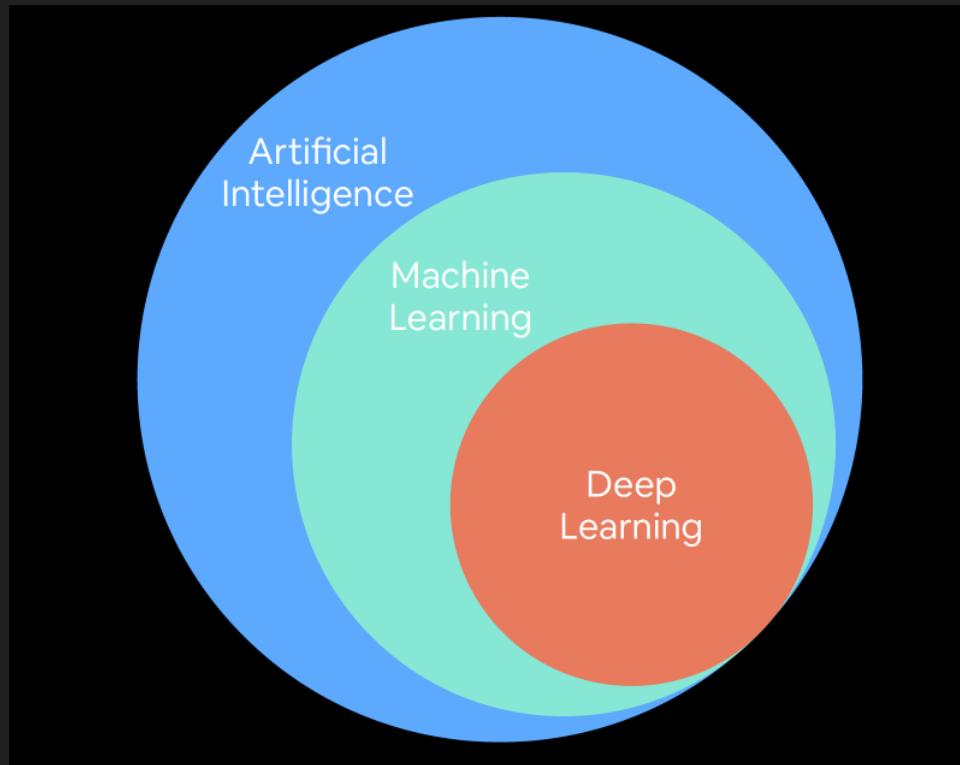


โครงการพัฒนาทักษะการเรียนรู้ของเครื่อง (Machine Learning) ของบัณฑิต เพื่อตอบสนองการพัฒนาประเทศไทย 4.0

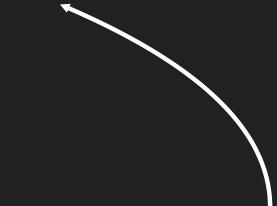
10 และ 17 กุมภาพันธ์ 2566



Machine Learning vs. Deep Learning



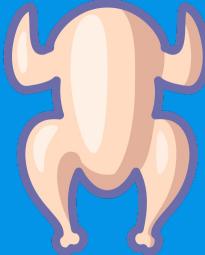
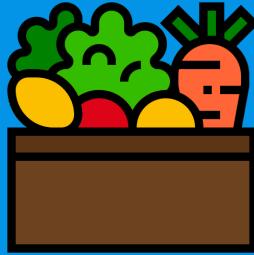
Machine learning is turning things (data) into numbers and **finding patterns** in those numbers.



The computer does this part.
How?
Code & math.
We're going to be writing the code.

Traditional programming

Inputs



Rules

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



Output

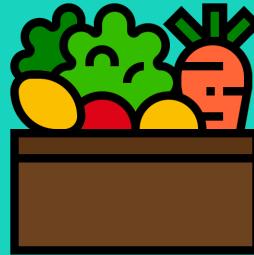


Starts with

Makes

Machine learning algorithm

Inputs



Output



Rules

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

Starts with

Figures out

Better reason: For a complex problem, can you think of all the rules?
(probably not)

simple rule-based

— A wise software engineer... (actually rule 1 of [Google's Machine Learning Handbook](#))



- **Problems with long lists of rules**—when the traditional approach fails, machine learning/deep learning may help.
- **Continually changing environments**—deep learning can adapt ('learn') to new scenarios.
- **Discovering insights within large collections of data**—can you imagine trying to hand-craft rules for what 101 different kinds of food look like?

(typically)



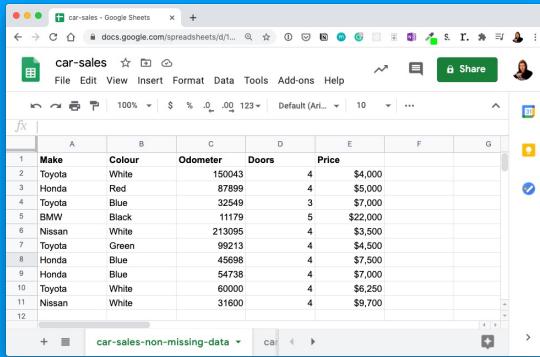
- **When you need explainability**—the patterns learned by a deep learning model are typically uninterpretable by a human.
- **When the traditional approach is a better option** — if you can accomplish what you need with a simple rule-based system.
- **When errors are unacceptable** — since the outputs of deep learning model aren't always predictable.
- **When you don't have much data** — deep learning models usually require a fairly large amount of data to produce great results.

