CS688:

Web-Scale Image Search

Sung-Eui Yoon
(윤성의)

Course URL:
http://sglab.kaist.ac.kr/~sungeui/IR

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About the Instructor

- **ACM/IEEE Senior Members**
- **Joined KAIST at 2007**

- **Main research focus**
  - **Handling of massive data for various computer graphics and geometric problems**
  - **Paper and video: http://sglab.kaist.ac.kr/papers.htm**
  - **YouTube videos: http://www.youtube.com/user/sglabkaist**

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Research Theme: Scalable Ray Tracing, Image Search, Motion Planning

- **Designing *scalable graphics and geometric algorithms* to efficiently handle massive models on commodity hardware**

Photo-realistic rendering

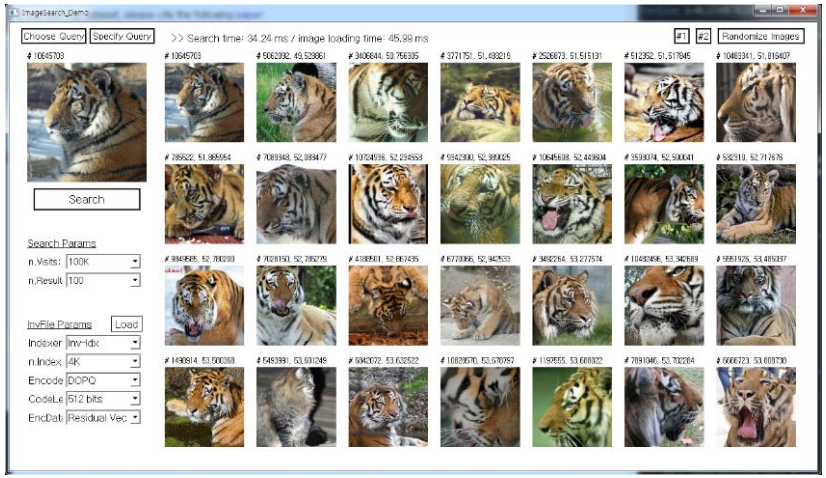

Image search

Motion planning

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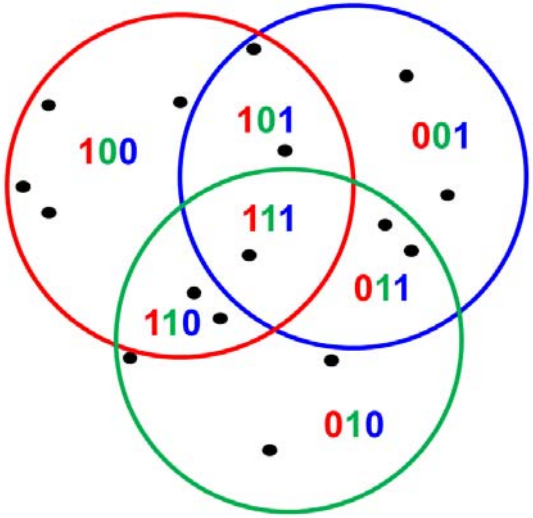
My Recent Work



