10th Workshop on the MANUFUTURE AET-community, Hanover, 10.11.2023

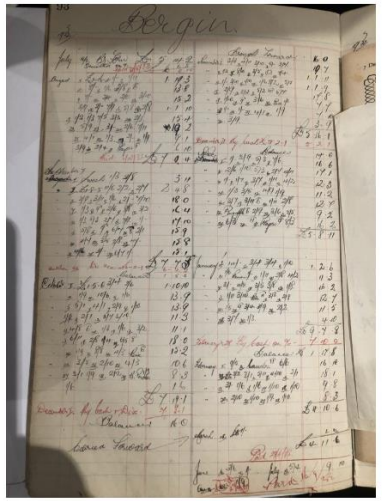
Towards User-Centered Solutions through Interoperable Data and AI-Services

Sebastian Bosse


What is special about agriculture
Human-centered aspects
Human-AI collaboration in agriculture
The role of interoperability

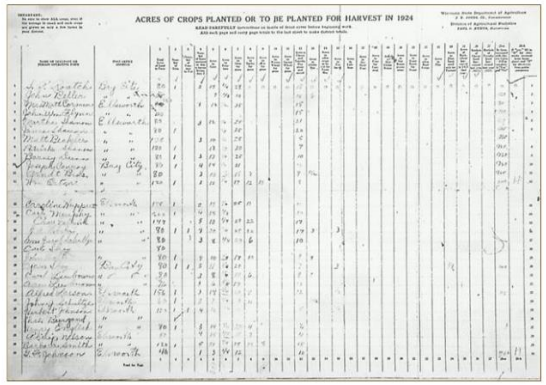
Digitalization: Agriculture vs Retail

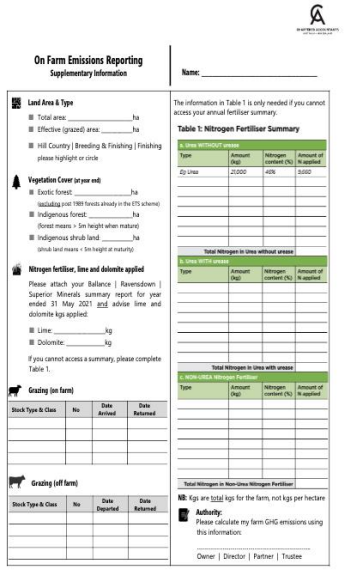
In retail, in one generation from mother to son, from ledger book to self-scanning...



In farming, in almost a century from 1928 to 2021, from pencil and paper to pencil and paper...

Why?

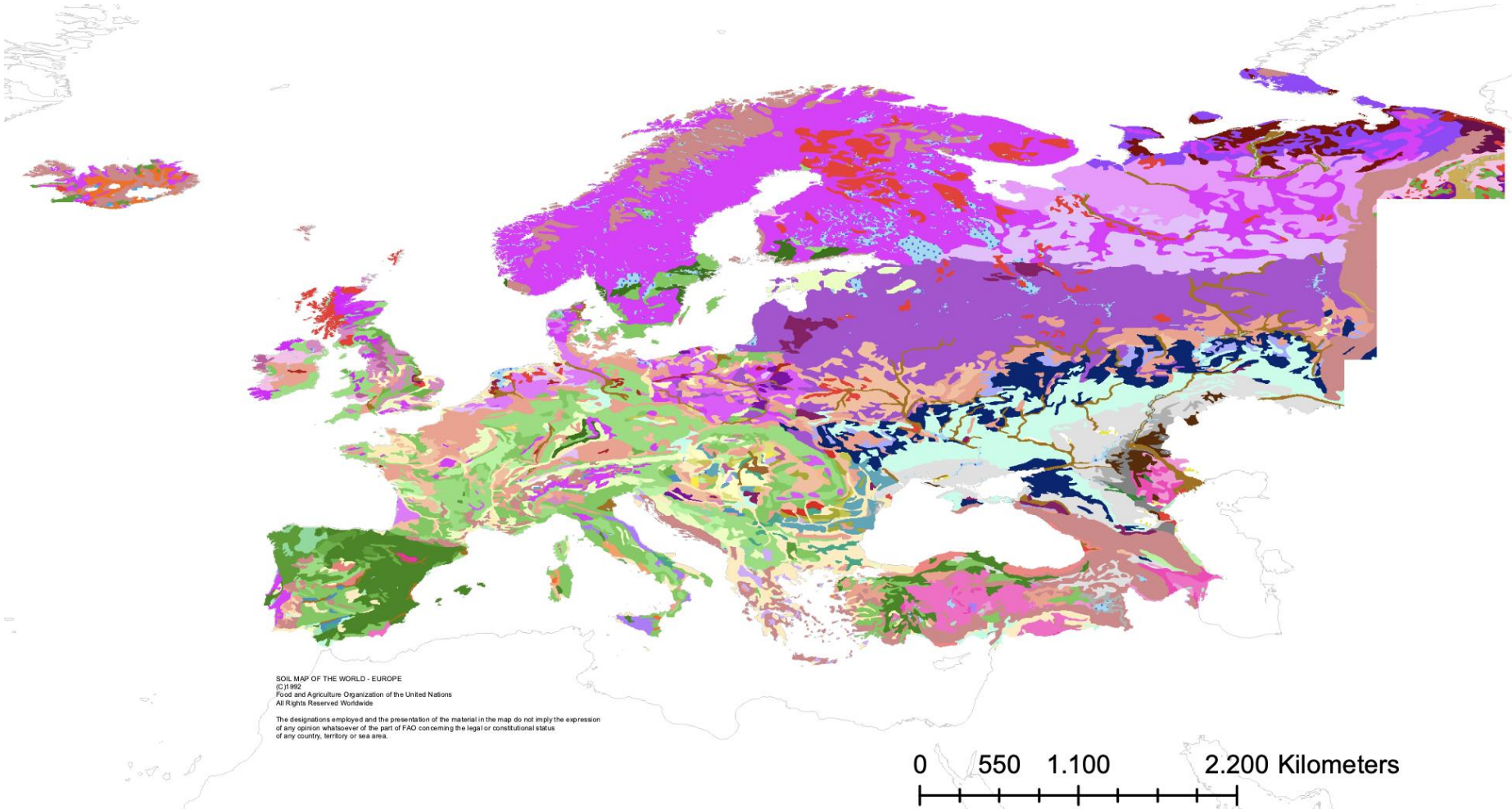




Courtesy of Kenneth Irons

Agroecological heterogenity: Soil types in Europe

Agriculture is special…



- https://www.fao.org/fileadmin/user_upload/soils/docs/Soil_map_FAOUNESCO/acrobat/Europe_V.pdf

