IS883: Deploying Generating AI

Mohannad Elhamod

BOSTON UNIVERSITY

Boston University Questrom School of Business

Welcome!

What is this class about?

BOSTON UNIVERSITY

ChatGPT... Absolute Terror!

The Washington Post
Democracy Dies in Darkness

TECH Artificial Intelligence Help Desk Internet Culture Space Tech Policy

INNOVATIONS

ChatGPT took their jobs. Now they w dogs and fix air conditioners.

Technology used to automate dirty and repetitive jobs. Now, artificial intelligence chatbots are coming aft ones.

By Pranshu Verma and Gerrit De Vynck
June 2, 2023 at 6:00 a.m. EDT

Forbes

FORBES > LEADERSHIP > EDUCATION

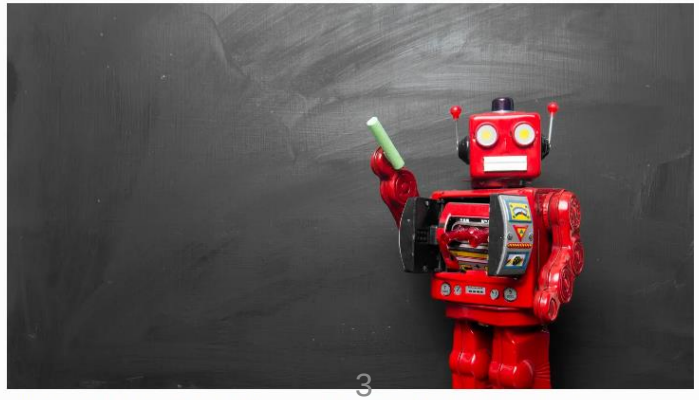
ChatGPT Will Not Replace Teachers But Could Act As A Teaching Assistant

Ray Ravaglia Contributor
I write about education at the intersection of tech and innovation.

Follow

0 Mar 31, 2023, 01:15pm EDT

Listen to article 4 minutes



While Not Replacing Teachers Anytime Soon, GPTs Can Still Be Useful in the Classroom GETTY

The Guardian

Sport Culture Lifestyle More

tics Business Tech Science Newsletters Fight for democracy

hatGPT said I did not exist': how rtists and writers are fighting back gainst AI

Forbes

INNOVATION > ENTERPRISE TECH

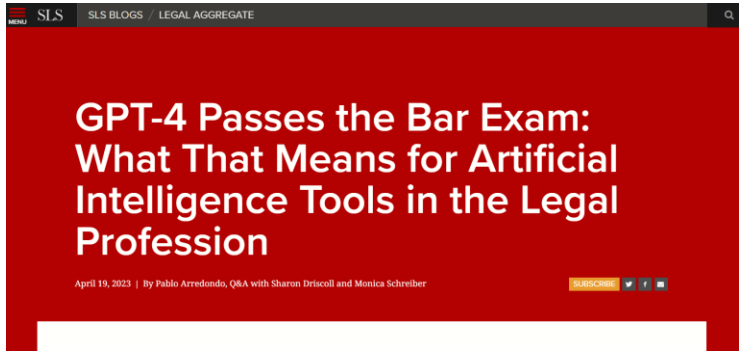
ill ChatGPT Put Data Analysts ıt Of Work?

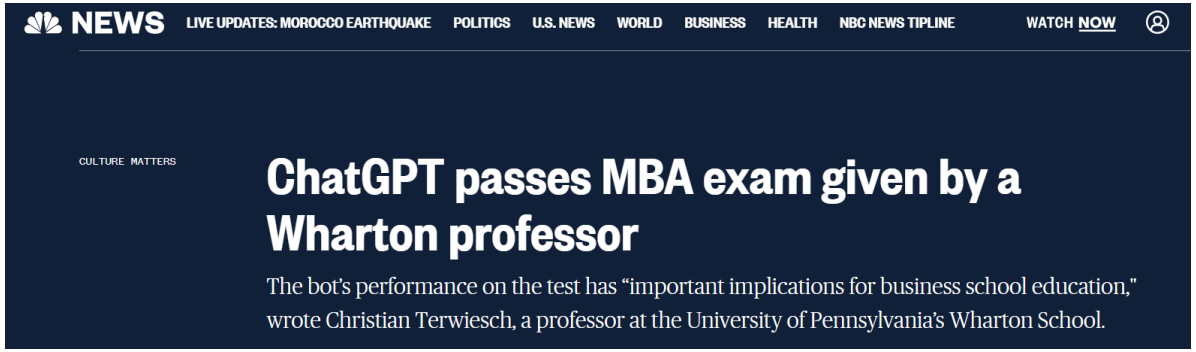
rd Marr Contributor

Follow

3 Feb 7, 2023, 01:40am EST

ChatGPT can do anything!



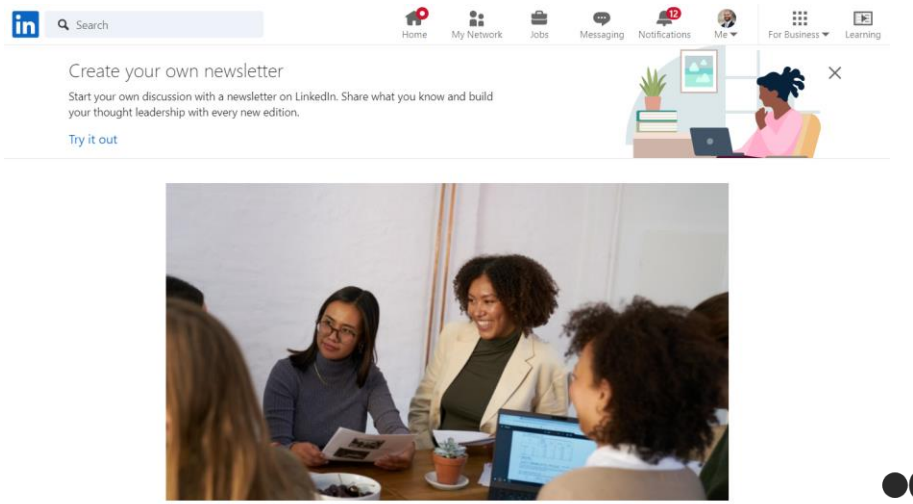


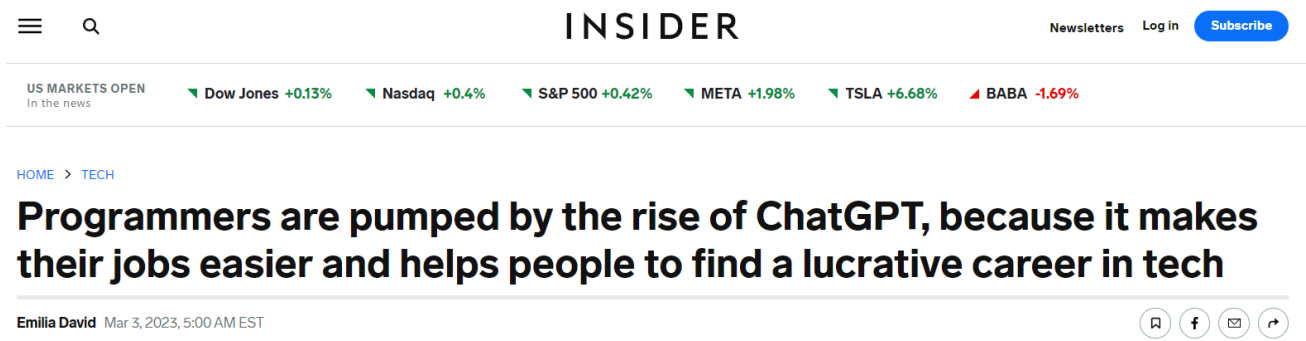
The New York Times

When Doctors Use a Chatbot to Improve Their Bedside Manner

Despite the drawbacks of turning to artificial intelligence in medicine, some physicians find that ChatGPT improves their ability to communicate empathetically with patients.

ChatGPT is amazing!



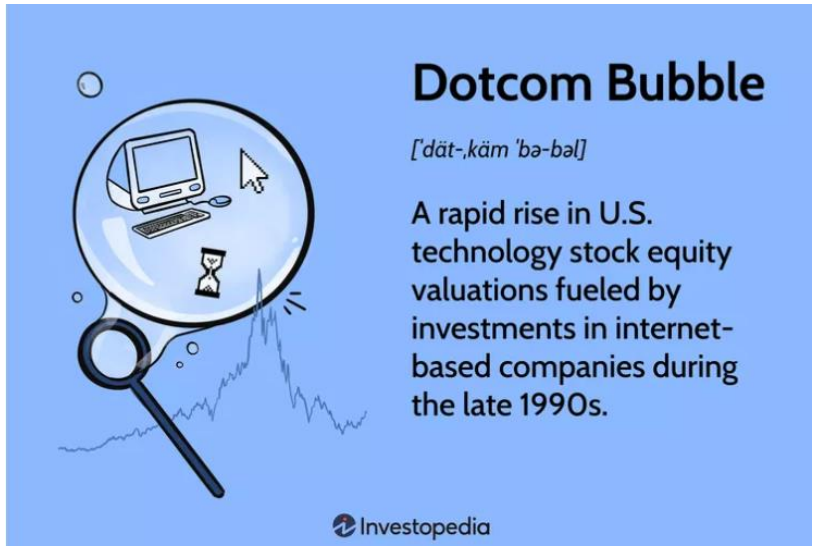


ChatGPT is horrible!

