ADVANCED CNNS

OBJECT DETECTION

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`WiFi : SG-Guest`

Problems with Installation? **ASK!**

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PLAN OF ACTION

TODAY

- Advanced CNNs : Object Detection
- Personal Project work

PLAN OF ACTION

MONDAY

- seq2seq, AIAYN, captioning
- Personal Project work

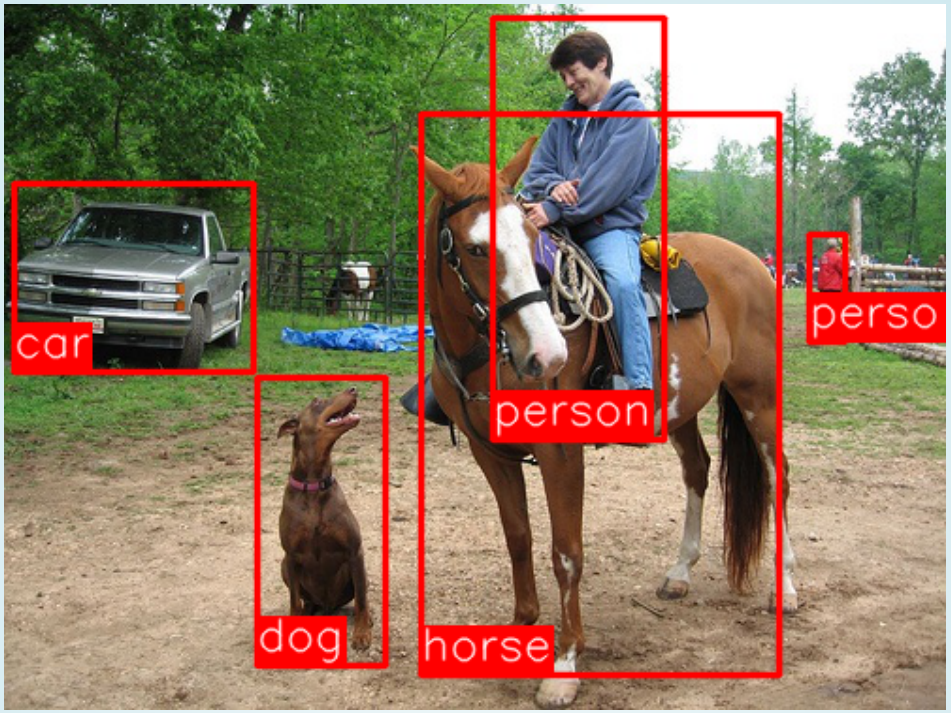
THE PROJECTS

- Set pieces :
  - Dense+features (== addition)
  - CNN+features (eg: image search)
  - RNN categorisation (eg: sentiment)
- 'Personal Projects' :
  - Project 1; potentially leading to...
  - Project 2
- Plan to finish : **20**-Nov (last session)
- WSG DEADLINE : 30-Nov (small write-ups)

OBJECT DETECTION

- Describe the goal
- History (abridged) :
  - Pre-CNN methods
  - R-CNN method
  - Fast(er) R-CNN methods
  - YOLO and SSD