(though we'll see how to get great results without huge amounts of data)

Machine Learning

Algorithm: gradient boosted machine

dmlc
XGBoost



Make	Colour	Odometer	Doors	Price
Toyota	White	150043	4	\$4,000
Honda	Red	87899	4	\$5,000
Toyota	Blue	32549	3	\$7,000
BMW	Black	11179	5	\$22,000
Nissan	White	213095	4	\$3,500
Toyota	Green	99213	4	\$4,500
Honda	Blue	45698	4	\$7,500
Honda	Blue	54738	4	\$7,000
Toyota	White	60000	4	\$6,250
Nissan	White	31600	4	\$9,700



Structured data

Deep Learning



Daniel Bourke @mrdbourke · Nov 1
"How do I learn #machinelearning?"

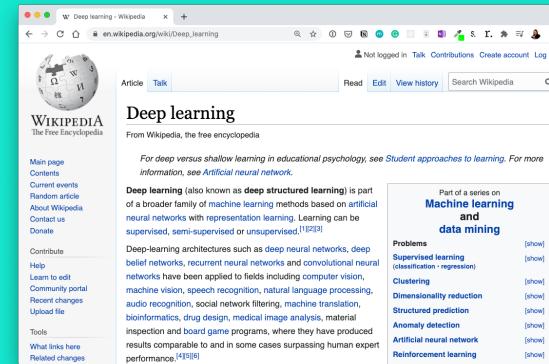
What you want to hear:

1. Learn Python
2. Learn Math/Stats/Probability
3. Learn software engineering
4. Build

What you need to do:

1. Google it
2. Go down the rabbit hole
3. Resurface in 6-9 months and reassess

See you on the other side.



Deep learning

From Wikipedia, the free encyclopedia

For deep versus shallow learning in educational psychology, see [Student approaches to learning](#). For more information, see [Artificial neural network](#).

Deep learning (also known as [deep structured learning](#)) is part of a broader family of machine learning methods based on [artificial neural networks](#) with [representation learning](#). Learning can be supervised, semi-supervised or unsupervised.^{[1][2]}

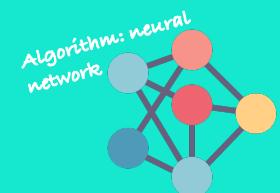
Deep-learning architectures such as [deep neural networks](#), [deep belief networks](#), [recurrent neural networks](#) and [convolutional neural networks](#) have been applied to fields including [computer vision](#), [machine vision](#), [speech recognition](#), [natural language processing](#), [audio recognition](#), [social network filtering](#), [machine translation](#), [biometrics](#), [drug design](#), [medical image analysis](#), [material inspection](#) and [game programs](#), where they have produced results comparable to and in some cases surpassing human expert performance.^{[3][4]}

Part of a series on
Machine learning and
data mining

Problems

- [Supervised learning](#) [show]
- [Classification - regression](#) [show]
- [Clustering](#) [show]
- [Dimensionality reduction](#) [show]
- [Structured prediction](#) [show]
- [Anomaly detection](#) [show]
- [Artificial neural network](#) [show]
- [Reinforcement learning](#) [show]

Unstructured data



- Random forest
- Gradient boosted models
- Naive Bayes
- Nearest neighbour
- Support vector machine
- ...many more

(since the advent of deep learning these are often referred to as "shallow algorithms")

(common algorithms)

- Neural networks
- Fully connected neural network
- Convolutional neural network
- Recurrent neural network
- Transformer
- ...many more

What we're focused on building
(with PyTorch)

(depending how you represent your problem,
many algorithms can be used for both)

Structured data

Unstructured data



Daniel Bourke @mrbourke - Nov 1
"How do I learn machinelearning?"

What you want to hear:
1. Learn Python
2. Learn Math/Stats/Probability
3. Learn software engineering
4. Build

What you need to do:
1. Google it
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See you on the other side.



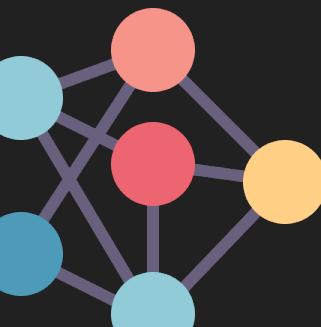
Inputs

Numerical encoding

(before data gets used with a neural network, it needs to be turned into numbers)

[[116, 78, 15],
 [117, 43, 96],
 [125, 87, 23],
 ...,

Learns representation (patterns/features/weights)



(choose the appropriate neural network for your problem)

