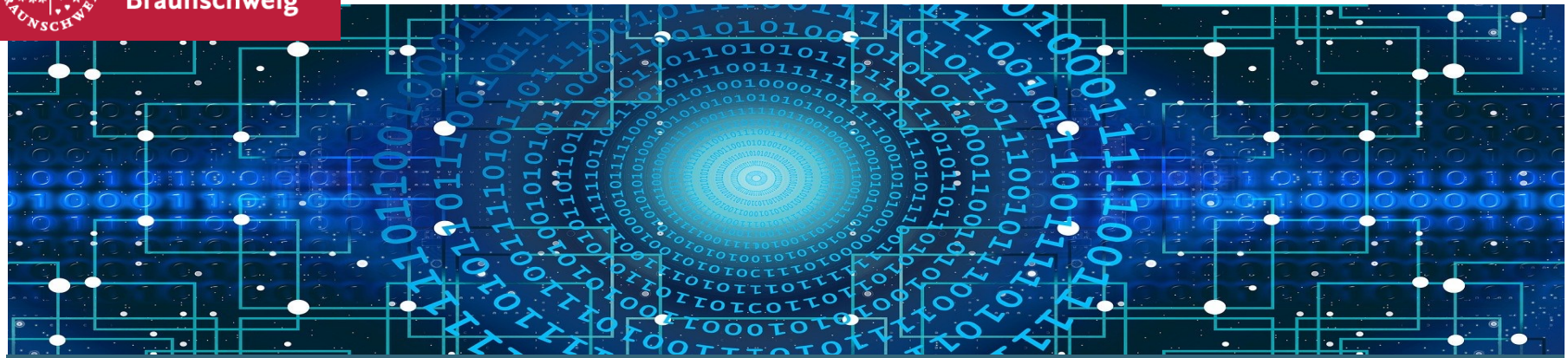
Technische Universität Braunschweig

KI 4 ALL

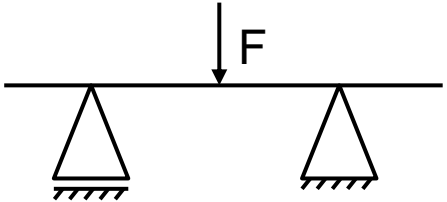


Mechanics goes data – between opportunities and overload

Henning Wessels, Pamela Bogdanow

The Challenge: Structural Health Monitoring

reality

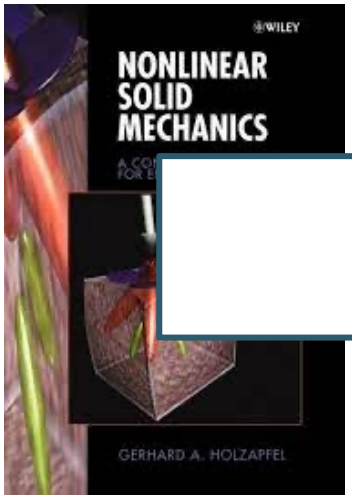


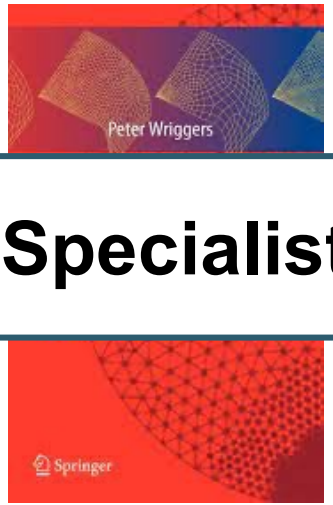
model

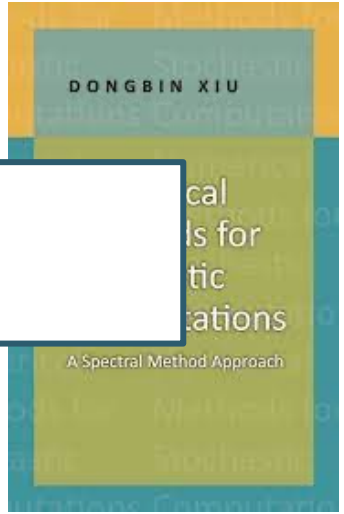
data

Interdisciplinary Research Requires Interdisciplinary Teaching

Mechanics & Numerics & Machine Learning & Uncertainty Quantification







Specialist competences

Interdisciplinary teaching must explain linkages:

What do these disciplines have in common?

