



Hochschule
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Introduction to Machine Learning

Foundations Course Winter Semester 2021

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What is Artificial Intelligence?

A revision from previous session



Guessing Time For AI!



Lets move to Kahoot!

What is Machine Learning?

A new topic for today!!!



Guessing Time For ML!



Again let's go to Kahoot!

Machine Learning



Figure 1: Applications of ML [1]

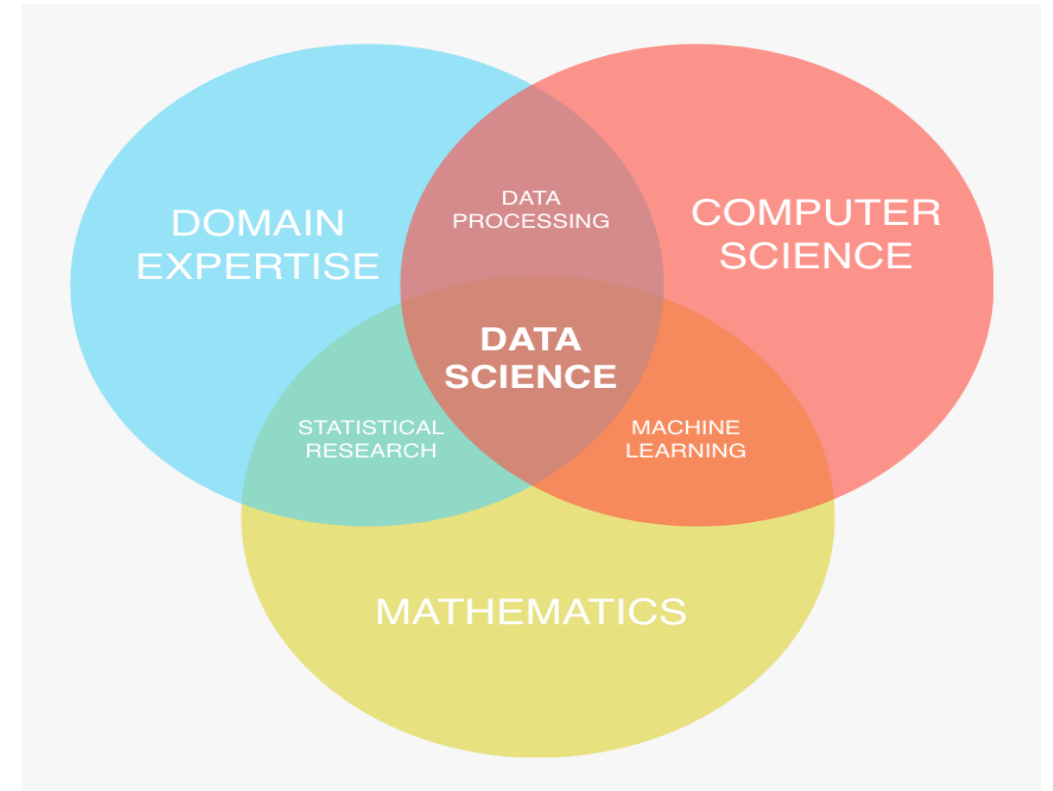


Figure 2: Overview of ML [2]

What is difference between AI vs ML?

Isn't it the same?

AI vs ML

Formal Definitions:

Artificial Intelligence...

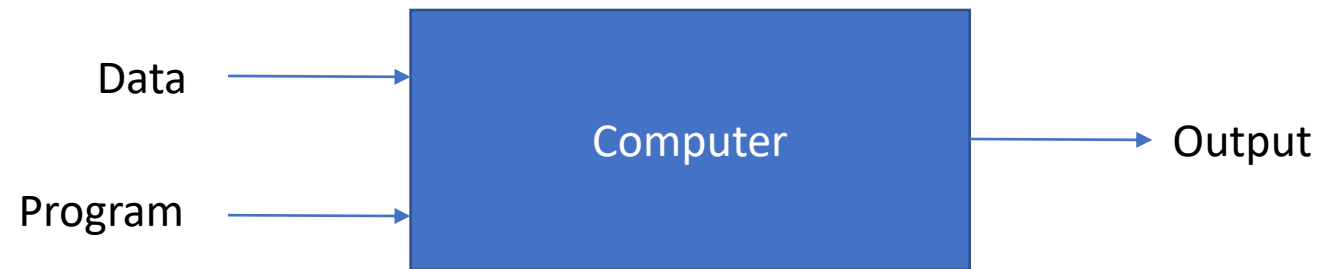
Artificial intelligence (AI) is the ability of a computer or a robot controlled by a computer to do tasks that are usually done by humans because they require human intelligence and discernment. [3]

Machine Learning...

A machine is said to learn from experience E with respect to some class of tasks T and performance measure P if its performance at tasks in T , as measured by P , improves with experience E . [4]

Traditional Programming v/s Machine Learning

Traditional Programming:



Machine Learning:

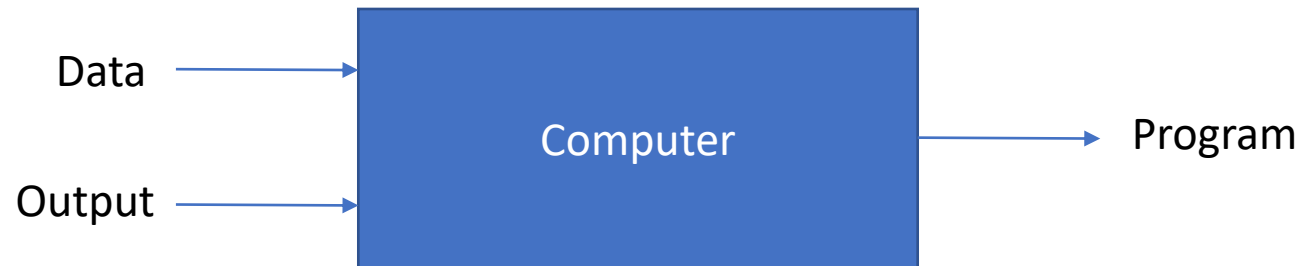


Figure 3: Traditional Programming vs Machine Learning [5]

AI vs ML

In simple terms...

Artificial Intelligence...

make intelligent systems that may or may not learn from data [6].

