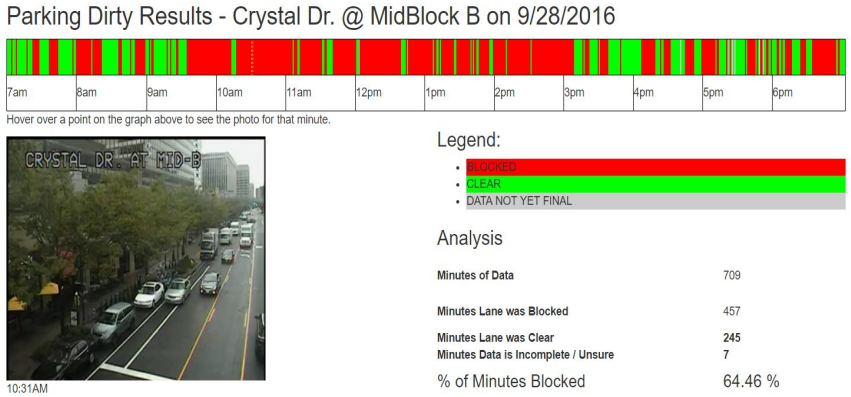
Identifying Bike Lane Obstacles Using Deep Learning and Object Detection

Brendan Freehart and Dan Bernstein
Data Science DC

March 14, 2019

Parking Dirty Data Set



- > 6,000 tagged images from multiple Arlington County traffic cameras
- Perfect for automation using computer vision

