

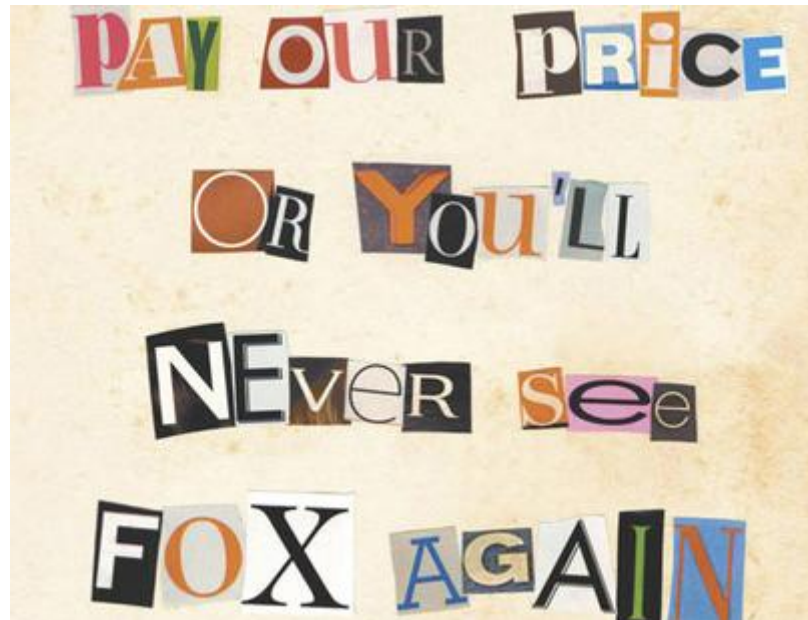
TOP-SURF: A Visual Words Toolkit



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What is TOP-SURF?

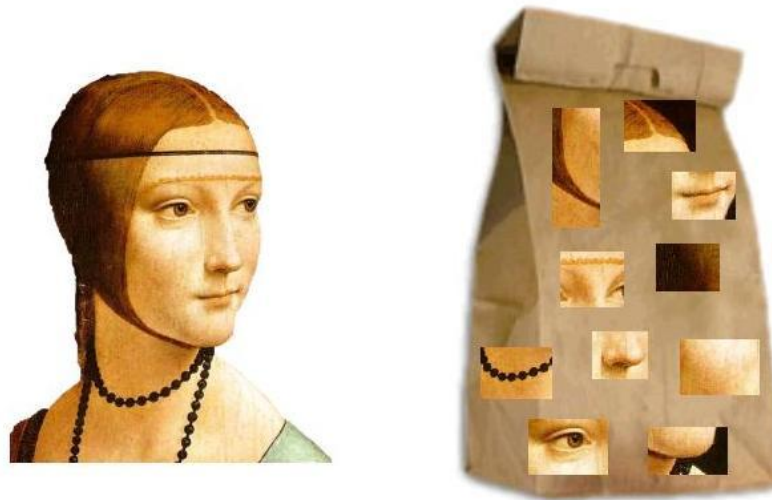
- toolkit for visual words



not this kind of visual words...

What are visual words?

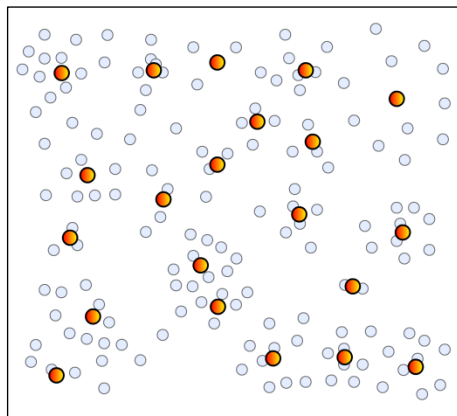
- bag-of-words model



- visual words are like textual words

Creating and using visual words

- extract representative set of image features
- group into desired number of clusters



cluster id	cluster center
1	(5.46, 5.23)
2	(12.99, 5.10)
3	(33.21, 56.88)
4	(3.39, 7.68)
...	...

- each cluster can be seen as a visual word
- all visual words are stored in a visual dictionary

Why TOP-SURF?

