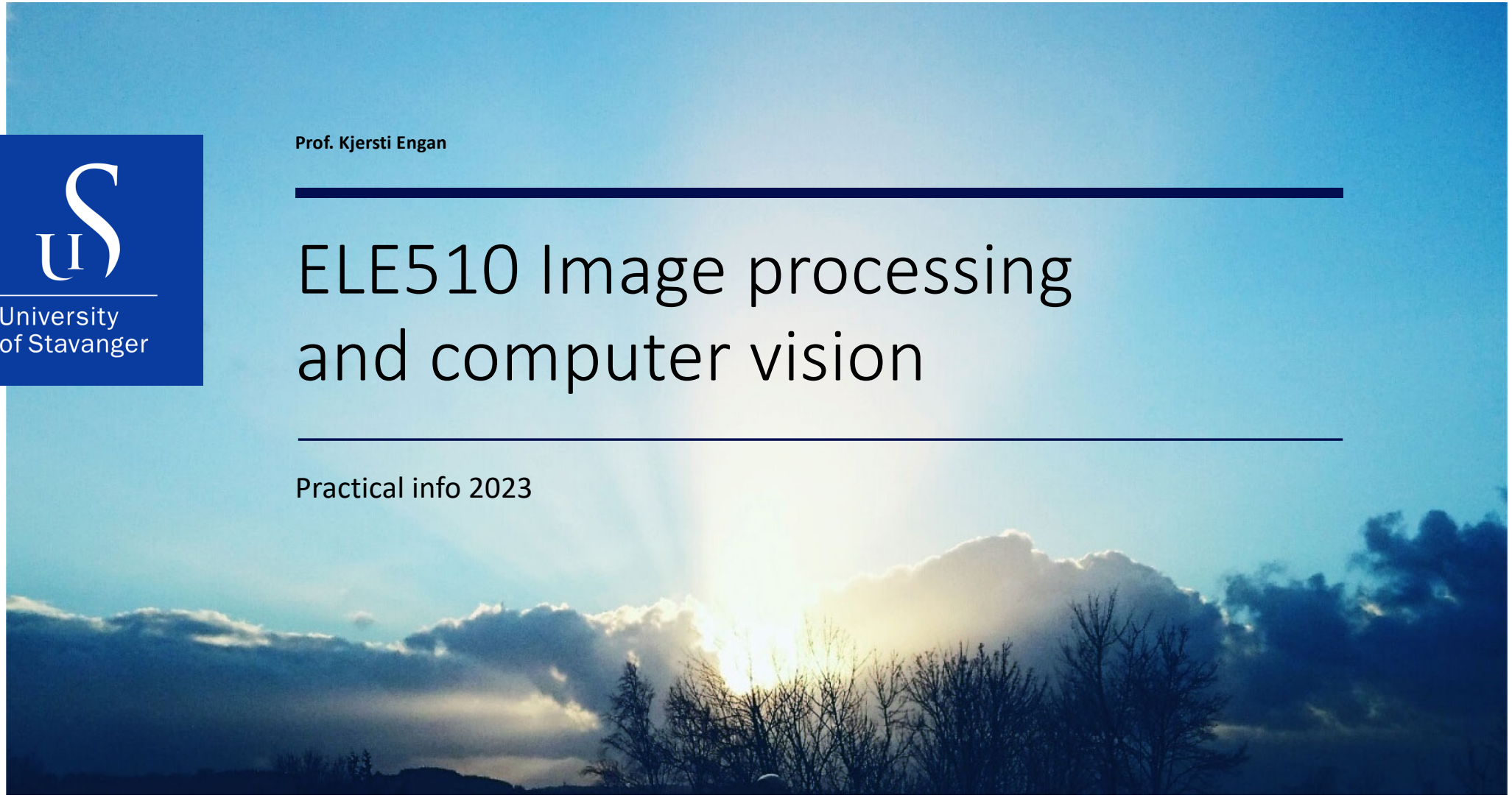


University of Stavanger

Prof. Kjersti Engan

ELE510 Image processing and computer vision

Practical info 2023

Practical information

Subject responsible and lecturer: prof. Kjersti Engan, office: KE E-431, kjersti.engan@uis.no
Teaching assistants (TA): PhD student Saul Fuster Navarro, saul.fusternavarro@uis.no
PhD student Jorge García-Torres, Jorge.Garcia-torres@uis.no

