# 0.50165 Public LB solution

posted in Dstl Satellite Imagery Feature Detection a year ago

60

General: Neural Network - Unet, Adam Optimizer.

Modifications to the original script:

1. Conv -> Conv + BN + ReLU
2. Hard Negative on Epoch. At each epoch, samples are randomly generated. After training on the epoch, the train samples are predicted. Among all samples, N samples of each class are selected, where the class is present and where jaccard score is the lowest. These samples are added in the next epoch. Total about 2700 samples per epoch, a third from Hard Negative
3. Augmentation: vertical and horizontal flips and rotation at an arbitrary angle for large classes. Turns to + -20 degrees for small classes.

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Pipeline 0:

- n01z3 kernel with bug fixes
- Result: **9 class (large vehicle): 0.02713** (316 epoch)

Pipeline 1:

- Image: 12 channels RGB + P + M, 1280 x 1280
- Network input: 128x128
- Prediction: 7 first classes, water merged
- Training: on the whole train without a small piece for validation
- Validation: On a small piece of something about 30% of the frame.
- Results: **1 class (bldg): 0.06403** (geom average ages: 489,450,245,196); **3 class (road): 0.08238** (489 epoch)

Pipeline 2

- Image: 4 channels RGB + P, 3360 x 3360
- Network input: 160x160
- Prediction: 7 first classes, water merged
- Training: on the whole train

- Validation: on pulled out representative fixed pieces. Also, each epoch predicted pieces of the test to assess the quality of the mask.
- Morphology: closing with a size of about 10, dividing regions by area for each image ID
- Results: **6 class (crops): 0.08149**; **7 class (fast water): 0.09688** (gmean epoch: 386, 349) **8 class (slow water): 0.05322** (subtraction from predictions of fast water, gmean epoch: 489, 450, 245)

Pipeline 3

- A network with three inputs, each channel is contacted to features as the size of the main brunch decreases (pic below)
- Images: RGB + P (3584 x 3584), M (896 x 896), A (224 x 224), no preprocess
- Input network: 224 x 224, 56 x 56, 14 x 14, all with BN
- Prediction: 8 first classes
- Training: 20 ID from the train
- Validation: for 5 ID from the train ['6010_1_2', '6100_2_2', '6110_1_2', '6140_1_2', '6170_2_4']
- Results: **2 class (struc): 0.01493** (518 epoch); **4 class (track): 0.03271** (457 epoch); **5 class (tree): 0.04977** (321 epoch);

