



Modern Deep Learning with PyTorch

07-10, 13:30–17:30 (America/Chicago), Classroom 106

Workshop Goal:

Understand and Use PyTorch Confidently,
Including Advanced Features

Schedule

1. Introduction to Deep Learning (1:30 - 2:00 pm)
2. Understanding the PyTorch API (2:00 - 2:30 pm)
3. Training Deep Neural Networks (2:30 - 3:00 pm)

10 Min Break

4. Accelerating PyTorch Model Training (3:10 - 3:45 pm)
5. Organizing PyTorch Code (3:45 - 4:15 pm)
6. More Tips and Techniques (4:15 - 4:45 pm)

10 Min Break

7. Finetuning LLMs (4:55 - 5:25 pm)
8. Wrap Up & Questions (5:25 - 5:30 pm)

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About the Instructor



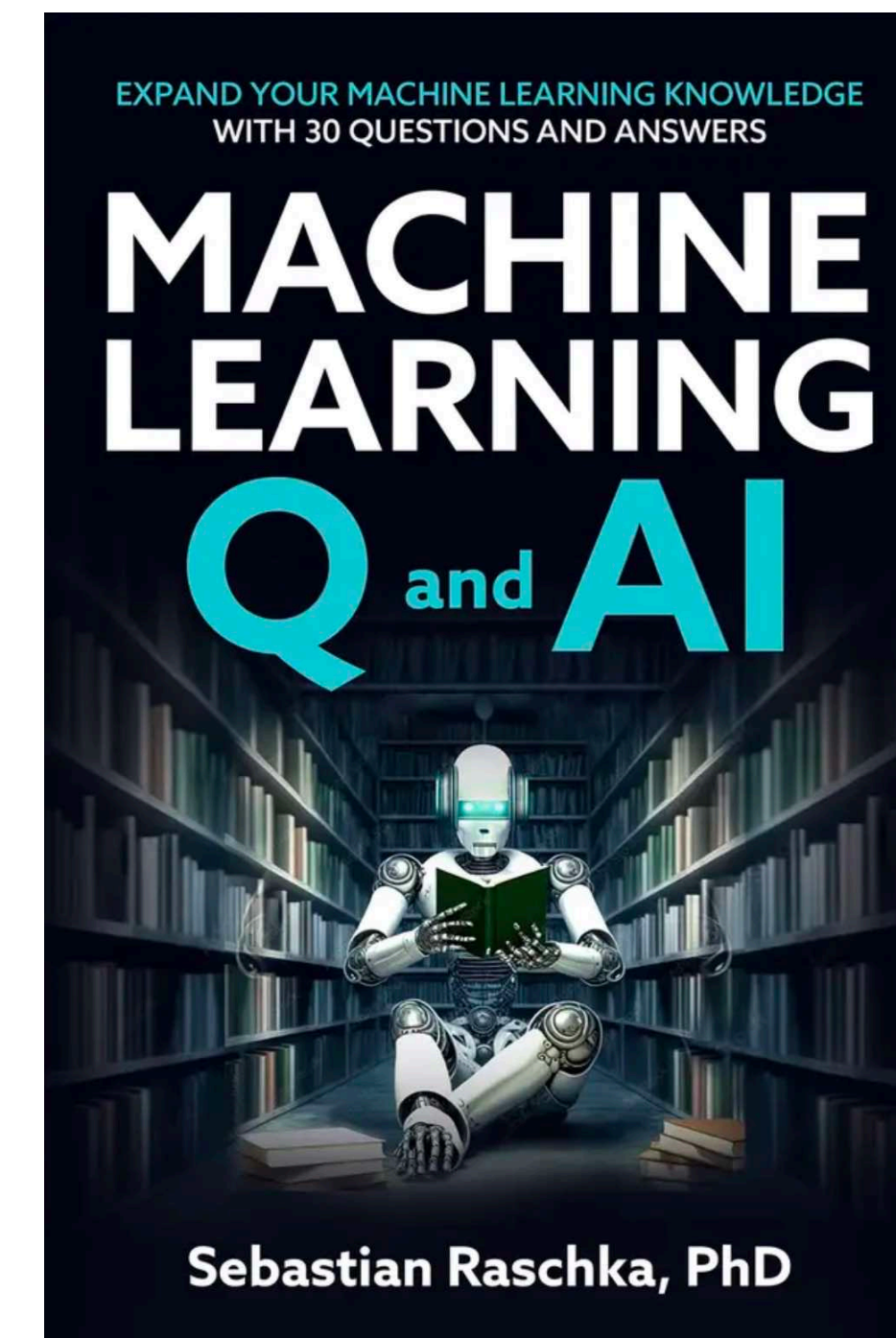
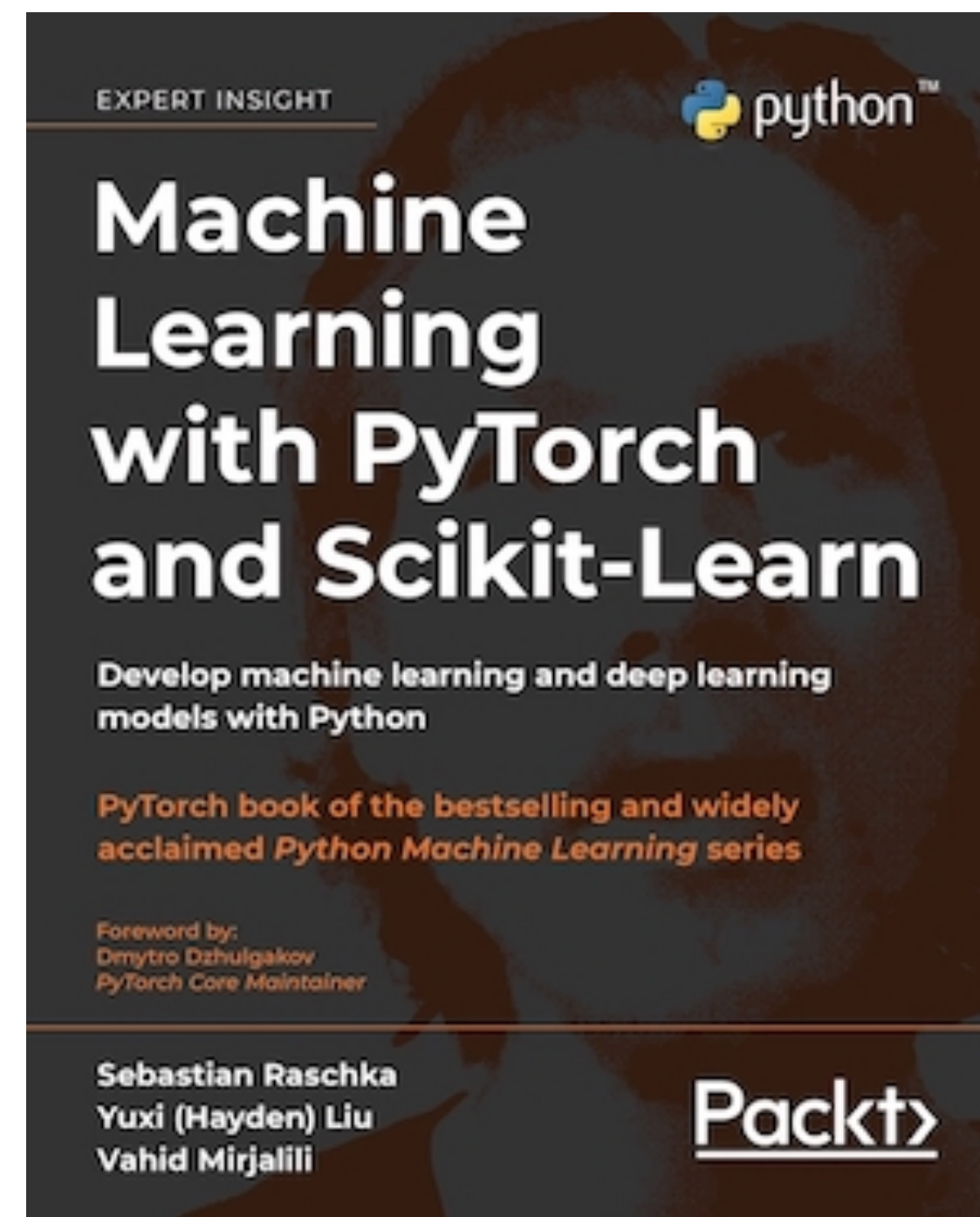
Sebastian Raschka

