Deep Self-taught Learning for Weakly Supervised Object Localization

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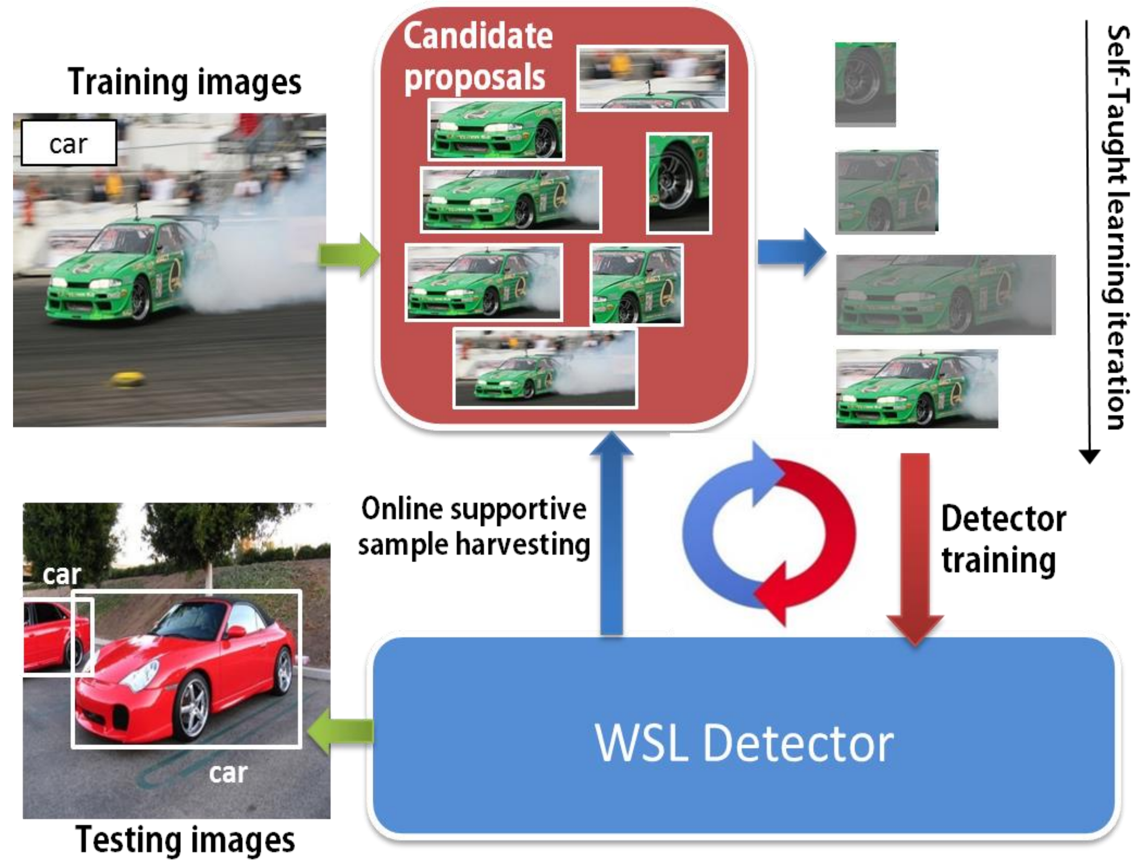
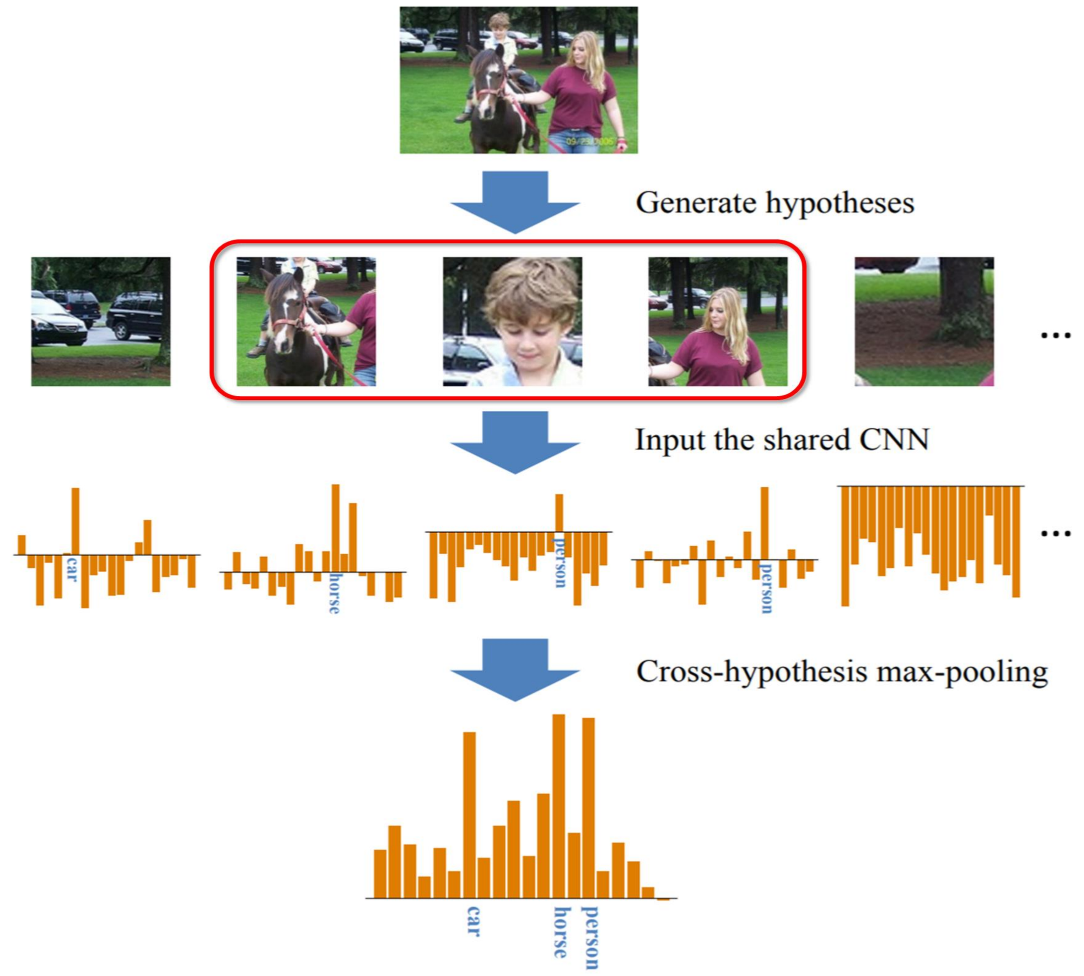
Overview