THE GOAL

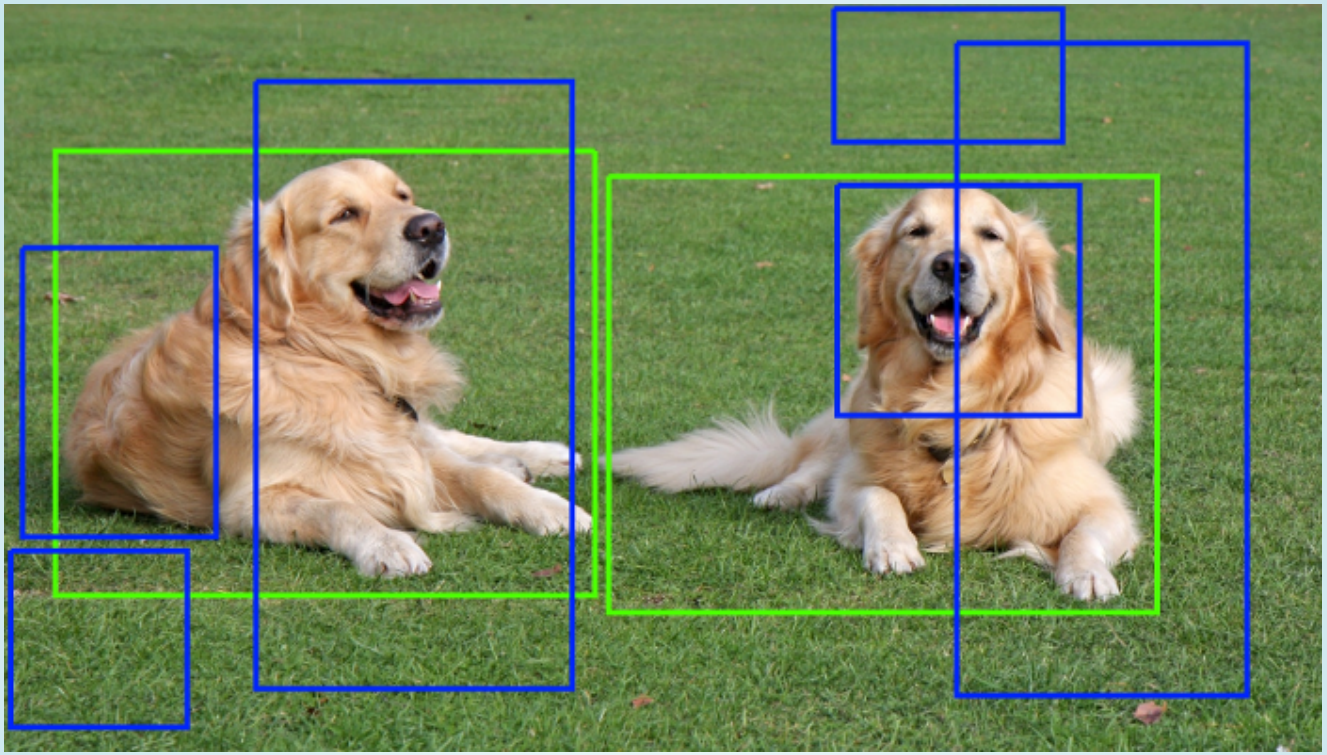


Brief History of Object Detection

EARLY METHODS

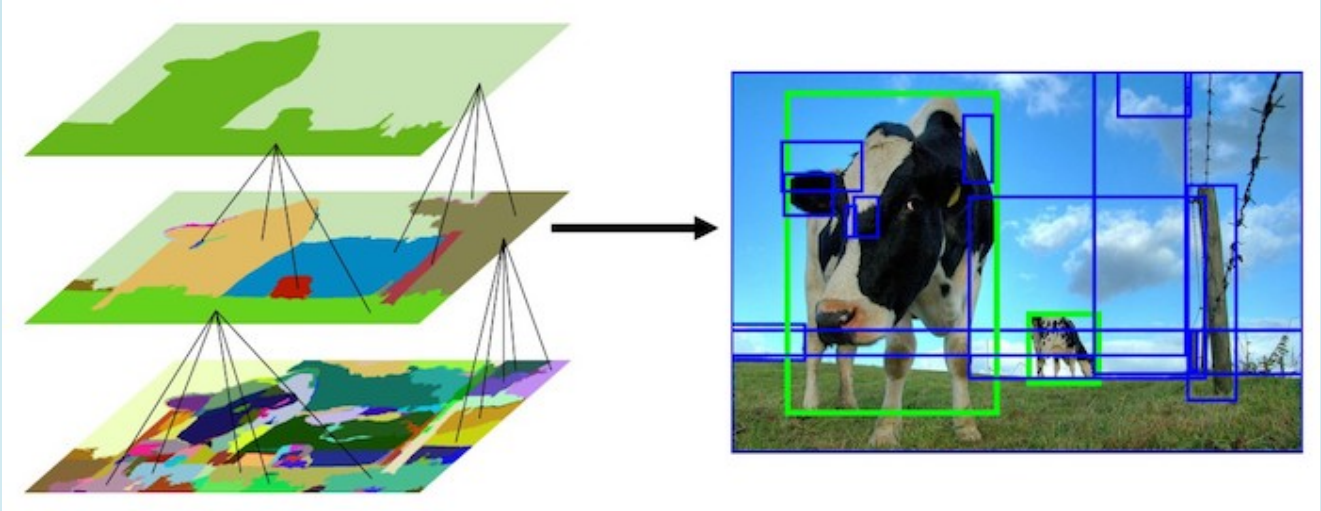
- Propose lots of regions :
  - Sliding Window
  - Selective Search
- OpenCV methods to categorise object in each region

REGION PROPOSAL



Blue Boxes: False Positives; Green Boxes: True Positives

SELECTIVE SEARCH



Selective Search for Object Detection (blog)

