

Machine Learning – Introduction

winter 2022/23

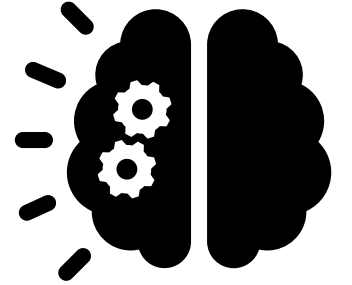


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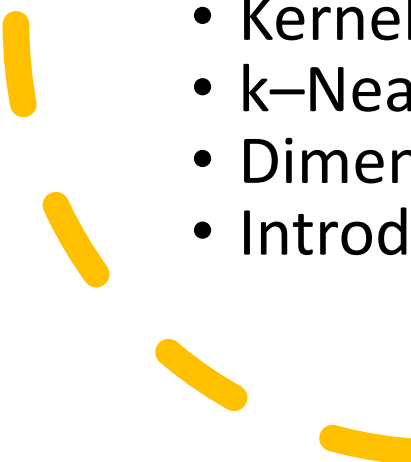
Organisation



- Consultations : open to suggestions – we will develop the date
- Grading:
 - Two **tests** based on the knowledge from the lecture and numerical skills – 20 + 25 pts
 - Whole semester **project** – 50pts – groups of 3
 - The earned points will be translated into the final grade according to:
 - 51 - 60: 3.0
 - 61 - 70: 3.5
 - 71 - 80: 4.0
 - 81 - 90: 4.5
 - 91 - 98: 5.0
 - 99 - more?: 5.5
- **Activity – live coding of the lists given beforehand in the front of the entire group (20 pts maximum) – yet that is worth it 😊!**
- Possibility of **one** test revision during consultations.
- You can be absent twice for the whole semester. Please try to be present for the presentation days – special situations will be discussed and managed individually.

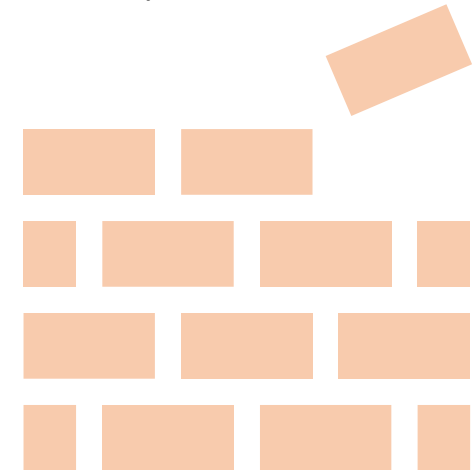


The topics that will be discussed in the lecture include:

- Machine Learning, general overview
 - A single perceptron, linear regression, etc
 - Training, gradient descent
 - Simple classification, systems with a few artificial neurons
 - Logistic regression
 - Support Vector Machine
 - Kernelization, Ridge regression
 - k-Nearest Neighbors
 - Dimensionality reduction: PCA, autoencoders, sparsity
 - Introduction to deep neural networks
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Classes – to be modified

1. 2022-10-05 – Introduction
2. 2022-10-12 – Fundamental Python libraries for modern Machine Learning – pandas and numpy – pt. 1
3. 2022-10-19 – Fundamental Python libraries for modern Machine Learning – matplotlib and scikit-learn – pt. 1
4. 2022-10-26 – Test 1 (Python programming – we'll see how it goes)
5. 2022-11-02 – Perceptron and linear regression
6. 2022-11-09 – Logistic regression
7. 2022-11-16 – Project ideas – present your ideas! - **last day you can send the project proposal**
8. 2022-11-23 – Support Vector Machine
9. 2022-11-30 – Kernelization, Ridge regression
10. 2022-12-07 – k-Nearest Neighbors
11. 2022-12-21 – k-means clustering – Christmas exercises
12. 2022-01-11 – Dimensionality reduction
13. 2022-01-18 – Test 2 (Machine Learning methods – up to the progress with the lecture)
14. 2022-01-25 – Presentation day 1 - **last day of sending the project report** (pdf or Jupyter file with description)
15. 2022-02-01 – Presentation day 2

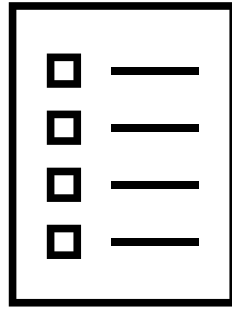


In-Class Tests

There will be **two** such tests.

