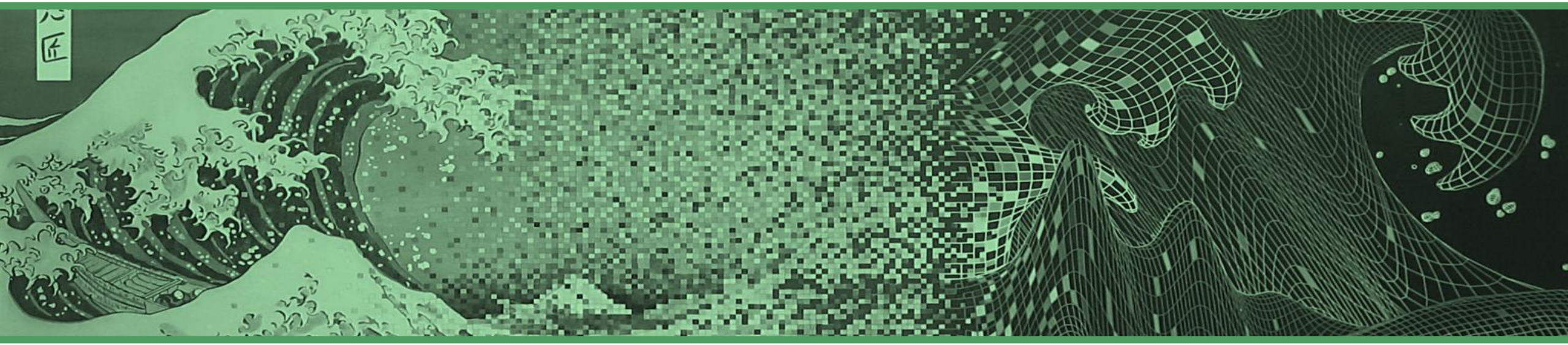
TÉCNICO LISBOA

Course organization

course objectives, assessment and plan



Aprendizagem 2023

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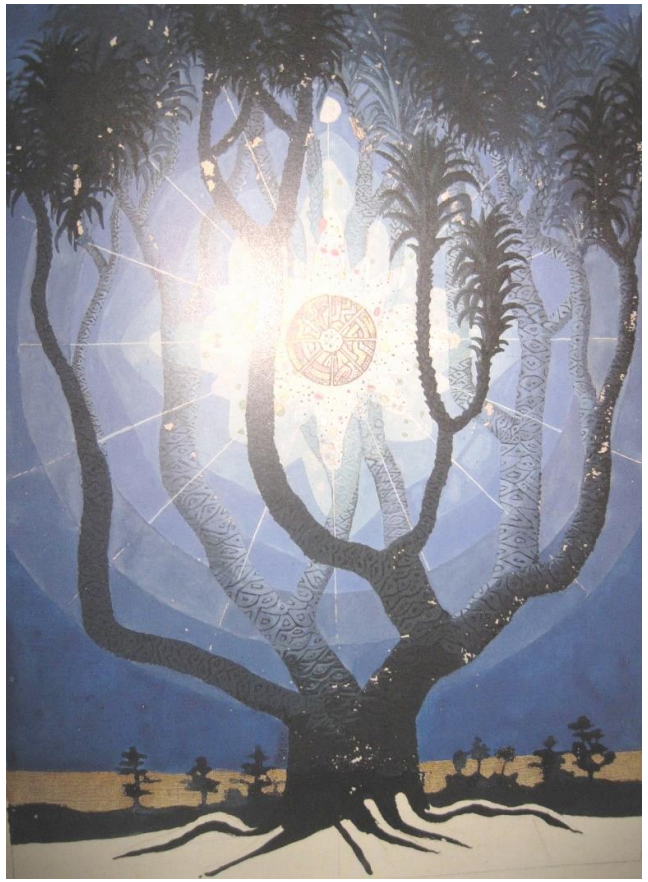
Andreas Wischert andreas.wichert@tecnico.ulisboa.pt

