Practical Deep Learning: A quick glance

Image classification and object detection

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Image classification

Convolution layers are the eyes of a CNN

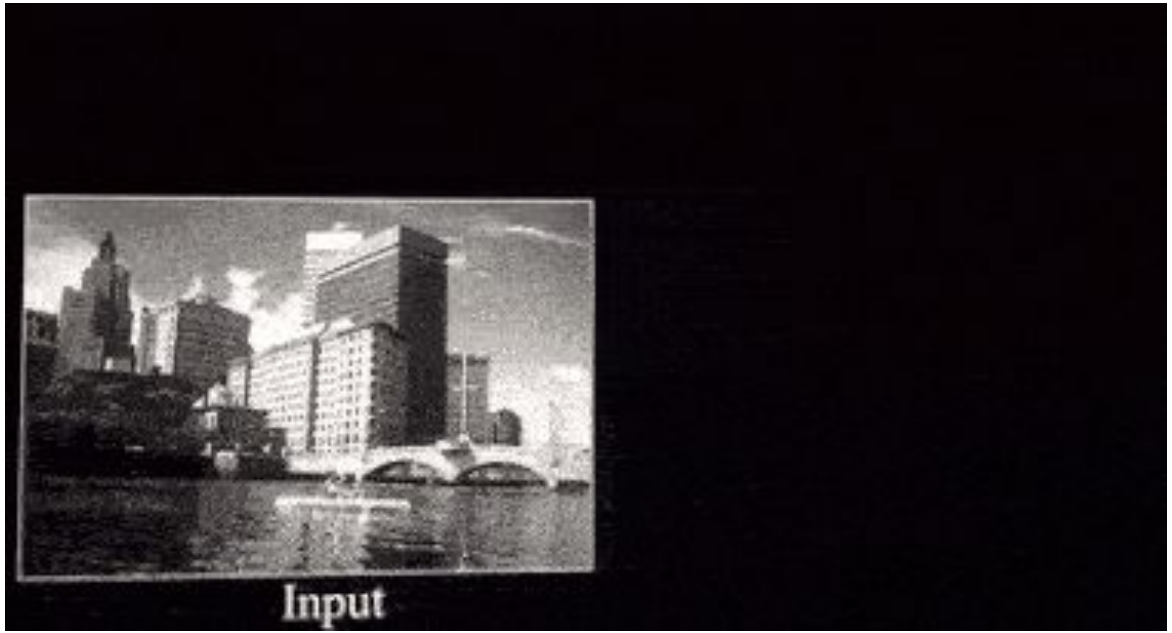
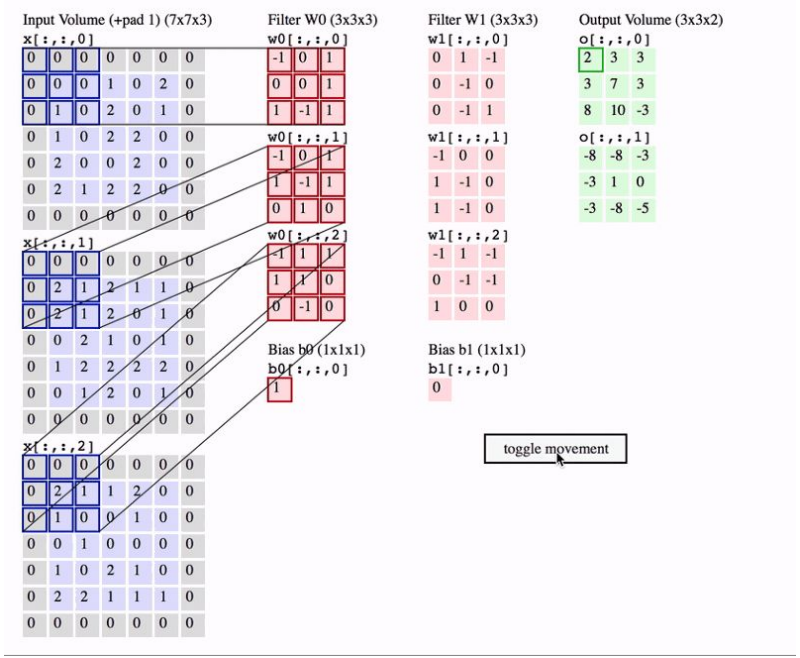