Machine Learning...

make predictive systems that learn from data [6].

AI vs ML

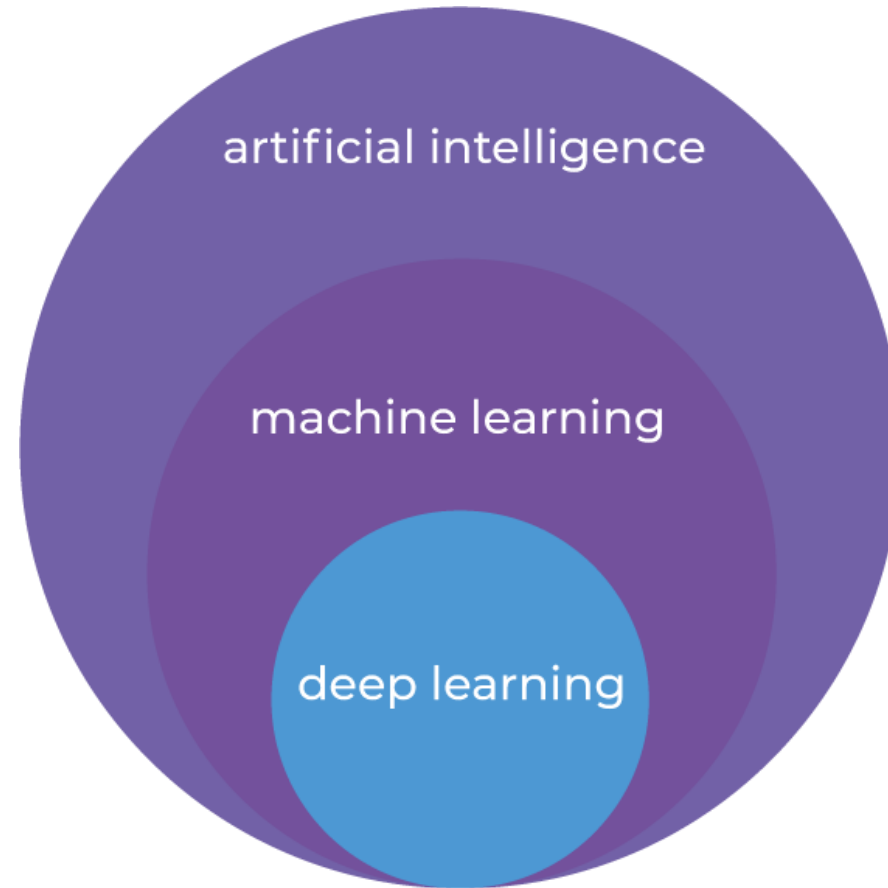


Figure 4: How are AI and ML related [7]

Are there multiple ML Algorithms?

How to classify them?



Exploring some ML Algorithms...

Classifying Algorithms based on how they learn:

- Supervised Learning
- Unsupervised Learning
- Reinforcement Learning

Some other ML Algorithms we will touch upon today:

- Artificial Neural Networks
- Deep Learning Algorithms

Machine Learning Paradigms

Grouping ML Algorithms by Learning Technique



Supervised Learning

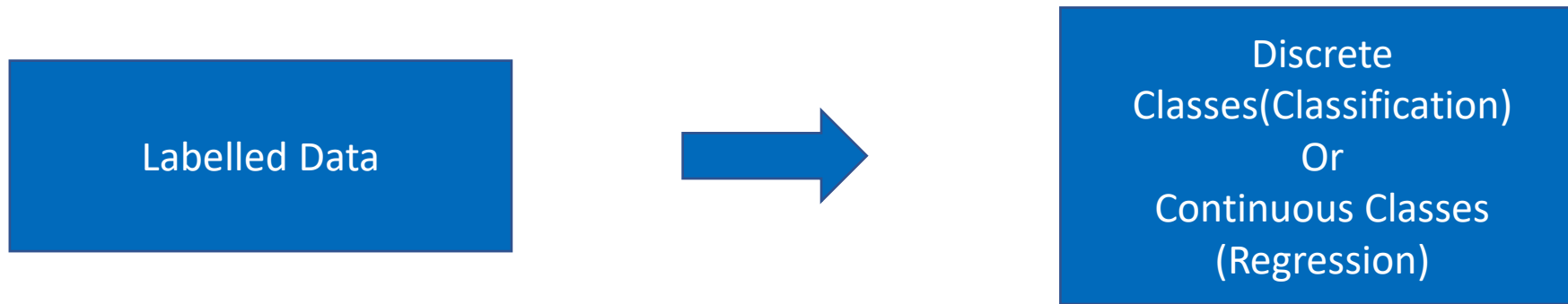


Figure 5: Overview of Supervised Learning [8]

Supervised Learning

Time for some examples!

Supervised Learning - Classification

Examples:

- 1. Spam Detection

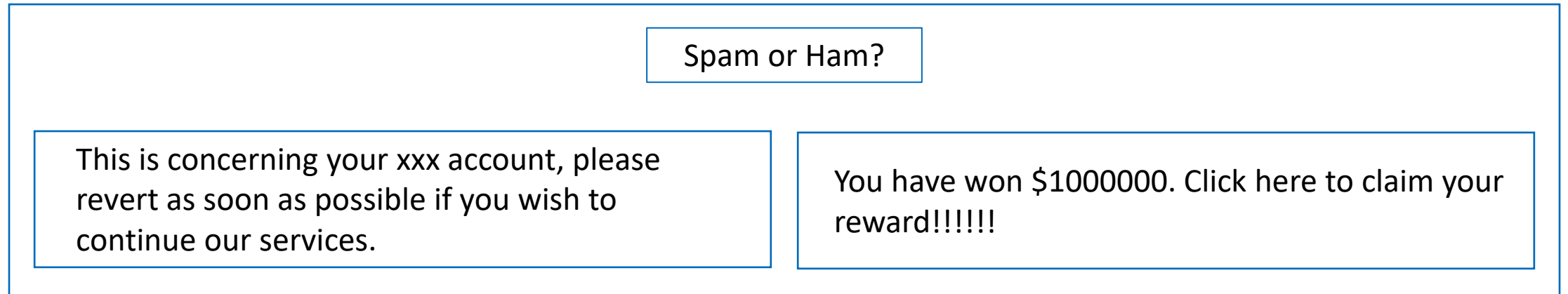


Figure 6: Spam Email Classification [9]

Supervised Learning - Classification

Examples:

- 1. Spam Detection

This is concerning your xxx account, please revert as soon as possible if you wish to continue our services.

