

Campus Analytics

Eduhub Days – Luzern – February 1st 2018



Patrick Jermann

Center for Digital Education - <http://moocs.epfl.ch>

MOOCs at EPFL 25 Apr 2017



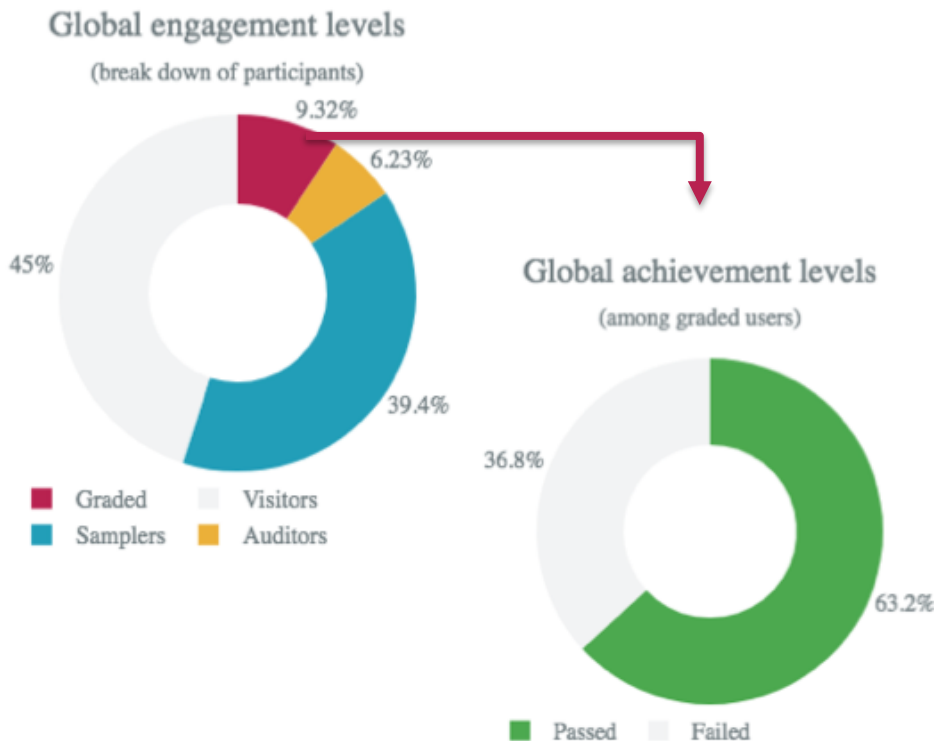
ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

CEDE

**Center for
Digital Education**

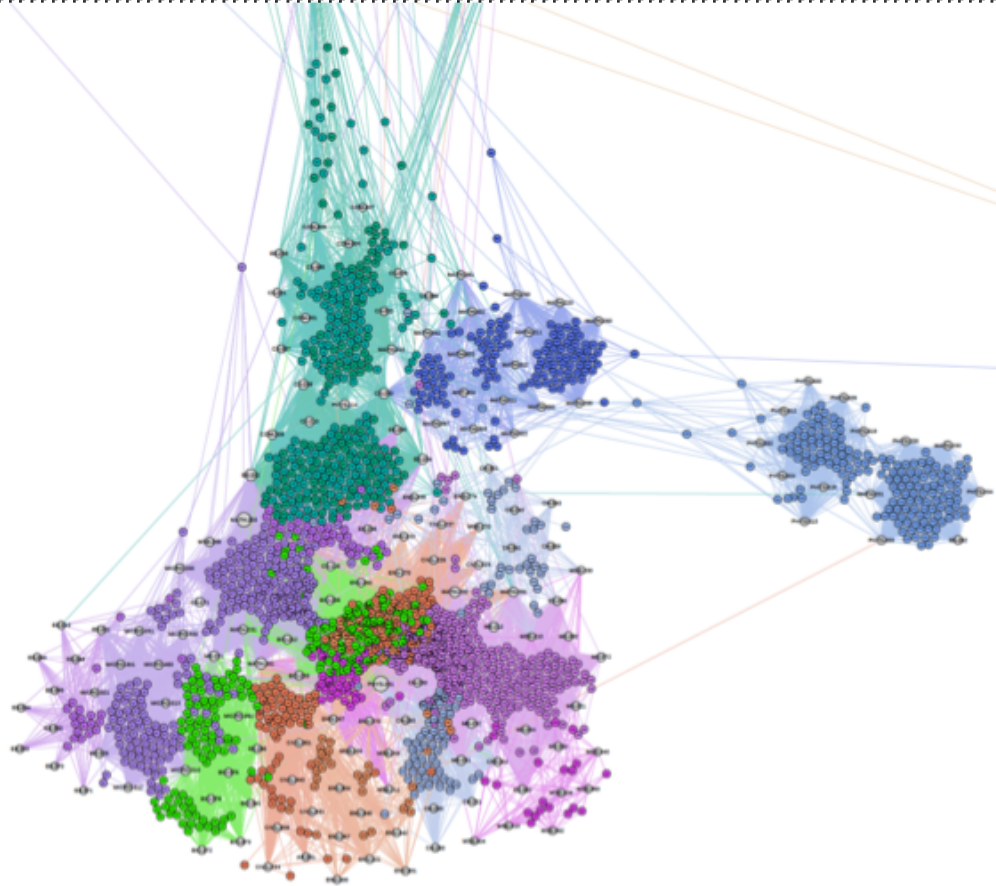
MOOC Factory

- #1 in Europe #10 in the world
- 89 MOOCs produced
- 2'000'000 registrations
- 100'000 online alumni
- 3 studios
- edX + Coursera + Local platform
- Swiss MOOC Service



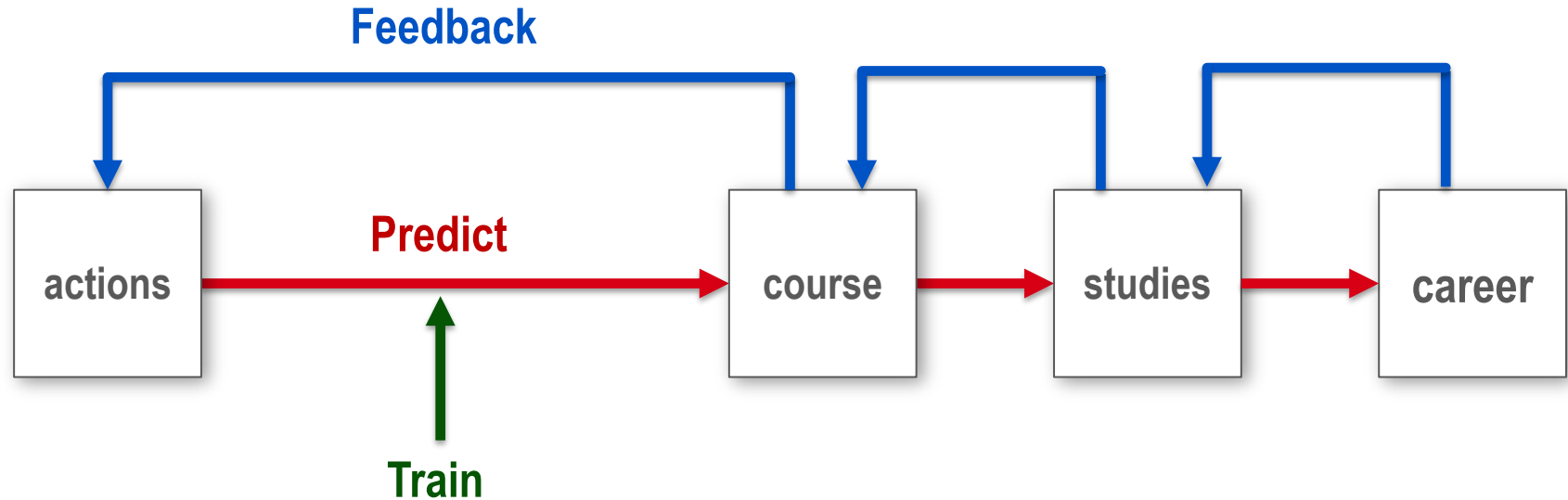
Campus Analytics

- Data for research
 - Curation and distribution of educational data
 - Legal and technical aspects
 - Collaborations with labs, SDSC, ...
- Data for action regulation
 - Regulation of the education system at different levels (course, curriculum, school)
 - Tools to take data-informed educational decisions, choosing a course, building curricula, detecting new opportunities.



Translational research in learning science

Evaluating and scaling innovations



Week 7 – part 4 :Generalized Linear Model (GLM)



Neuronal Dynamics: Computational Neuroscience of Single Neurons

Week 7 – Optimizing Neuron Models For Coding and Decoding

Wulfram Gerstner

EPFL, Lausanne, Switzerland

✓ 7.1 What is a good neuron model?

- Models and data

✓ 7.2 AdEx model

- Firing patterns and analysis

✓ 7.3 Spike Response Model (SRM)

- Integral formulation

7.4 Generalized Linear Model

- Adding noise to the SRM

7.5 Parameter Estimation

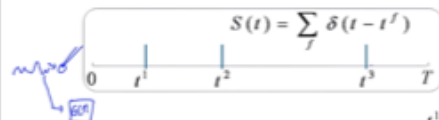
- Quadratic and convex optimization

7.6. Modeling in vitro data

- how long lasts the effect of a spike?

7.7. Helping Humans

Neuronal Dynamics – 7.4 Likelihood of a spike train in GLMs

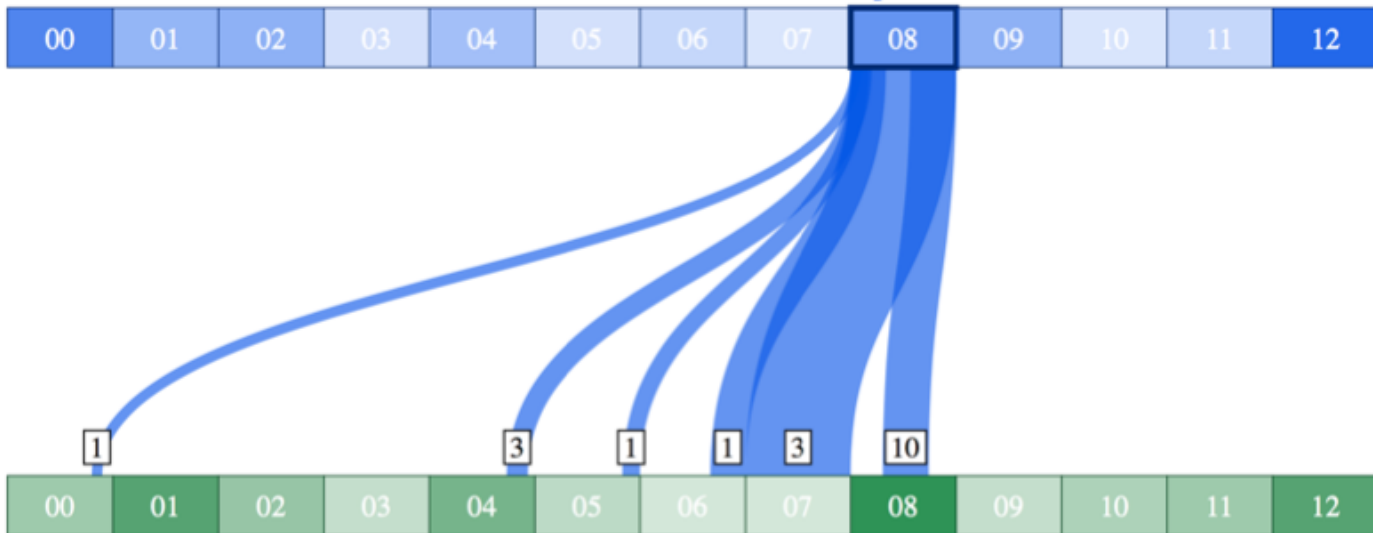


Measured spike train with spike times

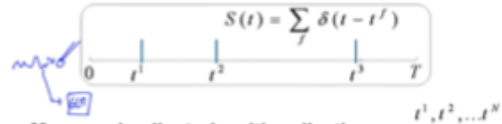
Likelihood L that this spike train could have been generated by model?

$$L(t^1, \dots, t^N) = \exp\left(-\int_0^T \rho(t') dt'\right) \rho(t^1) \cdot \exp\left(-\int_{t^1}^T \rho(t') dt'\right) \dots$$

19 users navigated from this slide.



