Prof. Kjersti Engan

ELE510 Image processing and computer vision

Introduction 2021

8/22/21

University of Stavanger

Image Processing and Analysis

Stan Birchfield
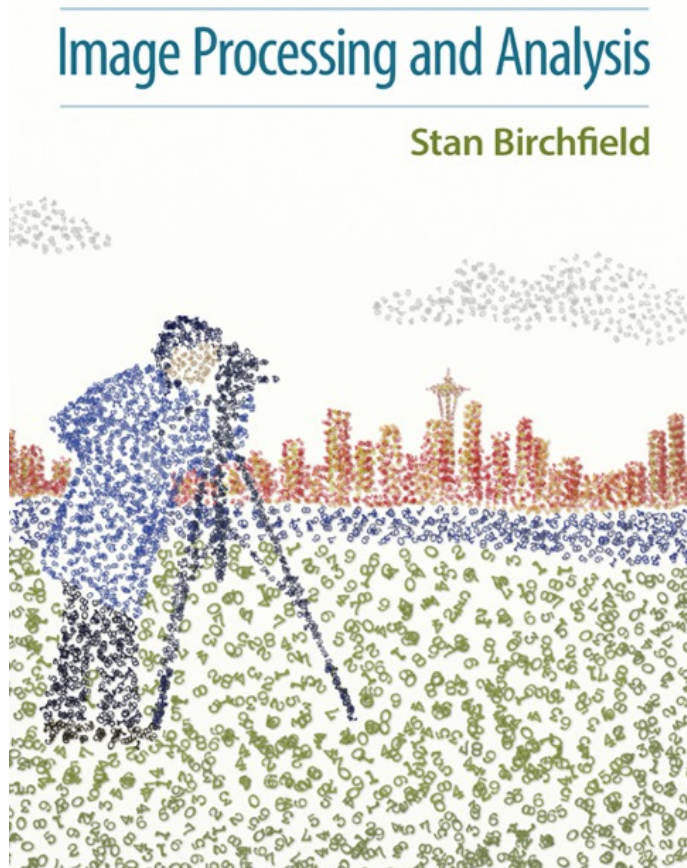
Parts in course presentations is material from Cengage learning.   It can be used for teaching, and it can be share it with students on access controlled web-sites (Canvas) for use in THIS course. **But it should not be copied or distributed further in any way** (by you or anybody).

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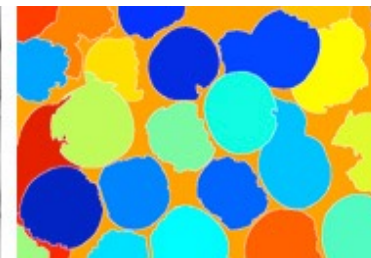# ELE510 Image processing and computer vision – terms and topics of the course
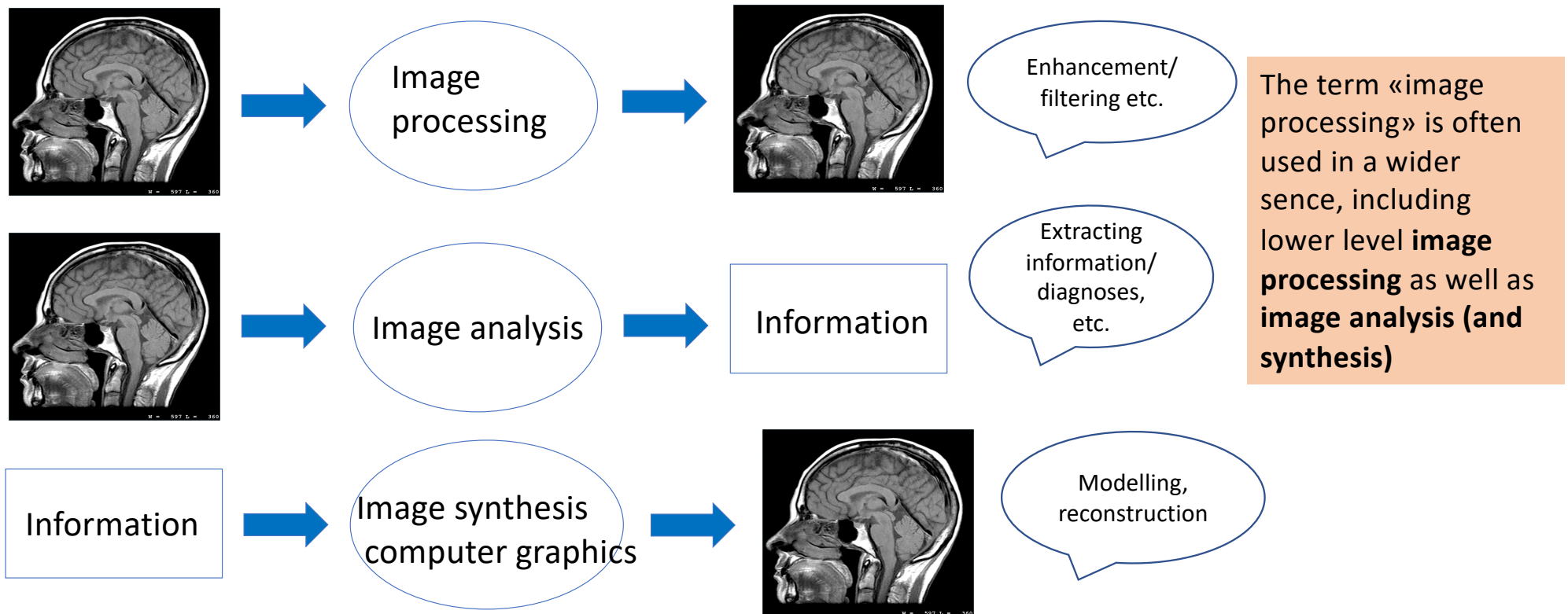

