

# Applied Machine Learning - Advanced

Prof. Daniele Bonacorsi

## Lecture 0

Data Science and Computation PhD + Master in Bioinformatics  
**University of Bologna**

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# Lingua / Language ?

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Italiano / English ?



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# Lingua / Language ?

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Italiano / **English**

All material in English  
Lectures in English

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# Material (including these slides)

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Access point to all you need → [bit.ly/CourseAML2223Adv](https://bit.ly/CourseAML2223Adv)

(details in next slides)



# People

This part (**Applied ML - Basic**):

Prof. **Daniele Bonacorsi** ( [daniele.bonacorsi@unibo.it](mailto:daniele.bonacorsi@unibo.it) )



- front lectures + hands-on

Dott. **Simone Rossi Tisbeni** ( [simone.rossitisbeni@unibo.it](mailto:simone.rossitisbeni@unibo.it) )



- PhD candidate in Data Science & Computation, tutor for this module

Next part (**Applied ML - Advanced**):

Prof. **Daniele Bonacorsi** ( [daniele.bonacorsi@unibo.it](mailto:daniele.bonacorsi@unibo.it) )



- front lectures + hands-on

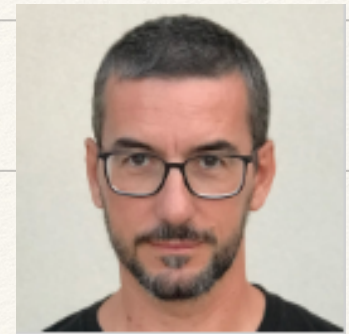
Dott. **Luca Anzalone** ( [luca.anzalone2@unibo.it](mailto:luca.anzalone2@unibo.it) )



- PhD candidate in Data Science and Computation, tutor for this module



# Who am I?



<https://www.unibo.it/sitoweb/daniele.bonacorsi>

I am a **physicist**. My field is “**experimental high-energy particle physics (HEP)**”, in particular with particle accelerators.

## Research:

- subnuclear physics in OPAL at LEP, in CMS at LHC
- over last >20 years: focus on Software/Computing for the CMS experiment
  - ❖ CERN: <https://home.cern/>; CMS: <https://cms.cern/>

## Teaching:

- General Physics, Data Analysis, Physics Laboratory, Applied Machine Learning, Software&Computing (focus on Nuclear and Subnuclear Physics), Quantum Machine Learning
- “Scuole” (i.e. Faculties): Physics, Engineering, Natural Sciences
  - ❖ L, LM, PhD



# What this course **is**, and what it **is not**

First of all, “expectations tuning”.

Despite we will talk about...

- ML concepts, statistics, data science, computer science, software, hardware..

... this course:

- is not a “theoretical” ML / statistics course
- is not a “theoretical” {data, computer} science course

It is a **~30 + ~50 hours journey through (selected) ML concepts and their application to a variety of use-cases through “intuitions” from theory + tutorial-like hands-on exercises**

- allow me brevity, accelerations, simplifications, time-constraints driven choices

Consider it a “portal” towards **your** travel into data science and ML

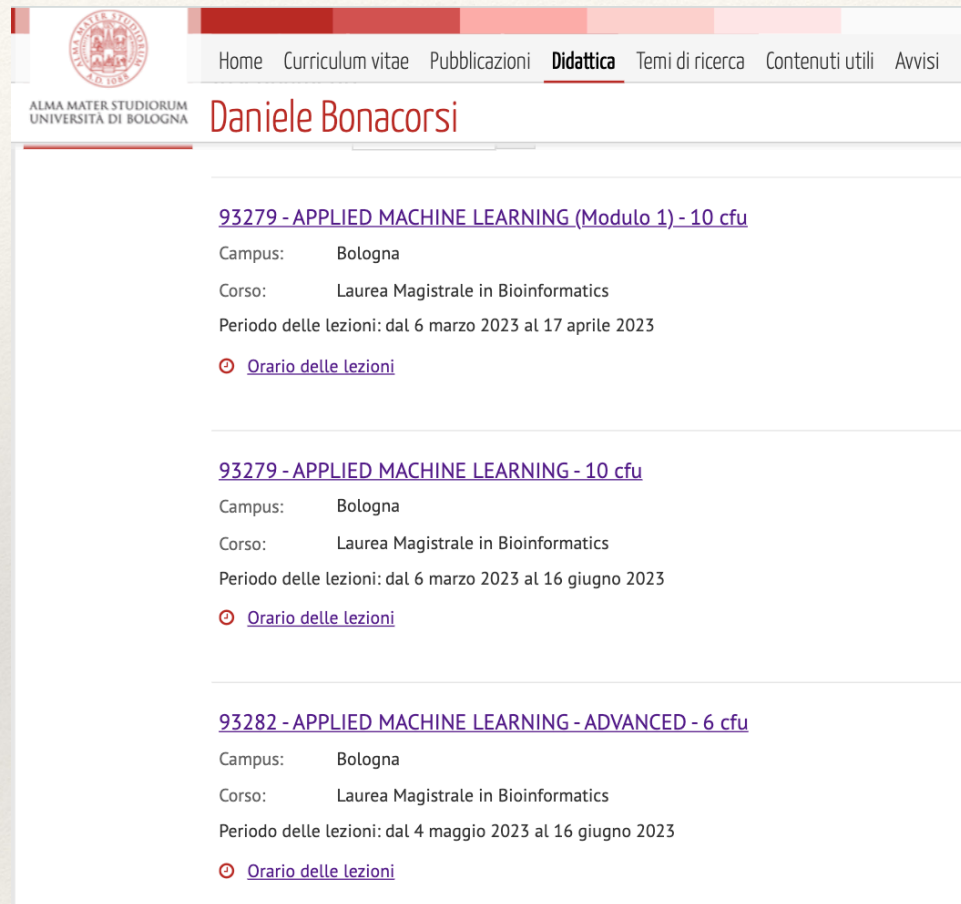
- you should expect to build some awareness + skills on toolkits, that enable you to embark into some “real world” ML projects during/after the end of the course





