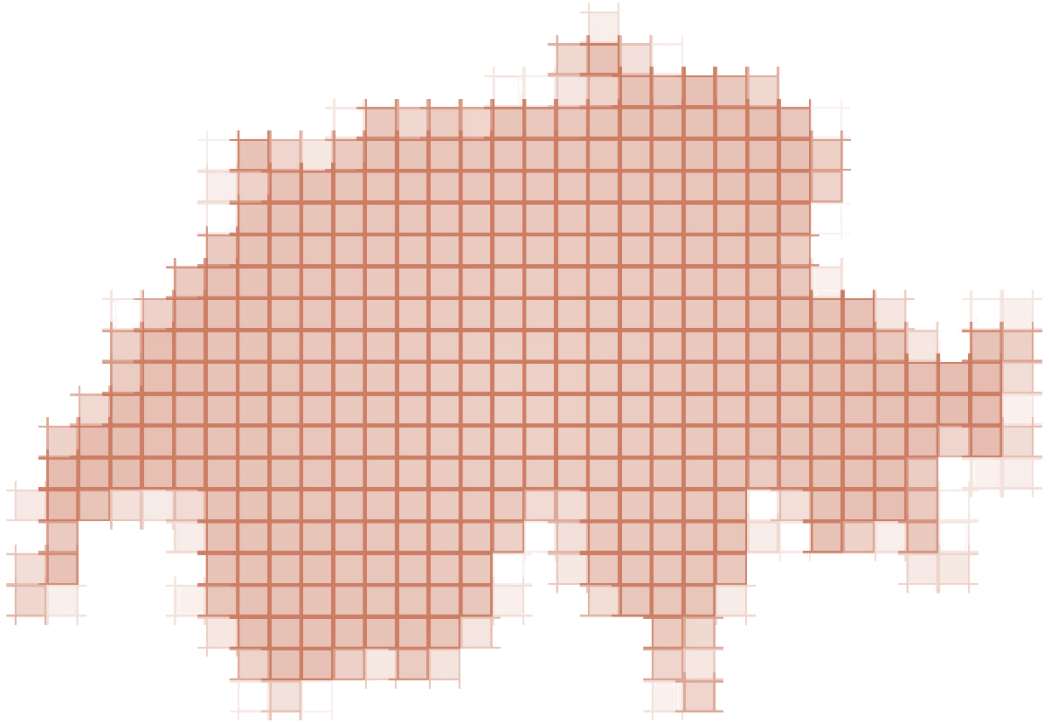
Zürcher Hochschule
für Angewandte Wissenschaften

What kind of digitalisation support can Innosuisse offer to SMEs?

Innosuisse Plenary, CERN, August 29, 2018

by Thilo Stadelmann



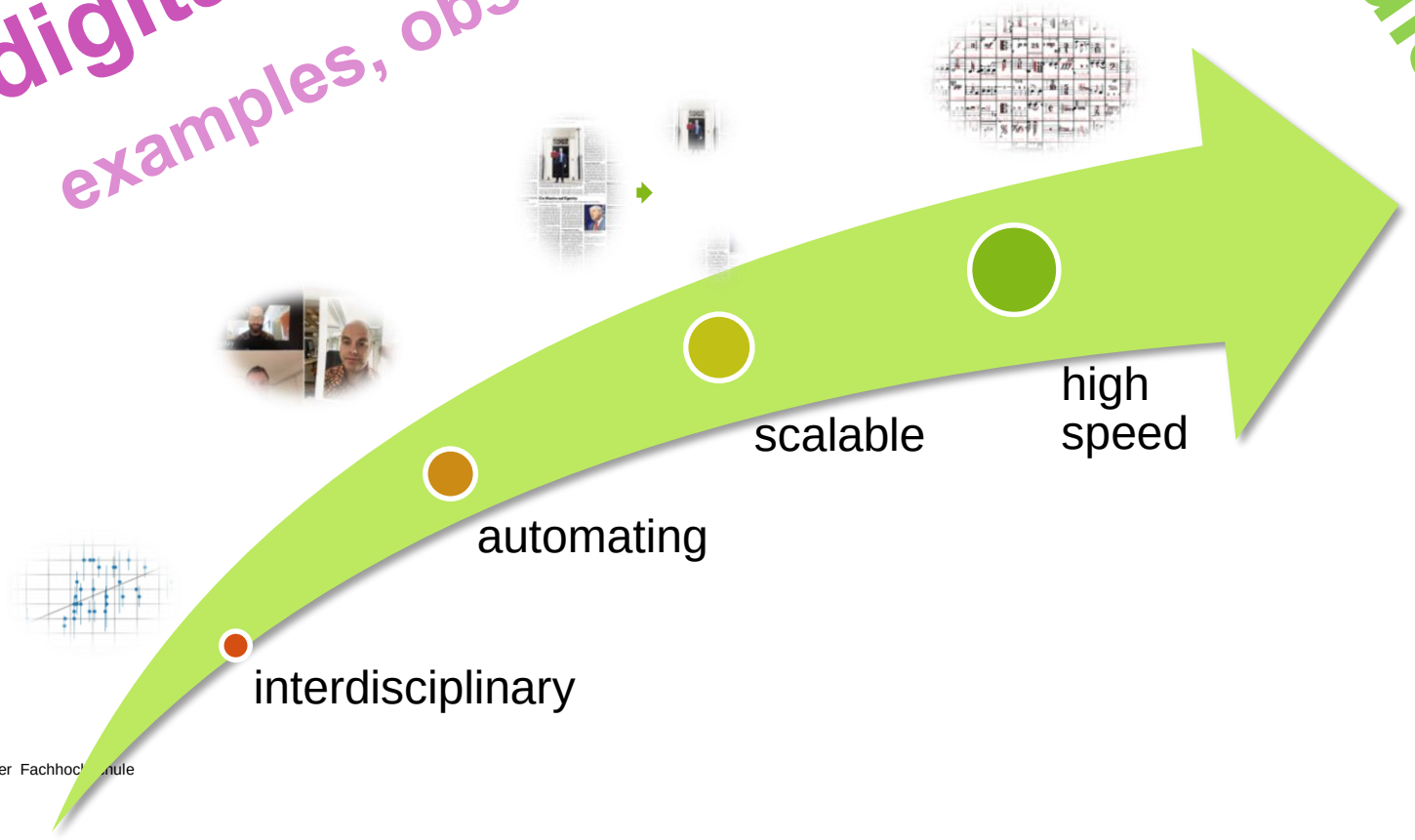
Swiss Alliance for
Data-Intensive Services