Open Sourced Intelligence & Research Software Engineering

Google "We Have No Moat, And Neither Does OpenAI"

Leaked Internal Google Document Claims Open Source AI Will Outcompete Google and OpenAI

DYLAN PATEL AND AFZAL AHMAD

4 MAY 2023 · PAID

While our models still hold a slight edge in terms of quality, the gap is closing astonishingly quickly. Open-source models are faster, more customizable, more private, and pound-for-pound more capable. They are doing things with $100 and 13B params that we struggle with at $10M and 540B. And they are doing so in weeks, not months. This has profound implications for us:

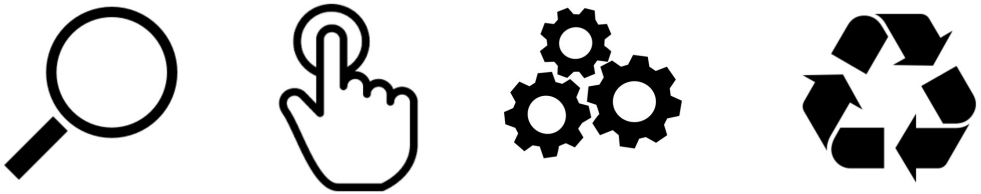
We are quit successful at the moment

… but will we be in future?

Source: https://www.semianalysis.com/p/google-we-have-no-moat-and-neither

Open Sourced Intelligence & Research Software Engineering

Findable Accessible Interoperable Reusable



git docker

Nowadays required by

DFG
Deutsche Forschungsgemeinschaft

who is funding projects like

Suresoft
SUSTAINABLE RESEARCH SOFTWARE

Methodological competence

Source: https://www.semianalysis.com/p/google-we-have-no-moat-and-neither

Starting Point: Mechanical and Civil Engineering Curricula

Bachelor

- Statics
- Mechanics of materials
- Dynamics

Master

- Continuum, Solid & Fluid Mechanics
- Finite Elements (Numerics)

