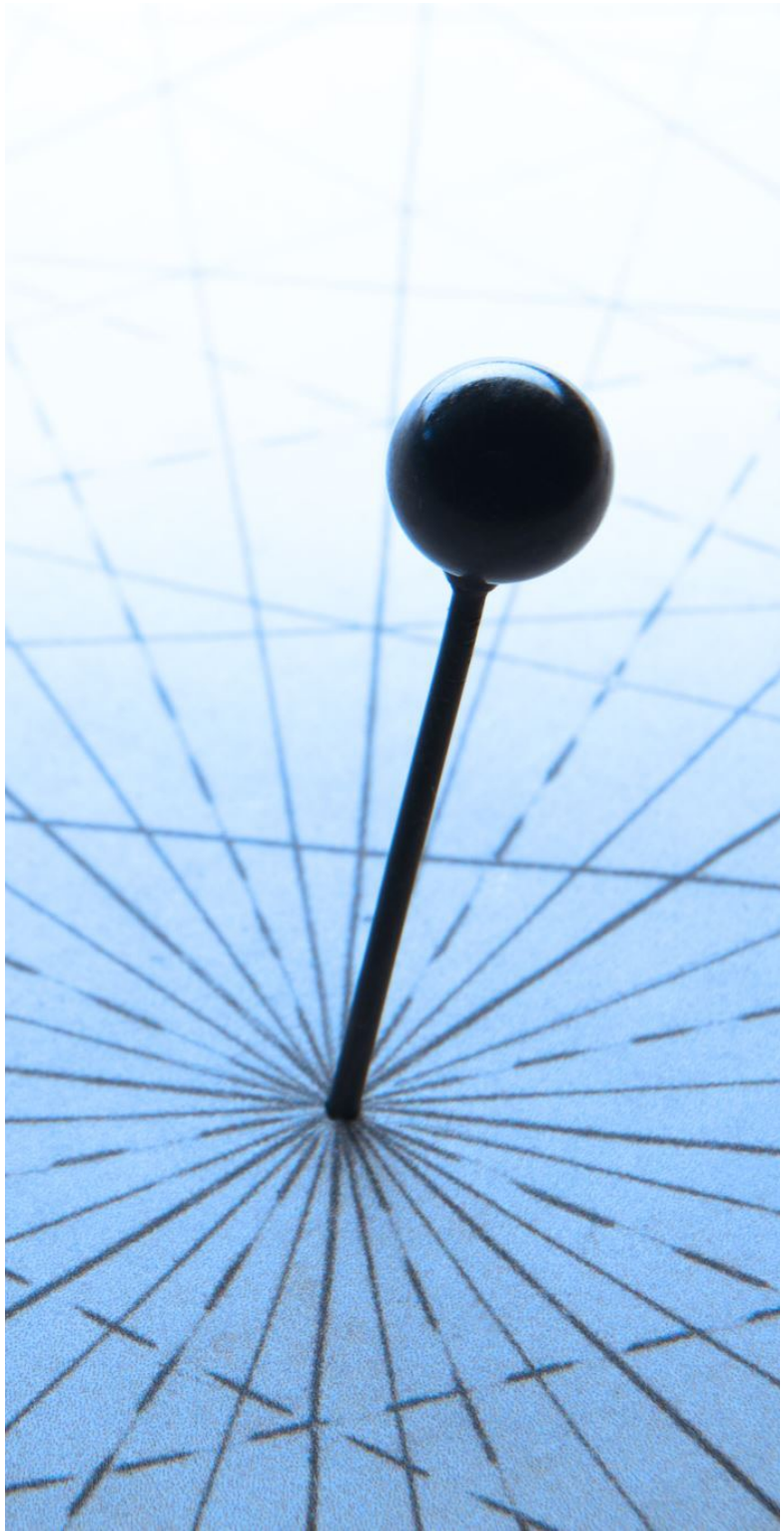

Short digression - back to the last lesson: a couple of useful references

- How to Use t-SNE Effectively: https://distill.pub/2016/misread-tsne

- On the Surprising Behavior of Distance Metrics in High Dimensional Space: https://bib.dbvis.de/uploadedFiles/155.pdf

Module #2

Needs-based recommendation systems, collaborative filtering, Next Best Actions

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Whealthype.ai (formerly Virtual B SpA)

