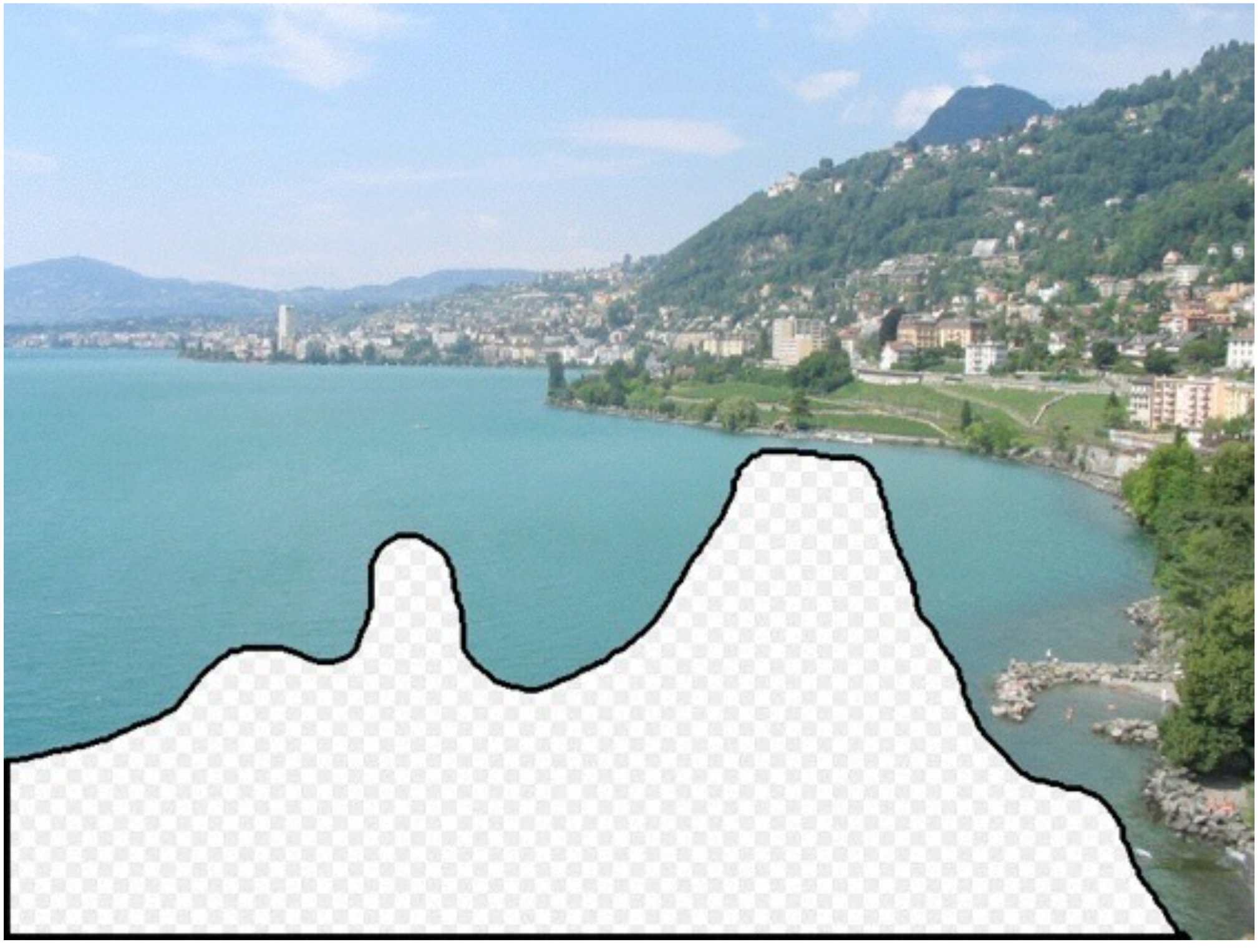
Données visuelles massives, partie 2

GIF-4105/7105 Photographie Algorithmique

Jean-François Lalonde

Qu’est-ce qu’il devrait y avoir dans la région?



Quel est l’original?

(a)

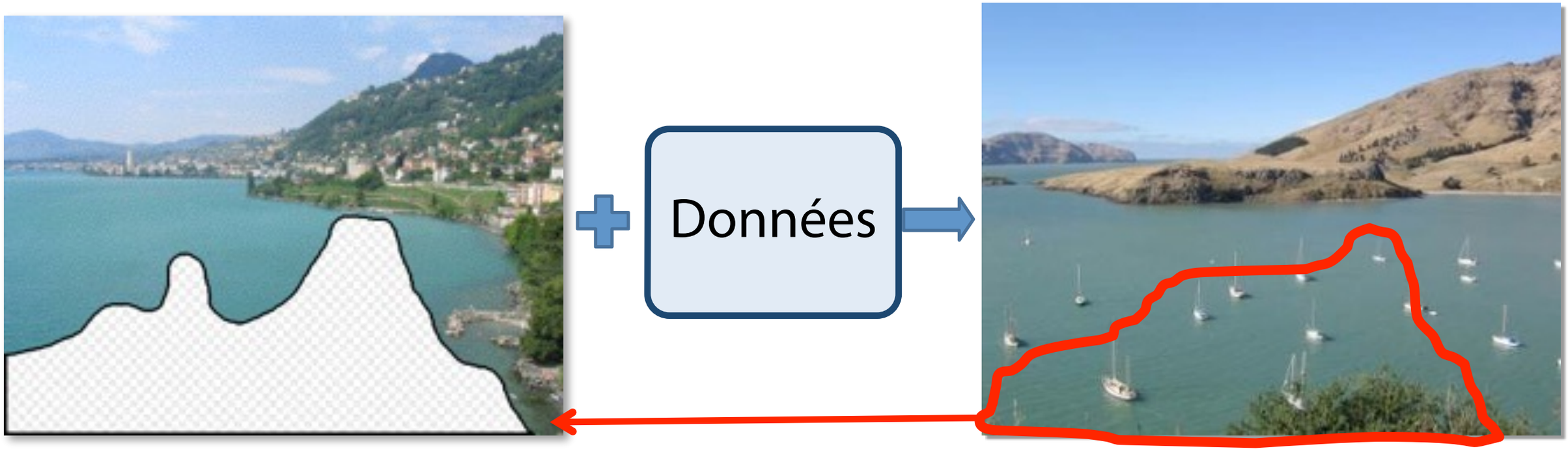
(b)

(c)

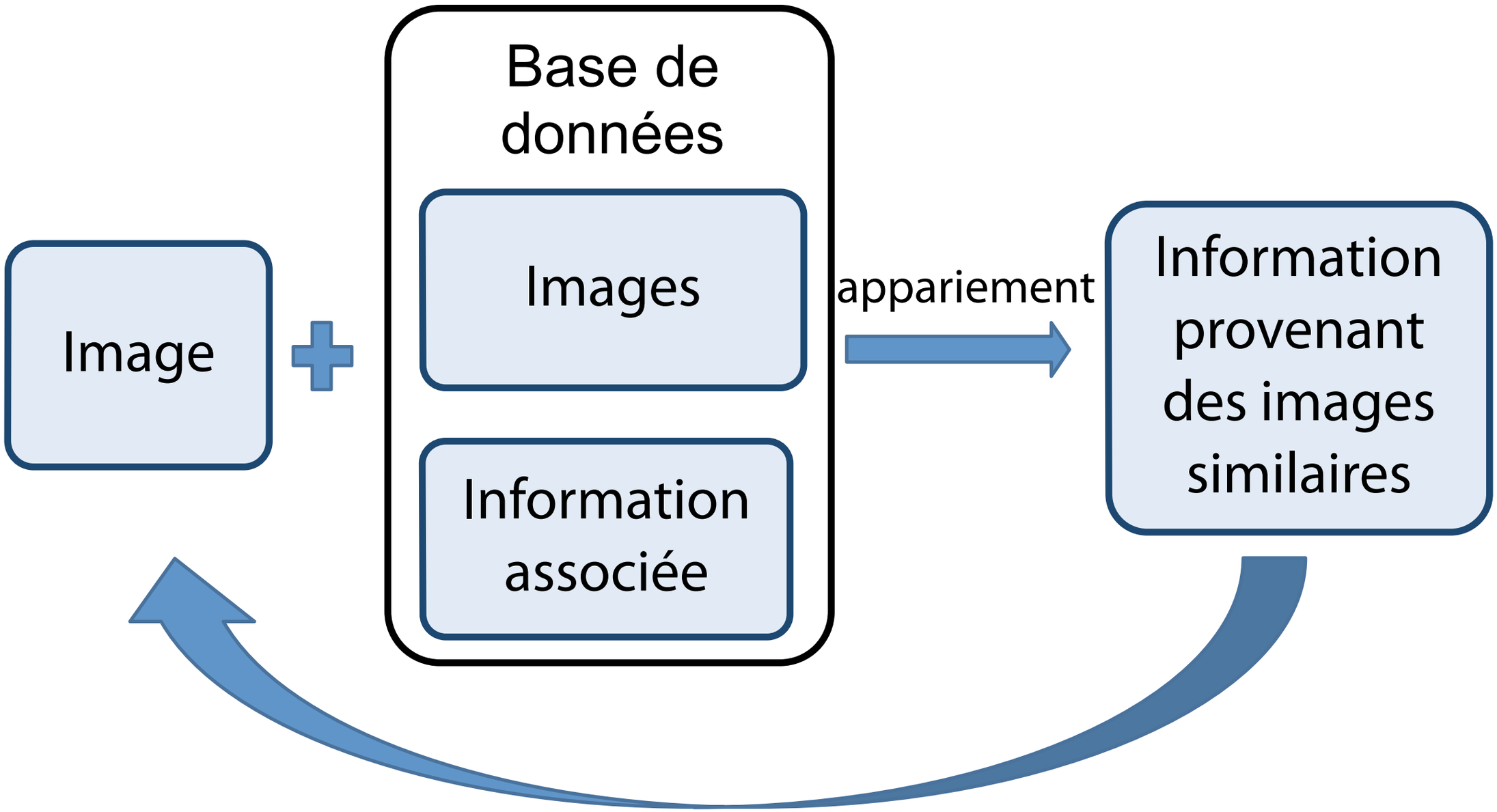
Comment ça marche

Trouver une image similaire dans une base de données

Copier une région dans le trou



Utiliser beaucoup de données!



Truc: si vous avez assez d'images, la base de données devrait contenir des images suffisamment similaires, faciles à trouver!

Combien d’images?



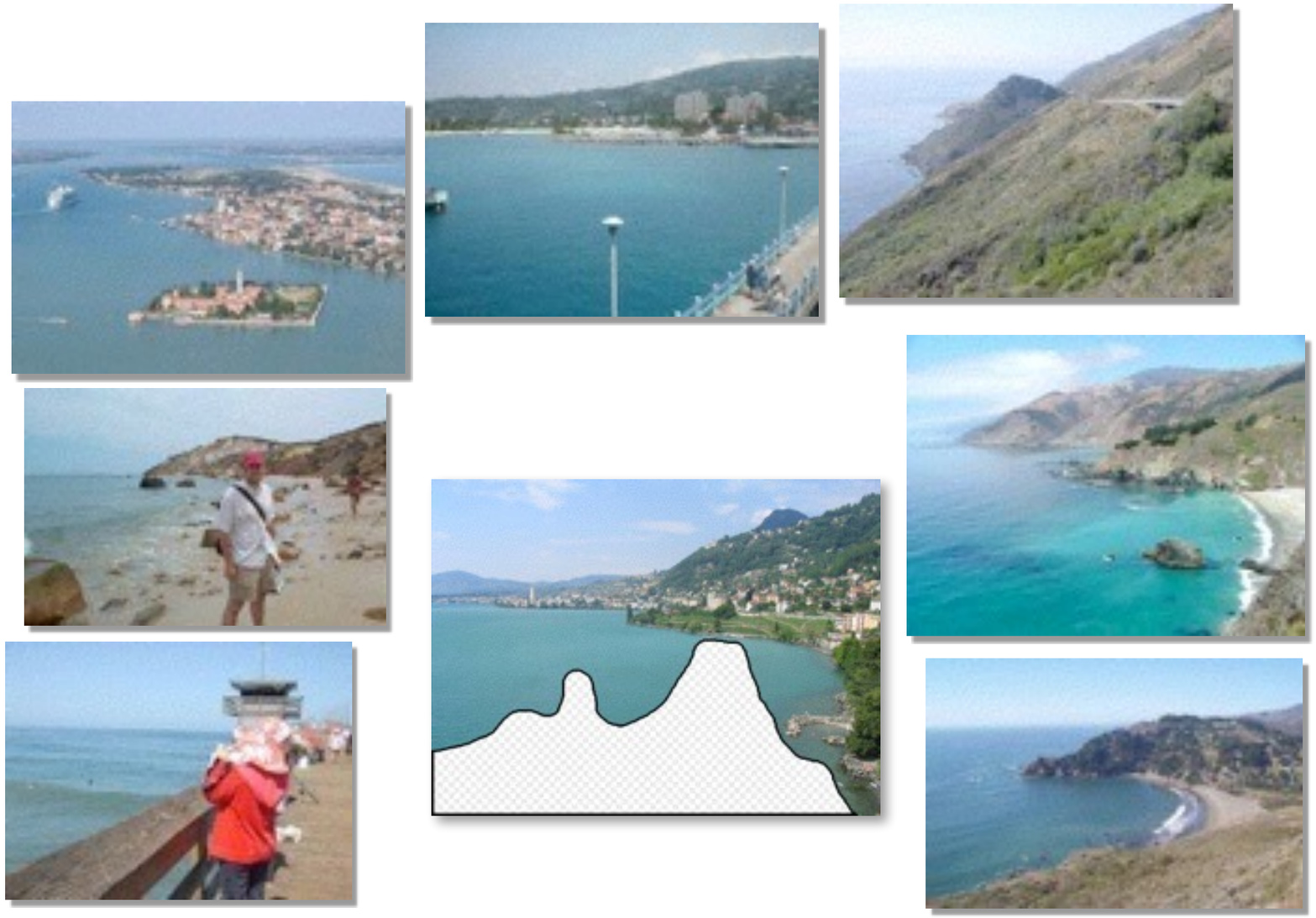








20,000 images



2,000,000 images

Aujourd’hui

Transférer de l’information

- Emplacement GPS
- Autre information (en fonction de l’emplacement)

Améliorer l’appariement

- Apparier des portions de l’image
- Déterminer ce qu’il faut apparier

im2gps (Hays & Efros, CVPR 2008)

6 millions d’images avec GPS

Quelle information géographique est disponible dans une image?

