

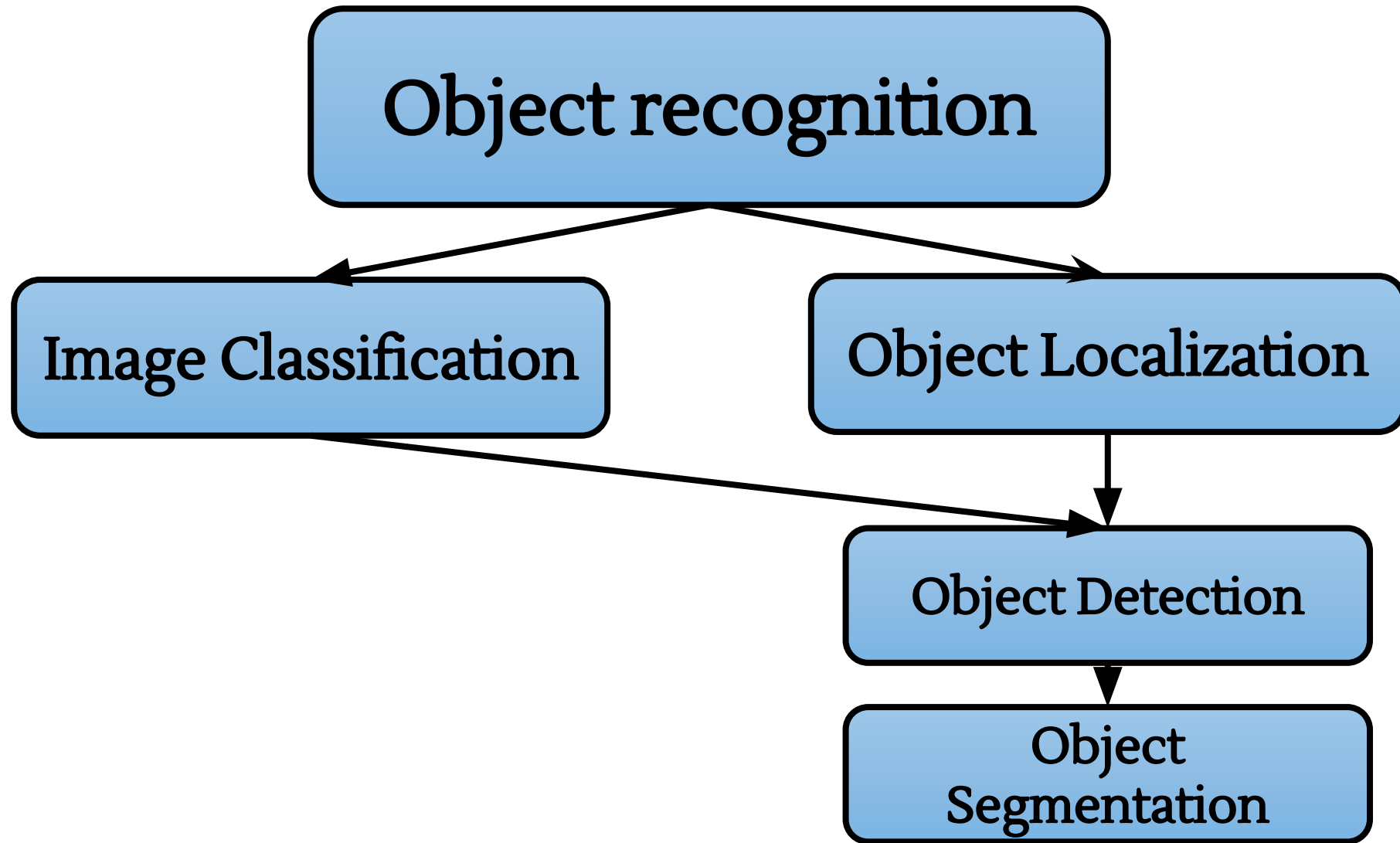
# OBJECT RECOGNITION

VIERA  
MASLEJ  
KREŠŇÁKOV  
Á

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# OBJECT RECOGNITION

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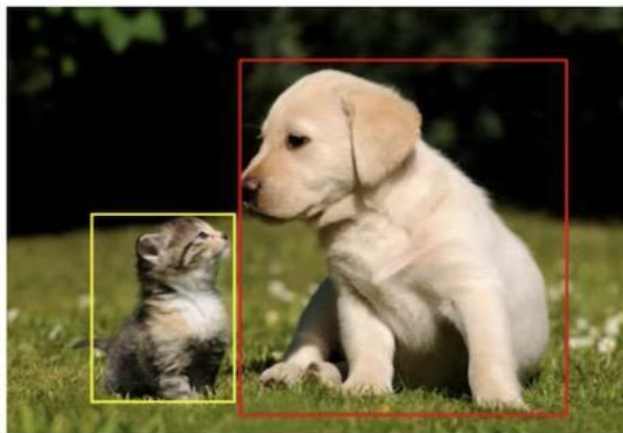
---

Is this a dog?



Image Classification

What is there in image  
and where?



Object Detection

Which pixels belong to  
which object?

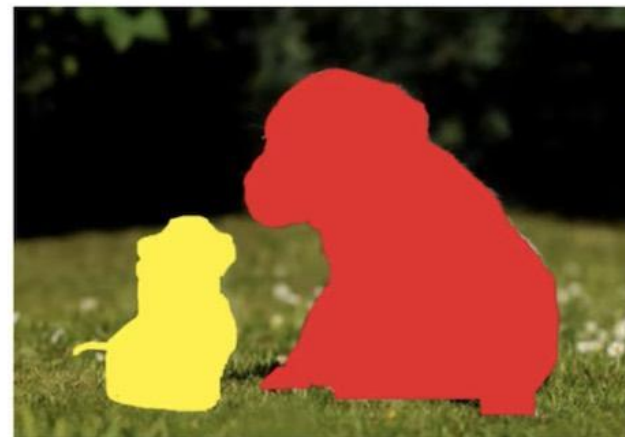
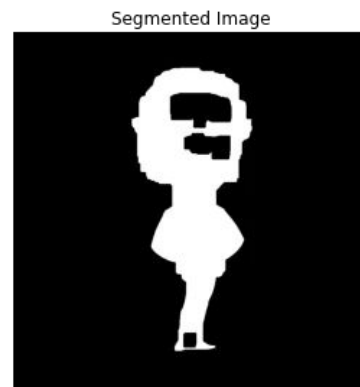
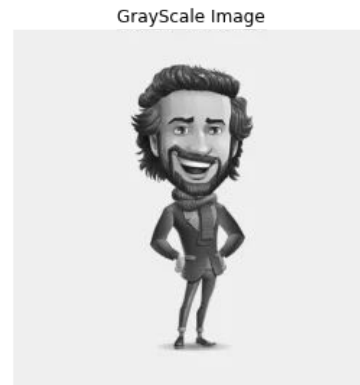
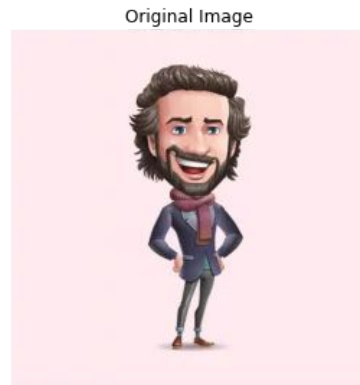


Image Segmentation

---

# TRADITIONAL IMAGE PROCESSING TECHNIQUES



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# TRADITIONAL IMAGE PROCESSING TECHNIQUES

## Binary Morphology

Dilate



Erode



Open (Erode  $\Rightarrow$  Dilate)



