AALBORG UNIVERSITY

Course Module Description

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

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

Module coordinator
Cumhur Erkut (coordinator), Judi Stærk Poulsen (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

Objectives and learning goals
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.

Knowledge:
- 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:
- 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.)

Competencies:
- 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 workload
5 ECTS. The workload is split into lecture preparation (2 ECTS), attending to lectures, and exercises (2 ECTS), project and exam preparation (1 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 project. The duration will be 15 minutes, followed by 5 minutes deliberation

Assessment: In accordance with the 7-point grading scale

Pre-approved aids: Project documentation, literature, slides and notes from the module

Prerequisites for participation: Timely hand-in of required project.

Further details on the exam: In the beginning of the exam the student will do an approximately 5 minutes presentation of the developed project, after which the examiner will ask follow-up questions within the topic of the project and curriculum topics related to it. The grade will be based on a joint evaluation of the quality of the project and the oral examination

Information concerning the project: The mini-project should be an application of the contents covered in the course applied to an implementation of machine learning with relevance to digital media. The work should correspond to 1 ECTS in total. The project topic will be chosen individually by the students from a repository provided at Moodle. Also, a code repository will be provided, and students will be free to choose their implementation platform.

In the mini-project, the student will implement and report an application making use of machine learning, such as learning from time-series data or sentiment analysis for text. In the exam, the student must demonstrate that s/he understands the involved machine learning theory, concepts and methods used in the mini project.

The mini-project should be handed-in to the Digital Exam no later than the specified date which will be announced during the semester. A mini-project delivery consists of a link to a machine-learning app working on the cloud, its source code, report, and presentation slides. The report should be submitted as a pdf with the app link, the slides and code as an appendix, in the desired format. Various platforms can support all these components from a single source, for example Jupyter Notebooks. If a Unity / Unreal project is involved, the students will hand in only the scripts they wrote and not the entire projects with all assets. They should however share their projects with the examiners using online code or collaboration repositories. Examples of mini-projects will be given in the second course lecture. Other mini-project topics are welcome but must first be approved by the lecturers. Mini projects must be completed individually.