



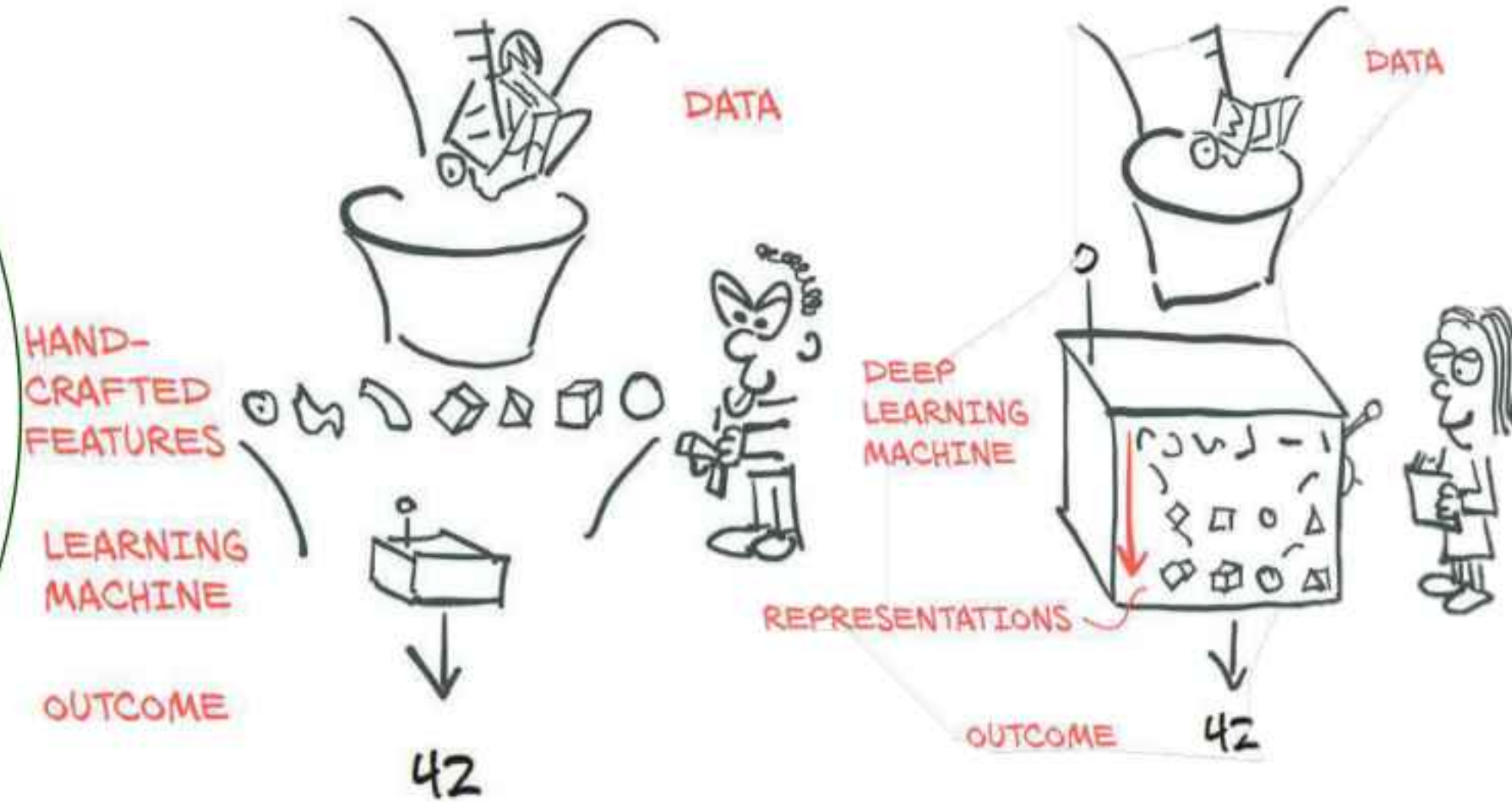
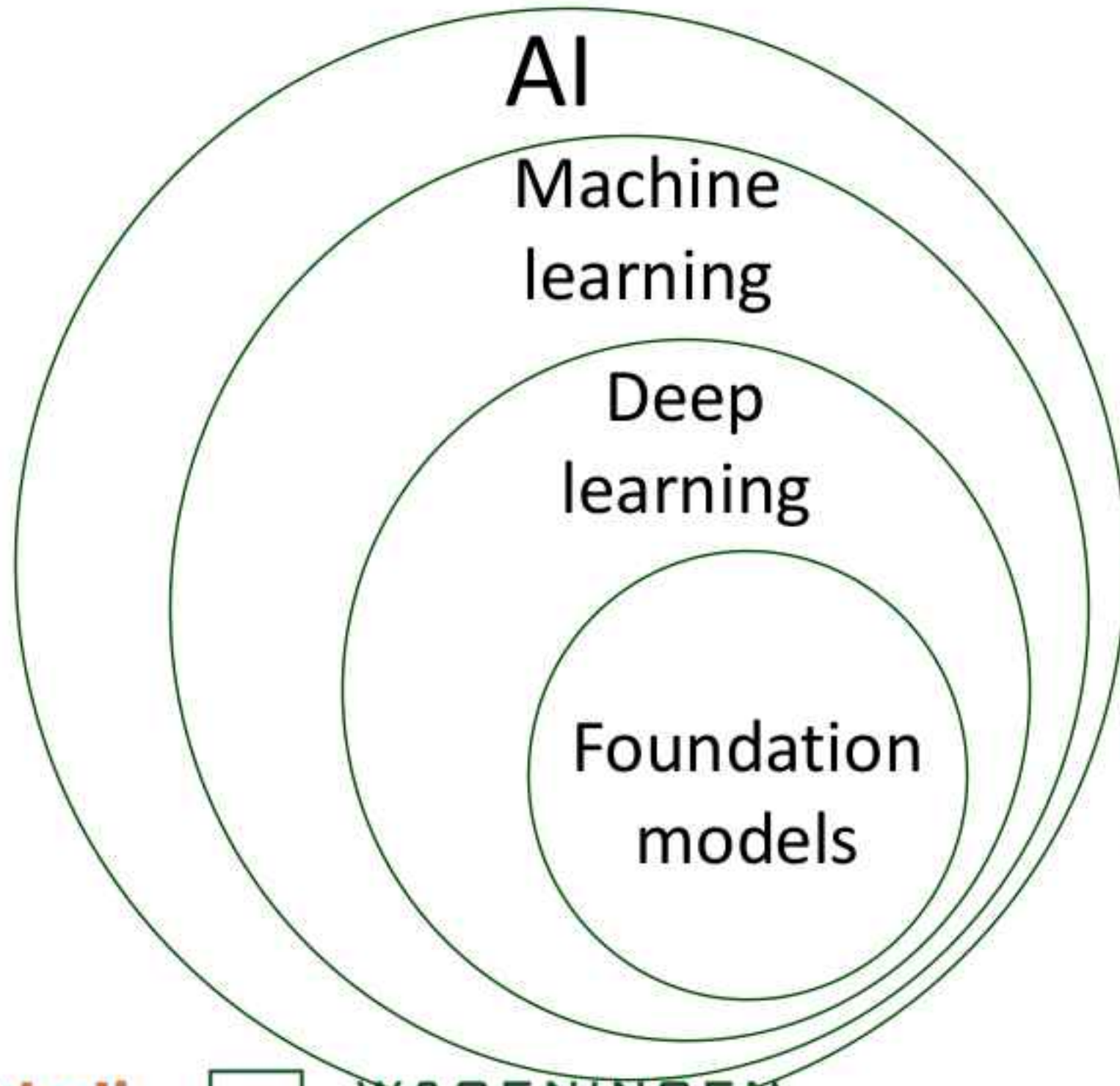
Funded by  
the European Union

# AI Foundation Models for Food Safety Risks

Bas van der Velden, PhD  
Head of Data Science & AI  
Wageningen Food Safety Research

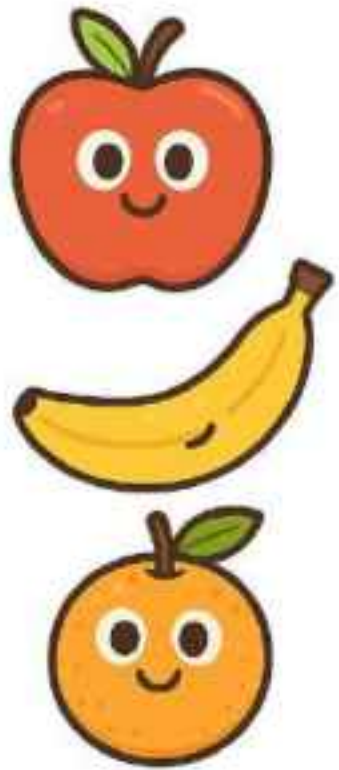
\*all fake-looking images are made with genAI