datalab
www.zhaw.ch/datalab

Agenda

properties of digital innovation

examples, observations



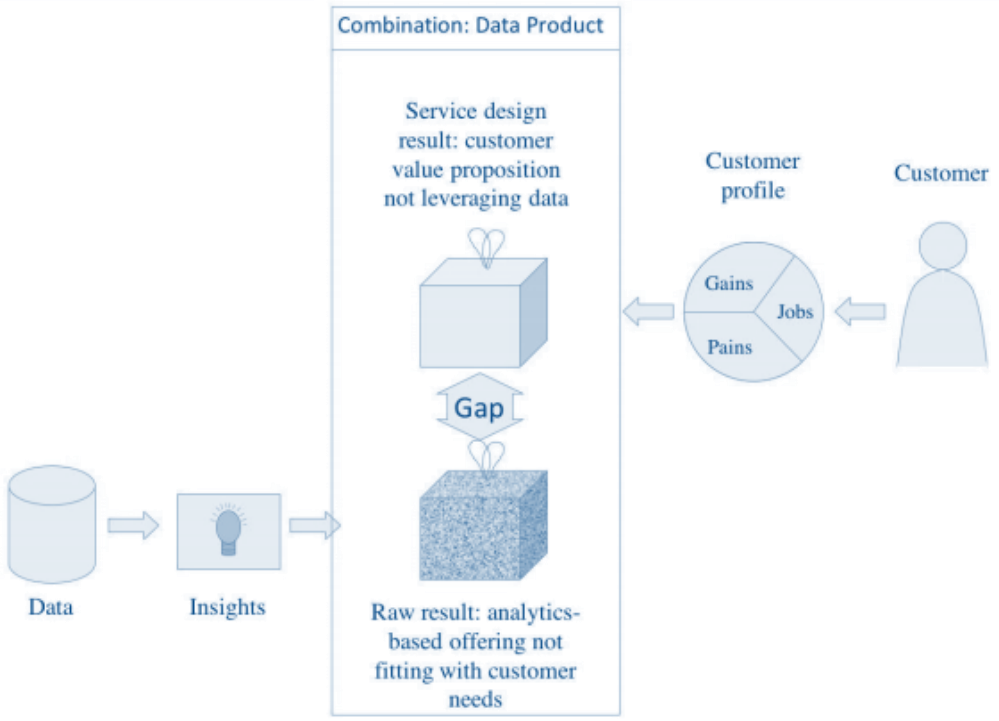
hypotheses, discussion

Properties of digital innovation

- Interdisciplinary
- Scalable
- Automating
- High speed

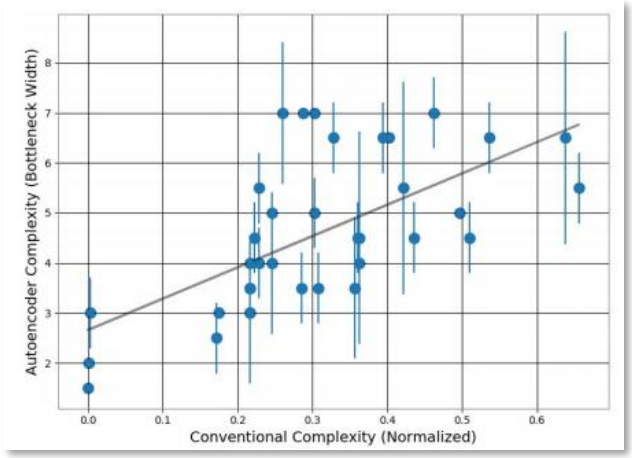
Data products are interdisciplinary artifacts

Business and technology need to connect for digital innovation to happen



Meierhofer, Stadelmann, & Cieliebak. *"Data Products"*. In: Braschler et al. (Eds). "Applied Data Science – Lessons Learned for the Data-Driven Business", Springer, 2018 (to appear).

Project example: Complexity 4.0



Goal

- **Reduce** unnecessary **complexity of product variability** in production environments in a data-driven (~automatable) fashion

Project team

- Business partners: **2 different industries** with large production facilities in CH
- **Economists**: ITEM-HSG (technology management, business models)
- **Engineers**: ZHAW-Engineering (machine learning), ZHAW-Life Sciences (simulation)

Results

- *"The paradigm of **data-driven decision support** can […] enter the domain of a highly qualified business consultant, **deliver**ing the **quantitative results** necessary to ponder informed **management decisions**."*
- *"**It is merely the knowledge** of what methods and technologies are possible and available **that** currently **hinders the faster adoption** of the data-driven paradigm in businesses."*

Hollenstein, Lichtensteiger, Stadelmann, Amirian, Budde, Meierhofer, Füchslin, & Friedli *"Unsupervised Learning and Simulation for Complexity Management in Business Operations"*. In: Braschler et al. (Eds). "Applied Data Science – Lessons Learned for the Data-Driven Business", Springer, 2018 (to appear).

Observation

Interdisciplinarity & Innosuisse:

Properties of digital innovation

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- Scalable
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Properties of digital innovation

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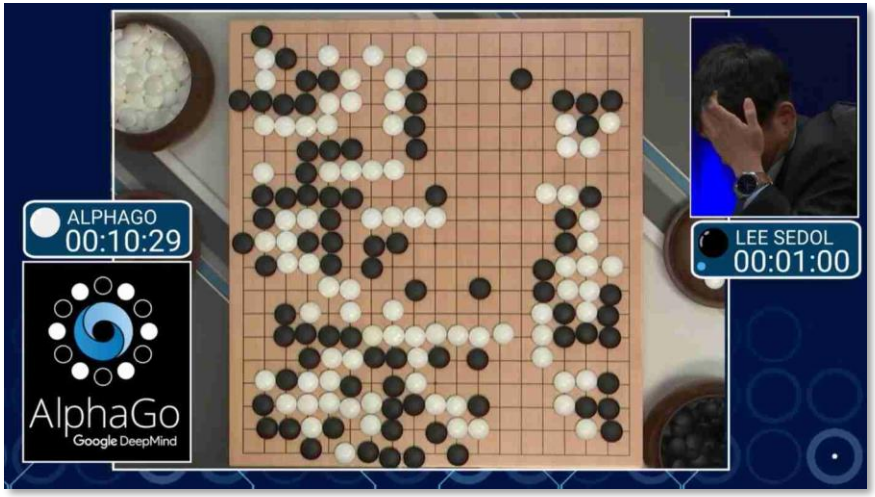
Automation at scale in a digitized world

