

CONSUMED

FOOD SAFETY MATTERS JUNE '24, ISSUE 9 / ISSN 2744-550X



Against a background of saturation media coverage and commentary on artificial intelligence, much of it warning us of the negative consequences – the scariest coming from the inventors themselves - the Centre held a one-day industry forum on 12 March to investigate potential applications to food safety practice: can it help us with pathogen recognition, product tracking, proving provenance, fraud prevention, ripeness/spoilage indicators, detecting cross-contact allergens, product recalls, outbreak tracing and management, scanning and summarising food safety-relevant science papers and regulatory information, anticipating algal blooms and other weather-related risks,

speeding up new product and ingredient development and testing? Director Libby Harrison says,

“Whatever problems may come with AI, it is here now, we all need to learn something about it and take advantage of the benefits it offers.”

“We want to support members to learn about it and access the expertise to help them apply it.”

While Miramar golfers teed off outside the window on a fresh autumn day, 51 Centre members convened in the Clubrooms (plus

SPECIAL AI EDITION

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IS
**OBESITY
 A FOOD
 SAFETY ISSUE?**



The NZFSSRC invites you to attend this special event following the annual symposium.

KIM HILL
 Broadcaster

Evening networking (drinks) and panel discussion: **\$30**

All the details on **PAGE 12**



Dame Professor Juliet Gerrard.

18 online) to hear a line-up of speakers who already have some experience or knowledge of AI, machine learning, and data science.

Dame Professor Juliet Gerrard opened the forum and caught everyone's attention with a convincing example of AI power that directly affects her own discipline. It has taken years, if not decades, and teams of protein scientists, to solve the composition and structure of a single protein comprising several hundred atoms. Now, says Juliet, AI has just about solved them all! She sees potential benefits of AI in food safety areas, including new enzymes for food processing, new insights into the gut biome, better predictions of consumer trends, and support with regulatory

"How are small companies supposed to find the time and money to think about it and source the necessary capability?"

compliance. She says risks, or areas where care and awareness is needed, include ethics of AI use, the requirement for accurate data and the need for skills in the workforce to enable the use of AI.

When jobs as we know them are threatened, it's easier to fixate on the possible downsides than the advantages. With so much data accumulating exponentially – they call it 'data obesity' - will we suffer data fatigue, drown in our own 'data lake', do we know what questions to ask of the data, will the cost of applying AI exceed the value of the answer, will we know the stats of everything and the value of nothing?

Will digital non-natives get left behind and become politically powerless and ever more susceptible to mis/disinformation? How can we manage people and systems we don't really understand? Will all our training and expertise become worthless overnight? Will we become dependent on AI and ditch all common sense, leading to UK Post Office-type debacles, where management blamed hundreds of their own people rather than the computer system? Will the public trust it once mistakes and abuses are uncovered and publicised? Already AI hallucinations have famously made fools of the algorithms, which are ignorant of context and miss the subtleties.

Will the pace of overseas uptake of AI force us to move faster than we are able to, and leave us further and further behind? How are small companies supposed to find the time and money to think about it and source the necessary capability?

Does food safety practice really need it?



Left to right: Wendy Newport-Smith, Miranda Miroso, Michal Dunn.



Pierre Venter, Fonterra, joins the discussion.

Dr John Donaghy,
Head of Food Safety, Corporate
Quality, Nestlé, Switzerland



John Donaghy was first up so that he could get to bed before midnight – John was in his native Ireland at the time. It’s hard to get your head around the size and complexity of Nestlé production. How do you keep tabs on so many different products, made in so many different factories, using thousands of ingredients from all over the world, and millions if not billions of consumers with different languages and food cultures. The production chains are mind-boggling. More and more, John’s management helpmates are big data, digitalisation, and AI tools like ‘large language models’ (LLMs).

John cited numerous examples of how Nestlé are using these tools already:

- AI tools are now regularly used to predict emerging food safety issues through early warning and foresight systems.
- Use of AI algorithms for defect root cause analysis. For example, in one facility where milk powder is produced >300 processing parameters are measured every minute. Occasional customer complaints about particles in milk powder were cross-referenced with these, using AI tools to home in on 6 processing parameters which lead to this quality defect.

