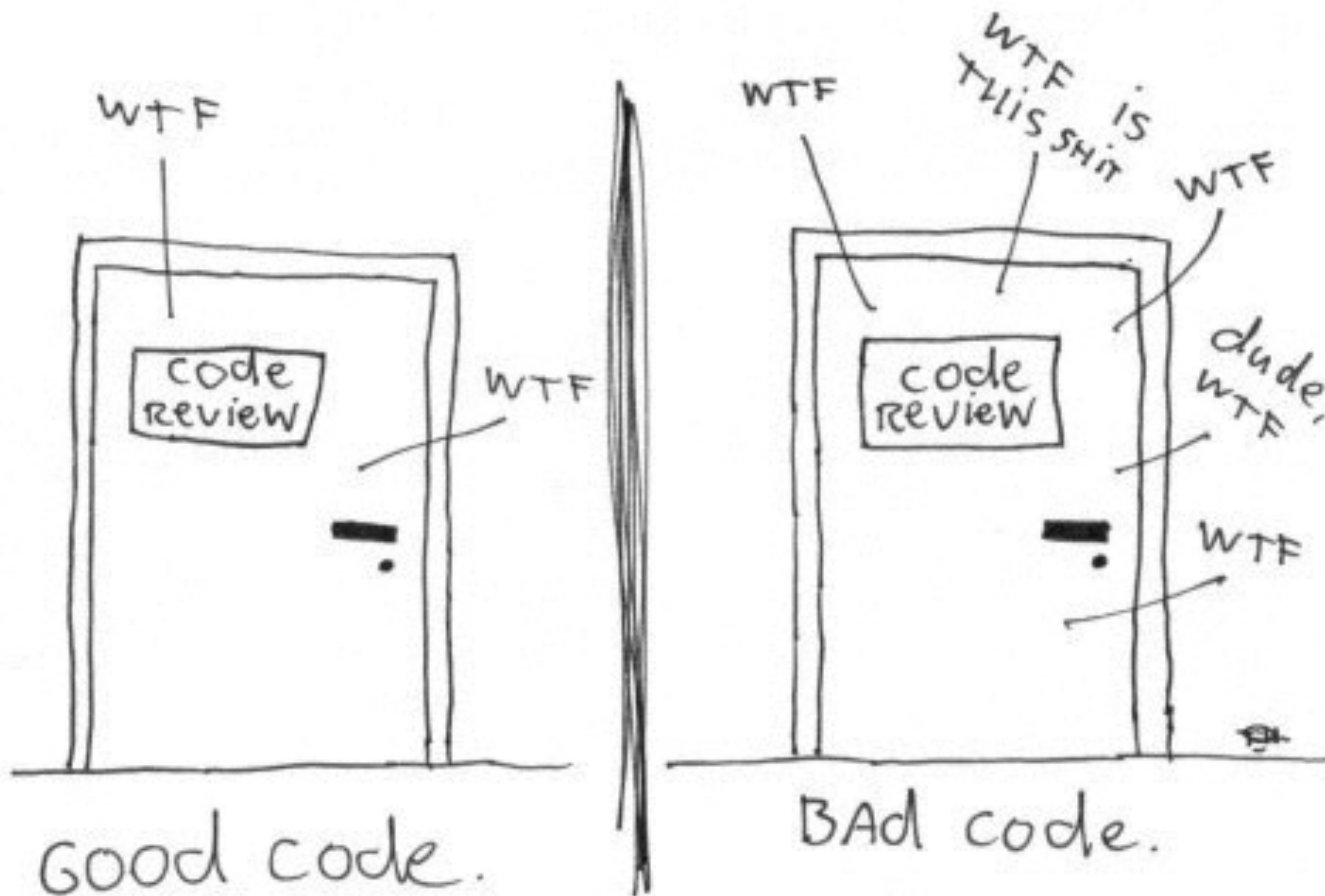


The ONLY VALID MEASUREMENT
OF Code QUALITY: WTFs/minute



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

Tobias Weyand, Chih-Yun Tsai, Bastian Leibe



ASdesign
Pictures 08



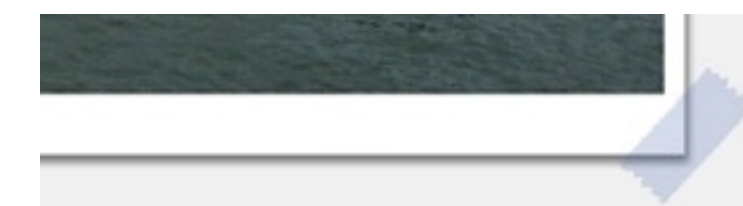
TOLOPROF
Lloyd Gross
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16/10/2007



02 25 2004



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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

