

Applied ML for veterinary epidemiologists

ISVEE pre-conference workshop - Day 4

Session 2 – Neural network fundamentals

Dr Tom Brownlie

Machine learning is turning things (data) into numbers and **finding patterns** in those numbers.

The computer does this part.

How?

Code & math.

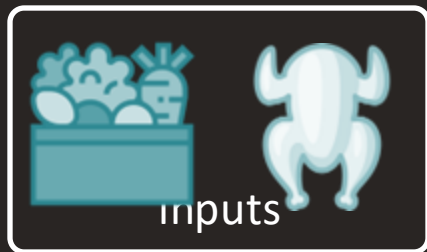
We're going to be writing the code.

Why use machine learning (or deep learning)?



What is deep learning?

Traditional programming



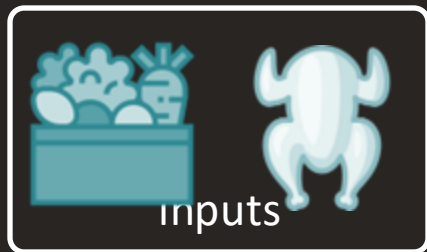
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1. Cut vegetables
2. Season chicken
3. Preheat oven
4. Cook chicken for 30-minutes
5. Add vegetables

makes



ML/DL approach



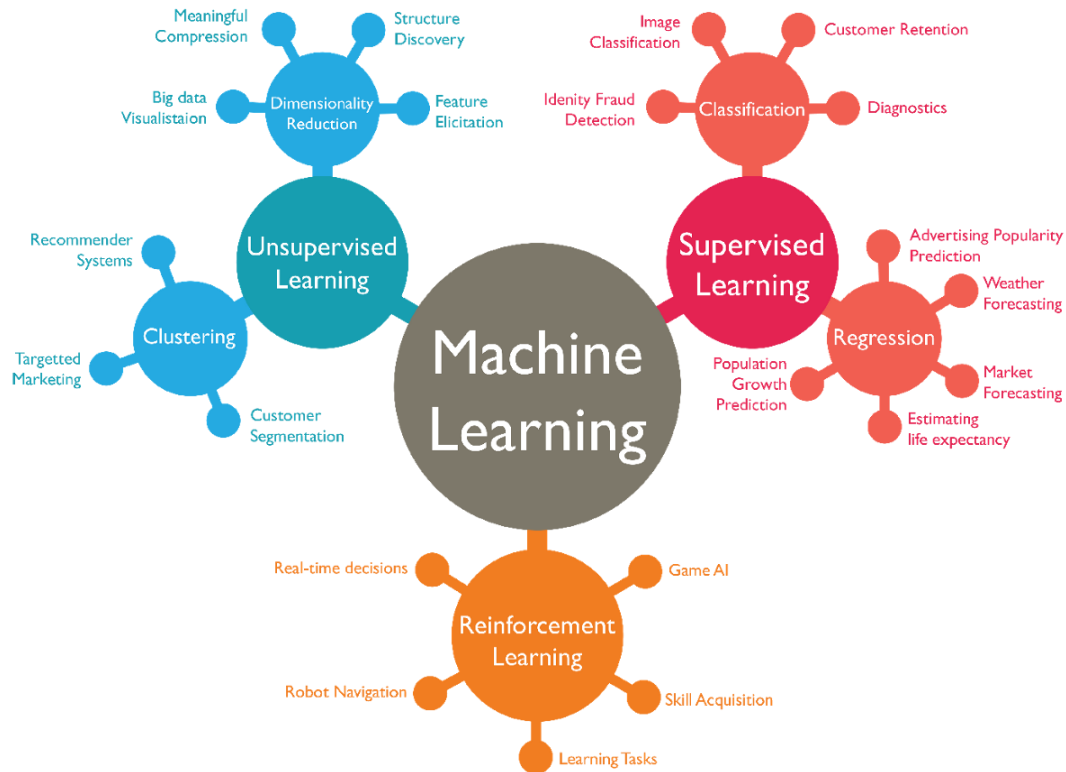
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figures
out