SISTEMA DI RACCOMANDAZIONE = NEXT BEST ACTION
(SOMETHING TO SELL)

IMPORTANTE PER FINANZA = TROVARE IL GIUSTO PRODOTTO PER LE PERSONE
OGGI DOBBIAMO ANTICIPARE I BISIGNO DELLI PERSONE SECONDO LE
LORO PERSONALITà

The key to financial personalization

Needs/goals are key to targeting clients

- After all, we are still monkeys: most of us don't really understand financial and insurance products (so we don't buy…)
- But we all have real needs – and we understand them, e.g.:
  - protect ourself, our family, our things → insurance
  - buy things → payment tools & services
  - save for future consumption → savings & investments
  - anticipate future consumption, or investments → borrowing

We tend buy what we need: thus, needs are a good starting point for recommending financial products and services in a personalized way

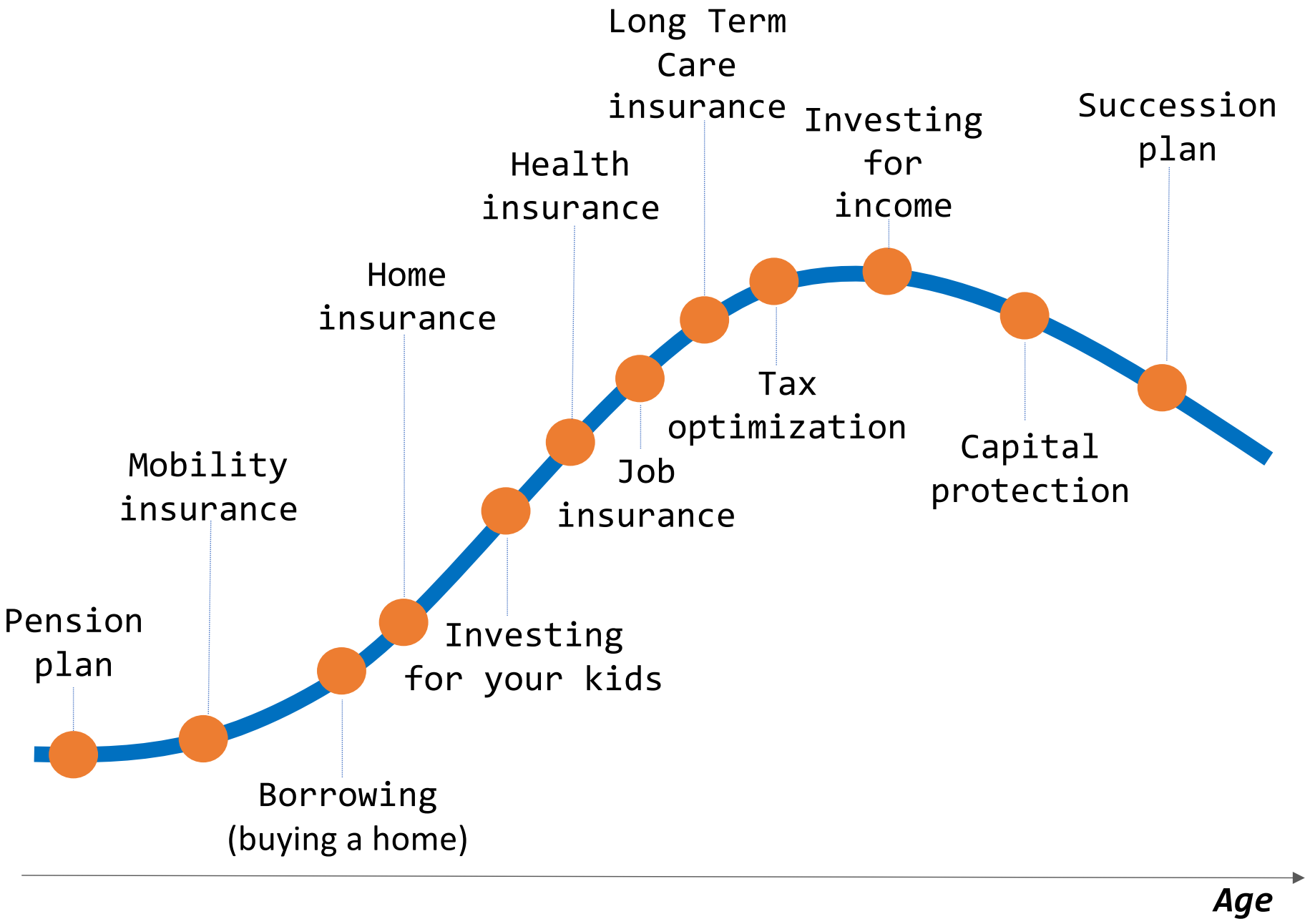
Another good reason to estimate client's needs: the law