- Digital monitoring devices placed strategically around factories trap insects, identify and count them, and upload data in real time to smart devices.
- Predictive AI can be applied so that false positives are recognised as products pass through X-ray detectors. This saves interruptions to production.
- Natural language processing can differentiate and quantify positive and negative feedback from customers, expressed in media, social media, and other communications, in many languages. With the unmanageable volume of social media, this is a very valuable application for such a large company.
- John can use predictive analytics to track the performance of ingredient suppliers, helping him to anticipate where supply chain disruptions are more likely to emerge. Climate and water quality information can be used to predict associated problems with contaminants.
- Nifty digital passports attached to products or packages send real time information about temperature, humidity, and location during transport and distribution.
- Recalls are much faster and easier to manage using store cards and electronic payment methods to trace and/or alert customers.
- AI can glean the key food safety-relevant facts from hundreds of scientific papers John would never have time to read himself. The external sources it draws on can be limited to the most reputable journals and organisations. John noted at the beginning of his presentation that about six million scientific papers are now produced every year!

- Global sharing of whole genome sequencing data has transformed pathogen and foodborne disease outbreak management. Data science is essential to deriving and presenting useful intelligence from whole genome sequencing and now metagenomics.
- Education and training. Here are two examples of very specific questions John put to Chat GPT (see graphic below).

Q. *What are the best thermal processing parameters for canned soups?*

Q. *I am an expert microbiologist. Could you tell me what is the minimum activity that will control the formation of ochratoxin on coffee beans together with the corresponding references?*

If only it were that simple, and sometimes it is. But, says John, every answer must be carefully validated by experts and there are considerable fundamental challenges. A lot of datasets are not standardized or are of doubtful quality. There is a lack of data science expertise in the food sector, a lack of facilities for sharing data, and challenges with scalability and data storage. Confidentiality related to data sharing and exposure can present an issue for many stakeholders in the food sector. In conclusion, John stressed, AI is not infallible and needs human oversight

Nestlé’s revenue is almost half of New Zealand’s GDP. Another realm. Where, by comparison, is New Zealand’s largest, but much smaller, food company at with AI/digitalisation/data science development? Fonterra, which is a supplier to Nestlé, has about a tenth of the turnover. Nevertheless, it has an R&D force of 350, reflecting the paramount importance of food safety and quality, and its drive to develop new dairy-based products with specific health benefits.

ChatGPT: Ask the Expert – Training & Education

Q. *What are the best thermal processing parameters for canned soups?*
 To ensure safety and quality of canned soups, the recommended thermal processing parameters include:

- Temperature: Reach at least 240°F (116°C) through pressure canning.
- Processing Time: 85-100 minutes for quart-sized containers; adjust for smaller sizes.
- Rapid Cooling: Cool to around 70°F (21°C) after processing.
- Acidification: If necessary, add acid to low-acid soups.
- Balance Safety and Quality: Avoid overprocessing for better texture and flavor.
- Heat Penetration Studies: Validate parameters with temperature measurements.
- Regulatory Compliance: Ensure compliance with relevant food safety regulations.
- Specific parameters may vary based on soup, ingredients/recipe. Consultation with food safety experts is essential.

Q. *I am an expert microbiologist, could you tell me what is the minimum water activity that will control the formation of ochratoxin on coffee beans together with the corresponding references.*

A. According to the available information, the minimum water activity required to control the formation of ochratoxin on coffee beans is 0.83 (equivalent to approximately 14% moisture content). This information is based on in vitro (in lab) production of green coffee. It is important to note that even with the minimum water activity, improper storage or other factors could still lead to Ochratoxin formation. Additionally, the specific references for this information were not provided in the search results. To obtain the corresponding references and more detailed information on the topic, I recommend conducting a more comprehensive literature search or referring to scientific publications and research articles related to ochratoxin formation on coffee beans.

References: [1](#) [2](#) [3](#) [4](#) [5](#) [6](#) [7](#) [8](#) [9](#) [10](#) [11](#) [12](#) [13](#) [14](#) [15](#) [16](#) [17](#) [18](#) [19](#) [20](#) [21](#) [22](#) [23](#) [24](#) [25](#) [26](#) [27](#) [28](#) [29](#) [30](#) [31](#) [32](#) [33](#) [34](#) [35](#) [36](#) [37](#) [38](#) [39](#) [40](#) [41](#) [42](#) [43](#) [44](#) [45](#) [46](#) [47](#) [48](#) [49](#) [50](#) [51](#) [52](#) [53](#) [54](#) [55](#) [56](#) [57](#) [58](#) [59](#) [60](#) [61](#) [62](#) [63](#) [64](#) [65](#) [66](#) [67](#) [68](#) [69](#) [70](#) [71](#) [72](#) [73](#) [74](#) [75](#) [76](#) [77](#) [78](#) [79](#) [80](#) [81](#) [82](#) [83](#) [84](#) [85](#) [86](#) [87](#) [88](#) [89](#) [90](#) [91](#) [92](#) [93](#) [94](#) [95](#) [96](#) [97](#) [98](#) [99](#) [100](#)