SELECTIVE SEARCH

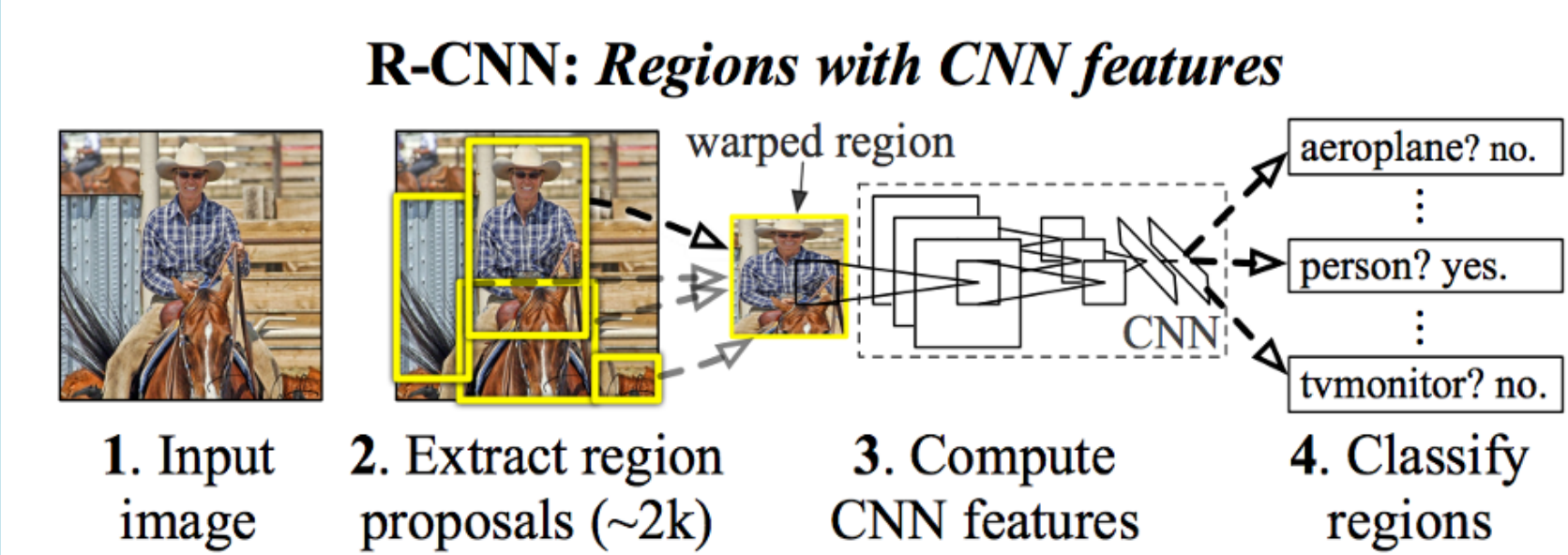
Figure 2: Two examples of our selective search showing the necessity of different scales. On the left we find many objects at different scales. On the right we necessarily find the objects at different scales as the girl is contained by the tv.

Selective Search for Object Recognition (paper)

R-CNN METHOD

- Selective Search to propose regions
- CNN categorisation on each one
- Vary boundaries and measure confidences
- Linear interpolation to get better bounds

R-CNN PICTURE



Rich feature hierarchies for accurate object detection and semantic segmentation (CVPR 2014)

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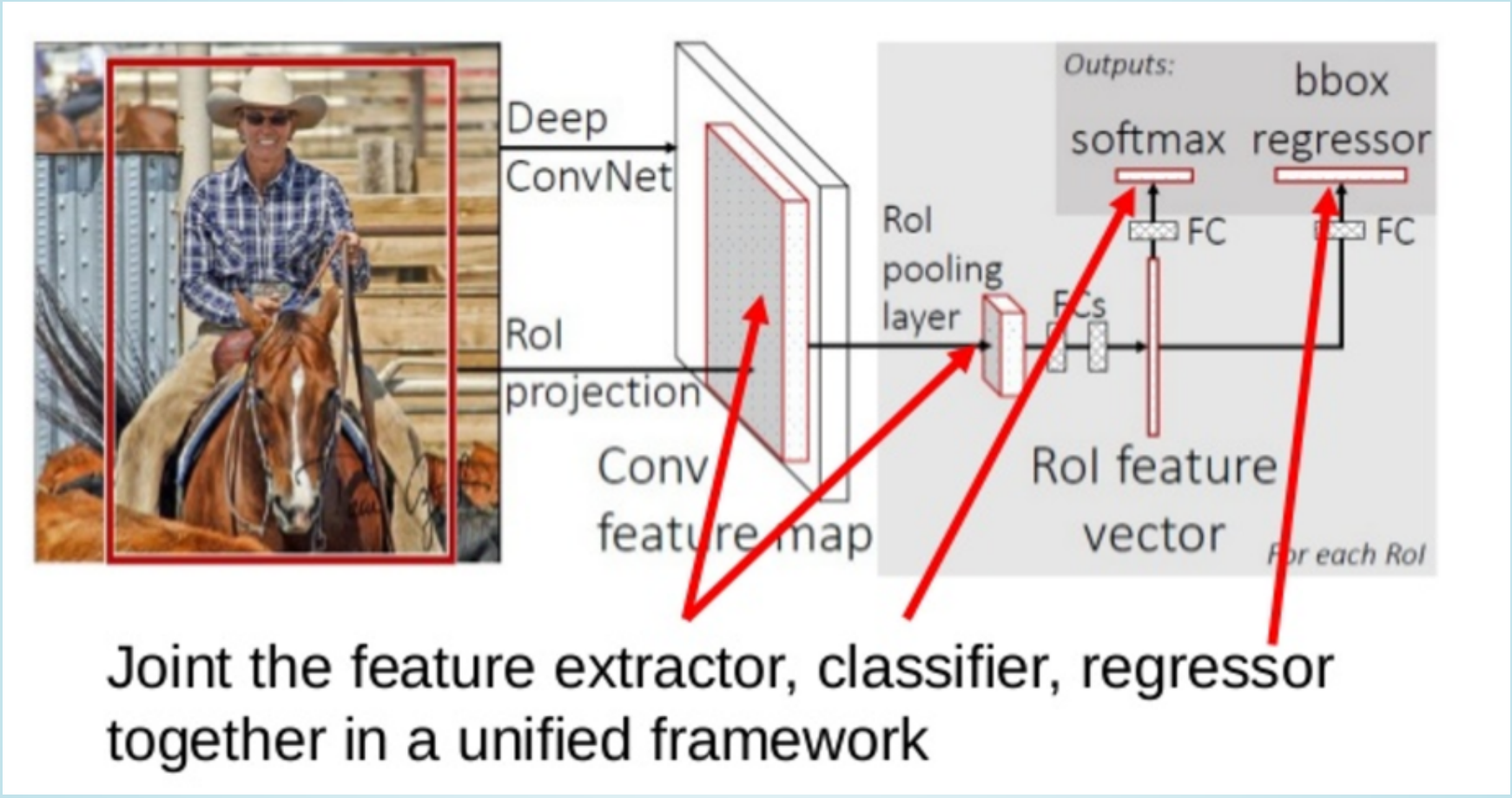
FAST R-CNN METHOD