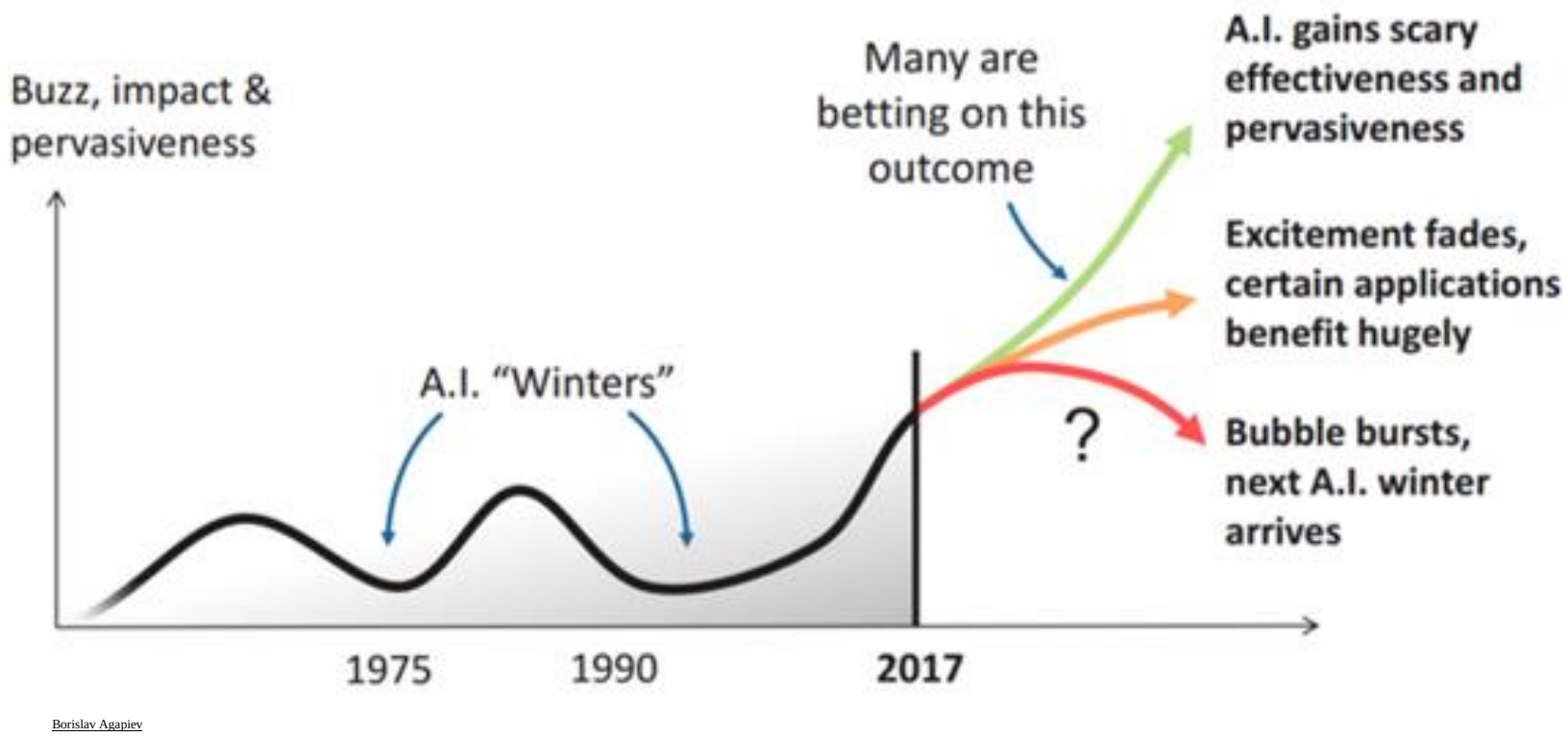
ChatGPT.. What is it really about though?

Let’s play a bit!

Is this a hype?



Is this a hype?

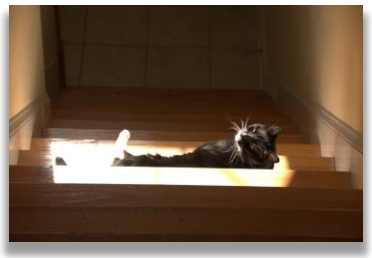


Borislav Agapiev

General Guidelines

BOSTON UNIVERSITY

Who is your professor?



Why are you here?

- I am sure it eventually leads to money….
- Maybe it is just a required class?

- Nonetheless, understanding how things work is essential for decision making and innovation.

> Someone who had begun to [study] geometry asked Euclid, 'What shall I get by learning these things?' Euclid called his slave and said, 'Give him [some money], since he must make gain out of what he learns'.
>
> (Heath, 1981, loc. 8625)

Euclid

Fundamentals are important!

- The more foundational knowledge you skip, the more fundamental errors you will make.
- Work hard. **Be patient!**

Zen Speaks: Shouts of Nothingness

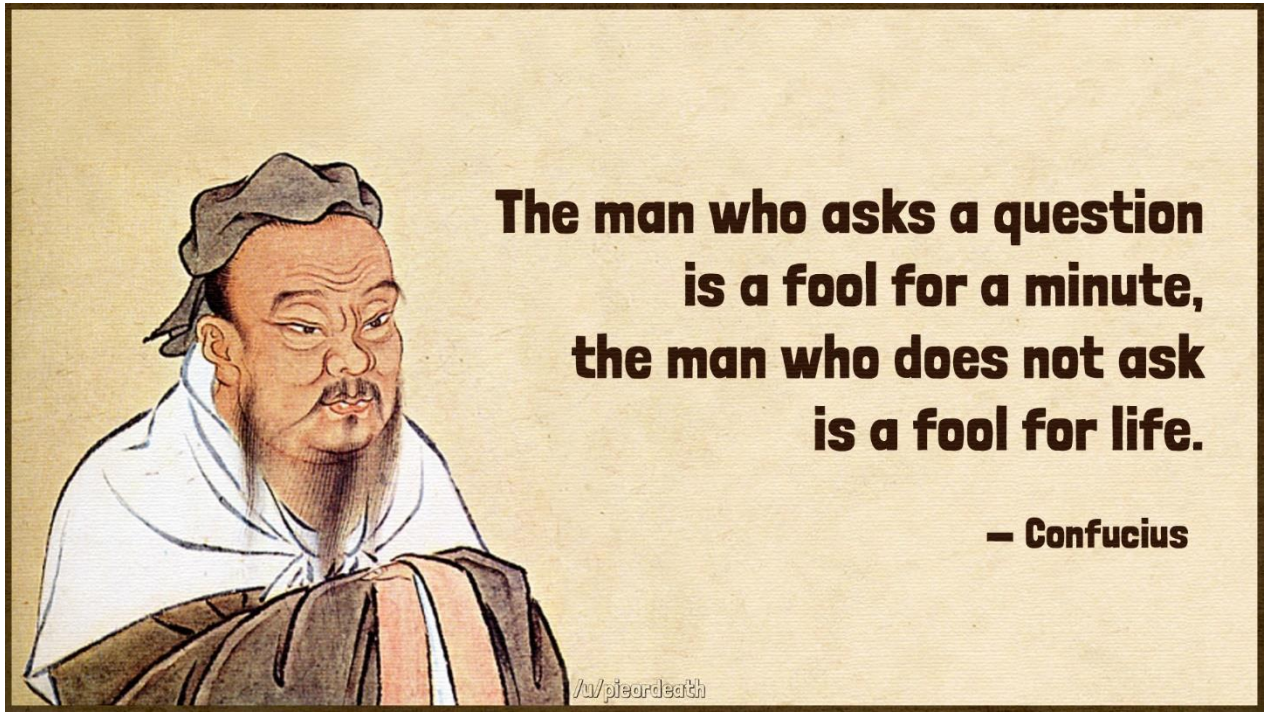
Your professor is not a God

- Deep Learning and Gen AI are fast-growing domains.
- The internet nowadays has all kinds of learning material.

- Your professor is **NOT** here as a walking encyclopedia. He is here to guide your learning experience and build you a solid foundation, so you could continue learning on your own later.

