
CS688:
Web-Scale Image Search

Sung-Eui Yoon
(윤성의)

Course URL:
<http://sgvr.kaist.ac.kr/~sungeui/IR>

KAIST



About the Instructor

- **Joined KAIST at 2007**
- **Notable recognitions**
 - **Organized tutorial on image search at CVPR**
 - **Worked with Adobe, Naver, Hancom, etc.**
 - **Produced a professor on image search (SKKU)**
 - **Received next-generation scientist award (IT category) at 2019 from S-Oil and Korea Academy of Science**
- **Related materials**
 - **Paper and video:**
<http://sgvr.kaist.ac.kr/publication>
 - **YouTube videos:**
<http://www.youtube.com/user/sglabkaist>

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

- Designing *scalable techniques* to efficiently handle massive models on commodity hardware or clouds



Photo-realistic rendering

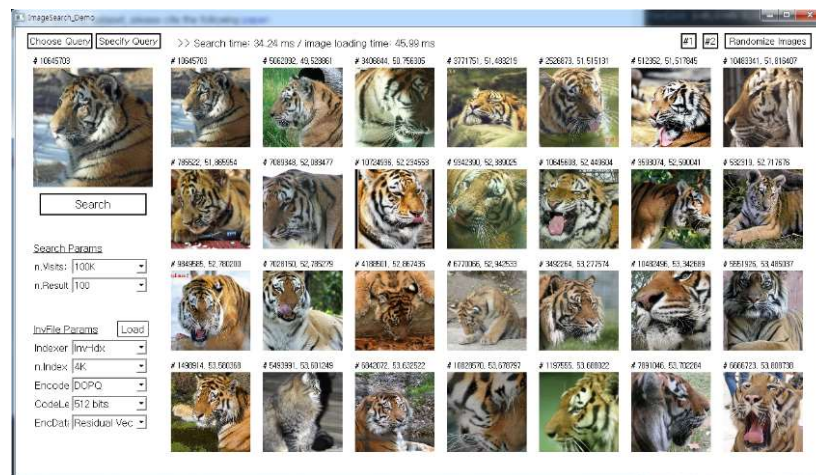


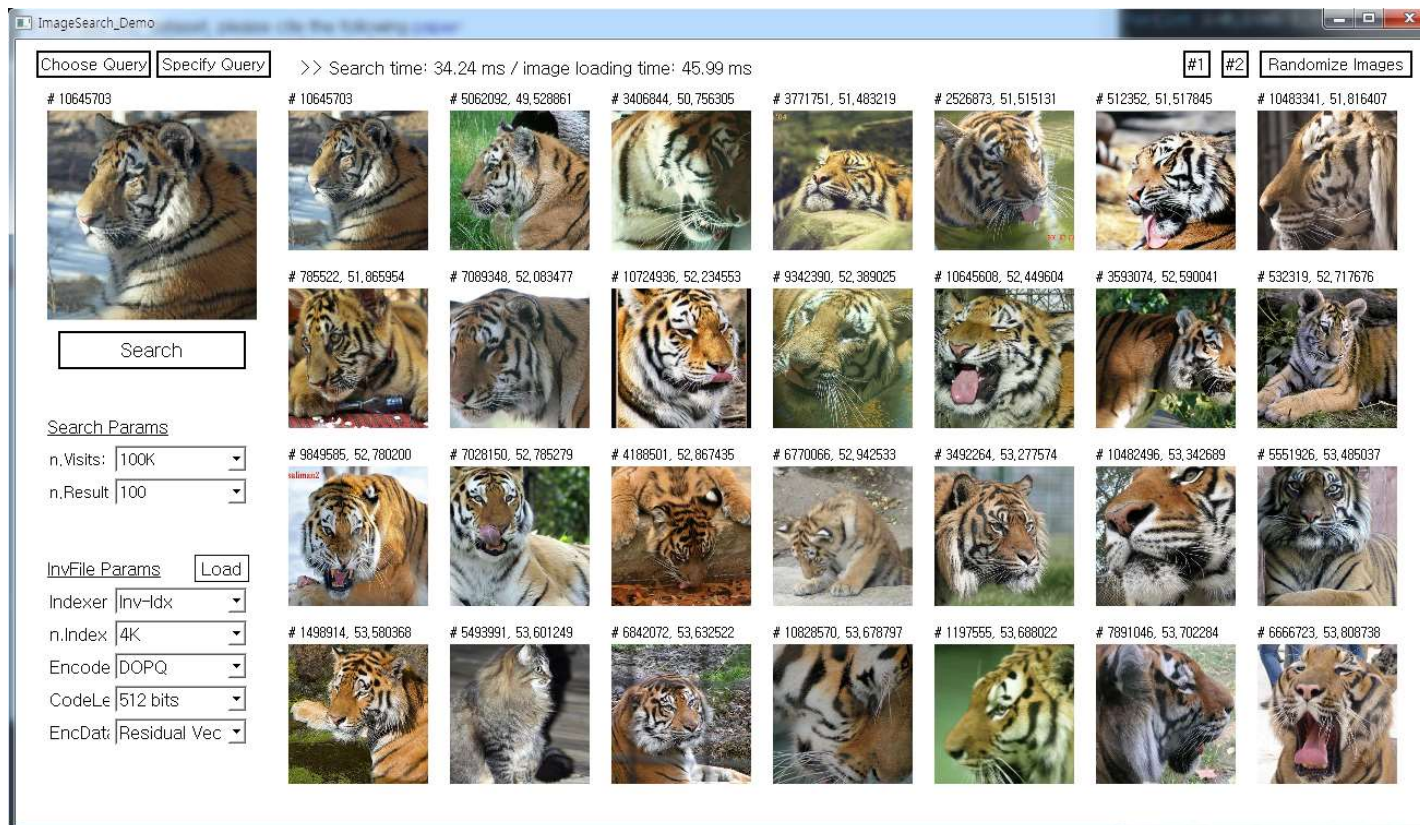
Image search



Motion planning

Results of Image Search

- Collaborated with Adobe, NAVER, Hancorn
 - 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@kaist.edu**
- **Office: 3432 at CS building (E3-1)**
- **Homepage: <http://sgvr.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**

TA

- **JaeYoon Kim (김재윤)**
 - Room: E3-1 #3443
 - jaeyoon1603@gmail.com

- **Use KLMS first** for questions and discussions, instead of sending emails



