객체탐지

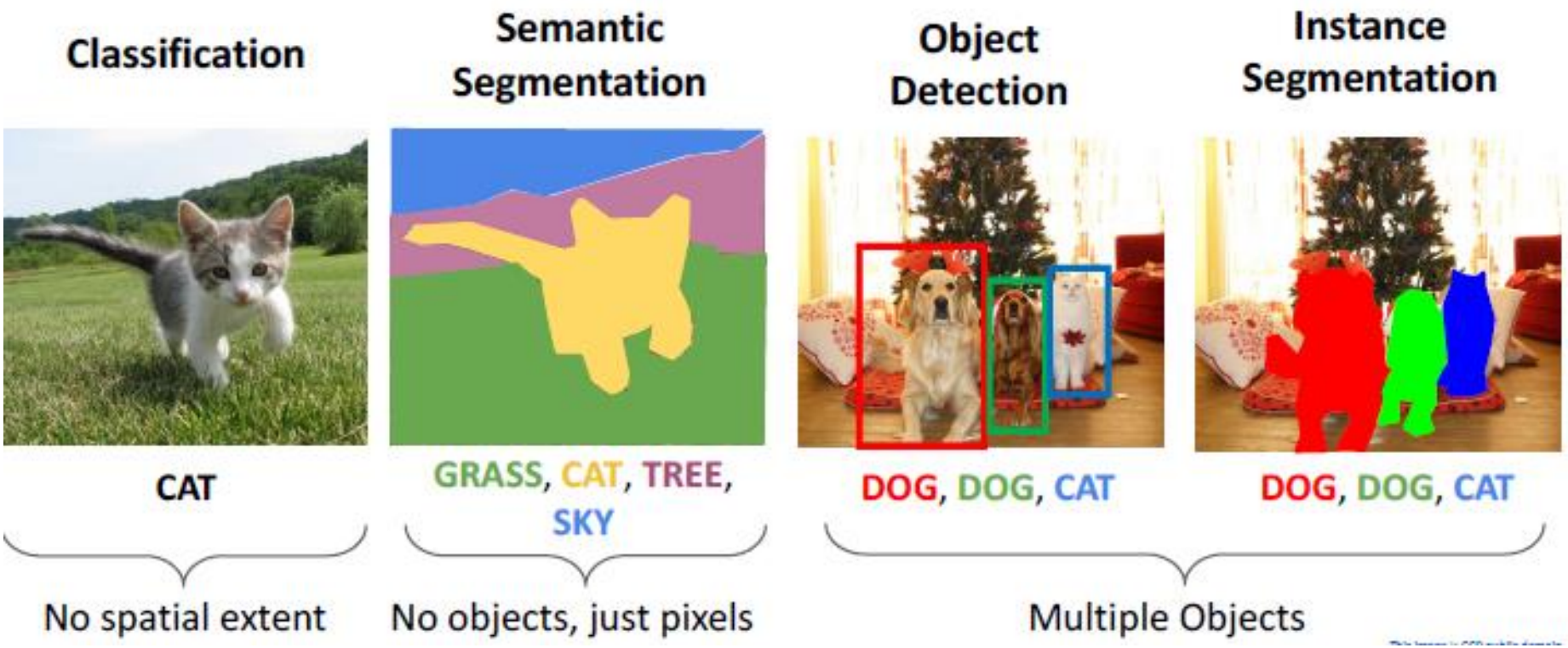
object detection

Dr. Rhee
Feb 2020

R-CNN

컴퓨터 비전 작업

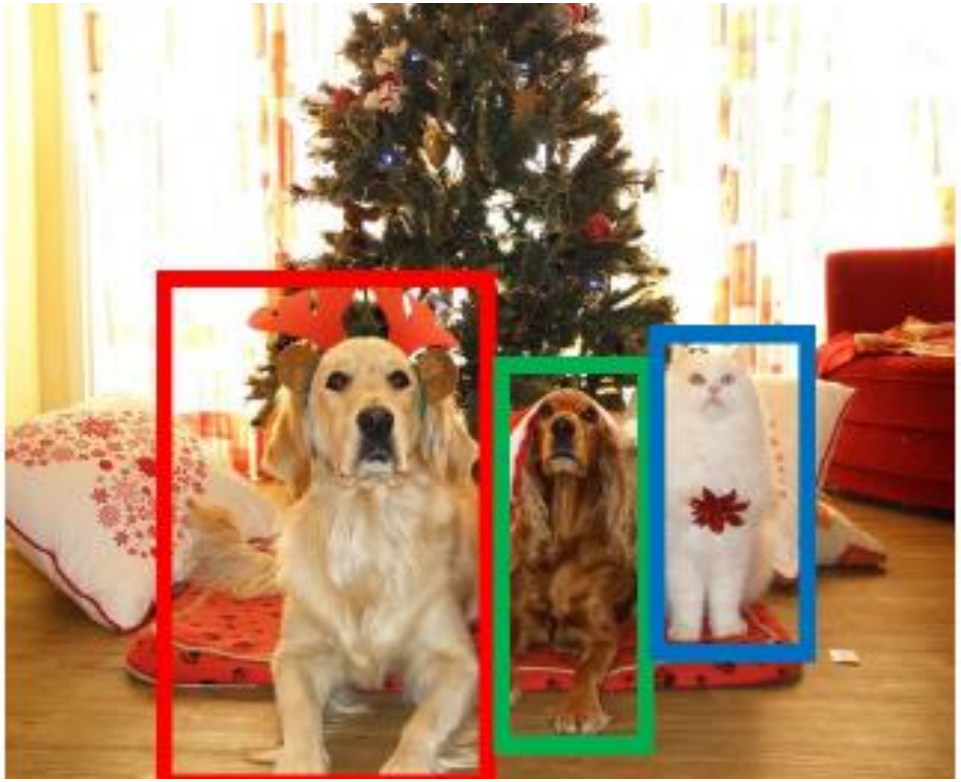
- 비전 작업의 종류



객체 탐지:작업 정의

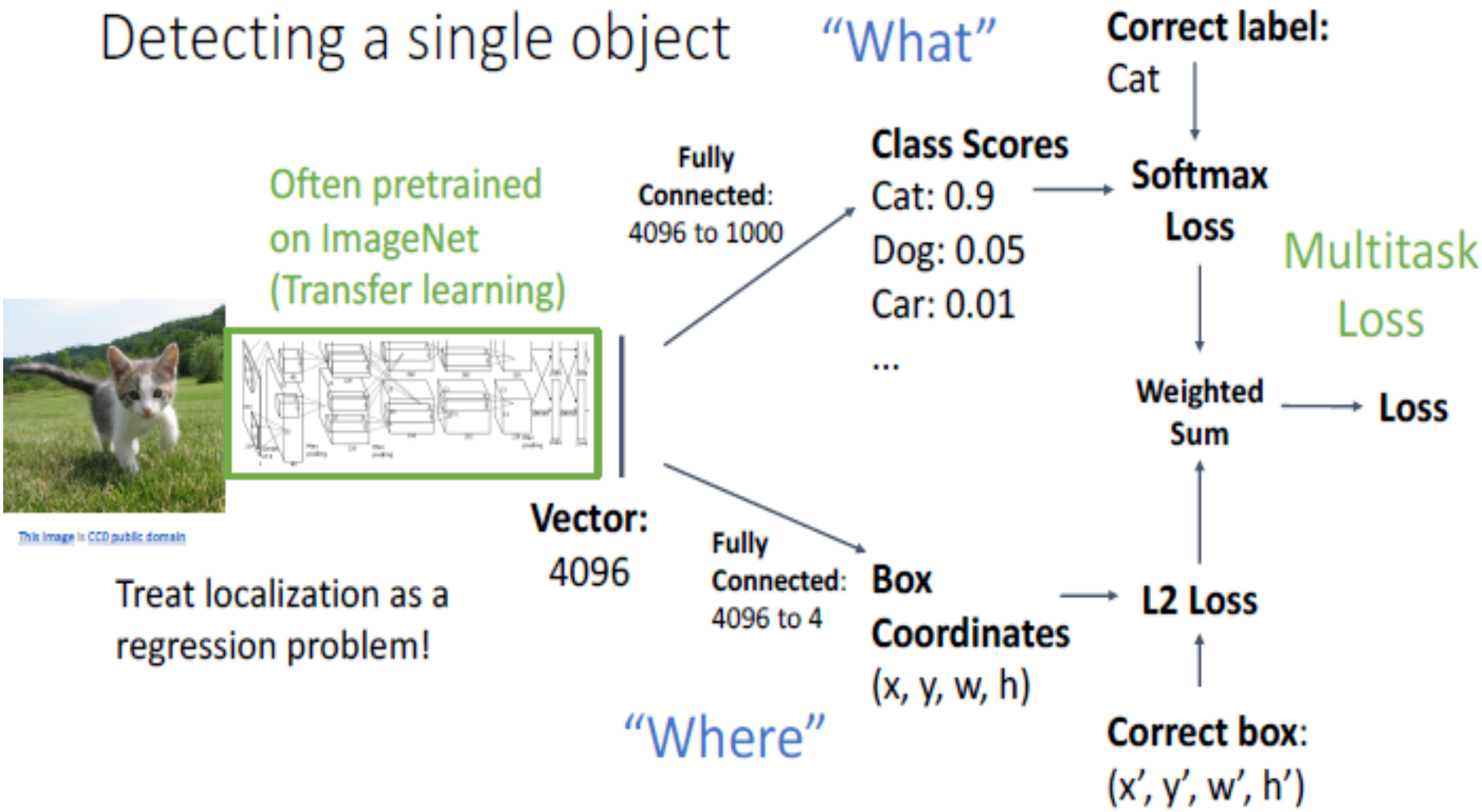
- 입력: 단일 RGB 이미지
- 출력: 탐지된 객체

1. 카테고리 레이블 (고정 수의 알려진 카테고리)
2. 바운딩 박스 (4개의 수치: x, y, 너비, 높이)