- Selective Search to propose regions
- CNN feature maps on whole image (once)
- Aggregate maps within each region
- Decide on classification and confidence for each
- Linear interpolation to get better bounds

FAST R-CNN PICTURE

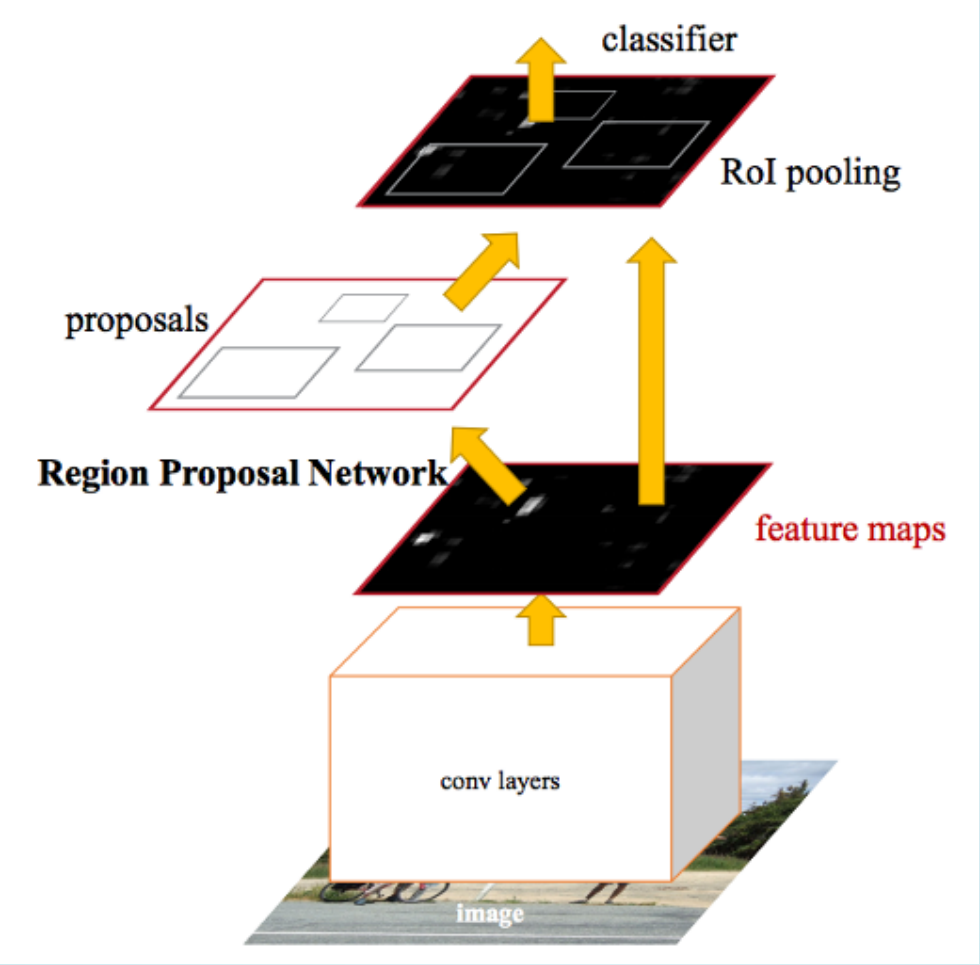


Fast R-CNN (ICCV 2015)

FASTER R-CNN METHOD

- CNN feature maps on whole image (once)
- Separate into two paths :
  - One path to suggest likely regions
  - One path to aggregrate maps within regions
- Decide on classification and confidence for each
- Regions have been obtained 'for free'

