Moving Object Detection with Deep Convolutional Networks and LSTM

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Last week...

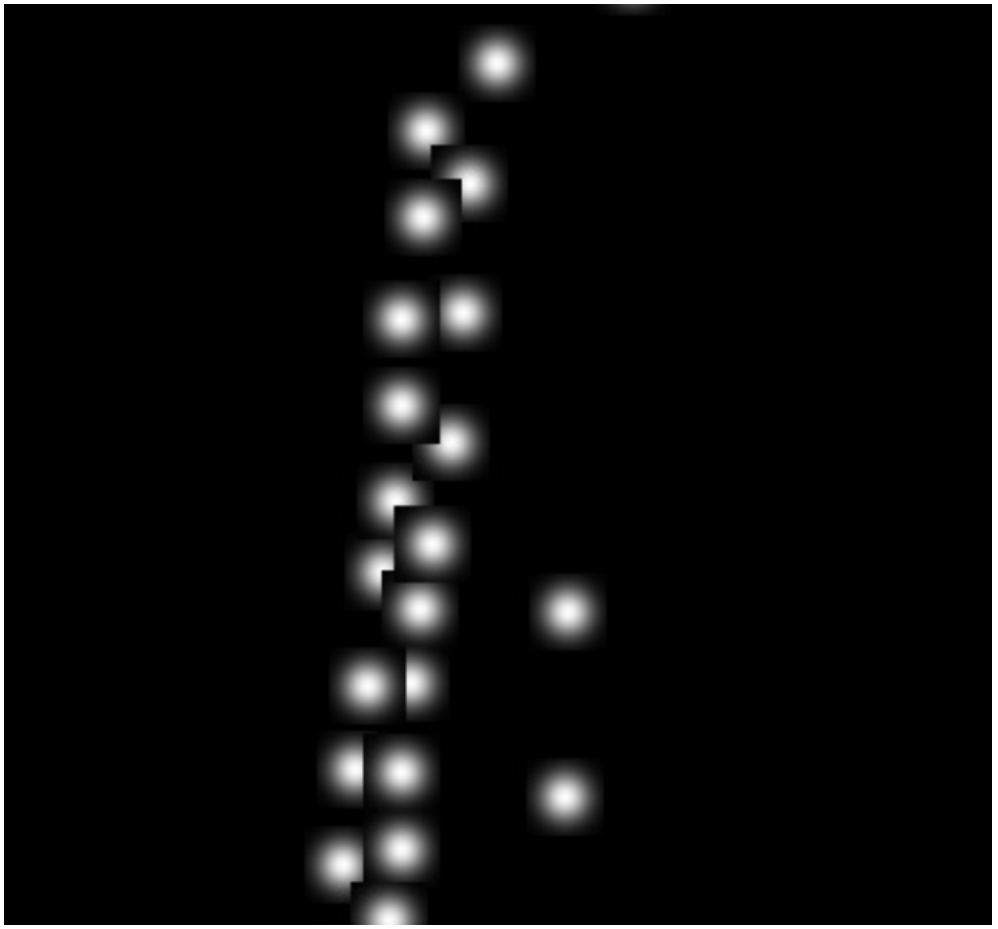
- Heatmap had some problems
- Still had not visualized output
- The loss function was low, but still did not know if network was learning anything