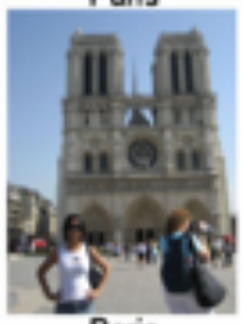

Paris


Paris


Paris


Paris


Paris


Paris


Paris

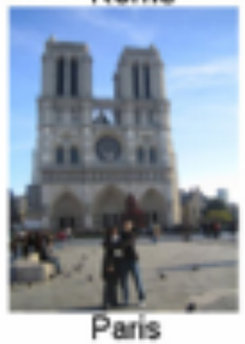

Madrid


Rome


Paris


Cuba


Paris


Paris


Poland


Paris


Paris

Exemples

Madrid

england

France

Paris

Croatia

heidelberg

Macau

Malta

Cairo

Italy

Italy

Italy

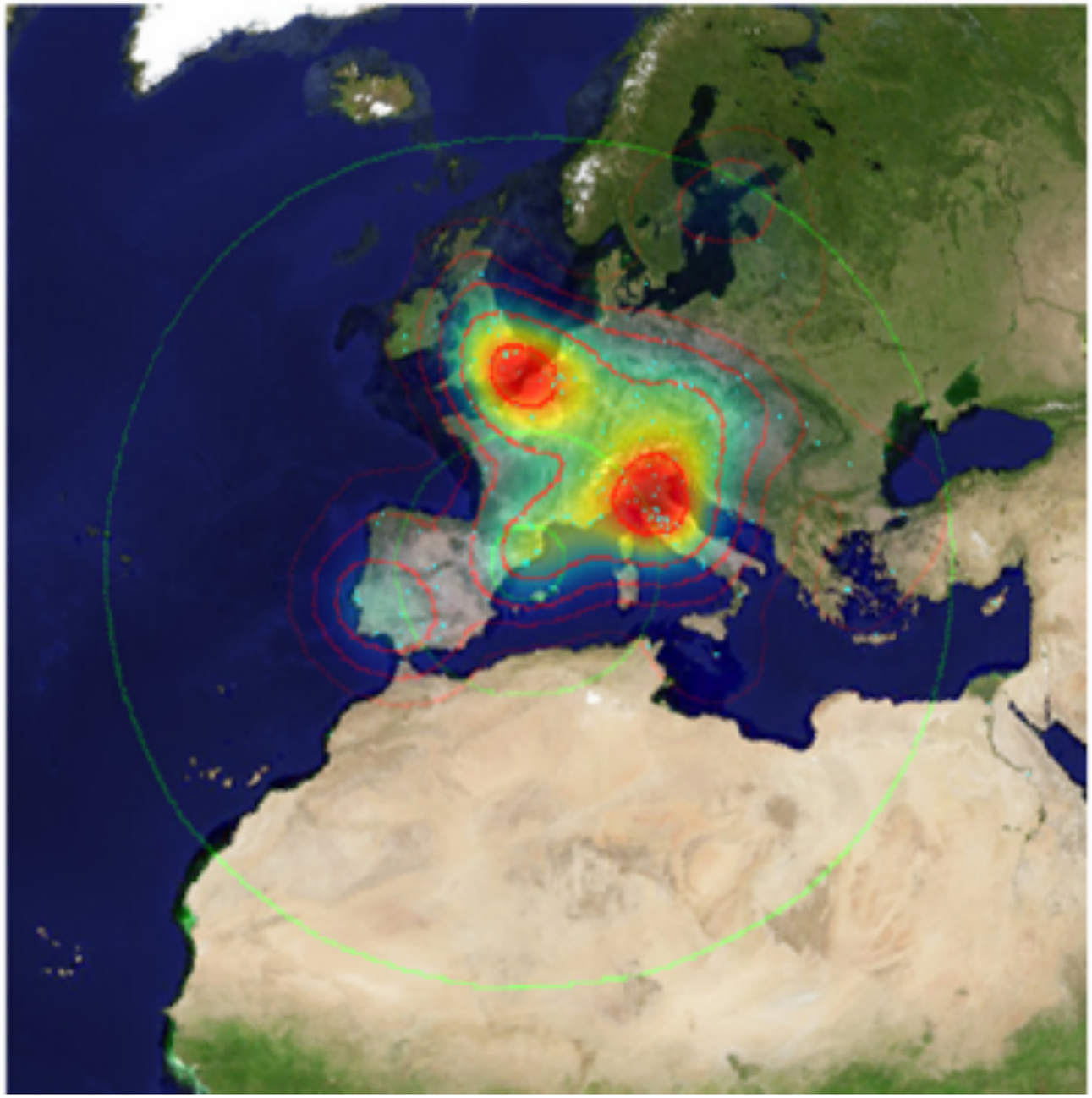
Latvia

europe

Barcelona

Austria

Votes



Philippines

Houston

Thailand

Houston

Maldives

Philippines

NewZealand

Bermuda

Palau

Mexico2

Brazil

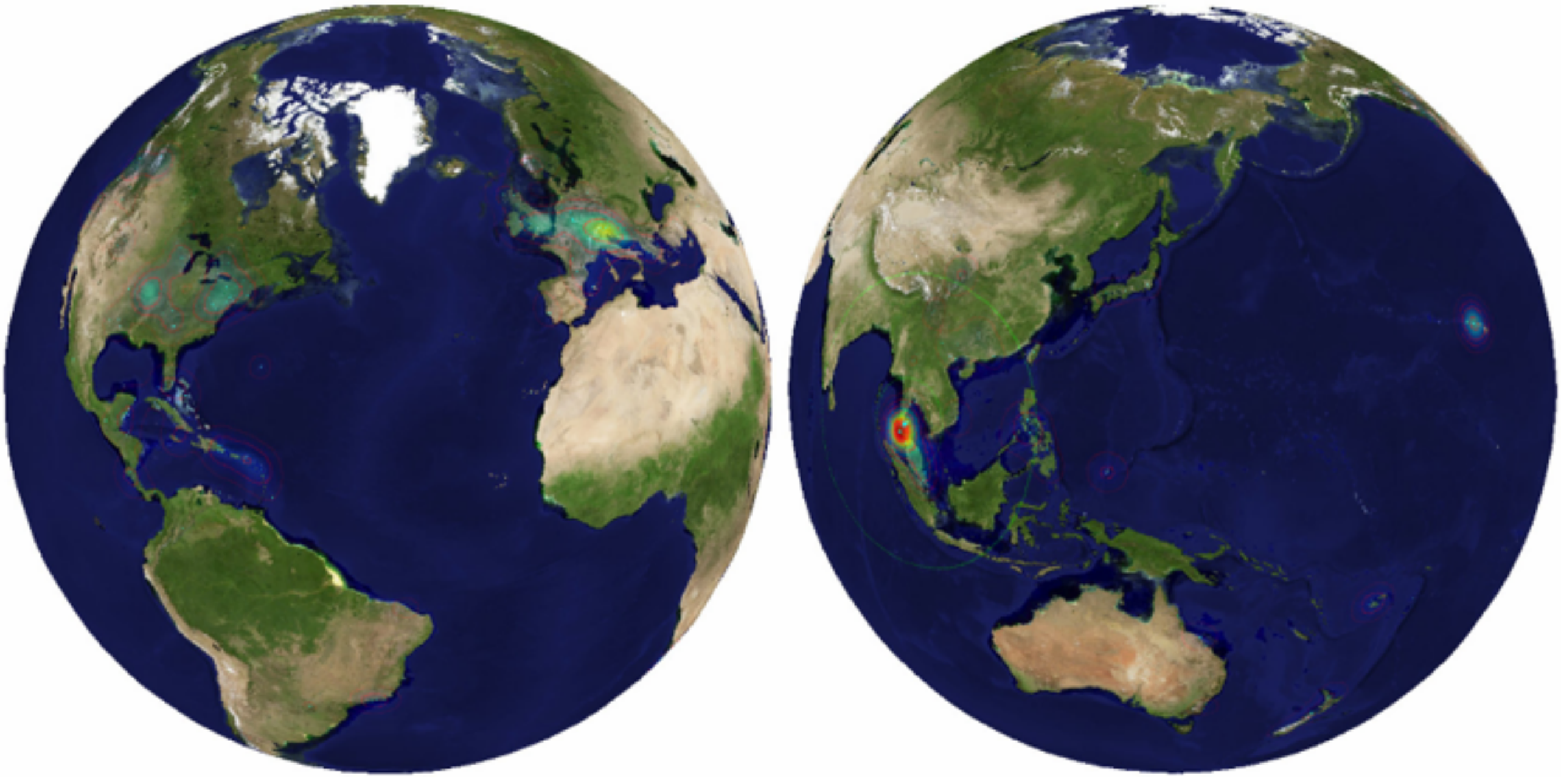
Mendoza

Brazil

Thailand

Arkansas

Hawaii



Switzerland

SouthAfrica

California

Barcelona

Italy

Italy

Nevada

Washington

Paris

Madrid

California

Oregon

SouthDakota

USA

Bangkok

Italy

USA

Utah

Arizona

Utah

Utah

Utah

Tunisia

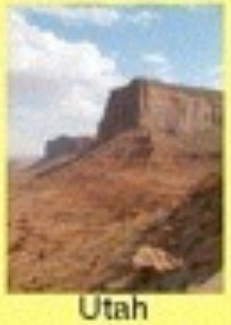
Kenya

Utah

LosAngeles

Burundi

NewMexico

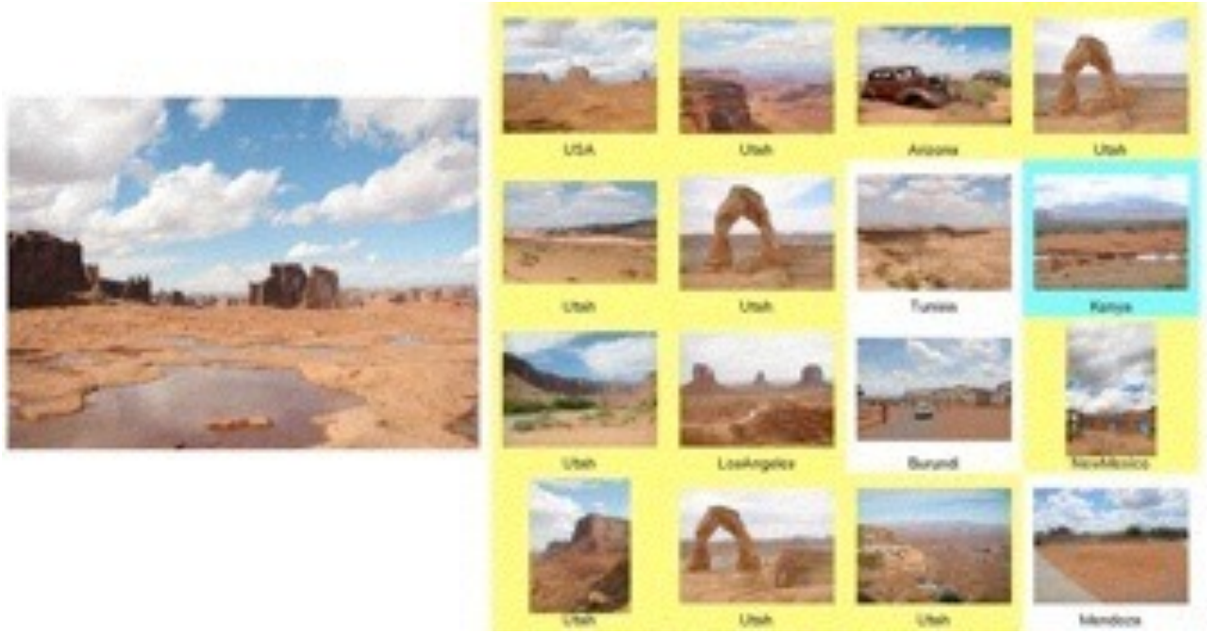


Utah

Utah

Utah

Mendoza


USA
Utah
Arizona
Utah
Utah
Utah
Tunisia
Kenya
Utah
LosAngeles
Burundi
NewMexico
Utah
Utah
Utah
Mendoza