WTFs in Image Matching



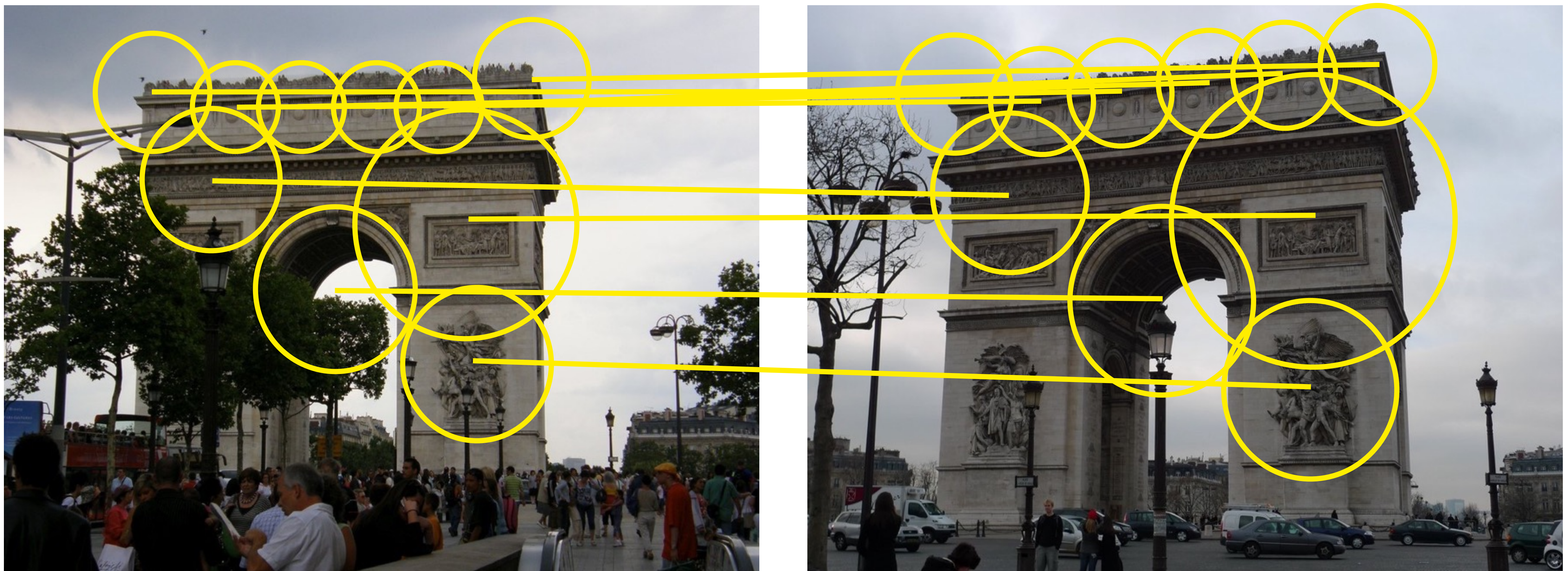
WTFs in Image Matching

Invalid matches



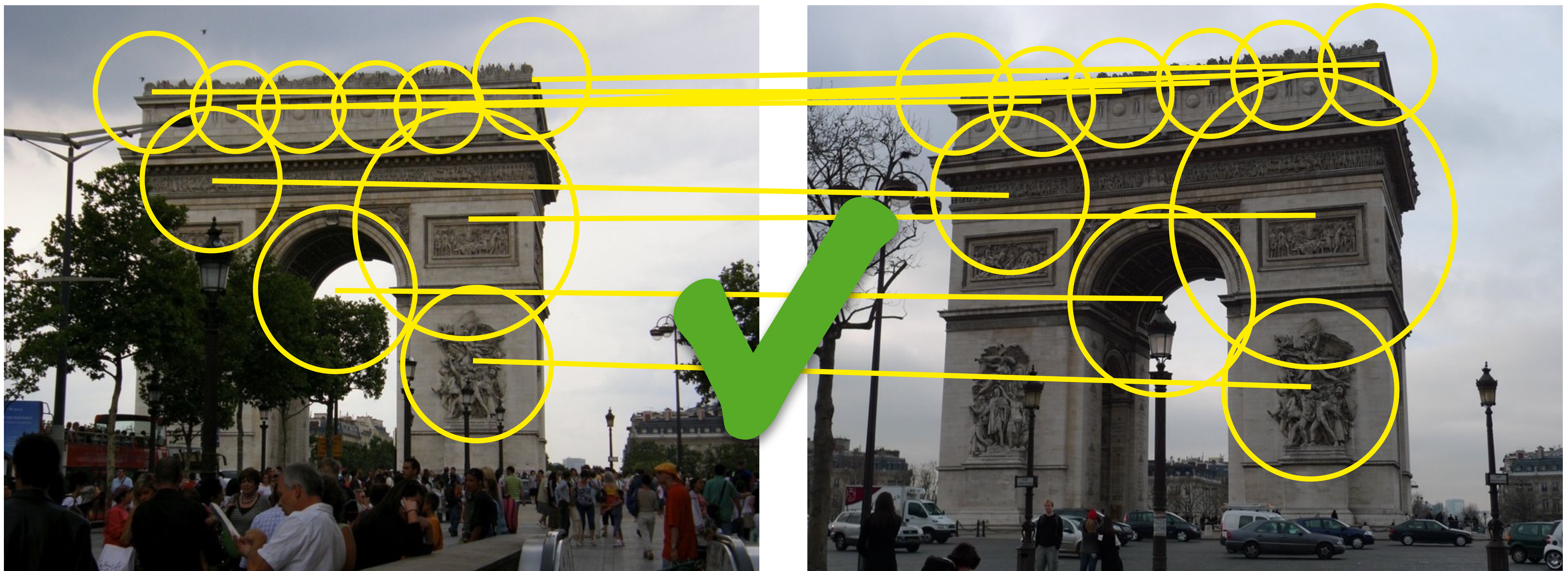
WTFs in Image Matching

Invalid matches

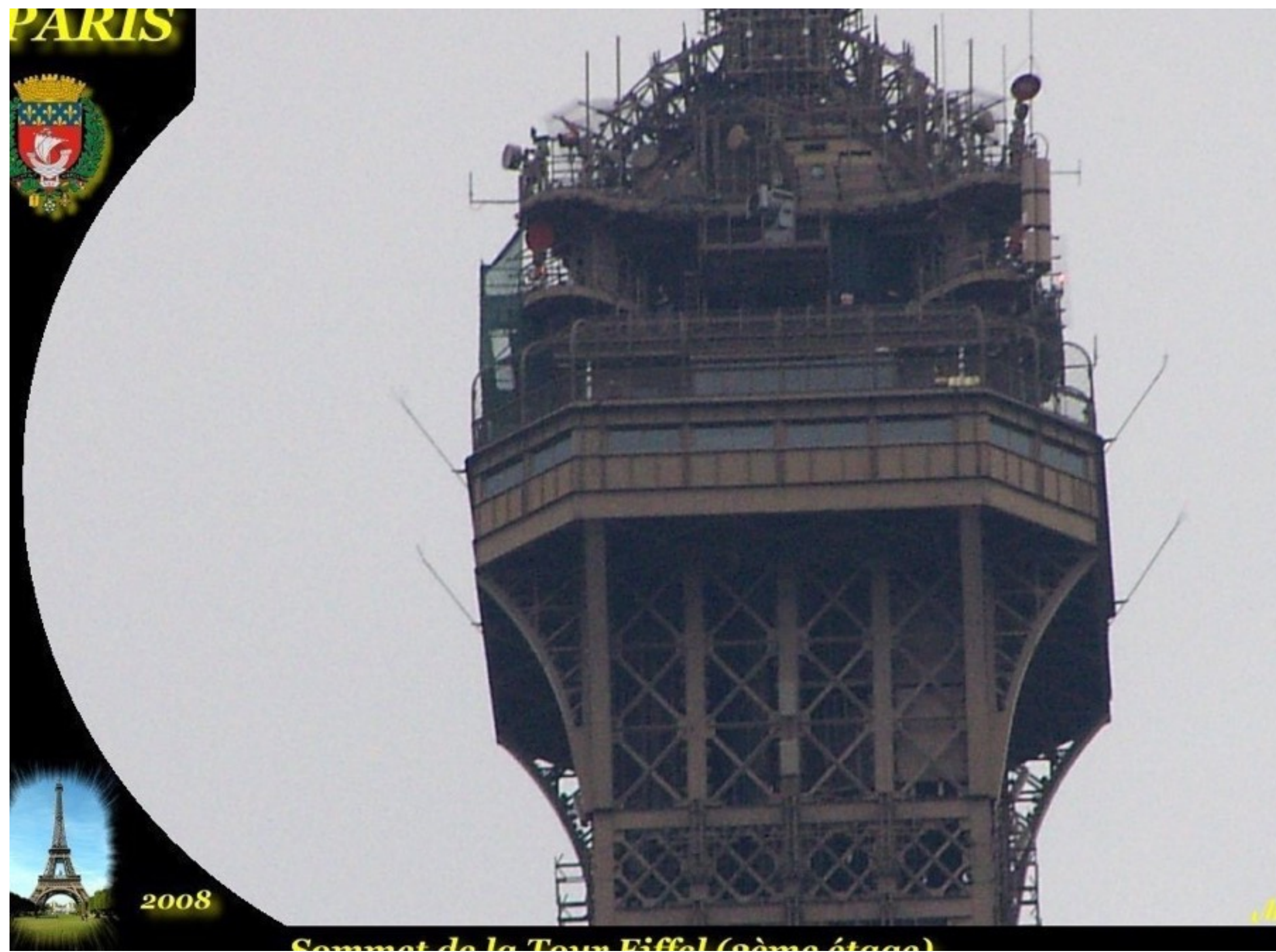


WTFs in Image Matching

Invalid matches

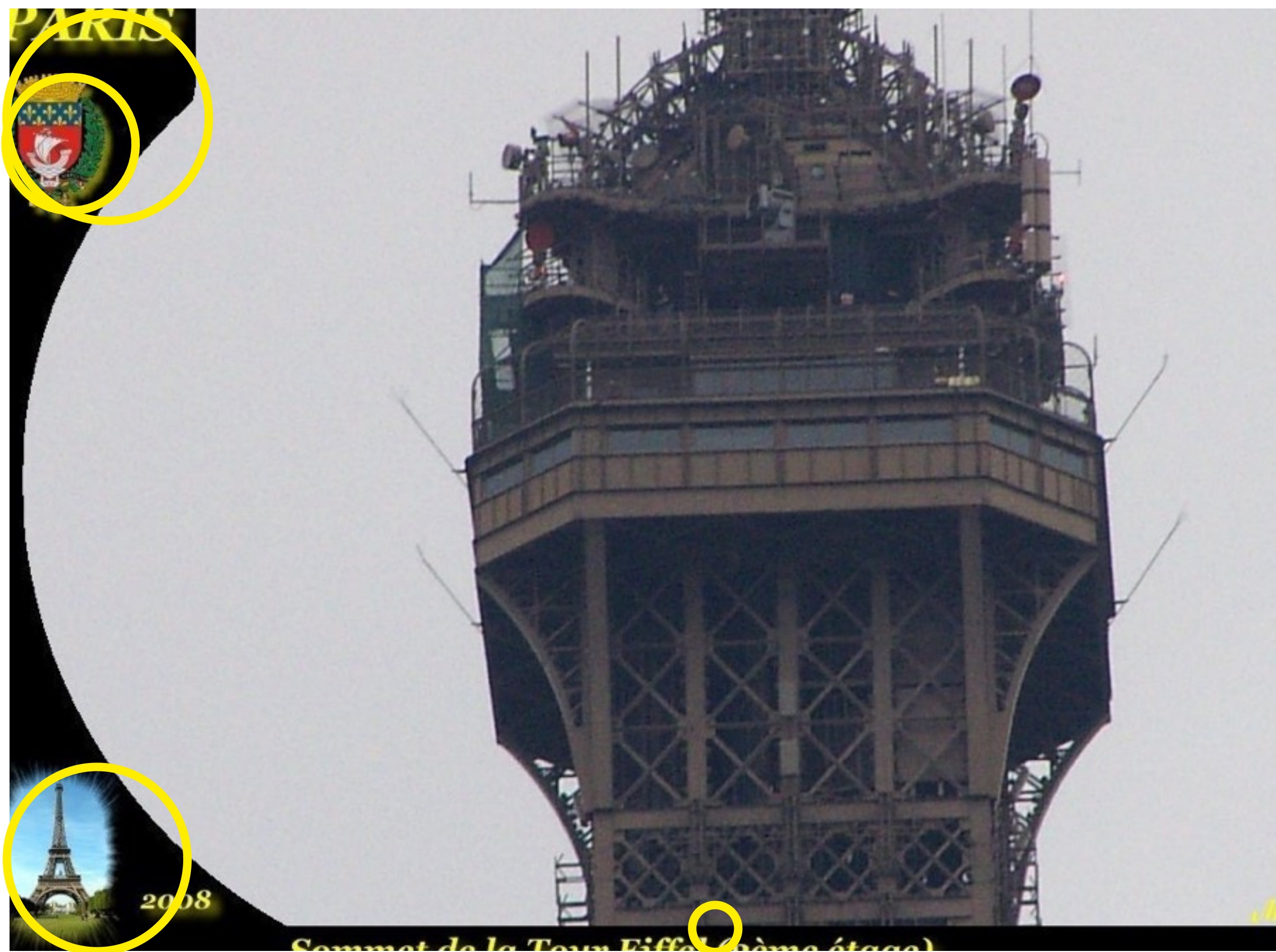


WTFs in Image Matching



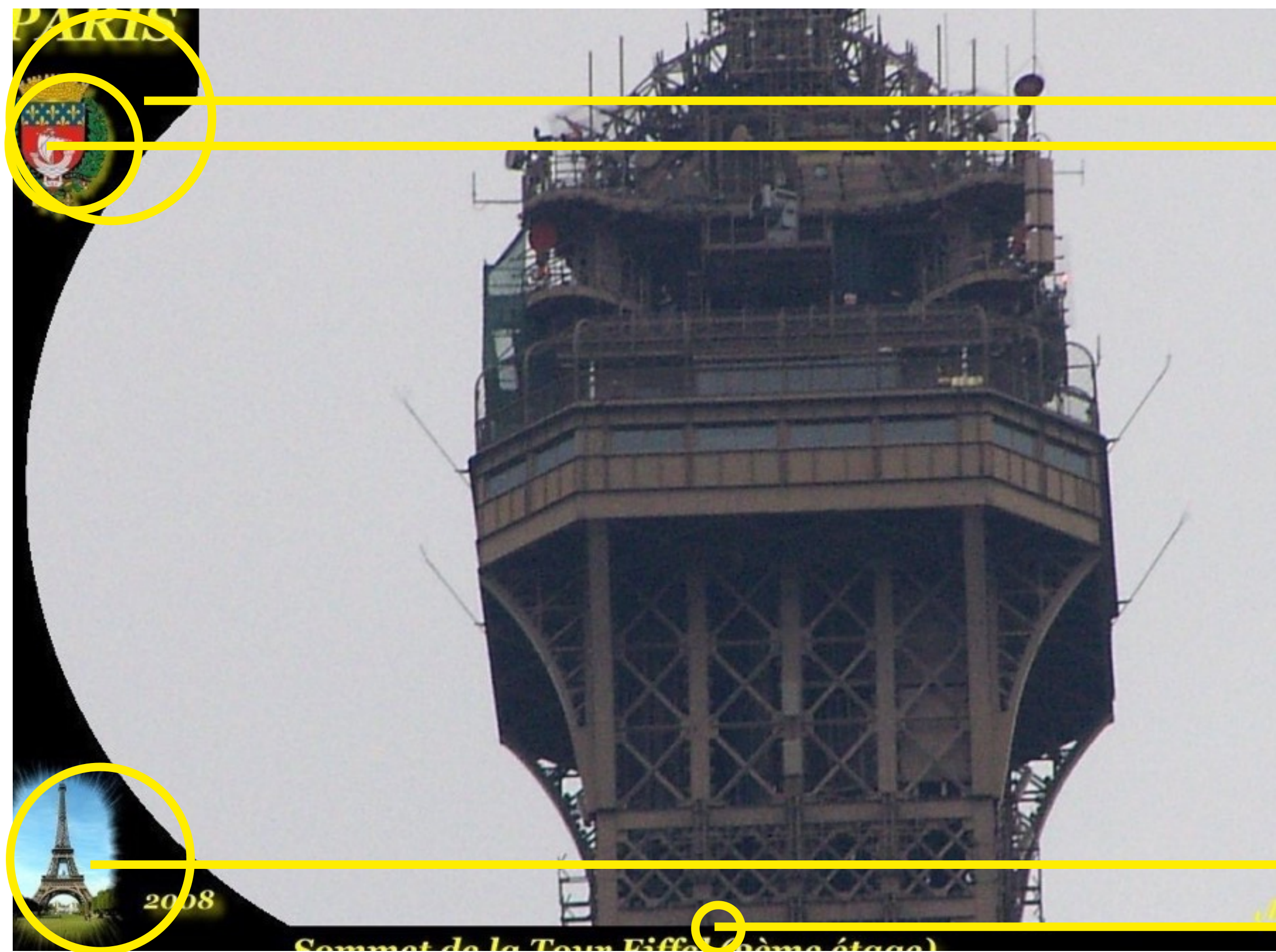