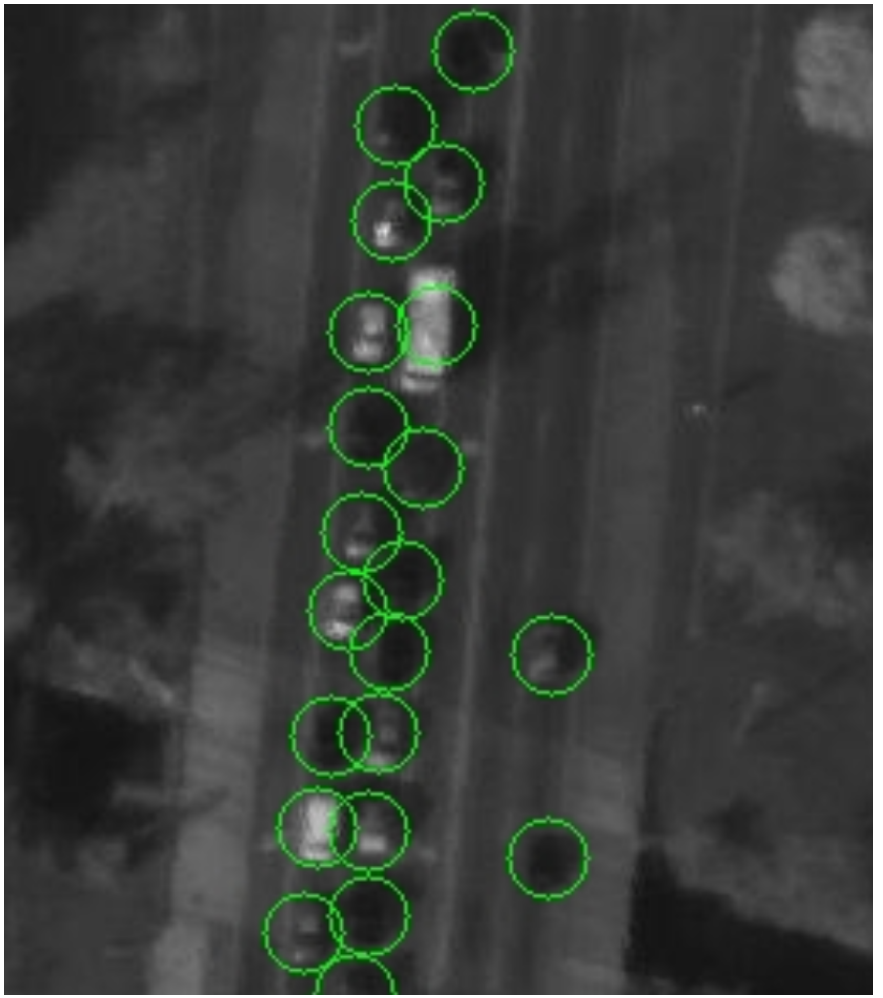
This week...

