Computer Vision with Videos
(Introduction)

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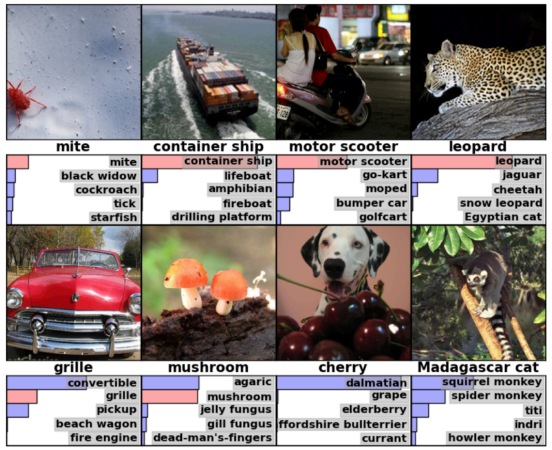
Recap: Computer Vision with Images

Visual Classification

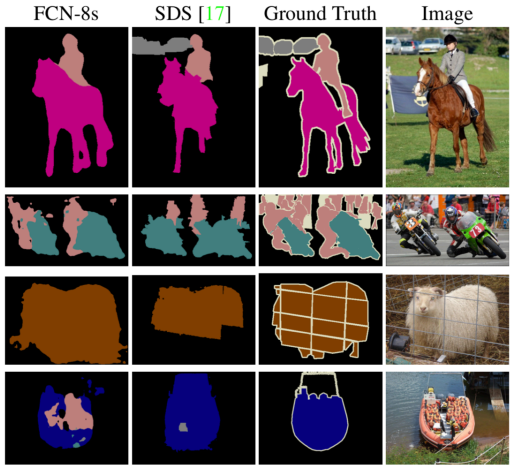


(Alex et al. Imagenet classification with deep convolutional neural networks. NIPS 2012.)

Object Detection

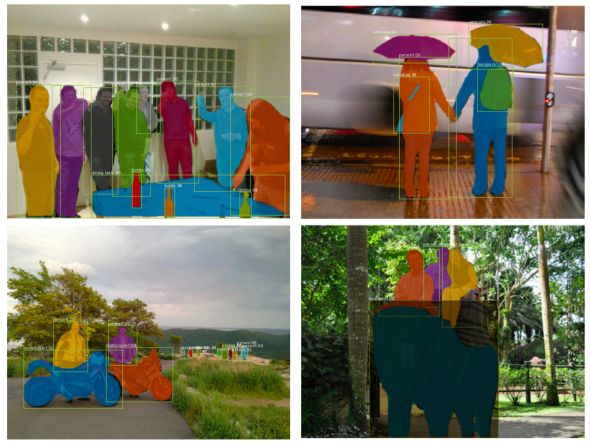
(Ren et al. Faster R-CNN: Towards Real-Time Object Detection with Region Proposal Networks. NIPS 2015.)

Semantic Segmentation



(Long et al. Fully convolutional networks for semantic segmentation. CVPR 2015.)

Instance Segmentation



(He et al. Mask R-CNN. ICCV 2017.)