The main format of the class is physical lectures and assignments. Video lectures recorded in 2020, some in 2021 will be made available at Canvas. In some selected topics the students might be told explicitly to watch the video lectures, to give time for questions and other activities in class. Most topics will be physically lectured – and might deviate a bit from the videos. Videos will nevertheless be available and a good option if missing a class.

Lecture times - starting week 34, first lecture 21.08, KE C-101

Mondays: 08:15-10:00, KE C-101

Fridays: 08:15-10:00, KE C-101

Lab hours with student assistant (one of the timeslots – see Canvas for information on how to choose):

Mondays: 10:15-12:00, room KE E-456

Fridays: 10:15-12:00, room KE E-264

Assignments and Project

Assignments (mandatory, not graded)

- 6 out of 7 (or 8) assignments must be approved to get the course grade.
- Assignments consist of some theoretical questions and some programming (Python, openCV).
- Assignments will be given as Jupyter notebooks.

Project (mandatory and graded)

- The project is done in groups of 2 persons (possible 1 if special needs).
- The project title will be given Friday 27th October, and deadline for deliver is Friday 10th November, i.e. it will be over 14 days. (pre-announced grace-period until Sunday 12th nov)
- The delivery of the project is done by uploading two files to Canvas:
  1) A report, uploaded as a pdf document
  2) a 5-7 min video with your presentation of the project.
- The projects will be presented orally on Monday 13th November in lecture and lab class hours.

Course assessment

- Written report from project counts for 40% of course grade. The group gets the same grade.
- Written exam counts for 60% of course grade (4 hours)

- Oral presentation of project is mandatory to get the course grade
- 6 out of 7 (or 8) assignments must be approved to get the right to do the exam