Close (Dilate  $\Rightarrow$  Erode)







sale

colgate

granRisparmio

risotti

scotti

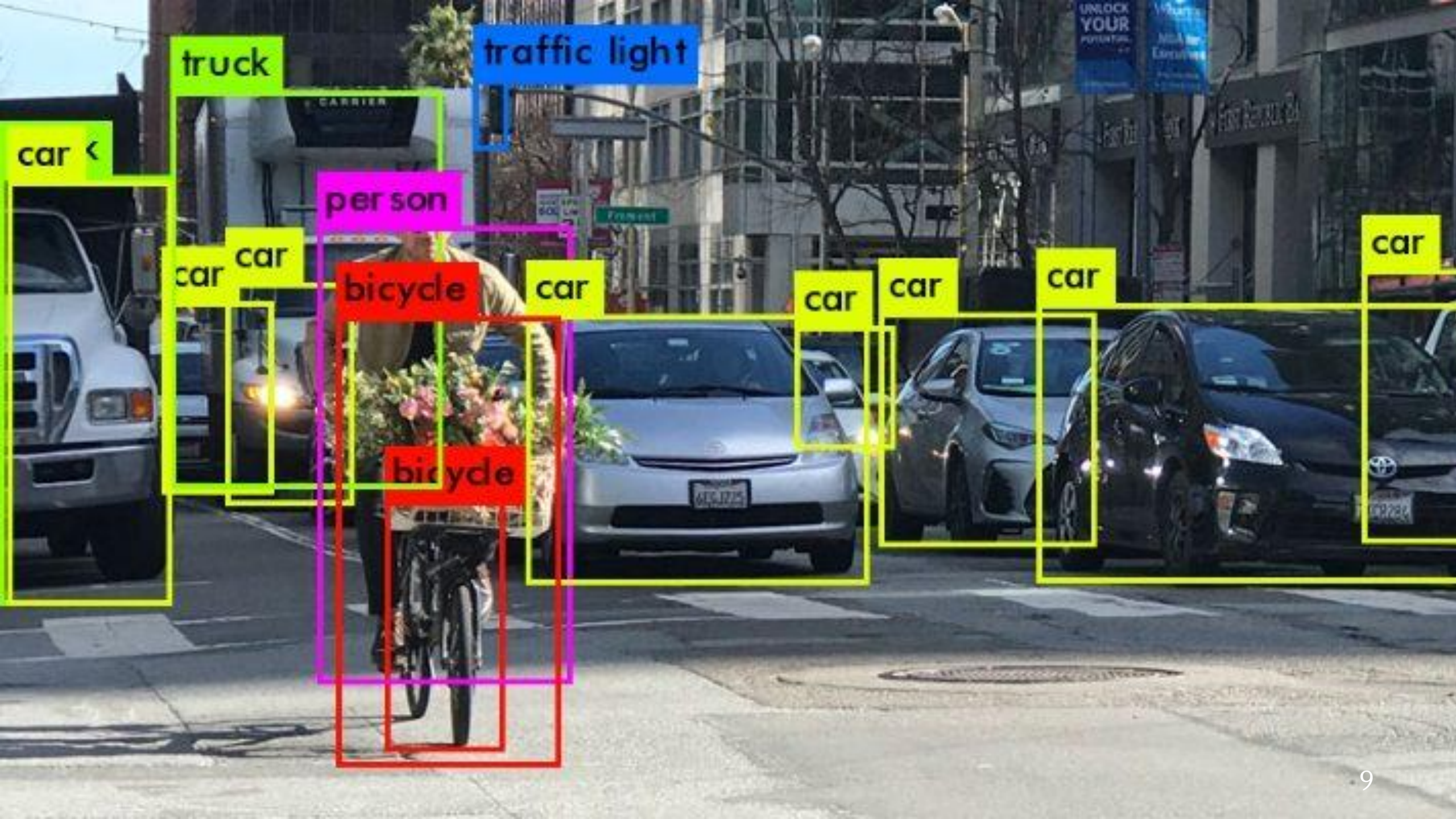
scotti

skipper

granRisparmio

tonnoRio





truck

traffic light

car

person

car

car

bicycle

car

car

car

car

