VOT-ST2020 Winners Presentation

RPT: Learning Point Set Representation for Siamese Visual Tracking

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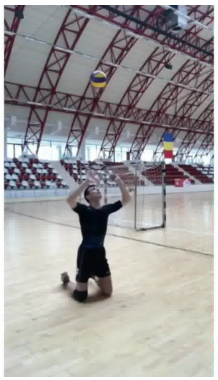
What is Visual Object Tracking?

Given the target region in the initial frame

Locate an arbitrary target of interest during a whole video sequence

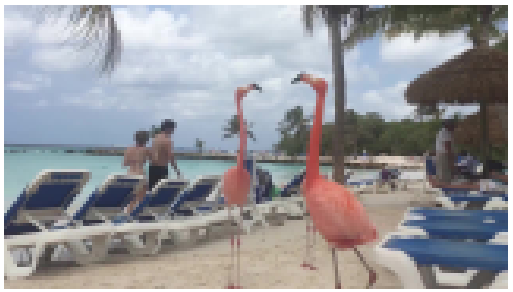
VOT2020 Challenges

Blur

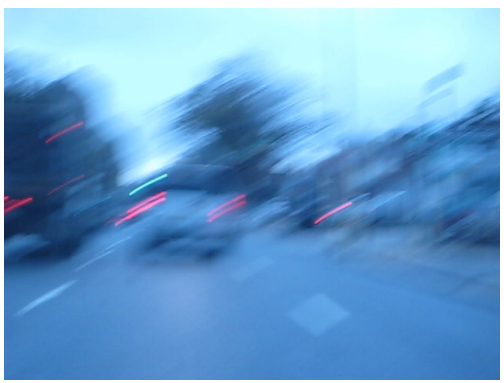


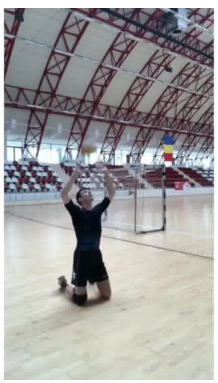
Large Motion

Posture Variations

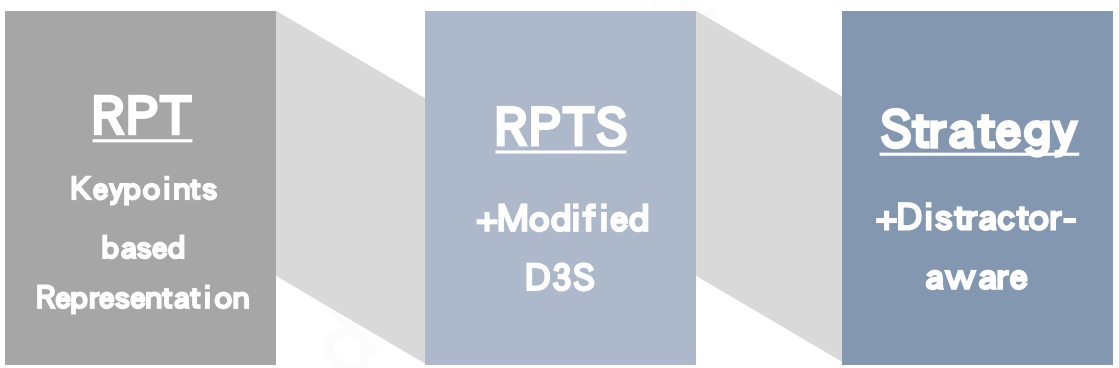


Occlusions



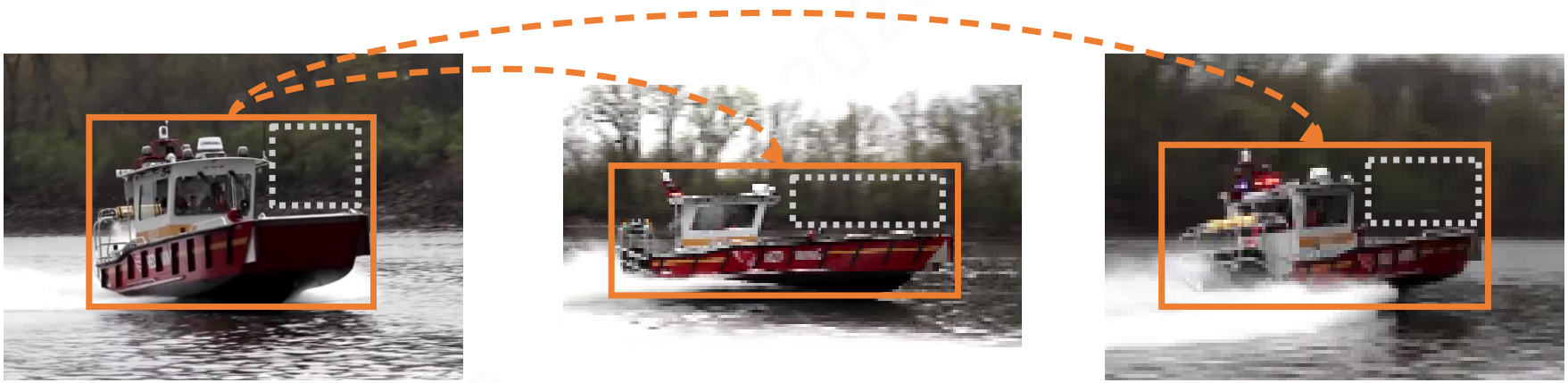


Content


RPT
Keypoints based Representation
