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# Using Big Data and AI to Advance Food Safety

Workshop #5

Tuesday, May 7

3:00 PM – 5:00PM

# Agenda

1. Speaker Introductions & AI Use Cases
2. Small Group Exercise
3. Wrap Up



# Panelists



**Tina Gettis**  
Institute for Food  
Safety and Health  
(IFSH)



**Alvin Lee, PhD**  
Institute for Food  
Safety and Health  
(IFSH)



**Brendan Ring**  
Creme Global



**Matt Stasiewicz, PhD**  
University of Illinois  
at Urbana-Champaign



**Michael Walton**  
BCD iLabs

# Small Group Exercise

1. Break 5 groups – see next slide
2. Discuss and identify (*20 minutes*)
  - a) Biggest food safety challenge(s) for your industry/company
  - b) Data needed to tackle these challenges
3. Report out & discussion (*10 minutes/group*)

# Exercise Groups

## Speaker Table

**GREEN**  
Production &  
Agriculture

**BLUE**  
Food  
Manufacturing

**ORANGE**  
Retailers &  
Distributors

**YELLOW**  
Restaurants &  
Foodservice

**PINK**  
Food Safety  
Services



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# Use of Big Data and AI – a Personal Perspective

**Alvin Lee (alee33@iit.edu)**  
**Institute for Food Safety and Health**



# What is Big Data?

- Big data primarily refers to data sets that are too large or complex to be dealt with by traditional data-processing application software
- Too complex for the human mind to handle



# What is Big Data?

ChatGPT 3.5 ▾



**You**

what is big data




**ChatGPT**


Big data refers to the vast amount of structured, semi-structured, and unstructured data generated by digital processes, devices, and interactions. This data is typically characterized by its volume, velocity, and variety, often termed the "3 Vs" of big data.

1. **Volume:** Big data involves extremely large volumes of data. Traditional data management tools and methods are often inadequate for handling such massive amounts of information.
2. **Velocity:** Data is generated and collected at high speeds from various sources such as social media, sensors, devices, and transactions. This continuous influx of data requires real-time or near-real-time processing and analysis.
3. **Variety:** Big data comes in diverse formats, including structured data (e.g., databases), semi-structured data (e.g., XML files), and unstructured data (e.g., text, images, videos). This variety presents challenges for storage, processing, and analysis.

# What is Big Data?

ChatGPT 3.5 ▾

 **You**  
what is big data

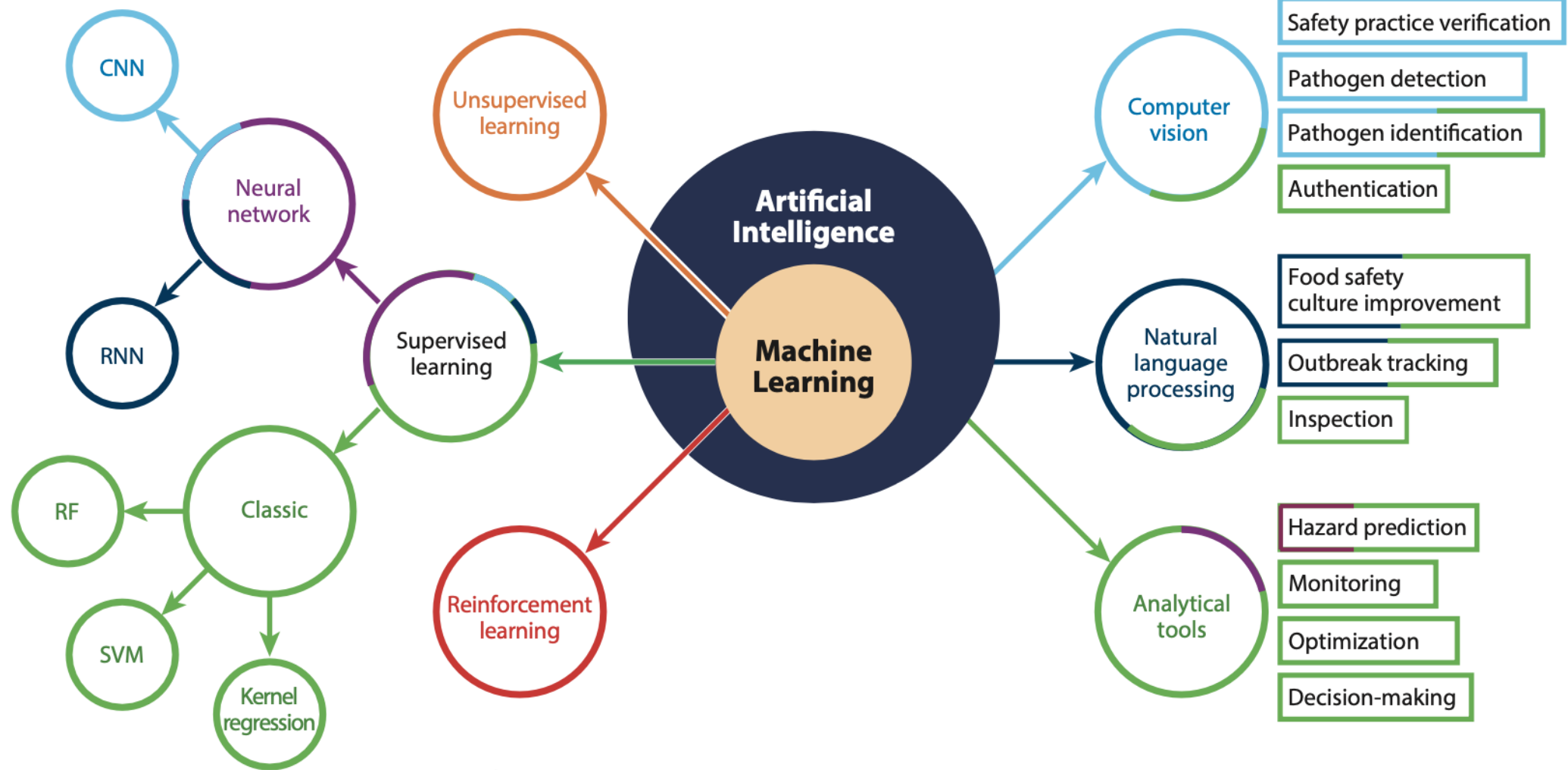
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# My Perspective

- Use of tools to predict outcomes e.g. ComBase to predict spoilage or growth, shelf-life etc
- Detection of microorganisms – tools in National Center for Biotechnology Information (NCBI)
- Drive change in culture
- Outbreaks and incident minimization or prevention
- Custom food safety and nutrition





Food safety applications

- Foreign object detection
- Safety practice verification
- Pathogen detection
- Pathogen identification
- Authentication
- Food safety culture improvement
- Outbreak tracking
- Inspection
- Hazard prediction
- Monitoring
- Optimization
- Decision-making