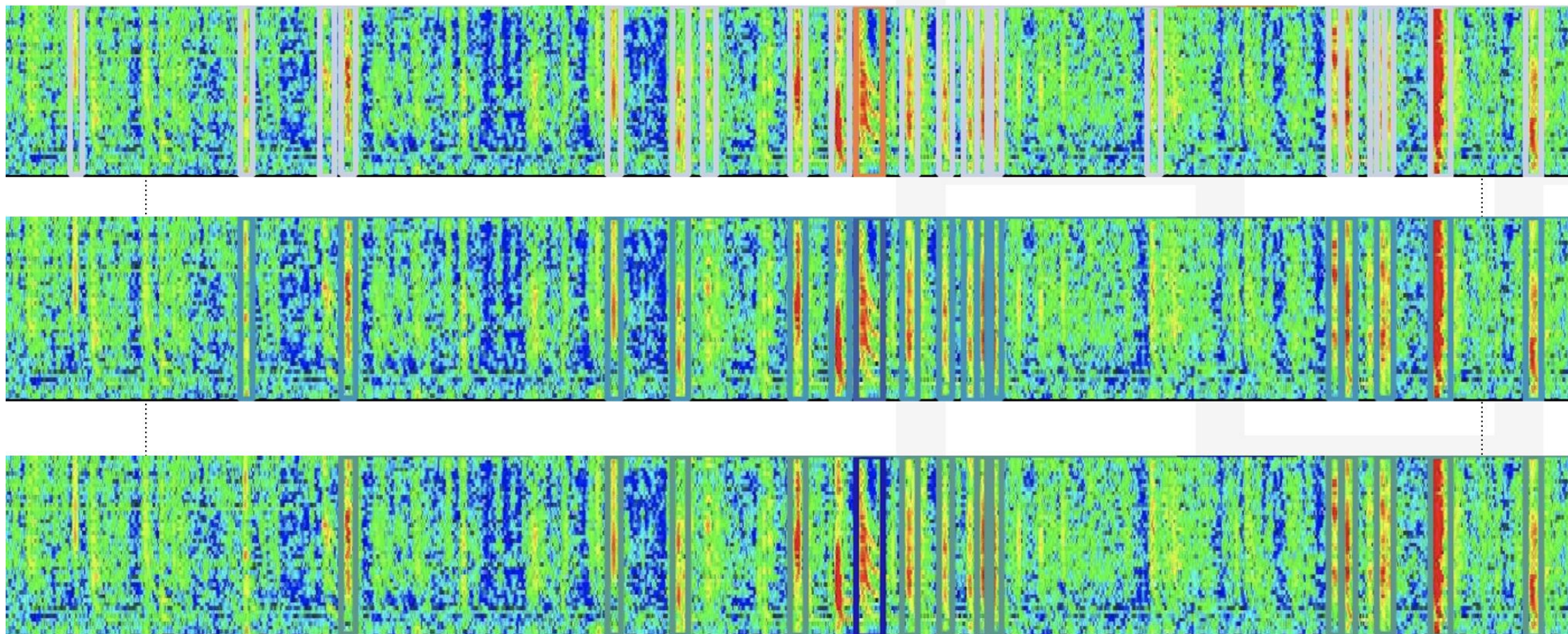
car

bicycle









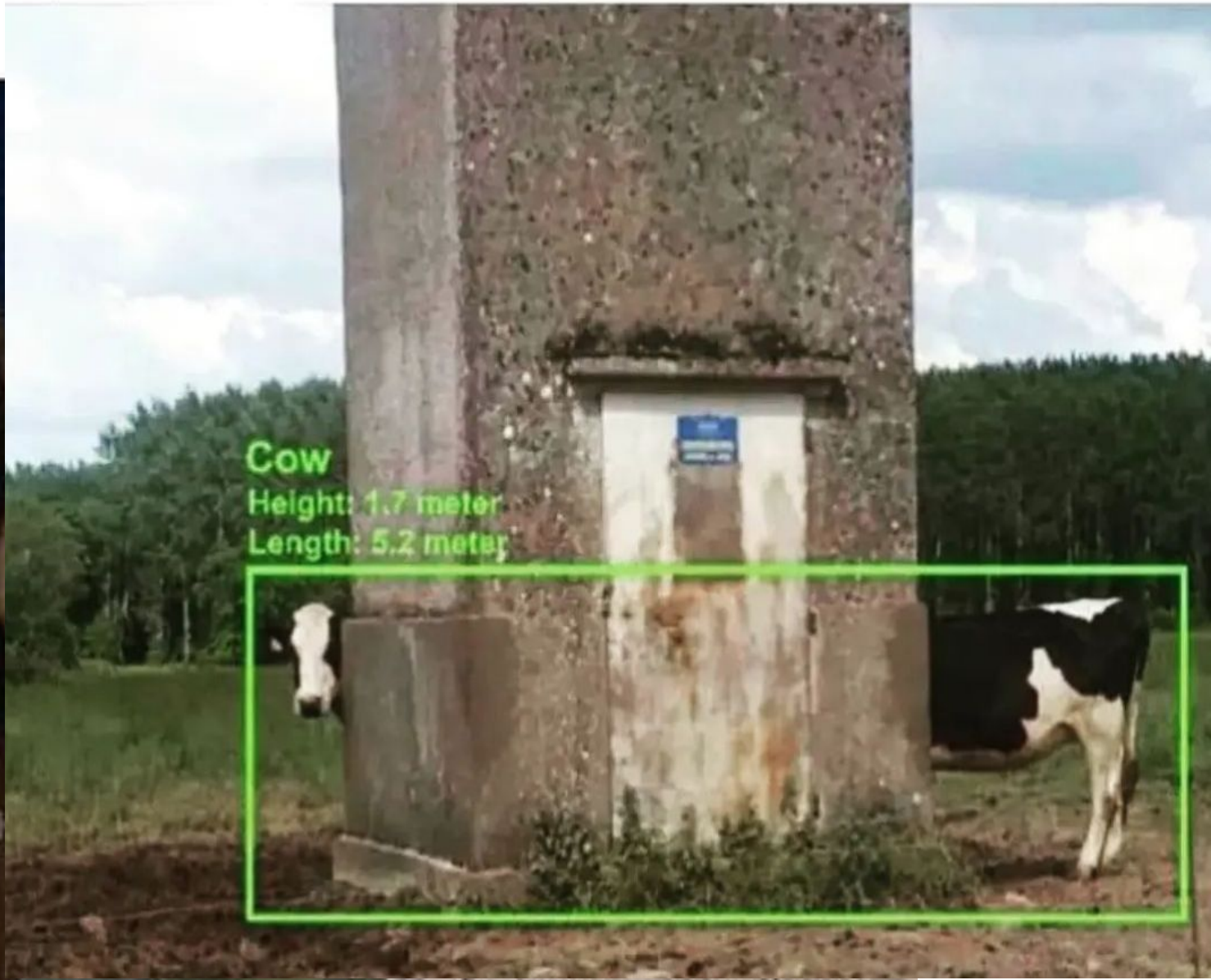
10/22



People with no idea  
about AI, telling me my  
AI will destroy the world

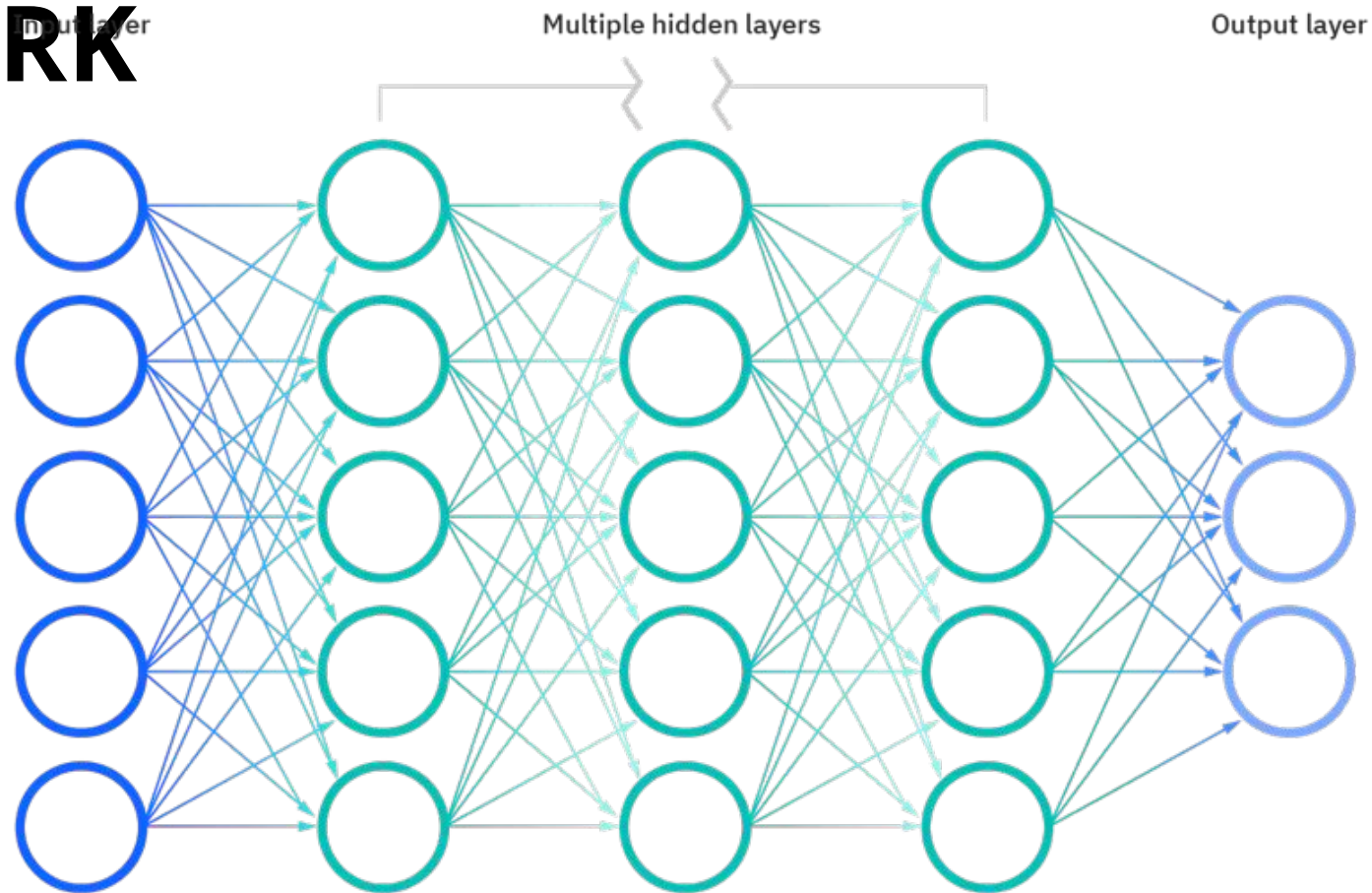


People: AI so smart, it will distroy us!  
AI:



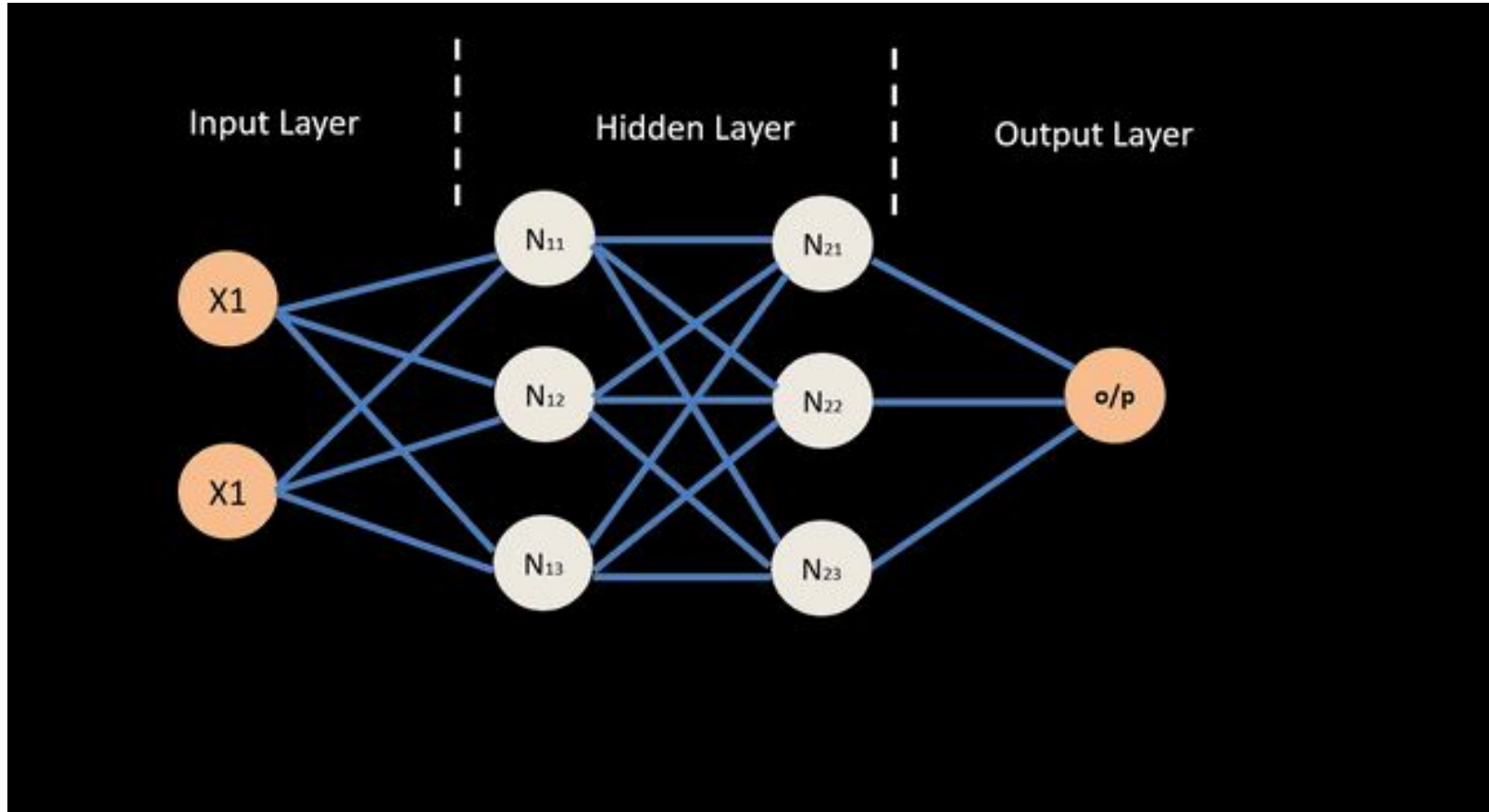
---

# DEEP NEURAL NETWORK

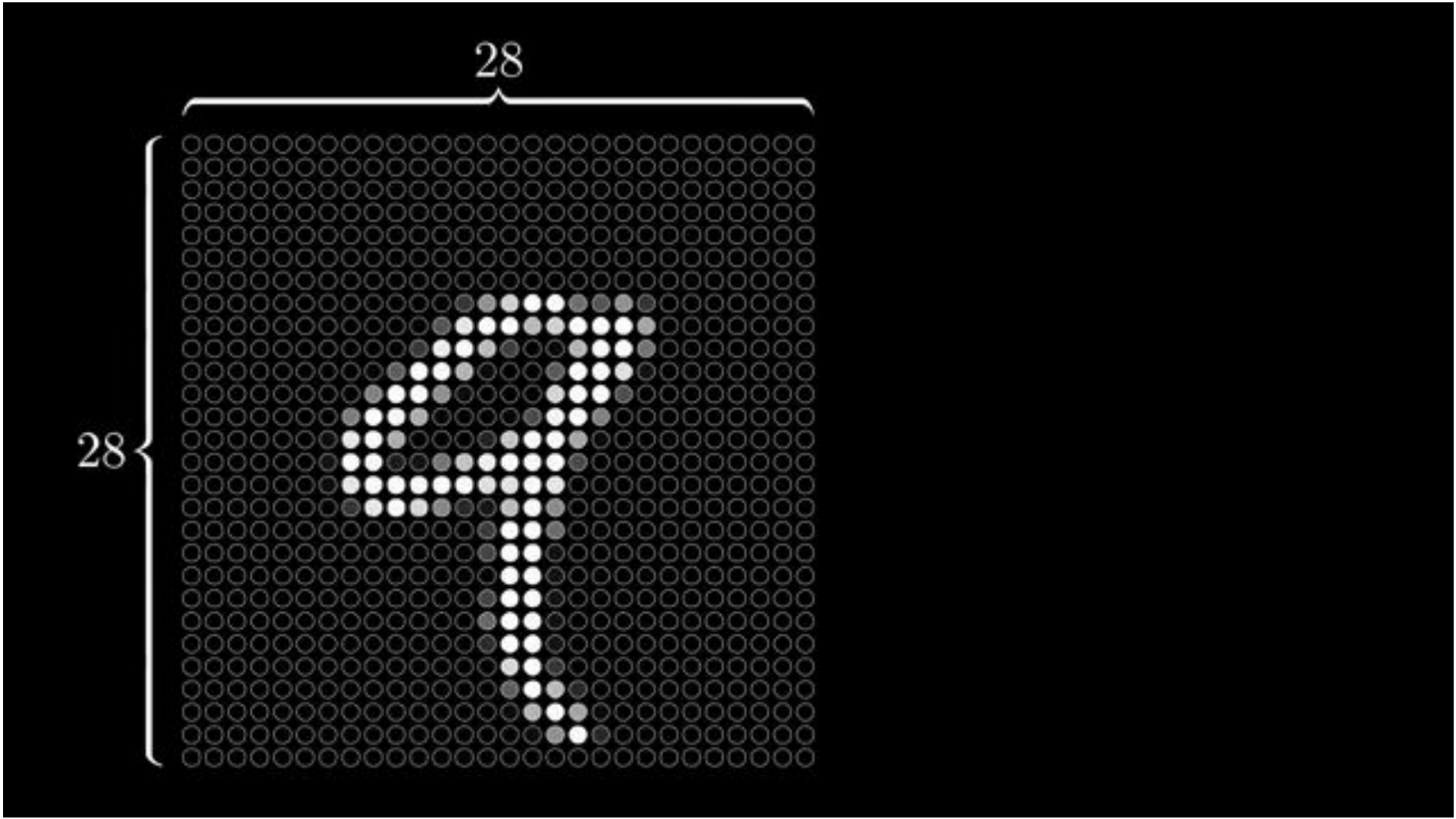


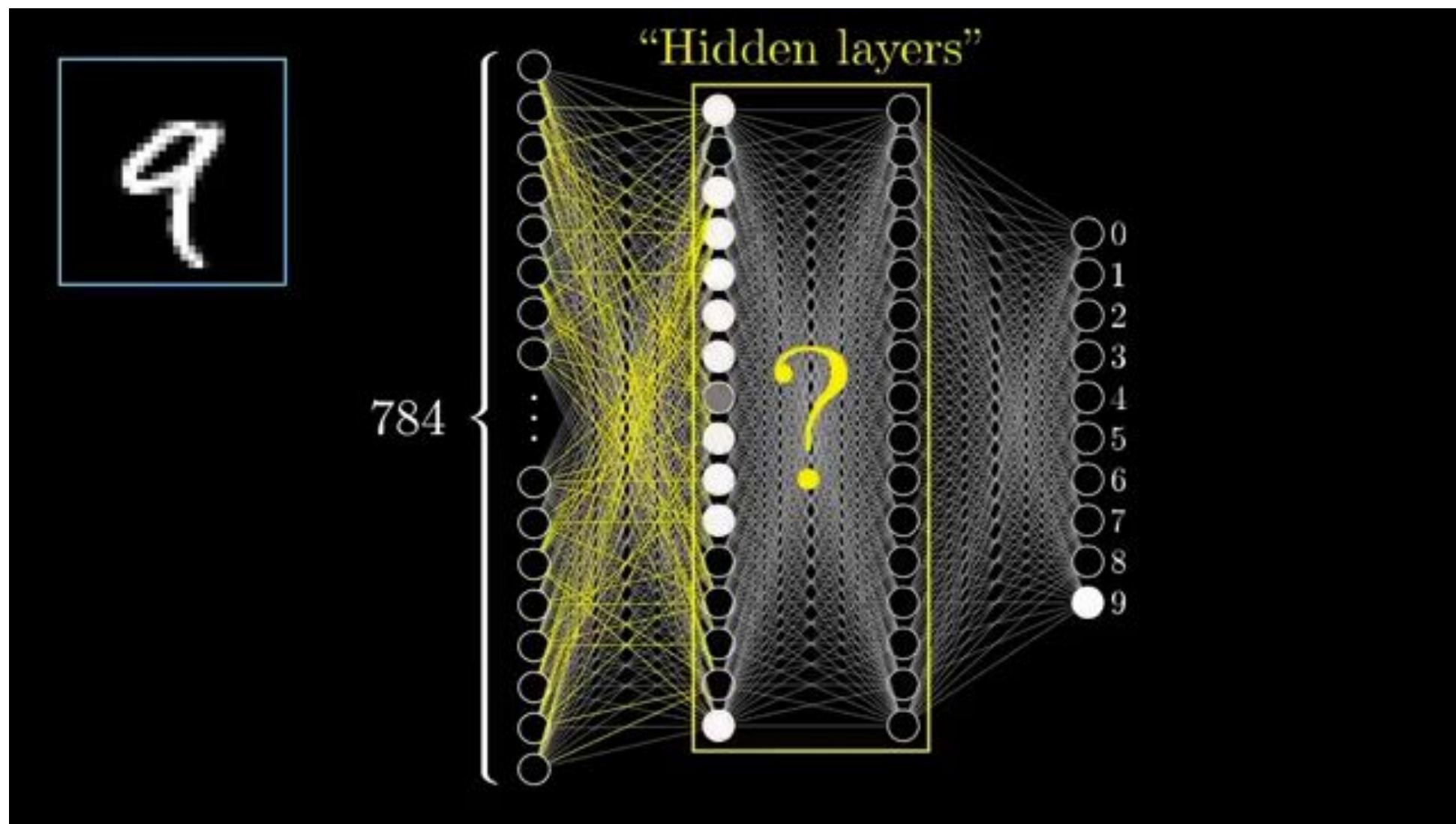
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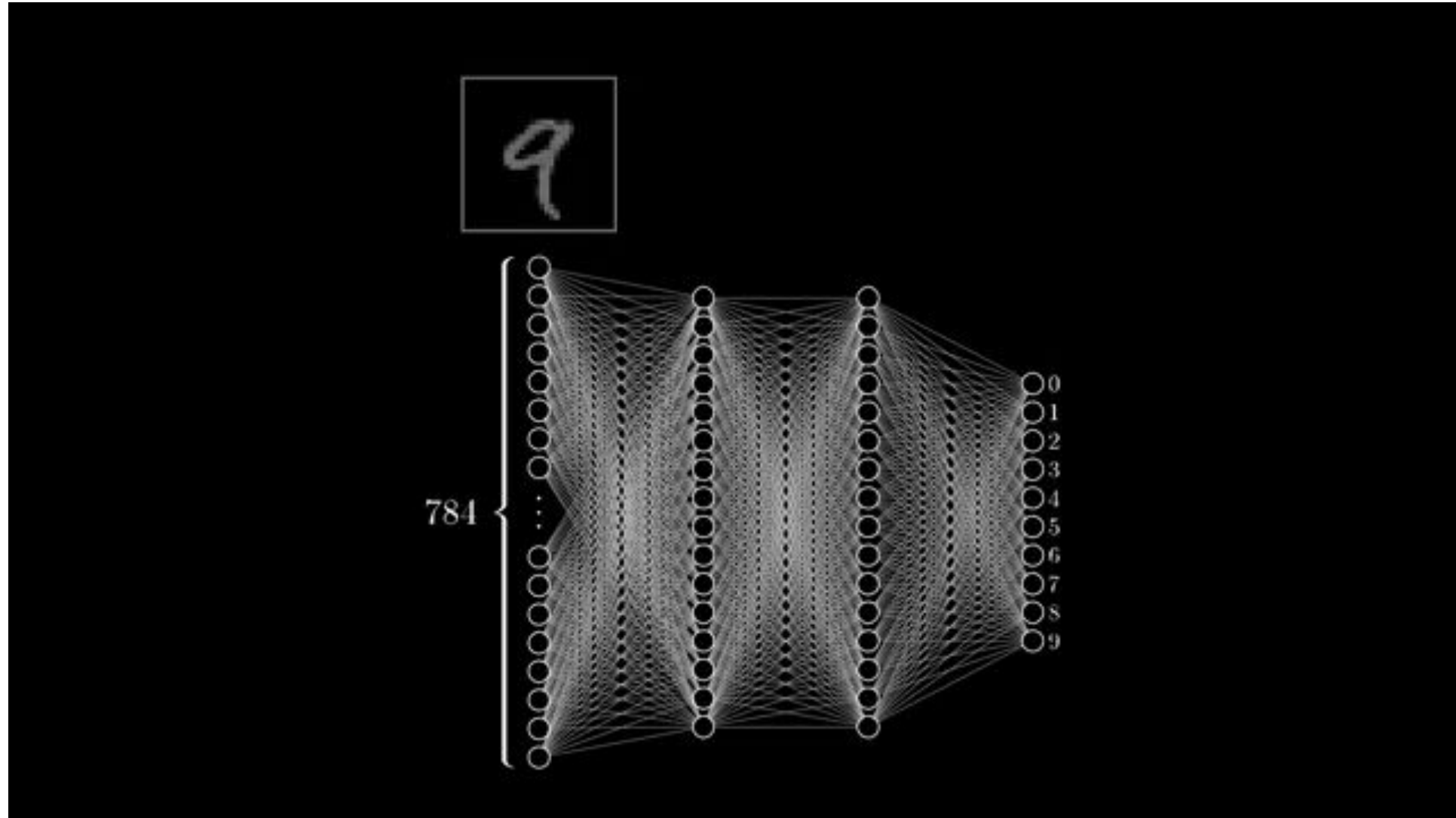