1. Cut vegetables
2. Season chicken
3. Preheat oven
4. Cook chicken for 30-minutes
5. Add vegetables

Family trees



Deep Learning with PyTorch

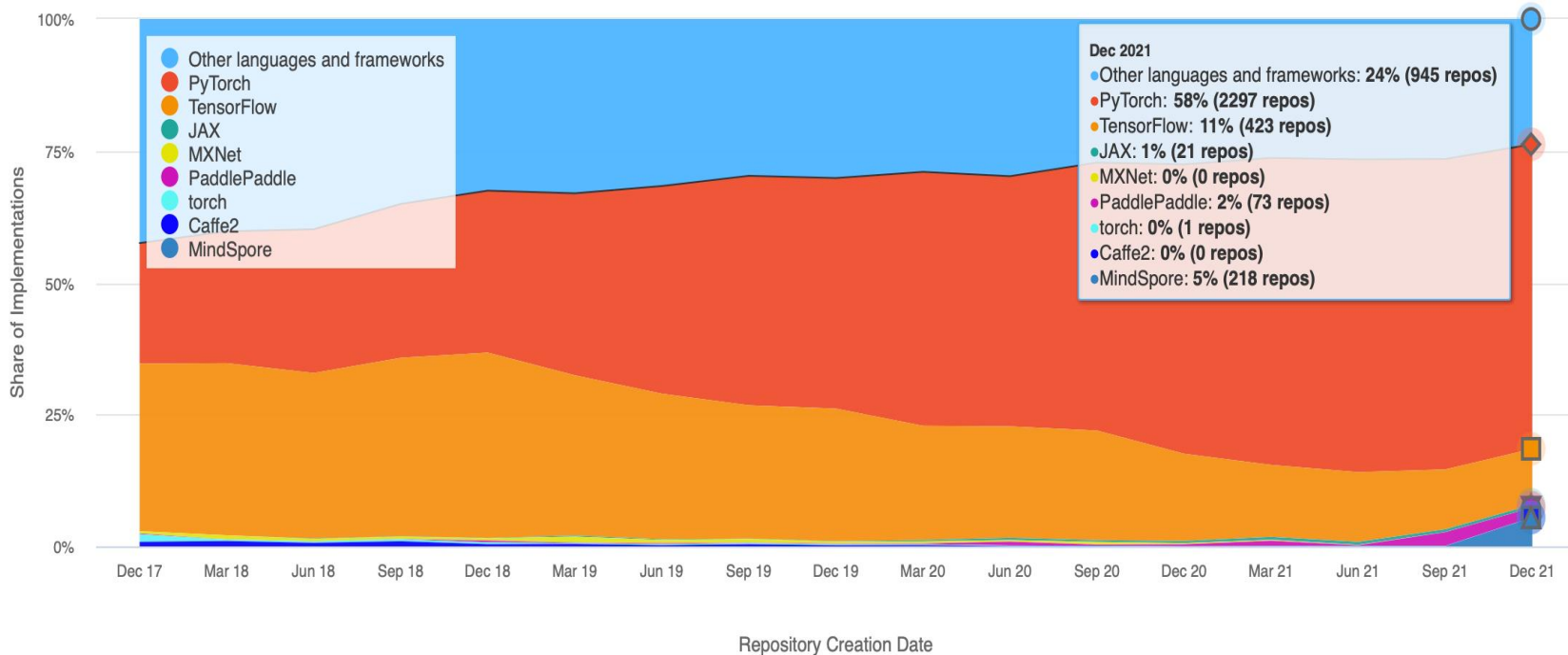


What is PyTorch?