- The first one would be from the things we already know numerically – but more or less corporate style – just to ensure we all have the tools to proceed with.
- The second one we need to do is going to be based on the knowledge from the lecture – it's worth to attend then – nothing more. The subjects will be discussed beforehand.

Projects



- Groups of maximally **3** people – I'll post the worksheet to sign yourself onto.
- The idea of the final project is to give you some experience trying to do a piece of original research in machine learning and writing up your results in a paper style format. You are welcome to choose a topic **for your project in any of the lecture areas**. Since next semester you will have a course devoted to the neural networks, if possible, please **try to avoid the last point**. You are strongly encouraged to choose a topic that you **would like to learn about**, rather than a topic you are already familiar with.

Projects pt. 2

- Your project **must** implement one or more machine learning algorithms and apply them to some data.
- You **must** turn in a one page **project report**.
- Your proposal **presentation** should describe the idea behind your self-defined project, briefly describe software you will need to write, and papers you plan to read. It should include:
 - **Motivation**: What problem are you tackling? Is this an application or a theoretical result?
 - **Method**: What machine learning techniques are you planning to apply or improve upon?
 - **Intended experiments**: What experiments are you planning to run? How do you plan to evaluate your machine learning algorithm?

Projects pt. 3

- The one page **project proposal (additional 5 pts.)** **can** be uploaded in a form of a PDF file named:
 - f“proposal_project{group_name}.pdf”
by noon on **November 16th**.
- The **project report (18 pts.)** should be uploaded in a form of a PDF file or Jupyter file named:
 - f“final_project{group_name}.{pdf if choice=='pdf' else 'ipnyb'}”
by noon on **January 24th**. The project should be **presented** during one of the last meetings of the class.
- The first **presentation (10 pts.) – 6 min, November 16th** , is designed to tell the group what you have written in the potential proposal and answer why is the subject interesting.
- The final **presentation (20 pts.) – 10 min** is ought to be presented during the last two meetings. It should contain the **brief reminder** and **results showcase**

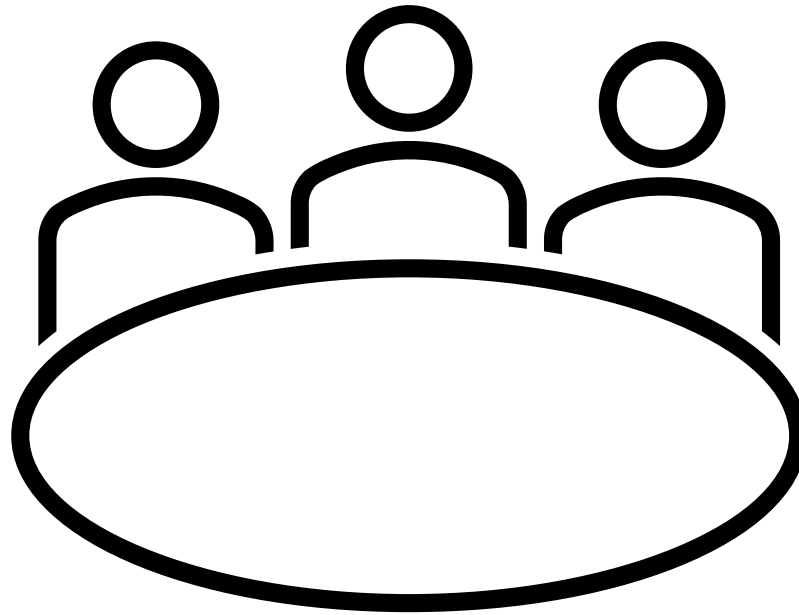
Project pt. 4

The following criteria will be taken into account when grading:

- Clarity/Relevance of problem statement and description of approach.
- Discussion of relationship to previous work and references.
- Design and execution of experiments.
- Figures/Tables/Writing: easily readable, properly labelled, informative.

Workstyle

We need to figure out the way the tutorials will be conducted.



live coding + Jupyter
GitHub