[[0.983, 0.004, 0.013],
 [0.110, 0.889, 0.001],
 [0.023, 0.027, 0.985],
 ...,

Representation outputs

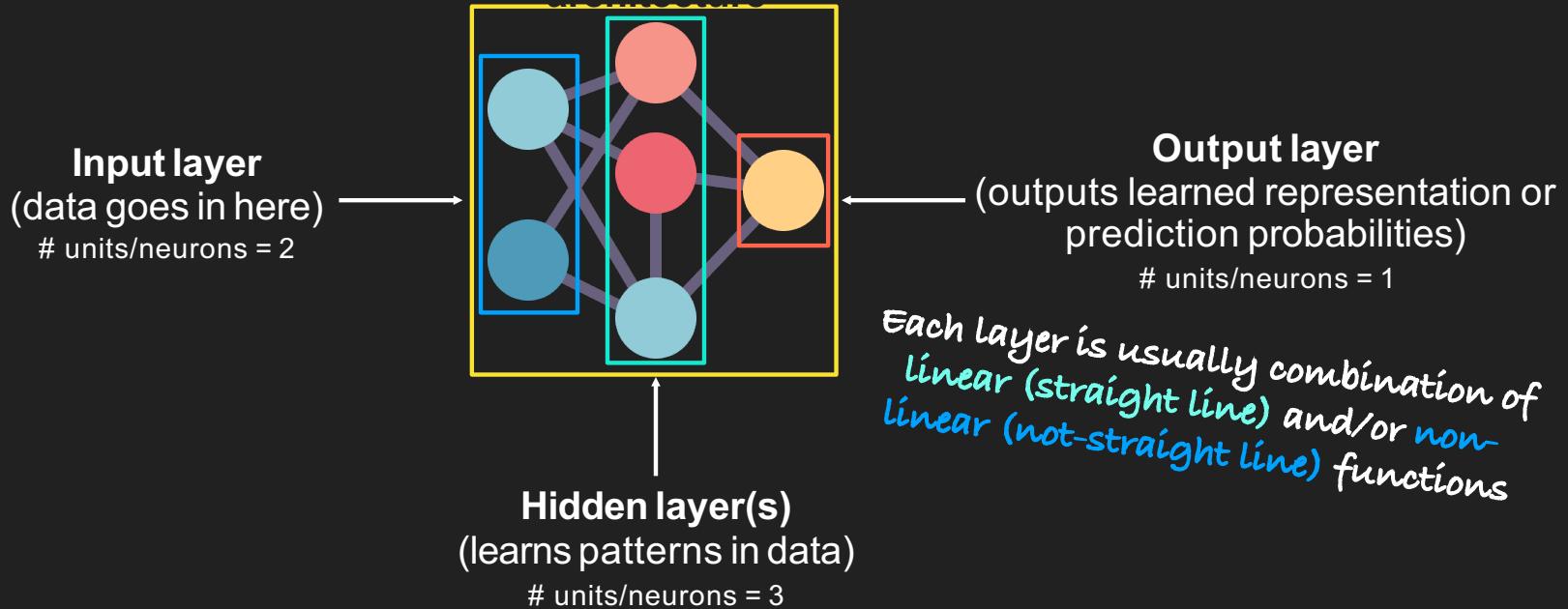
(a human can understand these)

Ramen,
Spaghetti

Not a disaster

"Hey Siri, what's the weather today?"

Outputs



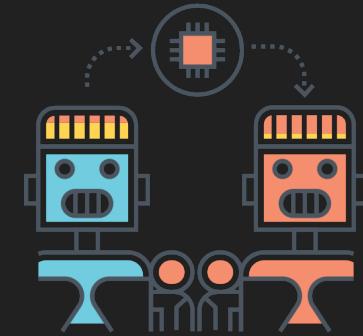
Note: “patterns” is an arbitrary term, you’ll often hear “embedding”, “weights”, “feature representation”, “feature vectors” all referring to similar things.



Supervised
Learning



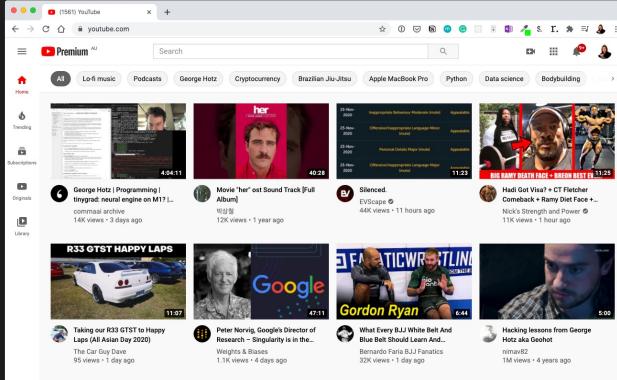
Unsupervised &
Self-supervised
Learning



Transfer
Learning

We'll be writing code to do these,
but the style of code can be adopted across learning paradigms.

(some)



Recommendation

A screenshot of the Google Translate website. The source language is set to "ENGLISH - DETECTED" and the target language is "SPANISH". The input text "deep learning is epic" is translated into "el aprendizaje profundo es épico".

Translation



"Hey Siri, who's the biggest big dog of them all?"

Speech recognition



To: daniel@mrdourke.com
Hey Daniel,

This deep learning course is incredible!
I can't wait to use what I've learned!

Not spam

To: daniel@mrdourke.com
Hay daniel...