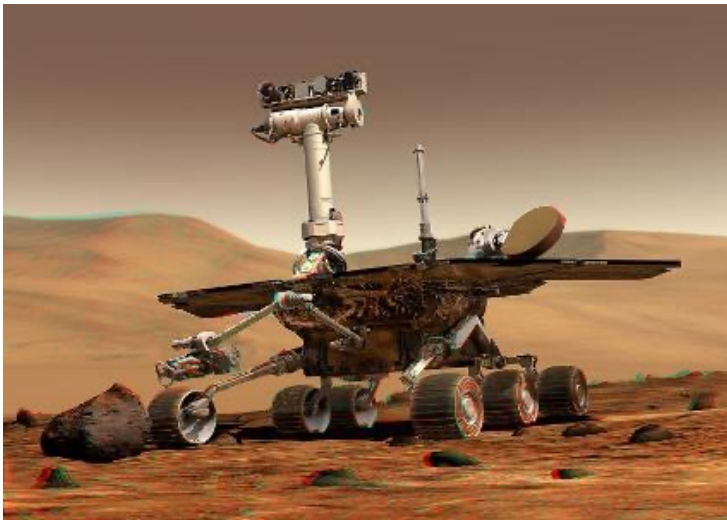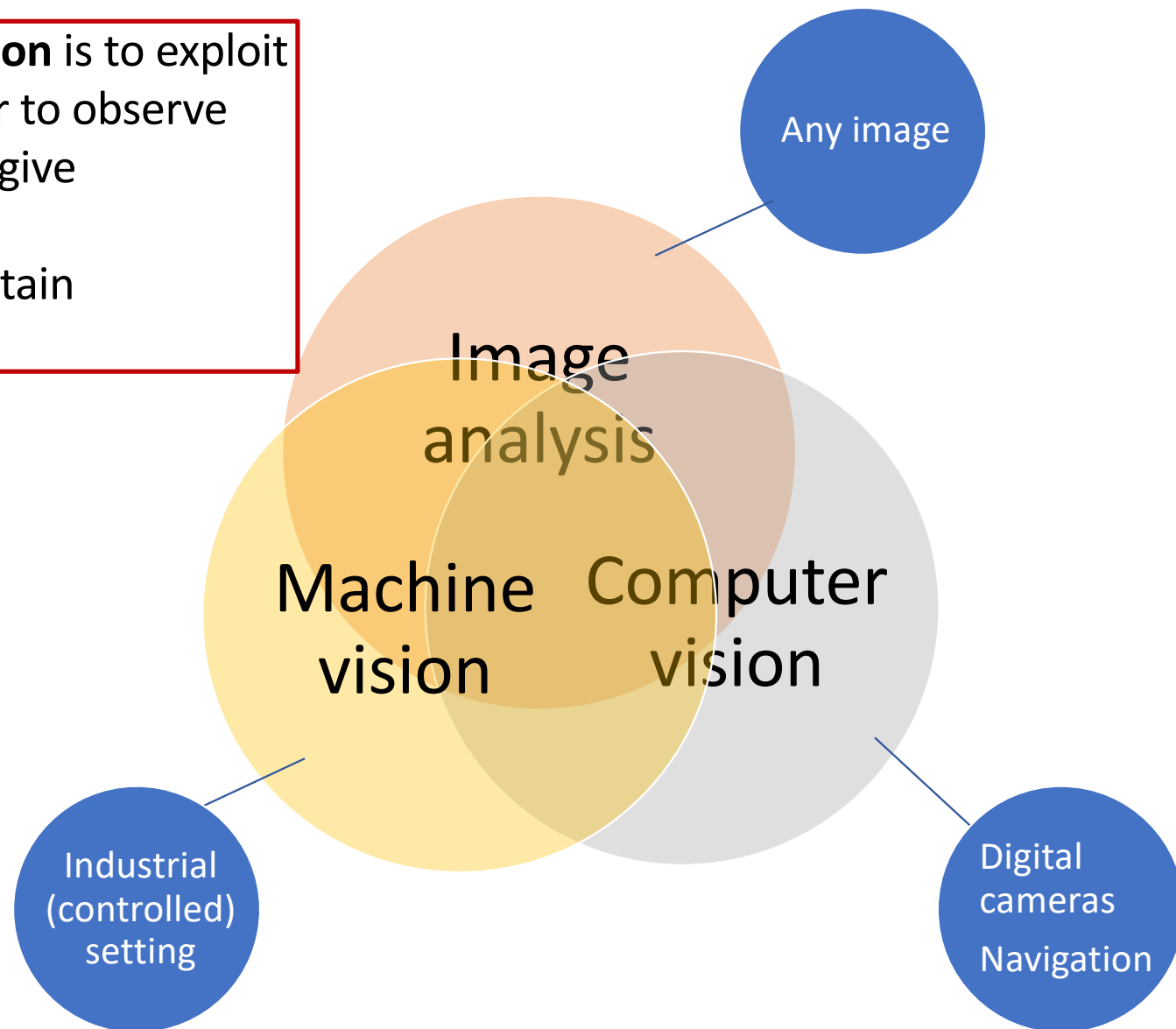| Image processing	Image Analysis
• Enhancement	• Segmentation
• Restoration	• Classification
• Compression	• Shape from X
• ..	• ..

