CS688:

Web-Scale Image Search and Classification

Sung-Eui Yoon
(윤성의)

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

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About the Instructor

- **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

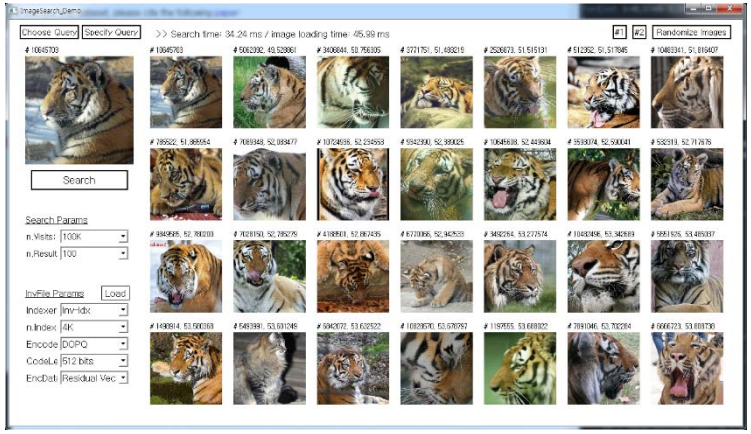

Image search

Motion planning

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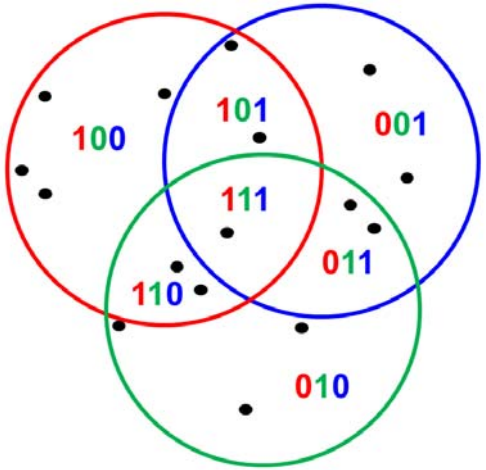
My Recent Work



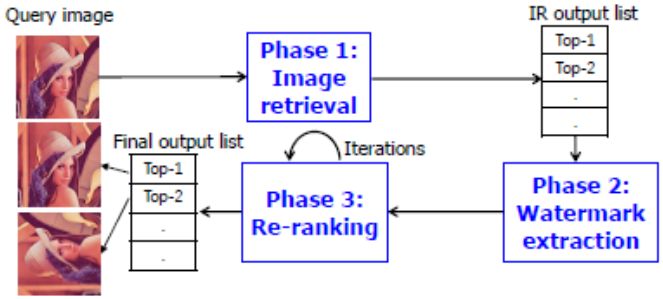
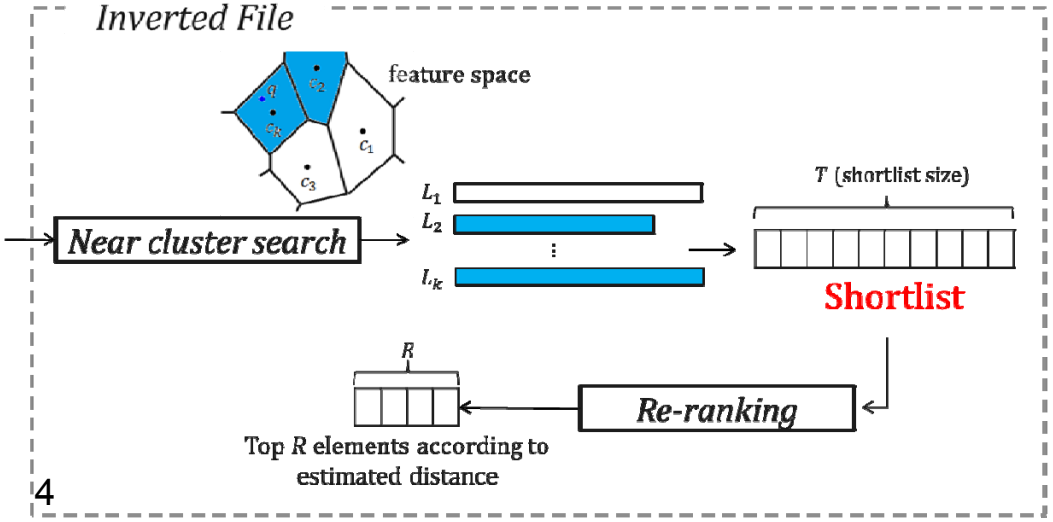
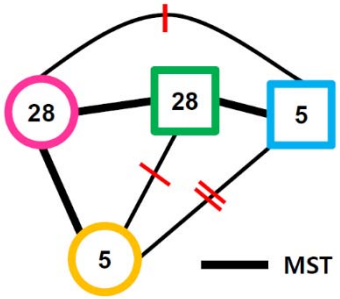


Fig. 1. This figure shows an overview of our IRIW framework.