Outline



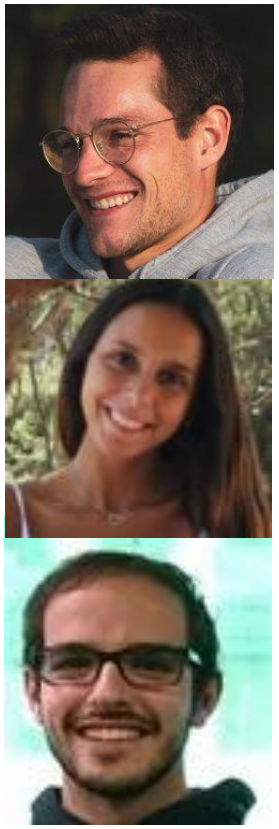
- Faculty hosts
- Objectives
- Planning
- Bibliography
- Evaluation
- Homeworks
- Schedule
- Lab attendance
- Office hours

Faculty hosts

- **Rui Henriques** (*responsible* @ Alameda)
  rmch@tecnico.ulisboa.pt
  Lectures [PT/EN] @ Alameda
  Office: Room 433, INESC-ID, Alameda

- **Andreas (Andrzej) Wichert** (*responsible* @ Tagus)
  andreas.wichert@tecnico.ulisboa.pt
  Lectures [EN] @ Tagus
  Office: Room N2 5-7, Taguspark

Faculty hosts: *practical classes*



- **David Calhas**
  david.calhas@tecnico.ulisboa.pt
- **Inês Magessi**
  ines.magessi@tecnico.ulisboa.pt
- **Gonçalo Correia**
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Faculty hosts: *practical classes*

- **Sérgio Gonçalves Pinto**
  sergio.g.pinto@tecnico.ulisboa.pt
- **Miguel Moreira**
  miguelmatamoreira@tecnico.ulisboa.pt
- **Guilherme Varela**
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- **Javier de Muller Santa-Maria**
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Objectives

- Answer real-world data-rich problems: **formalize** and **translate them into ML tasks**
- Understand **major topics on ML**
  - master the **statistical** and mathematical **foundations** behind ML
  - critically compare the behavior of ML approaches
    - **Bayesian learning**
    - **lazy** and **associative learning**
    - **neural network learning**
- Master **supervised ML** approaches, including classification and regression
- Master **unsupervised ML** approaches, including clustering and data transformations
- Robustly **evaluate ML solutions** (loss, statistical significance, generalization ability)

Planning

1. Introduction to ML	I
2. Univariate ML	
3. Associative learning	
4. Evaluation	
5. Bayesian learning	II
6. Lazy learning	
7. Kernel learning	
8. Regression learning	
9. Gradient descent	III
10. Neural network learning	
11. Deep Learning	
12. Clustering	IV
13. Dimensionality reduction	

Theoretical background

- Information theory (2,3)
- Probability theory (5,12)
- Algebra theory (6,7,13)
- Optimization theory (8-11)

Foundations
Supervised learning
Unsupervised learning

Practical classes

- **L1** Univariate statistics, evaluation
- **L2** Associative learning (decision trees)