(Most people know me from my books)

<https://sebastianraschka.com>



Previously
Asst. Prof. of Statistics



<https://sebastianraschka.com/books/>

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 <https://lightning.ai>

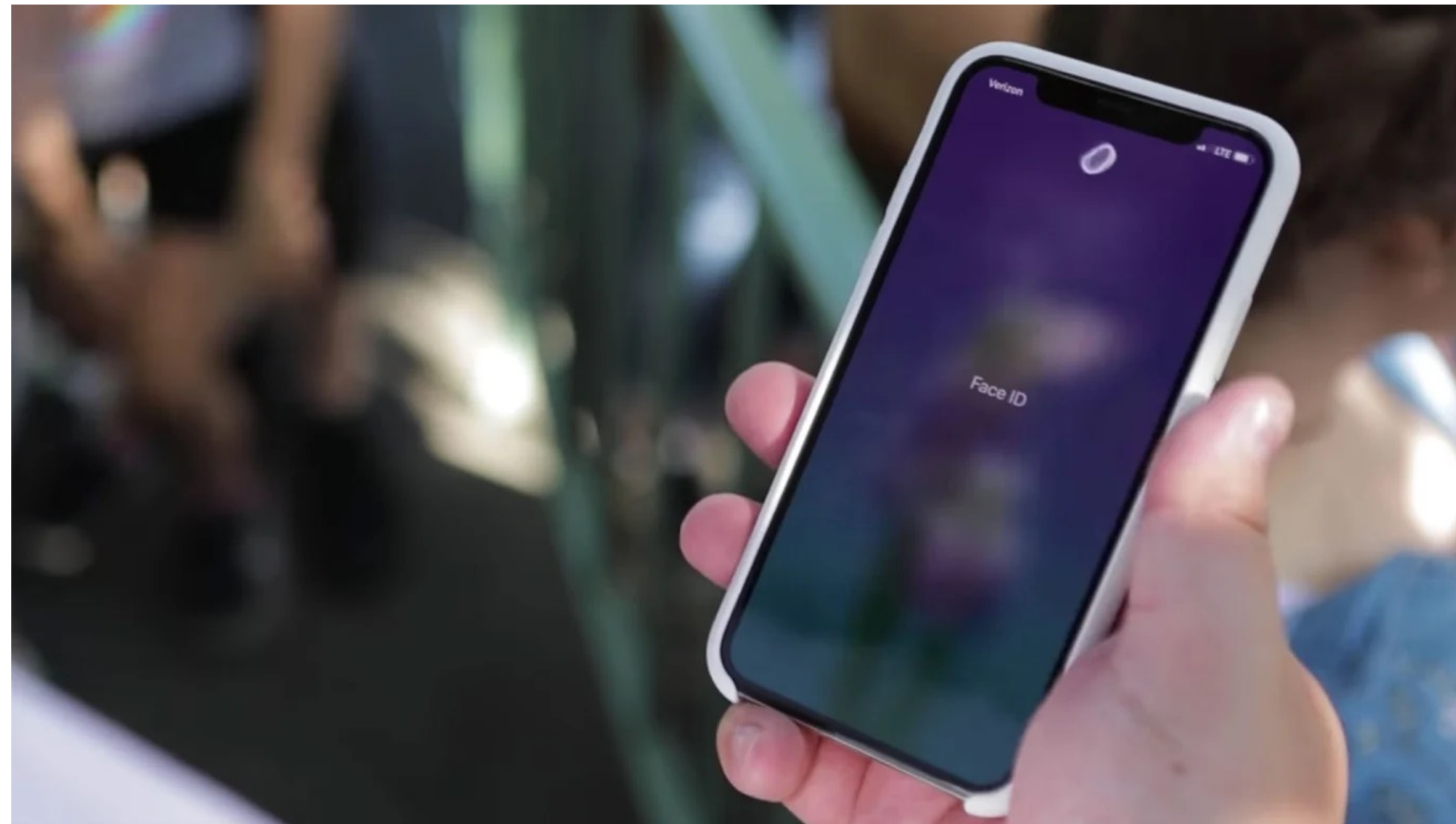
Code & slides

 <https://github.com/scipy2023-deeplearning>

1. Introduction to Deep Learning (1:30 - 2:00 pm)

Where do we see machine learning
being used in the real world?

Unlocking Our Phones