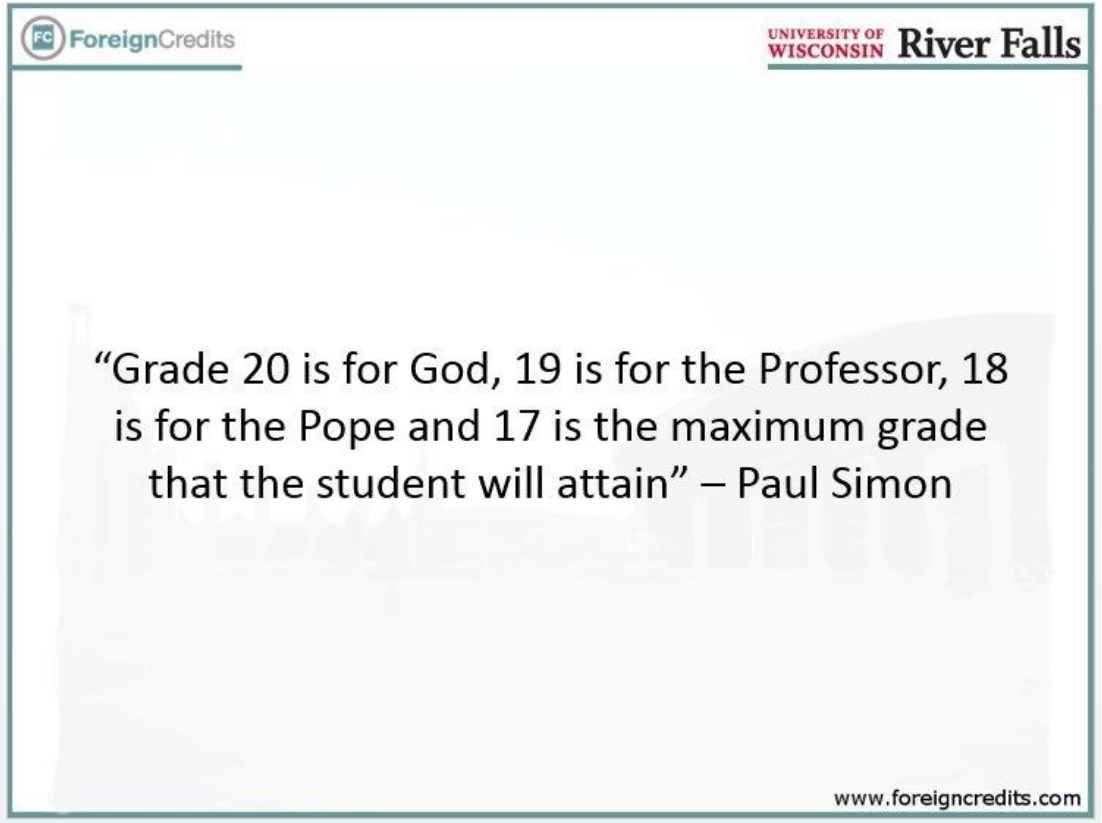
No Question is Foolish

- Other might have the same question.
- Knowledge is hierarchical.



Can I get an A?

- Questrom policy
- But you will get your fair chance.



Participation is Essential!

- 20% of your grade!
- The instructor reserves the right to cold-call.

Office Hours

- They are for you to take advantage of!
- However, to make the best of your and the TA's/instructor's time, do your homework before dropping in:
  - If you have a question about your project, make sure you have synched with your colleague in advance.
  - If you have question about assignments, make sure you have done your best and that your question is specific rather than "How do I solve this?".

Pass through the Syllabus

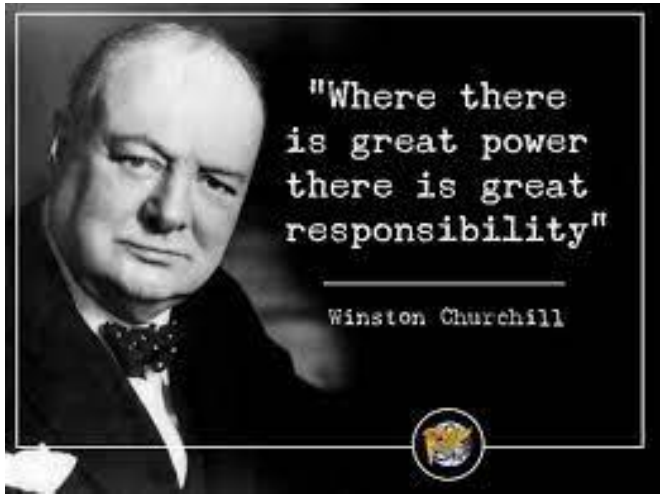
- Have you actually read it?!
- Pay attention to Piazza for announcements!

General Objectives

Assignments are meant to simulate challenges in real-life.

- Follow instructions regarding whether ChatGPT is allowed for each assignment.
- You can also discuss with others.
- You MUST cite your resources!

- You cannot have someone do the work for you though.
  - No copy-paste of others' solutions.
  - Deviating from instructions leads to penalties!
  - **You must own and understand your work!**
  - **Zero-tolerance for cheating!**



Intro to ML

BOSTON UNIVERSITY

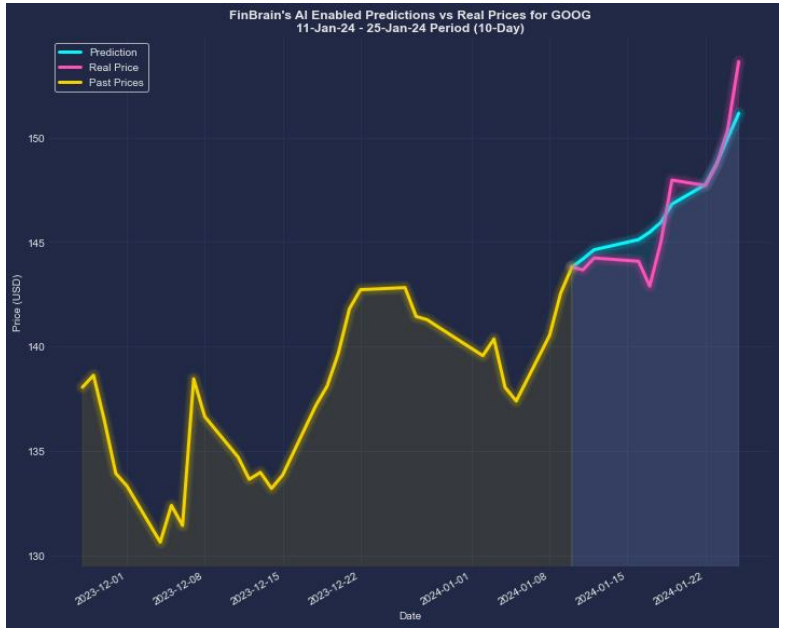
Boston University Questrom School of Business

What is Machine Learning?

- What challenges you find with this approach?