California

Oklahoma

SouthAfrica

Zambia

Kenya

Hyderabad

Mongolia

SouthAfrica

Kenya

Kenya

Zambia

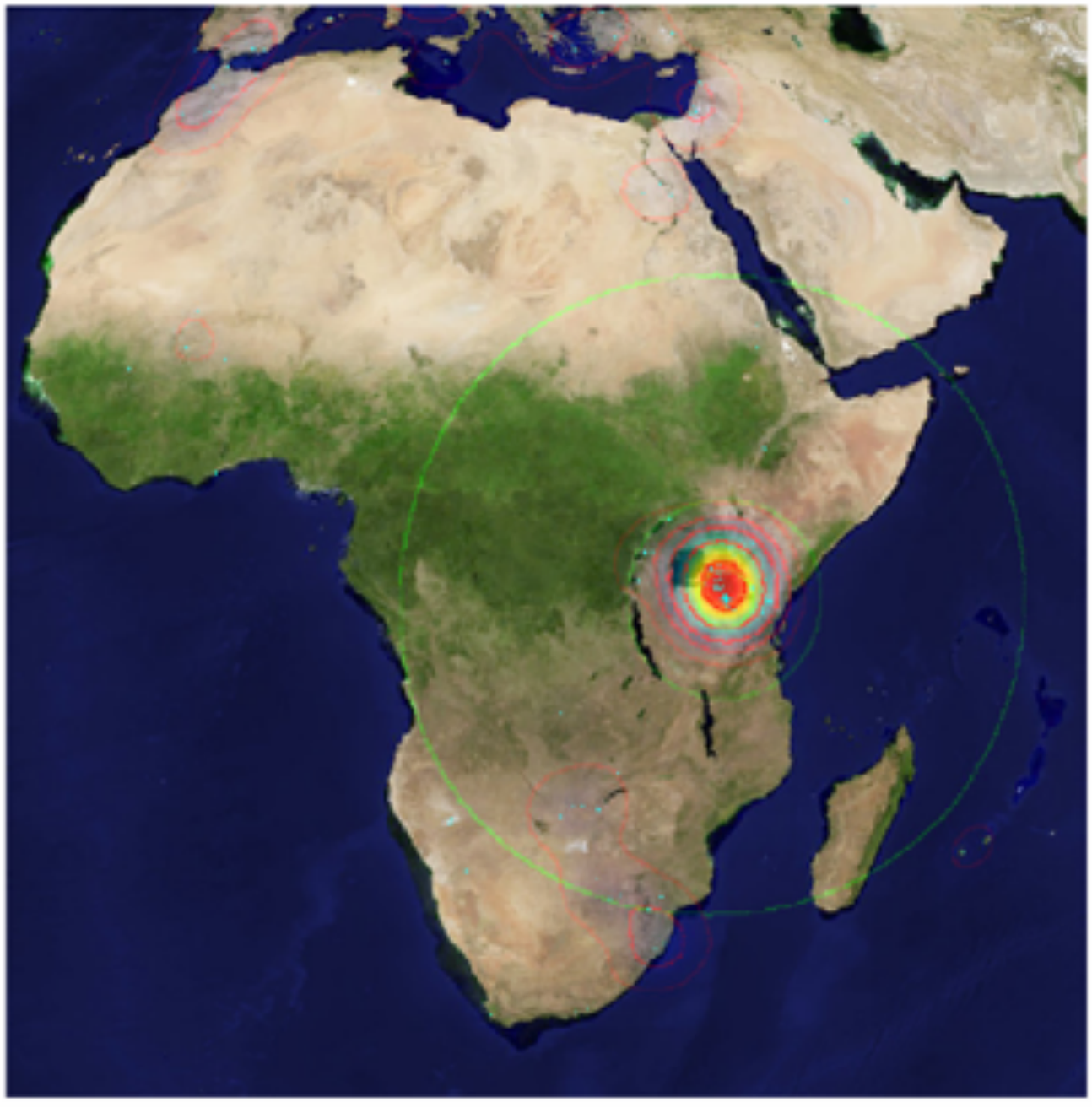
Ethiopia

Nevada

africa

Morocco

Tennessee



Toronto

Florida

NewYork

Boston

Boston

Oregon

Oregon

Oregon

NewYork

Barcelona

Oregon

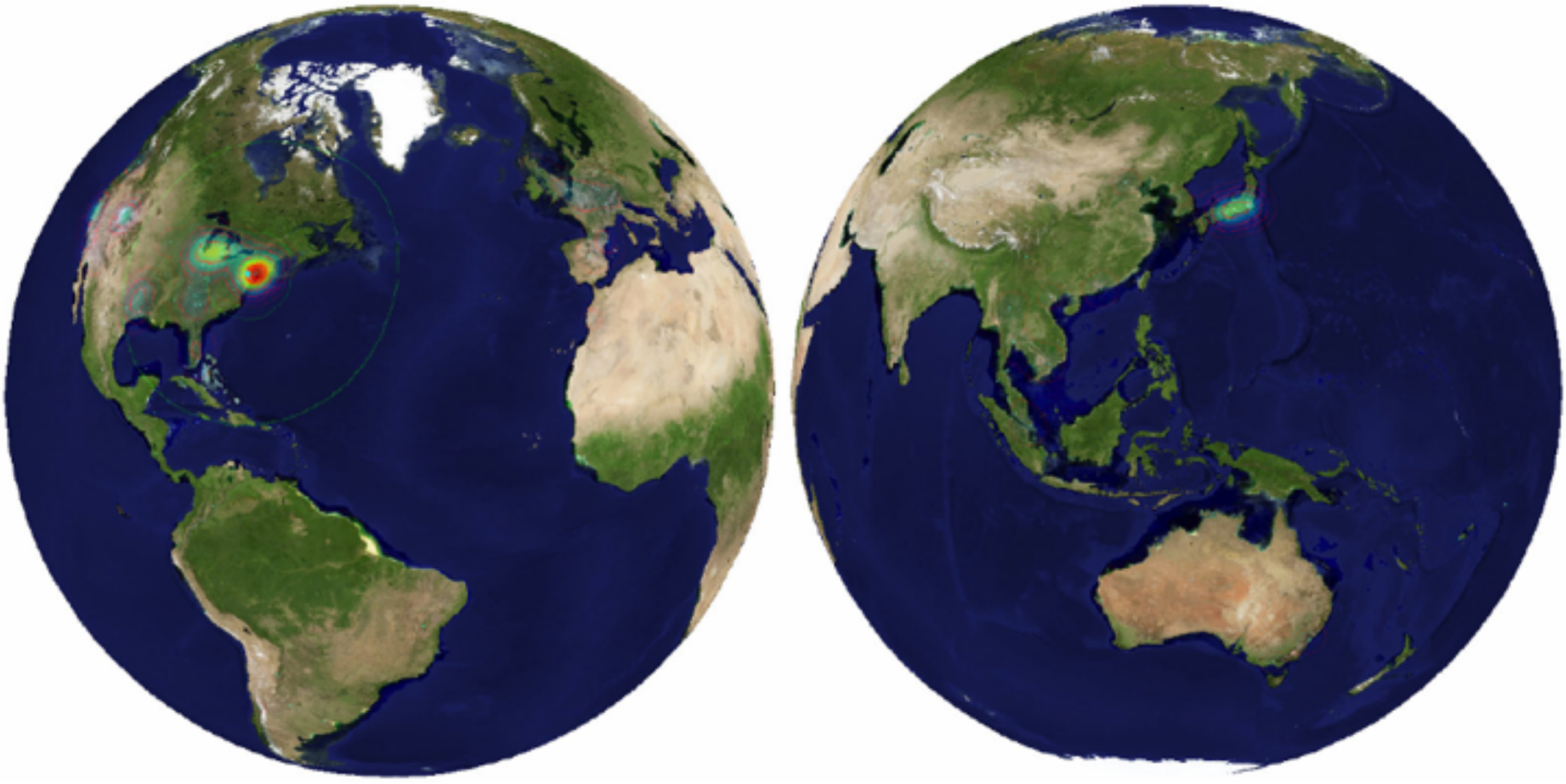
Chicago

Ohio

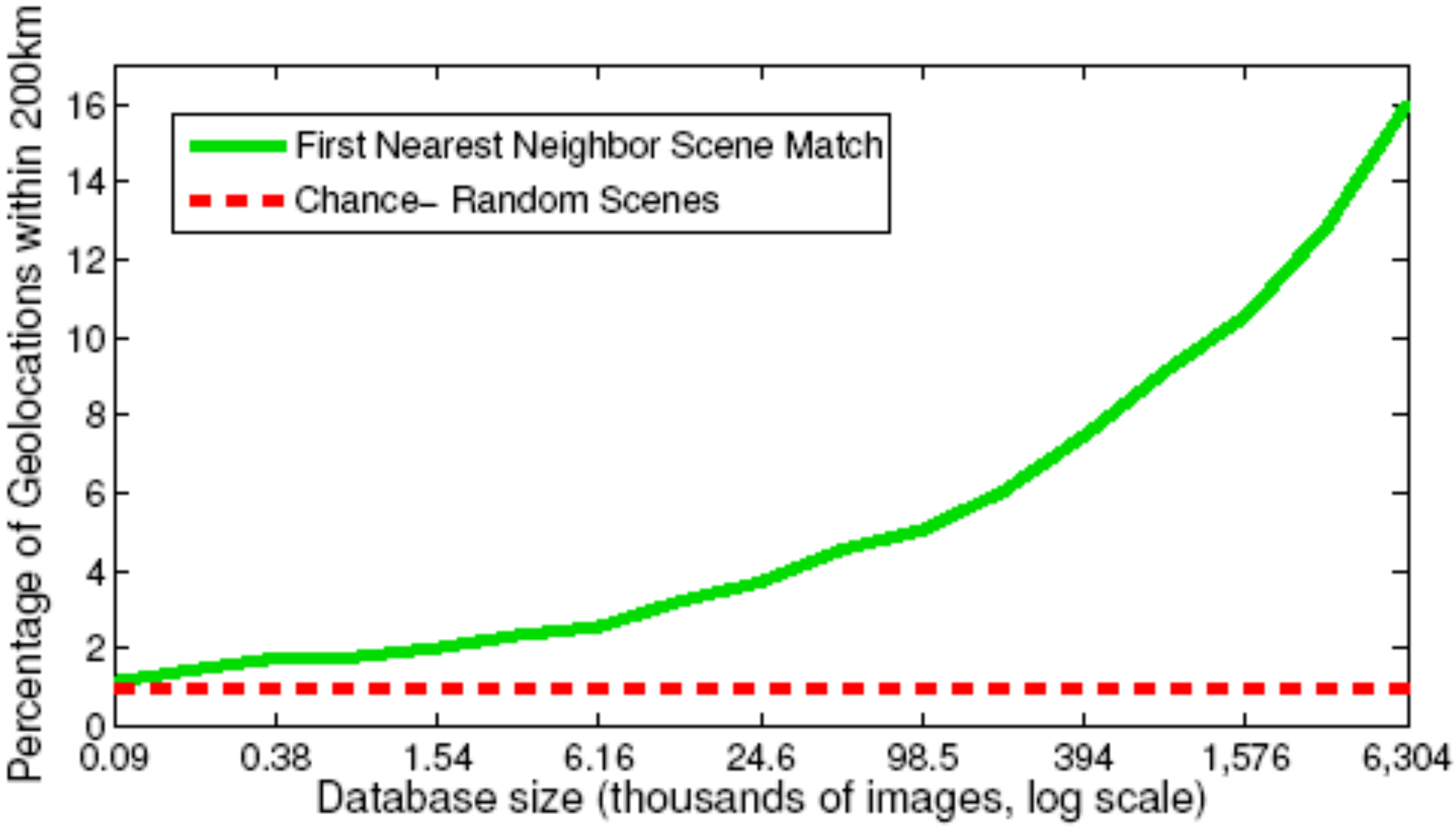
Philadelphia

NewYorkCity

Boston



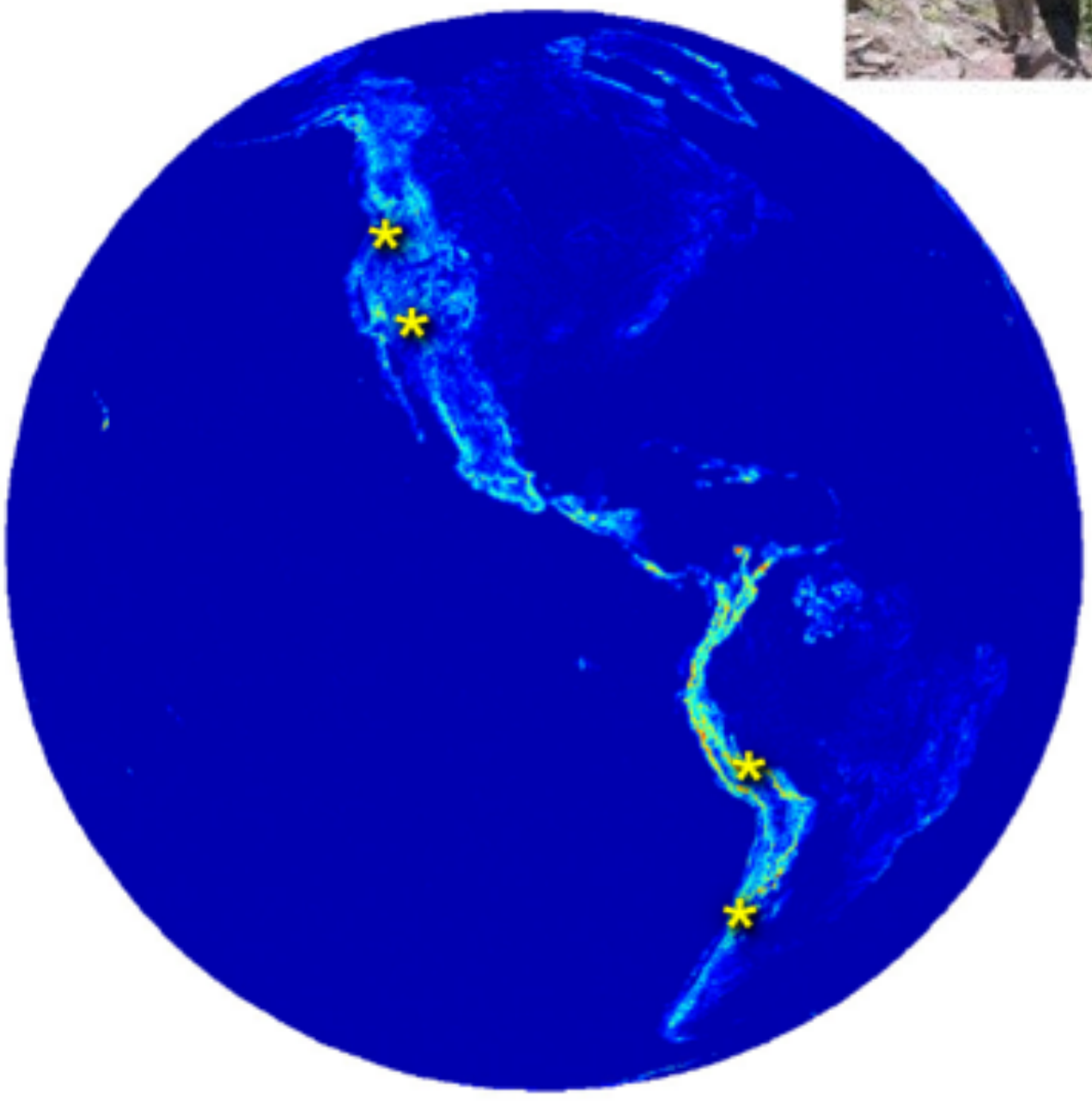
L’importance des données

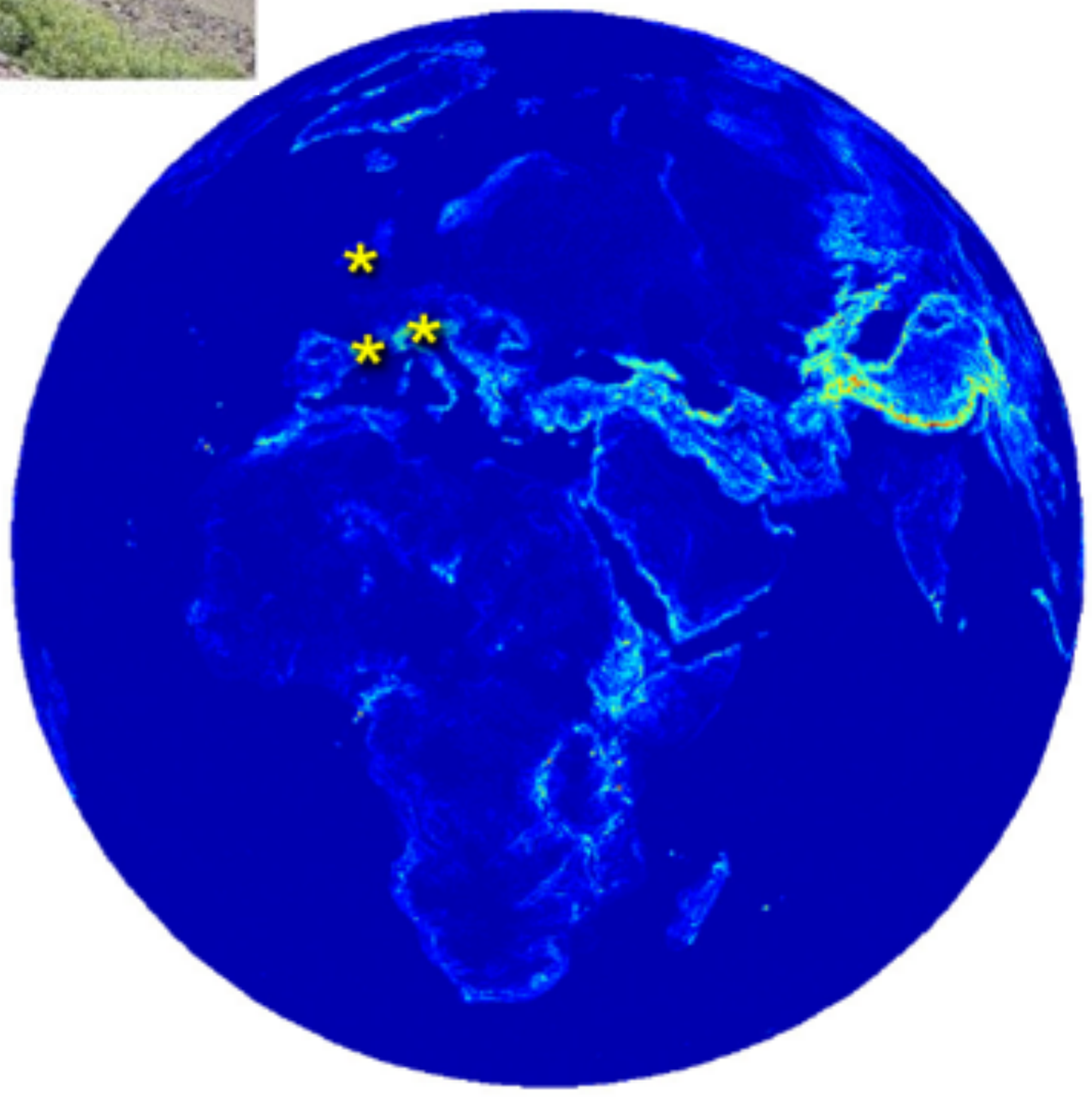


Data-driven categories


Argentina
Andorra
Andorra
Iceland
Idaho
Switzerland
Argentina
Bolivia
Nevada
Hawaii
Hawaii
Egypt
China
Arizona
Peru
Oregon

Elevation gradient = 112 m / km





Elevation gradient magnitude ranking

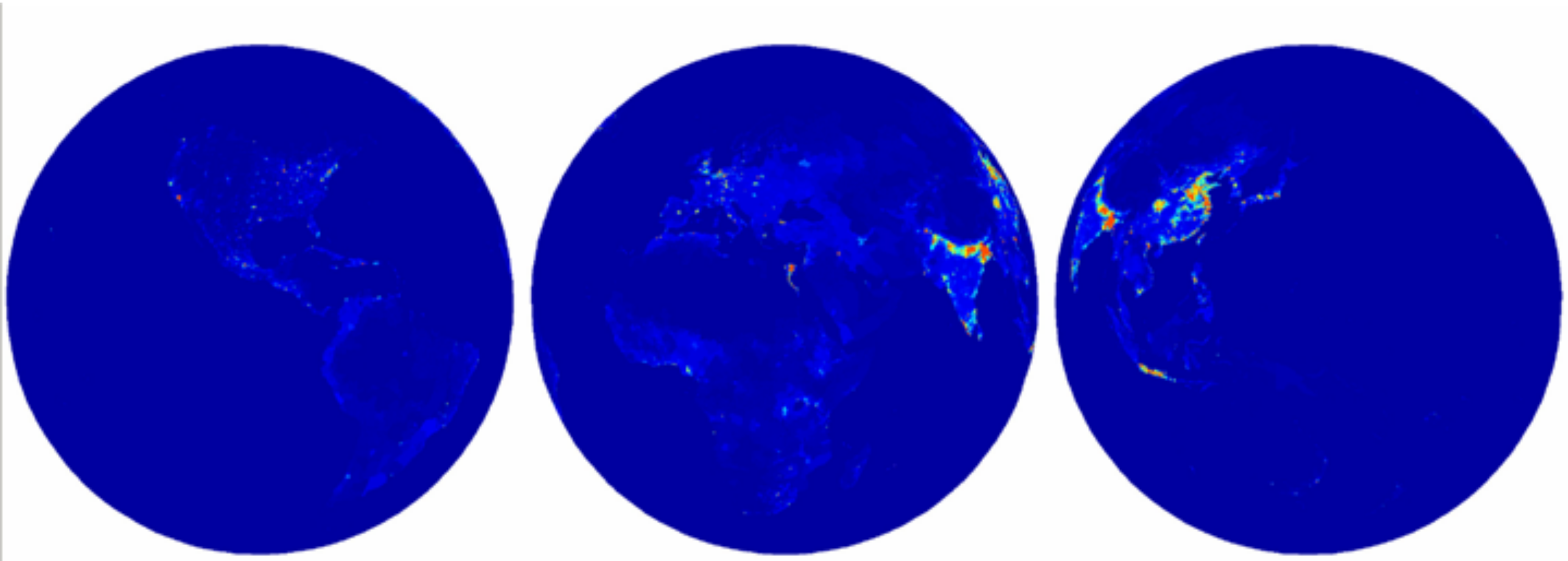


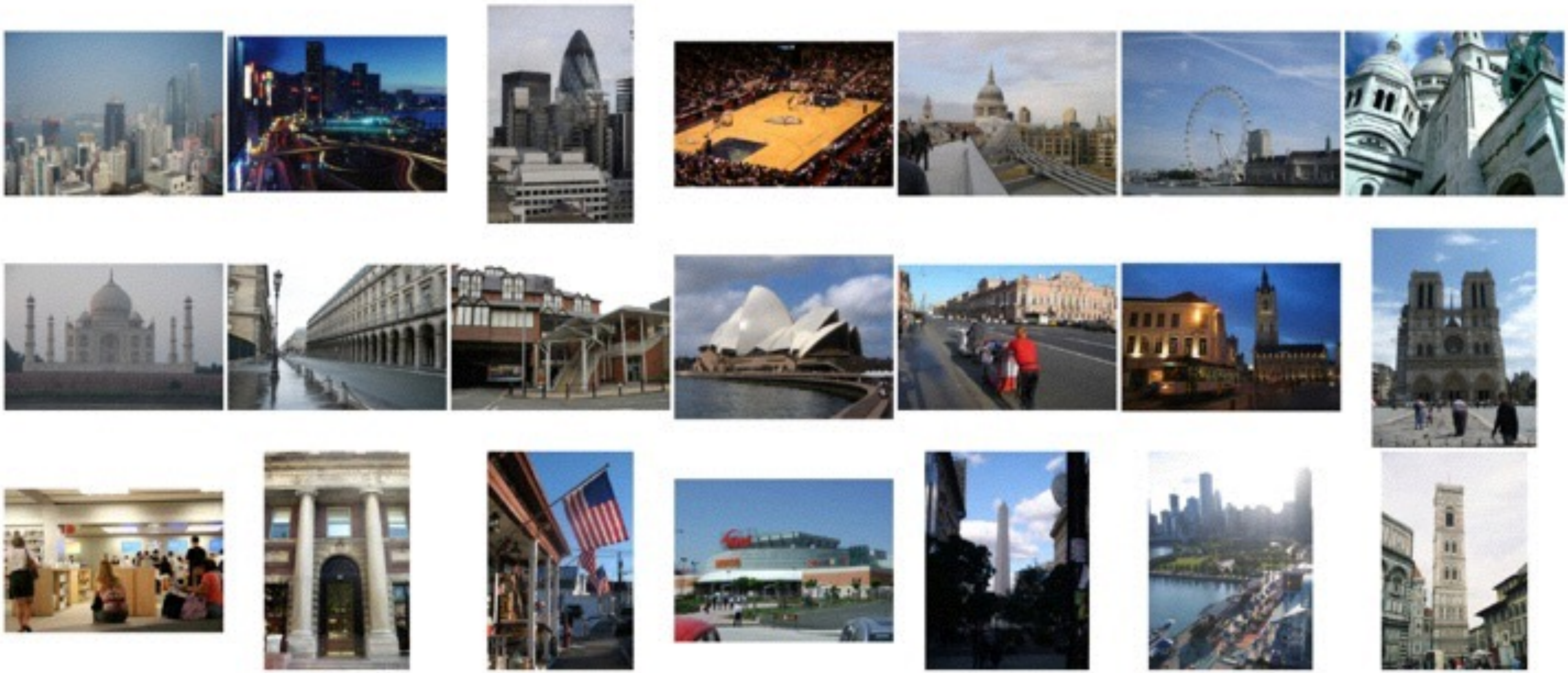
Figure 2. Global population density map.

