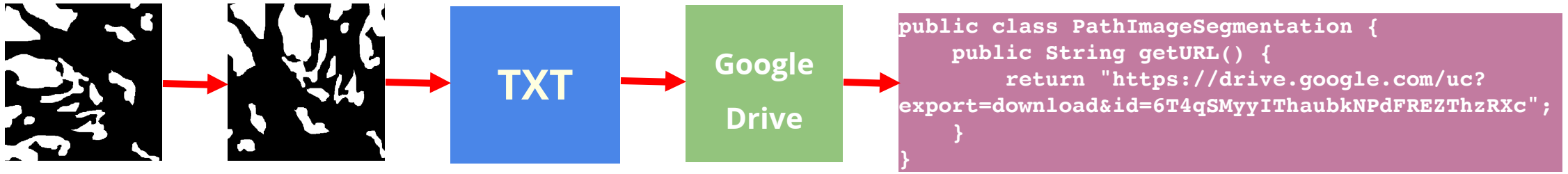
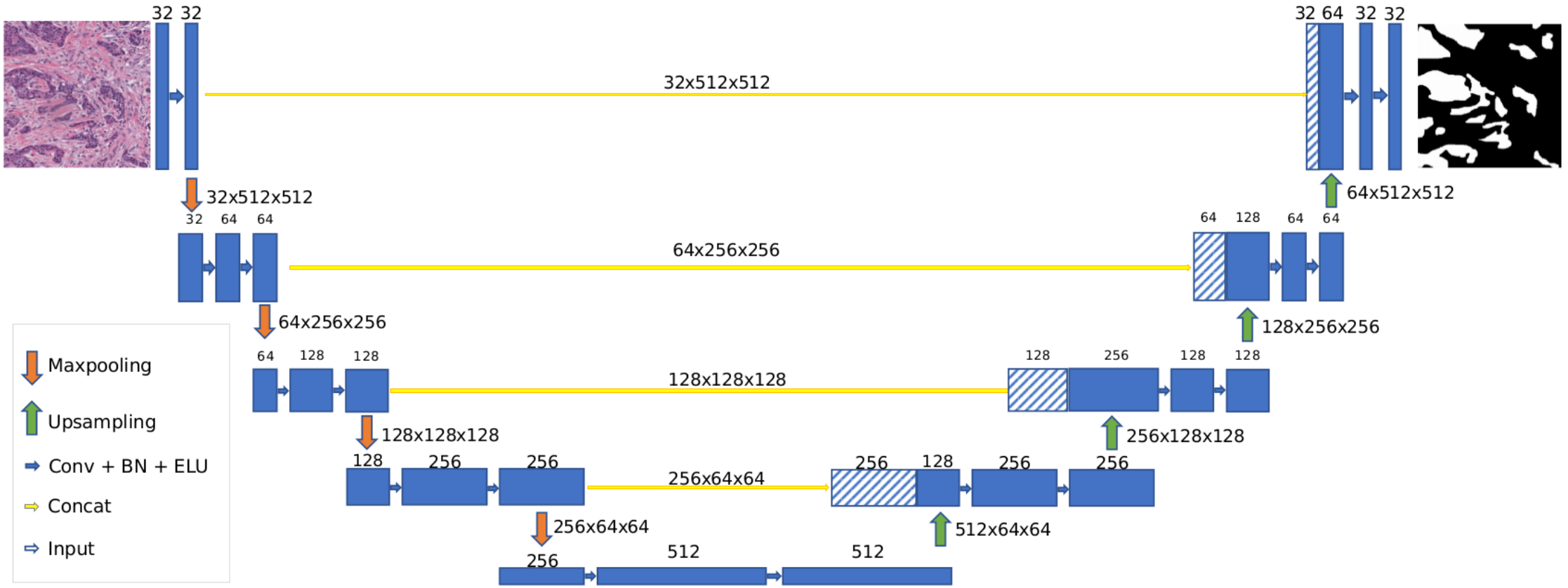