# What is AI?



# Machine learning

## SUPERVISED LEARNING EXAMPLE

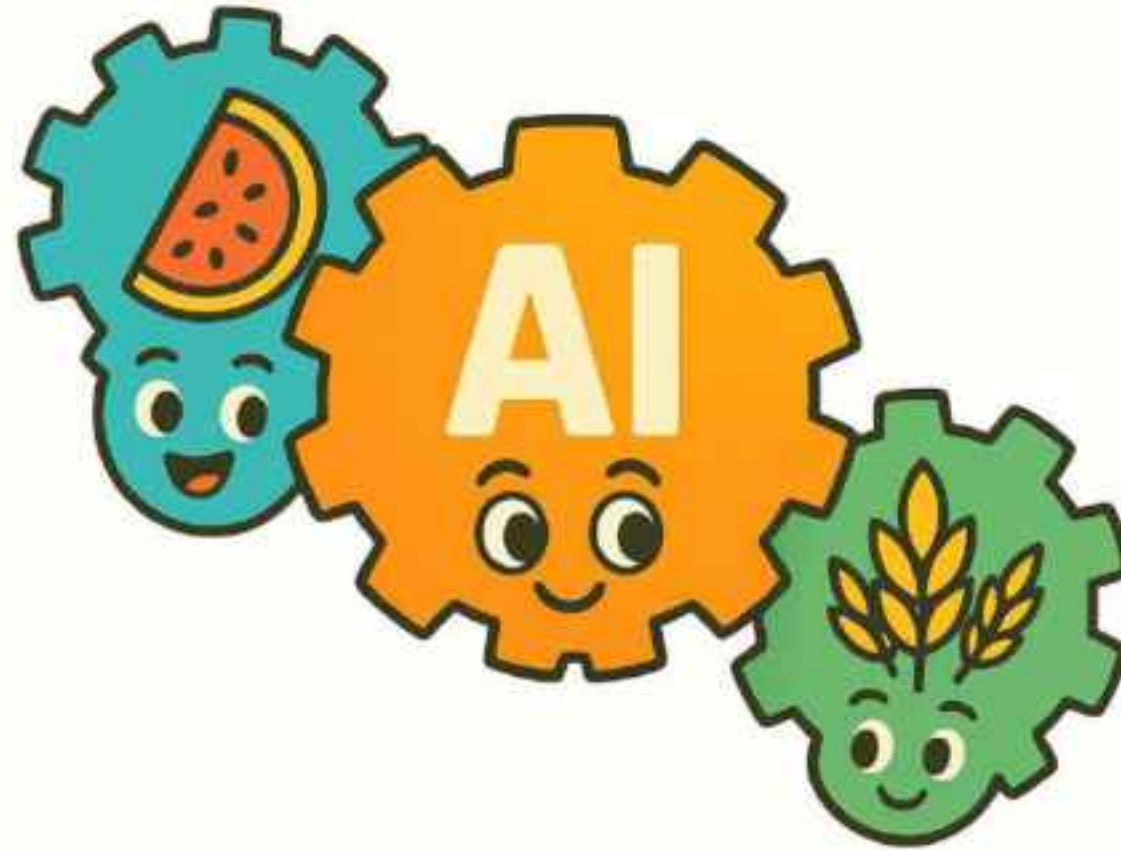


Apple

Banana

Orange

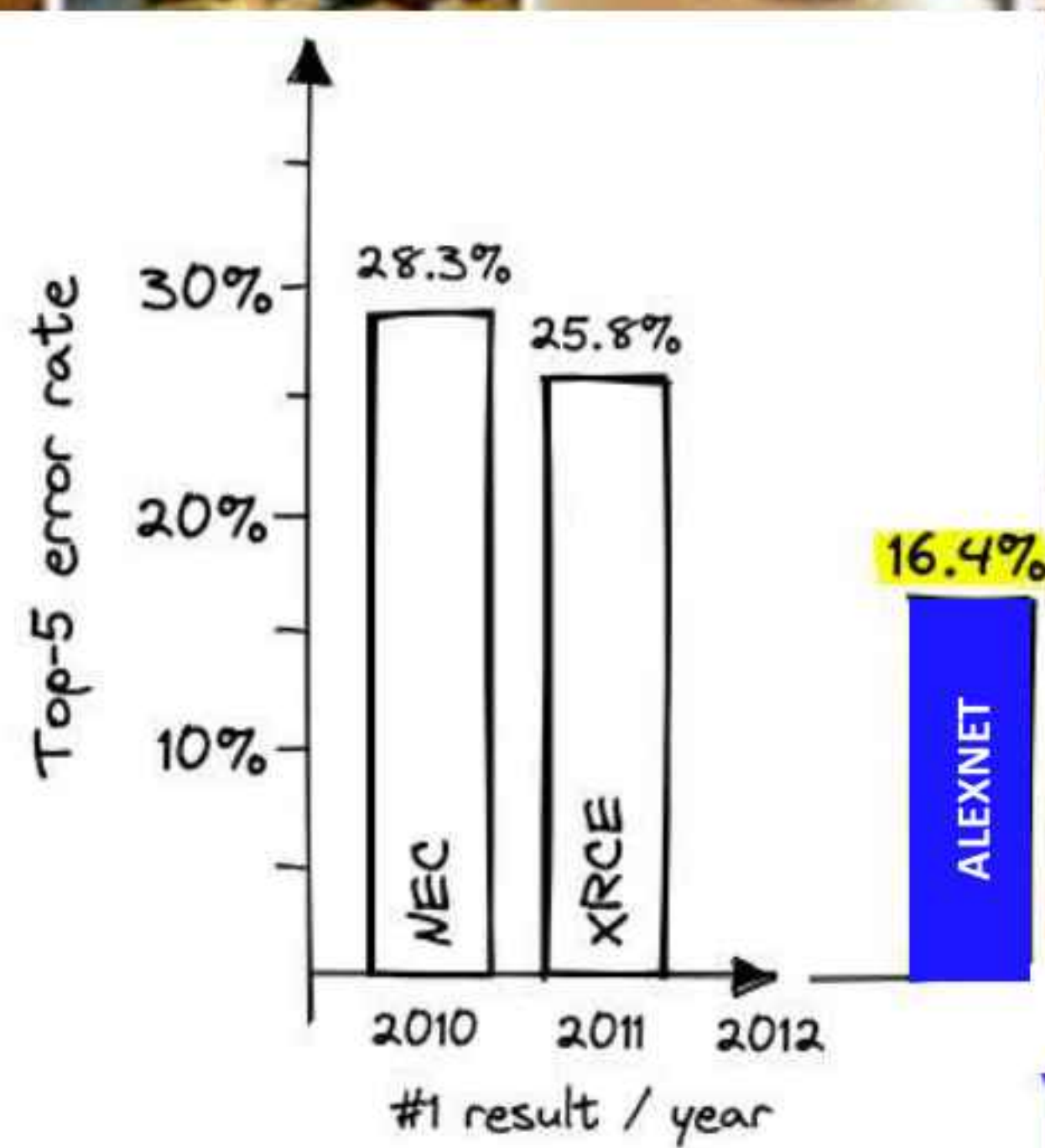
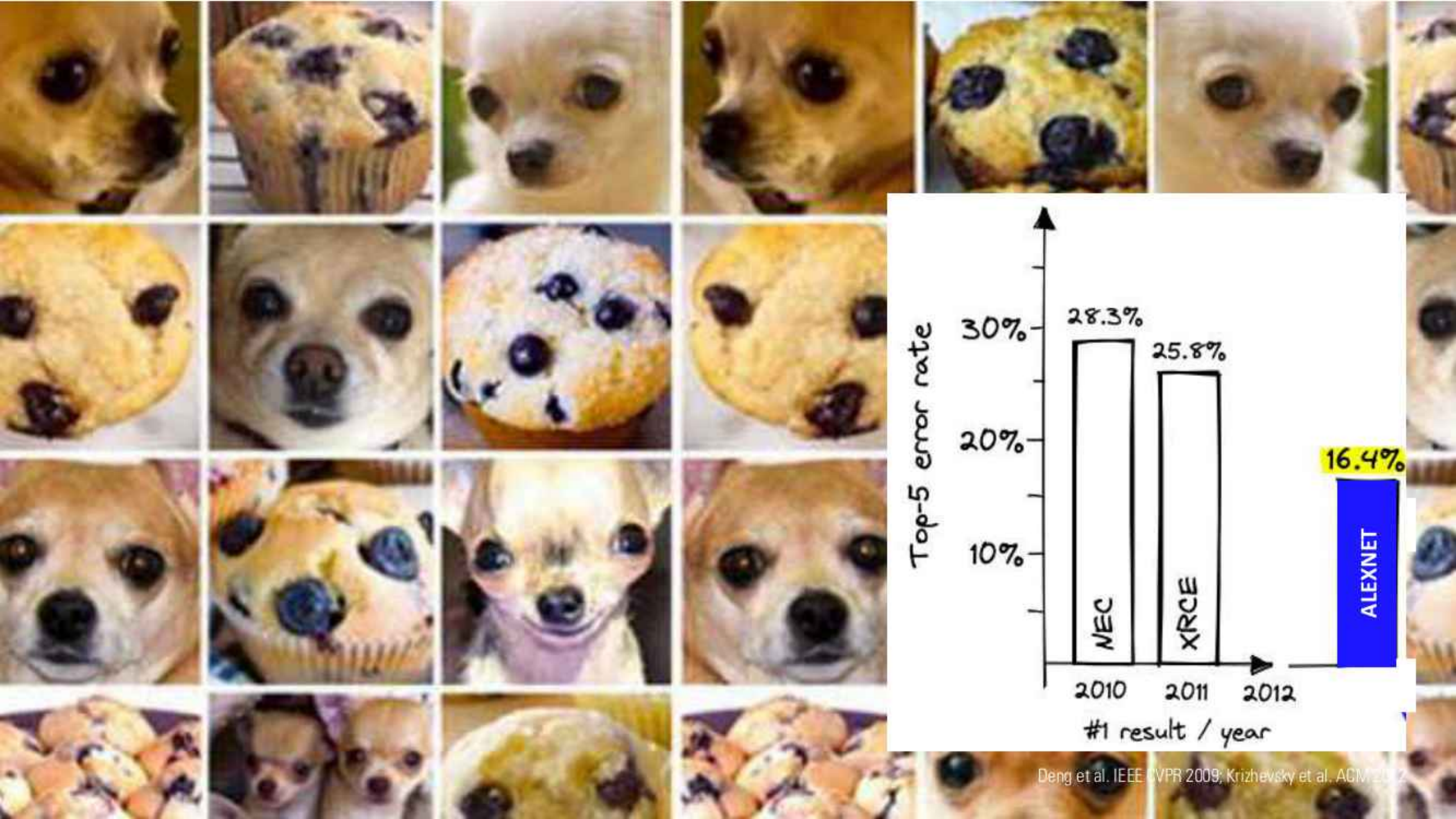
Training data



Apple



Test data



# Deep learning

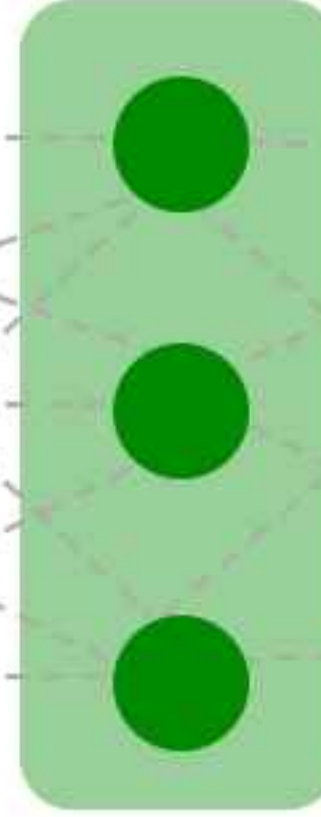
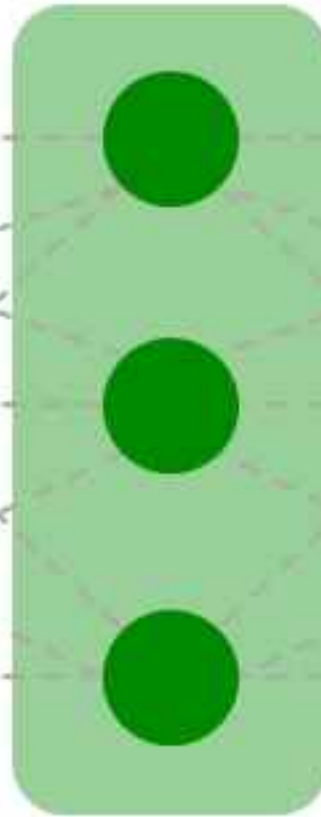
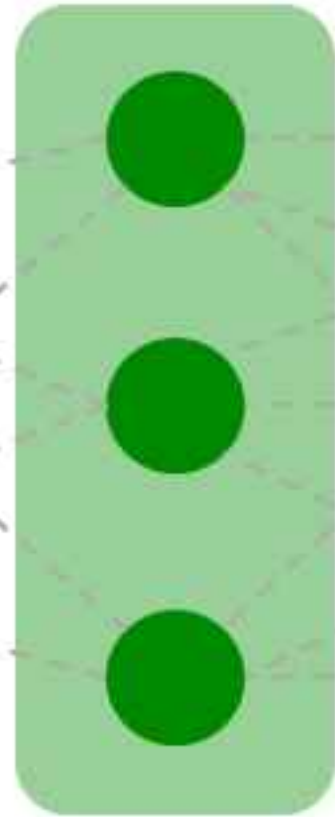