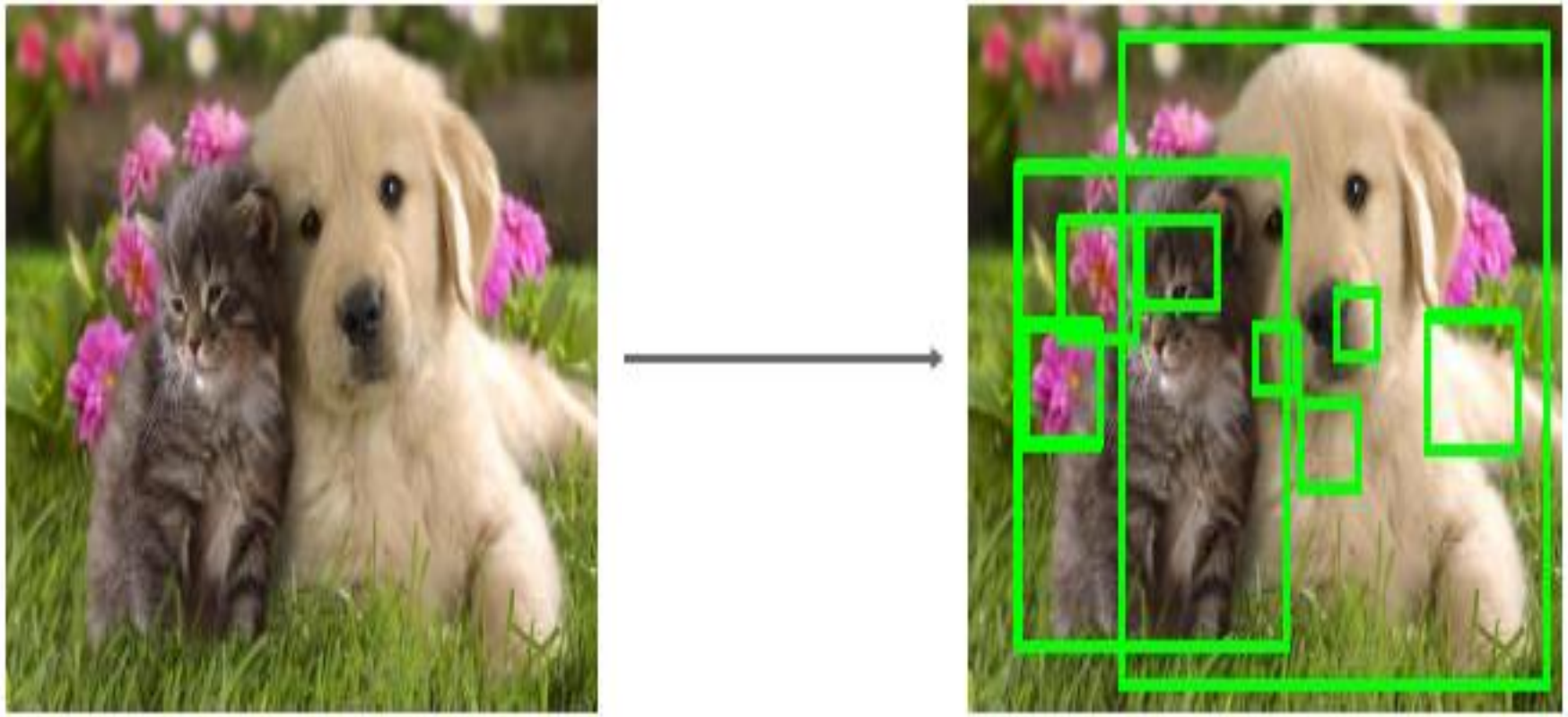
객체 탐지:작업 정의

- 단일 객체의 탐지



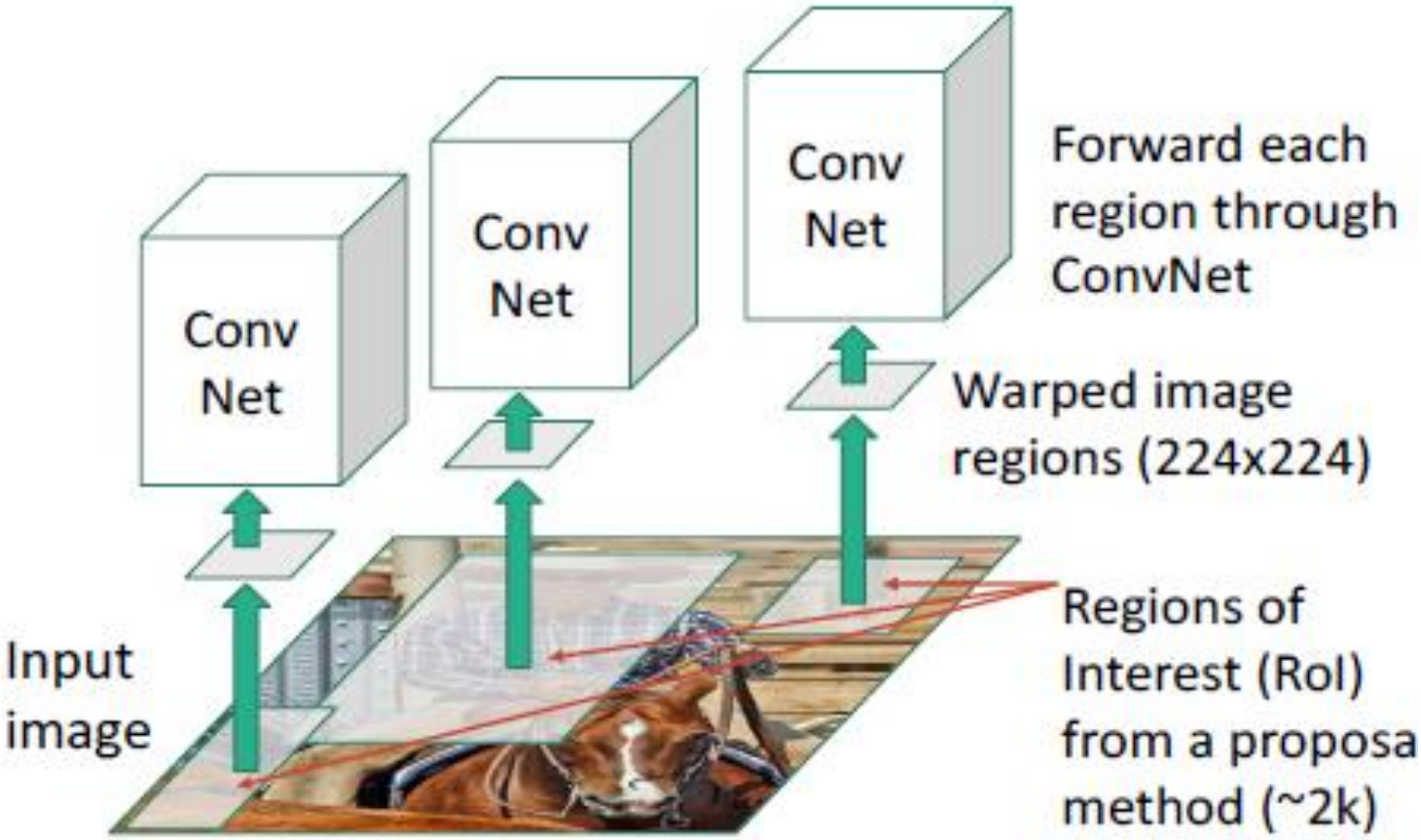
객체 탐지: 영역 프로포잘

- 영역 프로포잘: 모든 객체를 커버할 박스 집합을 발견



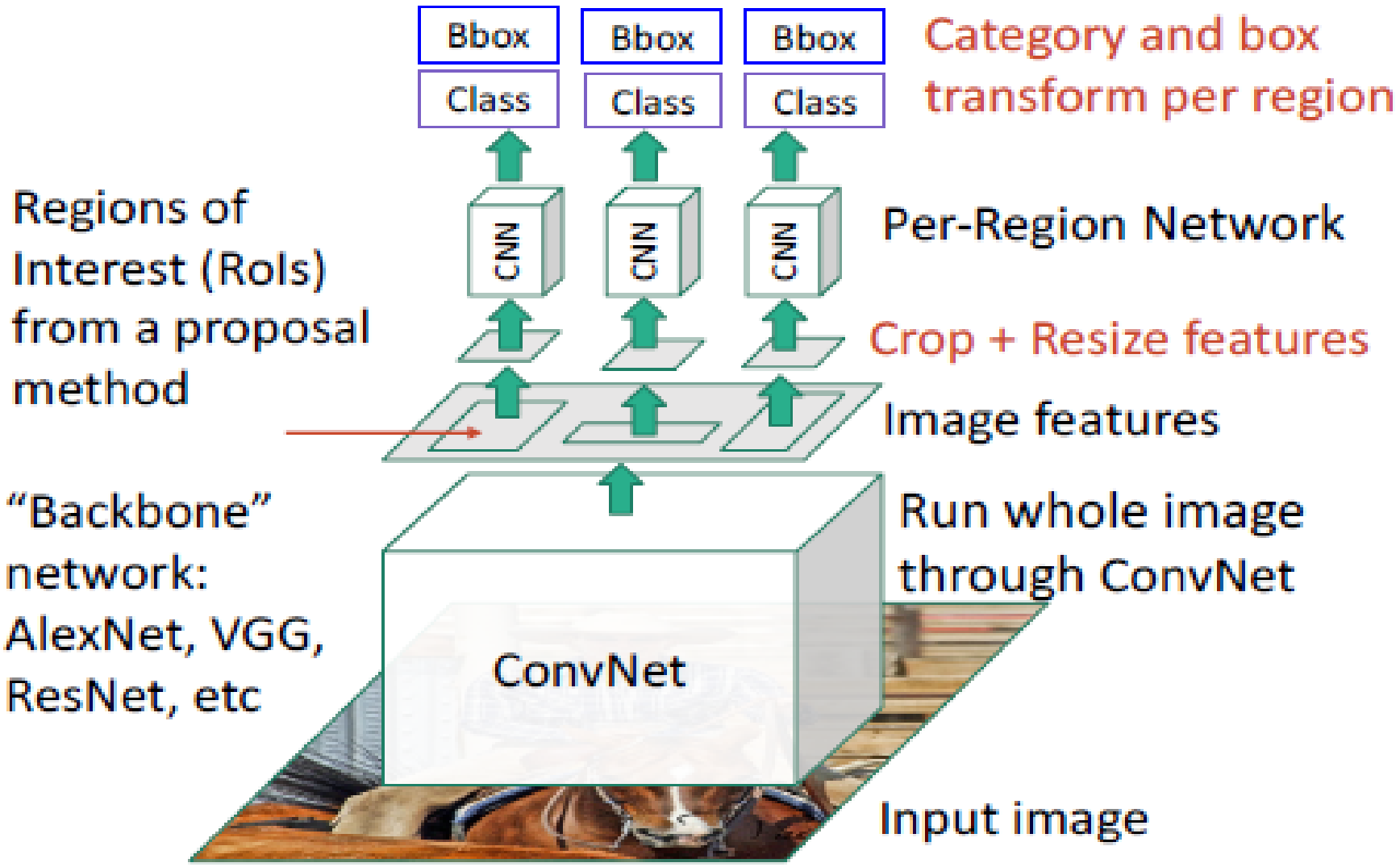
R-CNN: 영역 기반 CNN

- R-CNN (Region based CNN)



R-CNN: 영역 기반 CNN