The Diverse Nature of Food Safety Data

- **Structured**
 - Tabular Analytical Reports
 - Quantitative data
 - Internal surveillance/monitoring data
 - Supplier Performance Metrics
 - Batch Numbers/Production Times
- **Semi-Structured**
 - Graphical information
 - Consumer feedbacks
 - Power point presentations
 - Transcripts/Audio/Video
 - Certificates of Analysis (CoA)
- **Unstructured**
 - Machine data
 - Text messages/Emails
 - Survey responses
 - Scientific publications/Reports
 - Blogs

Dr Steve Taylor, Fonterra's GM R&D Technology Capability



Steve Taylor played a video imagining where their R&D operation could be in a few years' time, which is about as far as anyone can see into the future when it comes to the implications of generative AI (GenAI) in the workplace. In their ideal operating future, the questions that come into the R&D team every week would receive an immediate answer from well-organised knowledge and ever-accumulating data. Steve defines the role of GenAI as the ability to synthesise internal and external knowledge. He says the world is flooded with food safety data and that data is critical in dealing with food safety risks.

"We need good data scientists who can make sense of it. Without AI we will drown in our own data lake, as data continues to accumulate exponentially."

Fonterra has a huge 'library' of bacteria which it can whole-genome-sequence to find genes that may confer desirable health benefits. Whole genome sequencing produces massive amounts of data, and the correlation of genes makes the data analysis incredibly complex, as statistician Jonathan Marshall demonstrated (see page 7).

Probiotics are big business. Fonterra sells ingredients to infant formula manufacturers, e.g. complex and phospholipids which are very important for infant brain development and may also help stress management in adults. They are also researching probiotics to lift mood and aid weight loss – two holy grails. AI may help design clinical trials and do all the tedious but necessary preliminary work such as ethics approval registrations, scanning the existing literature, etc. Pharmaceutical companies are talking about AI speeding up clinical trials a thousand times. Steve is somewhat sceptical about that, but this is an application they are definitely pursuing.

Generally, Fonterra wants to streamline the R&D process, and organise their data in such a way that it's easy to target what you want, such as finding the gene(s) that generate the desired bioactivity.

This will include using AI to identify and schedule booking time with experts required for a particular project. With

such a big staff, all with individual skillsets, this is an important aspect to speeding up R&D timelines. AI search power can also quickly find the right expertise outside the company.

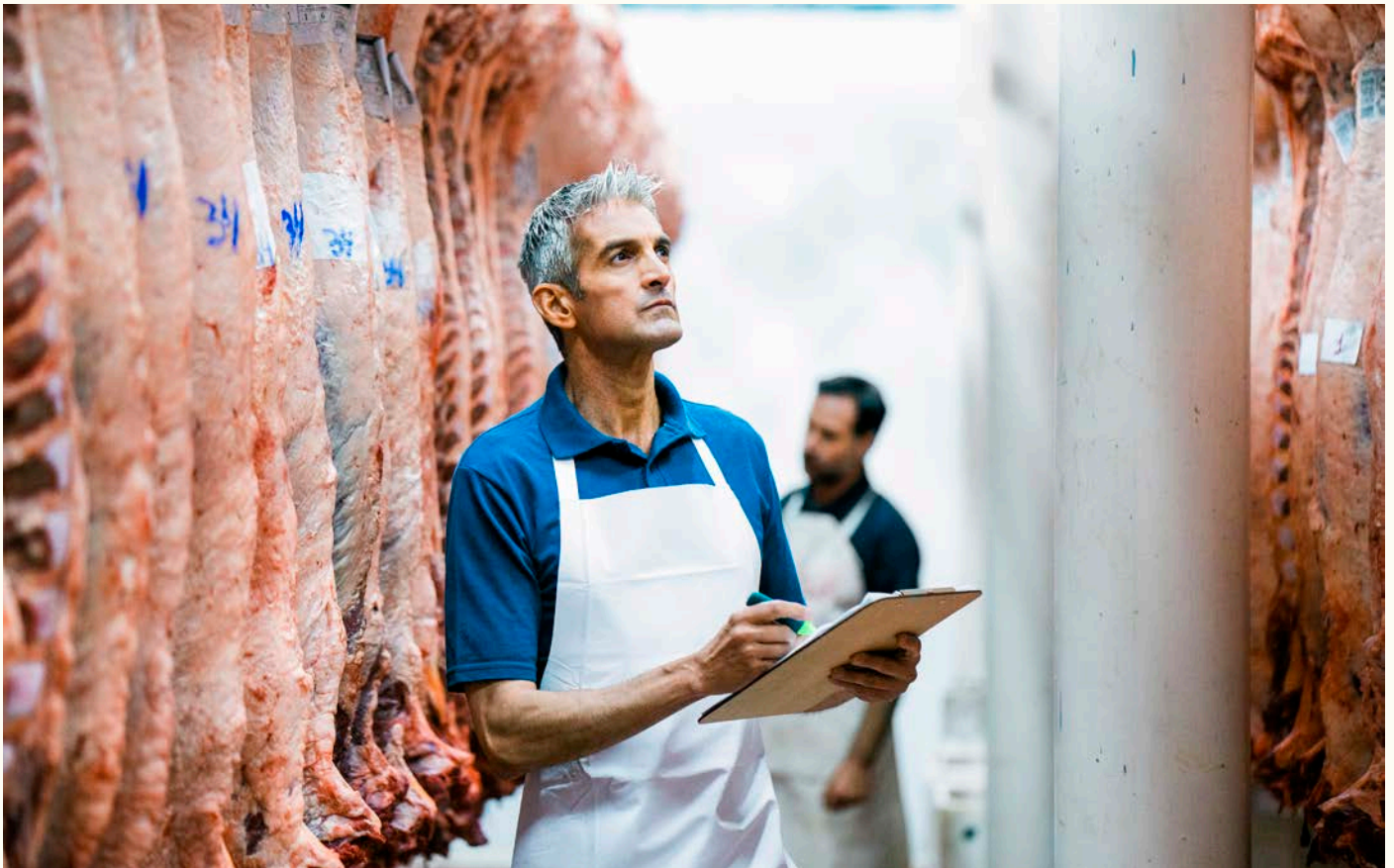
In the pre-computer era, staff in white lab coats used to go round dairy processing plants with a clipboard every half hour, recording process conditions. Now, scores of parameters are logged every half a second. This is yet another huge, accumulating data pool. We have already seen how John Donaghy used this data to find the cause of a problem in the manufacture of infant milk powder. With products like cheese, monitoring and controlling processing conditions is critical.