Heterogenity of the ecosystem

Agriculture is special

There are about 540-570 million

of which about 470 million

Small farms are effective in achie
human labor

Smallholder farms produce abou

ut 6.000 airlines

000 major banks

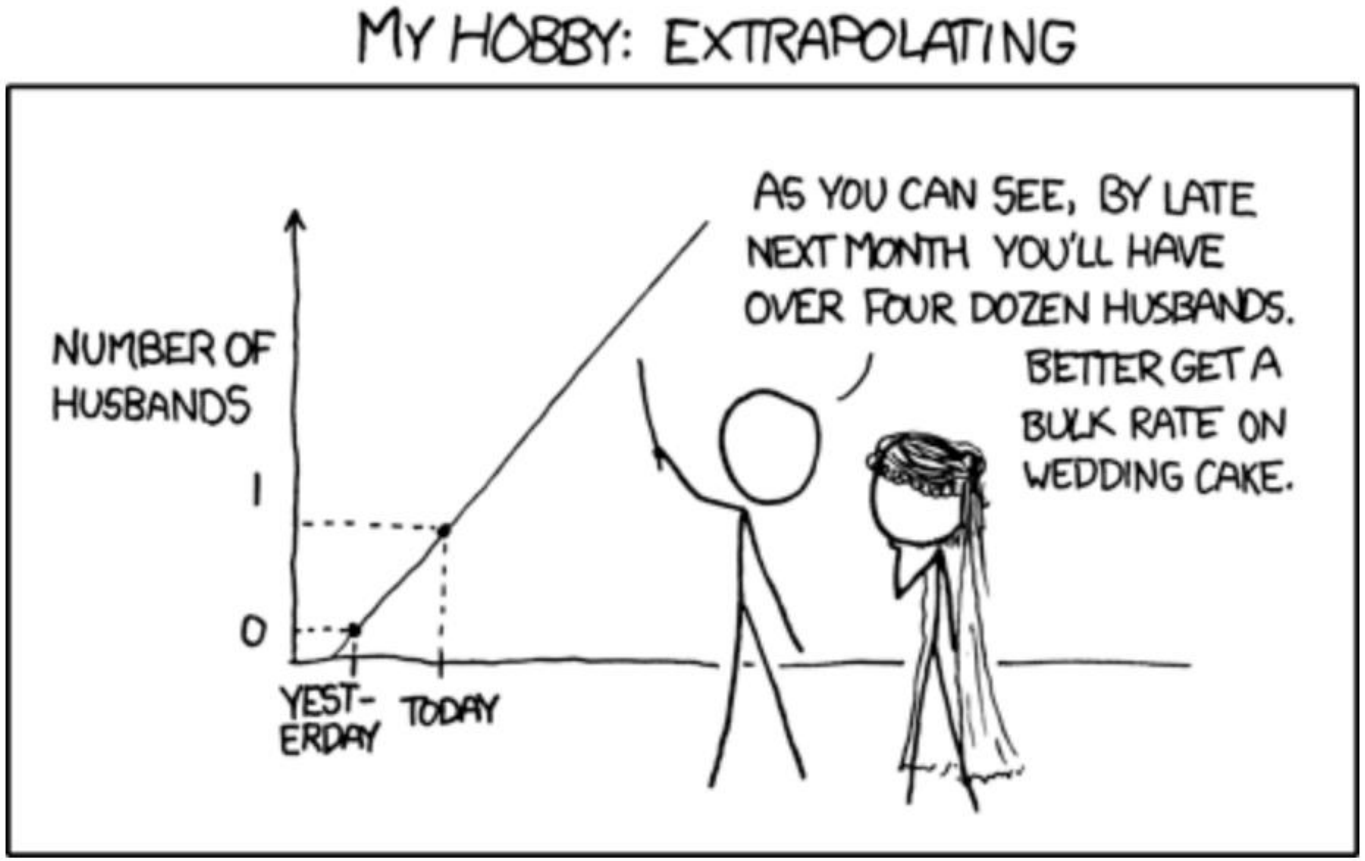
000 supermarket groups

540 -570 million business decisions

Why is this relevant for AI in agriculture?

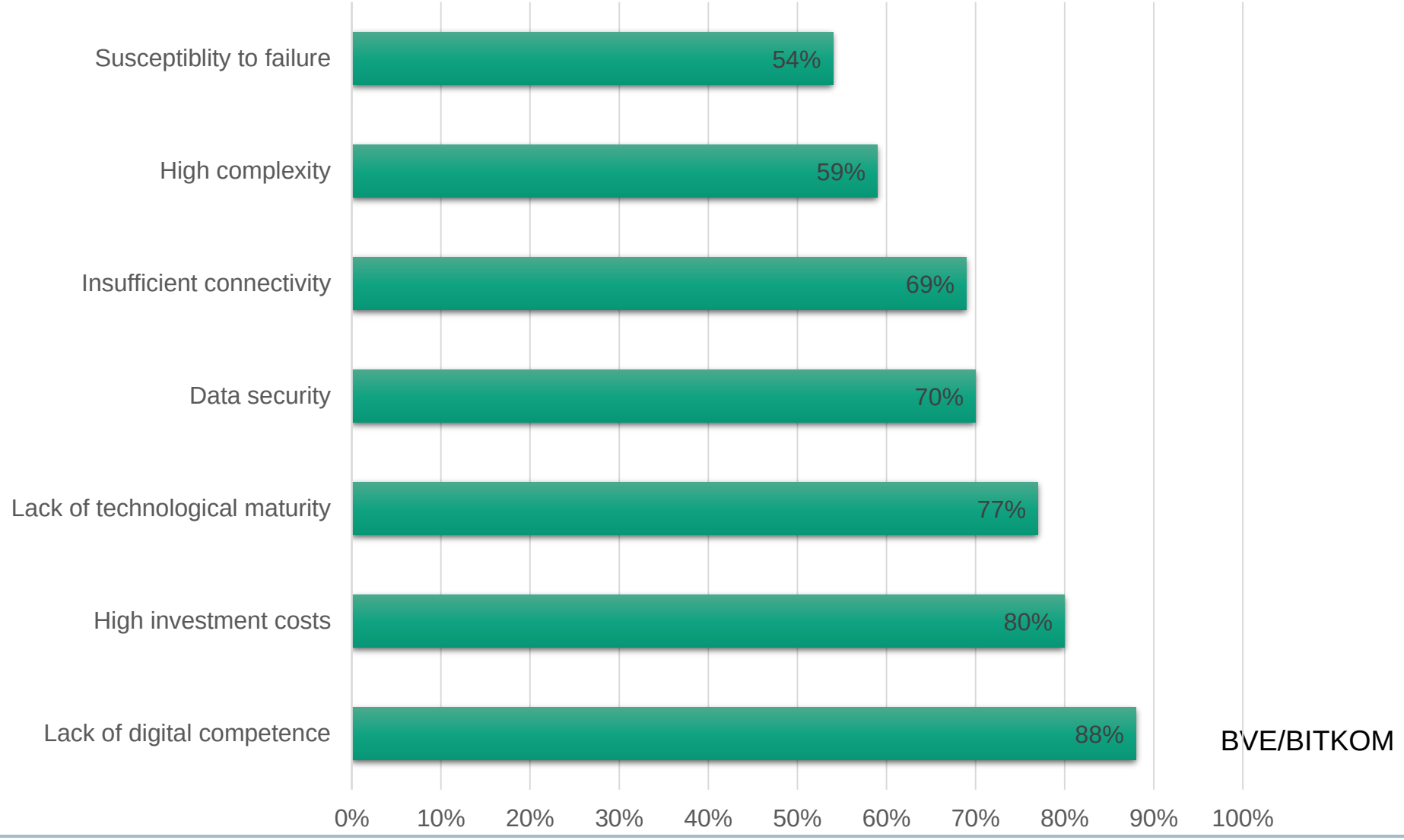
We need to extrapolate quite a bit, but

- Artificial intelligence is notorously bad at extrapolation
- Datasets need to be representative to train generalizing models
- Heterogenity inherently causes distribution shifts