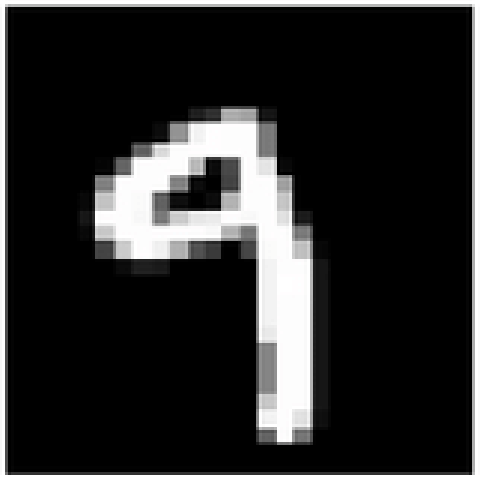
https://blog.finbrain.tech/

Knowledge-based modeling

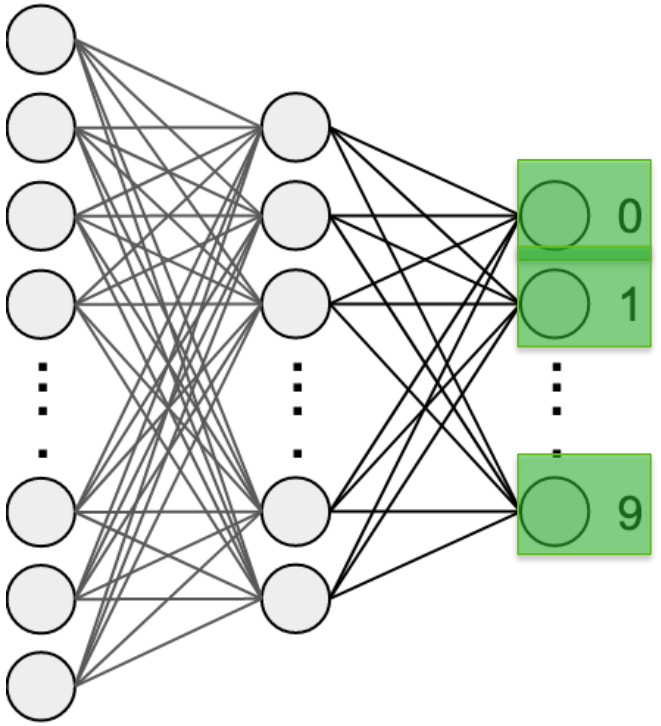


Data-driven modeling

Data-driven Modeling

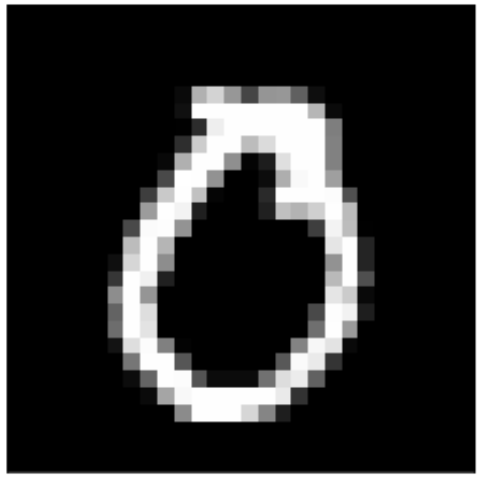


MNIST Dataset

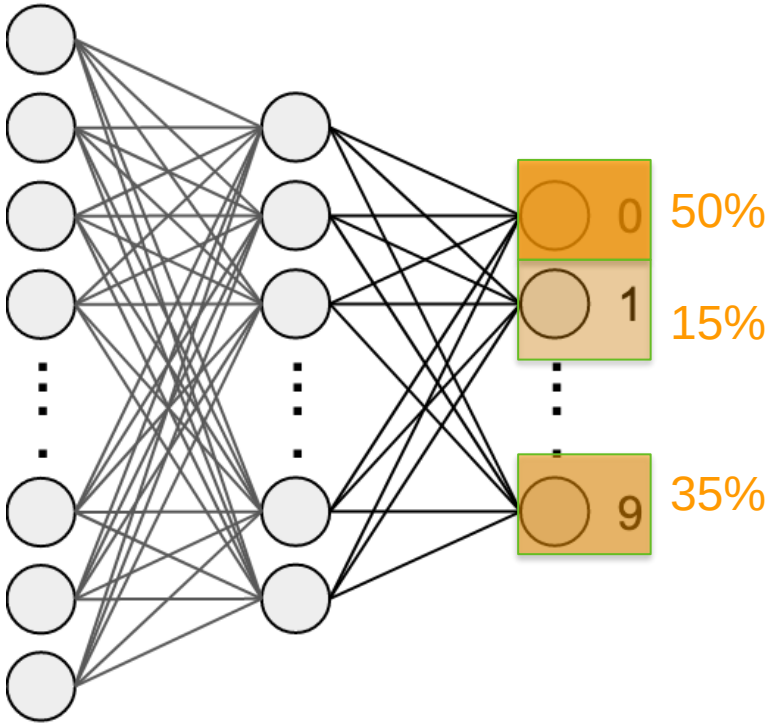


Phase 1: Training

Data-driven Modeling



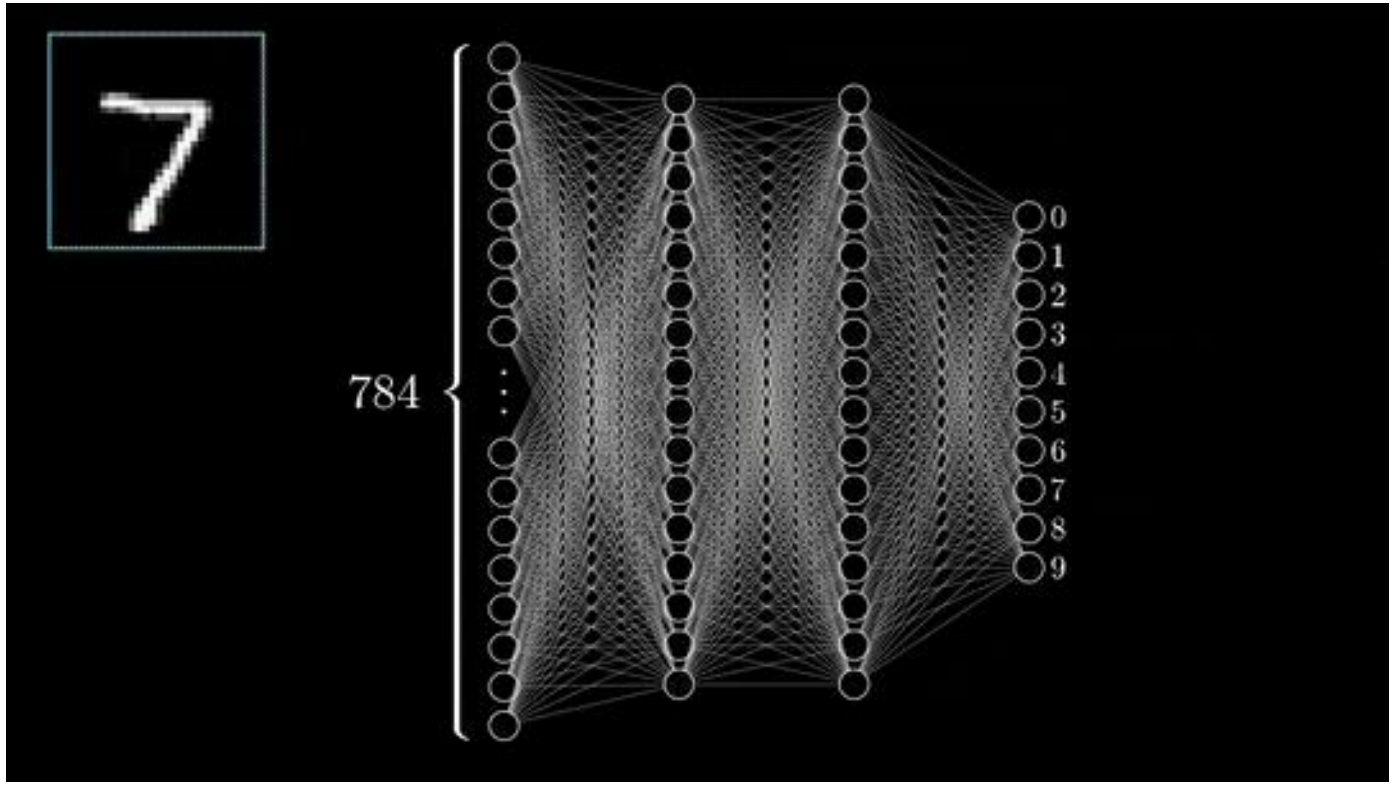
MNIST Dataset



Phase 2: Validation/Testing

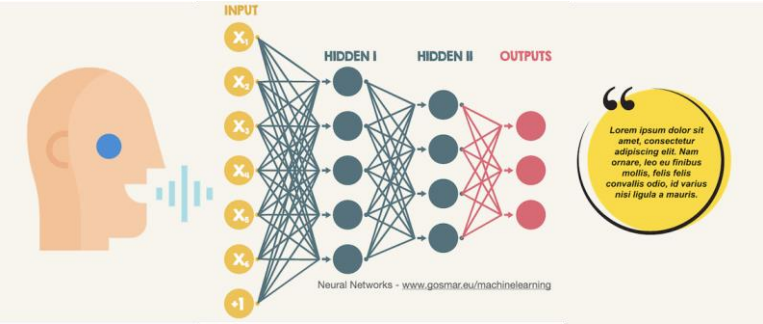
Data-driven Modeling

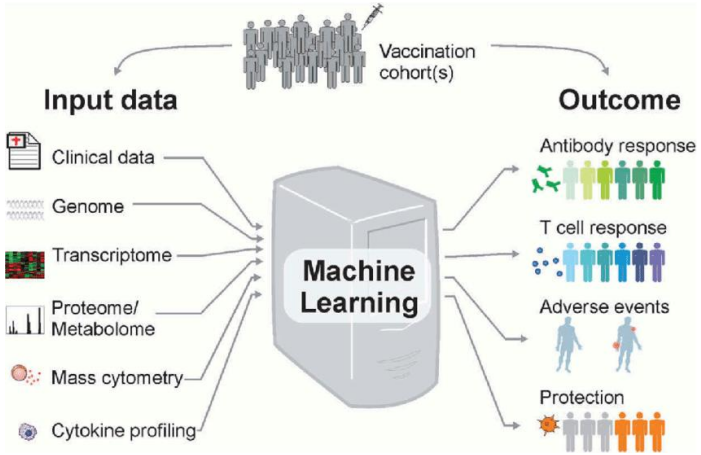
- Demo



https://gfycat.com/gifs/tag/3b1b

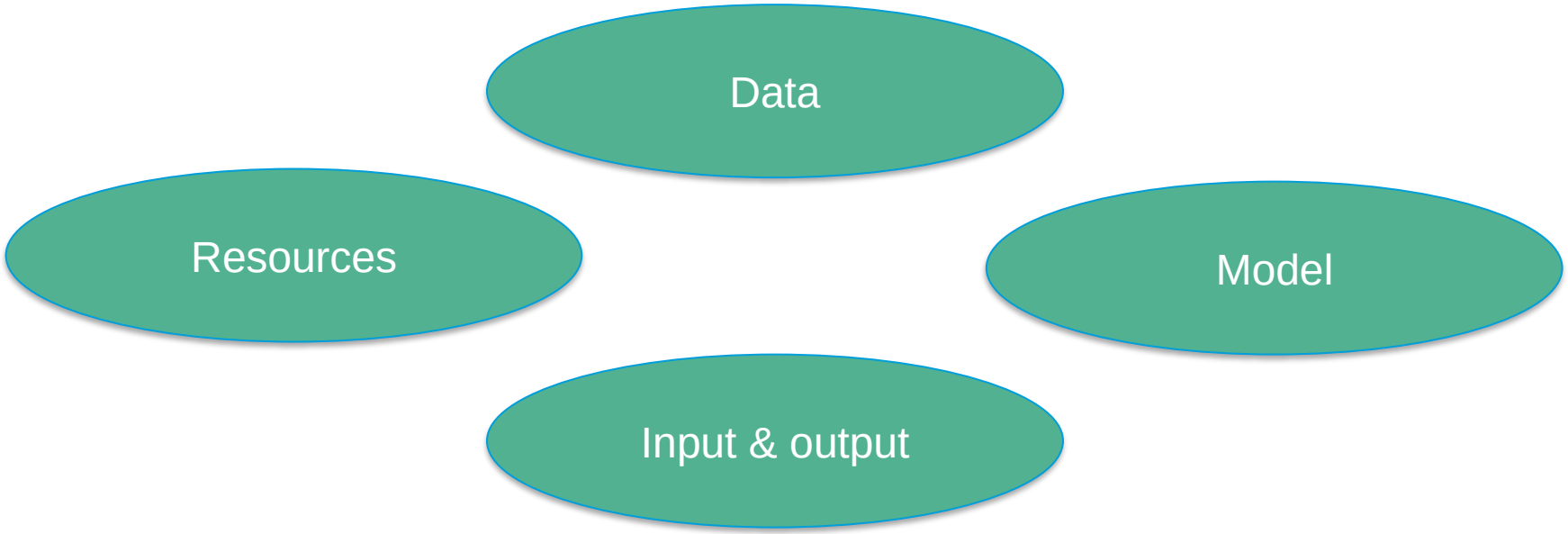
Applications





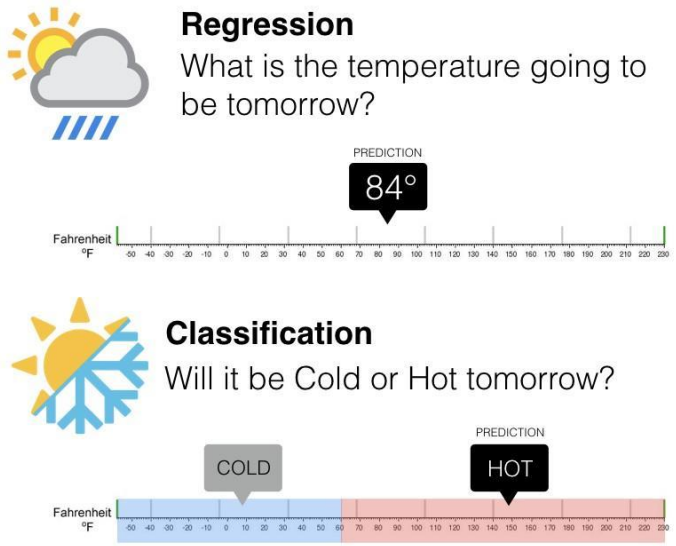
•https://www.gosmar.eu/machinelearning/2020/05/25/neural-networks-and-speech-recognition/
•https://www.ufrjnautilus.com/post/vis%C3%A3o-computacional-e-carros-aut%C3%B4nomos