# Neural network

input

hidden layers

output



flamingo 0.90

⋮

cat 0.05

## Hungry for Energy, Amazon, Google and Microsoft Turn to Nuclear Power

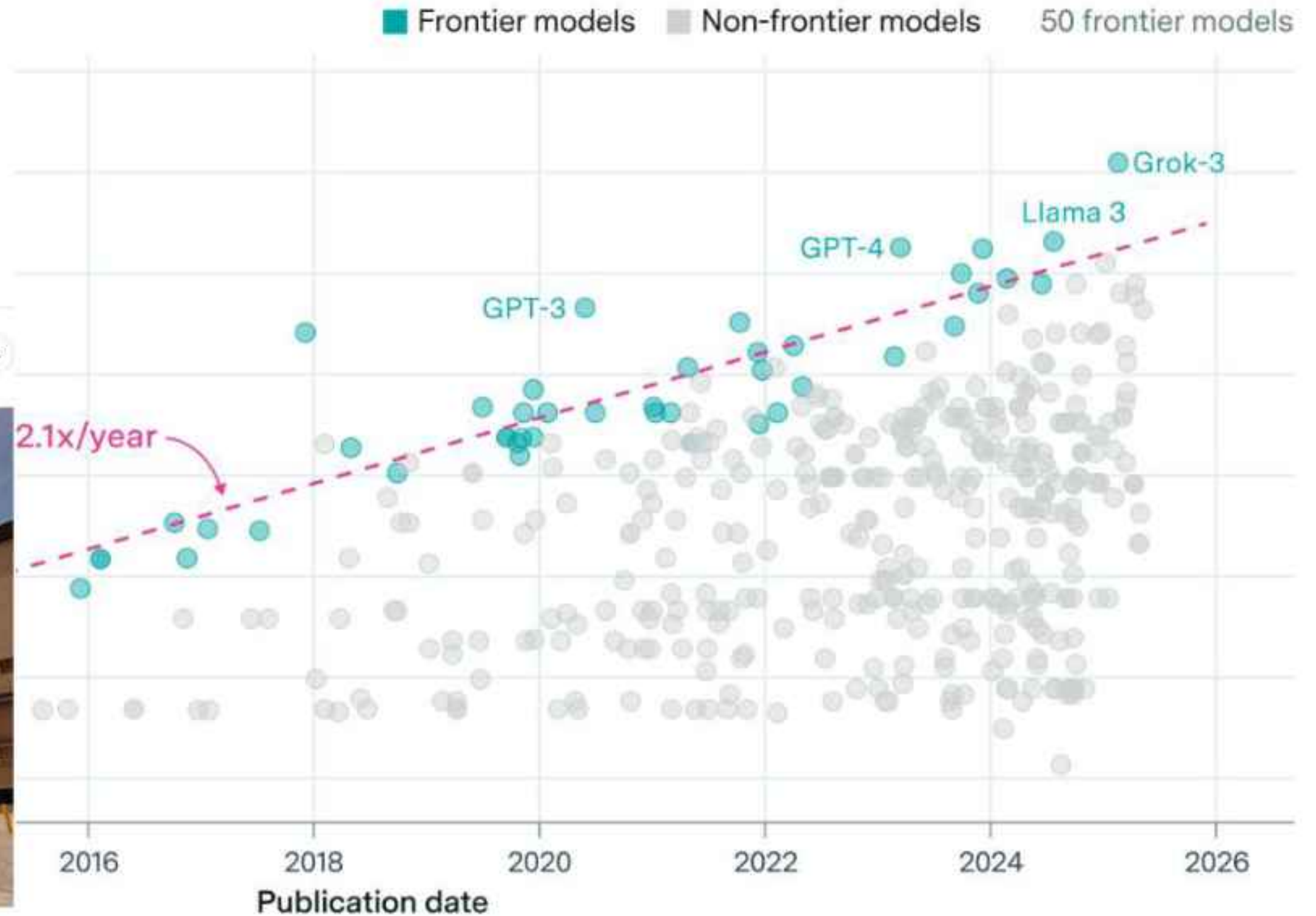
Large technology companies are investing billions of dollars in nuclear energy as an emissions-free source of electricity for artificial intelligence and other businesses.

Listen to this article · 7:41 min [Learn more](#)

Share full article



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# Manual labeling is infeasible