- Most popular research deep learning framework
- Writes fast deep learning code in Python (and supports GPU runtimes)
- Able to access many prebuilt deep learning models (TorchHub etc.)
- Whole stack. Preprocesses data, models data, deploys to applications/cloud
- Originally designed in-house by Meta. Now open sourced and used by Tesla, Microsoft and OpenAI etc.

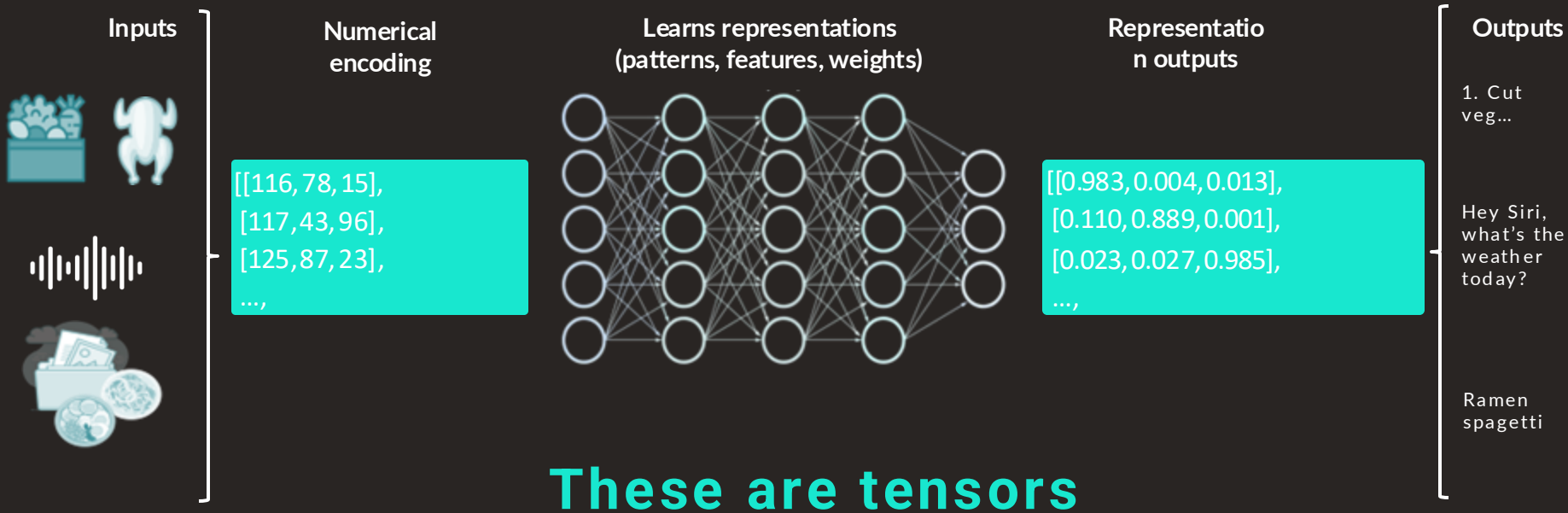


Why PyTorch?