⇒ **HW1**

- **L3** Bayesian learning
- **L4** Lazy learning
- **L5** Linear regression

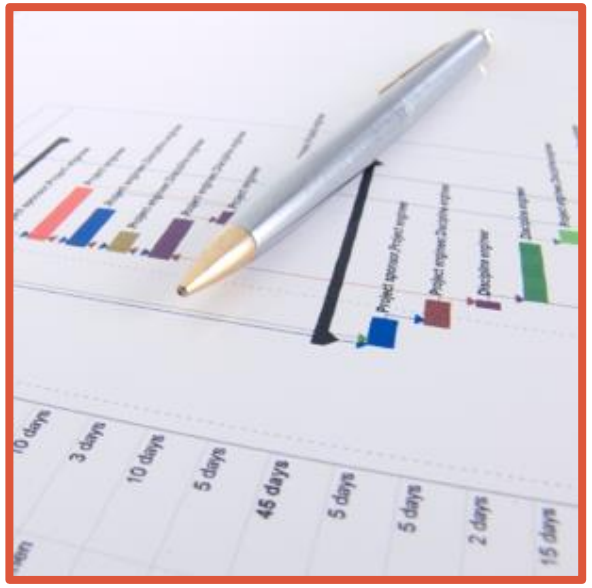
⇒ **HW2**

- **L6/7** Gradient descent learning
- **L8/9** Neural network learning

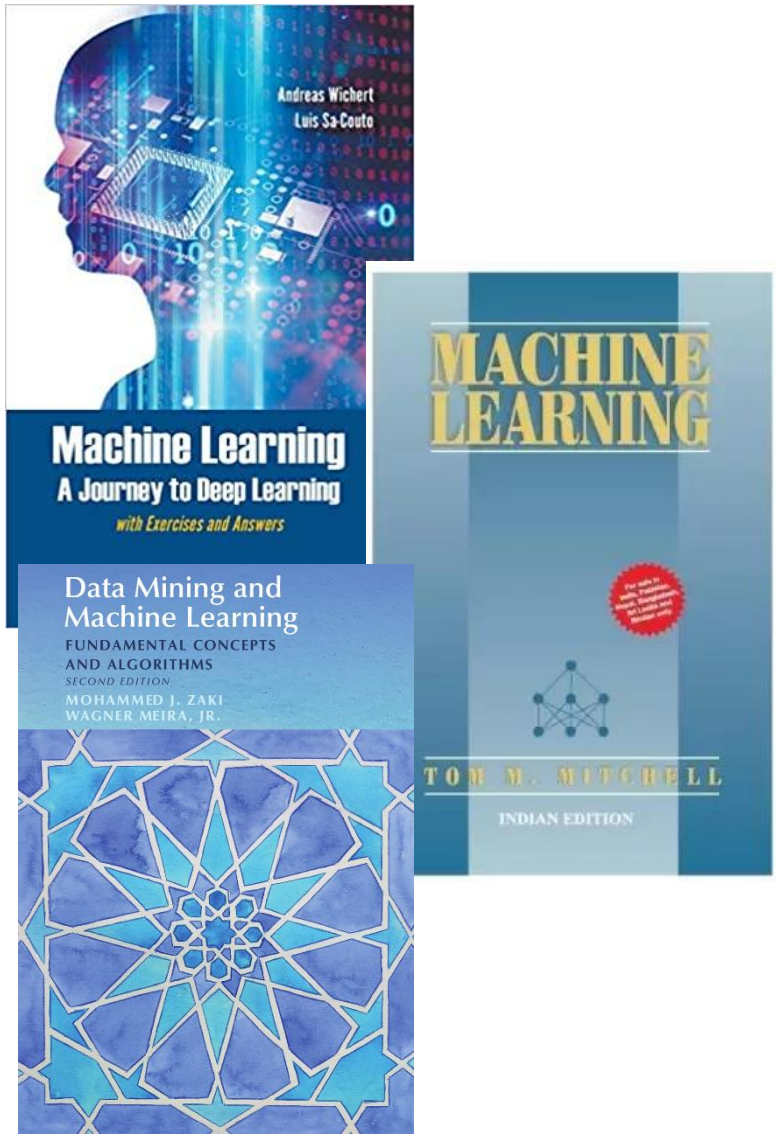
⇒ **HW3**

- **L10** Clustering
- **L11** Dimensionality reduction

⇒ **HW4**



Main literature



- **reference slides** @ course's webpage

- **Machine Learning: A Journey to Deep Learning**
  Andreas Wichert and Luis Sá Couto, World Scientific, 2021
  https://www.worldscientific.com/worldscibooks/10.1142/12201

- **Machine Learning**
  Tom Mitchell, McGraw Hill, 1997
  http://www.cs.cmu.edu/~tom/mlbook.html

- **Data Mining and Machine Learning: Fundamental Concepts and Algorithms**
  Mohammed J. Zaki and Wagner Meira Jr, Cambridge Univ. Press, 2nd Ed., 2020
  https://dataminingbook.info/