…enabled by two key technologies

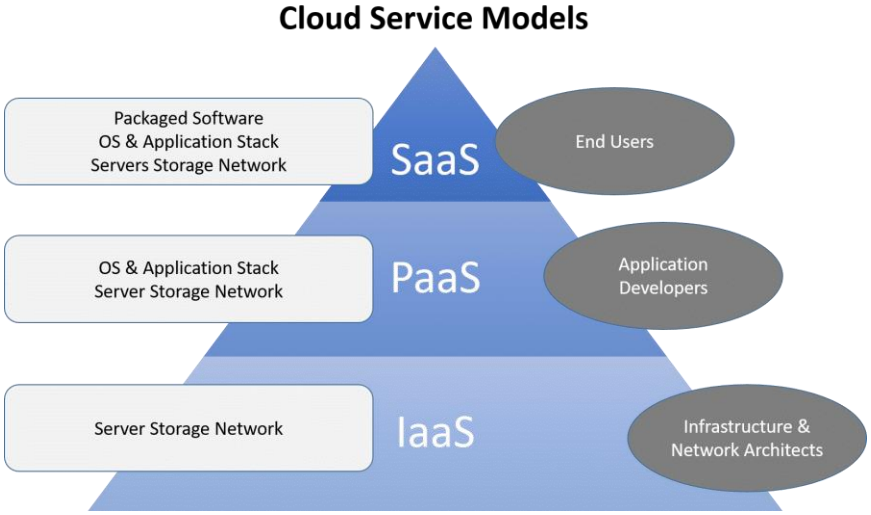
AI

Increased automation depth due to advances in pattern recognition



CLOUD COMPUTING

No need for huge investments / large facilities to do big business



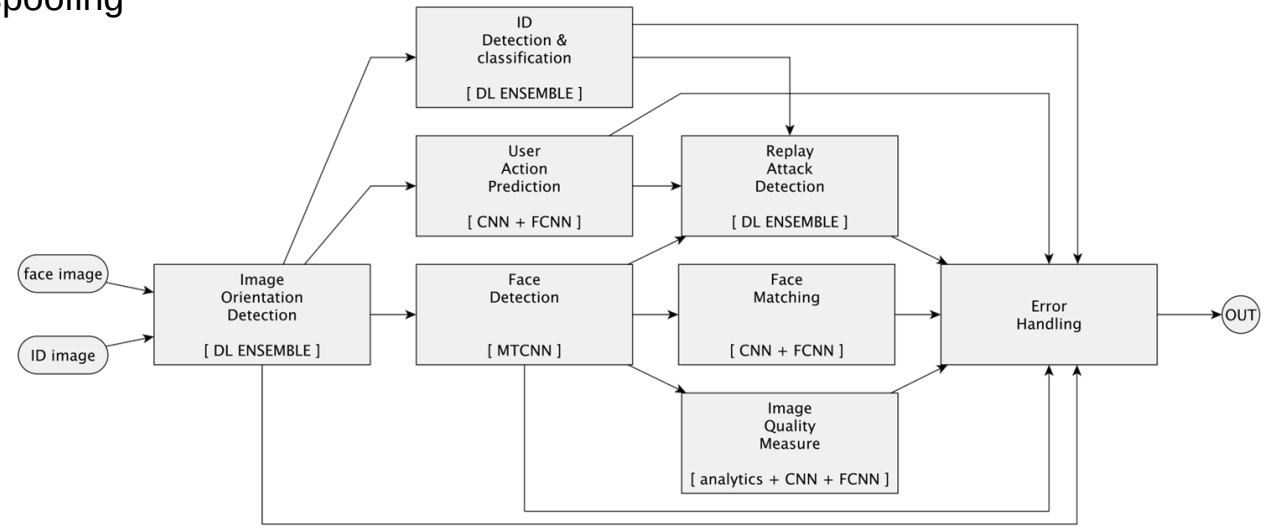
Project example: LIBRA
Face matching for MLD4 compliance

Goal

- **Check customers** for MLD4 compliance prior to transaction by comparison of, inter alia, **portrait pictures**, with sanction lists

Approach

- **Larger architecture of machine learning** models to prepare and perform robust face verification and anti-spoofing



Stadelmann, Amirian, Arabaci, Arnold, Duivesteijn, Elezi, Geiger, Lörwald, Meier, Rombach & Tuggener (2018). "*Deep Learning in the Wild*". ANNPR 2018.

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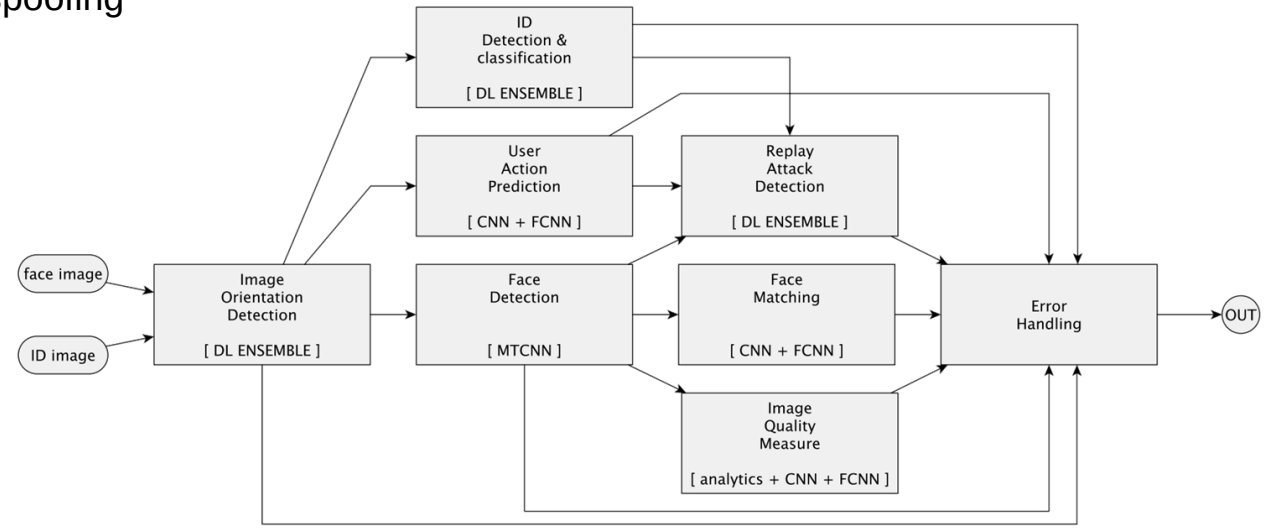

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Project example: PANOPTES

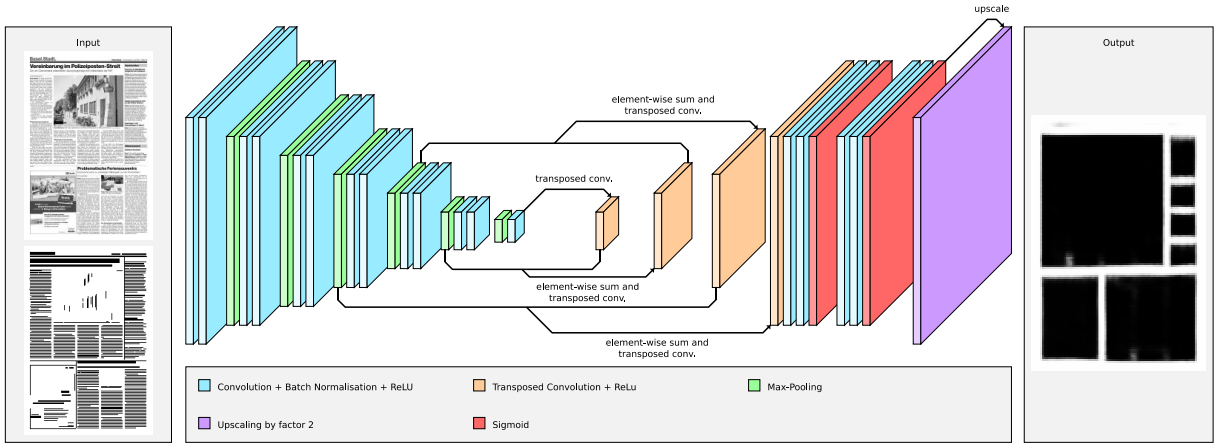
Newspaper article segmentation for print media monitoring

Goal

- **Automatically segment newspaper pages** into constituting articles for automatic print media monitoring

Approach

- **Image-based** approach with **deep neural network**s that learn layouting principles from examples



Meier, Stadelmann, Stampfli, Arnold, & Cieliebak. *"Fully convolutional neural networks for newspaper article segmentation"*. ICDAR 2017.

Stadelmann, Tolkachev, Sick, Stampfli, & Dürr. *"Beyond ImageNet - Deep Learning in Industrial Practice"*. In: Braschler et al. (Eds). "Applied Data Science – Lessons Learned for the Data-Driven Business", Springer, 2018 (to appear).

Observations

Size of idea ≠ size of company

…SMEs can **build whatever they want** (given know-how and an interesting case)

…the **business model needs trust** (or rather the people behind it)

Technology is independent of specific industry

…enabling **new** collaborations and **alliances**

…increasing the **importance of networks** of partners

Properties of digital innovation

- Interdisciplinary ✓
- Scalable (✓)
- Automating (✓)
- High speed

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The speed of digital innovations

