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Artificial Intelligence for Manufacturing in the Food and Drink Sector: Opportunities and Challenges

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About me

- Professor of Machine Learning in the School of Engineering and Built Environment at SHU
- Research theme lead for Digital Connectivity and Technology at AFIC
- Interests:
  - Machine Learning and AI
  - Internet-of-Things / Industry 4.0

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Advanced Food Innovation Centre (AFIC)

- <u>**£10.5m sector leading food processing**</u> and innovation facility funded by:

Office for Students OfS

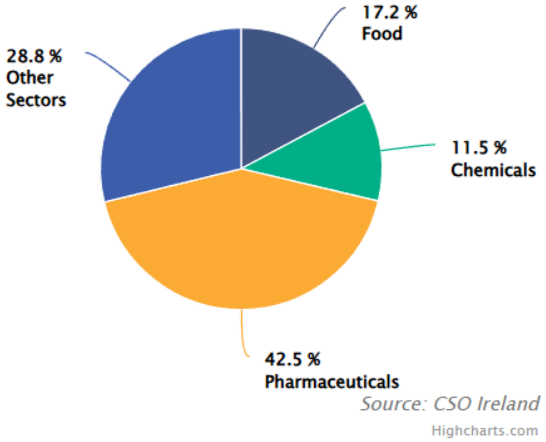
NORTHERN POWERHOUSE HM Government

Sheffield City Region

European Union European Regional Development Fund

A bit of background …

- Food and drink manufacturing accounts for **<u>50%</u>** of Irish manufacturing expenditure(1) and **<u>8%</u>** of Irish GDP(2) …
- … and directly employs **<u>160,000</u>** people(2) (c4.5% of the Irish workforce)



1) Ibec / FDI Food and Drink Manufacturing Report 2025
2) BORD BIA (Irish Food Board)

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A bit of background …

- Adoption of AI is a priority for **1/3rd** of Irish food and drink manufacturers …
- … and nearly **50%** of businesses plan to adopt AI technologies over the next 2 years

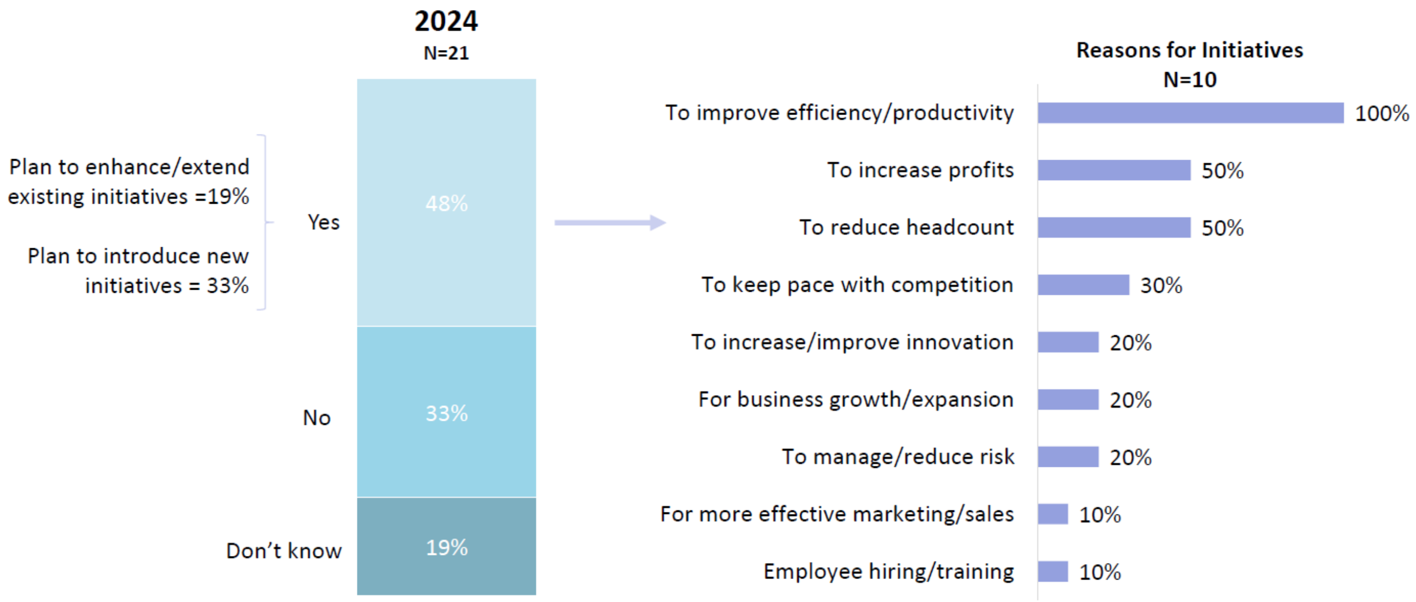

Figure from Ibec / FDI Food and Drink Manufacturing Report 2025

A bit of background …

- However, adoption of **<u>digital and intelligent manufacturing</u>** in the food and drink sector has been slow due to a range of factors:
    - **Lack of "fit for purpose" technology**
    - **Capital investment required**
    - **Lack of technical skills**
    - Complexity of food and drink manufacturing processes
    - Food safety issues

New Food Tech Trends Report 2022

The importance of data

- Who here thinks they have good data from their manufacturing processes?