Ham

You have won \$1000000. Click here to claim your reward!!!!!!

Spam

Figure 6: Spam Email Classification [9]

Supervised Learning - Classification

Examples:

- 1. Spam Detection

This is concerning your xxx account, please
revert as soon as possible if you wish to
continue our services.

Ham

You have won \$1000000. Click here to claim
your reward!!!!!!

Spam

Figure 6: Spam Email Classification [9]

Supervised Learning - Classification

Examples:

- 1. Spam Detection

Steps involved in Spam Detection”

- a. Create classes (Spam or Ham)
- b. Represent each message by features (keywords, spelling, etc.)
- c. Create reasonable rules.

Supervised Learning - Classification

Examples:

1. Spam Detection
2. Image Classification

Example for Image Classification

Follow this [link](#)

Supervised Learning - Regression

Example:

1. Predicting the temperature

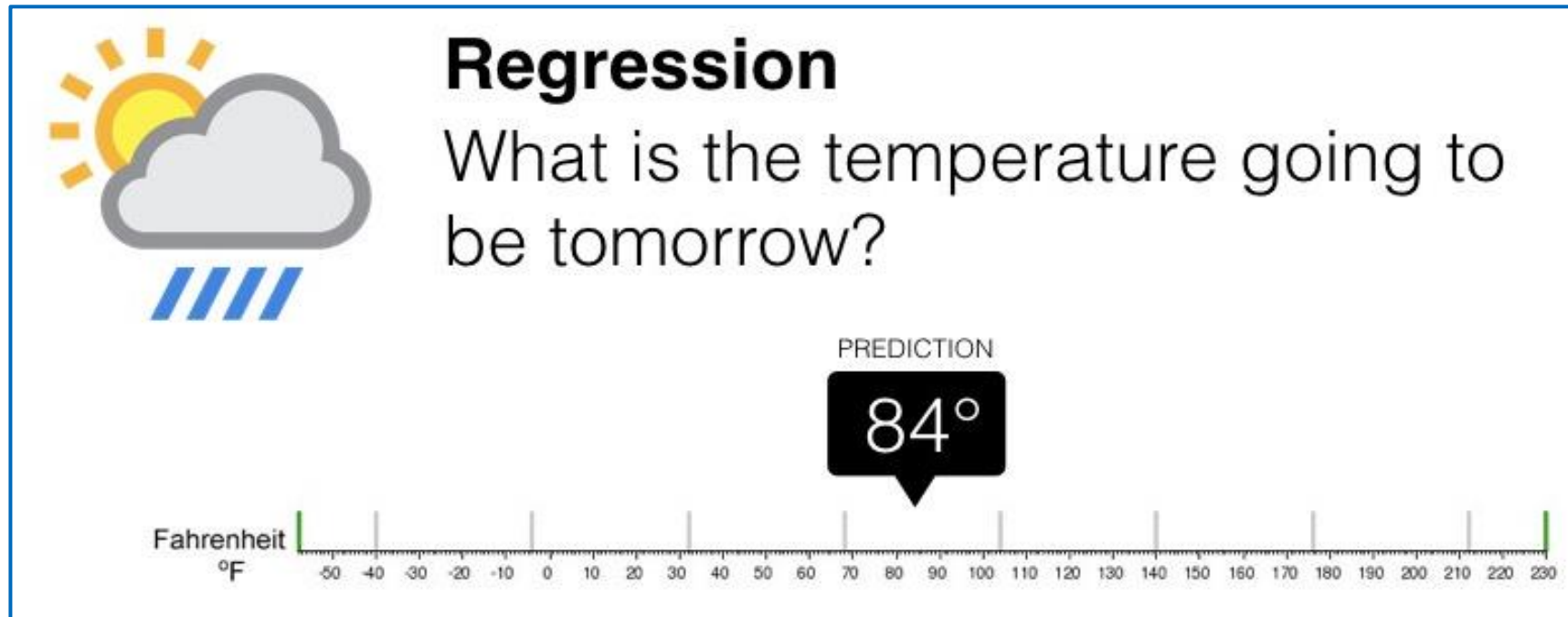


Figure 7: Predicting the temperature – Regression Example [10]

Unsupervised Learning

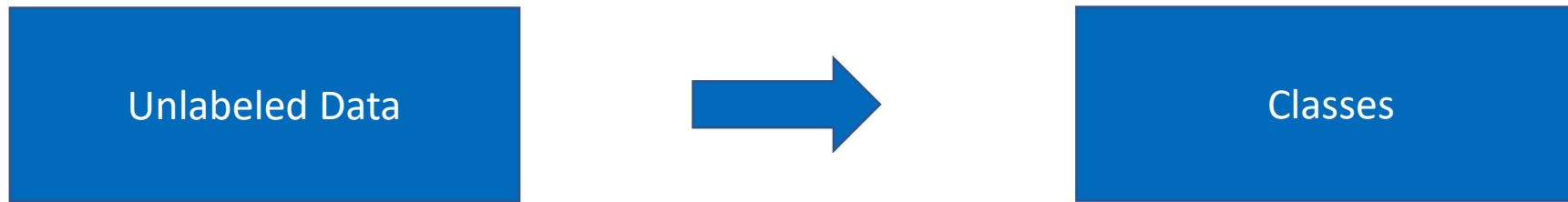


Figure 8: Overview of Unsupervised Learning [8]

Unsupervised Learning

Time for some examples!

