Human-centered Machine Learning

Aalto University Prof. Alex Jung
Polito Prof. Luca Vassio
UPC Prof. Cecilo Angulo
Program Manager: Marcela Acosta in collab
Piergiorgio Rossi
Teaching Model – short term course

- Focuses on **recent research and development** in the field

- **Has a duration of 2 weeks (10 teaching days),** beginning the second week of August

- **Awards 3 ECTS.** Awarded ECTS may be recognised within the degree programme at the home institution.

- Has a focus on **interactive lessons** and **project-based learning.**

- Courses take place **in-campus** (whenever possible) but allows for **some virtual guest lectures** from other universities.

- Encourages **international networking** and the development of **multicultural skills.** Encourages learning of the **local culture** by including short cultural introductions, visits, and social events as part of the official program

- Includes a view on **ethical** issues and ethical handling of data
Human-Centered Machine Learning is an innovative and hands-on bachelor's level course on the main components and combinations of current machine learning systems. This two-week course will teach you some of the most widely used machine learning (ML) techniques. The focus will be on human-centered applications of ML methods that require high levels of privacy protection and transparency. The course includes lectures that teach basic principles of human-centered ML and its applications (such as elderly care). You will learn to implement privacy-preserving and transparent ML methods by using a few lines of Python during exercise sessions.

**Must know**
- Basic Workflow of Model Training, Validation and Selection
- Basic Techniques for Privacy Preservation
- Apply methods in Python (scikit-learn)

**Need to know**
- Basic probabilistic models for data (“i.i.d.”)
- Basic Clustering Methods (k-means, GMM)
- Basic Feature Learning Methods (PCA)

**Nice to know**
- Regularization techniques
- Basic Idea of Gradient-Based Methods
- Computational/Statistical Tradeoffs (SGD)
Detailed application schedule 2022

- Application period: 1\textsuperscript{st} March – 15\textsuperscript{th} May 2022
- Application form: will be uploaded 1\textsuperscript{st} March 2022
- Student pre-selection: 23\textsuperscript{rd} May 2022
- Student selection: latest 30\textsuperscript{th} May 2022
Information about the course

Human-Centered Machine Learning | Aalto University

Disciplines: Engineering – computer science
Language: English
Level: 2nd and 3rd year Bachelor’s
When: 8th - 19th August 2022 + independent online work
Where: Aalto University, Espoo, Finland
Mode of instruction: blended

Credits: 3 ECTS  total 99 hours
15 hours ML bootcamp lectures
15 hours in-class work
9 hours specialised lectures
9 hours study visits/expert guest
10 hours independent work for specialized project
50 hours independent work

Prerequisites: „Hello world“ in python and Matrices.
Fees: none
### Basic schedule template 1.5 hours lecture + 1.5 hour work/slot

<table>
<thead>
<tr>
<th>Week 1</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morning slot 9-12</td>
<td>Welcome to Aalto</td>
<td>Regression Prof. Alex Jung</td>
<td>Classification Prof. Alex Jung</td>
<td>Model Validation and Selection Prof. Alex Jung</td>
<td>Generalization Prof. Alex Jung</td>
</tr>
<tr>
<td>Noon</td>
<td></td>
<td></td>
<td></td>
<td>Lunch break</td>
<td></td>
</tr>
<tr>
<td>Afternoon slot 13-16</td>
<td>Three Components of ML Prof. Alex Jung</td>
<td>Multicultural teamwork/intro to Finnish culture</td>
<td>GDPR/Ethics</td>
<td>Support vector machines (SVM) – UPC – online project with Cecilio Angulo</td>
<td>Sauna evening</td>
</tr>
<tr>
<td>Evening</td>
<td></td>
<td></td>
<td></td>
<td>Social programme organised by Summer School</td>
<td></td>
</tr>
</tbody>
</table>

8th -12th August 2022
### Basic schedule template

**Week 2**

<table>
<thead>
<tr>
<th></th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Morning slot 9-12</strong></td>
<td>Regularization Prof. Alex Jung</td>
<td>Deep Learning Prof. Alex Jung</td>
<td>Clustering Prof. Alex Jung</td>
<td>Feature Learning Prof. Alex Jung</td>
<td>Trustworthy ML Prof. Alex Jung</td>
</tr>
<tr>
<td>Noon</td>
<td></td>
<td></td>
<td>Lunch break</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Afternoon slot 13-16</strong></td>
<td>Privacy preserving data processing Polito – Luca Vassio</td>
<td>Company visit/visiting lecture/cultural program</td>
<td>Company visit/visiting lecture/cultural program</td>
<td>Farewell evening</td>
<td></td>
</tr>
<tr>
<td>Evening</td>
<td></td>
<td></td>
<td></td>
<td>Social programme organised by Summer School</td>
<td></td>
</tr>
</tbody>
</table>
### UPC
- Support vector machines (SVM)
  - Introduce ideas for generalization
  - How to get solutions

### Polito
- Privacy preserving data processing
  - Techniques for making data (differential privacy)
  - How to use ML together with privacy-preserving techniques
  - Library in python – privacy-preserving framework
  - Project
Future iterations

- Course feedback for improvement
- More universities involved
Aalto University, Espoo/Helsinki
KTH Royal Institute of Technology, Stockholm

Technical University of Darmstadt

Grenoble INP-UGA
Politecnico di Torino
Universitat Politècnica de Catalunya · BarcelonaTech
Universidade de Lisboa