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 search and matching problems**

Image Search or Content-Based Image Retrieval (CBIR)

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

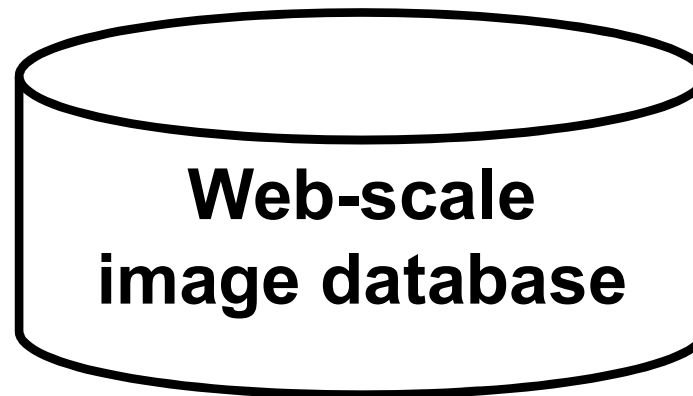
Image Search

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

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



Input



Output



apple



SafeSearch moderate

About 177,000,000 results (0.46 seconds)

Advanced search

- 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





sungeui.jpg x describe image here



About 4 results (0.29 seconds)

Advanced search

- Everything
- Images
- Videos
- News
- Shopping
- More



Image size:
200 x 272

Find other sizes of this image:
All sizes - Small

Pages that include matching images



[Sungeui Yoon \(성익, 윤성익\)](#)

[sglab.kaist.ac.kr/~sungeui/](#) - Cached

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

200 x 272



[درس این صفحه - 웹사이트공학 WebST](#)

- [Translate this page]

[webst.kaist.ac.kr/content.php?db=professor](#) - Cached

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

120 x 140



[2010.09.13 - KGC 2011](#)

- [Translate this page]

[www.kgconf.com/kor/html/conference_c_view.html?cate3...](#) - Cached

Kristian Segerstrale Playfish, 소셜게임의 미래 현재 소셜게임의 현주소와 빠르게 성장하는 소셜게임의 미래를 예리한 견식으로 소개 ...