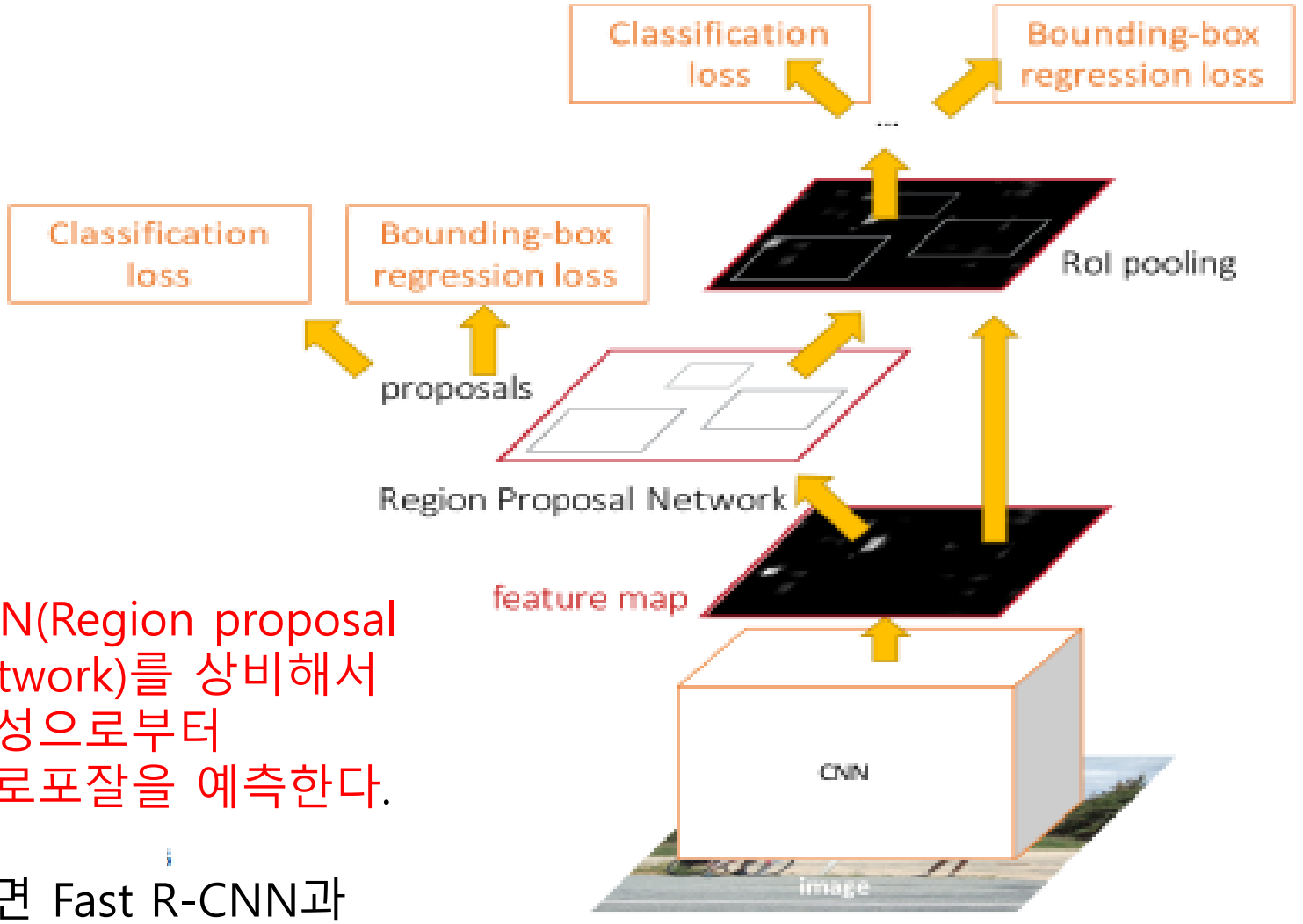
- Fast R-CNN



Girshick, "Fast R-CNN", ICCV 2015. Figure copyright Ross Girshick, 2015; source. Reproduced with permission.

R-CNN: 영역 기반 CNN

- Faster R-CNN

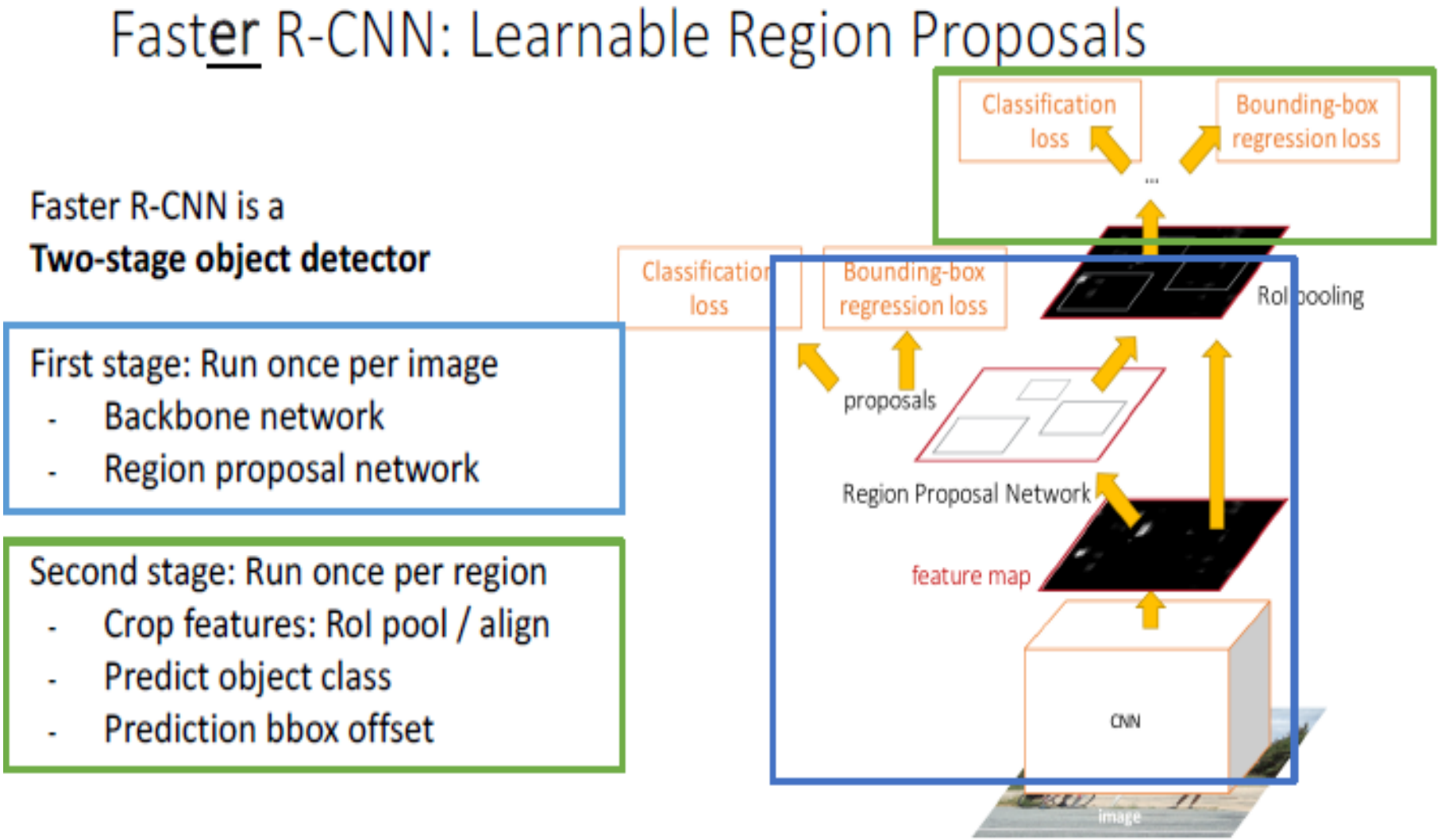


- RPN(Region proposal network)를 상비해서 특성으로부터 프로포잘을 예측한다.