Neuronal Dynamics – 7.4 Likelihood of a spike train in GLMs



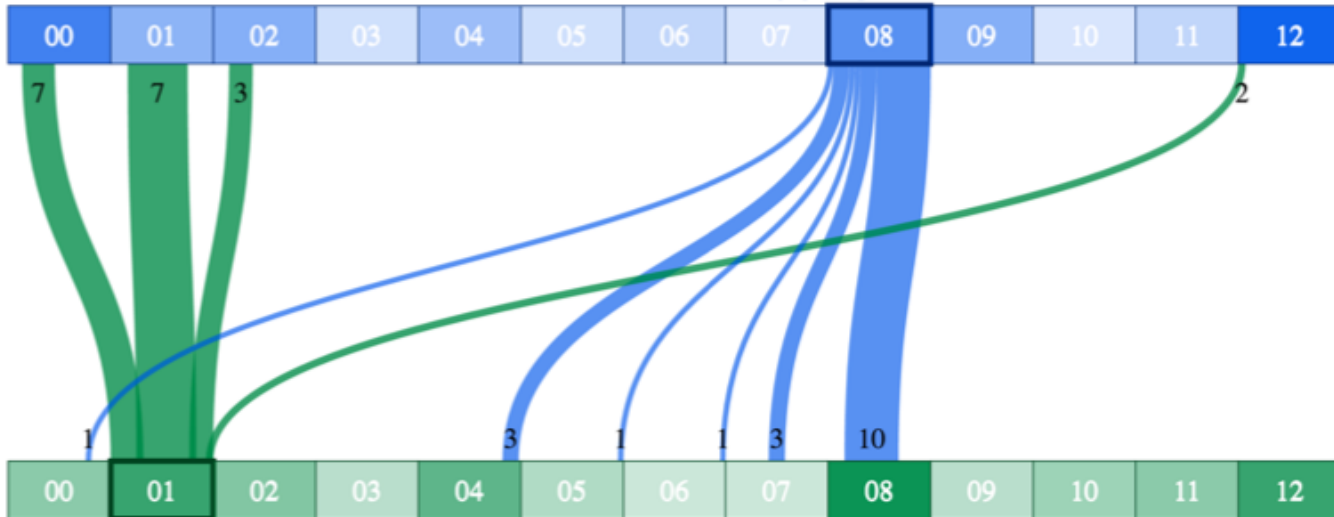
Measured spike train with spike times

Likelihood L that this spike train could have been generated by model?

$$L(t^1, \dots, t^N) = \exp\left(-\int_0^T \rho(t) dt\right) \rho(t^1) \cdot \exp\left(-\int_{t^1}^{t^2} \rho(t) dt\right) \dots$$





19 people navigated from this slide.



19 people navigated to this slide.

Neuronal Dynamics – 7.4 SRM with escape noise = GLM



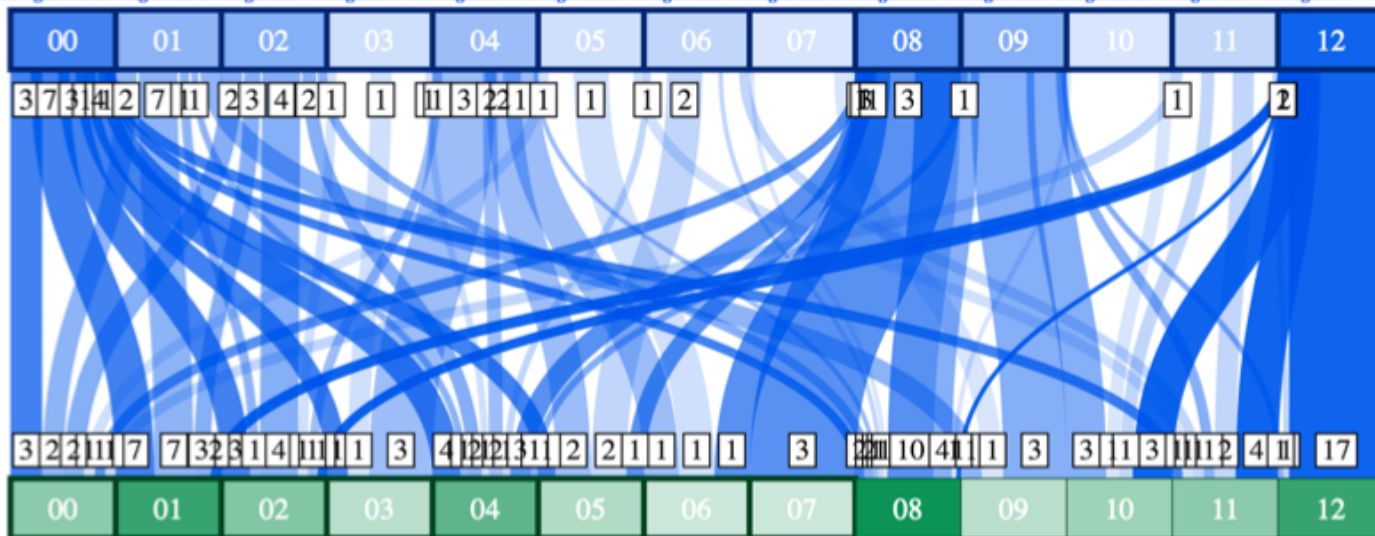


- linear filters
- escape rate
- likelihood of observed spike train
- parameter optimization of neuron model



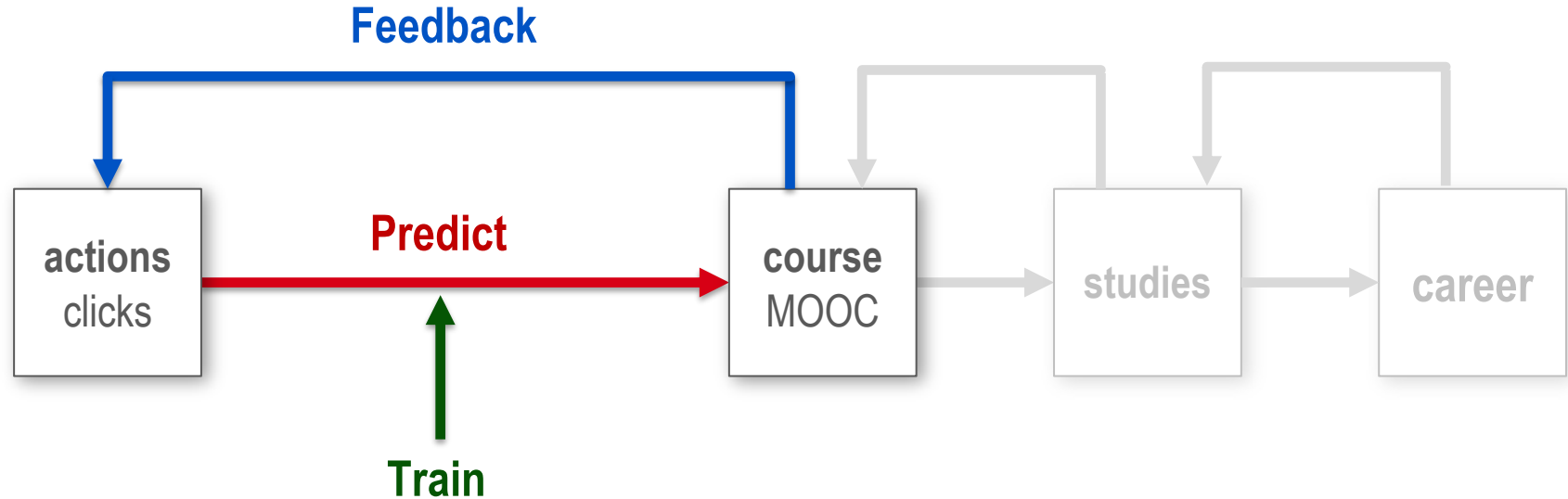
- linear filters
- escape rate
- likelihood of observed spike train

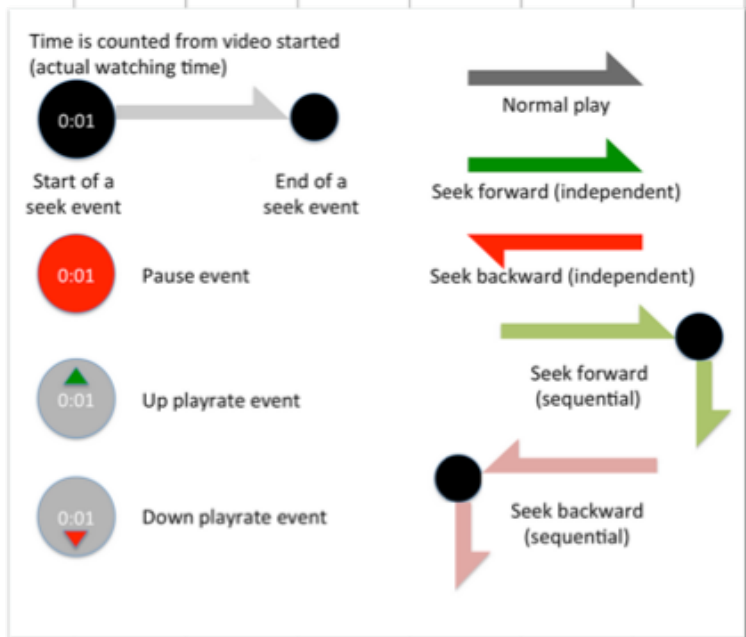
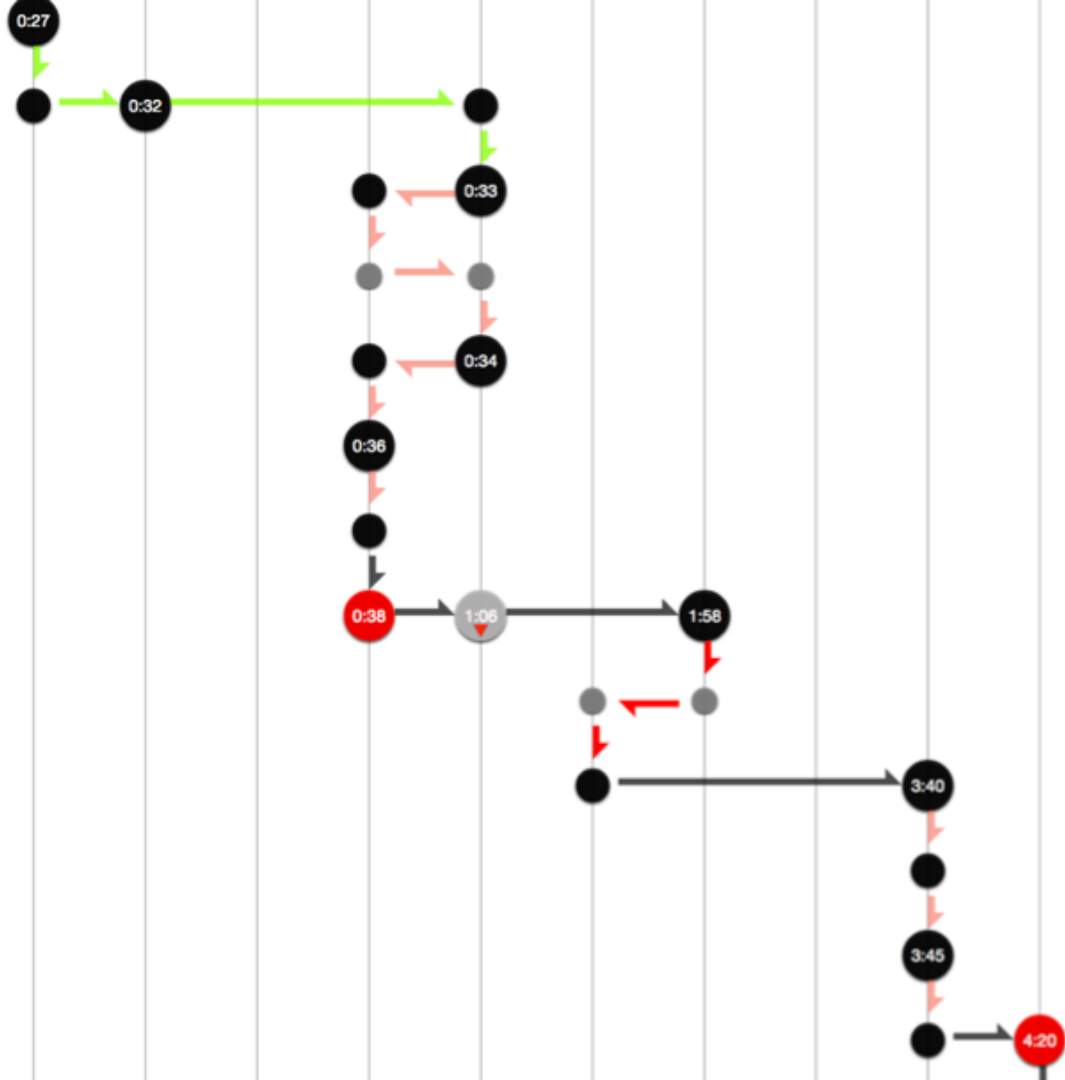
→ parameter optimization of neuron model