- MIFID/IDD: coherence between needs/goals and financial/insurance products sold to clients
- Key information about clients must be collected by the use of a MIFID/IDD questionnaire → Data
- Data → a lot of detailed information collected through MIFID/IDD questionnaires can be crunched by algorithms
- Basically you get a broad survey for free – that's the reason why MIFID/IDD questionnaires should be properly prepared

BISOGNA DARGLI PRODOTTI
CHE HANNO BISOGNO EFFETTIVAMENTE

"Make a virtue out of necessity"

Financial needs: “the theory”



The reality of financial & insurance needs

- Not everybody will start a family at 30…
- Maybe at 72 not everybody is willing to plan her inheritance process, maybe is getting ready for a marathon or sailing around the world
- What about if at 50 you have 2 divorces and 2 maintenance allowances?
- Maybe at 35 someone faces a big recession, is fired, and cannot buy a home
- …

Financial needs change over time following our random life

And our random lifes are not all equal

Financial needs change overtime

How? Ask data!

ETà, ...

Need(i, t) = f(client situation(t), context(t))

CONTEXT DELLA PERSONA

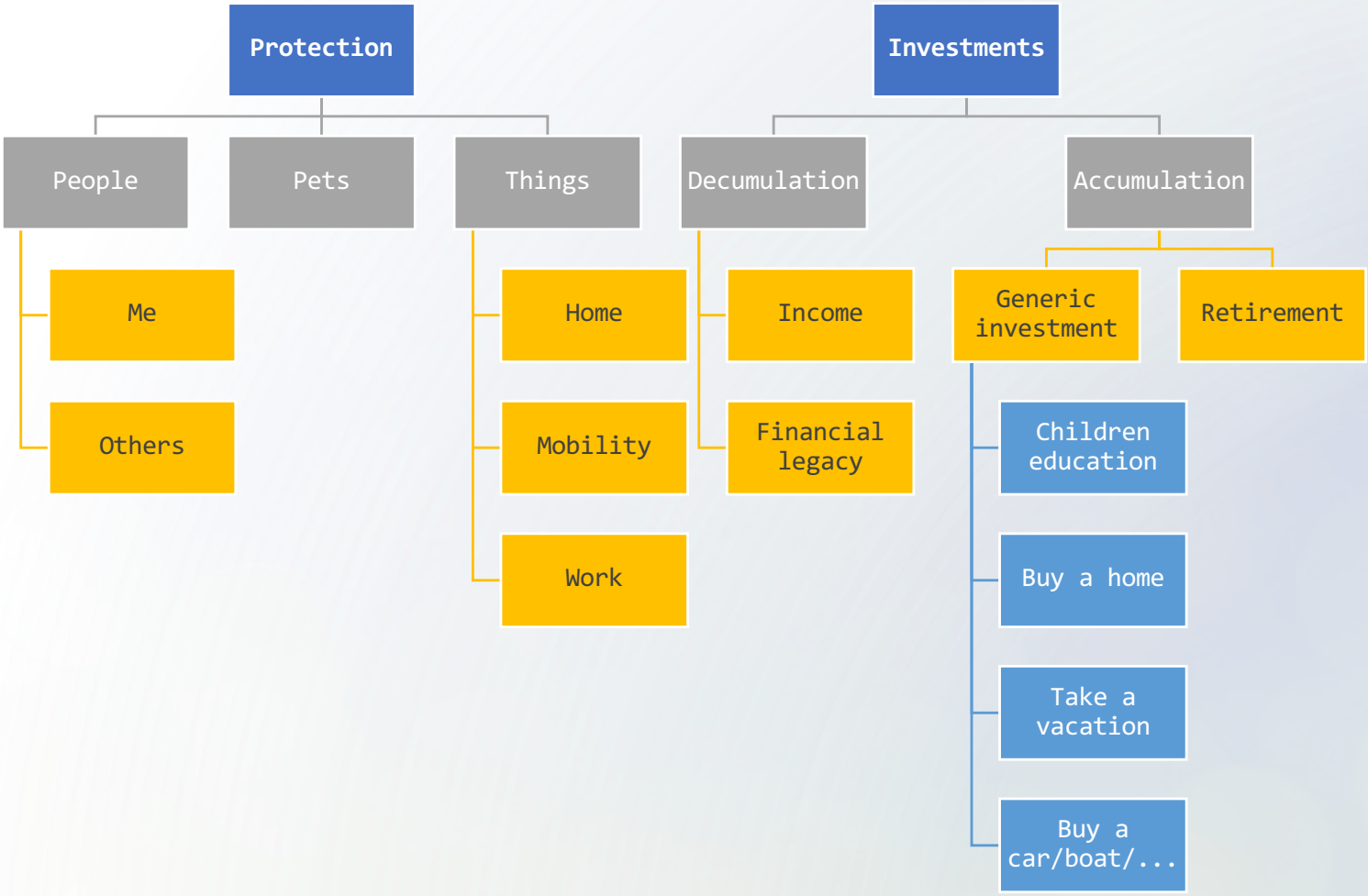
That is (...smell of ML):

