Deep Learning Based High Accuracy Traffic Sign Detection

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Date: 05/01/2023

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Problem Description

Traffic sign detection is an important task for autonomous driving systems.

necessary information for navigation & safety

- detect the changes in sign size, shape, color, occlusion, and illumination makes it a hot topic in the CV domain.
- require high accuracy and real-time performance, which is usually a natural shortage of object detection models.

Dataset

German Traffic Sign Detection Benchmark (GTDRB): 900 photos with traffic signs.

HOME GTSRB GTSDB

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The German Traffic Sign Detection Benchmark

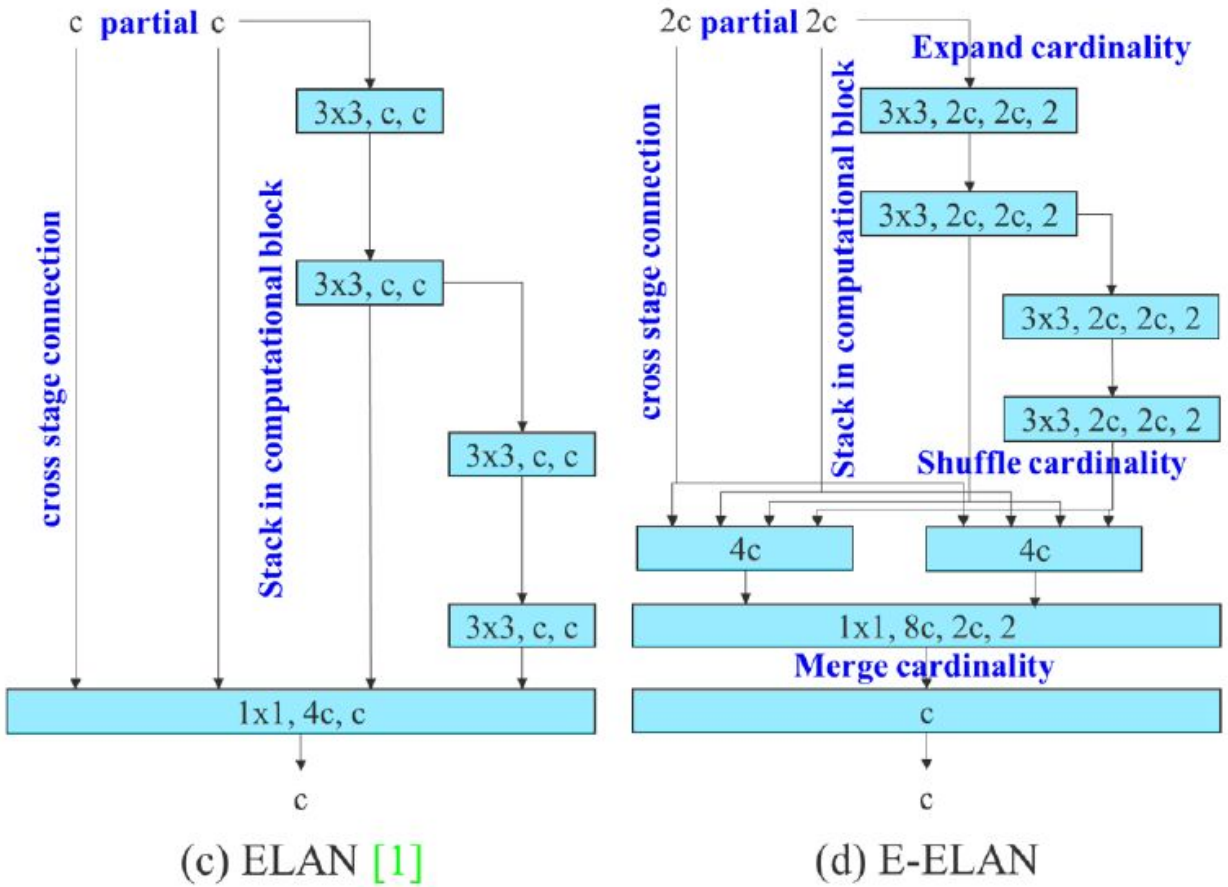
The German Traffic Sign Detection Benchmark is a single-image detection assessment for researchers with interest in the field of computer vision, pattern recognition and image-based driver assistance. It is supposed to be introduced on the IEEE International Joint Conference on Neural Networks 2013. It features ...