Image classification

Eyes? How CNNs extract features

Each kernel extract some features

More depth -> more abstraction



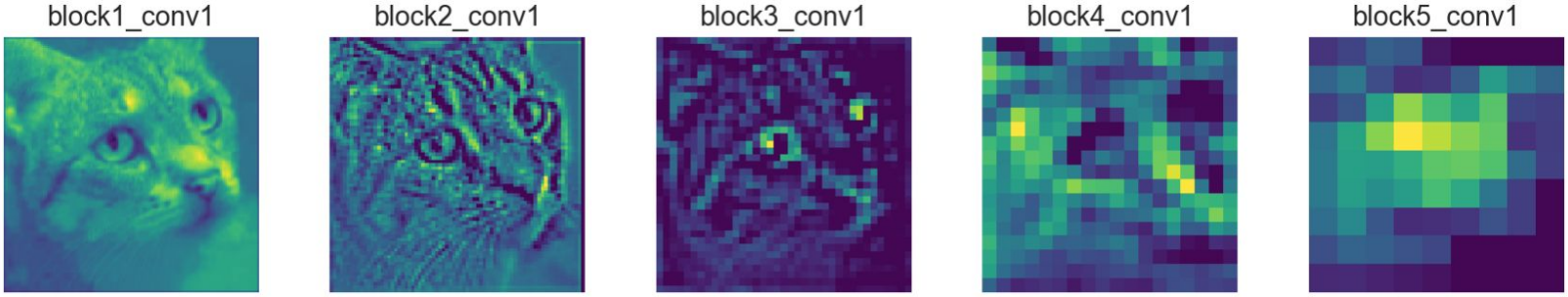


Image classification

Architecture of CNNs:

- Feature extraction
- Dimension reduction

State-of-the-art models

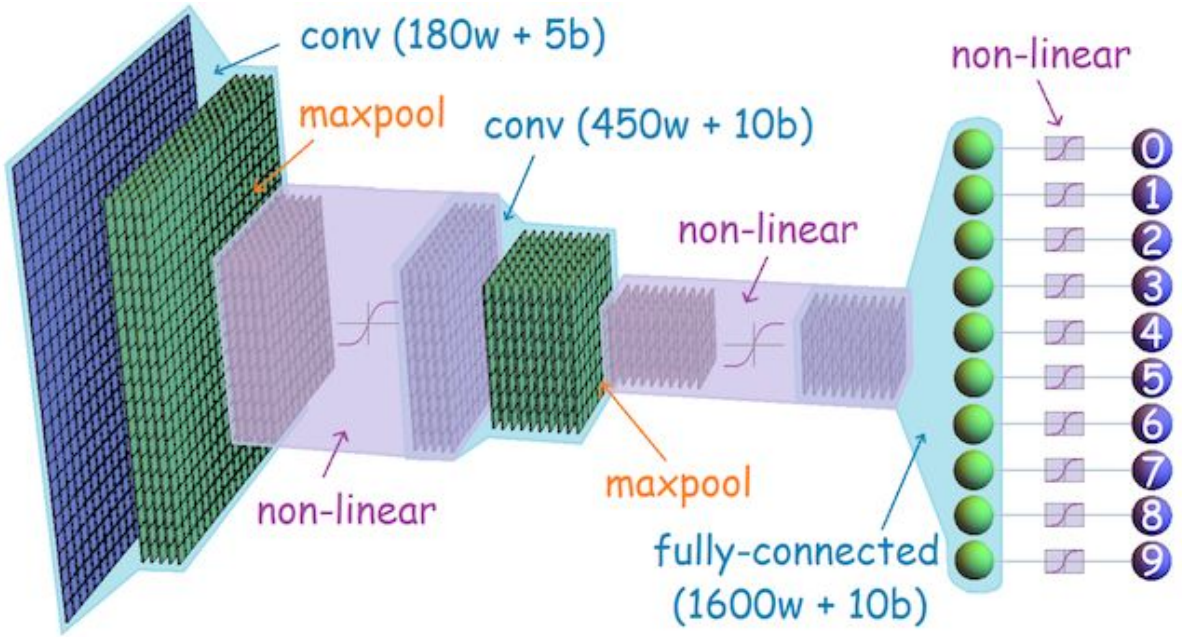


Image classification

Feature extraction is the input of the dense layer classification stage

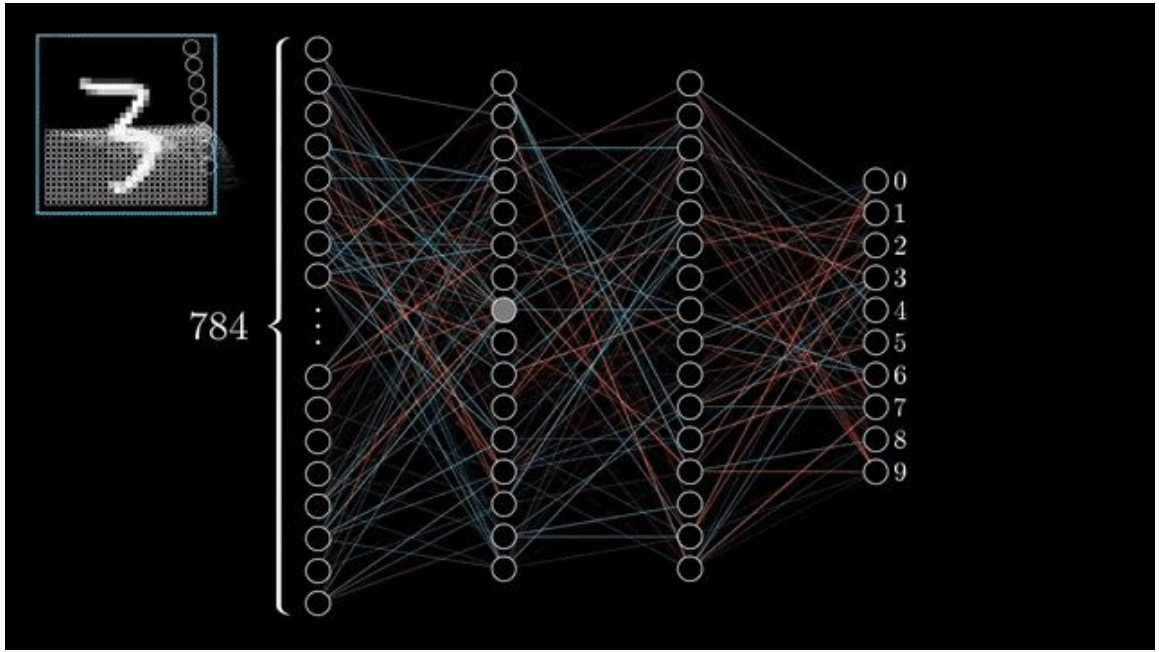
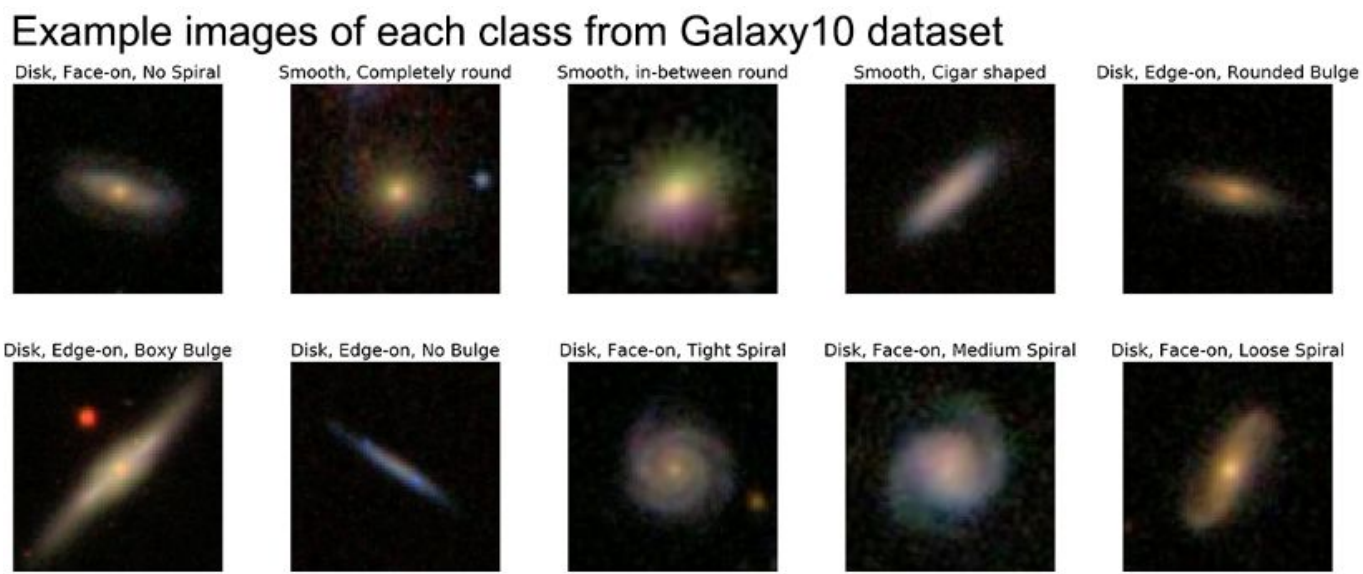


