

Overview of Computer Vision

Delivered by

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What we will learn ...

- Topics relate to the use of computer to
 - Acquire/generate
 - Process/manipulate/store
 - Model/analyse/interpret/recognise, and
 - Display

Images



Three related sub-fields

- Image processing
- Computer vision
- Computer graphics



Image Processing

- Mainly study these topics



The World

123 33 234 45 67 90 12 134
34 56 89 54 67 98 111 56 67
90 65 34

Numerical representation of the
brightness and colors of the world
scene

Image Processing

- Two principal application areas –
 - Improvement of pictorial information for human interpretation;
 - Processing of image data for storage, transmission, and representation for autonomous machine perception.



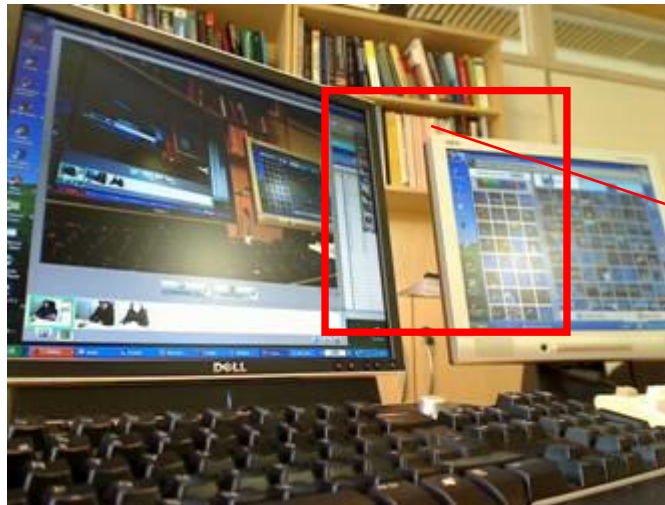
Image Processing

- Mainly study these topics
 - **Image acquisition** – (low-level) digital representation of the world scenes
 - **Image processing** – noise removal, smoothing, sharpening, contrast enhancement, alter the appearance of an image
 - **Image compression** – efficiently represent image data for storage (save disk space) and communication (save network bandwidth)
 - **Display** – render the image data on reproduction media (monitors, printing papers)



Image Processing

- **Image acquisition** – (low-level) digital representation of the world scenes



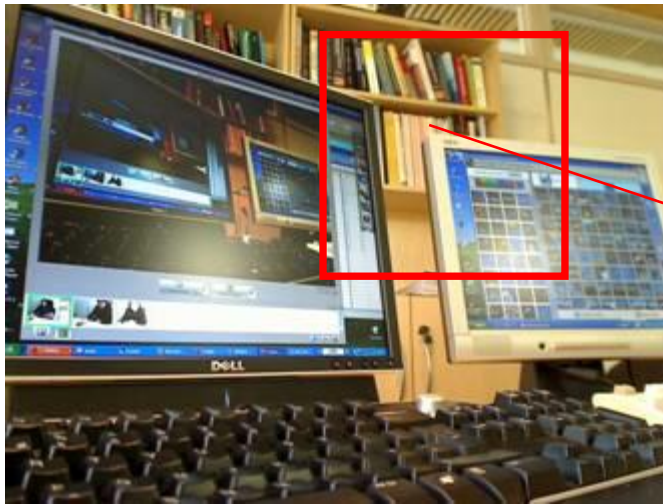
123	33	234	45	
67	90	12	134	34
56	89	54	67	98
111	56	67	90	65
34			



Numbers represent the brightness and colors of the world objects, but we have no knowledge what object, e.g., books, monitors, these numbers contain – hence low-level

Image Processing

- **Image acquisition** – (low-level) digital representation of the world scenes



123 33 234 45
67 90 12 134 34
56 89 54 67 98
111 56 67 90 65
34



What numbers?

How many numbers?

How large/small should the numbers be?