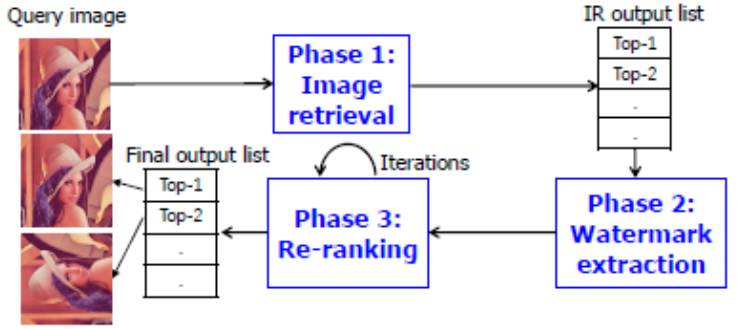
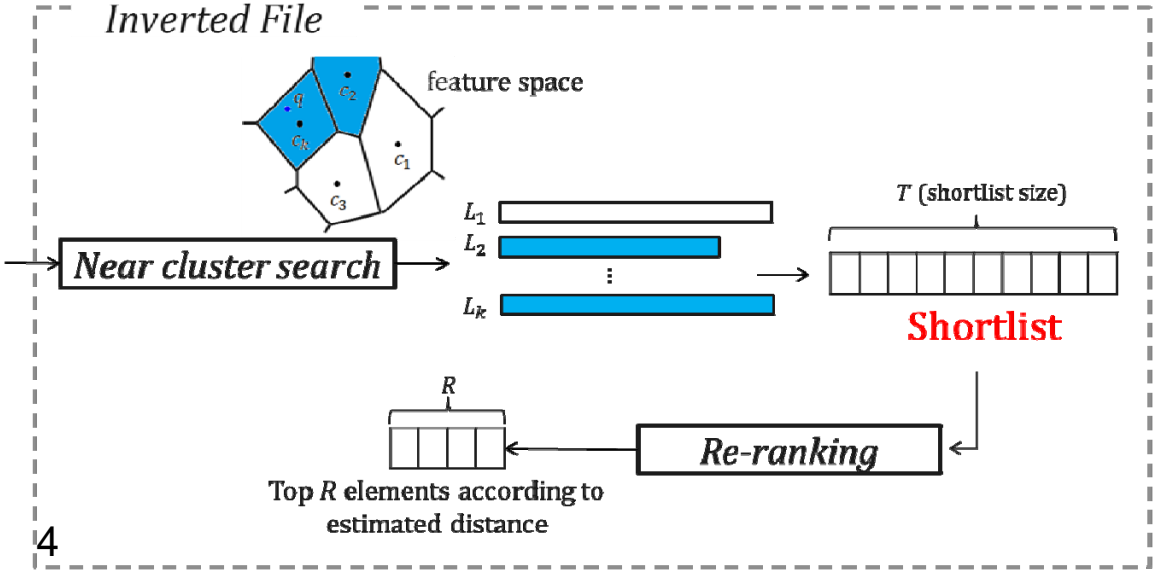
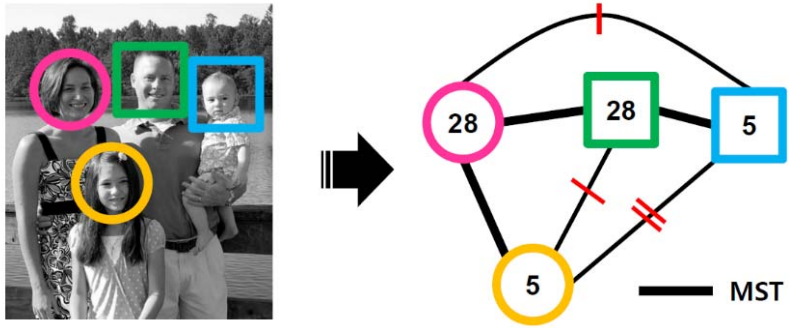


Fig. 1. This figure shows an overview of our IRIW framework.





My Recent Work

- **Tutorial at CVPR 16 about:**
  - **Recent Image Search Techniques**
  - **Organizers: Sung-eui Yoon and Zhe Lin**

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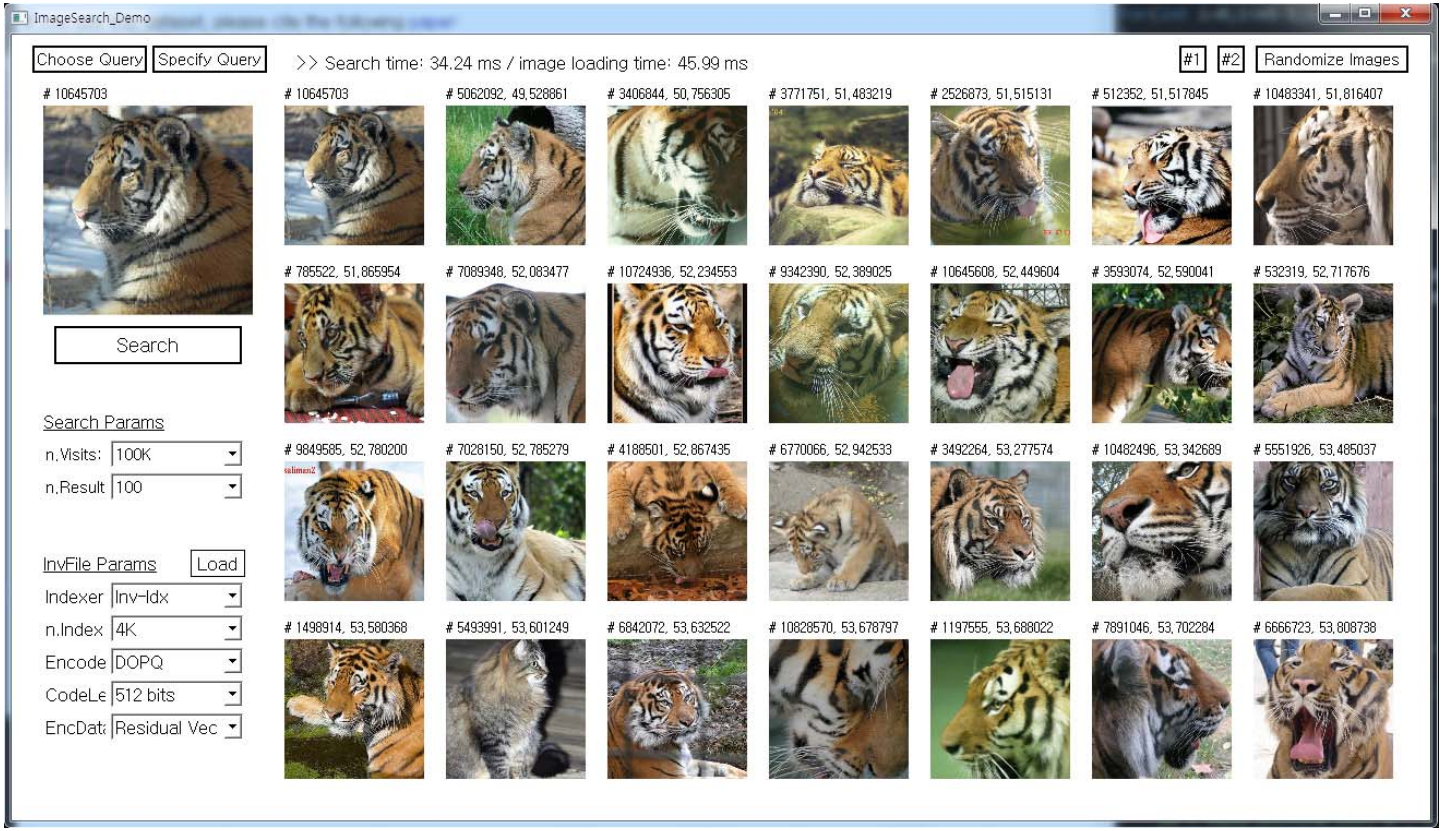
Results of Image Search