RPTS
+Modified D3S
Strategy
+Distractor-aware

Bounding Box Representation

Problem: Redundant background & Geometric transformations



Point Set Representation

● Predicted Point Set ▭ Ground Truth

- ✔ Fine-grained localization
- ✔ Modeling of object appearance

Reppoints: Point set representation for object detection. In ICCV 2019

Point Set Representation

- Target Candidates

Initialization

$$R = \{(x_k, y_k)\}_{k=1}^{n}, x_k = i, y_k = j, k = 1, 2, ..., n$$

Point Set Representation

Target Candidates

Predicted Point Set

Refinement

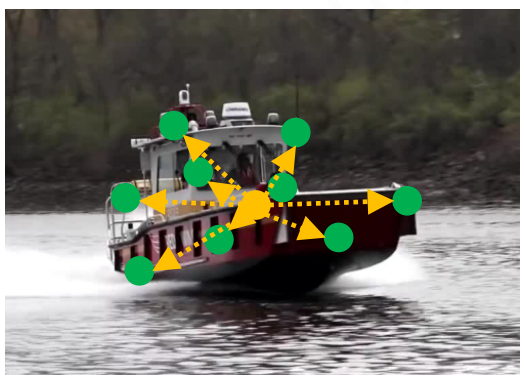
$$R_r = \{(x_k + \Delta x_k, y_k + \Delta y_k)\}_{k=1}^{n}$$