$$\boldsymbol{Y = f(x_1, x_2, x_3, \dots)}$$

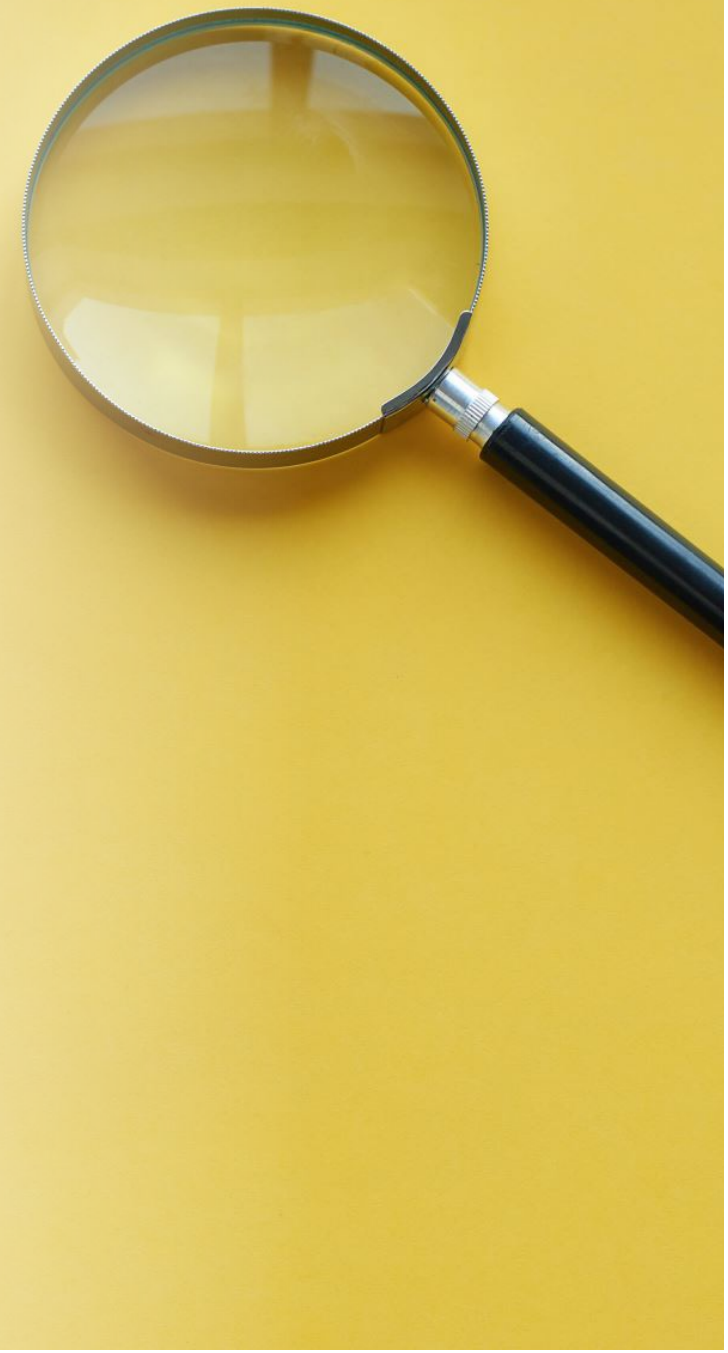
$\boldsymbol{Y}$ = responses = Need

$\boldsymbol{x_1, x_2, x_3, \dots = X}$ = features = client situation, context

Needs & goals, an example for an insurance company with a wealth management business