- **Collaborated with Adobe**
  - **11M images**
  - **Use deep neural nets for image representations**
  - **Spend only 35 ms for a single CPU thread**



About the Instructor

- **Contact info**
  - **Email: sungeui@gmail.com**
  - **Office: 3432 at CS building**
  - **Homepage: http://sglab.kaist.ac.kr/~sungeui**

Class Information

- **Class time**
  - **2:30pm ~ 4:00pm on TTh**
- **Office hours**
  - **Right after the class time**
  - **You can make arrangements by sending emails**

TAs

- **Woobin Im (E3-1 3443)**
  - **iwbn@me.com**
  - **Office hour: right after the class on Thur**
  - **Room: E3-1 #3443**

About the Course

- **We will focus on the following things:**
  - **Broad understanding on image (and video) search techniques and classification**
  - **In-depth knowledge on recent methods for web-scale data**
  - **Design better technologies as your final project**

- **Main theme:**
  - **Think about how we can connect any techniques (e.g., classification) to image/video search; e.g., Google photo**
  - **Accuracy, performance, interaction, and novel applications**

Image Search or Content-Based Image Retrieval (CBIR)

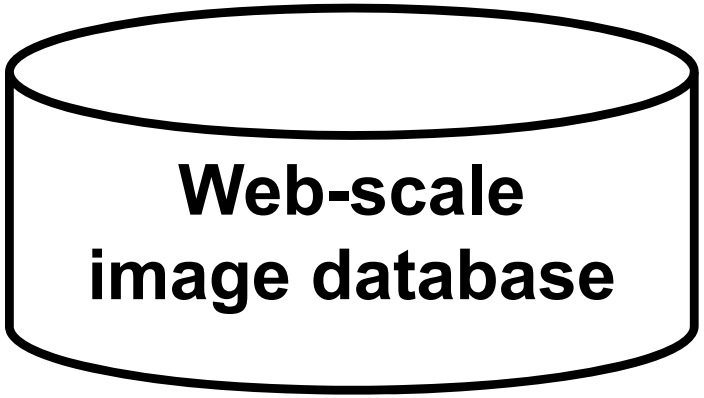
- **Identify similar images given a user-specified image or other types of inputs**

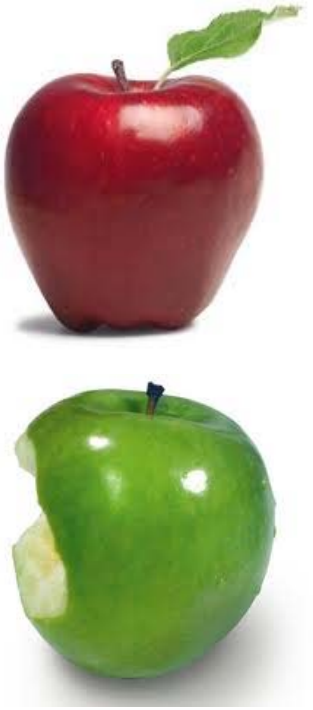
Image Search

- **Identify similar images given a user-specified image or other types of inputs**

Extract image descriptors (e.g., SIFT or CNNs)

Input





Output

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Gmail - Inbox - sungeui | Google Calendar | apple - Google Search

www.google.com/search?q=apple&hl=en&biw=1024&bih=600&prmd=ivnsu&source=lnms&tbm=isch&ei=zxpNTv7bN8_OrQeB9v

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Google

apple

About 177,000,000 results (0.46 seconds)

Advanced search

SafeSearch moderate

Everything
Images
Videos
News
Shopping
More

Related searches: apple **iphone 5** apple **logo** apple **wallpaper** **red** apple apple **background** apple **mac**

Sort by relevance
Sort by subject

Any size
Large
Medium
Icon
Larger than...
Exactly...