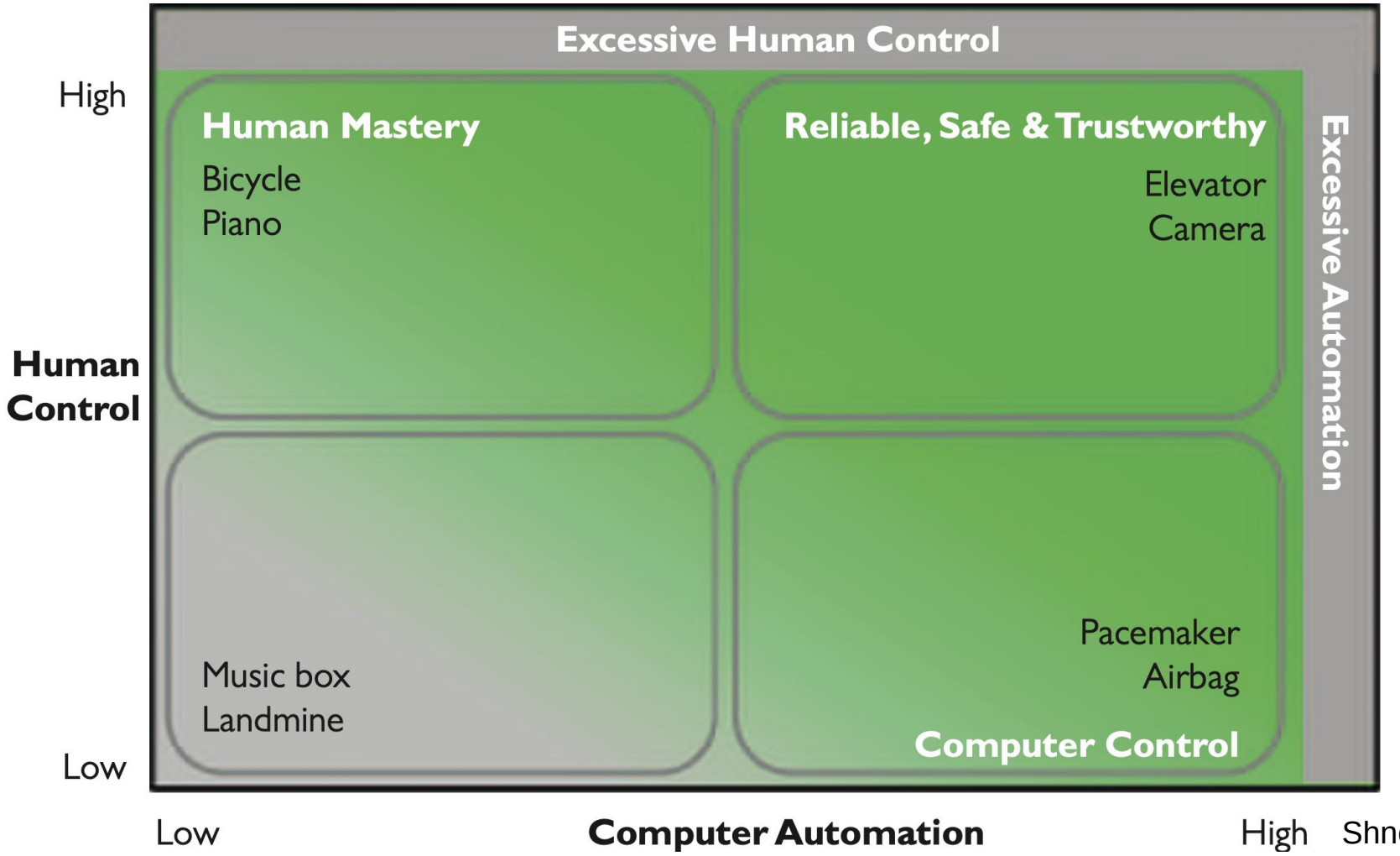
Source: https://xkcd.com/605/

”What are the greates obstacles in digitizing the food industry?”



B'VE/BITKOM

Human and computer control



Shneiderman, 2022

NaLamKI: Platform-based human-centered design of AI in agriculture

Inherently brings

- Data sovereignty
- Heterogeneous ecosystems
- Graceful complexity reduction
- Mitigation of lack of digital compentence

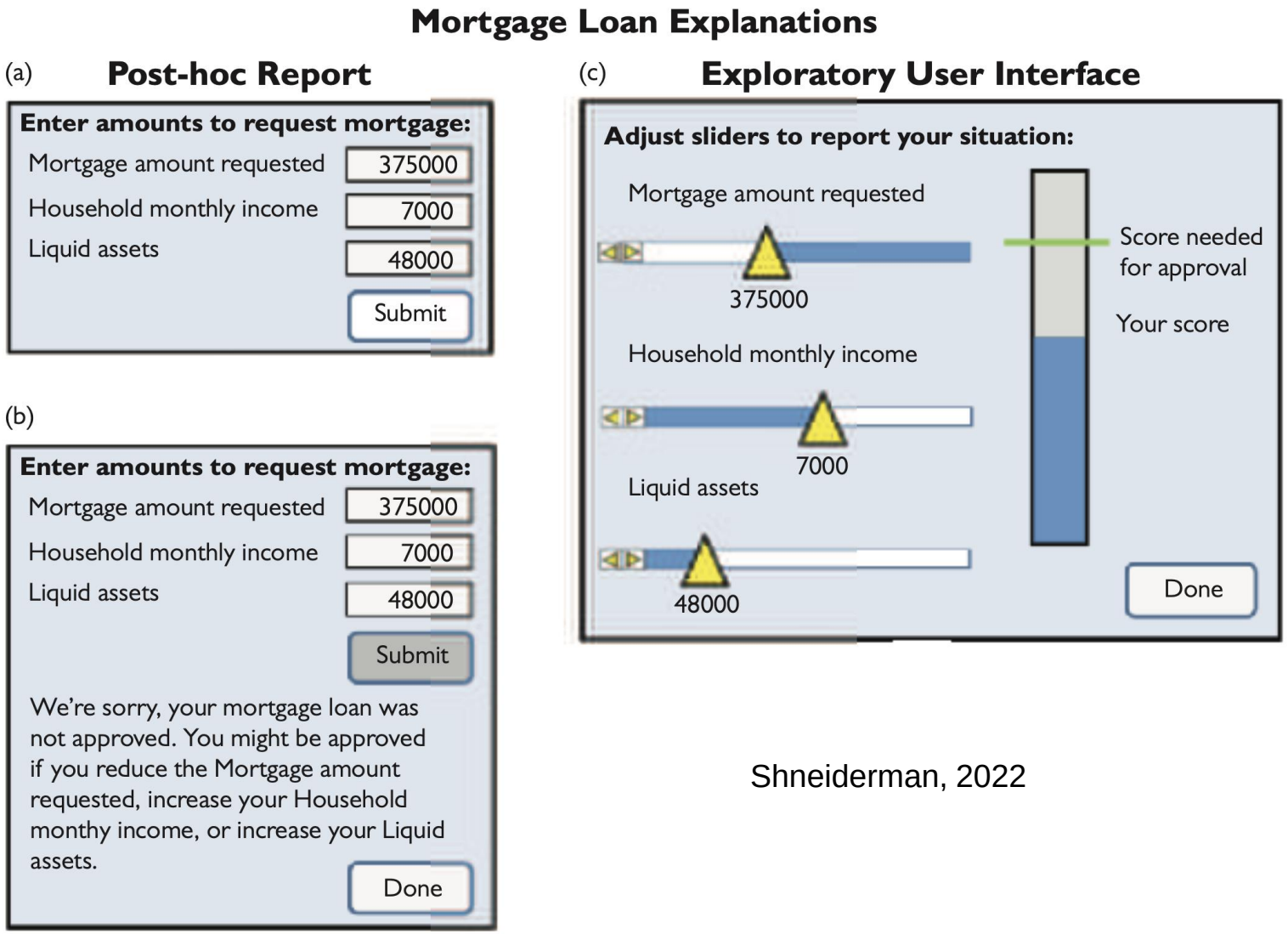
Supported by:

Federal Ministry
for Economic Affairs
and Climate Action

on the basis of a decision
by the German Bundestag

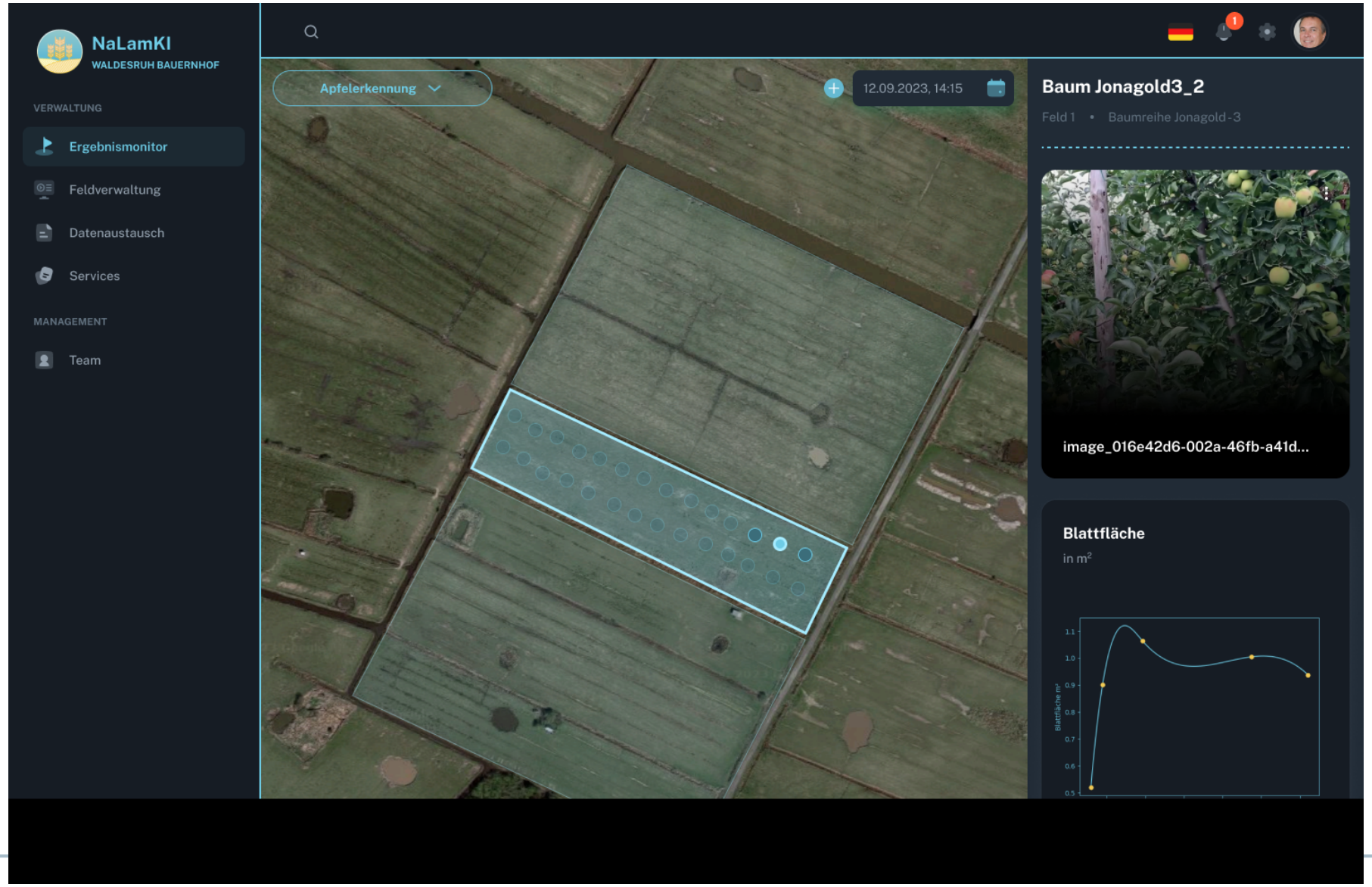
Presentation tomorrow at 12:00

The role of interfaces



Shneiderman, 2022

Example of visualizations: NaLamKI



Bonn Consulting

Explaining AI with horses: Computer, what do you see?

“Of course, it’s a horse!”

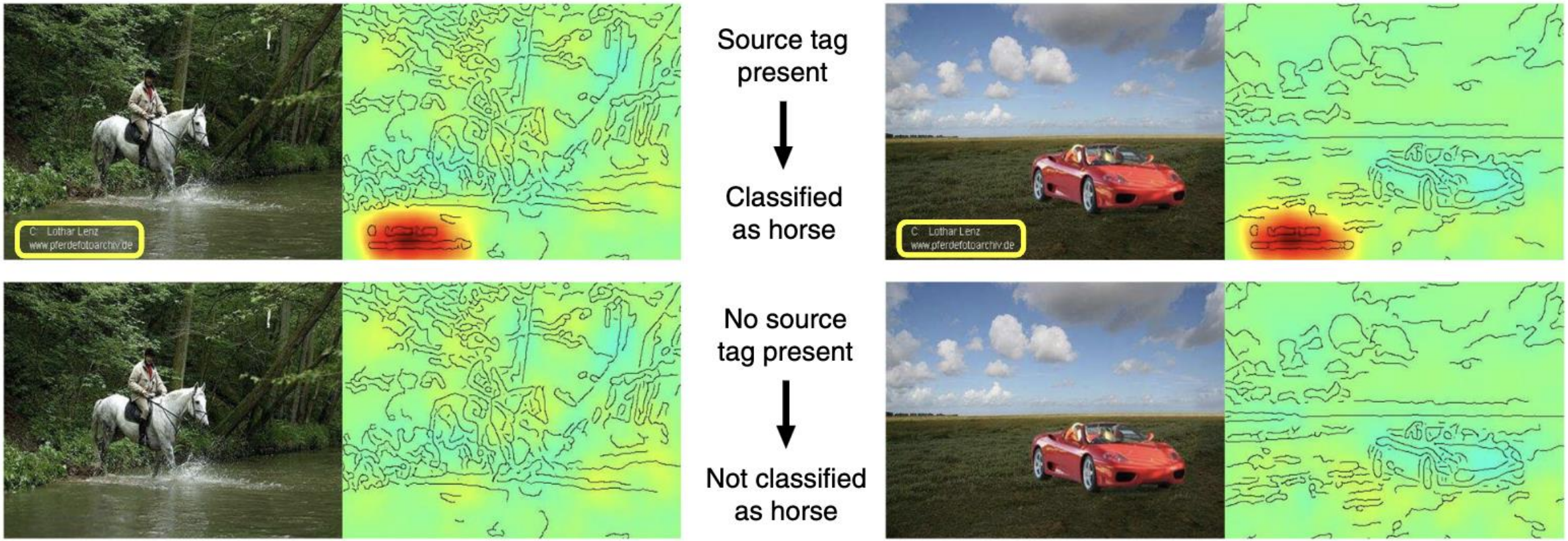
Explaining AI with horses: Computer, what do you see?

“I don’t know, but certainly not a horse!”

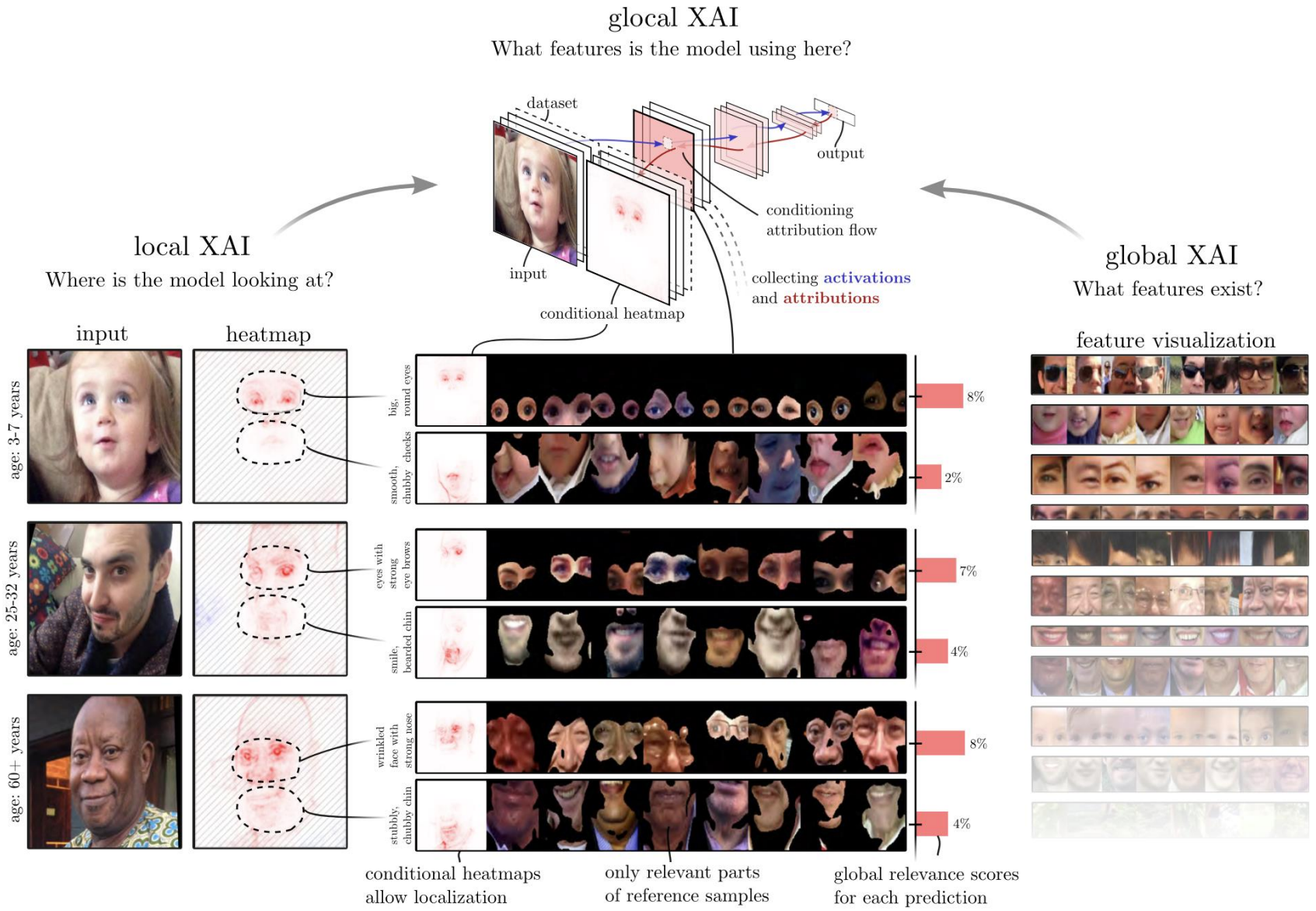
Why would I trust you?