Image Processing

- **Image processing** – noise removal, smoothing, sharpening, contrast enhancement, alter the appearance of an image



Noise removal



Image Processing

- **Image processing** – noise removal, smoothing, sharpening, contrast enhancement, alter the appearance of an image



Sharpening



Image Processing

- **Image processing** – noise removal, smoothing, sharpening, contrast enhancement, alter the appearance of an image



Blurring/smoothing



Image Processing

- **Image processing** – noise removal, smoothing, sharpening, contrast enhancement, alter the appearance of an image



Contrast enhancement



Image Processing

- **Image processing** – noise removal, smoothing, sharpening, contrast enhancement, alter the appearance of an image



**Alter
appearance**



Image Processing

- **Image compression** – efficiently represent image data for storage (save disk space) and communication (save network bandwidth)



245,760 bytes



69,632 bytes



5,951 bytes

Image Processing

- **Display** – render the image data on reproduction media (monitors, printing papers)

123	33	234	45
67	90	12	134 34
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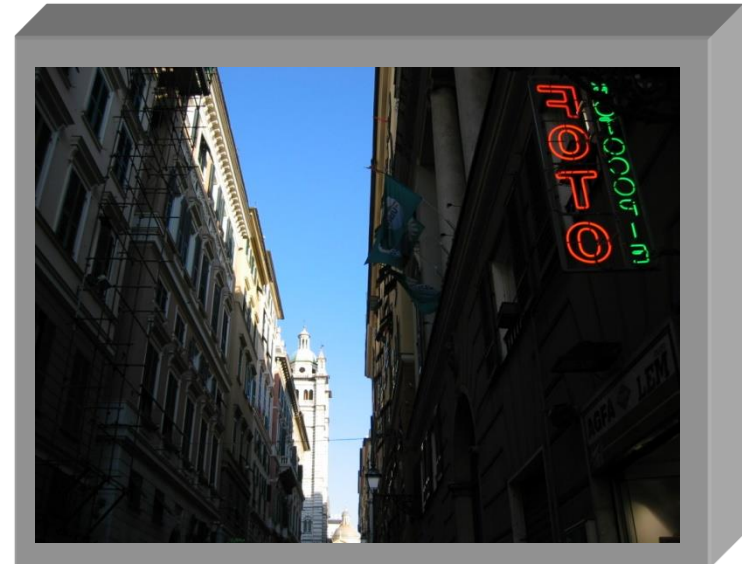
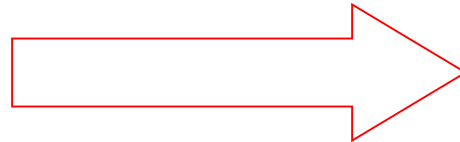
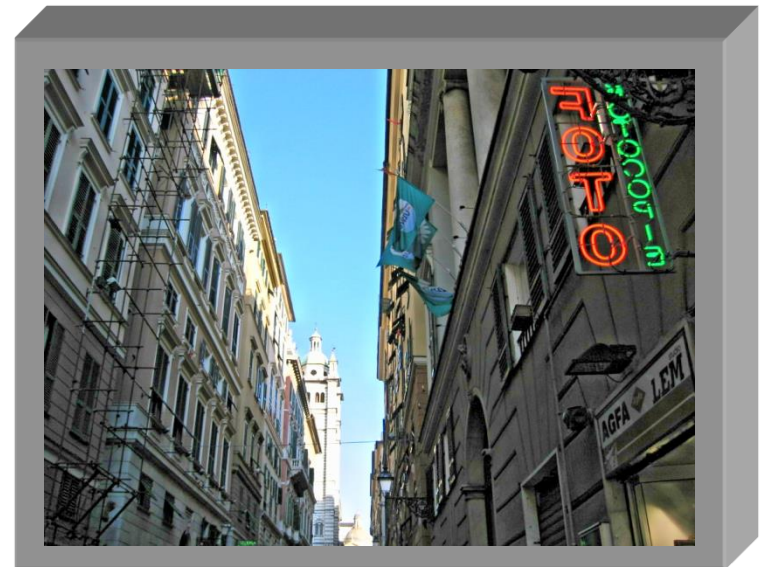
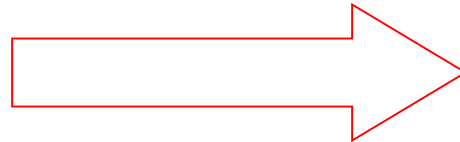