This paper proposed a deep self-taught learning approach, allowing the detector learn the strong object-level features reliable for acquiring tight positive bounding box samples and afterwards re-train itself based on them.

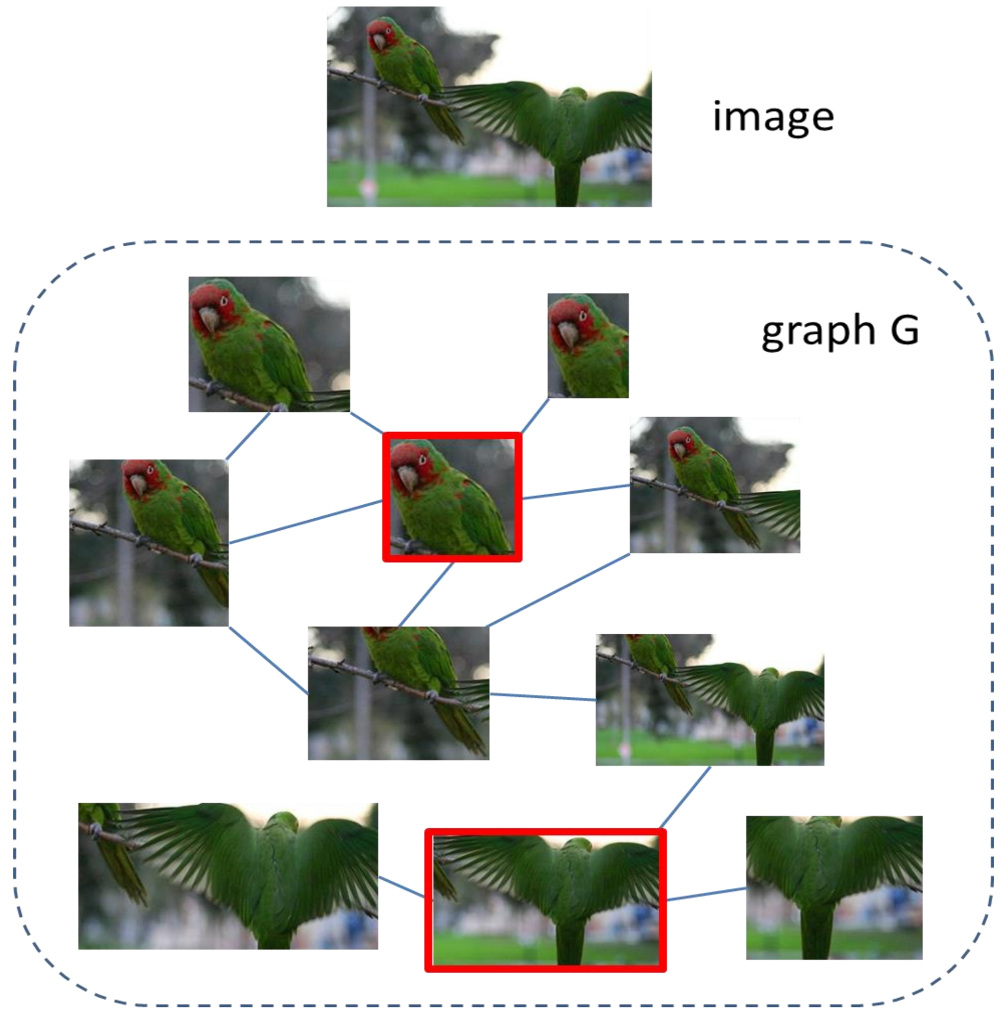


Seed Sample Acquisition

1. Hypothesis-CNN-Pooling (HCP) to obtain high-quality positive proposals with image-level annotations, achieving image-to-object transferring.



2. Dense Subgraph Discovery (DSD) to mine the most confident class-specific proposals among the spatially highly correlated proposals. Iterative pruning of the graph to get the most dense nodes.