Image Processing – Image Analysis
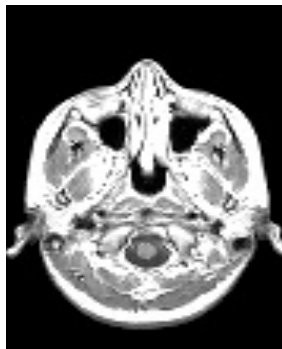
Example images

The goal of **machine/computer vision** is to exploit the power of visual sensing in order to observe and perceive the environment and give appropriate reactions to it.
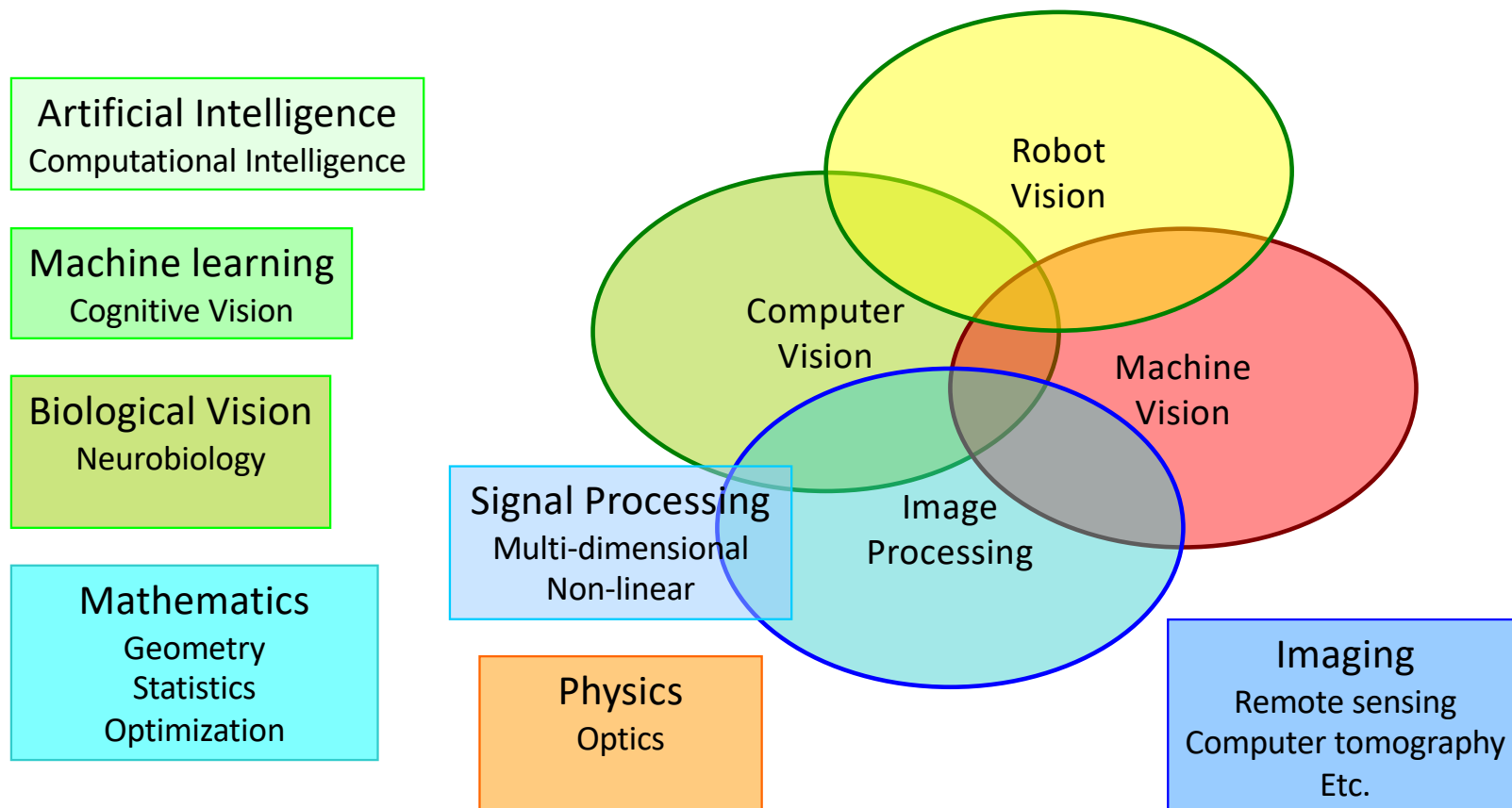... building artificial systems that obtain information from images.