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My Recent Work

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

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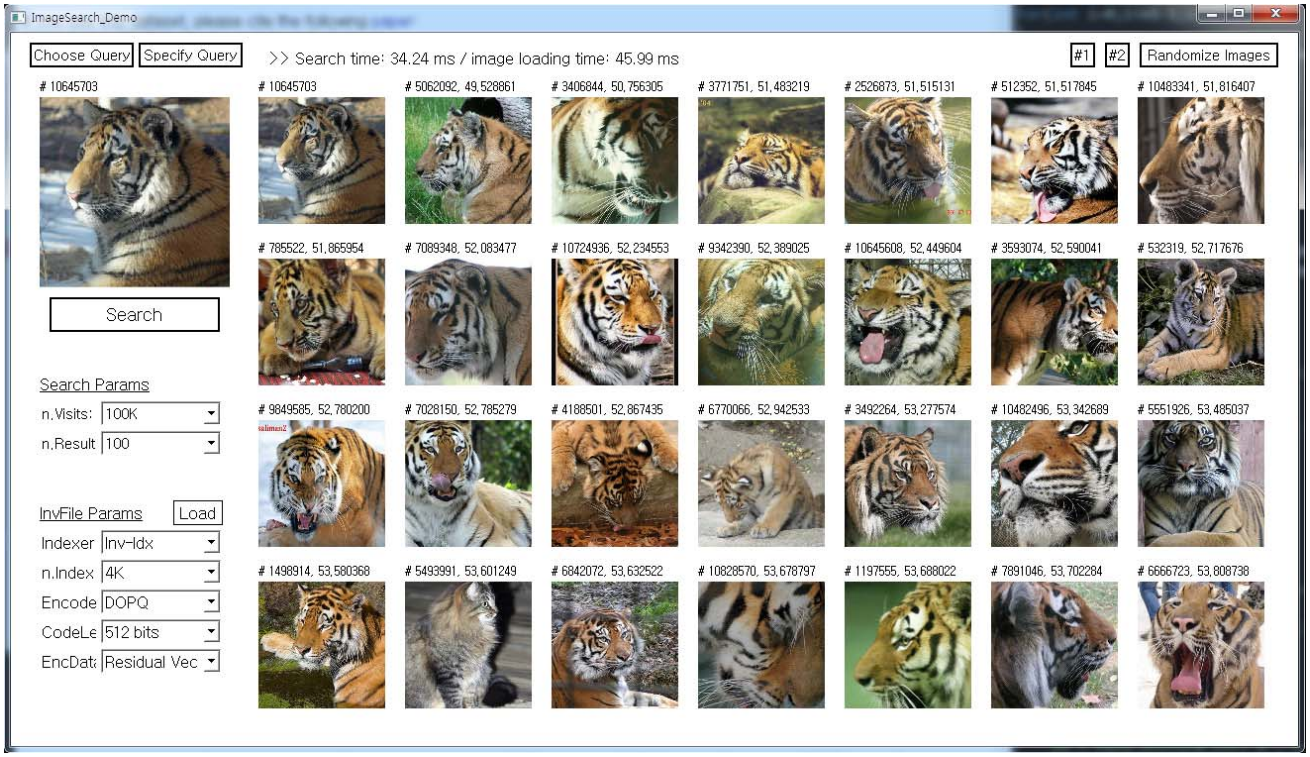
Results of Image Search

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



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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**
  - **4:00pm ~ 5:15pm on TTh**
- **Office hours**
  - **Right after the class time**
  - **You can make arrangements by sending emails**

TAs

- **Soomin Kim (E3-1 3440)**
- **soo.kim813@gmail.com**

- **Taeyoung Kim (E3-1 3443)**
- **retupmoc14@gmail.com**

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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: Scalability!**
  - **Better search accuracy w/ more objects**
  - **More compact memory requirement and faster query performance**
  - **Easier 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**