C0ongratu1ations! U win \$1139239230

Spam

Computer Vision

Natural Language Processing (NLP)

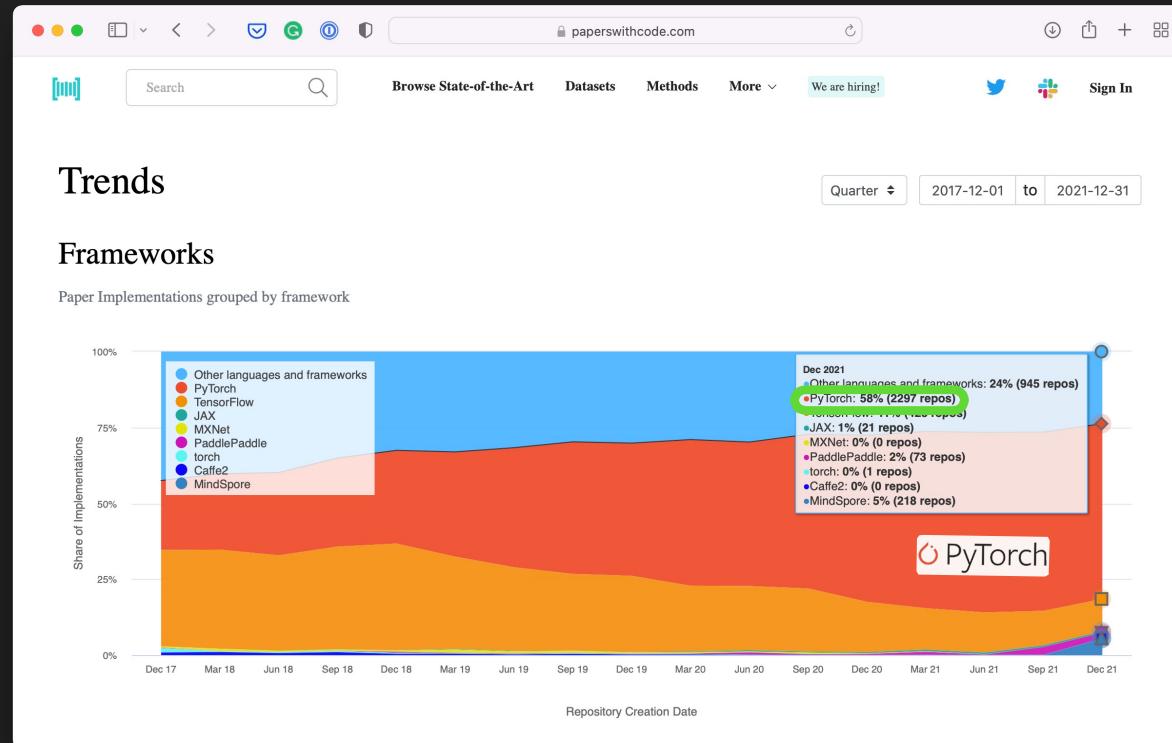
Sequence to sequence (seq2seq)

Classification/regression





- Most popular research deep learning framework*
- Write fast deep learning code in Python (able to run on a GPU/many GPUs)
- Able to access many pre-built deep learning models (Torch Hub/
torchvision.models)
- Whole stack: preprocess data, model data, deploy model in your application/cloud
- Originally designed and used in-house by Facebook/Meta (now open-source and used by companies such as Tesla, Microsoft, OpenAI)



Research favourite



François Chollet @fchollet

and PyTorch

With tools like Colab, Keras, and TensorFlow, virtually anyone can solve in a day, with no initial investment, problems that would have required an engineering team working for a quarter and \$20k in hardware in 2014

7:03 AM · Nov 21, 2020 · Twitter for Android

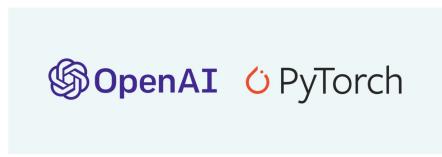
Source: [@fchollet Twitter](#)



A screenshot of a YouTube video player. The video shows a man, Andrej Karpathy, standing on a stage at a conference. He is wearing a dark shirt and jeans, and is gesturing with his right hand. Behind him is a large screen displaying the text "PLEASE WELCOME ANDREJ KARPATHY SR DIRECTOR OF AI AT TESLA". The stage has a blue and purple lighting scheme. The YouTube interface shows the video title "PyTorch at Tesla - Andrej Karpathy, Tesla", the view count "407,684 views · Nov 7, 2019", and the duration "0:25 / 11:10 · Chapters >". Below the video player, there is a search bar and a list of related videos.

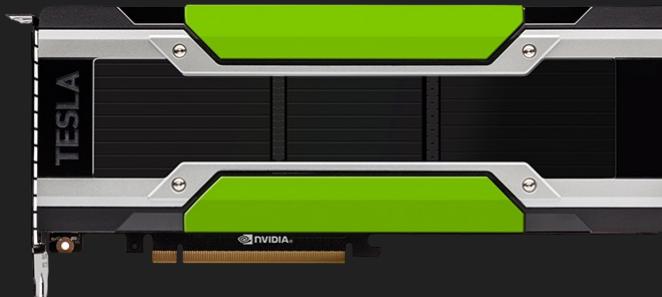
OpenAI Standardizes on PyTorch

We are standardizing OpenAI's deep learning framework on PyTorch. In the past, we implemented projects in many frameworks depending on their relative strengths. We've now chosen to standardize to make it easier for our team to create and share optimized implementations of our models.