# Self supervised learning



# Foundation model

pretraining



fine-tuning



# AI & foundation models @ WFSR

# Data Science team



Andrea Jr  
*Chemometrics*



Antoine  
*Data mining*



Bas  
*Explainable AI*



Daan  
*AI*



Eva  
*Data Science*



Floor  
*Multivariate statistics Bioinformatics*



Joost  
*Genomics*



Leonieke  
*AI*



Lois  
*Applied biostatistics*



Marieke  
*Internship*



Nehir  
*Bioinformatics*



Neris  
*Text mining*



Niek  
*Chemical AI*



Osman  
*AI*



Rosan  
*Data engineer*



Karsten  
*Toxicology AI*



Santiago  
*Data Science*



Thijmen  
*Bioinformatics*



Thijs  
*AI*



Valerie  
*Bioinformatics*



Wenjuan  
*AI in food systems*



Wouter  
*Data engineer*



Xinxin  
*Machine learning*



Zuzanna  
*AI*

# Large language model (LLM)

 Claude



 Gemini



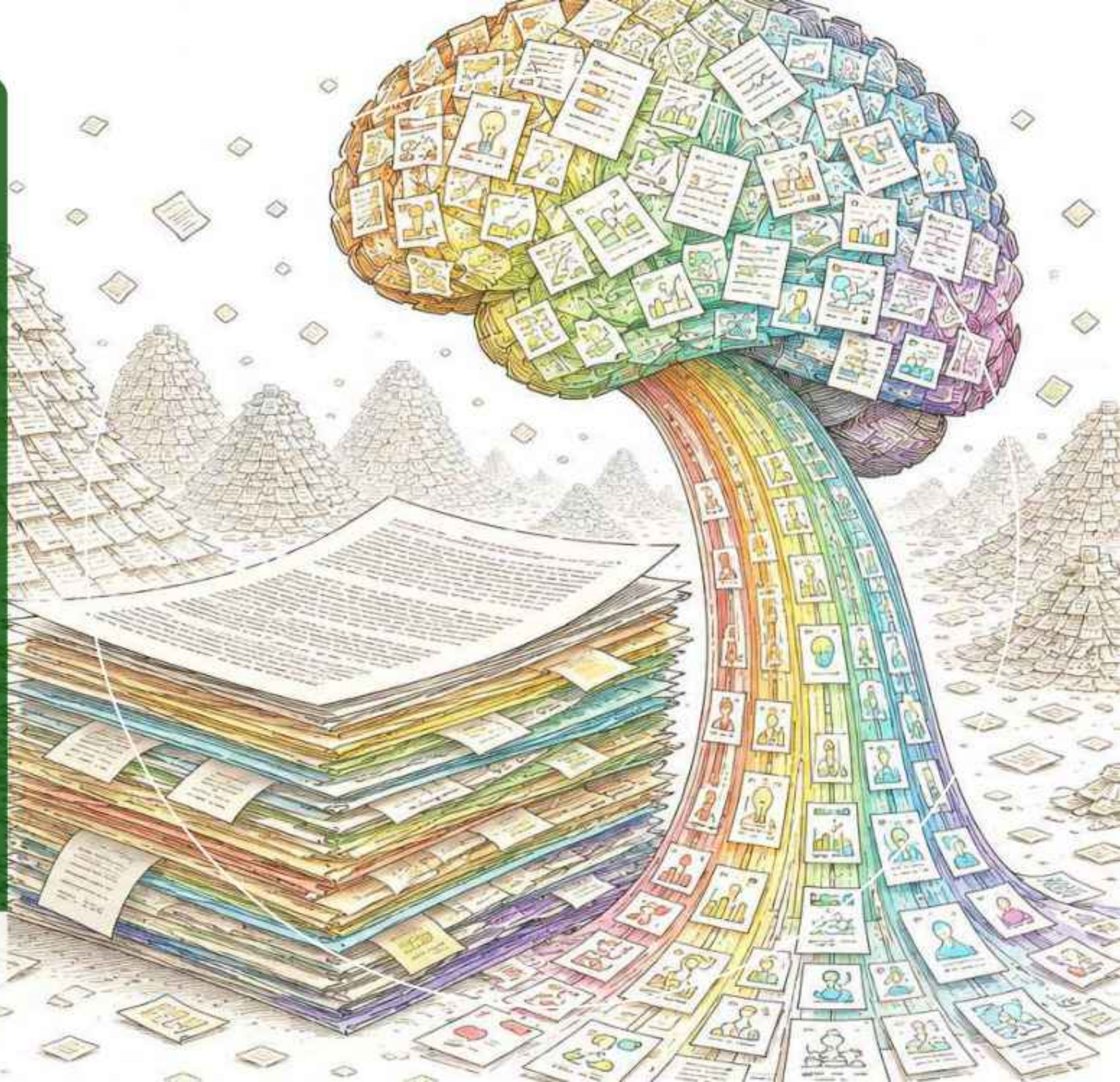
Copilot



**Hugging Face**

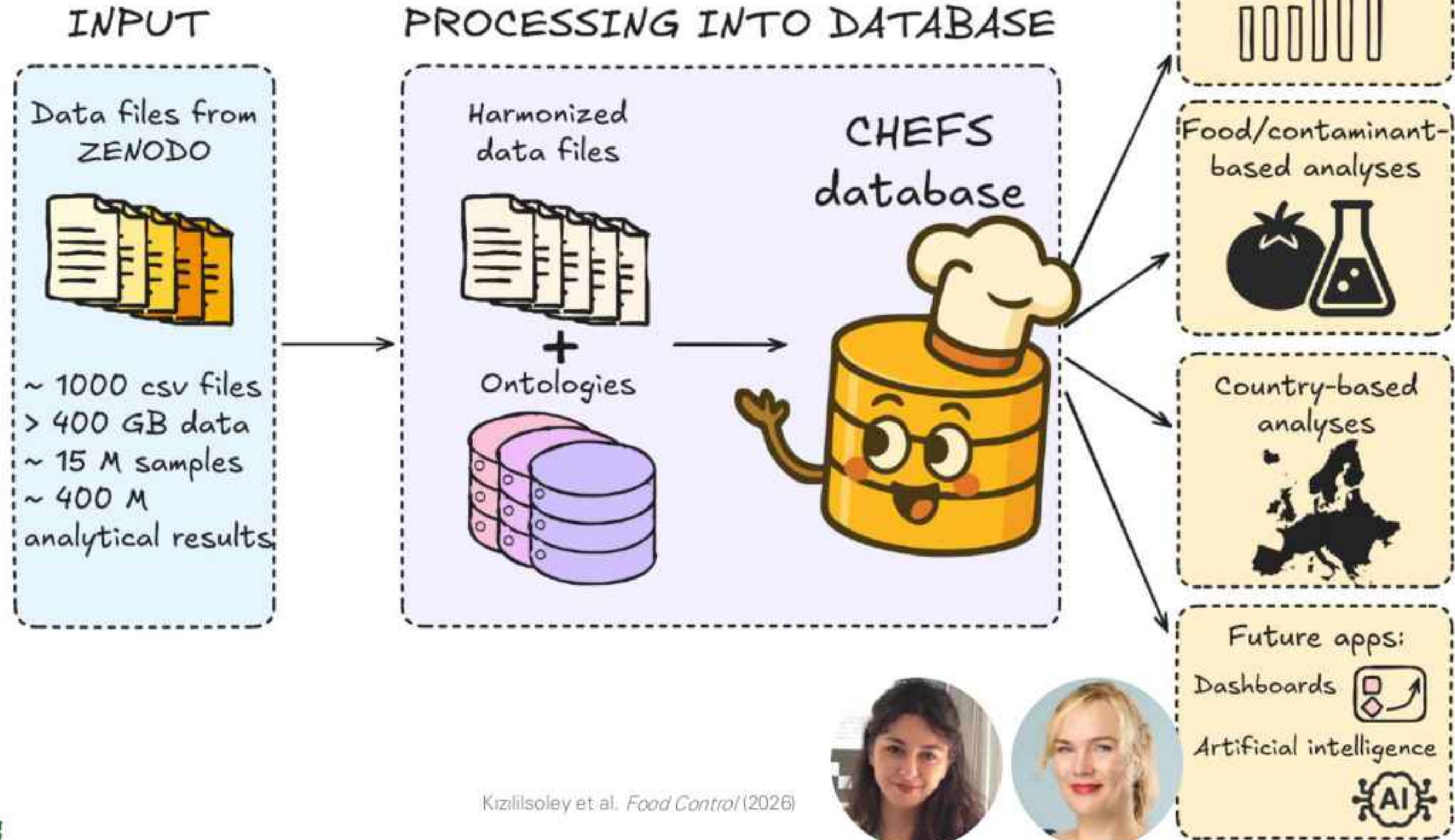
# LLM for knowledge extraction

Large Language Modeling 12.00-12.15



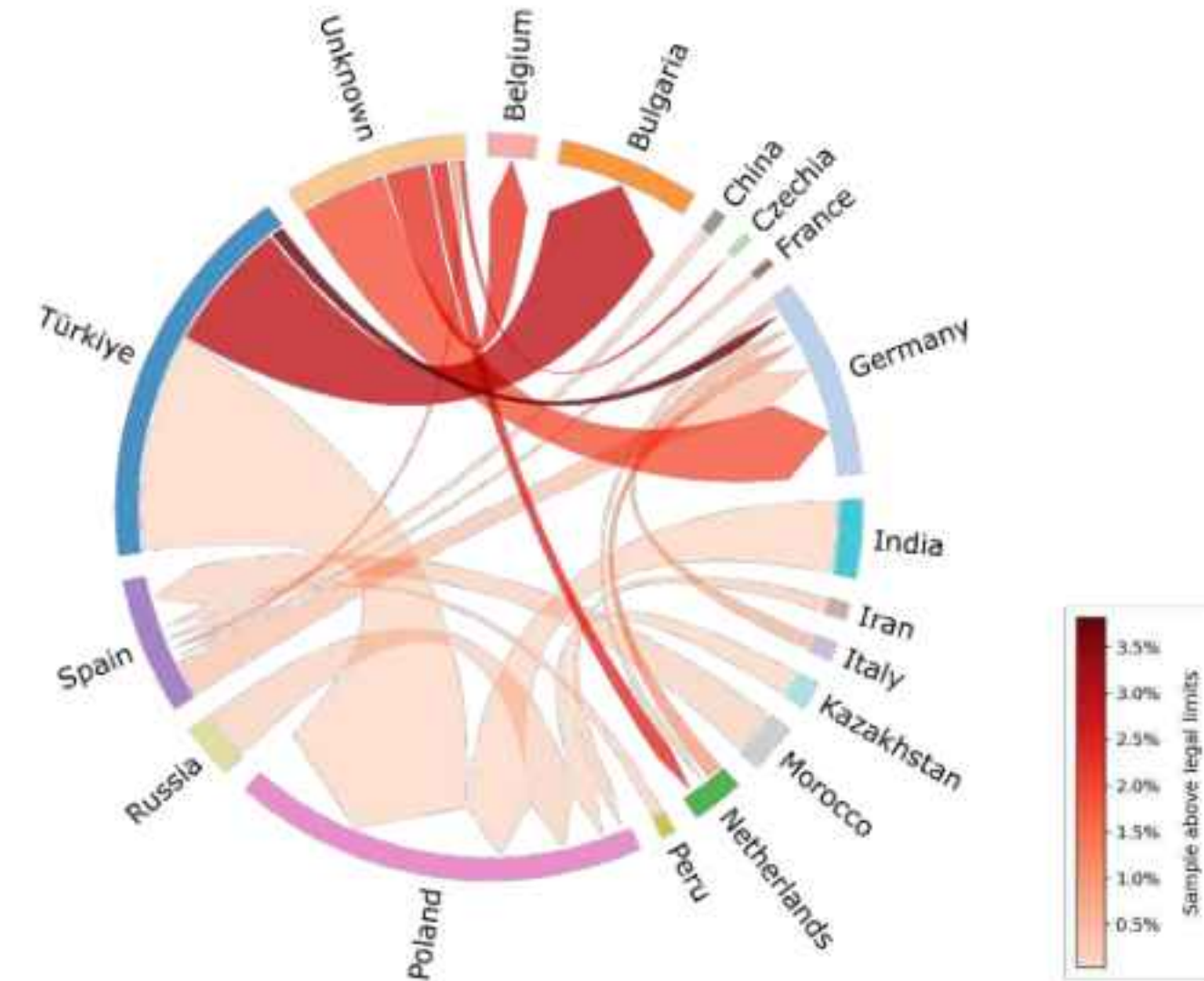
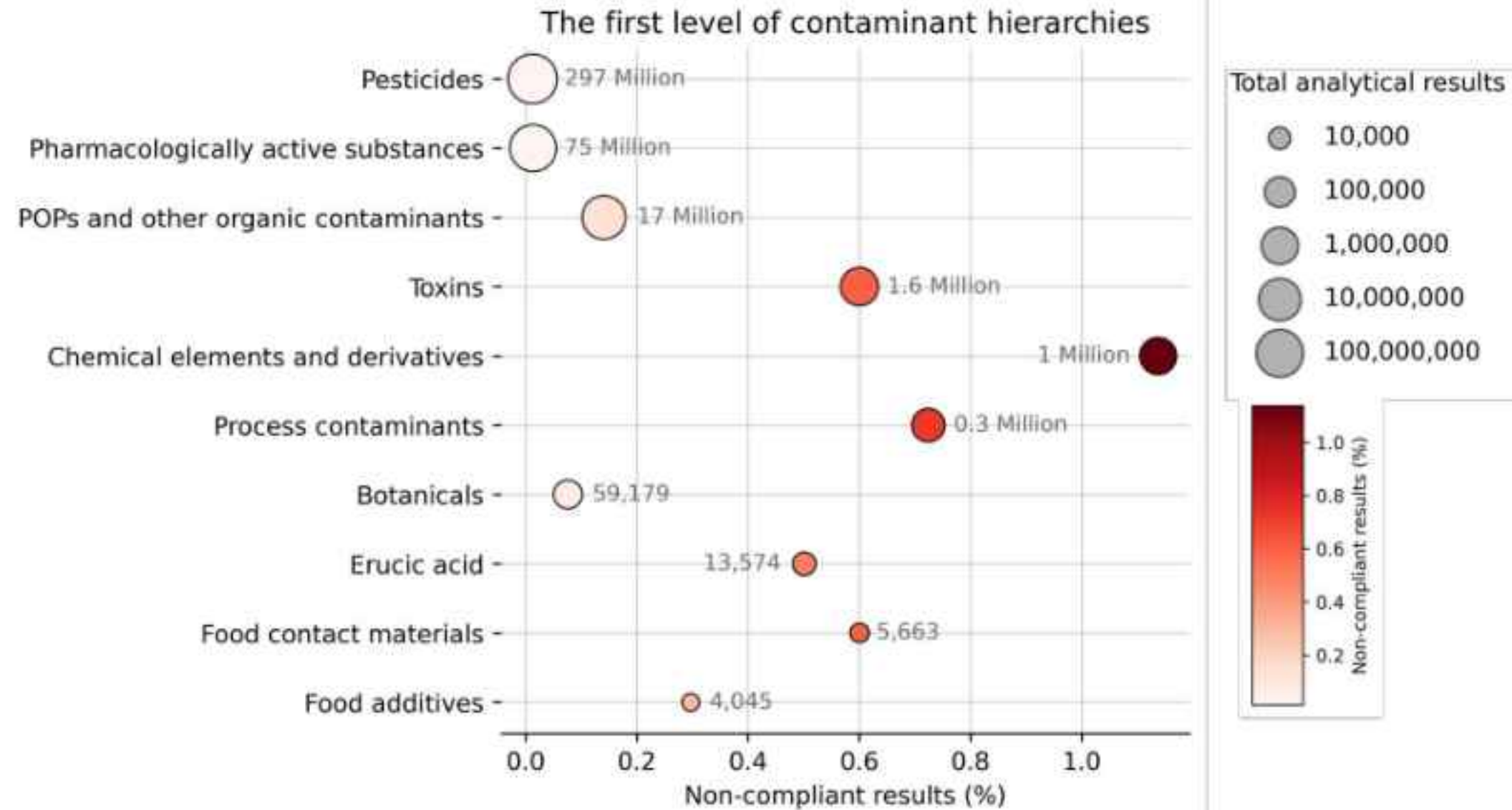
# Big dataset: CompreHensive European Food Safety (CHEFS) database

