



CS F425: Deep Learning

20

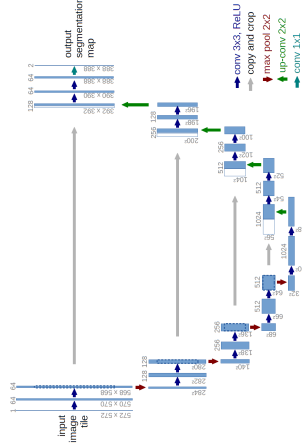
U-NET, and R-CNN Family



Dr. Kamlesh Tiwari
 Assistant Professor, Department of CSIS,
 BITS Pilani, Pilani Campus, Rajasthan-333031 INDIA
 Mar 07, 2023 **ON-CAMPUS** Campus @ BITS-Pilani [Jan-May 2023]

<http://ktiwari.in/dl>

U-Net¹



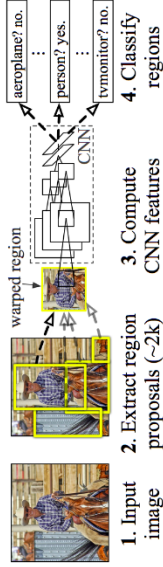
- ISBI DIC-HeLa achieved 77.6% iou as compared to 46.0% second
- ISBI Cell tracking 2015, achieved 92% IoU as compared to 83%

second

¹ [Cite 57328](#) O. Ronneberger and P.Fischer and T. Brox, *U-Net: Convolutional Networks for Biomedical Image Segmentation*, Medical Image Computing and Computer-Assisted Intervention (MICCAI), LNCS-9351, pages 234–241, Springer-2015

R-CNN ²

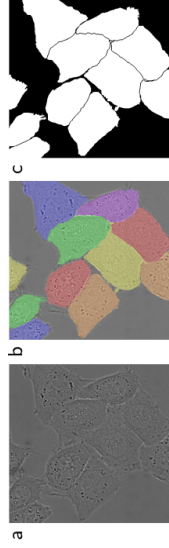
R-CNN: Regions with CNN features



- Region proposals ~20K (from external selective search)
- Warped image (resizing)
- SVM for classification (one for each class)

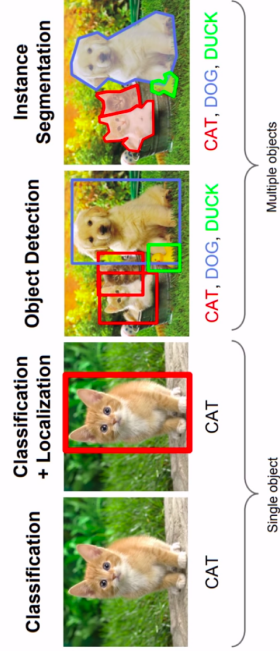
² [Cite 11049](#) Girshick, Ross and Donahue, Jeff and Darrell, Trevor and Malik, Jitendra, *Rich feature hierarchies for accurate object detection and semantic segmentation*, Conference on computer vision and pattern recognition, pages 580–587, IEEE-2014

Segmentation

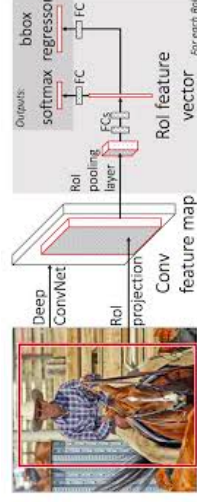


- ISBI challenge for segmentation of neuronal structures in electron microscopic stacks
- Works with very few training images (30/application) and touching boundary. Yield more precise segmentation
- Data augmentation is essential (mainly shift, rotation and elastic deformation)

Object Detection and Localization



Fast R-CNN ³



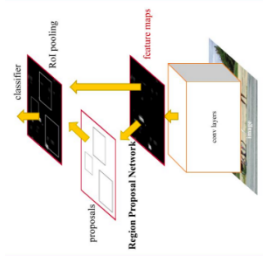
- RoI pooling
- Multi-task loss

³ [Cite 7885](#) Girshick, Ross *Fast R-CNN*, International Conference on computer vision, pages 1440–1448, IEEE-2015

Faster R-CNN ⁴

Thank You!

- Region Proposal Network (RPN)
- Four loss: RPN classification loss, RPN regress loss, Final classification loss, Final box coordinate loss
- 250 times faster than R-CNN. (Fast R-CNN is 25 times fast)



Thank you very much for your attention!

⁴ [Cite 14669 Ren, Shaoqing and He, Kaiming and Girshick, Ross and Sun, Jan Faster R-CNN: Towards real-time object detection with region proposal networks, Advances in neural information processing systems, pages 91–99, IEEE 2015](#)