(아니면 Fast R-CNN과 동일)

R-CNN: 영역 기반 CNN

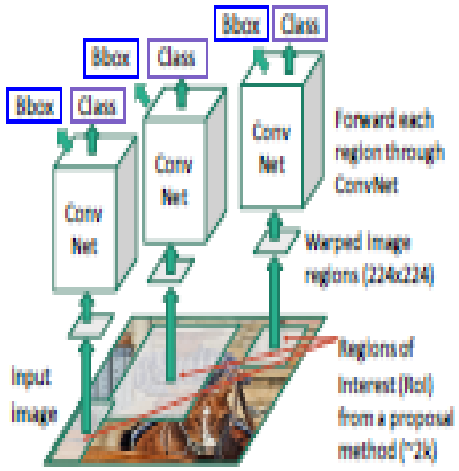
- 2단계 탐지기



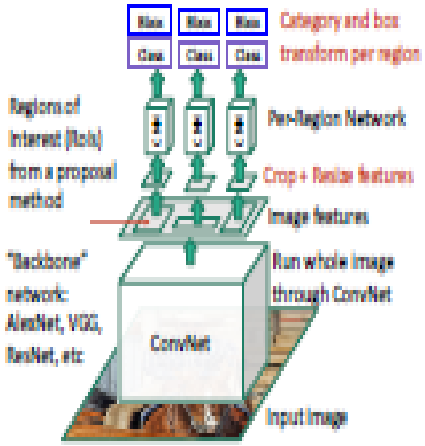
R-CNN: 영역 기반 CNN

- R-CNN 요약

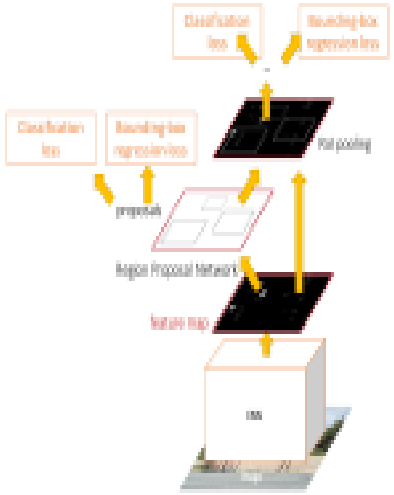
"Slow" R-CNN: Run CNN independently for each region



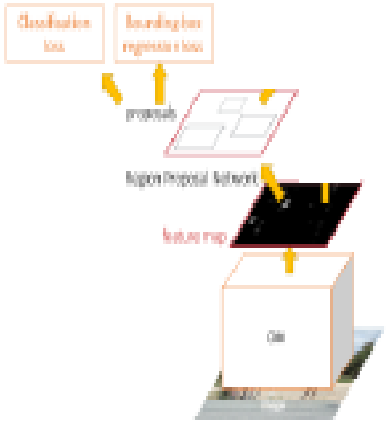
Fast R-CNN: Apply differentiable cropping to shared image features