- significance in research
 - many of the top methods in well-known image and video comparative benchmarks use the visual words approach



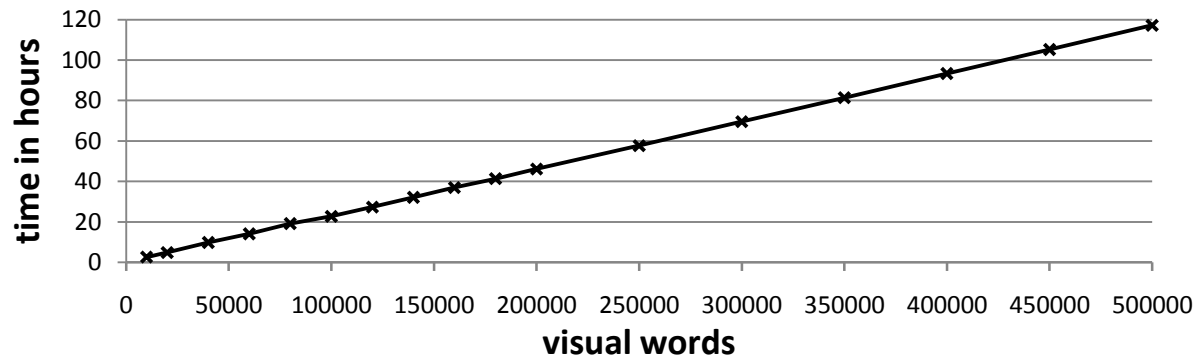
Why TOP-SURF?

- significance in education
 - visual words are perhaps the most intuitive gateway to computer vision and content-based visual analysis



Why TOP-SURF?

- to implement bag-of-words
 - many components are necessary
- to create a visual word dictionary
 - high computational requirements



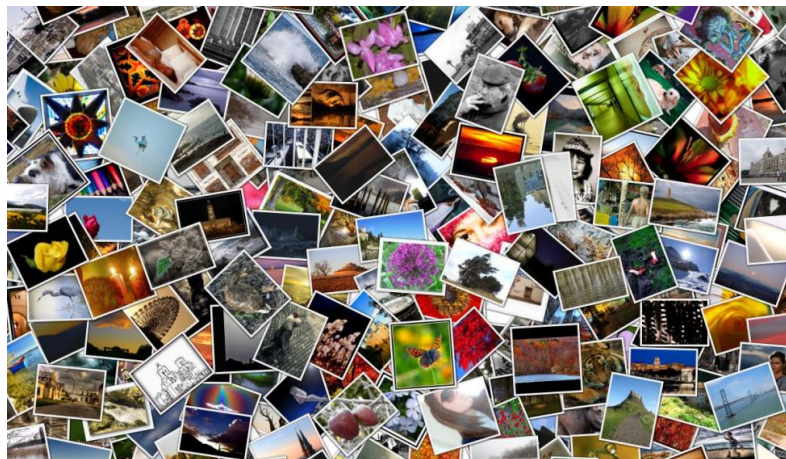
- TOP-SURF is an all-in-one solution

Recent important advances

- diverse and legal image content
 - MIR-FLICKR 1M
- SURF
 - shown to be accurate and fast
- approximate nearest neighbors search
 - necessary for creating new visual word dictionaries efficiently

Contribution of TOP-SURF

- very easy-to-use API for creating and using visual words
- a pre-computed set of visual word dictionaries (10K, 100K, 200K, ..., 1M) generated from over 1M images