FASTER R-CNN PICTURE

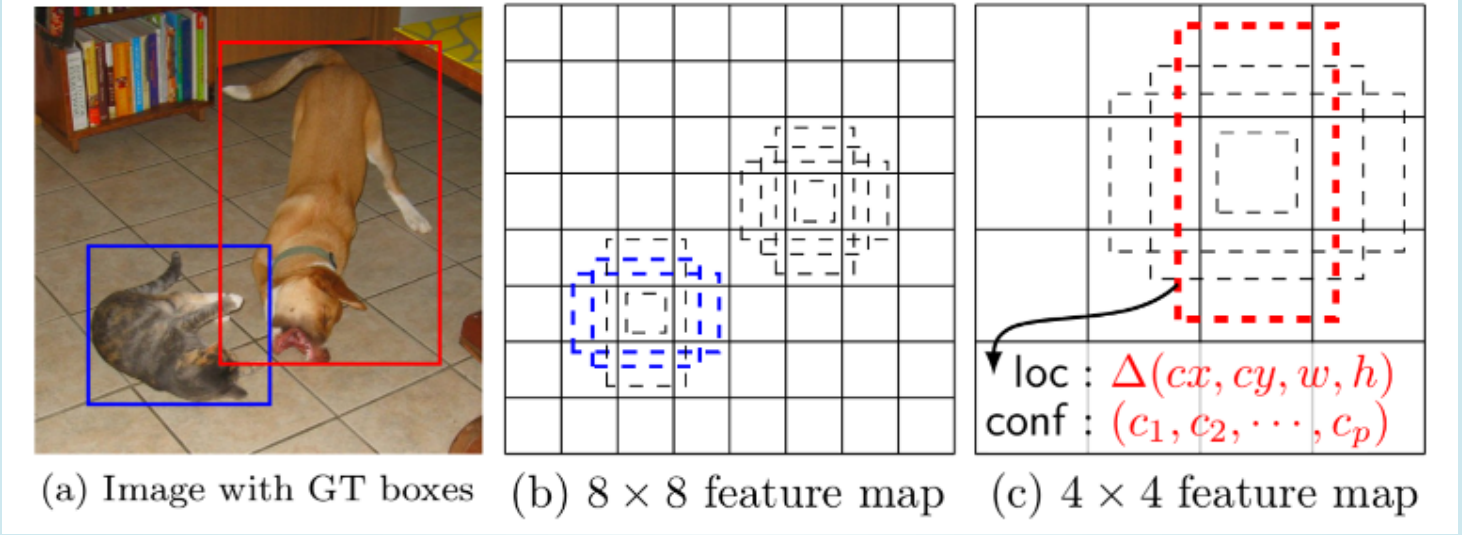


Faster R-CNN: Towards Real-Time Object Detection
with Region Proposal Networks (NIPS 2015)

SSD & YOLO

- YOLO : You Only Look Once (CVPR 2016)
- SSD : Single Shot MultiBox Detector (ECCV 2016)
- Same (basic) concept...
- First step is headless ImageNet CNN
- Then divide into an even grid and simultaneously predict:
  - Bounding boxes
  - Confidence in those boxes; and
  - Class probabilities