## APPLICATIONS



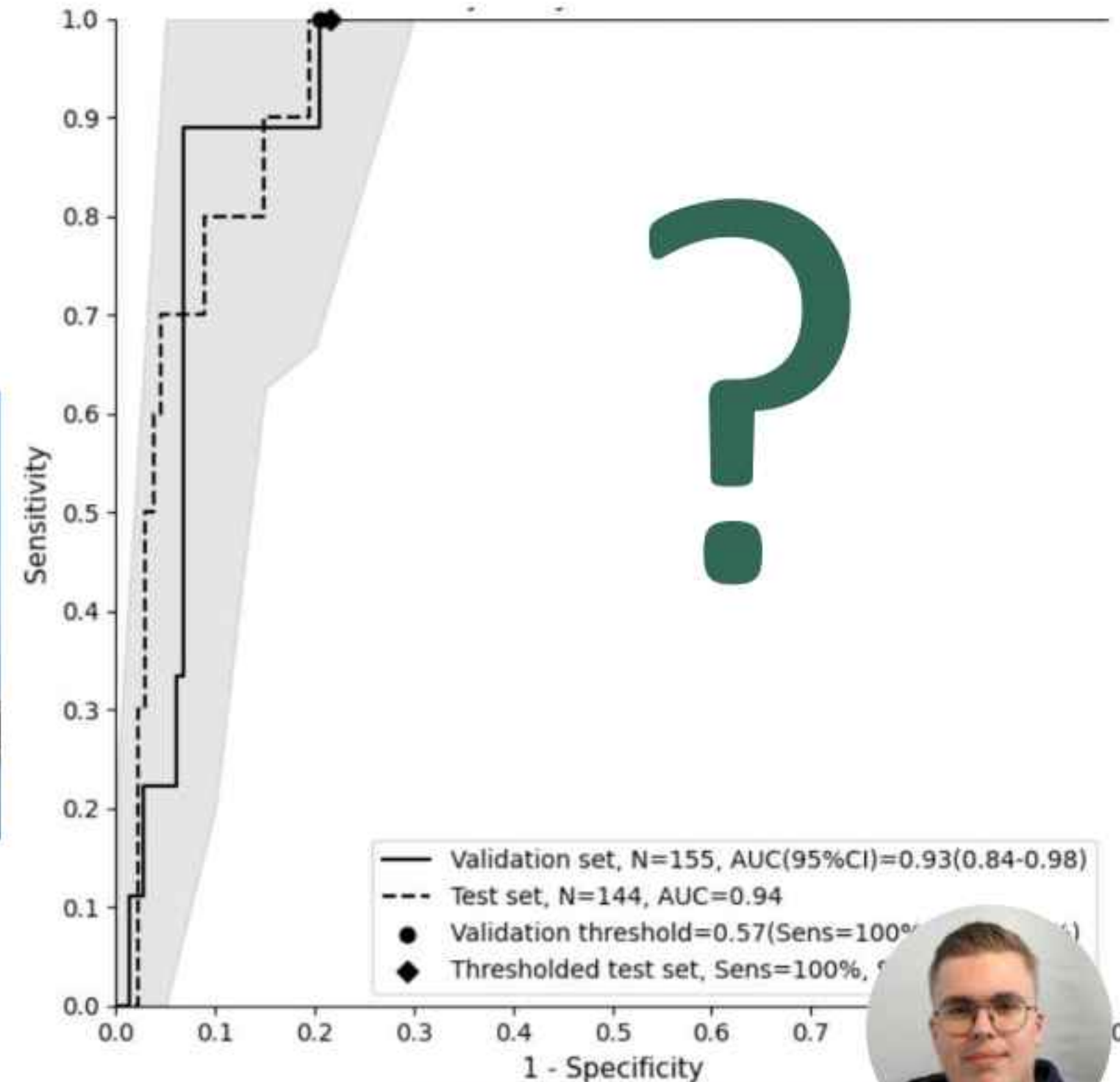
# Trend analyses

2020 - 2024



# Tetrodotoxins in shellfish

- ▶ 1156 samples
- ▶ 222 above limit of detection
- ▶ 44 above legal limit



Schoppema et al, Nature Sci.Food 2026



# Black box

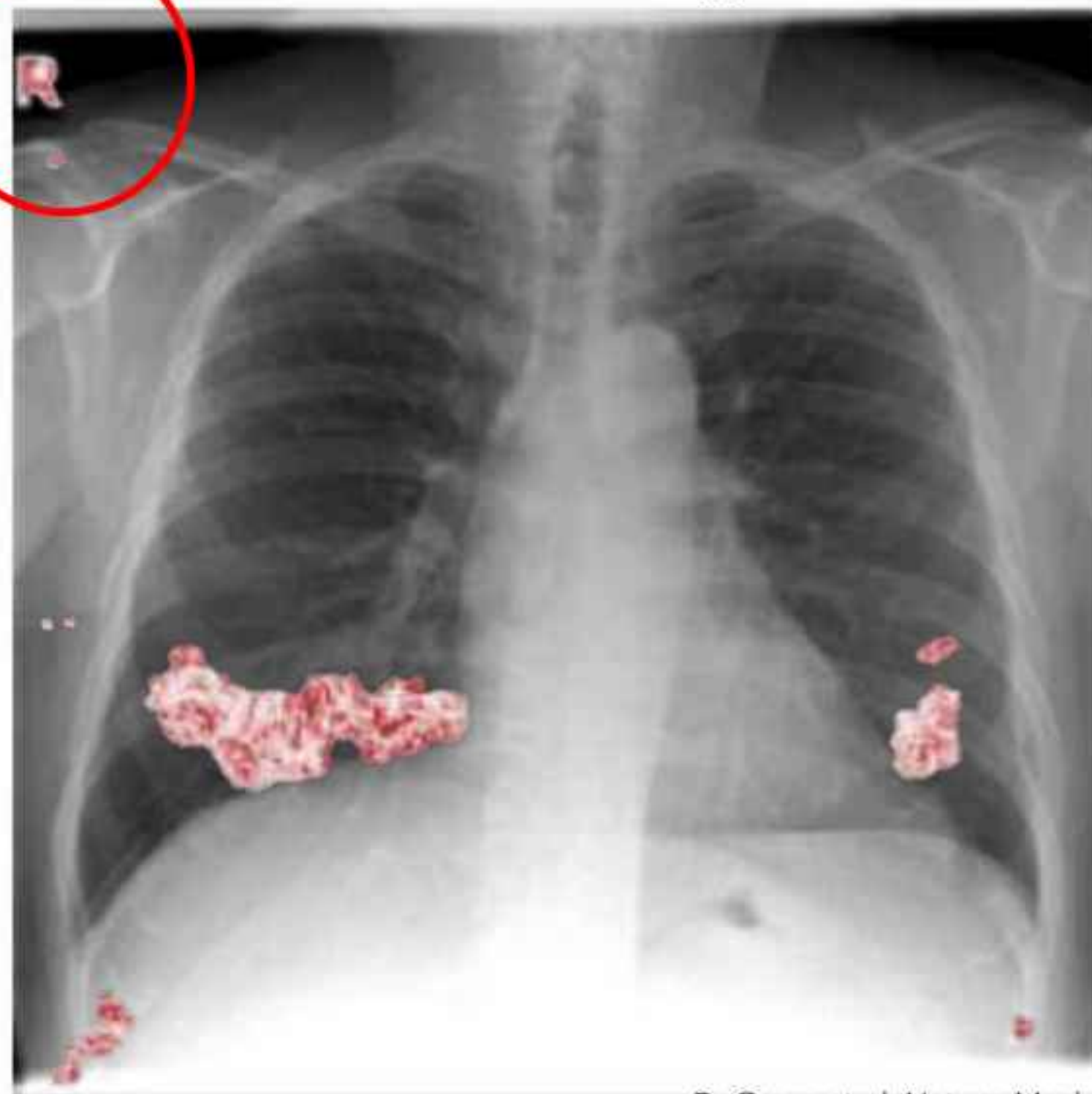


