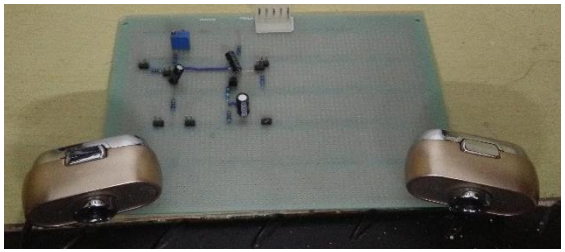
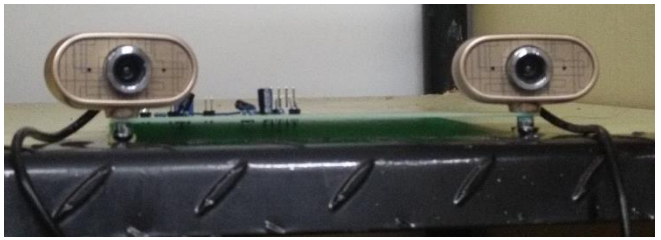
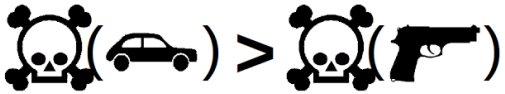
基于双目系统的目标跟踪与预测

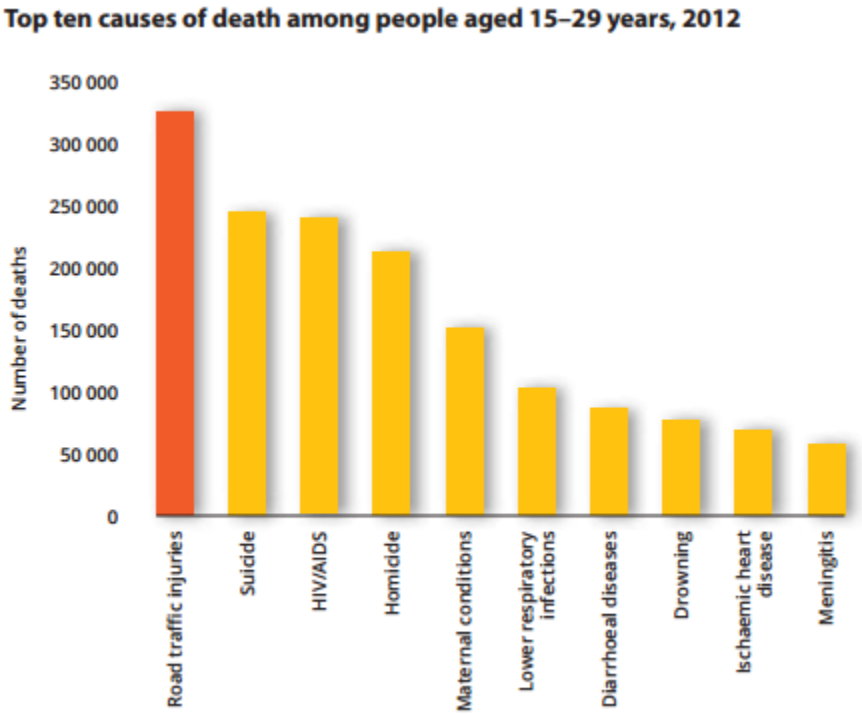
行人检测





背景

- 2015全球道路安全报告
  - 1  / week ≈ 1 / week
  - 2 



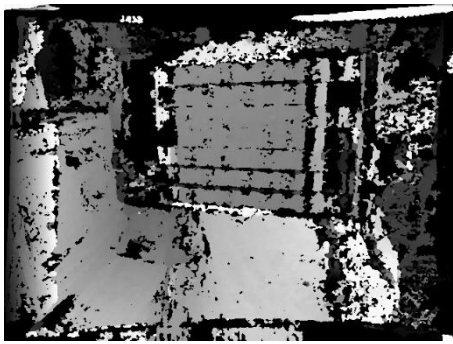
http://www.who.int/violence_injury_prevention/road_safety_status/2015/en/

