

Deep Learning and Convolutional Neural Network (42028)

Introduction to Instance Segmentation
NVIDIA Digits and Case studies

Introduction to Instance Segmentation

Computer Vision Problems:

Classification



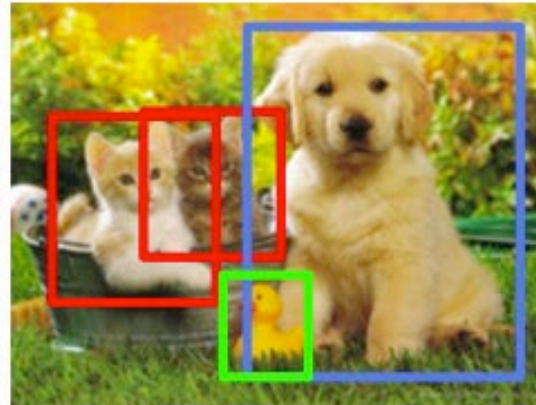
CAT

**Classification
+ Localization**



CAT

Object Detection



CAT, DOG, DUCK

**Instance
Segmentation**



CAT, DOG, DUCK

Introduction to Instance Segmentation

Semantic Segmentation Vs Instance Segmentation:

- Semantic segmentation classifies object pixels on specific classes/category
- Instance Segmentation identifies each pixels object instance



Input Image



Semantic Segmentation



Instance Segmentation

Introduction to Instance Segmentation

Popular Techniques:

Semantic Segmentation	Instance Segmentation
Conditional Random Field (CRF) Fully Convolutional Network (FCN) U-Net Pyramid Scene Parsing Network (PSPNet) etc.	SegNet, DeepMask, SharpMask, MaskRCNN , etc.