- Reinforcement learning
- Unsupervised learning
- Classic machine learning methods
- CNN (convolutional neural network)
- RNN (recurrent neural network)
- Neural networks



## SUPPLY CHAIN

### DATA

#### Environment data

- Temperature
- Wind
- Land use

### TECHNIQUES

#### Analytical tool

- Random forest
- Gradient boost

### APPLICATIONS

Prediction of pathogen prevalence in the field/farm

## PUBLIC HEALTH

### DATA

#### Social media data

- Twitter
- Restaurant reviews

### TECHNIQUES

#### Natural language processing

- Recurrent neural network
- Maximum entropy

### APPLICATIONS

Real-time detection of foodborne outbreaks

## MICROBIAL DATA COLLECTION

### DATA

#### Image data

- Images of agar plates

### TECHNIQUES

#### Computer vision

- Convolutional neural network

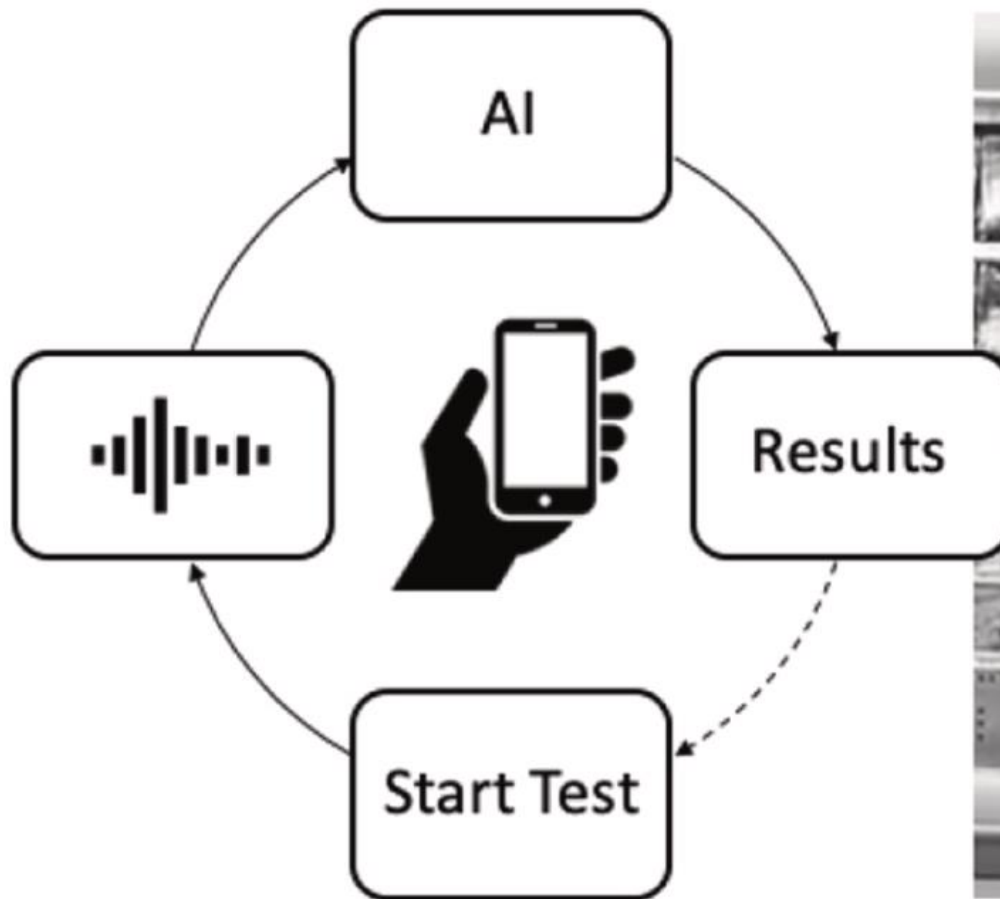
### APPLICATIONS

Early detection of pathogens



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# For the Consumer





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# Using Big Data & AI to Advance Food Safety

**Brendan Ring**  
Creme Global



# Creme Global

A Data Science company





# Creme Global

Bringing credibility, validation and science

Building trusting relationships for industry-wide insights





**The food supply chain is global and complex.**





**The food supply chain is global and complex.**

**Data is confidential.**





**Analysis and insight requires a lot of data.**





Solution?





# A Data Trust







# What is a Data Trust?

An **agreement** to share data +  
a **secure platform** to share data.





## Benefits for Members



Easy, Secure & Safe



Data in one place



User-friendly



Document curation  
Report writing



Foundation of AI & ML



Reduced risk of  
pathogens



# Benefits of Data Sharing



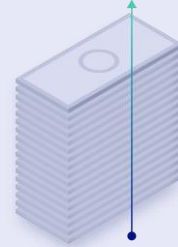
## **Safer food**

Discover anomalies not obvious in your own data.



## **Reduce costs**

Optimise cost effective preventative measures.



## **Maximise revenue**

Determine accurate and realistic regulatory limits.