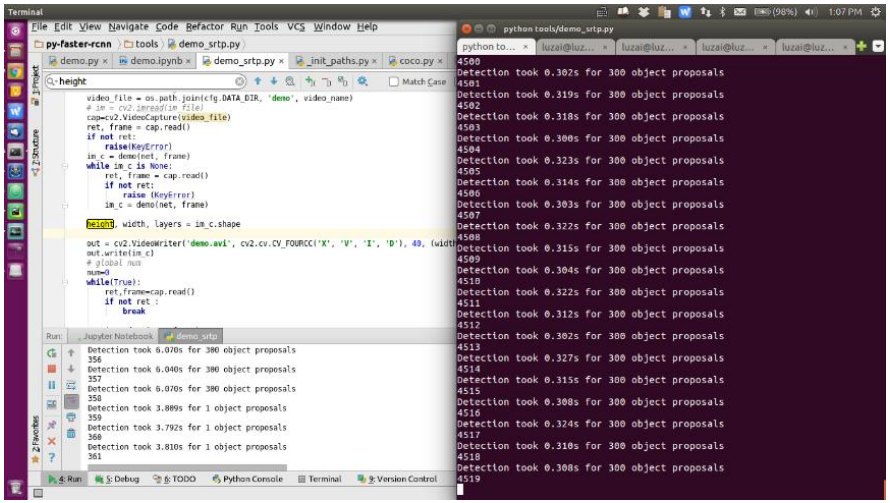
大纲

- 背景
- 计划+分工：
  - Particle Filter
  - Stixel World，HOG+SVM
    - 双目信息的效果
  - faster-rcnn
    - Rich feature 效果
- 总结遇到的问题
- 成果
- 规划
  - 双目/尺度/遮挡
- 参考文献

分工

- 增辉：
  - **Particle Filter**
  - OpenCV
  - Computer Vision(cs4495)
- 启睿
  - Stereo Camera
  - Machine Learning(cs229)
  - **Stixel World，HOG+SVM**
- 兴路
  - **Faster-rcnn**
  - ConvNet(cs231n)





Particle Filter

以追踪人脸patch为例

Stixel World, Idea

- 如何利用双目信息？
  - 一般思路：

Stixel World, Idea

- 利用双目优点：
  - 适用于室外场景

- 避开缺点：
  - 匹配速度慢
  - 视差图质量差

Stixel World, Objectness Estimation

原理：是行人+脚下是地面
（详见Supplementary Material ）

(a) Object evidence (b) Ground evidence

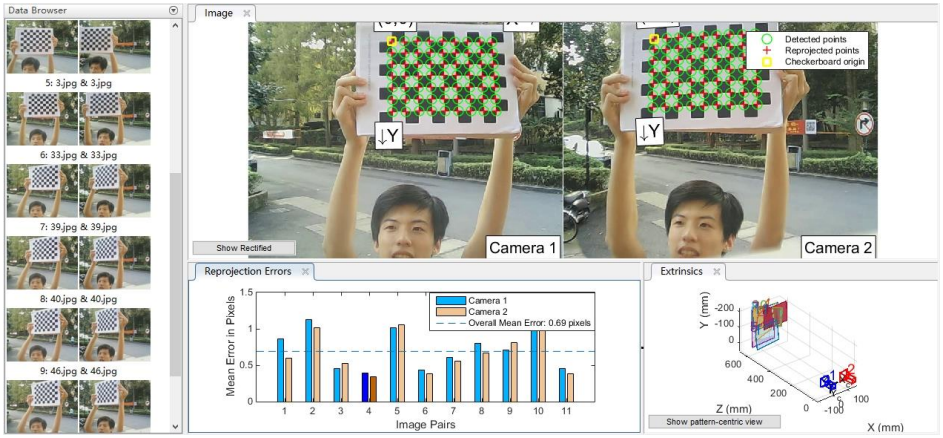
Figure 3: The object and ground costs are computed by matching pixels in the left and right images. White dots on the image indicates object-ground boundary candidates, based on horizontal gradient maxima.