Faster R-CNN: Compute proposals with CNN

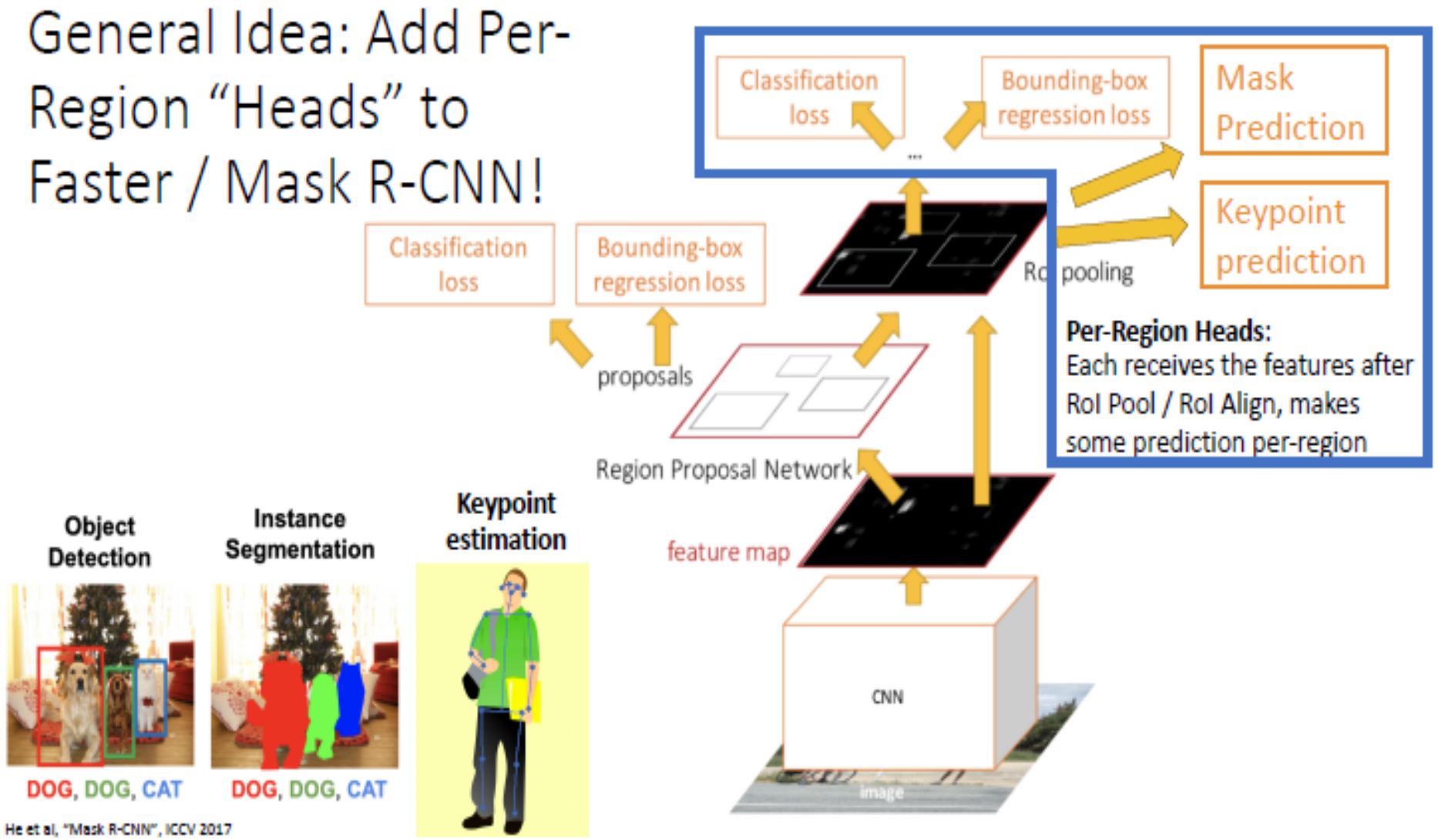


Single-Stage: Fully convolutional detector



이미지 분할

- Mask R-CNN

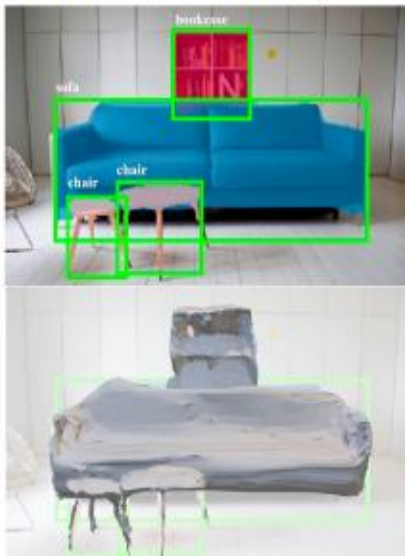


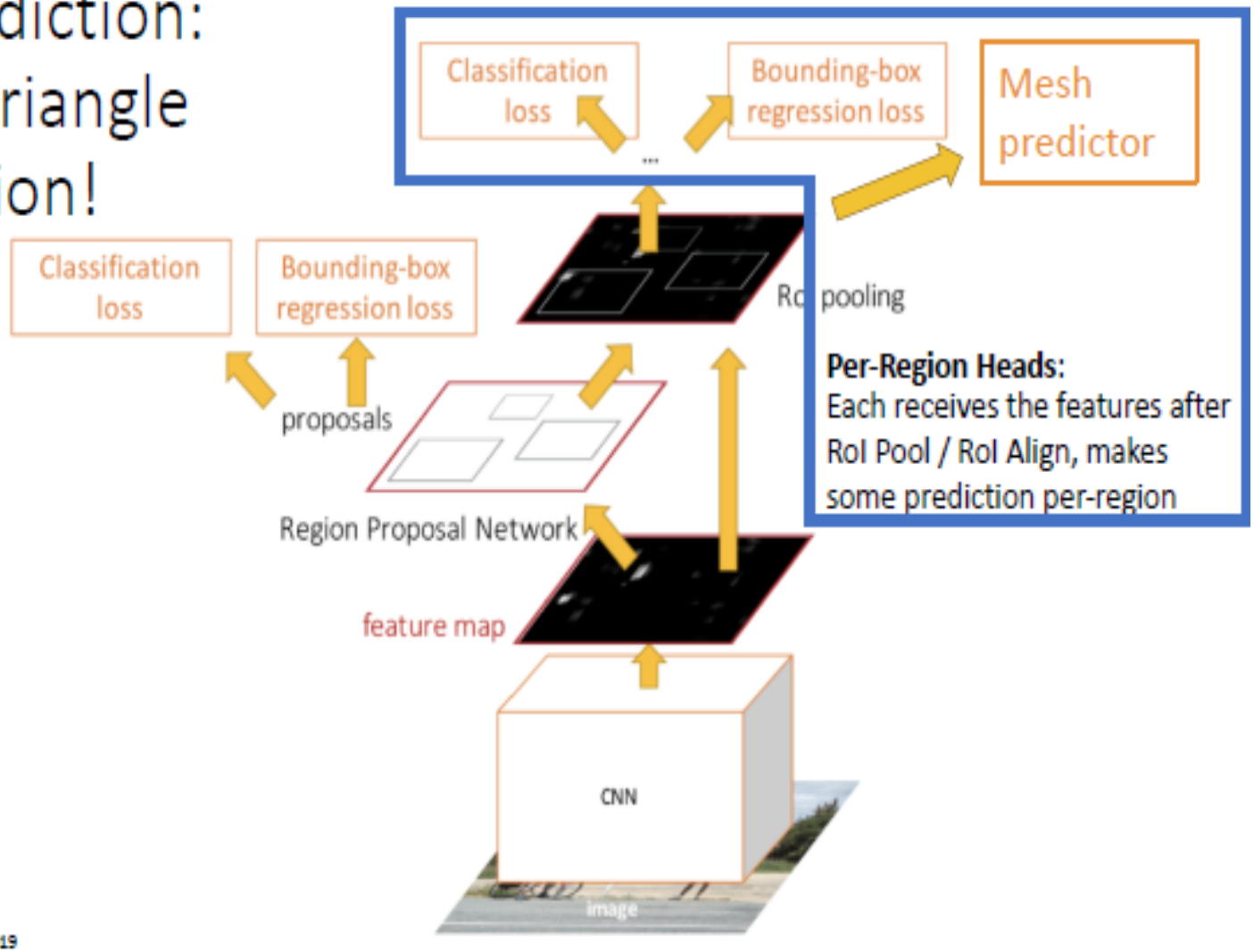
3D 모양 예측

- Mask R-CNN + Mesh Head

3D Shape Prediction:
Predict a 3D triangle mesh per region!

Mesh R-CNN:
2D Image -> **3D** shapes



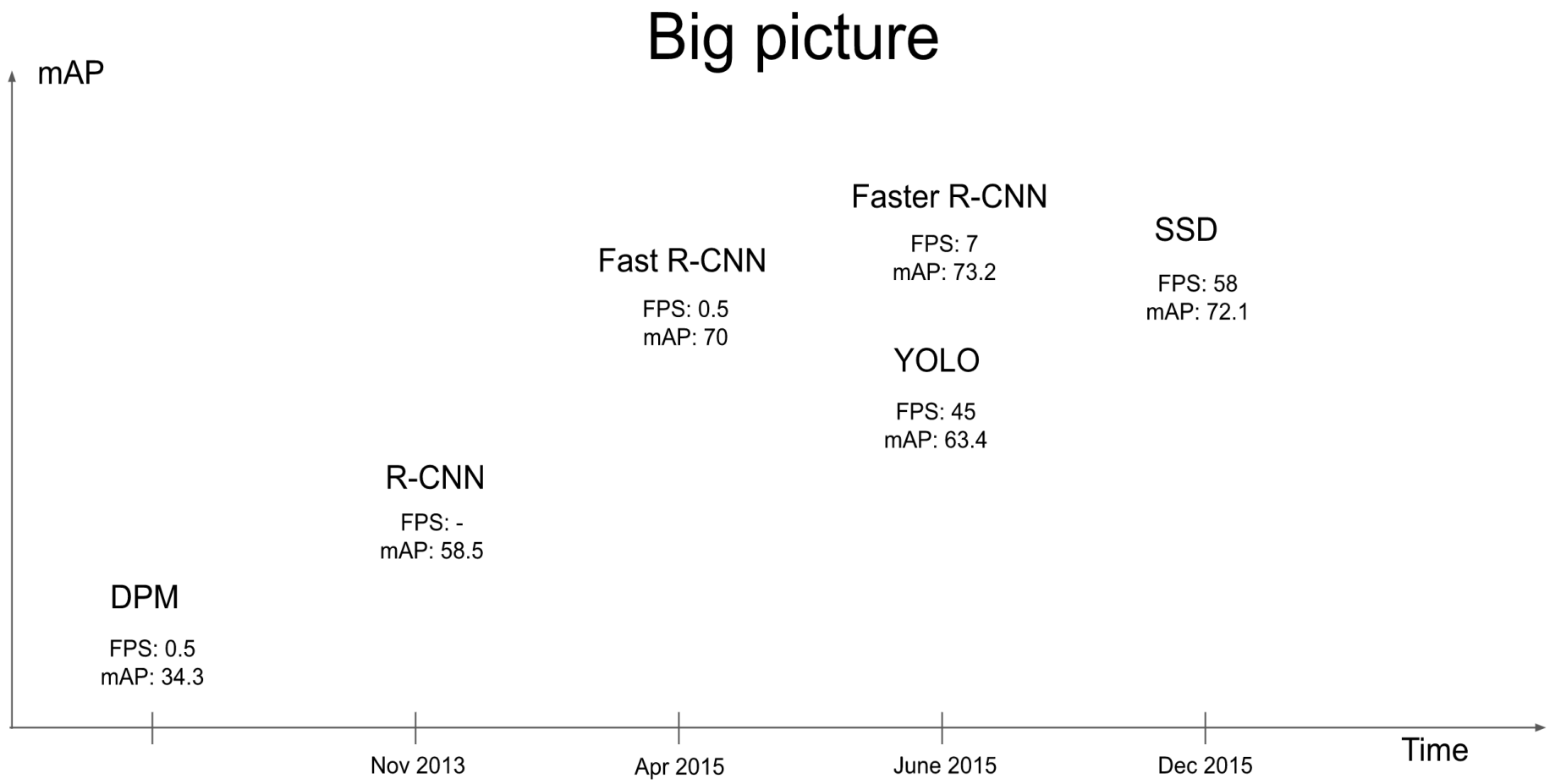


Gkioxari, Malik, and Johnson, "Mesh R-CNN", ICCV 2019

실무적 1단계 객체 탐지

객체 탐지

- 객체 탐지의 역사



Результаты на тестовой выборки Pascal VOC 2007. Обучение на trainval sets 2007+2012

deepsystems.io

객체 탐지:작업 정의

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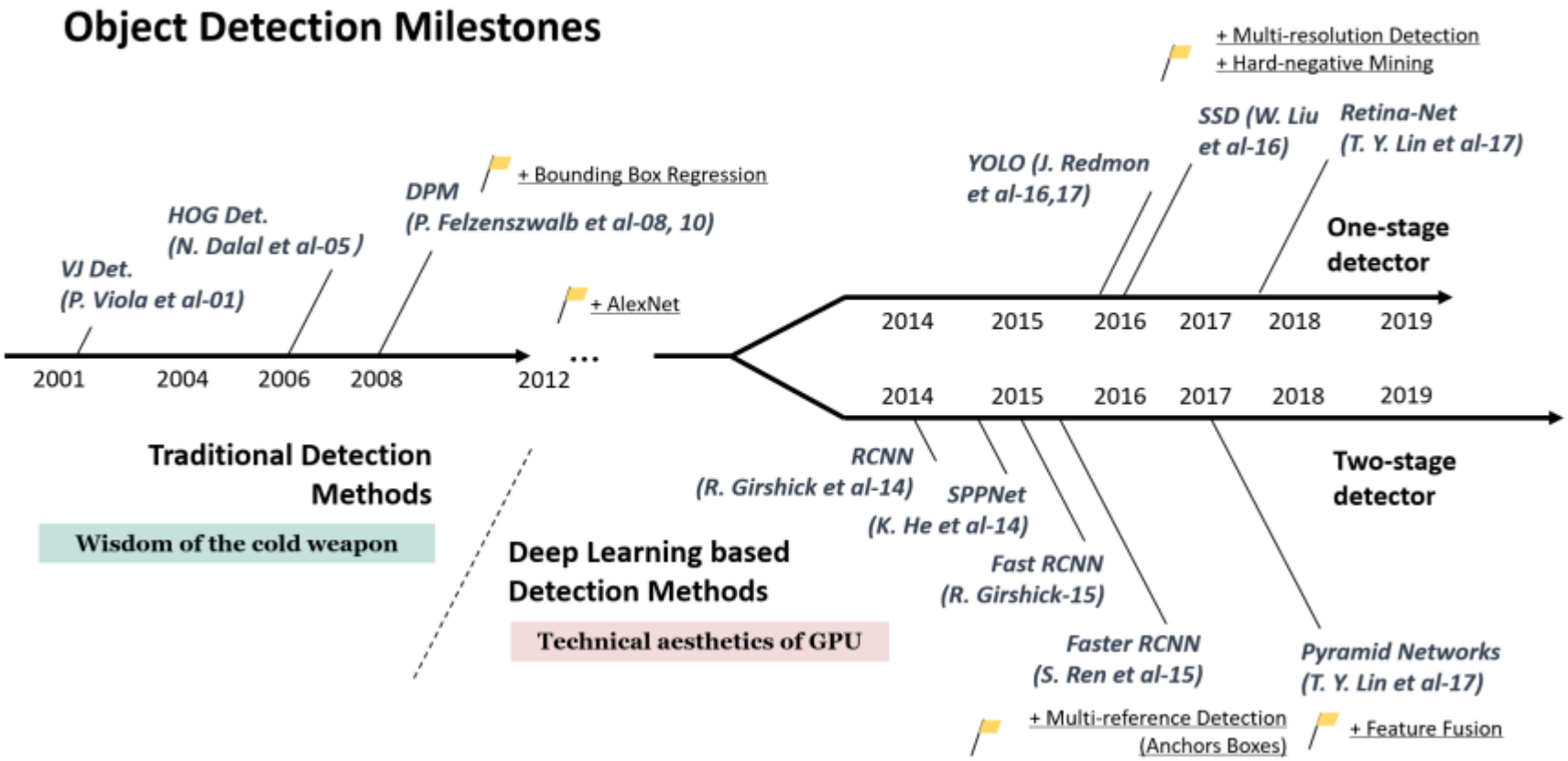