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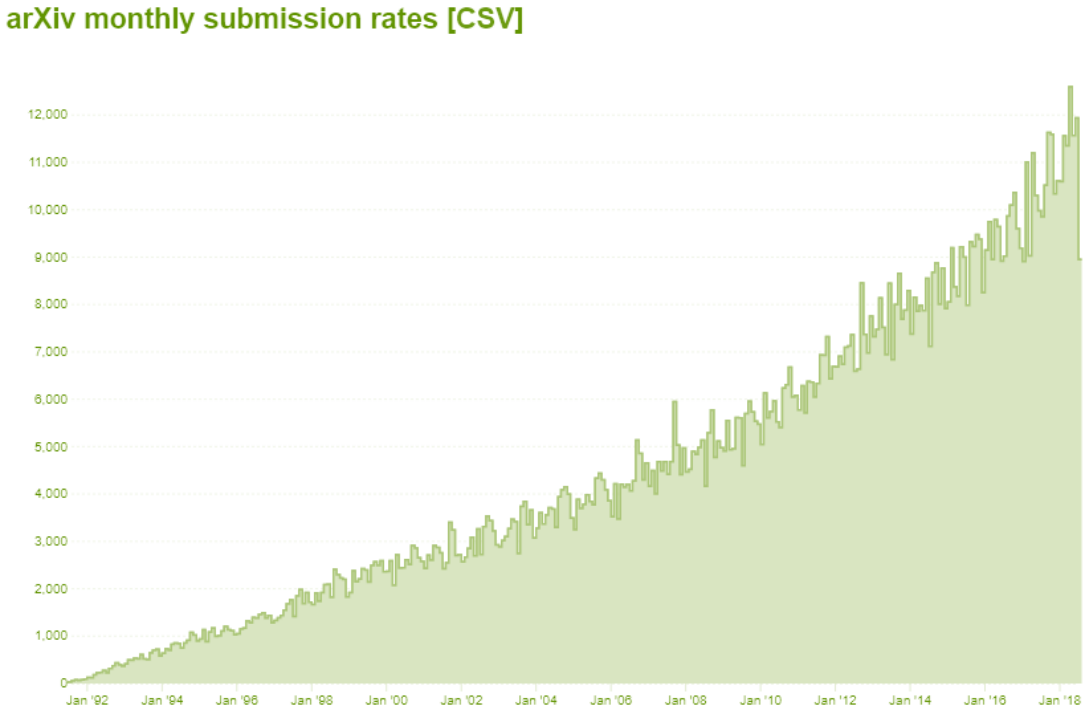
Approx. time from research publication (on arXiv) to application in project: 3 month



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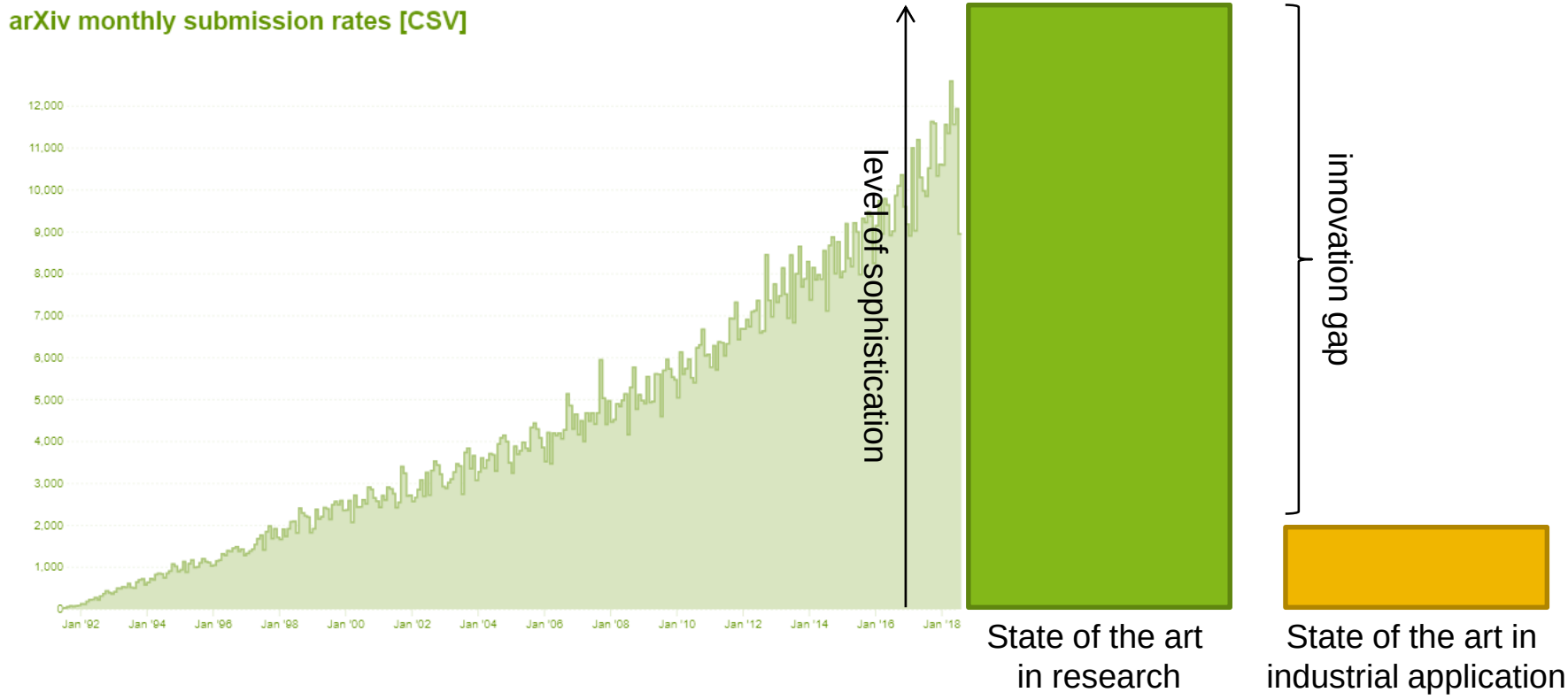
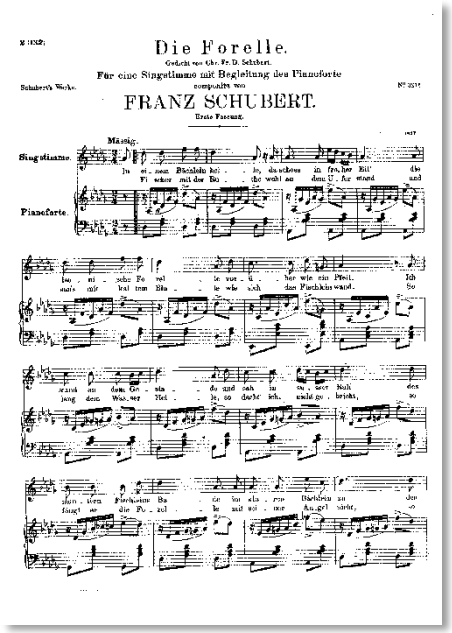
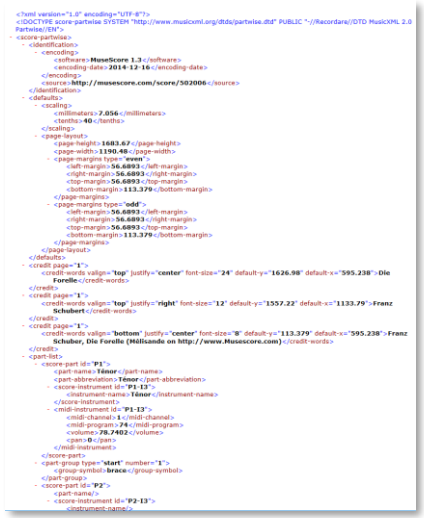
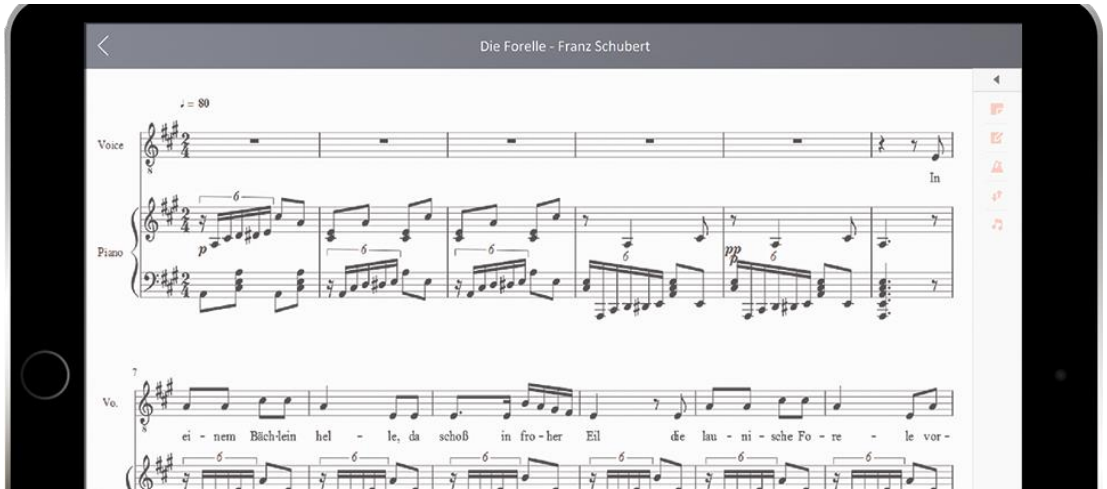