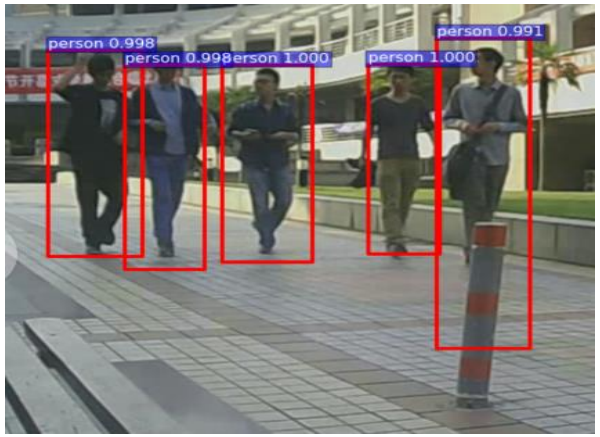
Stixel World, Hog + SVM

效果：

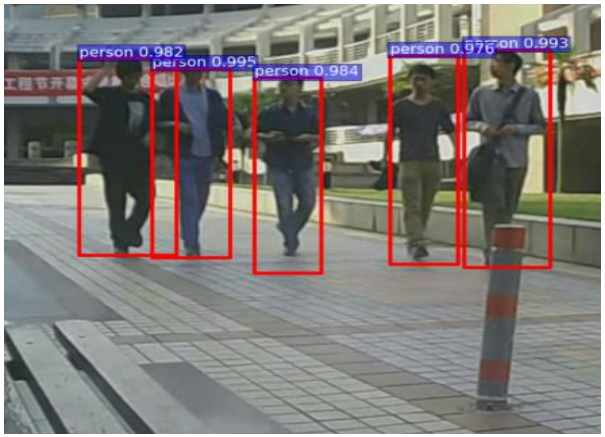
利用先验

- 先验=人和地面的位置关系+人的身高



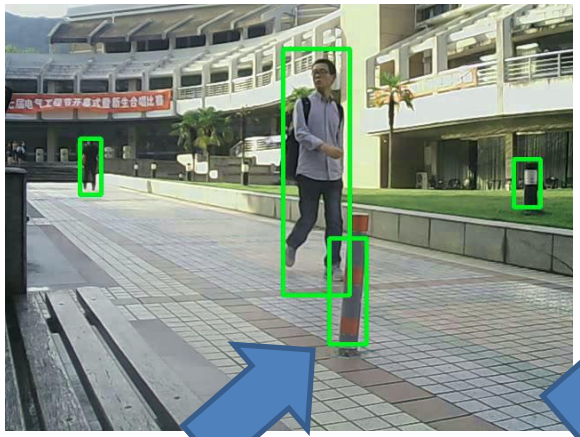


利用先验



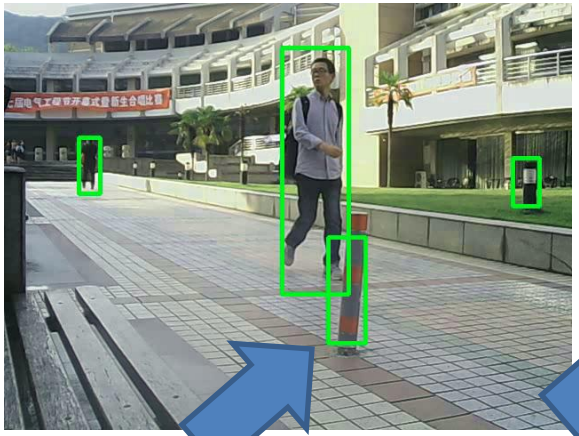
Stixel World, Hog + SVM

问题出在哪里？



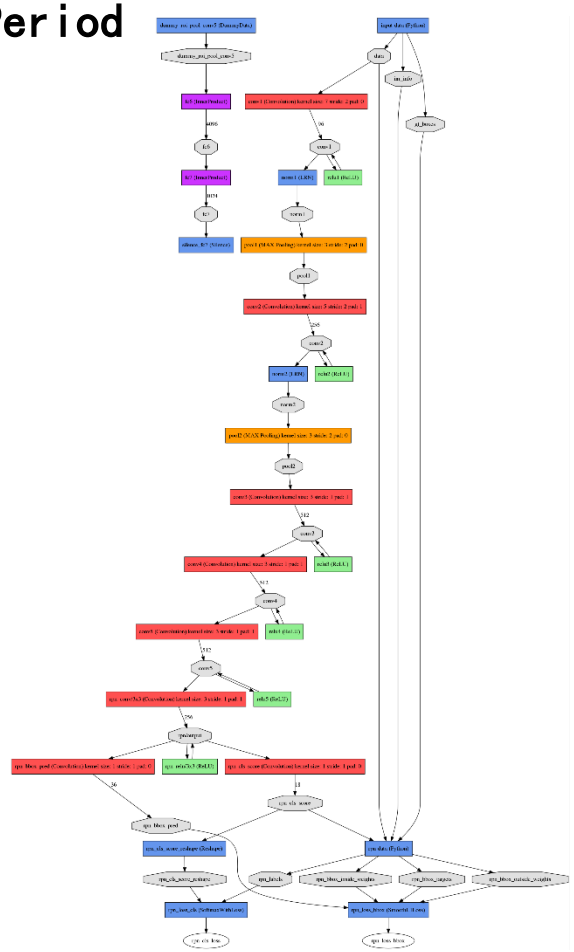
Stixel World, Hog + SVM

Hog特征 饱和