AlexNet, 2012
SqueezeNet, 2016

R-CNN, 2013
Fast/Faster R-CNN, 2015
YOLO, 2015

FCN, 2015

Mask R-CNN, 2017

Recap: Computer Vision with Images

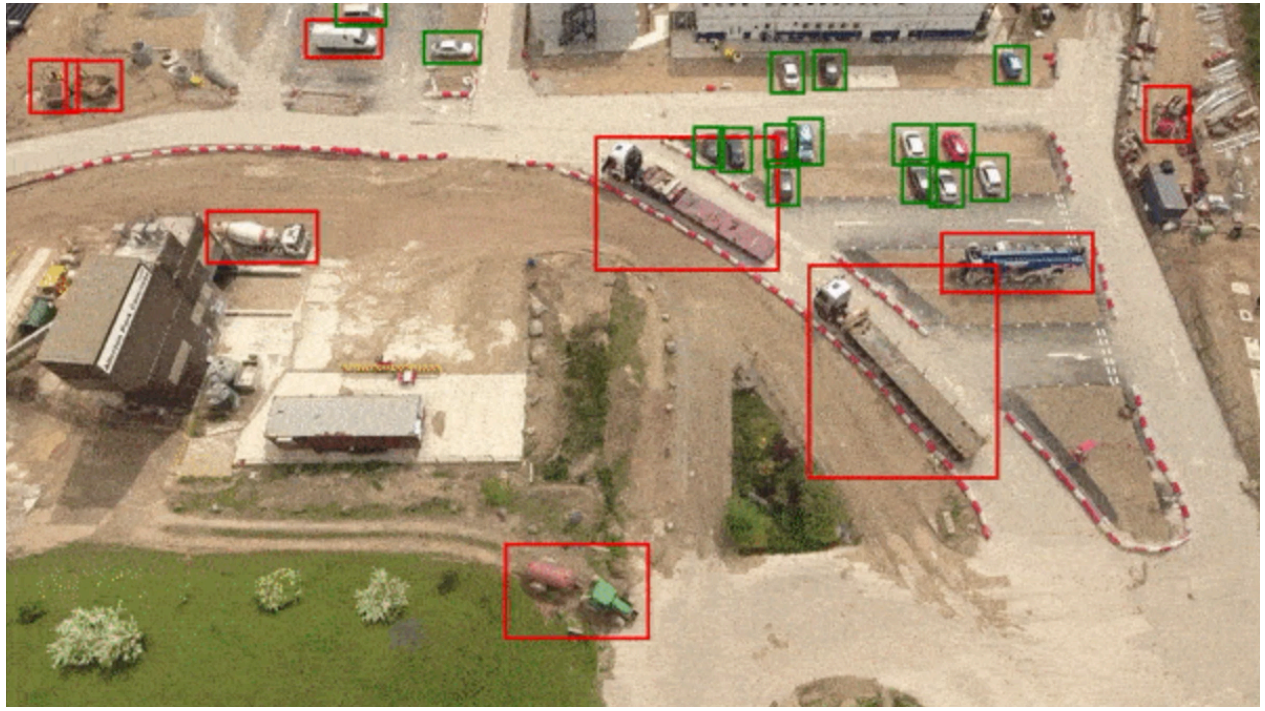
Image Captioning

(Oriol, et al. Show and tell: A neural image caption generator. CVPR 2015.)

Generative Models

(Oriol, et al. Show and tell: A neural image caption generator. CVPR 2015.)

Going further



https://medium.com/nanonets/how-we-flew-a-drone-to-monitor-construction-projects-in-africa-using-deep-learning-b792f5c9c471

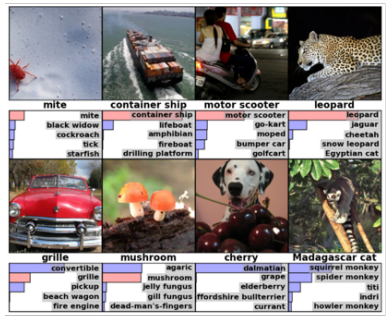
https://www.theverge.com/2016/9/12/12886698/machine-learning-video-image-prediction-mit

Simple approach: classical methods

Problem?
Not using previous frame(s)

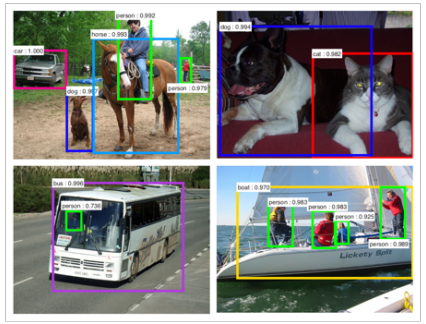
- Large computational cost
- Can't track specific objects accurately

Visual Classification



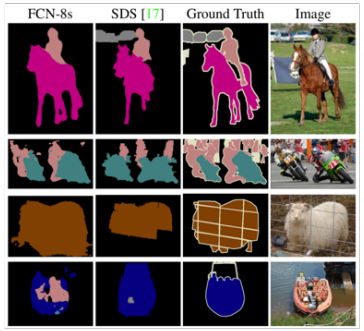
(Alex et al. Imagenet classification with deep convolutional neural networks. NIPS 2012.)

