Good Practices for Learning Video Concept Detectors from Social Media
Semantic Indexing with No Annotations Task

SVETLANA KORDUMOVA, XIRONG LI, CEES G.M. SNOEK

ACKNOWLEDGEMENT

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LEARN DETECTORS FROM SOCIAL MEDIA

The potential of harvesting training data from the web was recognized by many

**Research Question 1:**

What visual tagging source is most suited for selecting training examples for learning video concept detectors?
Not all images tagged with Car contain a car

POSITIVE EXAMPLES

X. Li et al. TMM 2009
D. Liu et al. WWW 2009
S. Zhu et al. TMM 2012
POSITIVE EXAMPLES

X. Li et al. TMM 2009
D. Liu et al. WWW 2009
S. Zhu et al. TMM 2012

Only ranking
No selection

POSITIVE EXAMPLES

Ulges et al. CIVR ’08
Cross validate different selections

\[ r=0, s=30.654 \]
\[ r=1, s=21.042 \]
\[ r=2, s=13.022 \]
\[ r=3, s=8.751 \]
\[ r=n-1, s=0.031 \]
\[ r=n-2, s=0.078 \]
POSITIVE EXAMPLES

Ulges et al. CIVR ’08
Cross validate different selections

$r=0$, $s=30.654$
$r=1$, $s=21.042$
$r=2$, $s=13.022$
$r=3$, $s=8.751$

$r=n-2$, $s=0.078$
$r=n-1$, $s=0.031$

Comes with the expense of manually annotated validation set

POSITIVE EXAMPLES

Calculate cut-off
We introduce a binary random variable $y$

$y=1$ means visual example $x$ is positive and 0 otherwise

Bayesian decision:

- $x$ is selected, if $\frac{p(y=1|x)}{p(y=0|x)} > 1$
- unselected, otherwise

Kordumova et al. CBMI 2013
POSITIVE EXAMPLES

Research Question 2:
What strategy should be used for selecting positive examples from tagged sources when learning video concept detectors?

NEGATIVE EXAMPLES

Common strategy
Random selection of images or videos not tagged with the concept name

A. Ulges et al. ICVS 2008
A. Setz et al. ICME 2009
S. Zhu et al. TMM 2012
G. Li et al. ICMR 2011
A. Ulges et al. ICMR 2012
NEGATIVE EXAMPLES

Li et al. TMM 2013 – Negative bootstrap

Inspired by R. Yan et al. MM 2003 – Pseudo negative
NEGATIVE EXAMPLES

Research Question 3:
What strategy should be used for selecting negative examples from tagged sources when learning video concept detectors?

EXPERIMENTS

Experiment 1. What source?
1. Tagged Images
2. Tagged Videos

Experiment 2. What positive examples?
1. Random
2. Relevant ad-hoc
3. Relevant cut-off

Experiment 3. What negative examples?
1. Random
2. Pseudo negative
3. Negative bootstrap
SYSTEM OVERVIEW

RESULTS EXPERIMENT 1

<table>
<thead>
<tr>
<th>Concept</th>
<th>Tagged Videos</th>
<th>Tagged Images</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animal</td>
<td>0.078</td>
<td>0.122</td>
</tr>
<tr>
<td>Beach</td>
<td>0.158</td>
<td>0.359</td>
</tr>
<tr>
<td>Building</td>
<td>0.334</td>
<td>0.500</td>
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<tr>
<td>Car</td>
<td>0.157</td>
<td>0.230</td>
</tr>
<tr>
<td>Child</td>
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<td>0.118</td>
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<tr>
<td>City</td>
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<td>Face</td>
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<td>Hand</td>
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<td>0.048</td>
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<td>0.481</td>
</tr>
<tr>
<td>Outdoor</td>
<td>0.816</td>
<td>0.722</td>
</tr>
<tr>
<td>Plant</td>
<td>0.188</td>
<td>0.270</td>
</tr>
<tr>
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Tagged Images are better source for 19 out of 20 concepts, and 16% better in terms of overall MAP.
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Tagged Images are better source for 19 out of 20 concepts, and 16% better in terms of overall MAP.

Good practice 1.
Tagged Images are a better source compared to Tagged Videos for learning video concept detectors.

RESULTS EXPERIMENT 2

![Graph showing Mean Average Precision vs Fraction selected]
Results Experiment 2

Good practice 2:
For learning video concept detectors from social media, as positive examples use relevant cut-off selection of tagged images.
RESULTS EXPERIMENT 3

Good practice 3:
For learning video concept detectors from social media, use bootstrapping of relevant negatives from tagged images
RESULTS EXPERIMENT 3

TRECVID 2013 SIN NO ANNOTATION

Three good practices
1. Tagged images as a source
2. Relevant cut-off for positive examples from tagged images
3. Negative bootstrap of tagged images

Implementation details
Multi-frame
Densely sampling with SIFT, RGB-SIFT and T-SIFT descriptors
Fisher vector coding with codebook size 1024
Spatial pyramid 1x1+1x3
Linear Kernel SVM

Types
Type E: Automatically generated queries using Wikipedia anchor text and titles of redirect pages
Type F: Manually created queries
Good practice 1.
Tagged images are a better source then tagged videos for learning video concept detectors.

Good practice 2.
Positive examples with relevant cut-off of tagged images show best performance.

Good practice 3.
Relevant negatives are best selected with negative bootstrap of tagged images.