•https://www.nature.com/articles/d41586-019-03298-6
•https://www.forbes.com/sites/johnkoetsier/2023/04/14/generative-ai-music-platform-creates-forever-songs-with-artists-unique-sounds-melodies-and-beats/?sh=75a691eada47
•Gonzalez-Dias, Patrícia & Lee, Eva & Sorgi, Sara & Lima, Diógenes & Urbanski, Alysson & Silveira, Eduardo & Nakaya, Helder. (2019). Methods for predicting vaccine immunogenicity and reactogenicity. Human Vaccines & Immunotherapeutics. 16. 1-8. 10.1080/21645515.2019.1697110.

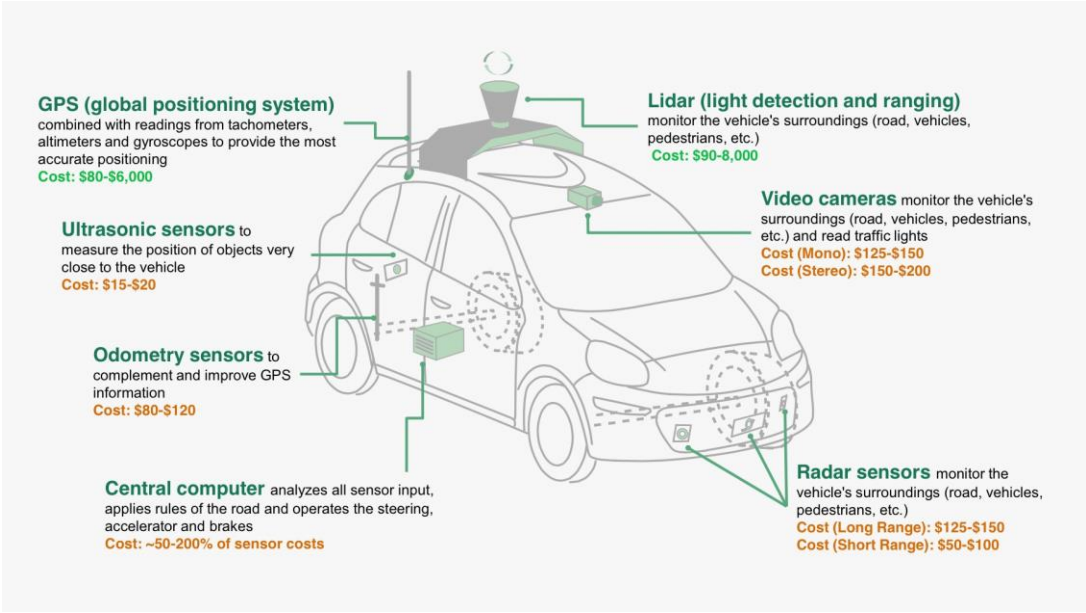
"Pillars" of Using ML



Input & Output

- What exactly are you trying to model?





https://www.wired.com/2015/04/cost-of-sensors-autonomous-cars
https://medium.com/@ali_88273/regression-vs-classification-87c224350d69

Data

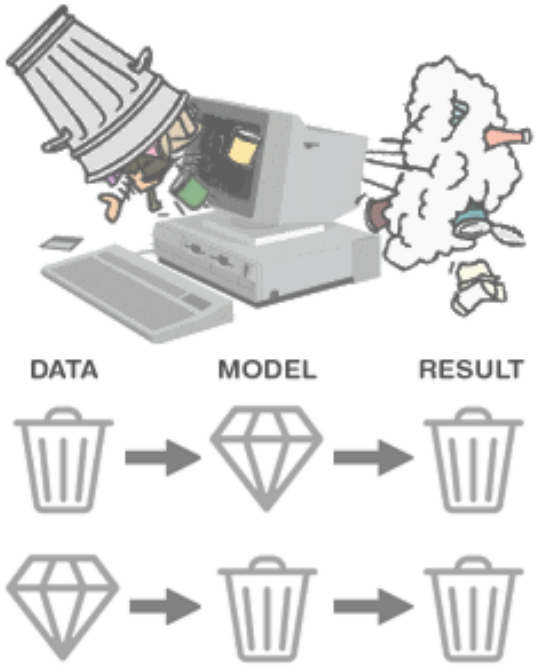
- Is there enough of it?
- Does it need clean-up?