"Generally," says Steve

***"we're focusing
on taking away
the drudgery of
people's jobs."***

"The biggest thing is being able to tell what is real, and what isn't. You need to feed AI a curated set of knowledge and it is critical to tell it not to make things up if it doesn't know the answer. In food safety, you don't want it to be making up stuff!"





Matt Scott,
Innovation Lead, AsureQuality



AsureQuality is a New Zealand State-owned Enterprise, competing for work commercially. Traditionally, their singular mission was to ensure food safety. Now, they have two additional questions to answer: Is this food really what it says it is?" and "Does this food align with customers' values?"

About a third of their business is meat inspection. They currently have a 650-strong force of meat inspectors (out of a total workforce of 1800) and boast the largest laboratory in the southern hemisphere.

With 28 million carcasses a year passing before their expert eyes, the potential application of AI/Predictive AI soon became obvious. Conceivably, cameras could be trained on the processing line to pick up a certain pathology.

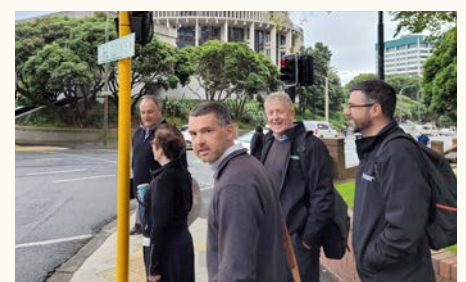
At a Futures Thinking Workshop, the 100 or so meat inspection plant supervisors decided they wanted to take a lead in experimenting with automated meat inspection. They believe that if tedious and repetitive tasks are automated, the team can focus on higher value food safety and "quality over quantity" tasks. They came up with two expressions: "from overalls to lab coats" and "from Meat Inspectors to Protein Processing Quality Experts" to summarise the future they want AsureQuality to work towards.

With 28 million carcasses a year passing before their expert eyes, the potential application of AI/Predictive AI soon became obvious.

They needed to create a safe space in which to experiment. Matt says, "We are uploading data to the cloud so we can use Amazon Web Services' supercomputers to train the AI model. Creating the safe space meant convincing the regulators and Market Access delegation that our experiment

will run in parallel to the usual meat inspection process and won't affect the usual process in any way." They are starting with beef carcasses which are cut in half, so it's easier to see any sign of disease.

Matt says it's important to take everyone with them on this journey. Regular get-togethers over sausage rolls at morning tea is their proven modus operandi and something AI can never replicate.



Members of the Meat Inspection Management Team in Wellington for a meeting with MPI.

Associate Professor Grant Dick,

Department of Information
Science, University of Otago



Grant Dick painted the big picture of emerging trends in AI. He says he's an AI neutralist – they're hard to find. Media reporting and commentary seems polarised between doomsday scenarios and promises of better jobs with higher pay for fewer hours, due to vastly increased productivity. Grant says many of the claims about the future of work (e.g., that artificial intelligence agents will replace the jobs of workers in fields like software engineering and the creative arts) are likely exaggerated but he is certain we will become "more productive as a species".