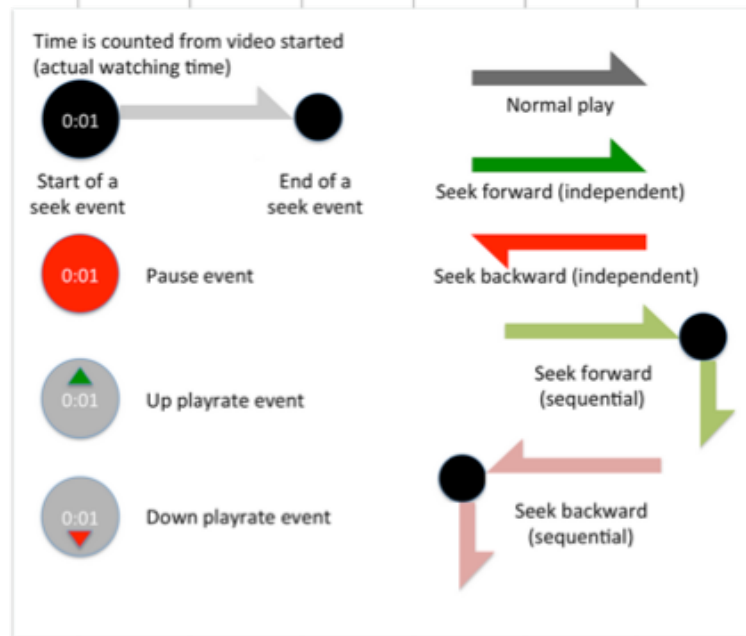
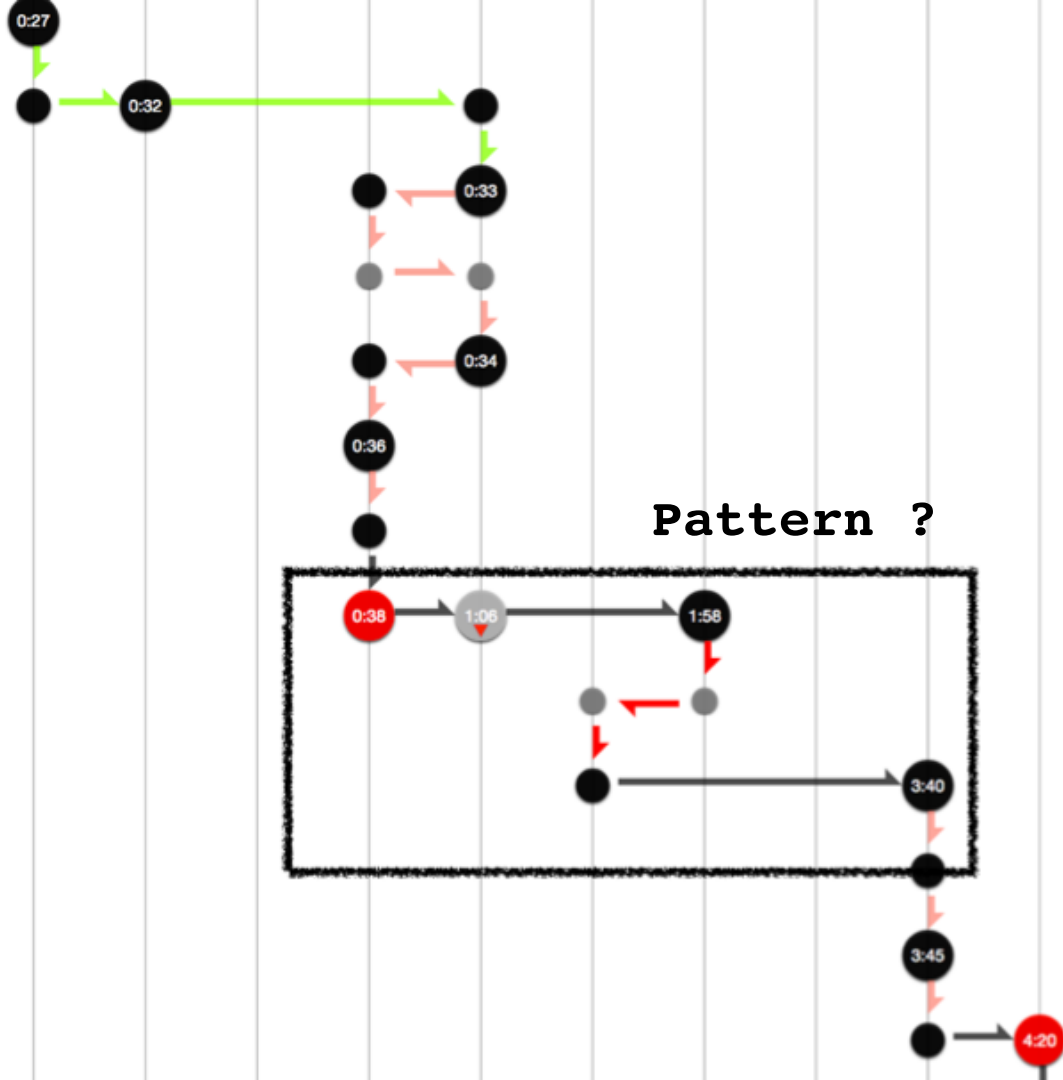
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Can we predict MOOC success from clickstreams ?







Sequence

Play

Forward

Pause

Play

PlPaSfSfPaSbPaPlSfSfSfaSbPa

4-gram

PlPaSfSf

PaSfSfPa

SfSfPaSb

....

Pattern

- **Rewatch:** PlPaSbPl, PlSbPaPl, PaSbPlSb, SbSbPaPl, SbPaPlPa, PaPlSbPa
- **Skipping:** SfSfSfSf, PaPlSfSf, PlSfSfSf, SfSfSfPa, SfSfPaPl, SfSfSfSSf, SfSfSSfSf, SfPaPlPa, PlPaPlSf

- **Clear Concept:** PaSbPlSSb, SSbSbPaPl, PaPlSSbSb, PlSSbSbPa (a combination of SeekBw and ScrollBw clicks, indicating high tussle with the video lecture content)
- **Checkback Reference:** SbSbSbSb, PlSbSbSb, SbSbSbPa, SbSbSbSf, SfSbSbSb, SbPlSbSb, SSbSbSbSb (a wave of SeekBw clicks)

Pattern

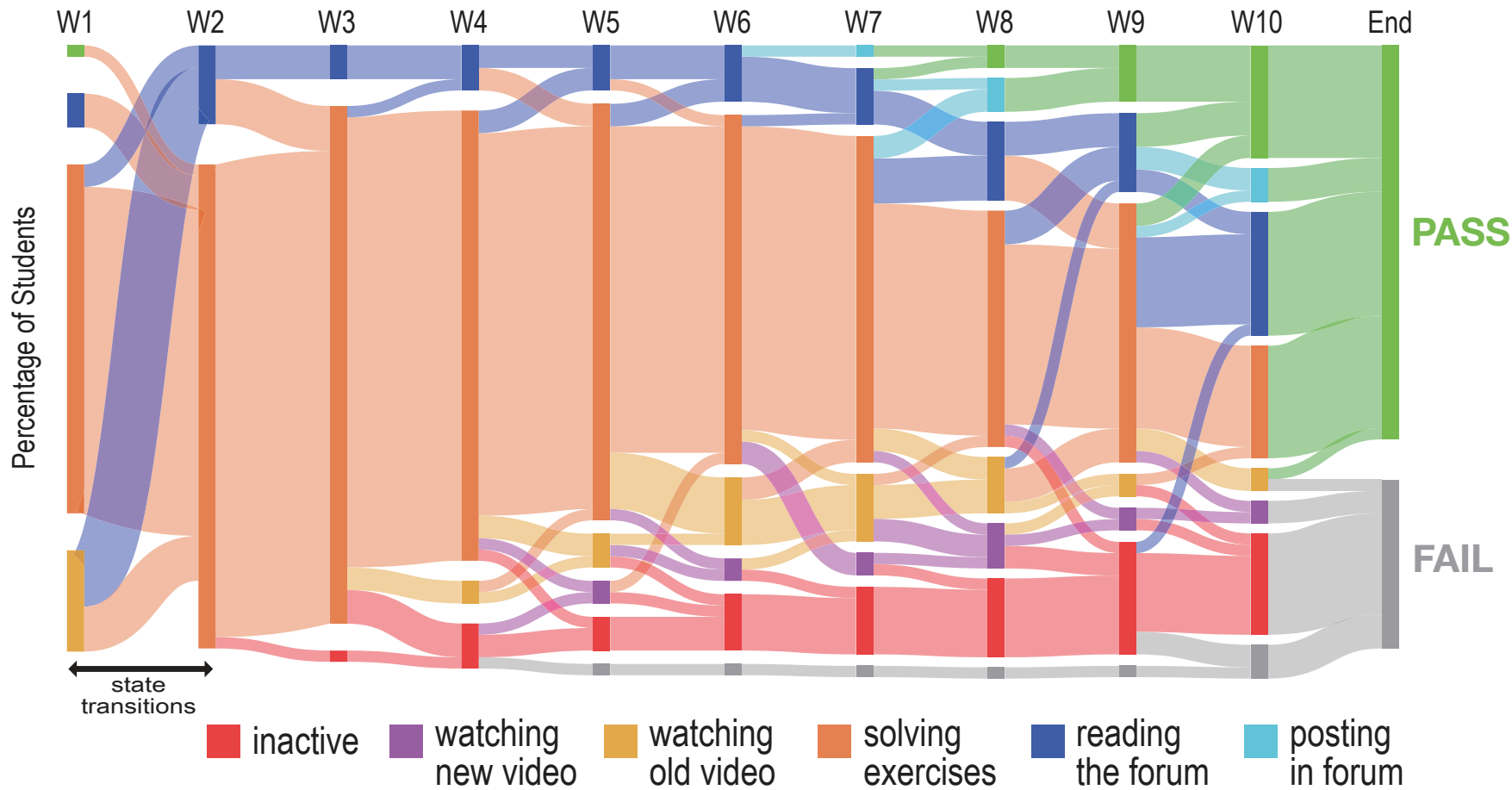
- **Rewatch:** PIPaSbPl, PlSbPaPl, PaSbPlSb, SbSbPaPl, SbPaPIPa, PaPlSbPa
- **Skipping:** SfSfSfSf, PaPlSfSf, PlSfSfSf, SfSfSfPa, SfSfPaPl, SfSfSfSf, SfSfSfSf, SfPaPIPa, PIPaPlSf
- **Clear Concept:** PaSbPlSSb, SSbSbPaPl, PaPlSSbSb, PlSSbSbPa (a combination of SeekBw and ScrollBw clicks, indicating high tussle with the video lecture content)
- **Checkback Reference:** SbSbSbSb, PlSbSbSb, SbSbSbPa, SbSbSbSf, SfSbSbSb, SbPlSbSb, SSbSbSbSb (a wave of SeekBw clicks)

Information Processing

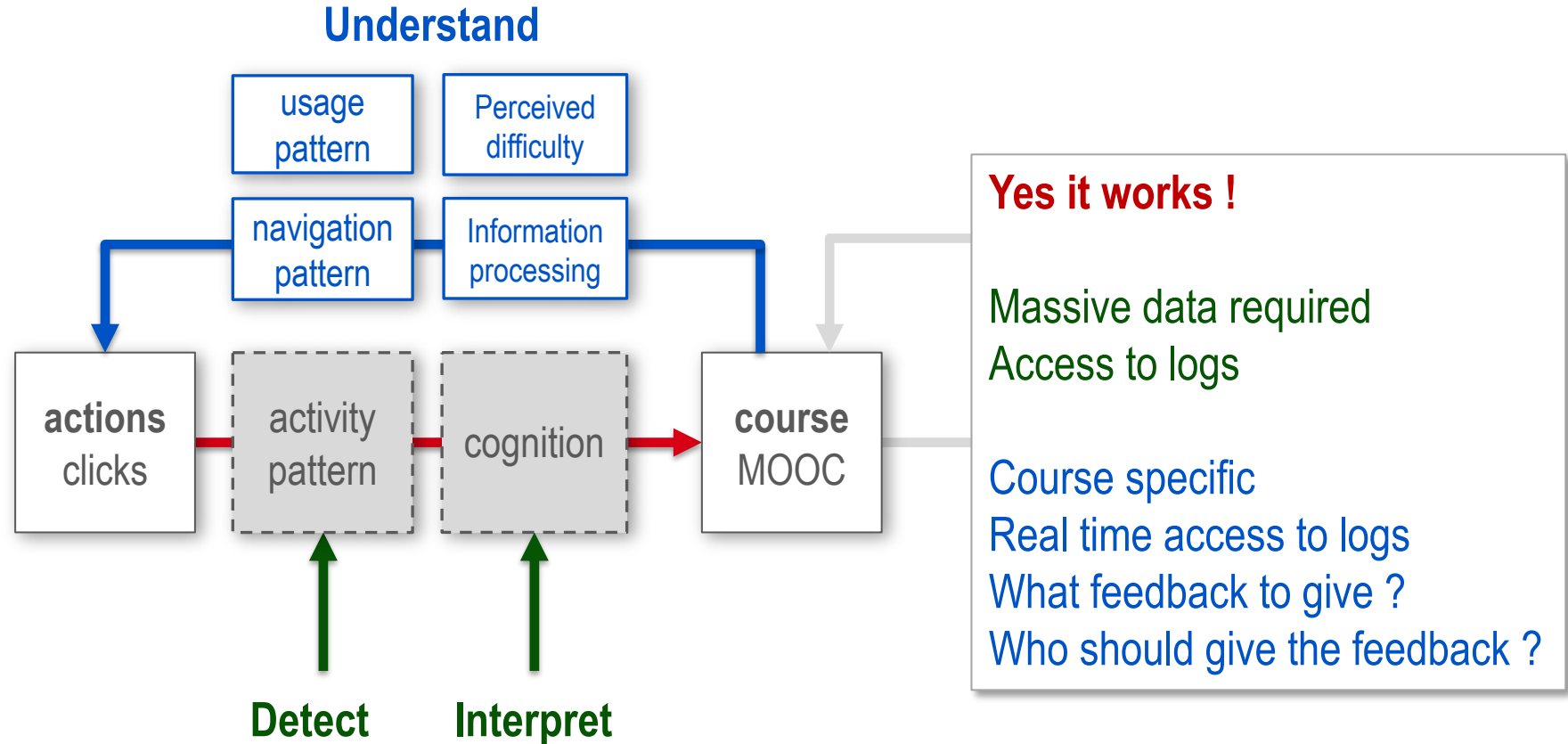
Behavioral Actions	WeightAssign	
Clear Concept	3	High Information Processing
Slow Watching	2	
Rewatch	1	
Playrate Transition	0	
Checkback Reference	-1	
Fast Watching	-2	Low Information Processing
Skipping	-3	