WTFs in Image Matching

Invalid matches



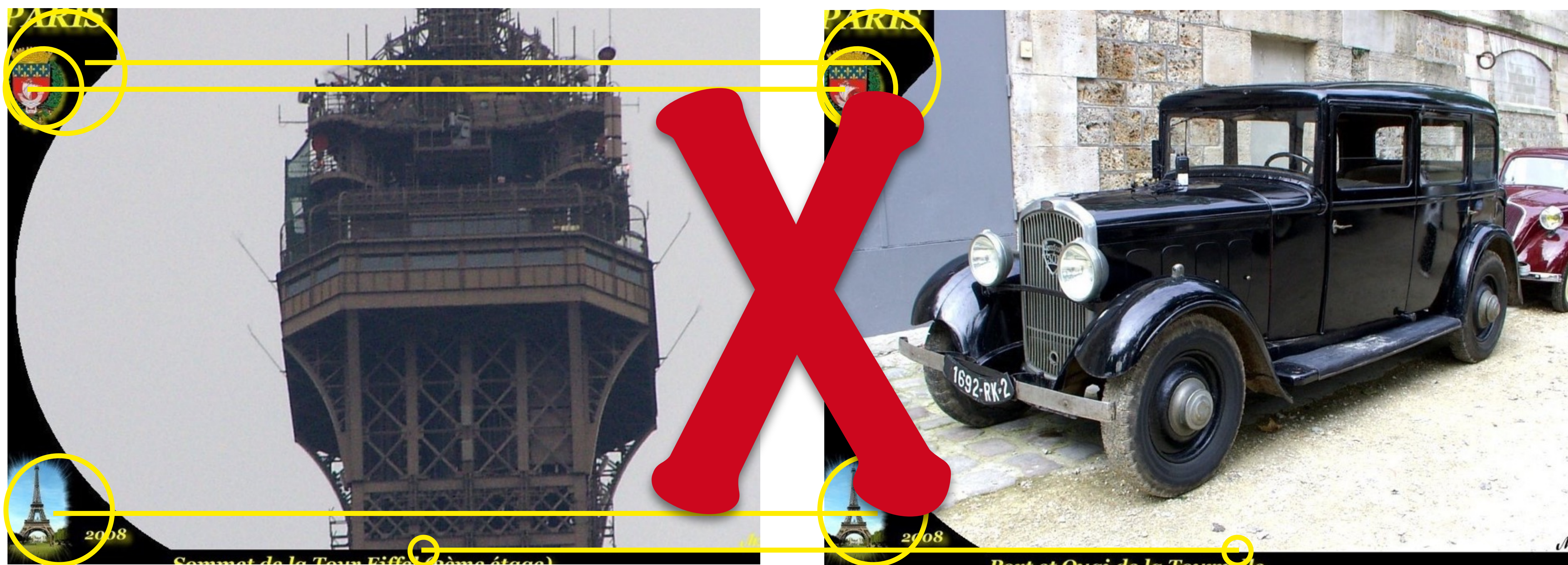
WTFs in Image Matching

Invalid matches



WTFs in Image Matching

Invalid matches



WTFs in Image Retrieval

Query Image



WTFs in Image Retrieval

Query Image



WTFs in Image Retrieval

Query Image

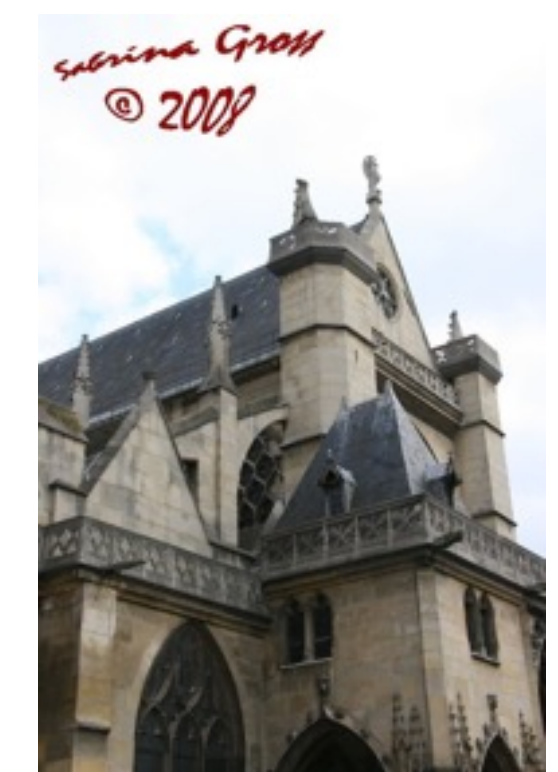


WTFs in Image Retrieval

Query Image



Results



WTFs in Image Retrieval