Horse-picture from Pascal VOC data set

Artificial picture of a car



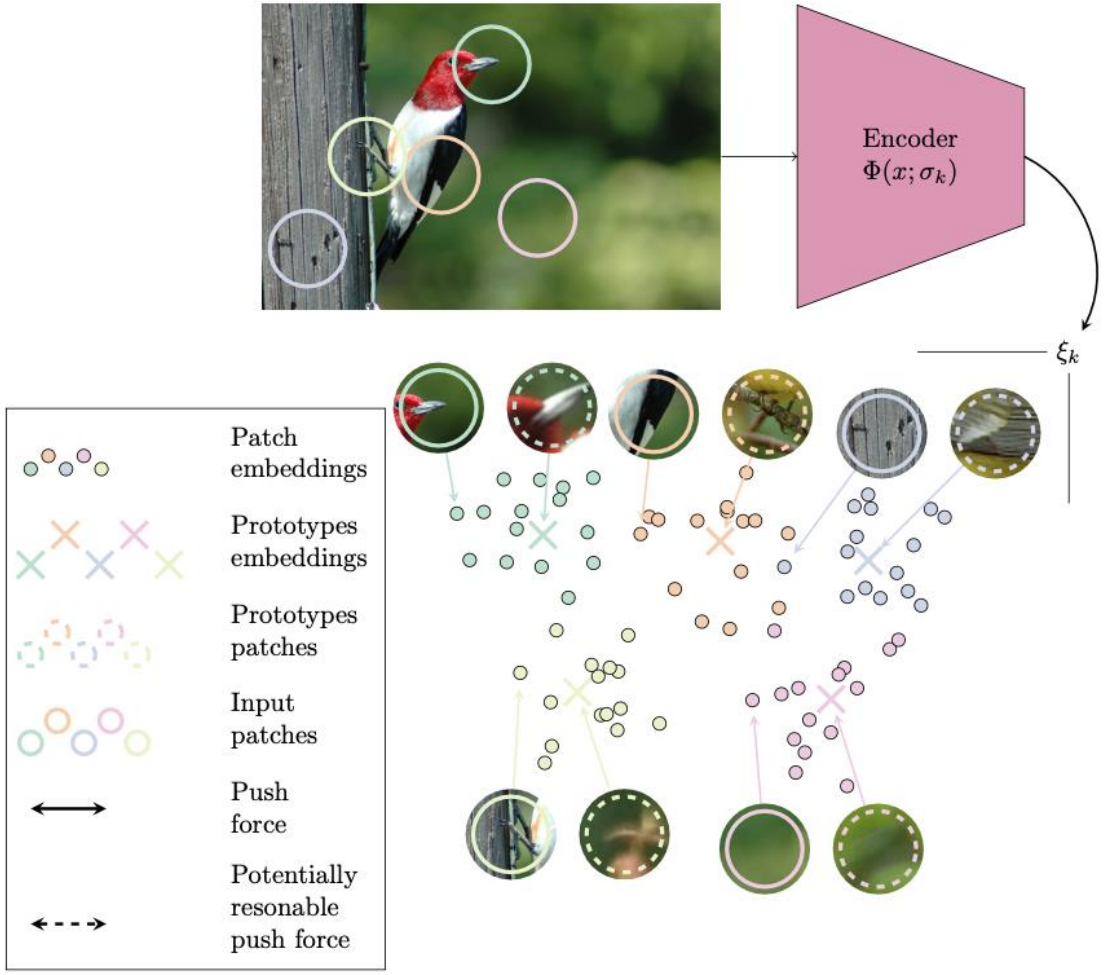
Towards understanding the inner workings