Unsupervised Learning - Clustering

Examples:

- 1. Customer Segmentation

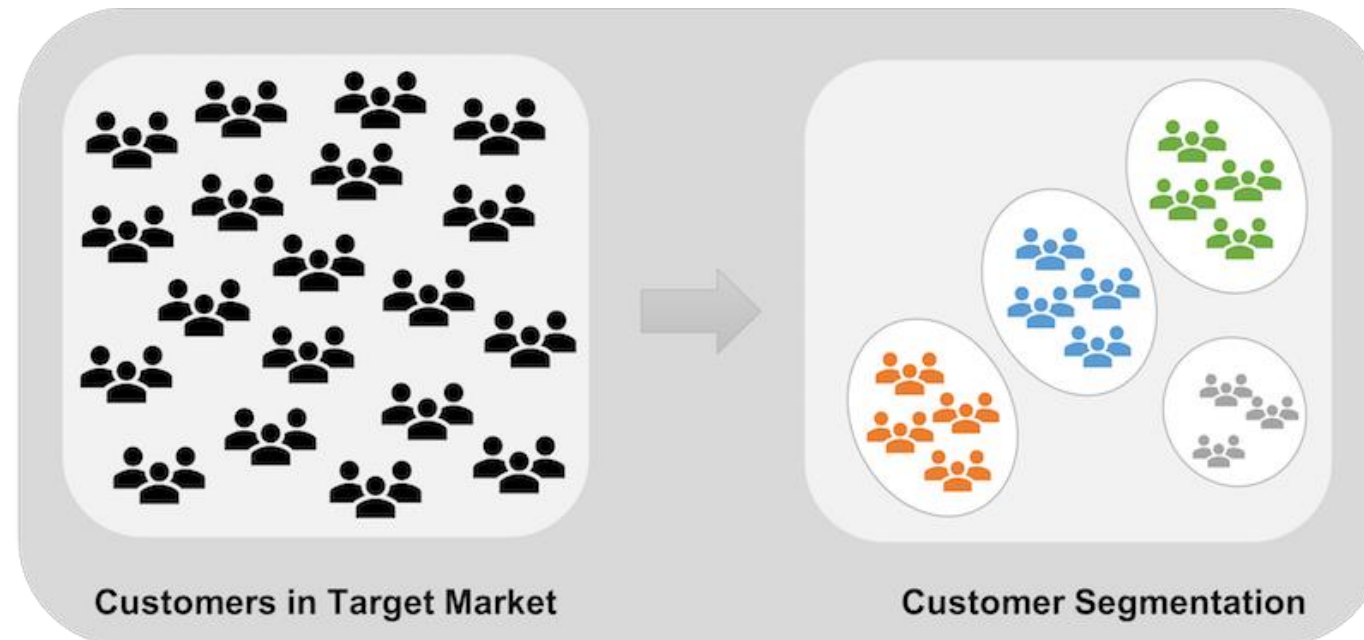


Figure 9: Clustering Customers [11]

Unsupervised Learning - Clustering

Examples:

1. Customer Segmentation
2. Social Network Analysis



Figure 10: Analysis Social Connections [12]

Unsupervised Learning – Anomaly Detection

Examples:

1. Golf Cart – Anomaly

Normal Clip



Abnormal Clip



Figure 11: Golf Cart as an anomaly [12]

Unsupervised Learning – Anomaly Detection

Examples:

1. Golf Cart
2. Credit Card Fraud Detection

Real Time Anomaly Detection

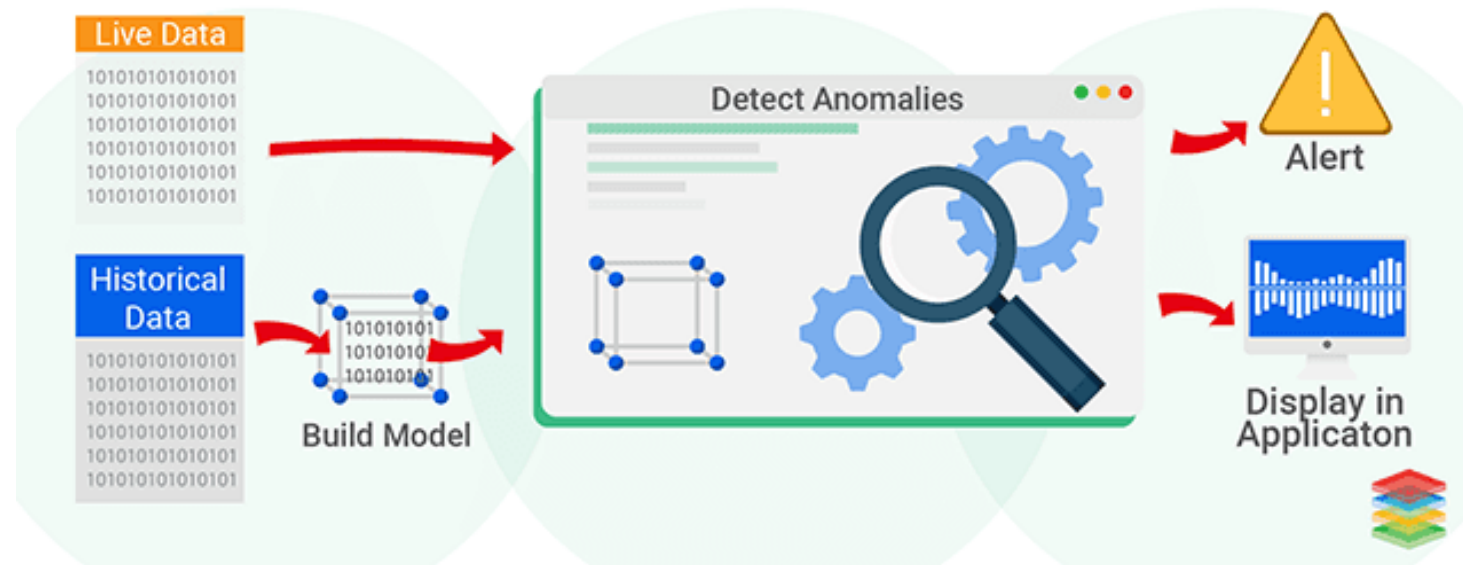


Figure 12: Credit Card Fraud Detection [13]