Source: <https://techcrunch.com/2017/11/04/a-closer-look-at-the-capabilities-and-risks-of-iphone-x-face-mapping/>

Detecting Road Signs



Source: https://www.researchgate.net/figure/Example-of-autonomous-vehicle-with-speed-sign-recognition-system_fig1_338455384

Recommending Movies

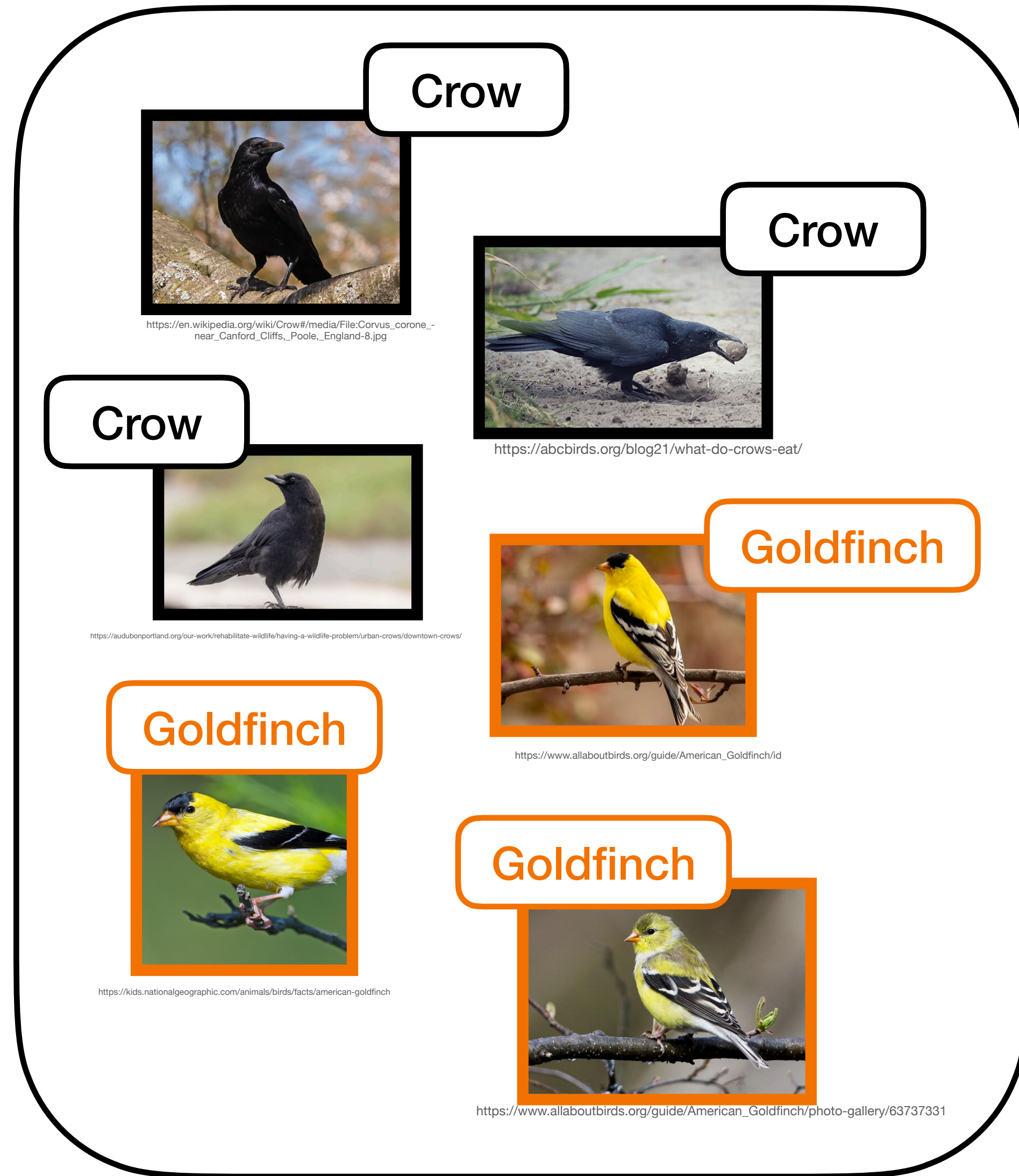


Source: <https://www.pinterest.com/pin/684758318333854483/>

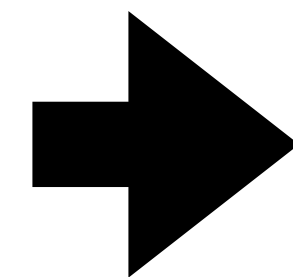
Machine learning is almost
everywhere!

So, how does it work?