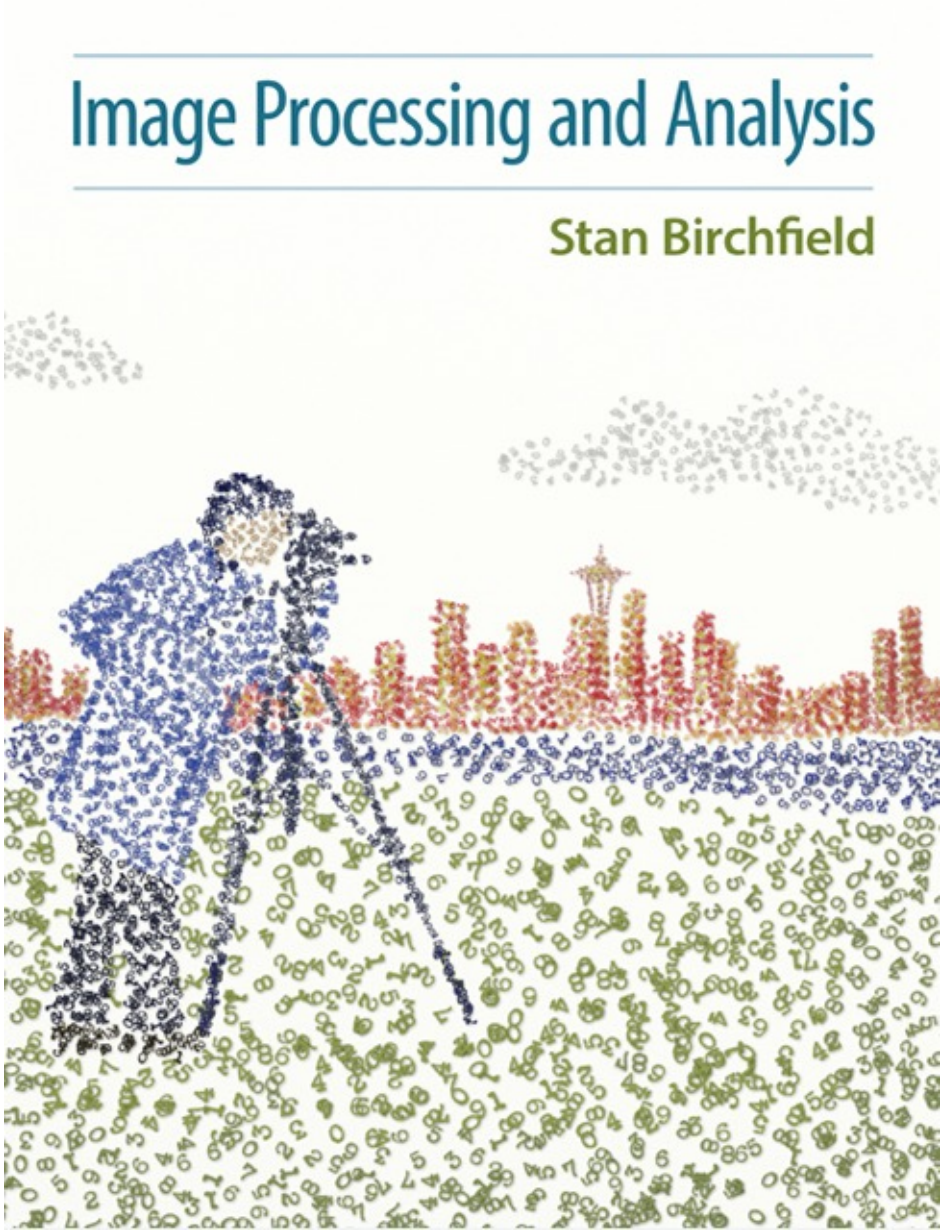
Curriculum

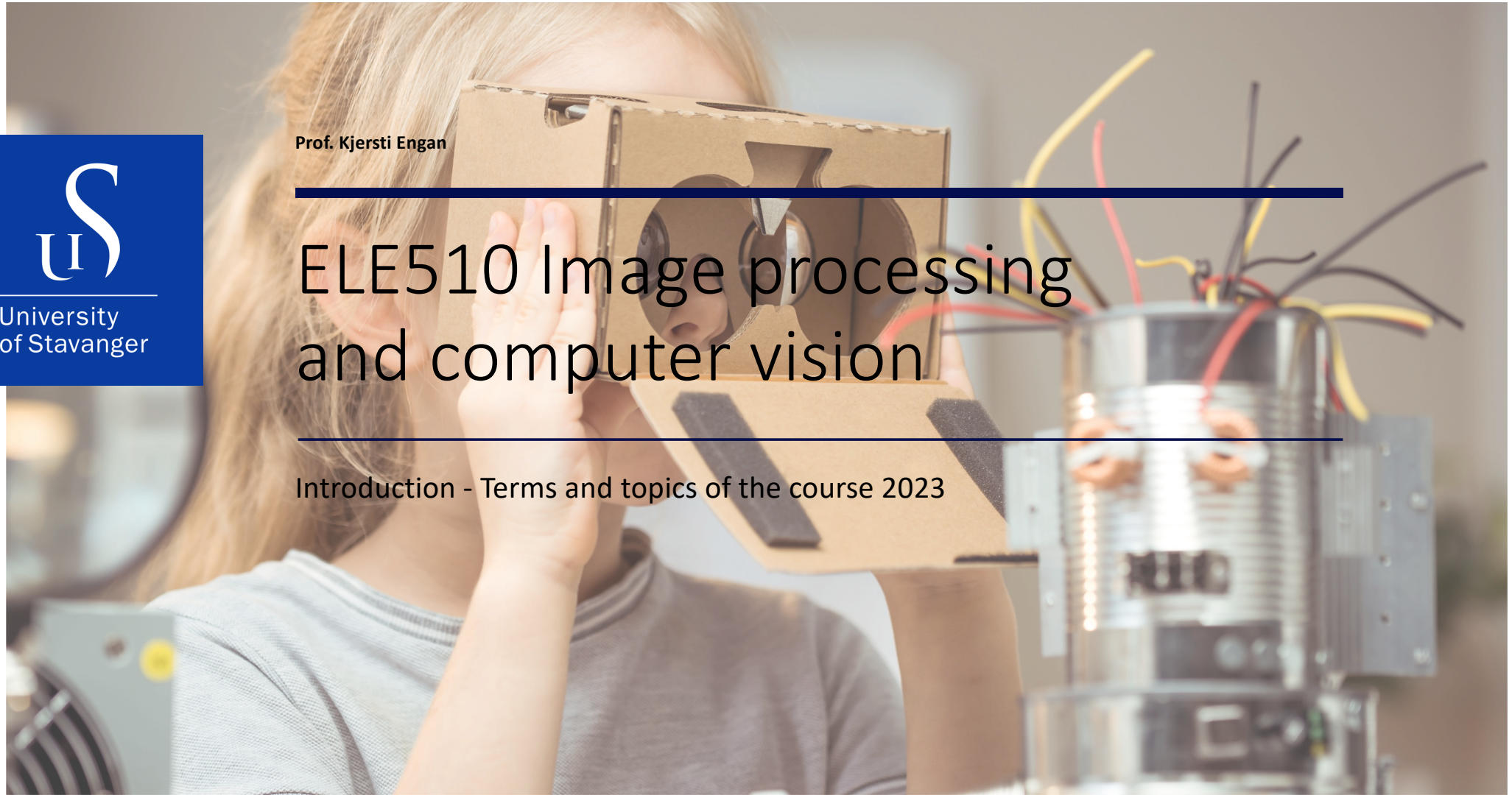
From Stan Birchfield, “Image processing and Analysis”, list under, subject to minor changes.