Any color
Full color
Black and white

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 sungeui.jpg describe image here

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- Images
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Sungeui Yoon (성의,윤성의)
sglab.kaist.ac.kr/~sungeui/ - Cached
Sung-Eui Yoon (윤 성의) Assistant professor. Scalable Graphics/Geometric Algorithm Lab. Dept. of Computer Science · KAIST ...


120 × 140

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sungeui.jpg | 콜로퀴엄_2011_08_···.doc | 콜로퀴엄_2011_08_···.doc | 다운로드 항목 모두 표

Applications

- Search
- Image stitching
- Object/scene/location recognitions
- Robot motion planning
- Copyright detection

Panorama Stitching

(a) Matier data set (7 images)

iPhone version available

(b) Matier final stitch

[Brown, Szeliski, and Winder, 2005]

http://www.cs.ubc.ca/~mbrown/autostitch/autostitch.html

Object Detection

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Product Image Recognition

[X. Shen et al., ECCV 2012]

Examples of product images in the database

Examples of query images taken by mobile phones

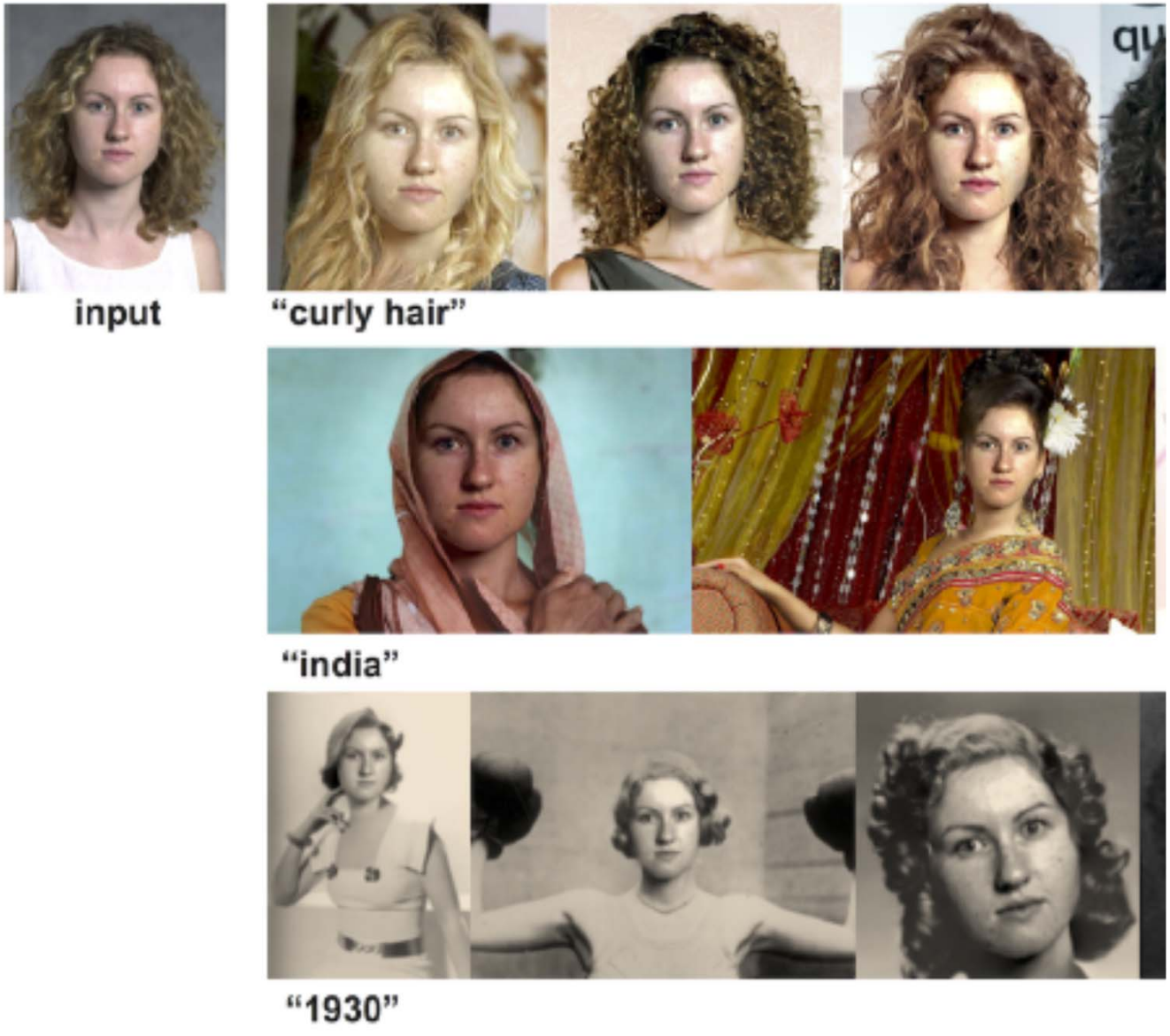
Landmark or Location Detection

query

City-scale image DB

Chen et al. KAIST

Example: Transfiguring Portraits [SIG. 16]



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Time-Lapse Photography and Edit Transfer [Shen et al.]

Figure 1: *Our regional foremost matching for Internet images estimates accurate regional correspondence and enables several applications.*

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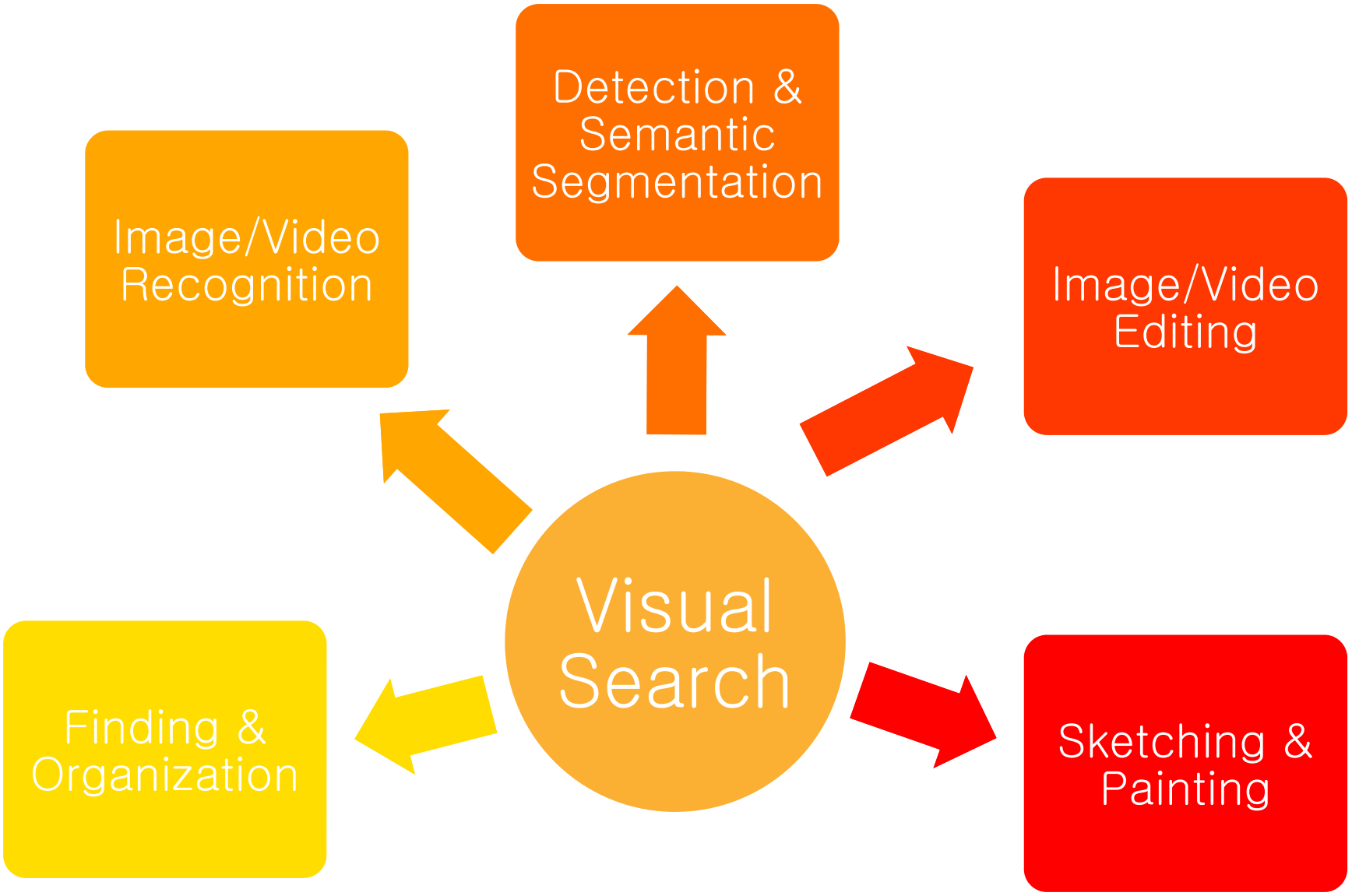
Possible Application Domains



Adobe

Web-Scale Visual Data and Novel Applications

- **Visual data are widely used for various communication and, and are more widely consumed at Web and mobile devices**
  - **YouTube, Facebook, Flickr, etc.**

- **Processing them requires scalable algorithms**
- **Web-scale visual data can enable new applications (e.g., photo tourism and scene completion)**

Ack.: Hays

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Issues of Web-Scale Image Search

- Accuracy issues
- Memory issues
- Performance issues, etc.
- Handling dynamic databases of images
- Novel applications?