100 x 100

Applications

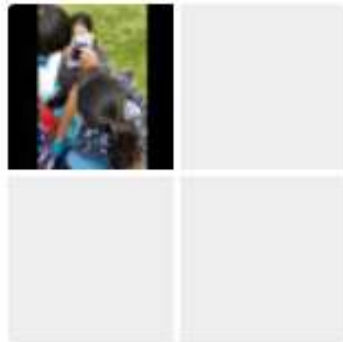
- **Search**
- **Image stitching**
- **Object/scene/location recognitions**
- **Robot motion planning**
- **Copyright detection**

Google Photos and Many Search Functionality

Google Photos



Search "Daehak-ro"



★ Favorites



People & Pets



Places



Things

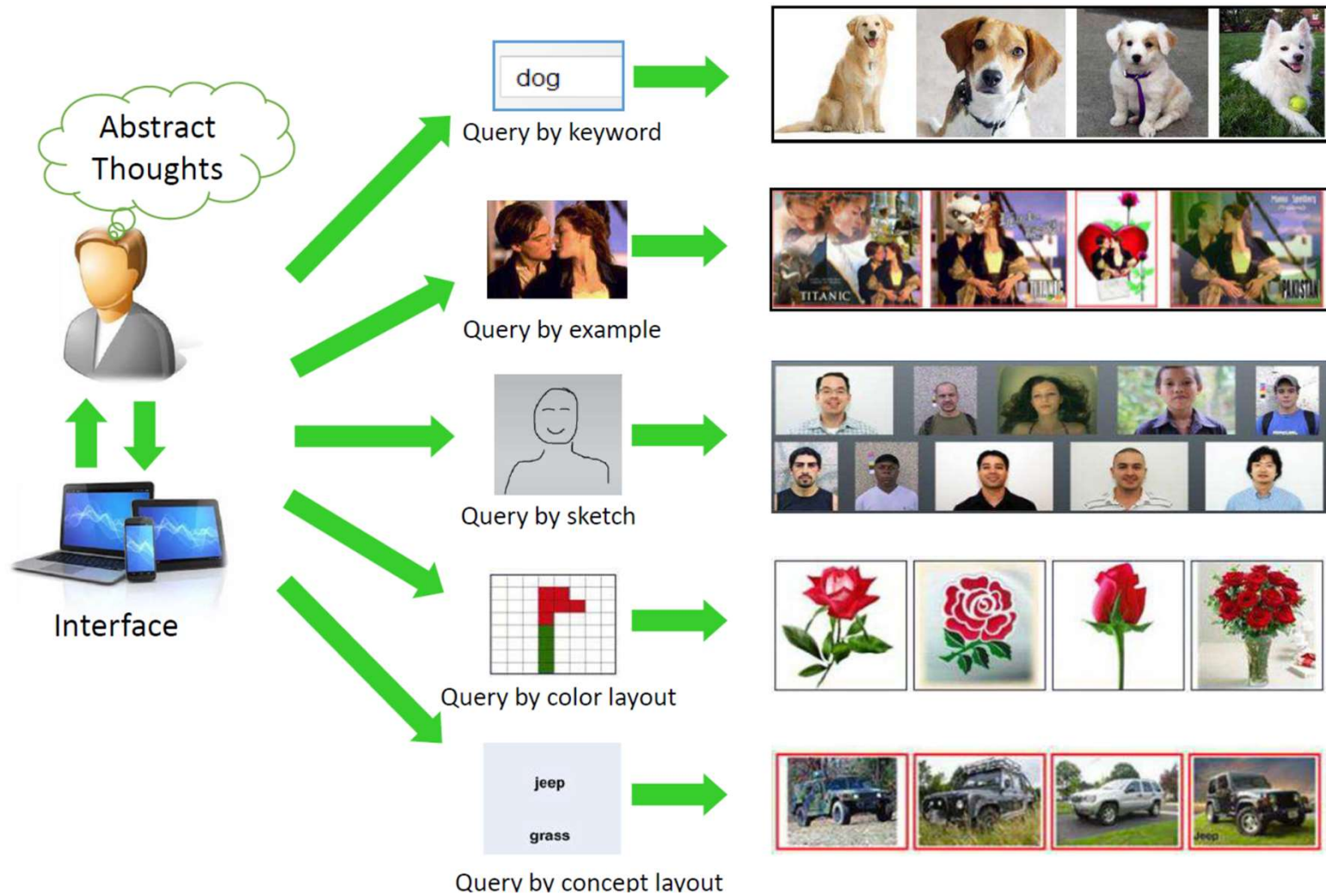
Cross Domain Image Search

- Visual similarity across image domains



Shrivastava et al., SIGA