YOLO (You only look once)

- 통합된 탐지: 영역 프로포잘과 분류를 통합

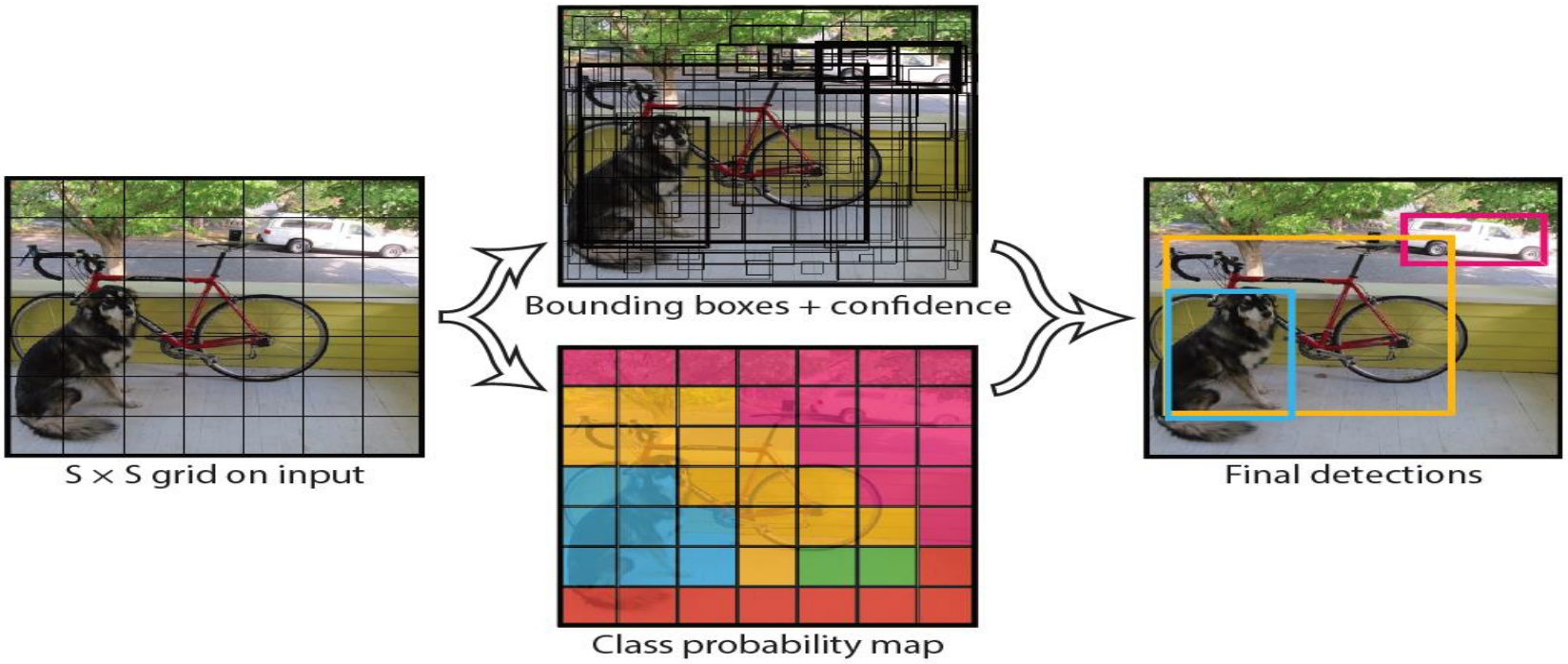
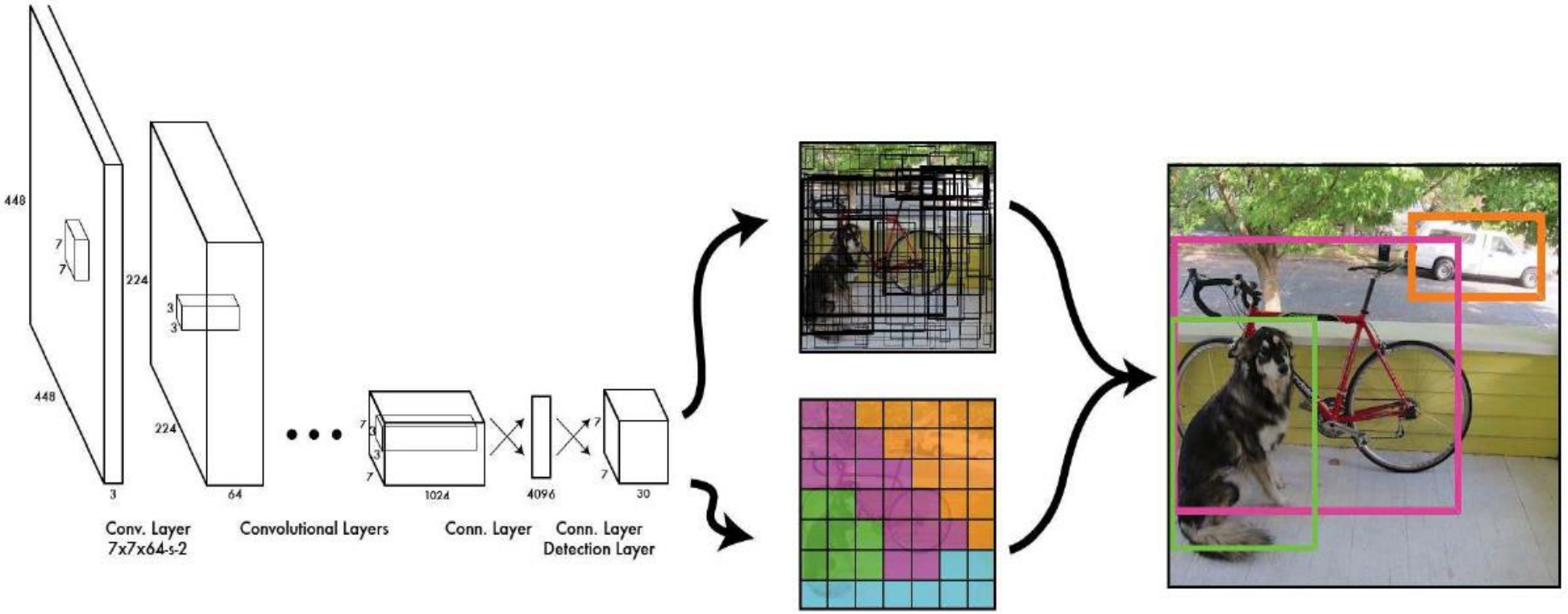


Figure 2: The Model. Our system models detection as a regression problem. It divides the image into an $S \times S$ grid and for each grid cell predicts B bounding boxes, confidence for those boxes, and C class probabilities. These predictions are encoded as an $S \times S \times (B * 5 + C)$ tensor.

YOLO (You only look once)

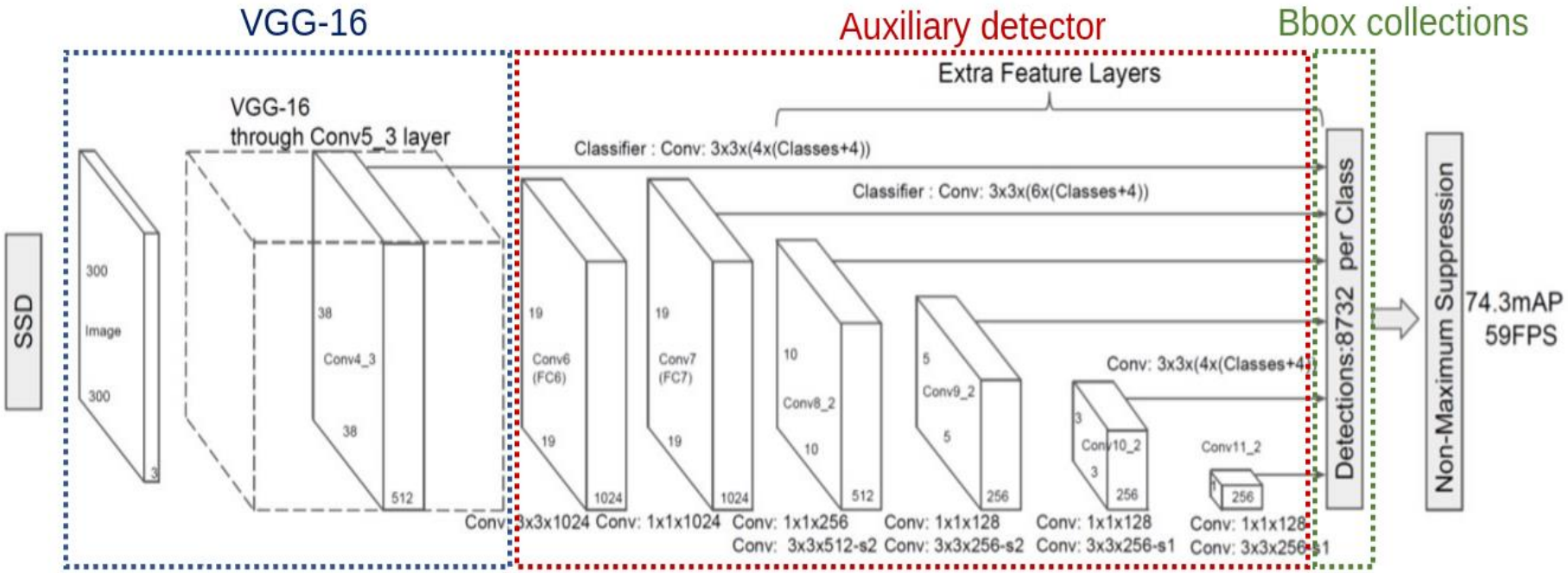
- YOLO 파이프 라인: 24개의 conv 층과 2개의 FC층

- 분류 성능은 떨어지지만 속도 향상을 달성



SSD (Single Shot MultiBox Detector)