A screenshot of a GitHub repository page for "PyTorch". The repository has 8400+ stars, 1700+ forks, and an MIT license. The description reads: "A wide variety of tutorials, projects, libraries, videos, papers, books and anything related to PyTorch." Below the repository details, there is a news article titled "AI for AG: Production machine learning for agriculture" by Chris Padwick, published on Aug 7, 2020. The article discusses how farming affects daily life in cities and the role of AI in agriculture. At the bottom of the page, there is a "RESEARCH" section with a post from June 2, 2021, titled "PyTorch builds the future of AI and machine learning at Facebook".

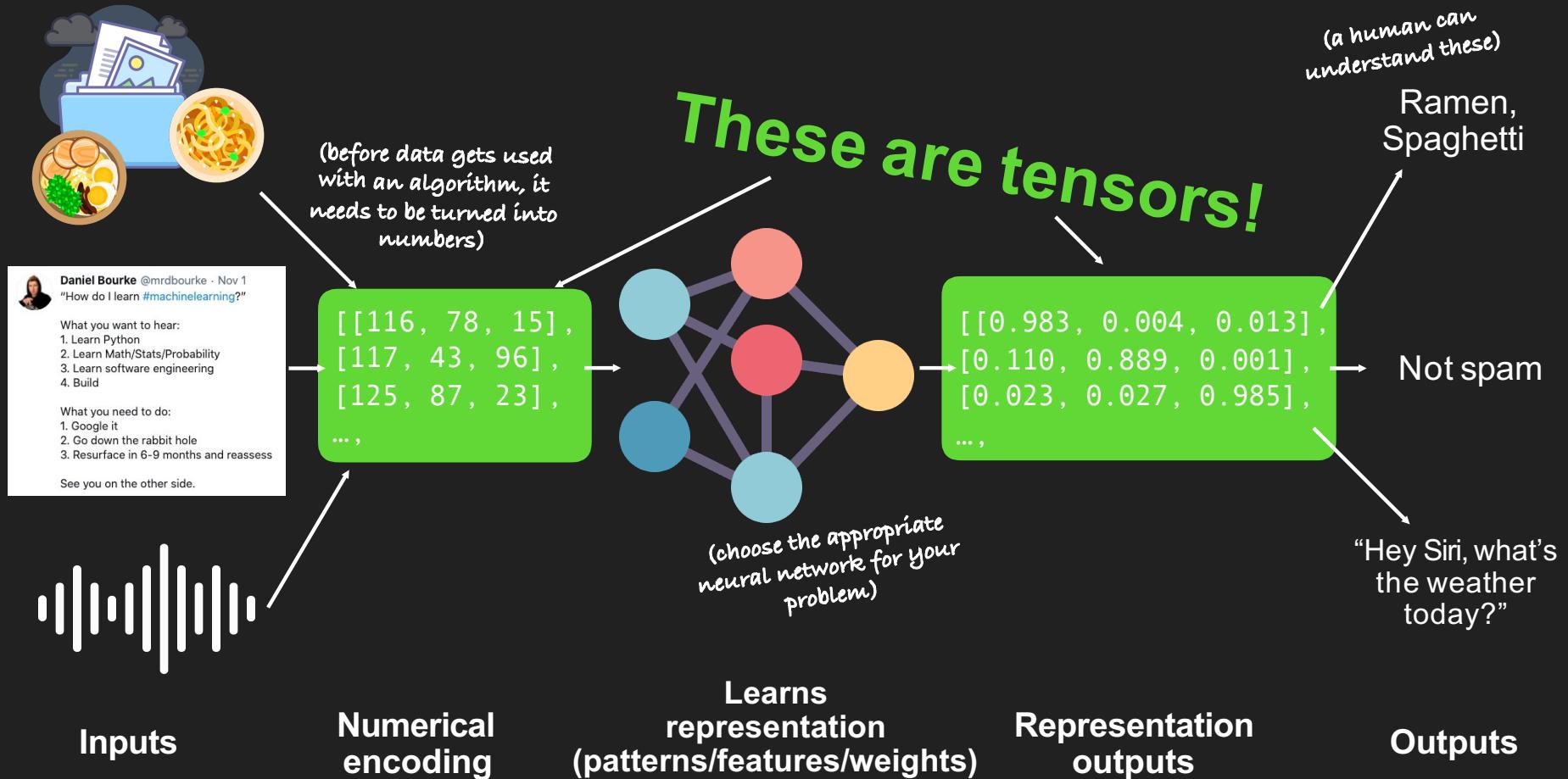
A screenshot of a Microsoft news article. The Microsoft logo is at the top. The article is titled "AI for AG: Production machine learning for agriculture" and is attributed to Chris Padwick. It discusses the impact of farming on city life and the role of AI in agriculture. The article includes a "Share on Facebook" button and a "Share on Twitter" button. To the right of the article, there is a small image of a field with rows of crops. The Microsoft logo is also present at the bottom of the page.