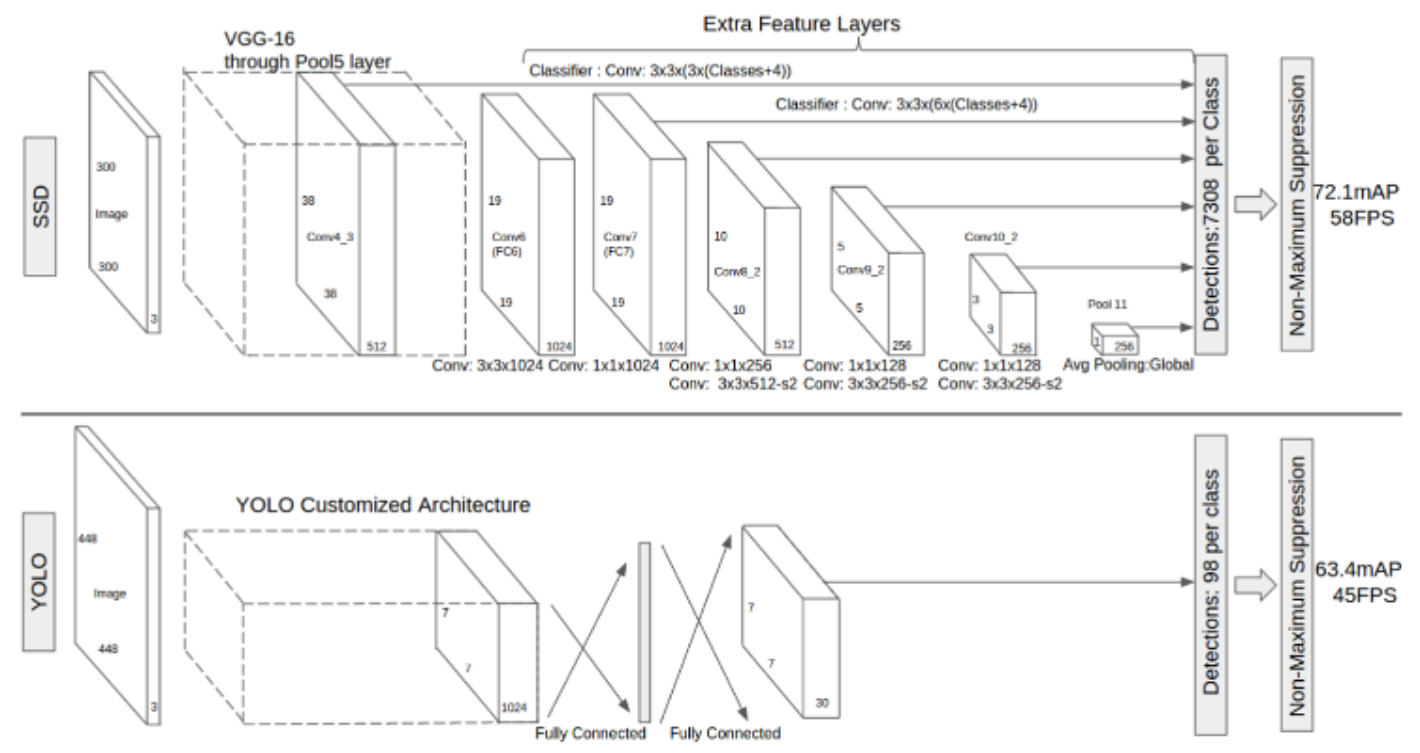
SSD REGIONS



(a) Image with GT boxes (b) 8×8 feature map (c) 4×4 feature map

Middle output map is : 8x8 x 4 x (4 + 1 + #classes)

SSD & YOLO



From : Single Shot MultiBox Detector (ECCV 2016)

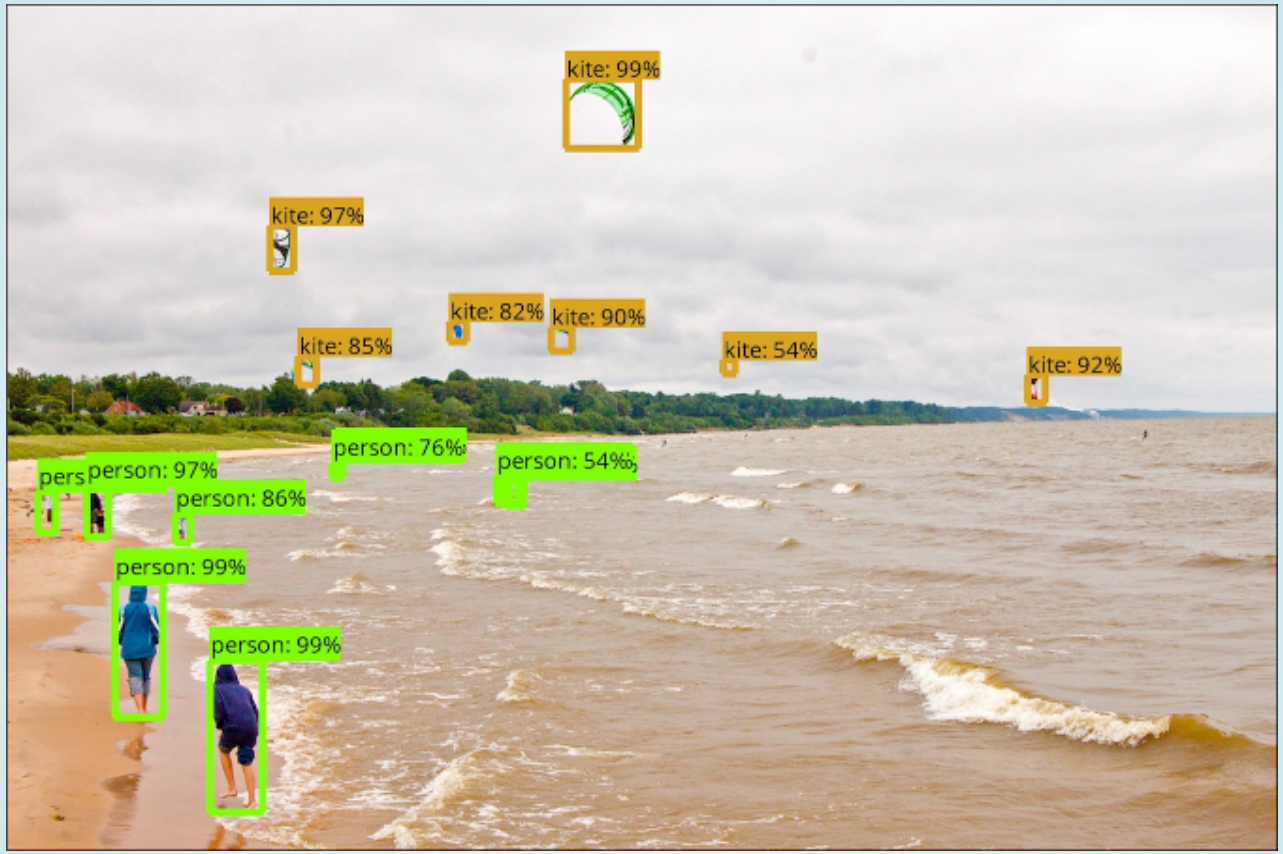
SSD & YOLO

- Code :
  - YOLO : Darknet-based
  - SSD : Google-backed

TF OBJECT DETECTION

- A selection of trainable detection models, including:
  - Single Shot Multibox Detector (SSD) with MobileNets
  - SSD with Inception V2
  - Region-Based Fully Convolutional Networks (R-FCN) with Resnet 101
  - Faster RCNN with Resnet 101
  - Faster RCNN with Inception Resnet v2

