Introduction to the Course

KOM4520 Fundamentals of Robotic Vision

Today's lecture

- Information about the course
- Introduction to Robotic Vision

Information About The Course

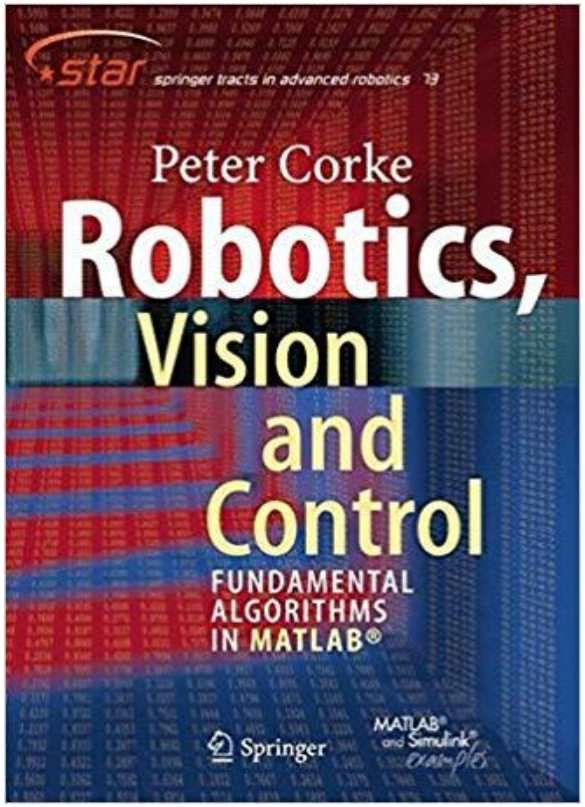
Information about the course

- Instructors: Dr. Muharrem Mercimek A-216
- Office Hours: [A-216]
- Class Hours: […] Tuesday 13:00-15:50
- Course Materials: Avesis website of the instructor
- Online system (for assignment and project submission)

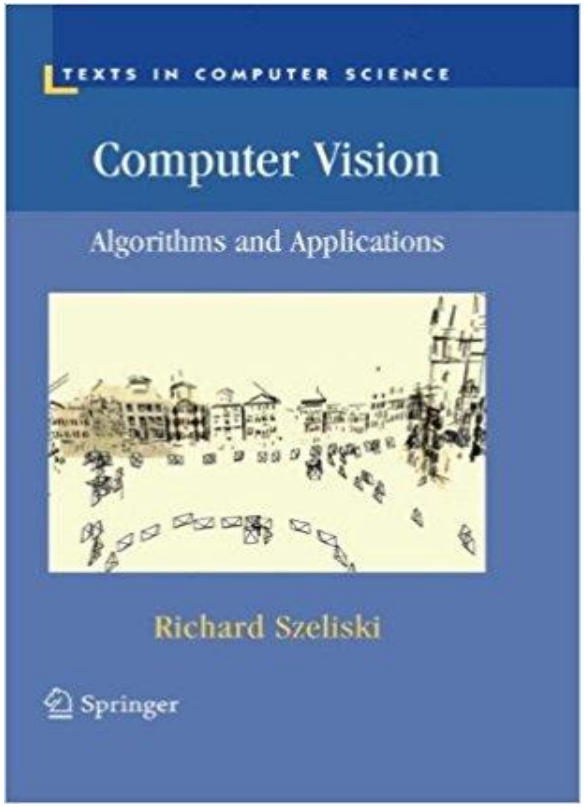
Information about the course

Textbook and course Materials

Robotics, Vision and Control: Fundamental Algorithms in MATLAB, Peter Corke, 2nd ed., Springer Verlag. 2017.