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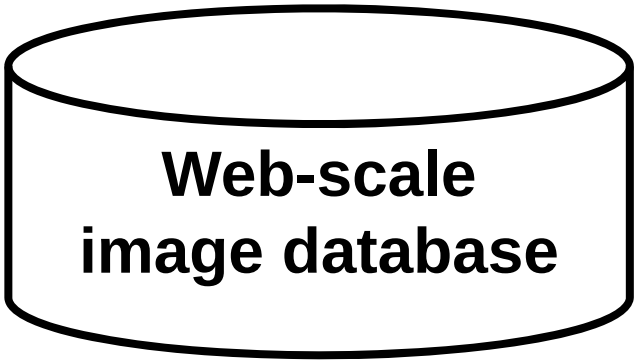
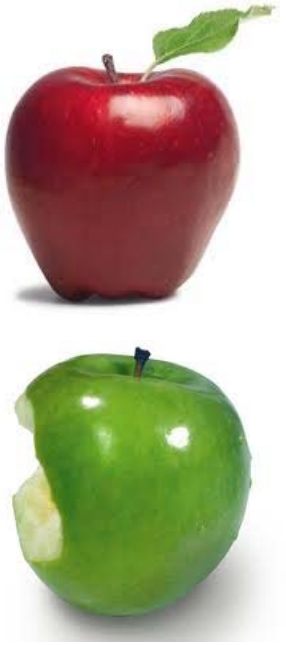
Image Search

- **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

Web **Images** Videos Maps News Shopping Gmail more ▾ Sung-Eui Yoon

Google

apple

SafeSearch moderate ▾

About 177,000,000 results (0.46 seconds)

Advanced search

Everything
Images
Videos
News
Shopping
More

Sort by relevance
Sort by subject

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

Any color
Full color
Black and white

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

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Web **Images** Videos Maps News Shopping Gmail more Sung-Eui Yoon

Google

sungeui.jpg describe image here

About 4 results (0.29 seconds) Advanced search

- Everything
- Images
- Videos
- News
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- More

Image size:
200 × 272

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Pages that include matching images

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Sung-Eui Yoon (윤 성의) Assistant professor. Scalable Graphics/Geometric Algorithm Lab. Dept. of Computer Science · KAIST ...

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이름Cha, Meeyoung (차미영) 조교수; 연구분야Social Computing, Data-Driven Social Science; 학위PhD, KAIST, 2008; 전화번호+82-42-350-2922; 이 메일meeyoungcha ...

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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]

input

"curly hair"

"india"

"1930"

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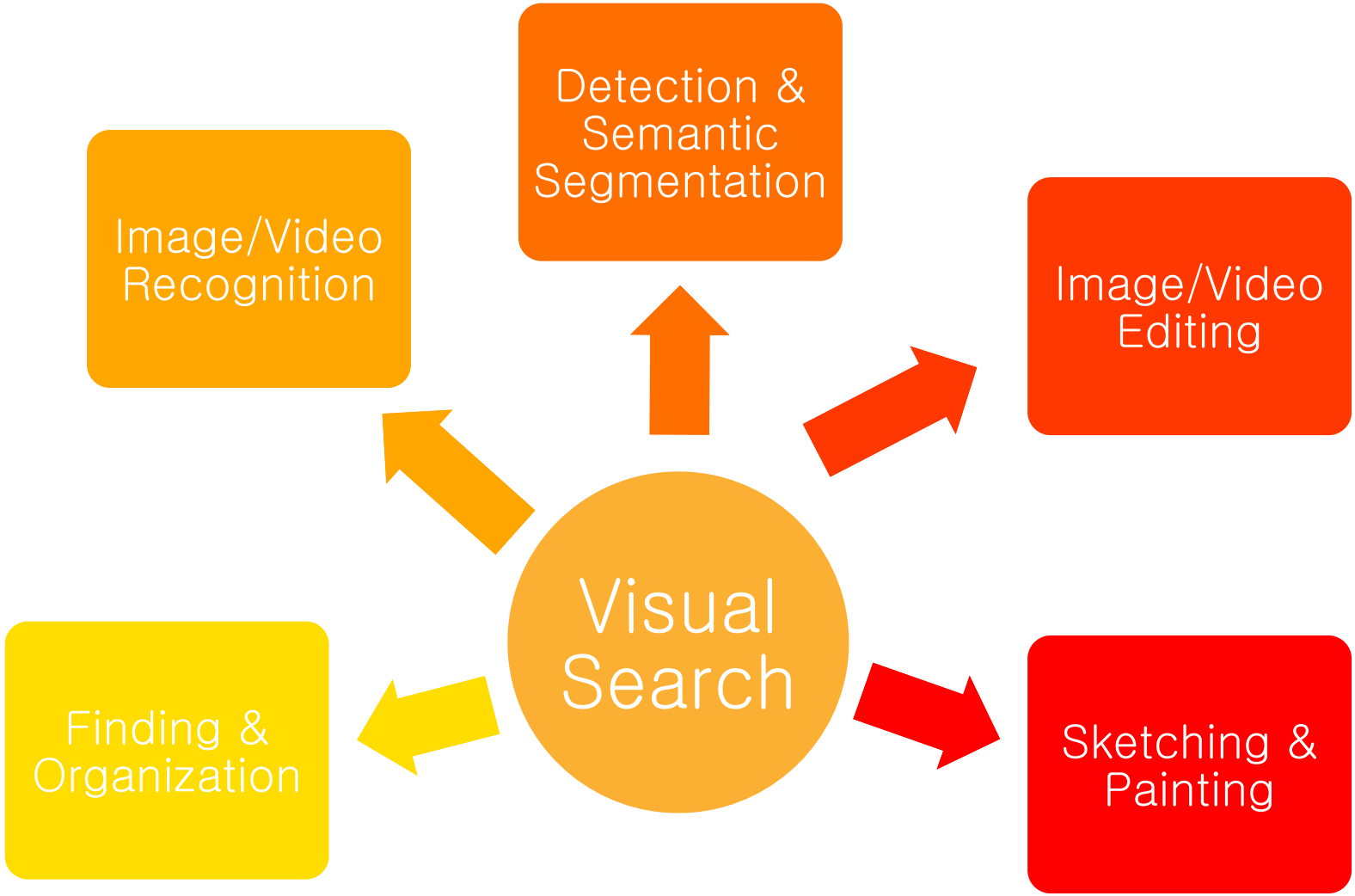
Possible Application Domains