Research Question	Condition	Accuracy	False	Most representative (weighted) features that characterize classes
		Kappa	Negative Rate	
Engagement Prediction	1)Raw Clicks	0.81 0.63	0.24	High (skipping=low, playrate transition=low, rewatch=high, slow watching=low, checkback reference=low, clear concept=high)
	2)Summarized behavioral action vectors	0.75 0.49	0.15	Low (skipping=high, playratetransition=high, rewatch=low, slow watching=high, checkback reference=high, clear concept=low)
Next Click Prediction	1)Raw Clicks	0.68 0.57	-	SeekFw (playratetransition=low, skipping=low, fast watching=high, clearconcept=low)
	2)Summarized behavioral action vectors	0.66 0.54	-	SeekBw (checkbackreference=high, rewatch=low,playratetransition=low, propSeekBw, clearconcept=high) Ratechange fast (playratetransition=high, rewatch=low, checkbackreference=low) Ratechangeslow (playratetransition=high, clearconcept=high)
In-Video dropout Prediction	1)Raw Clicks	0.90 0.69	0.19	Non dropouts (skipping=low, clearconcept=high, slow watching=high, Checkbackreference=low, rewatch=high, engagementfromStart=low, engagementlastClick=high)
	2)Summarized behavioral action vectors	0.90 0.70	0.15	Dropouts (skipping=high, clearconcept=low, slowwatching=low, engagementfromStart=high, rewatch=low, engagementlastClick=low, checkbackreference=high)

Table 3: Performance metrics for our machine learning experiments. Random baseline performance is 0.5 (50%)

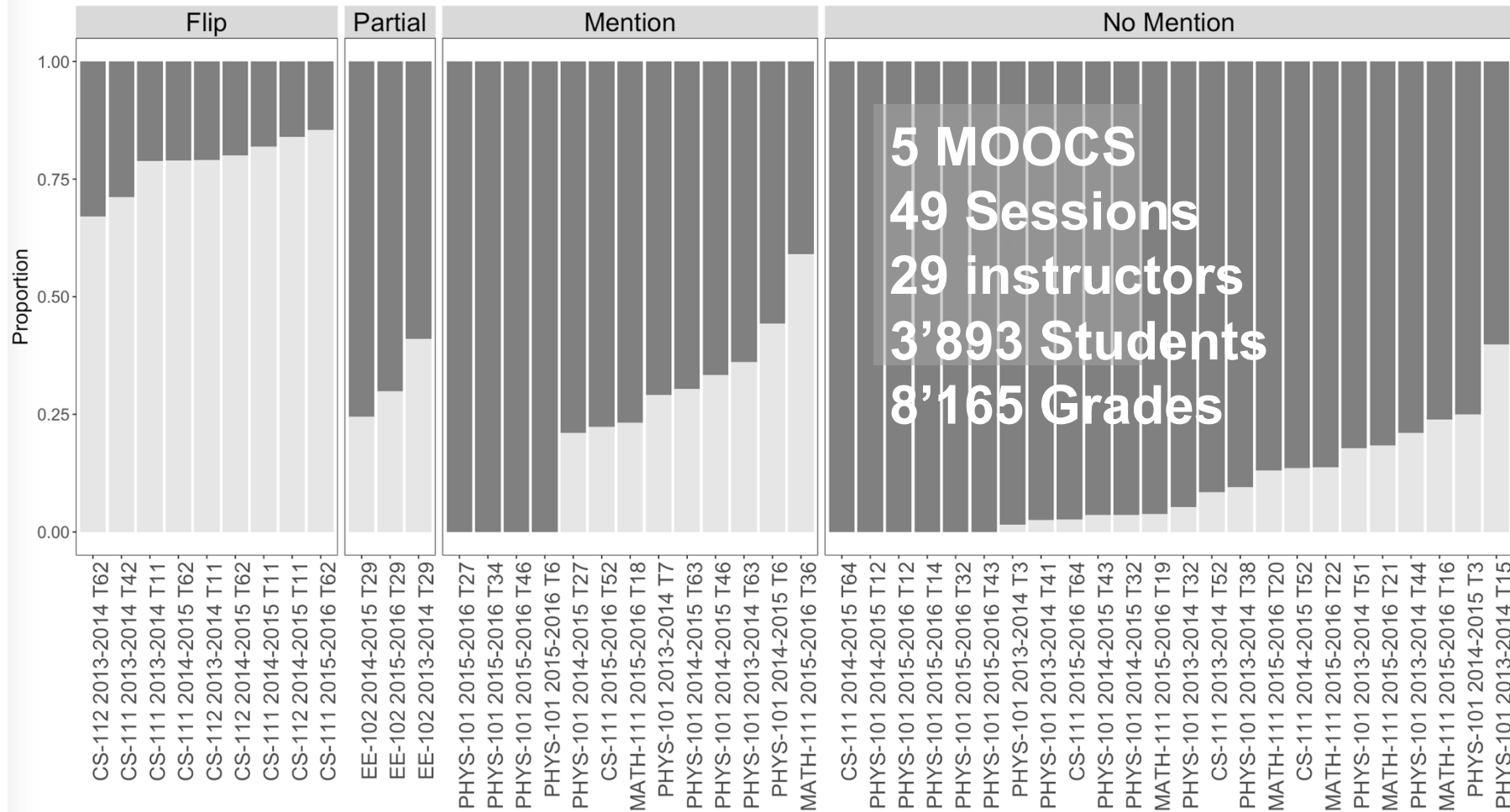


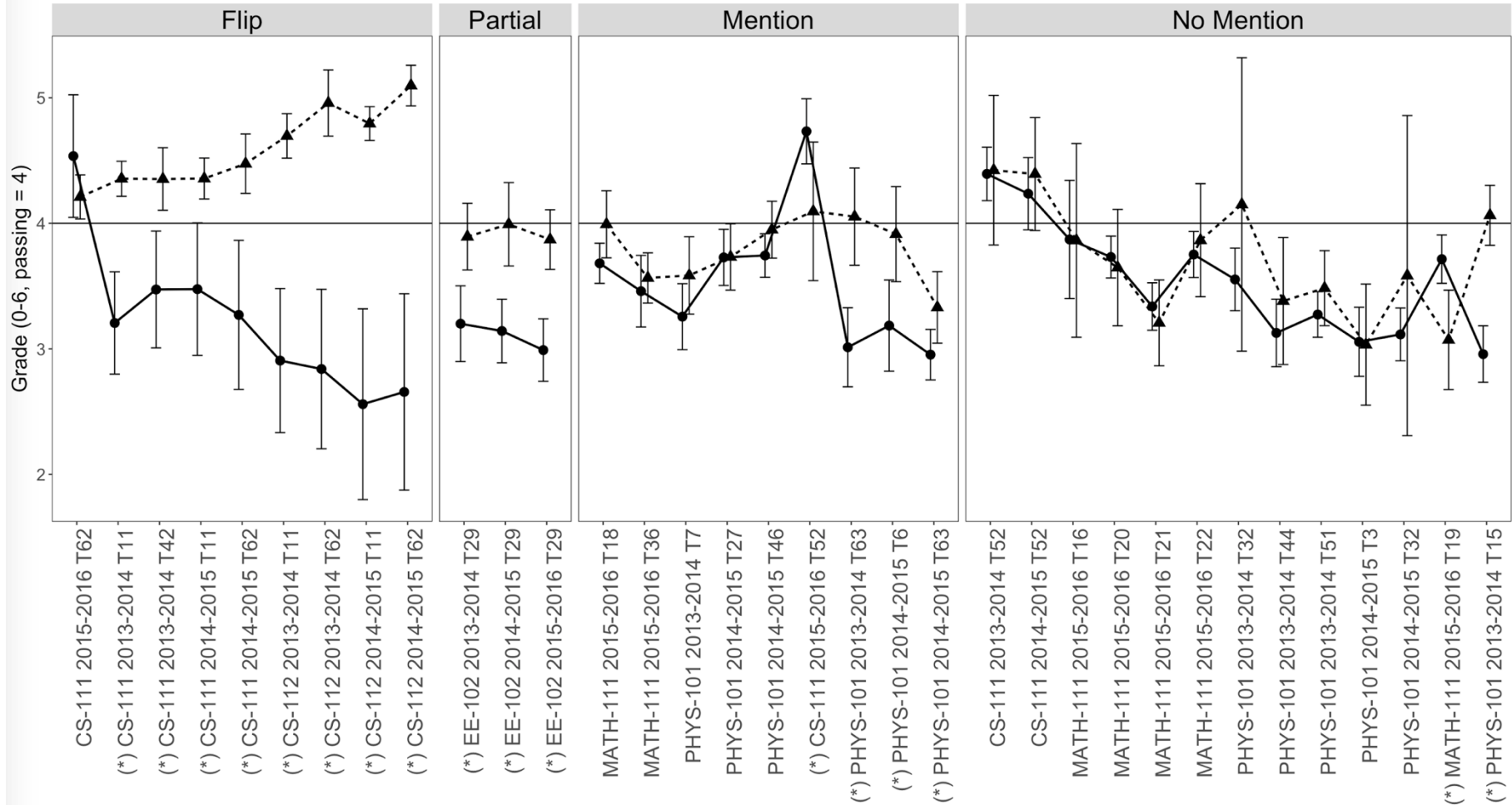
Can we predict MOOC success from clickstreams ?



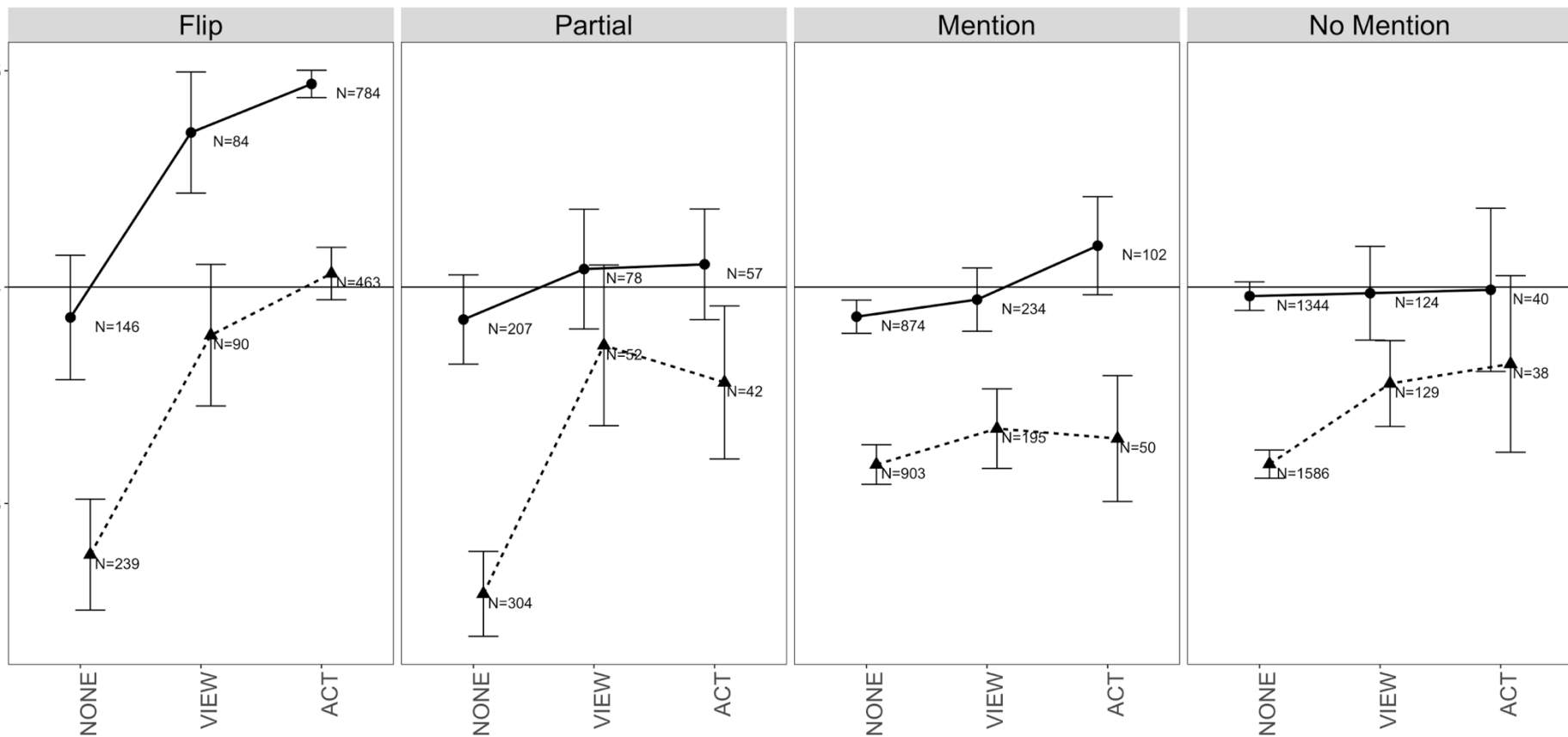
A photograph of three students in a modern office or library setting. A man in a black hoodie is pointing at a laptop screen, while a woman with glasses and a purple shirt look on. The background features large glass windows. A white banner with black text is overlaid on the bottom right.