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The importance of data

- Who here thinks they have good data from their manufacturing processes?
- Data should be:
  - Diverse
  - Annotated / labelled
  - Relevant
  - Consistent and standardised
  - Complete

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Some projects …

1. Bringing rice milling into the 21st century
2. Quality assessment and process optimisation in the baking industry
3. AI based predictive modelling (in brewing)
4. Hyperspectral imaging and AI for inline quality assessment of meat

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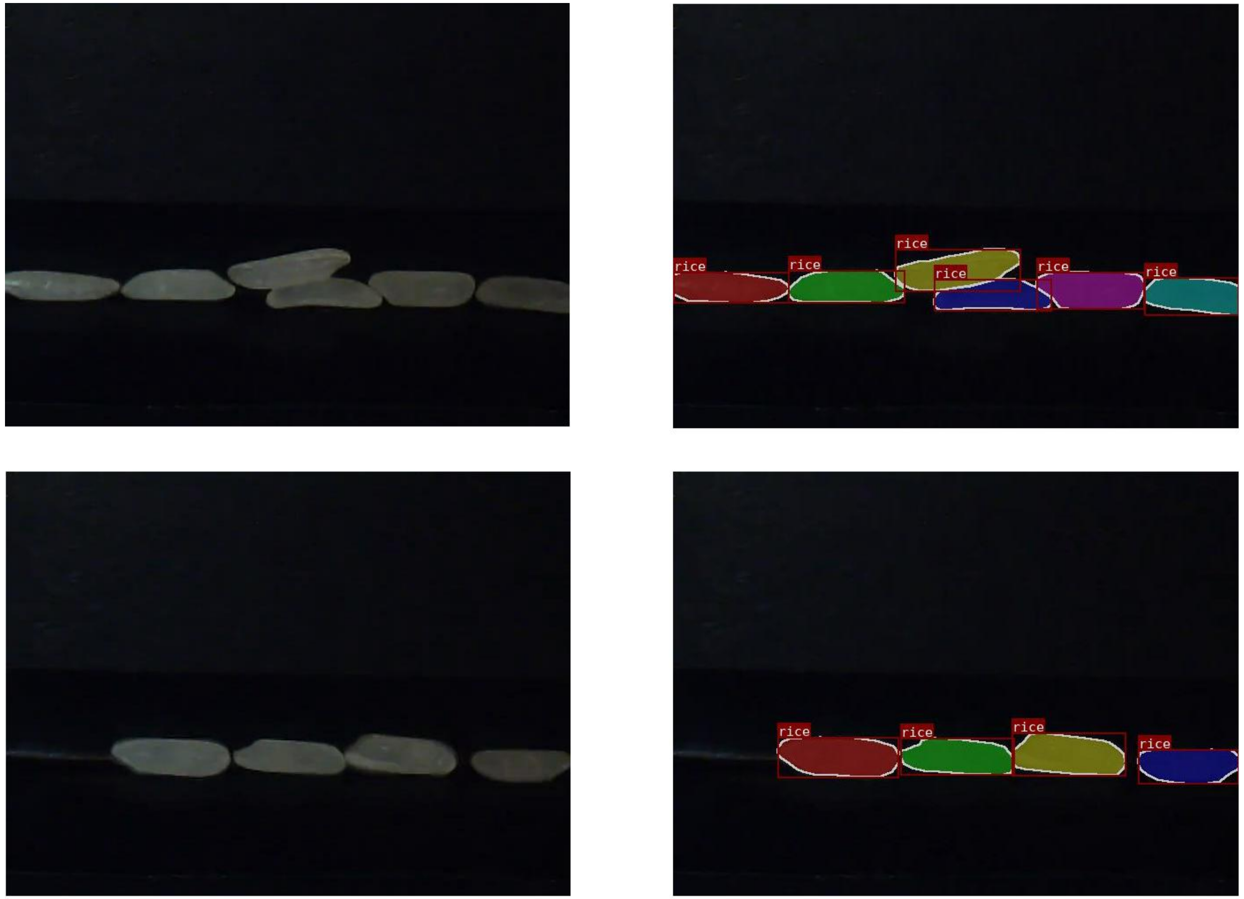
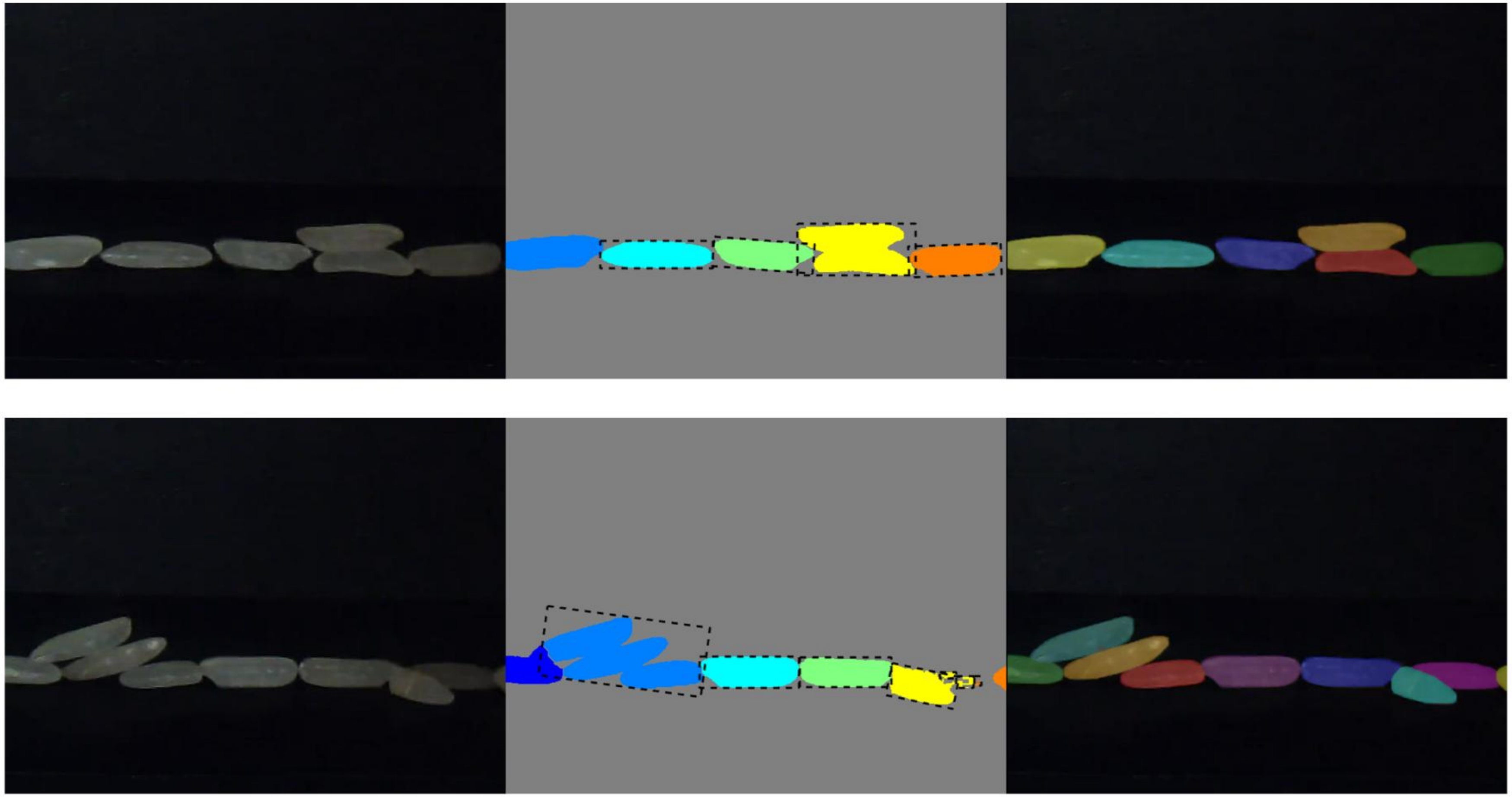
Optimising rice milling



