EQ2425 Analysis and Search of Visual Data 7.5 credits

Analys och sökning av visuella data

This is a translation of the Swedish, legally binding, course syllabus.

Establishment

Course syllabus for EQ2425 valid from Spring 2019

Grading scale

A, B, C, D, E, FX, F

Education cycle

Second cycle

Main field of study

Electrical Engineering

Specific prerequisites

For single course students: 120 credits and documented proficiency in English B or equivalent.

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

After passing this course, participants should be able to:

(1) Qualitatively describe the principles of analysis and search of visual data, i.e., visual vocabularies, image features, classification, recognition, and visual queries.

(2) Develop and implement (for example with MatLab) schemes for image feature extraction, classification, recognition, and mobile visual search.

(3) Analyze, compare, and explain design choices using the principles of analysis and search of visual data.

(4) Assess the performance of the developed query / recognition schemes quantitatively.

(5) Analyze given query problems, identify and explain the challenges, propose possible compression schemes, and explain the chosen design.

To achive higher grades, participants should also be able to:

- Solve given project problems well and submit clear, scientifically sound, and well-written reports.

Course contents

This course introduces the principles of analysis and search of visual data, discusses fundamental concepts for similarity queries, and provides hands-on experience for selected popular visual search algorithms. The course includes topics on visual vocabularies and bags of words, image features, image feature detection and description, feature-based object recognition, classification and clustering, robust recognition, scalable recognition, compression of image feature descriptors, rate-constrained feature selection, mobile visual search, similarity queries on compressed data, identification rate for D-admissible systems, and compression schemes for similarity queries.

Course literature

Lecture notes and selected papers / book chapters are available on the course Web page, for example:

- B. Girod, V. Chandrasekhar, D. M. Chen, N. M. Cheung, R. Grzeszczuk, Y. Reznik, G. Takacs, S. S. Tsai and R. Vedantham, “Mobile Visual Search”, IEEE Signal Processing Magazine, vol. 28, no. 4, pp. 61-76, July 2011.

- J. Sivic and A. Zisserman, “Video Google: A text retrieval approach to object matching in videos,” in Proc. IEEE Int. Conf. Computer Vision (ICCV), Washington, DC, 2003.

- D. Lowe, “Distinctive image features from scale-invariant keypoints,” Int. J. Comput. Vis., vol. 60, no. 2, pp. 91–110, 2004.

- D. Nistér and H. Stewénius, “Scalable recognition with a vocabulary tree,” in Proc. IEEE Conf. Computer Vision and Pattern Recognition (CVPR), New York, June 2006.

- H. Li and M. Flierl, "Mobile 3D visual search using the helmert transformation of stereo features," Proc. IEEE International Conference on Image Processing, Melbourne, Australia, Sept. 2013.

- David Chen and Bernd Girod, “Memory-efficient image databases for mobile visual search,” IEEE MultiMedia Magazine. Vol. 21, no. 1, pp. 14-23. January-March 2014.

- X. Lyu, H. Li, and M. Flierl, "Hierarchically structured multi-view features for mobile visual search," Proc. IEEE Data Compression Conference, Snowbird, UT, Mar. 2014.

Examination

- INL1 - Preparation assignments, 1.5 credits, grading scale: P, F
- PRO1 - Course projects, 3.0 credits, grading scale: A, B, C, D, E, FX, F
- TEN1 - Exam, 3.0 credits, grading scale: A, B, C, D, E, FX, F

Based on recommendation from KTH’s coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

If the course is discontinued, students may request to be examined during the following two academic years.

Other requirements for final grade

(1) Preparation assignments, 1.5 ECTS (P/F): A few days before an exercise session, we hand out a short assignment to be solved individually before the session. During the session, you will discuss your prepared solution with your peers. The commented version of your prepared solution will be handed in at the end of the exercise session.

(2) Course projects, 3 ECTS (A-F): The projects will provide hands-on experience and should be performed in groups of two students.

(3) Written exam, 3 ECTS (A-F)

The final grade will be determined by the average of course projects and exam. The examiner reserves the right to adjust the weighting for each course round.

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.

- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.