Reinforcement Learning

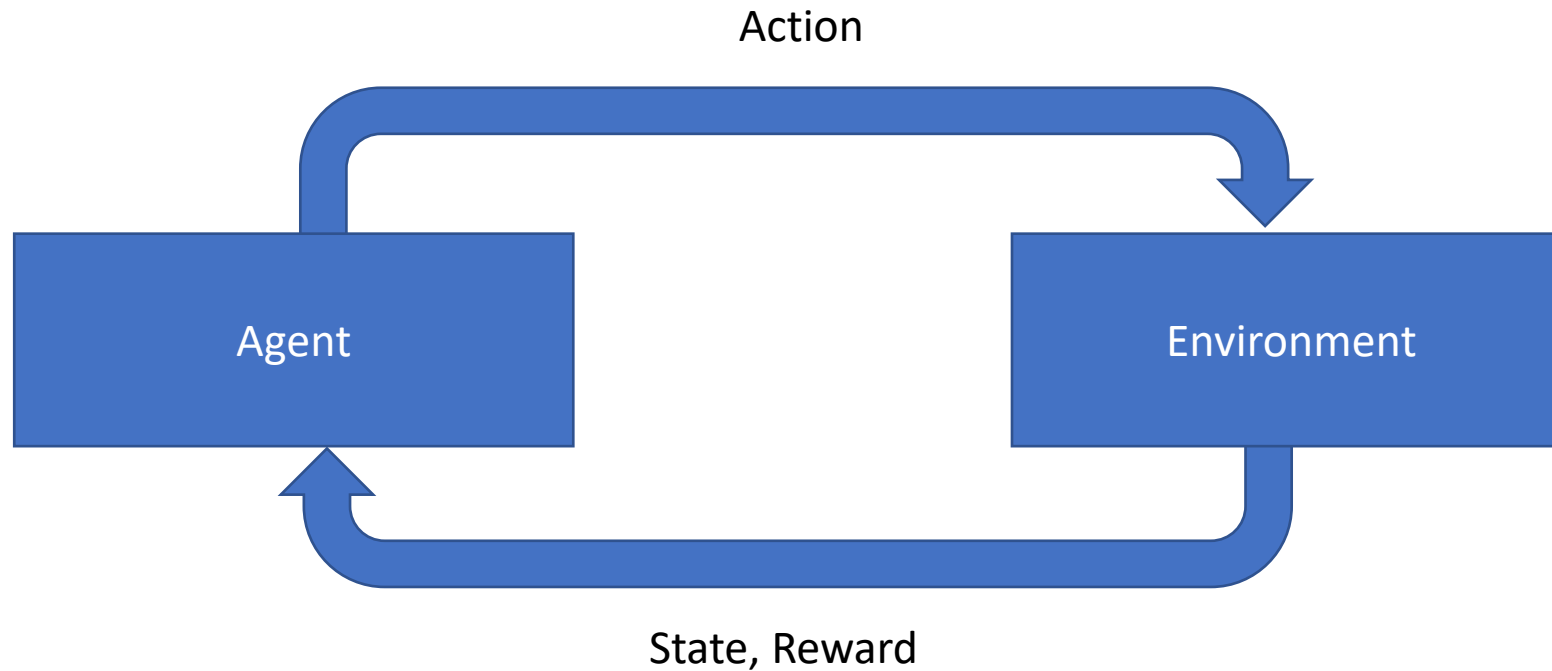


Figure 13: Overview of Reinforcement Learning [8]

Reinforcement Learning

Time for some examples!

Reinforcement Learning



Video 1: Deep Q Learning - Reinforcement Learning Example [8]

A bit more about Machine Learning

Exploring basics of Neural Networks!



Neural Networks

A simple neural network

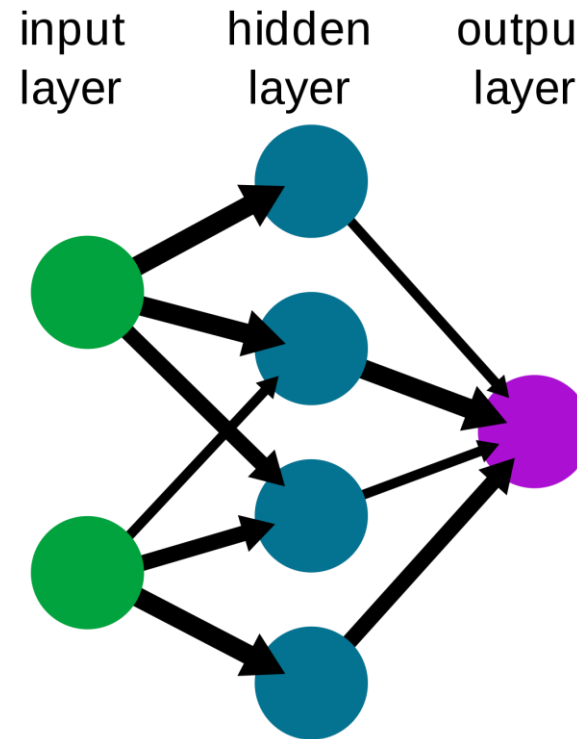


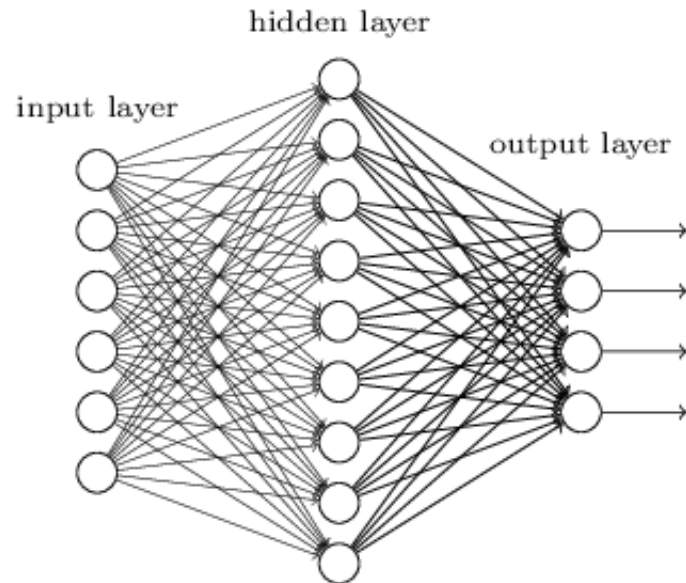
Figure 14: Structure of Neural Networks [14]

Let's train a Neural Networks model!

Open this [link](#) in your browser!