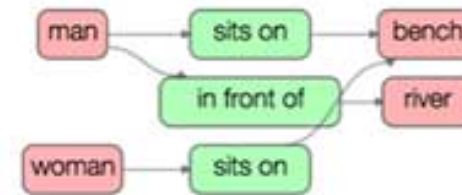
Introduction to Instance Segmentation

Applications: Autonomous Driving

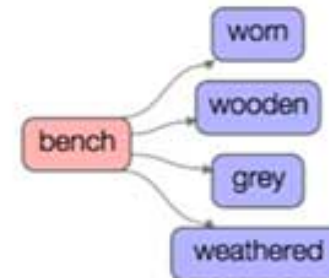


Introduction to Instance Segmentation

Applications: Scene Understanding



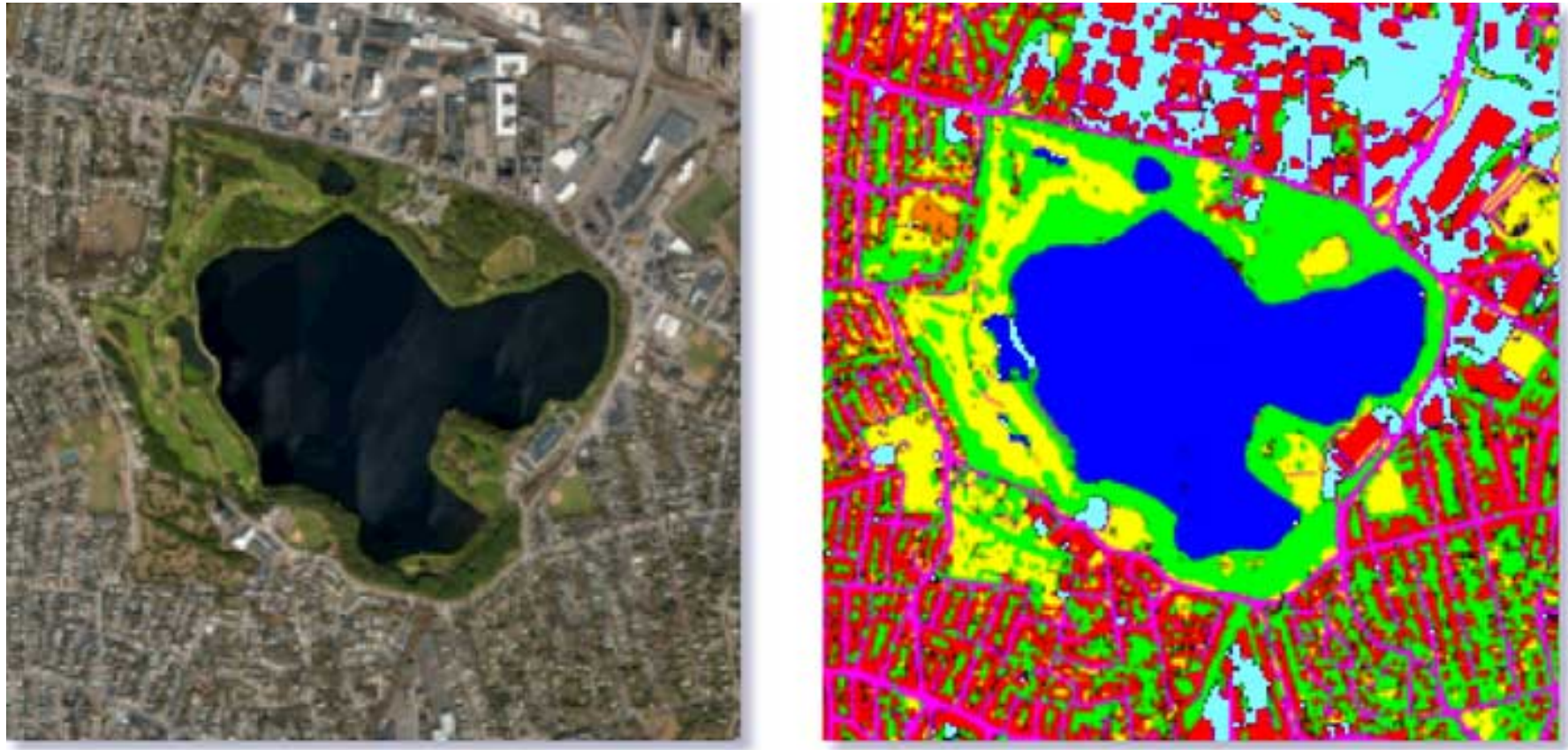
A man and a woman sit on a park bench along a river.