Computer Vision: Algorithms and Applications, Richard Szeliski, Springer Verlag. 2011



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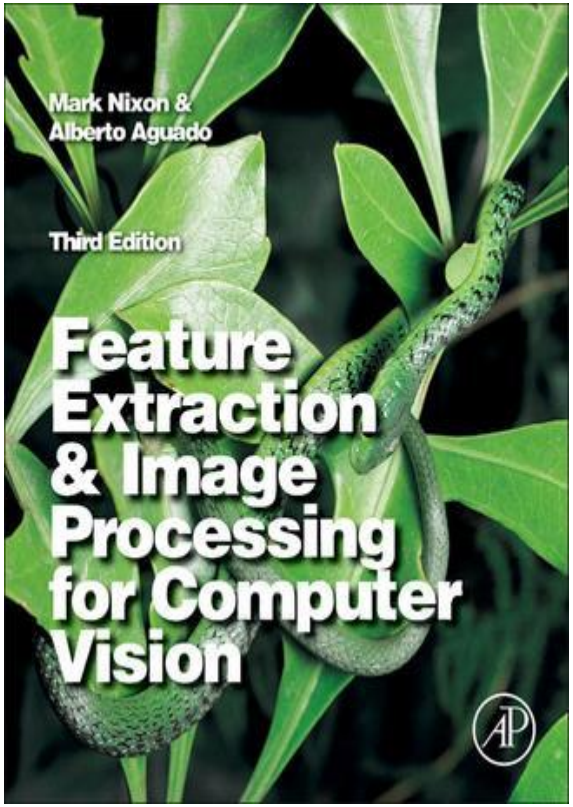
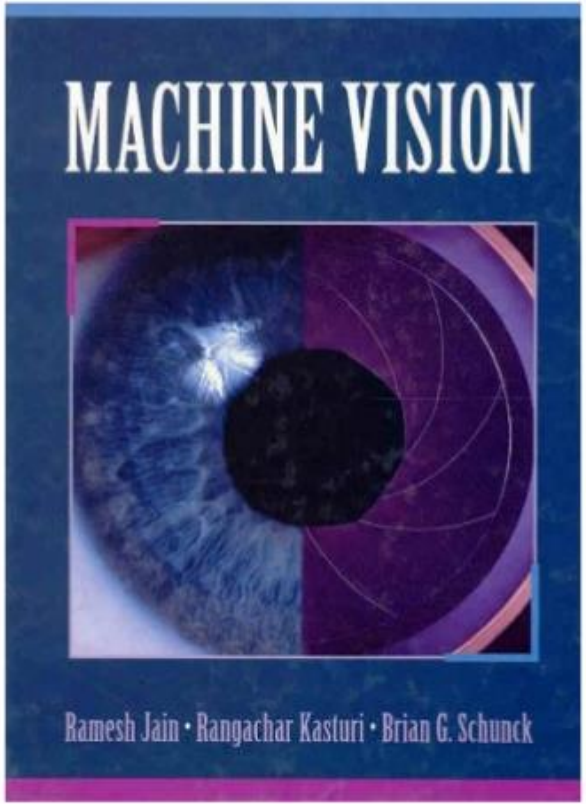
Feature Extraction and Image Processing for Computer Vision, Mark Nixon, 3rd ed., Elsiever, 2012.



Machine Vision (McGraw-Hill Series in Computer Science) by Ramesh C. Jain, Rangacher Kasturi, Brian G. Schunck, 1995