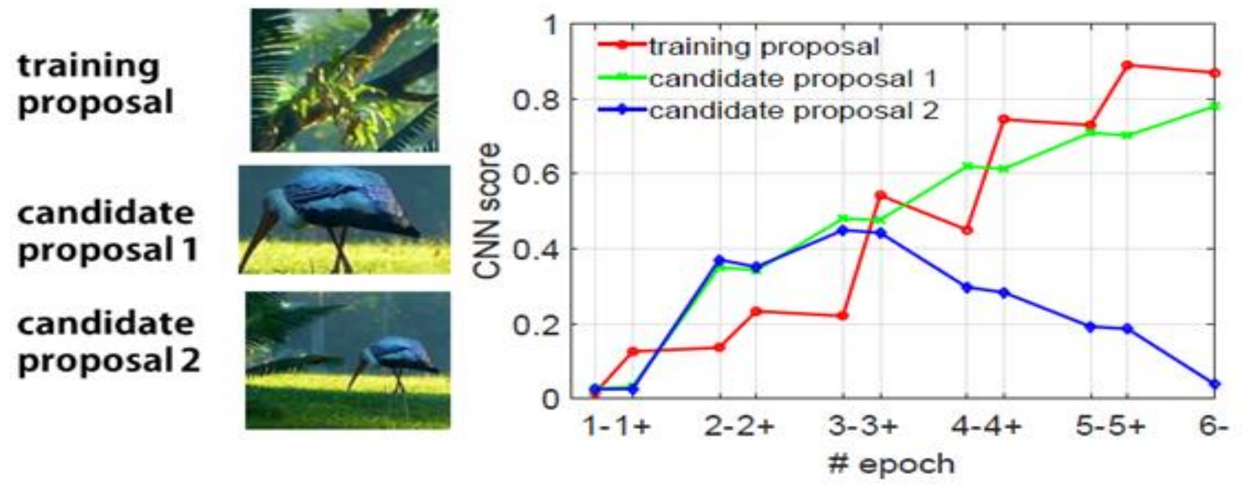
Mined most confident positive proposals

Online Supportive Sample Harvesting

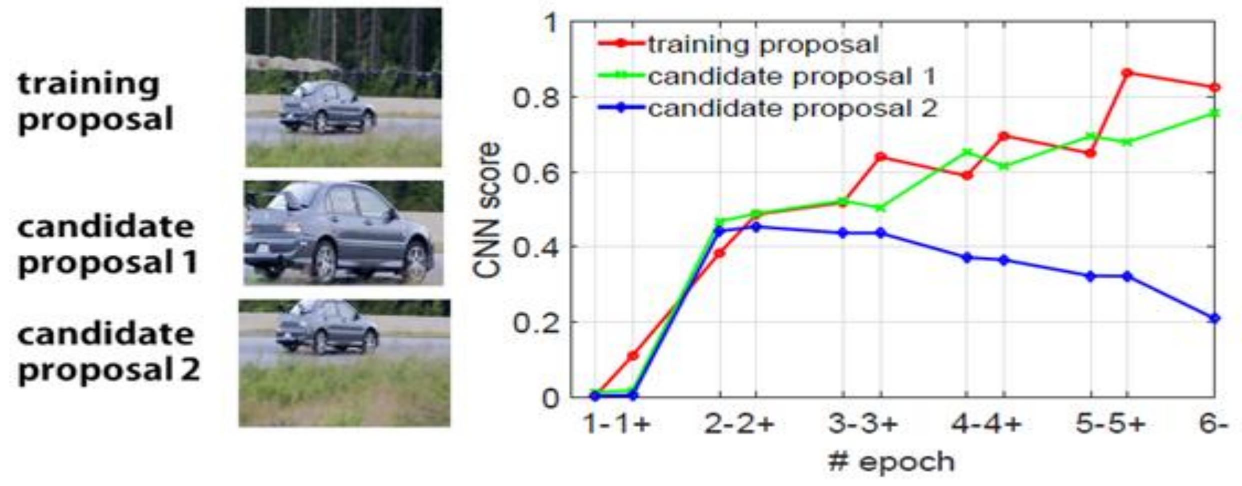
Progressively harvest the high-quality positive samples by the online alternating between detector training and positive sample re-localization.

However, the detector is easily trapped in poor local optima caused by poor initial seeds due to its stronger fitting capacity. A novel Relative Improvement (RI) metric is used for identifying the true high-quality positives. B_i^{t+1} is the score of i^{th}proposal before being trained at $(t+1)^{th}$ epoch, A_i^t is the score of it after being trained at t^{th} epoch.

$$P_{t+1}^* = \arg\max_i (B_i^{t+1} - A_i^t)$$



Example (a)



Example (b)

Results

Detection mAP comparisons with state-of-the-art methods:

VOC 07 testing set

method	mAP
Cinbis *et al.*	27.4
Song *et al.*	22.7
Bilen *et al.*	27.7
Wang *et al.*	31.6
Kantorov *et al.*	36.3
Li *et al.*	39.5
HCP	26.7
HCP+DSD	29.6
HCP+DSD+OSSH1	38.8
HCP+DSD+OSSH2	40.2
HCP+DSD+OSSH3	40.8
HCP+DSD+OSSH3+NR	41.7
HCP+DSD+OSSH3+NR (07+12)	43.7

VOC 12 testing set

method	mAP
Kantorov *et al.*	35.3
HCP+DSD+OSSH3+NR	38.3
HCP+DSD+OSSH3+NR (07+12)	39.4