Damaged specimen

Missing Features

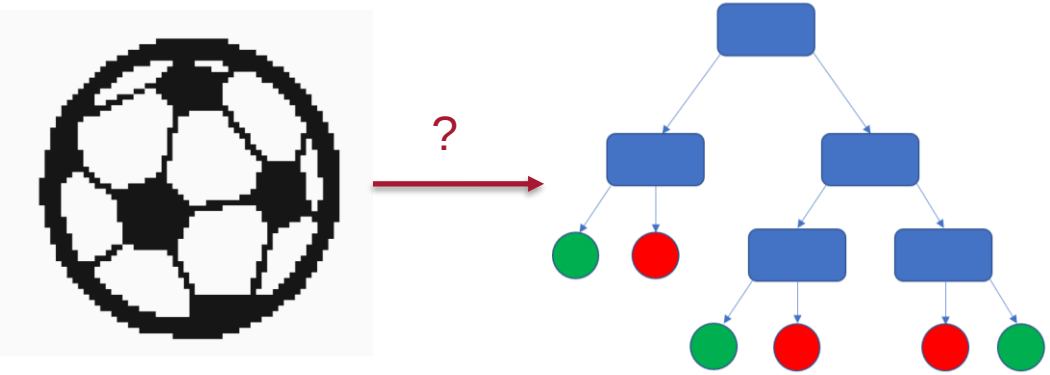
Occluded Features

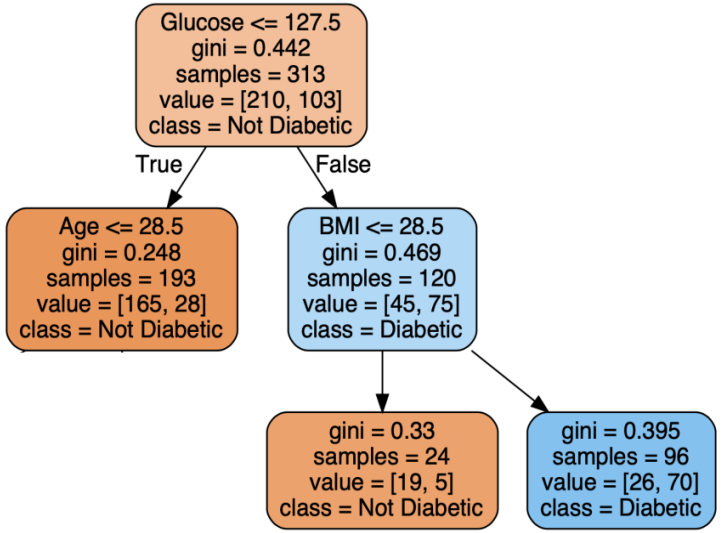
Elhamod, M., Diamond, K. M., Murat Maga, A., Bakis, Y., Bart, H. L., Mabee, P., Dahdul, W., Leipzig, J., Greenberg, J., Avants, B., & Karpatne, A. (2022). Hierarchy-guided neural network for species classification. *Methods in Ecology and Evolution*, 13, 642–652. https://doi.org/10.1111/2041-210X.13768



Model

- What kind of model would be sufficient/suitable for modeling your data?

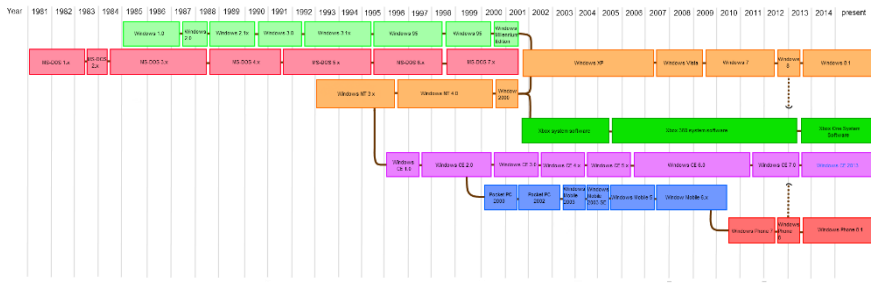




https://statisticallyrelevant.com/decision-trees-in-python-predicting-diabetes/

Resources

- What compute resources are available?
- What is the project's timeline?



In-Class Work

BOSTON UNIVERSITY

Intro to ML

Continued…

BOSTON UNIVERSITY

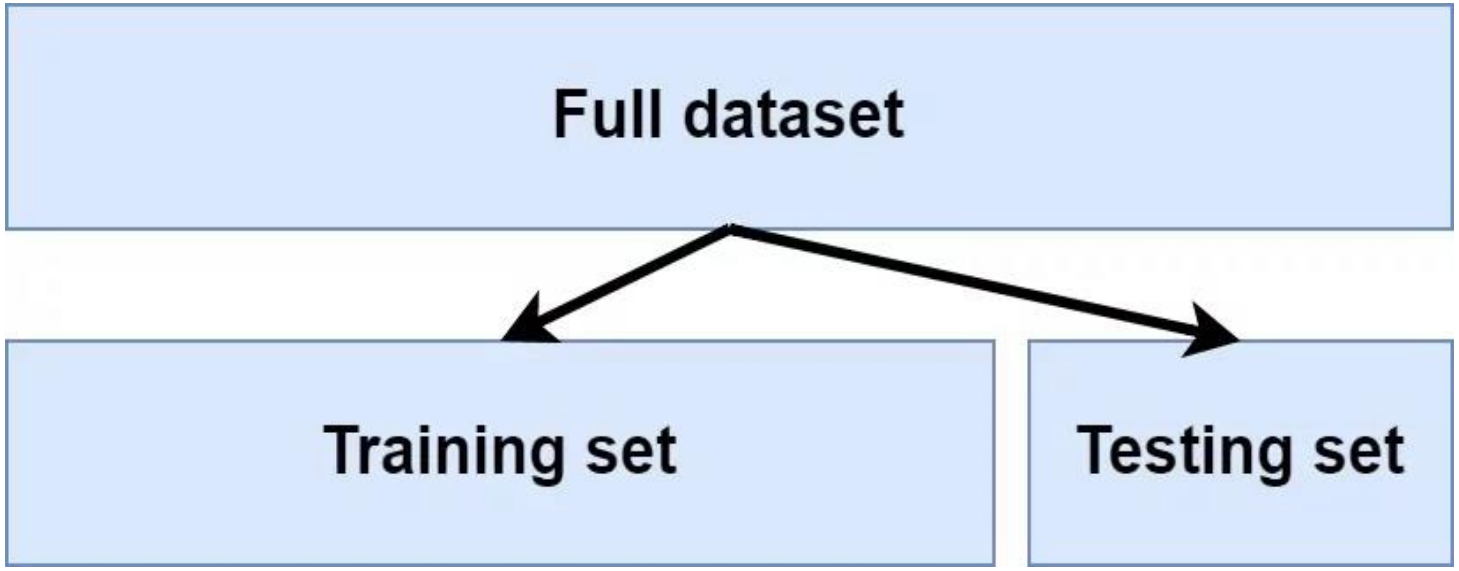
Model Generalization

- You build a model that *predicts a movie's box office revenue*. You have only a few movies to train on and for each movie you collect many features, including *whether the of the president at the time of release is a democrat*.
  - Since there are only a few movies for the model to train from, there is a chance that some noise exists.
  - **This is called overfitting!**

Model Generalization

- Now, you build another model that *predicts a movie's box office revenue*. You have lots of movies to train on. However, for each *movie you only collect one feature: month of release*.
  - While the month of release may have some signal, it is insufficient to provide an accurate prediction of the box office revenue.
  - **This is called underfitting!**

Model Generalization



https://www.machinecurve.com/index.php/2020/11/16/how-to-easily-create-a-train-test-split-for-your-machine-learning-model/

Model Generalization

https://medium.com/trusted-ai/explaining-ai-model-behaviour-with-ibm-watson-openscale-86515702c177