Different Search Scenario

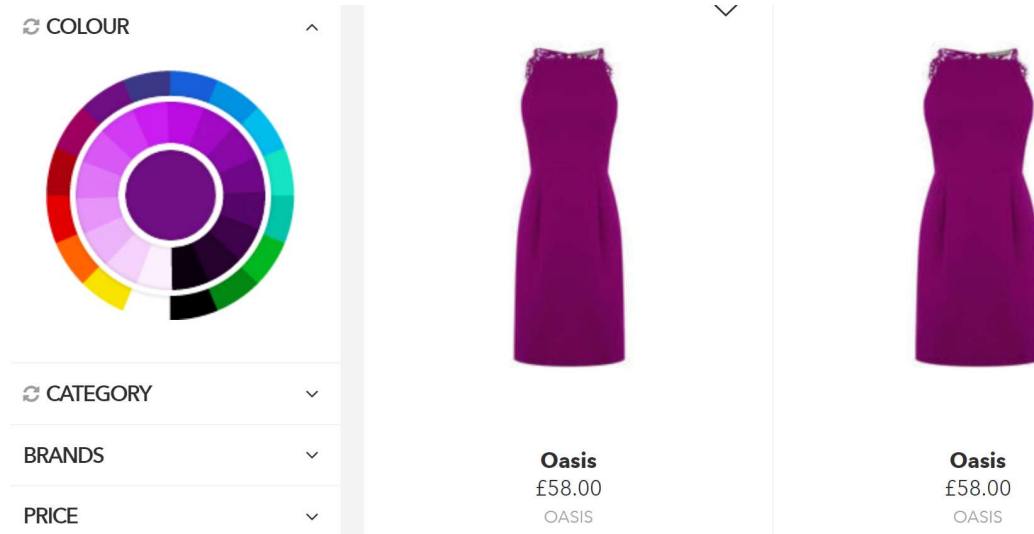


Zhou et al., arxiv

Some Image Search Companies



Based on near duplicate image search



Snap fashion

Some Startups

- 학생 창업
 - 클디, **2011**년 창업



클디 팀원들, 왼쪽부터 김효은 연구원, 백승욱 CEO, 이경인 CTO

기술기반 스타트업으로서 좋은 모범 사례를 남기고 싶다

Panorama Stitching



(a) Matier data set (7 images)



iPhone version
available



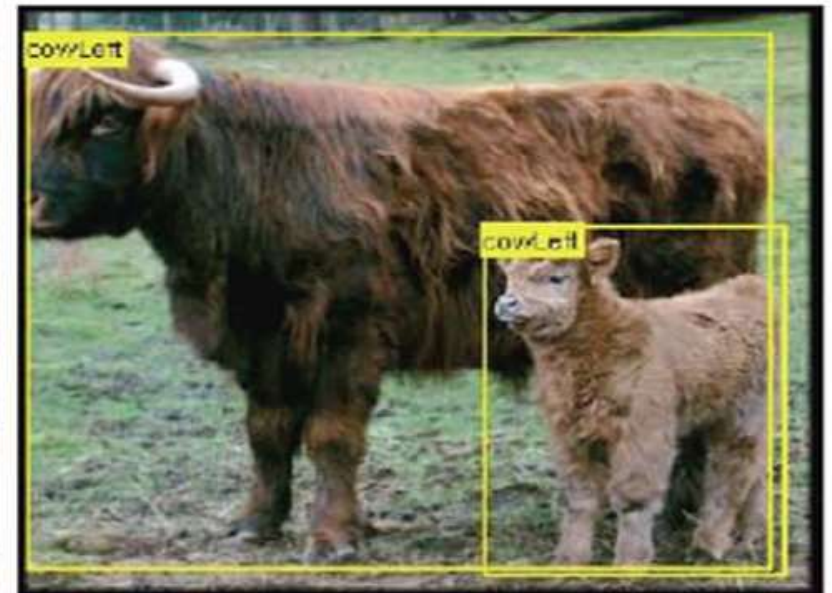
(b) Matier final stitch

[Brown, Szeliski, and Winder, 2005]