# BACKPROPAGATI ON











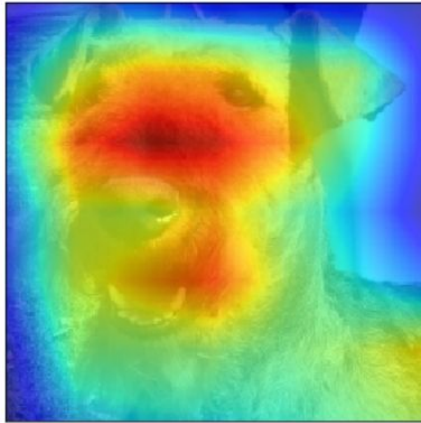


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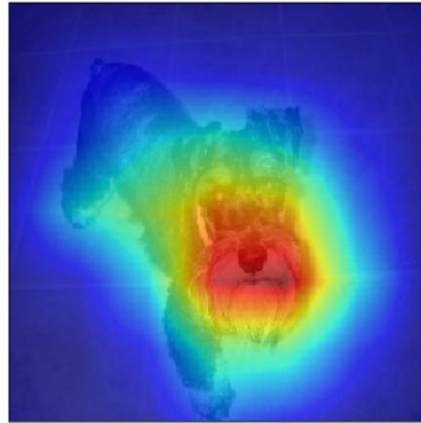
# CONVOLUTIONAL NEURAL NETWORK