# Real world implications

COVID-19 positive

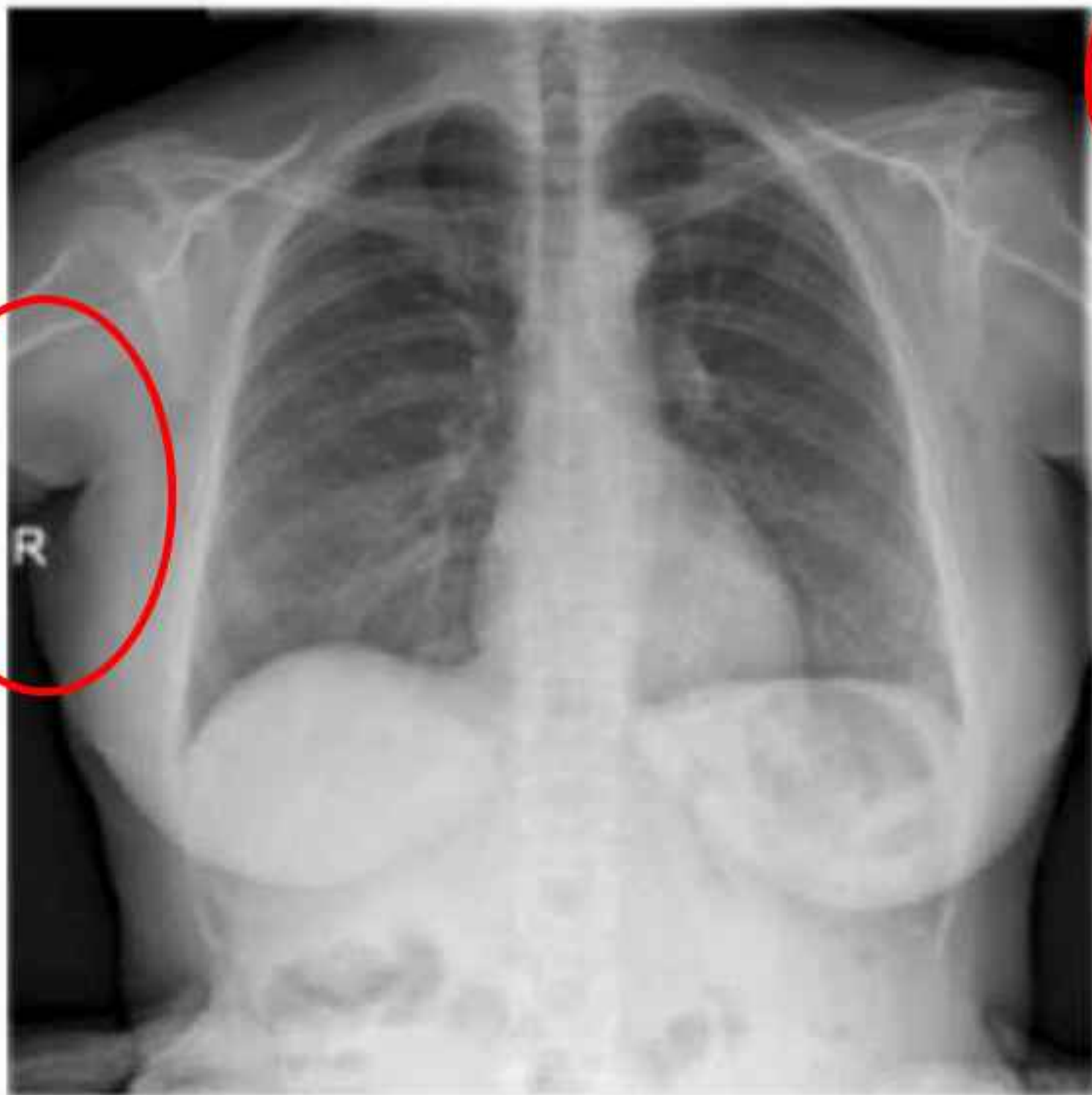


COVID-19 negative

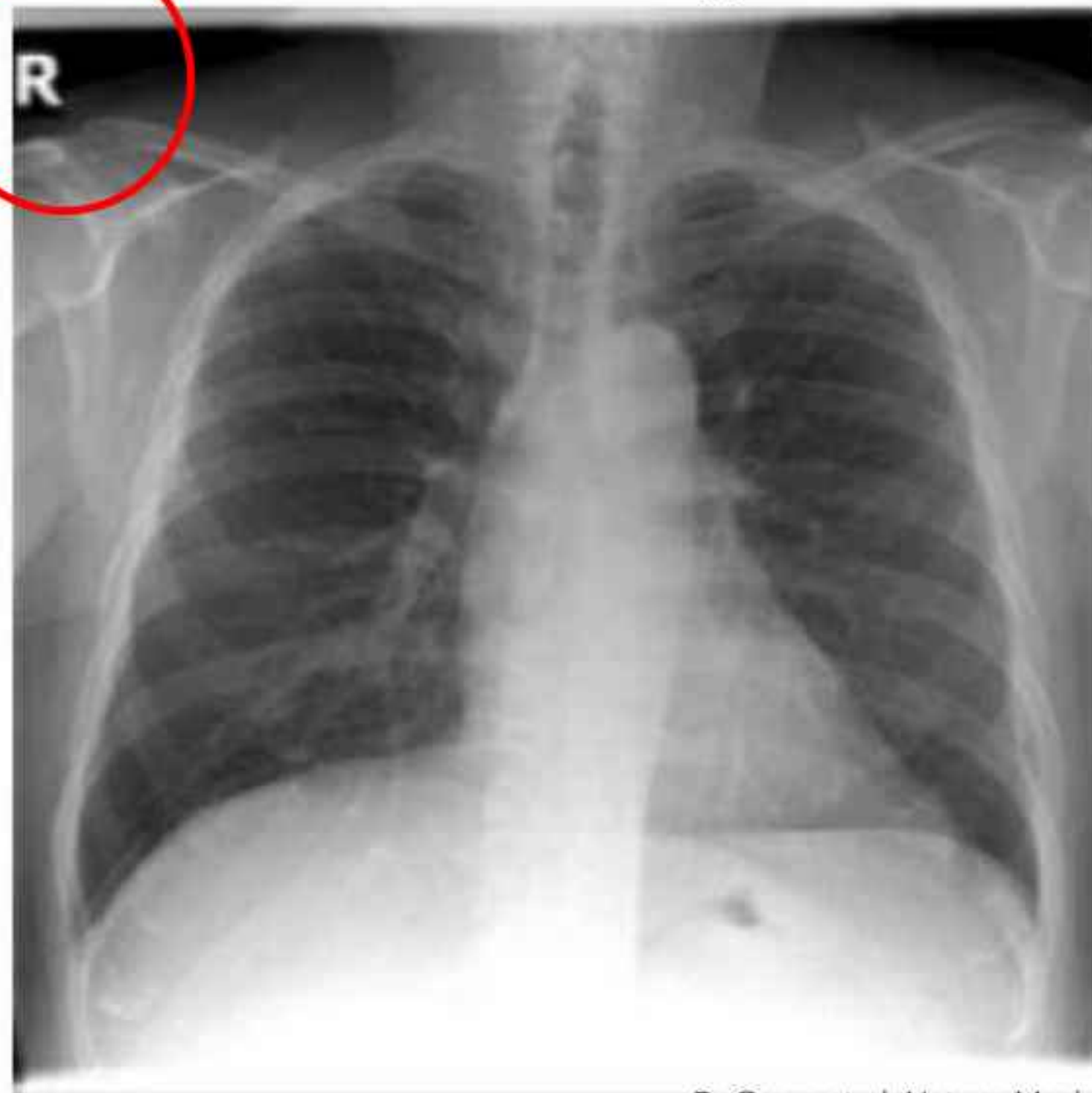


# Real world implications

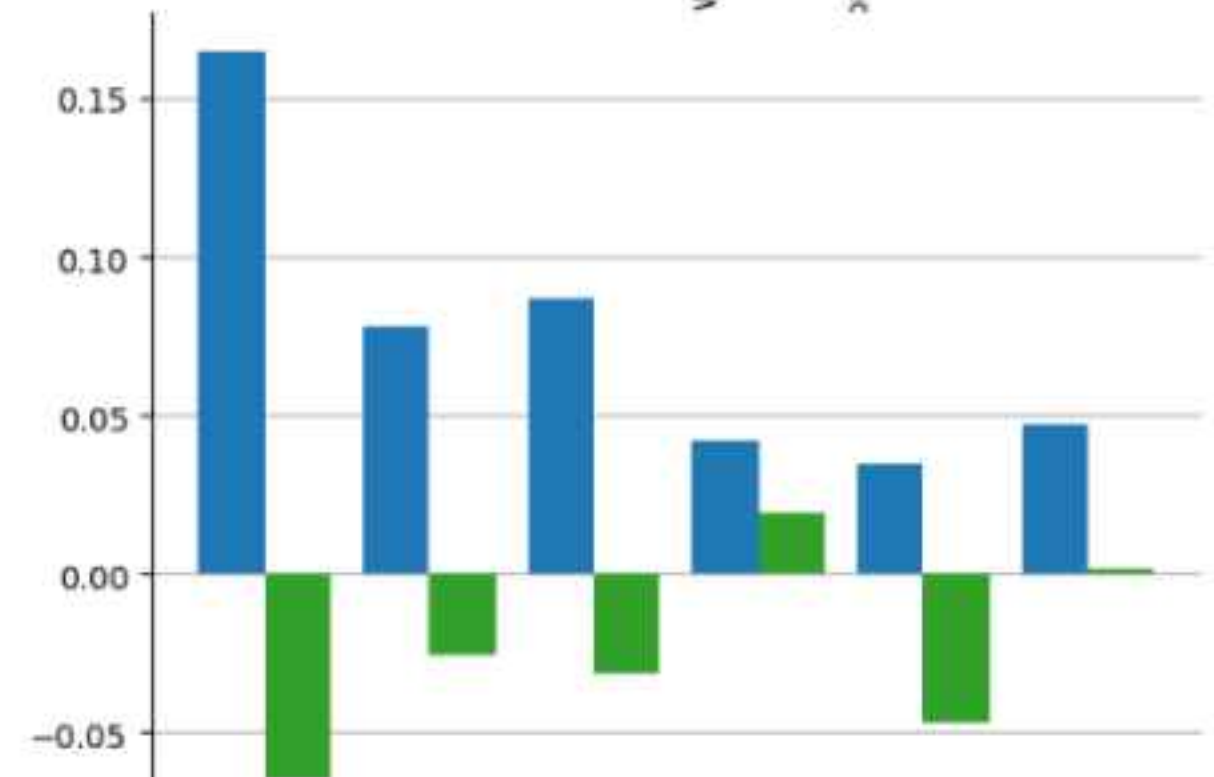
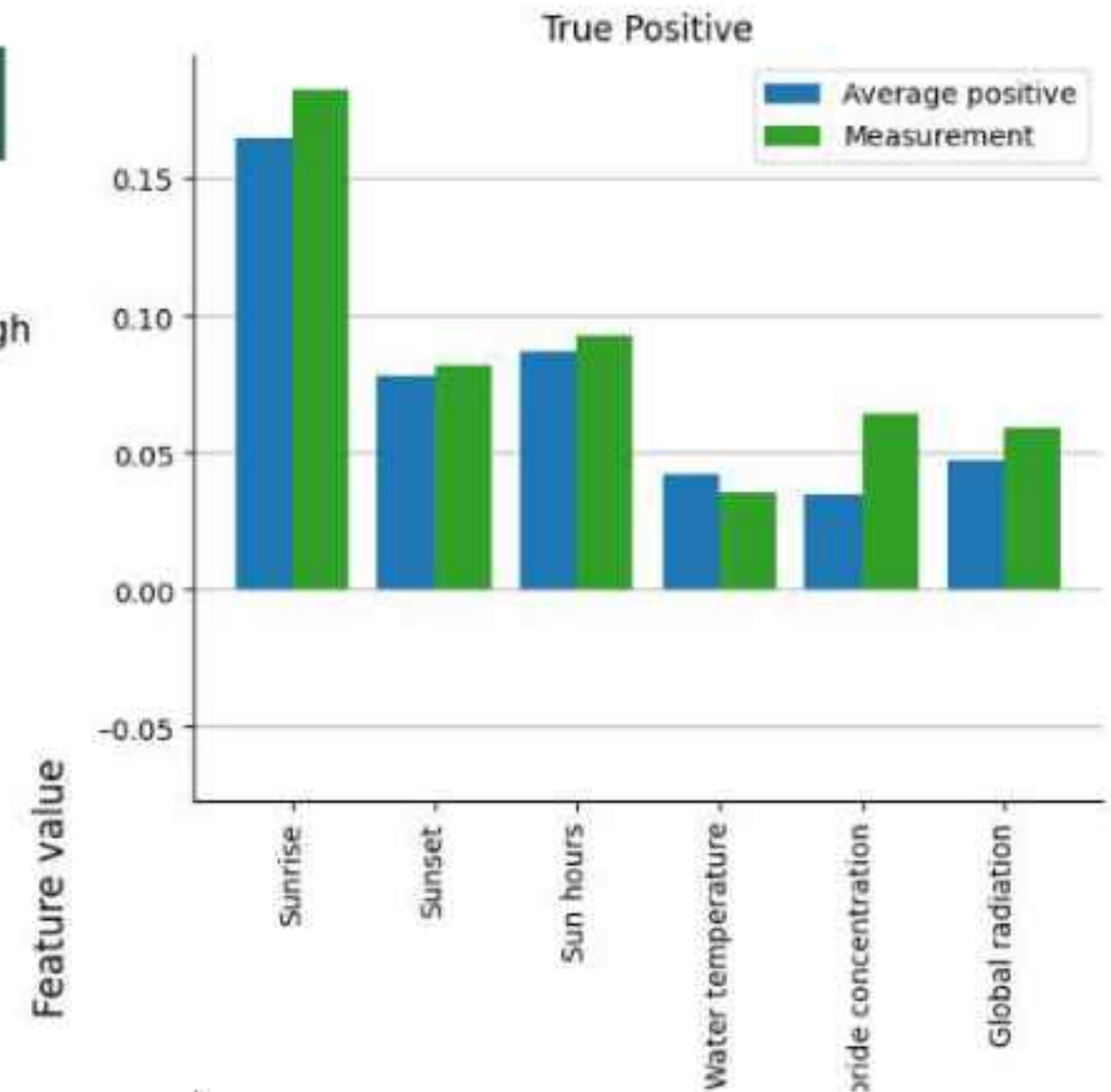
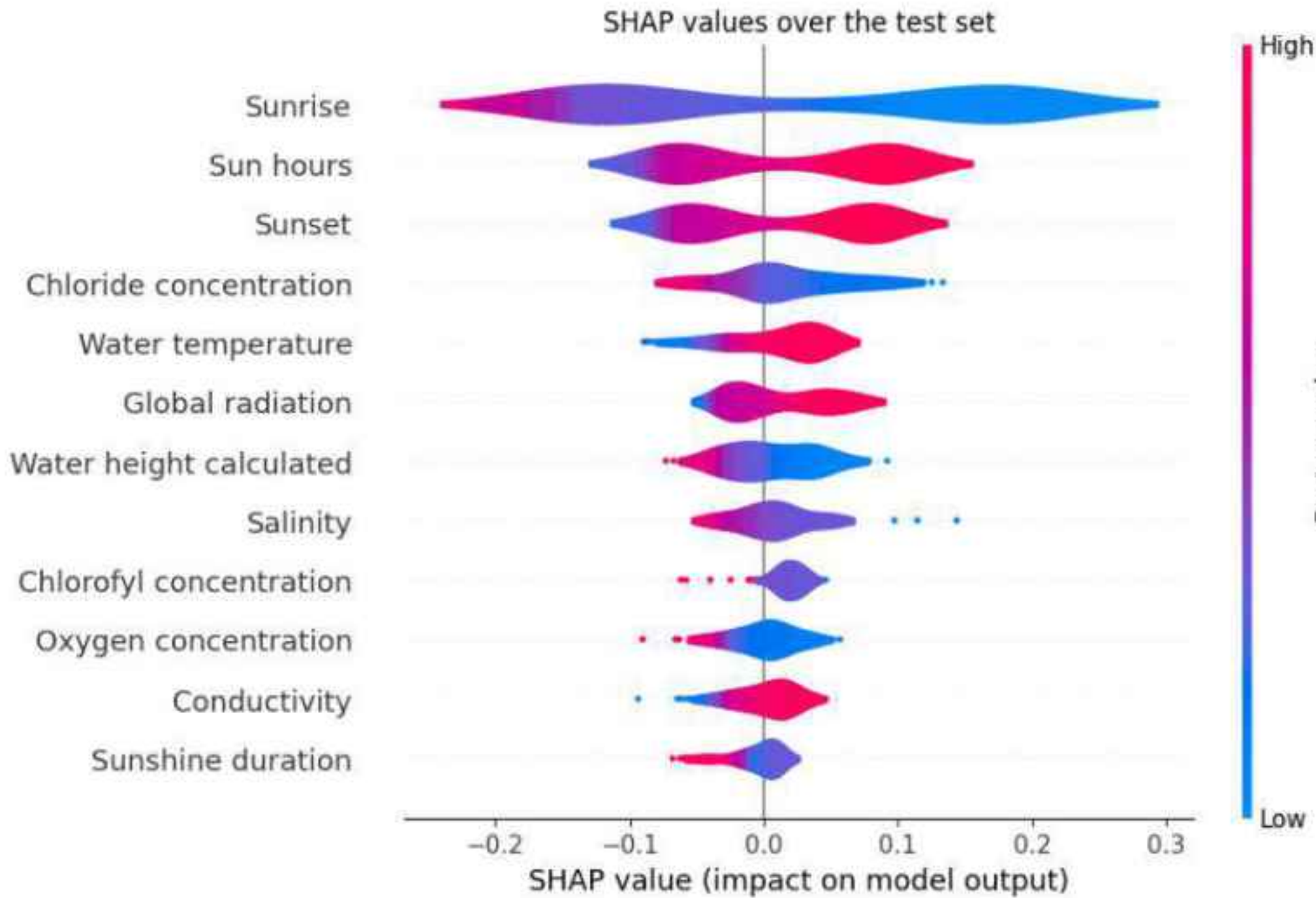
COVID-19 positive



