Long & Short Memory Balancing In Visual Co-tracking using Q-learning

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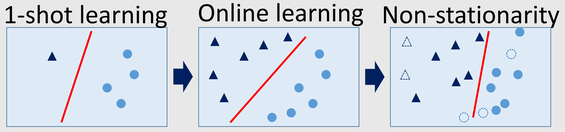
Problem

Visual Tracking



Challenges

Tracking Challenges:

- changes in illumination, camera pose, cluttered background, occlusions, etc.

Tracking-by-Detection Challenges:

- Self-learning Loop
- Label Noise Problem → Model Drift
- Heuristic Labeling
- Stability-Plasticity Dilemma

Active Co-Tracking

What is it?

Two or more classifiers learns from each other ONLY for the samples they have MOST difficulty labeling.

What is the uncertainty signal?

The uncertainty of labeling, either due to ineffectiveness of a feature in that case, being close to boundary, or missing information due to e.g. partial occlusion.

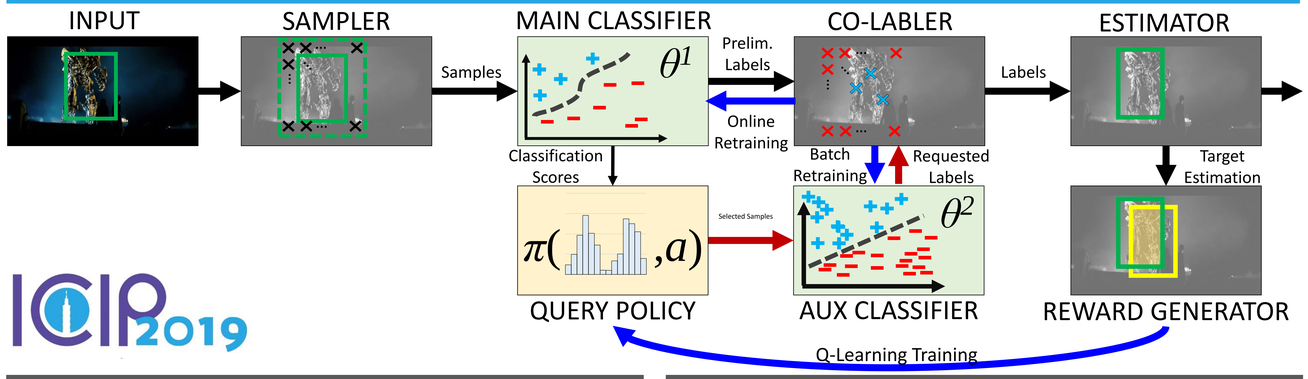
How the uncertainty signal is used?

Classifier "imports" the label from the collaborator if this signal appears, and then updates its model based on it.

What is the outcome?

Increase Accuracy (by Exchanging Information)
Break the Self-learning Loop
Increase the speed (using active learning)
Promote generalization (by exploiting uncertainty)
Increase robustness (by reducing label noise)

Q-Learning for Tuning Active Co-Tracker



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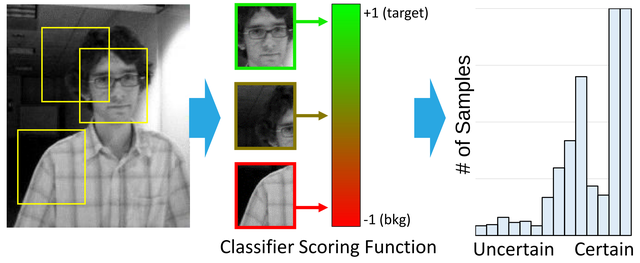
Histogram of Uncertainty

Novel way to express the internal state of a classifier

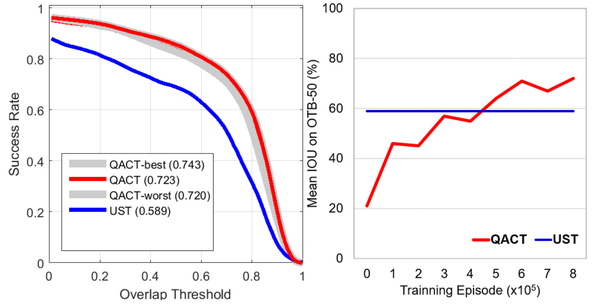


Memory Balancing

	Long term memory	Short term memory
Generalization	Low	High, forgetful
Speed	Slower	Faster
Robustness	Robust against outliers	Agile, detail-oriented
Stability	Stable boundary	Plastic boundary
Exploration	Exploiting	Exploring
Meaning of Uncertainty	**Novel target appearance**	**Lack of information**

Training

YouTube BB: data set consists of approx. 380,000 15-20s video segments, bounding boxes at 1 frame per second



Acknowledgement & References

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2. Meshgi et al., "Efficient diverse ensemble for discriminative co-tracking," in CVPR'18.
3. Dong et al., "Hyperparameter optimization for tracking with continuous deep qlearning," in CVPR'18.
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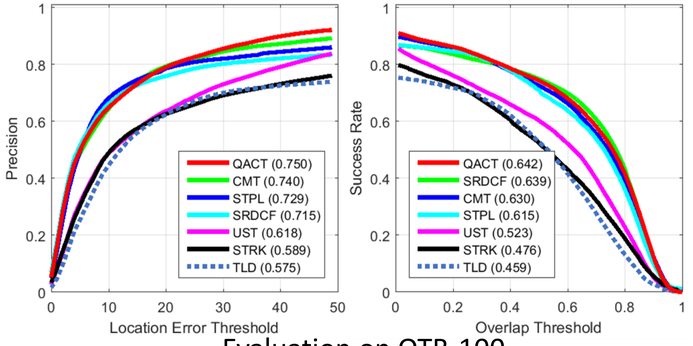
Results



Evaluation on OTB-100

Attribute	KNN+	SVM+	TLD	STRK	UST	MEEM	MSTR	QACT
IV	24.1	39.9	47.8	53.0	58.5	62.3	72.6	72.6
SV	23.0	42.4	49.1	50.7	58.8	58.3	70.6	72.3
IPR	25.3	44.4	50.4	53.7	61.9	57.7	68.5	73.4
OPR	25.8	43.1	47.8	53.2	59.7	62.1	70.2	70.4
DEF	28.9	41.0	38.2	51.3	55.9	61.9	68.9	66.1
OCC	23.5	39.9	46.1	50.2	58.6	60.8	71.0	71.7
OV	27.7	52.0	53.5	51.5	56.9	68.5	73.3	71.1
LR	13.3	13.6	36.2	33.3	33.1	43.5	50.2	56.0
BC	30.7	40.0	39.4	51.5	48.0	67.0	71.7	71.1
FM	23.0	43.2	44.6	52.0	53.4	64.6	65.0	64.3
MB	22.9	35.0	41.0	46.7	45.2	62.8	65.2	65.6
ALL	27.8	43.5	49.3	54.8	58.9	61.7	71.8	72.3
FPS	76.6	3.8	21.2	11.3	28.3	14.2	8.3	27.1

Attribute Evaluation on OTB-50