NASA's Mars Spirit Rover
http://en.wikipedia.org/wiki/Spirit_rover

Any image

Image analysis

Machine vision

Computer vision

Industrial (controlled) setting

Digital cameras
Navigation

Vision – related topics

Artificial Intelligence
Computational Intelligence

Machine learning
Cognitive Vision

Biological Vision
Neurobiology

Mathematics
Geometry
Statistics
Optimization

Signal Processing
Multi-dimensional
Non-linear

Physics
Optics

Robot
Vision

Computer
Vision

Machine
Vision

Image
Processing

Imaging
Remote sensing
Computer tomography
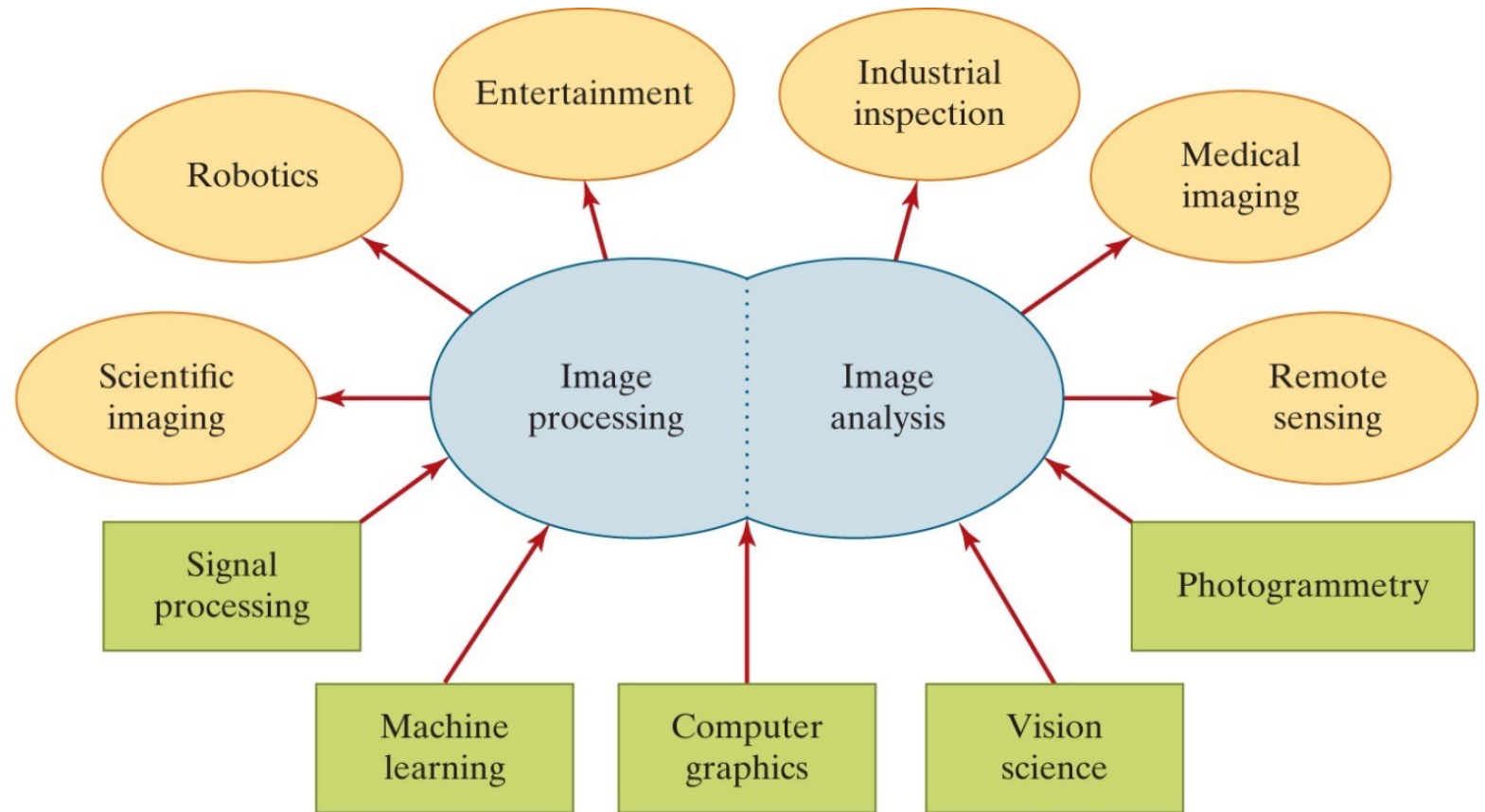Etc.

Figure 1.3: Image processing and analysis, along with related fields (bottom rectangles) and sample applications (top ovals).

|	Environment	Sensor	Algorithm	Output
Image processing	Any	Any	Low-level	Another image
Image analysis	Any	Any	Low-to-high level	nonimage
Machine vision	Industrial	Camera	Low-level	nonimage
Computer vision	Everyday	Camera	Mid-to-high-level	nonimage

Robot Takes on Landmine Detection While Humans Stay Very Very Far Away
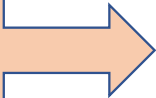IEEE Spectrum: By Evan Ackerman, Posted 23 Jan 2014

We will cover many topics from here..
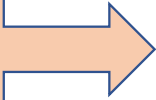
Low level processing

- Image formation/capture
- spatial filtering (convolution) / frequency domain filtering
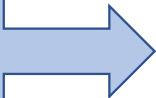- Feature extraction
- Stereopsis ..

And some from here..

mid level processing

- Edge detection
- Segmentation
- Motion analysis
- Tracking ..

Just a little bit from here

high level processing

- Registration
- Detecting objects in images
- Classifying images and objects
- Learning (deep learning) from images ..

we will discuss some topics from deep learning for images, including convolutional neural networks (CNN) – but not a large part of this course

Image Processing and Analysis – some expressions

- **Image processing:** the field of study in which algorithms operate on input images to produce output images.

- **Image analysis:** the field of study in which algorithms operate on images to extract higher-level information.

- **Enhancement:** an image processing problem that involves transforming an input image into another image so as to improve its visual appearance.

- **Restoration:** an image processing problem that has as its purpose to restore an image that has been corrupted by some type of noise.

- **Compression:** an image processing problem that involves storing an image with fewer bits than are required by the original signal.

- **Segmentation:** an image analysis problem that involves the process of determining which pixels in an image belong together, that is, which pixels are projections of the same object in the scene.

- **Classification:** an image analysis problem that involves determining which pixels or region in an image that belong to a model/class that has been created beforehand (for example by a machine learning algorithm on training data).

- **Shape from X:** an image analysis problem that aims to recover the three-dimensional (3D) structure of the scene using any of a variety of techniques.

- **Machine vision:** refers to systems in an industrial setting in which the placement of the camera and lighting conditions can be controlled.

- **Computer vision:** refers to systems operating on images taken in unstructured settings, such as those taken by ordinary people in everyday life using their personal digital cameras.