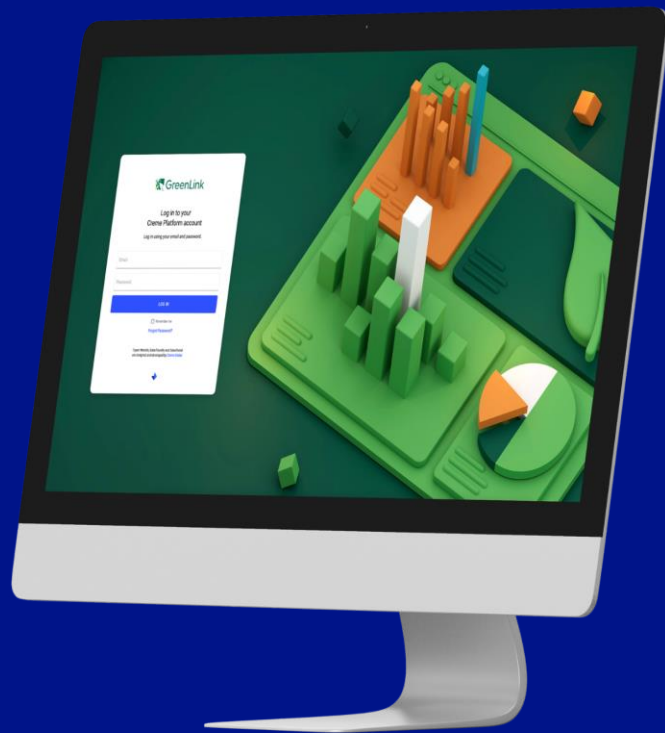
# Case Studies





Case Study

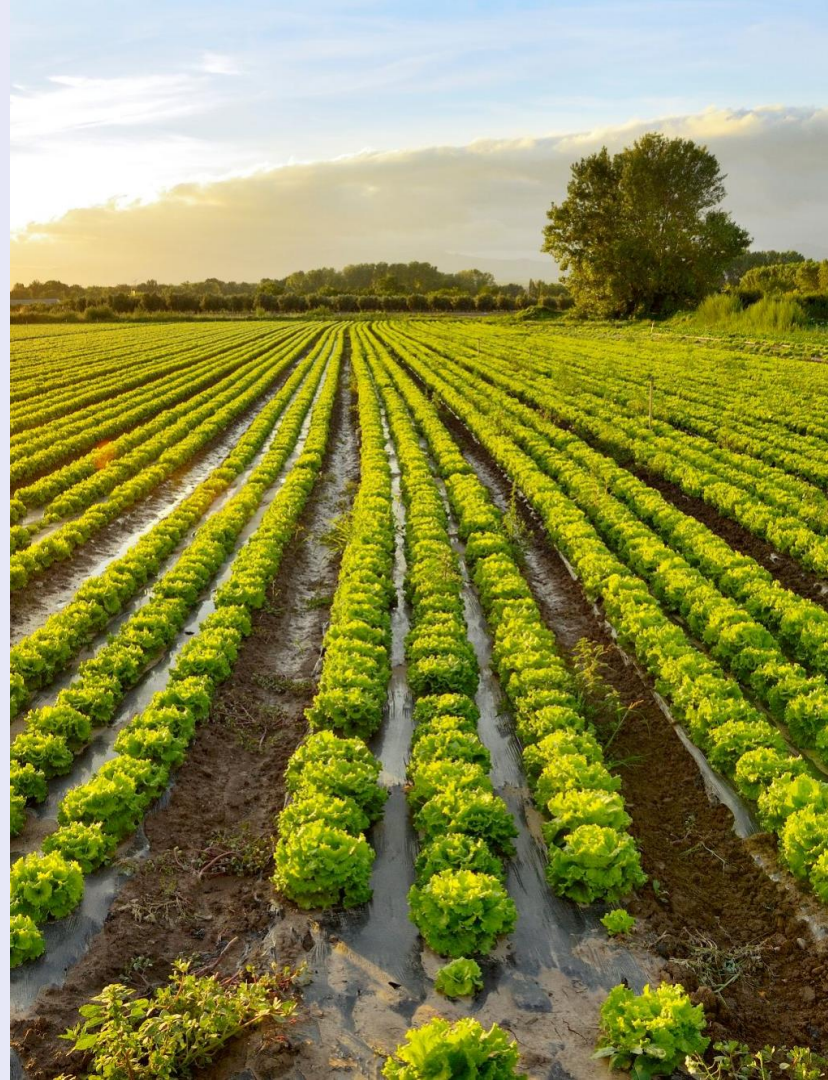
# Western Growers GreenLink Platform





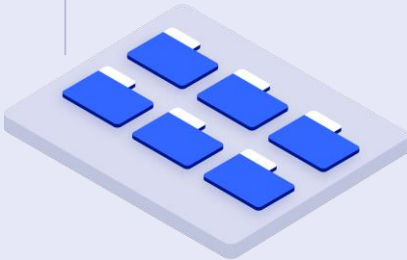
# **Western Growers** Food Safety Data Sharing GreenLink<sup>®</sup> Platform

Advancing data-driven food safety programs  
that reduce food safety risk.



# GreenLink® Platform Structure

Supplemental Data  
(public)



Data  
Modelling

Dashboard Results



Data  
Anonymization



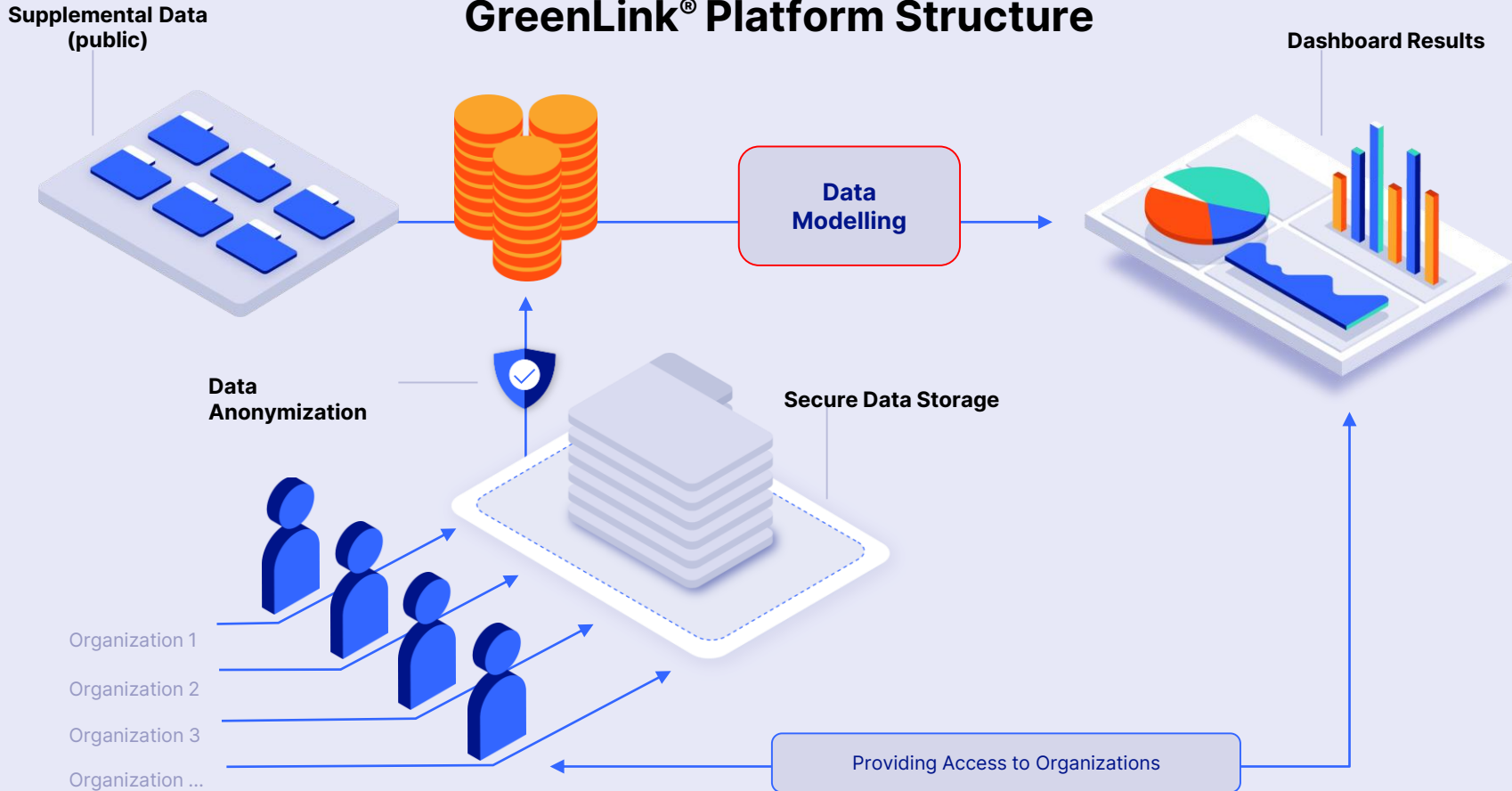
Secure Data Storage



- Organization 1
- Organization 2
- Organization 3
- Organization ...



