Machine Learning for Behavioral Data (CS-421)

Introduction

February 20, 2023

Today

- What is ML for Behavioral Data?
- Course Logistics
- Active Learning
- Projects: EdTech StartUp(s)

Today

- **What is ML for Behavioral Data?**
- **Course Logistics**
- Active Learning
- Projects: EdTech StartUp(s)

This will be an interactive course…

- More on this later
- For now: take your phone (or laptop) and join us on SpeakUp

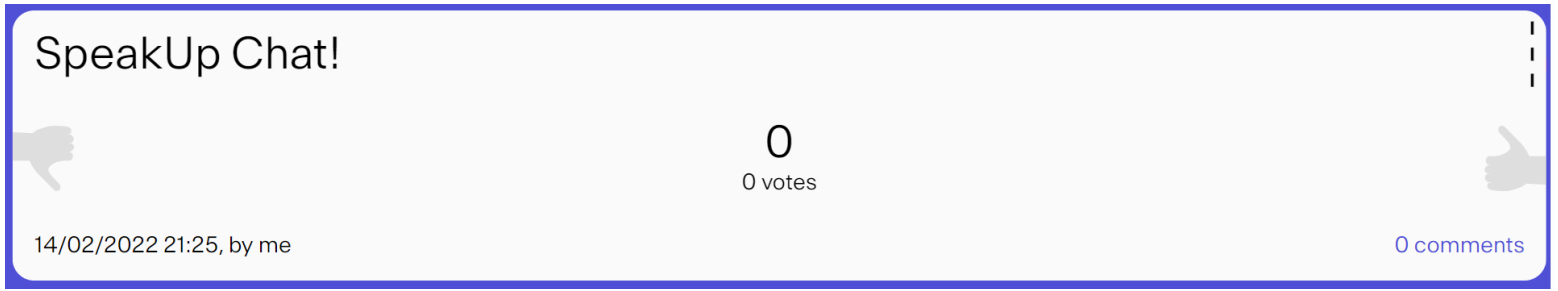
https://go.epfl.ch/speakup-mlbd

About Me

- Assistant professor at EPFL since May, 2020
- Head of the ML4ED lab
- In the past, I was a
  - senior data scientist at the SDSC
  - postdoc at Stanford University
  - postdoc at ETH Zurich/consultant for Disney research Zurich
  - PhD student at ETH Zurich

Students – Shake Hands

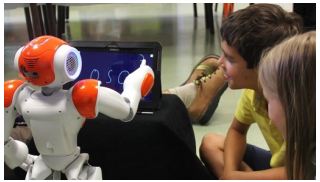
What is ML for Behavioral Data?



What is ML for Behavioral Data?

Human

Interaction with Environment



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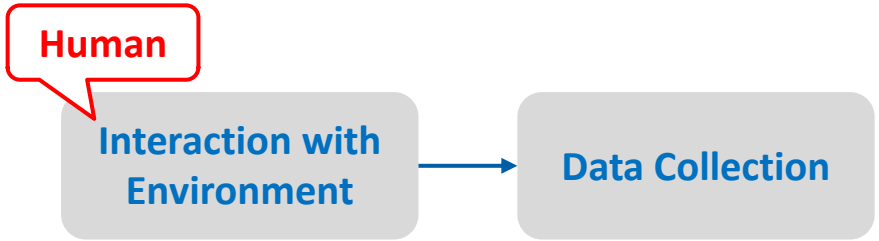

- Clickstream
- Text
- Categorical Data
- Images
- Video
- Sensor Data
- …

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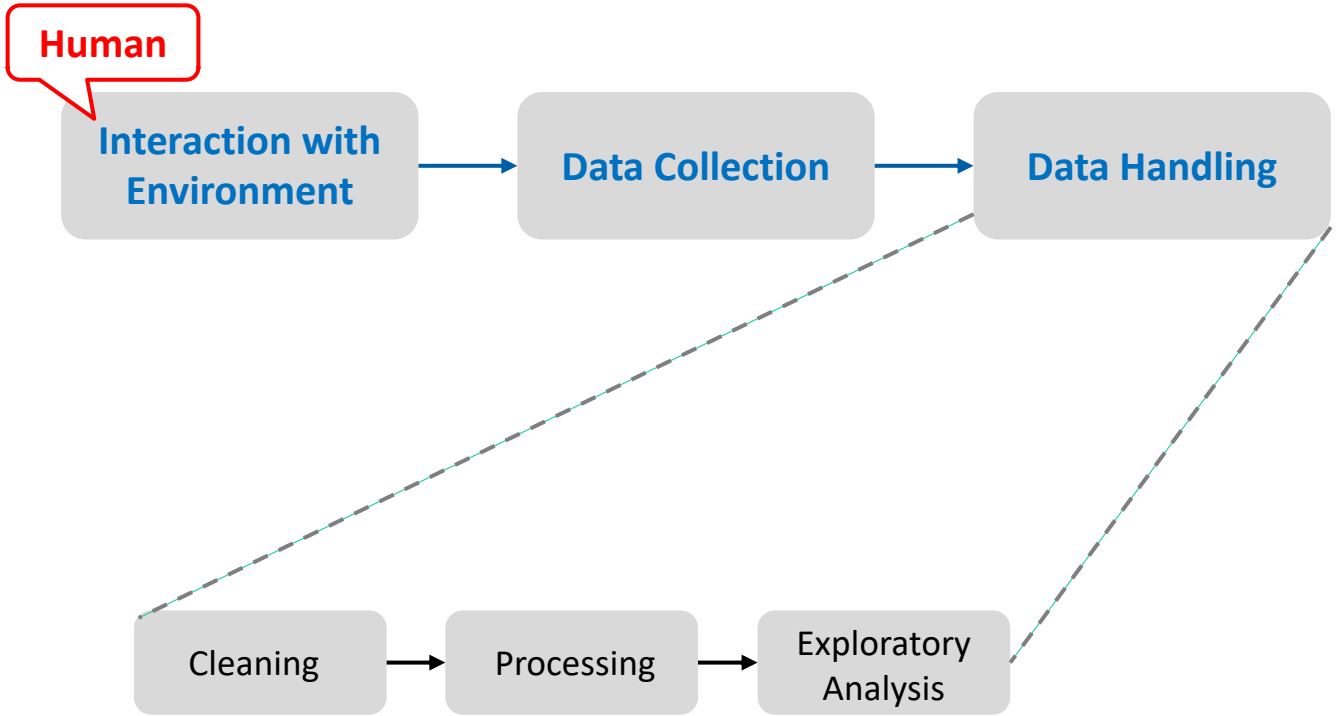