- YOLO 이후에 나온 것으로 당시 최고 기술인 2단계 Faster R-CNN을 초월



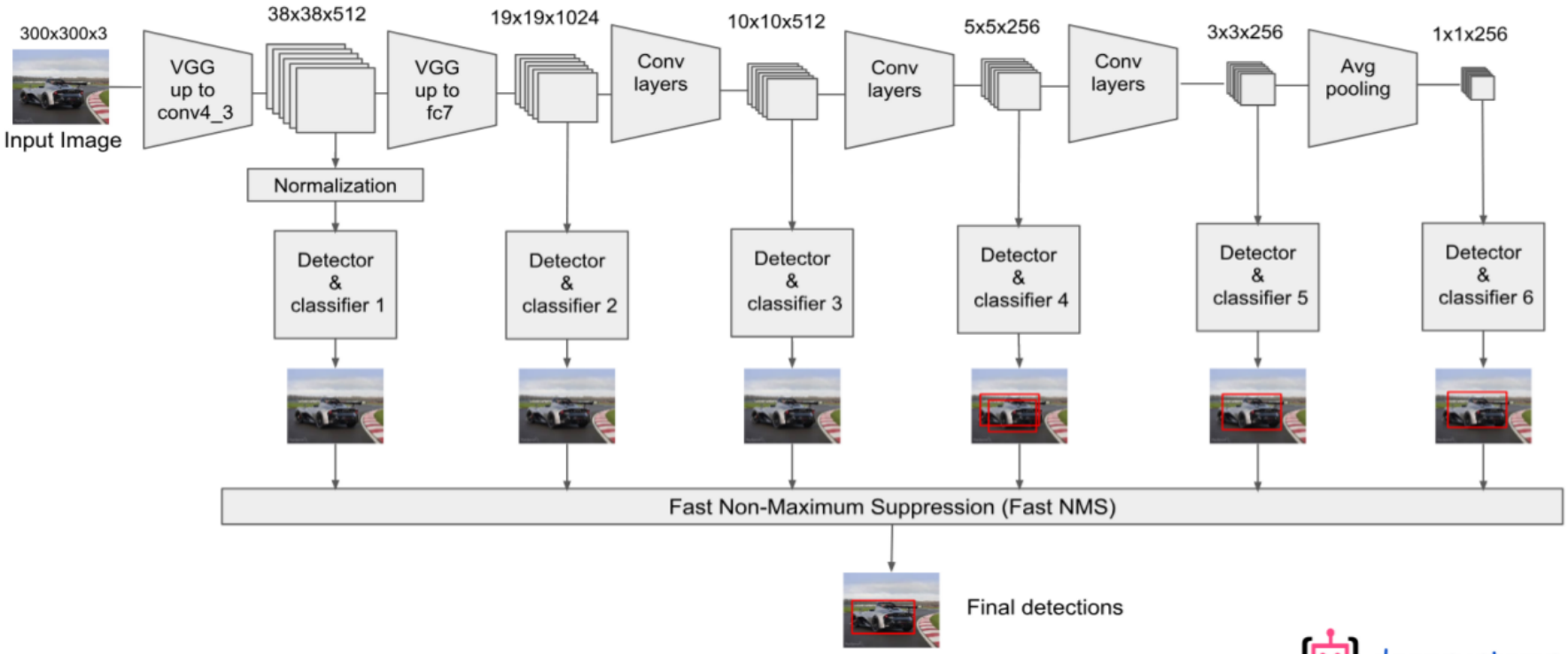
- 3등분 구조

1. VGG-16
2. 보조 탐지기로 정보 추출하고
3. 2에서 추출된 정보를 사용해 bbox 예측(회귀)

SSD (Single Shot MultiBox Detector)

- 핵심 아이디어: 한개의 물체를 다양한 크기의 bbox를 사용해 다해상도(multi-resolution) 환경에서 예측하는 것

Choosing Scales and Aspect Ratios for Default Boxes



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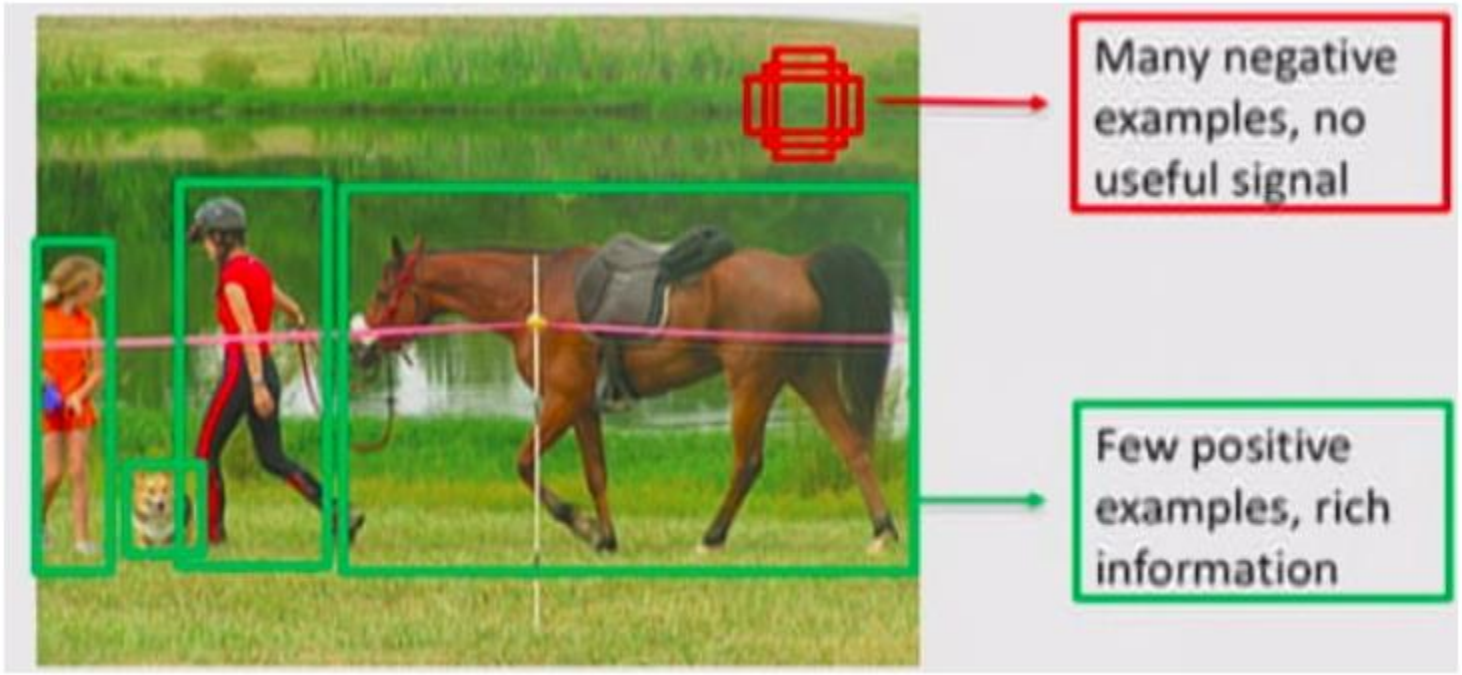
Slide from https://goo.gl/NsP6Wg