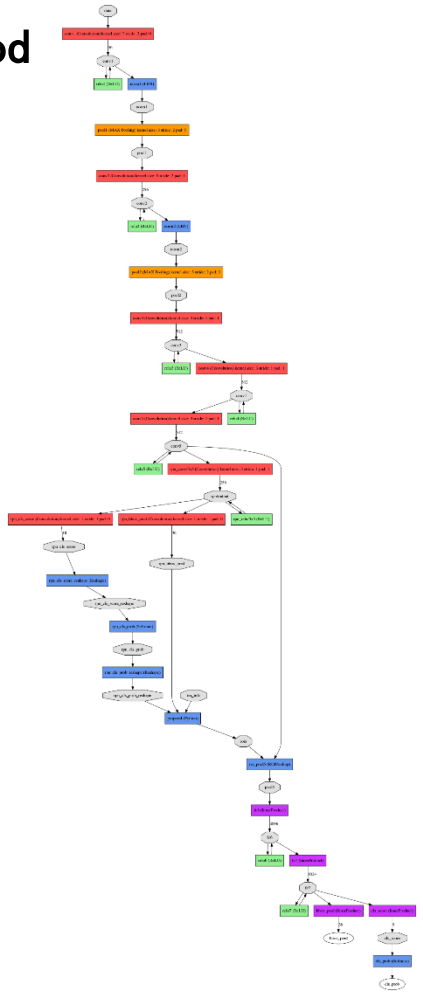


Faster-rcnn

Train Period



Test Period



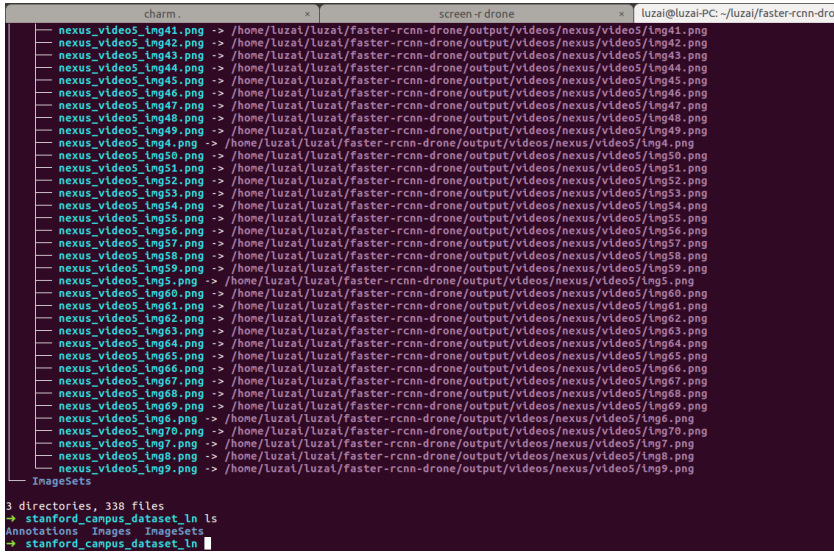
详见Supplementary Material

选取数据集

- KITTI's page(car,pedestrian, etc.): http://www.cvlibs.net/datasets/kitti/eval_object.php/
  - 数据量大
  - 场景单一

- Caltech-USA: http://www.vision.caltech.edu/Image_Datasets/CaltechPedestrians/
  - 场景单一