Assignments and lectures (presentations and lecture notes) are considered as part of the curriculum

Additional support material will be made available on Canvas

Chapter		Curriculum
1	Introduction	all
2	Fundamentals of Imaging	2.1,2.2,2.3,2.4
3	Point and geometric transformation	all
4	Binary image processing	4.1
5	Spatial domain filtering	5.1,5.2,5.3,5.4,5.5
6	Frequency domain processing	6.1,6.2,6.3,6.4,6.5
7	Edges and features	7.1,7.2,7.3,7.4,7.5
8	Compression	NOTHING
9	Color	9.1
10	Segmentation	10.1,10.3,
11	Model Fitting	NOTHING
12	Classification	12.4.6, 12.4.10
13	Stereo and motion	All (not all details, but all subchapters)



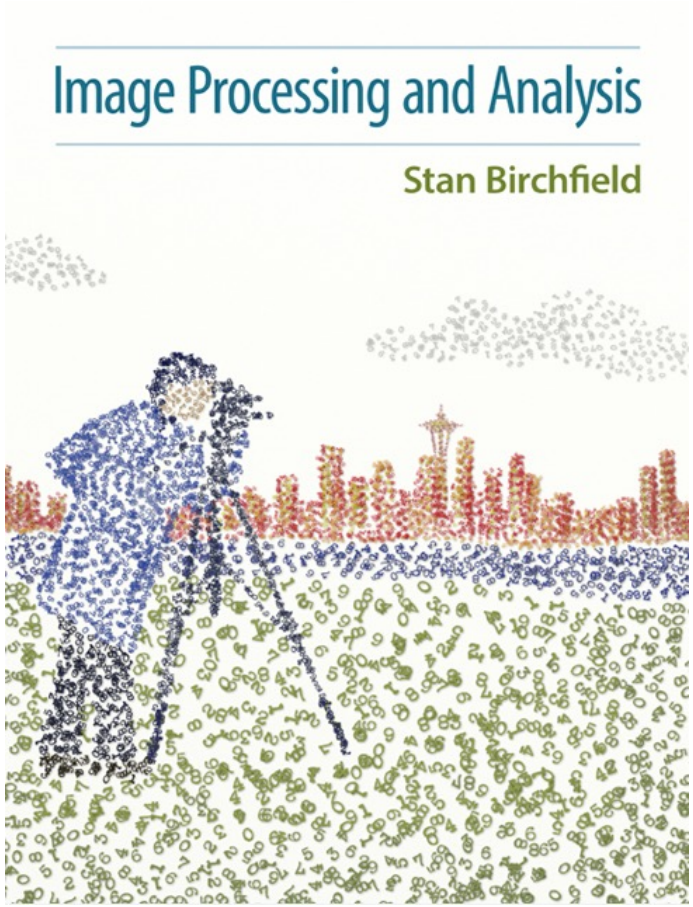


University of Stavanger

Prof. Kjersti Engan

ELE510 Image processing and computer vision

Introduction - Terms and topics of the course 2023



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).

Example images



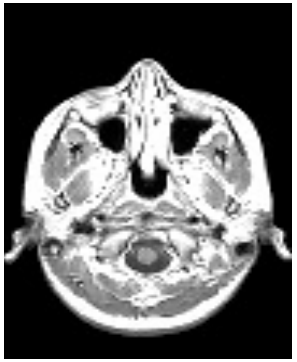




Image processing	Image Analysis	Computer vision
• Enhancement • Restoration • Compression • ..	• Segmentation • Classification • Shape from X • ..	• object detection • tracking • ..

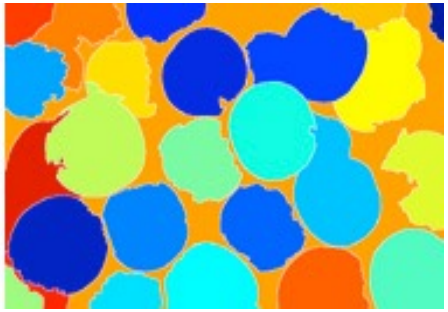


Image Processing – Image Analysis

Image processing

Enhancement/ filtering etc.

Image analysis

Information

Extracting information/ diagnoses, etc.

Information

Image synthesis computer graphics

Modelling, reconstruction

The term «image processing» is often used in a wider sence, including lower level **image processing** as well as **image analysis (and sometimes synthesis)**