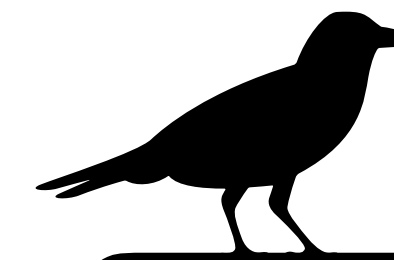
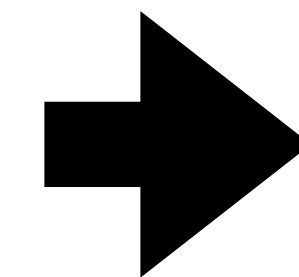
Machine learning lets computers learn from data



Labeled examples



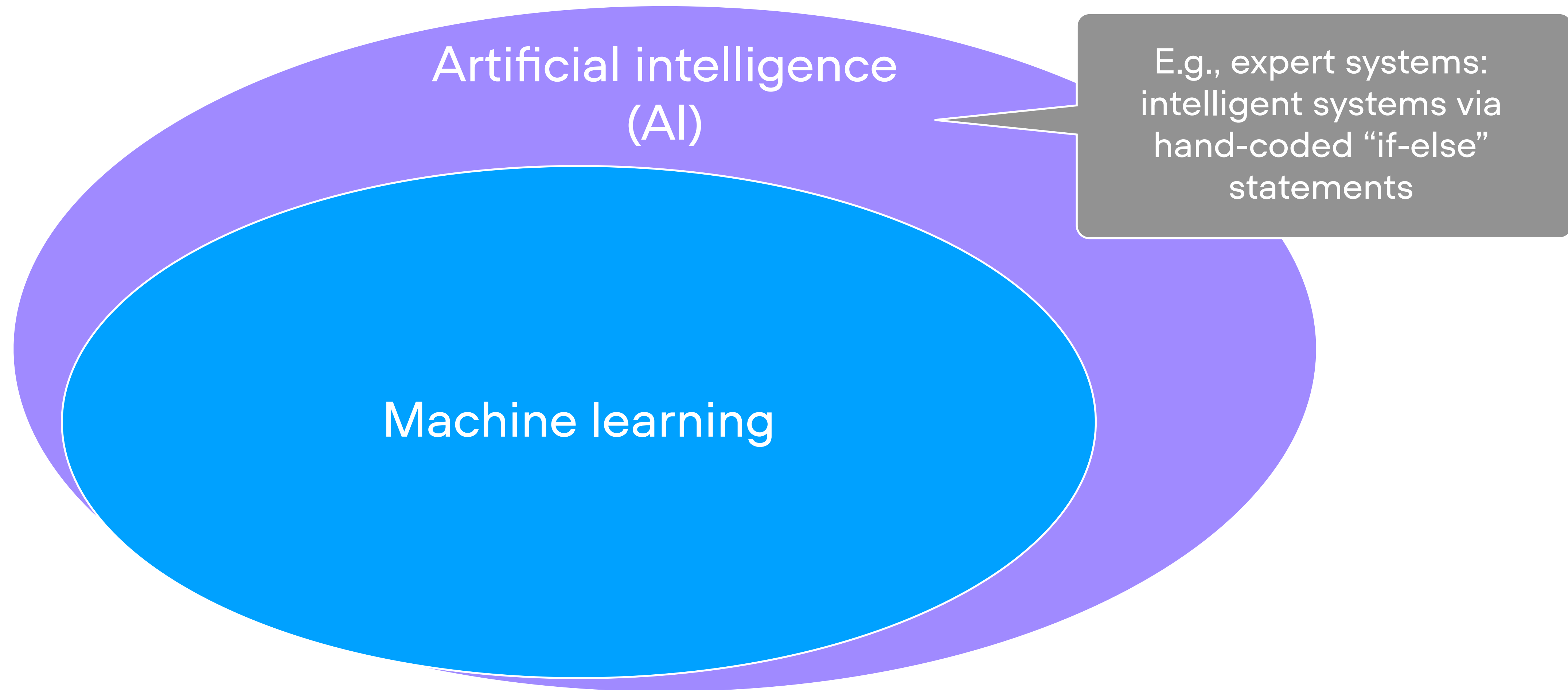
Machine learning
algorithm



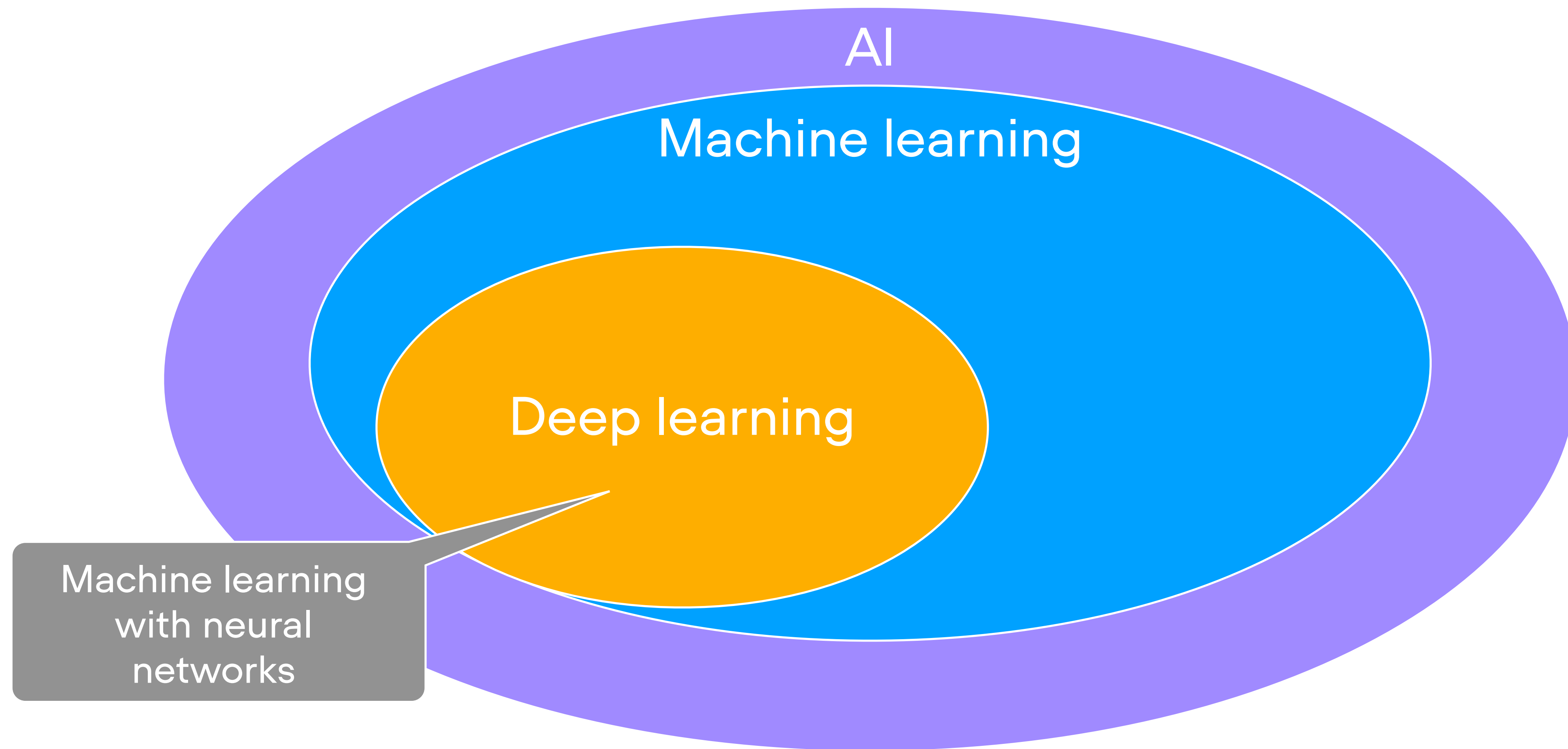
Bird classifier

What does this have to do with deep learning?

Machine Learning Started as a Subfield of AI



Deep Learning is a Subset of Machine Learning



When do we use deep learning vs regular machine learning?

Deep learning

large datasets
in “unstructured” form
(e.g., images and text)



https://en.wikipedia.org/wiki/Crow#/media/File:Corvus_corone_-_near_Canford_Cliffs,_Poole,_England-8.jpg



<https://abcbirds.org/blog21/what-do-crows-eat/>



<https://audubonportland.org/our-work/rehabilitate-wildlife/having-a-wildlife-problem/urban-crows/downtown-crows/>



https://www.allaboutbirds.org/guide/American_Goldfinch/id



<https://kids.nationalgeographic.com/animals/birds/facts/american-goldfinch>



https://www.allaboutbirds.org/guide/American_Goldfinch/photo-gallery/63737331

Deep learning