Query Image



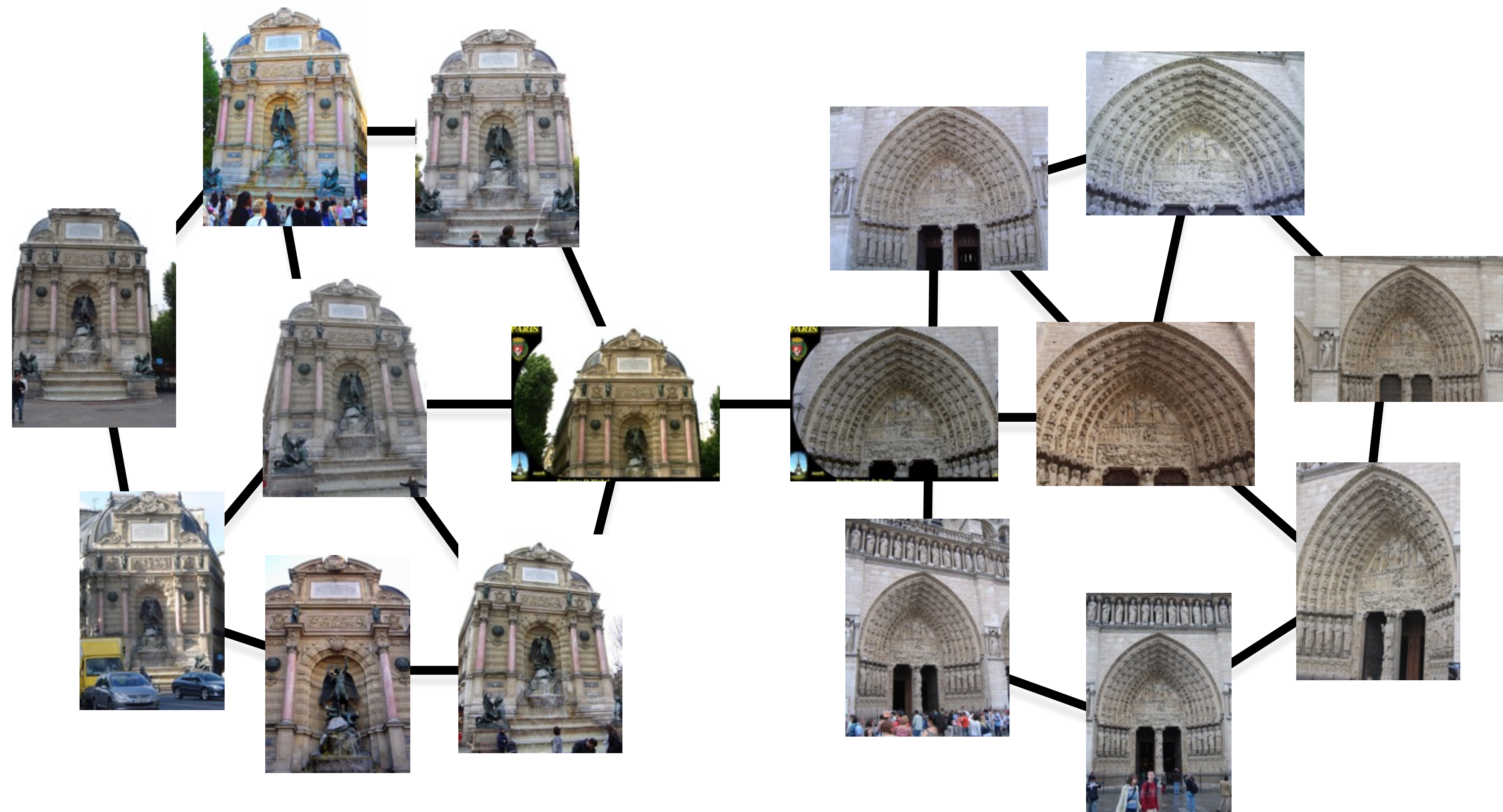
Results



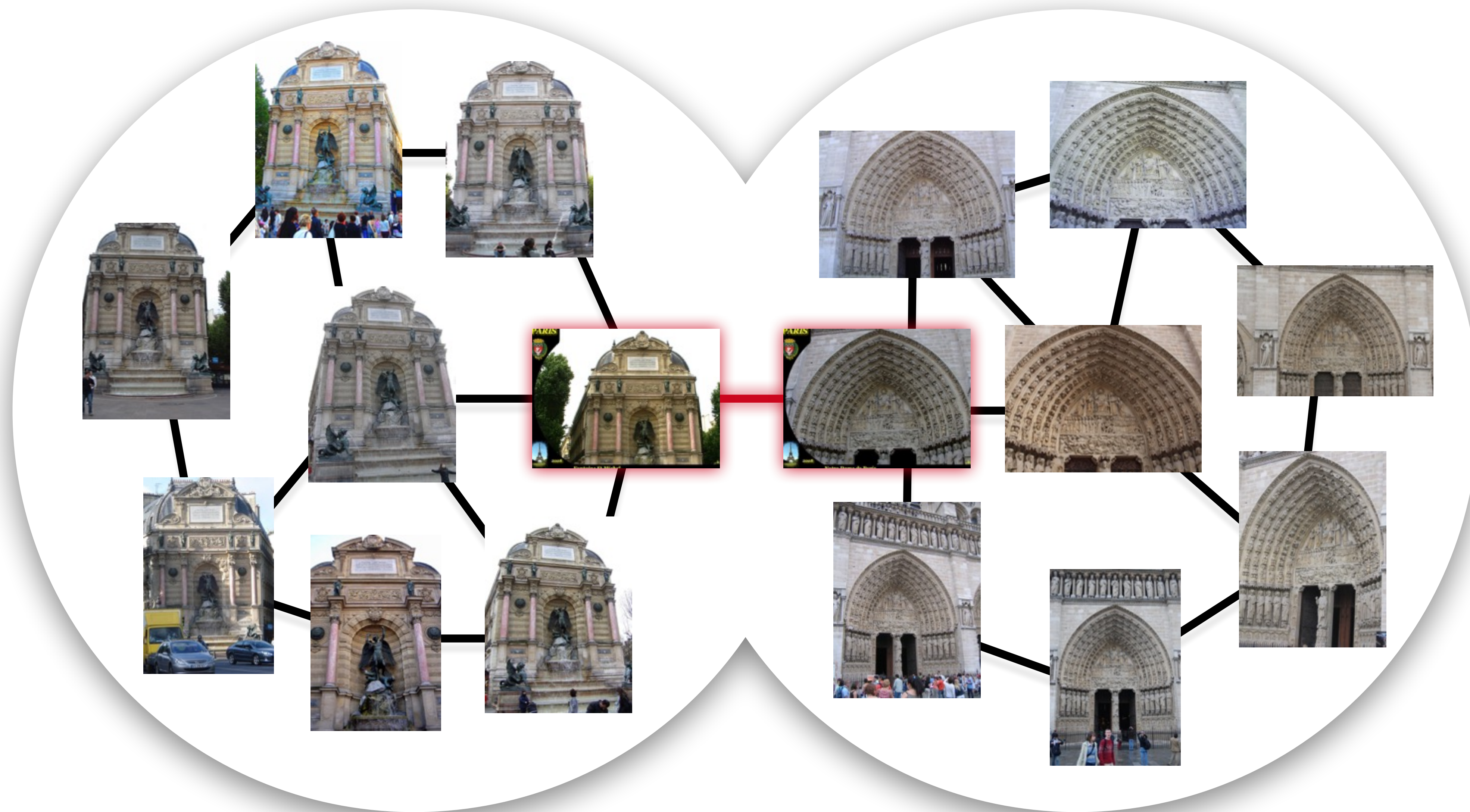
WTFs in Image Clustering



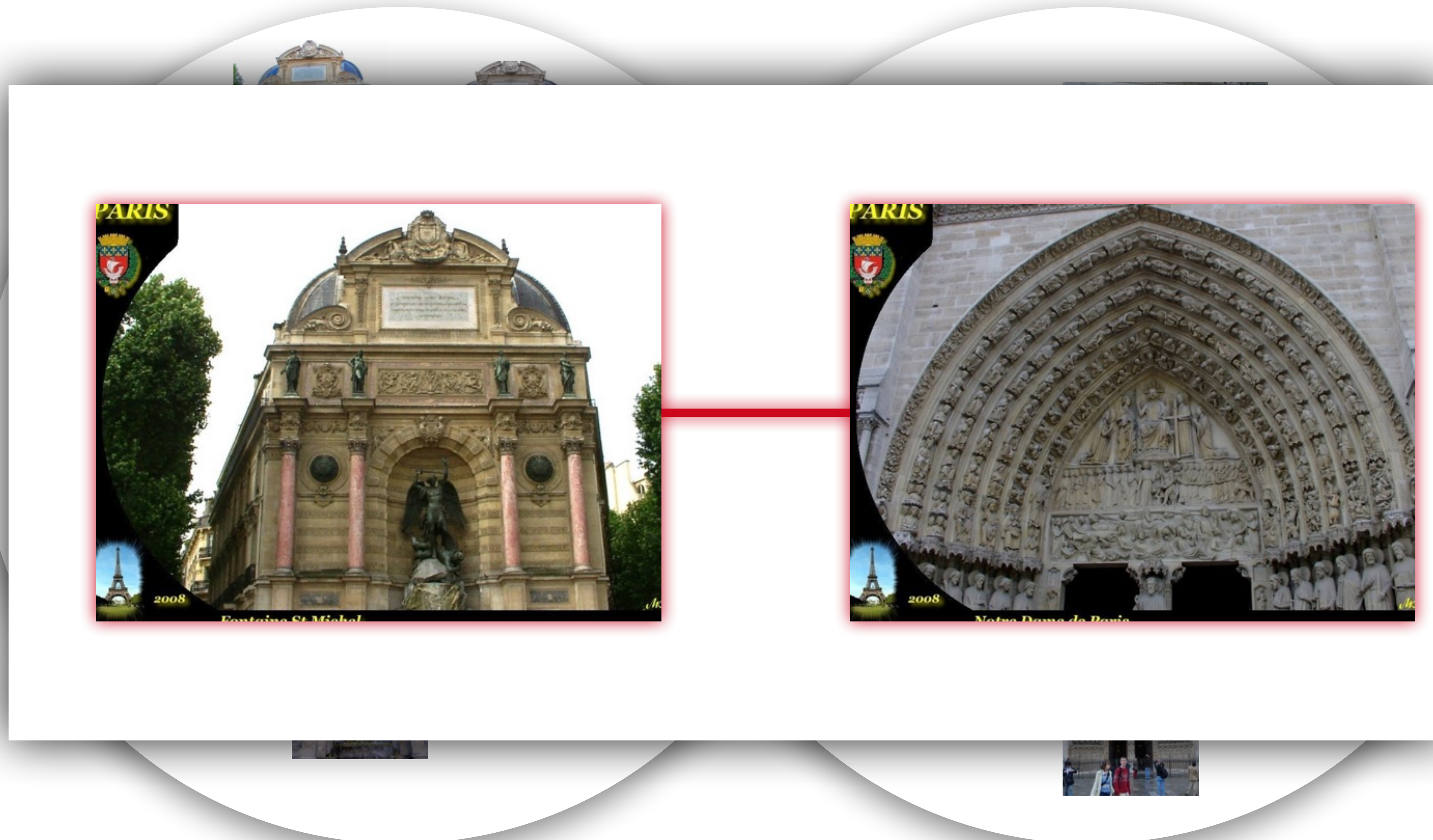
WTFs in Image Clustering



WTFs in Image Clustering

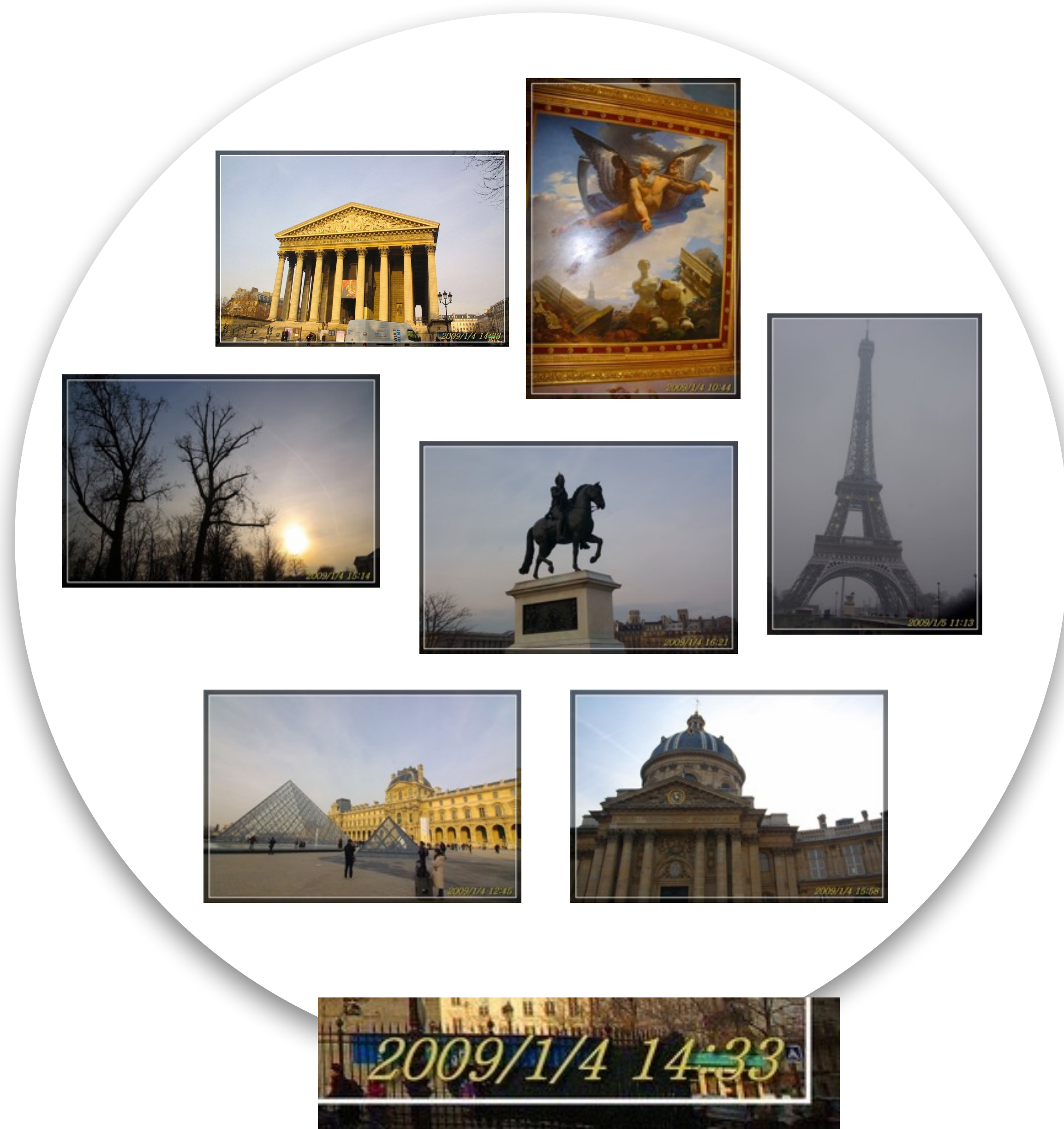


WTFs in Image Clustering



WTFs in Image Clustering

Pseudo-Clusters



Method

Method

Key assumptions:

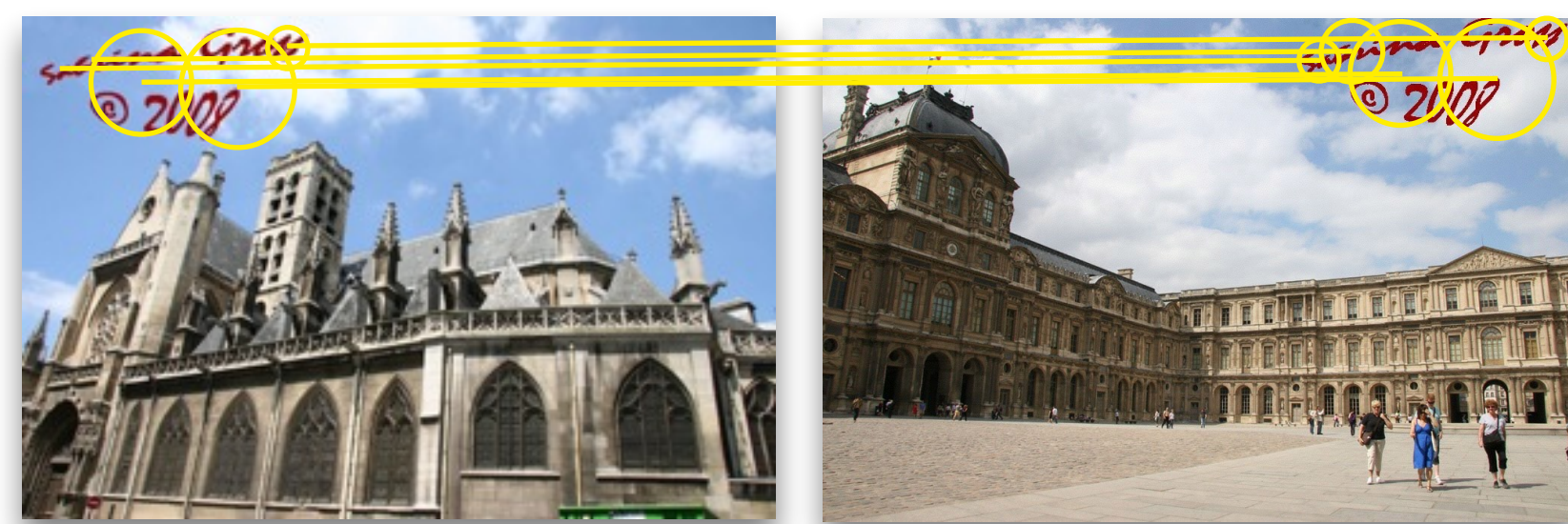
WTFs have **similar appearance** and occur **in certain image positions**.

Method

Key assumptions:

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

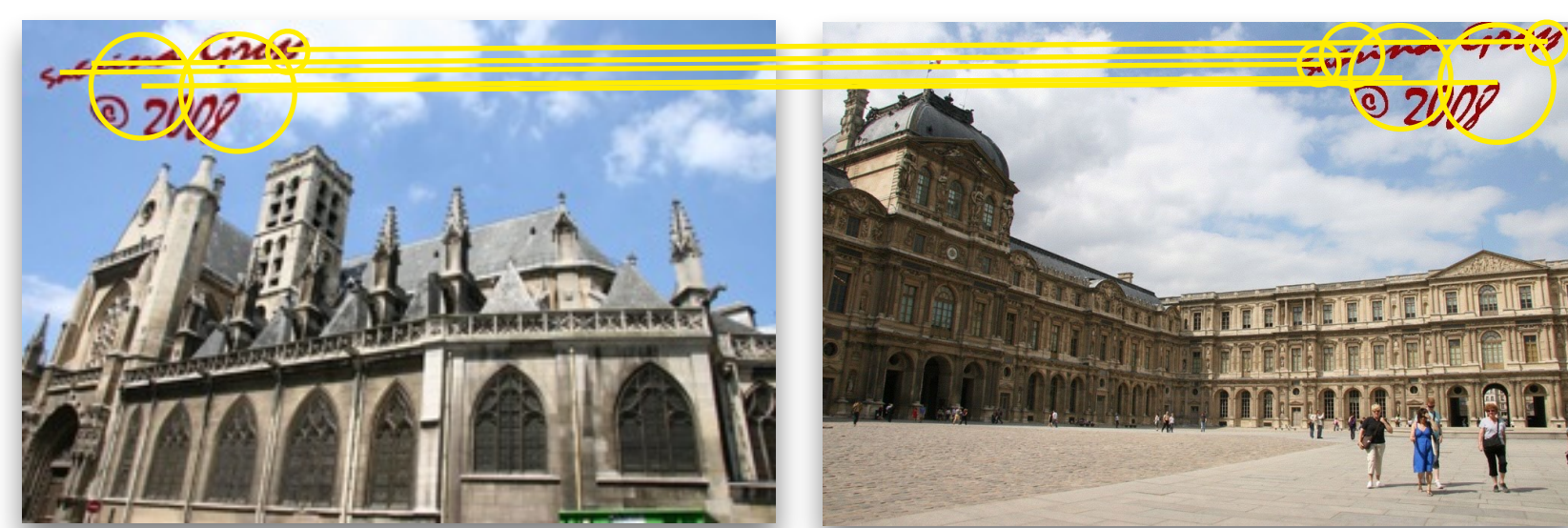
Input Image Pair with feature matches



Method

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

Input Image Pair with feature matches



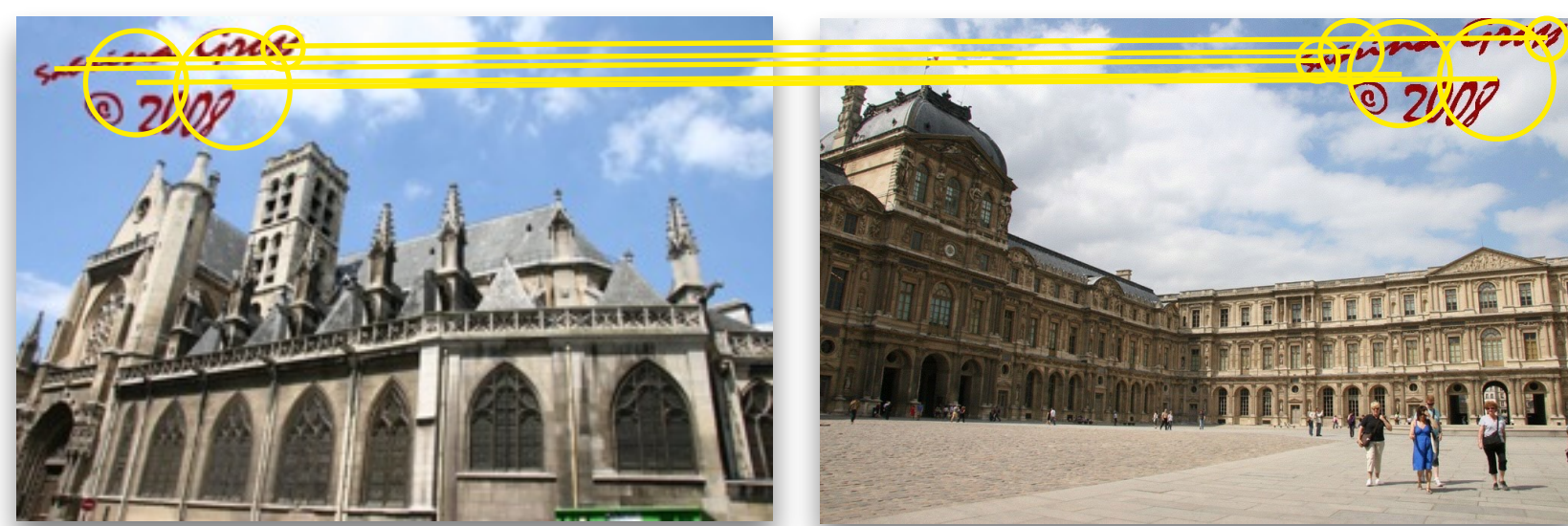
Similarity Map



Method

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

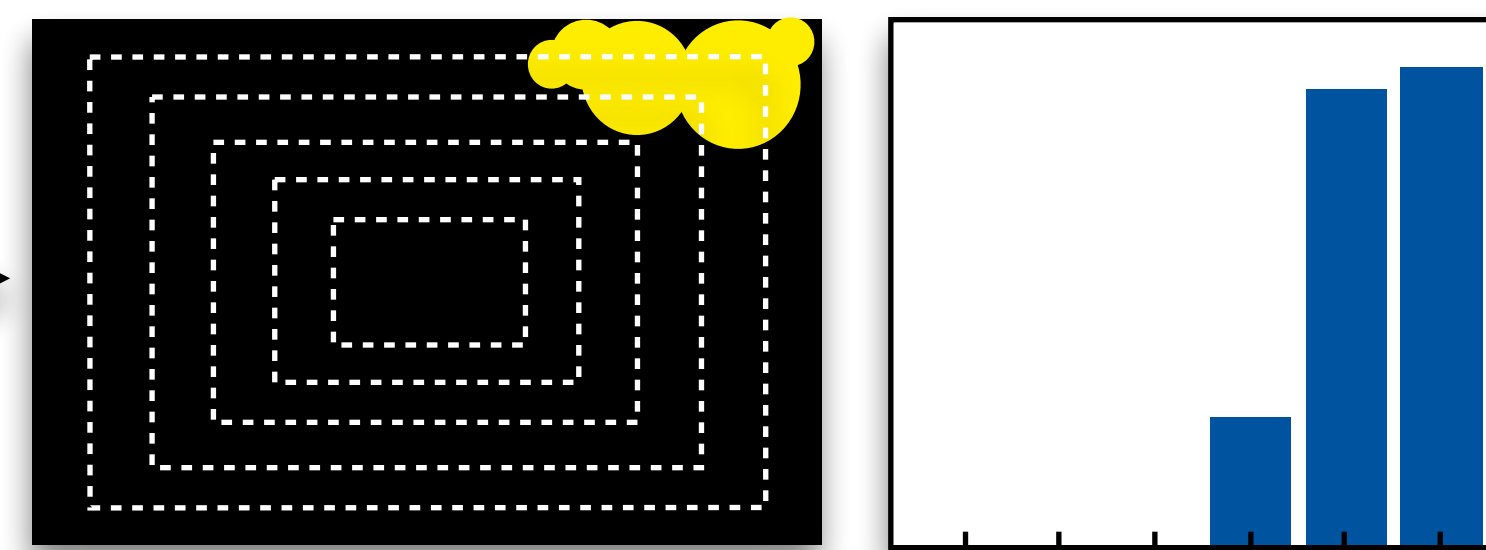
Input Image Pair with feature matches



Similarity Map

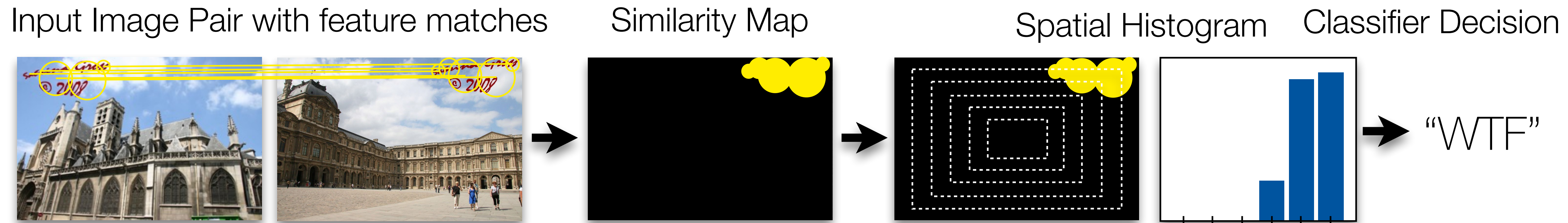


Spatial Histogram



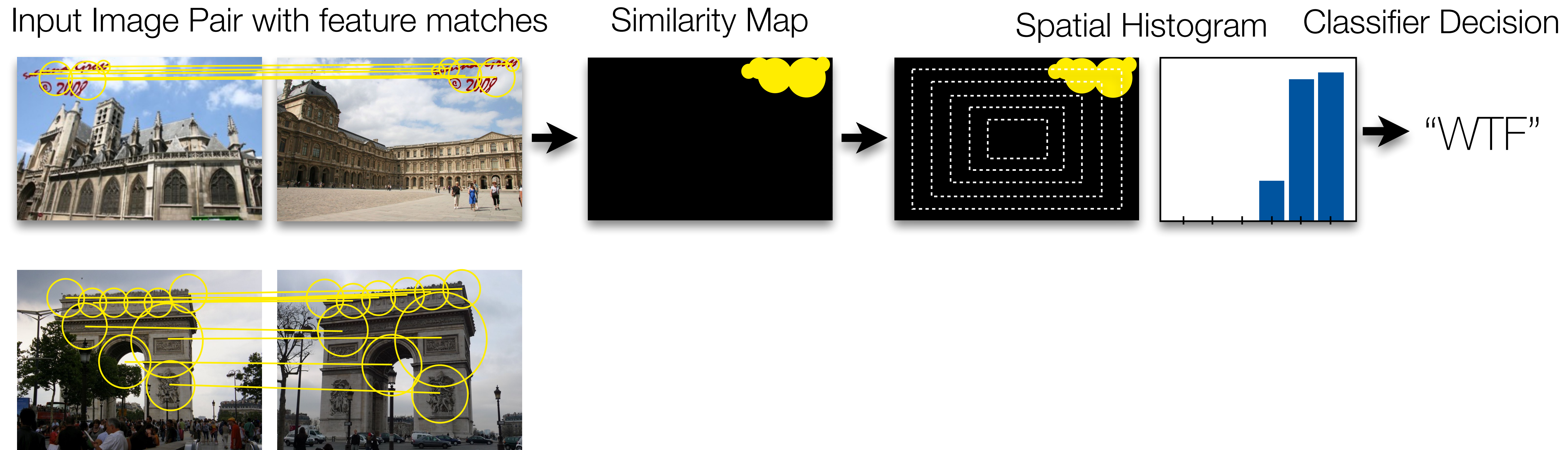