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

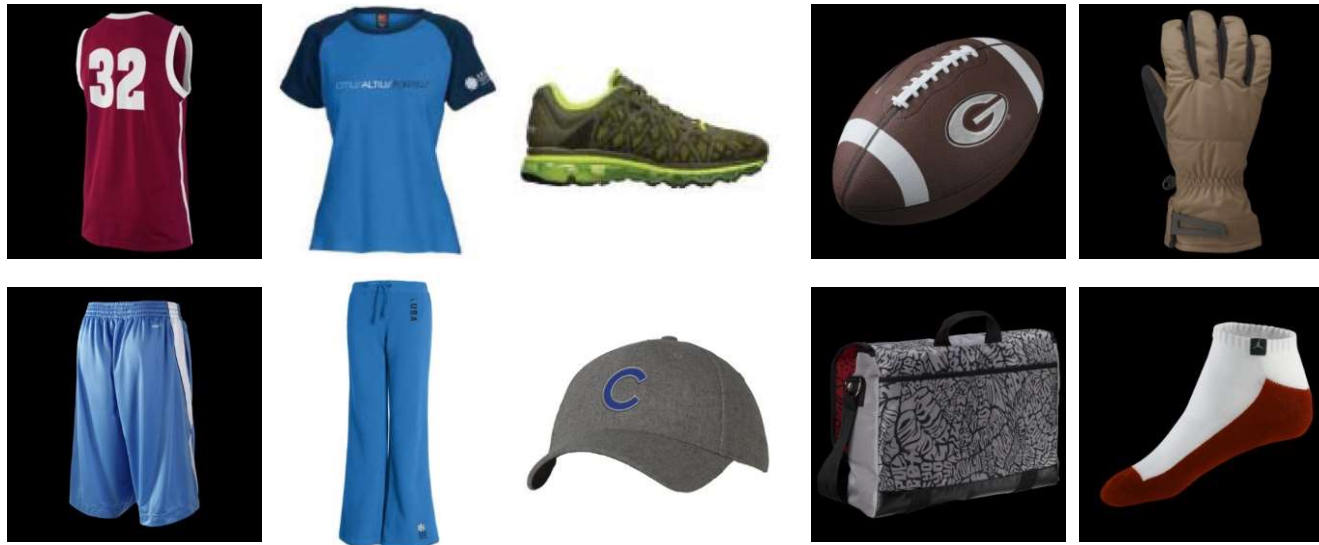
Object Detection

PASCAL challenge



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

3D Reconstruction

- Conducted by feature matching among many images



Photo tourism

Example: Transfiguring Portraits [SIG. 16]



input



"curly hair"



"india"