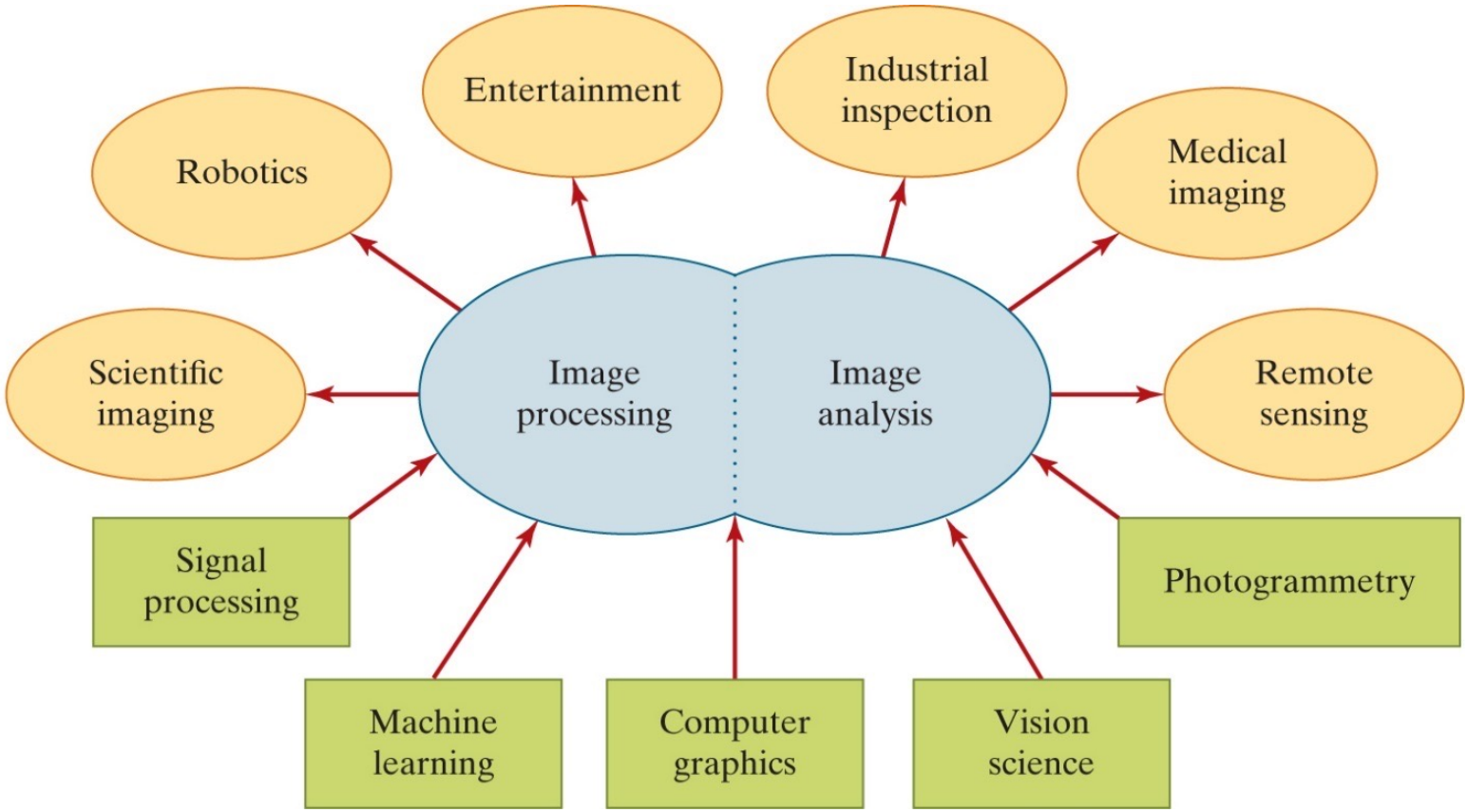
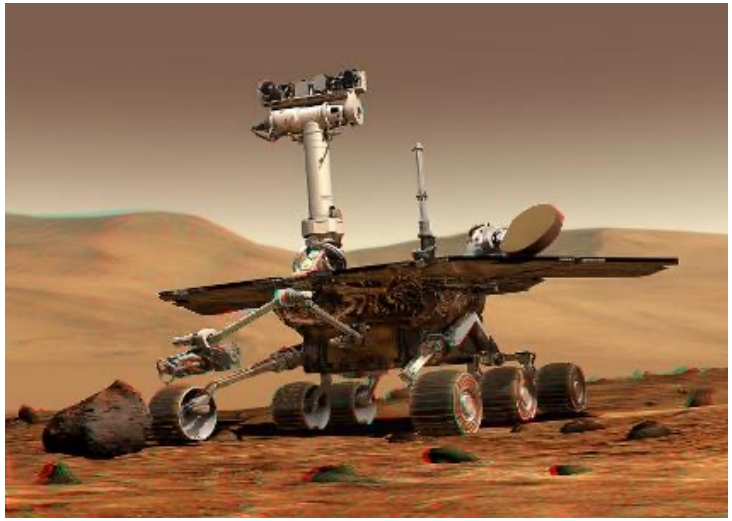


Figure 1.3: Image processing and analysis, along with related fields (bottom rectangles) and sample applications (top ovals).

