Instance Segmentation

Computer Vision

Why still use a two-stage object detector?

- Better recall of RPN as compared to SSD/YOLO
  - Trained with all object instances
  - Generic first stage, usable for multi task
- Finer control over training classifier
  - Custom minibatch (sampling 3:1 negative samples)
- Instance-level multi task (Mask-RCNN)

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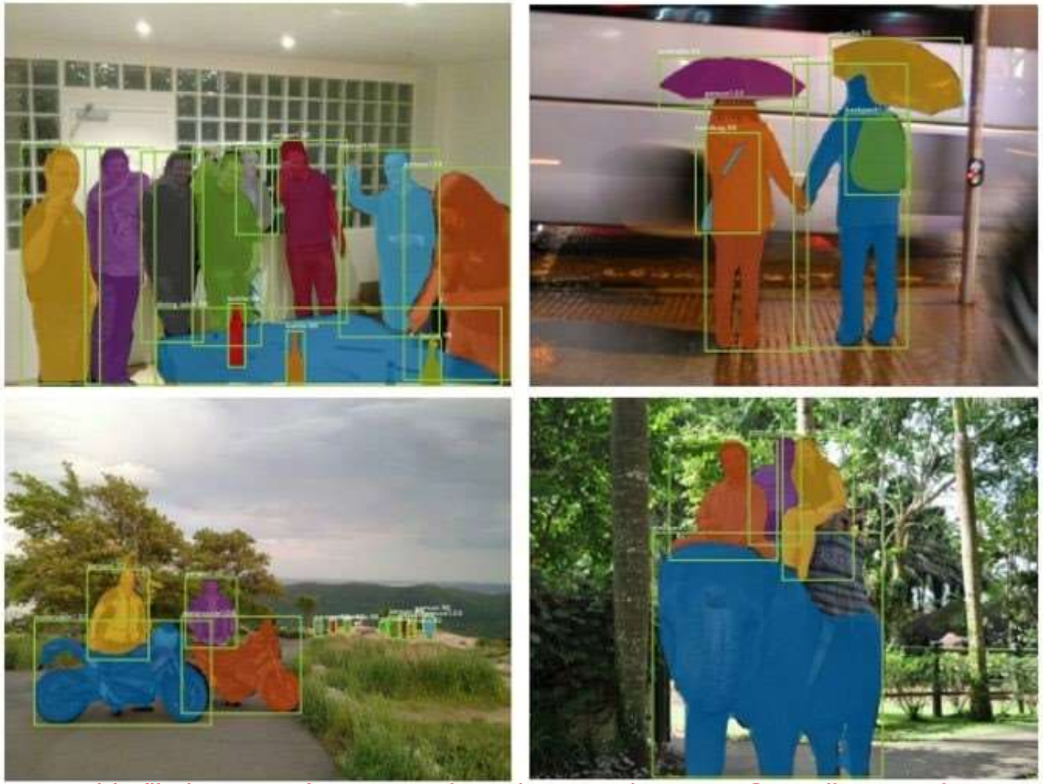
Mask R-C NN – Towards Instance-Level Understandi