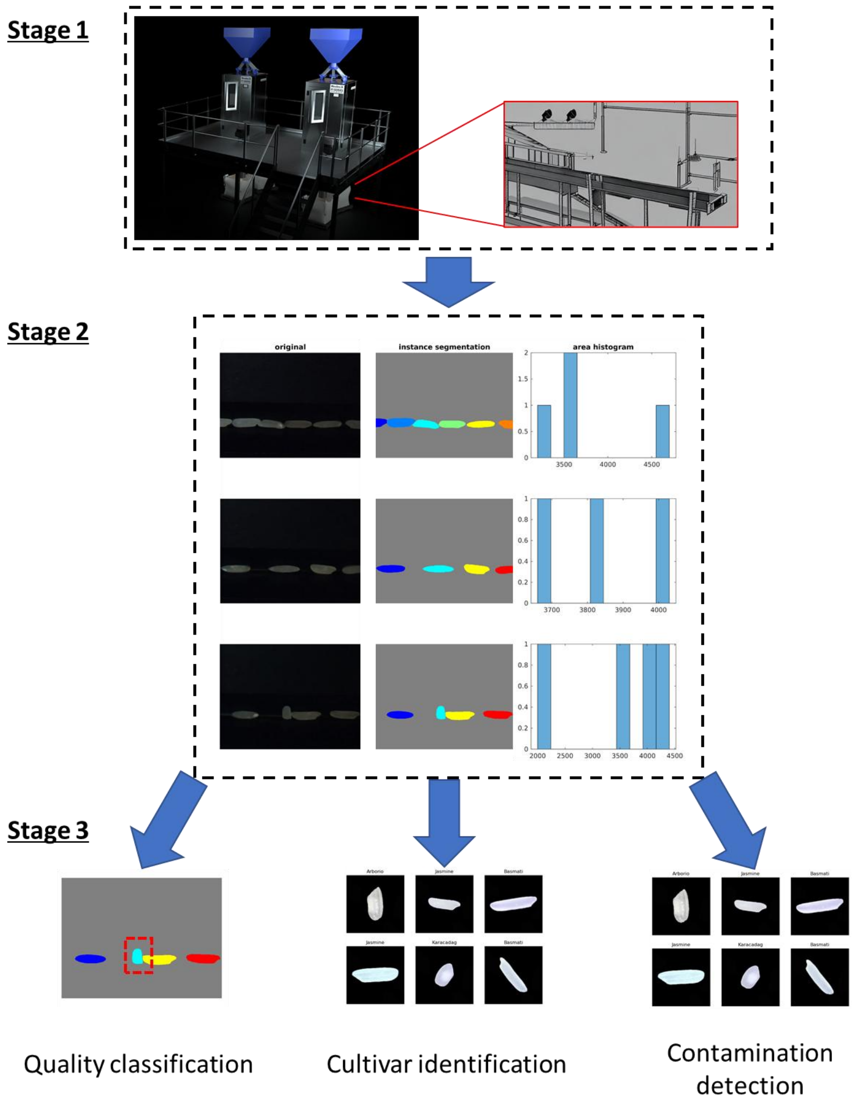
Optimising rice milling

Original image | Machine vision | AI-based segmentation



Optimising rice milling

- Key objectives:
  - Assess quality to feed back into the milling process to adjust parameters in real time
  - Detect rice fraud / adulteration with low value cultivars
  - Detect diseased grains or physical contamination