Do MOOC help succeed in EPFL courses ?

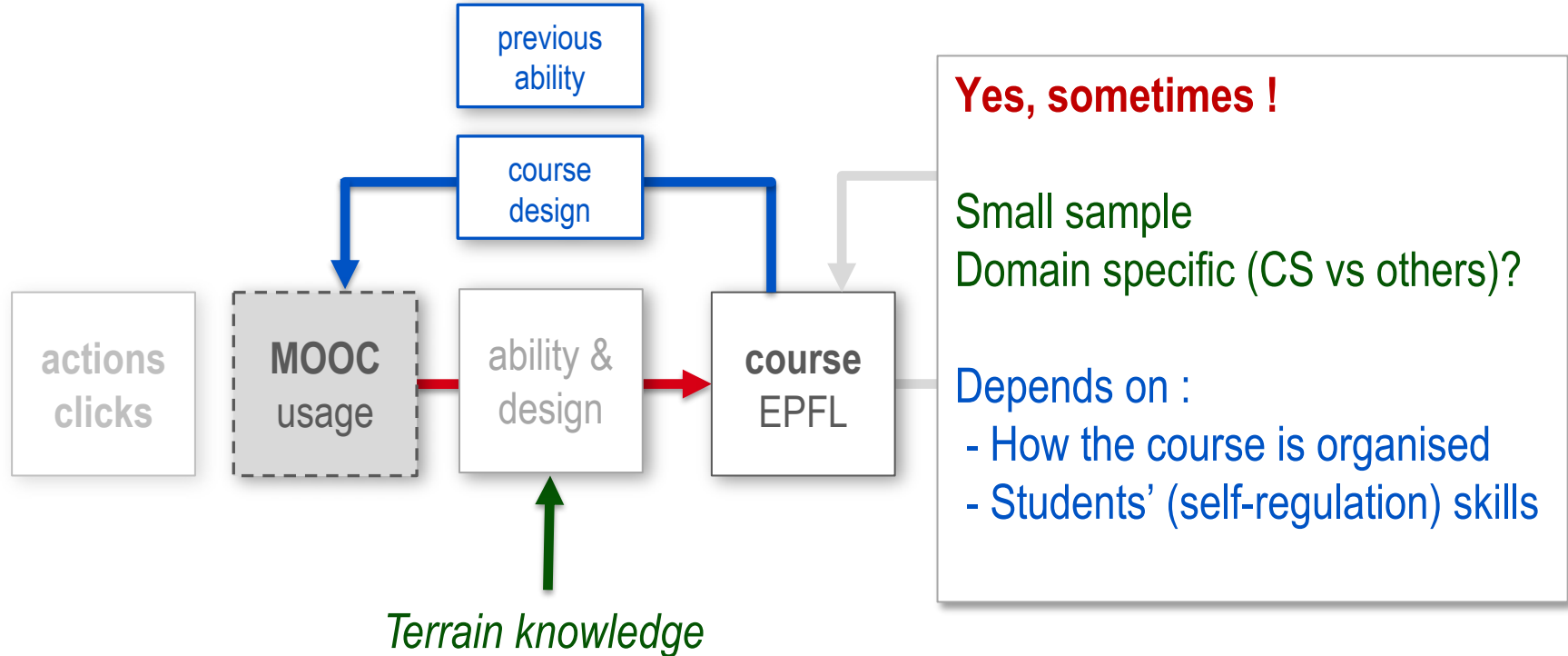


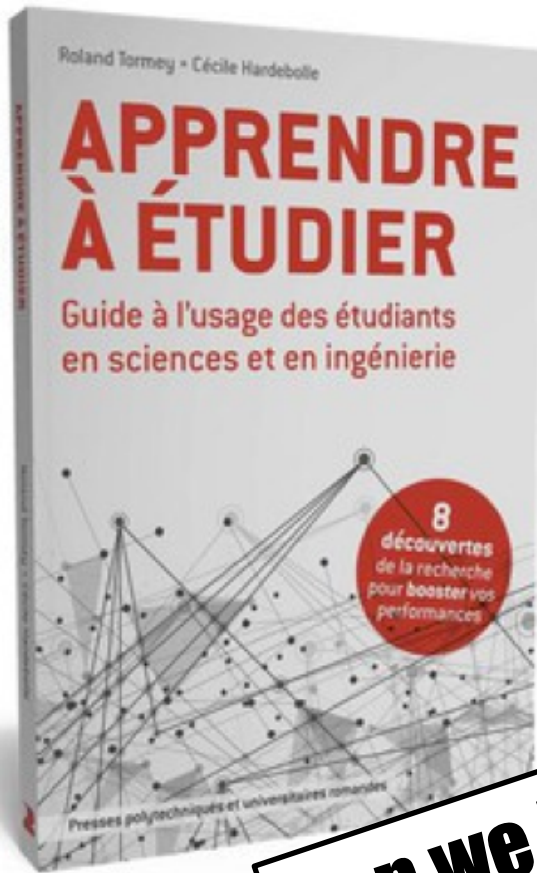


Prior Performance ● High Highschool Score ▲ Low Highschool Score



Do MOOC help succeed in EPFL courses ?



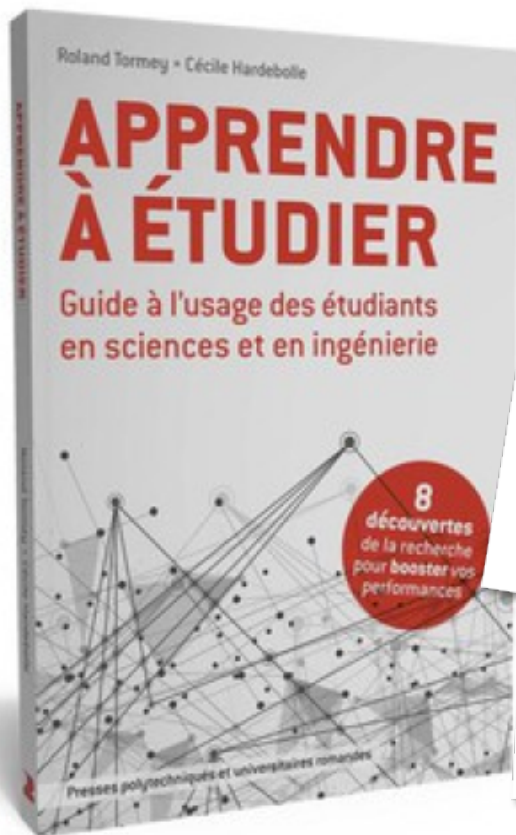


Roland Tormey • Cécile Hardebolle

APPRENDRE À ÉTUDIER

Guide à l'usage des étudiants
en sciences et en ingénierie

Can we improve students' study skills?



Habitude n°1 : Planifier vos différents temps d'étude

Diagnostic personnel

Habitude n°2 : Prendre des notes de façon méthodique

Diagnostic personnel

Les questions

Habitude n°3 : Etre méthodique dans la résolution des exercices

Diagnostic personnel

Les questions ci-dessous vous permettront d'évaluer si vous avez déjà acquis les bonnes habitudes d'apprentissage.

Quand je commence un exercice, je prends le temps d'analyser en détails l'énoncé.

Je liste les différentes méthodes / formules applicables avant de me lancer dans la résolution.

J'écris les étapes de la résolution sans sauter d'étape et en vérifiant que je ne fais pas d'erreur.

A la fin, je vérifie la solution que j'obtiens.

Je reviens à l'énoncé de l'exercice après l'avoir résolu.

Souvent Rarement

☐
☐
☐
☐
☐
☐
☐
☐
☐
☐

Si vous avez obtenu une majorité de « rarement », il est temps de modifier vos habitudes ci-dessous.

Apprendre à étudier en sciences et ingénierie EPFL

ENROLL IN ETUDIER



Les résultats de la **recherche** sur les méthodes les plus efficaces.



La mise en **pratique** concrète de ces méthodes, avec des exemples.






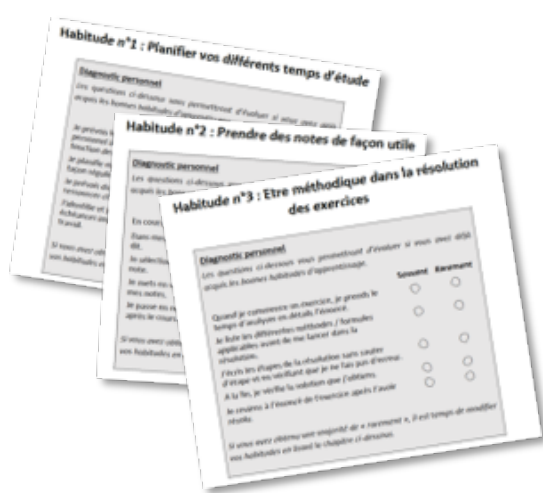
Des "**Personal Analytics**" pour savoir où vous en êtes dans vos méthodes de travail.



Des opportunités de **pratiquer** ces méthodes et recevoir un retour sur votre performance.



 Course Number	Etudier
 Classes Start	Sep 11, 2017
 Estimated Effort	02:00



Habitudes d'apprentissage

Prendre des notes utiles

Réviser ses cours de manière efficace

Se préparer pour les examens

Jugement mental

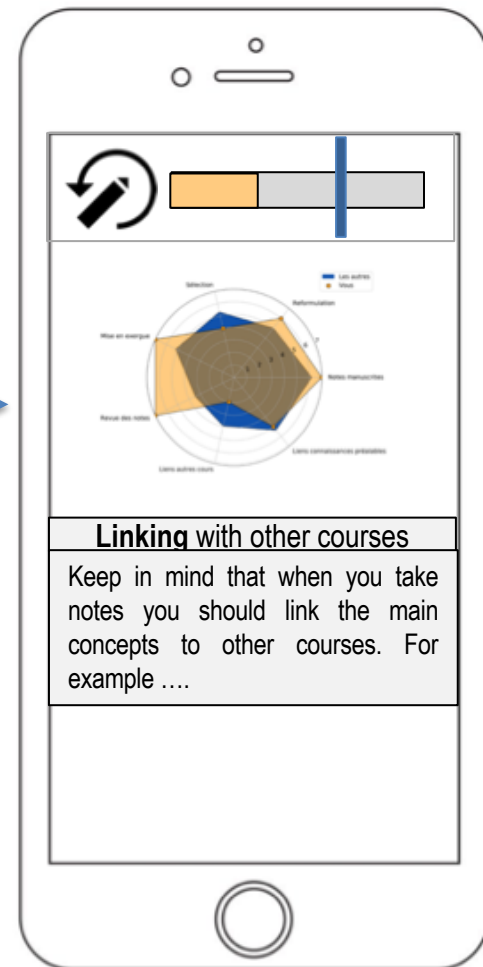
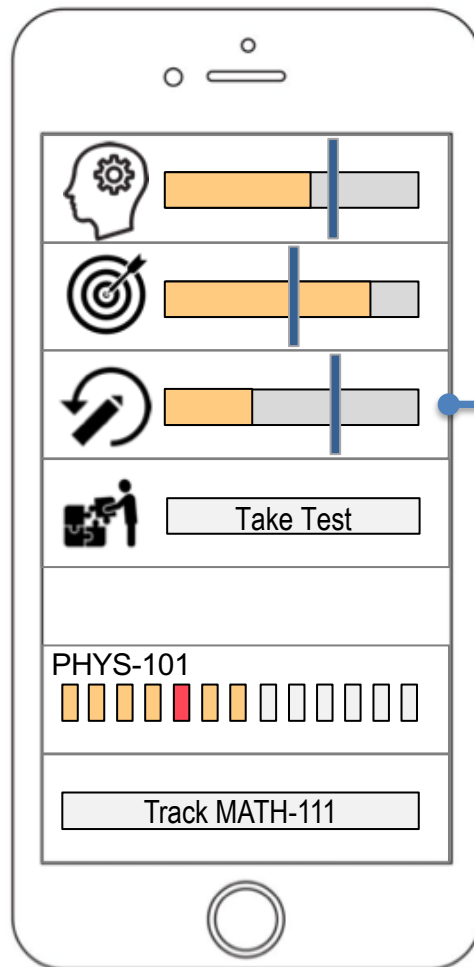
Compréhension

