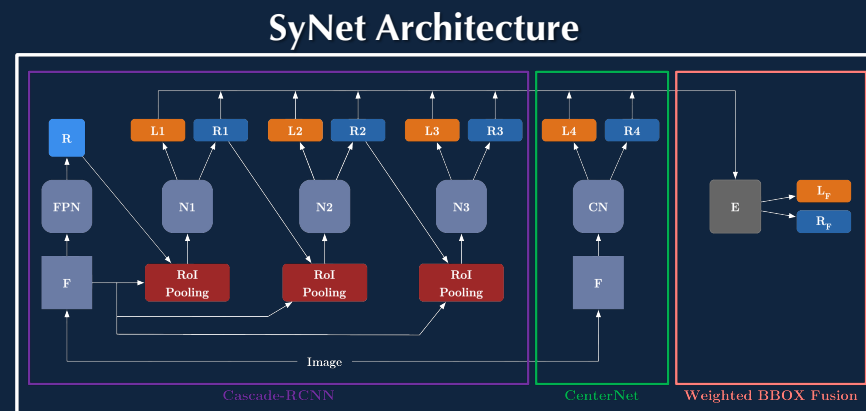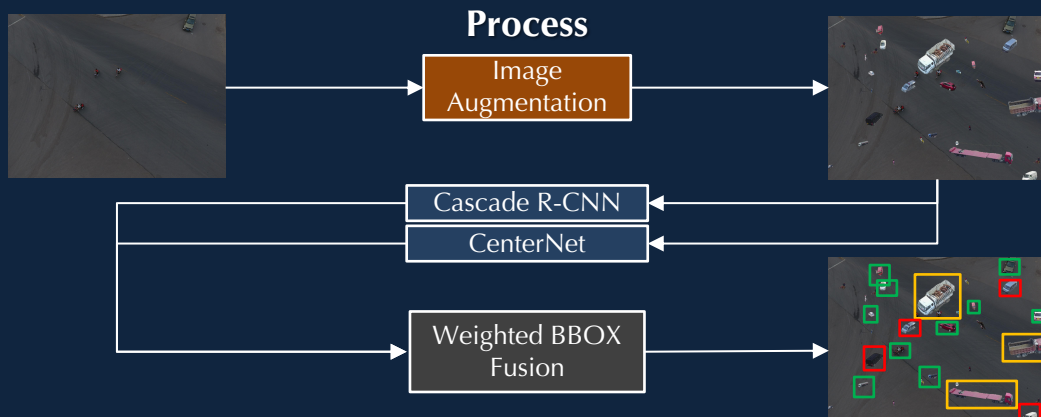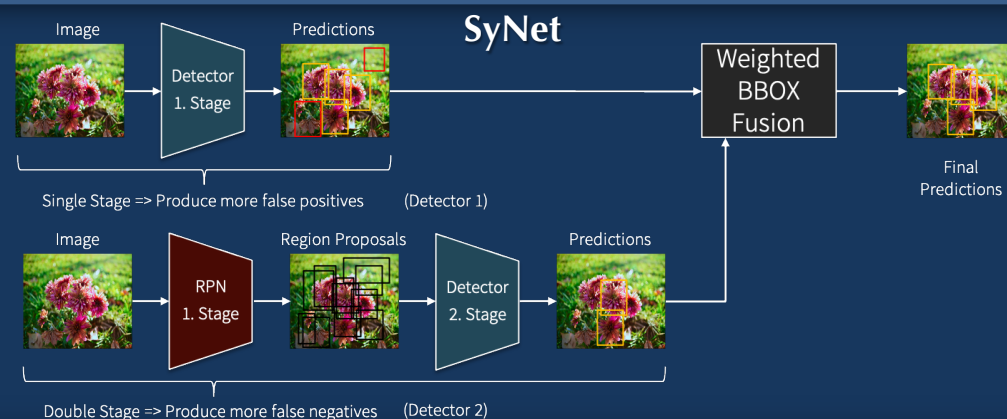# SyNet: An Ensemble Network for Object Detection in UAV Images

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Main Contributions

- A synergistic approach for better object detection in UAV images
  - Combine multiple state-of-the-art detectors
  - Data augmentation to solve class imbalance problem
  - Better detection accuracy
- State-of-the-art performance in VisDrone and MS-COCO
  - VisDrone 2019: 2.5% improvement in mAP over Cascade R-CNN
  - MS COCO Dataset: 3.2% improvement in mAP over Cascade R-CNN

SyNet

Single Stage => Produce more false positives (Detector 1)

Double Stage => Produce more false negatives (Detector 2)

Process

SyNet Architecture

Experimental Results

MS-COCO

	Backbone	mAP_C	$mAP_{0.50}$	$mAP_{0.75}$
SyNet (ours)	ResNet101 + DLA-34	**47.2**	**66.4**	**52.1**
Cascade R-CNN	ResNet101	42.7	61.6	46.6
	ResNet50	40.3	59.4	43.7
CenterNet	Hourglass-104	40.3	59.1	44.0
	DLA-34	37.4	55.1	40.8
Faster R-CNN	ResNet101	38.5	60.3	41.6
	ResNet50	36.4	58.4	39.1
Mask R-CNN	ResNet101	39.4	60.9	43.3
	ResNet50	37.3	59.0	40.2
Retina Net	ResNet101	37.7	57.5	40.4
	ResNet50	35.6	55.5	38.3
Cascade Mask R-CNN	ResNet101	42.6	60.7	46.7
	ResNet50	41.2	59.1	45.1
Hybrid Task Cascade	ResNet101	44.9	63.8	48.7
	ResNet50	43.2	62.1	46.8

VisDrone

	mAP_C	$mAP_{0.50}$	$mAP_{0.75}$
SyNet (ours)	**25.1**	**48.4**	**26.2**
Cascade R-CNN	24.7	43.7	24.3
CenterNet	14.3	26.6	13.1

	SyNet (ours)	Cascade R—CNN	CenterNet
Pedestrian	**48.1**	42.6	22.6
People	**37.8**	33.1	20.6
Bicycle	**23.8**	21.2	14.6
Car	**83.2**	79.8	59.7
Van	**55.4**	49.3	24.0
Truck	**49.3**	43.5	21.3
Tricycle	**34.2**	31.6	20.1
Awning-Tri	**24.2**	21.5	17.4
Bus	**66.0**	61.9	37.9
Motor	**44.8**	43.1	23.7

Quantative Results

Sample 1

Ground Truth

Cascade R-CNN

CenterNet

SyNet

Sample 2

Ground Truth

Cascade R-CNN

CenterNet

SyNet