Image classification

Galaxy10 toy dataset

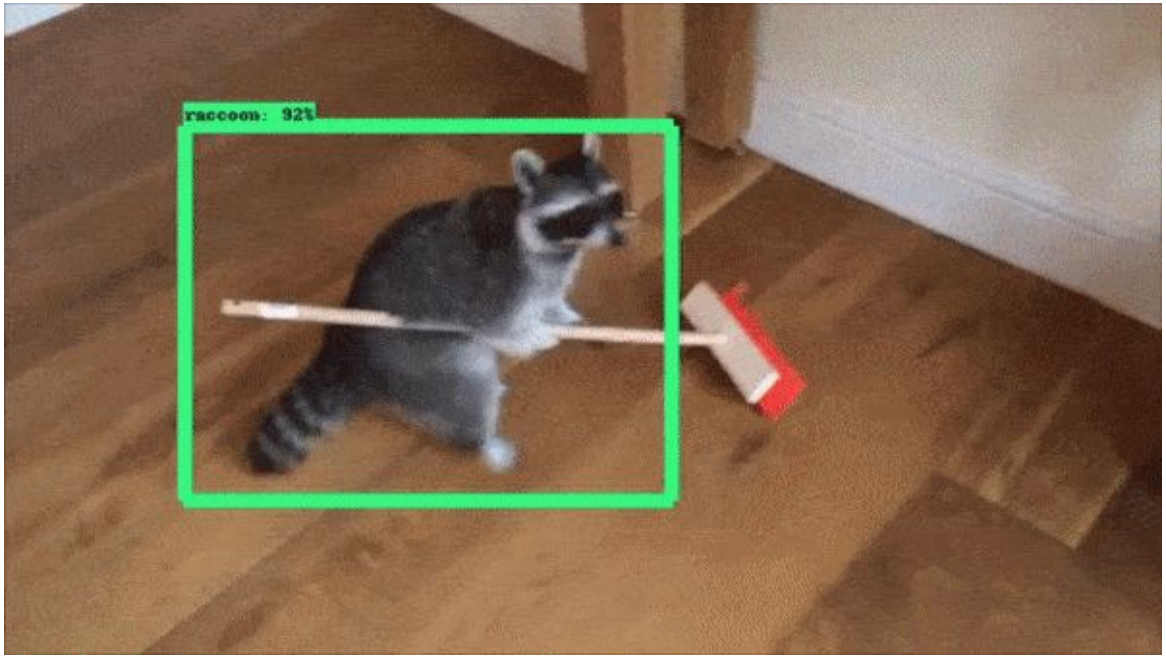
(astroNN web)

```
Galaxy10 dataset (21785 images)
├── Class 0 (3461 images): Disk, Face-on, No Spiral
├── Class 1 (6997 images): Smooth, Completely round
├── Class 2 (6292 images): Smooth, in-between round
├── Class 3 (394 images): Smooth, Cigar shaped
├── Class 4 (1534 images): Disk, Edge-on, Rounded Bulge
├── Class 5 (17 images): Disk, Edge-on, Boxy Bulge
├── Class 6 (589 images): Disk, Edge-on, No Bulge
├── Class 7 (1121 images): Disk, Face-on, Tight Spiral
├── Class 8 (906 images): Disk, Face-on, Medium Spiral
└── Class 9 (519 images): Disk, Face-on, Loose Spiral
```



Object detection

Provide the object (class) and location (bounding box/region)