RetinaNet

- 데이터의 클래스 불균형 문제



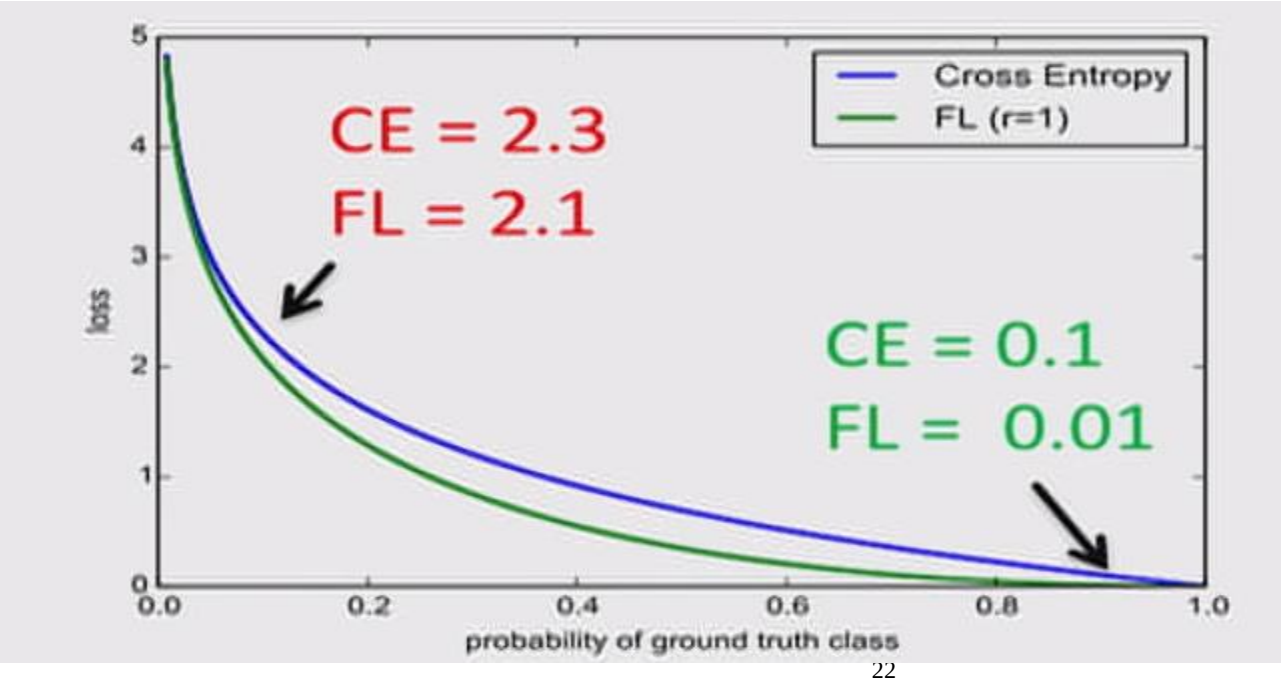
RetinaNet

- 교차 엔트로피(Cross Entropy)

$$\mathrm{CE}(p, y) = \begin{cases} -\log(p) & \text{if } y = 1 \\ -\log(1-p) & \text{otherwise.} \end{cases} \qquad (1)$$

- Focal Loss

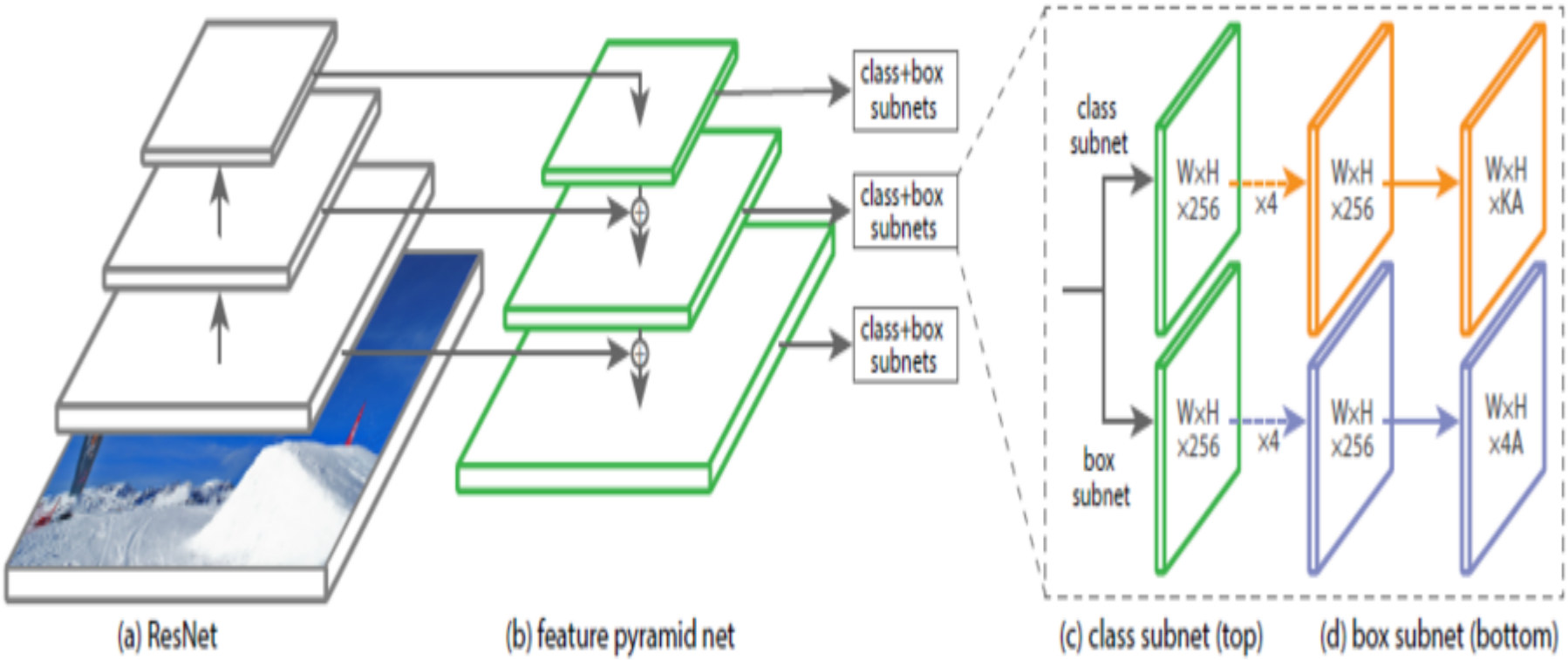
$$\mathrm{FL}(p_t) = -\alpha_t (1 - p_t)^{\gamma} \log(p_t)$$



RetinaNet

- 1단계 레티나넷 구조 (1 stage RetinaNet 구조):

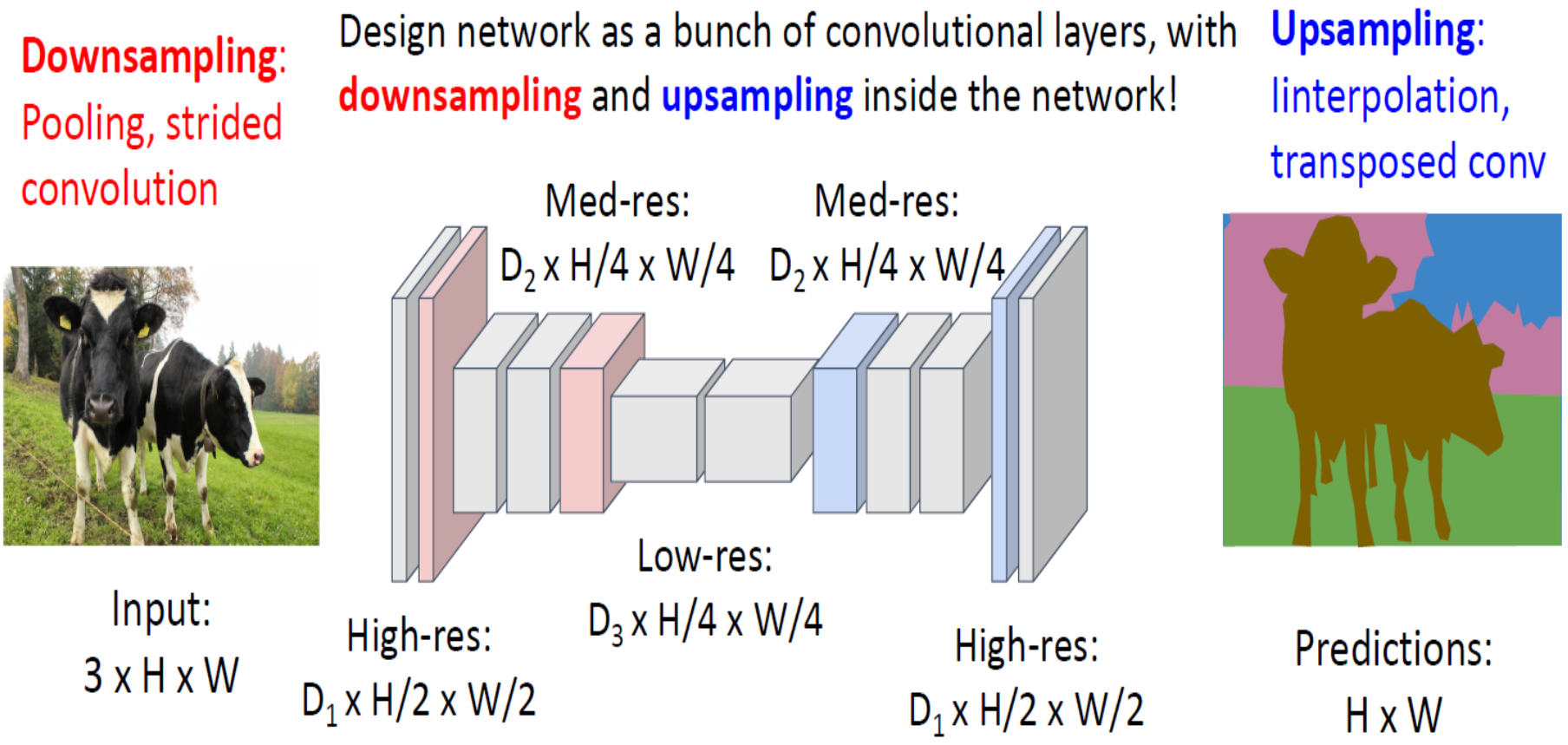
- 특성 피라미드 신경망(FPN: Feature Pyramid Network)



이미지 분할

이미지 분할

- 다운샘플링과 업샘플링의 합성곱층으로 구성된 네트워크 (Fully Convolutional Network)



Loss function: Per-Pixel cross-entropy

Long, Shelhamer, and Darrell, "Fully Convolutional Networks for Semantic Segmentation", CVPR 2015
Noh et al, "Learning Deconvolution Network for Semantic Segmentation", ICCV 2015