Project example: DeepScore

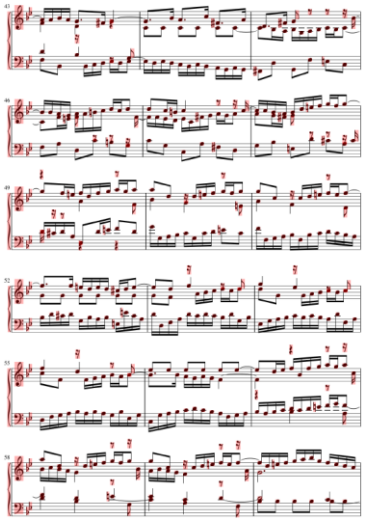
Music scanning to enable a digital music stand







Project example: DeepScore (contd.)



Tuggener, Elezi, Schmidhuber, Pelillo & Stadelmann (2018). *«DeepScores – A Dataset for Segmentation, Detection and Classification of Tiny Objects»*. ICPR'2018.
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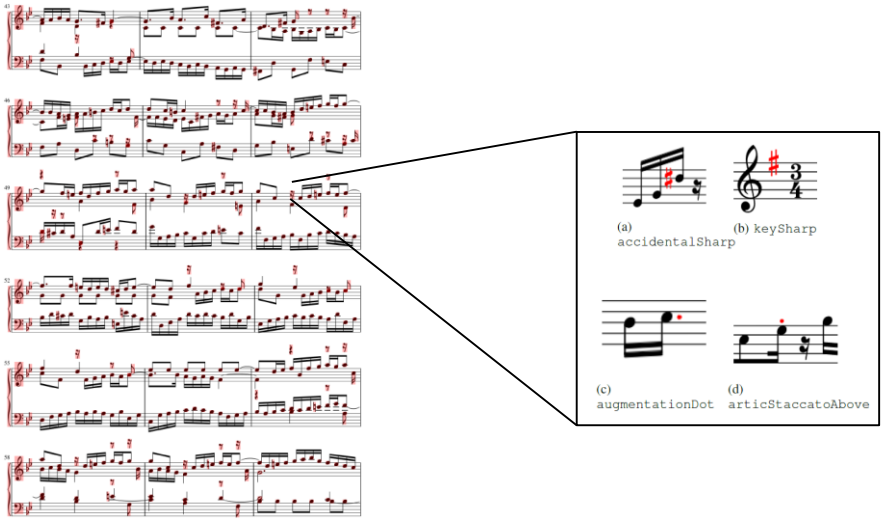
Project example: DeepScore (contd.)



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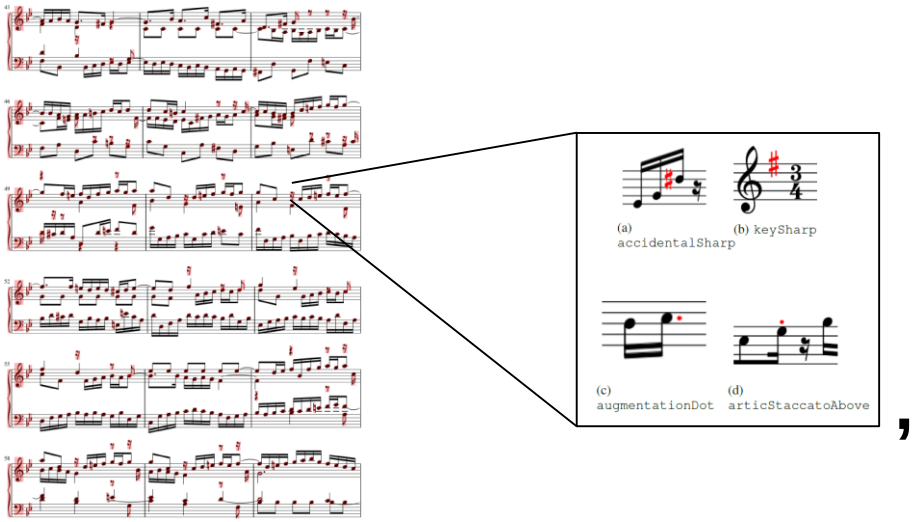

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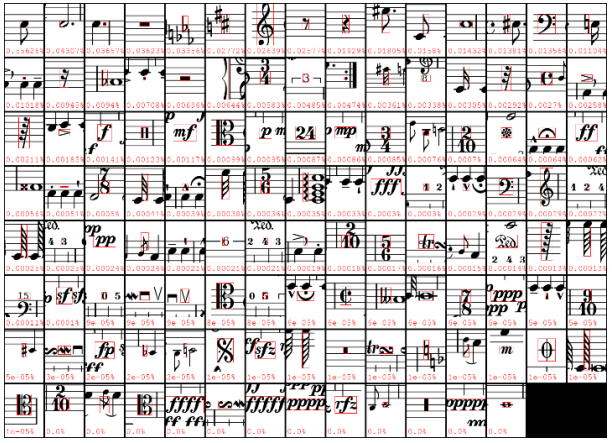

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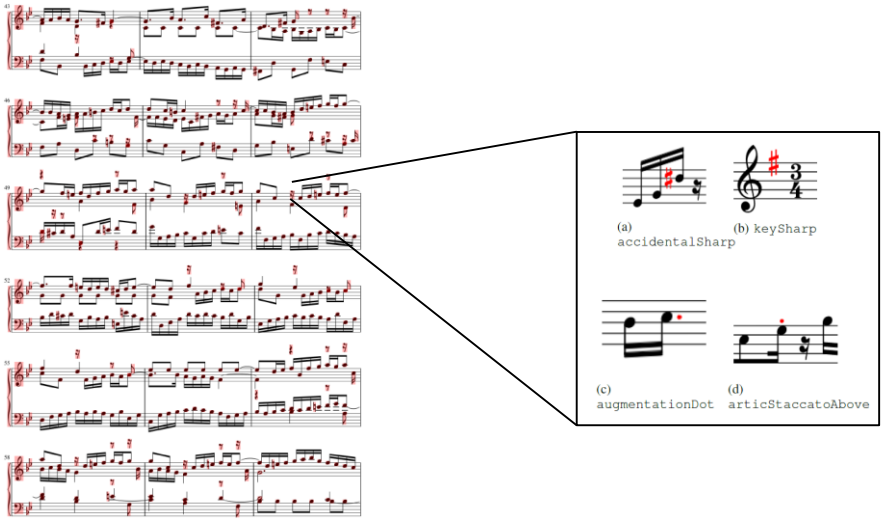