Providing Access to Organizations



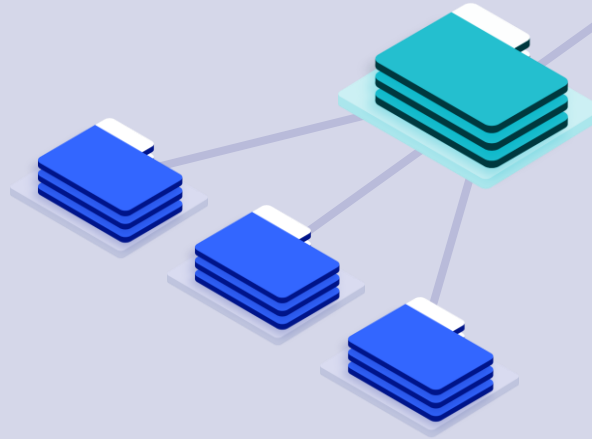


## Data Visualization



## Data Collection

- Data Upload Portals
- Excel, CSV, XML, JSON
- Data APIs

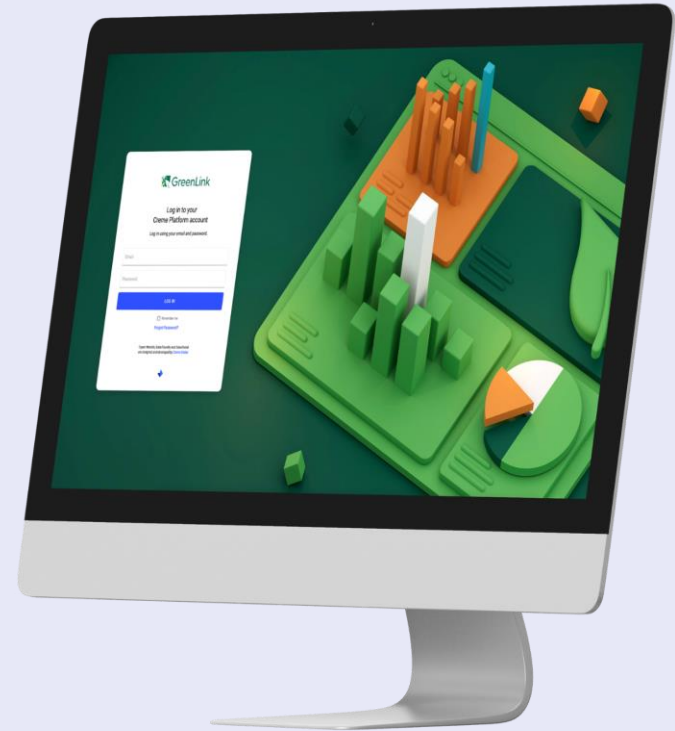






## Benefits

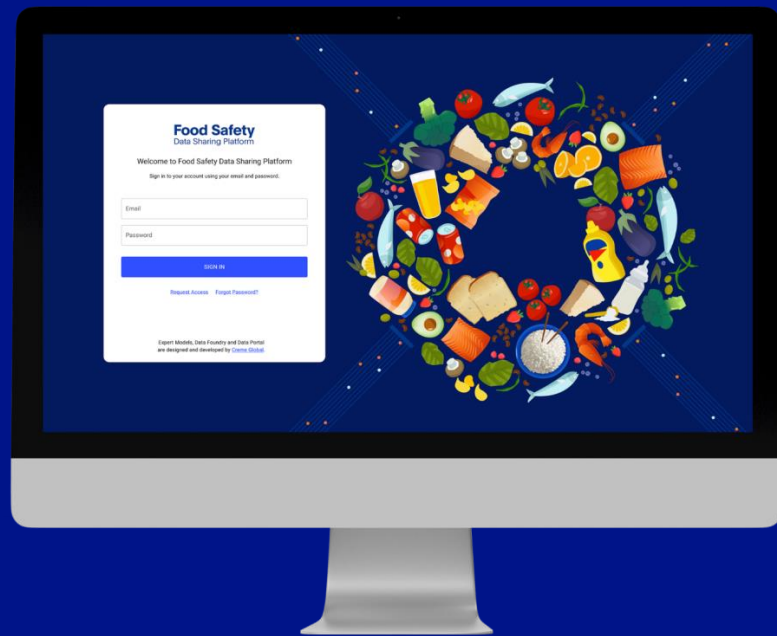
- **Advance food safety** – Inform best practices.  
Goal = Predict and Prevent
- **Maximize resources** - Optimize cost-effective preventative measures
- **Learn from the Data**
- **Benchmarking**
- **Build Trust** (Government, Buyers, Consumers)





