

# AI in Industry

## An Oddball

**This is a strange course**

For most courses, it's easy to figure out what to expect:

- "Fundamentals of Artificial Intelligence and Knowledge Representation"
- "Introduction to Algorithms and Programming"
- "Statistical and Mathematical Methods for Artificial Intelligence"
- "Machine Learning"
- "Deep Learning"
- "Combinatorial Decision Making and Optimization"
- ...

**...But what for something called "AI in Industry"?**

What do we mean by "industry"?

## Industry

**This is industry**



## Industry

**This is also industry**



## Industry

This is also industry



## Industry

This is also industry



## Industry

We are talking about industry in a very *broad* sense! Because...

**We will define "industry" as any activity that can generate *value***

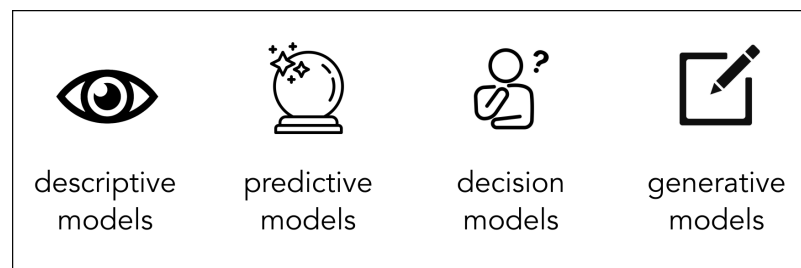
- So, this course is about how to *using AI to generate value*
- ...And since value is typically generated by solving problems

**This course is about using AI to *address real world problems***

**Which problems are we talking about?**

## Business Analytics

**A good starting point: AI is mainly about *models***



So we can, for example:

- Present data in an insightful fashion
- Make estimates or forecasts of unknown quantities or classes
- Recommend optimal or near-optimal decision

- Generate human-interpretable content

## Order and Chaos

**This is simple and useful characterization**

...But the truth is more like this!



## Order and Chaos

**Industrial applications are *complicated***

- The problems are not well defined
- Similar techniques may be applied in multiple settings
- ...And with different names
- Classical tasks typically only part of the whole problem
- It is often necessary to combine problems/techniques
- ...

A common opinion:

**try something, then add tweaks until the problem is solved**

## Order and Chaos

...But this is *evil*!





## Order and Chaos

Specifically, it reaches a *plateau* real quick:

- If you get lucky, you solve your problem and you do it fast
- But more often than not:
  - You fail, and you *don't understand why*
  - You end up with a much *messier solution* than needed
  - Your approach works on test data, but *not in the field*

More critically, you do not really improve your knowledge and skill

Our goal will be to bring *a measure of order* to the chaos

Which is actually impossible, but still the right thing to do

## What to Expect

### How I am Going to Play It

I am going to follow a few guiding principles

**How: Examples! I.e. Use Cases**

- Every few lectures we will introduce *a new use case*
- They will be *simplified* industrial problems
  - Real industrial problems would take too much to tackle
  - ...Not to mention they are subject to NdAs 🙄
- They will nevertheless be *representative*
- Some use cases will be covered in *seminars* by industrial partners

# How I am Going to Play It

I am going to follow a few guiding principles

**What: techniques, best practices, formalization**

- Mostly: how to *methodically tackle* a new problem
- But we will also introduce *new techniques*
- ...Ways to *apply* known techniques
- ...Ways to *combine* known techniques
- ...Some (light) software engineering
- ...And how to *formalize* problems and ideas

# How I am Going to Play It

I am going to follow a few guiding principles

**Why: my goal is for you to tackle problems better than most of your peers**

- Problems/solutions are often poorly understood
  - Formalizing is the first step towards understanding
- Different problems call for different tools
  - Using (say) ML for everything is just *inefficient*
- Many people can apply "boilerplate", mainstream AI methods
  - ...But much fewer are capable of *changing* or *combining* them