Population density ranking

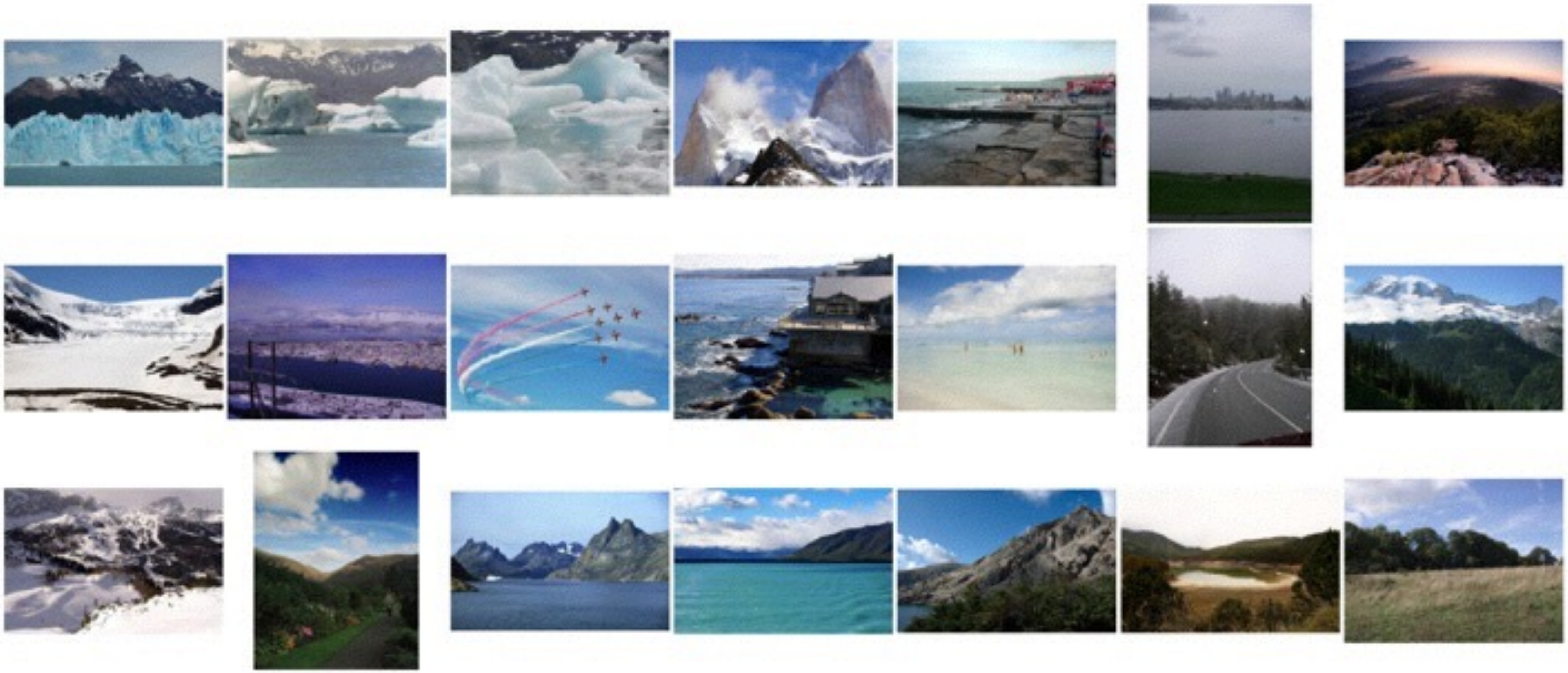
Figure 4. Global land cover classification map.

Barren or sparsely populated

Urban and built up



Snow and Ice



Savannah

Water

Où est-ce?

O. Vesselova, V. Kalogerakis, A. Hertzmann, J. Hays, A. A. Efros. “Image Sequence Geolocation,” ICCV 2009

Où est-ce?

Où sont ces images?

15:14,
June 18th, 2006

16:31,
June 18th, 2006

Où sont ces images?

15:14,
June 18th, 2006

16:31,
June 18th, 2006

17:24,
June 19th, 2006

Résultats (geo-loc < 400 km)

im2gps – 10%

temporal im2gps – 56%

Aujourd’hui

Transférer de l’information

- Emplacement GPS
- Autre information (en fonction de l’emplacement)

Améliorer l’appariement

- Apparier des portions de l’image
- Déterminer ce qu’il faut apparier

Fontaine de Médici, Paris

A. Shrivastava, T. Malisiewicz, A. Gupta, A. A. Efros, “Data-driven visual similarity for cross-domain image matching,” SIGGRAPH Asia 2011

Google images

Search by image

Drop image here

Move

Watch a short video to learn more.

Google

medici_summer.jpg × luxembourg gardens

Search

About 2 results (0.29 seconds)

Everything

Images

Maps

Videos

News

Shopping

More

Image size:
1024 × 829

No other sizes of this image found.

Visually similar

Medici Fountain, Paris (winter)

Google

 medici_winter.png × luxembourg gardens

Search

About 2 results (0.29 seconds)

Everything

Images

Maps

Videos

News

Shopping

More

Image size:
713 × 600

No other sizes of this image found.

Visually similar

Google

painting.png × describe image here

Search

About 2 results (0.29 seconds)

Everything

Images

Maps

Videos

News

Shopping

More

Image size:
319 × 482

No other sizes of this image found.

Visually similar

Google

medici_sketch.bmp × describe image here

Search

About 2 results (0.29 seconds)

Everything

Images

Maps

Videos

News

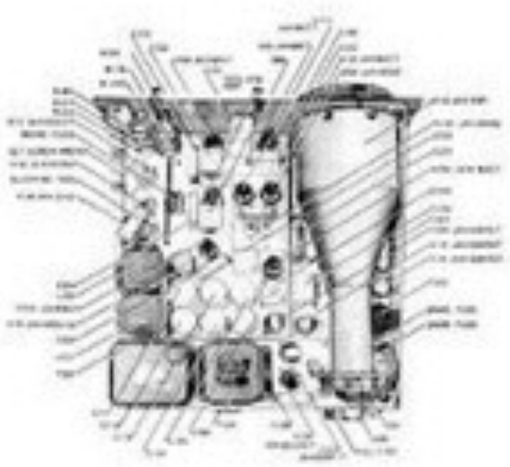
Shopping

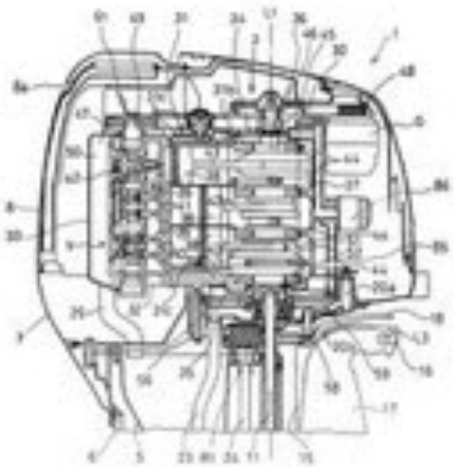
More

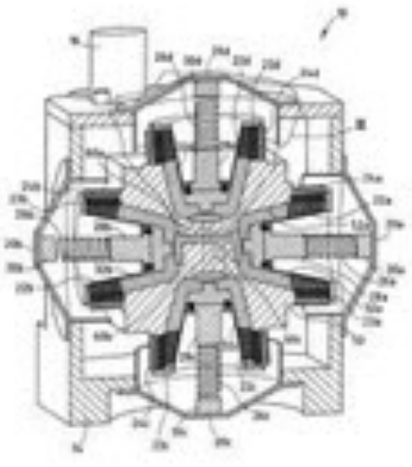
Image size:
443 × 482

No other sizes of this image found.

Visually similar

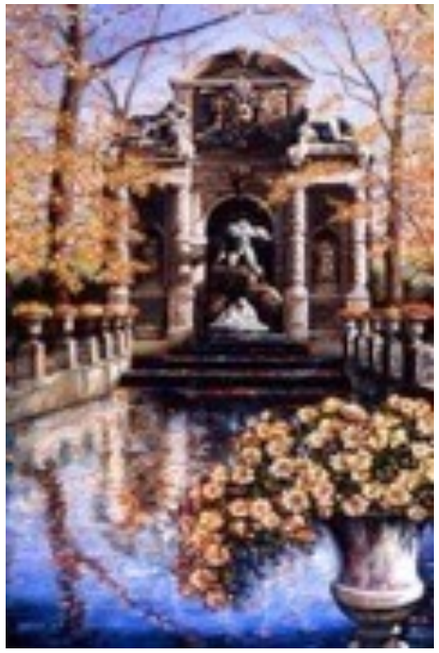


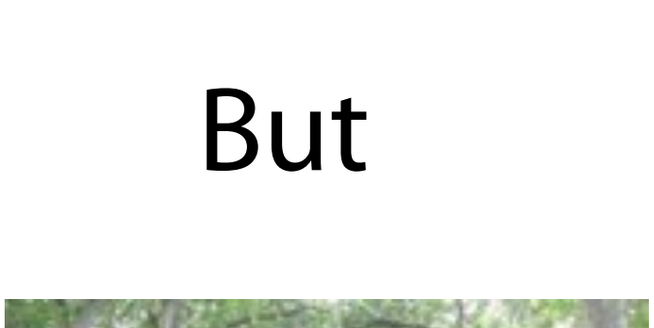




But







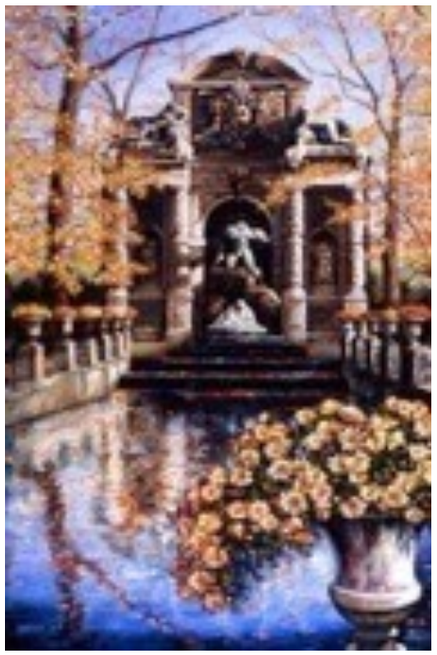






Pourquoi c’est si difficile?






Comparer les images

SIFT
(représentation des gradients
autour des coins)

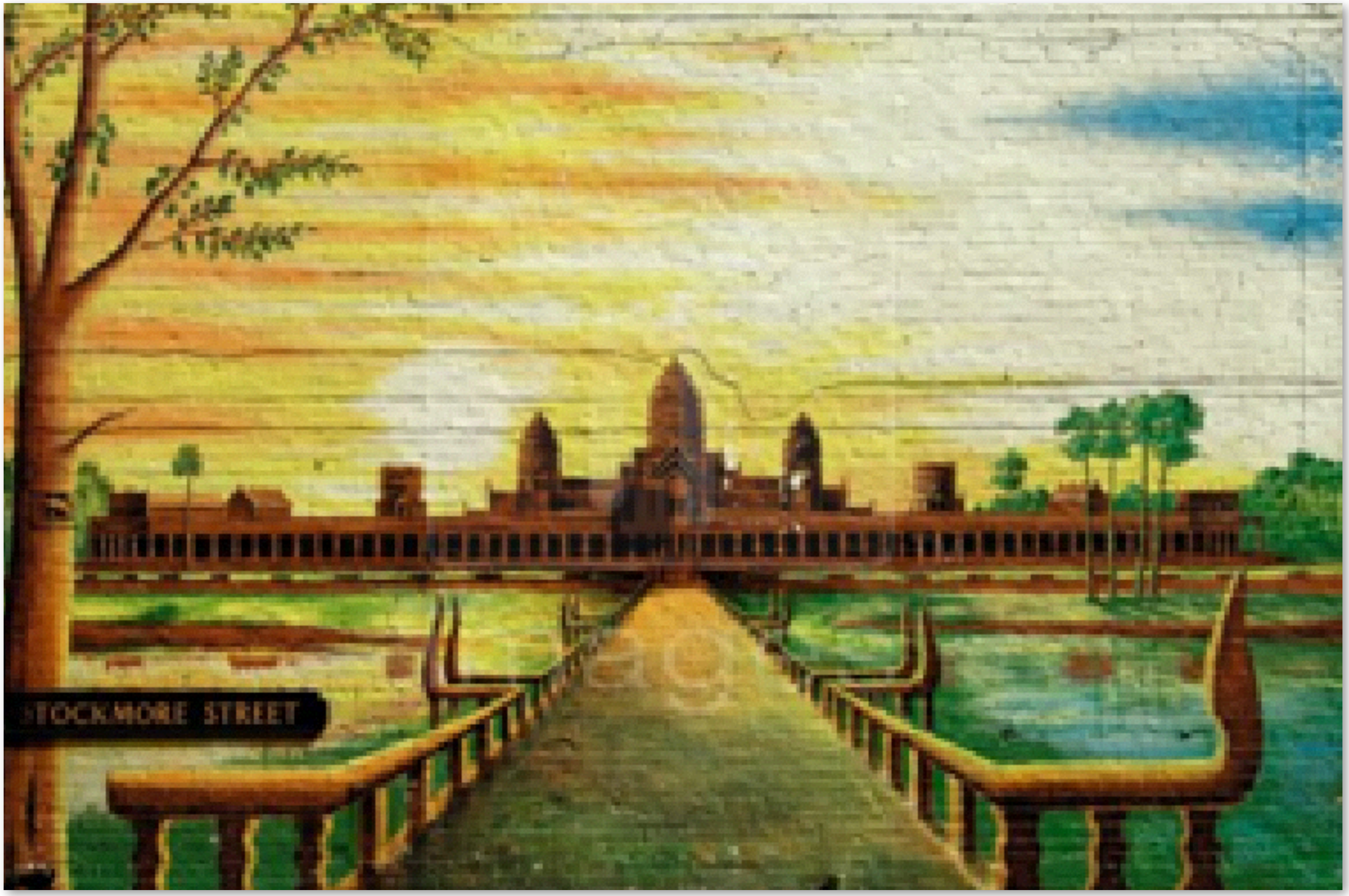
GIST
(représentation des gradients
dans l’image)