Object Detection



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

Semantic Segmentation



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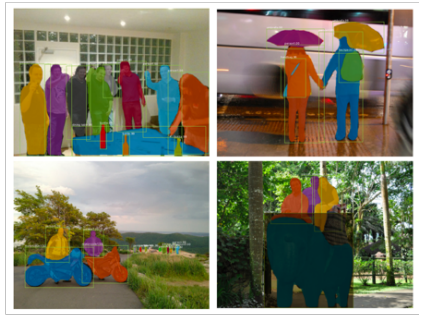
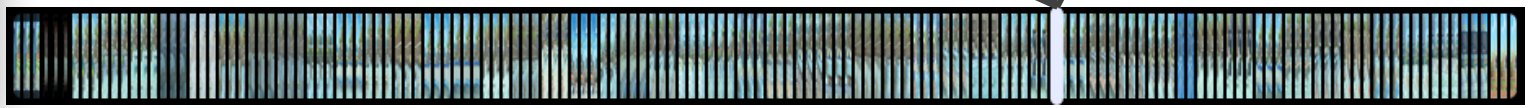
Instance Segmentation



(He et al. Mask R-CNN. ICCV 2017.)

Squence of image (frames)



Simple approach: classical methods

Problem?

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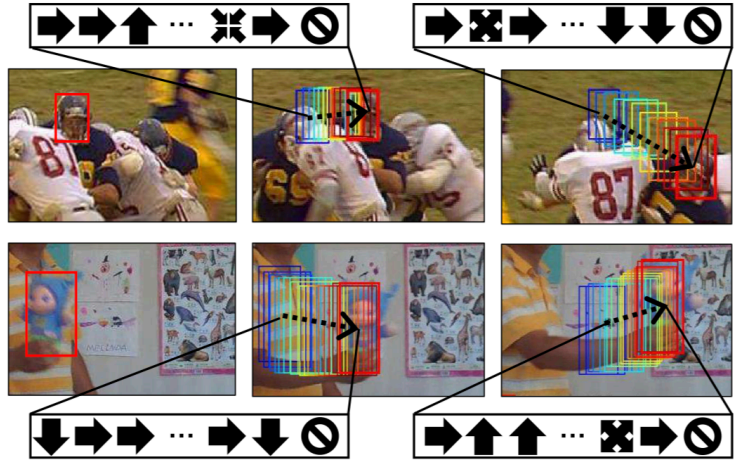
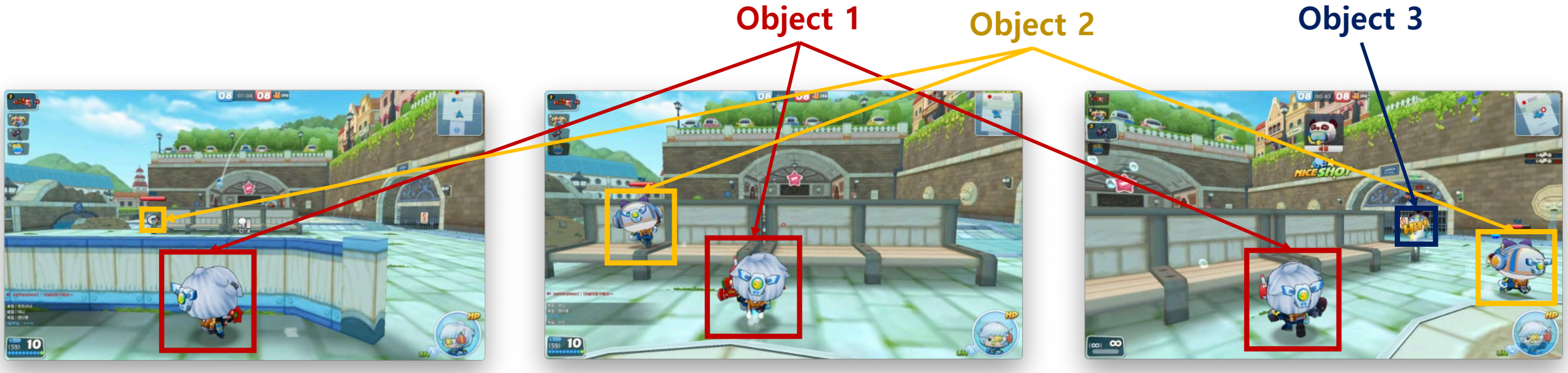
- Large computational cost
- Can't track specific objects accurately