Relative Offsets $\{(\Delta x_k, \Delta y_k)\}_{k=1}^{n}$

Point Set Representation

Target Candidates

Predicted Point Set



Pseudo Box

Supervision

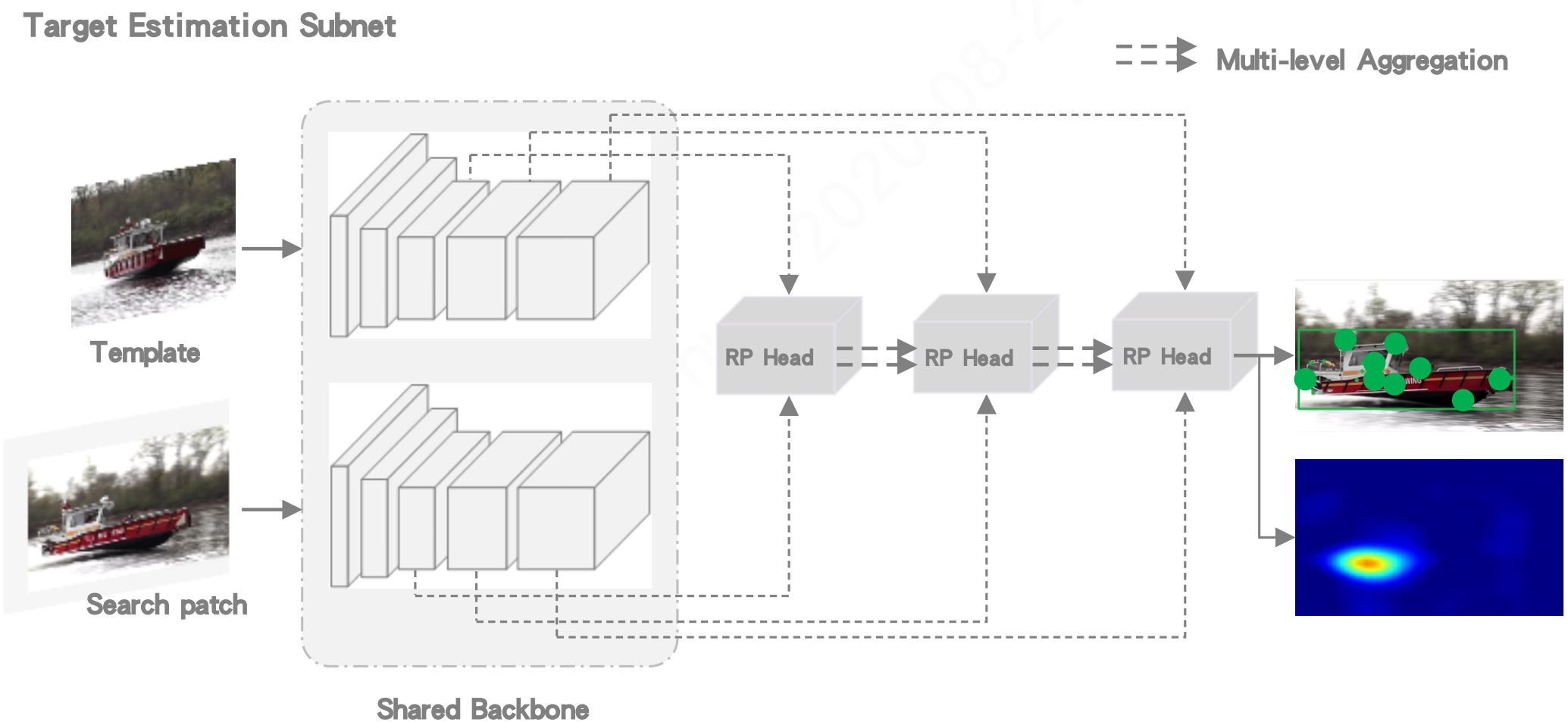
✔ *Pseudo* Box & IOU Loss

$$R_p = (\min\{x_k + \Delta x_k\}, \min\{y_k + \Delta y_k\}, \max\{x_k + \Delta x_k\}, \max\{y_k + \Delta y_k\})$$

