





Artificial Intelligence: the good, the bad, and the exciting

Ben Hayes









For this talk

AI = Artificial Intelligence

not Artificial Insemination!







ChatGPT, I have a carrot in the

fridge and a can of tuna in the

cupboard, and ten minutes

before hungry kids get back

from swimming, what should I











You can make a simple and nutritious meal by combining the carrot and tuna in a pasta dish. Here's a quick and easy recipe for tuna and carrot pasta:

Ingredients:

1 can of tuna, -1 carrot, grated, 1/2 onion, finely chopped, 2 cloves of garlic, minced, 2 tablespoons of olive oil, Salt and pepper to taste, 250g of pasta of your choice, Grated parmesan cheese (optional)

Instructions:

- 1. Cook the pasta according to the package instructions.
- 2. While the pasta is cooking, heat the olive oil in a large pan over medium heat.

••••

This simple pasta dish is quick to make and provides a good balance of protein and vegetables for your hungry kids. Enjoy your meal!







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Task – make an AI tool that warns us when a Tank is approaching

The Queensland Alliance for Agriculture and Food Innovation (QAAFI) is a research institute of The University of Queensland (UQ), supported by the Queensland Government.







Task – make an AI tool that warns us when a Tank is approaching

Train the Al.....





7







AI: A tank is coming!

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AI: A tank is coming!



Bad !







ChatGPT, how many litres of water are required to produce a kg of beef in Australia?

The Queensland Alliance for Agriculture and Food Innovation (QAAFI) is a research institute of The University of Queensland (UQ), supported by the Queensland Government.







The water footprint of beef can vary depending on factors such as the type of production system used, the animal's diet, and the location of the farm. However, on average, it is estimated that it takes about **15,415** liters of water to produce 1 kilogram of beef. This water footprint includes the water used for the cow's drinking water, irrigation of the animal's feed, and the water used in processing and packaging the meat. Keep in mind that these numbers can vary widely depending on various factors, but this figure provides a rough estimate of the water intensity of beef production.







The real answer?

~ 400L (Integrity Ag & Environment – E.SUB.0010, Life Cycle Analysis)







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The exciting:

How can AI make agriculture more profitable and sustainable?

Breeding as an example















Selection goal

Which traits are related to farm profit: bioeconomic model

Which traits are important to farmers: 1000 minds

How much to weight sustainability traits in an index: Use AI to gather info about consumer preferences







Selection goal

Which traits are related to farm profit: bioeconomic model

Which traits are important to farmers: 1000 minds

How much to weight sustainability traits in an index: Use AI to gather info about consumer preferences

















Phenotyping for target traits











Phenotyping for target traits





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Selection of parents

Can we get more reliable ABVg using AI (machine learning)?

Very unlikely!

Current methods take into account our knowledge of gene action – lots of genes with small effects on traits such as milk yield, AI does not

Review of 140 papers, conclusion: machine learning methods can be almost as good as existing methods for genomic prediction...







Selection of parents

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Genomic selection



Genomic selection



ABVg for balanced performance index (BPI





"FastStack"

Parent *n*

New parent selection strategy using Genetic Algorithm (GA) to define optimum crossing path with highest number of stacked chromosome segments

Which 'blocks' are important?

- Chromosome segments with favourable effects
- $\circ\,$ Rare alleles



Kemper et al. 2012 J. Dairy Sci 95:4646





Virtual assembly of 'ultimate genotype'



Heifer stacked with desired configuration of favourable blocks for multiple traits



Genetic Algorithm

- Choosing crosses highly combinatorial problem
- 100 possible parents, 25 crosses, number of possible crosses is 8.05E+51
- Use AI (genetic algorithm)











Faststacking wheat in practise (Eric & Dilani)















FastStack validation population (2022 Yield t/ha)









Application to Dairy?

- Faststack works best with large numbers of progeny per mating
- IVF!









Conclusions

- Al is here, good to have a basic understanding particularly of where the information to train it comes from
- All "facts" must be verified!
- High quality, curated data is going to become very, very, valuable
- Exciting applications in Ag and Dairy
- Particularly in use of large scale image data to get valuable trait information
- New ways of breeding?







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