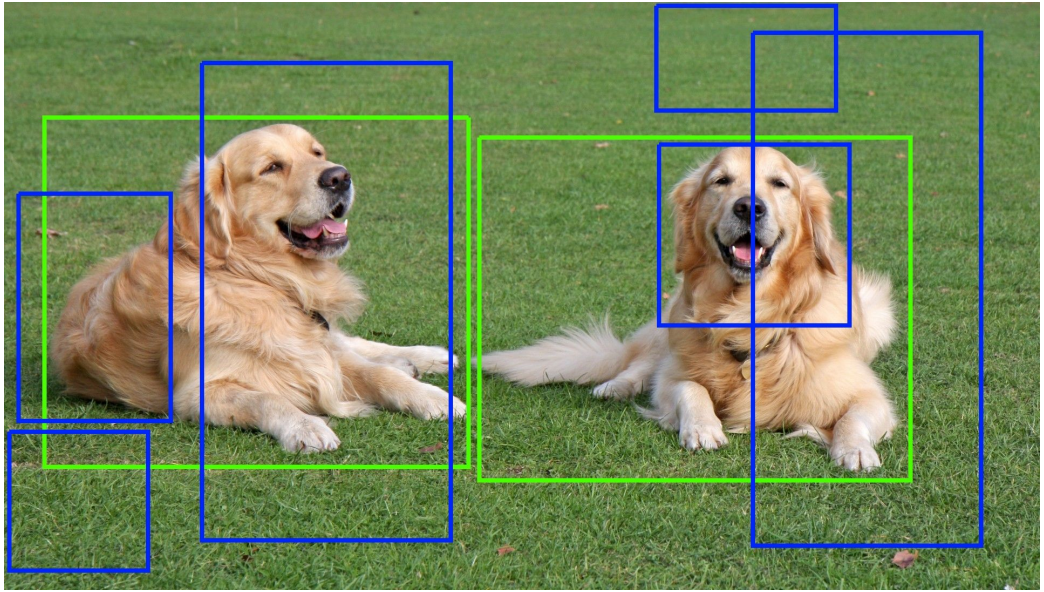
Object detection

Object detection models:

Simultaneously learns

- Region proposal
- Object classification

Output a set of candidates regions-class and confidence

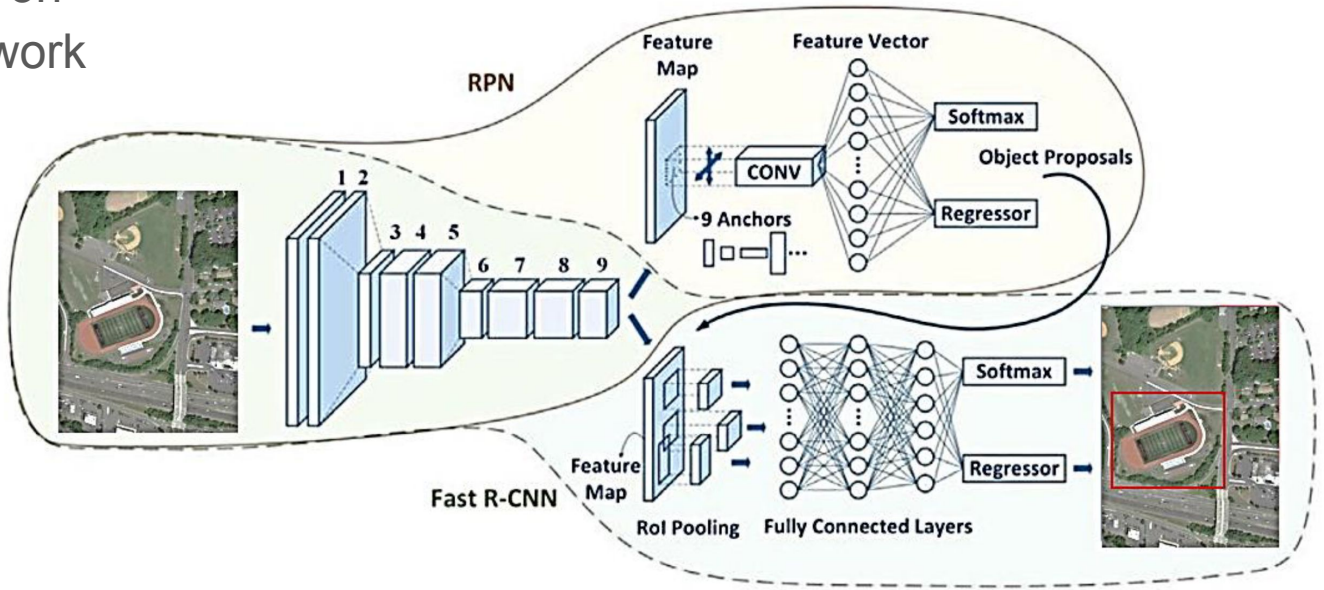


Object detection

Faster R-CNN architecture:

Region proposal based on
a Region Proposal Network

- Slower
- More accurate
- Small objects

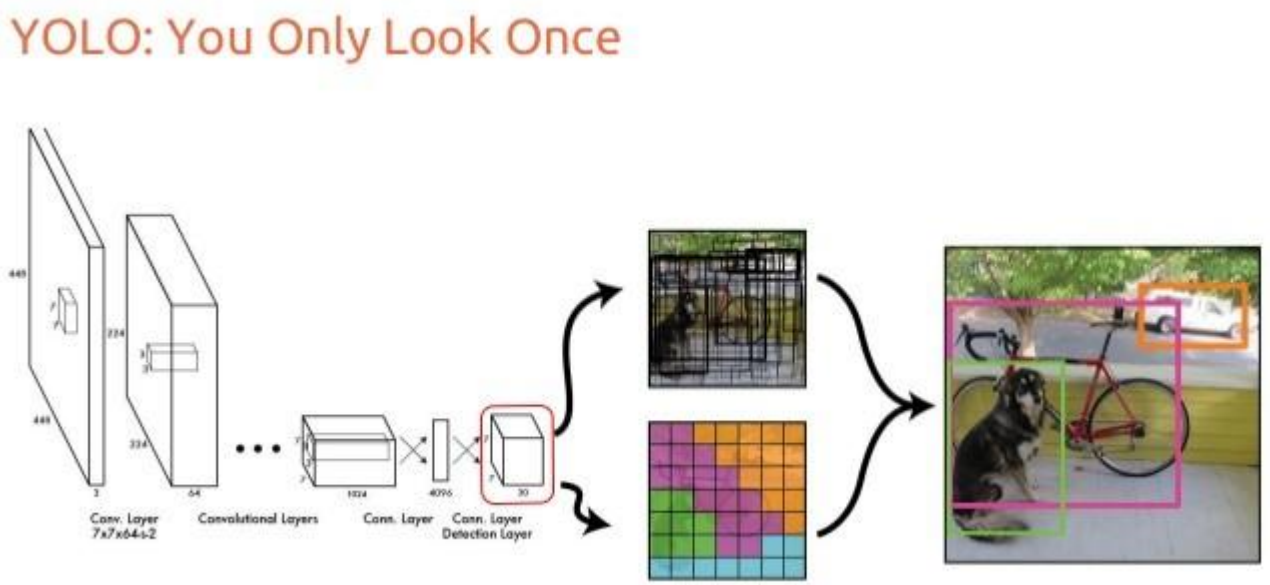


Object detection

SSD or YOLO

Region proposal based on grid

- Faster
- Less accurate
- Common objects



Object detection

Detect fiery looping rain on the Sun

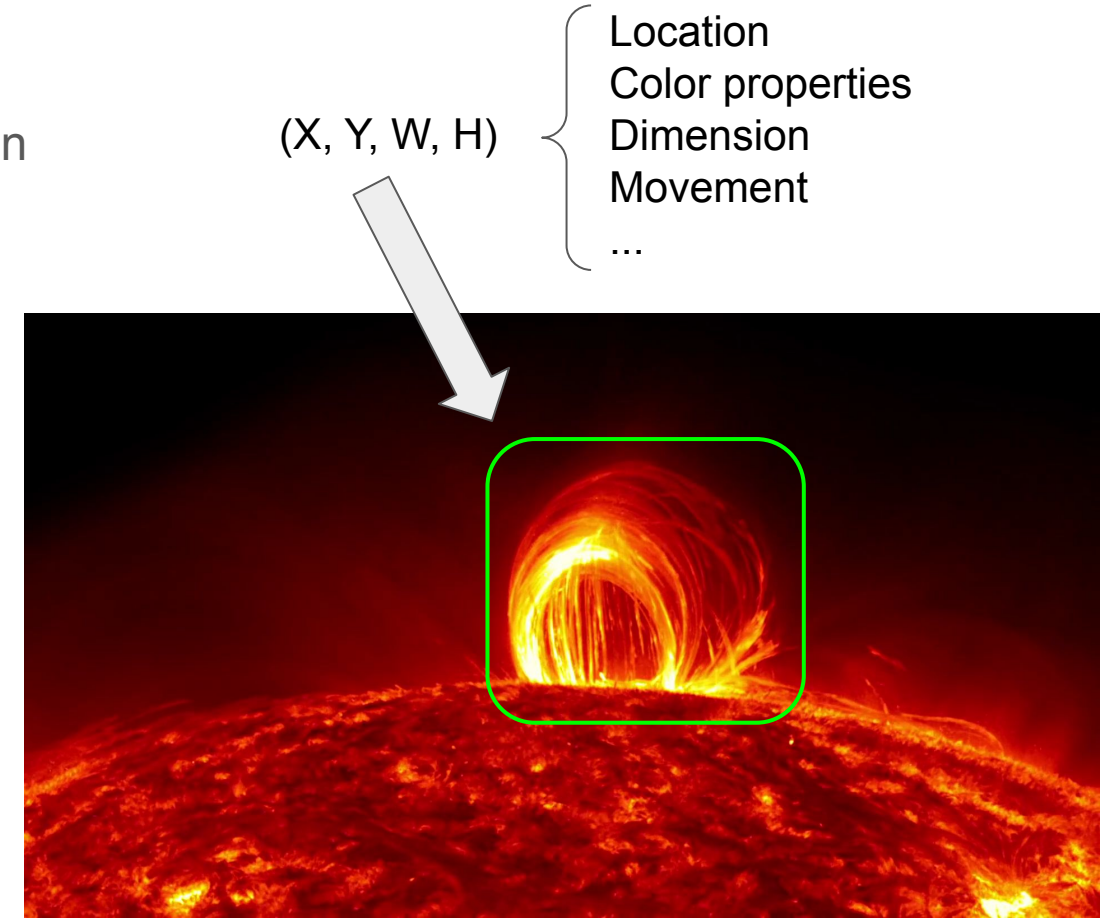
[Video]