Point Set Representation

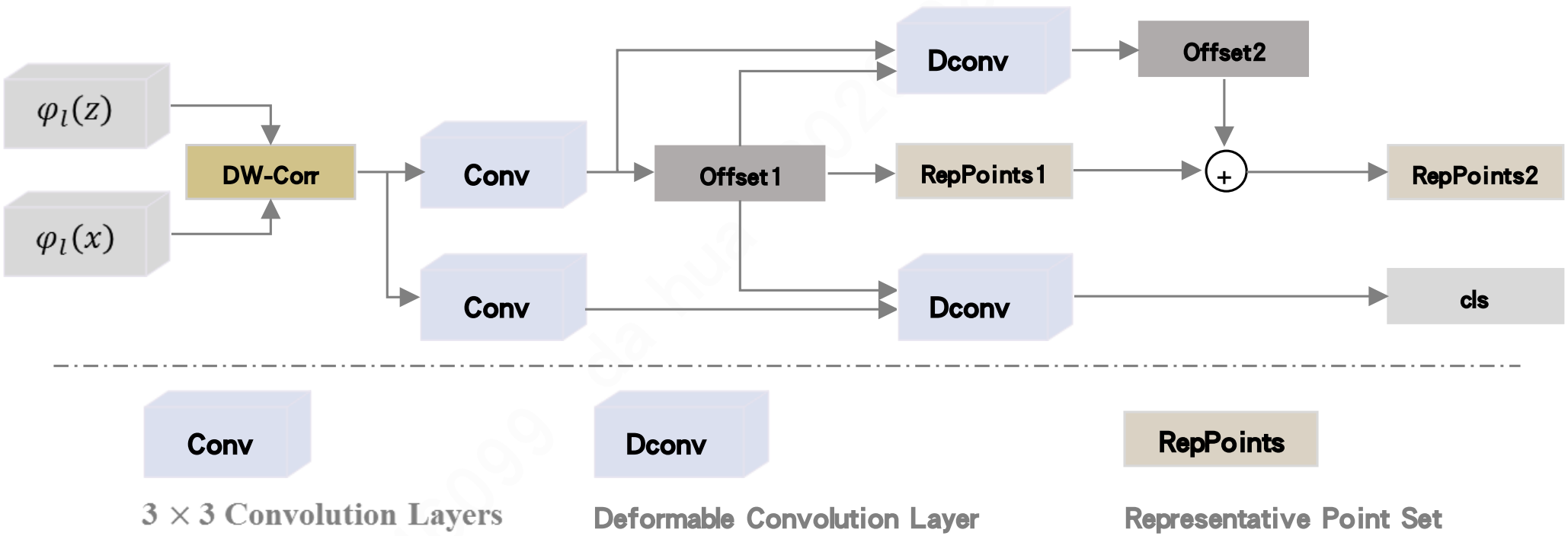
RPT Framework

Target Estimation Subnet



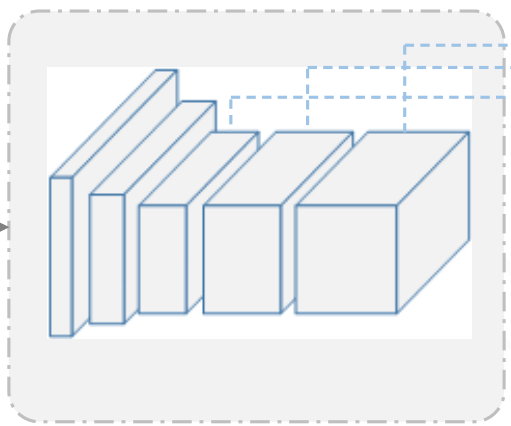
Target Estimation Subnet

RP Head



Online Classification Subnet

Training set



Shared Backbone

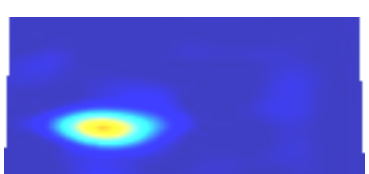
Classifier

Classifier

Classifier

Classification Head Output

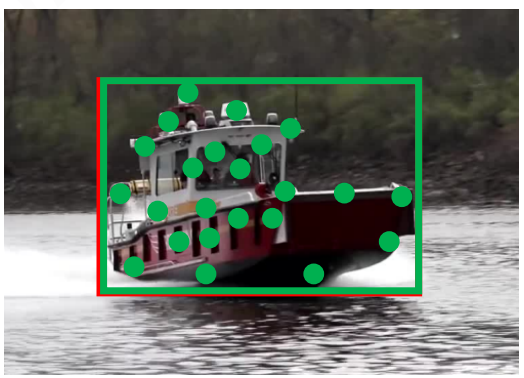
$$f_l = \alpha f^l_{online} + (1-\alpha) f^l_{offline}$$