Exemple: appariement SIFT

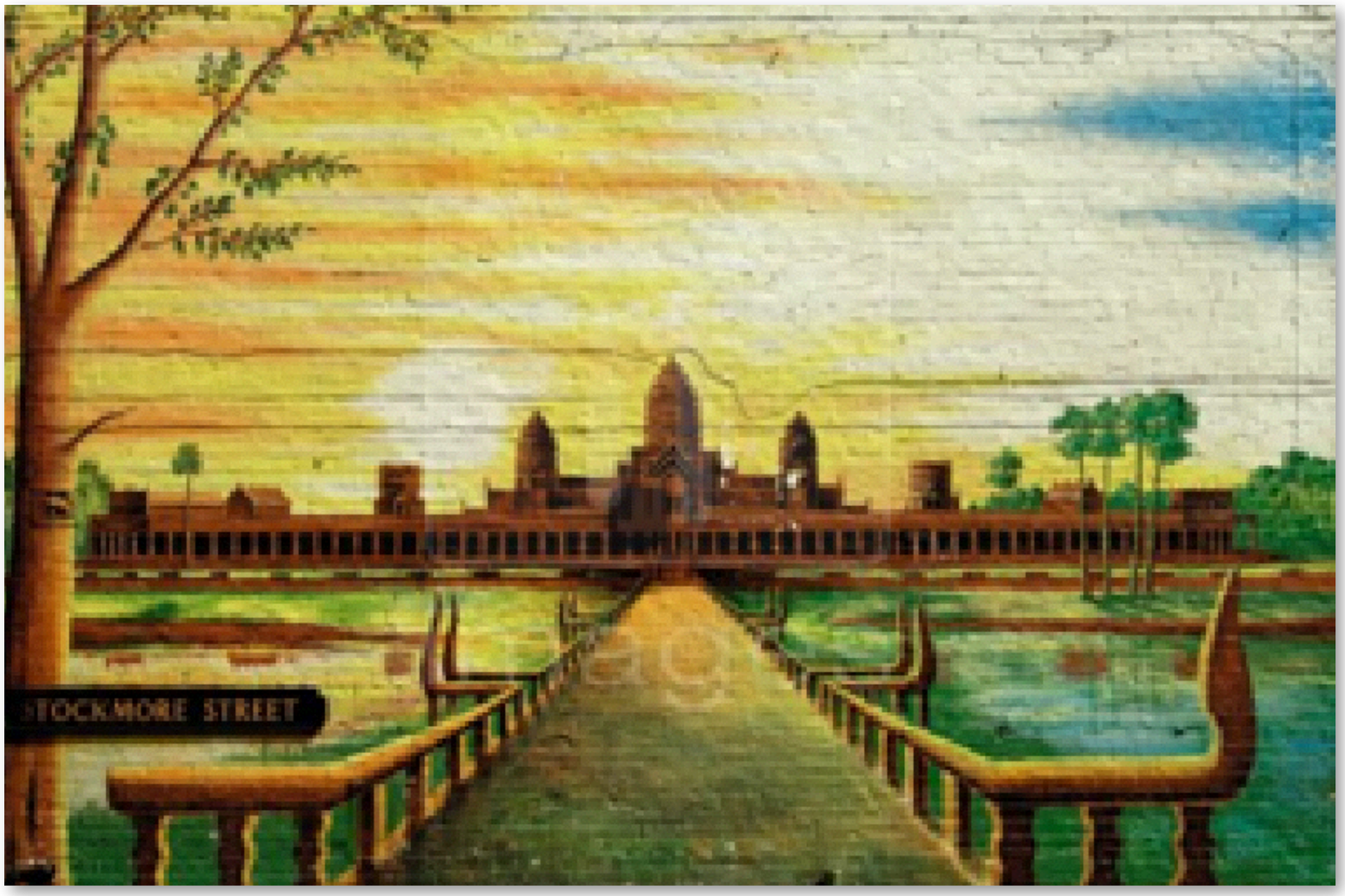
[SIFT: Lowe, 2004]

Exemple: appariement SIFT

[SIFT: Lowe, 2004]