Dataset

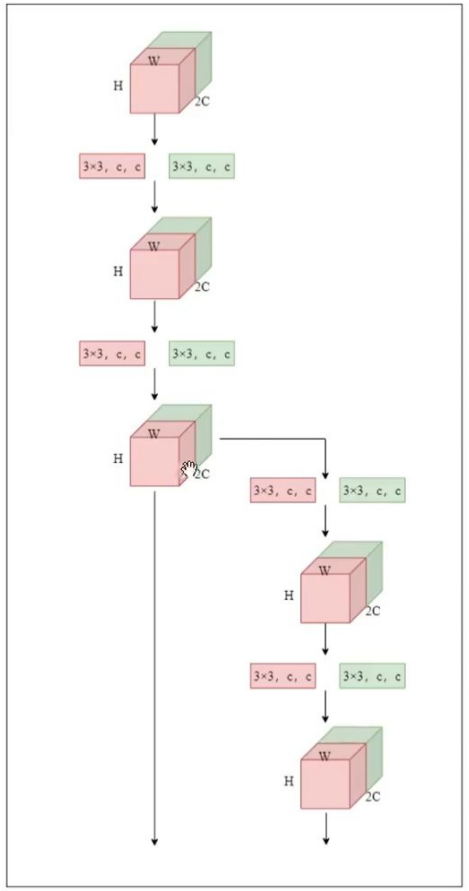
- The images contain zero to six traffic signs.
- Traffic signs are grouped into: prohibitory, danger, mandatory
- The sizes of the traffic signs in the images vary from 16x16 to 128x128
- Traffic signs appear in every perspective and under every lighting condition
- Original dataset are converted to the YOLO format.
- Images are in *.jpg format and have corresponding *.txt files with YOLO annotations.
- Annotations include bounding box information in the format of [Class Number] [center in x] [center in y] [Width] [Height].

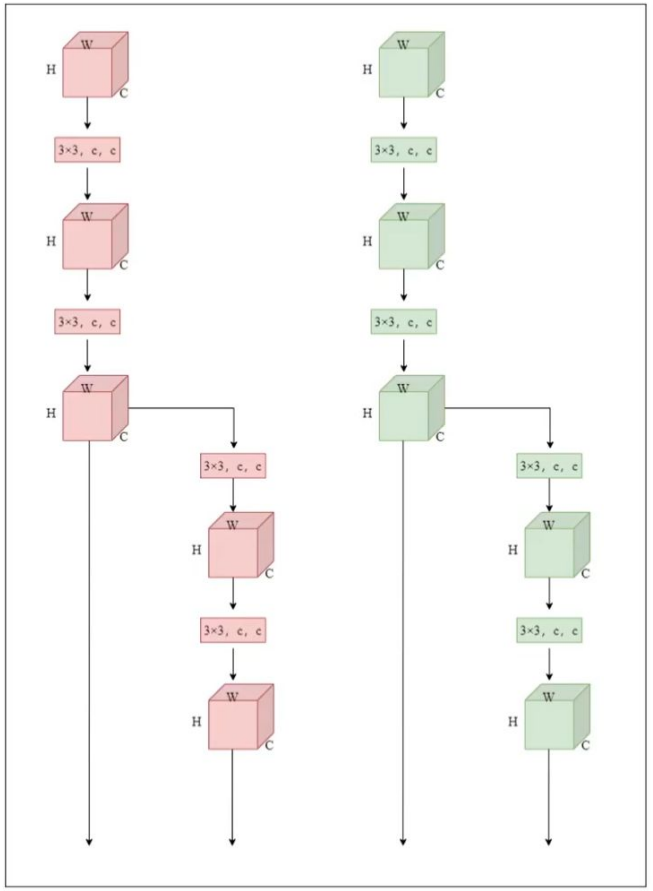
Approaches

What makes YOLOv7 model different?