Multi-level Aggregation

Predicted Point Set and *Pseudo* Box Ground Truth

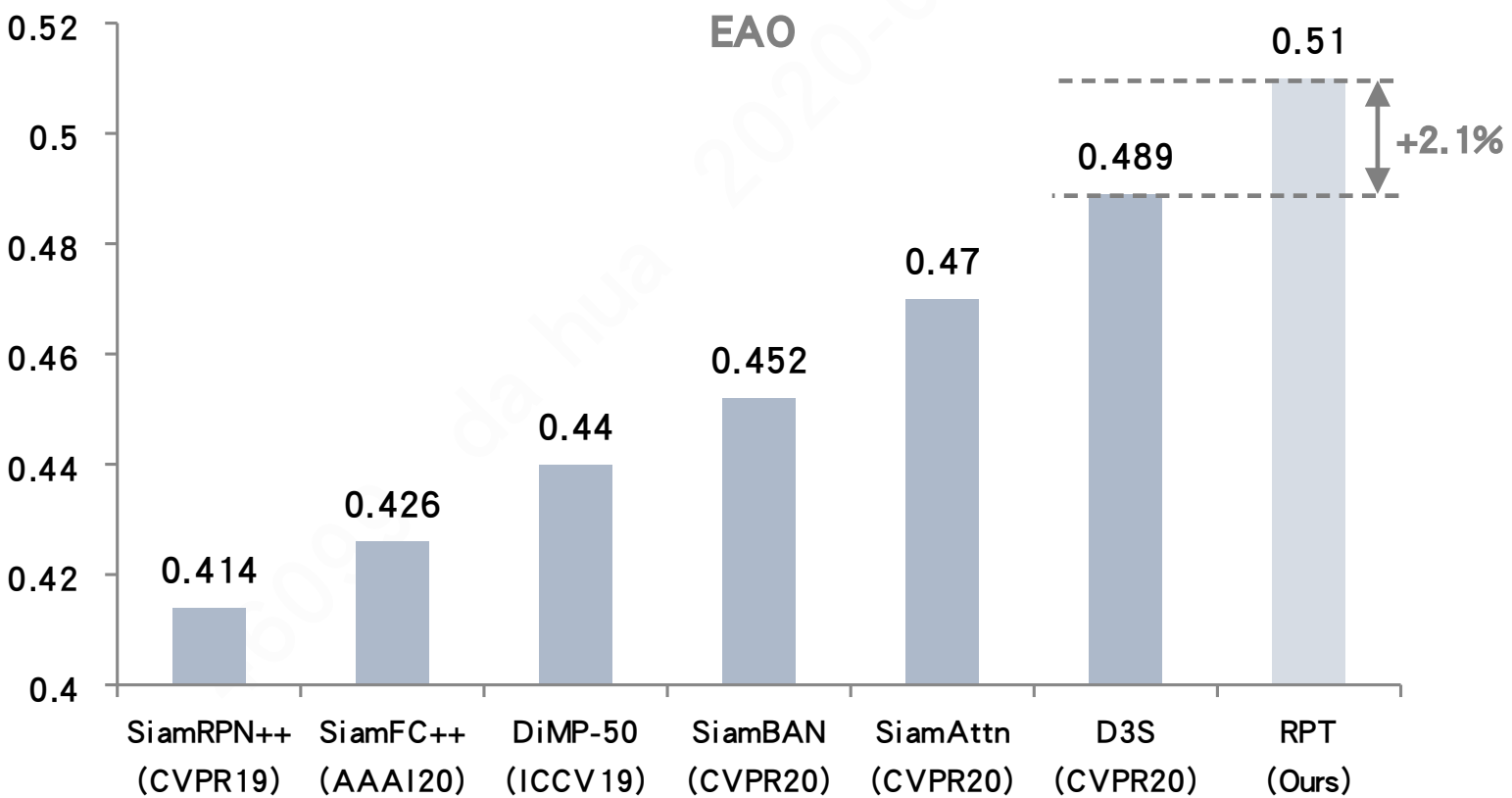
Sparse Point Set



Dense Point Set

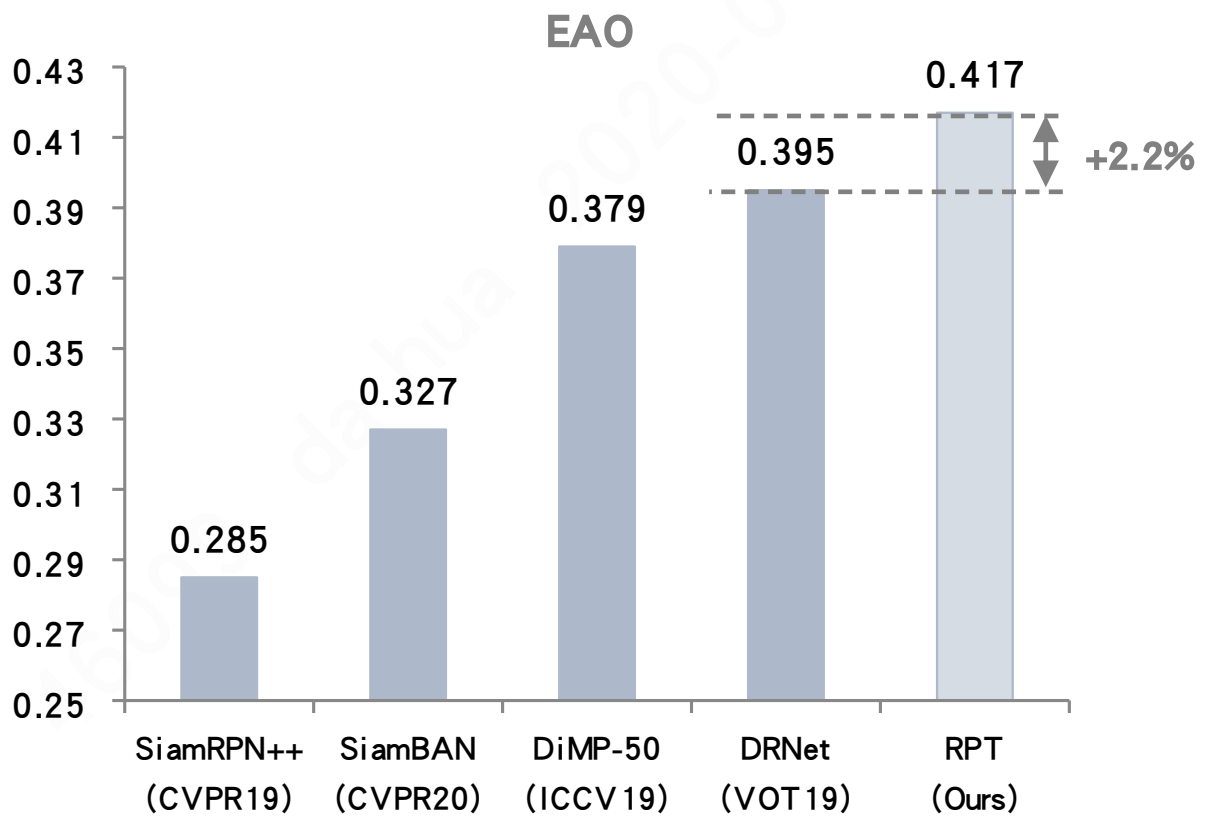