Image segmentation benchmark results

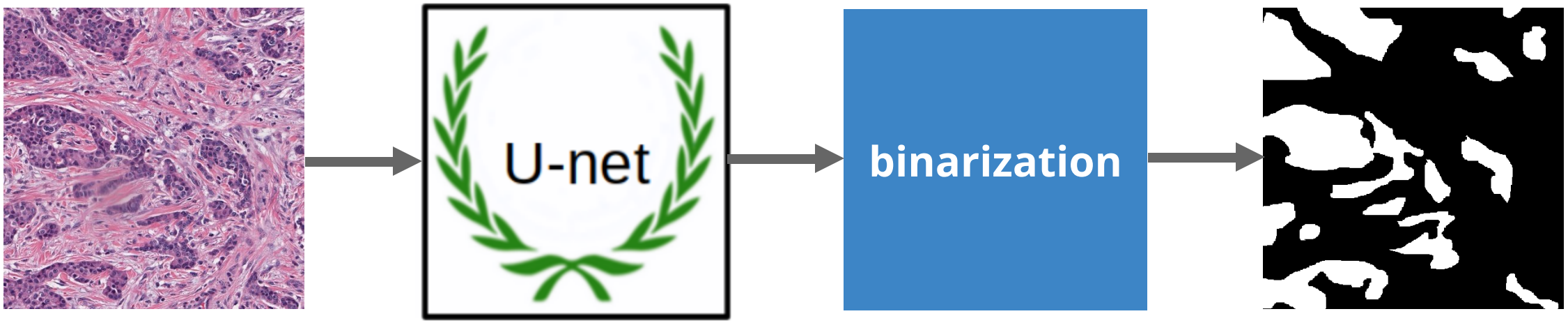
Source	Model	CityScapes IoU	VOC 2012 mIoU	CamVid IoU
1411.4038	FCN	*65.3*	*62.2*	*57.0*
1412.7062	DeepLab-V1	*63.1*	*68.7*	*61.6*
1502.03240	CRF-RNN	*62.5*	*72.0*	
1504.01013	Piecewise	*71.6*	75.3	
1505.04366	DeconvNet		*72.5*	*48.9*
1505.04597	U-Net			
1509.02634	DPN (deep)	*66.8*	*74.1*	
1511.00561	SegNet	*56.1*	*59.1*	*65.2*
1511.07122	Dilation	*67.1*		*65.3*
1603.08695	SharpMask			
1605.02264	LRR	69.7	*74.7*	
1606.00915	DeepLab-V2	*70.4*	*71.6*	
1606.02147	ENet	58.3		*68.3*
1611.06612	RefineNet	73.6	83.4	
1611.08323	FRRN	71.8		
1611.09326	DenseNet		*68.7*	66.9
1612.01105	PSPNet	78.4	82.6	
1703.00551	LRN		64.2	61.7
1704.08545	ICNet	69.5		
1706.05587	DeepLab-V3		85.7	
1707.01629	DPN (dual)		74.8	
1707.03718	LinkNet	76.4		68.3
CVPR-17	G-FRNet		68.2	68.7
CVPR-17	G-FRNet+CRF		70.4	71.0
CVPR-17	G-FRNet-101		79.3	77.8

https://nizhib.com/posts/image-segmentation

Network: UNet



Pipeline



- 5 folds
- Threshold based on out of fold predictions
- Train augmentations: D4 + color shift + contrast
- Test augmentations: D4
- Optimizer: Adam.
- Cyclic LR (1e-3: 1e-6)
- Loss: BCE - log(dice)

Does cross validation work?

CV	LB
836533	754414
868841	**792269**
885779	784527

1. CV and LB scores are inconsistent
2. Improvements in CV do not map to improvements at LB

Why?

1. Small amount of data (Train 168, Public test 81, Private test 81)
2. Data Leak (found by Evgeny Nizhibitsky)

Problem 1: No person id

Train set is NOT 168 patients with 500x500, but 42 with 1000x1000 => random split leads to data leak!

