Recurrent Instance Segmentation

Research Café BRGF

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# Computer Vision Tasks

Semantic Segmentation	Classification + Localization	Object Detection	Instance Segmentation
GRASS, CAT, TREE, SKY	**CAT**	**DOG, DOG, CAT**	**DOG, DOG, CAT**
No objects, just pixels	Single Object	Multiple Object	

This image is CC0 public domain

Image Credit: CS231 course

Image Classification

- 1,000 object classes (categories).
- Images:
  - 1.2 M train
  - 100k test.

Deng, J., Dong, W., Socher, R., Li, L. J., Li, K., & Fei-Fei, L. (2009, June). Imagenet: A large-scale hierarchical image database. In *Computer Vision and Pattern Recognition, 2009. CVPR 2009. IEEE Conference on* (pp. 248-255). IEEE.
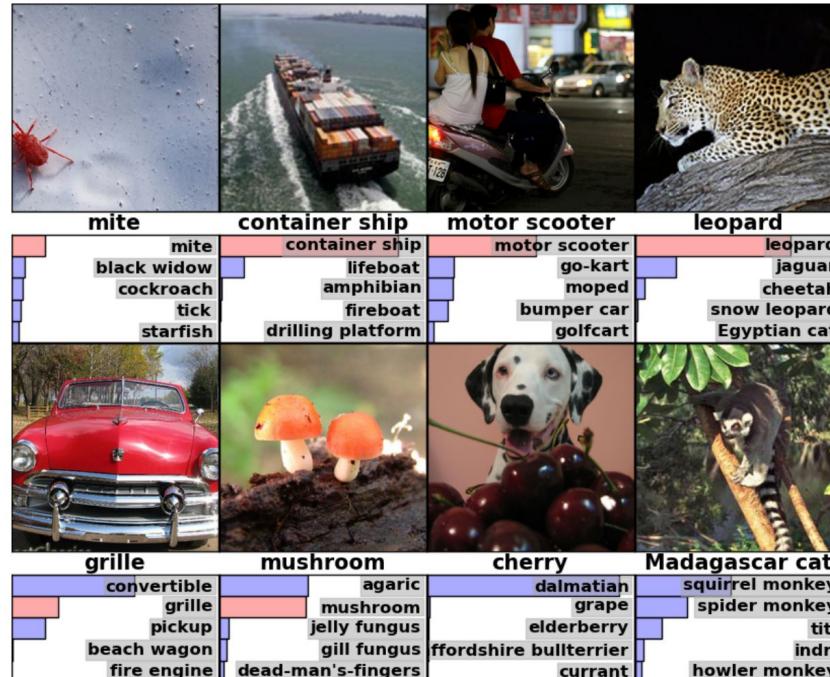
Image Classification

IMAGENET

Slide credit:
Rob Fergus (NYU)

