

Digital Image Processing - Digitální zpracování obrazu (33DZO, E33DZO)

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<http://cmp.felk.cvut.cz/cmp/courses/dzo/dzo.pdf>

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1 Annotation.

The course covers core areas of digital image processing, including image formation, acquisition, pre-processing, compression, edge-detection, detection of geometric features and segmentation. Methods commonly used in machine vision and medical image applications are presented.

2 Exam Questions.

<http://cmp.felk.cvut.cz/cmp/courses/dzo/exam-questions.pdf> (in english)

<http://cmp.felk.cvut.cz/cmp/courses/dzo/zkouskove-otazky.pdf> (česky)

3 Lectures

1. Image Formation, Radiometry. Sensors. Digitization.

Chapter 3 from Forsyths book:

http://cmp.felk.cvut.cz/cmp/courses/dzo/resources/chapter_radiometry_forsyth.pdf

2. Colour. Reflectance models.

Chapter 5 from Forsyths book:

http://cmp.felk.cvut.cz/cmp/courses/dzo/resources/chapter_color_forsyth.pdf

3. Imaging Geometry. Projective Transformation.

Zisserman's tutorial; easy to read:

http://cmp.felk.cvut.cz/cmp/courses/dzo/resources/tutorial_geometry_zisserman/epsrc_ssaz.html

Chapter 2 from Forsyths book:

http://cmp.felk.cvut.cz/cmp/courses/dzo/resources/chapter_cameras_forsyth.pdf

Triggs and Mohr; if you want to know everything :-)

http://cmp.felk.cvut.cz/cmp/courses/dzo/resources/tutorial_geometry_mohr-triggs.ps.gz

Important concepts from projective geometry

http://www.dai.ed.ac.uk/CVonline/LOCAL_COPIES/BEARDSLEY/

Projective geometry tutorial

<http://www.inrialpes.fr/movi/people/Triggs/isprs96/isprs96.html>

4. Fourier Transform (FT) in 2D. Theory and Applications.

4.1. Continuous and discrete Fourier transform.

- 4.2. the DFT and FFT algorithms.
- 4.3. Fast convolution via FT.
- 4.4. Deconvolution for motion blurr removal.
- 4.5. Wiener filtration for noise removal.
- 4.6. Signal Reconstruction.
- 4.7. Translation-invariant features via FT.

Mathematics of the DFT <http://ccrma-www.stanford.edu/~jos/mdft/>

The Fast Fourier Transform algorithm

http://www.cs.cf.ac.uk/Dave/Vision_lecture/node20.html

2 dimensional FFT

<http://astronomy.swin.edu.au/~pbourke/analysis/fft2d/>

FFTW links

<http://www.fftw.org/links.html>

DSP guide book

<http://www.dspguide.com/ch7.htm>

5. Texture

http://cmp.felk.cvut.cz/cmp/courses/dzo/resources/lecture_texture_sara.pdf

6. Compression

Chapter 27 of Smith's book on DSP

http://cmp.felk.cvut.cz/cmp/courses/dzo/resources/book_dsp_smith/datacomp.htm

- 6.1. Compression properties: lossy and lossless , progressive .
- 6.2. Entropy coding. The Huffman coder.
- 6.3. Predictive coding. Run-length coding.
- 6.4. Lempel-Ziv-Welsh LZW coding.
- 6.5. Transform coding. JPEG.

7. Edge Detection.

8. Detection of geometric primitives. Hough Transform

9. Corner Detection. The Correspondence problem

http://cmp.felk.cvut.cz/cmp/courses/dzo/resources/lecture_harris_urban.pdf

10. Segmentation with Snakes

http://cmp.felk.cvut.cz/cmp/courses/dzo/resources/lecture_snakes_sonka.html,

http://math.berkeley.edu/~sethian/Explanations/interface_explain.html (simple explanation),

<http://math.berkeley.edu/~sethian/Movies/Movieartery.html> (example),

<ftp://ftp.inria.fr/INRIA/publication/publi-pdf/RR/RR-4760.pdf> (application),

11. Point Distribution Models - Principal Component Analysis

http://cmp.felk.cvut.cz/cmp/courses/dzo/resources/lecture_pdf_sonka.html

http://cmp.felk.cvut.cz/cmp/courses/dzo/resources/tutorial_point-distribution_cootes

http://cmp.felk.cvut.cz/cmp/courses/dzo/resources/tutorial_pca_smith.pdf

12. Mathematical Morphology

http://cmp.felk.cvut.cz/cmp/courses/dzo/resources/lecture_morphology_sara.pdf

Literature: [1] Sonka, Milan; Hlavac, Vaclav; Boyle, Roger: Image Processing, Analysis and Machine Vision