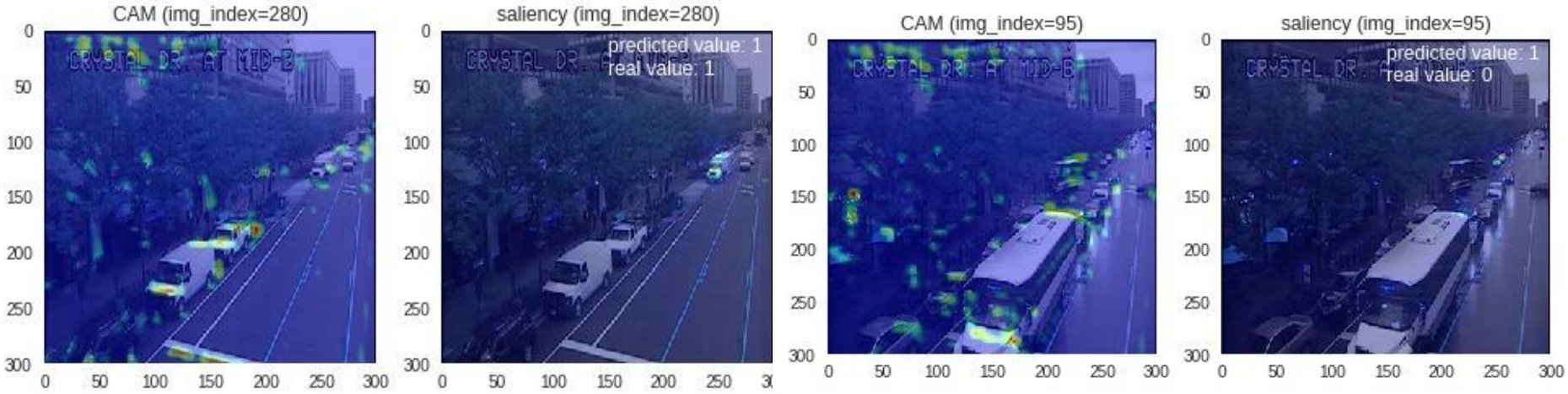
~85% test accuracy

Image Classification Model

```
model = models.Sequential()
model.add(layers.Conv2D(32, (3, 3), activation='relu',input_shape=(300, 300, 3)))
model.add(layers.MaxPooling2D((2, 2)))
model.add(layers.Conv2D(64, (3, 3), activation='relu'))
model.add(layers.MaxPooling2D((2, 2)))
model.add(layers.Conv2D(128, (3, 3), activation='relu'))
model.add(layers.MaxPooling2D((2, 2)))
model.add(layers.Conv2D(128, (3, 3), activation='relu'))
model.add(layers.MaxPooling2D((2, 2)))
model.add(layers.Flatten())
model.add(layers.Dense(128, activation='relu'))
model.add(layers.Dense(1, activation='sigmoid'))

## Compiler Includes Optimizer, and Learning Rate (LR), and Metrics
model.compile(loss='binary_crossentropy',
optimizer=optimizers.RMSprop(lr=1e-4), metrics=['acc'])
```

Grad-CAM and Saliency Maps



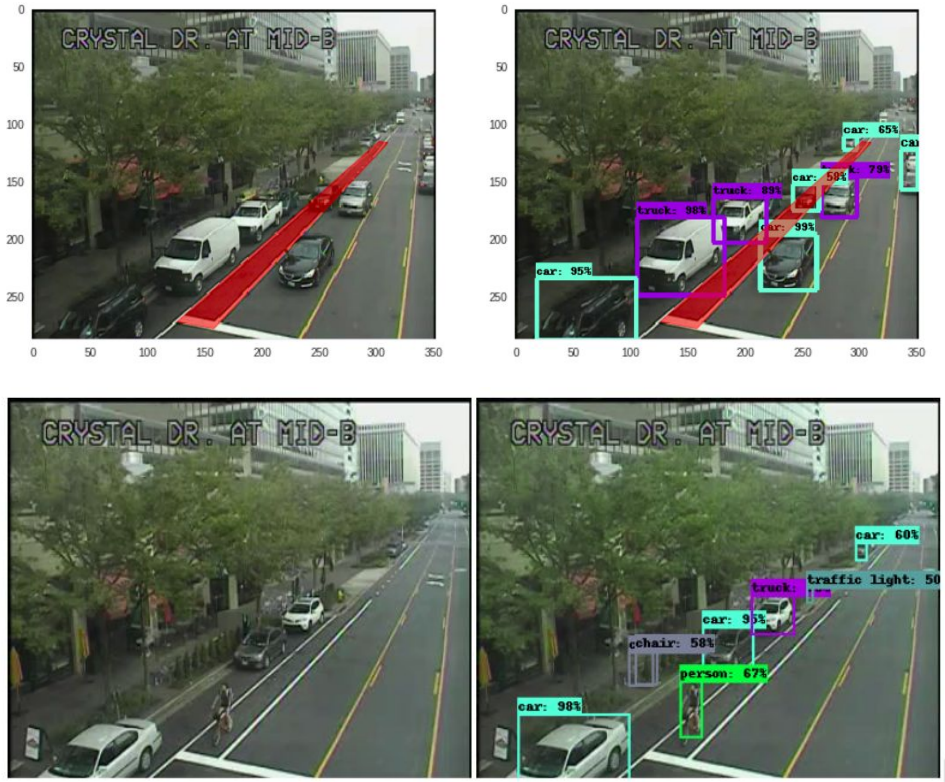
~81% accuracy

Object Detection Model

- Faster RCNN algorithm
- Inception ResNet architecture
- Common Objects in Context (COCO) dataset

Sensitivity analysis for optimal overlap

obstacle	correct	correct_pct
<chr>	<dbl>	<dbl>
combined	3144	81.8
25%	3128	81.4
20%	3112	81
30%	3093	80.5
centerPoint	3084	80.3
35%	3069	79.9
15%	2969	77.3
40%	2961	77.1
10%	2736	71.2
45%	2721	70.8
50%	2431	63.3



Next Steps

- Settle on a generalizable approach
- Create REST API
  - TensorFlow Serving
  - Flask
  - Heroku
- Streaming video with YOLO

github.com/bfraiche/parkingdirty