large datasets
in “unstructured” form
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https://www.allaboutbirds.org/guide/American_Goldfinch/id



<https://kids.nationalgeographic.com/animals/birds/facts/american-goldfinch>



https://www.allaboutbirds.org/guide/American_Goldfinch/photo-gallery/63737331

Regular machine learning

Datasets in “structured”
form like tables

	Beak length	Wing span	Primary color	...
Bird 1	3 cm	43 cm	black	...
Bird 2	0.5 cm	19 cm	yellow	...
Bird 3	5 cm	48 cm	black	...
Bird 4	4 cm	45 cm	black	...
...	...	...	...	...

Regular machine learning

“Unstructured” data



https://en.wikipedia.org/wiki/Crow#/media/File:Corvus_corone_-_near_Canford_Cliffs,_Poole,_England-8.jpg



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Manual feature extraction



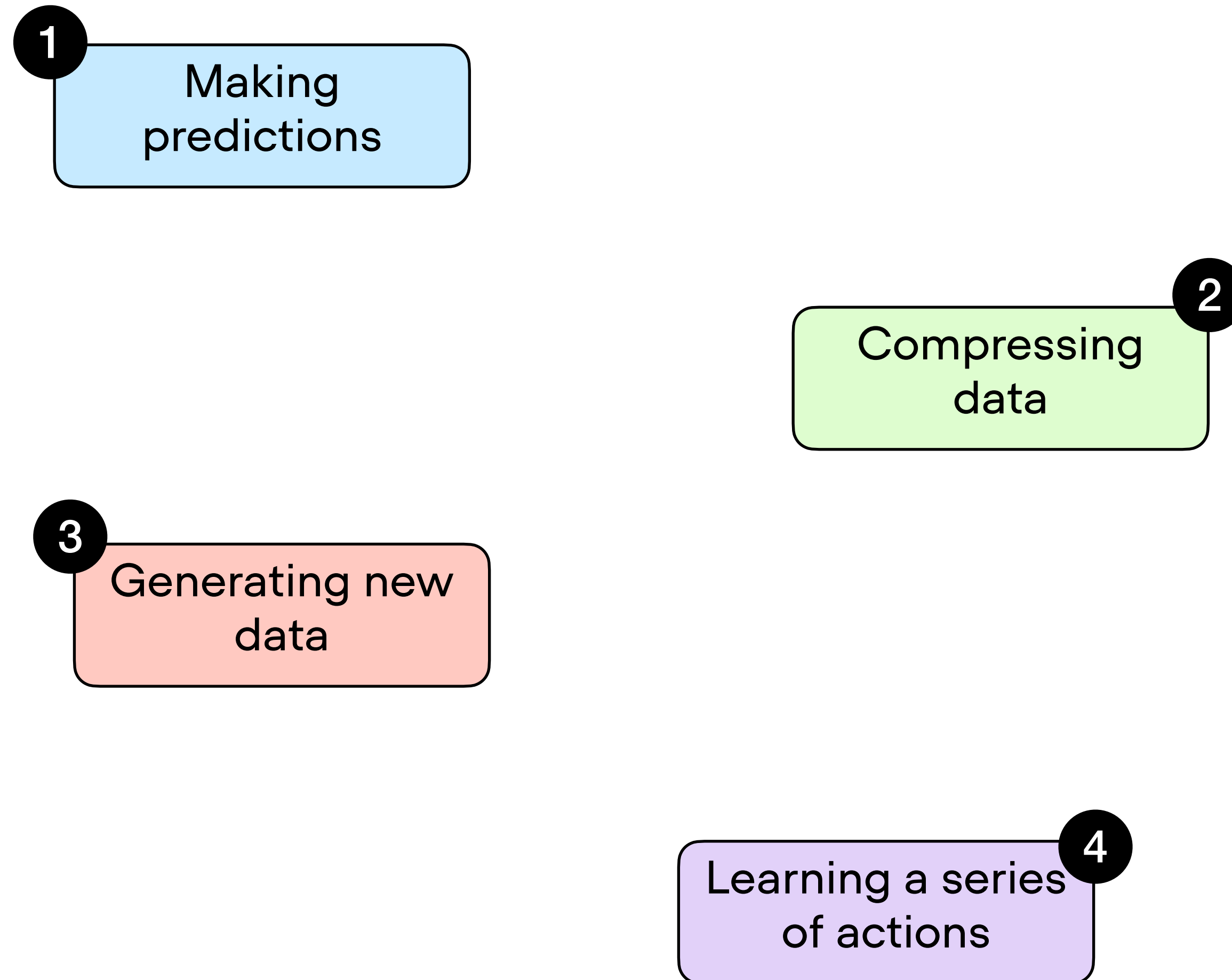
Datasets in “structured”
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	Beak length	Wing span	Primary color	...
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Bird 3	5 cm	48 cm	black	...
Bird 4	4 cm	45 cm	black	...
...	...	...	...	...