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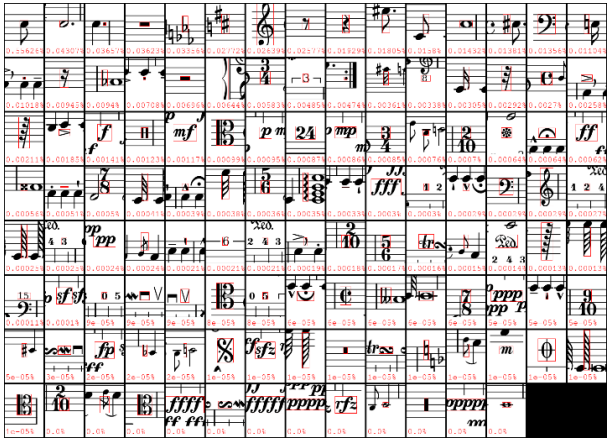

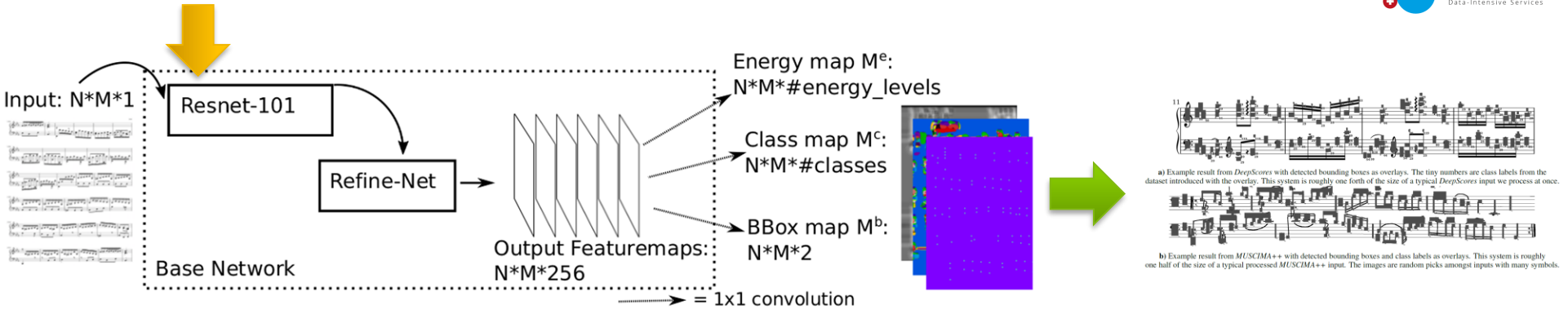

a) Example result from *DeepScores* with detected bounding boxes as overlays. The tiny numbers are class labels from the dataset introduced with the overlay. This system is roughly one forth of the size of a typical *DeepScores* input we process at once.

b) Example result from *MUSCIMA++* with detected bounding boxes and class labels as overlays. This system is roughly one half of the size of a typical processed *MUSCIMA++* input. The images are random picks amongst inputs with many symbols.

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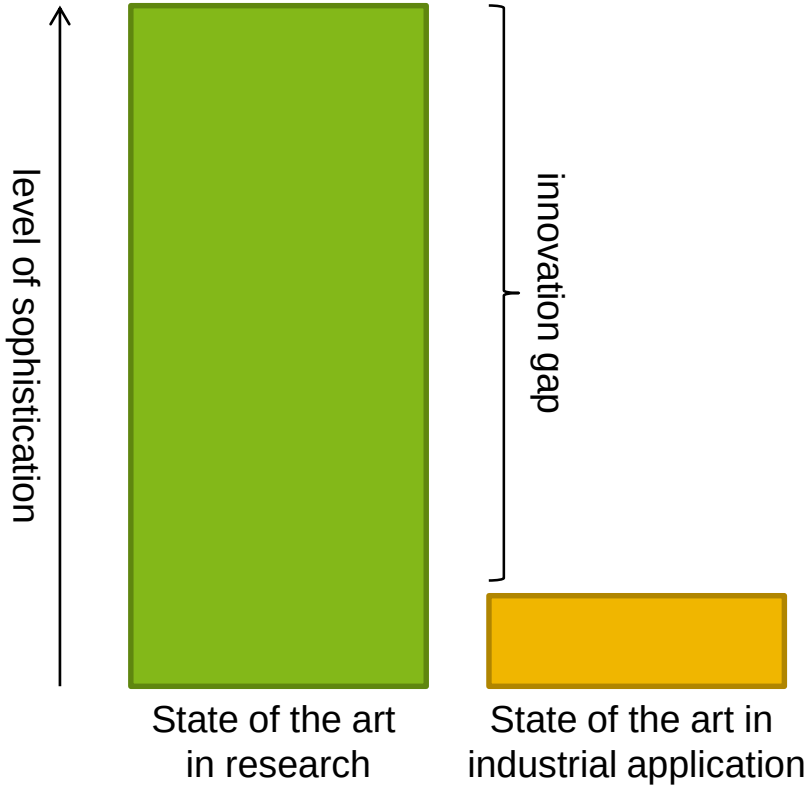
Observation

No sequential innovation process anymore

…fundamental **discoveries** are **triggered by** new **applications**

…basic **research**, applied research and technology **transfer** run **in parallel**

…teams and **networks** of partners with diverse skills are **most effective**



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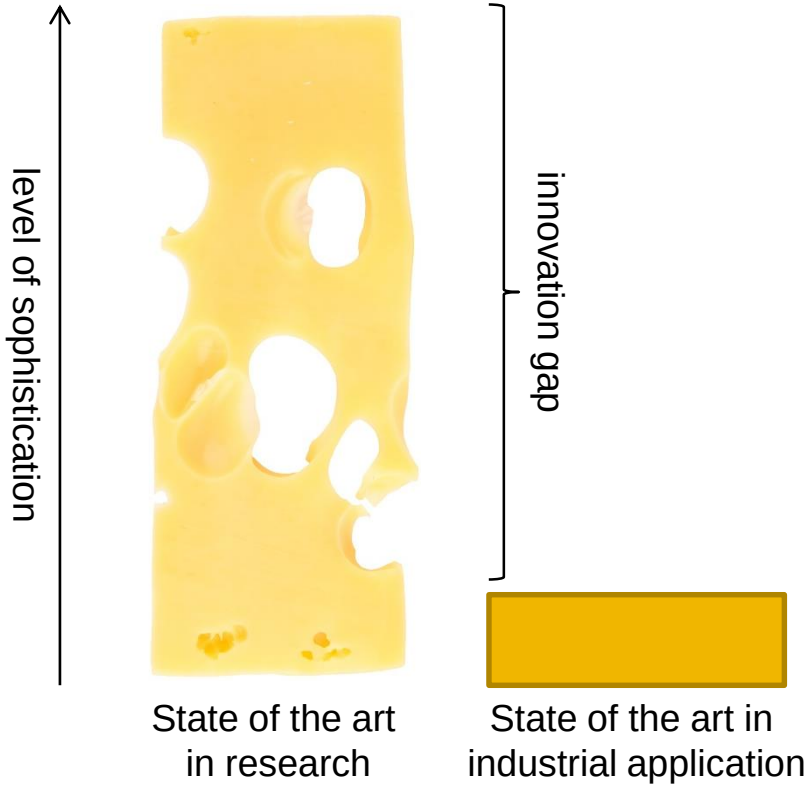


Properties of digital innovation

- Interdisciplinary ✓
- Scalable (✓)
- Automating (✓)
- High speed (✓)

Properties of digital innovation

Previous observations

- Interdisciplinary ✓
- Scalable (✓)
- Automating (✓)

size of idea ≠ size of company, independence of industry

- High speed (✓)