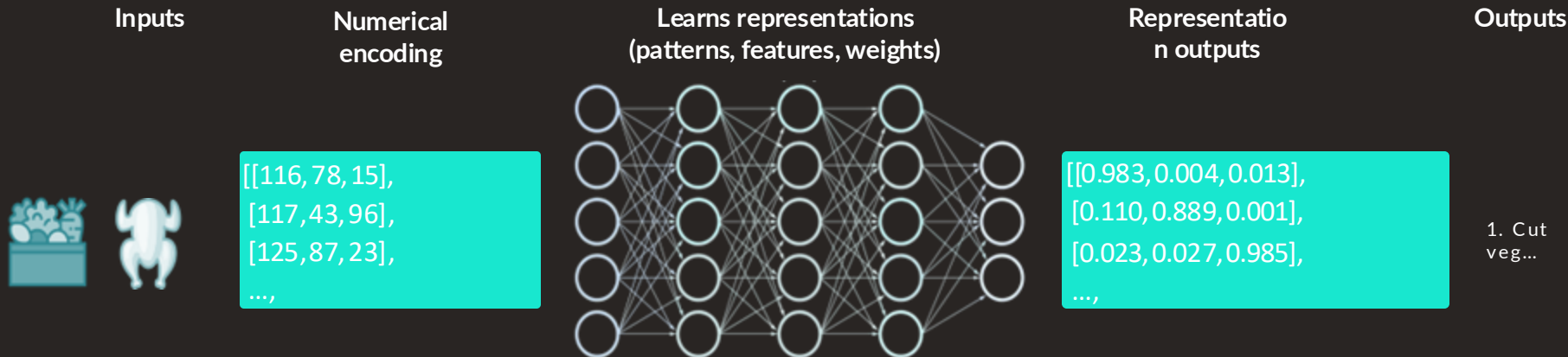


What is a tensor?

What are neural networks?



What are neural networks?



These are tensors

What is a tensor?

Scalar

7

Vector

$\begin{bmatrix} 7 \\ 4 \end{bmatrix}$ or $\begin{bmatrix} 7 & 4 \end{bmatrix}$

Matrix

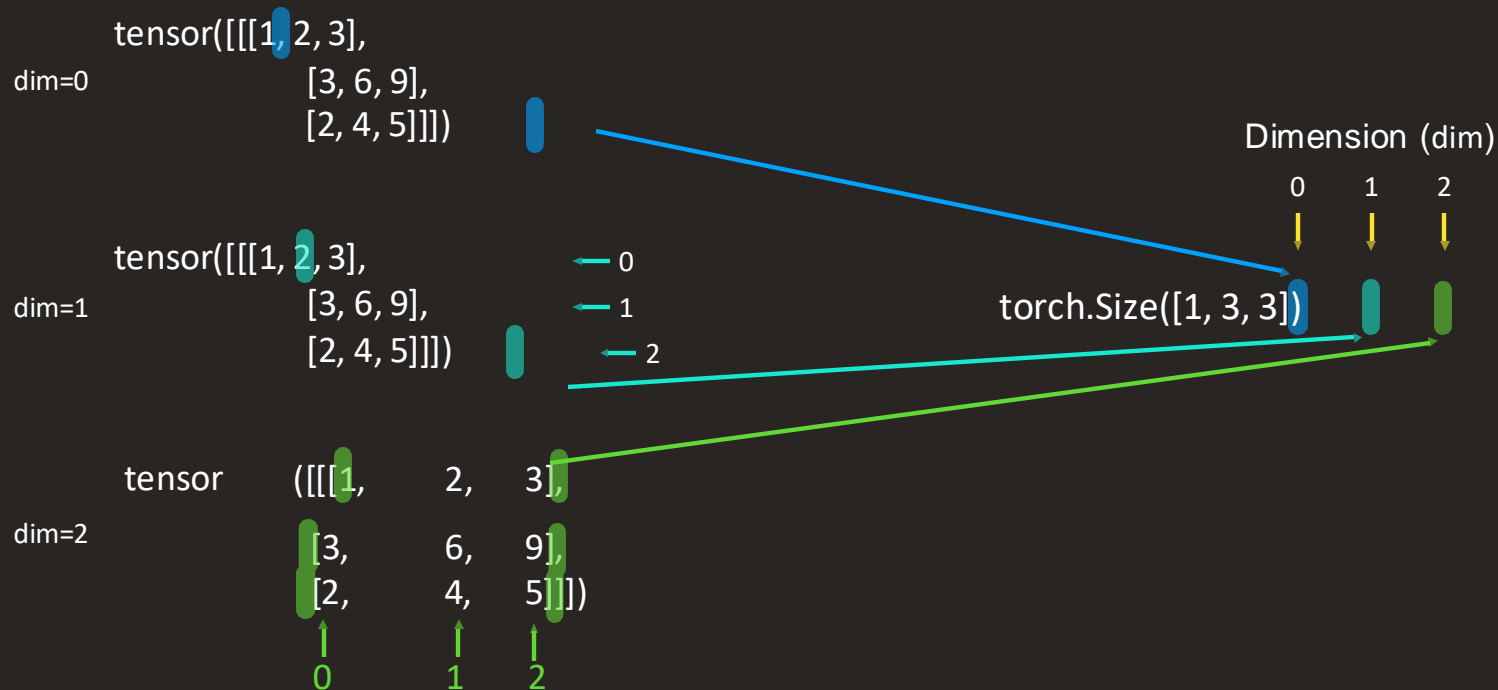
$$\begin{bmatrix} 7 & 10 \\ 4 & 3 \\ 5 & 1 \end{bmatrix}$$