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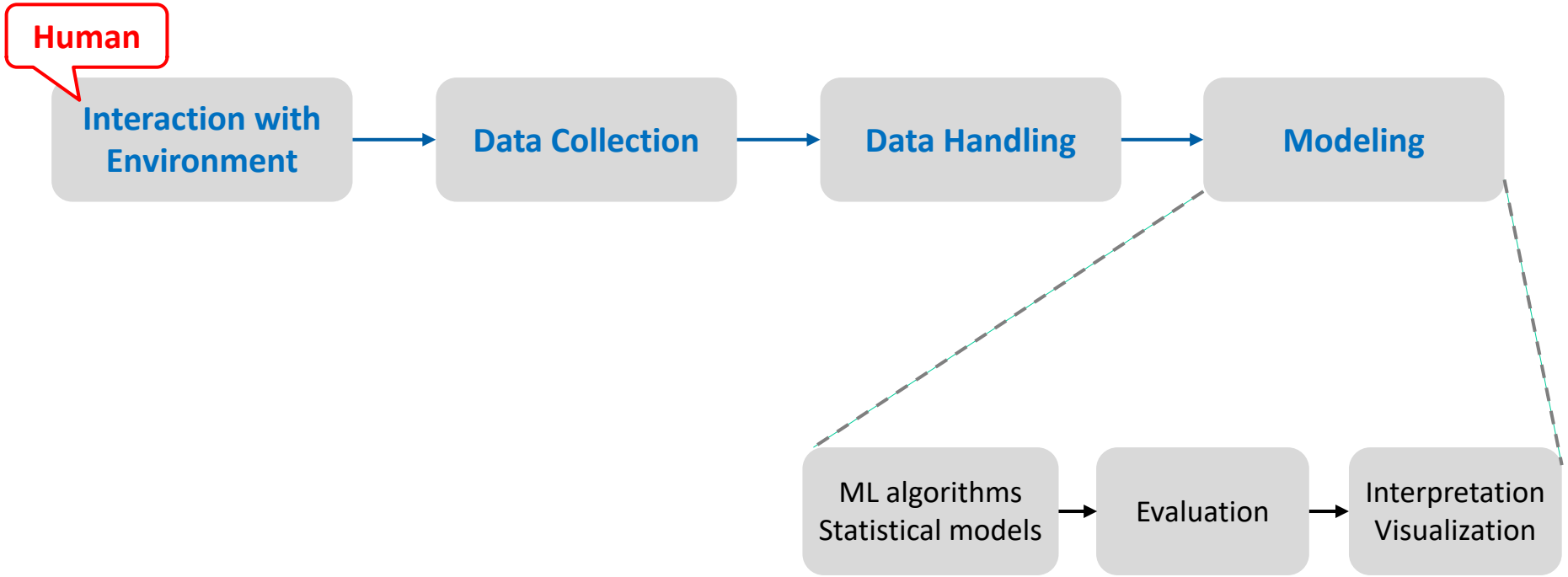

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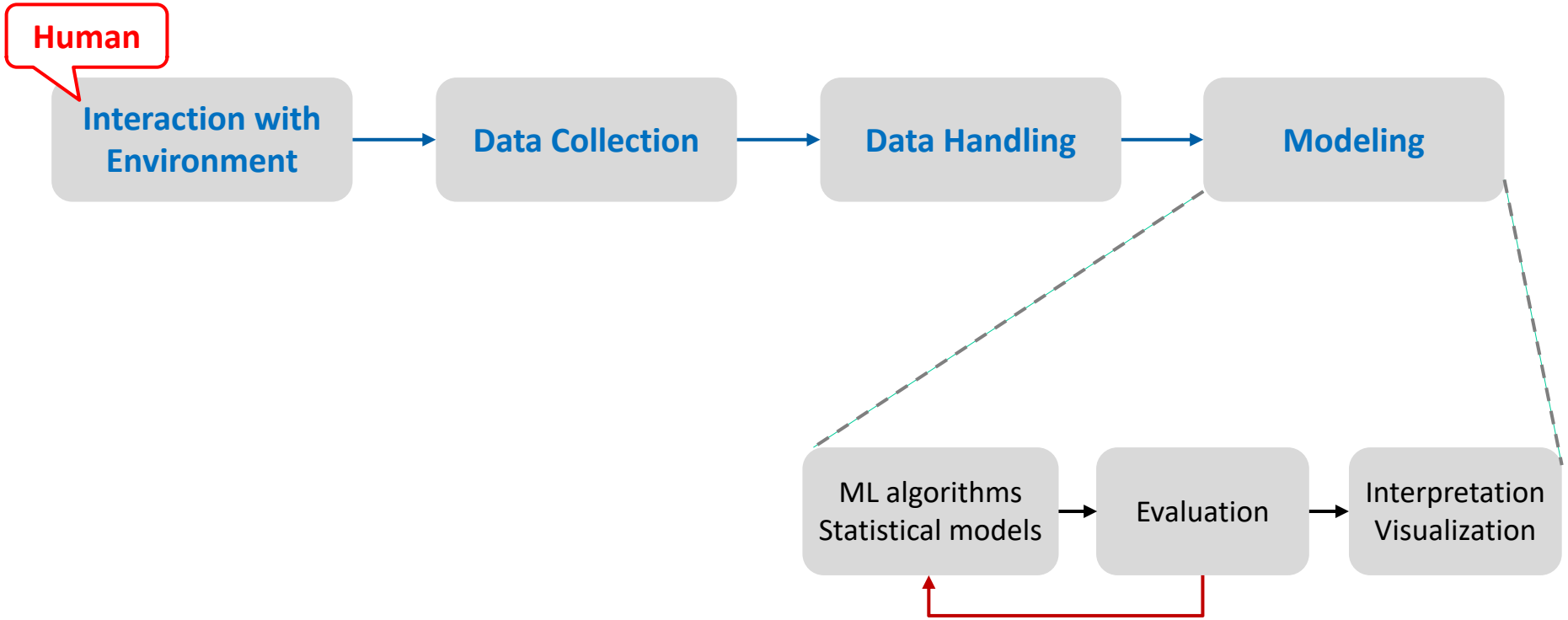