Machine Learning

Neural networks

Optimization

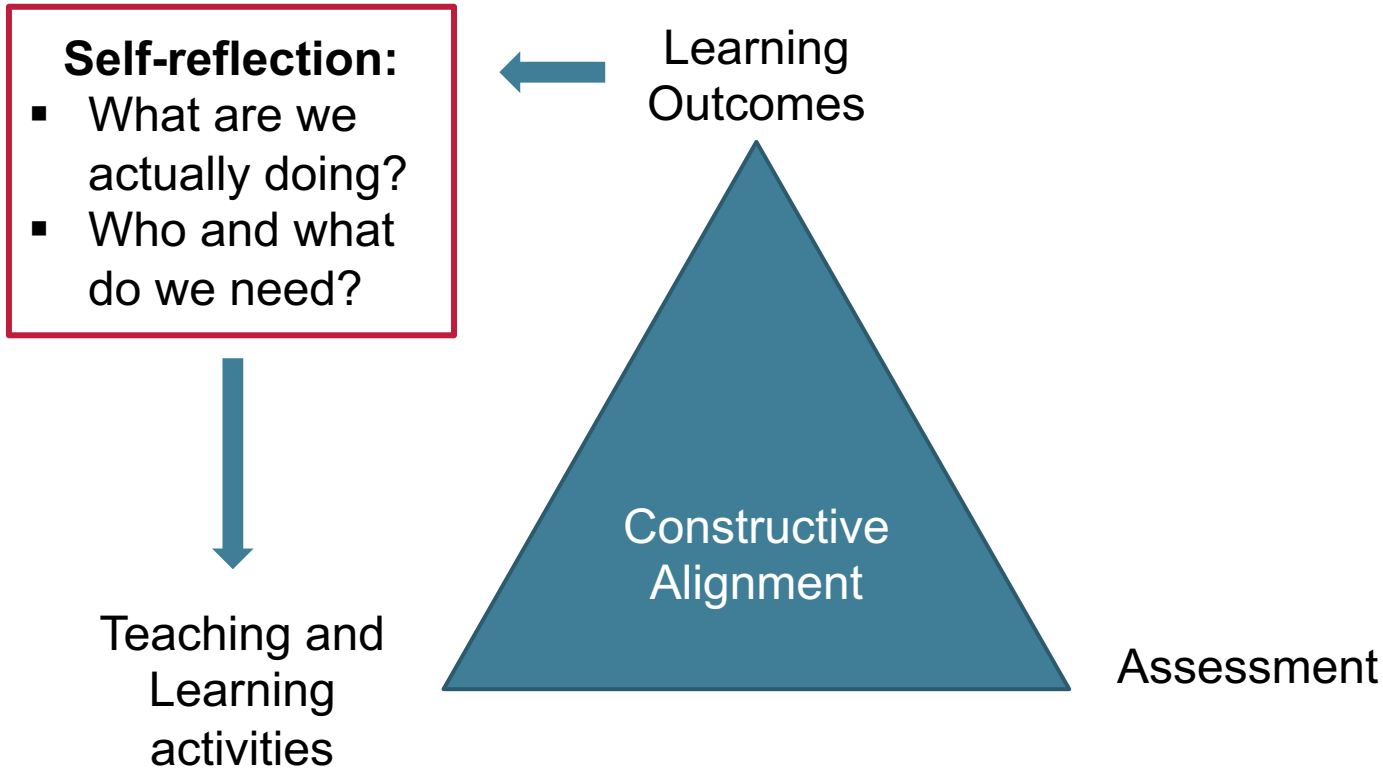
Bayesian ML

Classification

Reduced Order Modeling

"A bouquet of methods that have been developed during the past decades"