STOCKMORE STREET

Image

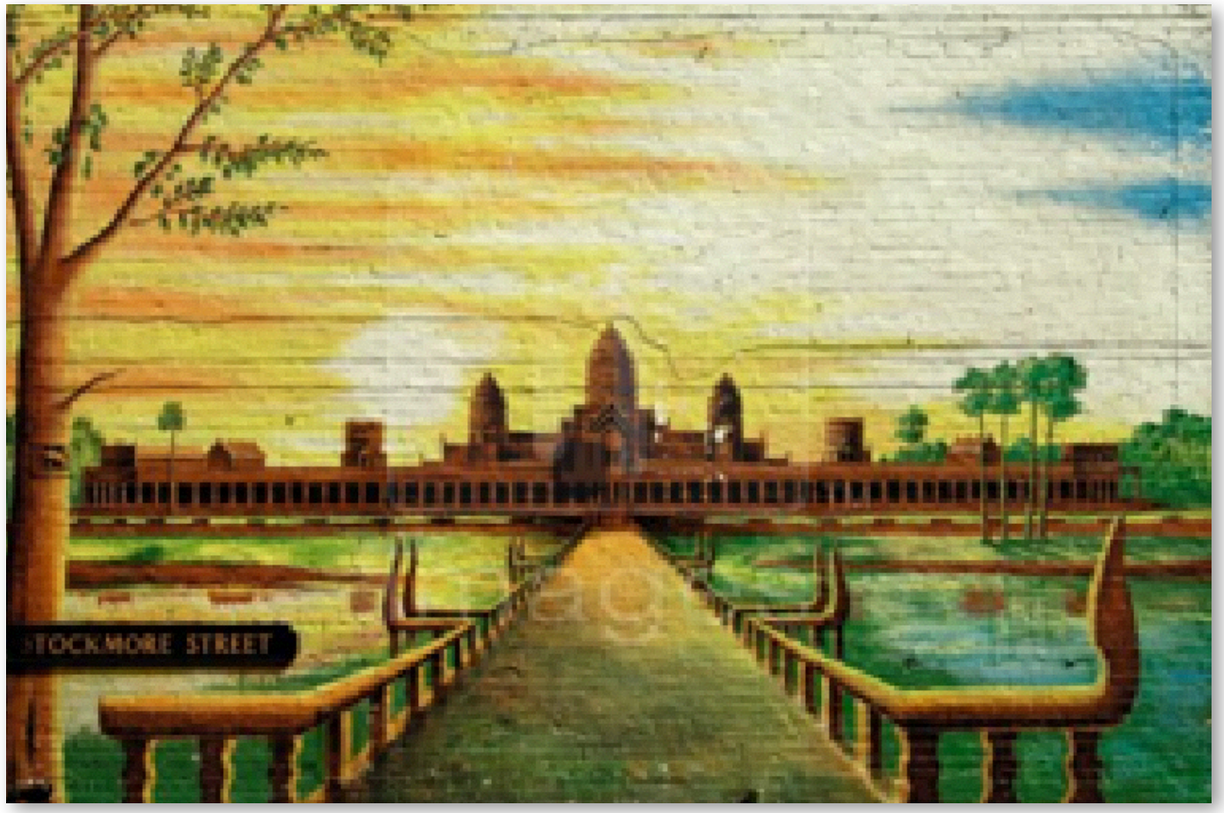






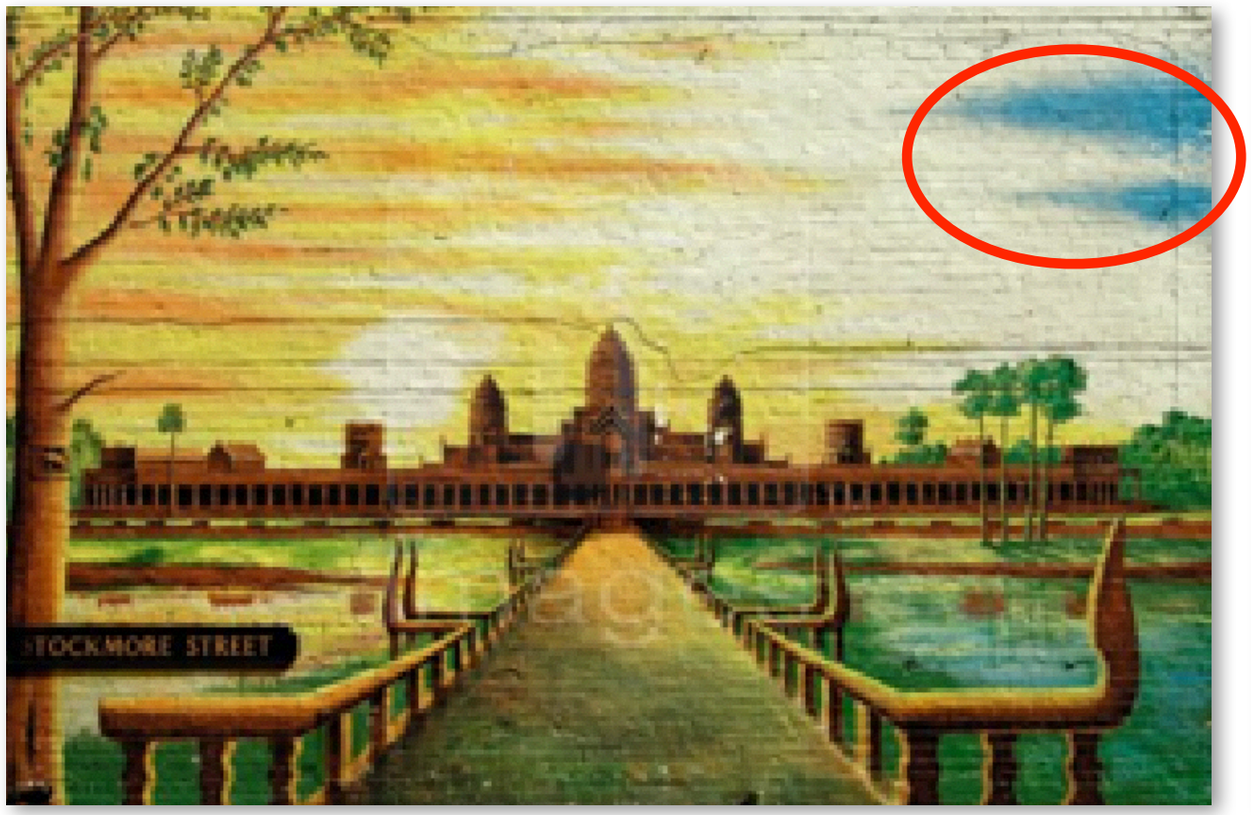
Plus proches voisins

Image



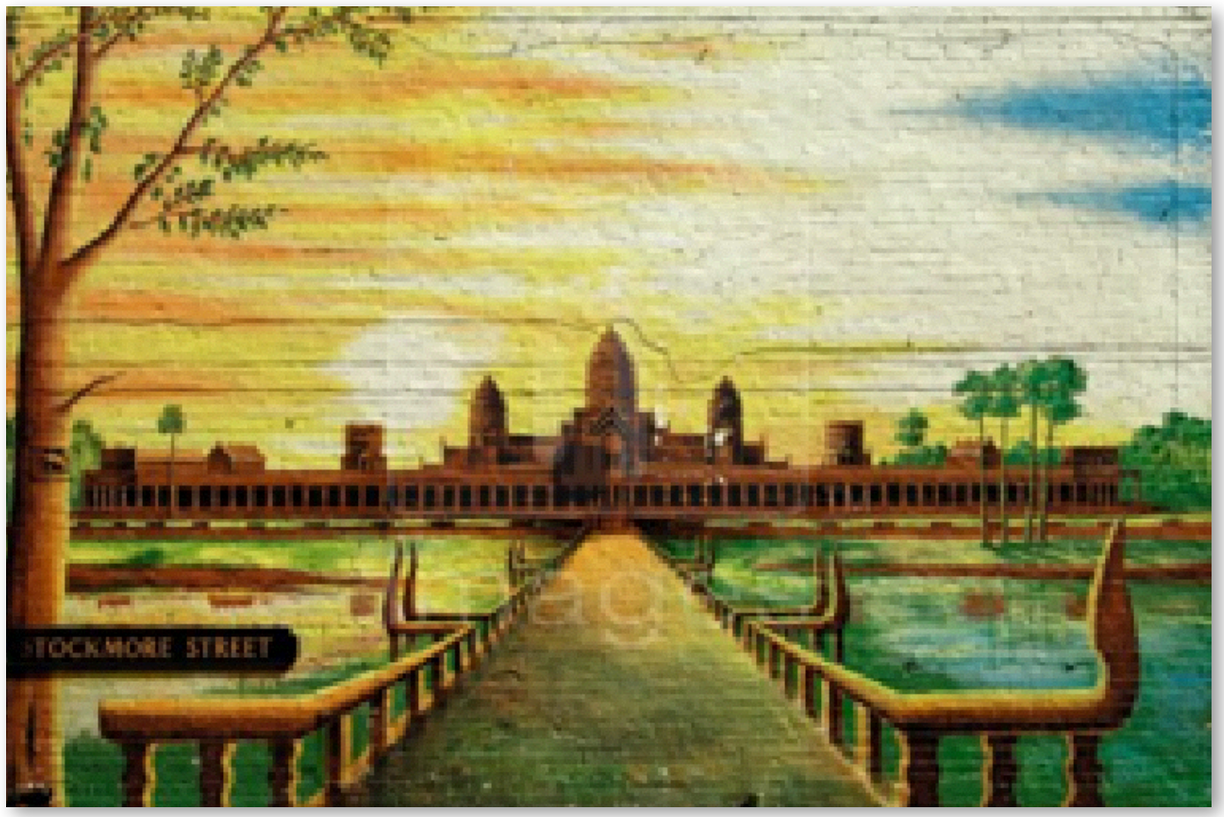
Plus proches voisins

Image



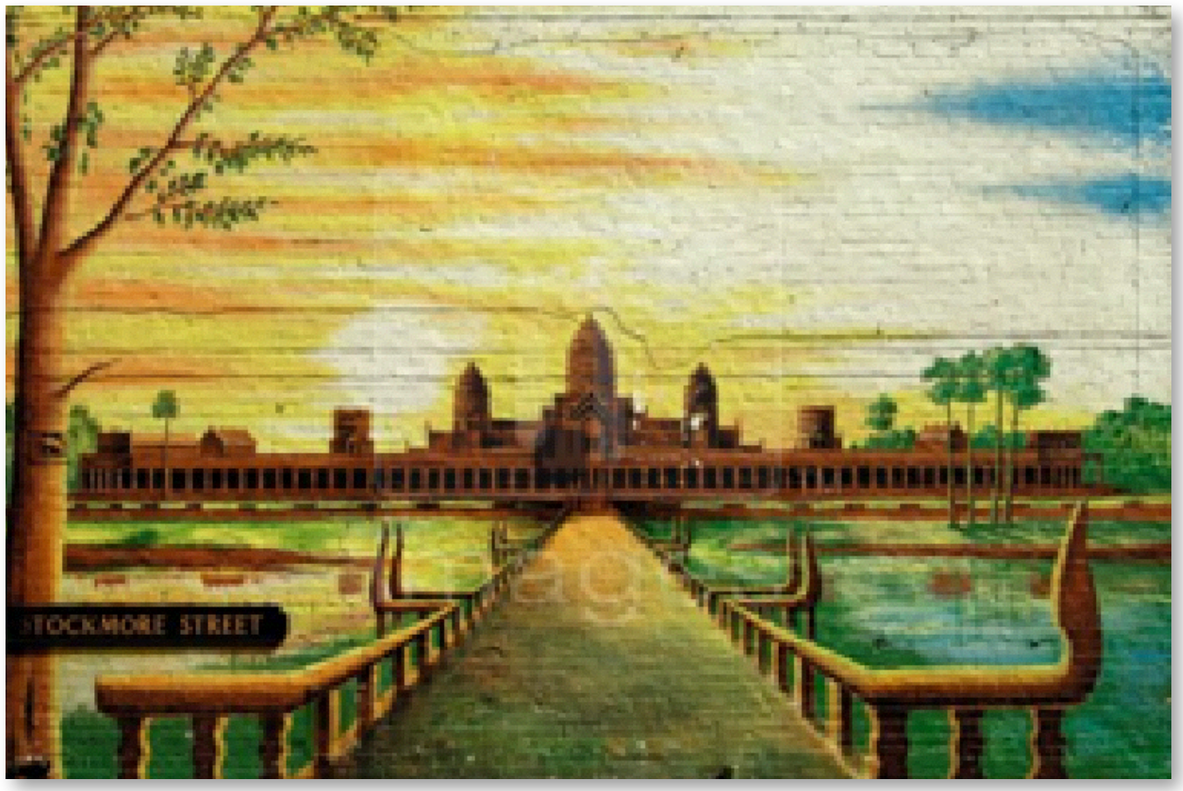
Plus proches voisins

Image

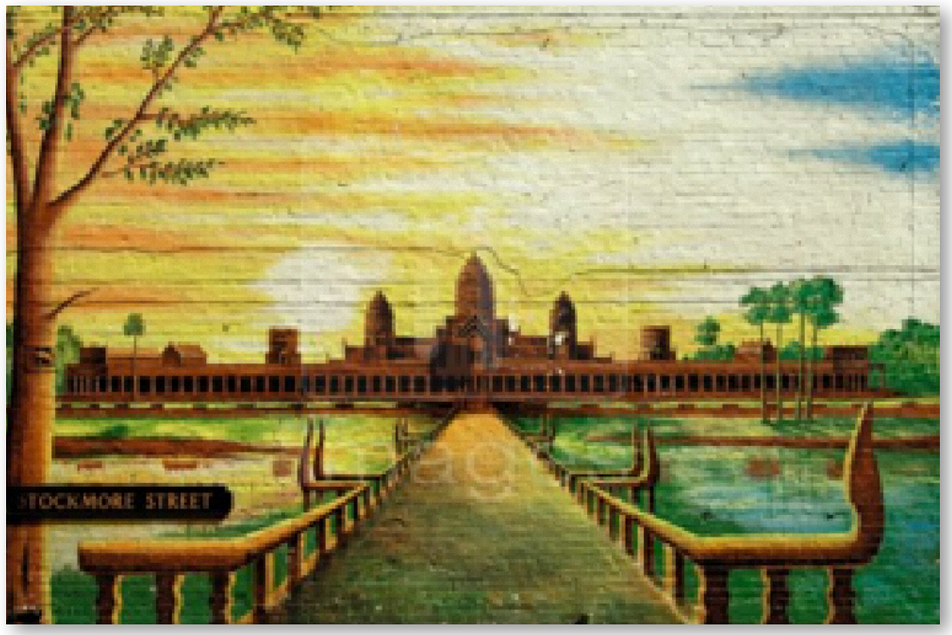


Parties importantes

Image

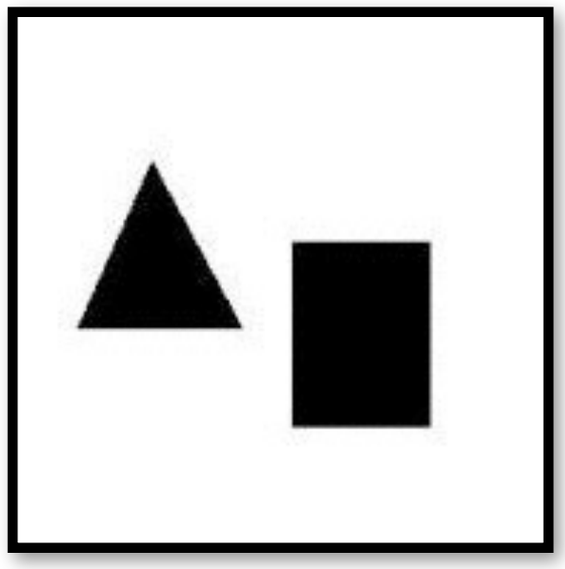


Plus proches voisins

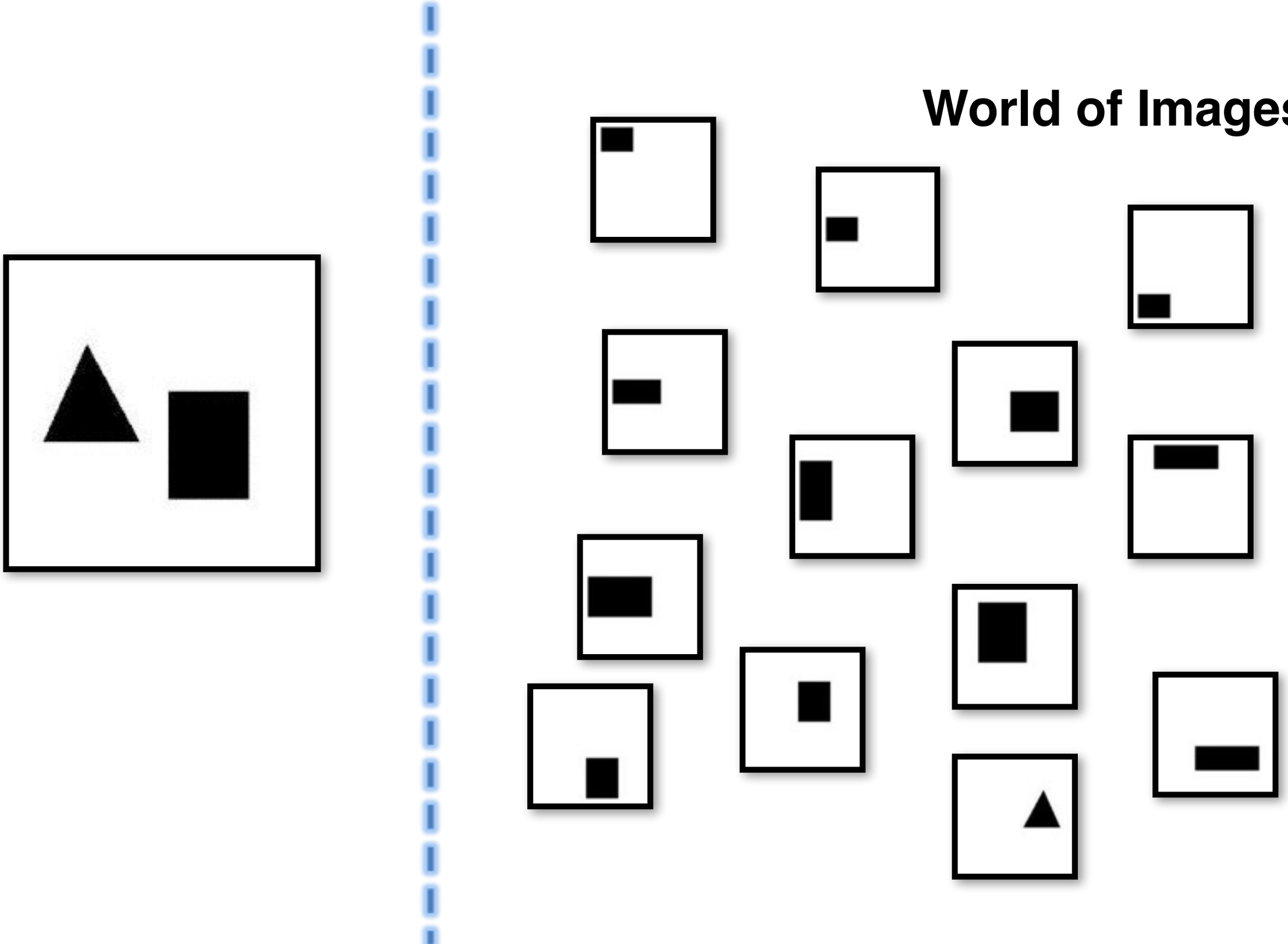


Utiliser les données pour déterminer ce qui est unique

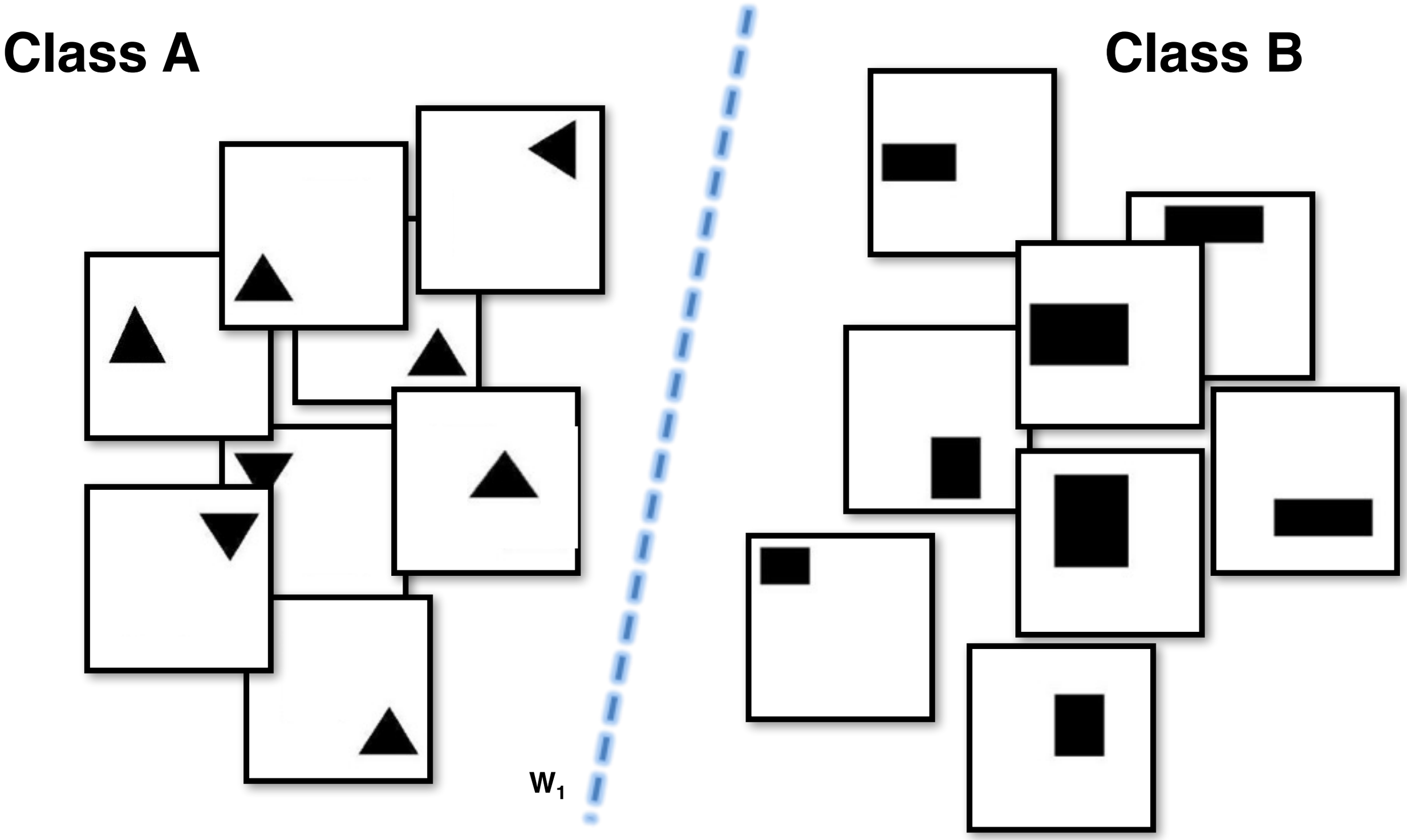
Qu’est-ce qui est unique?



Qu’est-ce qui est unique *étant donné le monde?*

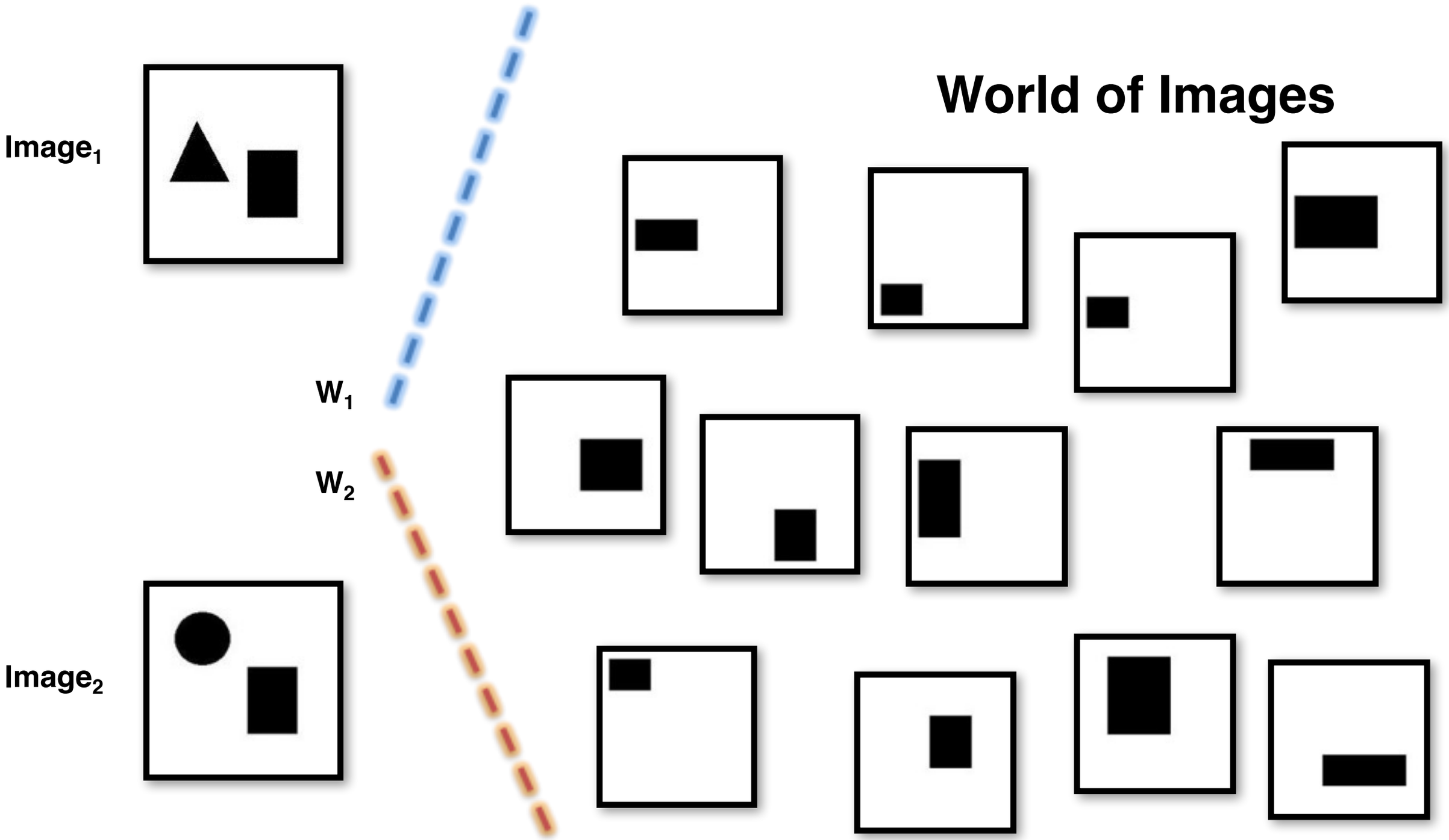


Support vector machine (SVM)



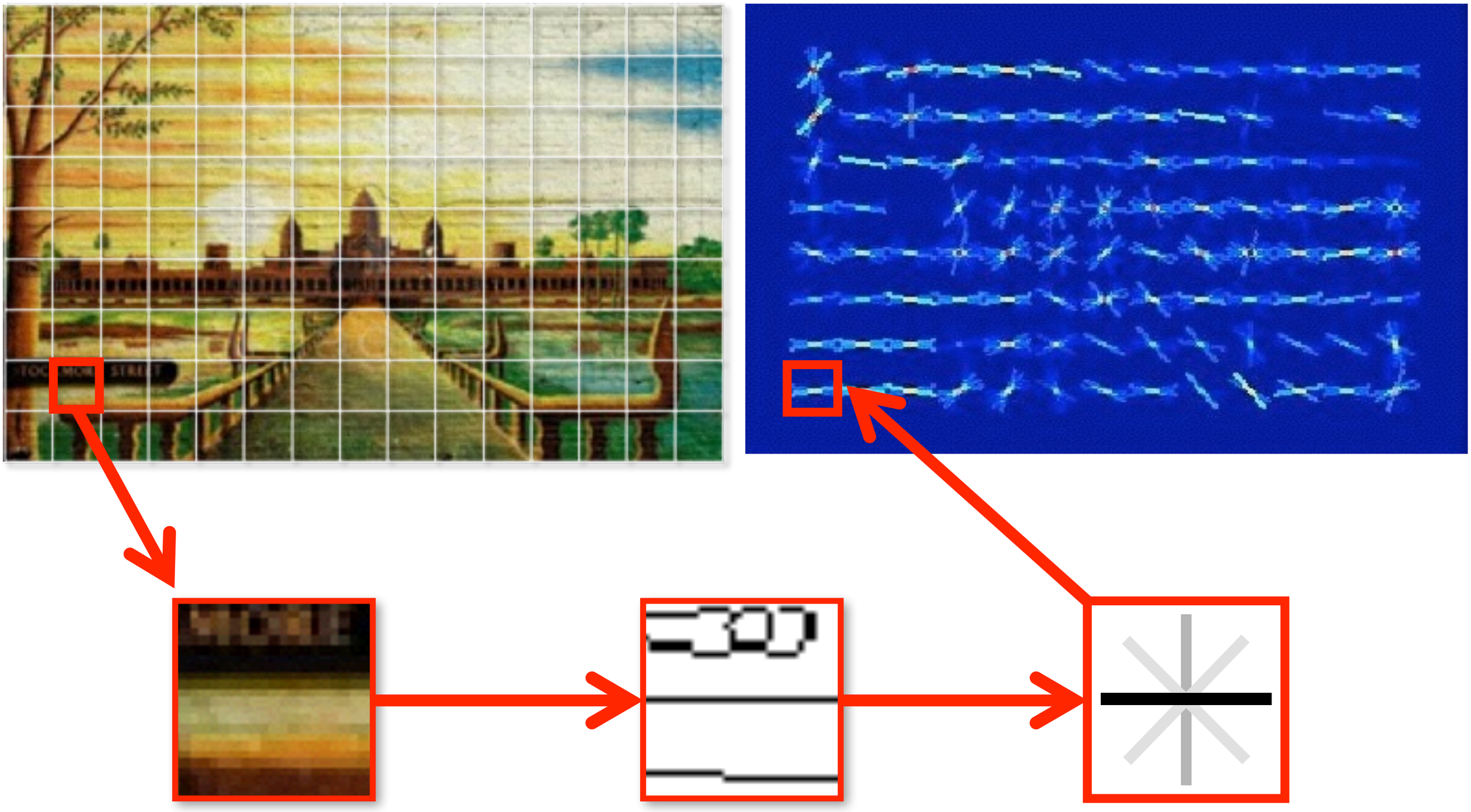
[Cortes and Vapnik, Machine Learning, 1995]