(c) ELAN [1] (d) E-ELAN

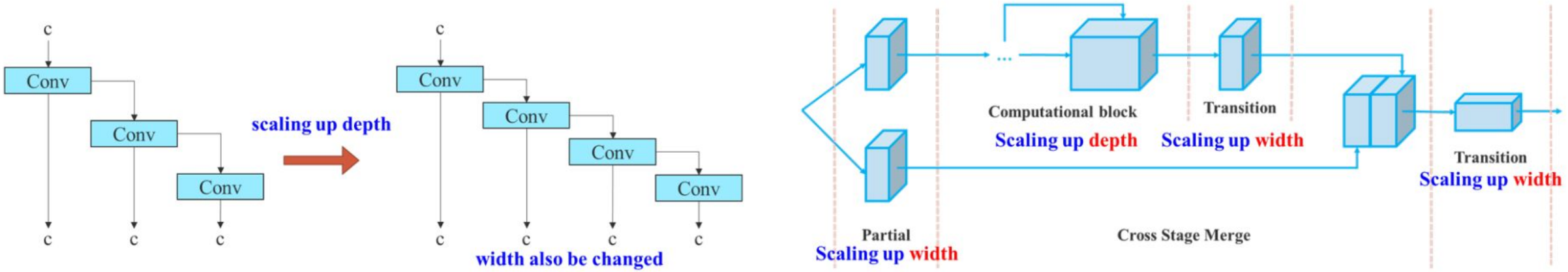




Extended efficient layer aggregation: Put the backbone together and pull features together from images.

Approaches

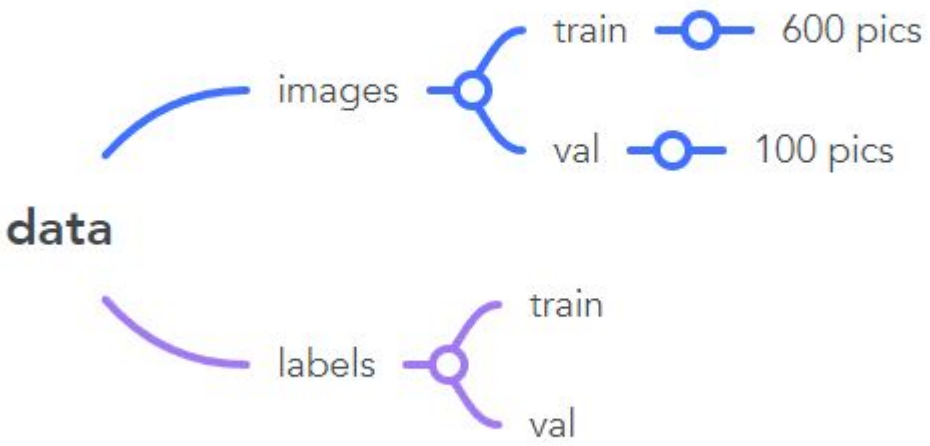
What makes YOLOv7 model different?



(a) concatenation-based model (b) scaled-up concatenation-based model (c) compound scaling up depth and width for concatenation-based model

Model scaling techniques: Change different layers to accommodate different sizes to make the neural network smaller or larger.