# On the Art of Cooking

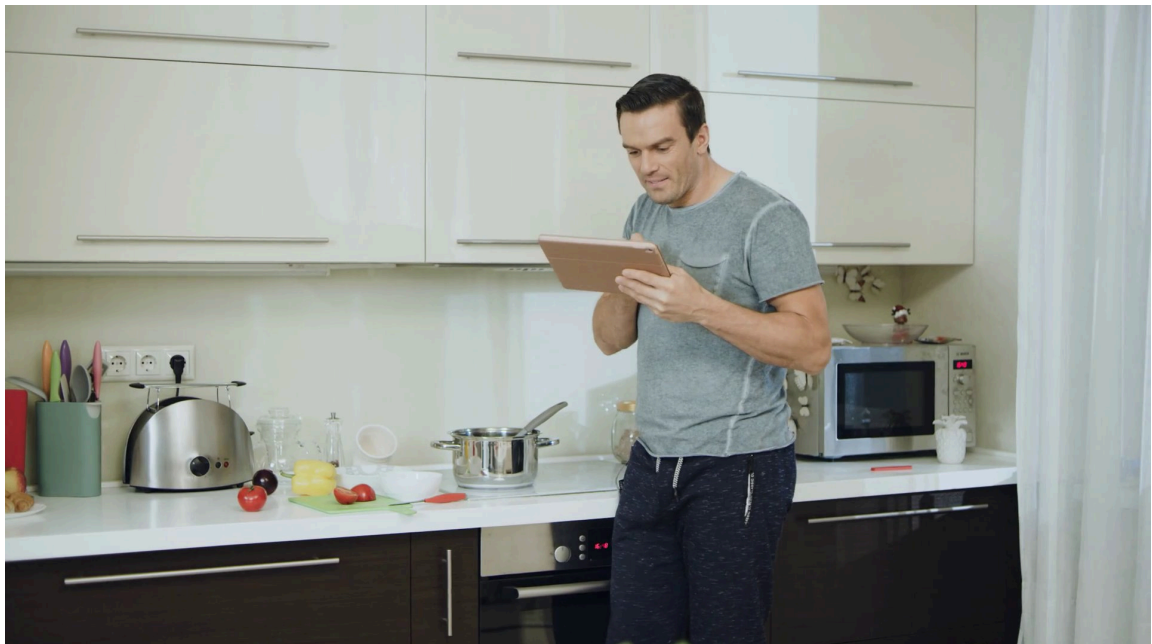
At some point, the course will start feeling like a cookbook



When you get there, there is *one thing you should remember*

## On the Art of Cooking

**Most people read cookbooks to follow recipes**



# On the Art of Cooking

...But *true chefs* read cookbooks to find *ideas*



So, learn, then *get creative*!

## Two Parts

**The course can be roughly divided in two parts**

In the *first part* we will (mostly):

- cover simpler techniques
- make sure that we use known tools properly
- learn to look at a problem as a whole

In the *second part* we will:



- cover more advanced techniques
- bend known techniques so as to make them behave as we wish
- learn how to combine heterogeneous information
- learn how to combine heterogeneous techniques

## Technical Information

### Teachers

#### Teacher:

- Michele Lombardi ([michele.lombardi2@unibo.it](mailto:michele.lombardi2@unibo.it))
- Office phone: 051 2093270 (it's close to teaching room 5.7)

Student hours: you can book an appointment (online by default) via:

<https://book.morgen.so/michelelombardi03/student-hours>

#### Tutor:

- TBA
- Assistance with projects and questions
- Student hours: on appointment (send an email)

### Course Material

Reference: [course web site on virtuale.unibo.it](https://virtuale.unibo.it)

- Jupyter notebooks + `requirements.txt` + [poetry configuration files](#)
- Hopefully PDF notes (these might come in late, due to technical issues)
- Recorded lectures (via Panopto, links on the web site)

#### **This course changes (a bit) every year**

- The good part: the course will *grow with you*
- The bad part: lecture material will typically arrive one/two days early at most

### Exam

**The exam will consist of *a project*:**

- You can *propose a topic* (this is the most typical solution)
- ...Or *pick one* from the list on <https://lia-unibo.github.io/>

- The topic must be *discussed with the tutor and the teacher* before starting
- Groups of 2-3 students tend to work best
- ...But individual projects are also fine

An advice: *wait until at least mid course* before choosing

### **Once you are done with your work**

...You'll need to schedule a call (online by default) via:

<https://book.morgen.so/michelelombardi03/a3i-exams>

## **Exam**

### **The students will need to:**

- Deliver the project code
- Give a presentation
- Be prepared to discuss their work

### **The evaluation**

- Will *not* focus on how successful your results are
- ...But on *how you reached them*
- This means I will evaluate:
  - *Why* you made the choices you made
  - *How* you have interpreted the results
  - Your familiarity with the *techniques* you chose to employ

## **The Exam and the 3CFU Project**

### **About the *optional 3-credits project***

- You can combine them
- The 3CFU project will be a *follow-up of the exam work*
- Typically, both works are presented at once
- ...But you can have separate presentations if you wish

### **If you wish to combine the projects**

...You should mention that when you pick the topic

- We'll make sure that the topic is broad enough for both

### **The 3ECTS project does not have an actual grade**

- Either you pass, or you don't
- By the time you are ready to present, you'll typically be fine