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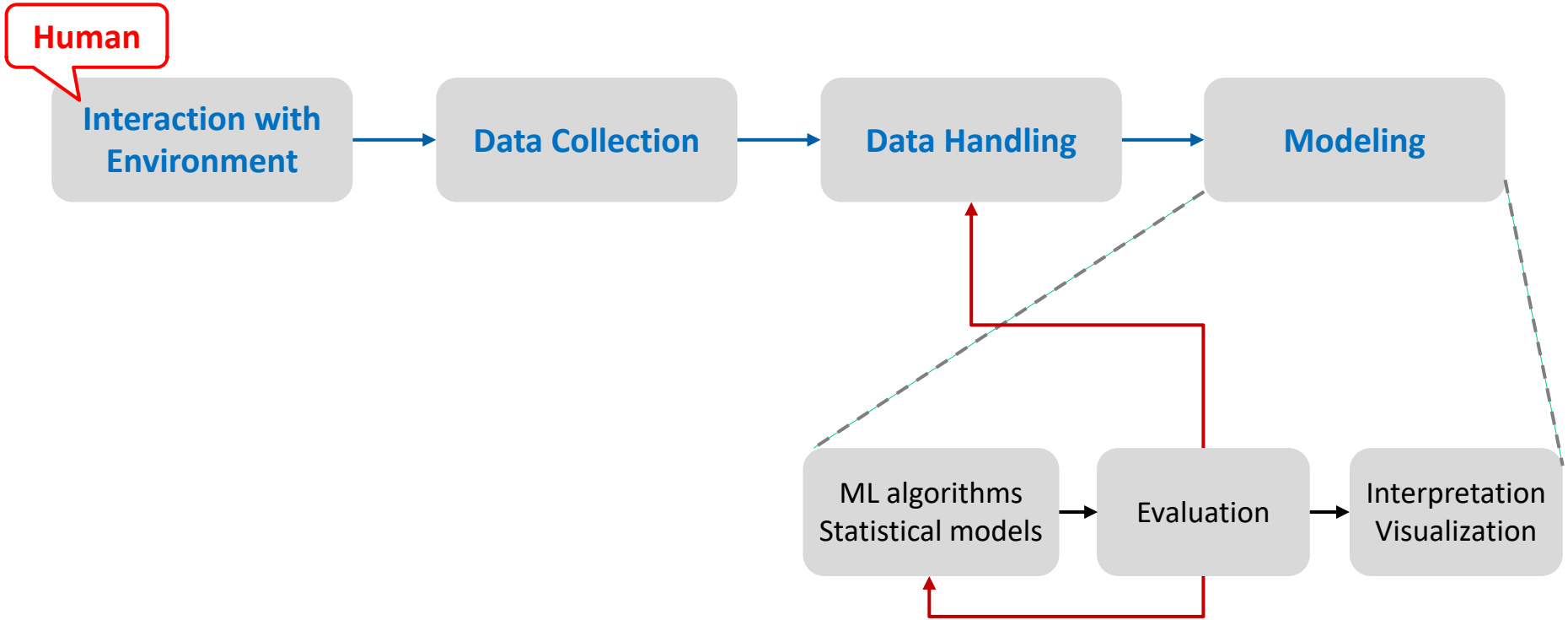