Training

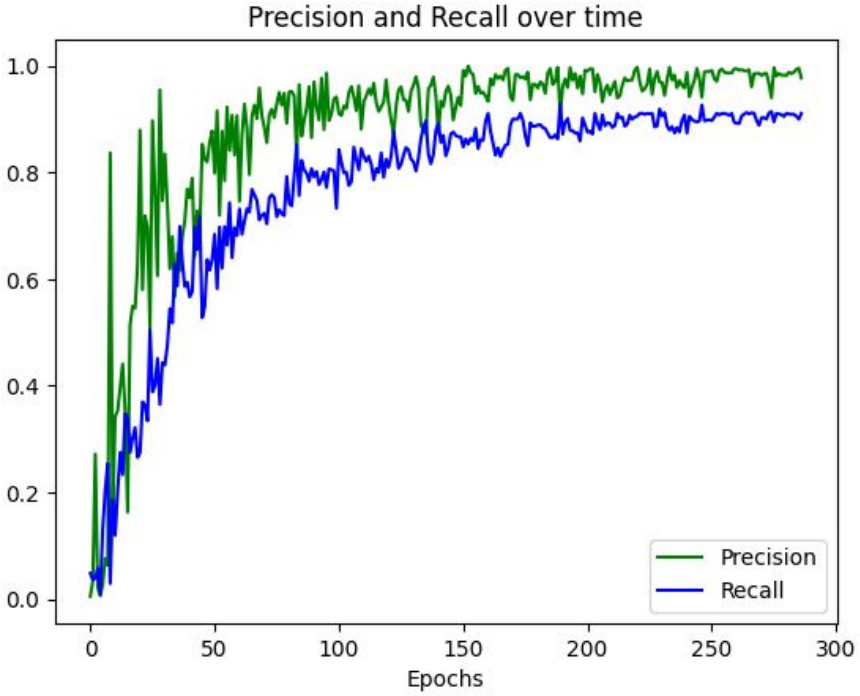


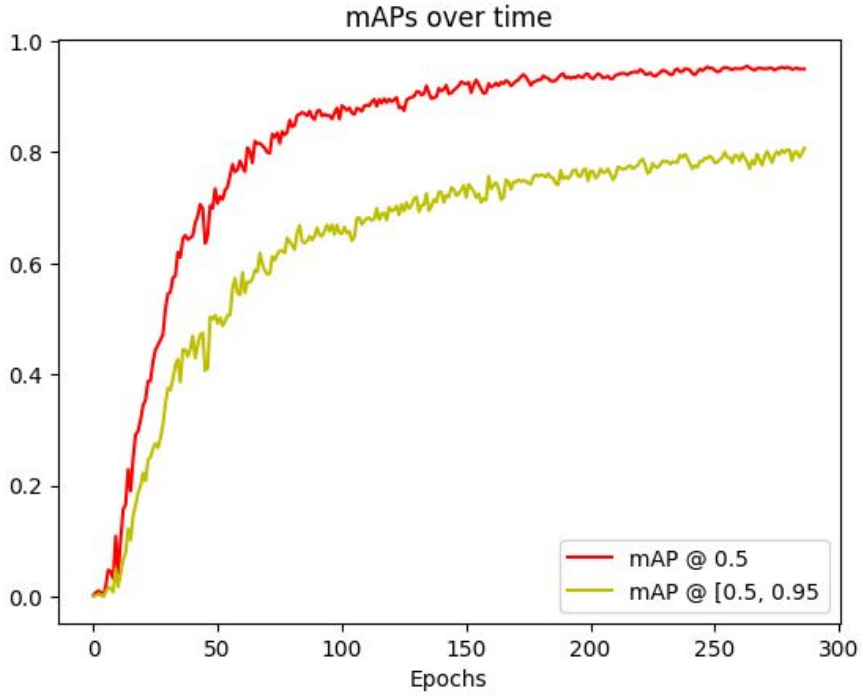

```
  Epoch    gpu_mem       box       obj       cls     total    labels  img_size
299/299      4.81G   0.01153  0.002572 0.0009846   0.01509        10       640: 100%|██████████| 111/111 [01:02<00:00,  1.78it/s]
           Class     Images     Labels          P          R     mAP@.5 mAP@.5:.95: 100%|██████████| 7/7 [00:02<00:00,  3.30it/s]
             all         78        119      0.977      0.911       0.95      0.807
      prohibitory         78         52      0.985          1      0.995      0.866
          danger         78         29          1      0.966      0.994      0.838
       mandatory         78         14      0.928      0.929      0.967      0.861
           other         78         24      0.996       0.75      0.843      0.664
```