Gmail - Inbox - sungeui
Google Calendar
apple - Google Search
www.google.com/search?q=apple&hl=en&biw=1024&bih=600&prmd=ivnsu&source=lnms&tbm=isch&ei=zxpNTv7bN8_OrQeB9
Web Images Videos Maps News Shopping Gmail more
Sung-Eui Yoon
Google
apple
About 177,000,000 results (0.46 seconds)
Advanced search
SafeSearch moderate
Everything
Images
Videos
News
Shopping
More
Related searches: apple iphone 5 apple logo apple wallpaper red apple apple background apple mac
Sort by relevance
Sort by subject
Any size
Large
Medium
Icon
Larger
Exactl
Any c
Full co
Black
What if I meant different products of “Apple” computer?
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Google JPG × eiffel tower

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Image size:
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Best guess for this image: ***eiffel tower***

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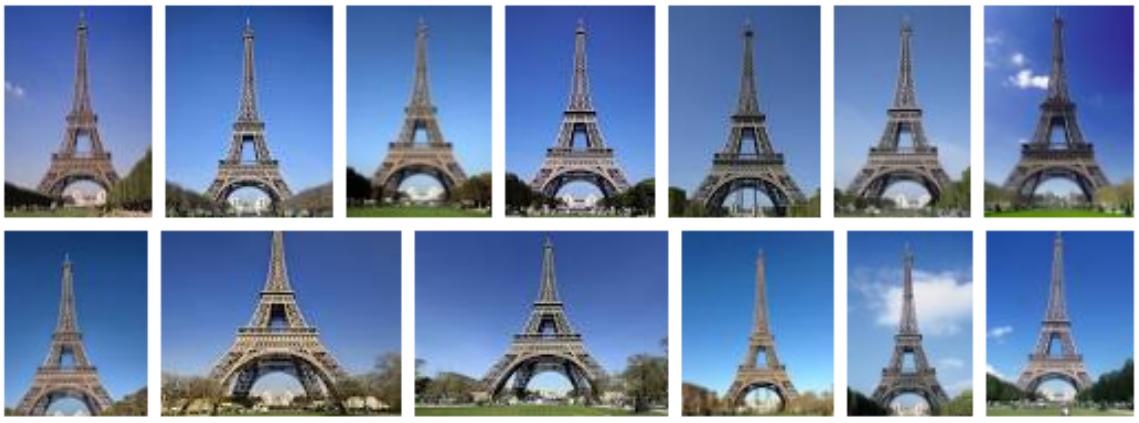