Based on SIFT + Fisher Vectors

-9.8%

Russakovsky, Olga, Jia Deng, Hao Su, Jonathan Krause, Sanjeev Satheesh, Sean Ma, Zhiheng Huang et al. "Imagenet large scale visual recognition challenge." International Journal of Computer Vision 115, no. 3 (2015): 211-252. [web]
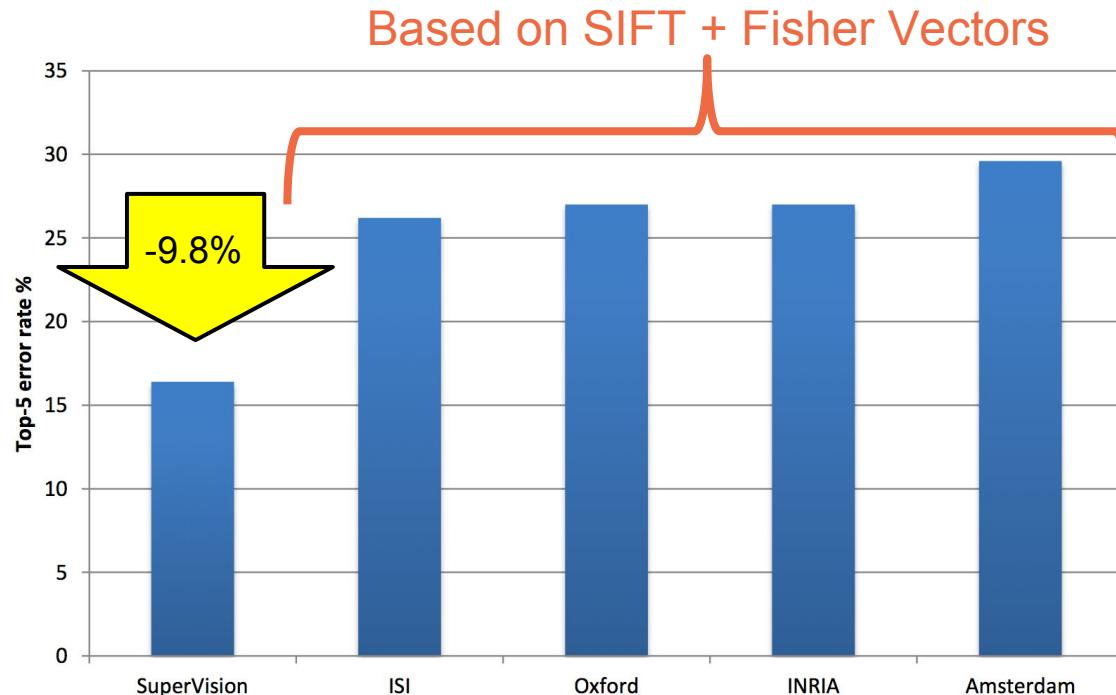
Convolutional Neural Networks

AlexNet
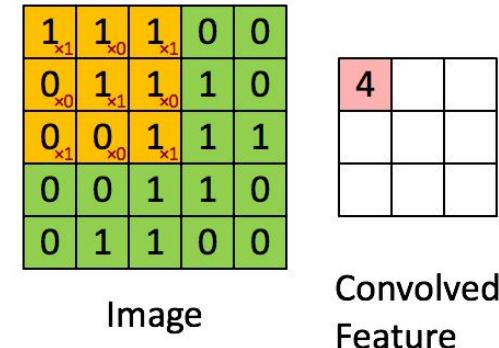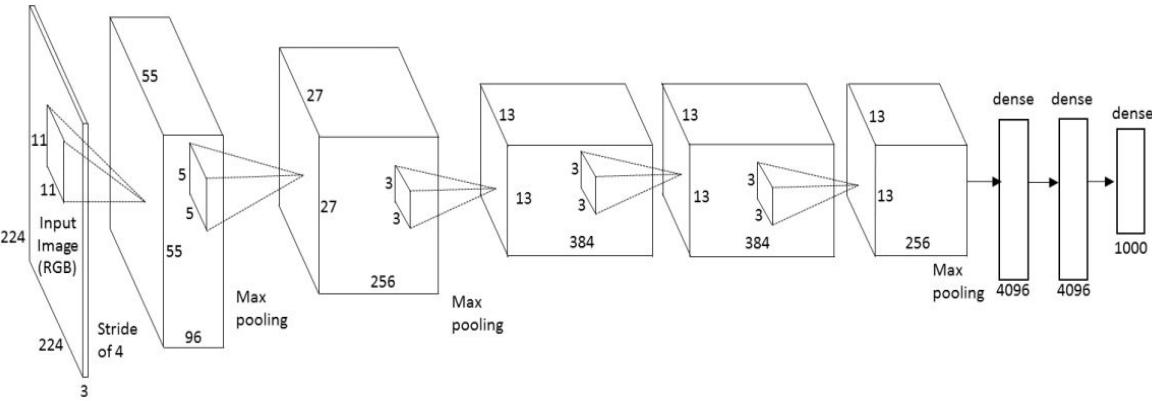