- Fixed heatmap
- Visualized network output
- Ran several experiments

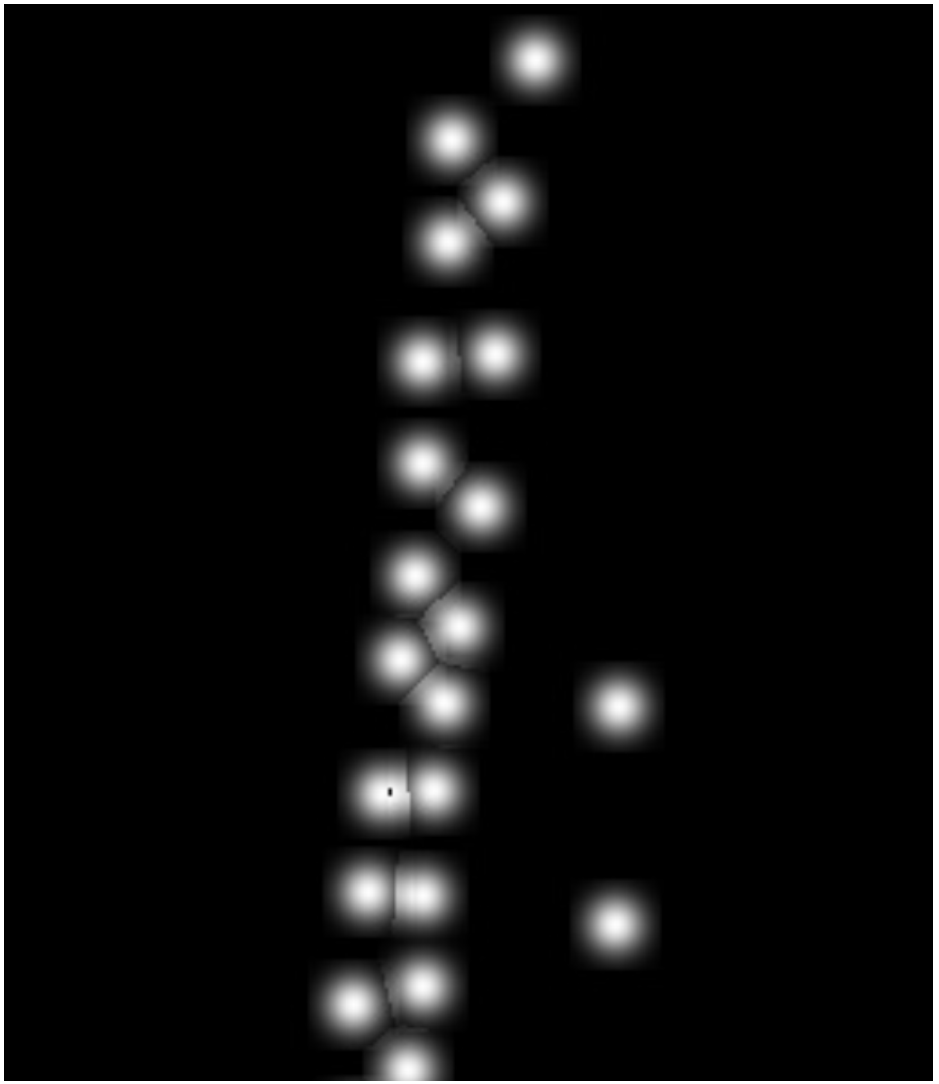
Fixed Heatmap

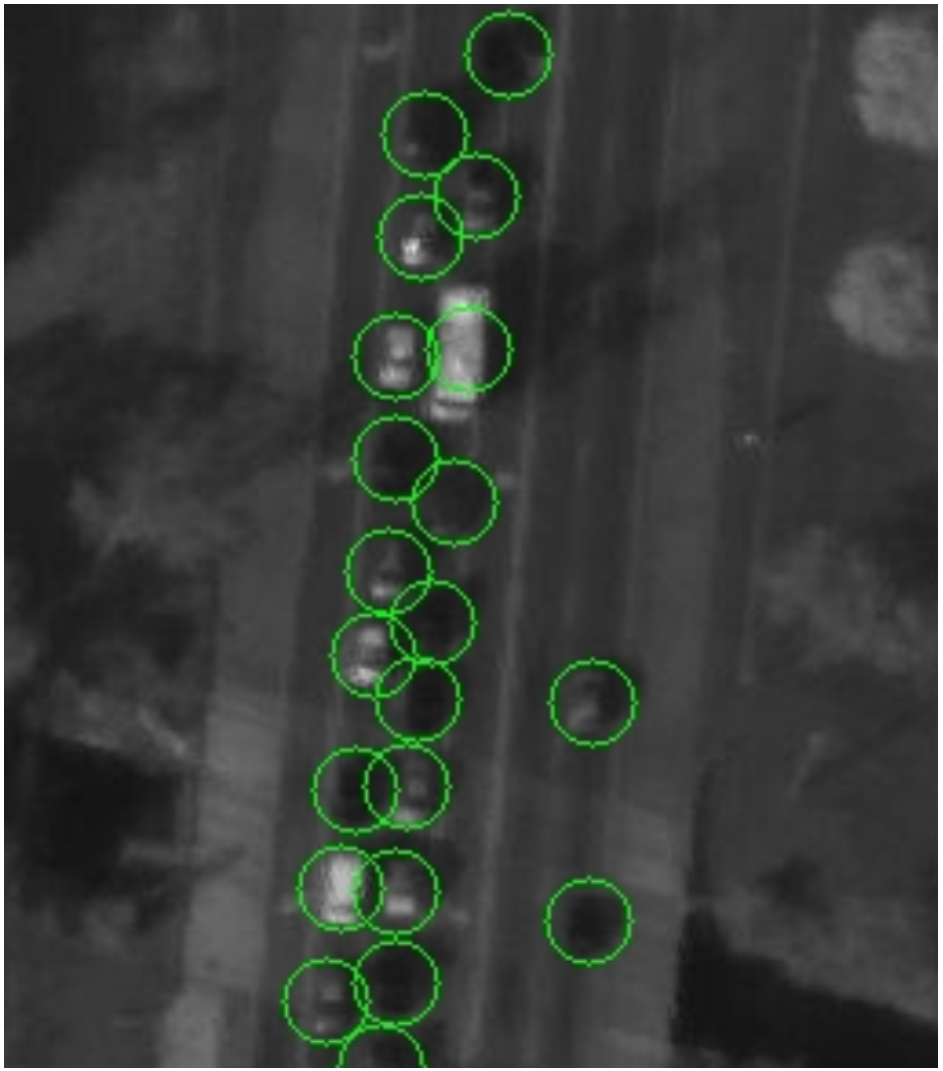
- Last week there was a problem with the heatmap