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

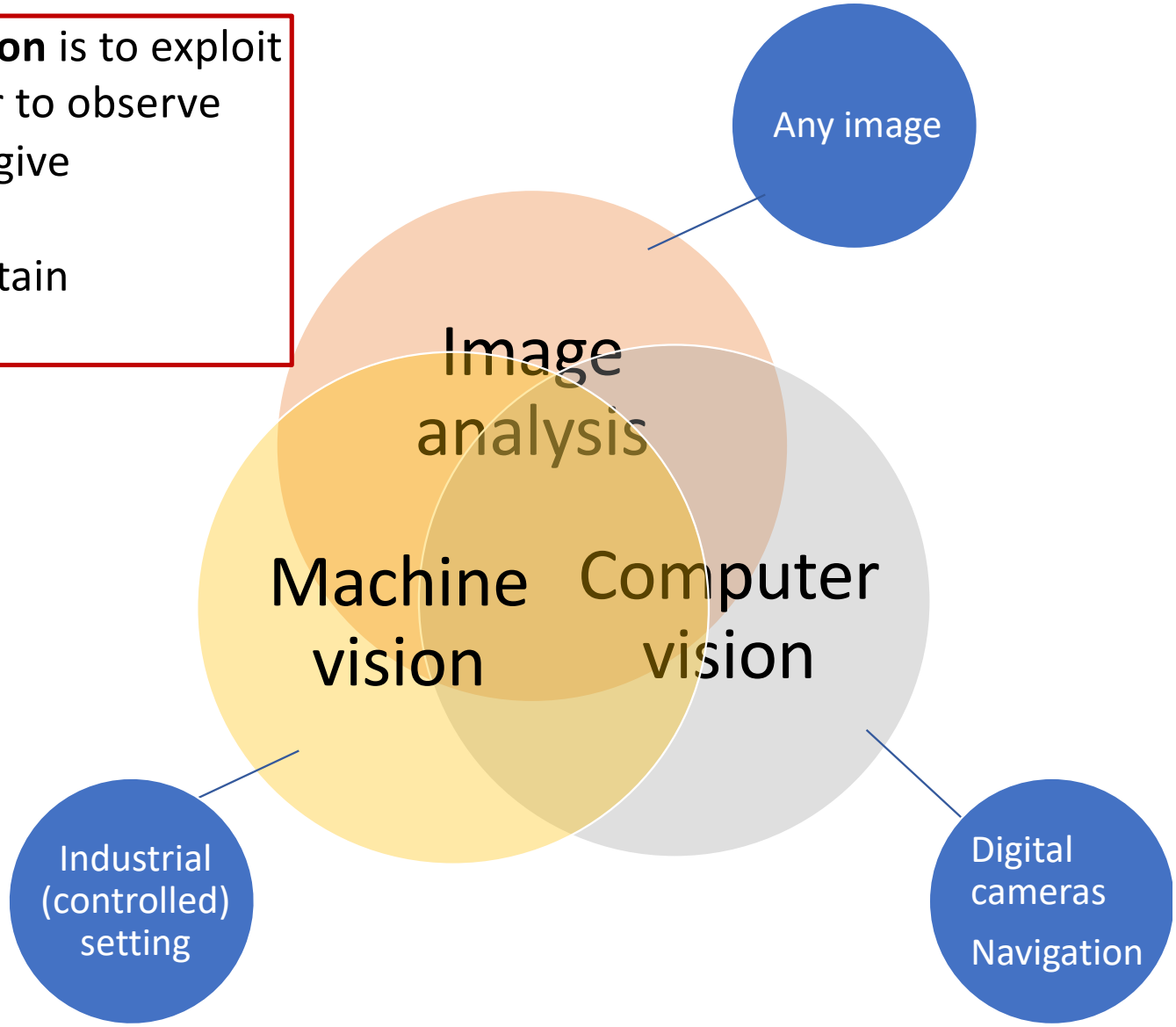


Image Processing and Analysis – some expressions

- **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).