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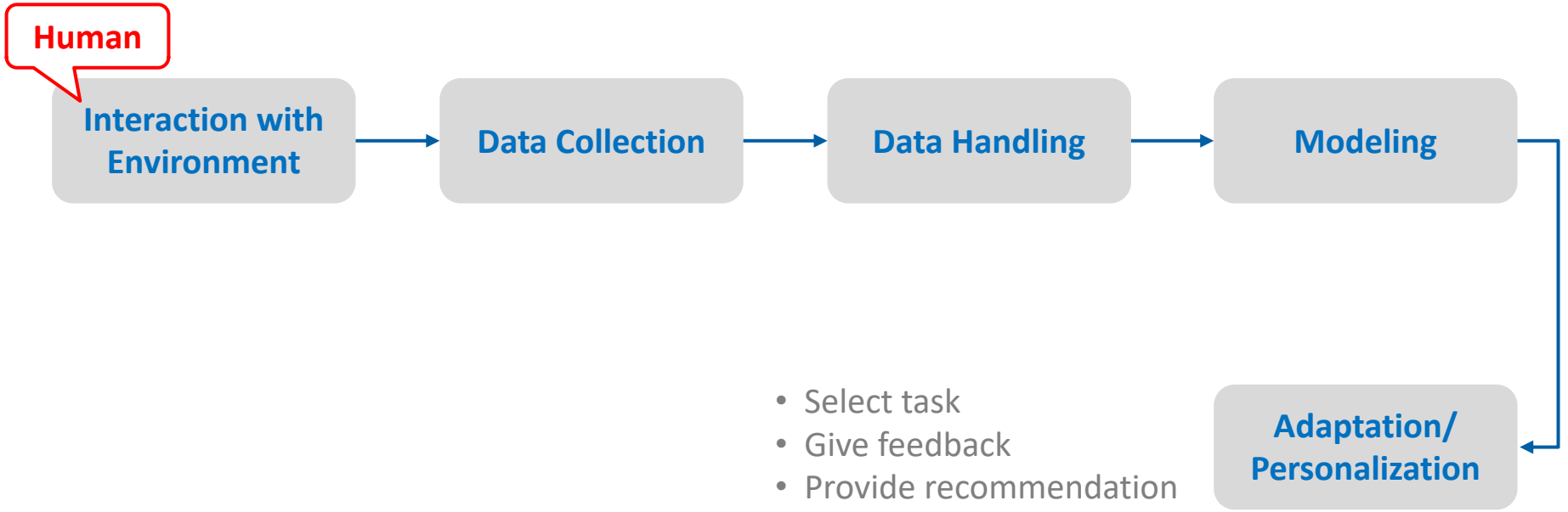

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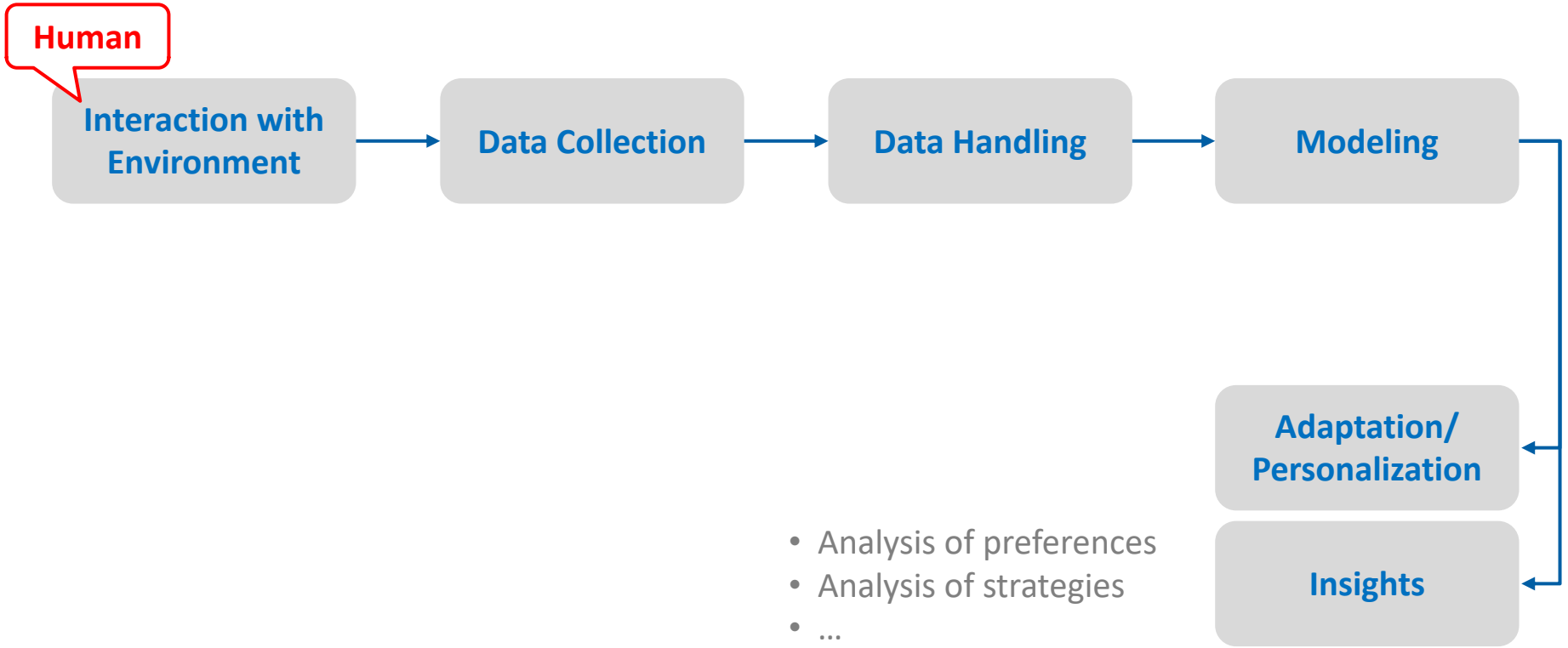