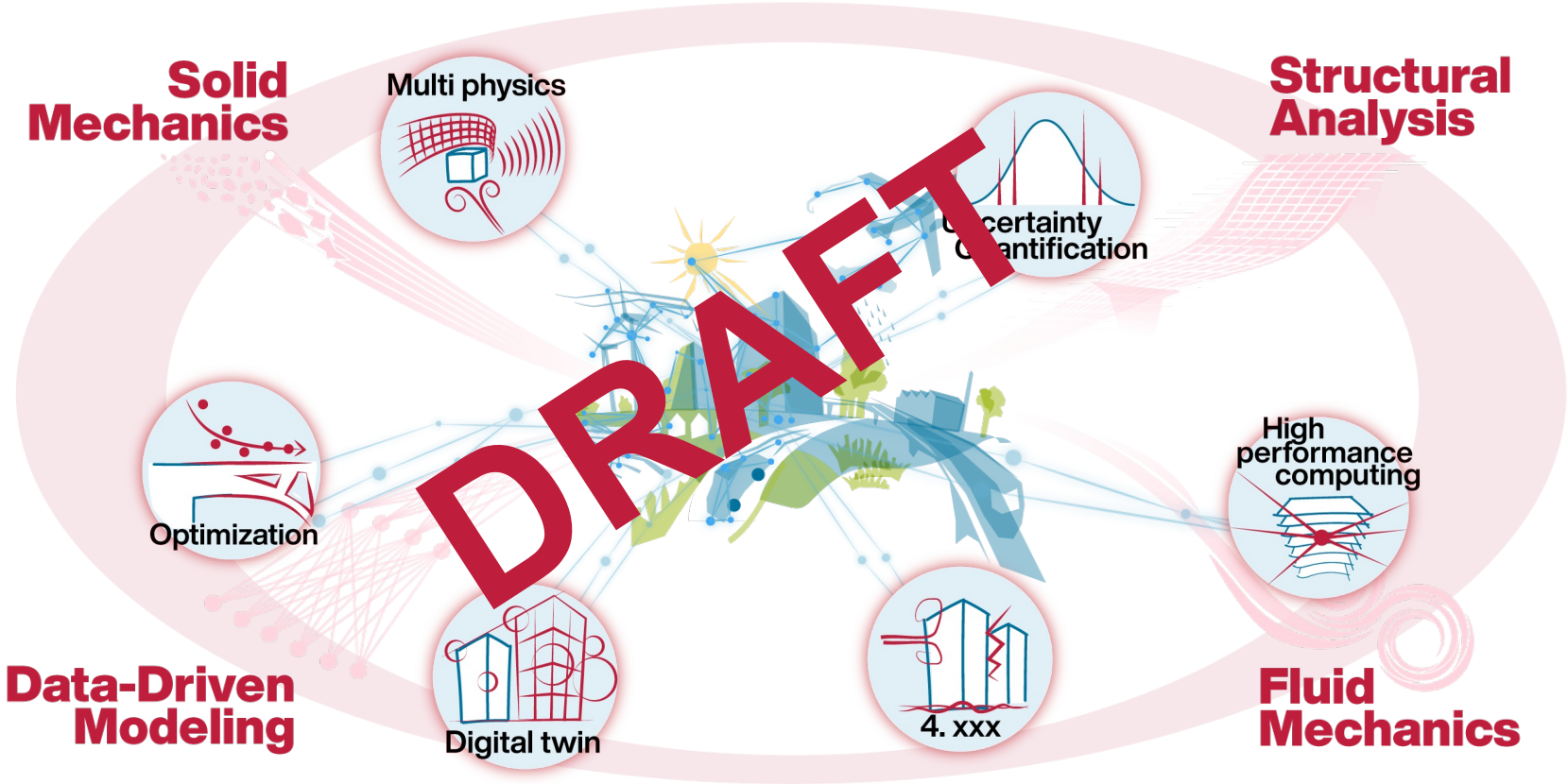
Constructive Alignment



Source: John Biggs, *Enhancing teaching through constructive alignment*, in: Higher Education 32 (1996), 347–364.

Constructive Alignment Computational Engineering

Constructive Alignment Computational Engineering

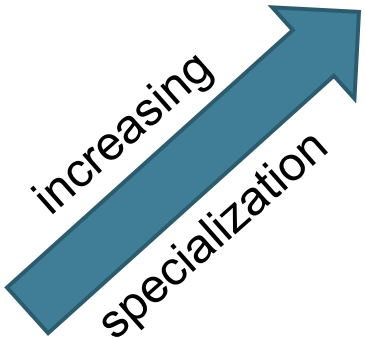


Research-Led Learning:
Master Course Data-Driven Material Modeling

You might have already heard about it – anyways, here you get a condensed overview