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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
What if I meant different products of “Apple” computer?
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Google Search
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Yoo Mi Choi. 소속: 디자인여성학회 회장 한국디자인 학회 이사 한국애니메이션학회 부회장 인포디자인학회 이사 한국 애니메이션 필림협회 이사 ...
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More
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이름Cha, Meeyoung (차미영) 조교수; 연구분야Social Computing, Data-Driven Social Science; 학위PhD, KAIST, 2008; 전화번호+82-42-350-2922; 이 메일meeyoungcha ...
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https://www.google.com/search?tbs=sbi:AMhZZiuIDxGKnZ9_1wT8VBeRZu5kWShzIORX4tI

Google JPG × eiffel tower

All Images Maps Shopping More Search tools

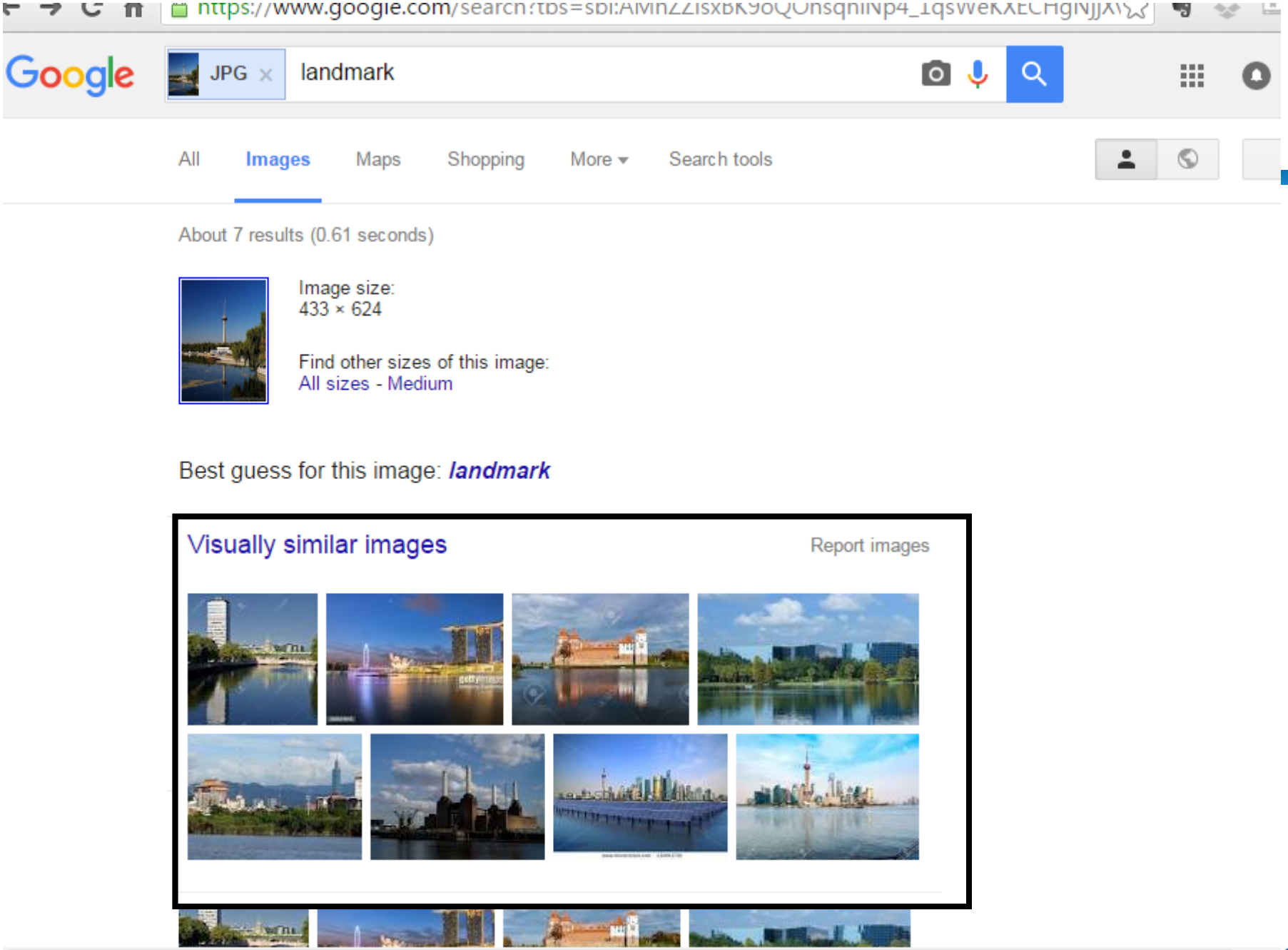
About 453 results (0.64 seconds)