How Can We Use Machine Learning?

Common Application Areas

Common Applications Areas



1

Making
predictions

Is this email **spam** or not?



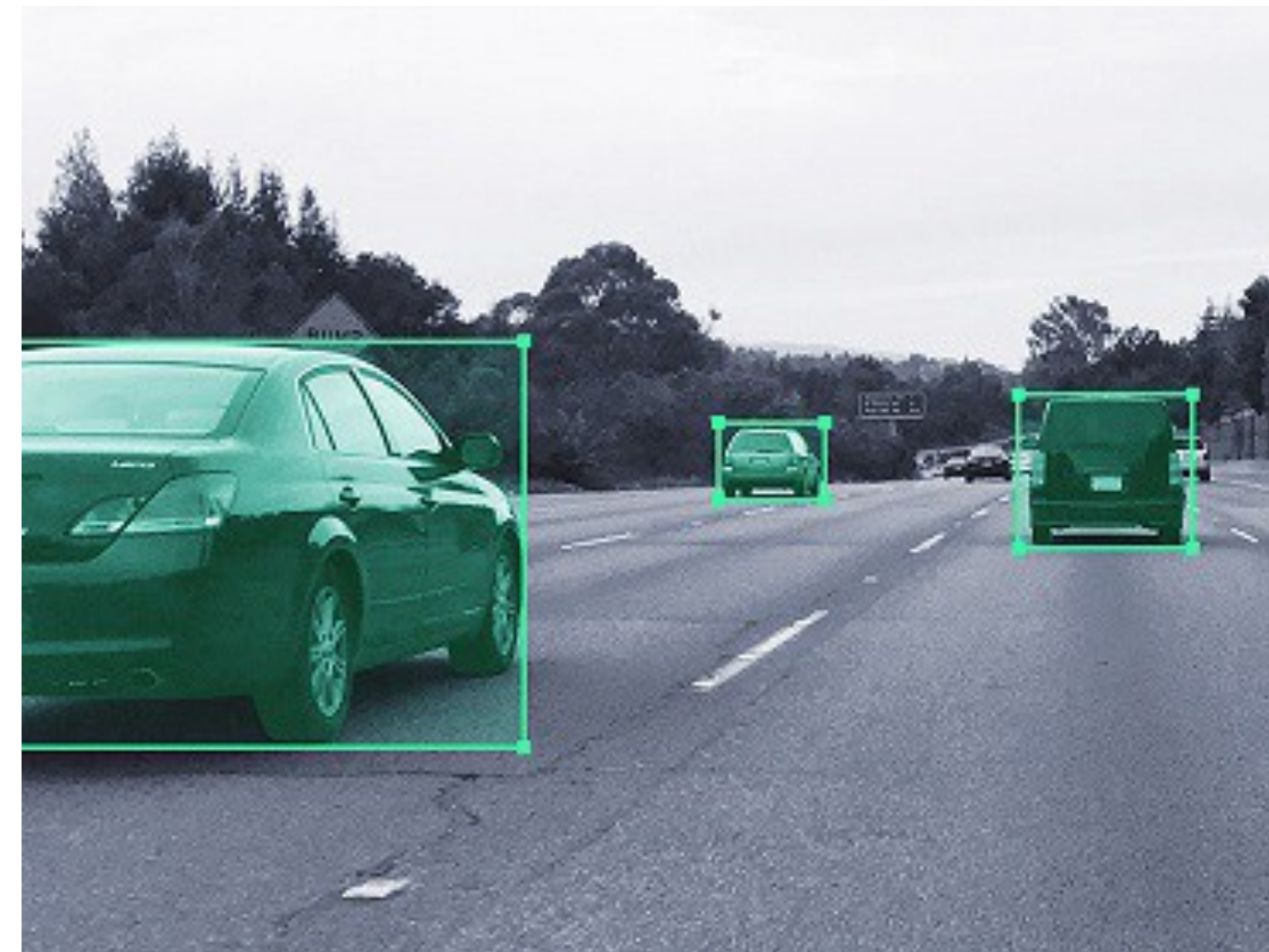
<https://computing.which.co.uk/hc/en-gb/articles/115002560545-Common-email-mistakes-that-lead-to-spam>

A label prediction task

1

Making
predictions

Where are the **cars** located?