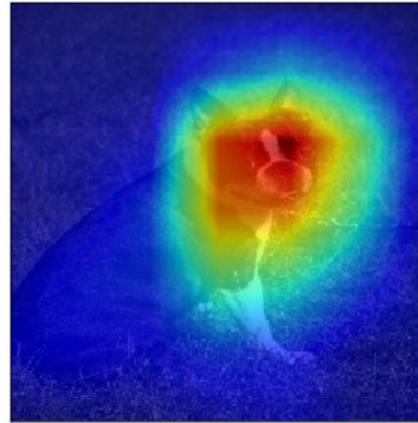
Airedale, Airedale terrier



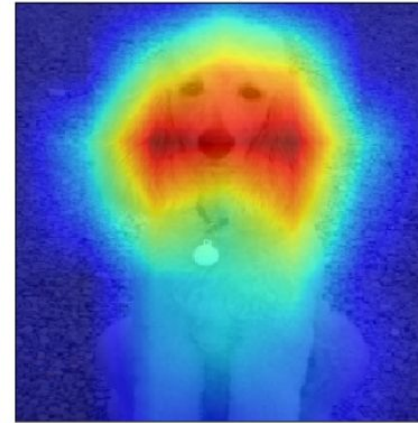
miniature schnauzer



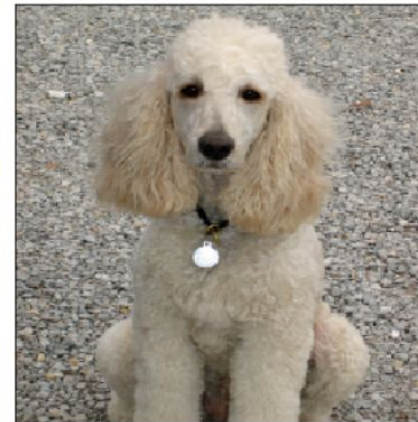
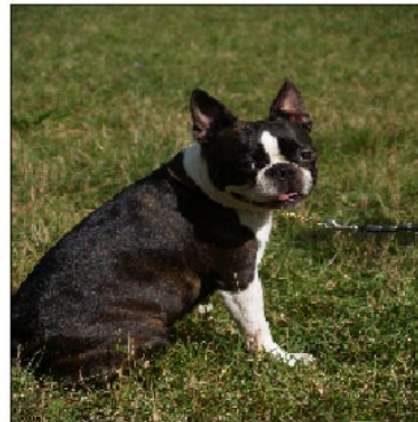
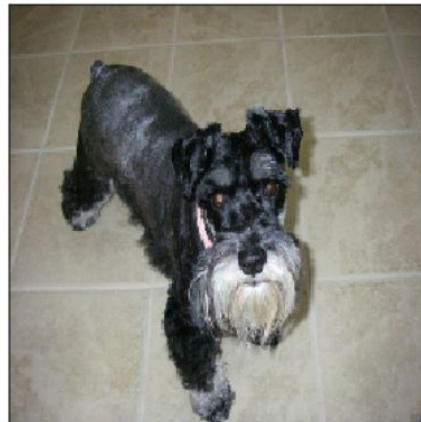
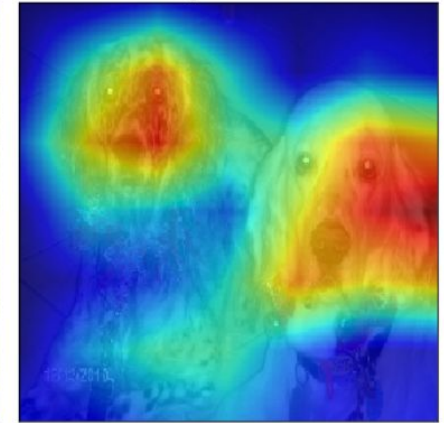
Boston bull, Boston terrier



standard poodle

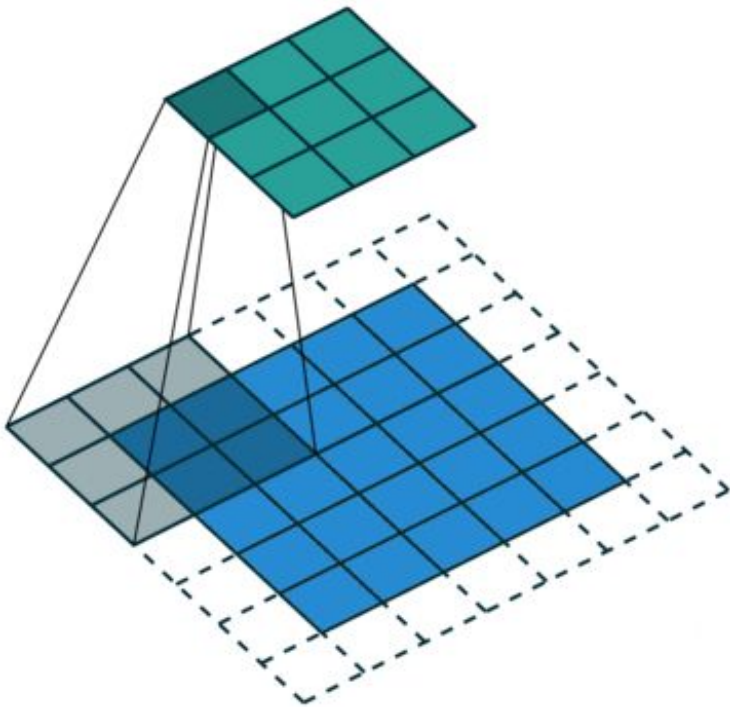


English setter



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# CONVOLUTIONAL LAYER



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# DEEP LEARNING OBJECT DETECTORS

**Task #1:** Find an arbitrary number of objects (possibly even zero)

**Task #2:** Classify every single object and estimate its size with a bounding box.



---

# DEEP LEARNING OBJECT DETECTORS

## Two-stage

- RCNN and SPPNet (2014)
- Fast RCNN and Faster RCNN (2015)
- Mask R-CNN (2017)
- Pyramid Networks/FPN (2017)
- G-RCNN (2021)

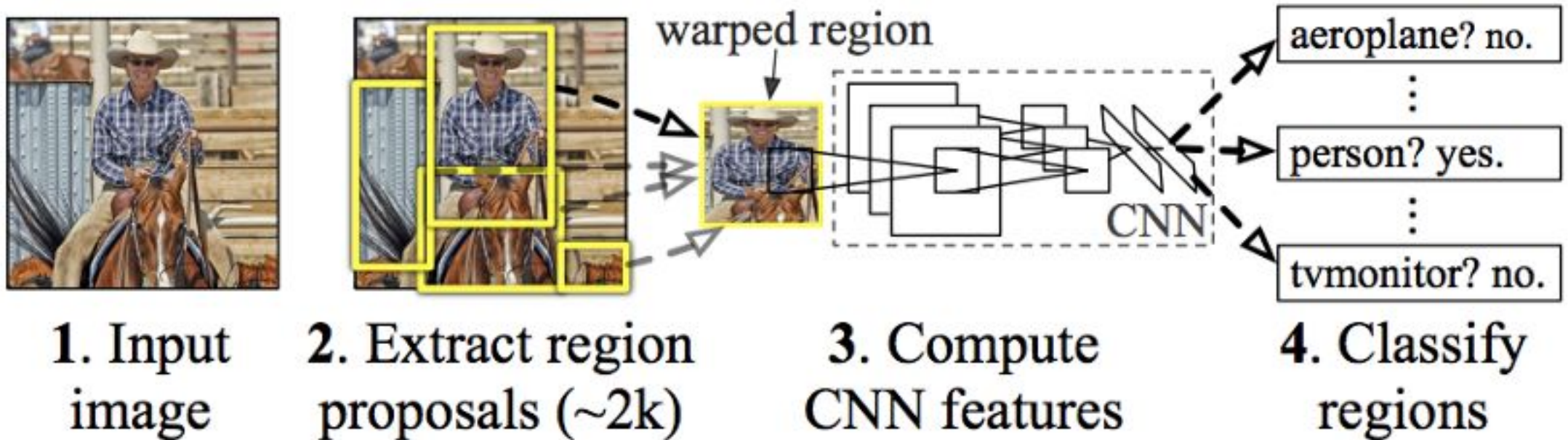
## One-stage

- YOLO (2016)
- SSD (2016)
- RetinaNet (2017)
- YOLOv3 (2018)
- YOLOv4, YOLOv5 (2020)
- YOLOR (2021)