Image size:
240 × 400

Find other sizes of this image:
All sizes - Small - Medium - Large

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

Visually similar images Report images


Google
JPG
landmark
All
Images
Maps
Shopping
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
- Visual vocabulary
- Convolutional neural network
- Generative and discriminative models
- 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 Thur. 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

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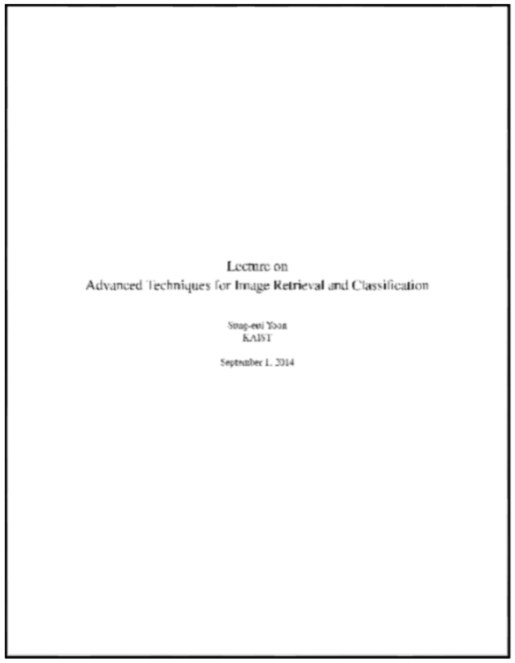
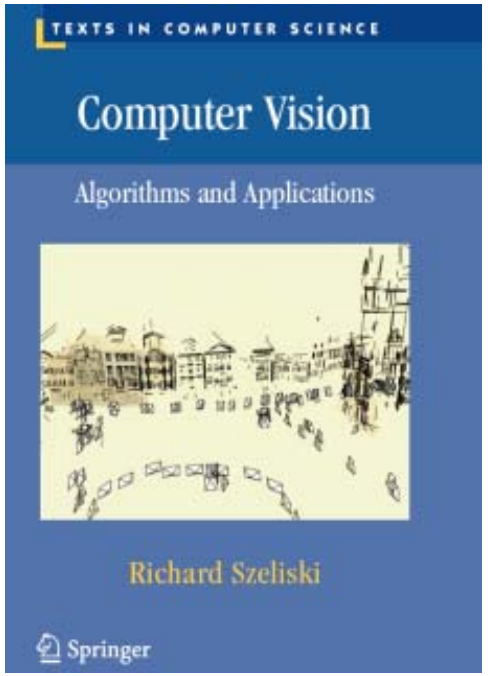
Resource

- 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



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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**

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Next Time

- **Feature detectors**

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About You

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

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