Image Processing

- **Display** – render the image data on reproduction media (monitors, printing papers)

123 33 234 45
67 90 12 134 34
56 89 54 67 98
111 56 67 90 65
34



Computer Vision

- Mainly study these topics



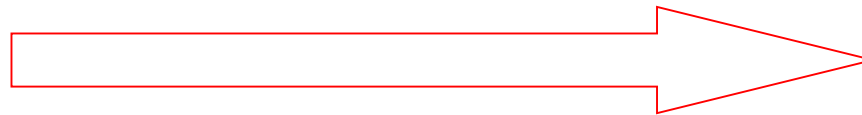
The World



Image
representation

High level knowledge of the scene, e.g.,

- i. Object ID,**
- ii. Scene structure,**
- iii. Indoor/outdoor scene**
- iv. Colors of the illumination etc**

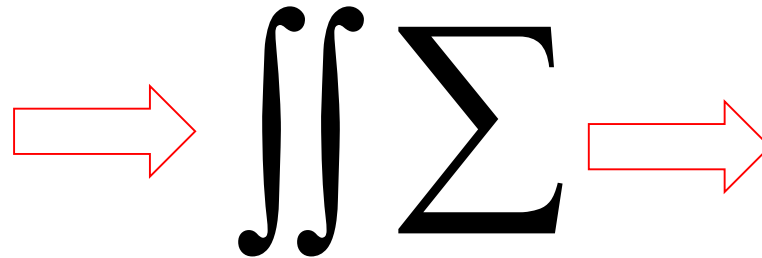


Computer Vision

- Mainly study these topics



Image



Model



**High level
knowledge**

Computer Vision

- Mainly study these topics
 - Building a mathematical model of the scene
 - Interpret the scene
 - Acquire high level knowledge of the scene, e.g., indoor/outdoor, man-made/nature
 - Detect the presence of certain objects, e.g., faces, cars
 - Recognize certain objects, e.g., person identification
- And other related topics

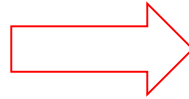


Computer Graphics

- Mainly study these topics

$\iint \Sigma$

Model



Image

Computer Graphics

- Mainly study these topics
 - Use computer (mathematical models) to create images of real world scenes and events
 - Lighting and shading modeling
 - Object modeling
 - Curves and surface modeling
 - Visibility modeling
 - Texture synthesis
 - Character animation
 - Modeling terrain, liquids, fire/smoke, cloth, hair/fur, feathers, skin etc