制作数据集



- INRIA: http://pascal.inrialpes.fr/data/human/
  - 数据量不足
  - 场景丰富

制作数据集

Positive sample

Negative sample

```
# print 'Loading: {}'.format(filename)
with open(filename) as f:  f: <closed file '/home/luzai/luzai/py-faster-rcnn/data/INRIA_Person_devkit/data/Annotati
    data = f.read()  data: '# PASCAL Annotation Version 1.00\n\nImage filename : "Train/pos/crop_000010.png"\nImage
import re  0: '(194, 127) - (413, 647)'  __len__: 1  re: <module 're' from '/usr/lib/python2.7/re.pyc'>
objs = re.findall('\(\d+, \d+\)[\s\-]+\(\d+, \d+\)', data)  objs: <type 'list'>: ['(194, 127) - (413, 647)']

num_objs = len(objs)  num_objs: 1

boxes = np.zeros((num_objs, 4), dtype=np.uint16)  boxes: [[194 127 413 647]]
gt_classes = np.zeros((num_objs), dtype=np.int32)  gt_classes: [1]
overlaps = np.zeros((num_objs, self.num_classes), dtype=np.float32)  overlaps: [[ 0.  1.]]

# "Seg" area here is just the box area
seg_areas = np.zeros((num_objs), dtype=np.float32)  seg_areas: [ 114620.]

# Load object bounding boxes into a data frame.
for ix, obj in enumerate(objs):  ix: 0  obj: '(194, 127) - (413, 647)'
    # Make pixel indexes 0-based
    coor = re.findall('\d+', obj)  coor: <type 'list'>: ['194', '127', '413', '647']
    x1 = float(coor[0])  x1: 194.0
    y1 = float(coor[1])  y1: 127.0
```

Finetune

ImageNet训练

From Caffe Model Zoo

- Inria Finetune
  - RPN
  - FC layer

```
    # print 'Loading: {}'.format(filename)
    with open(filename) as f:  f: <closed file '/home/luzai/luzai/py-faster-rcnn/data/INRIA_Person_devkit/data/Annotati
        data = f.read()  data: '# PASCAL Annotation Version 1.00\n\nImage filename : "Train/pos/crop_000010.png"\nImage
    import re  0: '(194, 127) - (413, 647)'  __len__: 1  re: <module 're' from '/usr/lib/python2.7/re.pyc'>
    objs = re.findall('\(\d+, \d+\)[\s\-]+\(\d+, \d+\)', data)  objs: <type 'list'>: ['(194, 127) - (413, 647)']

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        # Make pixel indexes 0-based
        coor = re.findall('\d+', obj)  coor: <type 'list'>: ['194', '127', '413', '647']
        x1 = float(coor[0])  x1: 194.0
        y1 = float(coor[1])  y1: 127.0
```
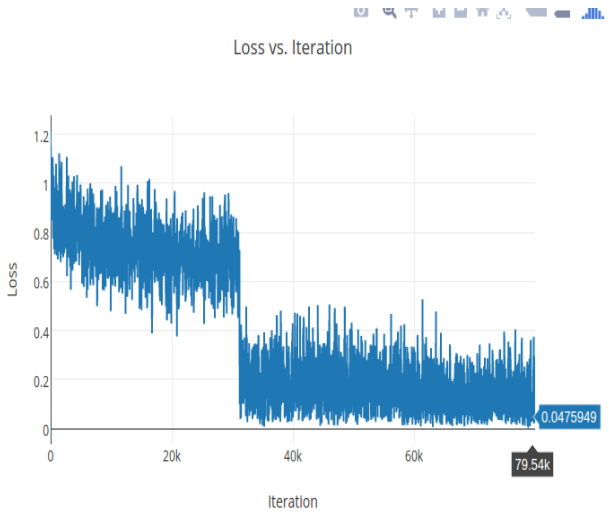