Fixed Heatmap





Visualized Network Output: Convolutional Kernel Size 5

Last week's results: First 10 images in dataset, 10 iterations

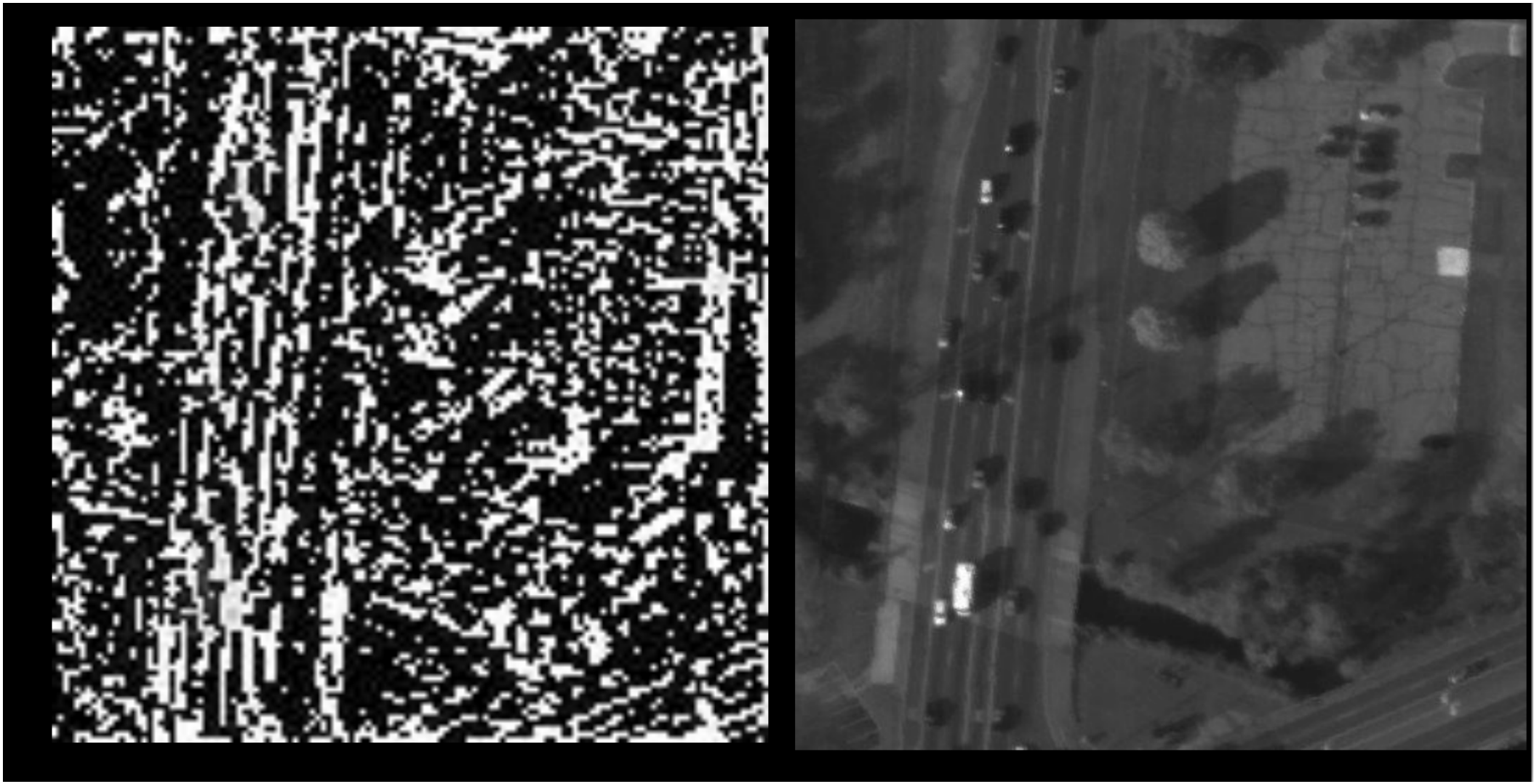




Visualized Network Output: Convolutional Kernel Size 5

Training Time: ~24 hours

First 10 images in dataset, 200 iterations



Modified Dataset

- In order to train the neural network, necessary to divide each image from our dataset into 512 x 512 patches
- >90% of these patches have no vehicles at all
- Vast majority of patches contain 1 or 2 vehicles, with a maximum of 24