COVID-19 negative



# Explainable AI



# Finding toxins from satellite images



2002 negative samples



82 positive samples

SATMAE Foundation Model  
**88% accurate**



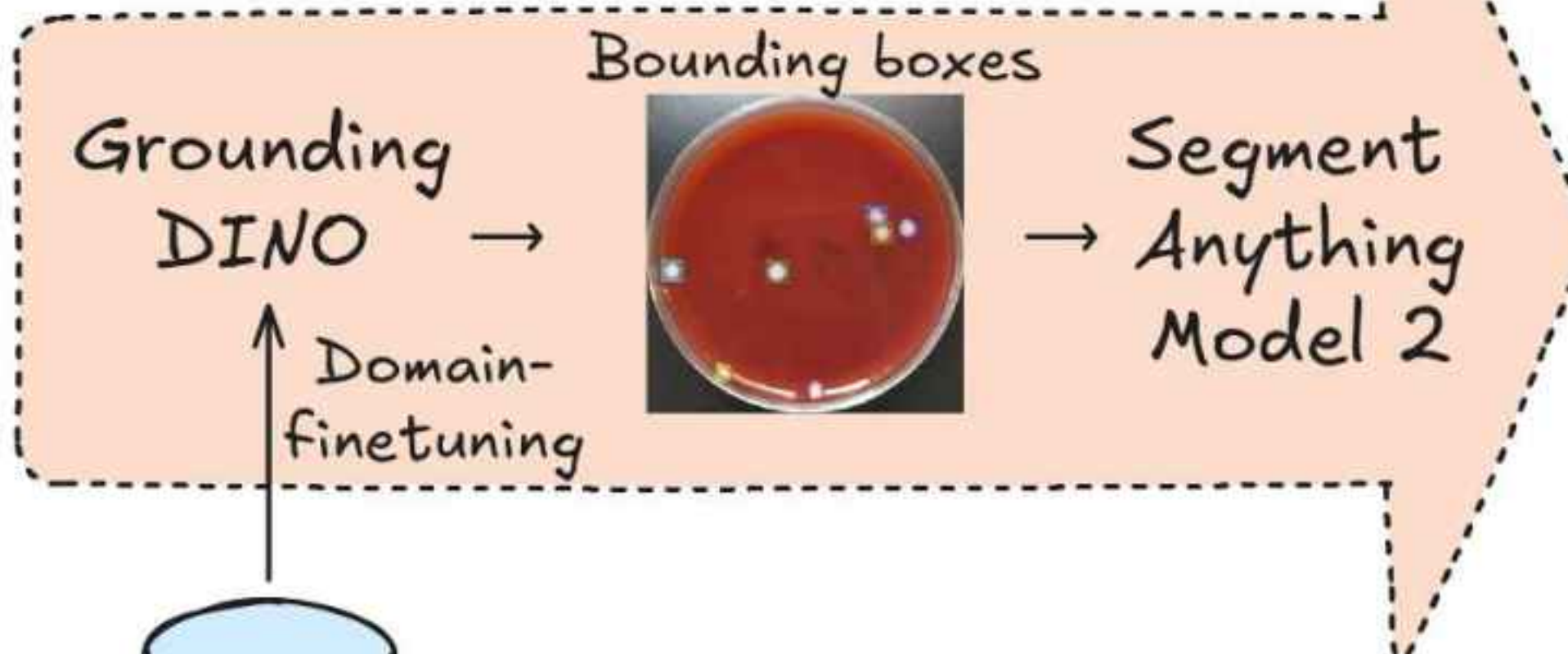
WAGENINGEN  
UNIVERSITY & RESEARCH



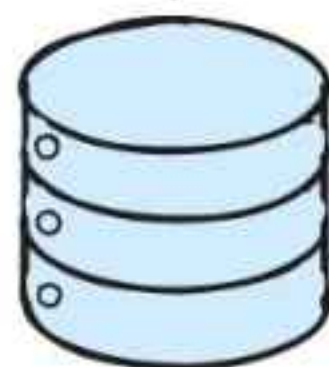
Input  
(RGB)



# Colony Grounded SAM2

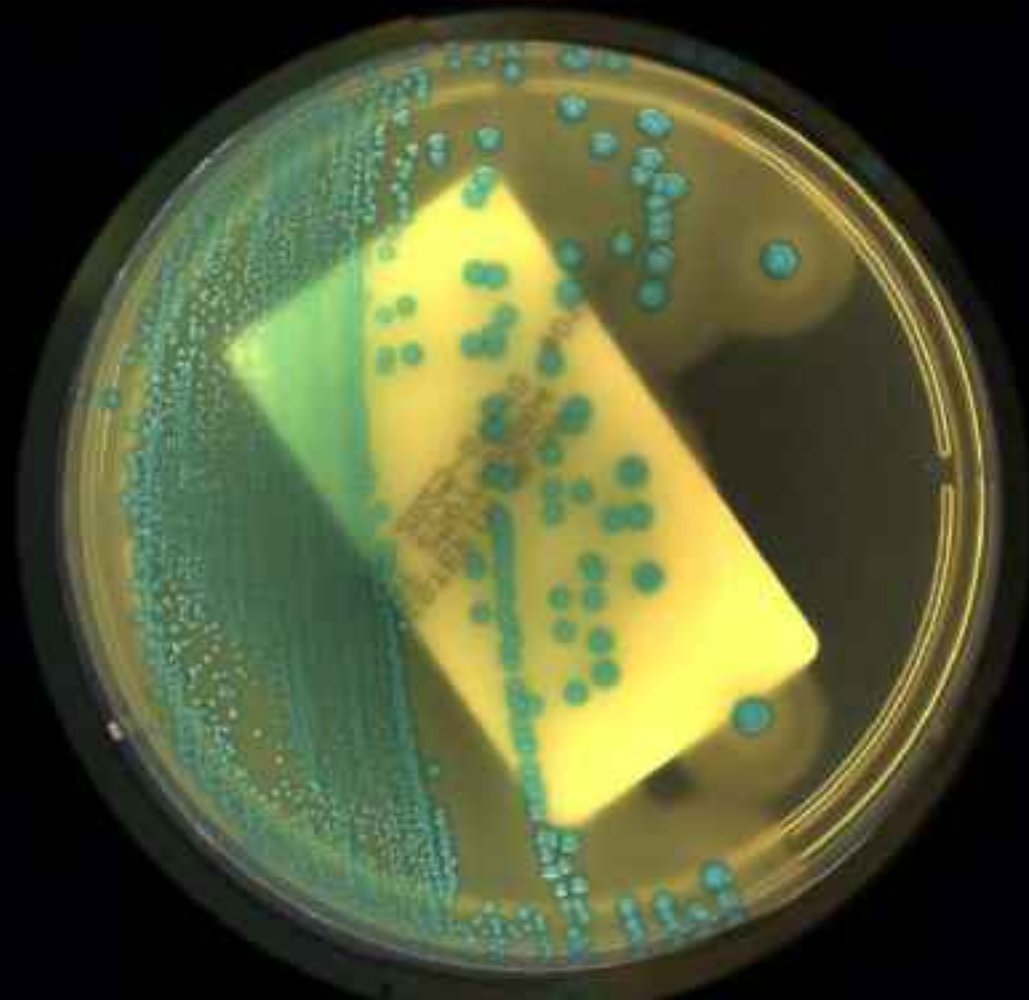
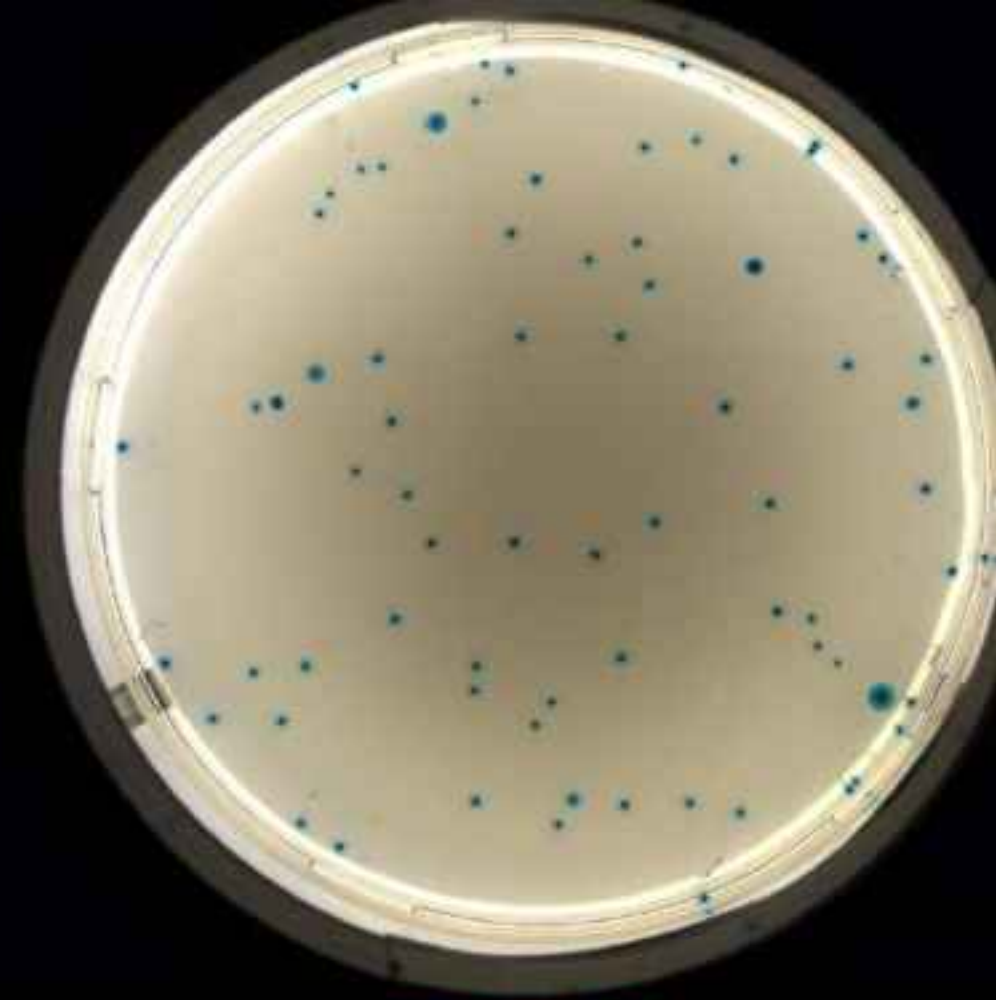


Output  
(segmentations)

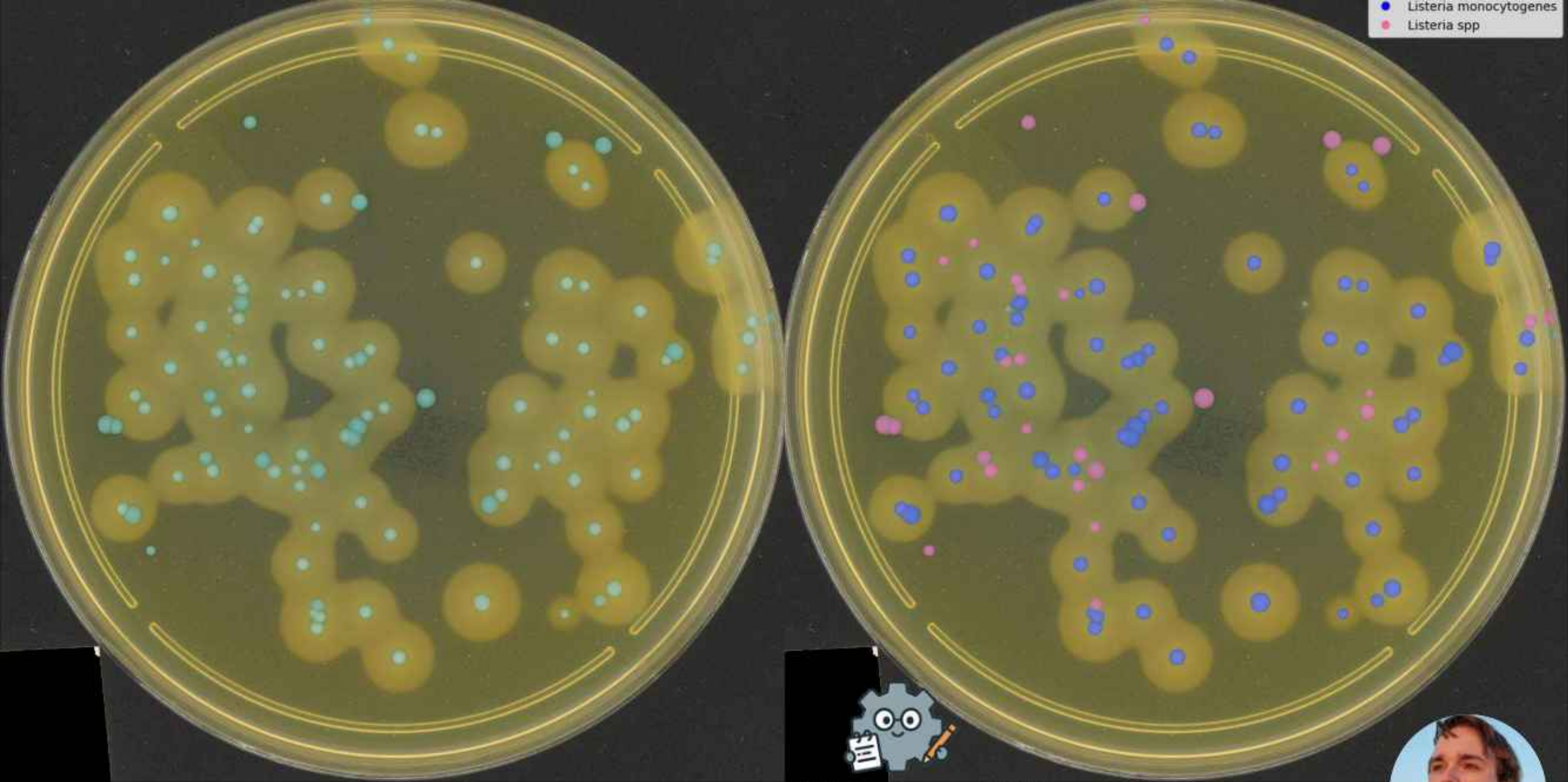


AGAR dataset  
(18000 photos)