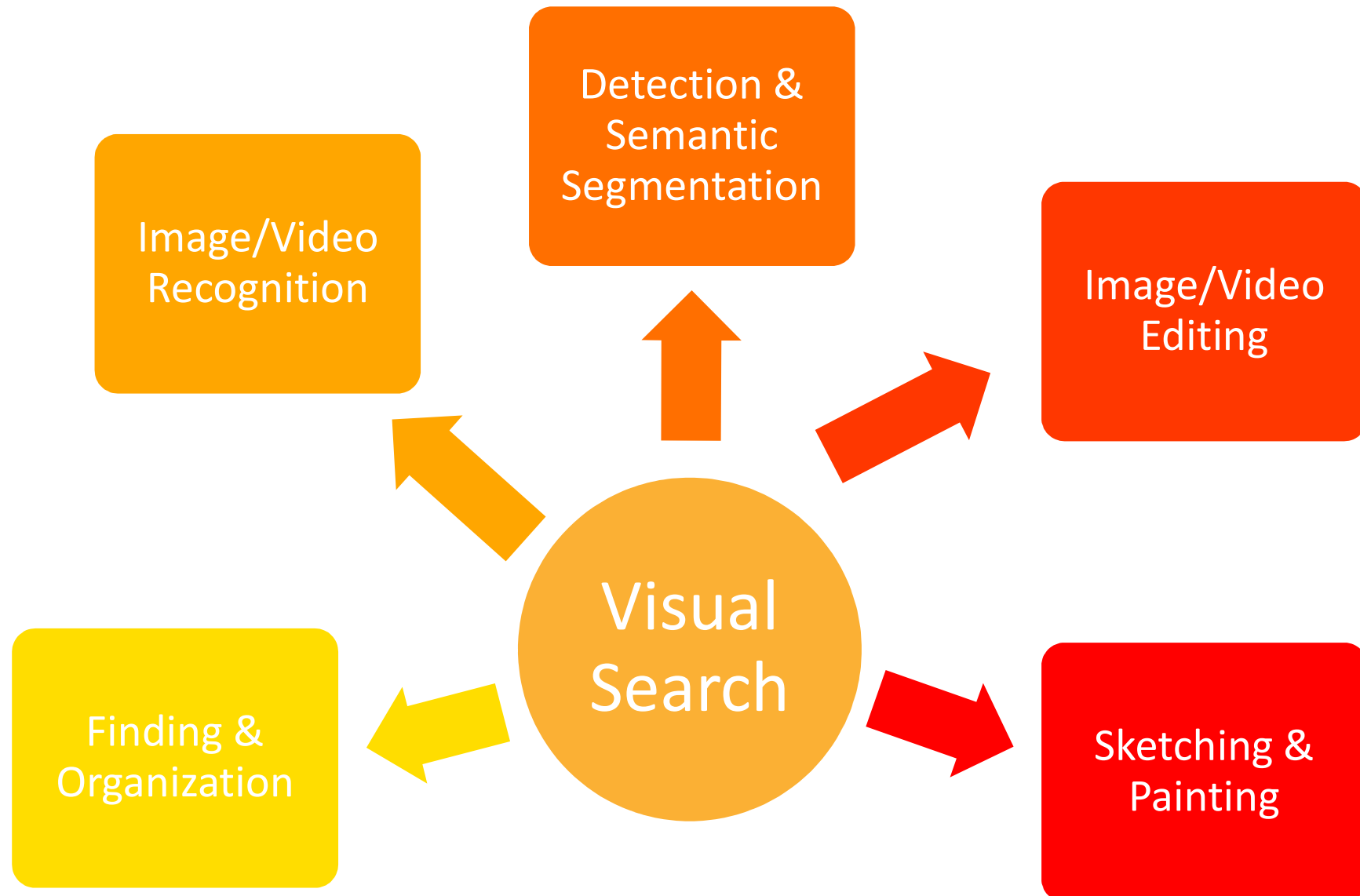
"1930"

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.

Possible Application Domains



Web-Scale Visual Data and Novel Applications

- **Visual data are getting more widely used in our daily life**
 - **YouTube, Facebook, Flickr, etc.**
- **Many challenging issues**
 - **Processing them requires scalable algorithms**
 - **Web-scale visual data can enable new applications (e.g., photo tourism)**
 - **Achieving high accuracy, each search UI, etc.**



Ack.: Hays



sungeui.jpg x describe image here



About 4 results (0.29 seconds)

Advanced search

Everything

Images

Videos

News

Shopping

More



100 x 100

2010.09.13 - KGC 2011 - [Translate this page]

www.kgconf.com/kor/html/conference_c_view.html?cate3... - Cached

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200 x 272

Welcome to ISAC2009!! - [Translate this page]

isac2009.or.kr/isac2009/speakers/domestic_bio.php - Cached

Yoo Mi Choi. 소속: 디자인여성학회 회장 한국디자인 학회 이사 한국애니메이션학회 부회장 인포디자인학회 이사 한국 애니메이션 필름협회 이사 ...

Visually similar images - Report images



Search Help Give us feedback



sungeui.jpg About 4 results (0.29 seconds)

It took a few seconds to get this result on my desktop computer.

- Everything
- Images
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- News
- Shopping
- More



Image size:
200 x 272

Find other sizes of this image:
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Pages that include matching images



Sungeui Yoon (성익, 윤성익) [sglab.kaist.ac.kr/~sungeui/](#) - Cached
Sung-Eui Yoon (윤 성익) Assistant professor, Scalable Graphics/Geometric Algorithm Lab. Dept. of Computer Science · KAIST ...