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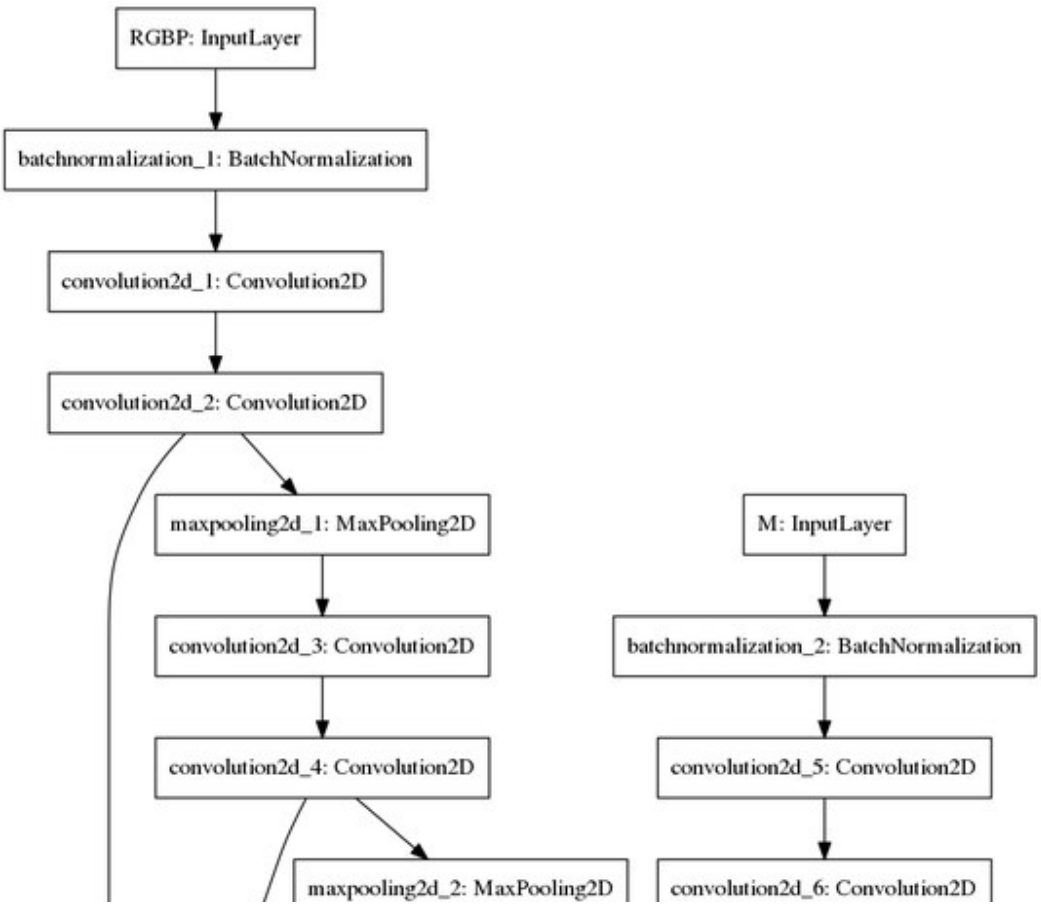
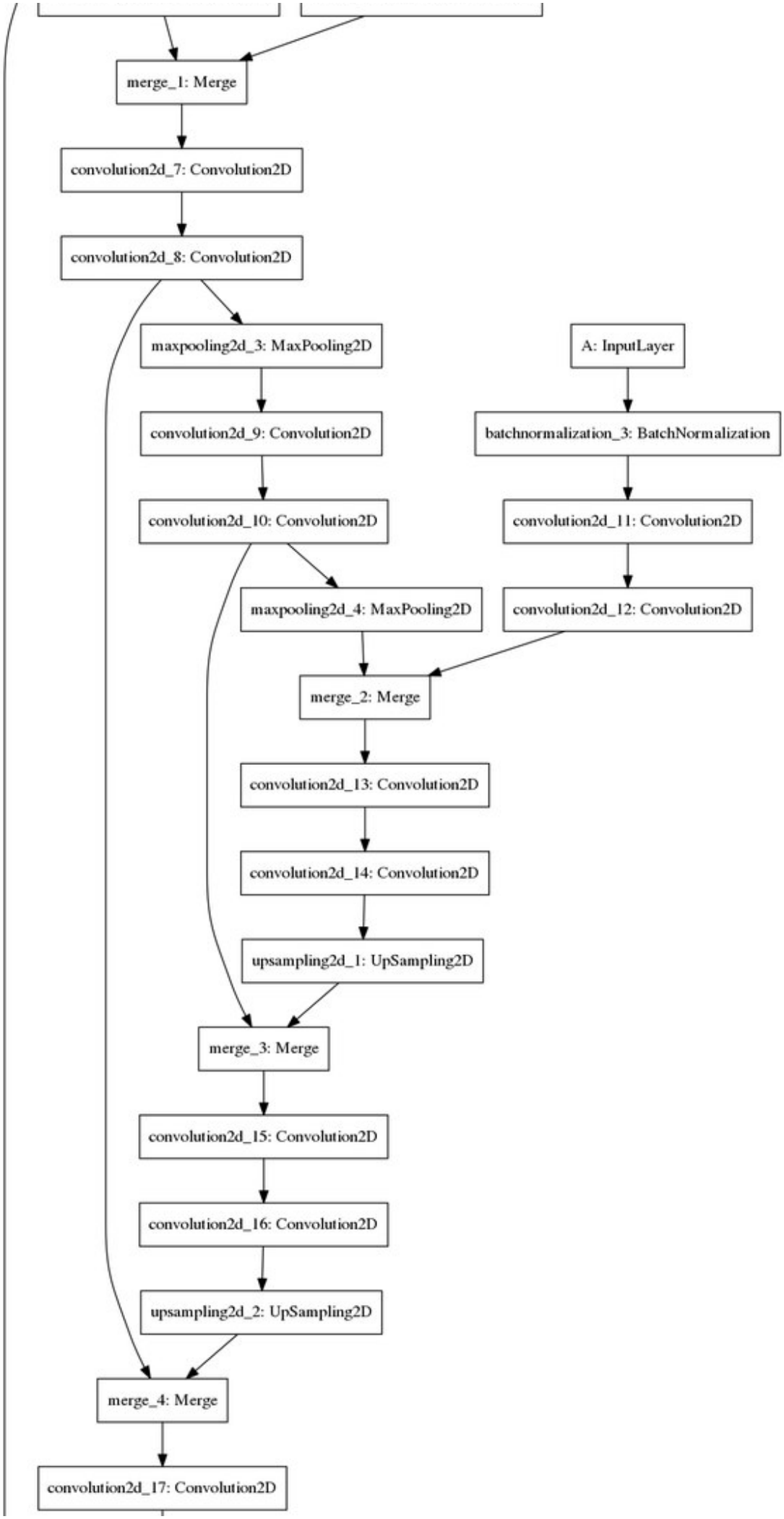