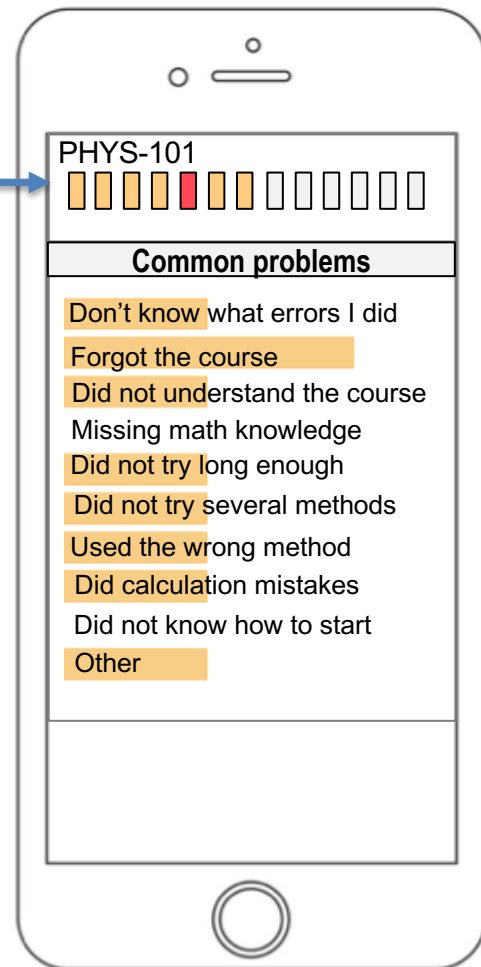
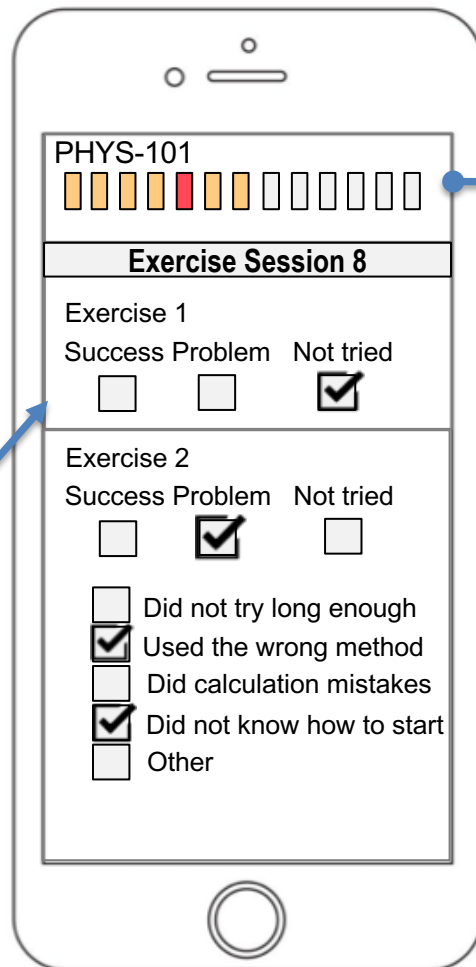
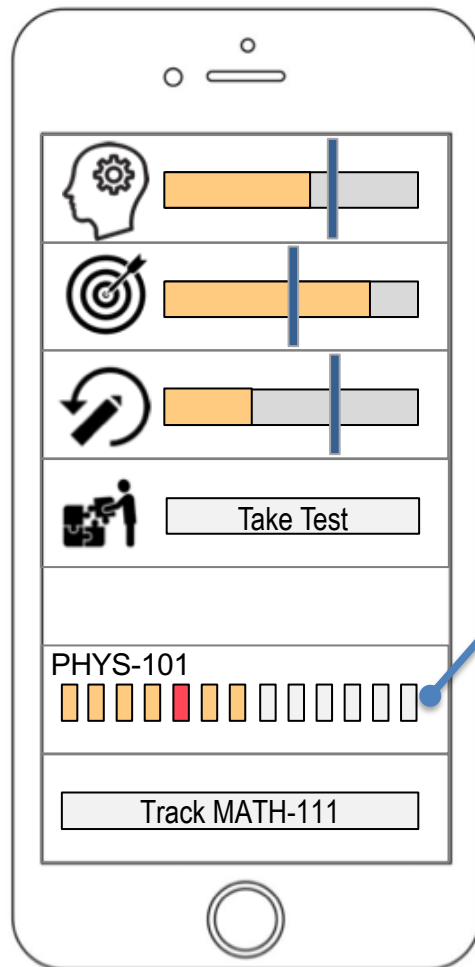
Obtenir de l'aide

Planifier ses différents temps d'étude

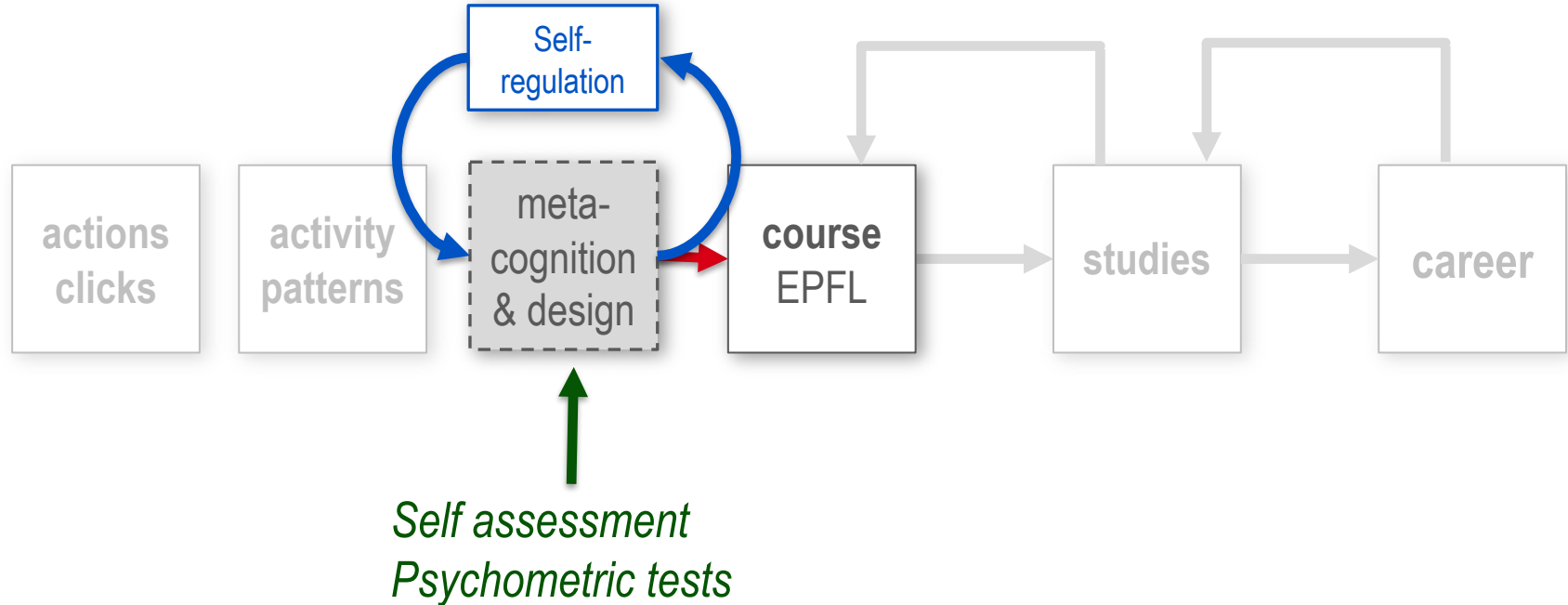
Gérer le Stress

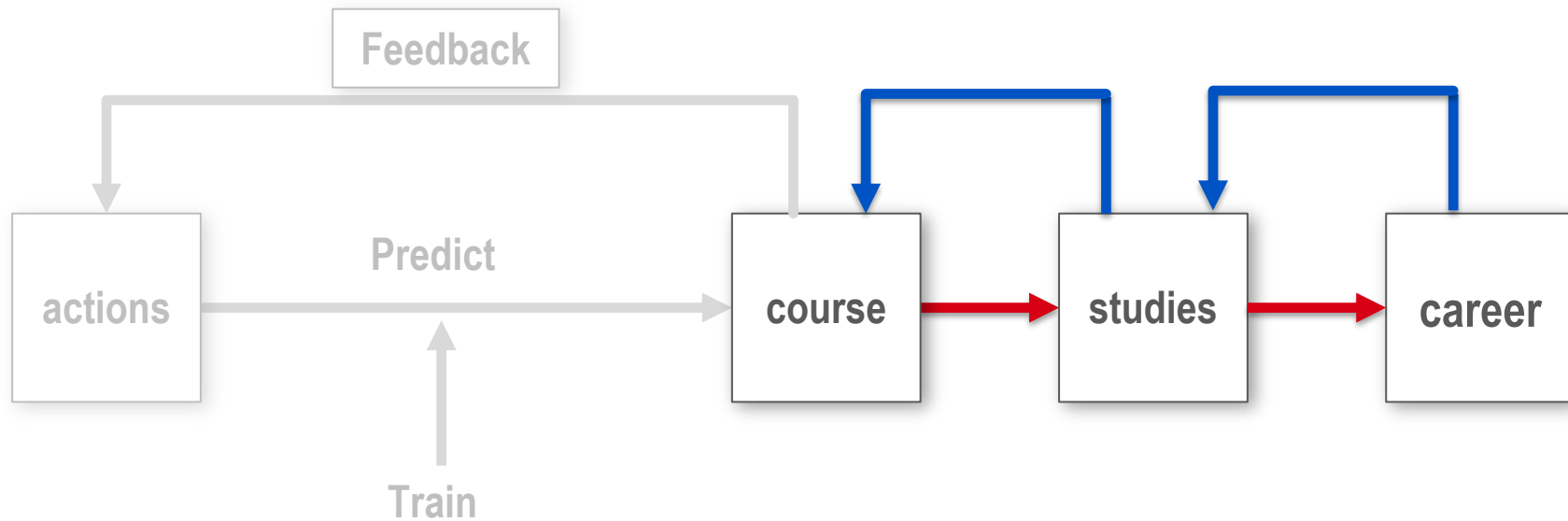
Suivre ses exercices





Can we improve students' study skills ?

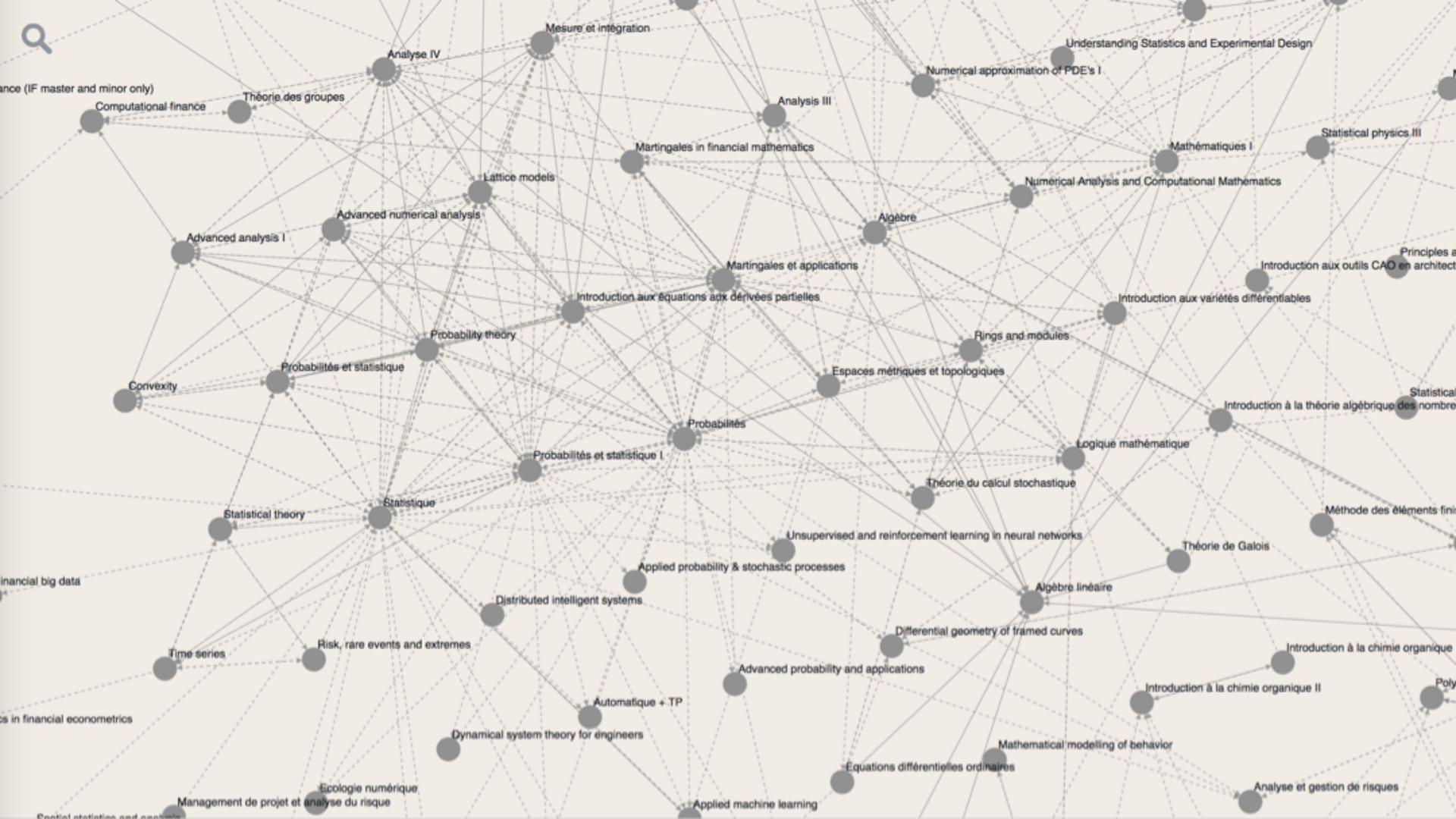






Can we help learners choose the best courses ?