Demo

Demo

Results





Precision	Recall	mAP @ 0.5	mAP @ [0.5, 0.95]
0.9995	0.9286	0.955	0.8072

Lessons Learned

1 Time to Run

- Local GPU vs Remote

2 Dataset Coverage

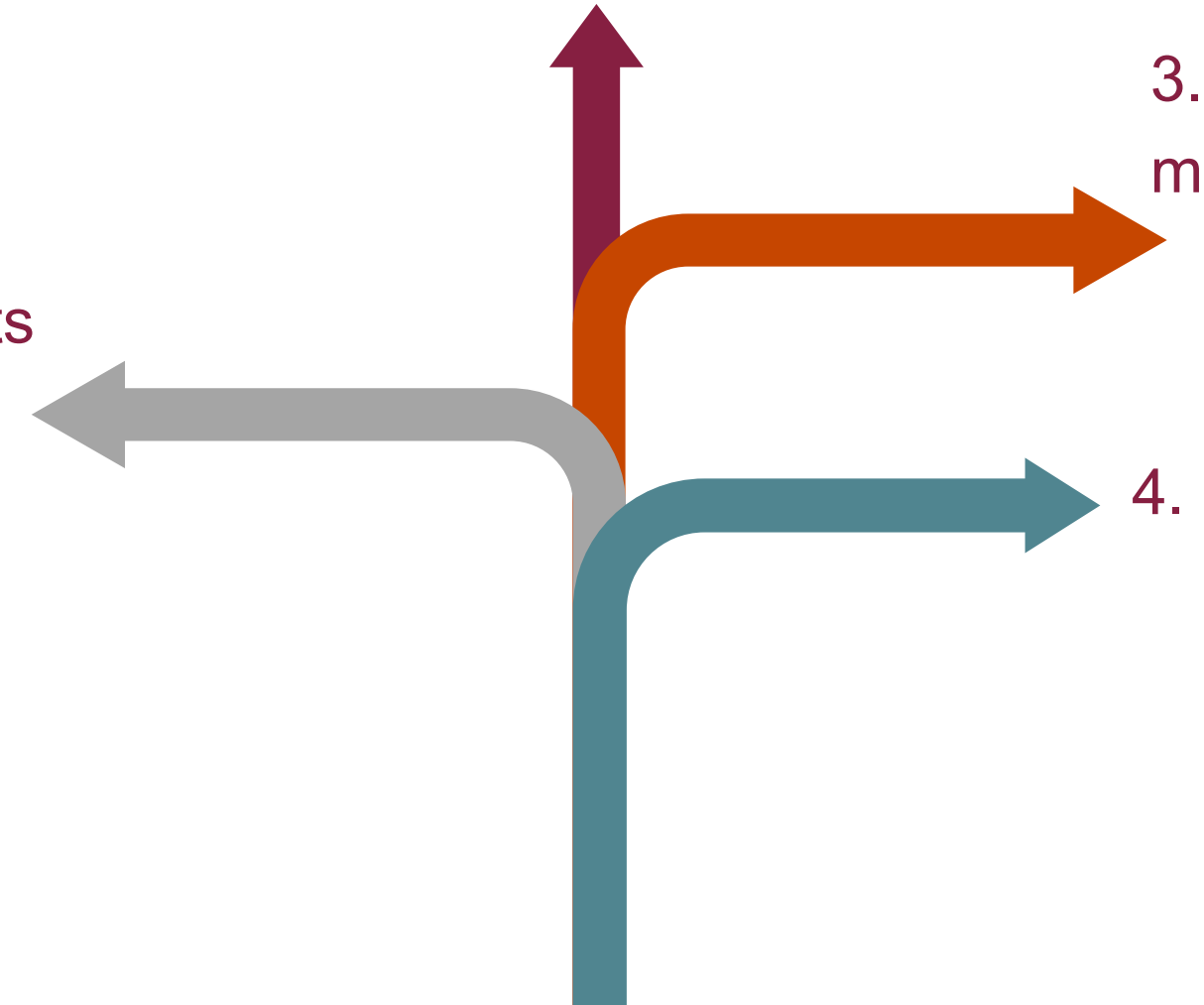
- Need a large and realistic dataset to train the model

3 From theory to practice

- Both efficiency and accuracy

Future Work

2. Utilize cloud computing platforms like Colab and AWS to speed up the training



3. Compare other YoLo models' performance

1. Use other datasets like CCTSDB

4. Segment anything?

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THANKS!!

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