Tensor

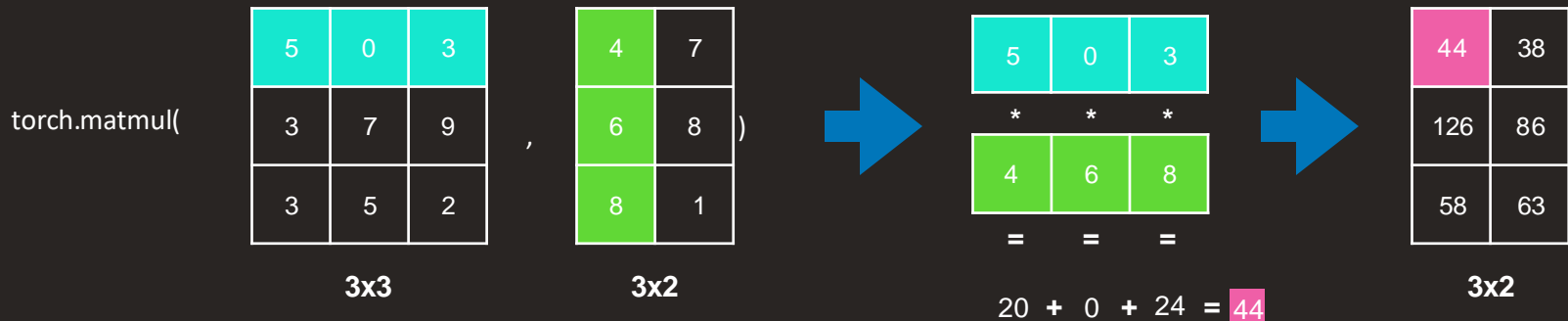
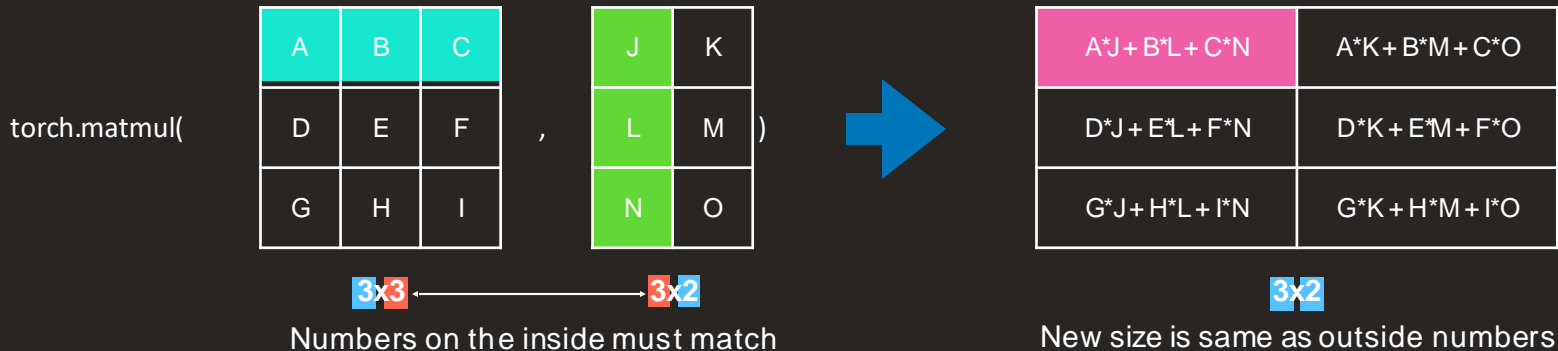
$$\begin{bmatrix} \begin{bmatrix} 7 & 4 \end{bmatrix} & \begin{bmatrix} 0 & 1 \end{bmatrix} \\ \begin{bmatrix} 1 & 9 \end{bmatrix} & \begin{bmatrix} 2 & 3 \end{bmatrix} \\ \begin{bmatrix} 5 & 6 \end{bmatrix} & \begin{bmatrix} 8 & 8 \end{bmatrix} \end{bmatrix}$$