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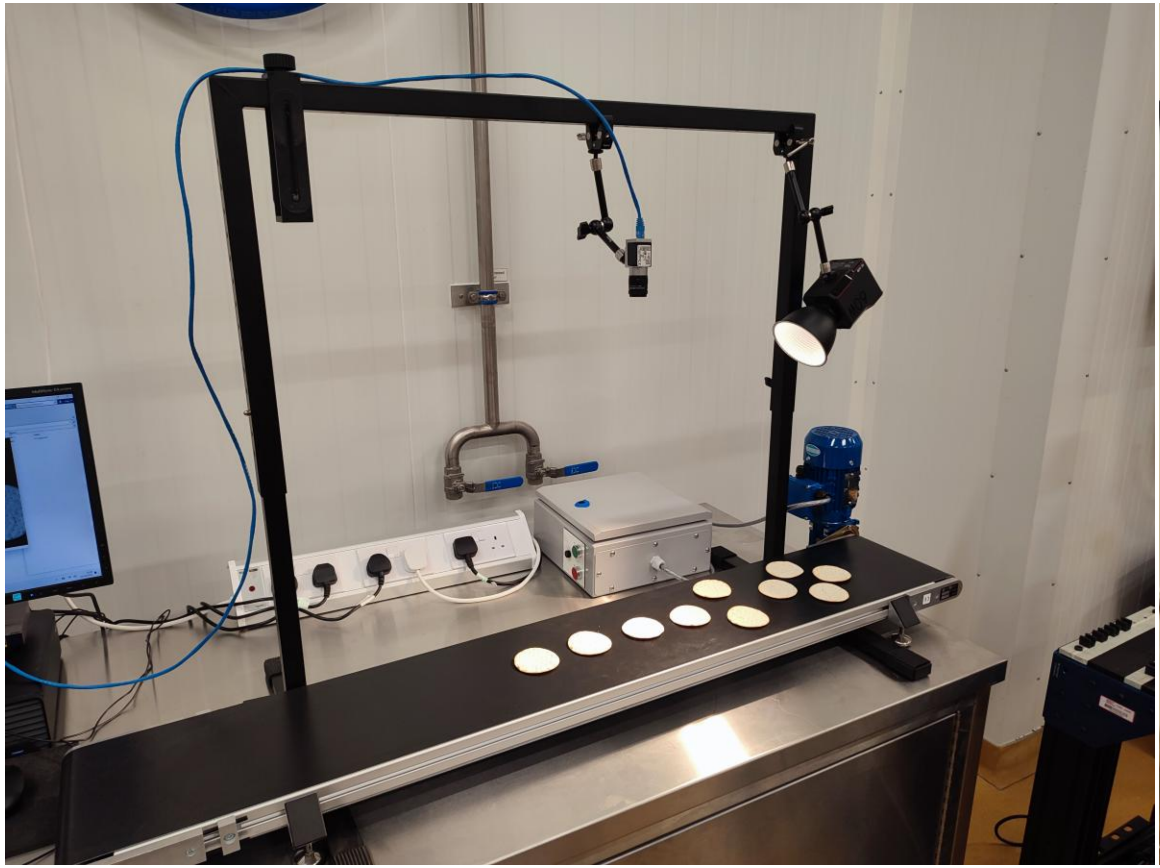
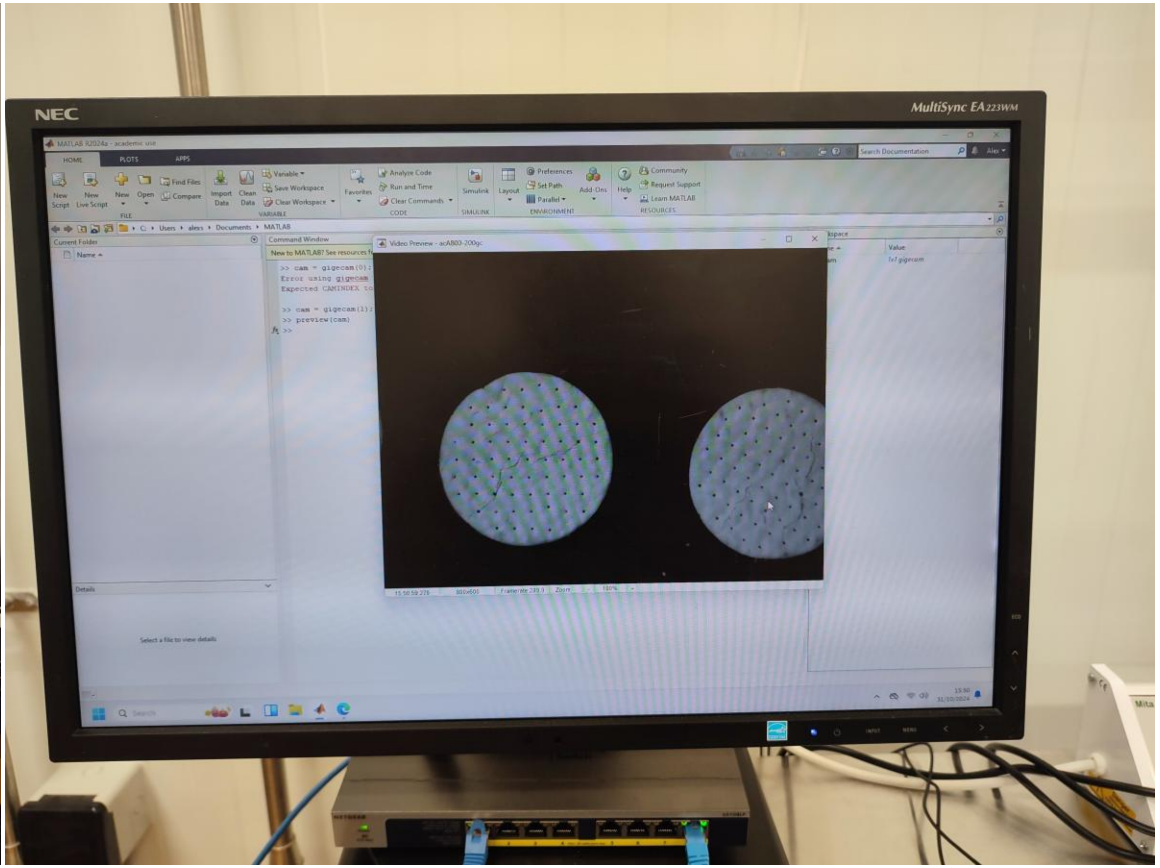