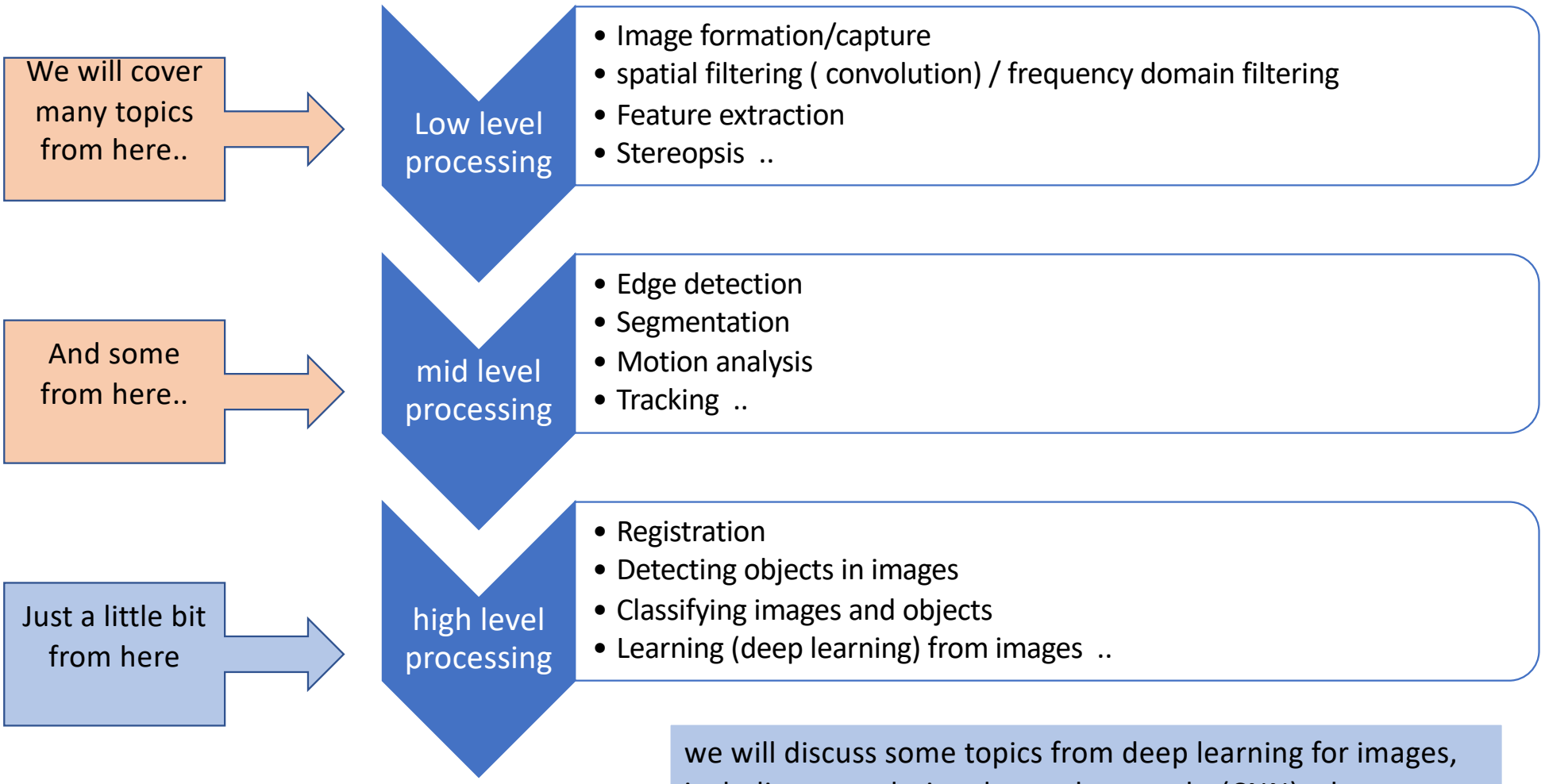
- **Shape from X:** an image analysis problem that aims to recover the three-dimensional (3D) structure of the scene using any of a variety of techniques.

- **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.

	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..
And some from here..
Just a little bit from here
Low level processing
• Image formation/capture
• spatial filtering (convolution) / frequency domain filtering
• Feature extraction
• Stereopsis ..
mid level processing
• Edge detection
• Segmentation
• Motion analysis
• Tracking ..
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