Comparison with SOTA

VOT2018



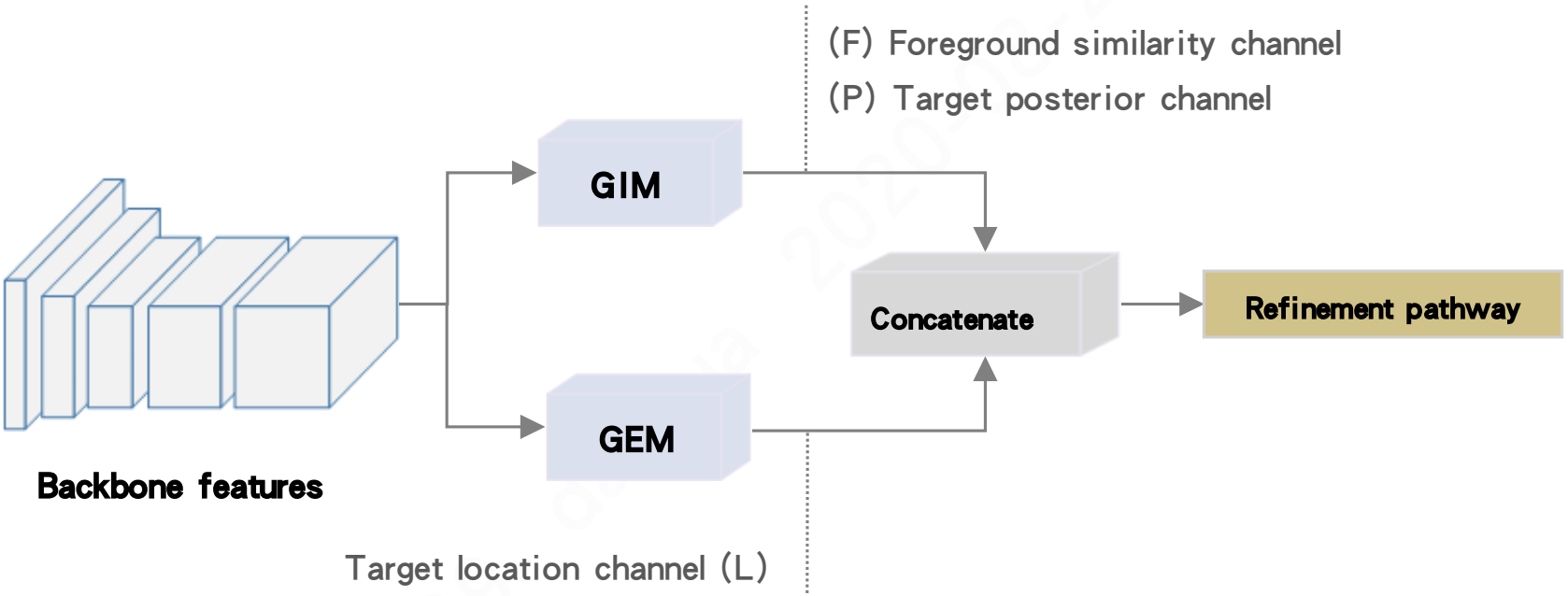
Comparison with SOTA

VOT2019



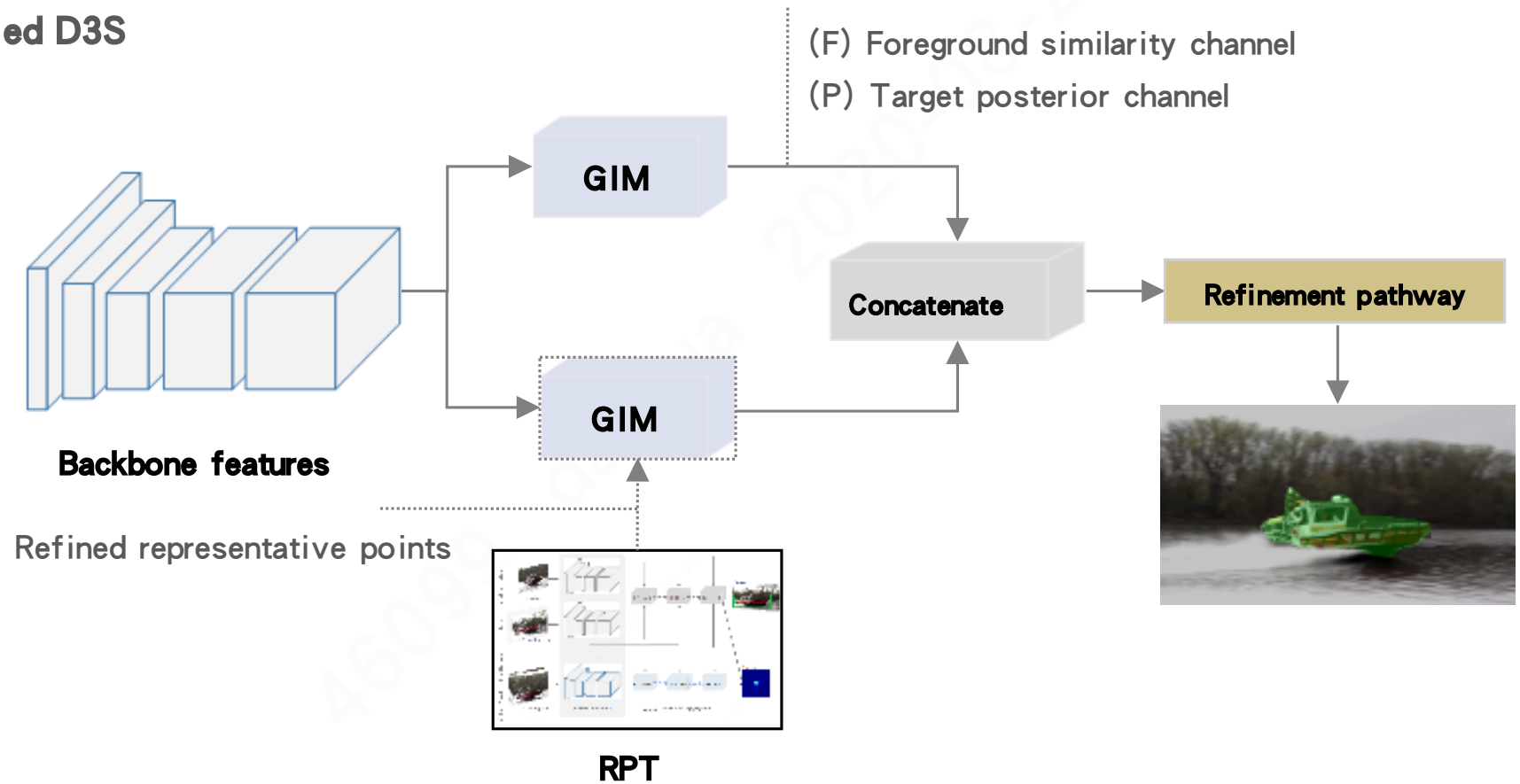
RPTS Framework

D3S