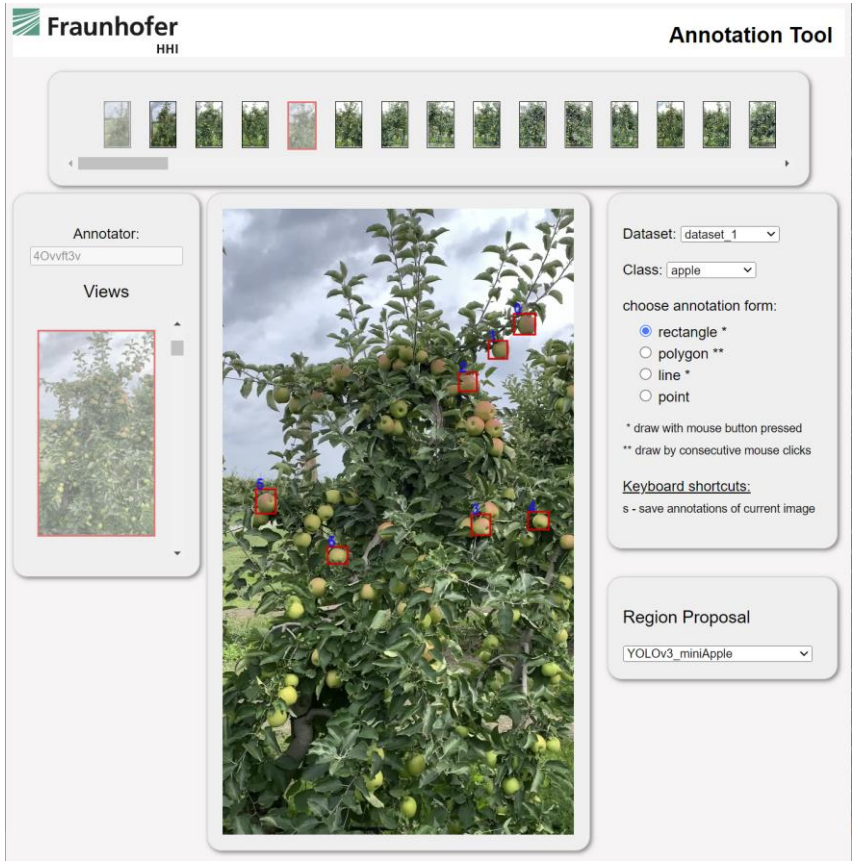
Explainatory interactive learning

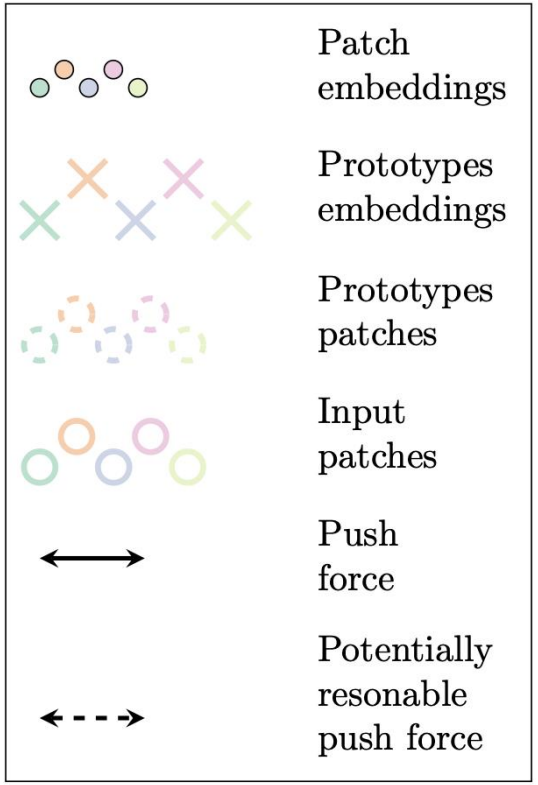
Attributes of an inference might be

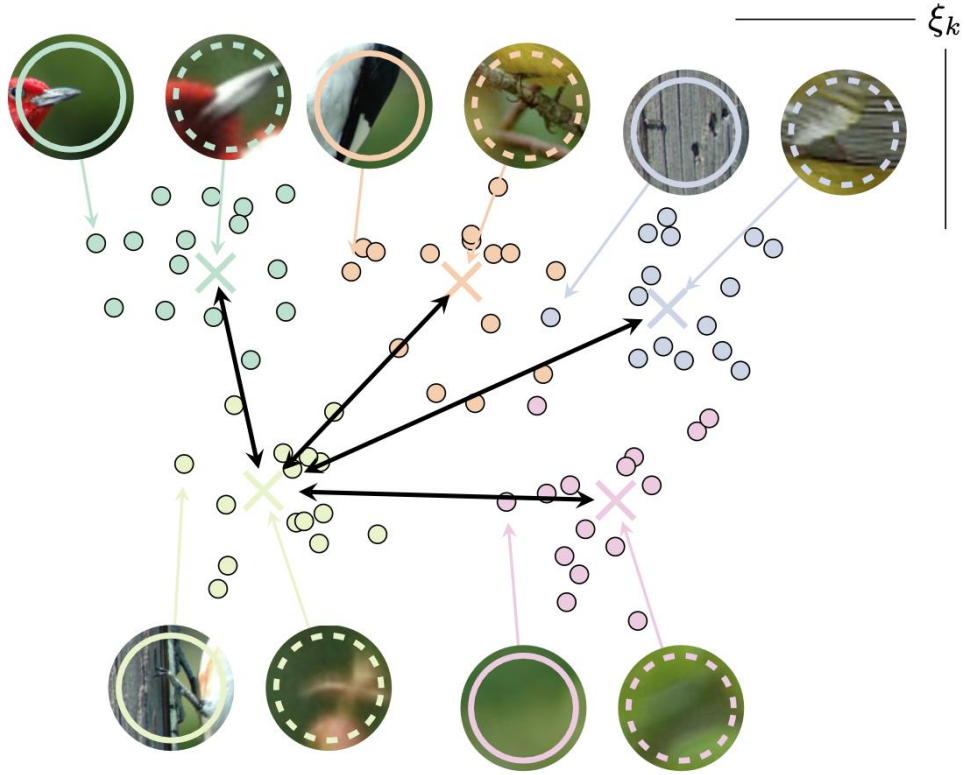
- Correct (trivial)
- Based on nonsensical concepts
- Based on a faulty choice of concepts
- Both