Per-exemplar SVM



[Malisiewicz et al., ICCV, 2011]

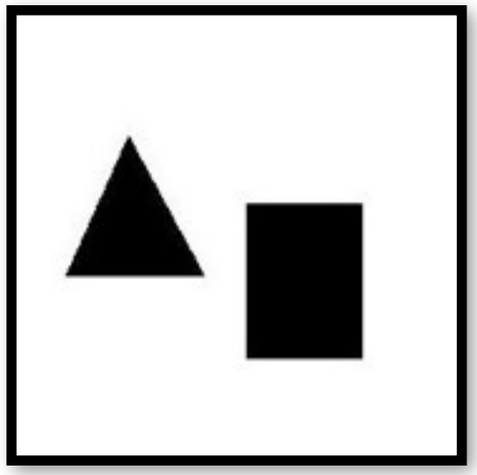
Histogram of oriented gradients (HOG)

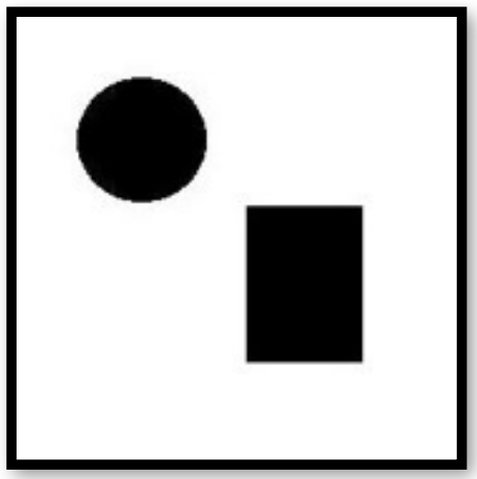


[Dalal and Triggs, CVPR, 2005]