# "Sito docente" → "Didattica"

ITA: <https://www.unibo.it/sitoweb/daniele.bonacorsi/didattica>  
ENG: <https://www.unibo.it/sitoweb/daniele.bonacorsi/teachings>



ALMA MATER STUDIORUM  
UNIVERSITÀ DI BOLOGNA

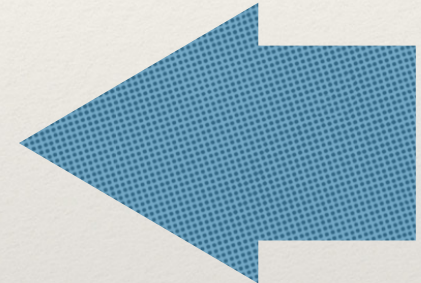
Home Curriculum vitae Pubblicazioni **Didattica** Temi di ricerca Contenuti utili Avvisi

**Daniele Bonacorsi**

[93279 - APPLIED MACHINE LEARNING \(Modulo 1\) - 10 cfu](#)  
Campus: Bologna  
Corso: Laurea Magistrale in Bioinformatics  
Periodo delle lezioni: dal 6 marzo 2023 al 17 aprile 2023  
[Orario delle lezioni](#)

[93279 - APPLIED MACHINE LEARNING - 10 cfu](#)  
Campus: Bologna  
Corso: Laurea Magistrale in Bioinformatics  
Periodo delle lezioni: dal 6 marzo 2023 al 16 giugno 2023  
[Orario delle lezioni](#)

[93282 - APPLIED MACHINE LEARNING - ADVANCED - 6 cfu](#)  
Campus: Bologna  
Corso: Laurea Magistrale in Bioinformatics  
Periodo delle lezioni: dal 4 maggio 2023 al 16 giugno 2023  
[Orario delle lezioni](#)



You can refer to this area for Teams (comments later on this), timetable, etc

# Calendar [1/2]

## AML - Basic: 6 March - 17 April

- 8 lectures →  $8 * 4\text{hrs} = 32\text{ hrs}$  → **4 CFU**

## AML - Advanced: 4 May - 16 June

- 12 lectures →  $9 * 4\text{hrs} + 4 * 3\text{ hrs} = 48\text{ hrs}$  → **6 CFU**

### Basic

mon Mar 6 14-18  
fri Mar 10 14-18  
mon Mar 13 14-18  
fri Mar 17 14-18  
mon Mar 27 14-18  
Fri Mar 31 14-18  
mon Apr 14 14-18  
fri Apr 17 14-18

### Advanced

thu May 4 14-18  
fri May 5 14-18  
thu May 11 14-18  
fri May 12 14-17  
thu May 18 14-18  
fri May 19 14-17  
thu May 25 14-18  
fri May 26 14-17  
thu Jun 1 14-18  
thu Jun 8 14-18  
thu Jun 9 14-18  
Thu Jun 15 14-18  
fri Jun 16 14-17

Dates are susceptible to change:  
in case, you will be notified in advance.



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# Calendar [2/2]

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Admittedly: tough.

- always 3 or 4 hours in a row
  - ❖ Note also the peculiarity of this room in the Dept closing at 18:45 roughly
  - ❖ up to mid June..

**I will do my best to mitigate everything for your protection.**



# Lectures format

## Format:

- Sort of “**hybrid**”:
  - ❖ **lectures are in presence** (especially for Bioinformatics students),
    - ❖ I will make some use of Teams → more info live at the introductory lecture
    - ❖ If so, be aware that this modality requires a strong motivation and maturity!
- **Frontal vs hands-on**
  - ❖ **frontal lectures** to start..
  - ❖ .. then (later on) we will inject **hands-on sessions**
- every hourly slot will be in the format: **45 mins lecture +15 mins pause**
  - ❖ this is my choice to support your best fruition of the course - if you prefer it different, speak up!
- **ask questions!**



# FAQs on lectures and material

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**Material** available? **Yes.**

- you will have slides in advance (gdrive) or soon after each lecture
- PDF updates after each lecture are possible, so check back!