The concept of the proposed visual tracking controlled by sequential actions

Yun et al. Action-Decision Networks for Visual Tracking with Deep Reinforcement Learning. CVPR 2017.

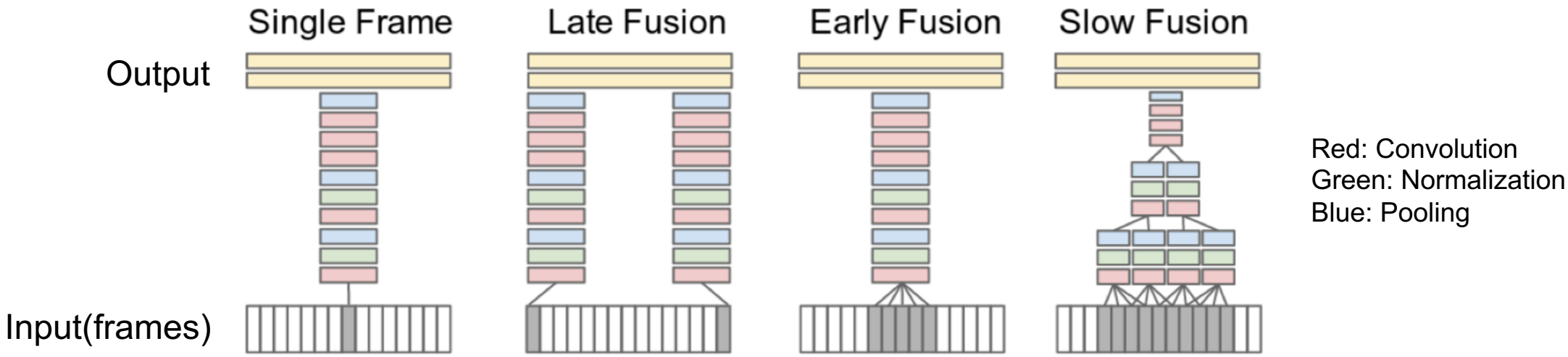




Video Classification

Karpathy et al. Large-scale Video Classification with Convolutional Neural Networks. CVPR 2014.