Park bench is made of gray weathered wood

Introduction to Instance Segmentation

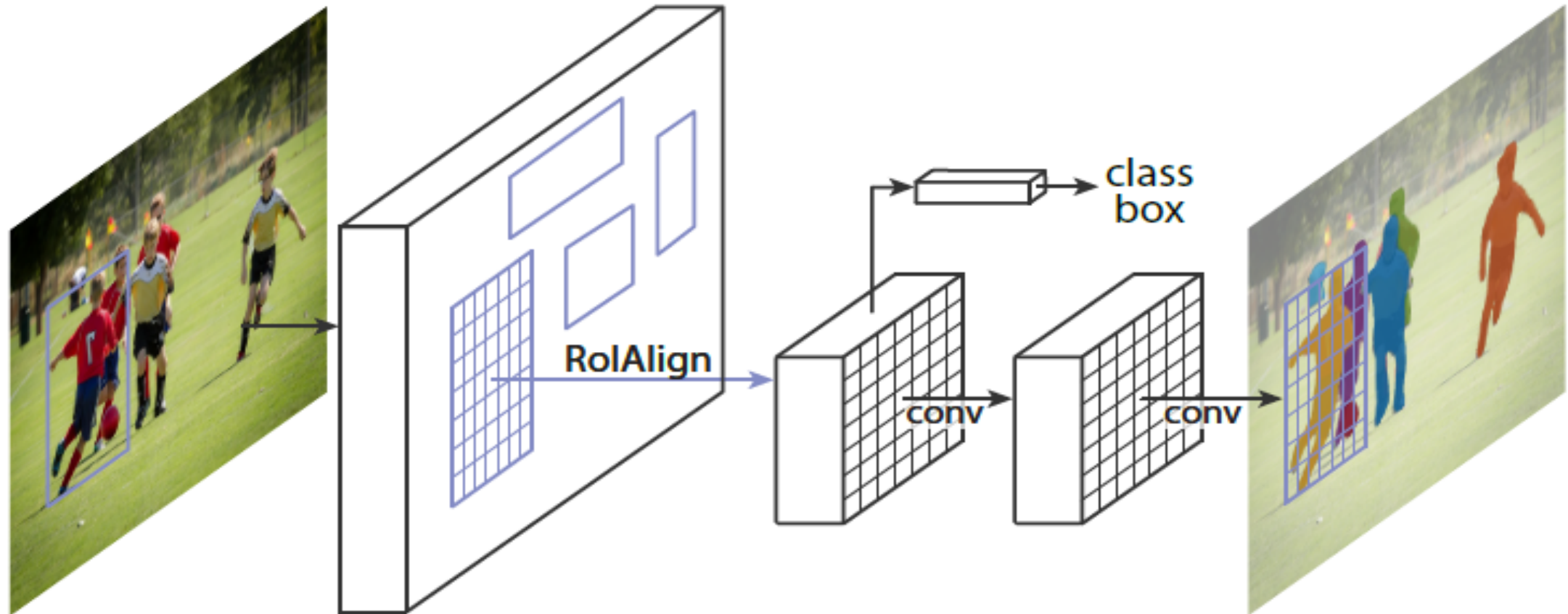
Applications: Aerial Image processing



Introduction to MaskRCNN

- Mask-RCNN → Mask-Region Convolutional Neural Network
- An addition to the RCNN family, performing instance segmentation
- Improved over FasterRCNN
- A Full Convolutional Network (FCN) for predicting Mask for each class/object.
- 2 Stages:
 - Stage 1: RPN proposes candidate object bounding boxes.
 - Stage 2: Classify the Candidates, refine bounding boxes, and predict mask.