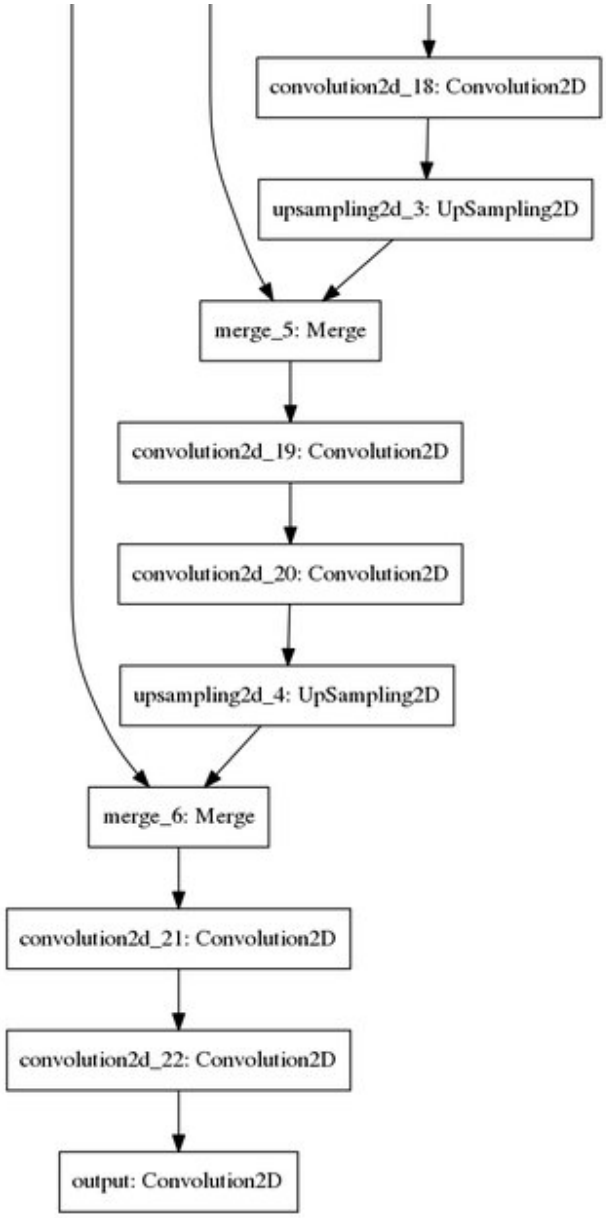
**Final solo score: 0.50165** on Public LB All other results were obtained by combining the predictions with ZFTurbo.