Of course, some of the more optimistic predictions come from vendor organisations and there is a difference between company attitudes to AI and those of individual, not particularly IT-savvy, citizens/consumers, who are still finding it difficult to prove they are not robots, and resentful of not being able to talk to humans on the phone about problems with their internet or

electricity connection. They live in fear of scammers emptying their bank accounts or breaking their hearts, not to mention the collapse of democracy and trust in public institutions. Will the digital divide become an impassable gulf?

Grant himself uses AI tools like deep learning and ensemble methods to predict the impact of flooding on oyster farms. It is hoped that AI can be used to predict the impact of natural disasters on crops/stock/environment. After cyclones Hale and Gabrielle this is urgent, and sadly we now have more data to work with.

Grant says humans are still "very much in the loop" and need to curate and validate data and results. They also need to understand and be able to define the problem they want AI to help solve. That is the essence of data science. He doesn't think AI will become "self-sentient" but that it will become problematic. For one, it quickly becomes out of date, and there are issues of data sovereignty which are of particular concern to Māori as Professor Tahu Kukutai emphasised in her presentation.

Multi-modal generative AI, incorporating images, video, text, and sound are where the interest is moving to now, says Grant, and generative code writing "is almost here".



There has been exponential growth in the capability of large language models, which are the 'foundation models' used to drive technologies like ChatGPT.

We've all heard the worries about students using LLMs for essay-type assignments. (It will become an art to pepper the result with the odd spelling error and non-sequitur to conceal the otherwise unaccountably well-versed and literate author.)

"Self-sentient AI is not happening, and I don't think it's ever going to happen."

With the increasing ease with which foundation models can be adopted and applied to many problems, Grant highly recommended a paper from Stanford University: Opportunities and Risks of Foundation Models. It contains many cautions about the use of foundation models. The introduction warns:

Despite the impending widespread deployment of foundation models, we currently lack a clear understanding of how they work, when they fail, and what they are even capable of due to their emergent properties. To tackle these questions, we believe much of the critical research on foundation models will require deep interdisciplinary collaboration commensurate with their fundamentally sociotechnical nature.





Associate Professor Jonathan Marshall,
School of Mathematical and Computational Sciences,
Massey University



Jonathan Marshall showed some of the fishhooks in using and customising open-source models, in this case random forests, based on the work of PhD student Helen Smith.

The pertinent case study he used by way of example, was how to attribute the source of *campylobacter* to cows, sheep, or chickens, based on the preponderance

of certain alleles in the *campylobacter* genome associated with each. Chickens don't usually have much to do with sheep or cows, so the species colonising them go their different ways genetically. It's easier to distinguish poultry as a source, compared with sheep and cows, which share environments.

This was population-level linking of *campylobacter* and clinical isolates, not the simpler task of matching a single clinical sample with a likely source. Because genes are correlated, and every single isolate is different, figuring out which genes to use and which alleles of those genes are associated with



“The risk is eliminating the human and placing too much of our trust in the models.”

different sources, requires quadrillions of permutations to be considered.

The overriding message for most at the AI seminar was, be cautious about trying this at home. You need people like Jonathan and his highly IT-literate PhD students, with advanced statistical training, to customise the models.

Jonathan says that what he wanted to get across at the forum was simply that, “There are a bunch of models out there developed by smart people, but few are the perfect match for your problems. There are subtleties, which, if ignored, result in biases and quite wrong answers. Initially, we thought it was going to be easy to apply these models, but once we got into it, we kept saying to ourselves, “hang on a sec!”. There always seem to be new fishhooks.

Ok, so how good was that fit?

- Split the source data into 5 sets.
- Use cross-validation to assess performance (sensitivity).
- Does well with poultry, less well with sheep and beef.
- For the isolates with unique alleles, poultry still gets assigned well.

Category	Beef	Poultry	Sheep
Beef	~0.75	~0.25	~0.25
Poultry	~0.25	~0.75	~0.25
Sheep	~0.25	~0.25	~0.75

Summary

- The details of machine learning model implementations matter!
- Don't assume a package is doing the right thing.
- Always check performance with completely independent data, even if the package computes it for you.
- If you have categorical variables, then they often have to be encoded. The method of encoding matters.
- Paper: Lost in the Forest (H.L. Smith) <https://www.biorxiv.org/content/10.1101/2022.09.12.507676v3>
 - Demonstrates existing encoding methods are biased, and presents a solution.
 - Shows how to use auxiliary information for the absent levels.