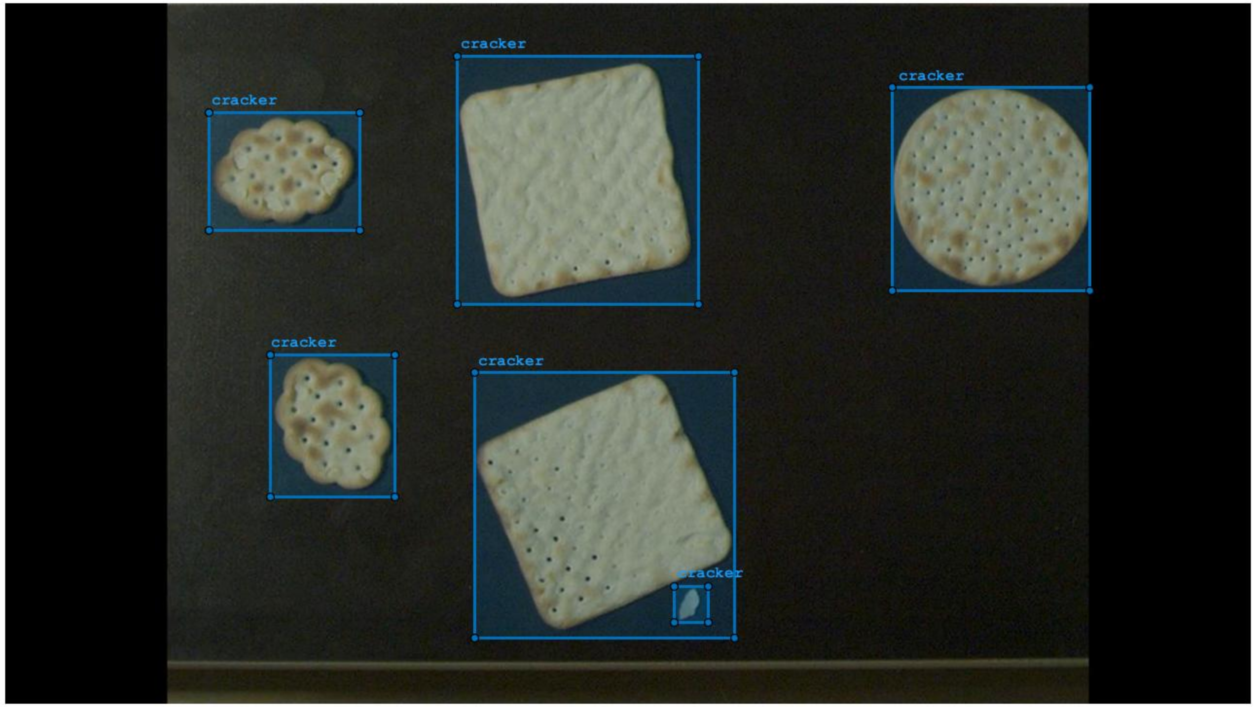
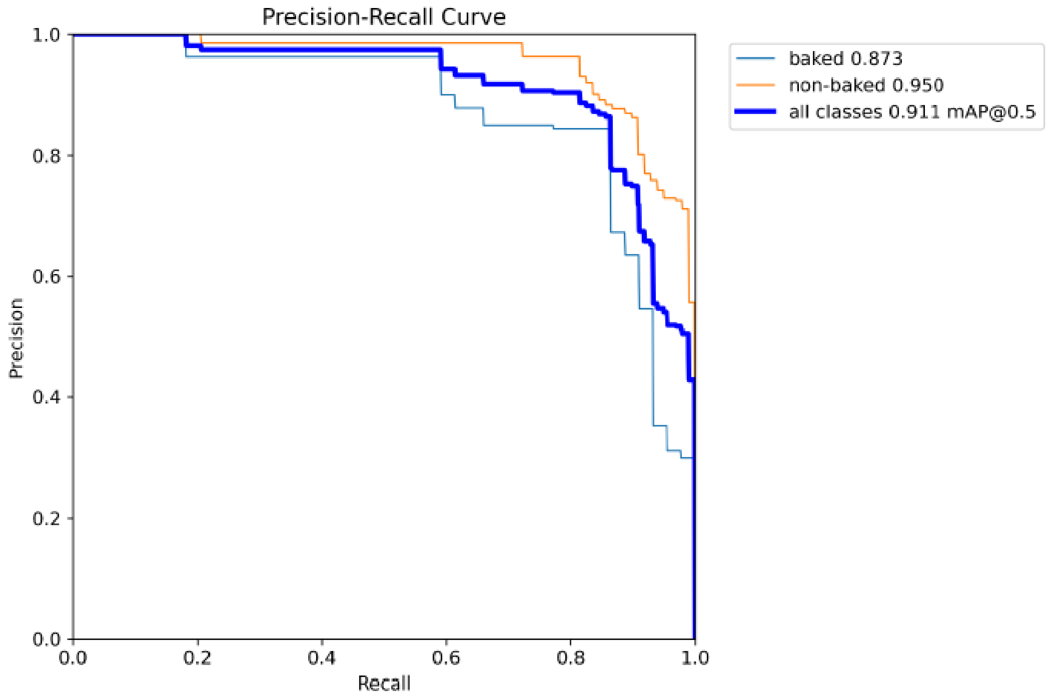
Sustainable baking