Case Study

# FDA Food Safety Data Sharing Platform

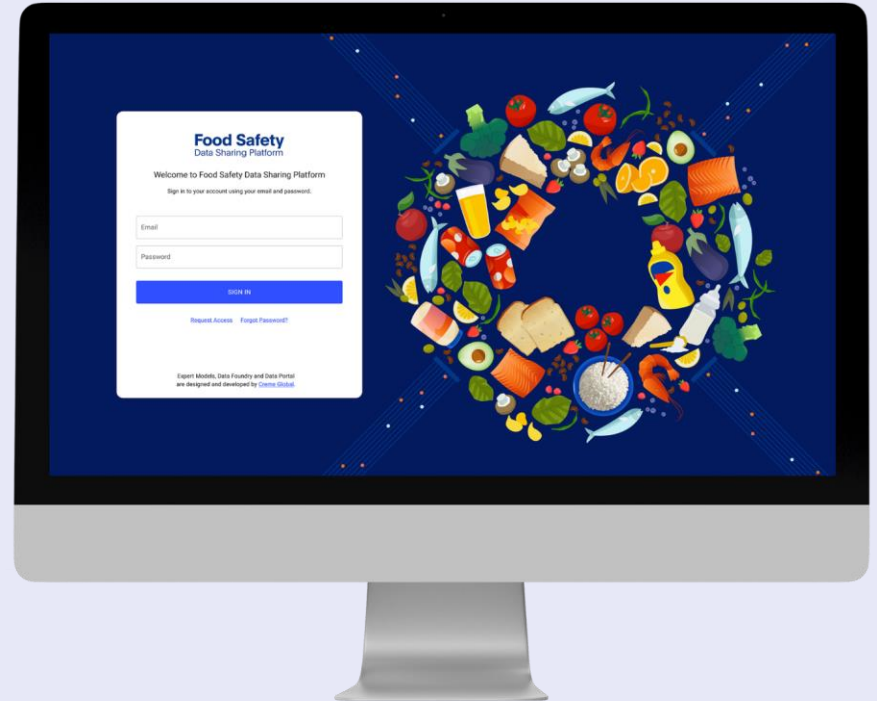


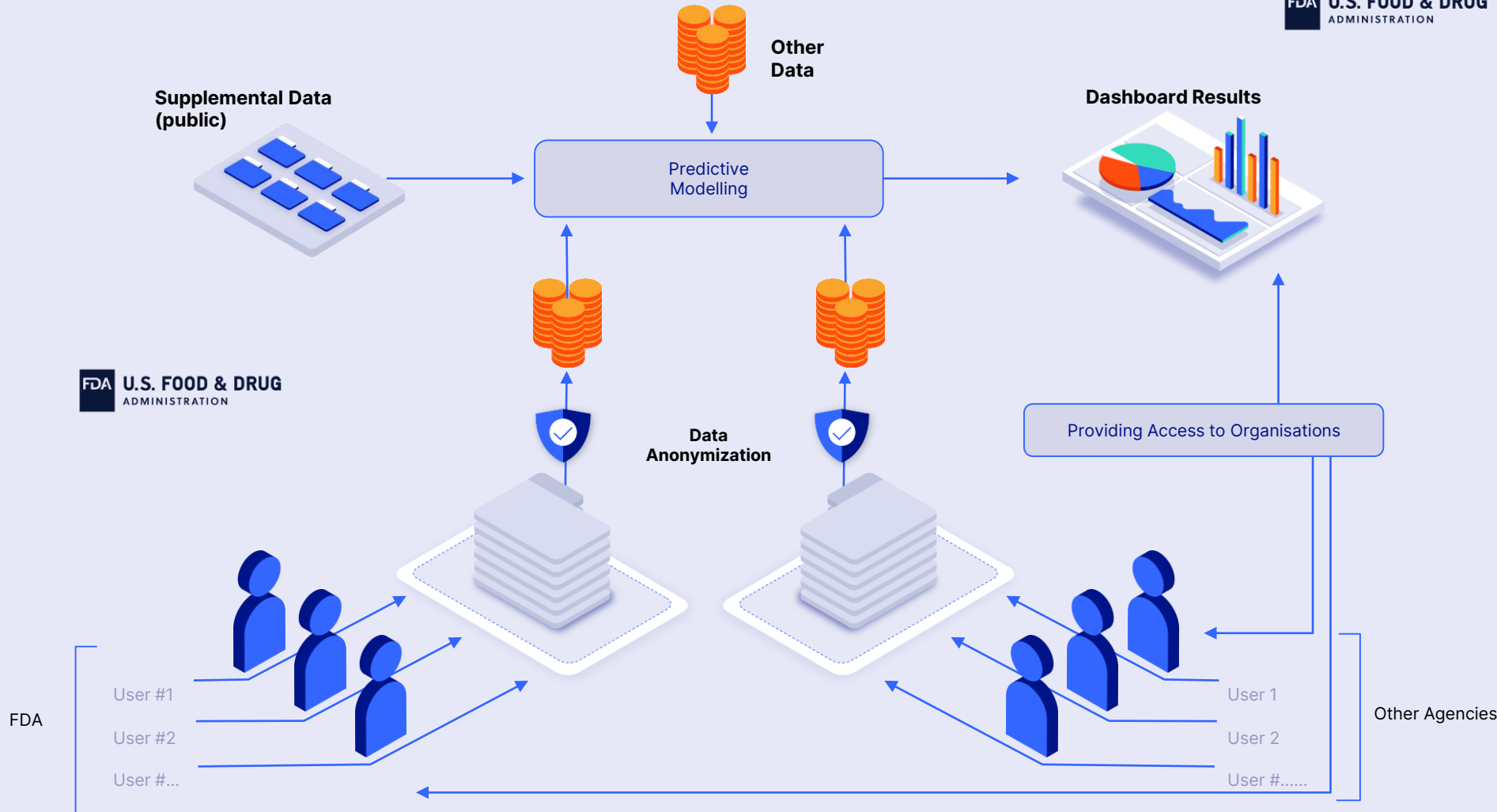


## FDA

Creme Global awarded FDA tender.

A multi Agency Food Safety  
Data Sharing Platform.





FDA

FDA U.S. FOOD & DRUG ADMINISTRATION

Supplemental Data (public)

Other Data

Predictive Modelling

Dashboard Results

Data Anonymization

Providing Access to Organisations

User #1  
User #2  
User #...

User 1  
User 2  
User #.....

Other Agencies



## Benefits

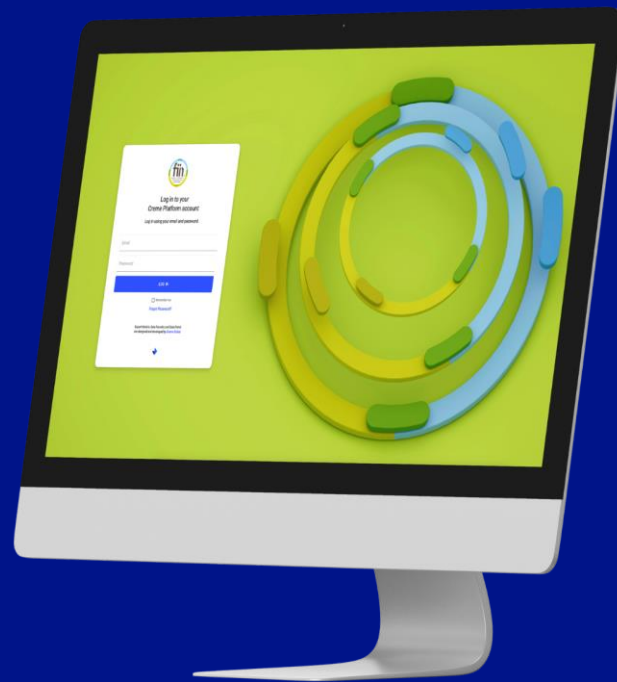
- Growth in available data.
- Can now ask better questions.
- New insights on presence and concentrations of contaminants in seafood products and from different regions.
- Resource management.





Case Study

# fiin Data Trust





# Food Industry Intelligence Network (fiin)

An anonymised data-sharing platform.

Giving fiin members insight across the global supply chain.





# Combating Food Fraud in a New Way

Established in 2015

To ensure integrity of food supply chains and  
protect the interests of the consumer.