Time Information Fusion

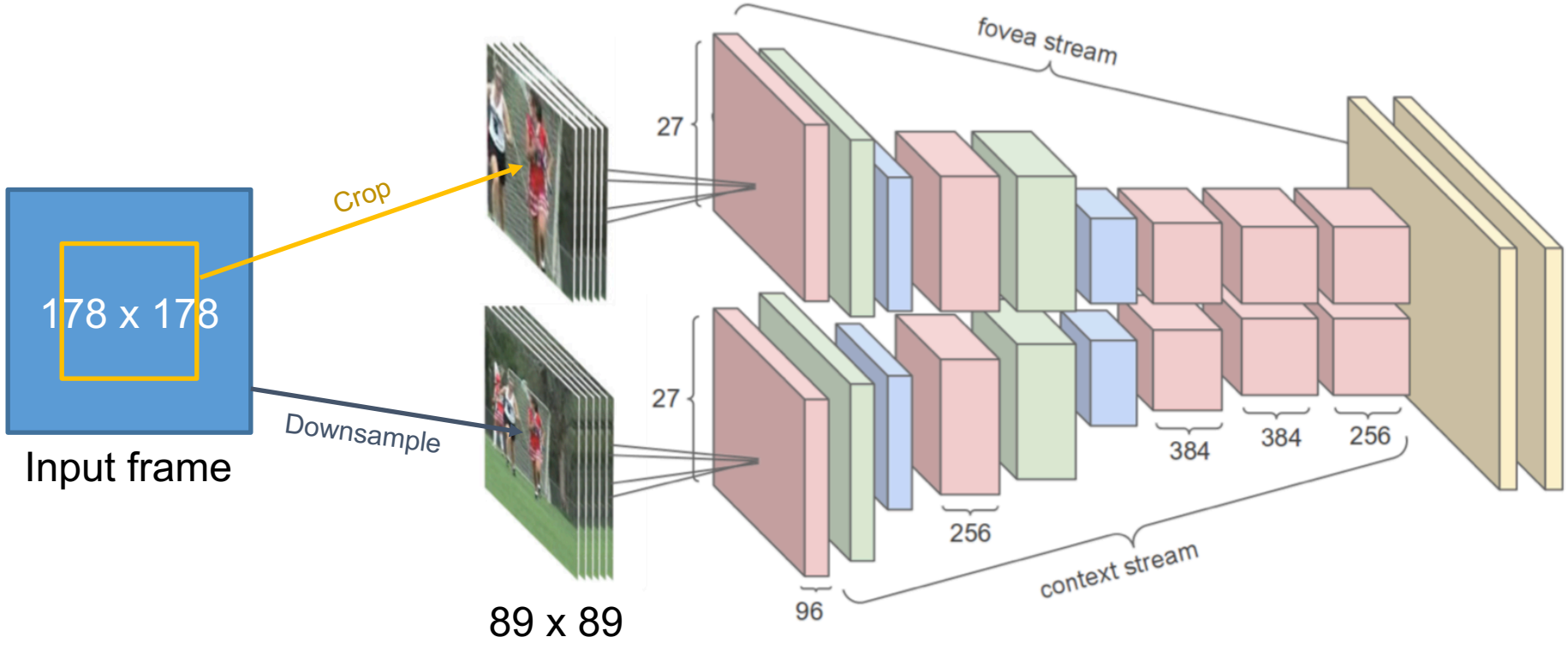


Red: Convolution
Green: Normalization
Blue: Pooling

Explored approaches for fusing information over temporal dimension through the network

Karpathy et al. Large-scale Video Classification with Convolutional Neural Networks. CVPR 2014.

