

TTA for object detection

Task : apply various TTA methods, and get the best performance out of a fixed model.

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Test-Time Augmentation survey

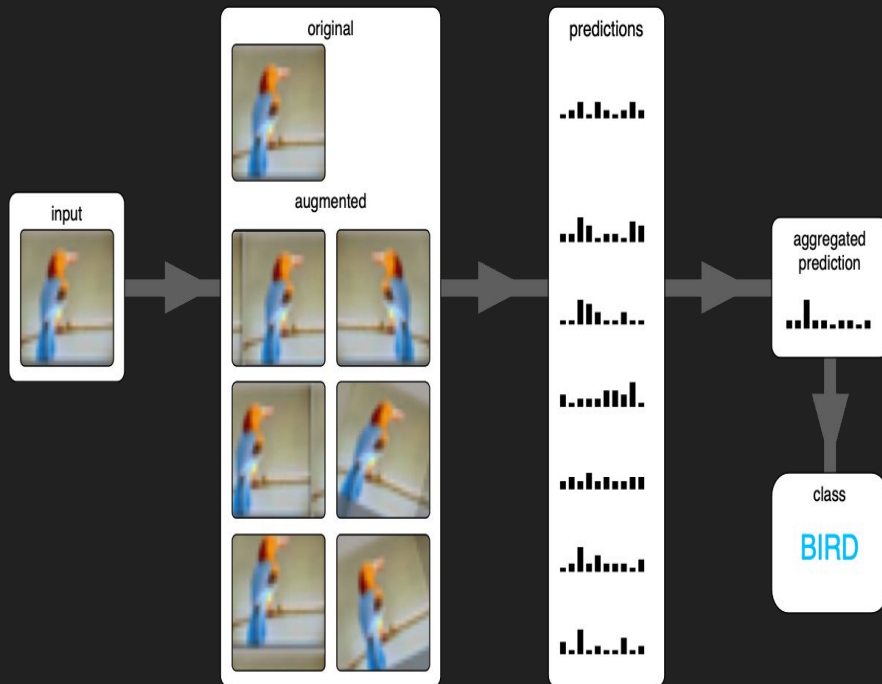
Test-Time Data Augmentation (short TTA) is a technique that can boost a model's performance by applying augmentation during inference and is a popular strategy to use with deep learning models.

It is used at test-time to obtain greater robustness, improved accuracy, or estimates of uncertainty.

It entails pooling predictions from several transformed versions of a given test input to obtain a "smoothed" prediction.

Test-Time Augmentation survey

- Positive scaling
- Negative scaling
- Horizontal Flip
- Vertical Flip
- Left rotation
- Right rotation
- Cropping
- Shifting
- Shearing



Source : <https://stepup.ai/>

COCO Dataset

COCO is a large-scale object detection, segmentation, and captioning dataset.

- Object segmentation
- Recognition in context
- Superpixel stuff segmentation
- 330K images (>200K labeled)
- 1.5 million object instances
- 80 object categories
- 91 stuff categories
- 5 captions per image
- 250,000 people with keypoints

Code architecture

- Python 3.8
- Pytorch framework
- Faster R-CNN pretrained model : Real-Time Object Detection model with Region Proposal Networks
- main_code : test_time_augmentation.py

Results

Evaluation metric : mAP (Mean Average Precision)

The mAP compares the ground-truth bounding box to the detected box by computing the average precision value for recall value over 0 to 1 and returns a score. The higher the score, the more accurate the model is in its detections.