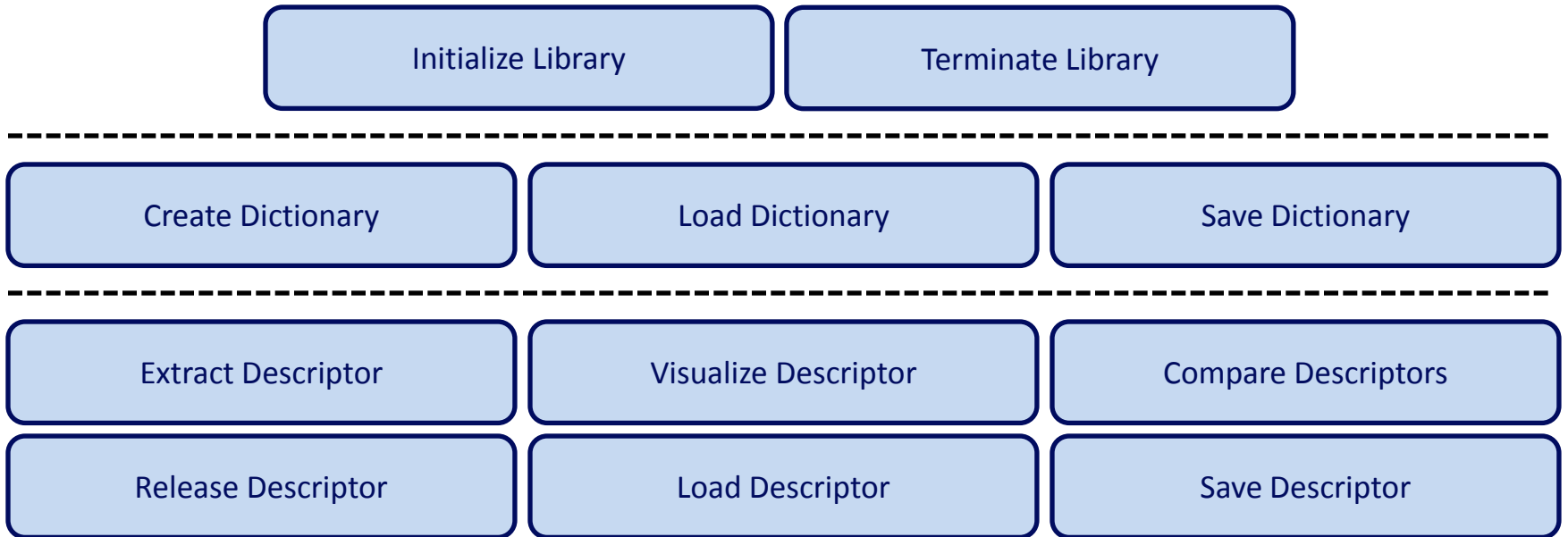
Contribution of TOP-SURF

- command line and GUI examples showing how to use the core functionality



- easily integrated into research and student projects

TOP-SURF API



TOP-SURF Example

```
#include "topsurf/api.h"
```

1

```
int main()
```

```
{
```

```
    // initialize the library
```

```
    TopSurf_Initialize(256, 100);
```

2

```
    // load a particular dictionary
```

```
    TopSurf_LoadDictionary("winter_olympics");
```

3

```
    // extract, save and release the descriptor of an image
```

```
    TOPSURF_DESCRIPTOR td;
```

```
    TopSurf_ExtractDescriptor("snowboarding1.jpg", td);
```

```
    TopSurf_SaveDescriptor("snowboarding1.top", td);
```

```
    TopSurf_ReleaseDescriptor(td);
```

4

```
    // terminate the library
```

```
    TopSurf_TerminateLibrary();
```

```
    return 0;
```

5

```
}
```

TOP-SURF Example

```
#include "topsurf/api.h"

int main()
{
    // initialize the library
    TopSurf_Initialize(256, 100);

    // load the descriptors of two images
    TOPSURF_DESCRIPTOR td1, td2;
    TopSurf_LoadDescriptor("snowboarding1.top", td1);
    TopSurf_LoadDescriptor("snowboarding2.top", td2);

    // compare the descriptors
    float distance = TopSurf_CompareDescriptors(td1, td2, TOPSURF_COSINE);

    // release the descriptors and terminate the library
    TopSurf_ReleaseDescriptor(td1);
    TopSurf_ReleaseDescriptor(td2);
    TopSurf_TerminateLibrary();
    return 0;
}
```

1

2

TOP-SURF Example

```
#include "topsurf/api.h"

int main()
{
    // initialize the library
    TopSurf_Initialize(256, 100);

    // create a new dictionary
    TopSurf_CreateDictionary("paintings", 100000, 100, 1000, 25); ①

    // save the dictionary
    TopSurf_SaveDictionary("dictionary_paintings"); ②

    // terminate the library
    TopSurf_TerminateLibrary();
    return 0;
}
```