SSD DEMO



See also : Dat Tran Blog Post

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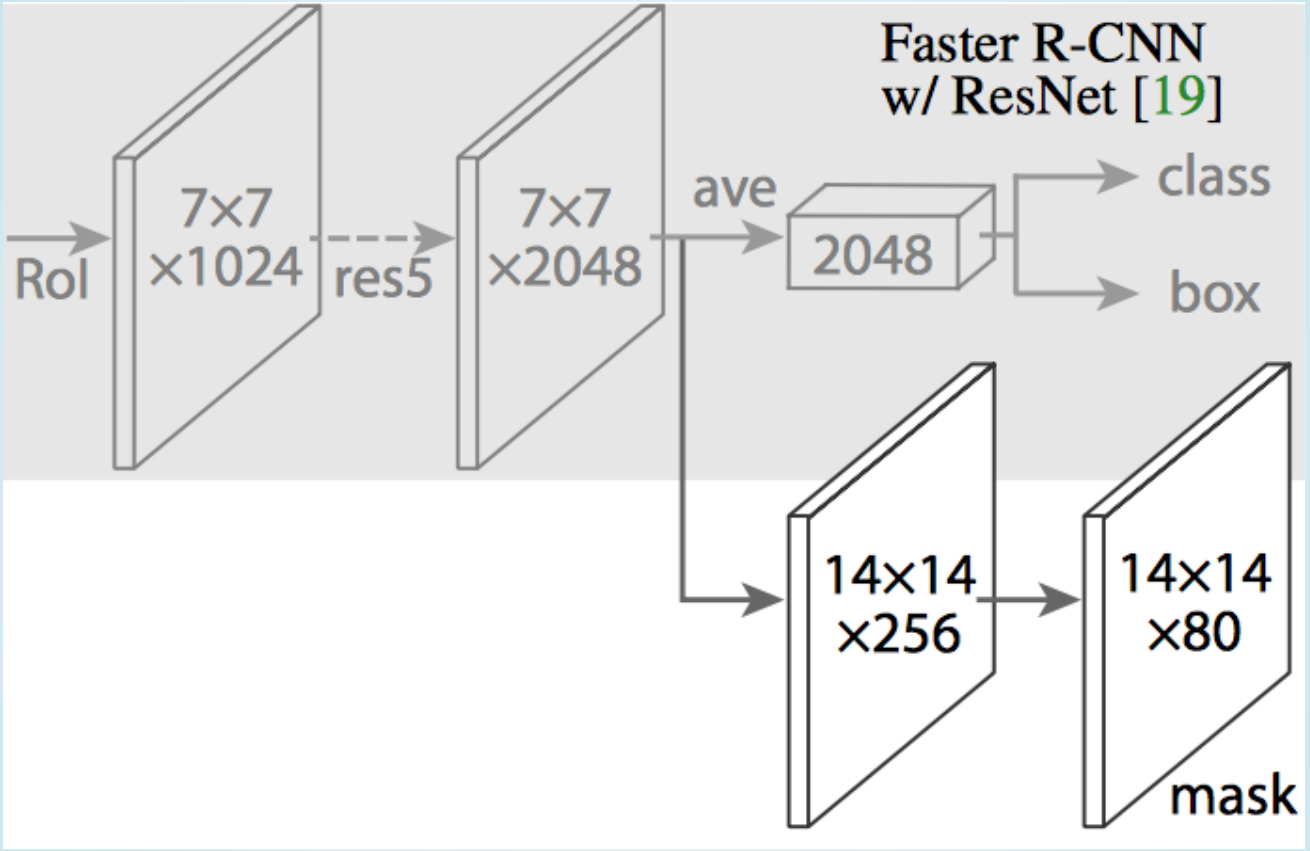
MASK R-CNN METHOD