Deep Neural Networks

"Non-deep" feedforward neural network



Deep neural network

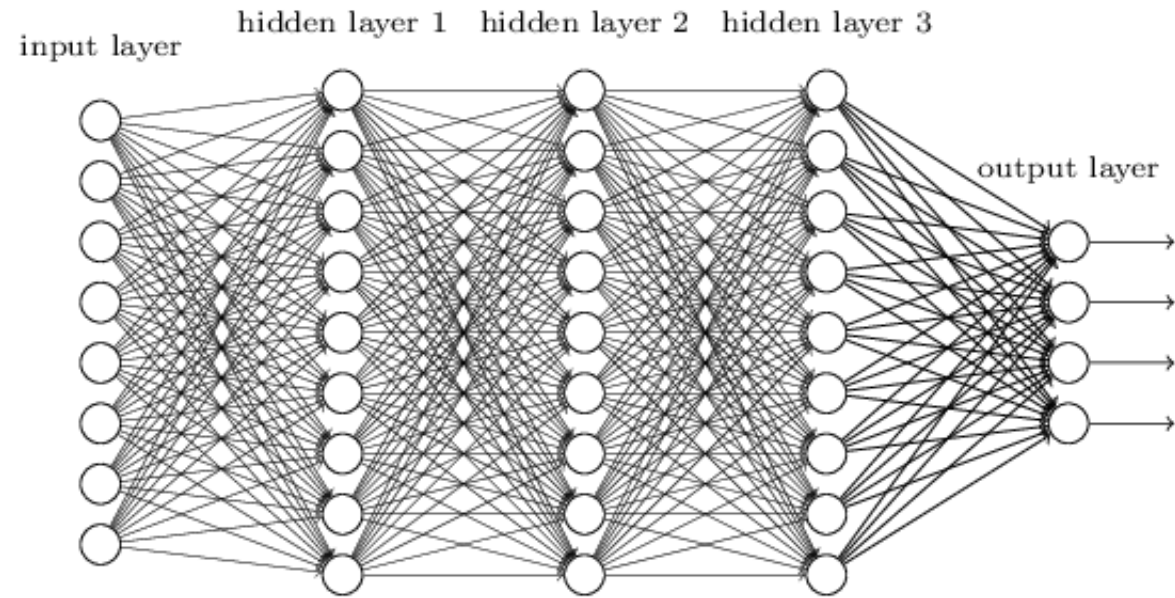


Figure 15: Structure of Deep Neural Networks [15]

Tools and Frameworks for ML

A quick overview



Frameworks and Tools for ML

- Programming languages
 - Python
 - R
 - C++
 - ...
- Many libraries
 - scikit-learn - For Classical ML
 - PyTorch
 - TensorFlow
 - Keras
 - ⋮

List 1: Some useful tools for Machine Learning [16]

What are the limitations?

Or are there any?

Data hungry models

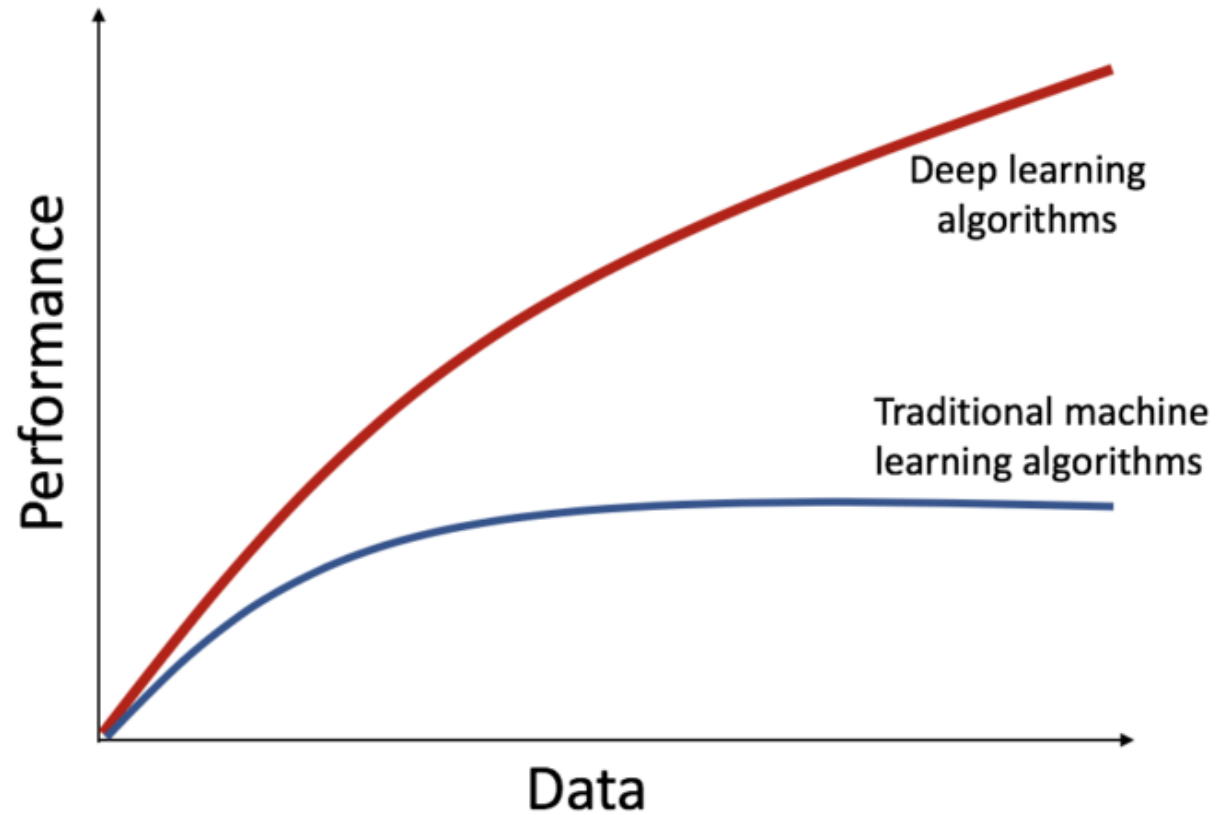


Figure 16: Hunger for huge volume of Data[17]