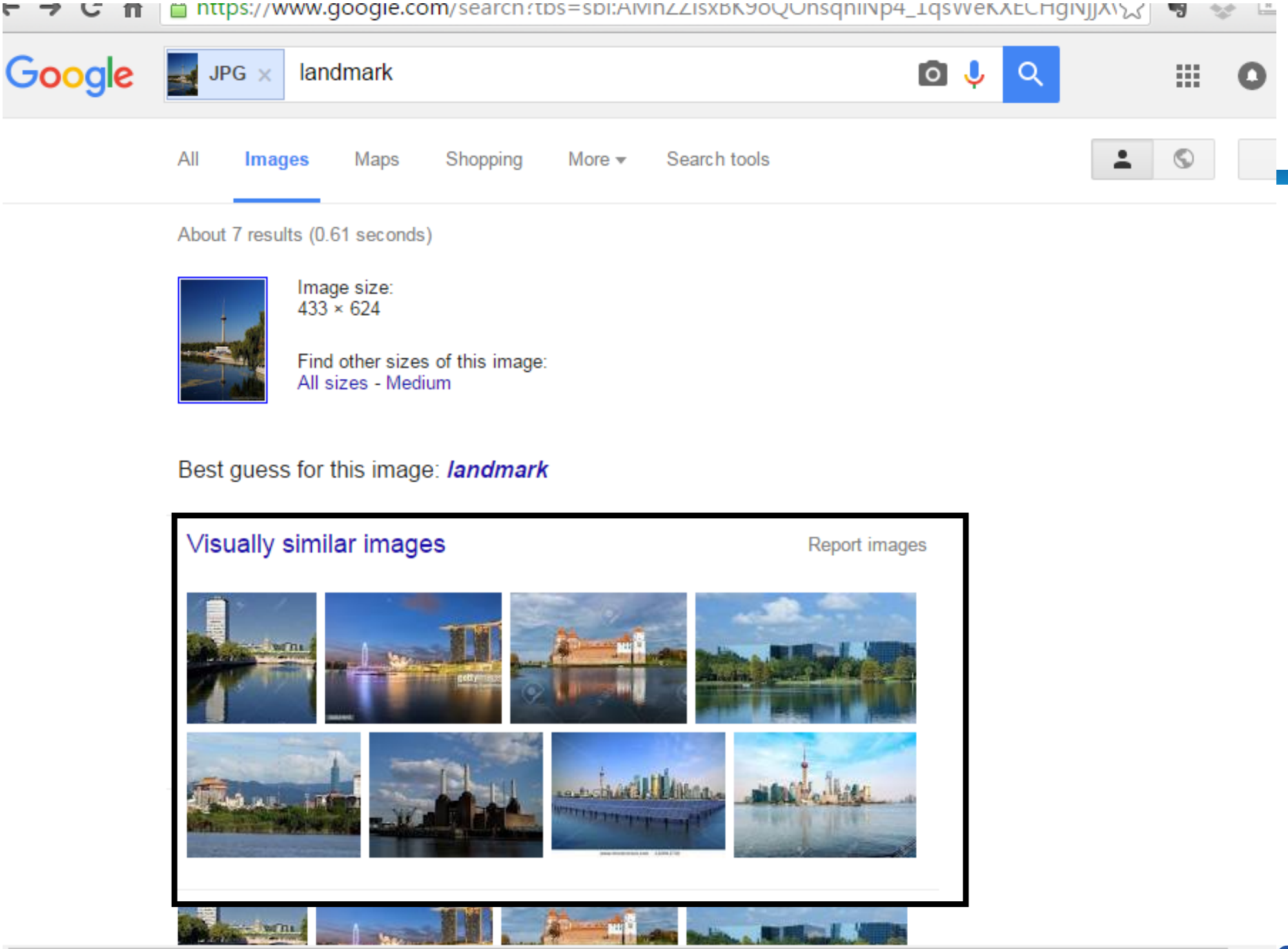
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Images
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More
Search tools
About 7 results (0.61 seconds)
Image size:
433 × 624
Find other sizes of this image:
All sizes - Medium
Best guess for this image: landmark
Visually similar images
Report images

Some of Topic Lists

- Feature detectors
- Descriptors
- Nearest neighbor search
- Bag-of-Word
- Convolutional neural network
- Hashing techniques
- Large-scale retrieval indexing techniques
- Video related techniques
- Various applications

Prerequisites

- **Basic knowledge of linear algebra and data structures**
  - **No prior knowledge on computer graphics and computer vision**
- **Some prior experiences on programming**

- **If you are not sure, please consult the instructor at the end of the course**

Course Overview

- **Half of lectures and other half of student presentations**
  - **This is a research-oriented course**

- **What you will do:**
  - **Choose papers and present them**
  - **Propose ideas that can improve the state-of-the-art techniques**
  - **Quiz, mid-term, final-term exams, and**
  - **Have fun!**

Course Overview

- **Grade policy**
  - **Quiz, assignment, and exams: 30%**
  - **Class attendance and presentations: 30%**
  - **Final project: 40%**
  - **Class presentation and projects are the most important activities in this class**
- **Instructor and students will evaluate presentations and projects**
  - **Instructor: 50% weights**
  - **Students: 50% weights**

Presentations

- **Read papers**
  - **Given a main paper, read two or three related papers**
  - **Look at pros and cons of each method**
  - **Think about how we can efficiently more realistic and complex search and classification issues, and think about novel applications**

Final Project

- **Propose ideas to address problems identified from your presentation papers**
  - **Show benefits of your ideas and how your ideas can improve the state-of-the-art techniques in a logical manner**
  - **Implementation of your ideas is not required, but is recommended**
- **Team project is allowed**
  - **Role of each student should be very clear**

Course Awards

- **Best speaker and best project awards**
- **A high grade will be given to members of the best project**
- **Lunch or dinner for awardees with me and TAs**

Programming HWs and Exams

- **Two programming assignments**
  - **Implement basic image search components**
- **Late policy**
  - **No score for late submissions**
  - **Submit your work before the deadline!**
- **Two exams**
  - **Mid-term exam covers class materials**
  - **Final-term exam covers presentation materials of students**

Honor Code

- **Collaboration encouraged, but *assignments must be your own work***
- **Cite any other's work if you use their code**