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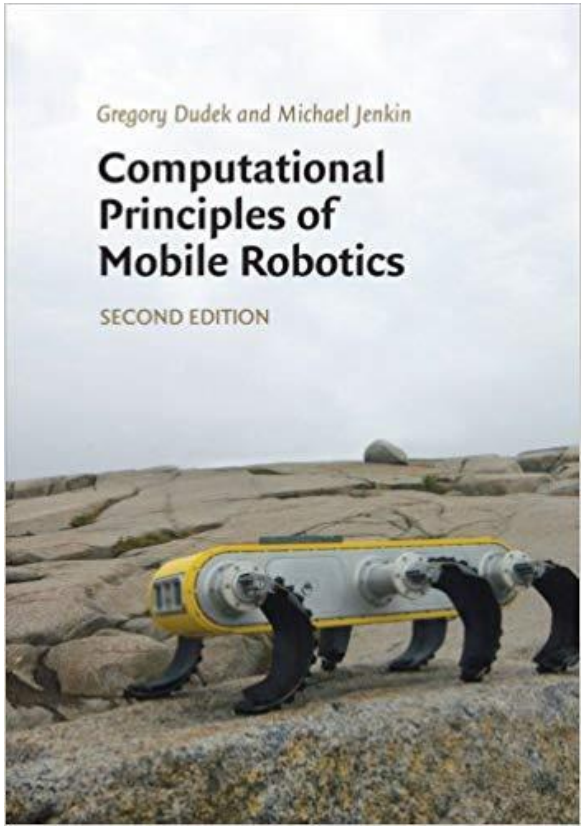
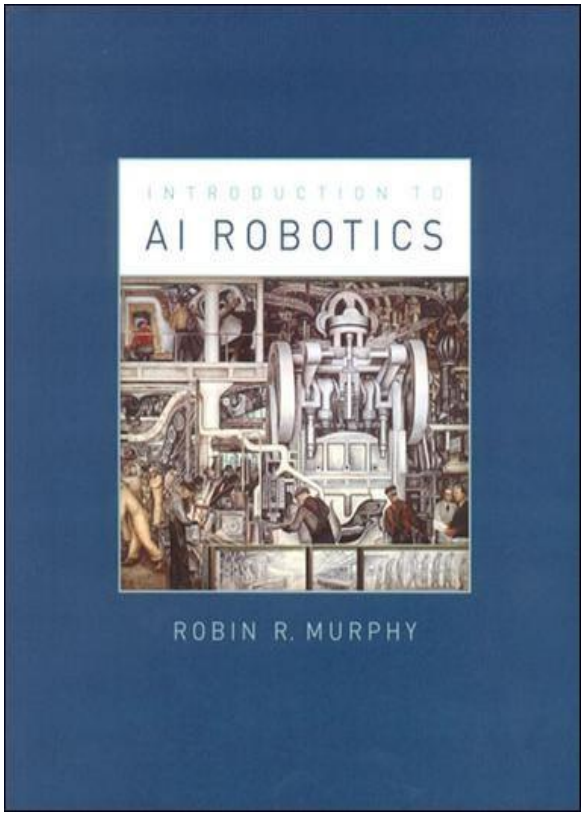
Computational Principles of Mobile Robots, Gregory Dudek, Michael Jenkin, Cambridge University Press, 2010.



Introduction to AI robots, Robin R. Murphy, MIT Press, 2000.



Information about the course

Grading		
	Assignments (1)	15%
	Project (with a technical rep.)	15%
	Midterm 1	30%
	Final	40%

Assignments

- There will be individual programming assignments and these will be listed on the schedule page. Due dates will be specified and the students should submit their material on time.
- Program submissions should be the outcome of each student's own endeavors. Collaborative study is encouraged, but any code and document you prepare must be your own.
- Submissions must include source codes as well as the documentations and data files (sometimes printed out when needed)
- When submitting your Assignments via online system always zip it, and name it like KOM4520_YourName_YourNumber_AssignmentNumber.{zip or rar}. When submitting an assignment always put a subject title relevant to why you are sending it. You can use the name of your zip file again.

Information about the course

Week	Subjects	Related Prep.
1	Introduction to Robotic Vision	Textbooks
2	Concepts on position and orientation of the robots	Textbooks
3	Mobile robots: Non-Holonomic Robots (Car-like robots)	Textbooks
4	Mobile robots: control tasks	Textbooks
5	Image Formation: camera models	
6	Image Feature Extraction: Region features , Line Features, Point Features	
7	Pose estimation using image data, image segmentation, image interpretation	Textbooks
8	Mid-term Exam	Textbooks
9	Automated navigation and path planning of mobile robots and their interaction with the environment	
10	Automated navigation and path planning of mobile robots and their interaction with the environment	Textbooks
11	Understanding of the mobile robot's surrounding – localization and mapping	Textbooks
12	Depth Data Acquisition: Feature correspondence , Multiple view geometry, Stereo Vision, Camera Calibration, Structured Light	Textbooks
13	Vision Based Control, Visual Servoing : use of image features	Textbooks
14	Vision Based Control, Visual Servoing : Applications, MATLAB Toolboxes use for Robotics and Vision- Seminar	Textbooks
15	Final Exam	

Information about the course

Programming environment

- The efforts in this course will involve quite good use of Matlab programming your codes can be tested and used by the instructor.