Solution:

- Merge 168 small patches => 42 large patches
- KFold by patient Id
- Random 500x500 crops from large patches

I did not do it :(

Problem 2: Lazy Scientists :(

Test

162 x 500 x 500

=>

30 x 1000 x 1000

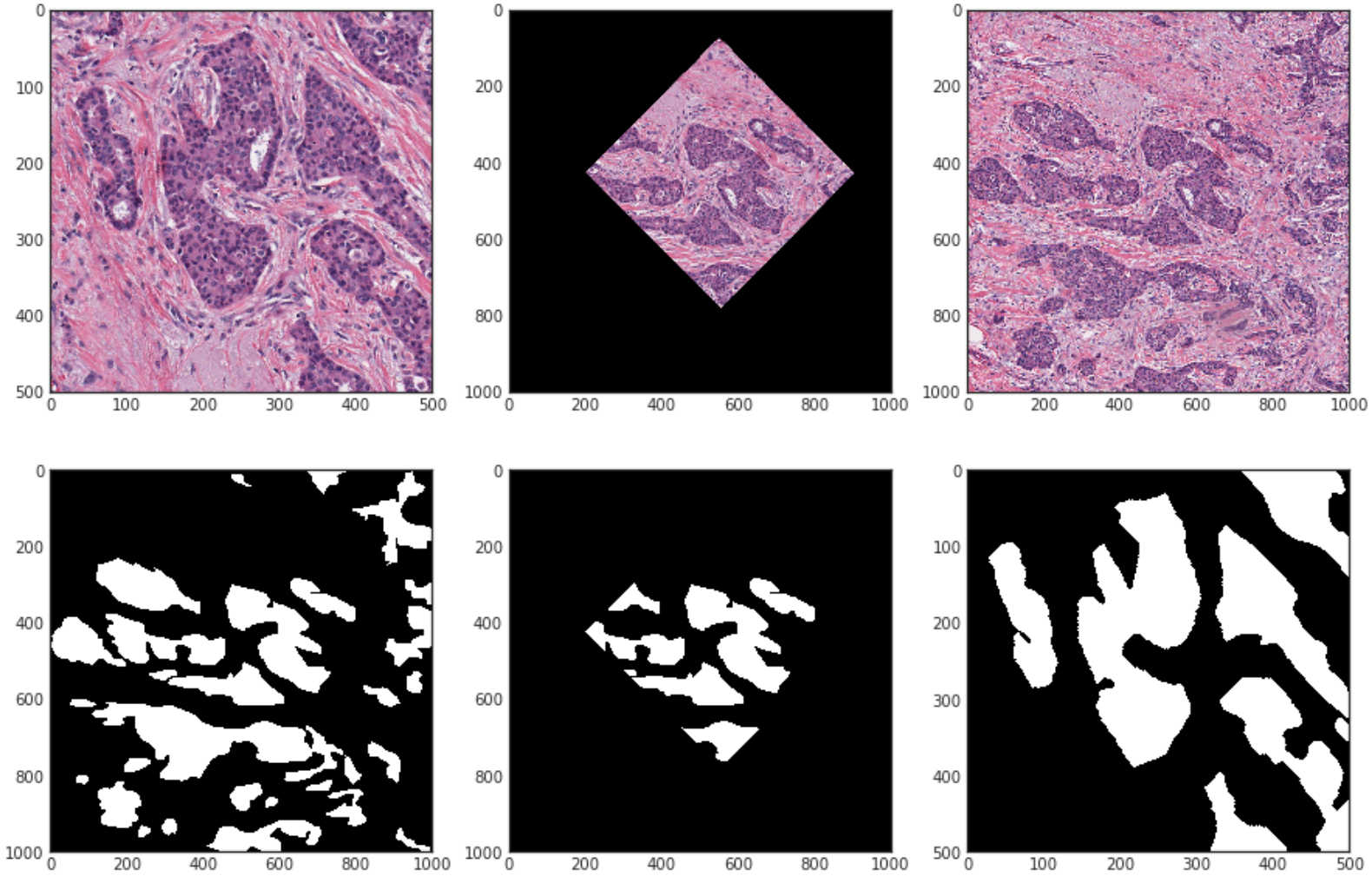
+

42 x 500 x 500

patches from train

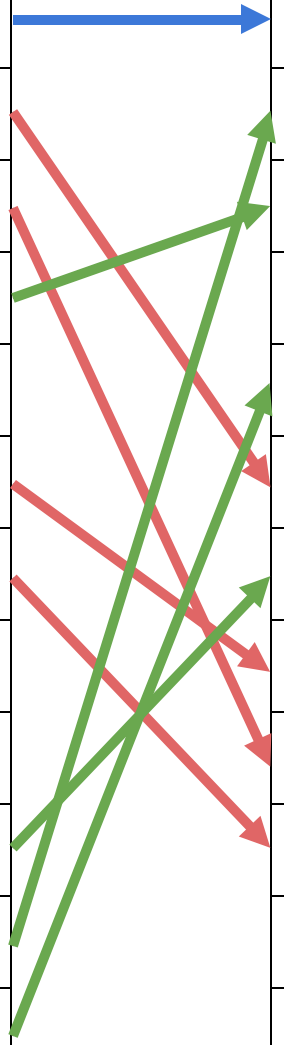
Test 500x500

Train 1000x1000