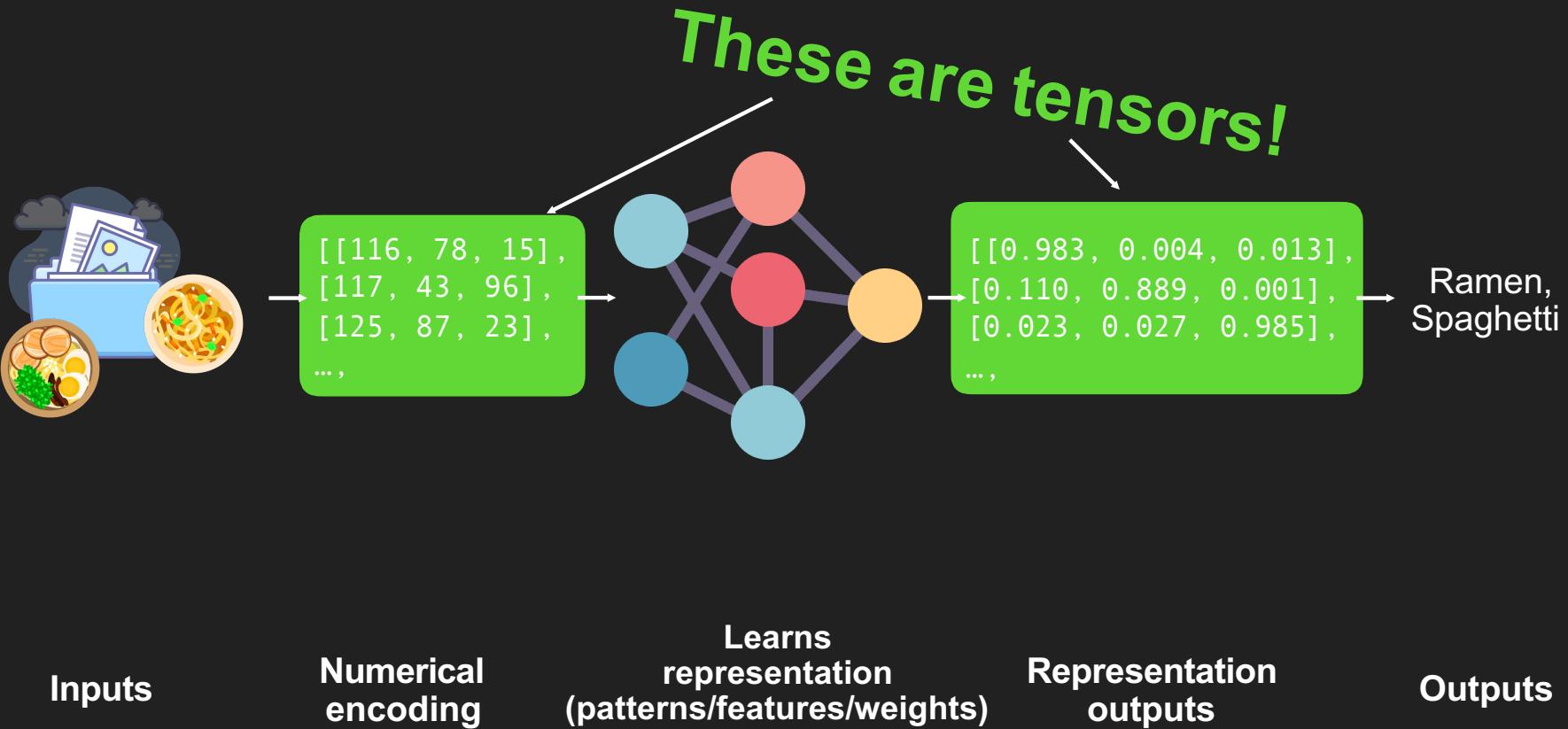


GPU (Graphics Processing Unit)



TPU (Tensor Processing Unit)





 **Elon Musk** 
@elonmusk

Deus ex machine learning

LEARNING ML,DL FROM UNIVERSITY	
ONLINE COURSES	
FROM YOUTUBE	
FROM ARTICLES	
FROM MEMES	

8:07 AM · Nov 18, 2020 · Twitter for iPhone

14.9K Retweets **2.3K** Quote Tweets **188.4K** Likes

Source: [@elonmusk Twitter](#)

(broadly)

- Now:
 - PyTorch basics & fundamentals (dealing with tensors and tensor operations)
- Later:
 - Preprocessing data (getting it into tensors)
 - Building and using pretrained deep learning models
 - Fitting a model to the data (learning patterns)
 - Making predictions with a model (using patterns)
 - Evaluating model predictions
 - Saving and loading models
 - Using a trained model to make predictions on custom data

(we'll be cooking up lots of code!)