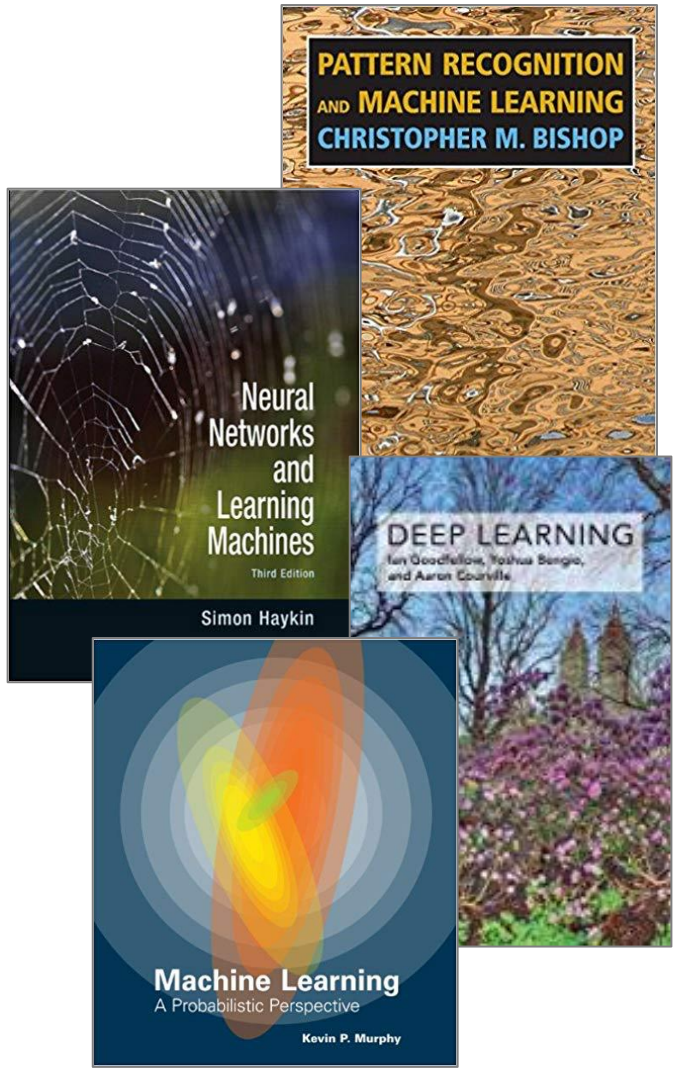
Secondary literature

- **Pattern Recognition and Machine Learning**
  Christopher M. Bishop, Springer 2006
  https://www.microsoft.com/en-us/research/people/cmbishop/#!prml-book

- **Neural Networks and Learning Machines**
  Simon O. Haykin, (3rd Edition), Pearson 2008

- **Deep Learning**
  I. Goodfellow, Y. Bengio, A. Courville, MIT Press 2016
  https://www.deeplearningbook.org

- **Machine Learning: A Probabilistic Perspective**
  K. Murphy, MIT Press 2012



Tertiary literature

- *Software literature*
  - **Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems**

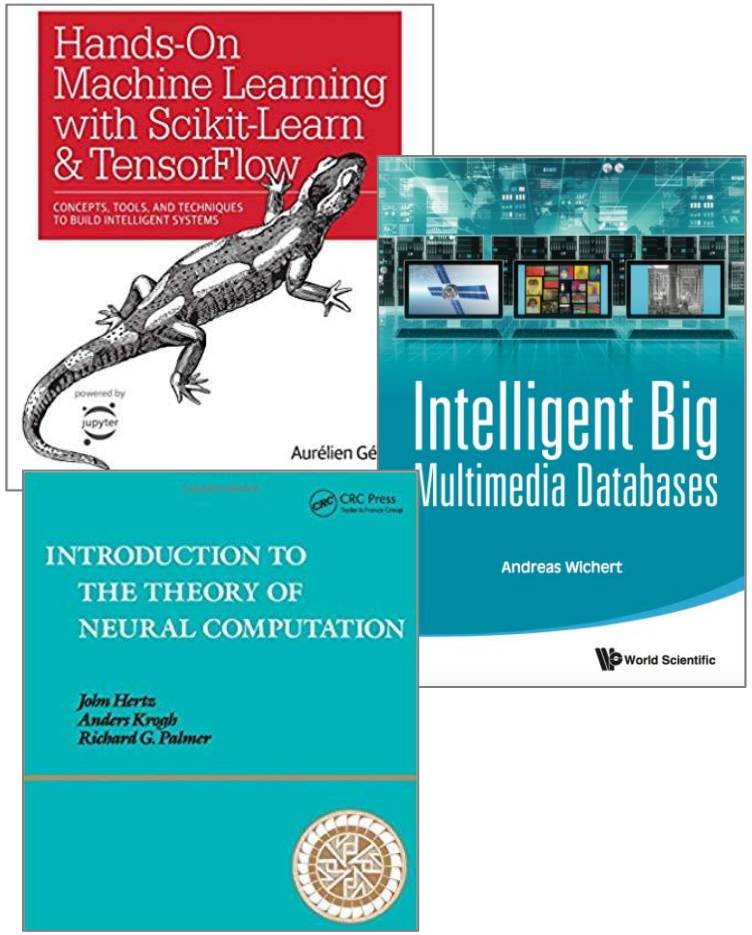
    Aurélien Géron , O'Reilly Media, 2017

    https://github.com/amitanalyste/aurelienGeron

- *Complementary*
  - **Intelligent Big Multimedia Databases**

    A. Wichert, World Scientific, 2015
  - **Introduction to the theory Of Neural Computation**

    J.A. Hertz, A.S. Krogh, R.G. Palmer, Addison-Wesley, 1991



Evaluation

Final grade: Homeworks × 50% + Exam × 50%

Homeworks:

- average(HW1,HW2,HW3,HW4)
- groups of **2** (no exceptions)

Exam: maximum(Exam1,Exam2)

Minimum exam grade: 8v

Working students

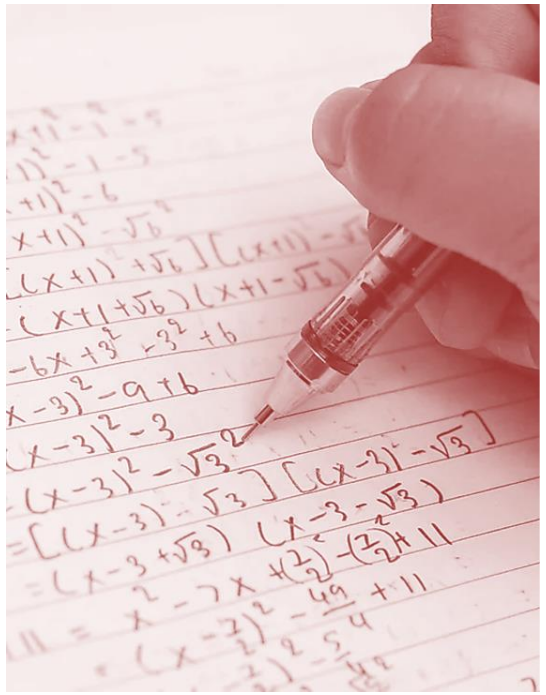
- (Homeworks × 50% + Exam × 50%) **or** 100% Exam
- decision communicated until September 22nd

Special season: 100% Exam

Deadlines

- **Homework deliveries**
  - HW1: Friday, September 29th 23h59
  - HW2: Monday, October 9th 23h59
  - HW3: Friday, October 20th 23h59
  - HW4: Monday, October 30th 23h59
  - *statements* released 10 days before delivery
- **Exams**
  - Exam1: November 6, 13h
  - Exam2: February 1, 10h30

Homeworks



- groups of **2** (*no exceptions*)
- statements at the course webpage two weeks prior delivery
- always consult webpage **FAQ** before posting questions
- three major **components**
  - **practical** pen-and-paper **quest**
  - small **computational quest**
  - **critical thinking**
    - excelling answers are clear, precise and succinct, and establish scientific hypothesis grounded on empirical evidence

Final exam

- **extensive** number of **contents** to prepare
  - requiring a good mastery: *critical analysis* and *practical calculus*
- comprehensive exam with a **2h duration**
- you are allowed to bring a **single** A4 **page with notes** (e.g. formulas)
- carefully follow theoretical classes to minimize risks
- objective assessment: quantitative result answers, true-or-false

Schedule @ Alameda

Horas	Segunda		Terça					Quarta	Quinta				Sexta		
8:00															
8:30	**T1**		**T1**							L8	L5		L10	L11	L12
9:00	VA4		VA4	L7	L6	L3	L5								
9:30															
10:00									**T2**						
10:30	**T2**			L10	L11		L9		FA2						
11:00	VA4					L8			**T1**						
11:30			**T2**						FA1						
12:00		L4	VA3	L12						L3	L9	L4	L7	L6	
12:30															
13:00															
13:30															
14:00															

provisory schedule

Schedule @ Tagus

Horas	Segunda	Terça	Quarta	Quinta	Sexta
8:00					
8:30					
9:00		L9	L5	**T** A1	
9:30					
10:00	L5				
10:30		L8	L4		
11:00				L9	
11:30	**T** A4				
12:00		L4			
12:30				L8	
13:00					
13:30					
14:00					

provisory schedule

Office hours

- Explore your questions during **practical classes** and **lectures**
- **Check webpage for latest information on office hours**
  - *Rui Henriques* office hours
    - Monday 12h, Tuesday 9h30, Thursday 12h (end of lectures)
    - additional office hours available via appointment
  - office hours of other faculty hosts on the webpage
- **Golden rule**
  - general e-mail contacts with subject preceded by **[Aprendizagem]**
  - homework-related questions preceded by **[HW Aprendizagem]**

Thank You

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