**YOLOv3 is 1000x faster than R-CNN and 100x faster than Fast R-CNN**

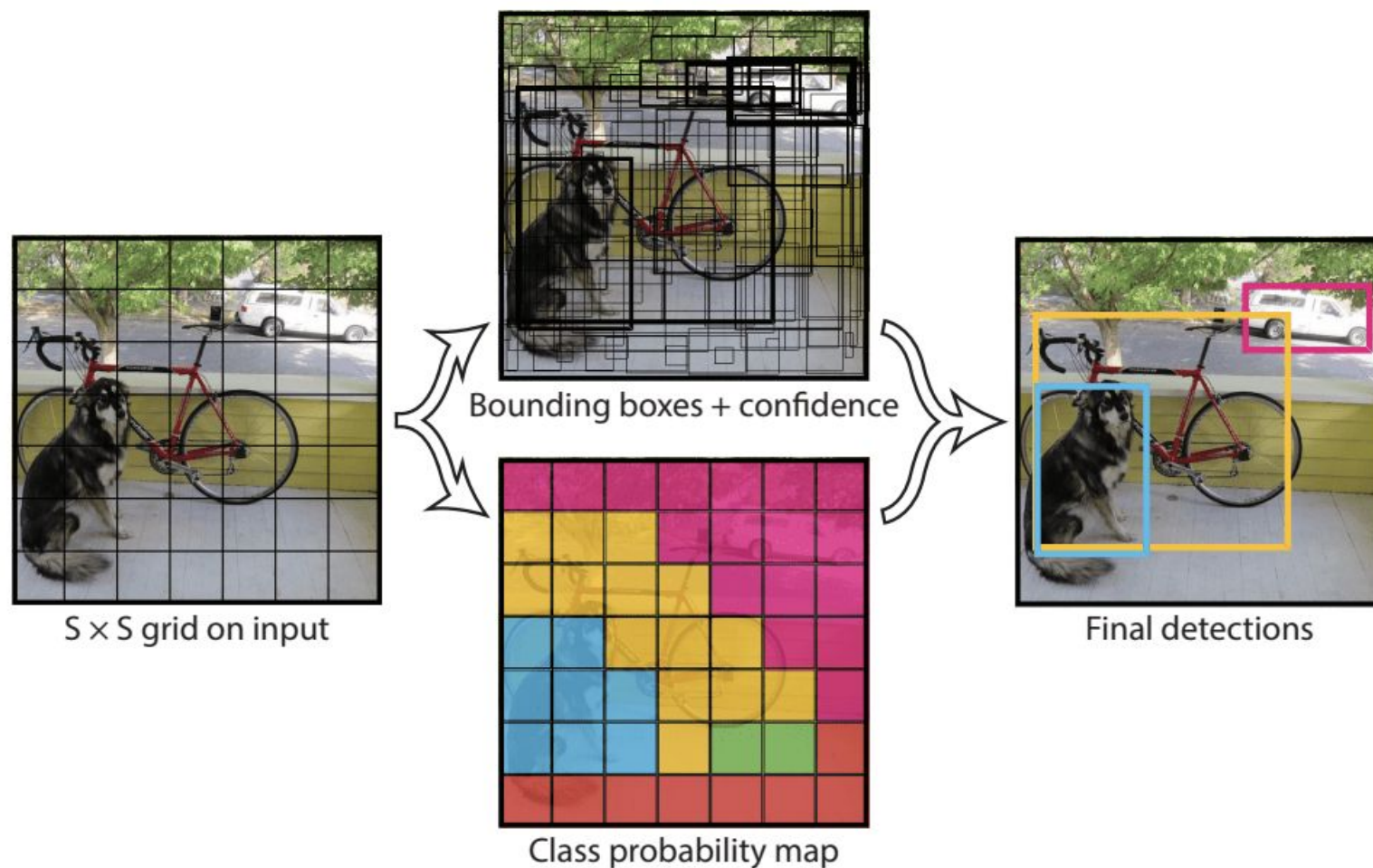
# R-CNN: REGION-BASED CONVOLUTIONAL NEURAL NETWORK

## R-CNN: *Regions with CNN features*

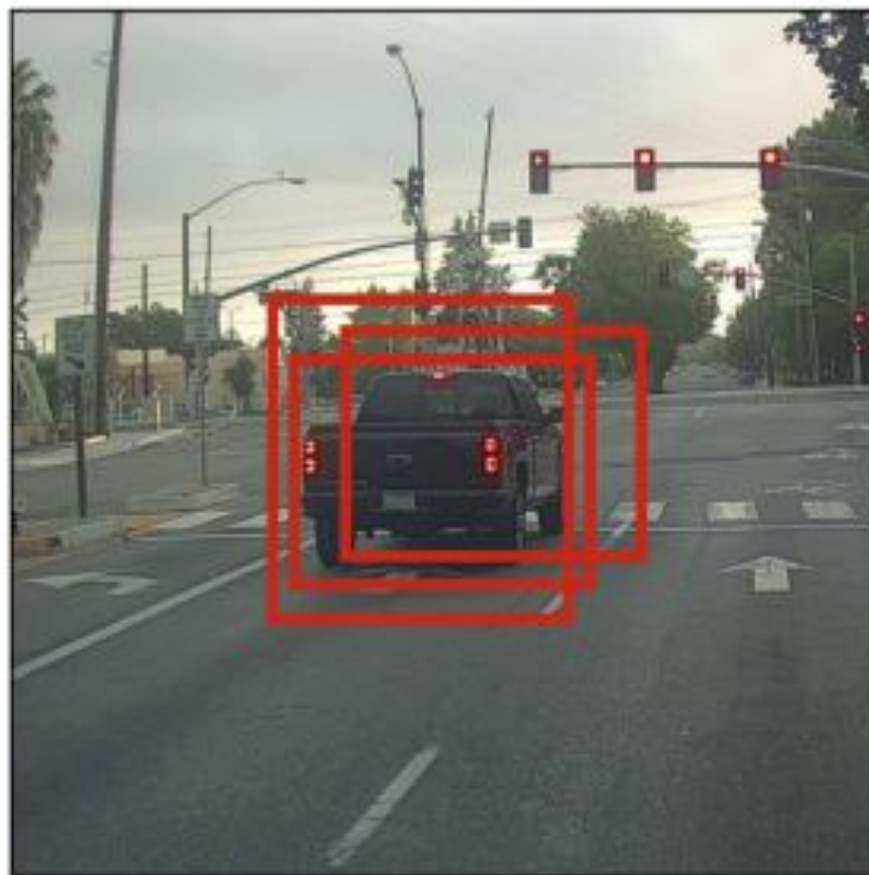


YOU  
ONCE  
LOOK  
ONLY

Verzia 5



Before non-max suppression



**Non-Max  
Suppression**



After non-max suppression

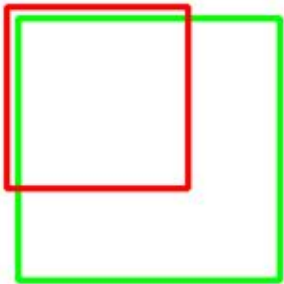




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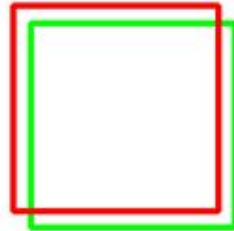
# INTERSECTION OVER UNION (IoU metrics)