Method

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



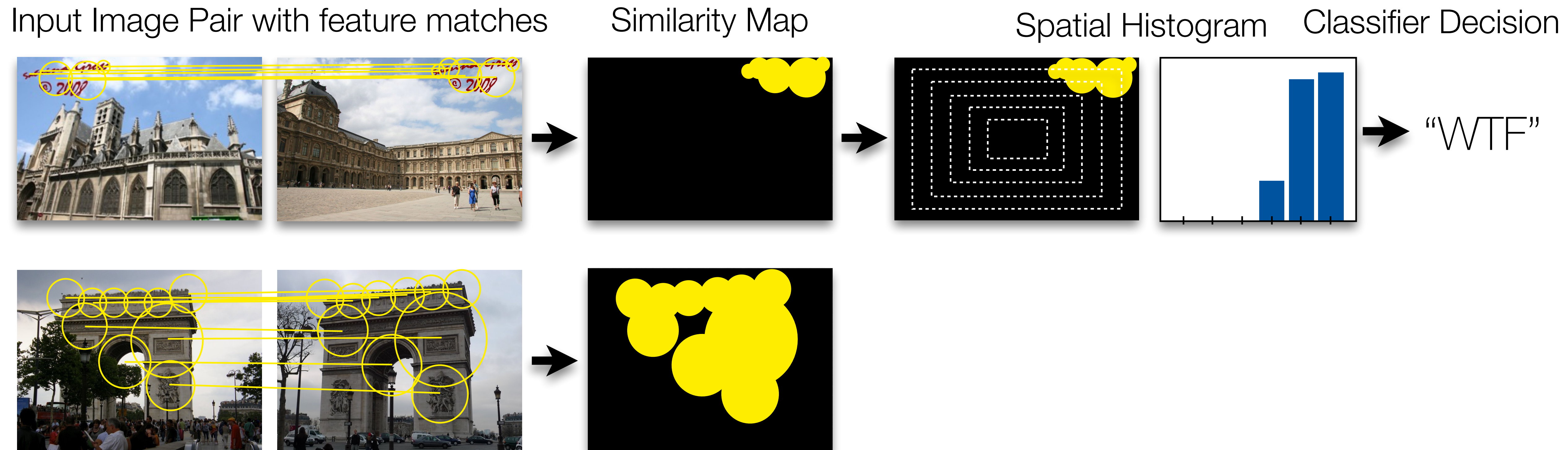
Method

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



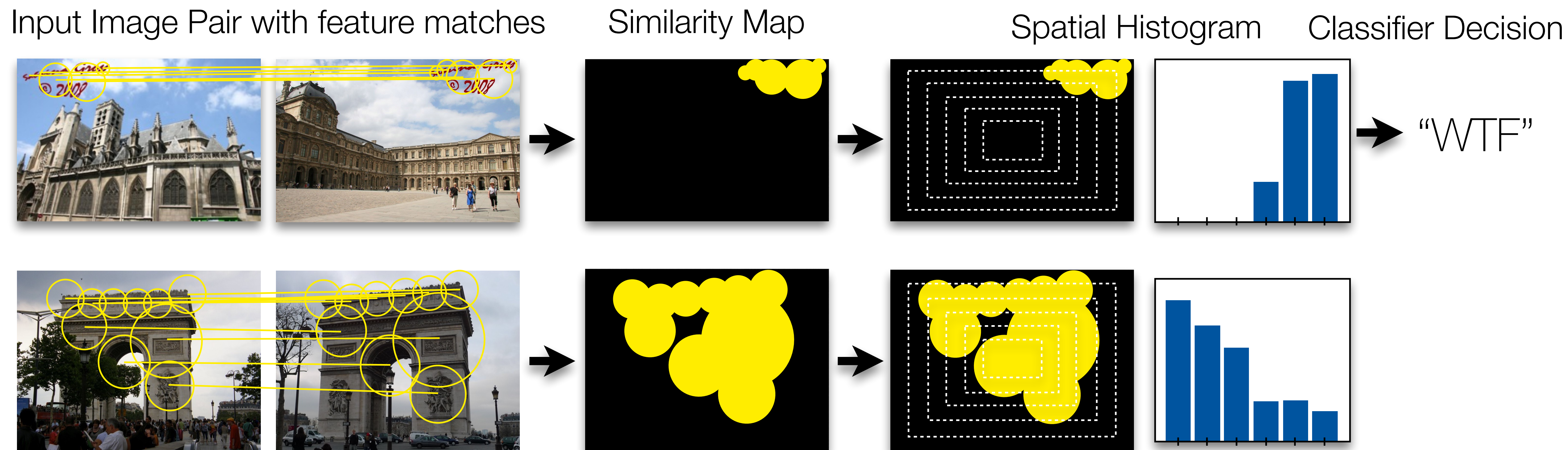
Method

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



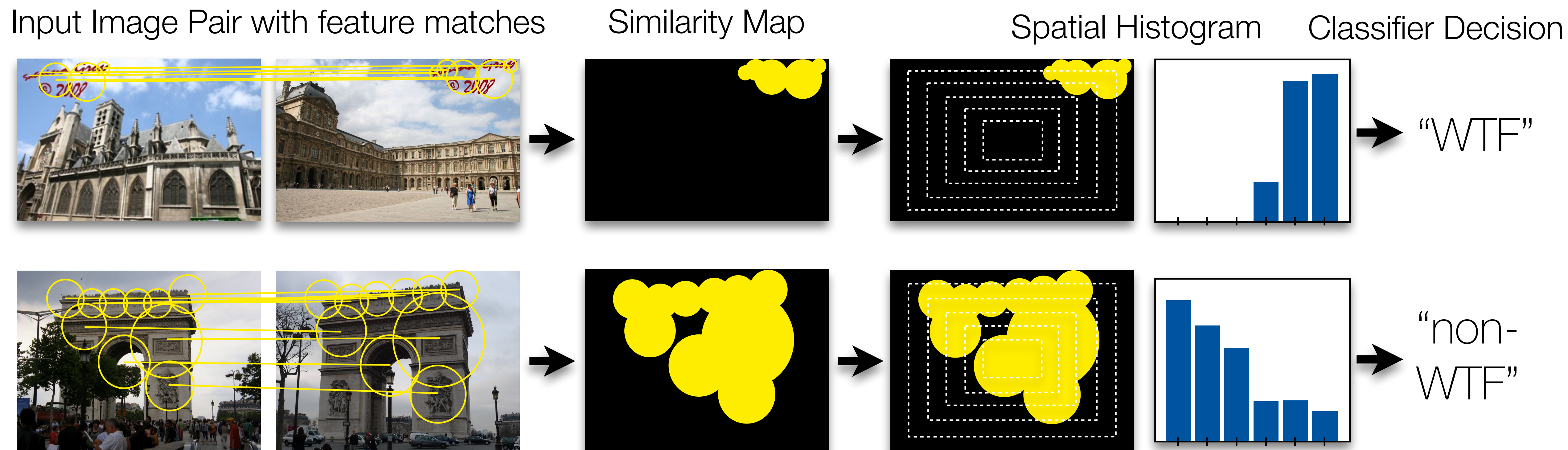
Method

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



Method

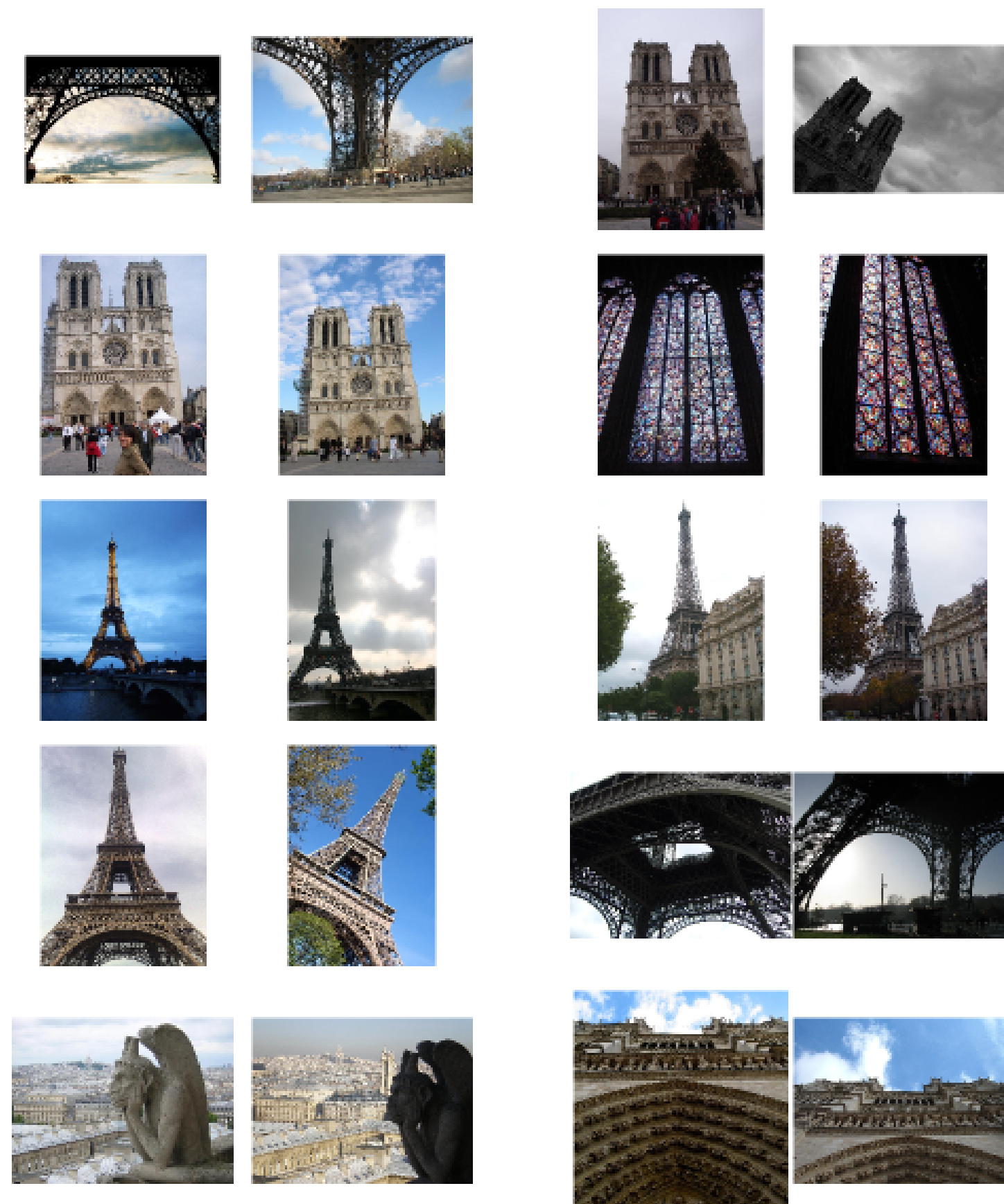
Key assumptions:
 WTFs have **similar appearance** and occur in **certain image positions**.