A recurrent pattern in a structured signal can be learned

- RGB images
- Texture, color, shape

Experiment configuration

[Download]



Object detection

Detection annotation

- Image information
- Objects
  - Class
  - Region

```xml
<annotation>
    <folder>train</folder>
    <filename>FieryLoopingRainSun-187.jpg</filename>
    <path>/home/alcasla/Escritorio/Astro/Solar-FieryLoop/train/FieryLoopingRainSun-187.jpg</path>
    <source>
        <database>Unknown</database>
    </source>
    <size>
        <width>1280</width>
        <height>720</height>
        <depth>3</depth>
    </size>
    <segmented>0</segmented>
    <object>
        <name>fiery_loopw</name>
        <pose>Unspecified</pose>
        <truncated>0</truncated>
        <difficult>0</difficult>
        <bndbox>
            <xmin>699</xmin>
            <ymin>376</ymin>
            <xmax>820</xmax>
            <ymax>471</ymax>
        </bndbox>
    </object>
</annotation>
```

Object detection

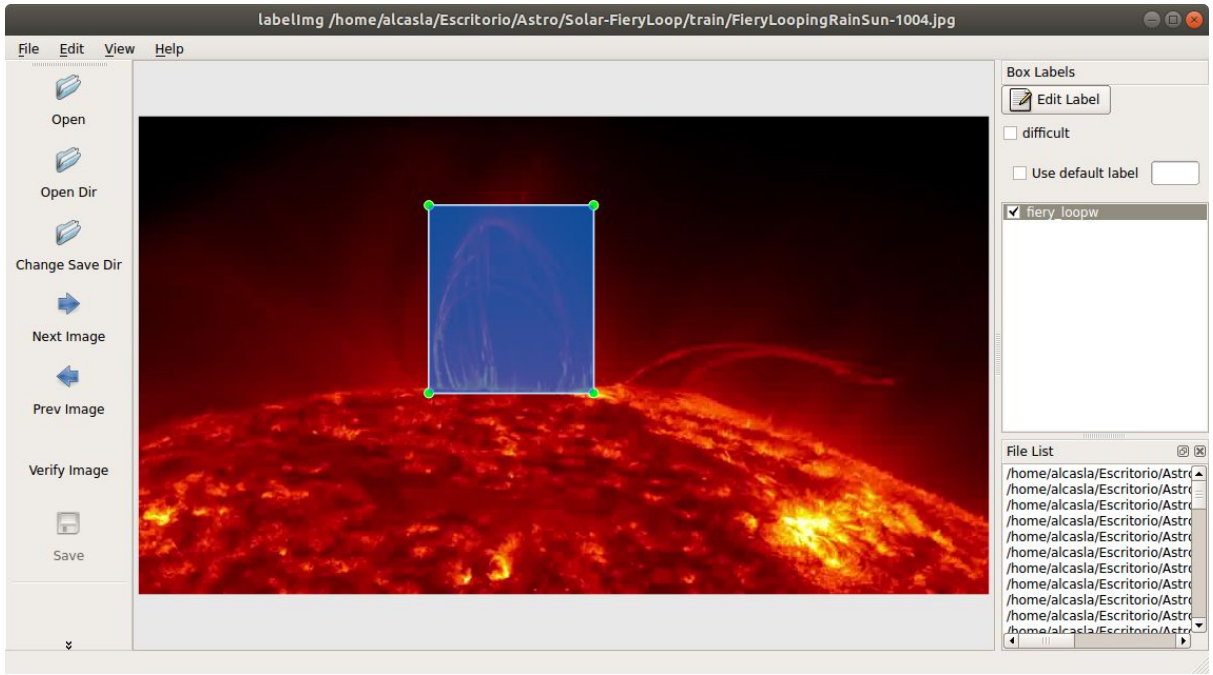
LabelImg

Repository

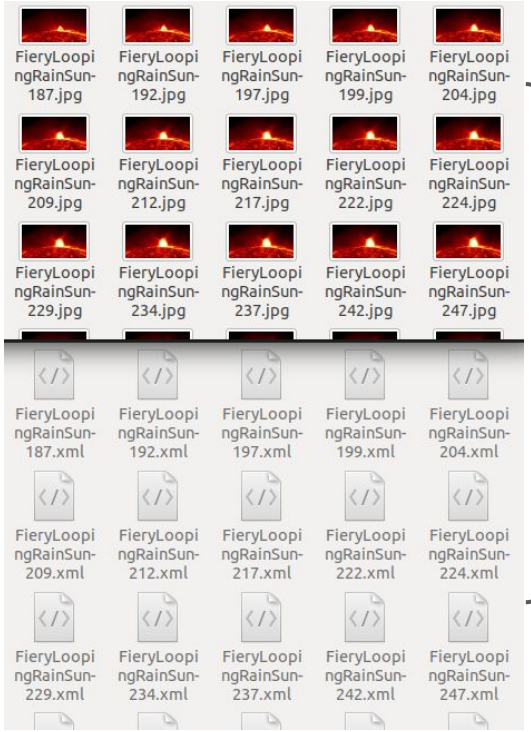
github.com/tzutalin/labelImg

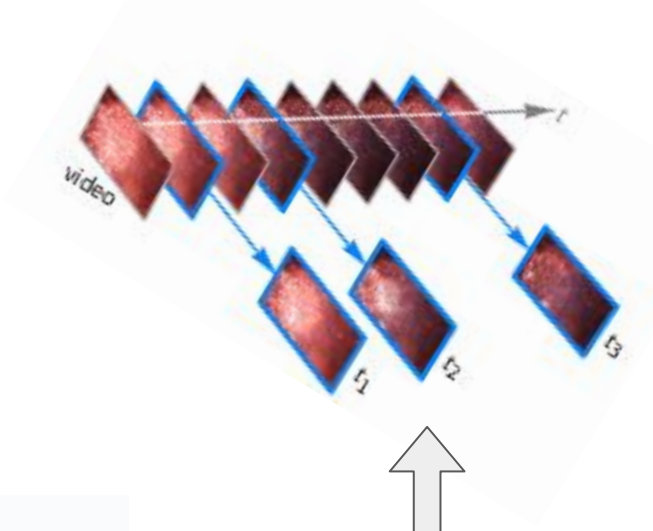
Installer file

tzutalin.github.io/labelImg/