改进

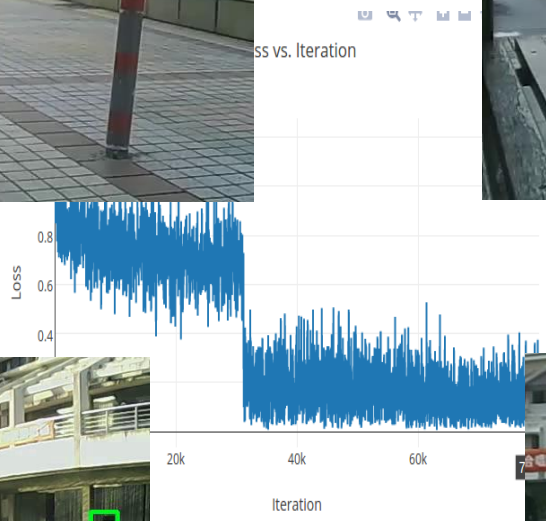
交替训练结果

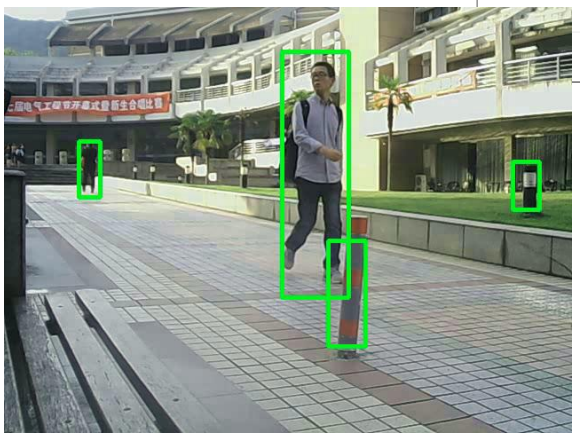

Loss vs. Iteration
Loss
1.2
1
0.8
0.6
0.4
0.2
0
0
20k
40k
60k
79.54k
0.0475949
Iteration

改进效果


Video


Video


ss vs. Iteration
Loss
0.8
0.6
0.4
20k
40k
60k
Iteration



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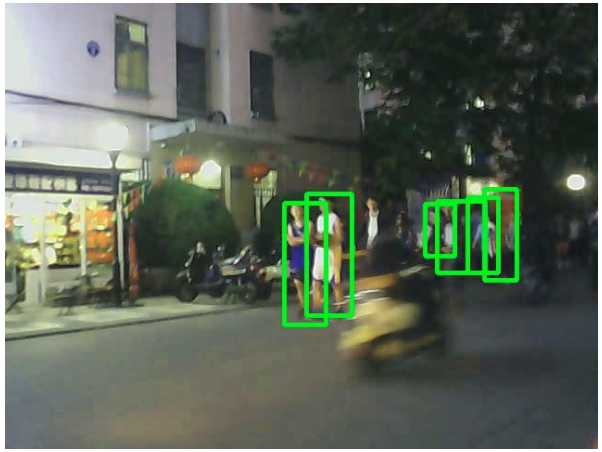
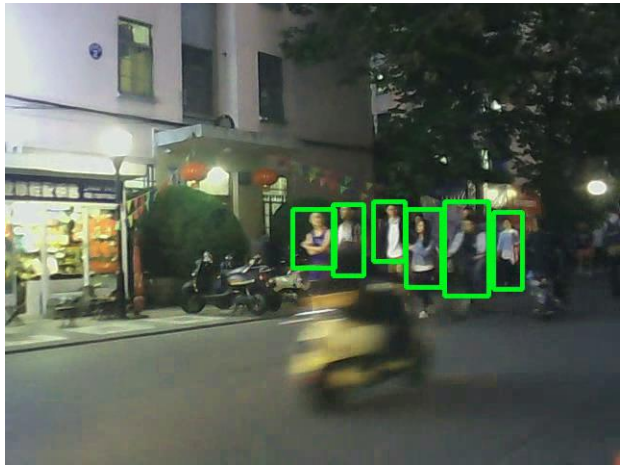
- 规划
  - 双目/尺度/遮挡
- 参考文献