Graeme Merrall,
Customer Engineering, Google



Graeme Merrall gave a comprehensive overview of the evolution of Predictive AI, which has been around for a few years now, and is very well developed, through to GenAI and multimodal AI. He says the speed at which it's 'coming at us' is phenomenal.

"Whereas with Predictive AI you have to train it by giving it a large number of examples, GenAI doesn't need educating, but there's a trade-off with accuracy and speed."

He gave two examples of Predictive AI which are apt for food safety and quality. Predictive AI was used to detect broken or imperfect biscuits, and defects in seals on tubes. You could readily see how the latter could be used to guard against contamination and tampering.

Regarding data security and confidentiality, Graeme says that GenAI applications for organisations have

very good guardrails, whereas free, open-source models are available for IT-savvy mischief makers of any age to create havoc. We already know about the robocalls from Joe Biden and Donald Trump. Graeme says Google is doing a lot of work to tag what is real and what isn't.

He reminds us that "free often comes at a price. Remember you are the product, and your input is being used to train AI."

Graeme advises anyone who wants to get started to do a bit of practice on the free tools, posing general, innocuous questions. "Just get comfortable asking questions, and how to phrase them to get what you want. There is a lot of skill in how to ask the question.

"Google is getting very good at natural language processing – you can interact in very normal conversation."

"When you are ready to graduate, I recommend Google AI Studio as a super-easy-to-use multi-modal model. It costs, but it's worth it. You just upload video, photos, whatever, and tell it what to do with them - the traffic is one way, so there's no danger of misappropriation by anyone else."

Graeme was asked if advanced multimodal power could have helped the young man in the film *Lion*, who was adopted from India by an Australian couple, after being separated from his brother and getting hopelessly lost. The five-year-old fell asleep on a long-distance train, ending up on the streets of Kolkata hundreds of miles away, and could not be reunited with his family. He held on to a vague memory of a water tower by the station, the layout and part of the name of the village he'd come from. Spoiler alert: after years of searching on Google Earth, he zeroed in on the village and returned to meet his mother. It turns out that Graeme had been contacted to help him use Google Earth, but was in another city, so someone else from the company was assigned – one of Graeme's big life regrets when he found out that Nicole Kidman was playing the Australian mother.

"Google is getting very good at natural language processing – you can interact in very normal conversation. Nevertheless, we're still in the pioneering phase, albeit moving at incredible speed. Tools are coming out to lower the barrier to entry to GenAI in work situations that will make it easier for small businesses to use them. The Centre can play a useful role in keeping members informed about developments and how to access expertise."



There's already a vast toolkit available

Predictive AI	Generative AI	Multimodal Generative AI
Regression & Classification Forecasting Sentiment Analysis Entity Extraction Object Detection	Text, Image & Code Generation Text & Code Rewriting & Formatting Summarization Extractive Q&A Image & Video Descriptions	Natural Image Understanding Video Question Answering Automatic Speech Recognition & Translation Spatial Reasoning and Logic Mathematical Reasoning in Visual Contexts
		Now

New Zealand FOOD SAFETY SCIENCE & RESEARCH CENTRE

Predictive Vision - Anomaly detection

~1,000 number of cookies per second to be screened for damages - and per production line

Primary objective: Increase speed of inference for 10+ categories of damages on the edge

Google Cloud

Proprietary & Confidential

New Zealand FOOD SAFETY SCIENCE & RESEARCH CENTRE

Predictive Vision - Packaging

Use case: Detect defects in cosmetic tubes manufacturing tube nozzle heads and sealing seams

Business Impact:

- Lower packaging costs and increase package quality

Performance metrics:

- Precision@0.95threshold: 1
- False negative rate: 0.099
- False positive rate: 0
- Recall: 0.901

Why Visual Inspection AI?

- Use unsupervised learning to minimize labelling costs
- Outperforms custom model
- Significantly lowers Overall rate and Escape rate

Thermal image of a good seal | Thermal image of a bad seal

Google Cloud

Proprietary & Confidential

New Zealand FOOD SAFETY SCIENCE & RESEARCH CENTRE

Hamish Darling, CEO, InstatData



Hamish Darling, born in the mid-1990s, is a foundation member of GenZ. As a true digital native, he added a valuable perspective to the forum. He is CEO of a company which evolved from an initiative his mother, Helen Darling, started. Attendees may remember the “big food industry picture” presentation Helen gave at the last NZFSSRC industry futures forum the Centre held in September 2022.

InstatData has moved from food industry applications – early identification of consumer trends, risks such as disease outbreaks and needles in strawberries etc. - into HR, as commercial opportunities have arisen, e.g. job candidate background-checking by plumbing the depths and byways of the internet.