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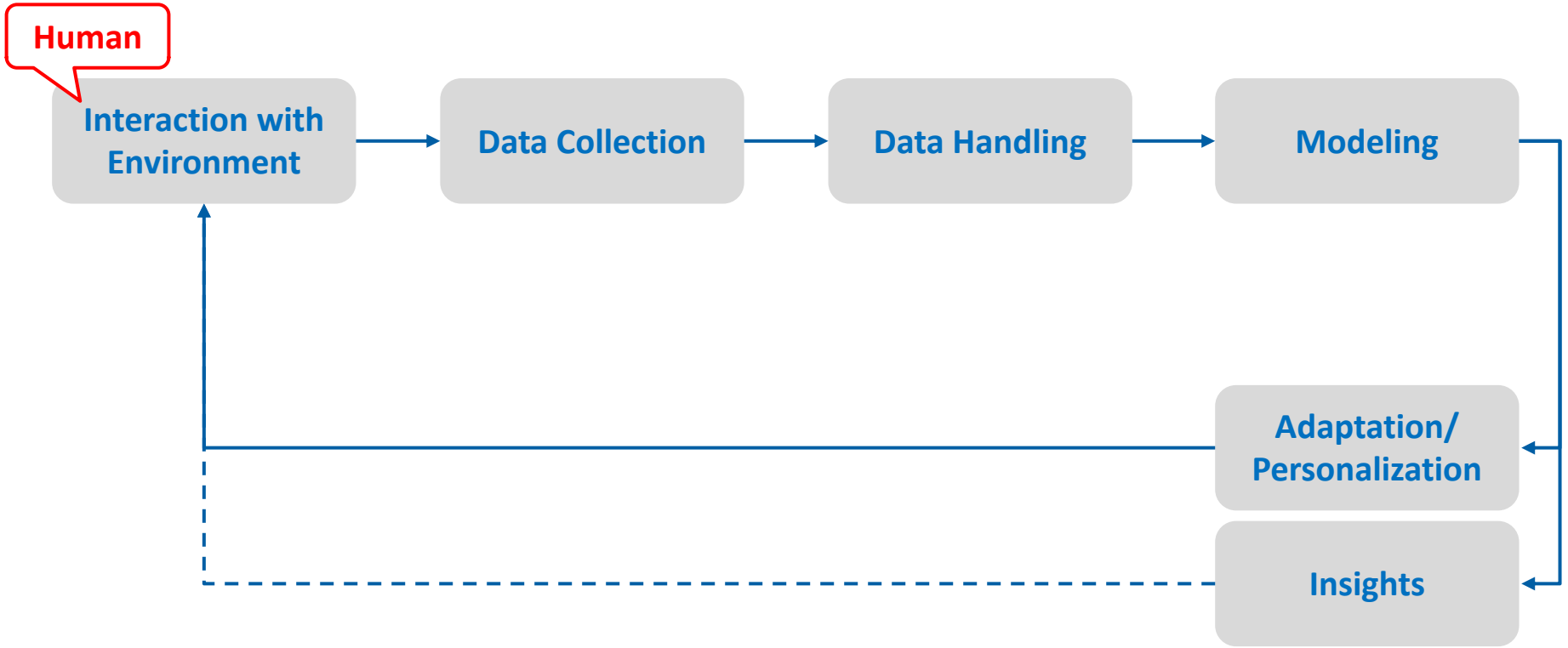

Lecture Syllabus

Week	Lecture/Lab
1	Introduction
2	Data Exploration
3	Regression
4	Classification
5	Model Evaluation
6	Time Series Prediction
7	Time Series Prediction

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- **Exploring & visualizing data**
- **Time Series Exploration**

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- **Generalized Linear Models**
- **Mixture Models**
- **Regression for time series**

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- **Random Forest, nearest neighbors, etc.**
- **Classifying time series data**

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- **Cross validation, bootstrap, information scores**
- **Error metrics & visualization**

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Complete pipeline for one use case:

- **Data exploration**
- **Prediction**
- **Model evaluation**

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Supervised learning on time series:
- **Probabilistic graphical models**
- **Neural networks: LSTM, GRU, etc.**

Lecture Syllabus

Week	Lecture/Lab
8	Spring Break
9	Time Series Prediction
10	Unsupervised Learning
11	Unsupervised Learning
12	Ethical Machine Learning
13	Ethical Machine Learning
14	Project Presentations
15	Whit Monday

Lecture Syllabus

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8	Spring Break
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- **K-Means, Spectral Clustering**
- **Choosing the optimal K***
- **Clustering time-series data**

Lecture Syllabus

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- **Fairness**
- **Explainability**

Lecture/Lab

- Monday, 15:15 – 18:00
- INR 113
- Lecture + practice session
- Slides will be uploaded to our GitHub
- Jupyter Notebooks will be uploaded to our GitHub
- Recording: we will make the recordings from the past year available

Project

- Teams of 3 people
- We will provide the data sets
- We will provide example research questions
- You will suggest an additional analysis/extension to the selected research question
- We will give feedback during the semester (see milestones)
- You will do a poster presentation in the penultimate week of the semester
- Final project (Code + Report) delivered by June 9, 2023 23:59 CET

Project (Office) Hours

- Wednesday, 9:15-10:00
- INM 10
- Content:
  - Introduction to project tasks
  - Individual feedback meetings with teams
  - Coaching
  - Drop-in office hours for questions regarding the lecture or project

Project Schedule

Week	Project Hours	Milestones
1	Detailed project presentation	-
2	Introduction to tasks for M2	*M1: Preferences on team members and start-up*
3	Office hours	
4	Office hours	
5	Introductions to tasks for M4	*M2: **Individual** exploration of selected data set*
6	Individual discussion with teams	*M3: selection of research question and approach*
7	Office hours	
8	Office hours	

Project Schedule

Week	Project Hours	Milestones
9	Spring Break	
10	Office hours	
11	Individual discussion with teams	*M4: submission of results for first research question* *M5: ideas for extension (+ approach)*
12	Office hours	
13	Office hours	
14	Office hours	
15	Project Presentations	*M6: Final Presentation*
16		*M7: Hand in report and code base*