EPFL Course Recommender System

Restart Section ▼ Recommend me courses

Select the courses you took

Name

Accounting for finance

Advanced algorithms

Advanced analysis I

Advanced analysis II

Advanced compiler construction

Advanced computer architecture

Advanced computer graphics

Advanced computer networks and distributed systems

Advanced cryptography

Advanced databases

Advanced derivatives

Advanced discrete mathematics

Advanced multiprocessor architecture

Advanced probability

Advanced probability and applications

Advanced signal processing : Wavelets and applications

Restart Section ▼

Recommendations

Distributed algorithms

Cryptography and security

Foundations of software

Concurrent algorithms

Intelligent agents

Information theory and coding

Advanced computer graphics

Program parallelization on PC clusters

Biometrics

Distributed intelligent systems



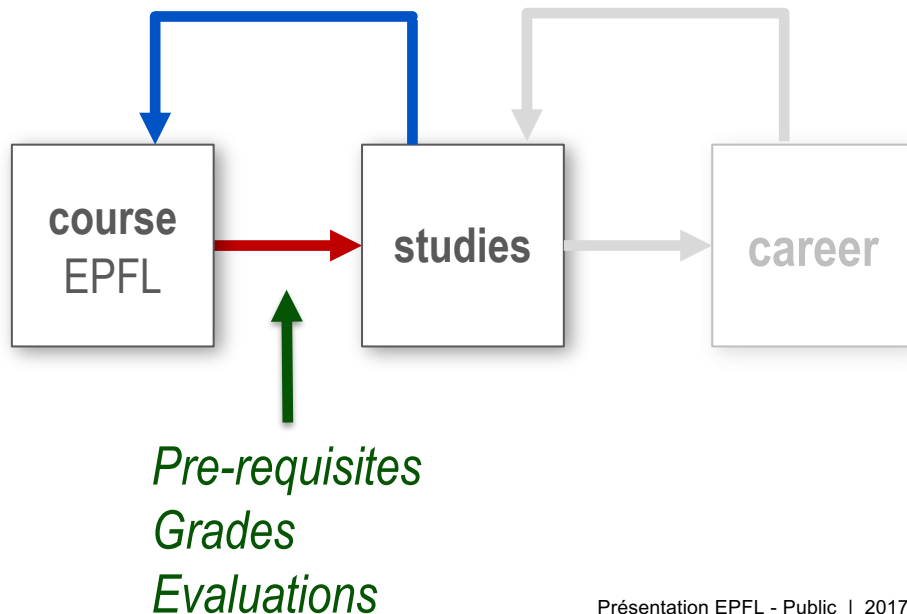
Can we help learners choose the best courses ?

Decent accuracy 66% chance that a student picks one of the top 3

Data Privacy

Recommender system :

- self-selection vs. institutional selection
- What are we optimizing ?
easy | useful | interesting