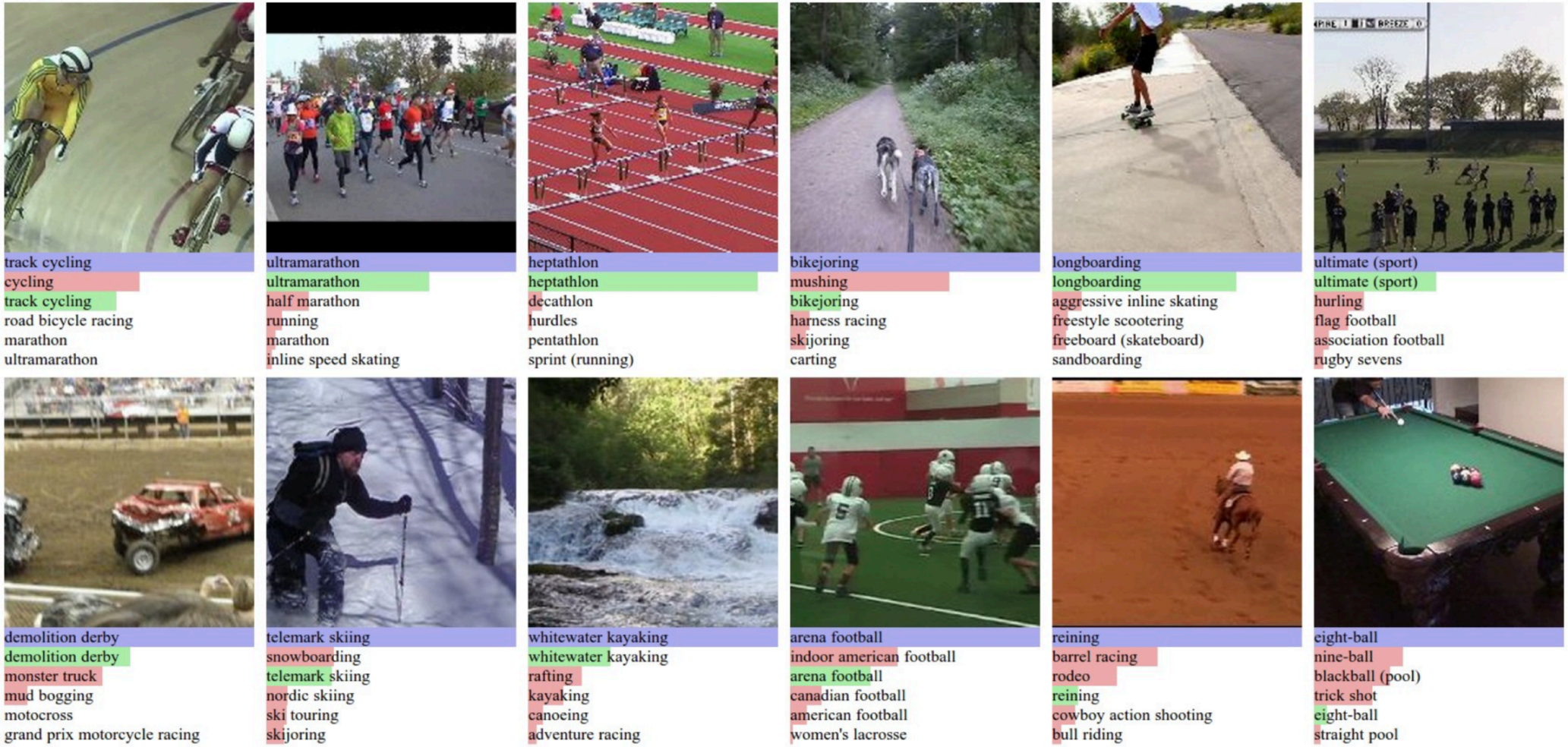
Multiresolution CNNs



Input frames are fed into two separate streams of processing.

Karpathy et al. Large-scale Video Classification with Convolutional Neural Networks. CVPR 2014.

Results



Karpathy et al. Large-scale Video Classification with Convolutional Neural Networks. CVPR 2014.

Results

Model	Clip Hit@1	Video Hit@1	Video Hit@5
Feature Histograms + Neural Net	-	55.3	-
Single-Frame	41.1	59.3	77.7
Single-Frame + Multires	**42.4**	**60.0**	**78.5**
Single-Frame Fovea Only	30.0	49.9	72.8
Single-Frame Context Only	38.1	56.0	77.2
Early Fusion	38.9	57.7	76.8
Late Fusion	40.7	59.3	78.7
Slow Fusion	**41.9**	**60.9**	**80.2**
CNN Average (Single+Early+Late+Slow)	41.4	63.9	82.4

Karpathy et al. Large-scale Video Classification with Convolutional Neural Networks. CVPR 2014.