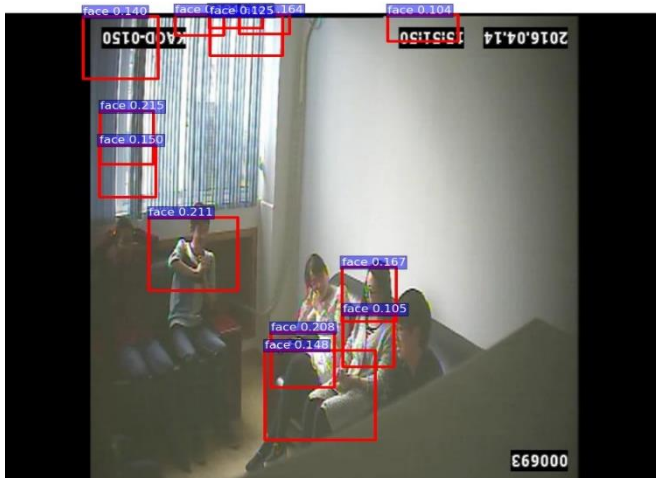
仍存在问题



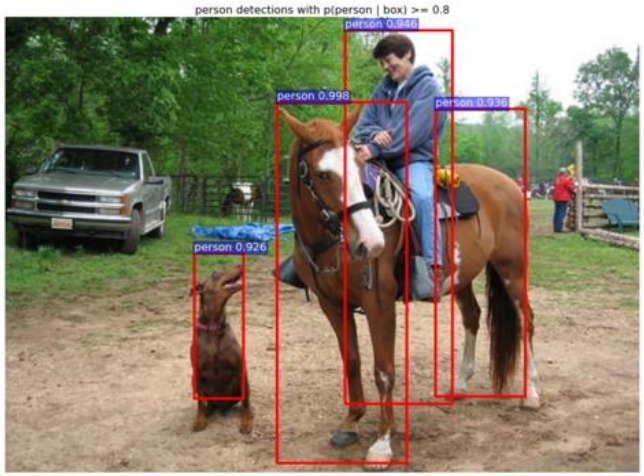
时序建模



应用于实际监控场景



泛目标->具体目标



规划

- 已有模型
  - Stixel World
    - 简洁的模型
    - 合理利用深度信息
  - Faster-rcnn
    - 泛目标检测框架
    - 更好的特征提取
- 理论上突破
  - 深度信息
    - 用于提取候选区
      - 建立自己的优化方程
    - 设计Rgb-d输入的RCNN
      - 视差信息输入
      - 能否End-to-End?
    - 干预CNN学习过程
      - 设计Loss 函数
      - 可视化CNN，观察(抑制)一些激活值
  - 时序建模
    - GRU-RCN(LSTM)

规划

- 已有模型
  - Stixel World
    - 简洁的模型
    - 合理利用深度信息
  - Faster-rcnn
    - 泛目标检测框架
    - 更好的特征提取
- 应用上突破
  - 行人再识别
    - Siamese Instant Search 思路
  - 模型压缩
  - 人脸超分辨重建
  - 行人性格分析

Reference

- **Benenson, R., et al., Pedestrian detection at 100 frames per second. 2012, IEEE. p. 2903 - 2910.**
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- Opitz, M., et al., Grid Loss: Detecting Occluded Faces. 2016
- Tao, R., E. Gavves and A.W.M. Smeulders, Siamese Instance Search for Tracking. 2016
- Reed, S., et al., Learning Deep Representations of Fine-grained Visual Descriptions. 2016.
- INRIA: http://pascal.inrialpes.fr/data/human/
- KITTI's page(car,pedestrian, etc.): http://www.cvlibs.net/datasets/kitti/eval_object.php/
- https://bitbucket.org/rodrigob/doppia/overview
- http://vision.ucsd.edu/~pdollar/index.html
- https://github.com/ShaoqingRen/faster_rcnn/

Reference

- He, K., et al., Spatial Pyramid Pooling in Deep Convolutional Networks for Visual Recognition. IEEE Trans Pattern Anal Mach Intell, 2015. 37(9): p. 1904-16.
- **Ren, S., et al., Faster R-CNN: Towards Real-Time Object Detection with Region Proposal Networks. IEEE Trans Pattern Anal Mach Intell, 2016.**
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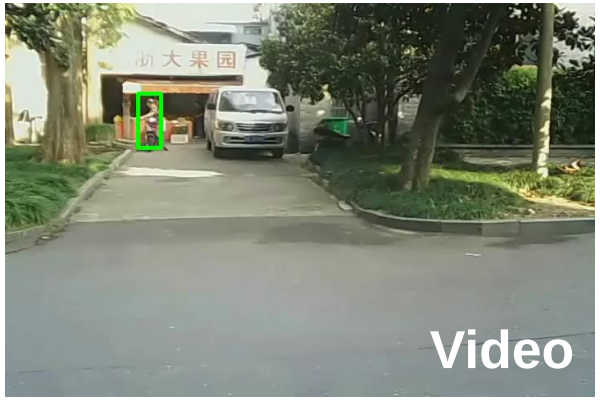
- Denton, E., et al., Deep Generative Image Models using a Laplacian Pyramid of Adversarial Networks. 2015.
- Larsen, A.B.L., et al., Autoencoding beyond pixels using a learned similarity metric. 2015.

成果



Thank You!