200 x 272



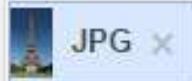
درس این صفحه - 웹사이트공학 WebST
- [Translate this page]
[webst.kaist.ac.kr/content.php?db=professor](#) - Cached
미름Cha, Meeyoung (차미영) 조교수; 연구분야Social Computing, Data-Driven Social Science; 학위PhD, KAIST, 2008; 전화번호+82-42-350-2922; 이 메일meeyoungcha

120 x 140



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100 x 100



About 453 results (0.64 seconds)



Image size:
240 x 400

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

Best guess for this image: *eiffel tower*

Visually similar images

Report images



All **Images** Maps Shopping More Search tools



About 7 results (0.61 seconds)



Image size:
433 x 624

Find other sizes of this image:
[All sizes - Medium](#)

Best guess for this image: *landmark*

Visually similar images [Report images](#)



The grid contains the following images:

- 1. A tall, cylindrical tower next to a body of water.
- 2. A city skyline at night with illuminated buildings and a bridge.
- 3. A large, ornate building with a clock tower, reflected in water.
- 4. A modern city skyline with several skyscrapers.
- 5. A city skyline with a prominent tower, viewed from a distance.
- 6. A city skyline with a prominent tower, viewed from a different angle.
- 7. A city skyline with a prominent tower, viewed from a different angle.
- 8. A city skyline with a prominent tower, viewed from a different angle.



Some of Topic Lists

- **Feature detectors**
- **Descriptors**
- **Nearest neighbor search**
- **Bag-of-Word**
- **Recognition**
- **Convolutional neural network**
- **Feature aggregation**
- **Hashing techniques**
- **Large-scale retrieval indexing techniques**
- **Video related techniques**
- **Various applications**
- **Image generation for cross domain**
- **Attention**

Prerequisites

- **Basic knowledge of linear algebra and data structures**
- **Basic knowledge on machine learning (e.g., regression) and deep learning**
 - **Assume you to know deep learning and modify it for your application**
- **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

- **Choose and present papers that are related to the course theme**
 - **Two talks for each student**
 - **Present a paper in each talk**

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

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**

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**
- **Submit questions three times before the mid-term exam**

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..**

Honor Code

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

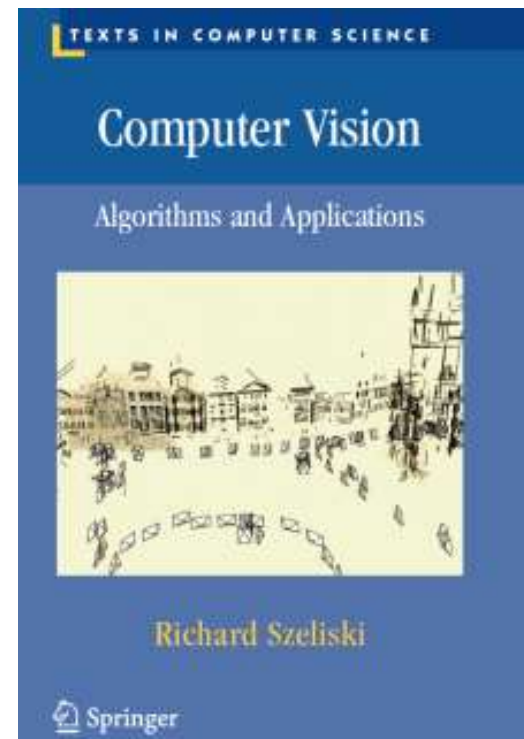
- **Classroom etiquette: help you and your peer to focus on the class**
 - **Turn off cell phones**
 - **Arrive to the class on time**
 - **Avoid private conversations**
 - **Be attentive in class**

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/>)



Other Resources

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



Schedule

- **Please refer the course homepage:**
 - <http://sgvr.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 not 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**
- **Hopefully, they will:**
 - **Lead to your next publication, or**
 - **Lead to your next start-up**

About You

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

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

- **Online submission:**
<https://forms.gle/gRcHfvfdP9DnQBjj8>

Next Time

- **Feature detectors**