Towards human interactions in the latent space

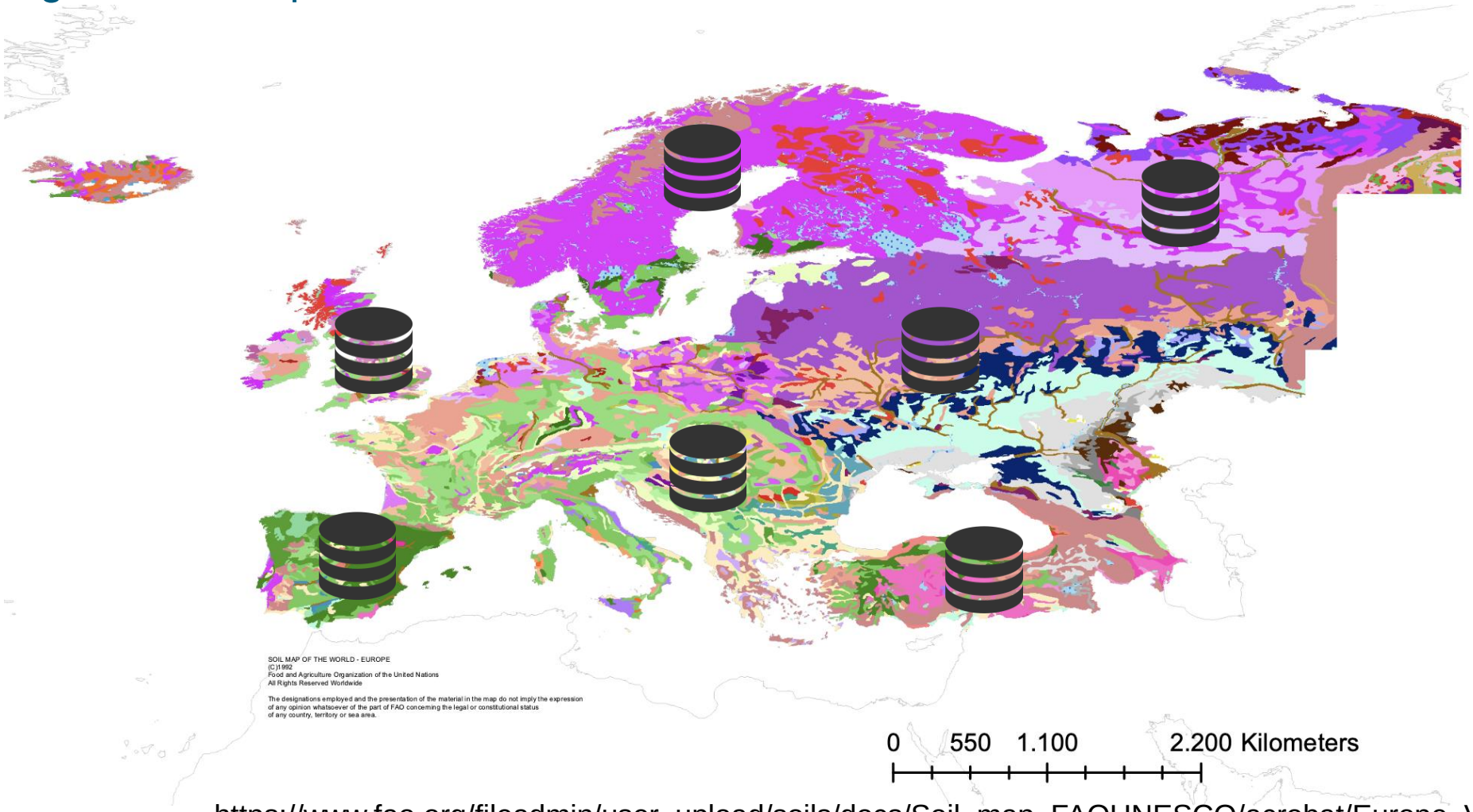






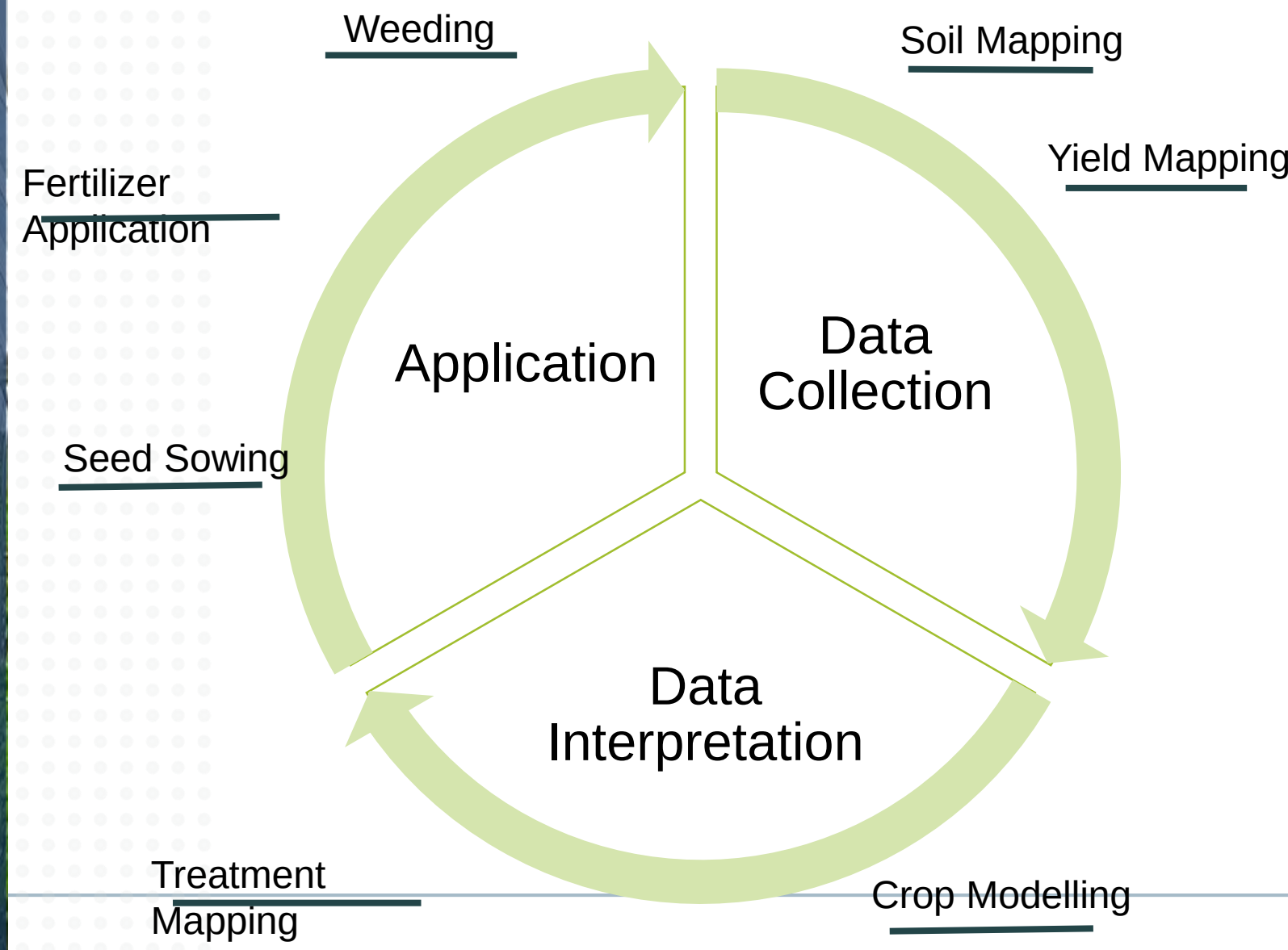
Why would I want to do that?

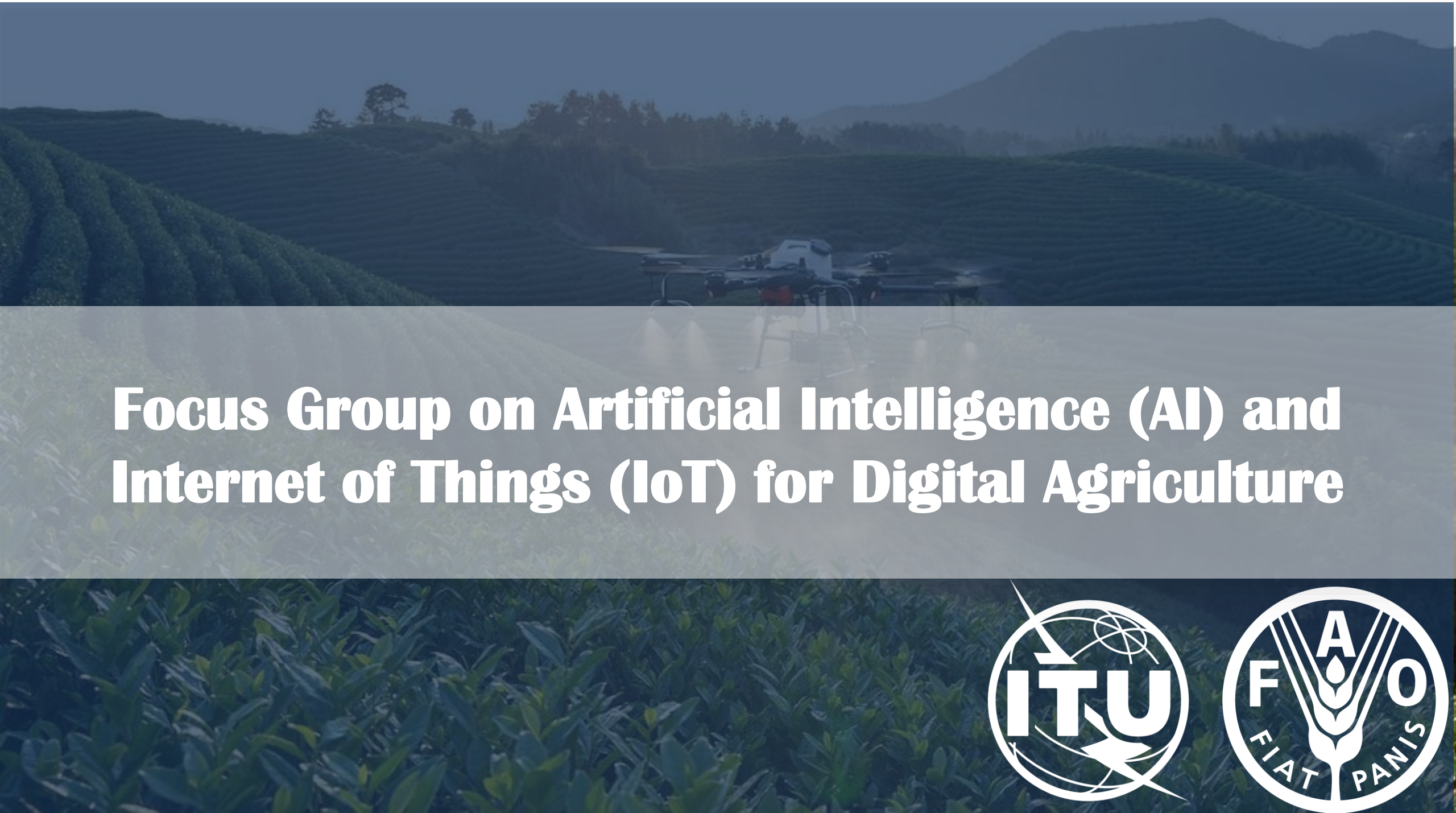
Because agriculture is special…



https://www.fao.org/fileadmin/user_upload/soils/docs/Soil_map_FAOUNESCO/acrobat/Europe_V.pdf

Digital Agriculture Cycle





Focus Group on Artificial Intelligence (AI) and Internet of Things (IoT) for Digital Agriculture