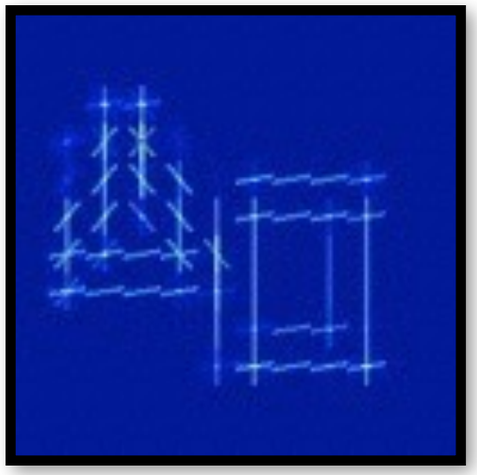
Visualizer ce qui est unique

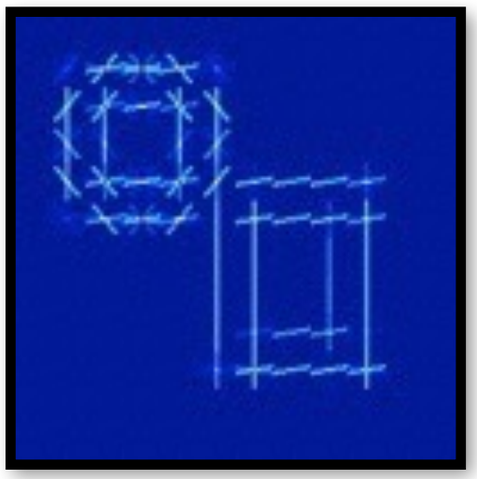
Query

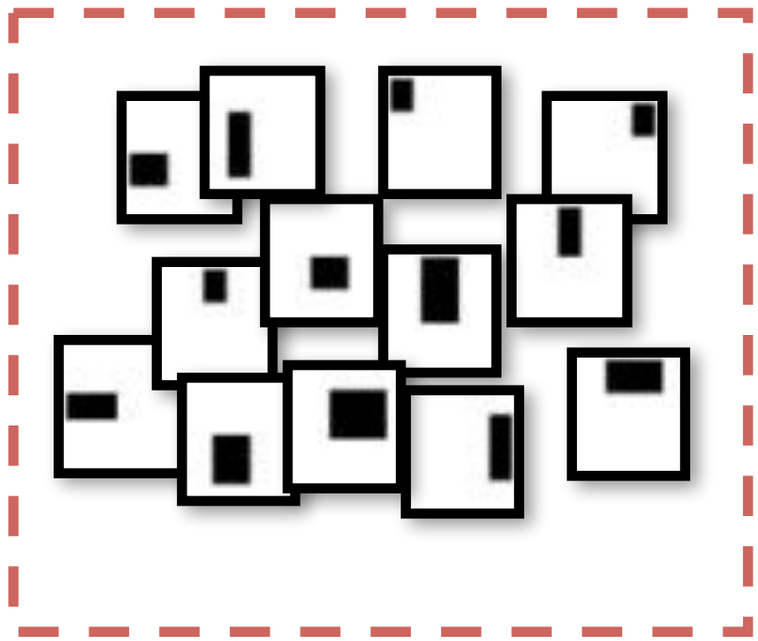




Before

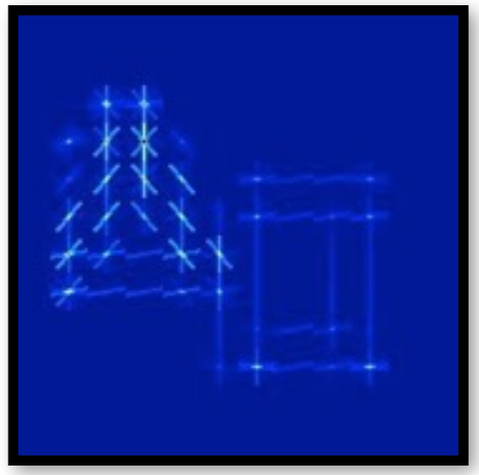


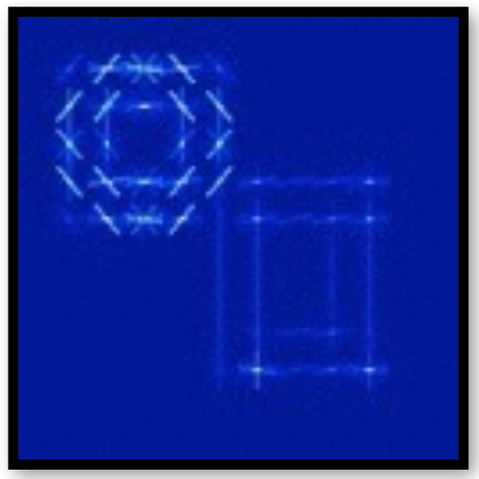




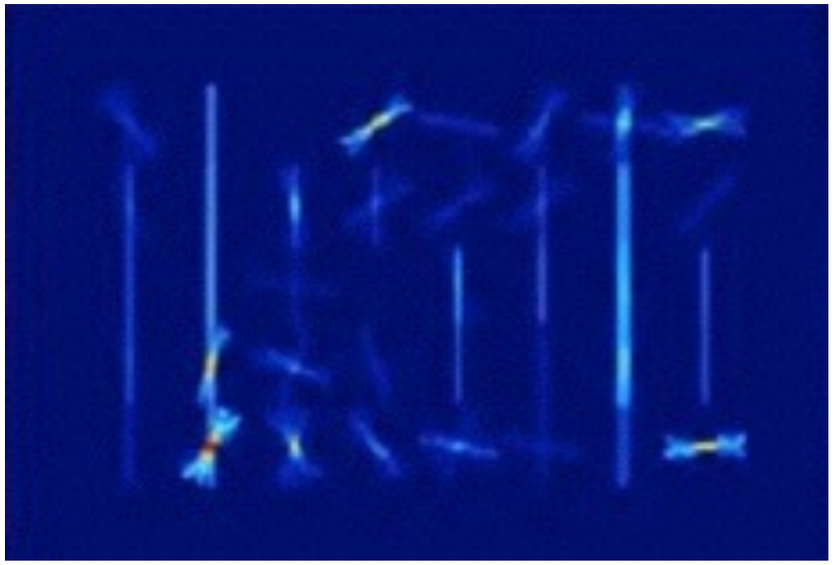
World of Images

After



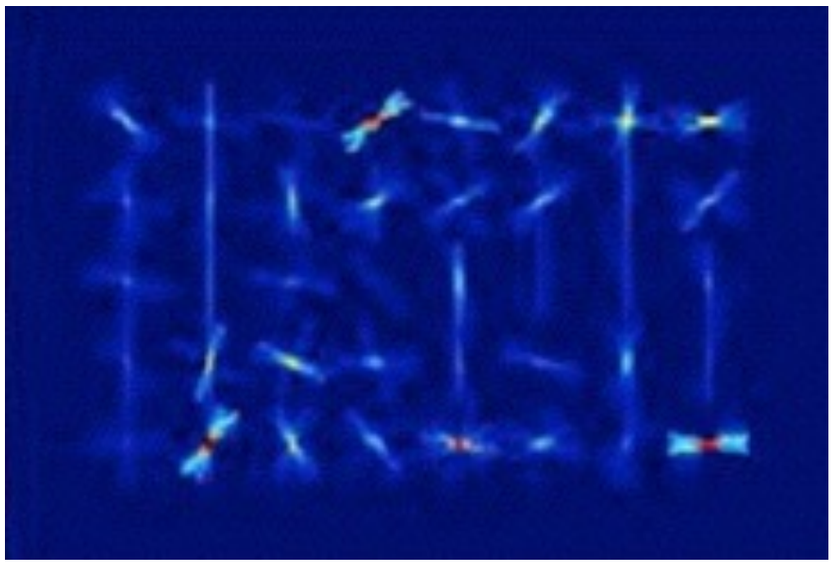


Input Query



HOG

Top Match



Learnt Weights

Top Match

Input Image

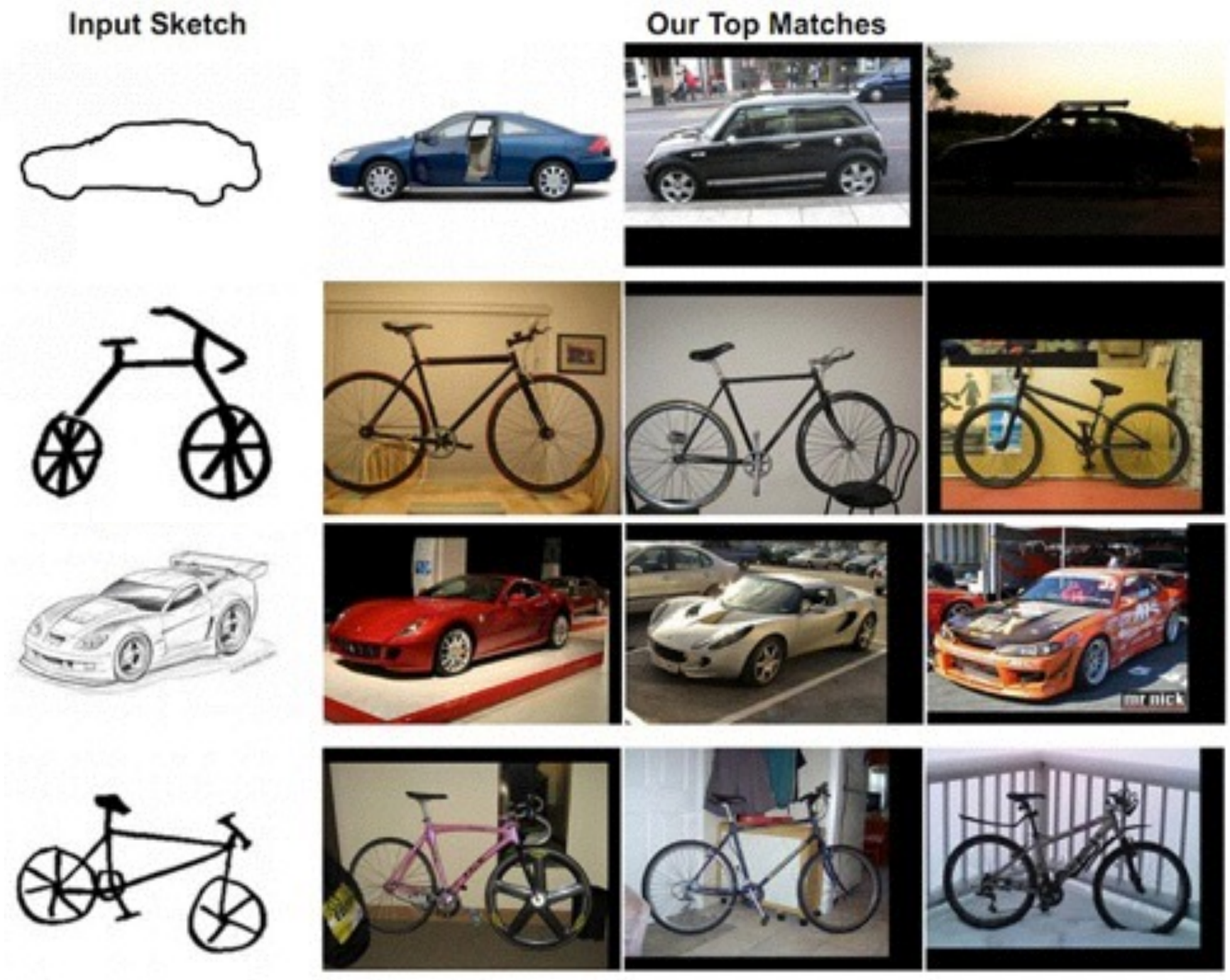
Uniform Weights

Learnt Weights

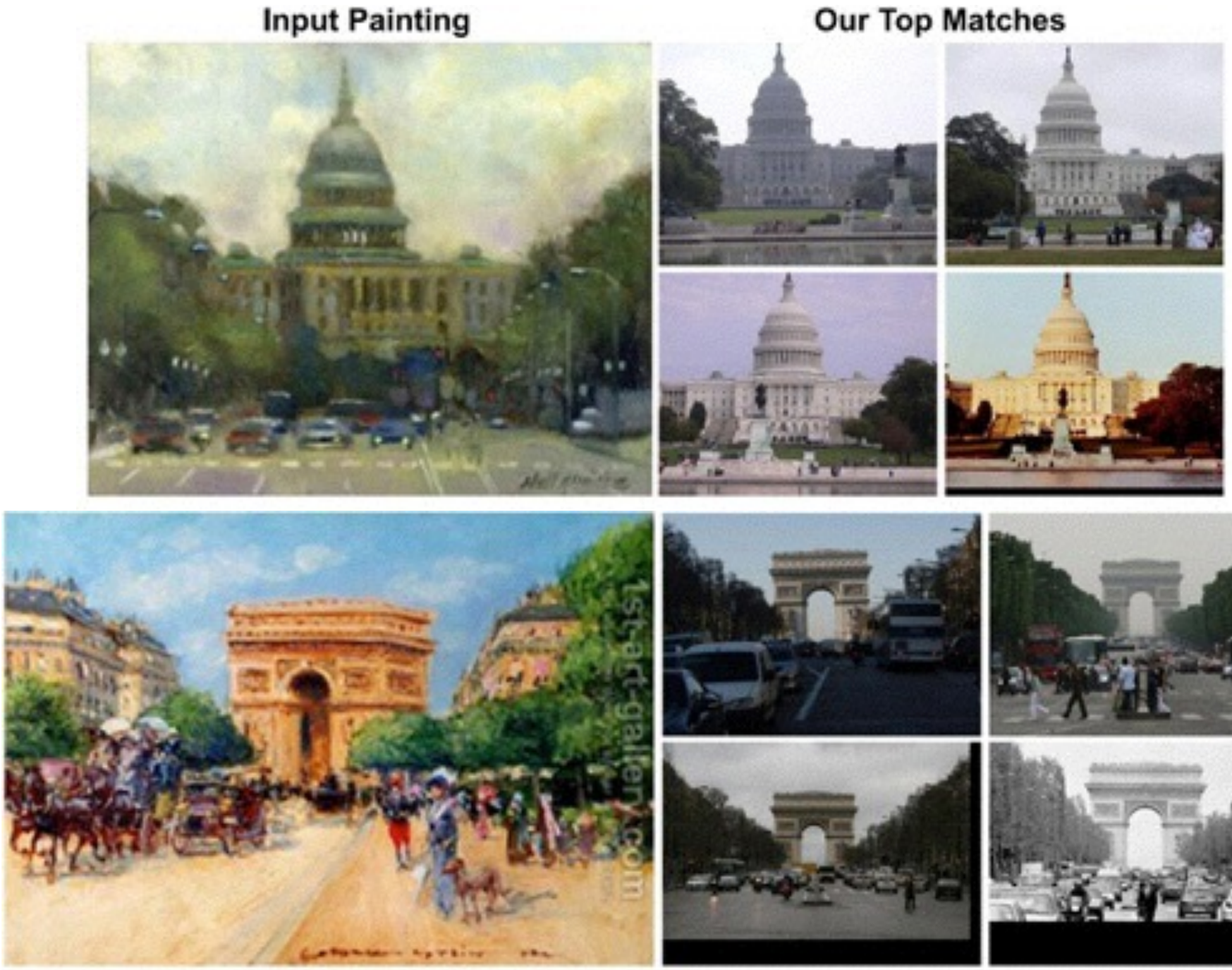
Uniform Weight Matches

Our Matches

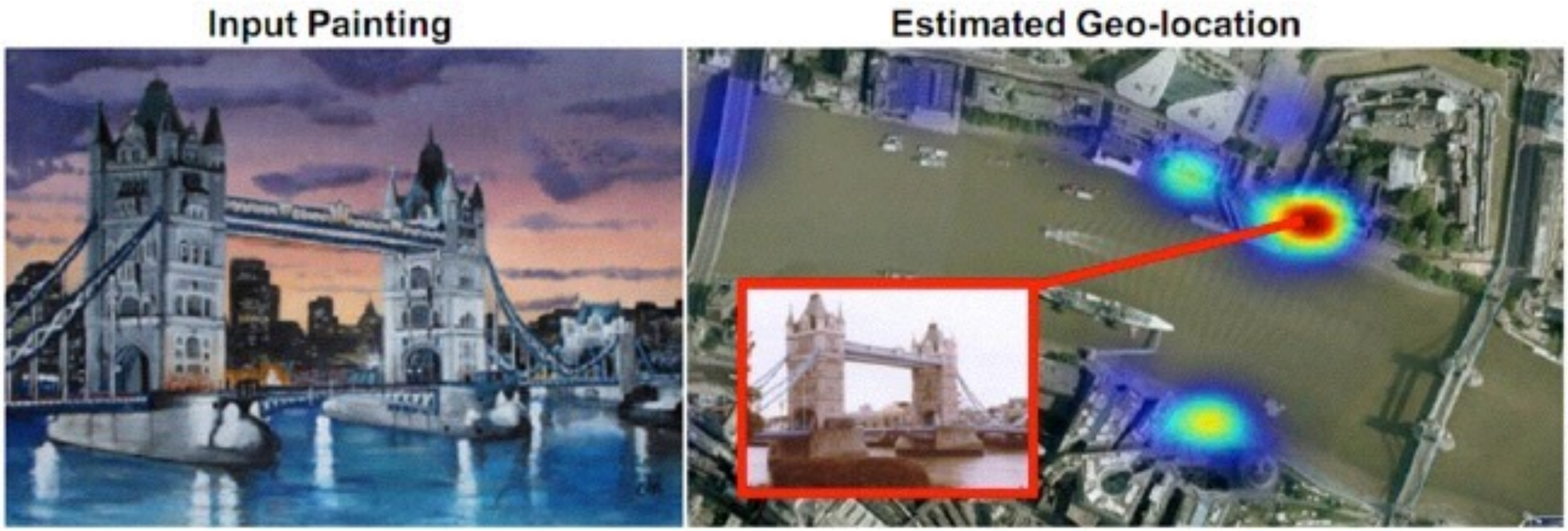
Sketch based Image Retrieval



Painting based Image Retrieval



painting2gps



Results

http://youtu.be/PY__Fo4o67I?t=1m15s

Les Dangers des Données

Biais

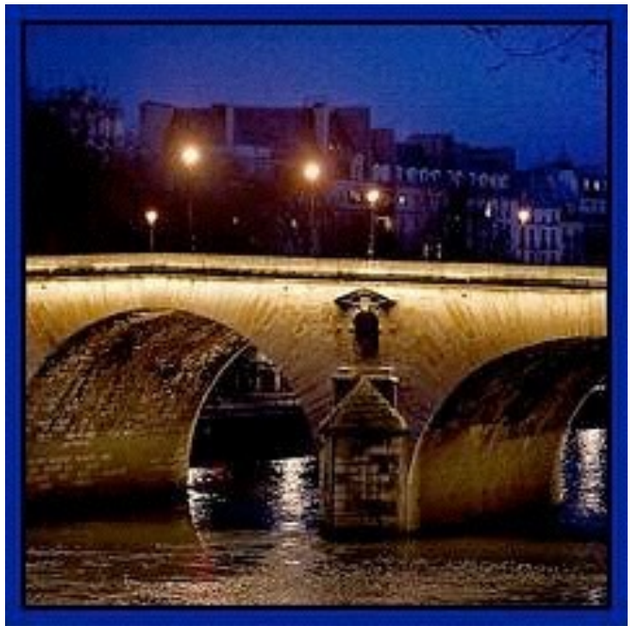
Internet contient un nombre énorme d'images (Flickr, YouTube, Picasa, etc.)

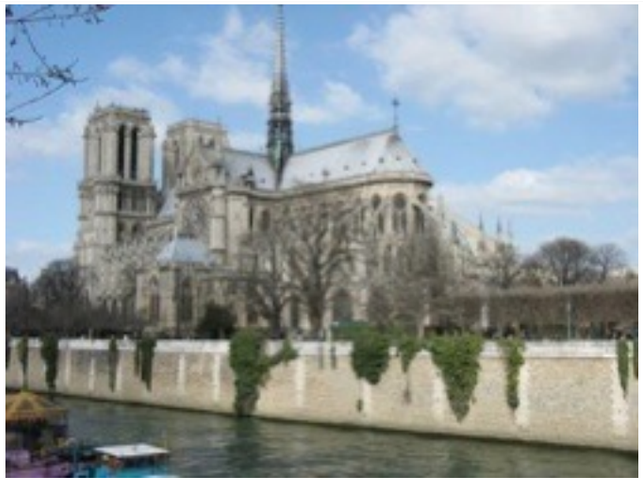
Les images ne sont pas échantillonnées aléatoirement

Plusieurs sources de biais:

- Échantillonnage
- Photographe
- Social

Flickr Paris





Vrai Paris











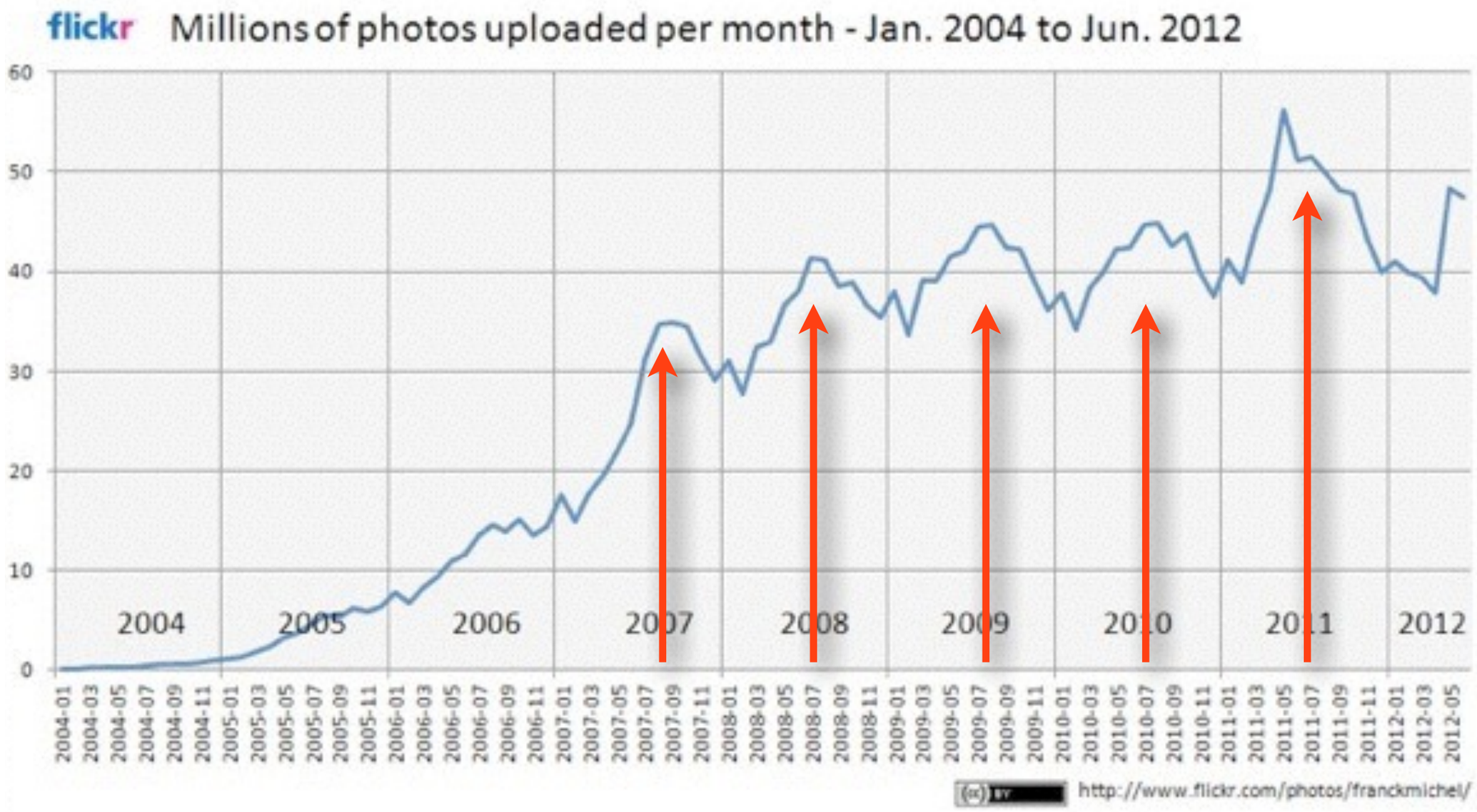

Vraie Notre Dame

Biais d’échantillonnage

Nous aimons prendre des photos en vacances

Biais d'échantillonnage

Nous aimons prendre des photos en vacances



Biais du photographe

Nous voulons que nos photos soient intéressantes, ou reconnaissables!

VS.

Biais du photographe

Conventions photographiques

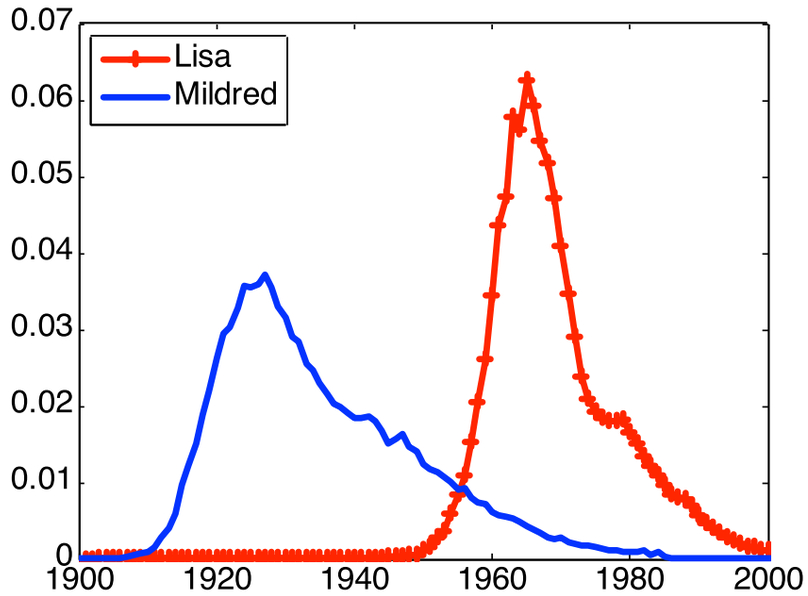
VS.

Biais social

"100 Special Moments" by Jason Salavon

Biais Social

Mildred and Lisa



Source: U.S. Social Security Administration

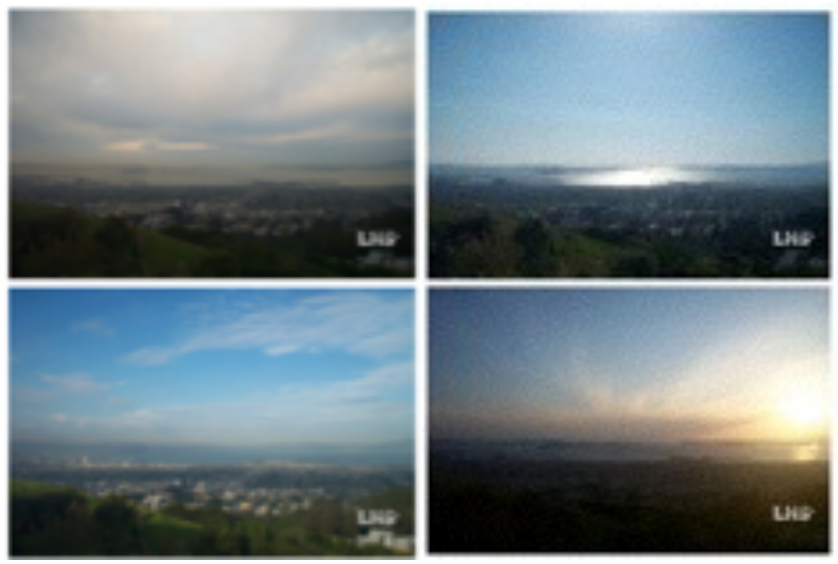
Gallagher et al CVPR 2008

Biais social

Limiter le biais

Street side
Google StreetView

Satellite
google.com

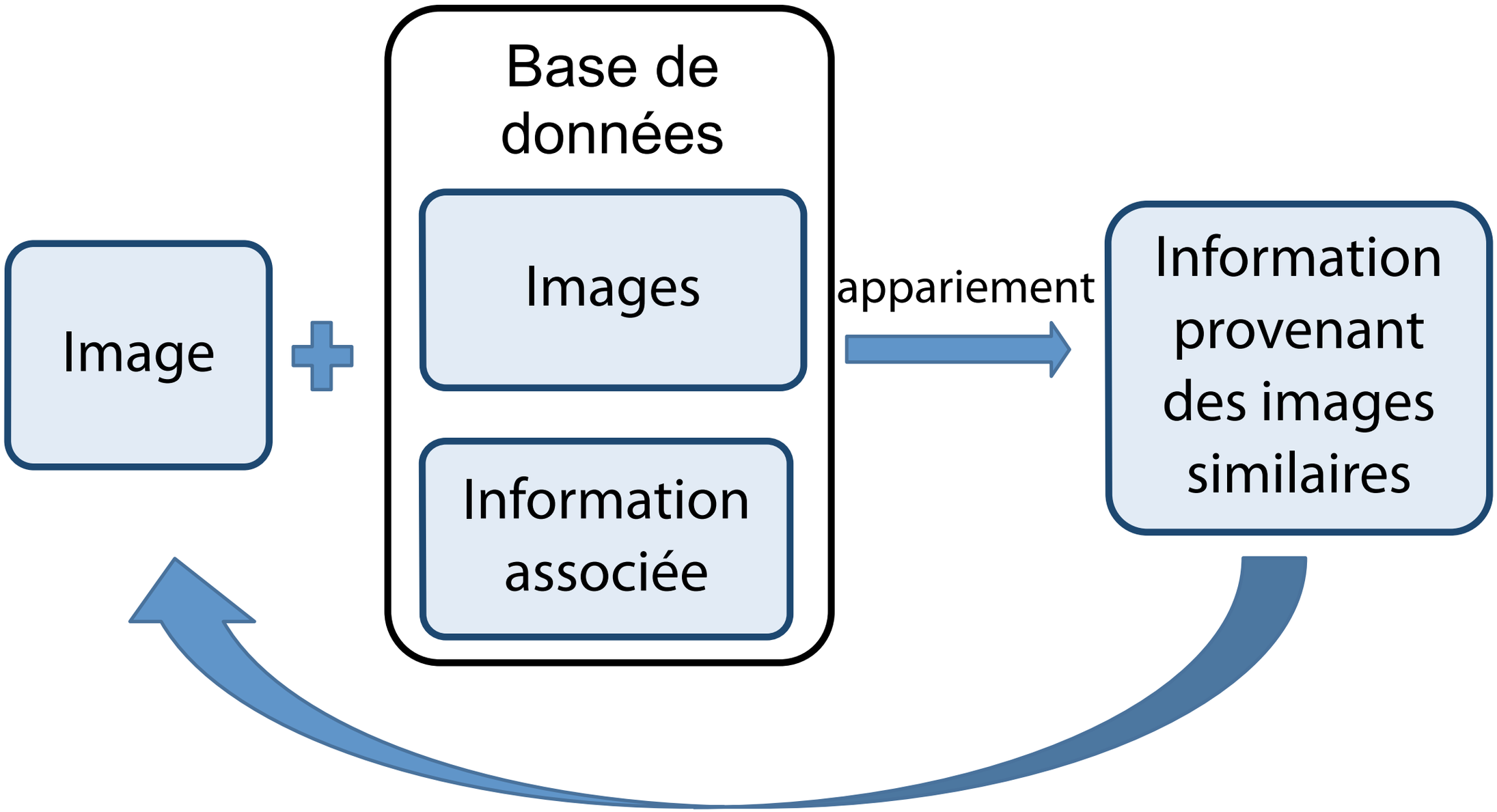


Webcams

Capture autonome réduit le biais

- On en a toujours un peu…

Survol



Truc: si vous avez assez d’images, la base de données devrait contenir des images suffisamment similaires, faciles à trouver!