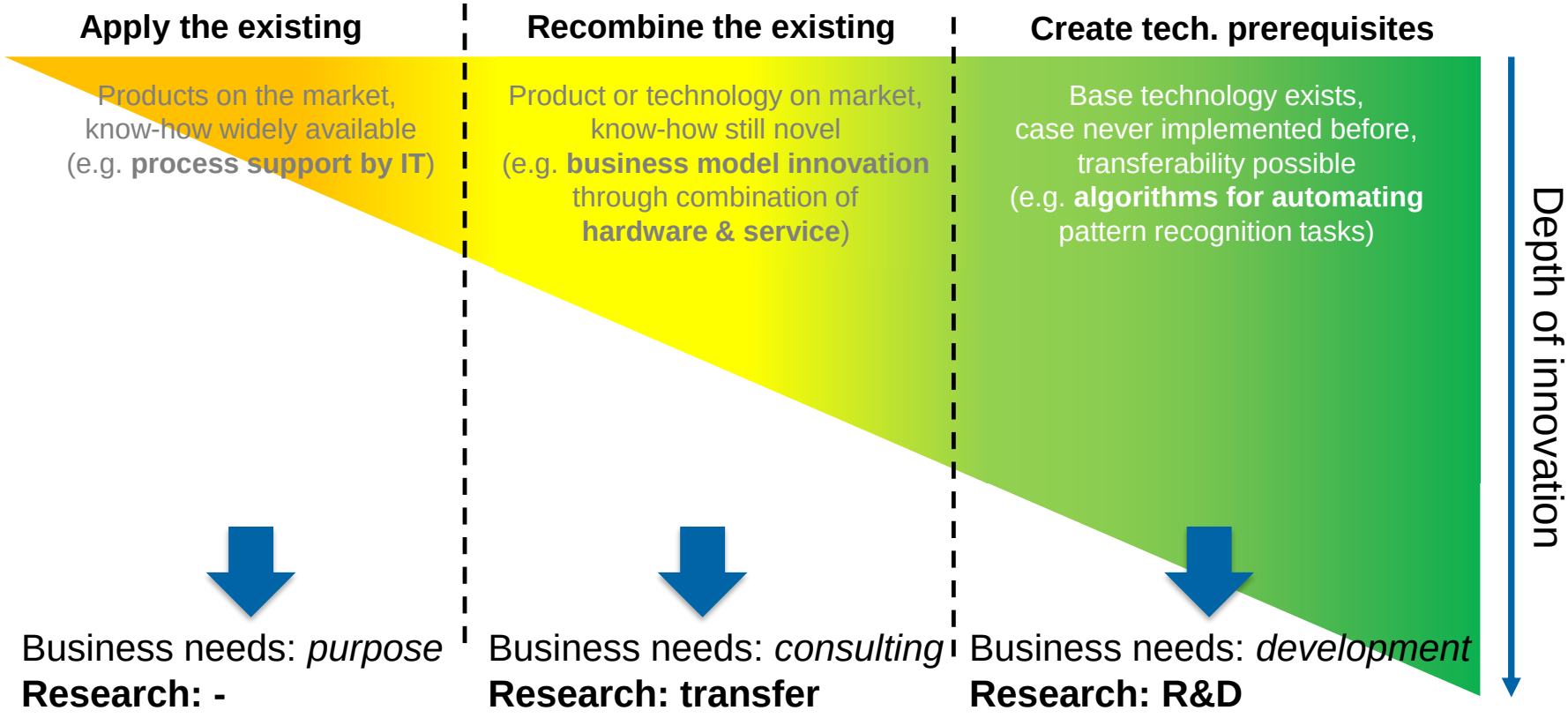
no sequential innovation process

➔ Hypotheses

Hypothesis 1: SMEs need access to networks

Why? Interdisciplinarity, independence of industry, scalability

SMEs can build similar digital products than any larger enterprise
…but have less specialized knowledge and human resources at their disposal