Narrow vs General AI

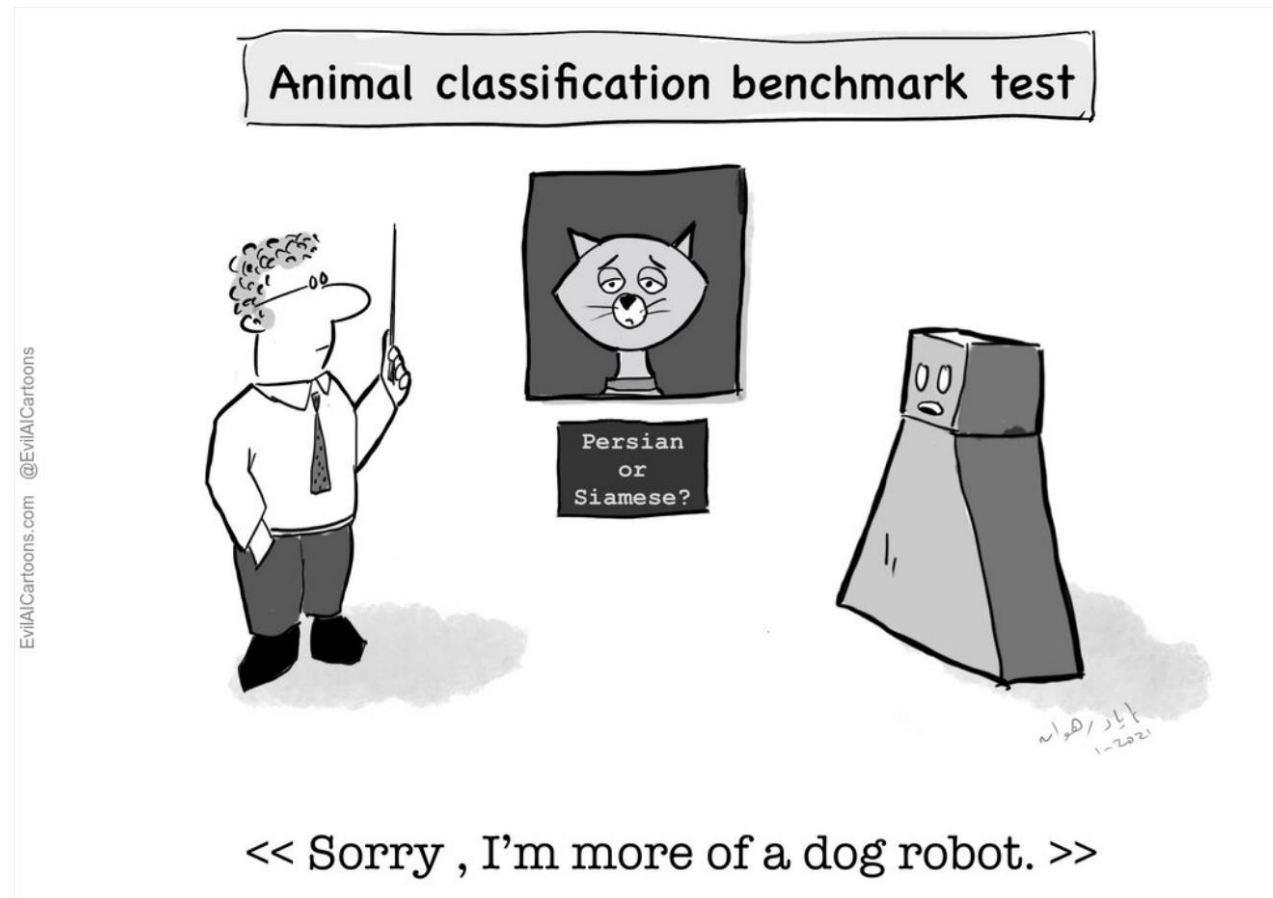


Figure 17: Limiting Models to Specific Tasks [18]

ML as a Black Box

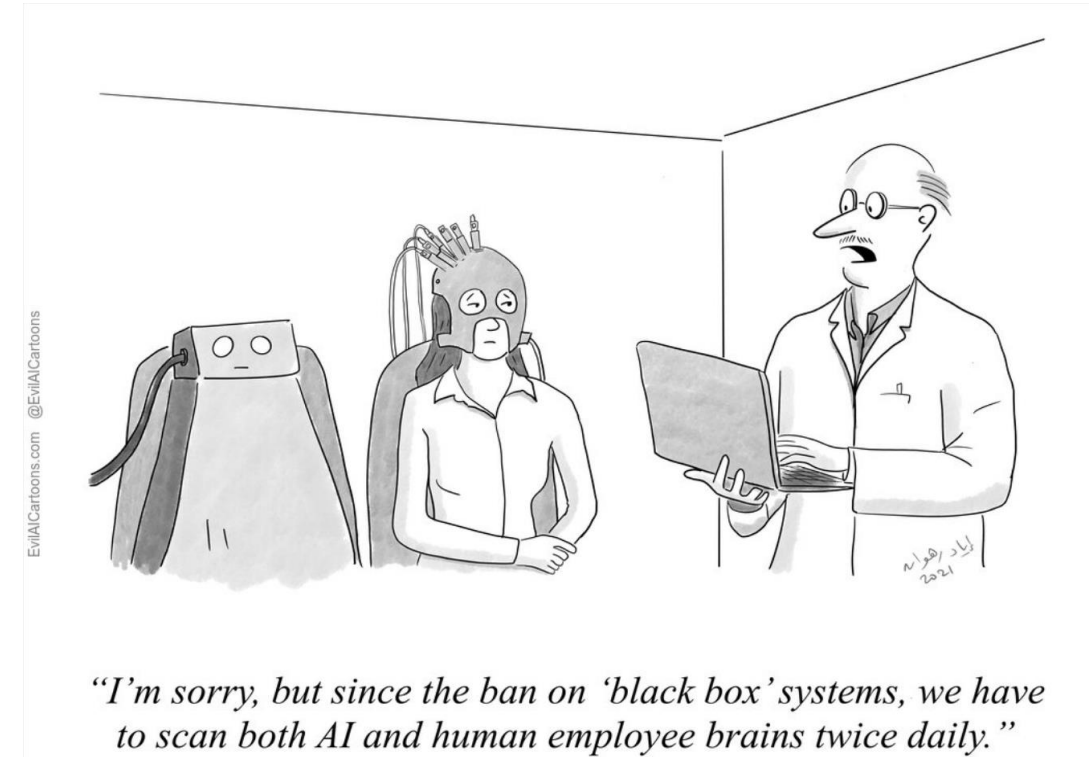


Figure 18: Structure of Deep Neural Networks [19] [20]