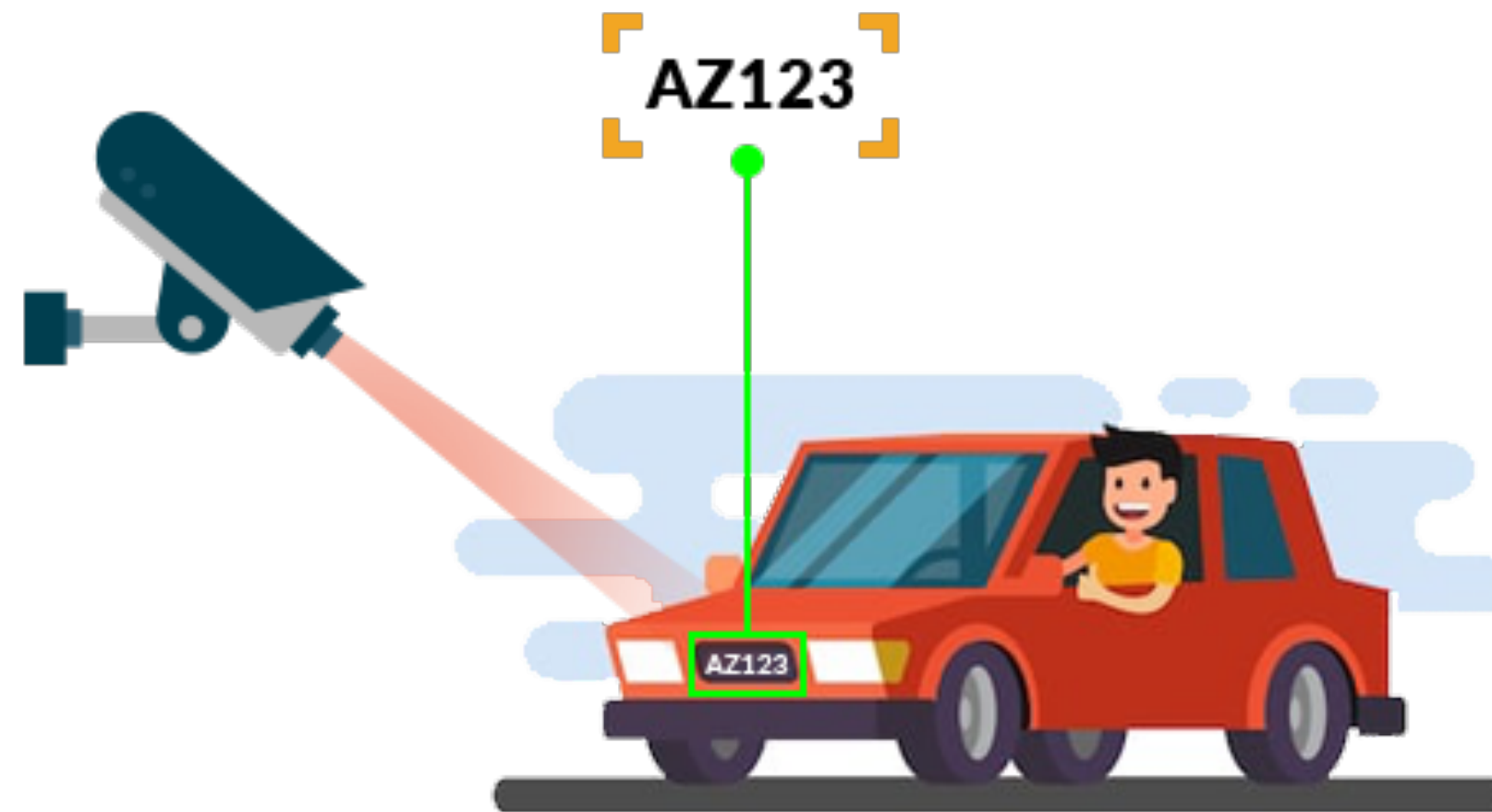
<https://medium.com/@harisriz/buiding-a-state-of-the-art-autonomous-vehicle-program-in-java-and-python-using-tiny-yolo-3b67301e8bac>

Predicting the bounding boxes

1

Making
predictions

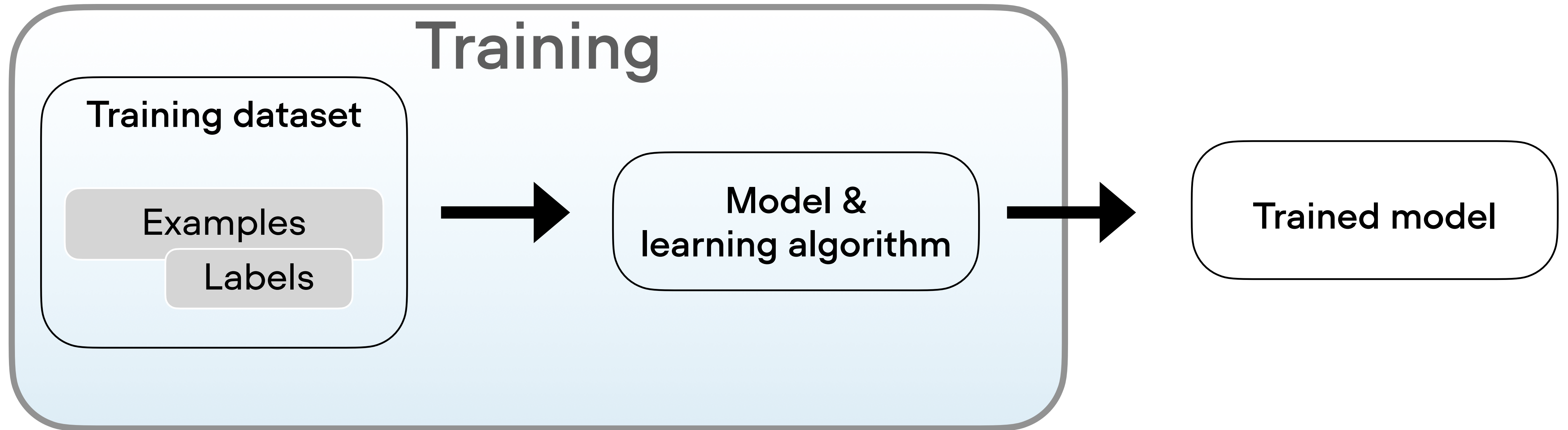
What is the license plate code?