Modified Dataset

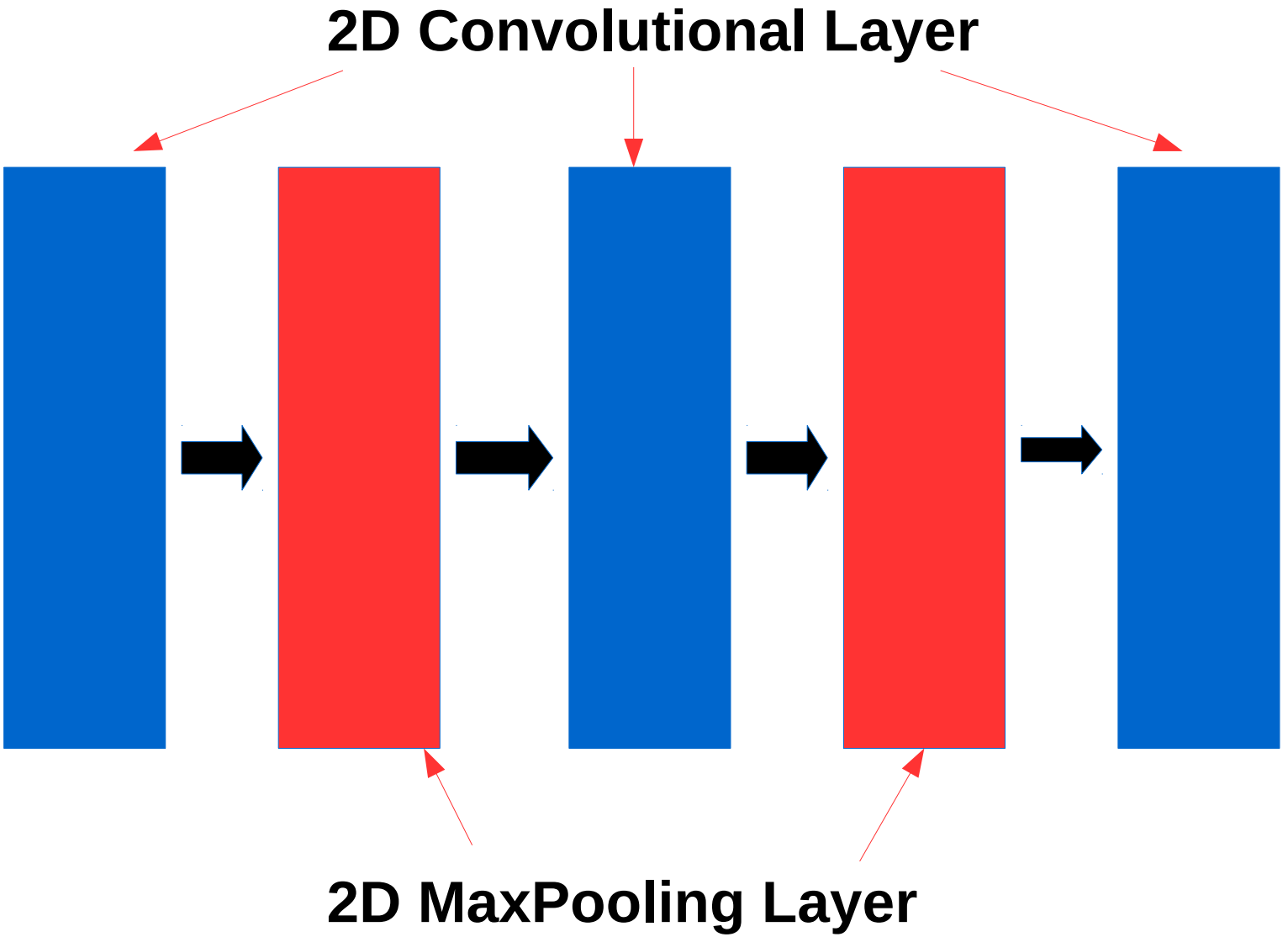


No vehicles in this image **Blank heatmap**

Modified dataset

- Eliminated the blank heatmaps and images with no vehicles
- First 10 images in the dataset have a high similarity
- Solution is to randomize the image patches