Image credit: Stanford course

Krizhevsky, Alex, Ilya Sutskever, and Geoffrey E. Hinton. "Imagenet classification with deep convolutional neural networks." NIPS 2012

Deep Neural Networks
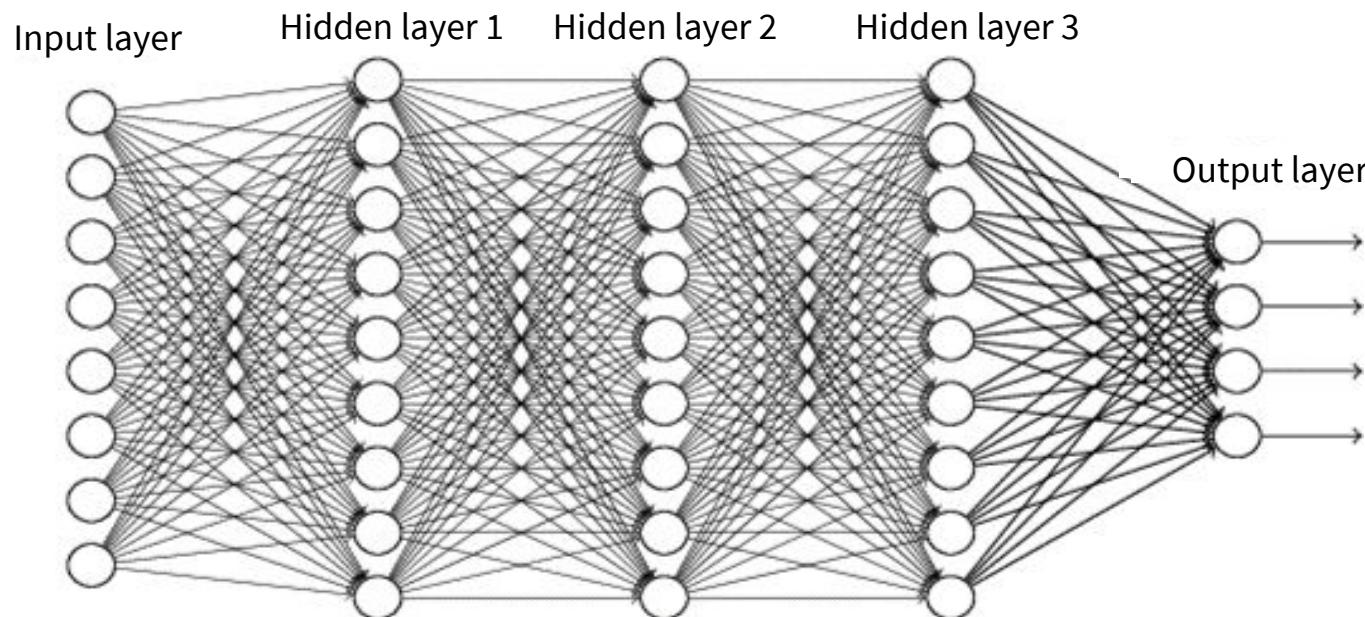
Convolutional Neural Networks
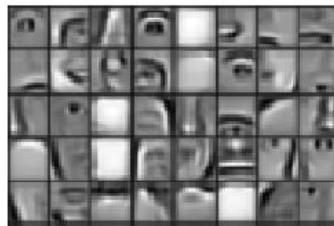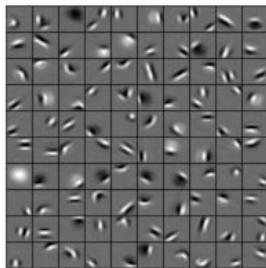
Filters at different levels of a CNN

