AALBORG UNIVERSITY

Course Module Description

General module information
Title: Machine Learning for Media Experiences
Type: Course module
Language of instruction: English
Location of lecture: Campus Aalborg

ECTS points: 5 ECTS

Period: 1 September 2022 — 31 January 2023

Placement
1st semester, M.Sc. in Medialogy
3rd semester, M.Sc. in Sound and Music Computing, Copenhagen

Module coordinator
Mads G. Christensen (teacher), Nicola Walker (secretary)

Academic content and relationships to other modules/semesters
The formal study plan description of the module can be found here:

https://moduler.aau.dk/course/2022-2023/MSNMEDM1222?lang=da-DK

In designing and developing interactive media systems and technology, one is often faced with looking for interesting patterns and trends. This course presents theoretical concepts and practical tools for analyzing data for multimedia applications and solving machine learning problems, such as classification, in media technology. Many of these methods are used in, e.g., automatic speech recognition, face detection, web page ranking, autonomous driving, etc. The course includes the following topics: multivariate probability density functions, Bayesian classification, estimation, and detection, parametric (e.g., Gaussian density-based) and non-parametric classifiers (e.g. k-nn, parzen, convolutional neural networks), regression, data fitting, evaluation of classifiers and estimators, unsupervised and supervised learning (e.g., reinforcement learning), feature selection and reduction. The course will contextualize these techniques by how they apply as tools for addressing media creation challenges.

Objectives and learning goals

KNOWLEDGE
Students who complete the module will obtain:

- understanding of multivariate statistics and how to model multivariate data, e.g., using probabilistic and parametric descriptions
- understanding of the principles of supervised (e.g., Bayesian classification, SVM, least squares regression, deep learning) and unsupervised learning methods, (e.g., k-means, hierarchical clustering, Gaussian mixture models)
- understanding of features, feature selection, feature learning, and dimensionality reduction (e.g., forward feature selection, principal component analysis, autoencoder)
- knowledge of the application of machine learning techniques and tools to address media creation problems (e.g. visual effects, games, procedural generated content, motion capture etc.)

SKILLS
Students who complete the module will be able to:

- choose, implement and apply machine learning methods to solve typical machine learning problems (e.g., classification, detection, regression)
- apply knowledge to compare machine learning methods in terms of performance and complexity
- apply the theory of multivariate statistics to analyze multimedia data (e.g., speech and music, images of faces, gestures, etc.)

COMPETENCES
Students who complete the module will be able to:

- apply multivariate statistics to analyze multimedia data, and reflect on a variety of possibilities to recommend a solution to the related machine learning problem(s)

- apply machine learning methods to such problems and evaluate, discuss and generalize the results and reflect on their implications regarding the problems and the data

Extent and expected work load
The total workload is 5 ECTS. This covers preparation for lectures (1 ECTS), lectures and exercises (2 ECTS), and individual project and preparation for the exam (2 ECTS).

Pre-requisites for participation
See the module description (find the link above) for any further detail on pre-requisites.

Examination

Modality and duration: Individual oral exam based on submitted mini project documentation. The duration will be 15 minutes followed by 5 minutes deliberation

Assessment: In accordance with the 7-point grading scale

Permitted aids: Mini project documentation for presentation of same.

Prerequisites for participation: To be eligible to take the exam, the student must timely have handed in any mandatory assignments. In this case, this means the documentation of the assigned mini project (see below).

Further details on the exam: In the beginning of the exam the student will do an approximately 10 minutes presentation of the mini project, after which the examiner will ask follow-up questions within the topic of the mini-project and the entire curriculum.

Information concerning the mini-project: Each student is assigned an individual project in which the methods covered in the course are applied to a real-life problem (e.g. a classification, detection, or regression problem from the UCI Machine Learning Repository: http://archive.ics.uci.edu/ml/). The programming environment/ software specified by the lecturer must be used. The student must bring a laptop with the prepared slides, and software, code, and data for the individual project to the exam. Any source code and data used in the project must be available at the exam. To attend the exam, the documentation of the project must be submitted in the form of a presentation (i.e., slides) and source code.