# PetriVision microbiology



WAGENINGEN  
UNIVERSITY & RESEARCH



Colony Grounded-SAM2  
+ clustering



WAGENINGEN  
UNIVERSITY & RESEARCH

Korporaal et al, SPIE MI 2026





Colony Grounded SAM2



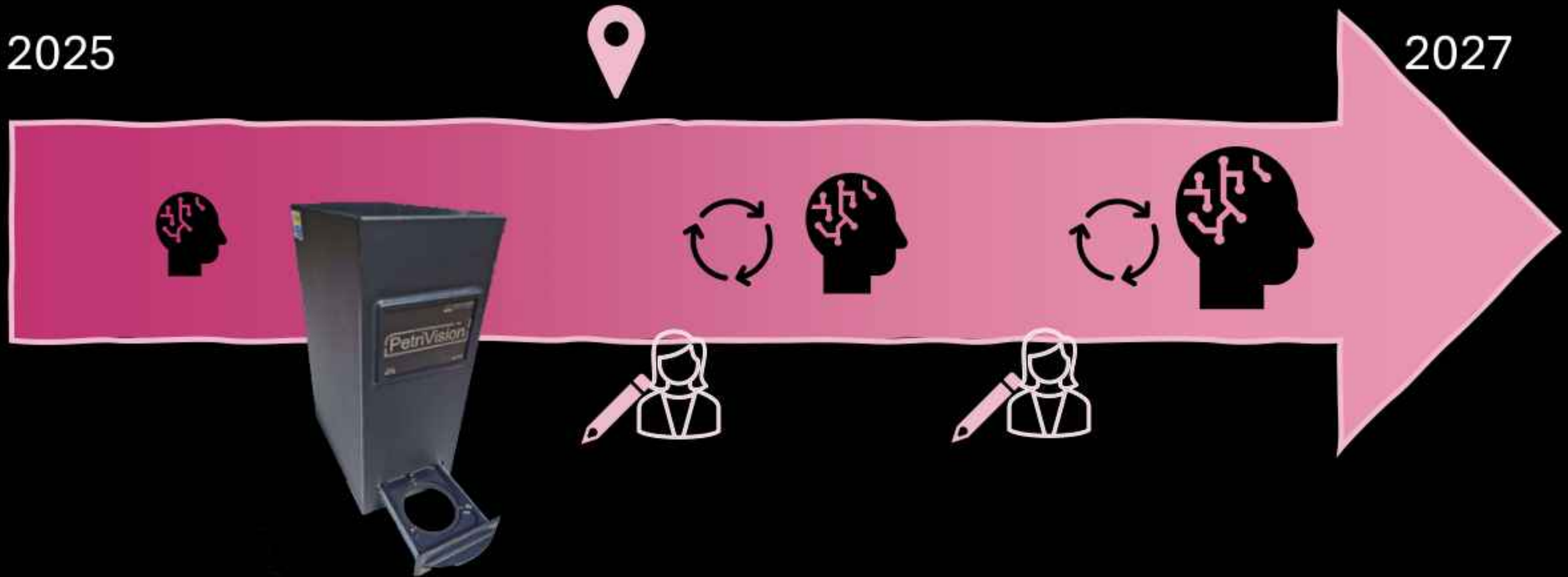
WAGENINGEN  
UNIVERSITY & RESEARCH

Korporaal et al, 2026



2025

2027



WAGENINGEN  
UNIVERSITY & RESEARCH

# LC-HRMS foundation model



Foundation Models for Liquid Chromatography High Resolution Mass Spectrometry: A New Era Beyond Labeled Datasets

Andrea Junior Carnoli<sup>†\*</sup>, Federico Padilla-Gonzalez<sup>†\*</sup>, Leonieke M. van den Bulk, Daan Korporaal, Martin Alewijn, Marco Blokland, Bas H.M. van der Velden

Wageningen Food Safety Research (WFSR), part of Wageningen University and Research, Wageningen 6708 GE, the Netherlands



ACS Publications  
Most Trusted. Most Cited. Most Read.

## CLASSIC APPROACH



Labeled  
dataset 1



Annotation  
(task 1)

# Training the foundation model

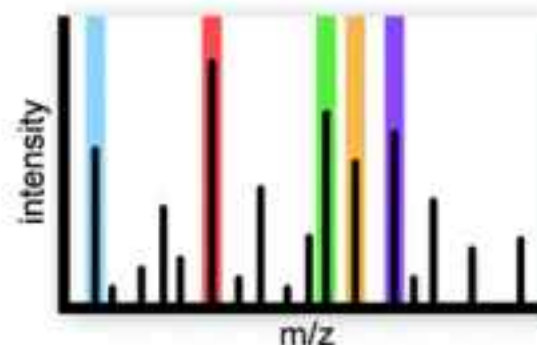


220 million

630 million

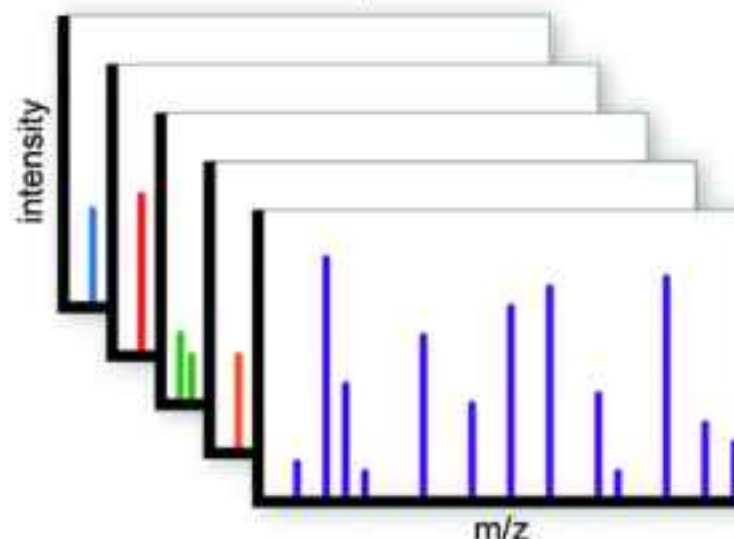
**A** DDA-MS  
survey scan &  
precursor selection

MS1



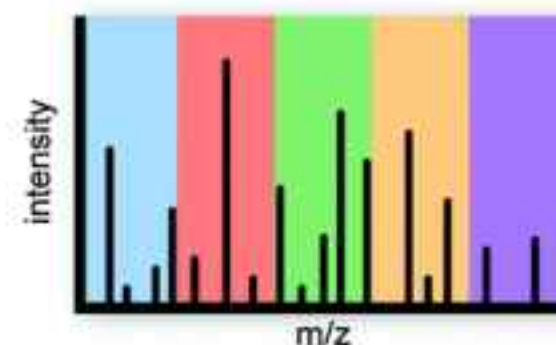
fragmentation of  
selected precursors

MS2

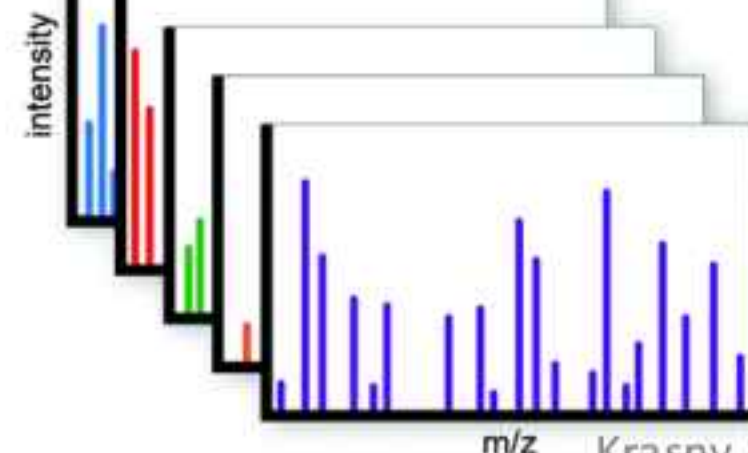


**B** DIA-MS  
survey scan  
across all isolation windows

MS1



fragmentation of  
all precursors in each window



Krasny & Huang 2020

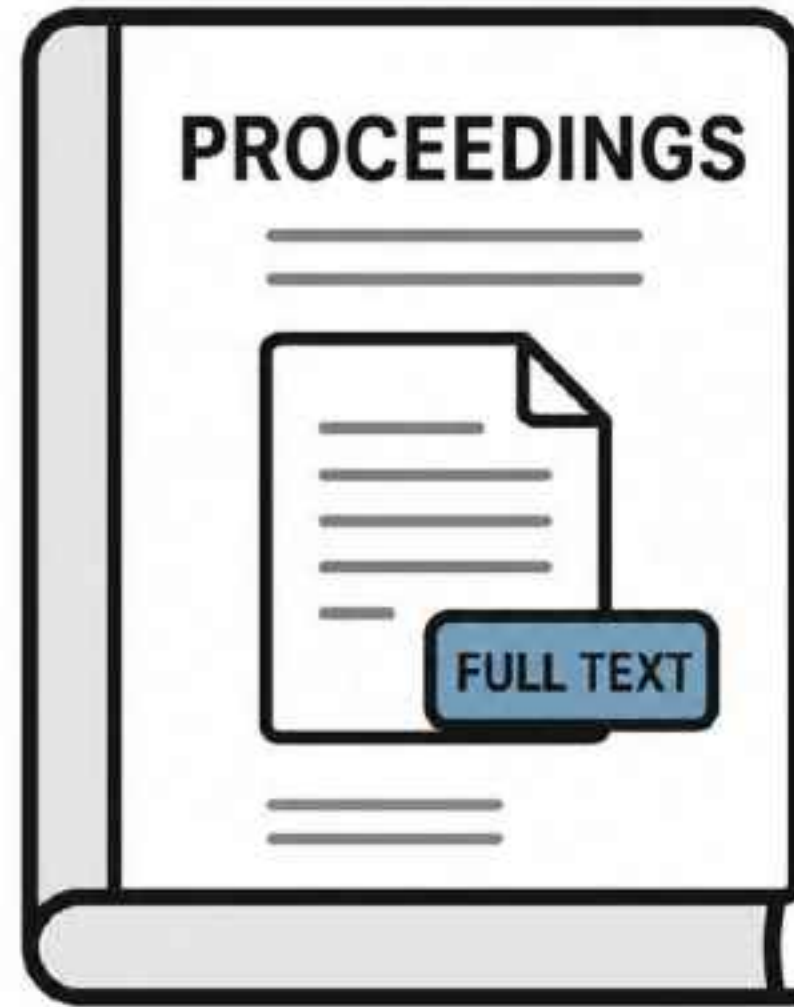
# AI for Food Safety Conference

[aifskonference.io](https://aifskonference.io)



**AIIFS**

AI for Food Safety



**1 September 2026**

Proceeding submission  
deadline

**8–9 April 2027**

Conference dates