Convolutional Neural Network



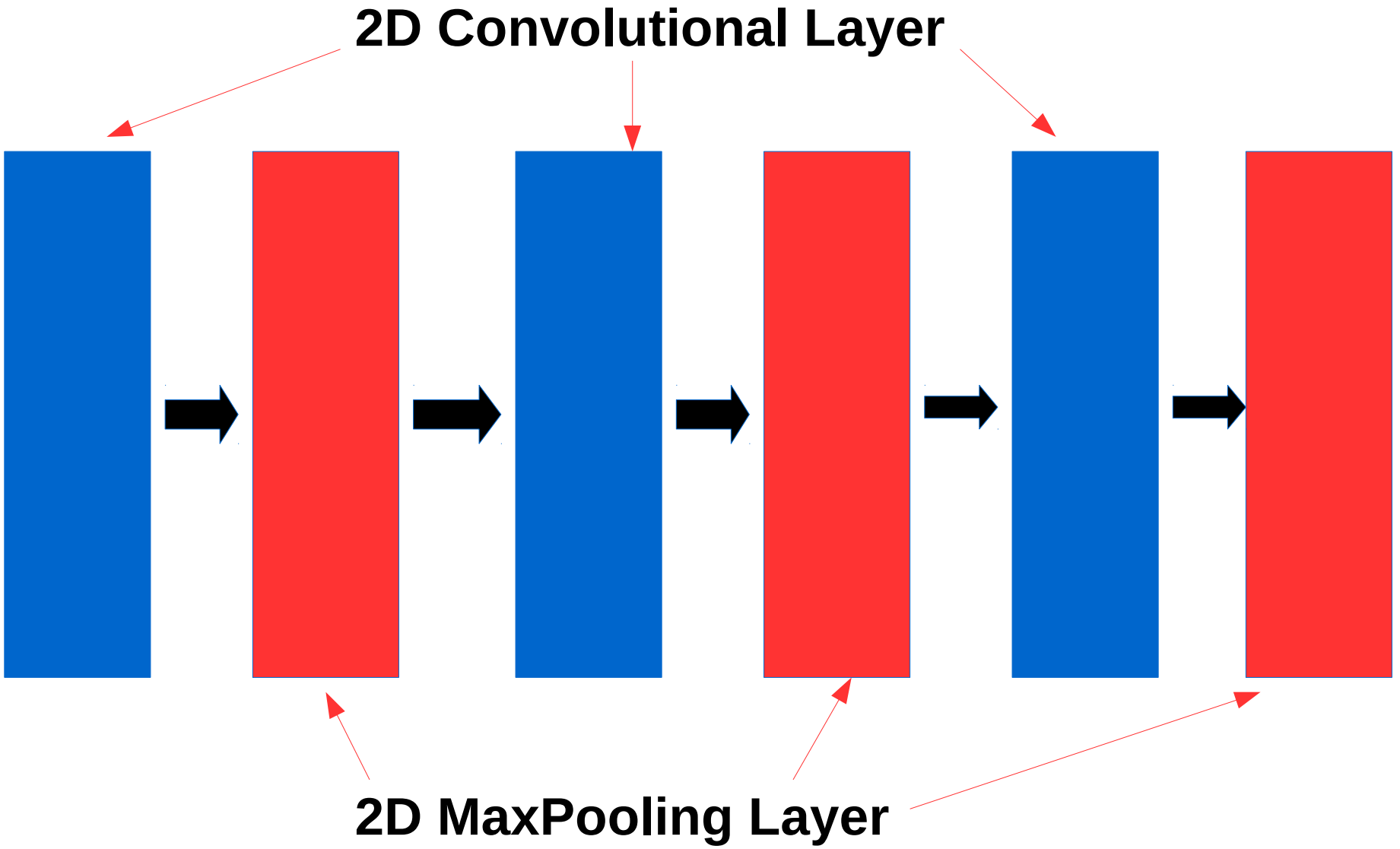
Experiment 1: Increased Convolutional Kernel size from 5 to 15

- Batch size = 3000, 1 iteration per batch
- Results inconclusive: Training time for only 8 iterations was 27 hours
- Loss function was small and did converge to less than 2% error, but unable to visualize results

```
Train on 2400 samples, validate on 600 samples
Epoch 1/1
2400/2400 [==============================] - 4320s - loss: 0.0481 - val_loss: 0.0323
('Test score:', 1.1796376655002434)
```

```
Train on 2400 samples, validate on 600 samples
Epoch 1/1
2288/2400 [==========================>..] - ETA: 488s - loss: 0.0178
```