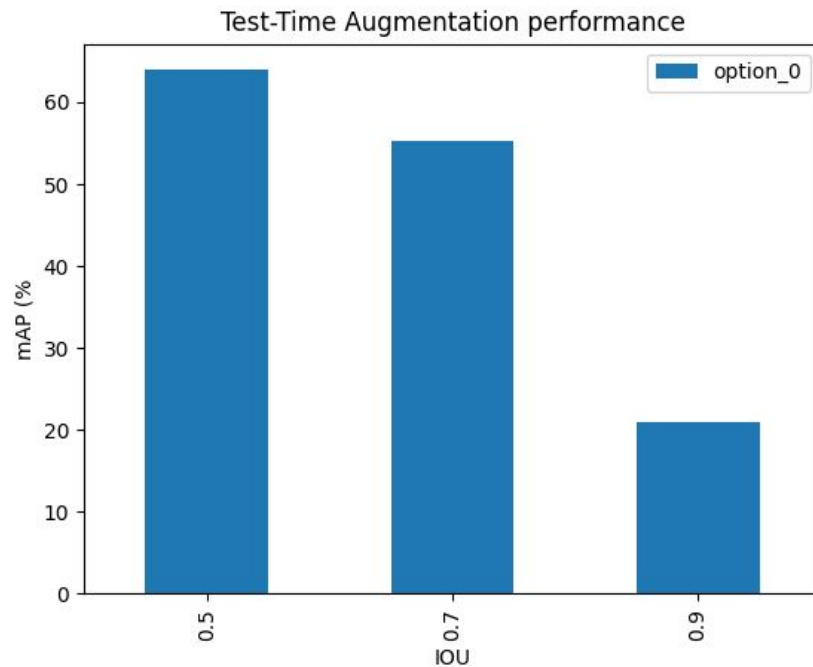
Hyperparameters :

- IOU : [0.5,0.7,0.9]
- Option 0 : No TTA
- Option 1 : Scaling of 0.9
- Option 2 : Horizontal Flip
- Option 3 : [Horizontal Flip, Scaling of 0.9, Scaling of 1.1]
- Option 4 : [Horizontal Flip, Scaling of 0.9, Scaling of 1.1, Vertical Flip, Left Rotation]

Results

Benchmarking

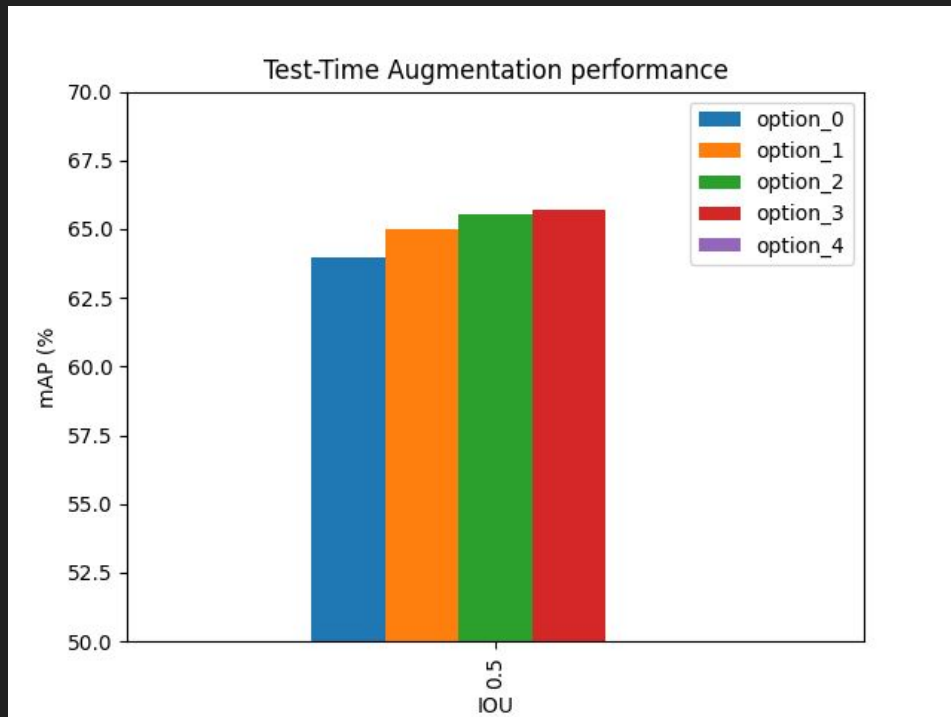
- $\pm 63\%$ mAP with IOU 0.5
- $\pm 55\%$ mAP with IOU 0.7
- $\pm 21\%$ mAP with IOU 0.9



Results

Comparison

- Gain of 1.4% with option 1
- Gain of 1.9% with option 2
- Gain of 2.1% with option 3
- Option 4 gives 0 in mAP



Analysis

Why option 4 failed ?

Rotation of 90 degrees affects prediction



Challenges

- The more you add TTA methods to the inference the more your inference time is
- Dis-augment the model's predictions.
- Some TTA methods can be detrimental. If model was trained without rotation for example, adding the rotation operation in the TTA will decrease the evaluation metric