Grading

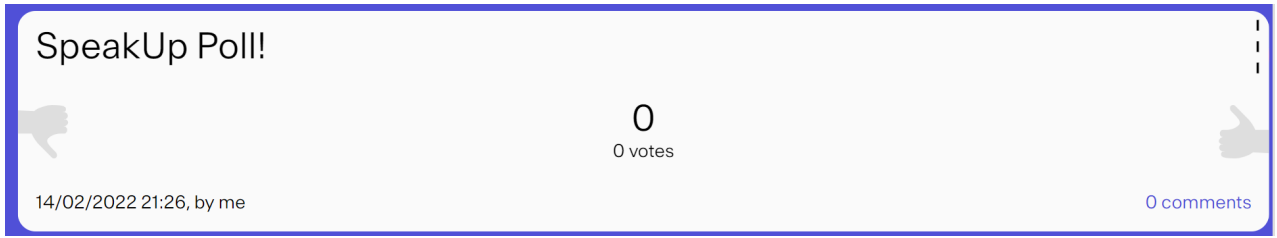
- **50% Project**
  - Teams of 3 people
  - 15% individual exploration (M2), 25% supervised learning (M4), 20% presentation (M6), 40% final results (M7)
- **50% Final Exam** (exam session)
  - Individually, at the laptop
  - Mix of conceptual and coding questions

Course Goals

- Explain the main machine learning approaches to personalization, describe their advantages and disadvantages and explain the differences between them
- Implement algorithms for these machine learning models
- Apply them to real-world data
- Assess / evaluate their performance

Which ML courses have you taken?

A. Introduction to Machine Learning
B. Machine Learning
C. Applied Data Analysis
D. Other



Course Prerequisites

- Probabilities and statistics
- Programming:
  - Project: Python
  - Exam: Python

- Foundations of machine learning

Important Websites

- Moodle: https://moodle.epfl.ch/course/view.php?id=16434
  - Contains all important information
  - Use forum for questions
  - For more personal questions contact head assistants
- Project:
  - GitHub: https://github.com/epfl-ml4ed/mlbd-2022
  - EPFL Noto: https://noto.epfl.ch/

Team

Instructor

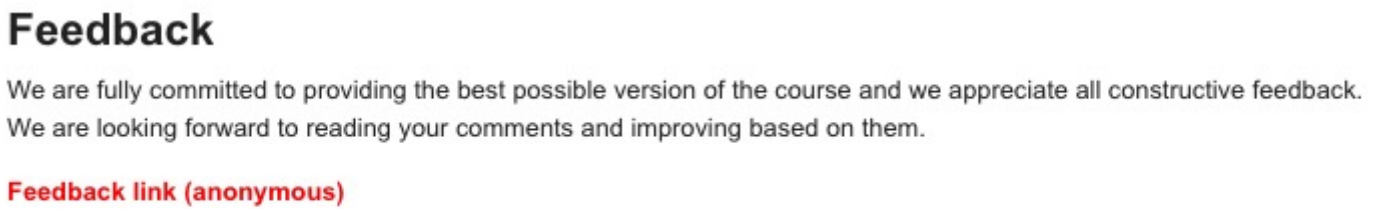
Tanja Käser
tanja.kaeser@epfl.ch

Teaching Assistants

Vinitra Swamy, Paola Mejia
vinitra.swamy@epfl.ch, paola.mejia@epfl.ch

Feedback

- Course is still new -> please give feedback
- If you want to give us feedback, there will be a link on Moodle:



Questions?

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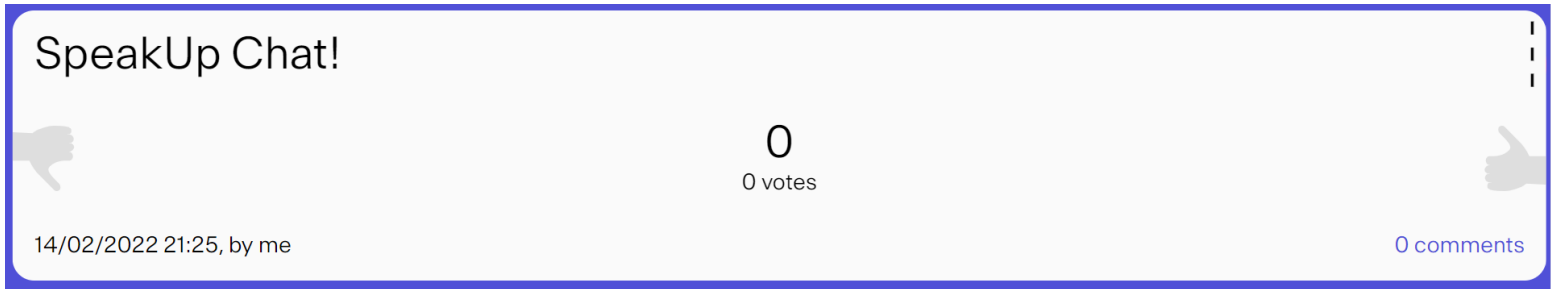
- Course Logistics
- **Active Learning**
- Projects: EdTech StartUp(s)

Active learning – what is it?



Active learning – what is it?

- Activities that students do to construct knowledge and understanding
  - Read
  - Write
  - Explore
  - Discuss
  - …