Lee, H. et al. (2011). Unsupervised learning of hierarchical representations with convolutional deep belief network
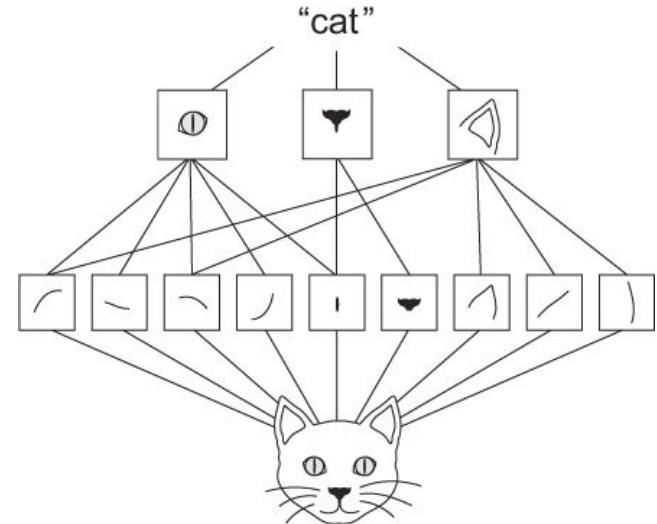
Hierarchy of patterns learned by a CNN

Image Credit: Deep Learning with Python

Image Segmentation

Semantic Segmentation
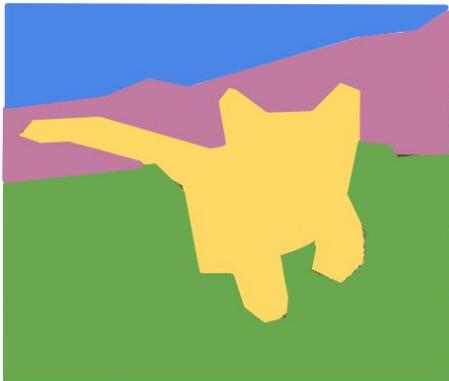
**GRASS**, **CAT**, **TREE**, **SKY**