(If only young people would remember that what they’re sharing online can come back to bite you in the job market.)

Hamish is a 4th generation fruit grower and won the Young Grower of the Year award for Central Otago in 2018. And so when he thinks about AI applications, he naturally imagines potential applications in the food industry. For example, scanning social media for complaints about produce, as John Donaghy does using large language models. He says

“Predictive AI levels the playing field in favour of smaller enterprises, who now have access to these very cheap and powerful tools.”

He thinks they will reduce costs in several ways and promote better compliance and safety.

When it comes to jobs, he notes that with every generation of technology, people seem to work more and more, not less, so worries about job losses are probably needless.

The flexibility conferred by technology, and the change in work culture post-pandemic, mean that Hamish can conduct his business from Bilbao in Spain, for part of the year at least, though it cannot yet manipulate time differences – the interview with Hamish was at 2am Bilbao time.

However, Hamish worries that the speed of AI adoption will widen the digital divide. He applauds the NZFSSRC for helping members make a start and stimulate their thinking about what they could use it for.

Hamish took part in the spirited panel discussion at the end of the 12 March forum.

The other panellists were:

Claire McDonald, PhD (MPI – New Zealand Food Safety)

Professor Dame Juliet Gerrard (Prime Minister’s Chief Science Adviser)

Fiona Wiremu (Member, Te Tira Whakamana, an advisory group on the NZFSSRC Board)

Distinguished Professor Phil Bremer (Chief Scientist of NZFSSRC and Chair of the Science Leadership Team).





The Panel

The Panel discussion aimed to help identify science gaps and research opportunities, including in the social and behavioural sciences. Questions and responses related to:

- Opportunities and risks around the use of AI on large data sets to inform risk assessment, and the continued need for human oversight

- Learnings from other areas such as health, where ‘mistakes’ in analysis are made by both humans and technology
- Issues around data oversight and ownership and the need for there to be trust and rights in systems and tools, including for Māori
- The ‘data fatigue’ that comes from the masses of data we now consume,

and the need to prioritise and focus on where AI might add value

- Concerns in industry about the pace of movement in the use of AI, including with respect to offshore regulators and market access
- The ability of SMEs to find ‘space’ to determine if these tools are valuable – the need for good critical analysis increases with the use of these tools

Left to right: Scott Champion (facilitator), Phil Bremer, Dame Professor Juliet Gerrard, Hamish Darling, Fiona Wiremu, Dr Claire McDonald.

ACKNOWLEDGEMENTS

The Centre thanks all the presenters who generously shared their knowledge and experience on 12 March. We also thank Richard Brooking (Member, Te Tira Whakamana, an advisory group on the NZFSSRC Board), Professor Dame Juliet Gerrard and Scott Champion for their contributions.

FULL LIST OF PRESENTERS

Grant Dick	University of Otago
John Donaghy	Nestlé
Tahu Kukutai	Waikato University
Claire McDonald	Ministry for Primary Industries
Jonathan Marshall	Massey University
Graeme Merrall	Google
Petra Muellner	Epi-interactive
Alvaro Orsi	Institute of Environmental Science and Research
Mariza Gomes	AgResearch Ltd
Matt Scott	AsureQuality Ltd
Steve Taylor	Fonterra

Phil Bremer

asks Chat GPT what it can do for food safety

Phil:

Can AI help with food safety?

Answer:

AI can help with food safety in several ways:

- 1. Quality Control:** AI can be used to inspect and analyse food products for quality control purposes. Predictive AI algorithms can be trained to identify defects, contaminants, or spoilage in food items, ensuring that only safe and high-quality products reach the market.
- 2. Pathogen Detection:** AI can aid in the early detection of harmful pathogens in food, such as Salmonella or E. coli. By analysing data from various sources, including sensor data from food processing facilities or historical data on foodborne illness outbreaks, AI algorithms can identify patterns and potential risks, allowing for timely intervention and prevention.
- 3. Traceability:** AI technologies like blockchain can be used to establish a transparent and secure food supply chain. By recording and tracking every step of the food production and distribution process, from farm to fork, AI can help identify the source of contamination or food safety issues, enabling faster recalls and reducing the impact of foodborne illnesses.
- 4. Predictive Analytics:** AI can analyse vast amounts of data, including weather patterns, soil conditions, and crop health, to predict and manage potential food safety risks. By monitoring these factors, AI can help farmers and food producers take proactive measures to prevent contamination or other hazards.
- 5. Food Labelling and Allergen Detection:** AI can assist in automatically reading and interpreting food labels, ensuring accurate ingredient information and allergen warnings. Natural language processing algorithms can analyse ingredients and allergen lists, helping consumers make informed choices and preventing allergic reactions.