Sustainable baking





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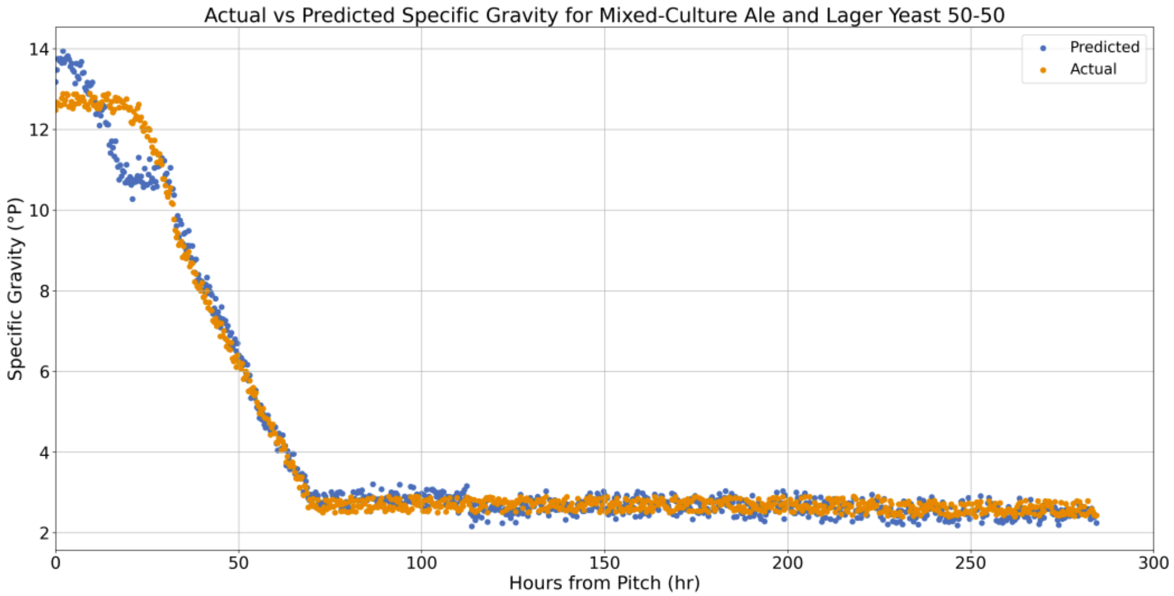
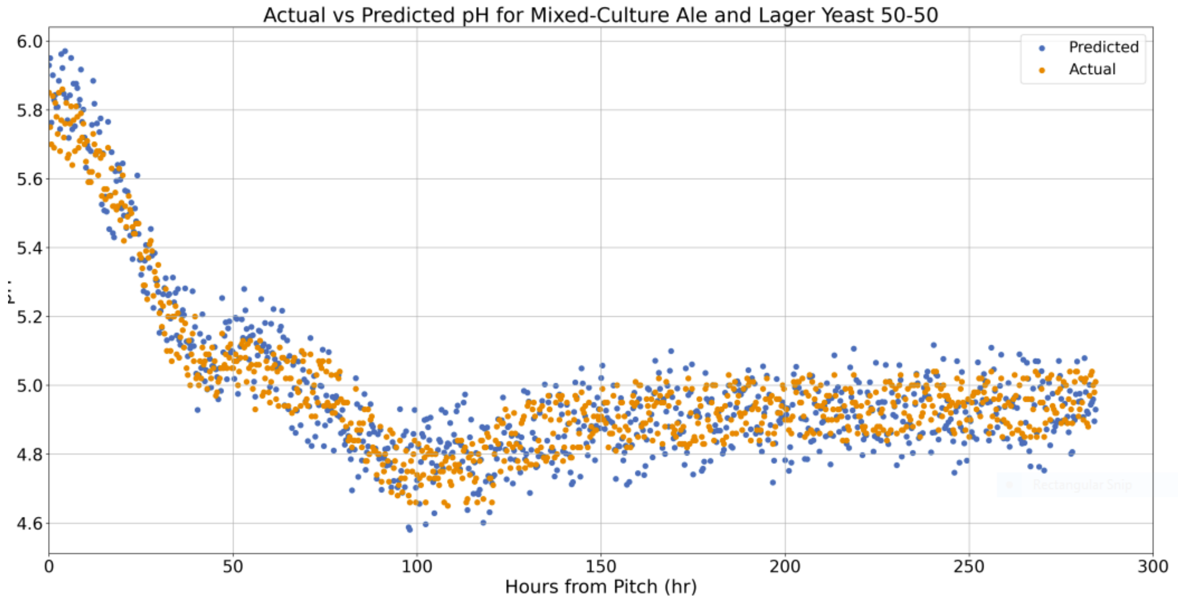
AI based predictive modelling