Let's look at the data



POSSO ANDARE A CALCOLARE
LA DENSITà DEI PRODOTTI PER OGNI OUTPUT
PER OGNI CLIENTE

-> MATLAB : Più BASE ANAISI

CON DATI NON BUONI MEGLIOE VITARE LINEA REGRESSION
MEGLIO CLASSIFICATION REGRESSION

Brainstorming

(don't be shy)

- What would you do?

- Which algorithm would you use? Why?

Estimating needs: a Supervised ML problem

- A client might have/not have a given financial need (or goal)
- Each client might have more needs

PRODOTTO = NEEDS

- Needs can be satisfied by financial products

I could teach a ML algorithm to recognize presence/absence of needs

It's a typical classification problem

(it might be a regression, too)

And what about the Ys? Welcome to the real world!

- In a classification problem we teach an algorithm to put labels
- But... Where are the labels?
- Who is able to say: «Client A has need Z»?
- **Needs are not observable!**
- Hence, we have our Xs but we are not sure about the Ys → We have a problem...

«I'm Mr Wolf, I Solve Problems»

- Basically, two ways:

1. Straight - explicit labels

   «*Client A has/has not need Z*»

2. Less straight - implicit labels

Case 1: explicit labels = = a human being creates the Ys

- She puts:

  Y = 1 if client(i) has need(j)
  Y = 0 otherwise

- Quite common in image recognition
- If the human-labeler is reliable → very good
- But: financial needs are not easy to spot – they are not cats/dogs/pedestrians/etc
- So: you need investment/insurance/banking experts → expensive

Case 2: Implicit labels =
= Ys inferred from expert behaviour

- We try to learn from those who should know if a given client has a given need/goal: financial advisors & C
- If an advisor sells a financial product that satisfies a given need/goal, then probably it was in order to satisfy a need
- Thus:

  Y = 1 if client(i) owns a product that satisfies need(j)

  Y = 0 otherwise

- If the human is reliable → very good
- If the human sells products that maximize HER OWN profits → the algorithm will learn exactly that process (do you remember all these fancy talks about AI and ethics?)
- Solutions:
  - filtering experts and their behaviors, doing «expert-picking»
  - using a priori information (Bayesian models)
  - combining a number of different models (Bayesian Model Averaging)

One-vs-All models
Vs
Multiclass models

- **One-vs-All (Binary classification, Binomial)**:
- 1 need ↔ 1 model
- As many models as there are needs (10 needs ↔ 10 models, 30 ↔ needs, etc)

C'è DA GESTIRE
SE PER ESEMPIO UN CLIENTE OTTIENE Più
PRODOTTI O NESSUN PRODOTTO

DAI SINGOLI MODELLI

- **True multiclass (Multiclass, Multinomial)**:
- N needs ↔ 1 model
- One single big model (10 needs ↔ 1 model, 100 needs ↔ 1 model, etc)

→ often more complex = might be less robust (see Occam's Razor)

From needs to recommendation (NBA): finding the best matching

- **Content-based filtering** - knowledge-based methods that rely mostly on the domain-knowledge
- **Case-based recommender systems** - apply case-based reasoning (CBR) that solves the recommendation problem based on (old) similar cases