Introduction to MaskRCNN



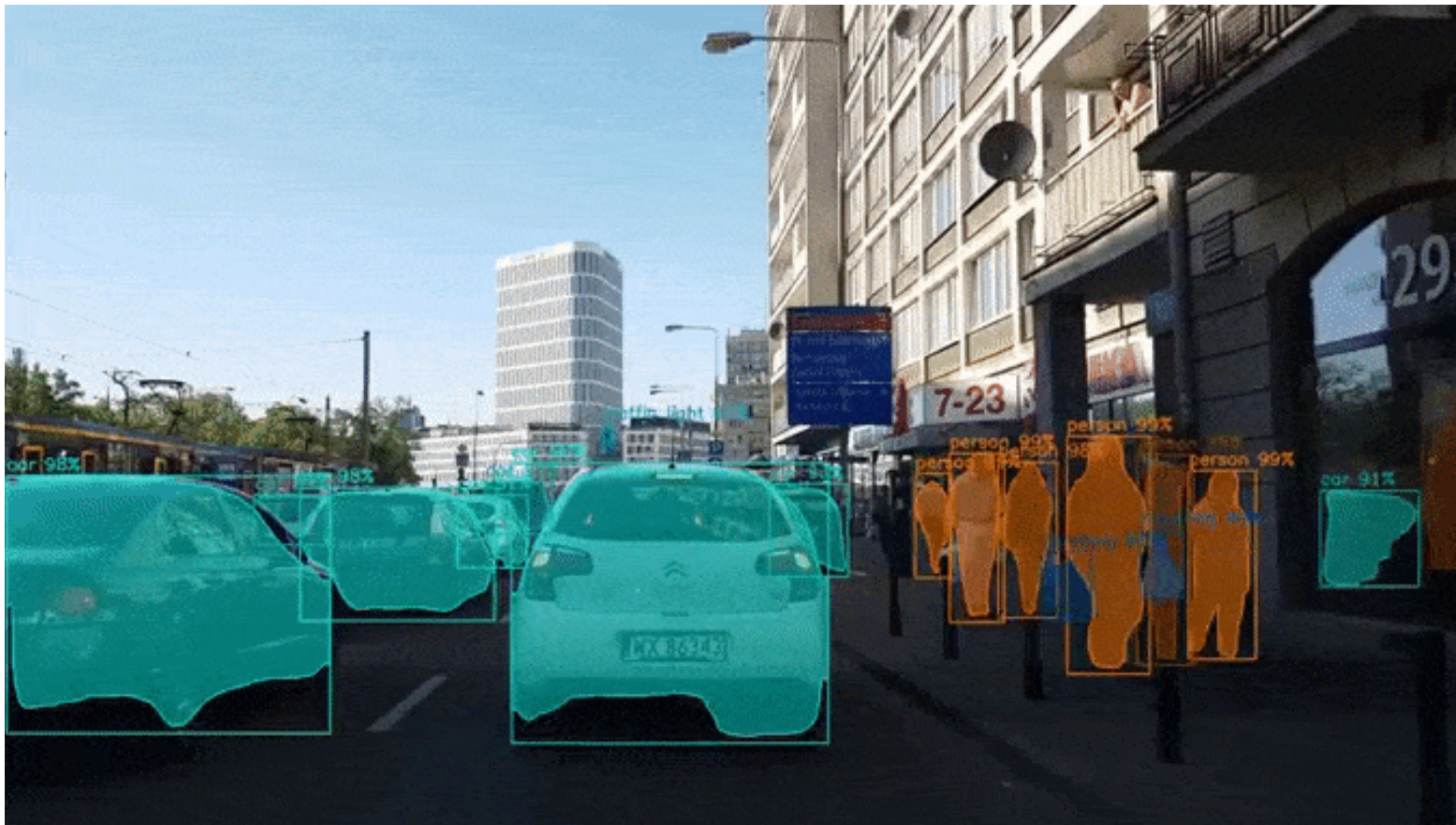
Introduction to MaskRCNN

- Sample Results



Introduction to MaskRCNN

- Sample Results on video:



Overview of Nvidia Digits

- The Deep Learning GPU Training System (DIGITS)
- It is not a framework
- It is a wrapper for NVCaffe and Tensorflow
- Provides a GUI for training and testing CNN models etc.
- DIGITS can be used to rapidly train highly accurate deep neural network (DNNs) for image classification, segmentation, object detection tasks, and more.

SharkSpotter Case Study

- A detailed Case study will be presented as part-2 of this lecture.
- Please check the below articles for details:
 - **The Conversation:** <http://theconversation.com/sharkspotter-combines-ai-and-drone-technology-to-spot-sharks-and-aid-swimmers-on-australian-beaches-92667>
 - **UTS News Room:** <https://www.uts.edu.au/about/faculty-engineering-and-information-technology/news/sharkspotter-ai-app-wins-national>
 - **The Herald:** <https://www.theherald.com.au/story/5678134/the-artificial-intelligence-helping-drones-tell-the-difference-between-sharks/>

Drone Detection Case Study

- Please check the below articles for details:
 - **A study on detecting drones using deep convolutional neural networks,** 2017 14th IEEE International Conference on Advanced Video and Signal Based Surveillance (AVSS).
Link → <https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=8078541>

Crowd Counting Case Study

- Please check the below articles for details:
 - **Crowd Counting in Low-Resolution Crowded Scenes Using Region-Based Deep Convolutional Neural Networks**, IEEE Access, 2019.
Link → <https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=8669755>

Week 12 Guest Lecture

Industry Guest Lecture will be presented by a Senior Solution Architect from Amazon Web Services (AWS) on 15th June 2020, 1pm-2.30pm.

For More details please check Canvas!