Introduction to

- Continuum Mechanics
- Finite Elements
- Machine Learning



Interdisciplinary linkage

- Constitutive modeling with neural networks
- Physics-informed neural networks

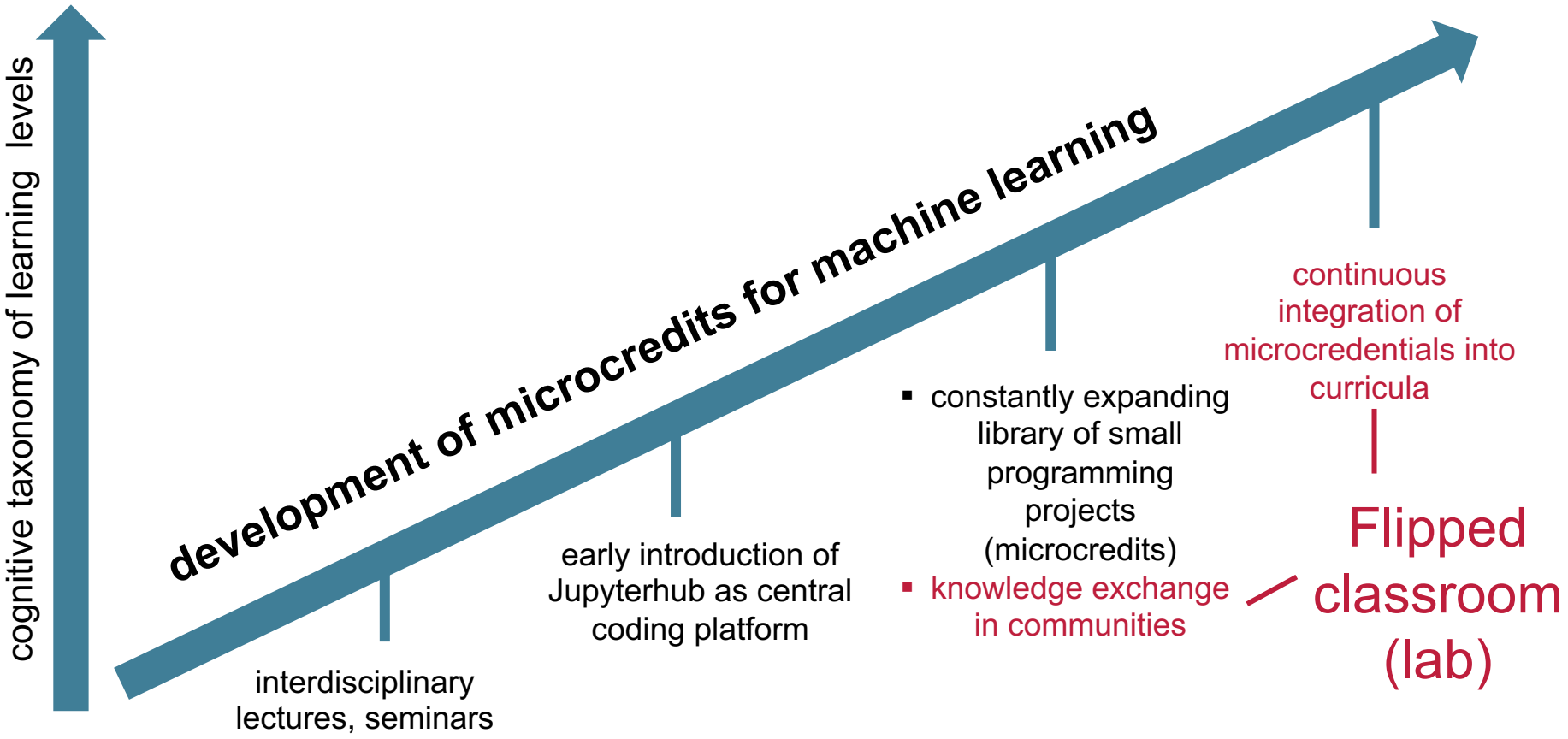
Basically learned all you need before – now it's all about innovative combinations!

Microcredits

- 0.25 – 1 ECTS
- Coding on Jupyterhub
- Exchange of materials
- Learning in communities (lab)

https://ki4all.gitlab-pages.rz.tu-bs.de/hub/content/index.html

Microcredits for Machine Learning



Summary

Machine Learning & Didactics

“A bouquet of methods that have been developed during the past decades.”

1. **Learning from didatics** of mathematics: Roadmap “Teaching in Computational Engineering”?

2. **The conflict between teaching for industry or science fades in interdisciplinary research & teaching**