Neural Networks

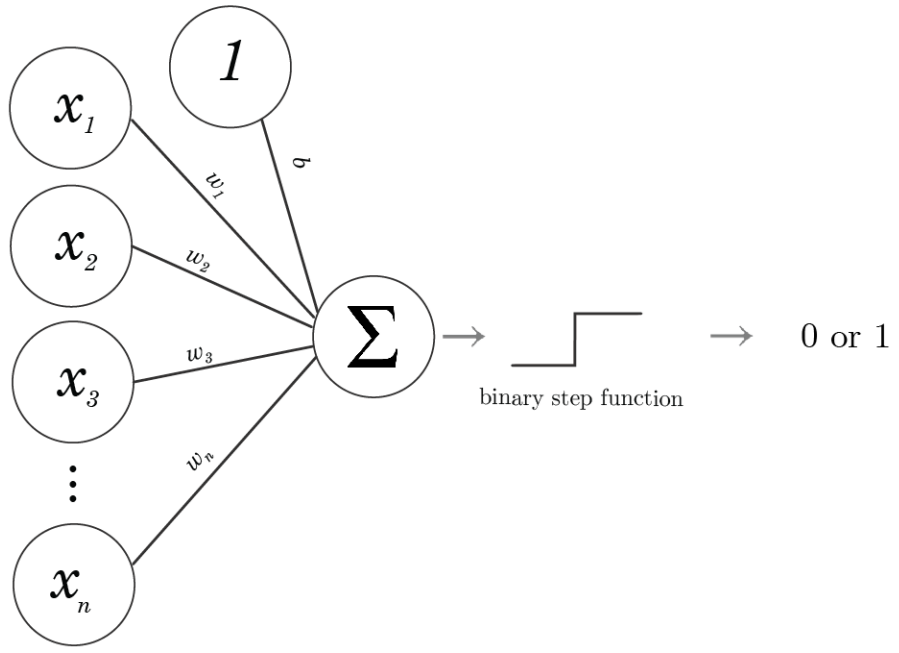
BOSTON UNIVERSITY

Boston University Questrom School of Business

The building block: The Perceptron

- Demo

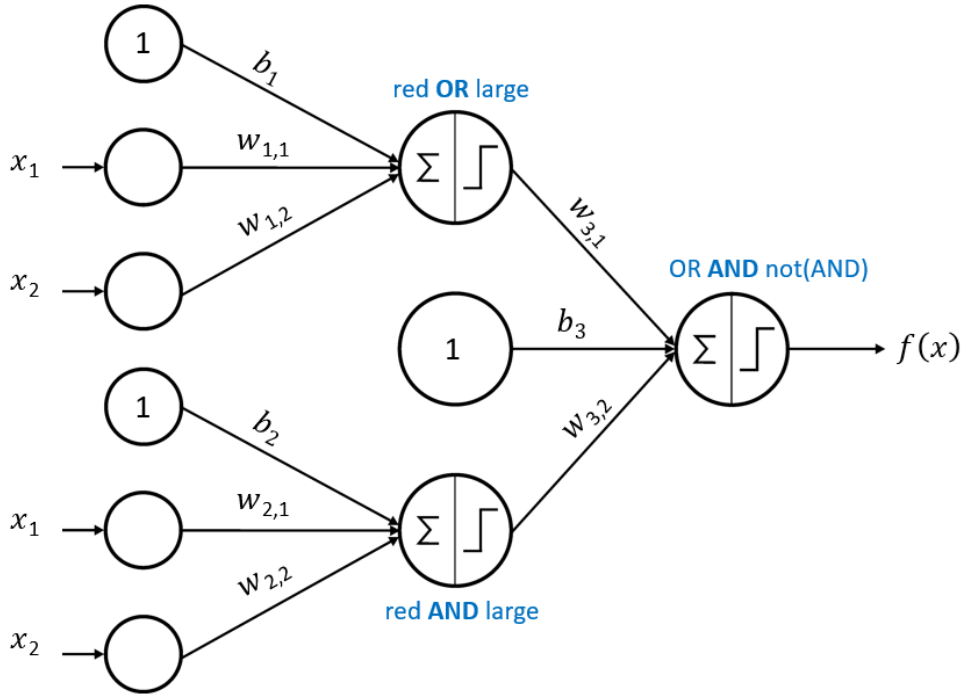
- Can we work around the “linear separability” issue”?



Adam Dhala

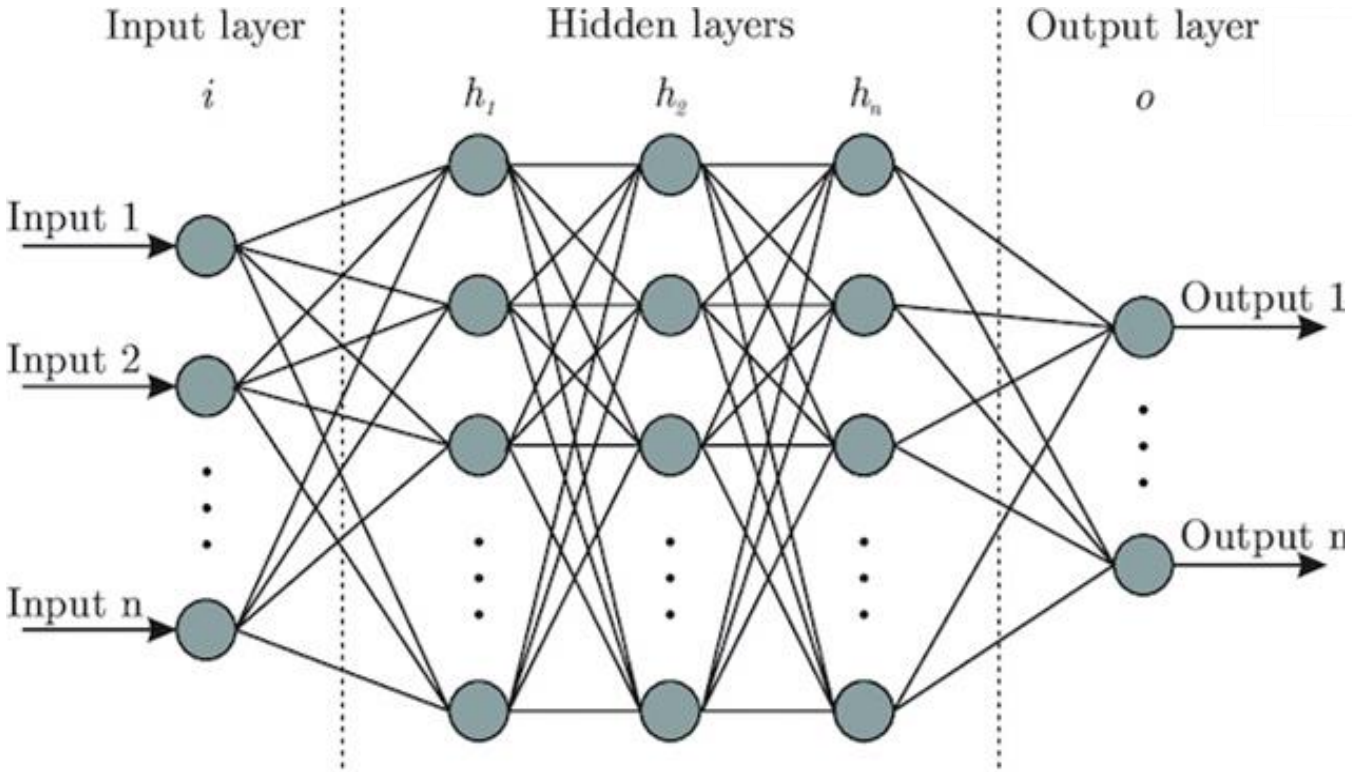
Power in Numbers: Multiple Perceptrons

- Demo



western-neuralnets.ca

Neural Newtorks

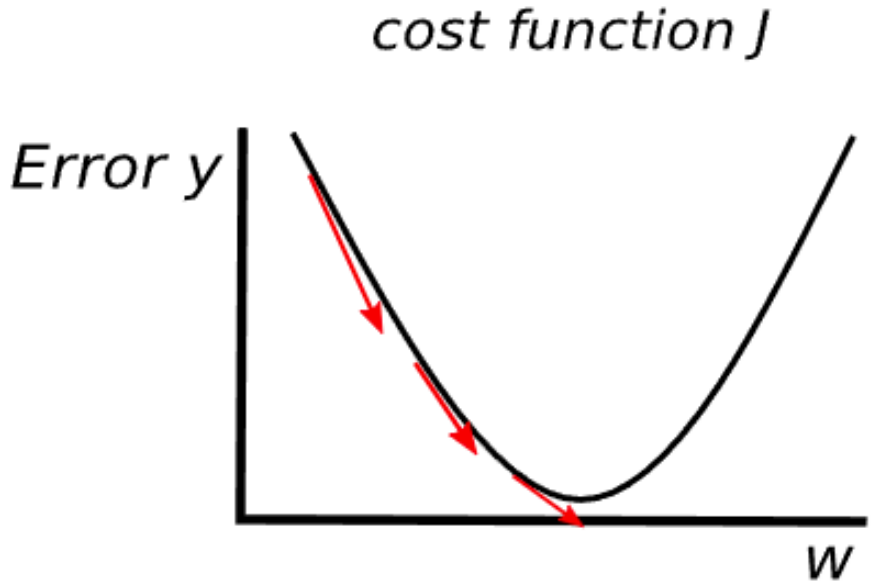


Neural Newtorks

- In theory, a single layer with an “infinite” number of neurons can approximate ANY function
  - In practice though…