Phil:

How can AI aid in the early detection of harmful pathogens in food?

Answer:

AI can aid in the early detection of harmful pathogens in food through various methods:

- 1. Image Recognition:** AI algorithms can analyse images of food samples or food processing environments to detect the presence of pathogens. By training Predictive AI models on a large dataset of images, AI can learn to identify specific pathogens or signs of contamination, such as mould or discoloration.
- 2. Sensor Data Analysis:** AI can analyse data collected from sensors embedded in food processing facilities or along the supply chain. These sensors can measure various parameters such as temperature, humidity, pH levels, or the presence of specific chemicals. AI algorithms can detect patterns or anomalies in the sensor data that indicate the presence of pathogens or potential contamination.
- 3. Genomic Analysis:** AI can analyse genomic data of pathogens to identify specific strains or genetic markers associated with foodborne illnesses. By comparing genomic sequences of pathogens found in food samples with a database of known pathogens, AI can quickly identify and classify the presence of harmful bacteria or viruses.
- 4. Data Integration:** AI can integrate and analyse data from various sources, including historical data on foodborne illness outbreaks, consumer complaints, or public health records. By combining this information with real-time

data from food processing facilities or the supply chain, AI can identify patterns or correlations that indicate potential risks or outbreaks.

- 5. Predictive Modelling:** AI can use Predictive AI algorithms to build predictive models that assess the risk of foodborne illnesses based on various factors such as environmental conditions, production practices, or ingredient quality. These models can help identify high-risk scenarios or locations, allowing for targeted interventions and preventive measures. By leveraging these AI techniques, early detection of harmful pathogens in food can be enhanced, enabling prompt intervention, prevention of outbreaks, and ensuring the safety of the food supply chain.

Phil:

Can you supply references?

Answer:

Certainly! Here are some references that provide more information on how AI can aid in the early detection of harmful pathogens in food:

- 1. Dharmaraj, S., & Kaur, M. (2021).** AI-based Techniques for Early Detection and Prevention of Foodborne Pathogens: A Review. *Recent Advances in Electrical & Electronic Engineering*, 14(3), 238-245.
- 1. Nguyen, T., & Bhandari, B. (2020).** Artificial intelligence for food safety and quality. *Comprehensive Reviews in Food Science and Food Safety*, 19(6), 3213-3238.
- 1. Kadam, S., & Choudhary, S. (2021).** AI and IoT-Based Food Safety and Quality Monitoring Systems: A Review. *Journal of Food Measurement and Characterization*, 15(4), 2771-2780.
- 1. Song, E., Wu, S., & Zhang, X. (2020).** Application of Artificial Intelligence Technologies in Food Safety. *Journal of Food Quality*, 2020, 1-9.
- 1. Nayak, R., & Dey, R. K. (2020).** Artificial intelligence in food safety: A review. *Food Control*, 112, 107141.

These references provide in-depth insights

IS OBESITY A FOOD SAFETY ISSUE?



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Cultivate Food Safety

VENUE: DISTINCTION HAMILTON
HOTEL & CONFERENCE CENTRE

ADDRESS: 100 GARNETT AVENUE,
TE RAPA, HAMILTON 3241

ROOM: CONFERENCE ROOMS 2-4

DATE: MONDAY 01 JULY 2024

TIME: 6:00 – 7:15PM

The NZFSSRC invites you to attend this special event following the annual symposium. Seats are limited. Please scan the QR code to register.



Evening networking (drinks) and panel discussion:

\$30



No admission after 6.00pm

The recording will be broadcast on RNZ's Sunday evening programme "In Conversation" (date to be advised).

A VIRTUAL CENTRE

The NZFSSRC pools the existing resources of partner organisations from across New Zealand. Current NZFSSRC partners are:

INDUSTRY MEMBERS:

AsureQuality	Meat Industry Association
Bakels Edible Oils NZ	NZ Apples and Pears Ltd
DCANZ	Oceania
Eagle Protect	Open Country
Eurofins	Poultry Industry Association of NZ
Fonterra	Sanford
Food & Grocery Council	Seafood NZ
Foodstuffs North Island	Synlait
Food Standards Australia New Zealand	Tatua
GSF Fresh Ltd	United Fresh
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Horticulture NZ	Westland
NZ King Salmon	Zespri
Mataura Valley Milk	

RESEARCH PARTNERS:



GOVERNMENT SUPPORTERS:



New Zealand
**FOOD SAFETY SCIENCE
& RESEARCH CENTRE**

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If you are interested in becoming a member of NZFSSRC, contact Industry Research Liaison Manager,

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and find out what the Centre has to offer, including significant research co-funding and professional development opportunities.