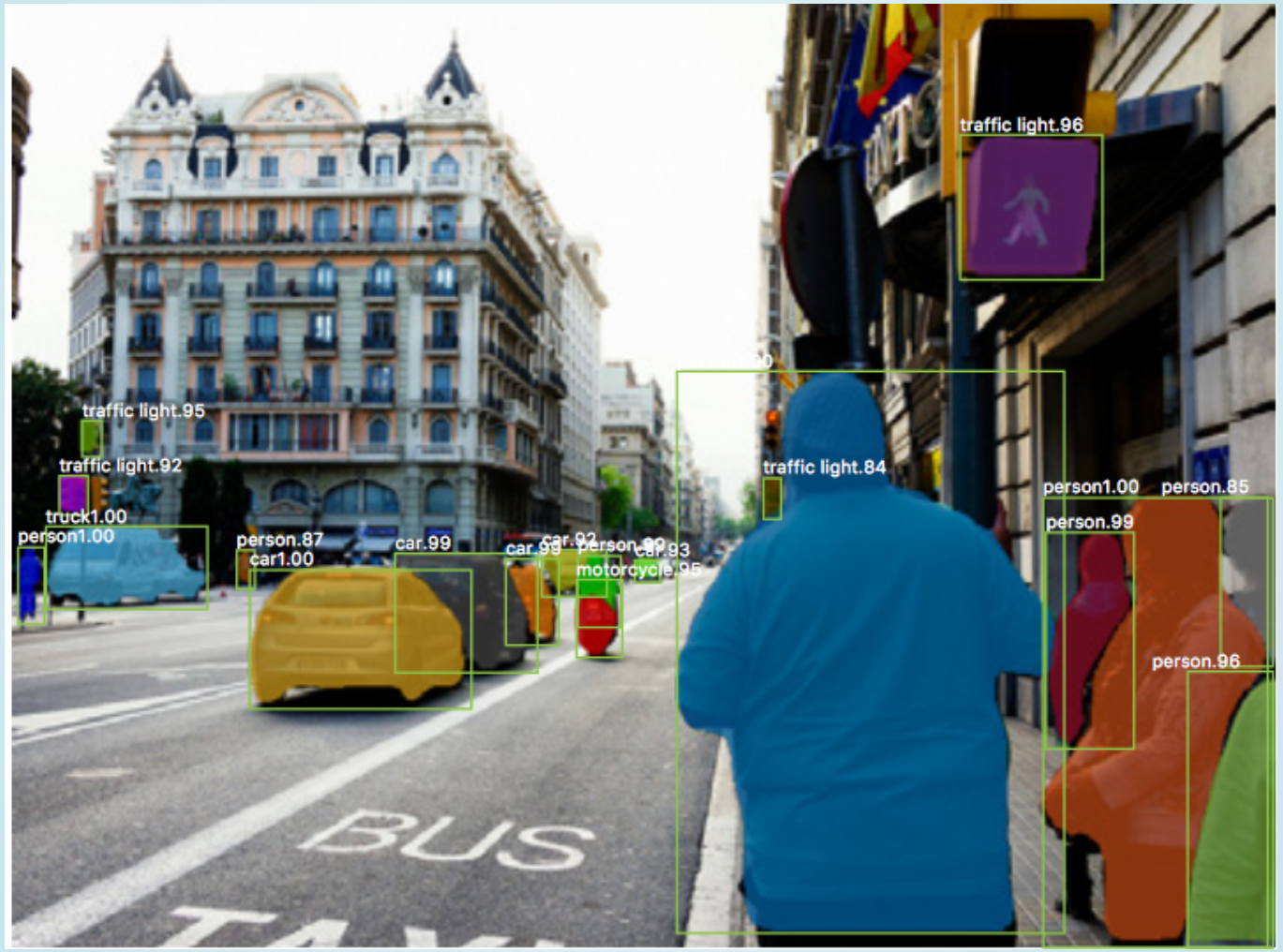
- CNN feature maps on whole image (once)
- Separate into three paths :
  - One path to suggest likely regions
  - One path to aggregrate maps within regions
  - Extra path to output pixel-wise mask
- Decide on classification and confidence for each
- Output regions, and pixel-wise masks

MASK R-CNN PICTURE



Mask R-CNN (ICCV 2017)

MASK R-CNN EXAMPLE



Code : This repo attempts to reproduce...

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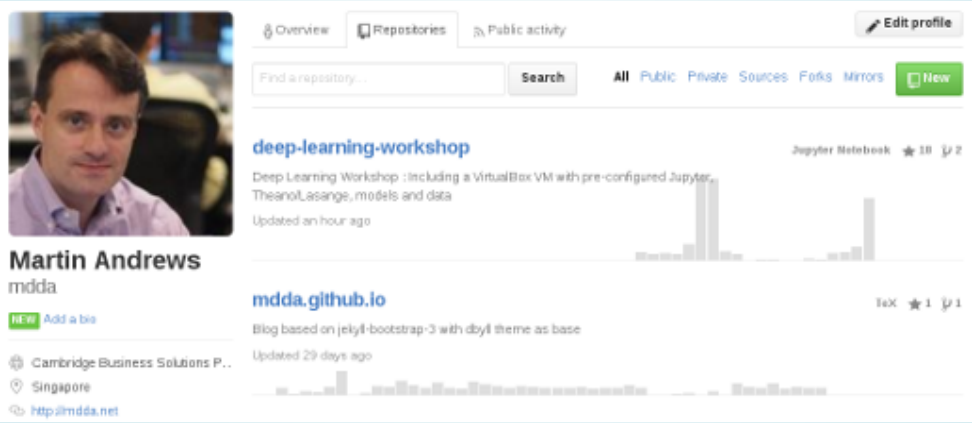
WRAP-UP

- Idea of progress over ~3 years
- Nice libraries may lag research
- Now practical on a Raspberry Pi



* Please add a star... *

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- QUESTIONS -

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My blog : http://mdda.net/

GitHub : mdda