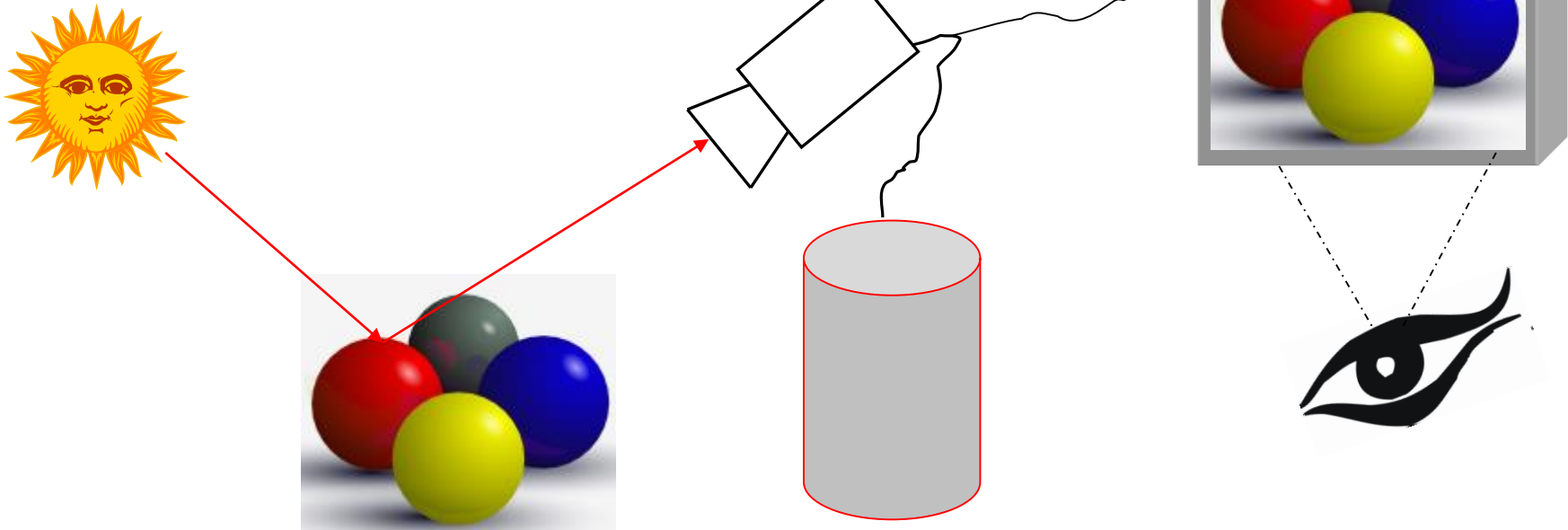
More related subjects

- Artificial intelligence
- Pattern recognition
- Machine learning
- Robotics
- Visualization



In this course we will study...

- Image formation

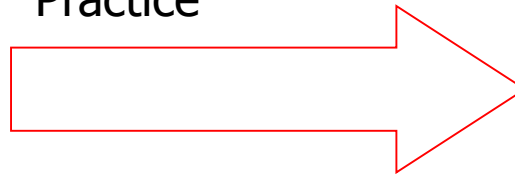


In this course we will study...

- Image processing theory and practices



Why this is possible?
How ?
Theory
Practice



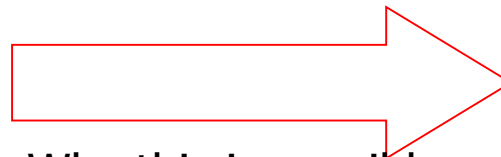
And much more ...

In this course we will study...

- Image compression



245,760 bytes



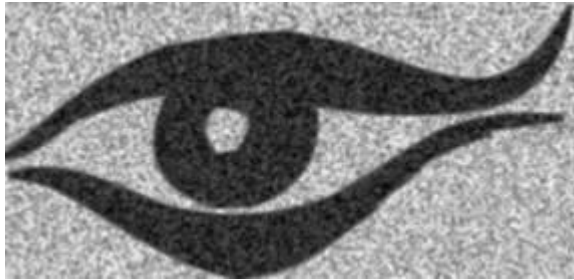
Why this is possible
How to do this
Theory
Practice



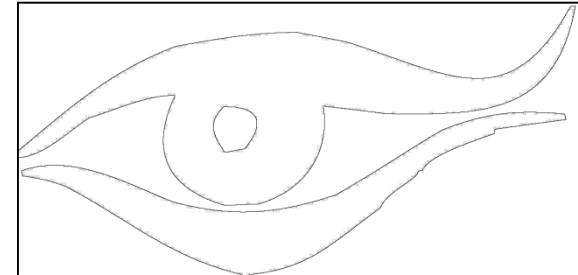
5,951 bytes

In this course we will study...

- Edge detection and image segmentation



How ?
Theory
Practice



Selected Advanced Topics

- Content-based image indexing and retrieval

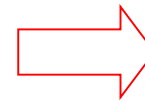


Selected Advanced Topics

- High dynamic range imaging (photography)



Conventional (low-dynamic range) images



High dynamic range image

Thank You

