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

Kourosh Meshgi, Maryam Sadat Mirzaei, Shigeyuki Oba {kourosh.meshgi, maryam.mirzaei@riken.jp}

RIKEN AIP / Kyoto University, Japan

Problem

Visual Tracking

- 1-shot learning
- Online learning
- Non-stationarity

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 learn 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

INPUT → SAMPLER → MAIN CLASSIFIER → CO-LABLER → ESTIMATOR

Histogram of Uncertainty

Novel way to express the internal state of a classifier

Memory Balancing

Long term memory

- Generalization
- Speed
- Robustness
- Stability
- Exploration
- Meaning of Uncertainty

- Low
- Slower
- Robust against outliers
- Stable boundary
- Exploiting
- Novel target appearance

Short term memory

- High, forgetful
- Faster
- Agile, detail-oriented
- Plastic boundary
- Exploring
- Lack of information

Results

Evaluation on OTB-100

Attribute Evaluation on OTB-50

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Acknowledgement & References

4. Lewis & Gale, “A sequential algorithm for training text classifiers,” in ACM SIGIR’94.