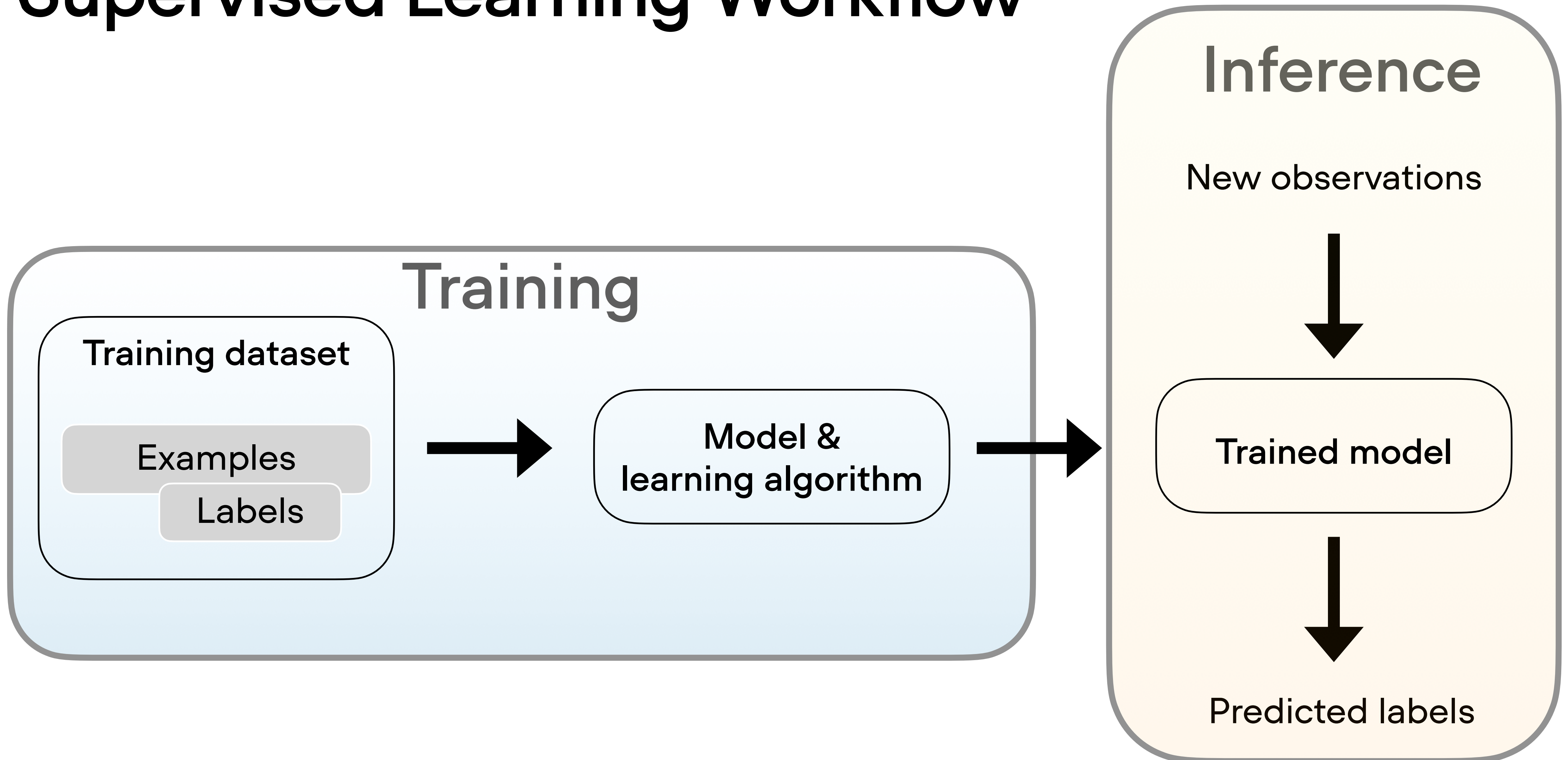
<https://www.innominds.com/connected-devices-and-iot/numix-video-analytics-solutions/anpr>

Recognizing or predicting letters and digits

Supervised Learning Workflow



Supervised Learning Workflow



Machine Learning vs Deep Learning

Supervised Learning Dataset

Unstructured data

Input:



https://en.wikipedia.org/wiki/Iris_setosa#/media/File:Irissetosa1.jpg

Label:

Iris-setosa

Supervised Learning Dataset

Structured data

Unstructured data



Inputs:

Sepal length	Sepal width	Petal length	Petal length
5.1	3.5	1.4	0.3
4.9	3	1.4	0.2
5.9	3	5.1	1.8
...	...	...	...

Labels:

Label
Iris-setosa
Iris-setosa
Iris-virginica
...

Supervised Learning Dataset

“Manual” feature engineering



Sepal length	Sepal width	Petal length	Petal length
5.1	3.5	1.4	0.3
4.9	3	1.4	0.2
5.9	3	5.1	1.8
...	...	...	...

Supervised Learning Dataset

Deep learning



“Traditional” machine learning

Sepal length	Sepal width	Petal length	Petal length
5.1	3.5	1.4	0.3
4.9	3	1.4	0.2
5.9	3	5.1	1.8
...	...	...	...

Exercise:

Download and set up environment
(if not done already)



<https://github.com/scipy2023-deeplearning>