IoU: 0.4034



Poor

IoU: 0.7330



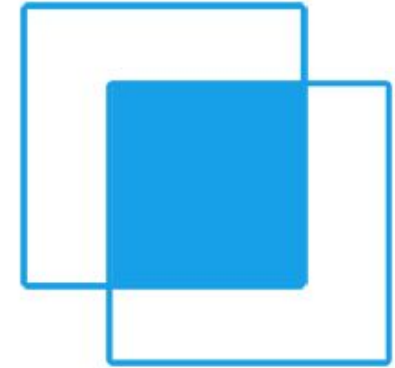
Good

IoU: 0.9264

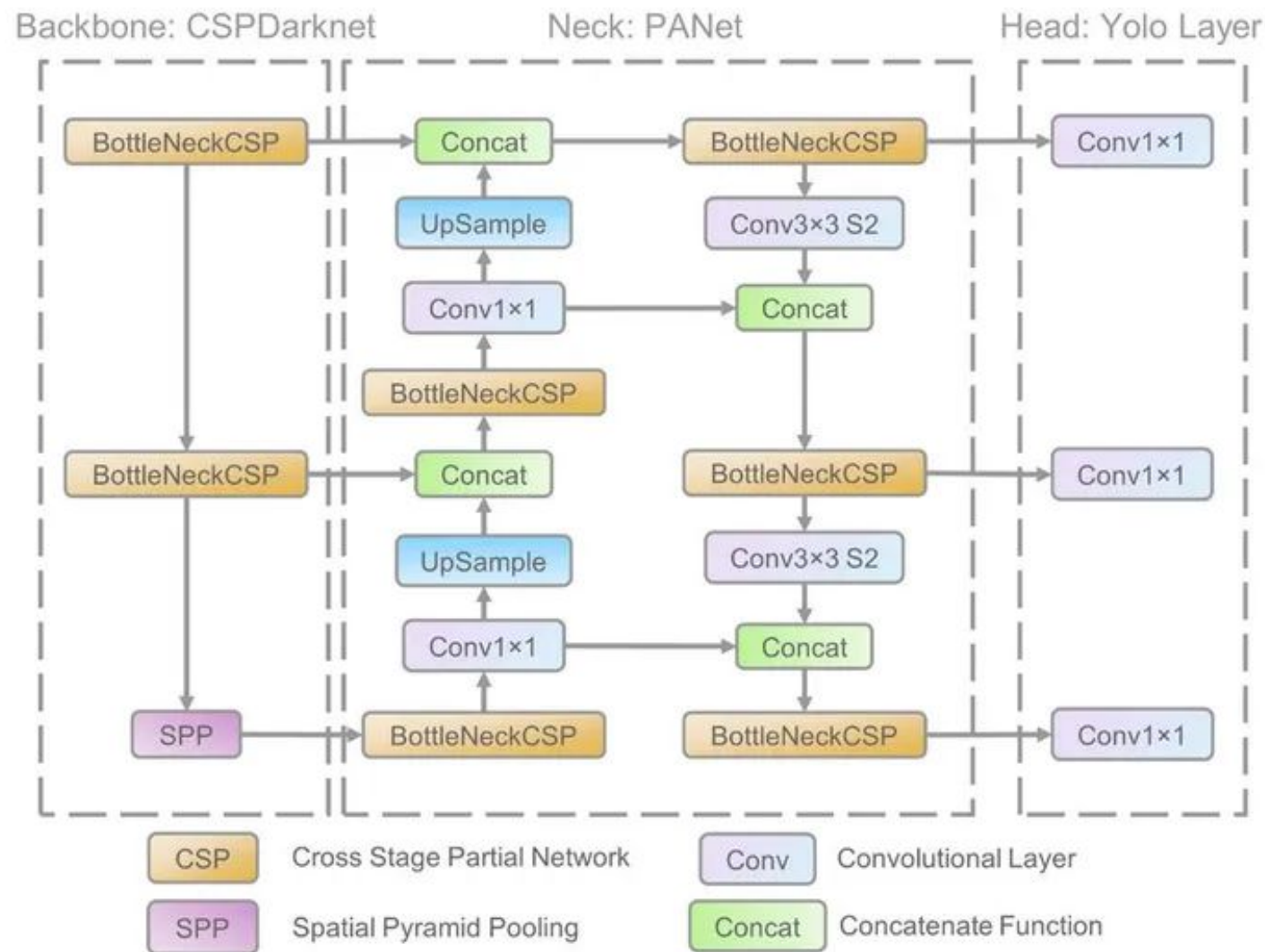


Excellent

$$\text{IoU} = \frac{\text{Area of Overlap}}{\text{Area of Union}}$$

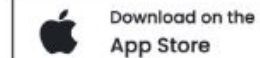


YOU  
ONCE  
LOOK  
ONLY  
Verzia 5





# YOLOv5 by


- ✓ Webcam
- ✓ Image
- ✓ Video
- ✓ Directory
- ✓ Global File Type
- ✓ RTSP stream
- ✓ RTMP stream
- ✓ HTTP stream



English | [简体中文](#)

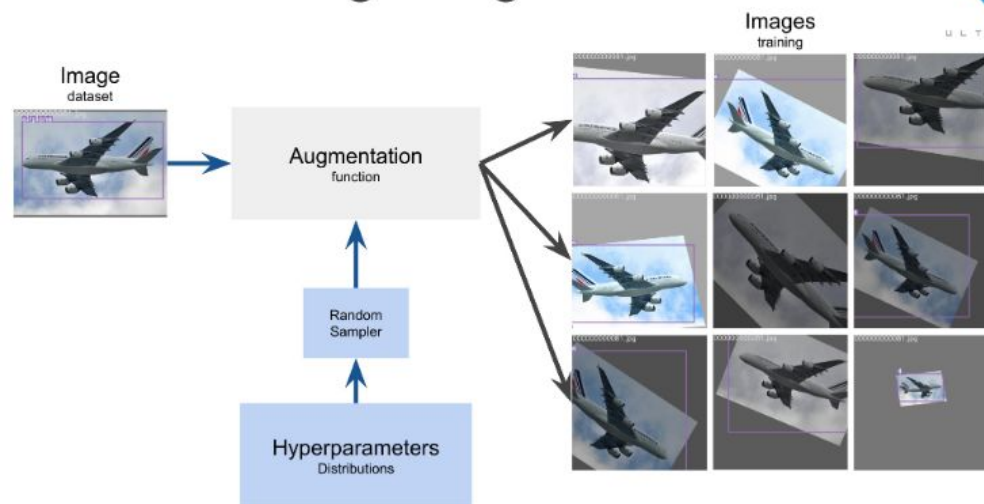
 YOLOv5 CI **passing**  DOI [10.5281/zenodo.7002879](https://doi.org/10.5281/zenodo.7002879)  docker pulls **241k**

 Open in Colab  Open in Kaggle  Slack  Join Forum

YOLOv5  is a family of object detection architectures and models pretrained on the COCO dataset, and represents [Ultralytics](#) open-source research into future vision AI methods, incorporating lessons learned and best practices evolved over thousands of hours of research and development.



# YOLOv5 Image Augmentation



www.ultralytics.com

44 | November 2020

YOLOv5 🚀 applies online imagespace and colorspace augmentations in the trainloader (but not the val\_loader) to present a new and unique augmented Mosaic (original image + 3 random images) each time an image is loaded for training. **Images are never presented twice in the same way.**






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<https://github.com/ultralytics/yolov5>

```
!git clone https://github.com/space-lab-sk/tle_detection.git
```



**SPACE::LAB**  
space-lab-sk

Unfollow

5 followers · 0 following

Department of Space Physics, Institute ...  
Košice, Slovakia  
www.space-lab.sk

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**tle\_detection** Public Star

This is repo for automatic detection of TLE events.

Jupyter Notebook GNU General Public License v3.0 Updated 11 hours ago

**summer-schools** Public Star

This is the repo with lectures from SPACE::LAB summer schools.

Jupyter Notebook 1 Updated 21 days ago

**sk-s2p\_swe** Public Star

This is a repo for documentation related to Space Weather (SWE) domain within Slovak Space Safety Program (SK-S2P) study.

Updated on 15 Jul





# END OF PART I

QUESTIONS  
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