Ethics & AI

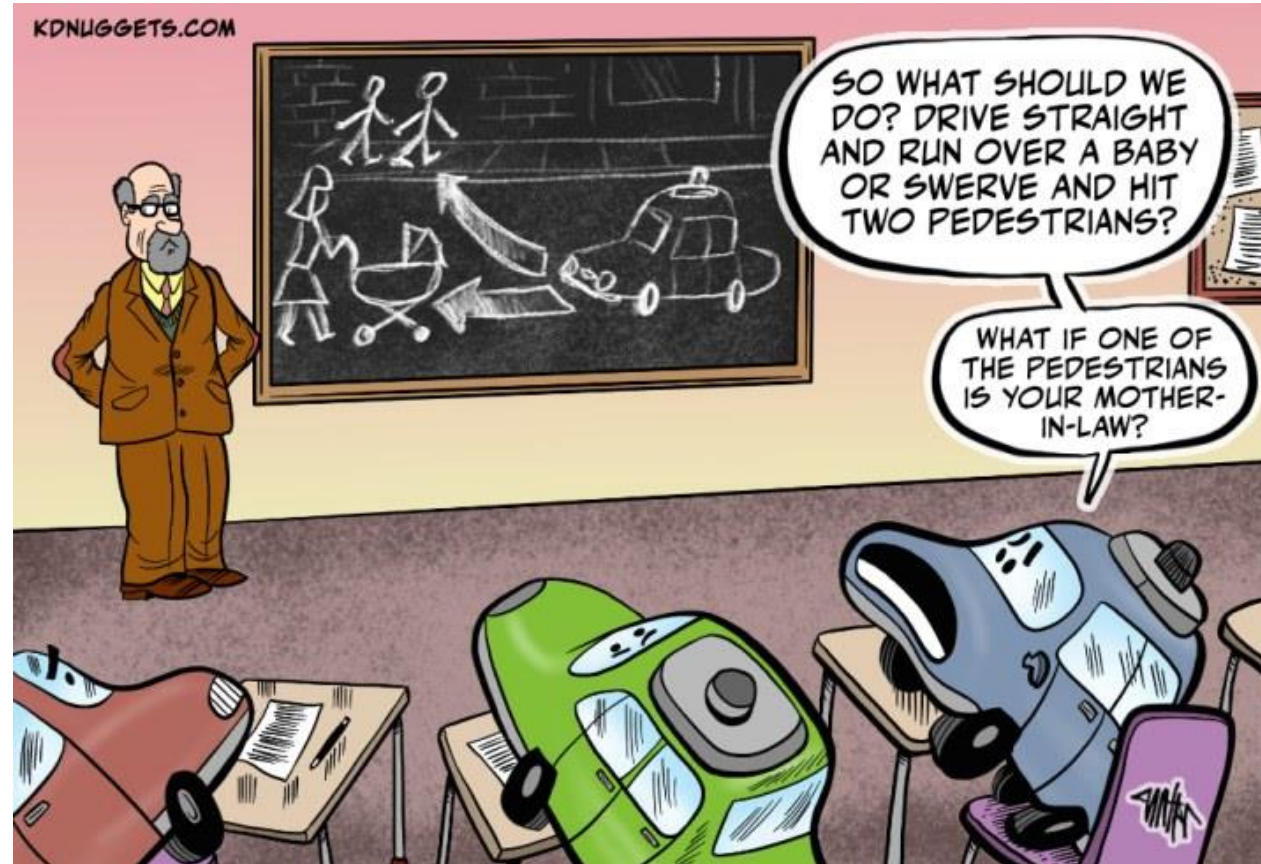


Figure 19: Creating Ethical Models [21]

Some failures regarding ML projects

Such failures occur because you are ...

- Asking the wrong question
- Trying to solve the wrong problem
- Not having enough data
- Not having the right data
- Having too much data
- Using the wrong tools
- Not having the right model
- ⋮

List 2: Common reasons for ML project failure [22]

References (1/6)

[1] <https://swisscognitive.ch/2021/03/18/applications-of-machine-learning>

[2] <https://crate.io/a/machine-learning-cratedb-jupyter/>

[3] <https://www.aitimejournal.com/@nisha.arya.ahmed/what-is-artificial-intelligence-ai>

[4] Mitchell, Tom. (1997). Machine Learning. McGraw Hill. p. 2. ISBN 0-07-042807-7.

References (2/6)

[5] Adapted from slides by Pedro Domingos

[6] <https://brilliant.org/wiki/machine-learning/>

[7] <https://neurospace.io/blog/2019/03/ai-and-ethics/>

[8] Adapted from "Machine Learning 10-401, Spring 2018" by Maria-Florina (Nina) Balcan

References (3/6)

[9] Adapted from "Machine Learning 10-401, Spring 2018" by Maria-Florina (Nina) Balcan

[10] <https://in.springboard.com/blog/regression-vs-classification-in-machine-learning/>

[11] <https://datalya.com/customer-segmentation-services.php>

[12] <https://towardsdatascience.com/prototyping-an-anomaly-detection-system-for-videos-step-by-step-using-lstm-convolutional-4e06b7dcdd29>

References (4/6)

[13] <https://www.xenonstack.com/blog/real-time-anomaly-detection>

[14] https://en.wikipedia.org/wiki/Neural_network/

[15] <https://stats.stackexchange.com/a/184921>

[16] Adapted from "Introduction to machine learning/AI" by Geert Jan Bex, Jan Ooghe, Ehsan Moravveji

References (5/6)

[17] <https://abyssal.eu/were-data-hungry/>

[18] <https://www.evilaicartoons.com/archive/terminology-narrow-vs-general-ai/>

[19] <https://www.evilaicartoons.com/archive/terminology-black-box>

[20] <https://xkcd.com/1838/>

References (6/6)

[21] <https://www.kdnuggets.com/2020/01/cartoon-teaching-ethics-ai.html/>

[22] Adapted from "Introduction to machine learning/AI" by Geert Jan Bex, Jan Ooghe, Ehsan Moravveji/

Further Reading(s)