No objects, just pixels

Classification + Localization

CAT

Single Object

Object Detection

DOG, **DOG**, **CAT**

Instance Segmentation

DOG, **DOG**, **CAT**

Multiple Object

This image is CC0 public domain

Image Credit: CS231 course

# Typical object detection/segmentation pipelines
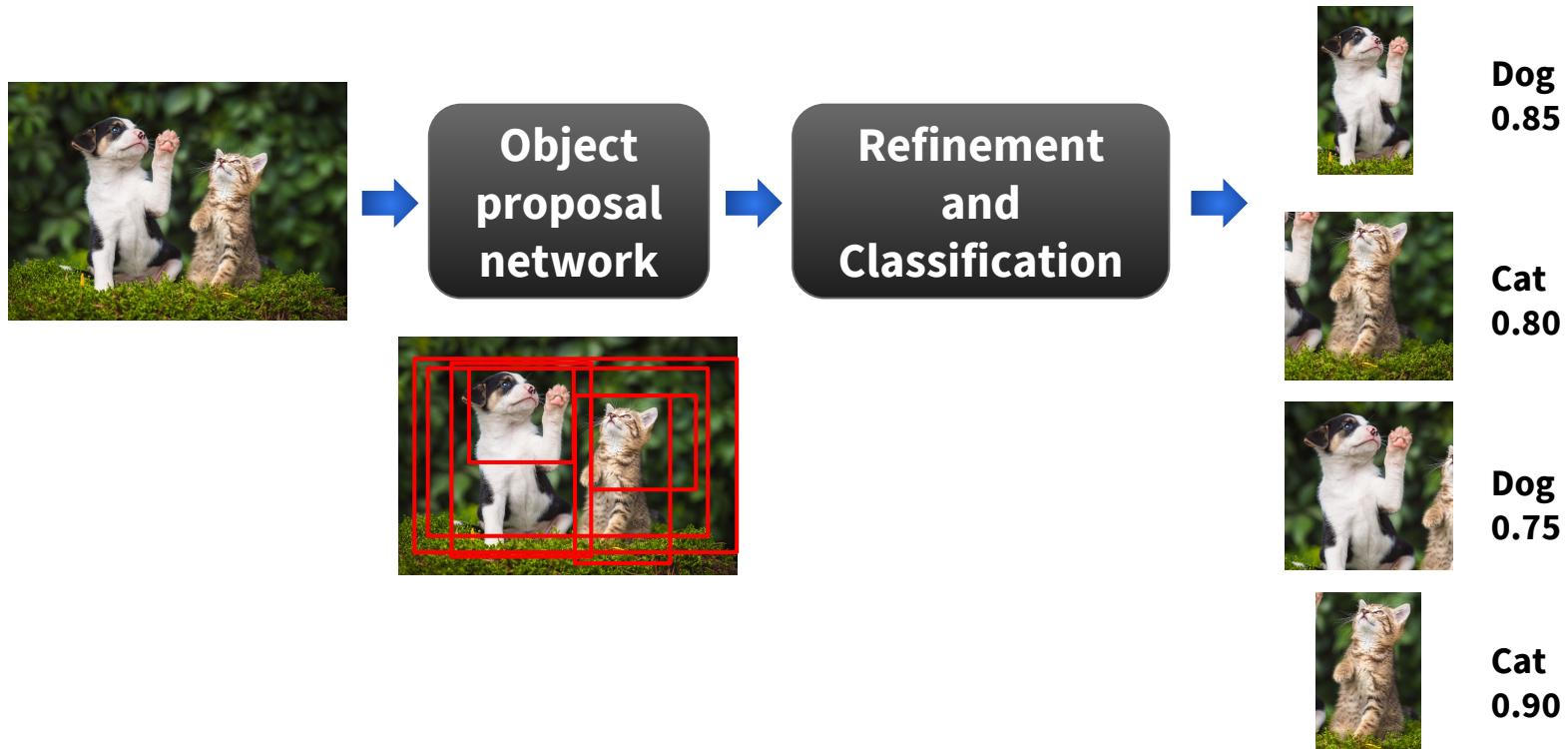
Typical object detection/segmentation pipelines
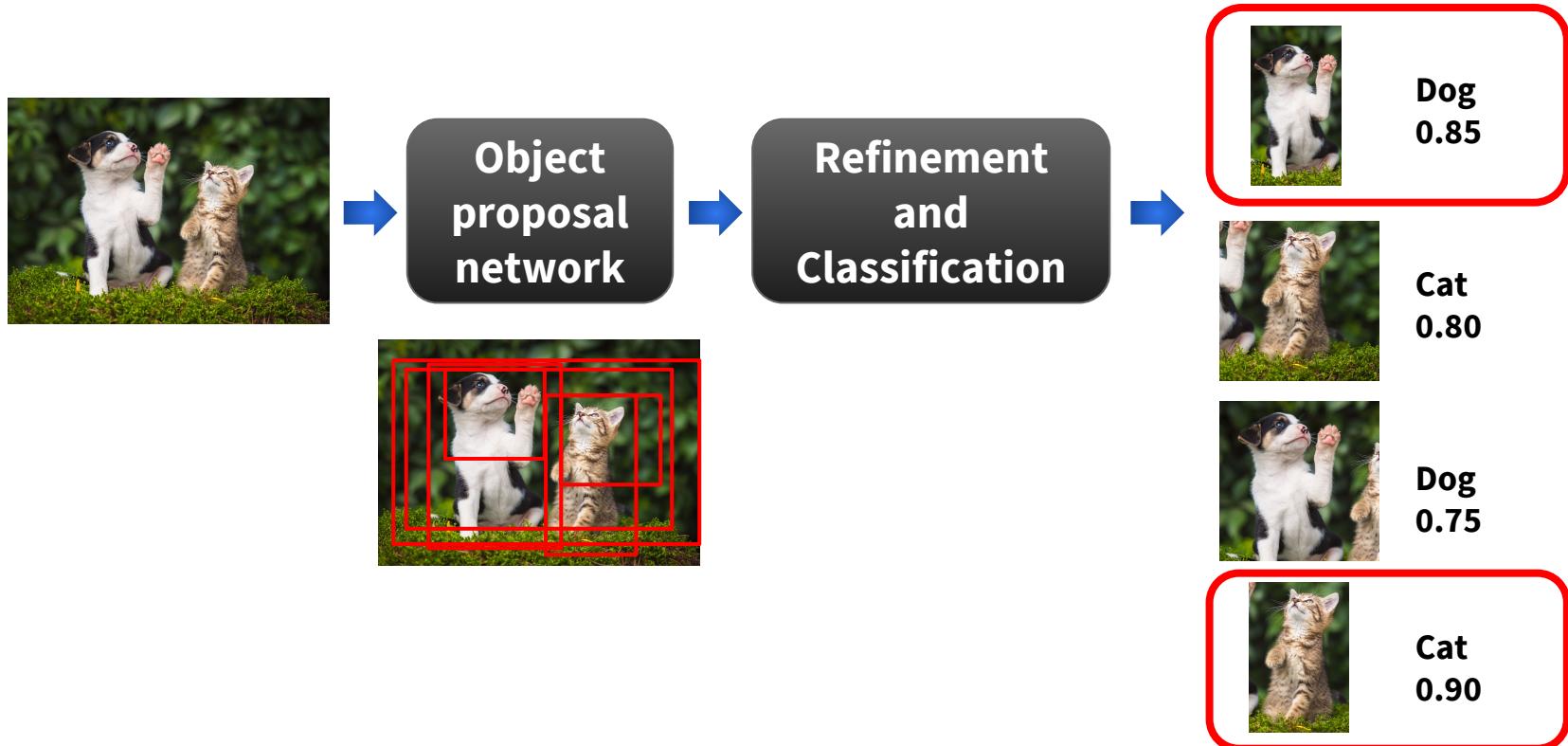
Typical object detection/segmentation pipelines