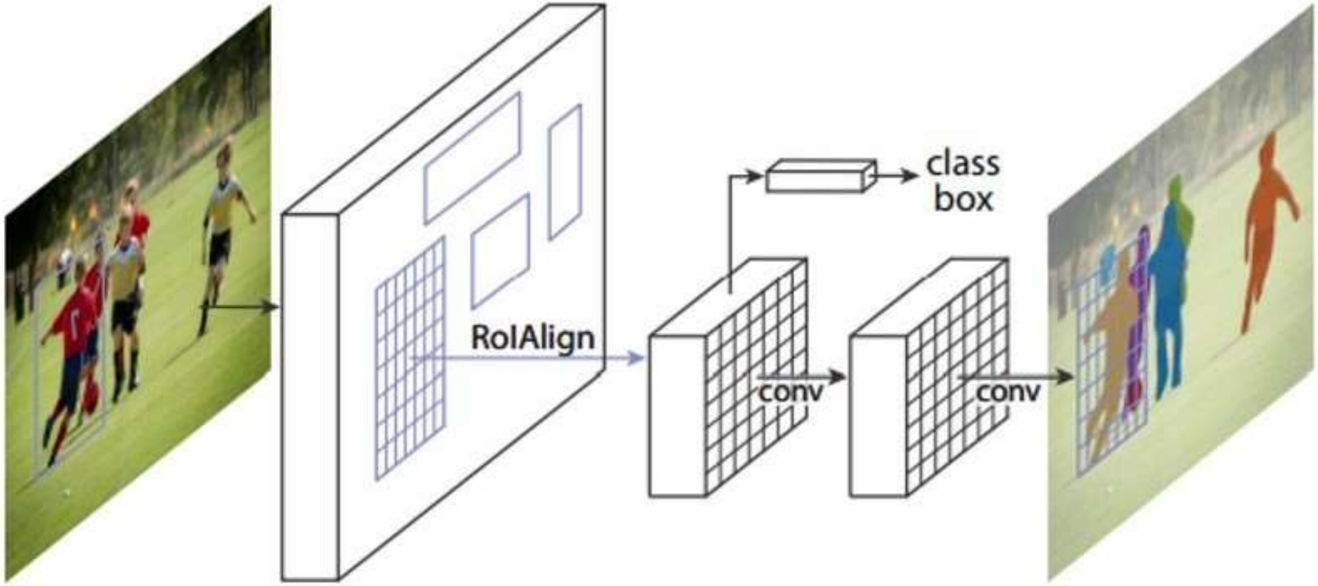


Mask R-CNN – Towards Instance-Level Understanding

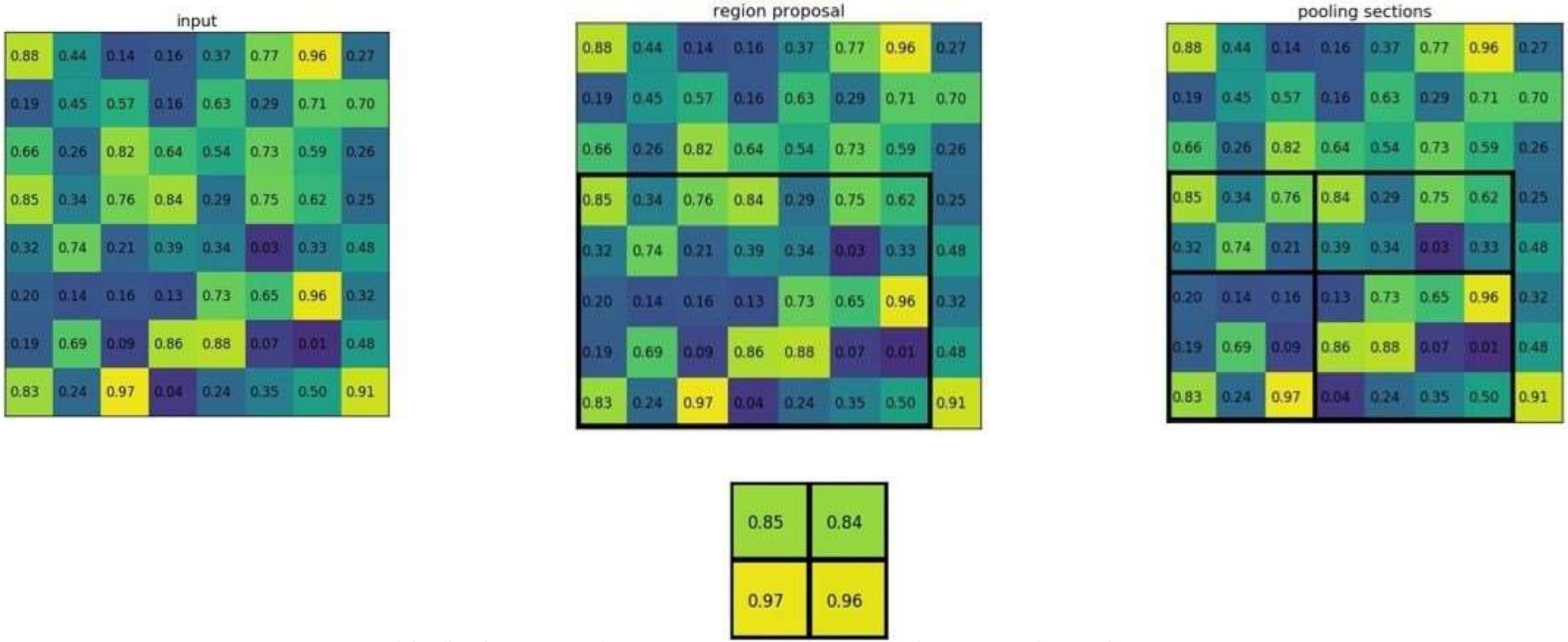
Zoom in on instances

Mask R-CNN

Preserves pixel-to-pixel alignment

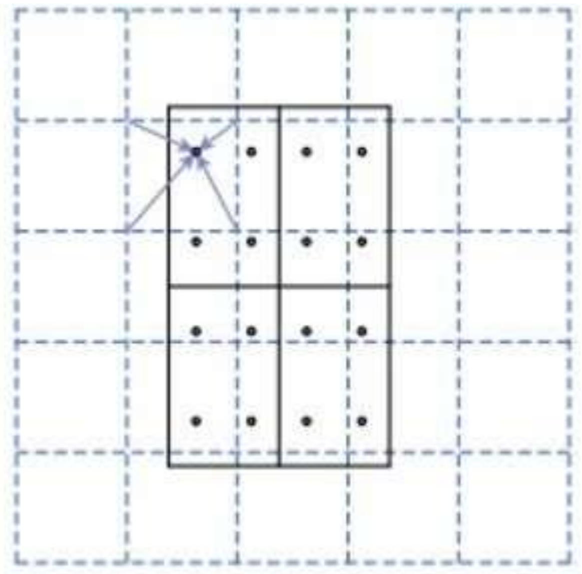


Quantization – loss of pixel-to-pixel alignment



RoI Align - Improvement on RoI Pooling

- Input: Feature map (5x5 here) and region proposal (normalized float coordinates)
- Output: 2x2 ‘pooled’ bins
- Sample 4 points in every bin uniformly
- Compute value at each bin using bilinear interpolation
- Max or average the 4 bins



Class Imbalance in Training a Classifier

- While training detectors, maximum samples are background (negatives)
- Faster R -C NN: Ratio of 3 negatives to 1 positive is maintained while training classifier head Custom minibatch
- Not easy in single stage detectors