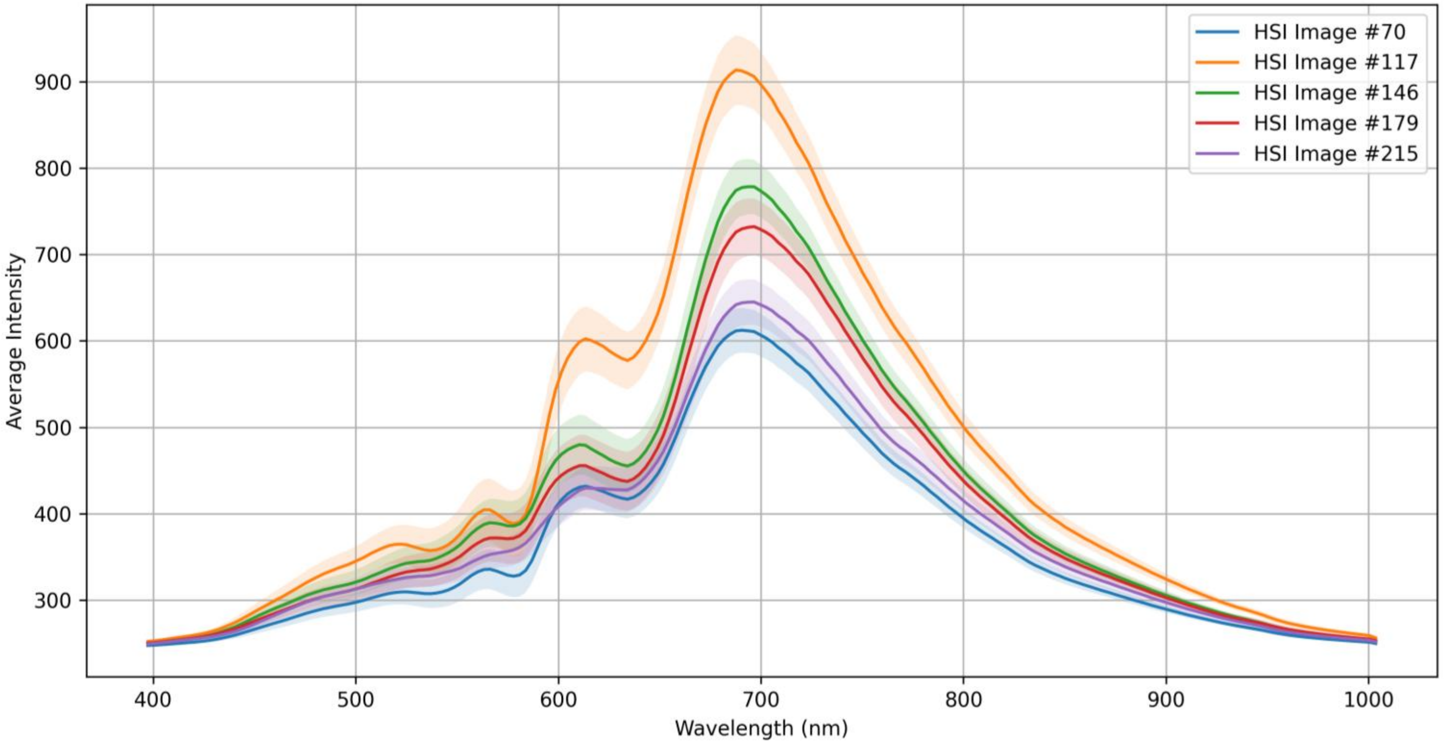
- Mixed yeast beer fermentation



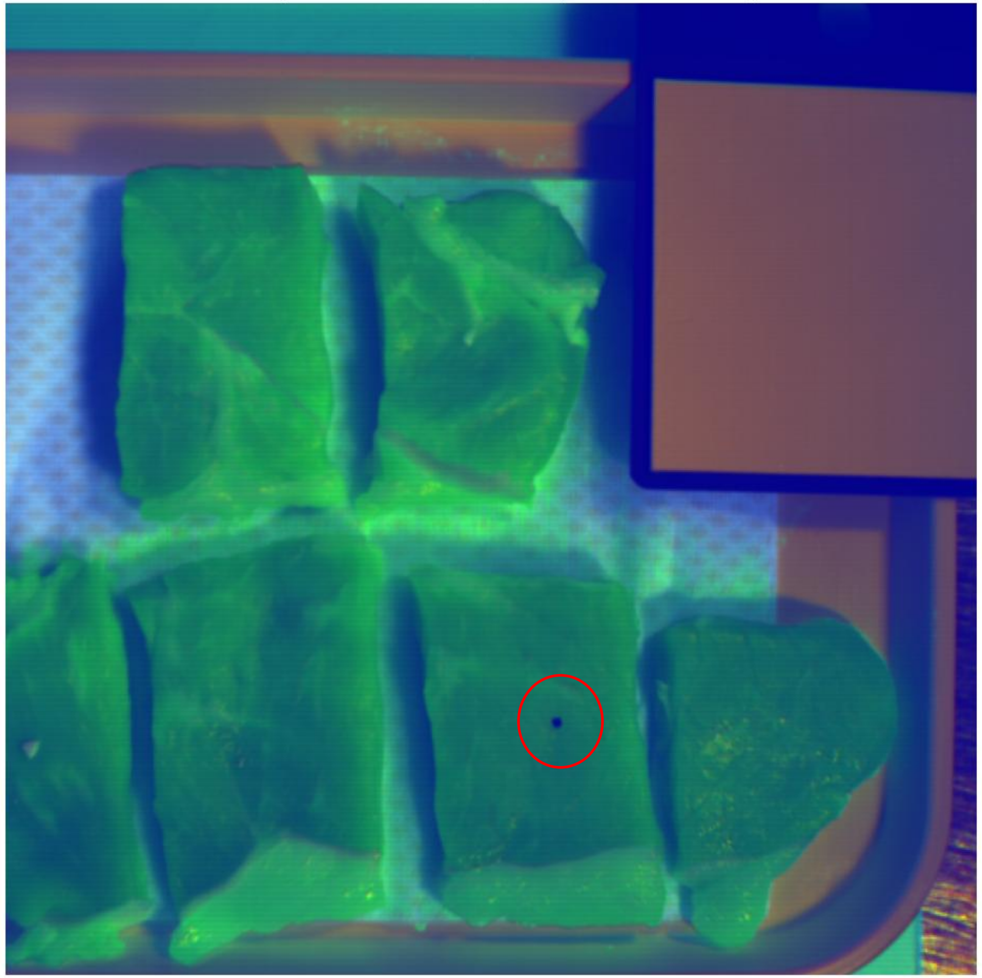


O'Brien, A., Zhang, H., Allwood, D. M., & Rawsthorne, A. (2024). From Data to Draught: Modelling and Predicting Mixed-Culture Beer Fermentation Dynamics Using Autoregressive Recurrent Neural Networks. *Modelling*, *5*(1), 201-222.
https://www.mdpi.com/2673-3951/5/1/11

Inline hyperspectral imaging for meat quality assessment



HS Image #146 — First 3 Principal Components as Color Image



Future sector challenges

- Climate change
- Growing world-wide population
- Political instability
- Future pandemics

https://www.newfoodmagazine.com/news/147964/climate-change-threatens-one-third-of-food-producing-regions/

Conclusions and lessons learnt

- Intelligent manufacturing starts and ends with **data**
- Food and drink manufacturers are still catching up with **Industry 4.0** technologies – they are not prepared for **Industry 5.0**!
- There is a **significant skills shortage**
- Strategic priorities are split:
  - 50% increasing profits
  - 50% labour reduction
  - 30% to keep pace with the competition

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Big thanks!





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Any questions?

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