Academic Honesty

- Any misconduct in this course is considered a serious offense and strong penalties will be the results of such behaviors. It is cheating to copy others' code. Fake program outputs and documents is also considered as cheating.

Introduction to Robotic Vision

Most of the contents are adopted from Robotics, Vision and Control: Fundamental Algorithms in MATLAB, Peter Corke, 2nd ed., Springer Verlag. 2017.

What is a robot?

- In the eighteenth century the people of Europe were fascinated by automata or mechanism which were very complex by the standards of the day, demonstrated what then seemed life-like behavior.

- Da vinci's knight.
- The mechanical monk
- Al-Jazari's floating orchestra
- The silver swan
- Vaucanson's digesting duck

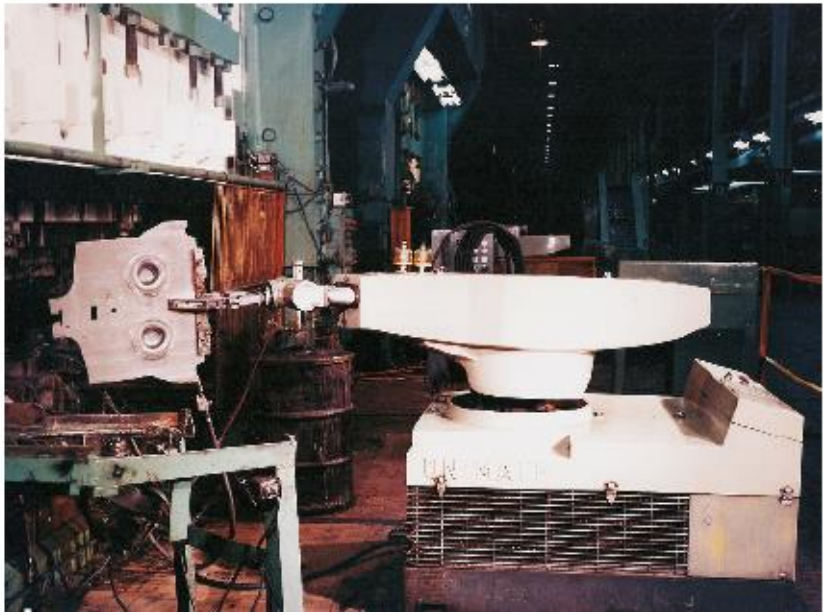
- Jacquard extended and developed a programmable weaving machine (1801). The pattern to be woven was encoded as a series of holes on punched cards. This machine has many hallmarks of a modern robot: it performed a physical task and was reprogrammable.

The first examples of Robots

- The first patented robot was a mechanical arm invented by Devol (1954).
- The first robotics company, Unimation, was founded by Devol and Joseph Engelberger in 1956.

- The original vision of Devol and Engelberger for robotic automation has become a reality and many millions of arm-type robots have been built and put to work at tasks such as welding, painting, machine loading and unloading, electronic assembly, packaging and palletizing.

- The first generation : stationary robots; fixed in place)
- The use of such robots has helped to increase the productivity and improve product quality.



Classification of robots

- By contrast **mobile robots** can move over the ground using wheels or legs, fly through the air using fixed wings or multiple rotors

- Another taxonomy is based on the task that the robot is accomplishing.

- Manufacturing robots : operate in factories and are the technological descendants of the first generation robots
- Service robots : service to people such as cleaning, personal care, medical rehabilitation or fetching and carrying
- Field robots : work outdoors on tasks such as environmental monitoring, agriculture, mining, construction and forestry
- Humanoid robots : have the physical form of a human being mimics functions of human beings

How does a robot work?

A robot is a goal oriented machine that can sense plan and act.

- How does a robot work? Robots are data-driven machines. They acquire data, process it and take action based on it.
- The data comes from sensors measuring the velocity of a wheel, the angle of a robot arm's joint or the intensities of millions of pixels that comprise an image of the world that the robot is observing.
- For many robotic applications the amount of data that needs to be processed, in real-time, is massive.
- For a vision sensor it can be of the order of tens to hundreds of megabytes per second.