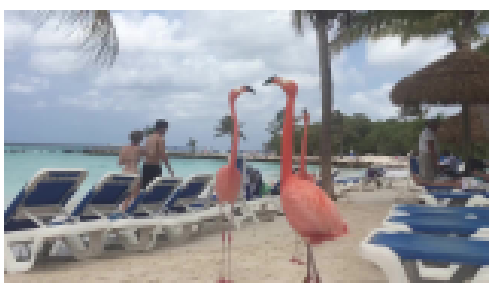


RPTS Framework

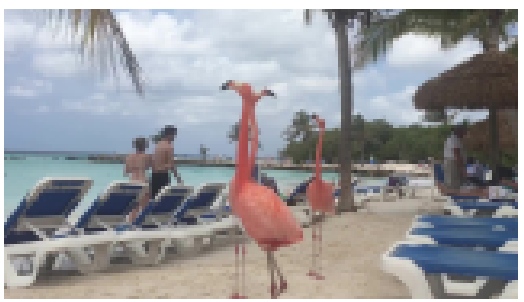
modified D3S



Distractor-aware Strategy








Improvement Details

VOT2020_Public Datasets

	Accuracy	Robustness	EAO
RPT	0.45632	0.79691	0.30817
RPTS (w/ modified D3S)	0.66204	0.86056	0.52556
RPTS (w/ tricks)	0.67949	0.86868	0.53946

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