Active learning in this course

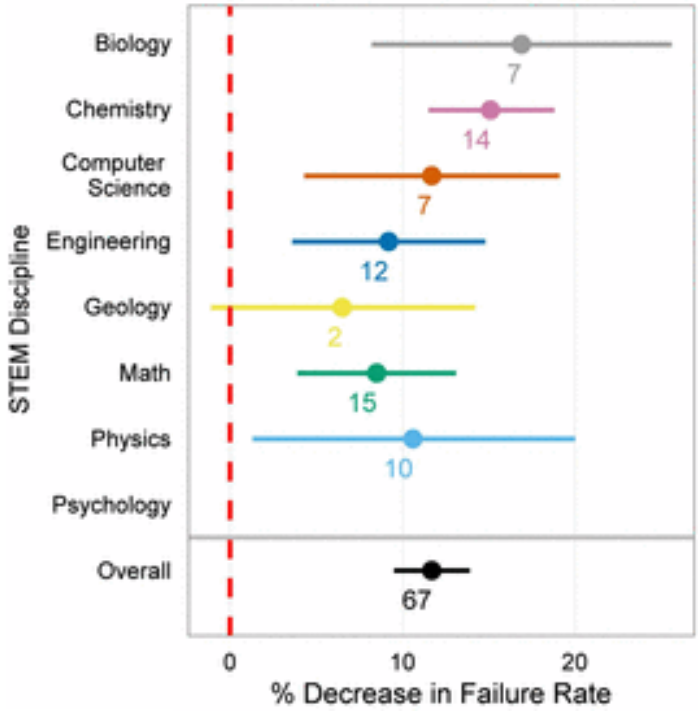
SpeakUp

- Collecting Ideas
- Polls
- Think – Pair - Share

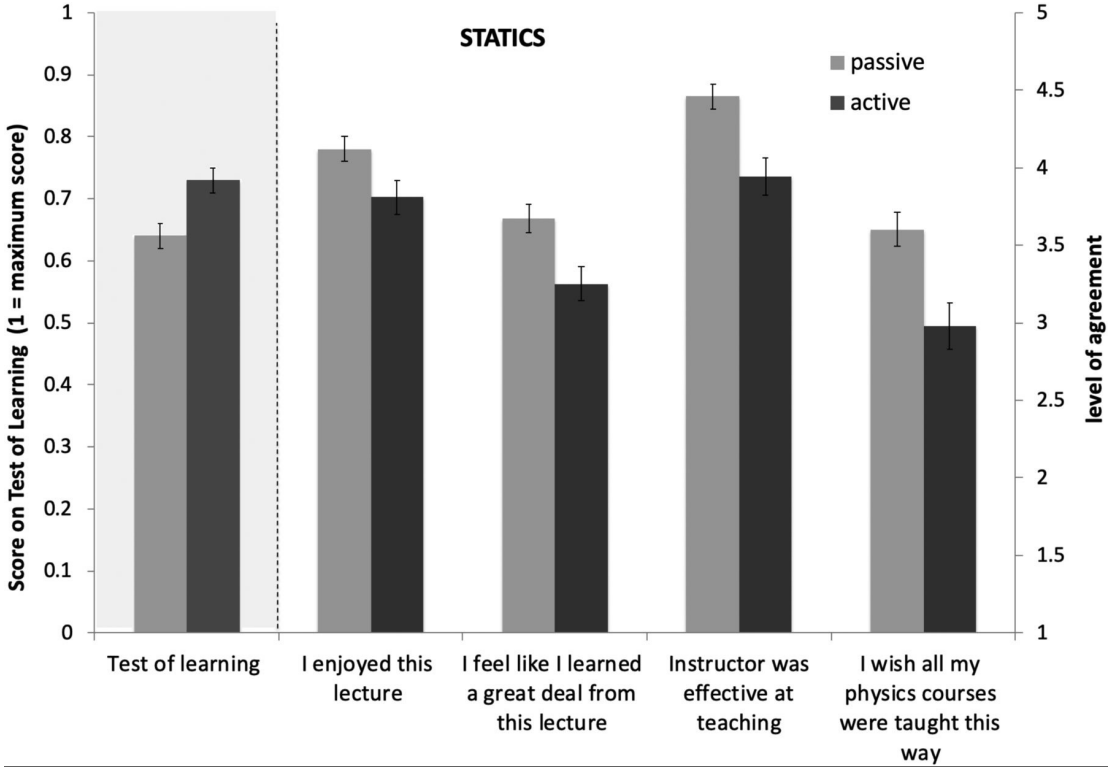
Jupyter Notebook

- Demonstration
- Worked examples
- Small coding tasks

Active learning increases performance



Watch out: Feeling-of-Learning can deceive you!



The lecture will be interactive, thus

- we expect you to attend the lecture
- we expect you to participate in all the activities

Important: bring your laptop !

Questions?

Today

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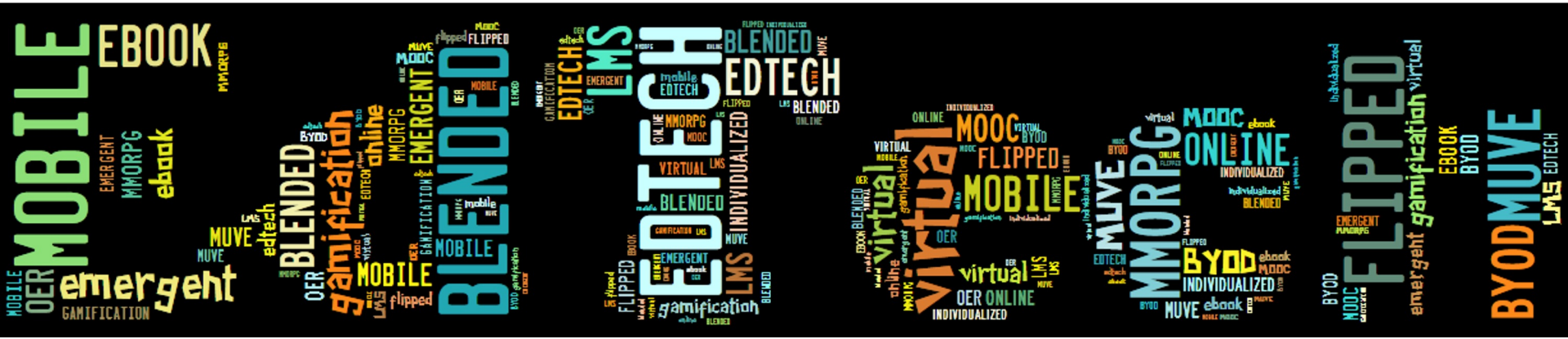
- Course Logistics
- Active Learning
- **Projects: EdTech StartUp(s)**

Swiss “EdTech” Hub

Why a Swiss “EdTech” Hub?