ALL

Admin. / HR / Consulting / CEO

Banking / Insurance

Catering / Food / Tourism

Chemical / Pharma / Biotechnology

Construction / Architecture / Engineer

Electronics / Engineering / Watches

Finance / Trusts / Real Estate

Graphic Art / Typography / Printing

Information Technology / Telecom

Machine / Plant Engin. / Manufacturing

Marketing / Communications / Editorial

Medicine / Care / Therapy

Public Admin. / Education / Social

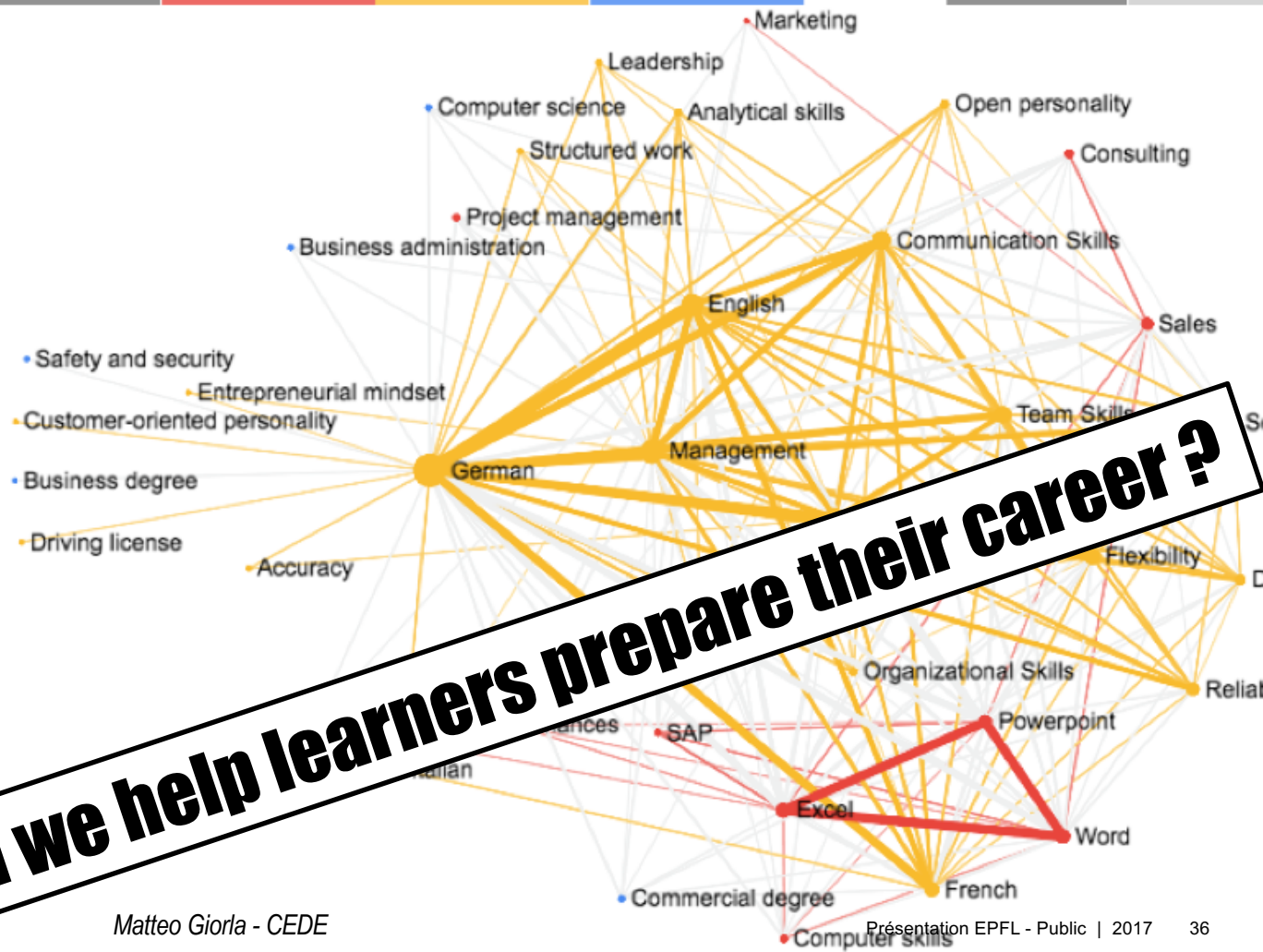
Purchasing / Logistics / Trading

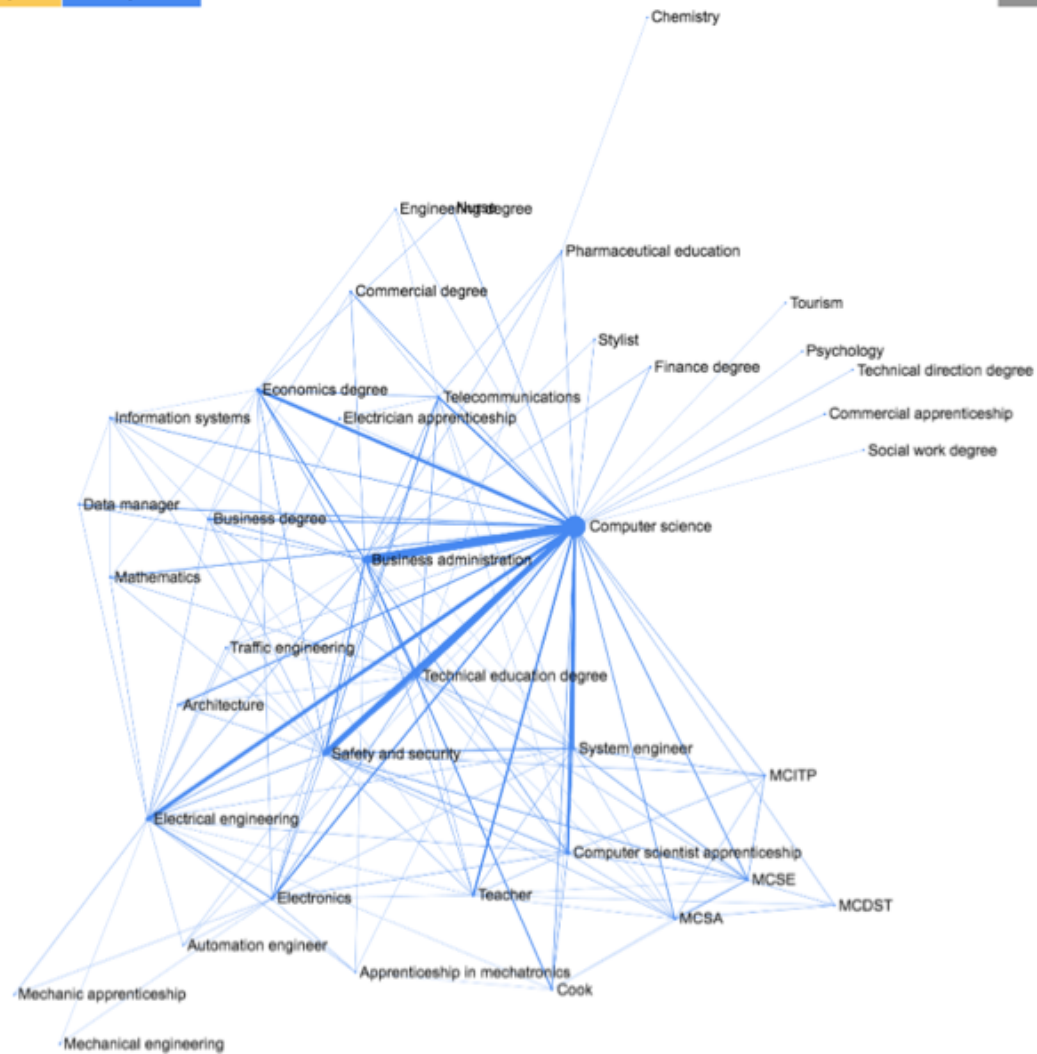
Sales / Customer Service / Admin

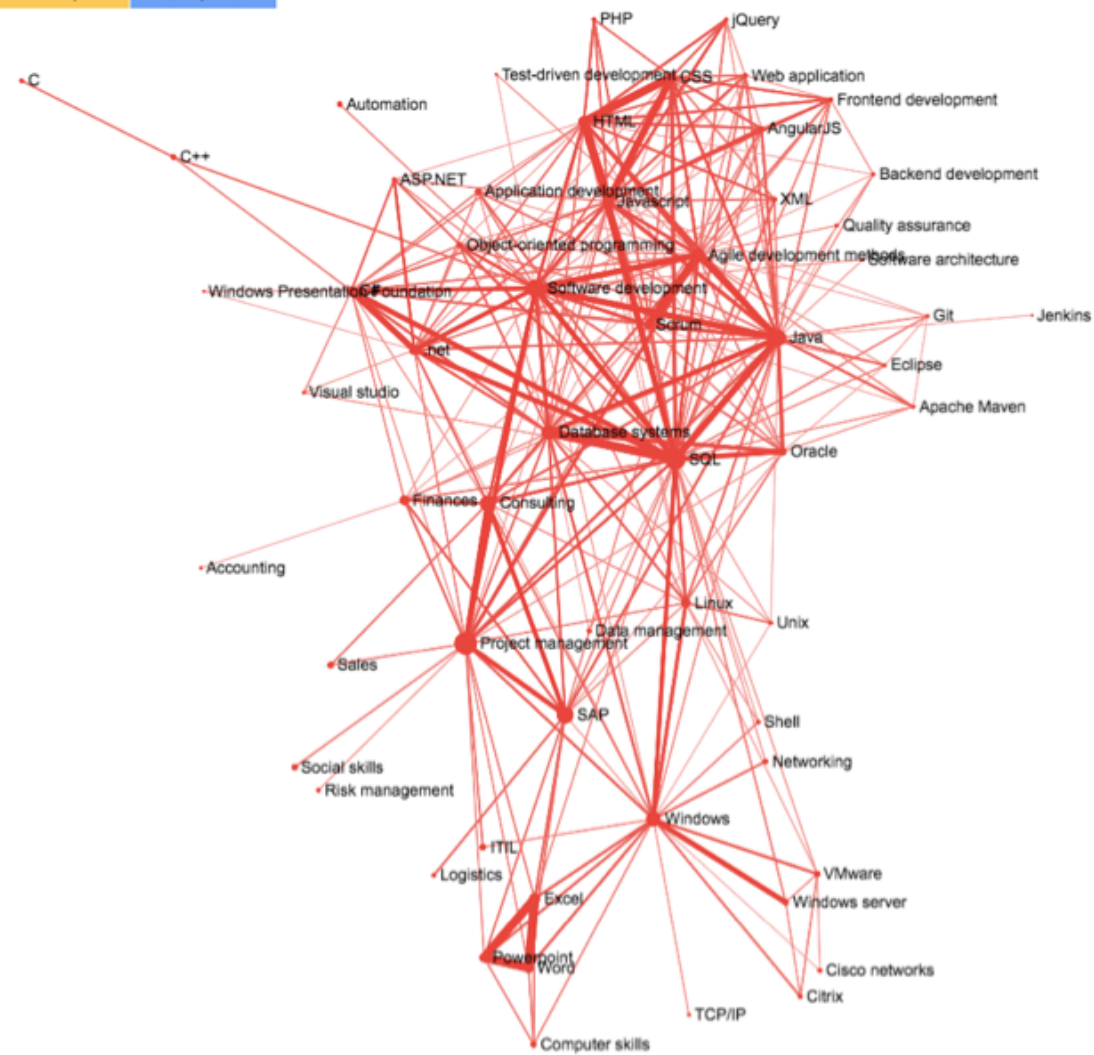
Sport / Spas and Wellness / Culture

Surveillance / Police / Customs /

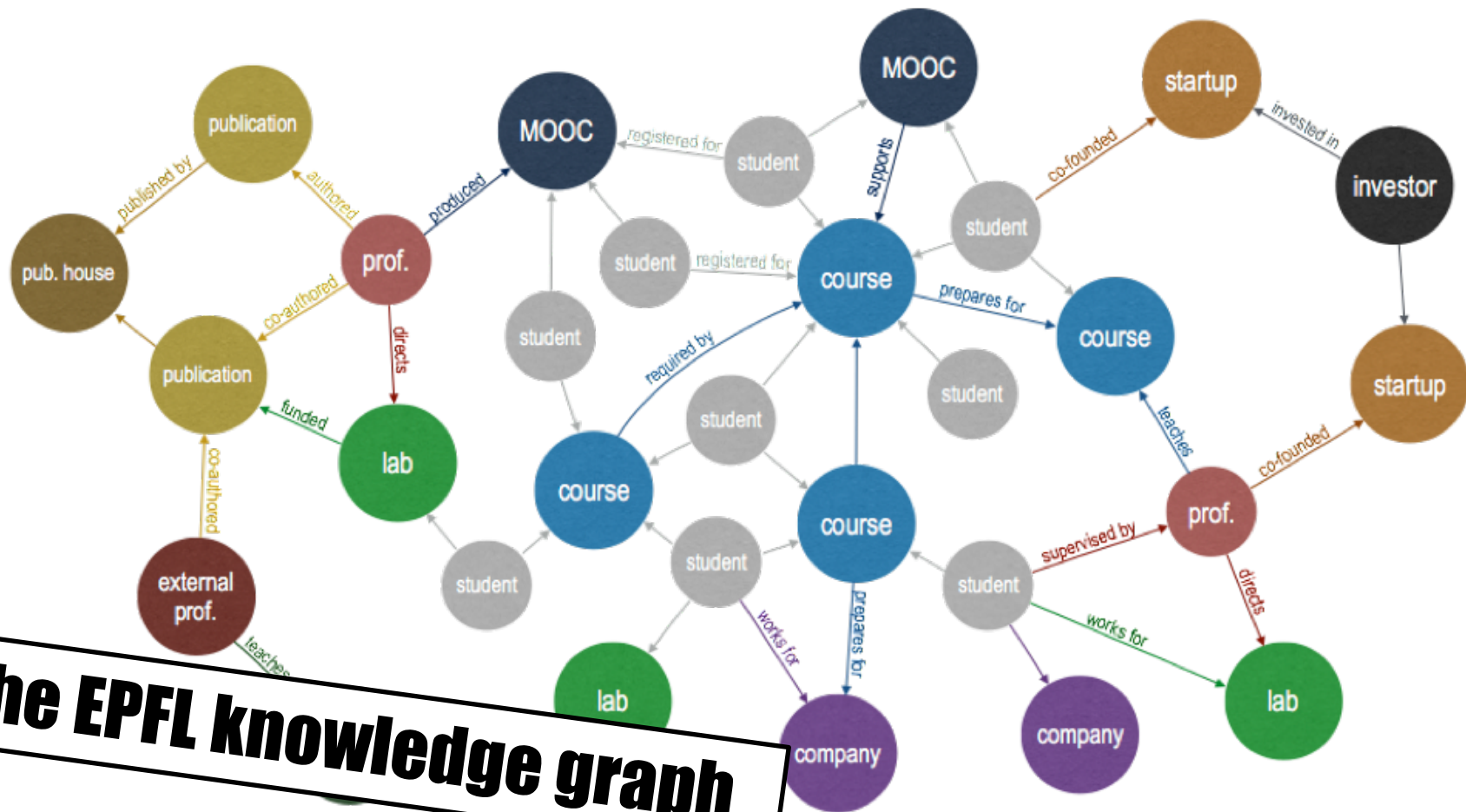
Vehicles / Craft / Warehouse / Tran







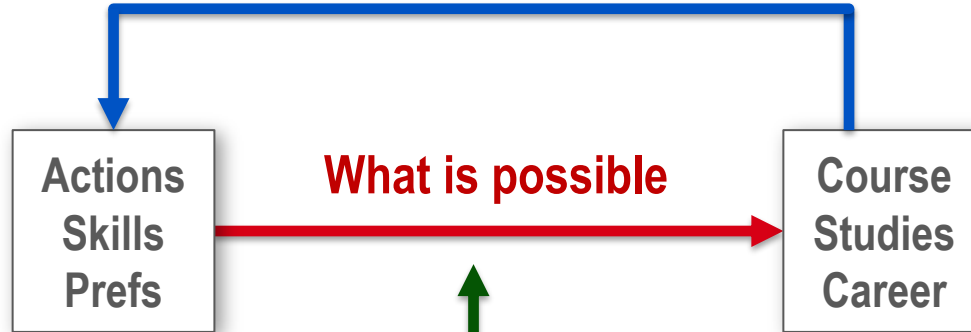




The EPFL knowledge graph



What is good ?



Data

Data Data

Data Data Data

Data Data Data Data

Data Data Data Data Data

NDA

CONFIDENTIALITY DECLARATION

Concerning the access of Personal Identifiable Information
For a research project
by

(hereinafter referred to as the "EPFL-Unit")
The Federal Act on Data protection¹ (FADP) requires strict confidentiality to be respected at all times regarding
Personal Data.

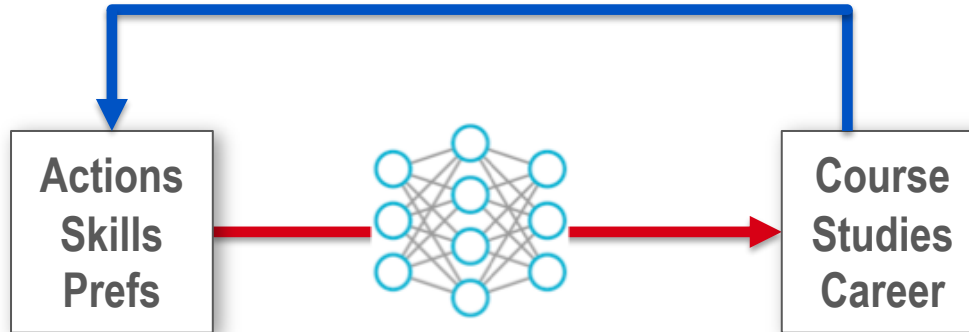
CEDE-EPFL recorded the following teaching and learning personal data:

- a) Course choices and **achievement record (IS-Academia)** as the final grade
- b) **Current employment and career history record (A3 database)**

(hereinafter referred to as the "Data").

Considering that the EPFL-Unit is likely to be interested in the Data mentioned below, CEDE-EPFL discloses the Data to the EPFL-Unit in order to enable the EPFL-Unit to carry out its research project.

Computational thinking ...



Die digitale Volkshochschule

Ein neues Bildungsangebot an der ETH Lausanne vermittelt man zukünftig in Beruf und Gesellschaft benötigt gibt keine Zugangsvoraussetzungen

Die Digitalisierung der Arbeitswelt ist das Schlagwort der Stunde. Gerade diese Woche ist ein Bericht des Staatssekretariats für Wirtschaft (Seco) erschienen, der die Folgen der Digitalisierung für verschiedene Berufsfelder untersucht. Fazit: Durch den technologischen Wandel sollten in der Schweiz mehr neue Jobs zum Beispiel für Analysten oder Programmierer entstehen, als etwa in der Textilindustrie oder im Detailhandel verloren gehen. Arbeitslosigkeit drohe vor allem dann, wenn sich die Menschen zu wenig weiterbildeten und ihre Kenntnisse nicht mehr den gesuchten Qualifikationen entsprächen.

«Der digitale Tsunami rollt nicht an, wir stecken bereits mittendrin», sagt Martin Vetterli, Präsident der ETH Lausanne (EPFL). Und weil seine Hochschule bei technologischen Entwicklungen mit gesellschaftlicher Relevanz seit Jahren an vorderster Front dabei ist, bringt jetzt die EPFL ein Weiterbildungsangebot auf den Markt, das in dieser

Extension School jetzt ändern. «Wir wollen unseren Teilnehmern vermitteln, wie Daten analysiert oder digitale Apps gebaut – das alles mit dem Gütesiegel EPFL», sagt Salathé.

Anders als bei einem klassischen Bildungsprogramm an einer Hochschule, das es in der Regel einen Erstabschluss braucht, müssen die Teilnehmer der Extension School keinerlei formale Bedingungen erfüllen oder gar Diplome vorweisen. Teilnehmen kann, wer sich den Kurs zutraut. Zudem gibt es für die fortgeschrittenen Programme ECTS Credits – Punkte zur Anerkennung von Studienleistungen im Bologna-System – sowie ein offizielles Zertifikat: das an

Nationaler Digitaltag

Was Blockchain mit Gärtnern zu tun hat

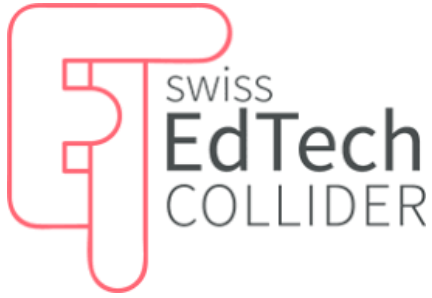
<http://exts.epfl.ch>

Enabling everyone to learn the skills necessary to benefit from the opportunities of the digital age

Are you ready for the jobs of tomorrow?
Industry experts say

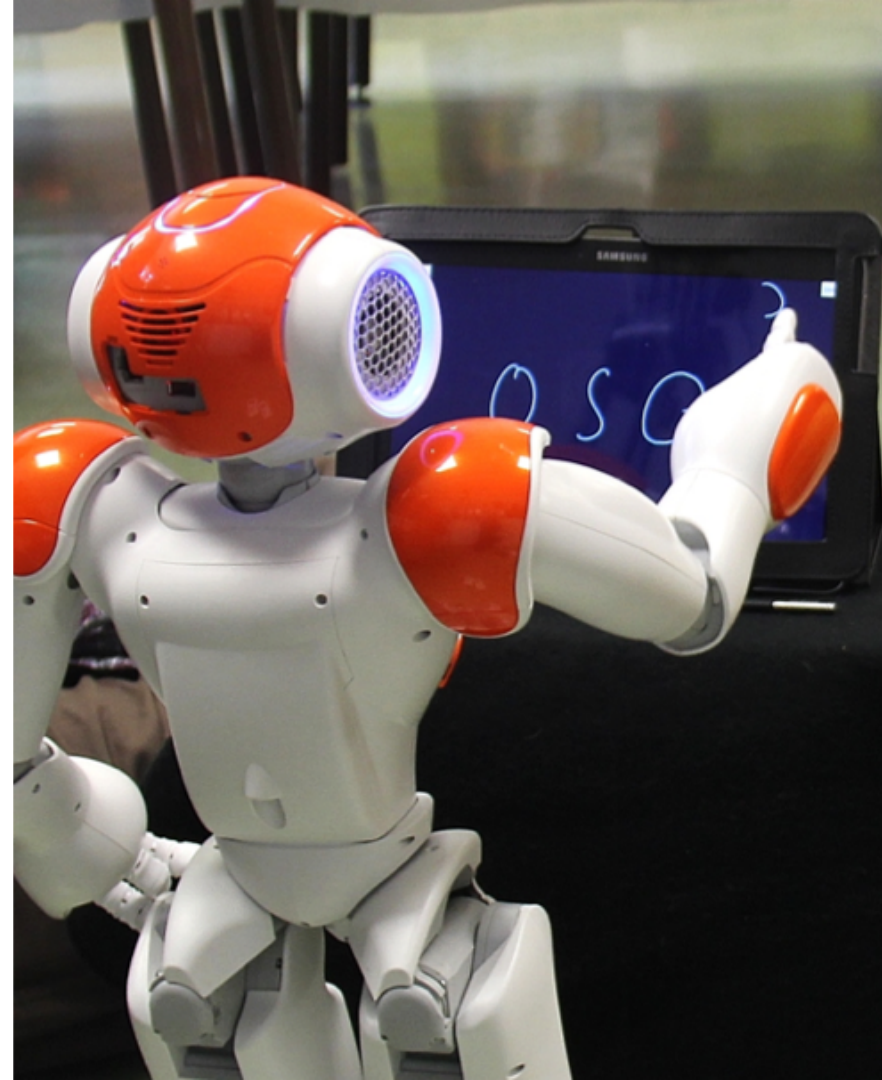
Are your courses & programs right for you?
These questions to find out

Are digital skills important for your career?
Our career forecasts



**Switzerland's first collaborative space
dedicated to ambitious entrepreneurs
transforming education and learning
through technology.**

> 60 education startups!





ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

LEARN

**Center for
The Learning Sciences**