# Legal Privilege and Data Anonymity

**Data Anonymity**  
Double Blinded & Protected

qwg3451@secure.datafounry.com  
345ff343@secure.datafounry.com  
fwrf2345jd@secure.datafounry.com  
qwg3451@secure.datafounry.com  
345ff343@secure.datafounry.com  
fwrf2345jd@secure.datafounry.com  
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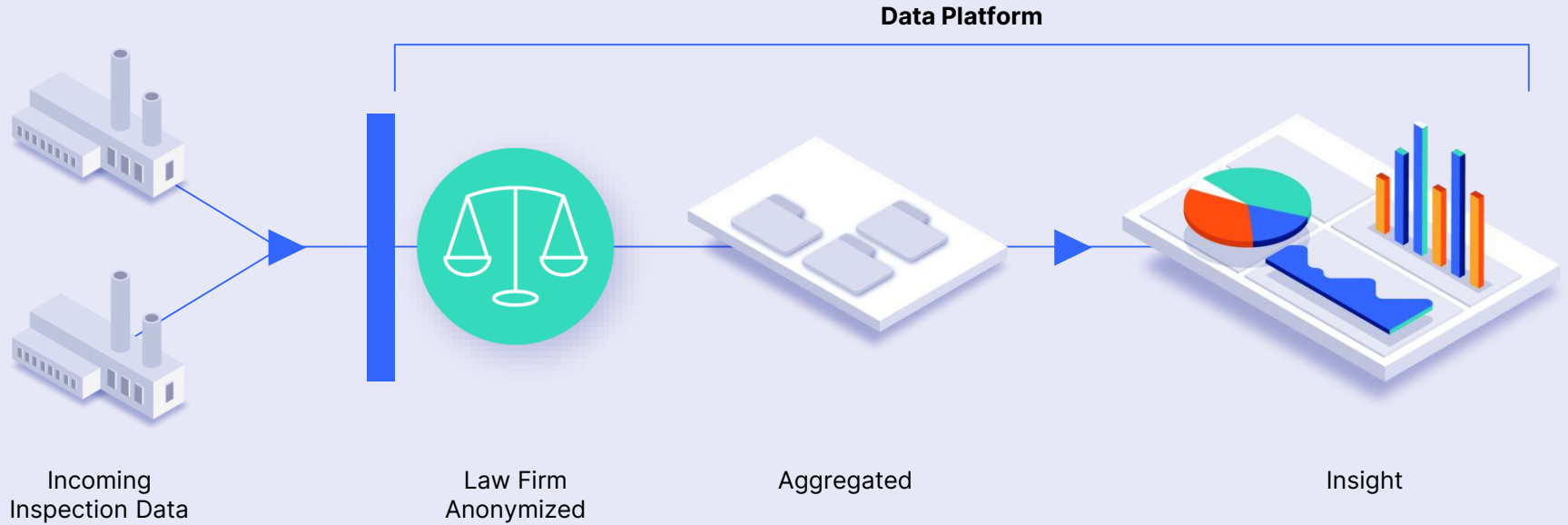


**jgoerzen@me.com**

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pgolle@verizon.net  
jgwang@sbcglobal.net  
engelen@gmail.com  
lushe@comcast.net  
hager@live.com  
osrin@yahoo.com  
frosal@mac.com  
improv@me.com  
osaru@aol.com  
treit@msn.com  
dburrows@hotmail.com  
lipeng@outlook.com  
kohlis@gmail.com



## fiin Data Trust Structure





## Benefits

- Prediction and prevention
- Safer, high-quality food
- Discover trends and anomalies not obvious in own data alone.  
**“Wisdom of the Crowd”**



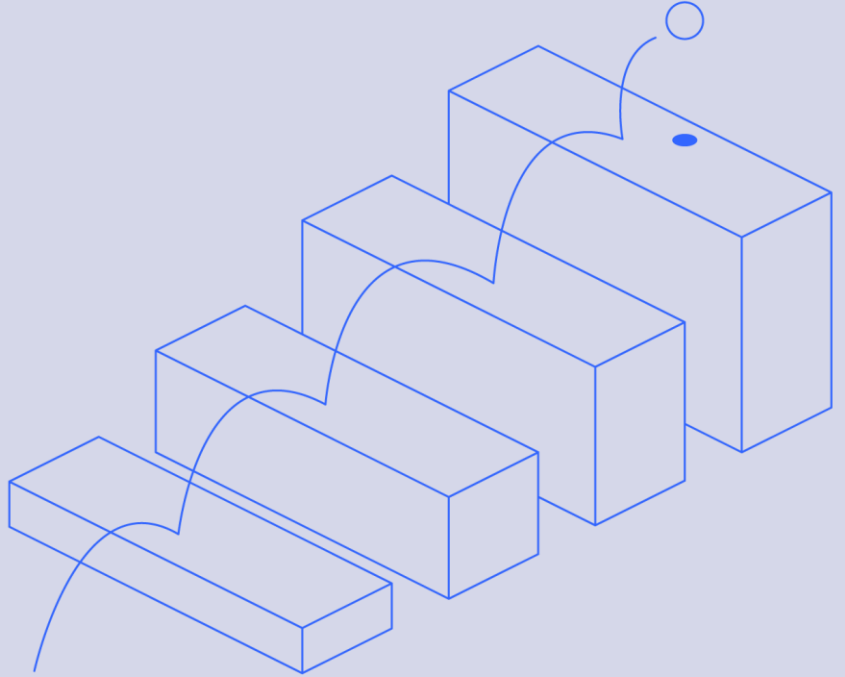
# Getting Started?



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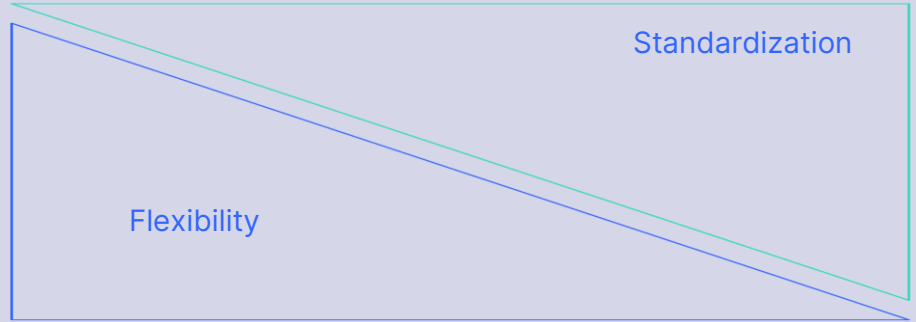