To support the digital transformation in **ED**ucation with **TECH**nological solutions

EdTech Market – Highly Fragmented

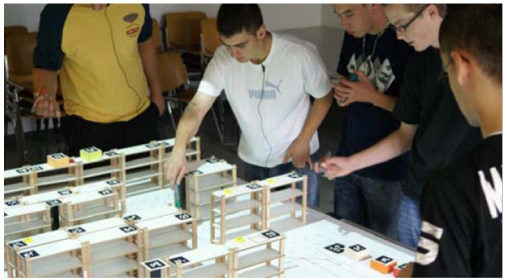


Large diversity in the use of technology-enhanced solutions

Early Childhood Education

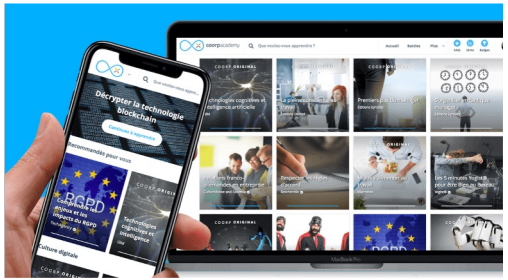
Compulsory Education

Upper Secondary / Higher Education



University/VET

Continuous Training & Education



Corporate Training & Learning

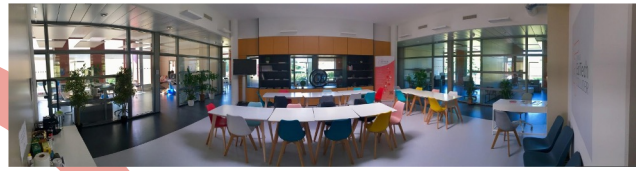
Mission and Vision

- Bring players in EdTech together in one place in order to create a market place around Education and EdTech
- Focus on future learning solutions / future skills
- Long-term partnerships (not a short-term incubator)
- Help to accelerate growth
- Sustainability / long term positive impact on society

EdTech Collider - Facts

SPACE

Physical co-working space / Virtual space



Independent Association/NPO (04/17)

Four EPFL Professors

93+ Members (EdTech startups)

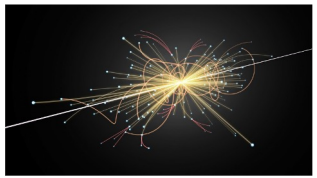
Support: EPFL, Jacobs Foundation, Credit Suisse

VISIBILITY

Create an image / branding and reputation Swiss EdTech Collider

COLLISIONS

Nourish the 'collision' of knowledge / sharing ideas / creating co-operations / collaborations (members/external)



+175 Collisions/Events

PROXIMITY EPFL

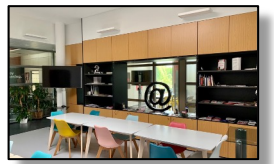
Close to EPFL Research (Digital Learning / Learning Sciences)

LEARN - Center for Learning Sciences EPFL

ECOSYSTEM

Establishing a unique ecosystem around EdTech

93 StartUps (status: 01.2022)



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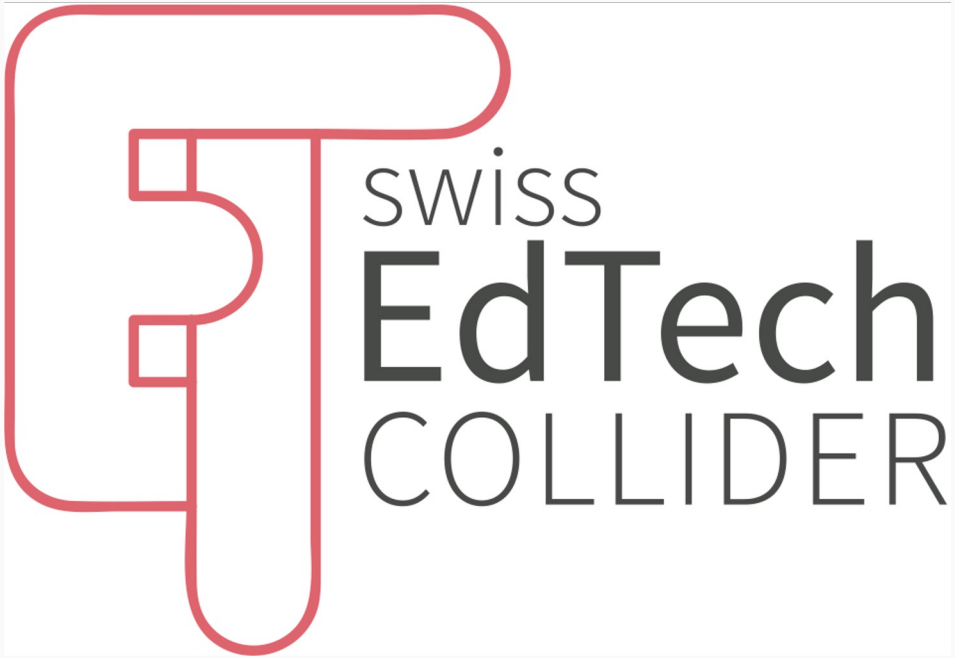

Two participating StartUps

- Dybuster Alemira (Marco Bär)
- Taskbase (Anette Hunziker)

Up next…

- Detailed information regarding the project: milestones, guidelines, grading, data sets, etc. [lab session today]
- Setting up GitHub and Jupyter notebook for the lecture [lab session on Wednesday]

Remember

- Register for the course on IS Academia
- Bring your laptop!
- You find everything on…

Moodle:

https://moodle.epfl.ch/course/view.php?id=16434