Class Imbalance in Training a Classifier

- Cross entropy loss

$$\mathrm{CE}(p_t) = -\log(p_t)$$

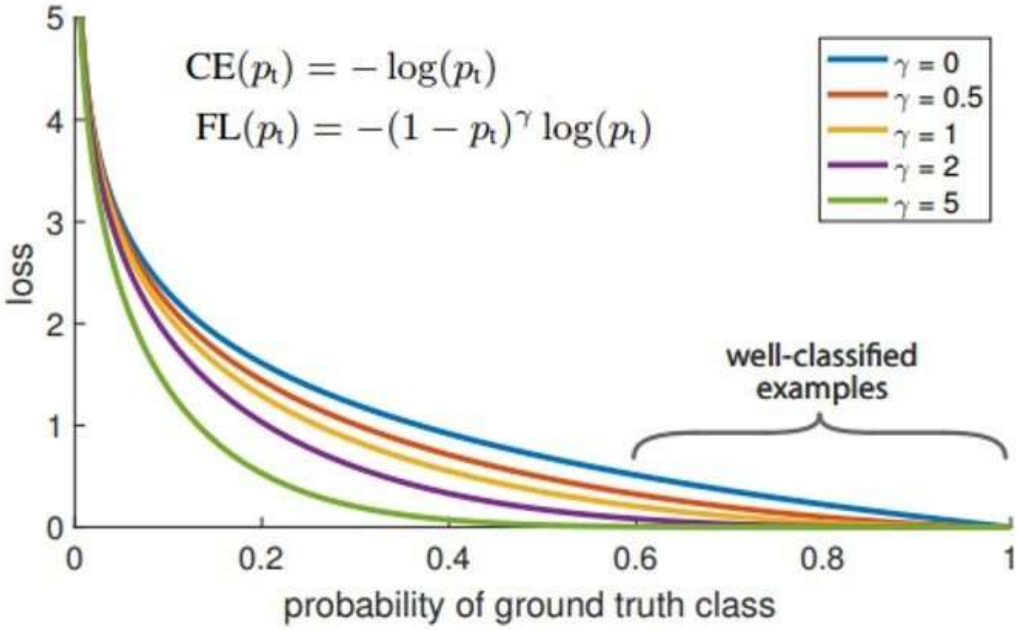
- Balanced cross entropy loss

$$\mathrm{CE}(p_t) = -\alpha_t \log(p_t)$$

- Focal
  Loss

$$\mathrm{FL}(p_t) = -(1-p_t)^{\gamma} \log(p_t)$$

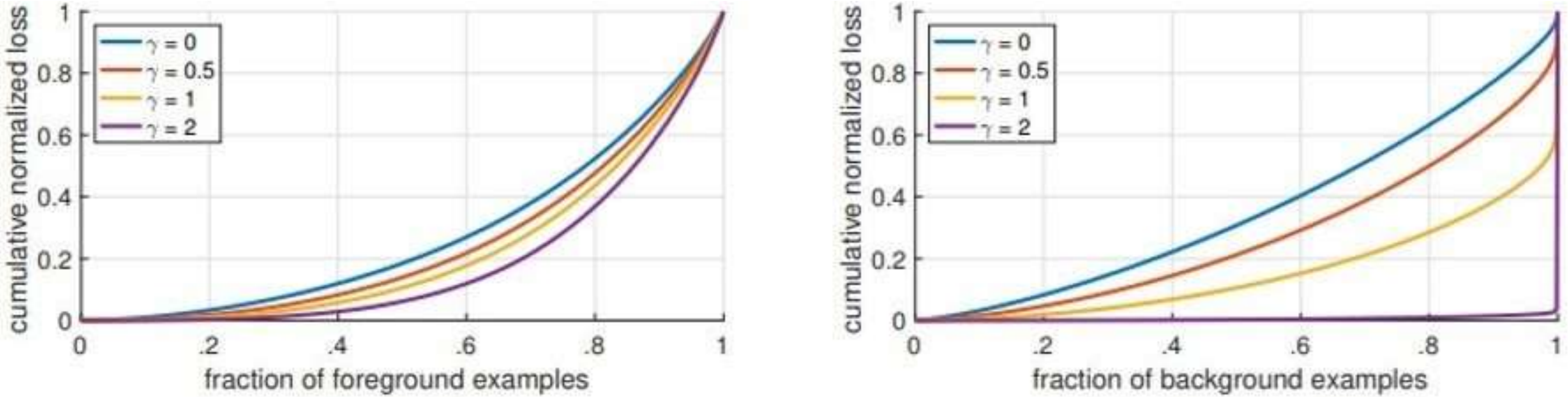
Focal Loss



$\mathrm{CE}(p_t) = -\log(p_t)$
$\mathrm{FL}(p_t) = -(1-p_t)^\gamma \log(p_t)$
γ = 0
γ = 0.5
γ = 1
γ = 2
γ = 5
loss
well-classified examples
probability of ground truth class
0
1
2
3
4
5
0
0.2
0.4
0.6
0.8
1

Focal Loss

$$\mathrm{FL}(p_t) = -(1 - p_t)^{\gamma} \log(p_t)$$



Thank you!

Happy Learning :)