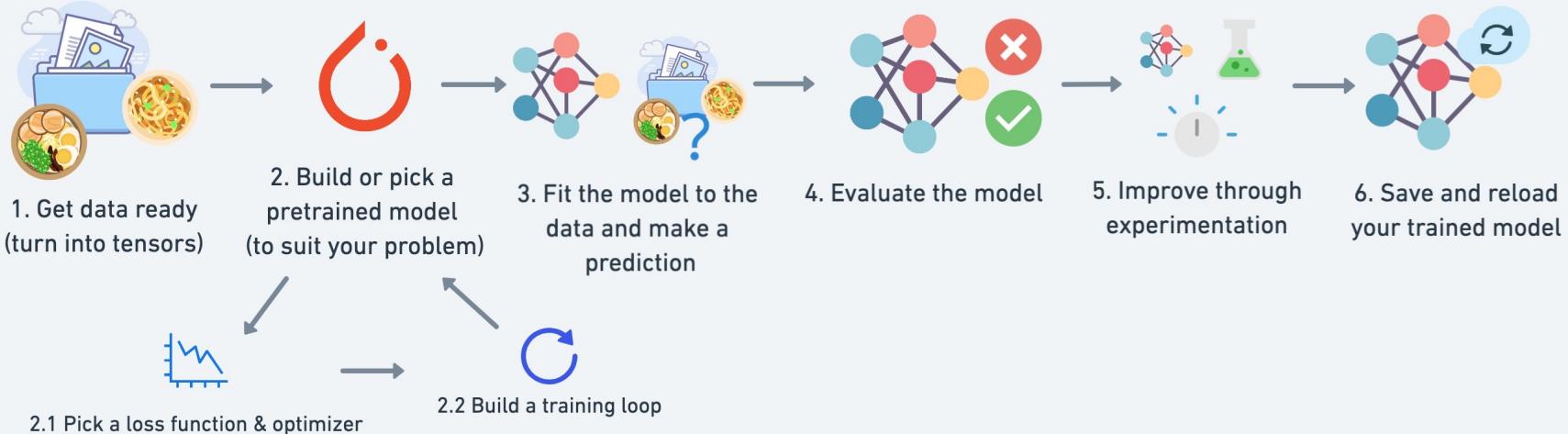
How:



What we're going to cover

A PyTorch workflow

(one of many)



```
1 # 1. Construct a model class that subclasses nn.Module
2 class CircleModelV0(nn.Module):
3     def __init__(self):
4         super().__init__()
5         # 2. Create 2 nn.Linear layers
6         self.layer_1 = nn.Linear(in_features=2, out_features=5)
7         self.layer_2 = nn.Linear(in_features=5, out_features=1)
8
9     # 3. Define a forward method containing the forward pass computation
10    def forward(self, x):
11        # Pass the data through both layers
12        return self.layer_2(self.layer_1(x))
13
14 # 4. Create an instance of the model and send it to target device
15 model_0 = CircleModelV0().to(device)
16 model_0
```

1. Code along

Motto #1: if in doubt, run the code!



(including the
“dumb” ones)

4. Ask questions



2. Explore and experiment



5. Do the exercises



3. Visualize what you don't understand



6. Share your work

not

Avoid:



**“~~I can’t learn~~
_____”**

This course

Course materials

A screenshot of a GitHub repository page. The repository name is 'mrdbourke/pytorch-deep-learning'. The page shows a list of files and folders, including 'main', 'branches', and 'tags'. A sidebar on the right contains sections for 'About', 'Materials for upcoming beginner-friendly PyTorch course (work in progress)', 'Code', 'Issues 28', 'Pull requests', 'Discussions', 'Actions', 'Projects 1', 'Wiki', 'Security', and 'Insights'. The 'About' section includes a link to 'learnpytorch.io'.

<https://www.github.com/mrdbourke/pytorch-deep-learning>

A screenshot of the GitHub discussions page for the same repository. It features a pink header with the text 'Announcements' and 'Welcome to pytorch-deep-learning Discussions!'. Below the header, there's a search bar and a 'New discussion' button. The main area shows categories like 'View all', 'Announcements', 'General', 'Ideas', and 'Q&A'.

<https://www.github.com/mrdbourke/pytorch-deep-learning/discussions>

Course online book

A screenshot of the 'Zero to Mastery Learn PyTorch for Deep Learning' online book homepage. It has a dark theme with white text. The top navigation bar includes links for 'Search', 'learnpytorch.io', and 'mrdbourke/pytorch_deep_le...'. The main content area says 'Welcome to the Learn PyTorch for Deep Learning book (work in progress)'. It explains that the course will teach foundations of deep learning and PyTorch, and that the videos are based on the contents of this online book. It also mentions the expected release date and how to get updates.

<https://learnpytorch.io>

PyTorch website & forums

A screenshot of the PyTorch website. The title is 'PyTorch' and the subtitle is 'FROM RESEARCH TO PRODUCTION'. Below the subtitle, it says 'An open source machine learning framework that accelerates the path from research prototyping to production deployment.' There is a 'Install' button. At the bottom, it says 'PyTorch 1.10 Release, including CUDA Graphs APIs, TorchScript improvements'.