UPD: checkout cool video with learning process https://www.youtube.com/watch?v=OfGsiPyx94I




merge_1: Merge
convolution2d_7: Convolution2D
convolution2d_8: Convolution2D
maxpooling2d_3: MaxPooling2D
A: InputLayer
convolution2d_9: Convolution2D
batchnormalization_3: BatchNormalization
convolution2d_10: Convolution2D
convolution2d_11: Convolution2D
maxpooling2d_4: MaxPooling2D
convolution2d_12: Convolution2D
merge_2: Merge
convolution2d_13: Convolution2D
convolution2d_14: Convolution2D
upsampling2d_1: UpSampling2D
merge_3: Merge
convolution2d_15: Convolution2D
convolution2d_16: Convolution2D
upsampling2d_2: UpSampling2D
merge_4: Merge
convolution2d_17: Convolution2D




**Rakpong Kitti...** • (34th in this Competition) • a year ago • Options • Reply

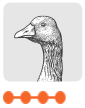
0

Thank you for all of your sharing, I have 2 questions. 1. Did you use hard negative on all pipeline including pipeline0? 2. I think it's a very good idea to separate bands by resolution and merge them in different stages of the model. Have you check if this improve performance comparing to combining them altogether at the beginning.

**n01z3** • (2nd in this Competition) • a year ago • Options • Reply

2

1. For all, 2. I didn't compare models side-by-side on same validation split. Also I was unable to find confident correlation between LB and local validation due to trainset size.



**Argmen** • (99th in this Competition) • a year ago • Options • Reply 0

I find the biggest trick maybe how to train the model( as i get only 0.3+ with the 0.42 script), do you use other tricks except hard negative mining during training?

**n01z3** • (2nd in this Competition) • a year ago • Options • Reply 0

Nope. I Just fixed all bugs and trained about 1000 epoch.

**Aakansh** • (43rd in this Competition) • a year ago • Options • Reply 0

How long does it take to train for 1000 epochs ?