A generalization of vectors and matrices to higher dimensions.

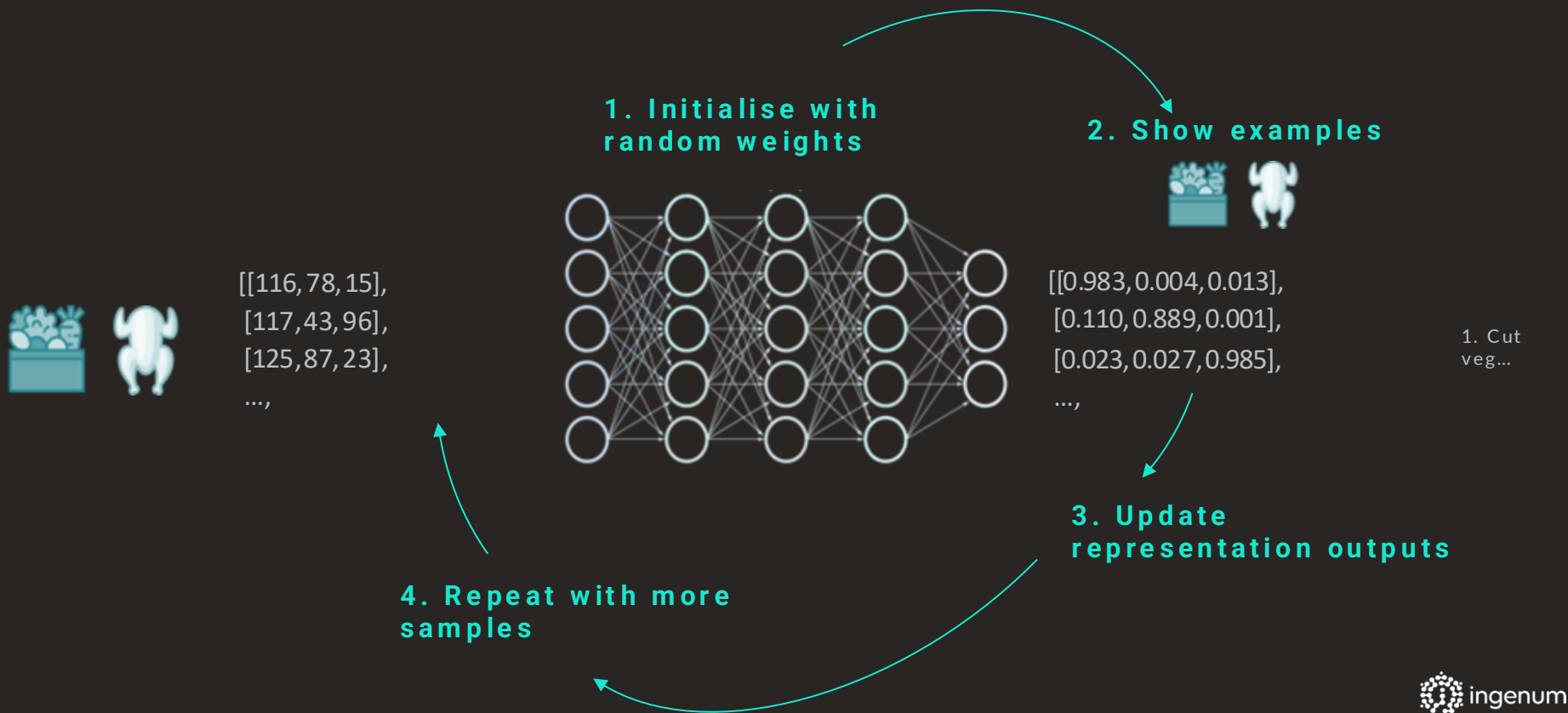
Tensor dimensions



Matrix multiplication (dot product)



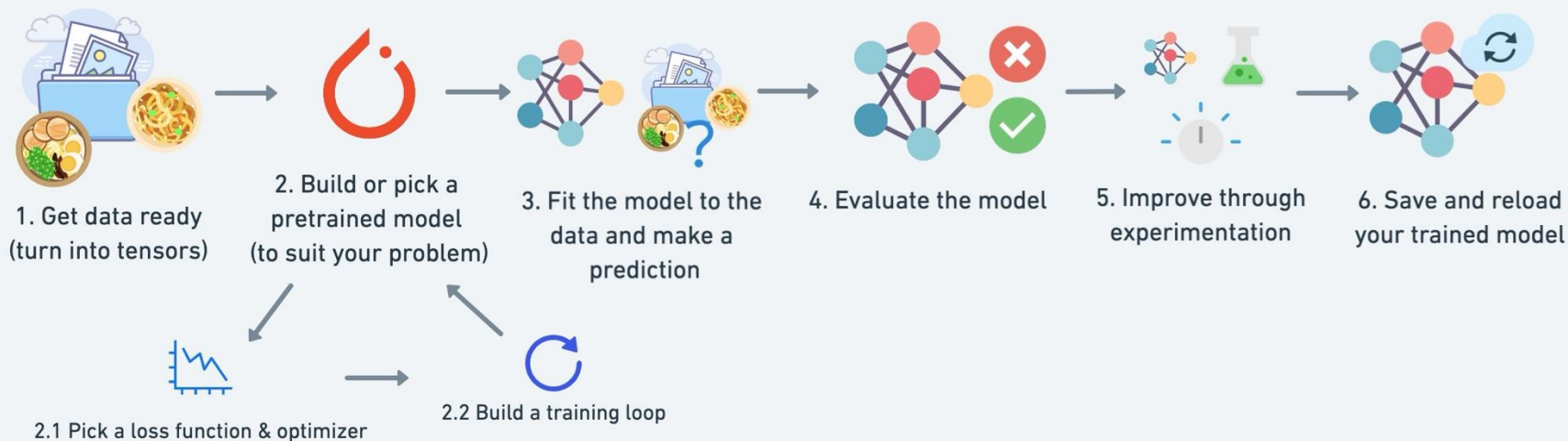
Supervised learning



Tensor attributes

Attribute	Meaning	Code
Shape	The length (number of elements) of each of the dimensions of a tensor.	<code>tensor.shape</code>
Rank/dimensions	The total number of tensor dimensions. A scalar has rank 0, a vector has rank 1, a matrix is rank 2, a tensor has rank n.	<code>tensor.ndim</code> <code>tensor.size()</code>
Specific axis or dimension (e.g. "1st axis" or "0th dimension")	A particular dimension of a tensor.	<code>tensor[0][1]...</code>

What are we going to cover?



Resources



Course tutors



Google's in-built
native LLM



<https://pytorch.org/>

HOW TO CONFUSE MACHINE LEARNING



```
print("Let's Code")
```

https://github.com/ingenium-ai/ISVEE_deepLearning_2024/

Open Notebook 2...