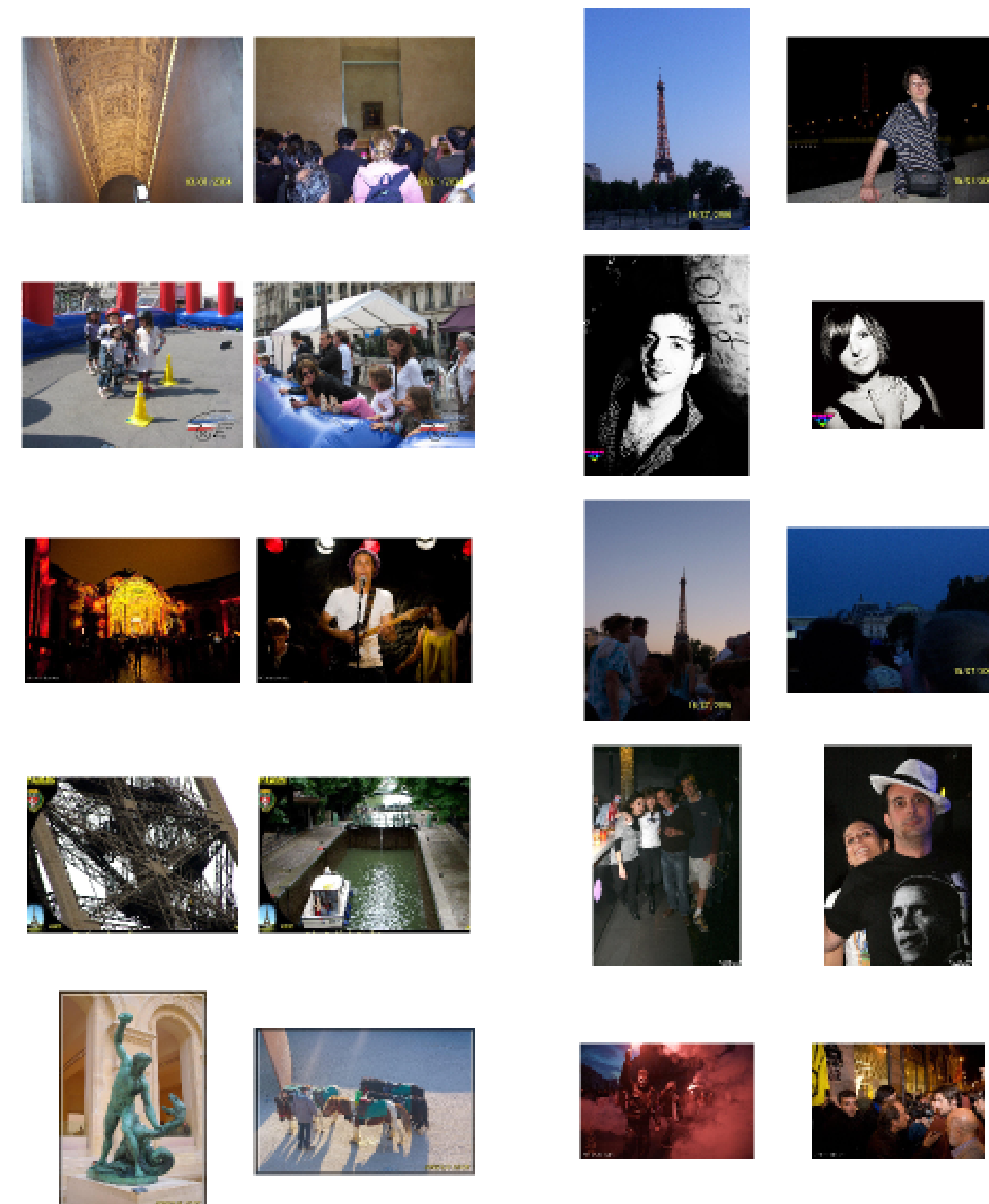
Dataset

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

Non-WTFs

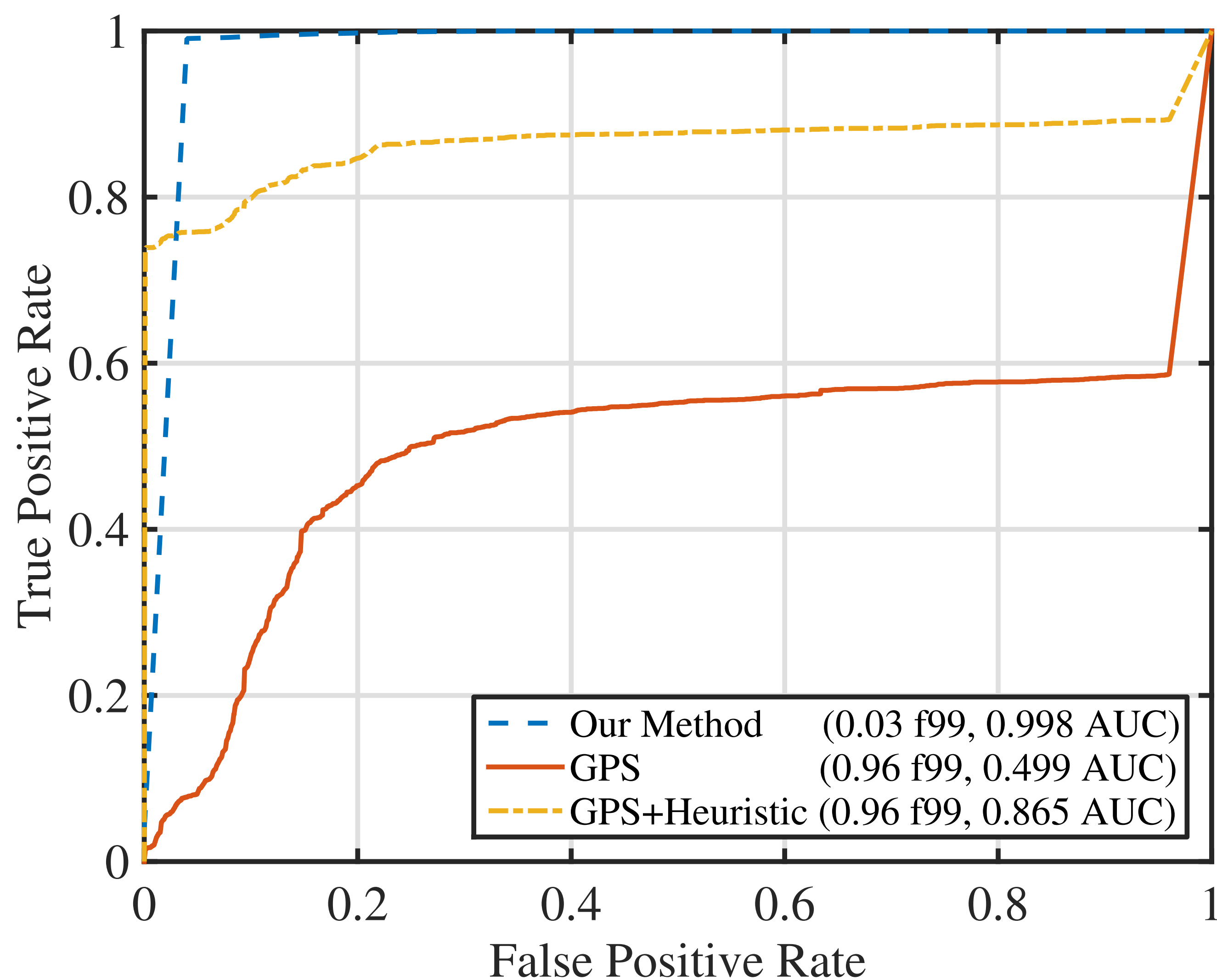


WTFs



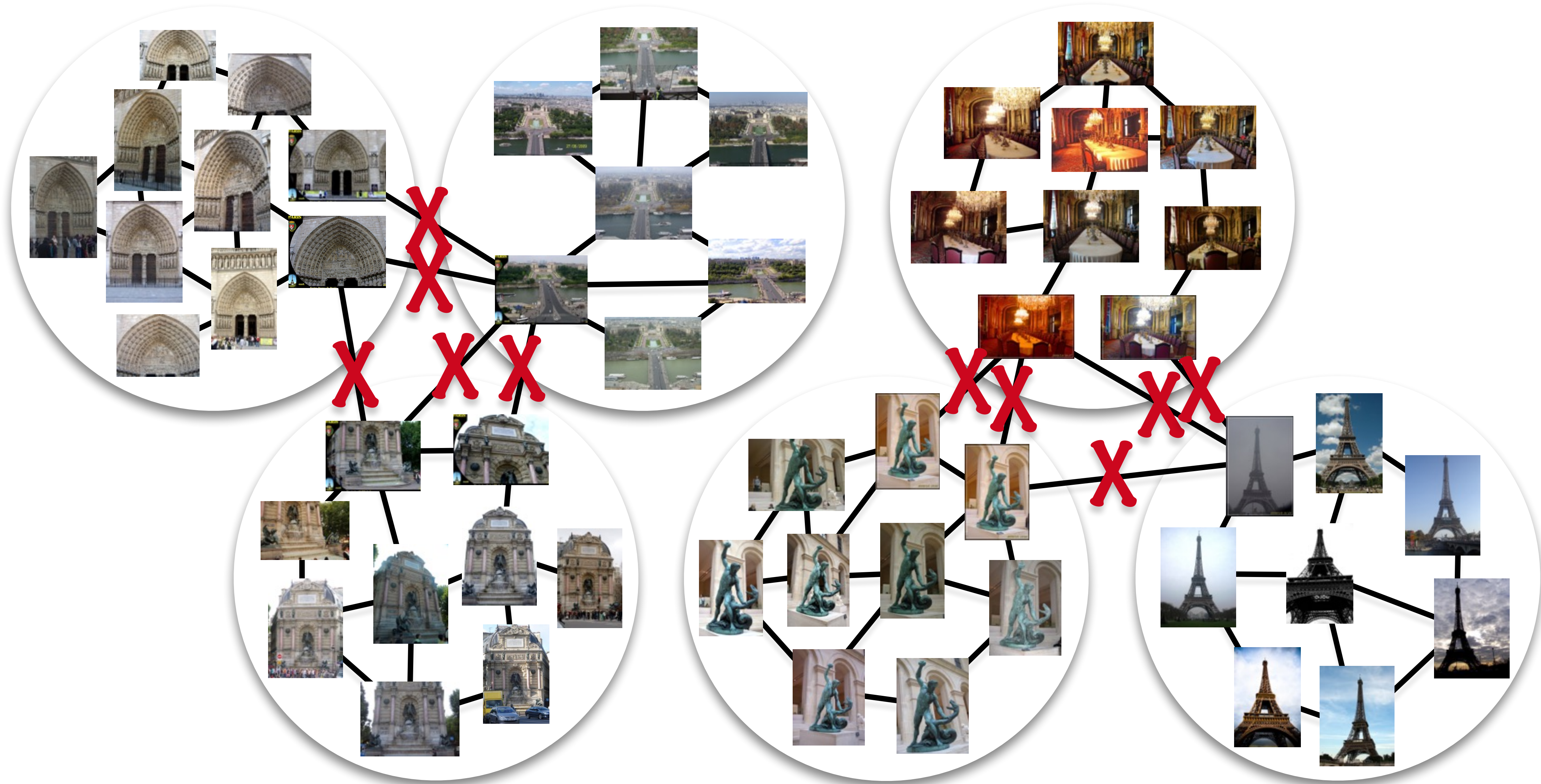
Results

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



Clustering results

Clusters with multiple objects were split.



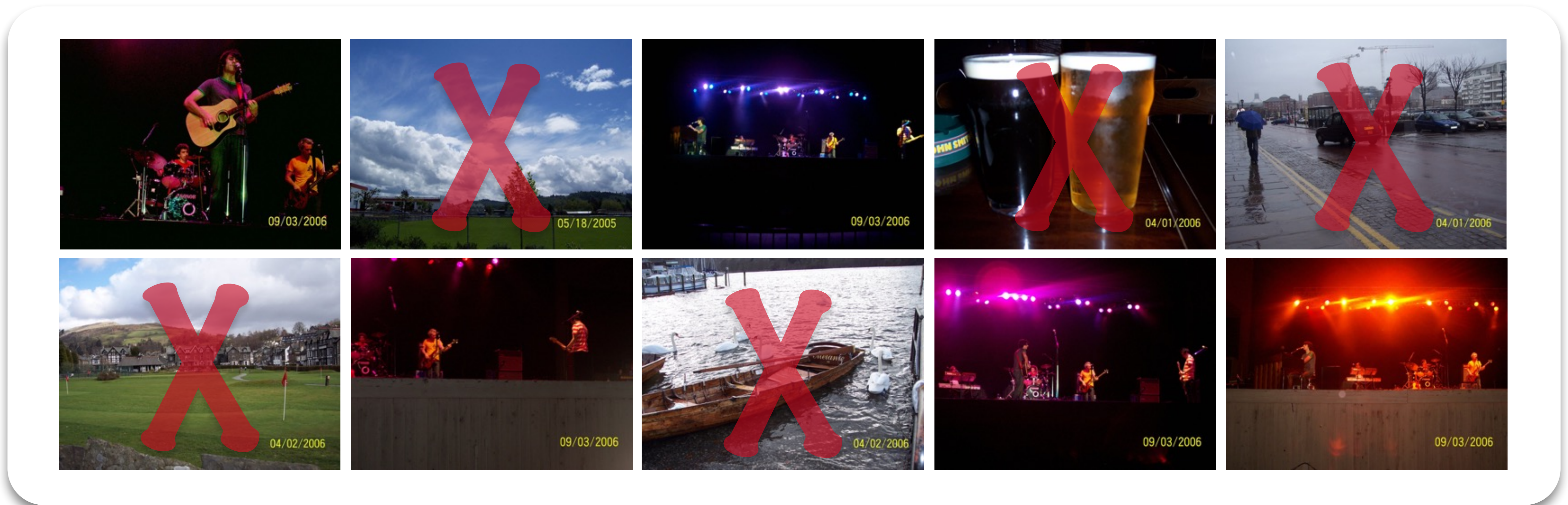
Clustering results

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

Come visit us at poster 26!

Get the code and dataset at tiny.cc/wtf