Scope of FG-AI4A

Established by ITU-T Study Group 20

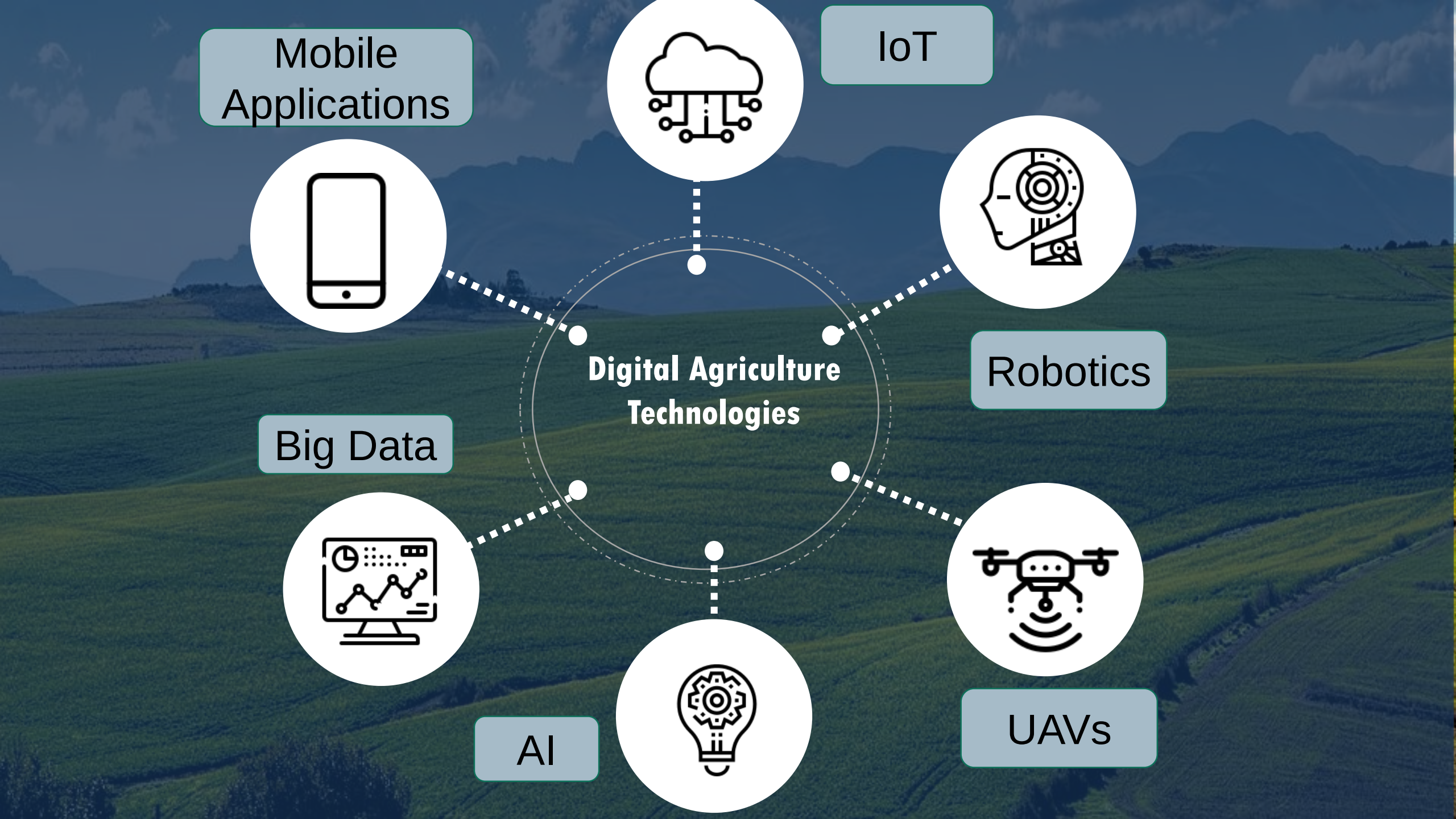
AI and IoT Use-cases

Key Concepts

Gap Analysis

Architecture

Community Building


Mobile Applications
IoT
Robotics
Digital Agriculture Technologies
Big Data
AI
UAVs

FG-AI4A Management

Chair

- Sebastian Bosse (Fraunhofer HHI, Germany)
- Ramy Ahmed Fathy (Egypt)

Vice-Chair(s)

- Chunlin Pang (TIAA, China)
- Zhongxin Chen (FAO)
- Gyu Myoung Lee (Republic of Korea)
- Paolo Gemma (Huawei Technologies Co., Ltd.)
- Guillermo Ariel González Conosciuto(Argentina)
- Ted Dunning (Hewlett Packard Enterprise)
- Sushil Kumar (Department of Telecommunications, Government of India)
- Long Hoang, John Deere
- Marco Brini, EnvEve

Working Groups

Glossary

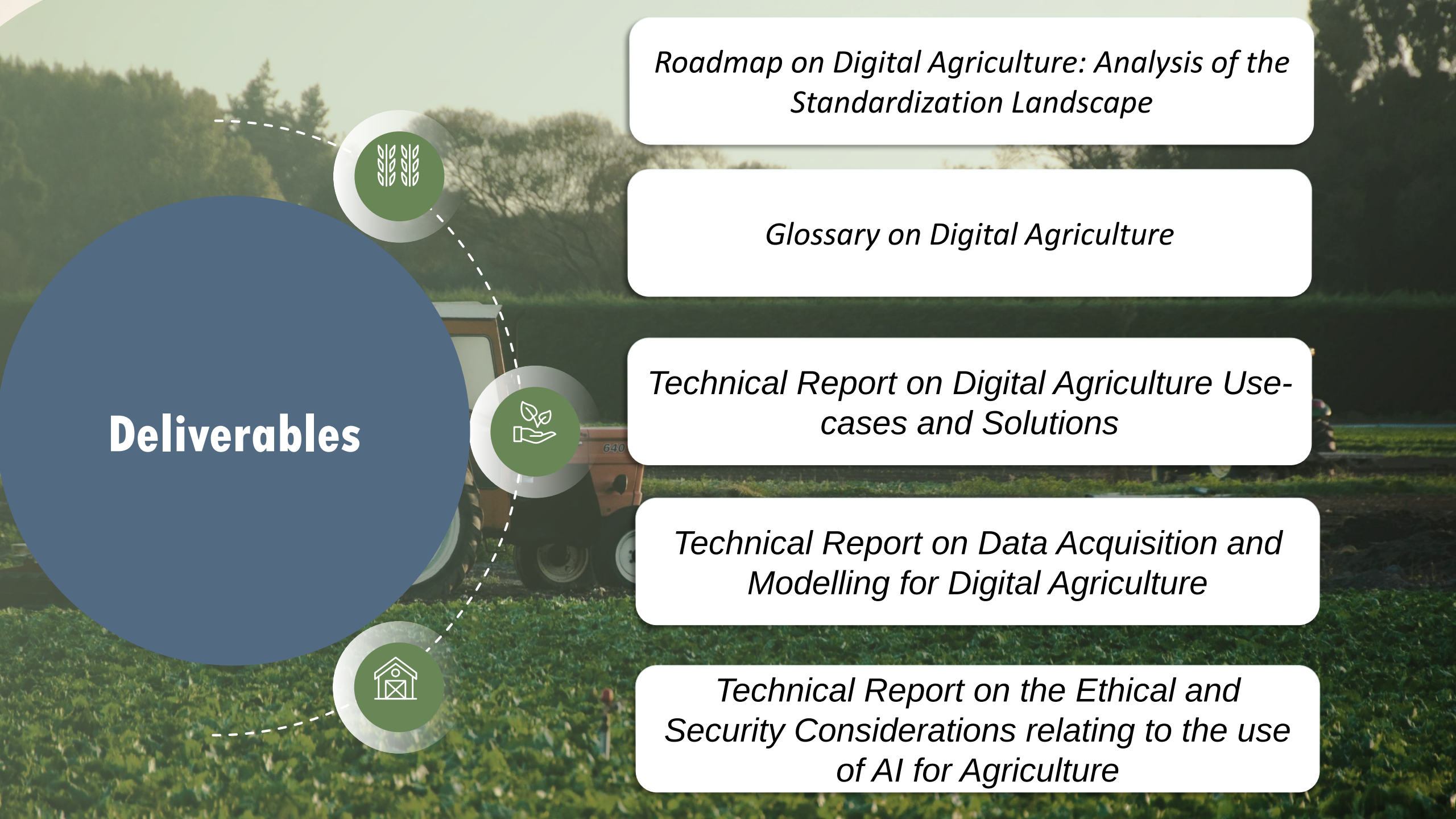
Use-cases and Solutions

Data Acquisition & Modelling

Roadmap

Ethics

Outreach



Deliverables

- *Roadmap on Digital Agriculture: Analysis of the Standardization Landscape*
- *Glossary on Digital Agriculture*
- *Technical Report on Digital Agriculture Use-cases and Solutions*
- *Technical Report on Data Acquisition and Modelling for Digital Agriculture*
- *Technical Report on the Ethical and Security Considerations relating to the use of AI for Agriculture*

Topics Groups

- Data Science for surface and underground water monitoring
- Georeferenced Data Management
- Weather modelling and forecasting
- Yield monitoring and Prediction
- Irrigation strategy and smart water management

Conclusion

Integration of human cognition into digital systems is a neccesary condition for the digitization of agriculture

Interoperability between data acquisition and AI and data models is a crucial

Fraunhofer HHI

Thank you very much!

NaLamKI

Supported by:

Federal Ministry for Economic Affairs and Climate Action

on the basis of a decision by the German Bundestag

AI: AI and Internet of Things for Digital Agriculture

ITU Focus Group