**Mandatory attendance?** **No**

- I may note down your presence, but it will not impact the final exam

**Remote attendance?** → **see the “hybrid” comment**

- **For all students in Bioinformatics, lectures are in presence**

**Recordings?** **Not really.**

- I may activate it, but for internal usage (e.g. tutors' training), not for students



# Course material and organisation

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## Static and dynamic material

- **Slides** and **Jupyter/Colab** notebooks
- (brief comment at the lecture about copyrights and material usage)

## Material both on gdrive and github (perhaps IOL?)

- Gdrive: **SEE LINK IN FIRST SLIDES**
- Github: — as soon as we start using notebooks —

## Access to course material:







- during the course: open to everyone having the link
- after the course: might restrict access to material from old courses (maintain it by providing your gmail in the Students Directory)



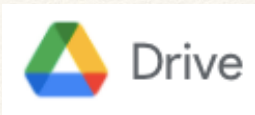
# More on material location(s)

Same set-up as  
AMLBas

Adv here..

Name	↓	Drive
	AML2223Bas_Notebooks	
	AML2223Bas_Lectures	
	AML2223Bas_StudentsDirectory	
	AML2223Bas_Lectures	

also editable



# Students' directory

Same set-up as  
AMLBas

Adv here..

## Students directory

Course AML Basic  
AY 2022-23  
Teacher Prof. Daniele Bonacorsi

"nb matricola"	Family name	Name	enrolled in:	Preferred email for communication	gmail o altro	mobile (PLEASE NOT FI
-	BONACORSI	DANIELE	-	daniele.bonacorsi@unibo.it	-	
						no

Details at the lecture.



# Join the course WA group!

Note: not mandatory at all - it will be used only to ease last-minute communications that may be required, and only regarding this course and the lectures/exams, as an additional and not exclusive communication channel (together with e.g. Teams chat..)

More later, as the **Students' Directory** gets filled...

## Applied ML (Basic)

**AY 2022-23 - D.Bonacorsi**

### Material from lectures

Selected material from the lectures is listed below.

*This material is intended to be used solely by students attending the AML course. Any sharing MUST be discussed with the teacher in advance. Thanks for the collaboration.*

- **Mar 6 (4 hrs)**
  - PDFs: Lecture0, Lecture1 (in progress)

Details at the lecture.



# The exam

# Exam (for LM students in Bioinformatics) [1/2]

The exam is composed of:

- **written exam(s)** (multiple choice) → **15/30** of the score
  - ❖ Almaesami for written exams dates and sign-up
- an **end-2-end ML project** (code+documentation) → **15/30** of the score
  - ❖ proposed by the student or selected in a list proposed by the teacher
  - ❖ In the latter case, I give you **problem+dataset+objective**. You always give me **approach+code+documentation**.
  - ❖ max 2 submission for the same project - if still unhappy with the score, you need to change project

*"Can I work in a team?"*

- In principle yes, but → constraints discussed at the introductory lecture



# Exam (for LM students in Bioinformatics) [2/2]

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Note: AML course composed of Basic (4 CFU) + Advanced (6 CFU):

- which score goes for “verbalizzazione”? It depends on your “Study plan”
  - ❖ written exams → 2 separate ones: one for Basic, one for Advanced
  - ❖ project → if you planned for 10 CFU, you can work on a unique project

To deliver a project, **send it by mail to teacher + tutors**

- You get an acknowledgement, then you enter the correction queue
- In case of URGENT correction needs, submit in due time and notify the teacher in advance!



# Exam (for DSC/Physics/other PhD researchers)

[ *DSC = Data Science and Computation* ]

The exam is composed of:

- an **end-2-end ML project** (code+documentation) → no score, just a **YES/NO**
  - ❖ Same rules as before, for 4 or 6 or 10 credits, plus...
  - ❖ ... some PhD researchers might want to discuss with the teacher their own specific case, depending on the learning plan their PhD programme foresees/requires (**CONTACT ME**)

No Almaesami. You submit the project when you are ready

- Be careful of your own (PhD-specific) deadlines



# Exam (for other PhD students, and “guests”)

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No exam.

Enjoy the course and I hope you find it useful.

# Jargon and icons in the slides/notebooks

Many acronyms throughout this course, e.g. obvious ones:

- (AI = Artificial Intelligence)
- ML = Machine Learning
- AML = Applied Machine Learning
- DL = Deep Learning
- algo = algorithm
- ...

As we will introduce concepts, we will create new acronyms.



There is a video in this slide.

[<tag>]

This is a reference. Find it in the references gdoc.



The final questionnaire(s)

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# Be prepared

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We will make 2 questionnaires. Details at the lecture.



Ready to go?

# My contacts



**daniele.bonacorsi@unibo.it**

*NOTE: to avoid unreceived/unseen mails, please ALWAYS write to teacher(s)+tutor*



**daniele.bonacorsi**

*Good for quick exchange of (not urgent) information*



**@DBonacorsi**



**phone -> see gdoc**

*The tutor will take care of*