TOP-SURF applications

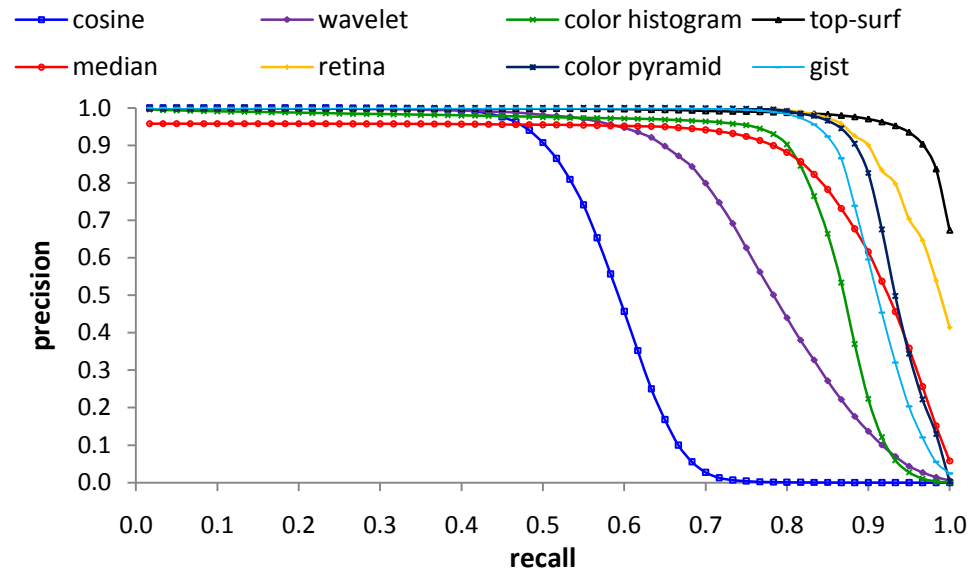
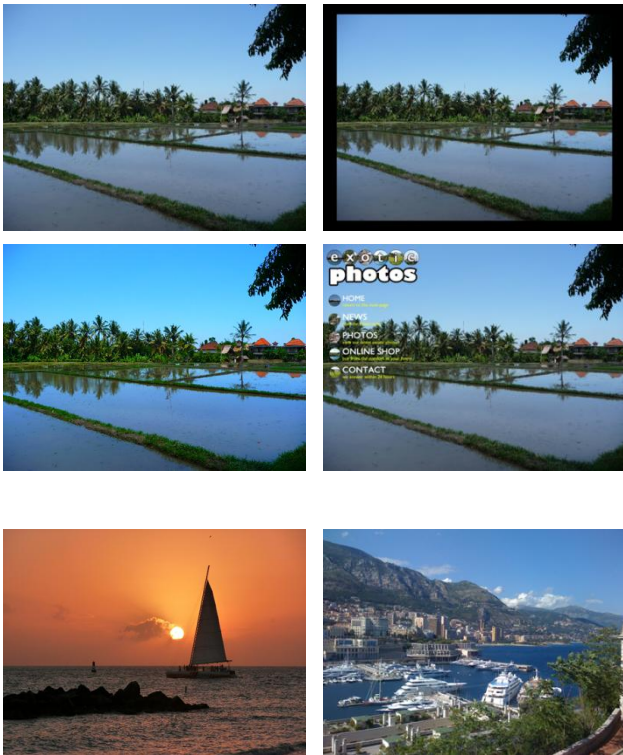
- student projects
 - has already been used in several master's courses, two of which are currently taking place



- used by students to create innovative solutions for problems such as *visual concept detection*

TOP-SURF Applications

- large-scale image similarity search
- near-duplicate image detection



TOP-SURF Applications

- other promising areas
 - mobile and embedded devices
 - optical character recognition
 - face detection
 - fingerprint recognition
 - object detection
 - real-time robotic navigation

Download TOP-SURF

<http://press.liacs.nl/researchdownloads/topsurf>

source code

binaries

dictionaries

examples

documentation