Our goal is to produce less candidates, removing any post-processing step:
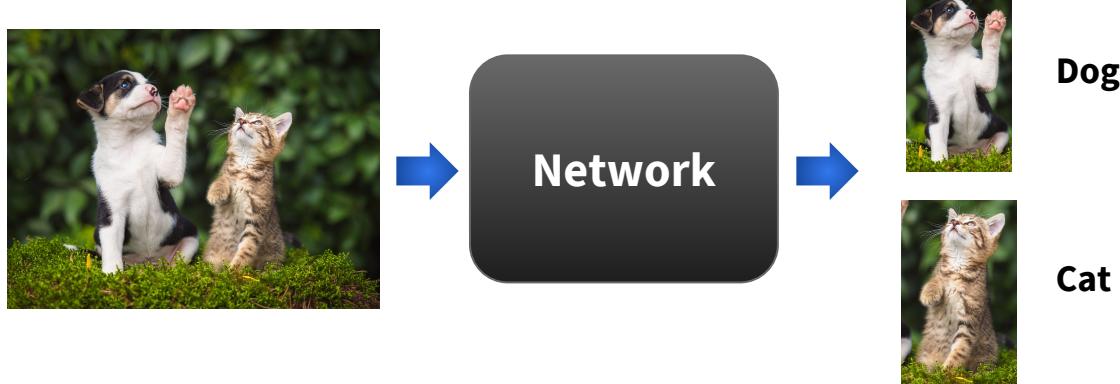
Typical object detection/segmentation pipelines

