

Computer Vision Project

Course level: Master [M1]

Track: MLDM

ECTS Credits: 6

Education period: Third semester **Language of instruction:** English



Syllabus:

The aim of this Computer Vision Project is to put the theory learned during the Computer Vision and Machine Learning classes in the 3 semesters of the MLDM program, into practice.

During the project, students will implement and compare different machine learning algorithms on a computer vision task, such as image classification. The project will be done by groups of 3 students that need to divide the work equally between them (the ability to work as a team will also count in the grade).

Students will be provided with an image dataset (for example one of <http://www.cs.utexas.edu/~grauman/courses/spring2008/datasets.htm> or <http://wang.ist.psu.edu/docs/related/>) and they will have to use both descriptor-based approaches and pixel-based methods to describe images.

For *descriptor-based approaches*, students will be able to use existing libraries such as VLFEAT (<http://www.vlfeat.org/>) to detect interest points in images and produce a description of those points (for example SIFT, HOG, SLIC, etc.). Students are then advised to create a visual vocabulary from those descriptors and then to describe images by means of Bag-of-Visual Words (as explained here: <http://www.cs.princeton.edu/courses/archive/fall09/cos429/papers/csurka-eccv-04.pdf>) that have proved to be relevant for image classification. To complete this last pre-processing step, students will need an efficient implementation of a *clustering algorithm* and think about good sampling strategies.

For *pixel-based approaches*, students will have to **learn** a relevant image description using, for example, a convolutional neural network (which can be implemented and trained from scratch or used as a black-box e.g. http://caffe.berkeleyvision.org/gathered/examples/feature_extraction.html)

Once the images described, students will have to compare multiple machine learning methods (*K-NN*, *Neural Networks*, *SVM*, *Decision Trees*, *Random Forest*) to classify images. One of the algorithms needs to be implemented from scratch in the project in any preferred programming language. For the other algorithms, it will be possible to use Machine Learning libraries such as *WEKA*, *R*, *scikit-learn*, etc. Students are expected to carefully divide their dataset into training/validation/test sets or to use cross-validation to assess their results.

Form(s) of Assessment: The defense of the Project (20mn of presentation followed by 15mn of questions) is scheduled at the end of the 3rd semester in February. A written report in English has to be sent to the coordinator of the project 2 days before the defense. The final grade will depend on (i) the quality of the oral presentation (with slides); (ii) the quality of the report (that could be used as a showcase for future job interviews) and (iii) the ability to fulfill the requirements of the project.

Additional information/Contacts:

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