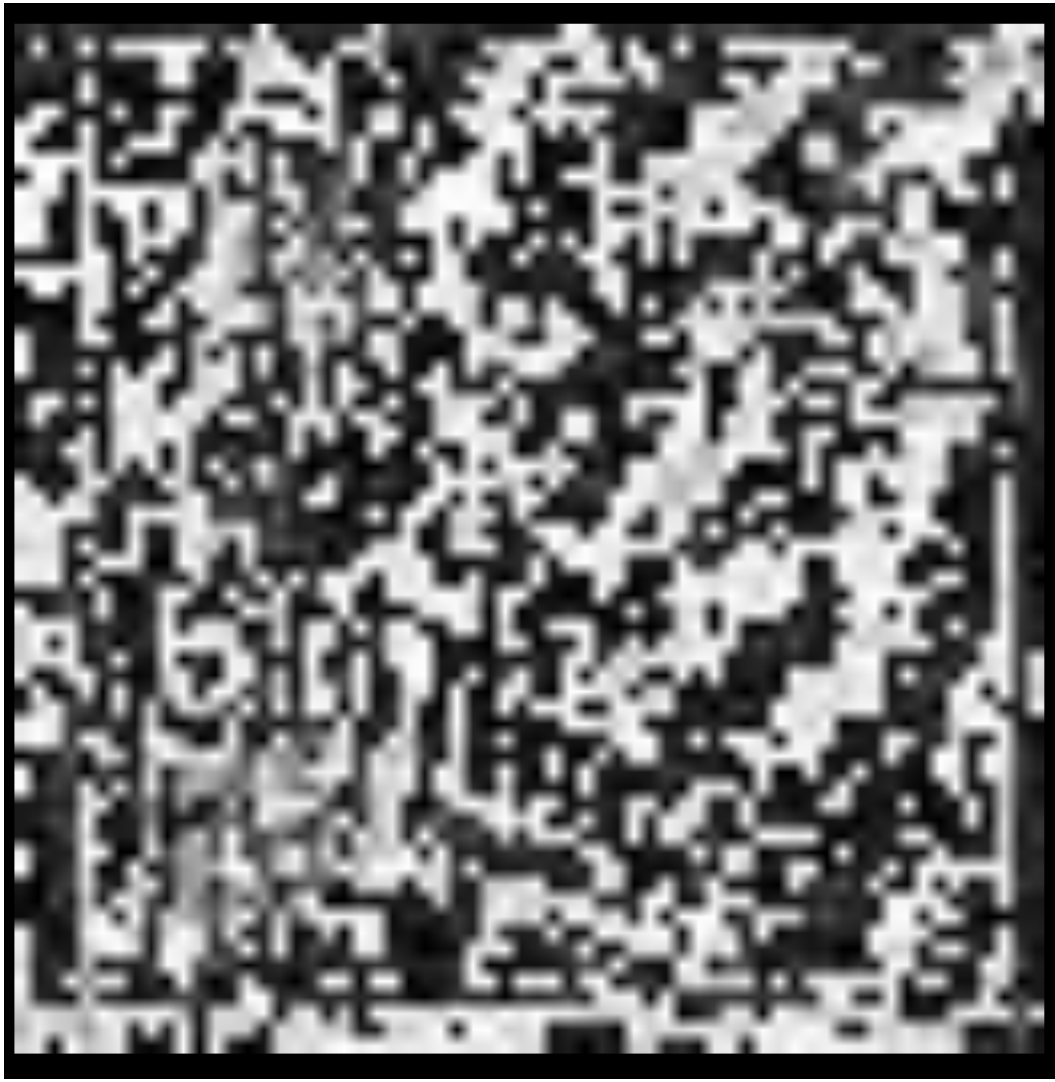
Experiment 2: Added MaxPool Layer, Increased Convolutional Kernel size from 5 to 15



Experiment 2: Added MaxPool Layer, Increased Convolutional Kernel size from 5 to 15

Training Time: ~18.75 hours

Batch Size = 3000, 1 iteration per batch, 20 iterations





Experiment 3: Convolutional Kernel Size 15, Train on 100 images

- Since training time was excessive, trained network using only 100 images, and used the same images for testing