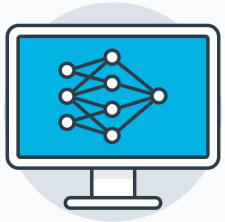


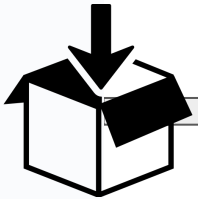
Object detection

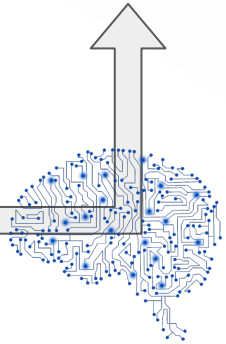




Data preparation







[Configuration and training]

[Packing]

[Inference]

Object detection

Object detection framework

github.com/tensorflow/models/tree/master/research/object_detection

Software configuration

github.com/spsrc/somachine2020

Build conda environment using .yml file

Model Zoo

We provide a large collection of models that are trained on several datasets in the Model Zoo.

Guides

- Configuring an object detection pipeline
- Preparing inputs
- Defining your own model architecture
- Bringing in your own dataset
- Supported object detection evaluation protocols
- TPU compatible detection pipelines
- Training and evaluation guide (CPU, GPU, or TPU)

Extras:

- Exporting a trained model for inference
- Exporting a trained model for TPU inference
- Inference and evaluation on the Open Images dataset
- Run an instance segmentation model
- Run the evaluation for the Open Images Challenge 2018/2019
- Running object detection on mobile devices with TensorFlow Lite
- Context R-CNN documentation for data preparation, training, and export