The only valid measurement of code quality: WTFs/minute

Good code.

Bad code.
Fixing WTFs - Detecting Image Matches caused by Watermarks, Timestamps, and Frames in Internet Photos

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Overview

• Many Computer Vision Applications use Internet photos, e.g.
  • **Image Retrieval**, **Image Clustering** and **Structure from Motion**
  • Internet photos increasingly contain Watermarks, Timestamps, or Frames (**WTFs**) that harm these applications.

• We propose a **simple**, **effective** and **fast** method to detect WTFs during matching.
• Code and dataset are **publicly available** at: tiny.cc/wtf
Fixing WTFs

WTFs in Image Matching
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Invalid matches
Fixing WTFs

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WTFs in Image Retrieval

Query Image
Fixing WTFs

WTFs in Image Retrieval

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Query Image

Results
Fixing WTFs

WTFs in Image Retrieval

Query Image

Results

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WTFs in Image Clustering

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**WTFs in Image Clustering**

Pseudo-Clusters
Fixing WTFs

Method
Fixing WTFs

Method

Key assumptions:
WTFs have similar appearance and occur in certain image positions.
Fixing WTFs

Method

Key assumptions:
WTFs have similar appearance and occur in certain image positions.

Input Image Pair with feature matches
Fixing WTFs

Method

Key assumptions:
WTFs have **similar appearance** and occur **in certain image positions**.

Input Image Pair with feature matches  

![Input Image Pair](image)

Similarity Map

![Similarity Map](image)
Fixing WTFs

Method

Key assumptions:
WTFs have *similar appearance* and occur *in certain image positions*.

Input Image Pair with feature matches → Similarity Map → Spatial Histogram
Fixing WTFs

Method

Key assumptions:
WTFs have **similar appearance** and occur in certain image positions.

Input Image Pair with feature matches → Similarity Map → Spatial Histogram → Classifier Decision → “WTF”
Fixing WTFs

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Dataset

- **36,240** image pairs from Flickr and Panoramio
- **10%** WTFs, **90%** non-WTFs
- Publicly available at: [tiny.cc/wtf](http://tiny.cc/wtf)

Figure 6: Example image pairs from our dataset. Left: non-WTFs, right: WTFs. Some WTFs are only visible when zooming into the PDF version. We will make the dataset available upon publication.
Results

3% False-positive rate @ 99% True positive rate

- **Our Method**: (0.03 f99, 0.998 AUC)
- **GPS**: (0.96 f99, 0.499 AUC)
- **GPS+Heuristic**: (0.96 f99, 0.865 AUC)
Clustering results

Clusters with multiple objects were split.
Fixing WTFs

Clustering results

Pseudo-clusters were removed.
Clustering results

Polluted clusters were cleaned.
Conclusion

• WTF matches harm many vision applications.
• We propose a **simple, fast and effective** detector for them.
• Our code is **open source** and **easy to integrate**: [tiny.cc/wtf](http://tiny.cc/wtf)
Come visit us at poster 26!

Get the code and dataset at [tiny.cc/wtf](http://tiny.cc/wtf)