Question HWs for Every Class

- **Come up with one question in the class and submit at the end of the class**
  - **1 for typical questions (that were answered in the class)**
  - **2 for questions with thoughts or that surprised me**
- **Write questions at least 4 times**
  - **Write a question per month**
  - **Multiple questions in one time will be counted as once**
- **Common questions are addressed at my draft**
  - **Some of questions will be discussed in the class**
- **If you want to know the answer of your question, ask me or TA on person**

Homework for Every Week

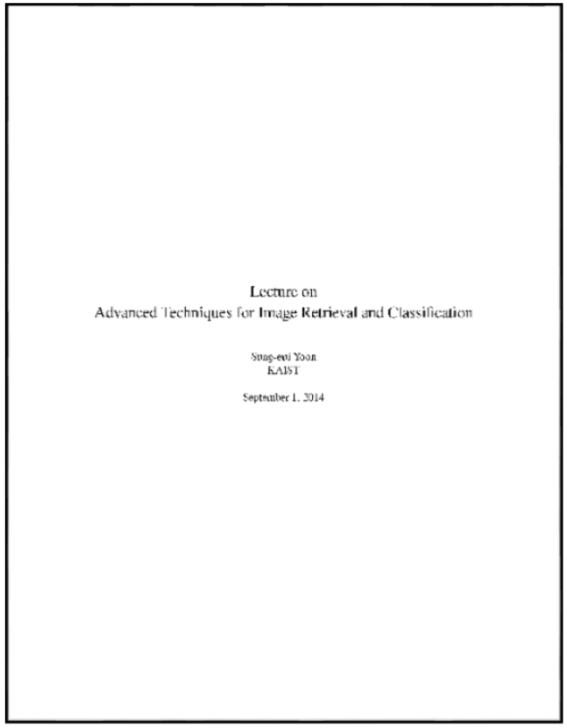
- Go over recent papers on image search
  - Those should be high quality and recent ones
  - Find two papers, and submit your summary before every beginning of the Tue. class
  - Online submission is possible
- Think about possible team members
- Too late if you think them later..

Class Attendance Rule

- Late two times → count as one absence
- Every two absences →lower your grade (e.g., A- → B+)
- To check attendance, I'll call your names
- If you are in situations where you should be late, notify earlier

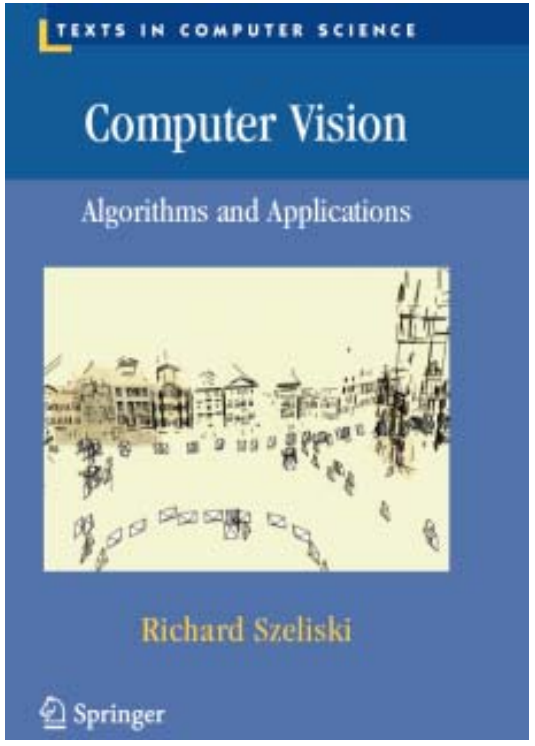
Resource

- My ongoing draft on image search
  - pdf file is available at the webpage
- Reference
  - Computer vision: algorithms and applications
    - Its file is available (http://szeliski.org/Book/)


Lecture on
Advanced Techniques for Image Retrieval and Classification

Sung-eui Yoon
KAIST

September 1, 2014



Other Resources

- Technical papers
  - CVPR, ICCV, ICMR, ACM MM, SIGGRAPH, etc.
  - Computer vision resource (http://www.cvpapers.com/)
  - Multimedia information retrieval (http://www.mirsociety.org/mweb/)
- Course homepages
- Google or Google scholar

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Schedule

- **Please refer the course homepage:**
  - **http://sglab.kaist.ac.kr/~sungeui/IR**

Official Language in Class

- **English**
  - **I'll give lectures in English**
  - **I may explain again in Korean if materials are unclear to you**
  - **You are no required to use English, but are recommended**

- **To non-native Korean speakers**
  - **Many Korean students prefer to use Korean for deeper discussions**
  - **In these cases, we will use Korean, but I will summarize main points in English**

My Wish for You

- **Follow up lecture materials and do various class activities/HWs well**

- **Lead to your next publication, or**
- **Lead to your next start-up**

Next Time

- **Feature detectors**

About You

- Name
- Your (non hanmail.net) email address

- What is your major?
- Previous experience on image search and computer vision
- Credit/audit