Optimization

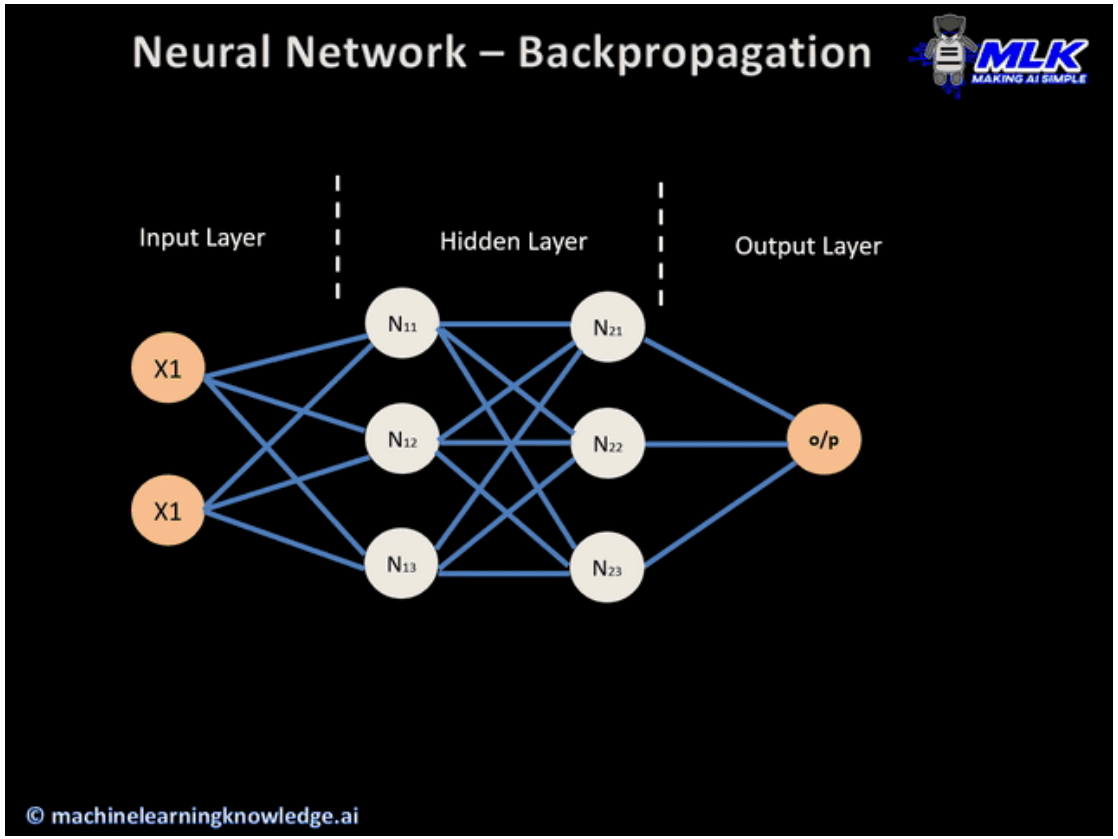
- The method that finds the best weights (i.e., weights that lead to lowest error).
  - Error ≡ loss ≡ cost function
  - Generally using gradient descent with backpropagation.



Elvira Siegel

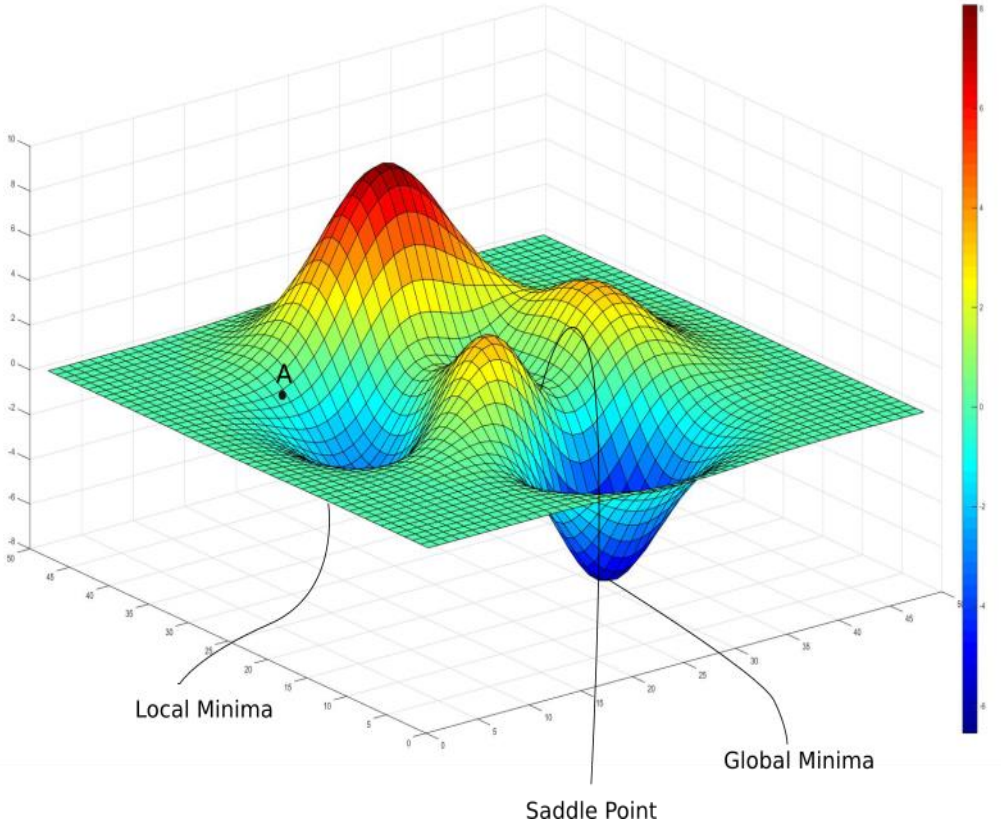
Optimization

- The method that finds the best weights (i.e., weights that lead to lowest error).
  - Error ≡ loss ≡ cost function
  - The method generally used is gradient descent with backpropagation.



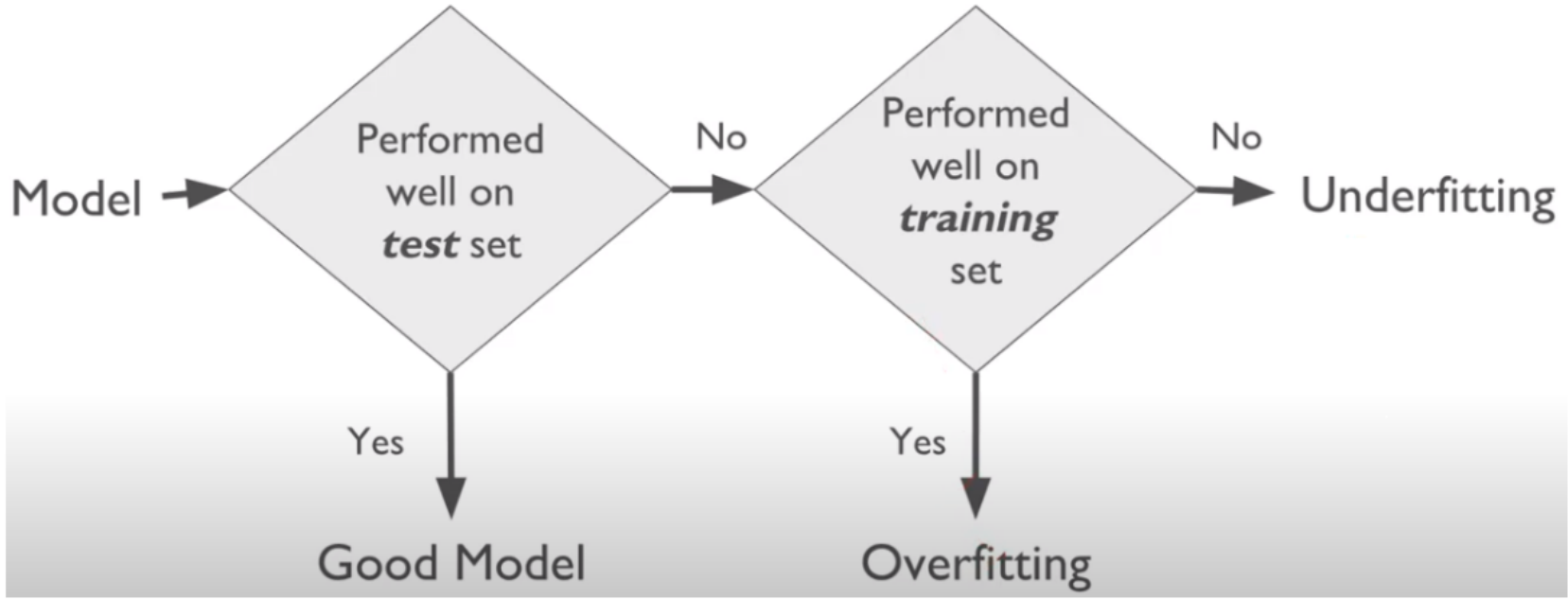
Optimization

- Can we always achieve lowest error?
- Demo



TechTalks

Overfitting and Underfitting



http://jcsites.juniata.edu/faculty/rhodes/ml/clusterAn.htm

Are the results bad?

- Check against a benchmark!
  - paperswithcode.com
  - kaggle.com
  - **huggingface.com

How do I improve my results?

- Best way: Get more **GOOD** data
  - If not, clean-up existing data.
- Are you overfitting or underfitting?
  - Overfitting: get more data or use a less complex model.
  - Underfitting: get a more complex model.
- Keep it simple!
  - Start with a simple model, simple data, simple code.
  - Test by component
  - Test by example