**n01z3** • (2nd in this Competition) • a year ago • Options • Reply 0

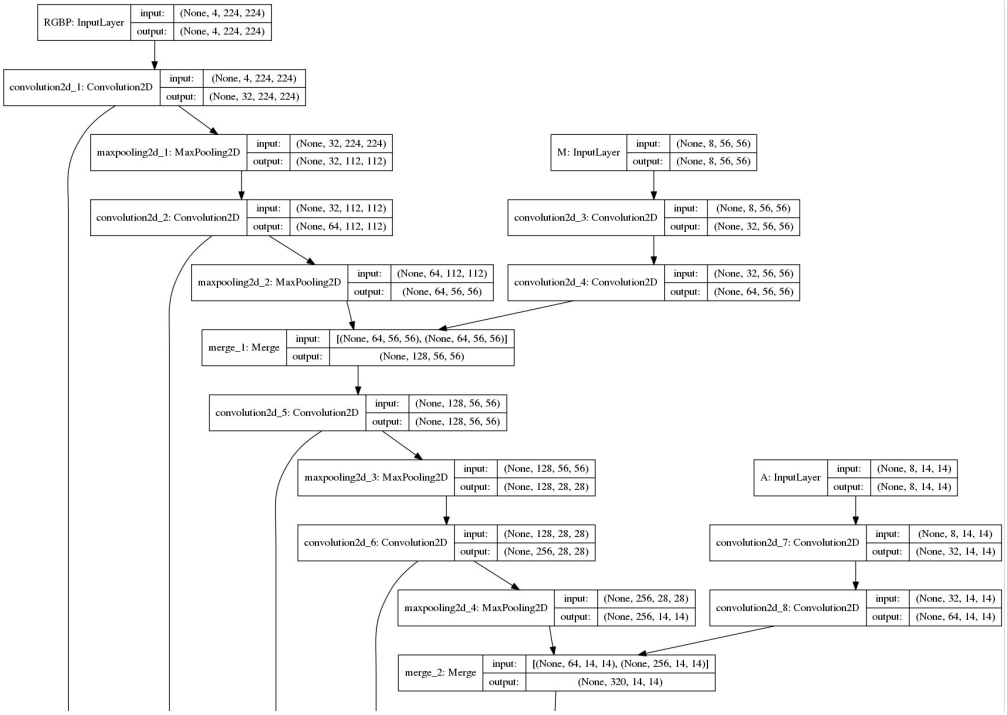
About 3 days

**Cogitae _ Tho...** • (31st in this Competition) • a year ago • Options • Reply 1

Hi @n01z3,

Thanks again for sharing. I tried very similar architecture at the beginning but with lot less epochs (100) as I did not have good metrics at that time and therefore did not get good enough results. I have some questions : I used 200x200, 50x50 and 8x8 to have the ratio matching and I see that you do not completely take the ratio (~1/25) for the SWIR(A) images into account. Is it to have more valid pixels in the convolution ? I suppose that all the inputs were centered on the same point including SWIR. How did you iterate at the borders, padding with 0, with means ?

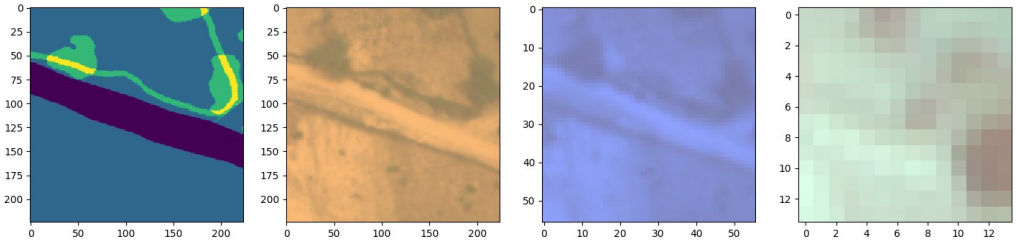
**n01z3** • (2nd in this Competition) • a year ago • Options • Reply 1




Hope now it more clear. I used convolutions with border_mode='same' and pooling with size 2.

**n01z3** • (2nd in this Competition) • a year ago • Options • Reply

2



Also might be helpful. This is an example of one train sample, left to right: Mask, RGBP bands, M band, A band

**visoft** • (157th in this Competition) • a year ago • Options • Reply

0

What did you use to draw the net architecture? (It matter only if it's automated)

**Cogitae _ T...** • (31st in this Competition) • a year ago • Options • Reply

2

It looks a lot like keras.utils.visualize_util.plot => https://keras.io/visualization/

**Cogitae _ T...** • (31st in this Competition) • a year ago • Options • Reply 0

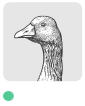
Thanks @n01z3 ! I was wondering if you used concat or sum for merge layers and it looks like you used concat. on the image SWIR looks to be bottom-right aligned to the other images. Am I right ?

**n01z3** • (2nd in this Competition) • a year ago • Options • Reply 1

@visoft: it's keras utils

```
from keras.utils.visualize_util import plot
plot(model, to_file='scheme.png', show_shapes=True)
```

@Cogitae _ Thomas Soumarmon: Yes, it's concat. I think A band misaligned. I didn't any alignment preprocess.



**CRaymond** • (119th in this Competition) • a year ago • Options • Reply 0

i don't really see "Conv -> Conv + BN + ReLU" on the graph plotted? I thought about this idea, and seems not much improvement? Thank a lot.

**n01z3** • (2nd in this Competition) • a year ago • Options • Reply 0

I removed BN+Relu from graph plot for simplicity and compact view. On graph plot Convolution2d = conv+bn+relu.