All things PyTorch

A screenshot of the PyTorch forums page. The title is 'PyTorch'. It shows a list of categories: 'vision' (141 posts), 'nlp' (38 posts), 'Uncategorized' (361 posts), 'autograd' (70 posts), 'mixed-precision' (7 posts), 'C++' (37 posts), and 'distributed' (35 posts). Each category has a list of posts with titles, user names, and timestamps.

```
tensor([[1, 2, 3],  
       [3, 6, 9],  
       [2, 4, 5]])]  
dim=0
```

```
tensor([[1, 2, 3],  
       [3, 6, 9],  
       [2, 4, 5]])]  
dim=1
```

```
tensor([[[1, 2, 3],  
         [3, 6, 9],  
         [2, 4, 5]]])  
dim=2
```

Dimension (dim)

0 1 2

↓ ↓ ↓

torch.Size([1, 3, 3])

0 1 2

```
torch.matmul(
```

A	B	C
D	E	F
G	H	I

J	K
L	M
N	O

3x3 → 3x2

Numbers on the inside must match



A*J + B*L + C*N	A*K + B*M + C*O
D*K + E*M + F*O	D*K + E*M + F*O
G*K + H*M + I*O	G*K + H*M + I*O

3x2

New size is same as outside numbers

```
torch.matmul(
```

5	0	3
3	7	9
3	5	2

4	7
6	8
8	1

3x3

3x2



5	0	3
*	*	*
4	6	8

$$= \quad = \quad =$$

$$20 + 0 + 24 = 44$$

44	38
126	86
58	63

3x2



For a live demo, checkout www.matrixmultiplication.xyz

2. Show examples



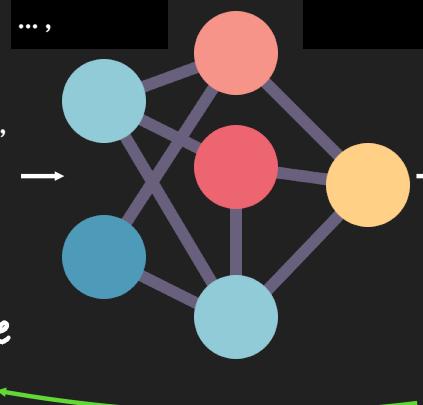
(overview)

1. Initialise with random weights (only at beginning)



→
[[116, 78, 15],
[117, 43, 96],
[125, 87, 23],
...,

[[0.092, 0.210, 0.415],
,
[0.778, 0.929, 0.030],
[0.019, 0.182, 0.555],
...,



→
[[0.983, 0.004, 0.013],
[0.110, 0.889, 0.001],
[0.023, 0.027, 0.985],
...,

Ramen,
Spaghetti

4. Repeat with more examples

3. Update representation outputs

Inputs

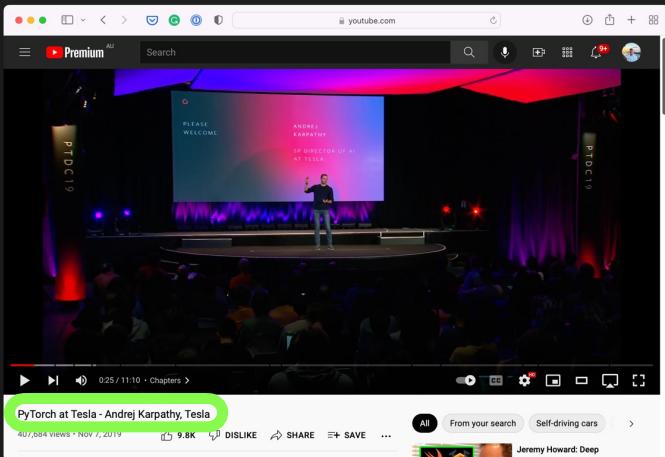
Numerical encoding

Learns representation (patterns/features/weights)

Representation outputs

Outputs

Shape	The length (number of elements) of each of the dimensions of a tensor.	<code>tensor.shape</code>
Specifying axis or dimension (e.g. "1st axis" or "0th dimension")	A particular dimension of a tensor.	<code>tensor[0]</code> , <code>tensor[:, 1]</code> ...



OpenAI Standardizes on PyTorch

We are standardizing OpenAI's deep learning framework on PyTorch. In the past, we implemented projects in many frameworks depending on their relative strengths. We've now chosen to standardize to make it easier for our team to create and share optimized implementations of our models.

The OpenAI logo (a blue circular icon with a white swirl) and the PyTorch logo (an orange circle with a white 'P') are displayed side-by-side. The PyTorch logo is highlighted with a green rounded rectangle.

AI for AG: Production machine learning for agriculture

Author: Chris Padwick, Director of Computer Vision and Machine Learning at Blue River Technology

How did farming affect your day today? If you live in a city, you might feel disconnected from the farms and fields that produce your food. Agriculture is a core piece of our lives, but we often take it for granted.

A photograph of a green tractor in a large, green agricultural field. A white and blue precision control machine is attached to the back of the tractor, operating in the rows of crops.

RESEARCH

PyTorch builds the future of AI and machine learning at Facebook

June 2, 2021

Facebook's AI models perform trillions of inference operations every day for the billions of people that use our technologies. Meeting this growing workload demand means we have to continually evolve our AI frameworks. Which is why, today we're announcing that we're migrating all our AI systems to PyTorch.

Share on Facebook
Share on Twitter

Our Work

A portrait photo of Joelle Pineau, a woman with dark hair, wearing a black top, sitting in front of a colorful, abstract background.