Results.

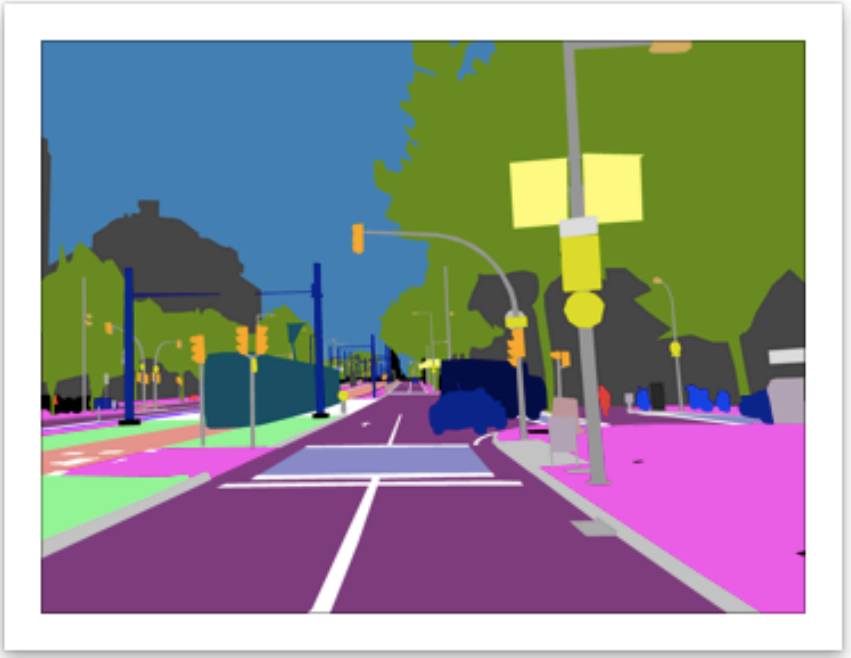
Public Test
smudge
pfr
EgorLakomkin
vkassym
ualabs
nizhib
albu
zaq1xsw2tktk
forcesh
ZFTurbo
n01z3
ternaus



Private Test
smudge
n01z3
vkassym
dulyanov
ternaus
pfr
ZFTurbo
nizhib
EgorLakomkin
albu
ywi4ebyrawi
eagle4

$10,000
$7,000
$5,000
$3,000
$1,000

When UNet does not perform well?



- A lot of data.
- Many classes.