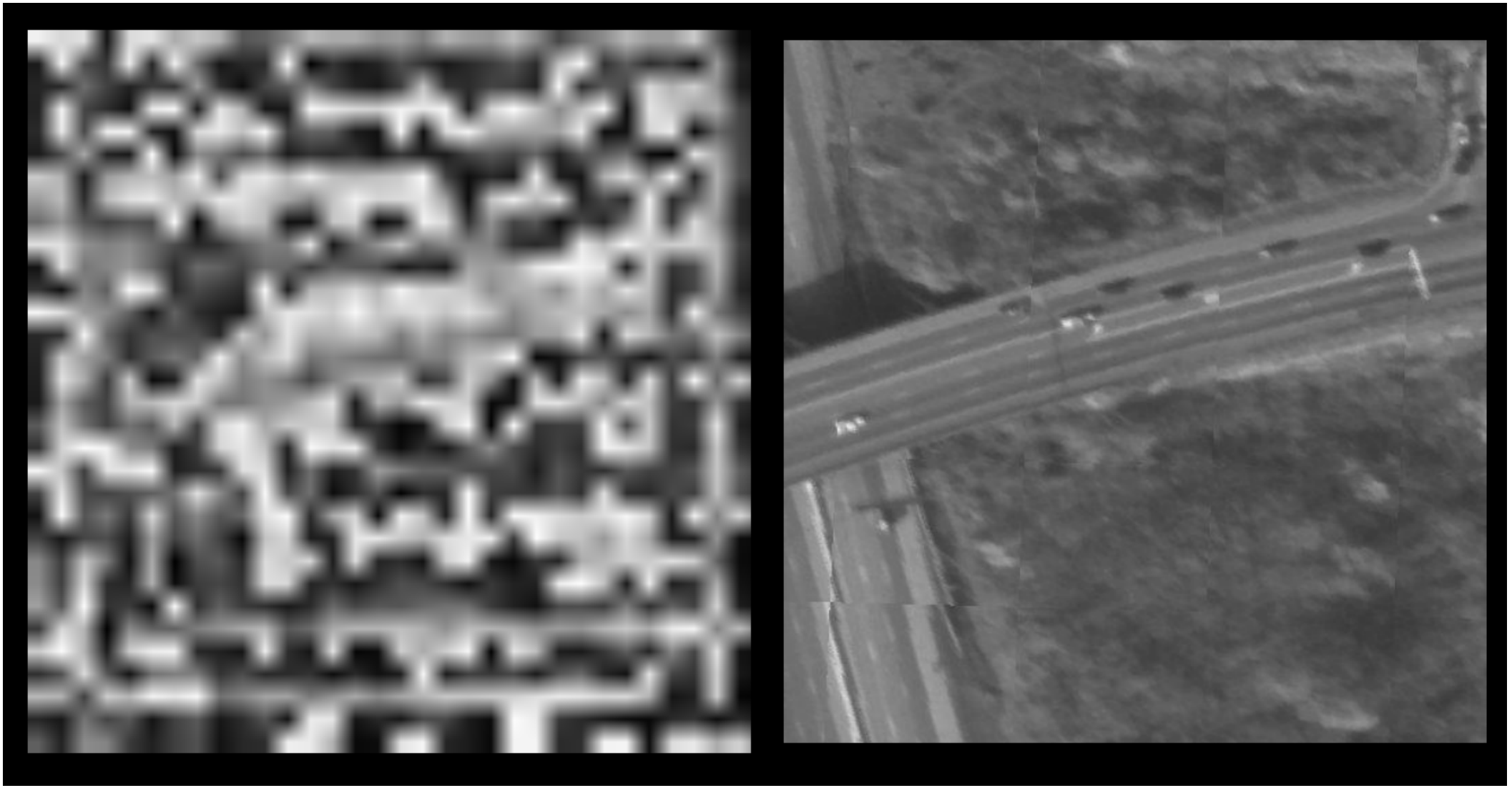
- After 15.35 hours, still only ~240 iterations

Experiment 3: Convolutional Kernel Size 15, Train on 100 images





Experiment 4: Convolutional Kernel Size 15, 100 images, Input Size 128 x 128



Next Steps...

- Work on background subtraction, image registration, and using multiple frames