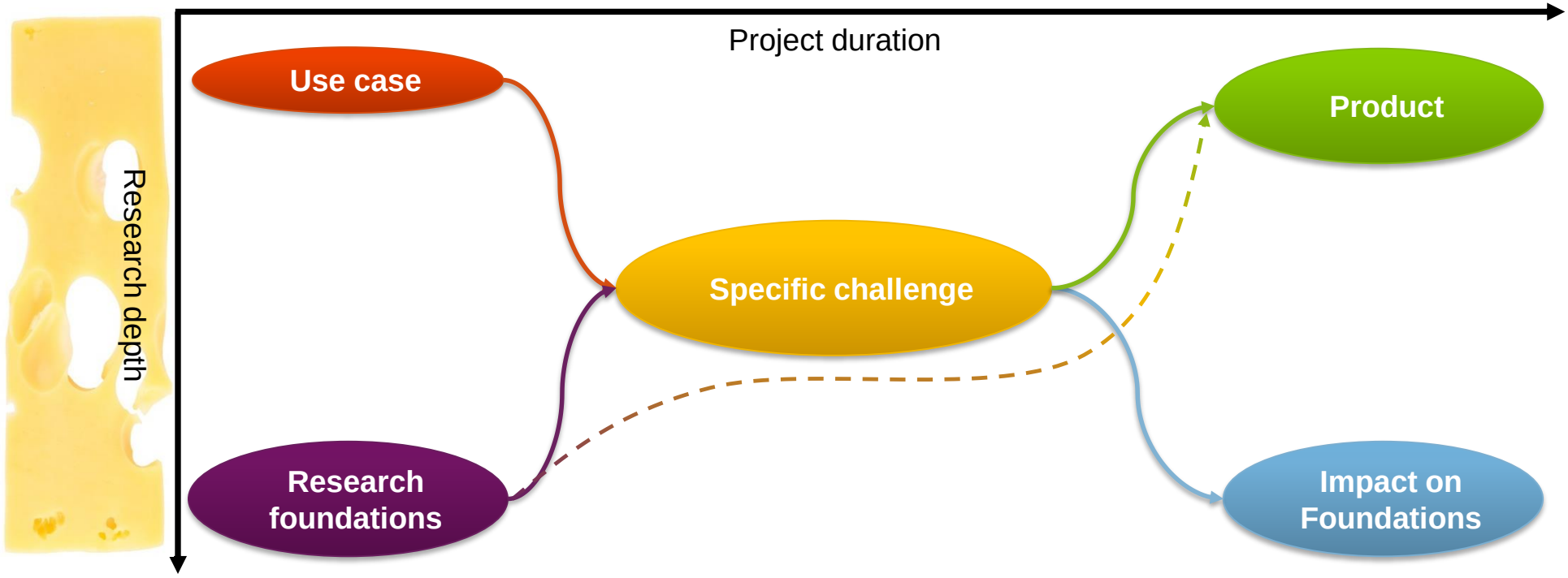


Hypothesis 2: basic & applied research converge

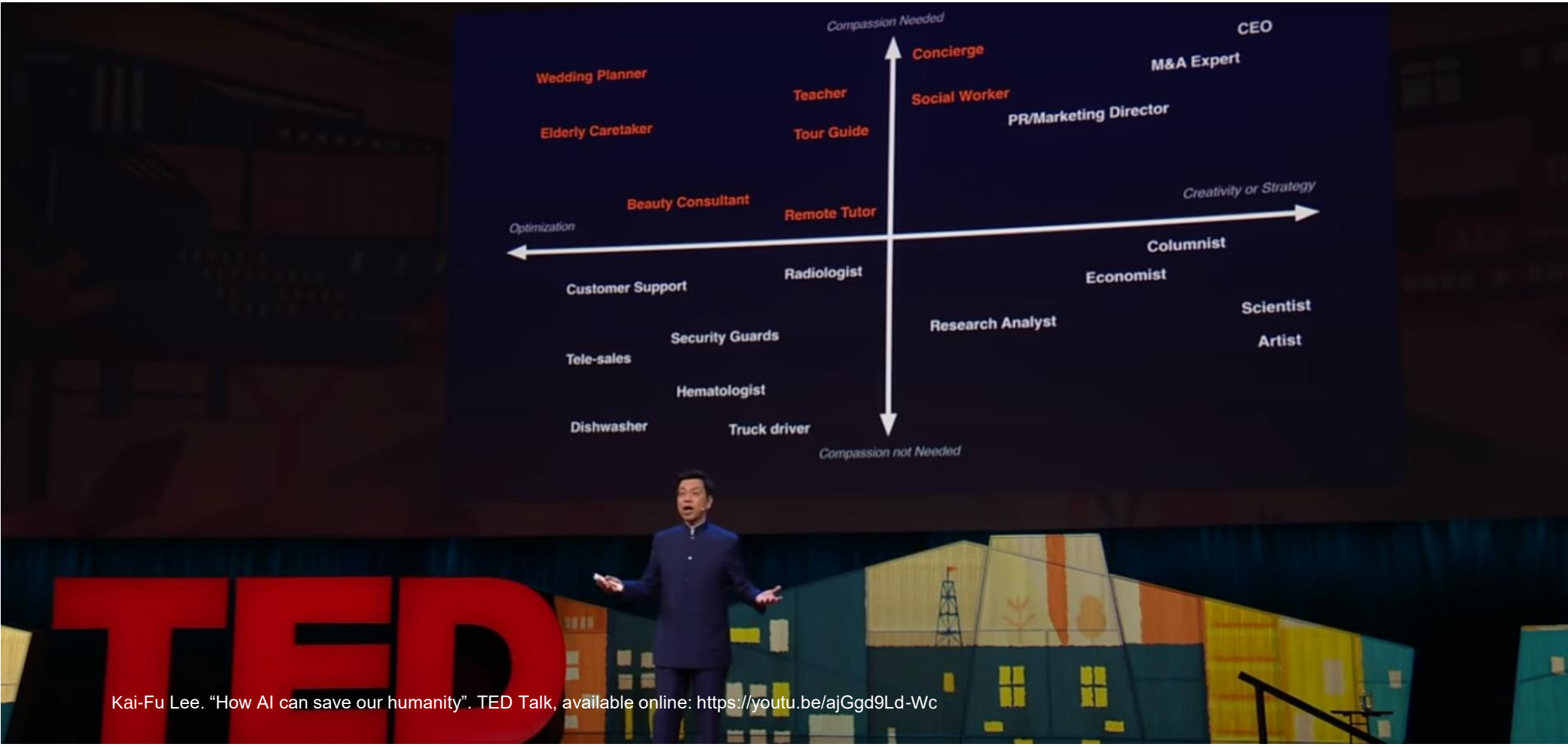
Why? Speed of innovation, breakthrough driven by application

Business innovation funding needs to adapt to new turnover times and skill profiles

…applied R&D is more than transfer and needs to be grounded in scientific community



Hypothesis 3: crucial digital innovation needs be happen the level of society, not business



Kai-Fu Lee. “How AI can save our humanity”. TED Talk, available online: https://youtu.be/ajGgd9Ld-Wc

Conclusions

Support in digitalisation for SMEs can build on the following corner stones:

- Access to **interdisciplinary teams and networks** of experts with diverse skills
- **Industry** sector affiliation and **size** of business play a **decreasing role**
- If research is involved, then it is likely **touching basic & applied research**
  → needs environment to strive

Moreover:

- besides business, we as **society need specific support** to shape our digital future

Swiss Alliance for Data-Intensive Services

www.zhaw.ch/datalab

On me:

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- 058 934 72 08
- https://stdm.github.io/

Data+Service Alliance: www.data-service-alliance.ch

➔ Happy to answer questions & requests.

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für Angewandte Wissenschaften

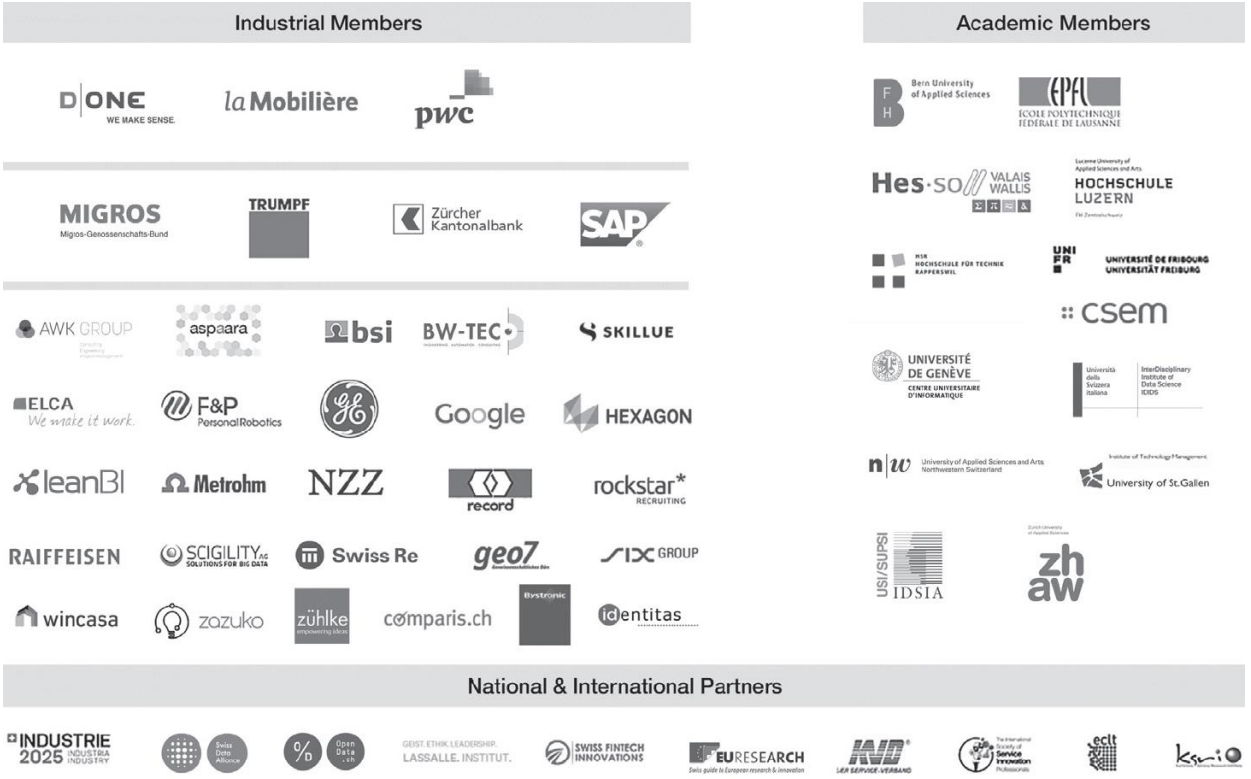
APPENDIX

Swiss Alliance for
Data-Intensive Services

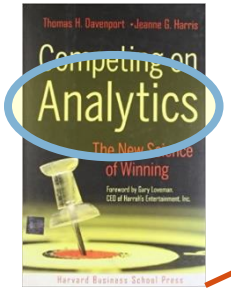
Zürcher Hochschule
für Angewandte Wissenschaften

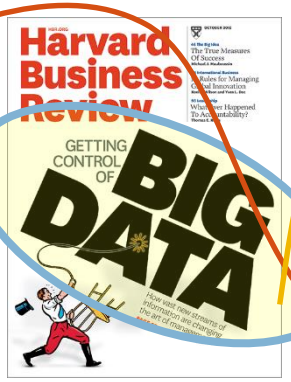
The Swiss Alliance for Data-Intensive Services provides a significant contribution to **make Switzerland an internationally recognized hub for data-driven value creation**.

In doing so, we rely on **cooperation in an interdisciplinary expert network** of innovative **companies** and **universities** to combine knowledge from different fields into marketable products and services.



Digitalization: buzz words and technical drivers





digitalswitzerland

INDUSTRY 4.0

2025 INDUSTRIE INDUSTRIA

SWISS FINTECH INNOVATIONS

...

2007

2012

2016