PSPNet => 0.52

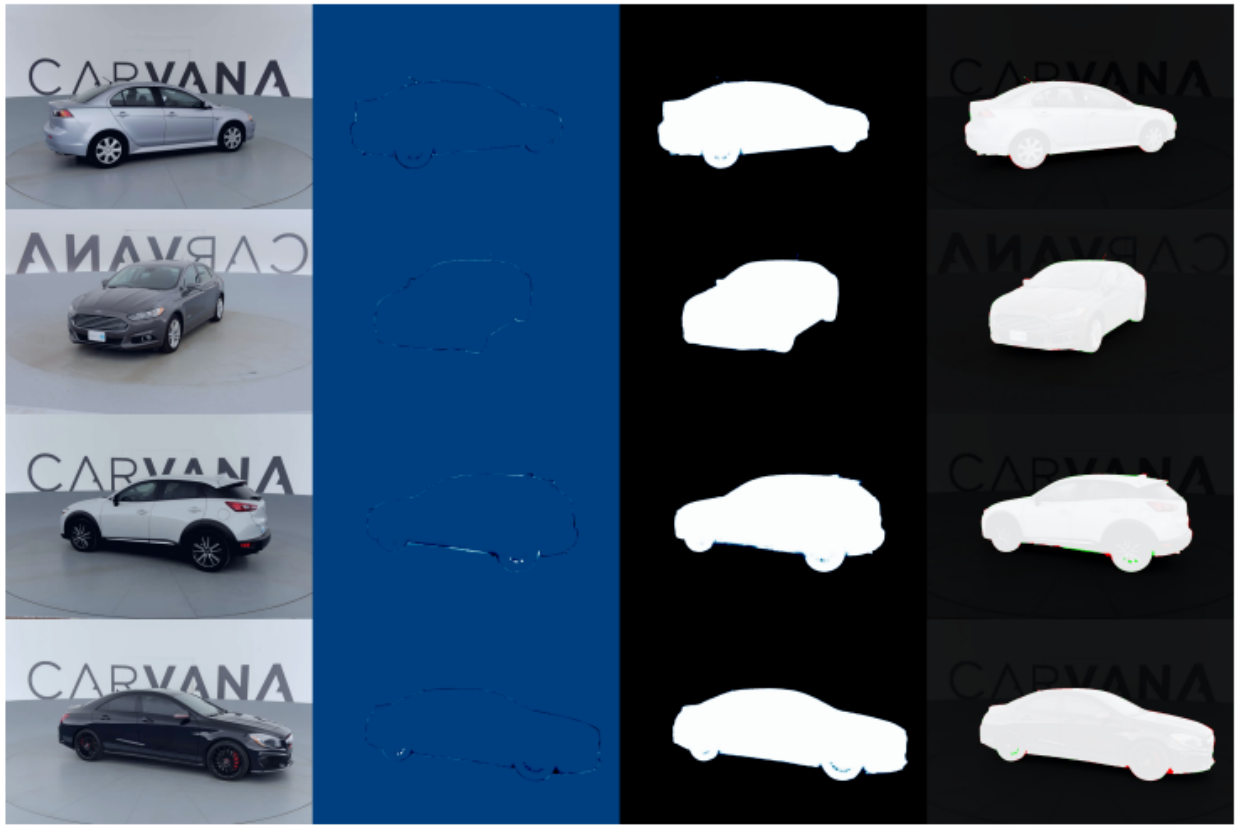
UNet => 0.26

Rank	Participant Team	score
1	PSPNet	0.52
2	MSS_CHAIMI	0.33
3	Vladimir Iglovikov	0.26
4	iiau_adelaide	0.25
	yateam	0.23

When UNet performs well?

- Small amount of data.
- Binary mask.

For practice Carvana Image Masking Challenge (ends in 3 weeks)



Summary

- Time invested: couple evenings
- Money earned: $1000

Software

PyTorch + OpenCV

Hardware

- i7-5930K
- 32Gb RAM
- 4 x GTX 1080 Ti

Rank	Handle	Final Score
1	smudge	860 421,26
2	n01z3	857 612,24
3	vkassym	855 453,57
4	dulyanov	855 356,45
5	ternaus	849 265,13
6	pfr	849 113,01
7	ZFTurbo	848 728,42
8	nizhib	845 720,92
9	EgorLakomkin	840 432,62
10	albu	834 570,35