Our proposal is to output regions sequentially.
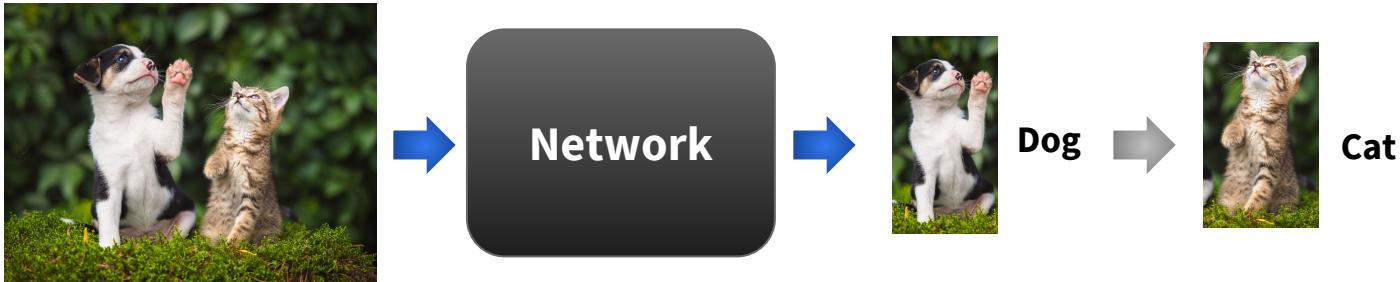
Recurrent Neural Networks
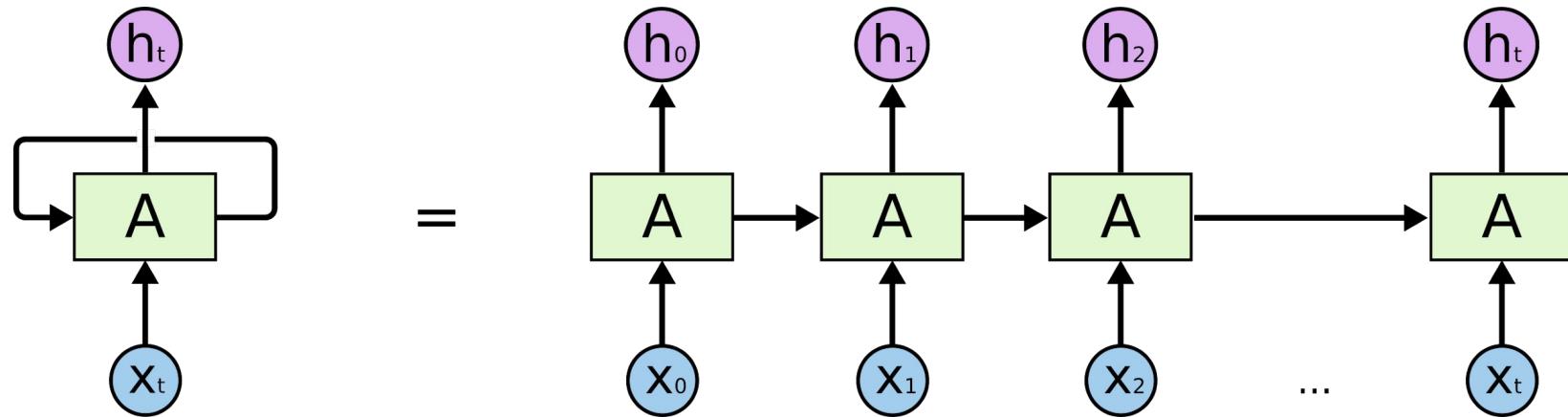
Image Credit: Colah's Blog

Recurrent Semantic Instance Segmentation

Salvador, A., Bellver, Campos. V, M., Baradad, M., Marqués, F., Torres, J., & Giro-i-Nieto, X. (2017). Recurrent Neural Networks for Semantic Instance Segmentation