## **Articulate the vision & benefits**



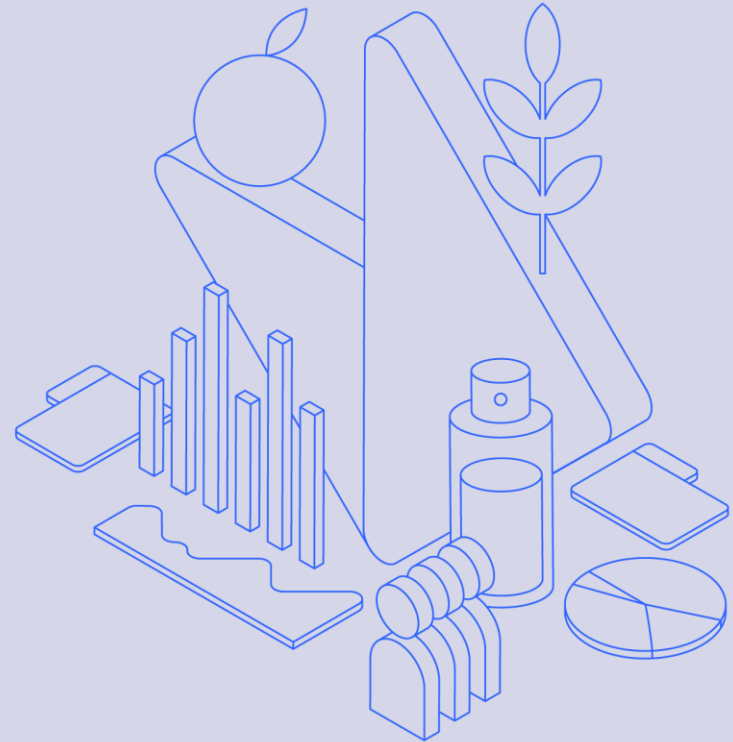


# Balance between standardization and flexibility



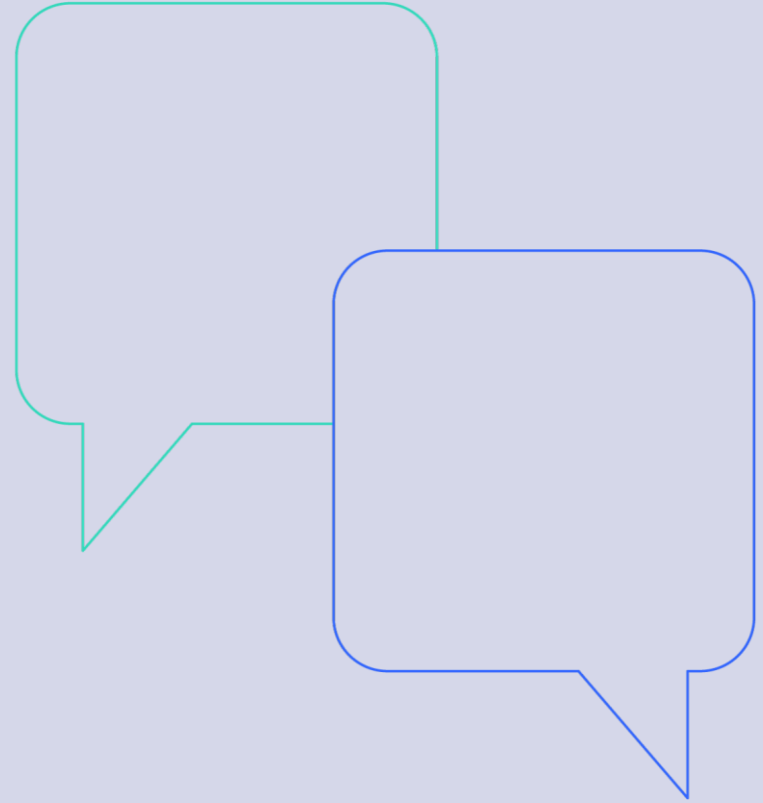


**Scientific input  
is needed**





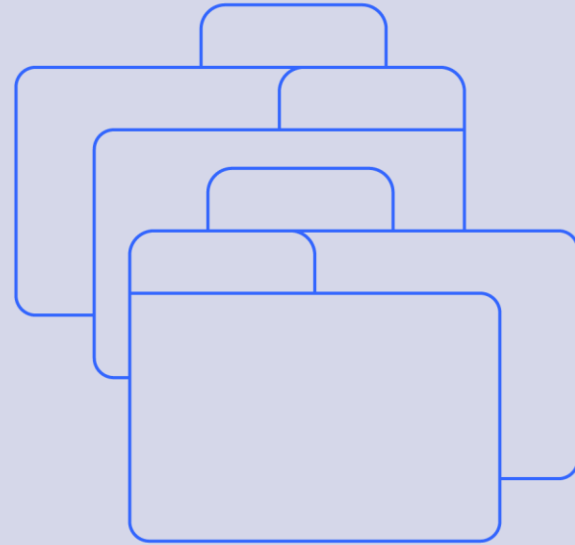
**Align on terminology**







**Start collecting data**



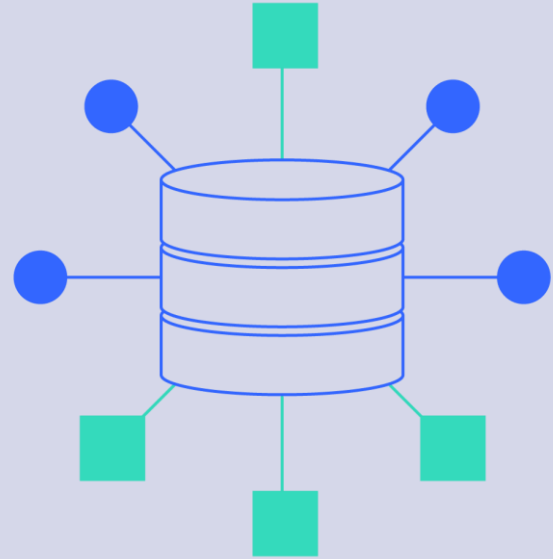


**Visual analytics  
are powerful**



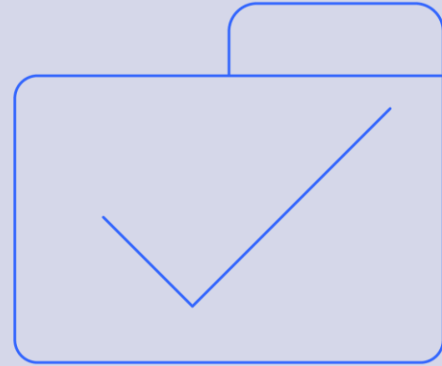


**Focus on clean data**  
(Best use of AI tools)





**Keep Going!**



▶ Creme Global

# Thank You

**Brendan Ring**

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Creme Global  
Dublin, Ireland  
NYC, USA



[www.cremeglobal.com](http://www.cremeglobal.com)



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# Use of Big Data and AI – Working With Academics

**Matthew J. Stasiewicz**  
Associate Professor of Applied Food Safety  
University of Illinois at Urbana-Champaign  
[mstasie@illinois.edu](mailto:mstasie@illinois.edu)



# My Connection

Site Lead



Research Lab Leader



# How Might You Get Started – With Academics

- **Project** – Slower, More depth
  - Allows faculty to lead student and staff on a project
  - Within university structures
  - Typically best if work could be public, generally useful
  - Get **progress** on an AI, data, or modelling problem
- **Consulting** – Faster, higher-level
  - Hire faculty or senior staff by the hour
  - Outside of formal university structures
  - Typically for private, one-off work
  - Get **guidance** on how to proceed with AI, data, questions