Collaborative filtering: learning from similar situations/guys

Using Singular Value Decomposition to Build a Recommender System, or NN

Method based on latent variables

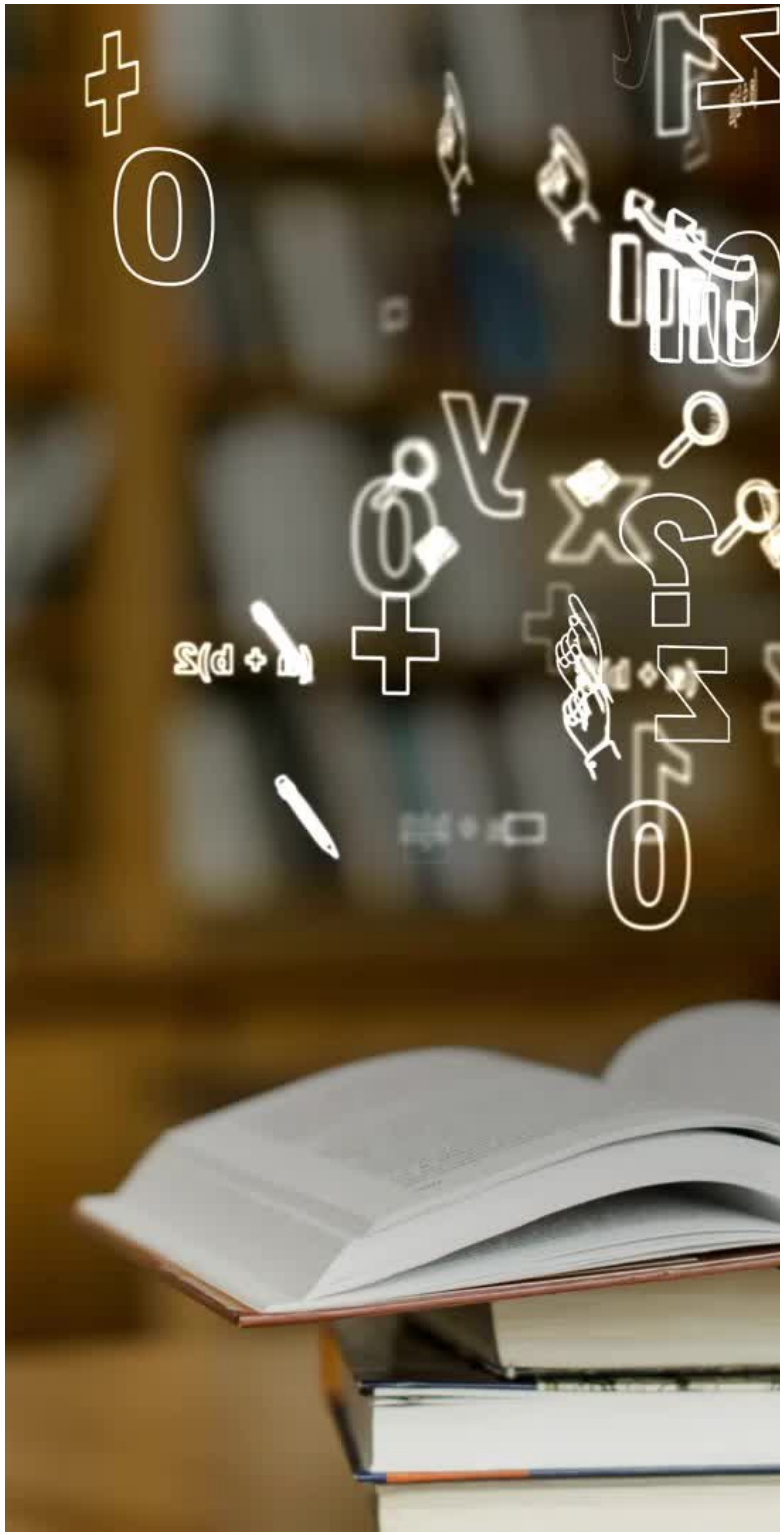
Often it does not go to the heart of the matter: it is unable to manage complex situations (for example, in recommending financial products, it is necessary to take into account many factors, primarily regulatory constraints).

Matlab session starts

Take home on estimating needs and find the NBA, and on collaborative filtering

- Need based :typical application of Supervised ML (but other methods can be applied…)
  - Point of advantage = Business know-how during feature selection/engineering
  - Several business applications:
    - Next Best Action (recommendations)
    - Product targeting of needs' estimation
    - Cross-selling/Up-selling
    - Precision marketing online/offline
    - …
- Collaborative filtering: simple recommendations based on past behaviors

- **Now YOU**
- **It's your turn: use your favorite techniques to estimate customers' needs and recommend products, write the code (use my code, or start from scratch, or whatever…as you like), and we'll talk about it next time**



Next «Office hours»

- Wednesday, March 22, h 17:30-18:30
- Wednesday, March 29, h 17:30-18:30
- We will use Webex (my room = same virtual room used for the lectures)
- Please book if you want to talk to me; **write to me at this email address** (NOT the Politecnico email):

  raffaele.zenti@virtualb.it