Recurrent Semantic Instance Segmentation

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Recurrent Semantic Instance Segmentation
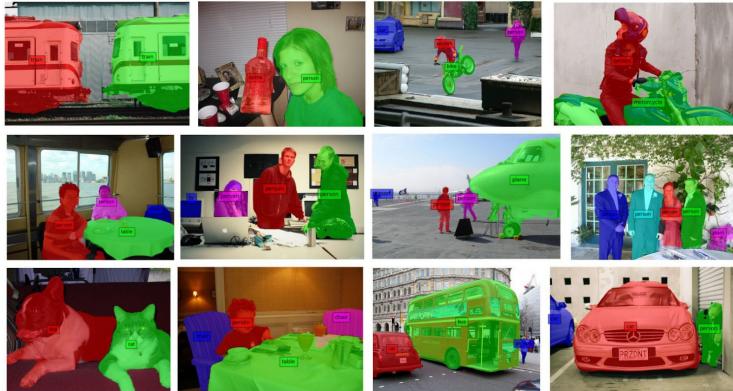
Pascal VOC

CVPPP

Cityscapes

Salvador, A., Bellver, Campos. V, M., Baradad, M., Marqués, F., Torres, J., & Giro-i-Nieto, X. (2017). Recurrent Neural Networks for Semantic Instance Segmentation
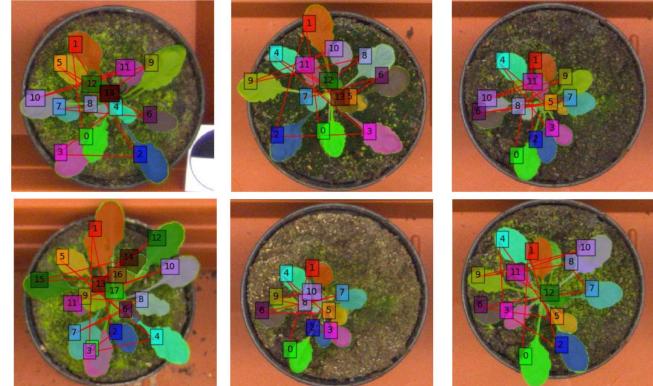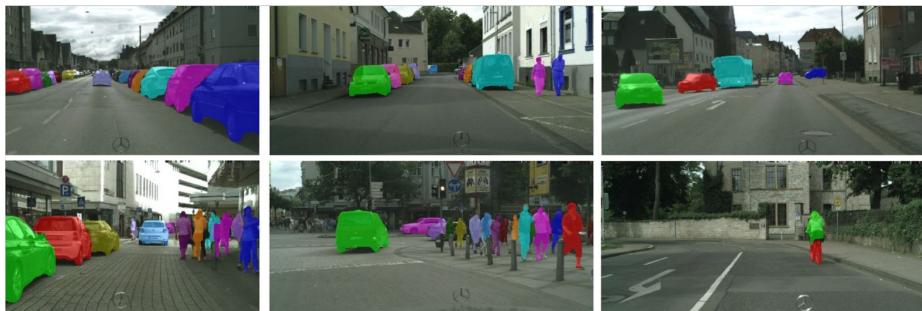
Recurrent Semantic Instance Segmentation

Object Discovery Patterns

Salvador, A., Bellver, Campos. V, M., Baradad, M., Marqués, F., Torres, J., & Giro-i-Nieto, X. (2017). Recurrent Neural Networks for Semantic Instance Segmentation

Recurrent Semantic Instance Segmentation

Contributions

- **First end-to-end recurrent model for semantic instance segmentation:** previous approaches produced class agnostic masks.

- **Competitive performance** against previous sequential methods on three instance segmentation benchmarks: Pascal VOC, CVPPP and Cityscapes

- We analyze its behavior in terms of the **object discovery patterns** it follows.

Salvador, A., Bellver, Campos. V, M., Baradad, M., Marqués, F., Torres, J., & Giro-i-Nieto, X. (2017). Recurrent Neural Networks for Semantic Instance Segmentation

The End!

Questions?

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Download our paper, code and pretrained models at:
imatge-upc.github.io/rsis/