Choose a likely path

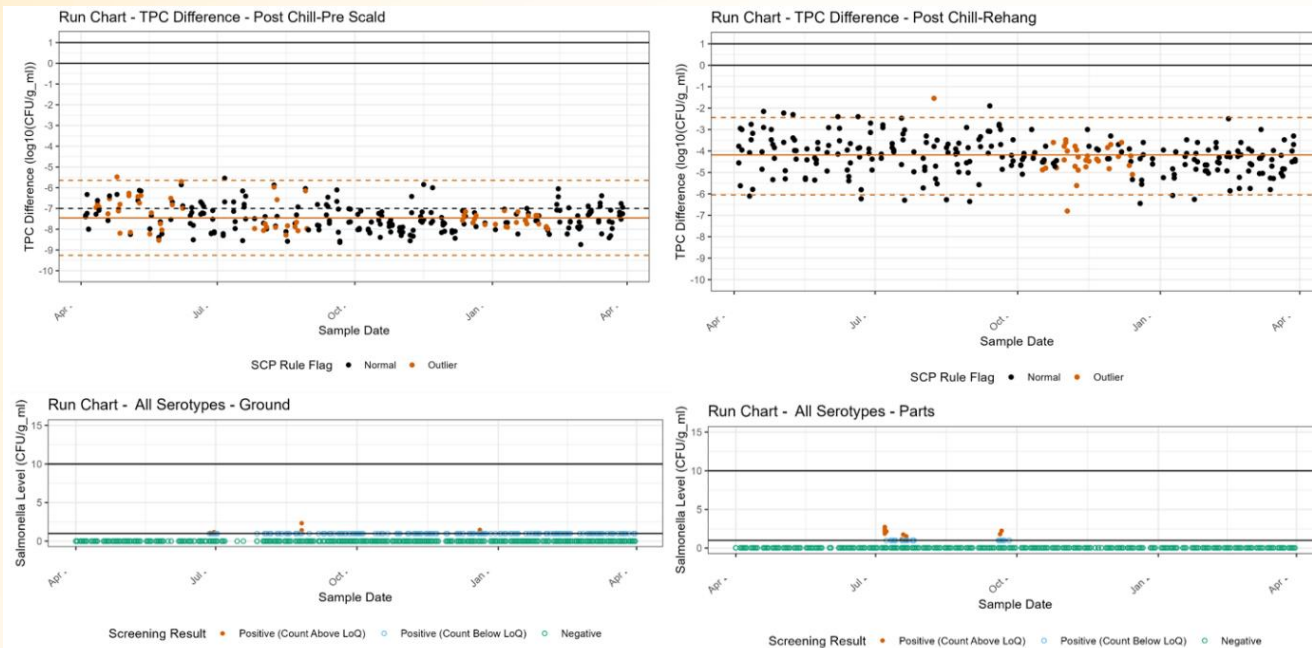
Regardless, will likely handoff to a software provide or professional full-time analyst for ongoing analytics work



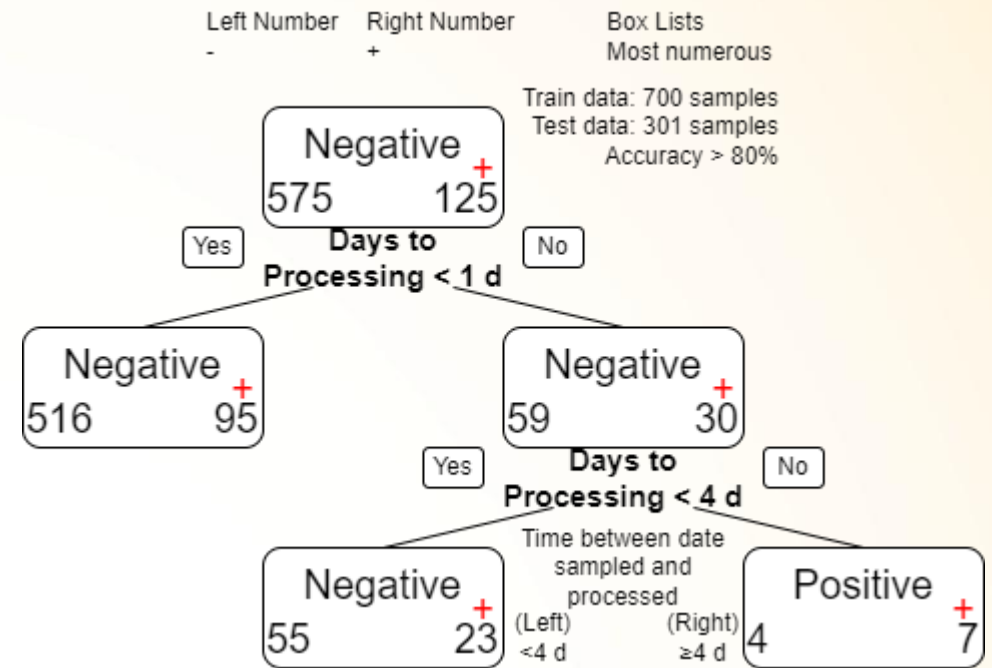
# Case Study – Poultry Safety

Received data from 1 plant, for a year. Many calls to understand. Did cleaning, analytics, reports. What's next.

## Data Analytics – But AI?



## Machine Learning – Closer to AI





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# Use of AI in Poultry

**Michael Walton (mw Walton@bcdilabs.com)**  
**BCD iLabs: AlforFood**

# Poultry!

## But could be many other food products

- Artificial Intelligence (AI) is playing a significant role in enhancing food safety in the poultry industry. Here are some key applications of AI in this sector:
  - Health Monitoring: AI systems use machine vision and sound analysis to monitor chicken health and welfare.
  - Environmental Control: AI technologies help farmers manage environmental conditions like temperature, light, and humidity, promoting better animal health and operational efficiency.
  - Production Management: AI-driven systems can optimize poultry production by adapting to data inputs, leading to more resilient operations against anomalous events including color, brine injection points, brine needles, and more!
  - Automation: Advanced sensors and robotics, guided by AI, can perform tasks such as egg grading, monitoring flock behavior, and even transporting birds to processing plants.
  - Allergen Free: AI can formulate food product to be allergen free





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# Use of Big Data and AI

**Tina Gettis ([tgettis@iit.edu](mailto:tgettis@iit.edu))  
Institute for Food Safety and Health**

# Understanding Data

- Standardized data
  - Trusted data that is accurate and represents the problem
- Open to data sharing
  - Better predictions with more data
- Data from various sources
  - Models may require data from various sources
- Deciphering collected data
  - Data itself may not tell the entire story
- Frequency of sharing data
  - May impact the preparation and methods on sharing data
- Data security & privacy
  - Who has rights to the data and how is it being protected



# Example

- Using sensors to monitor temperature during transportation.



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