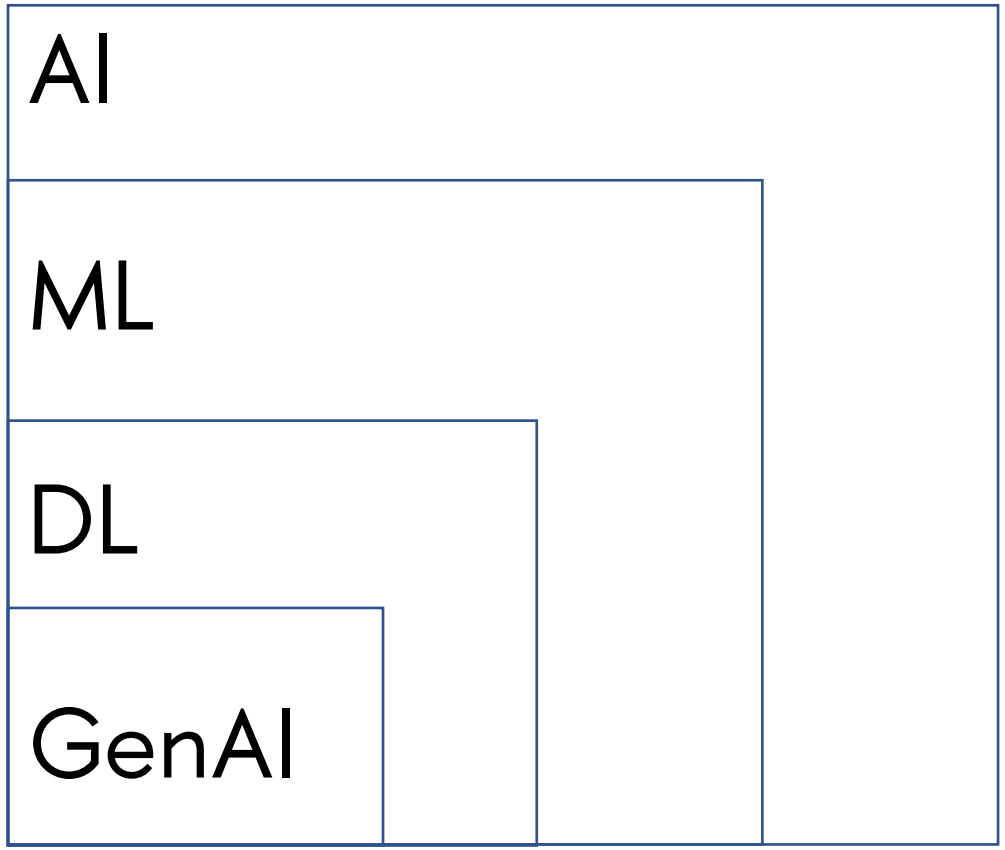
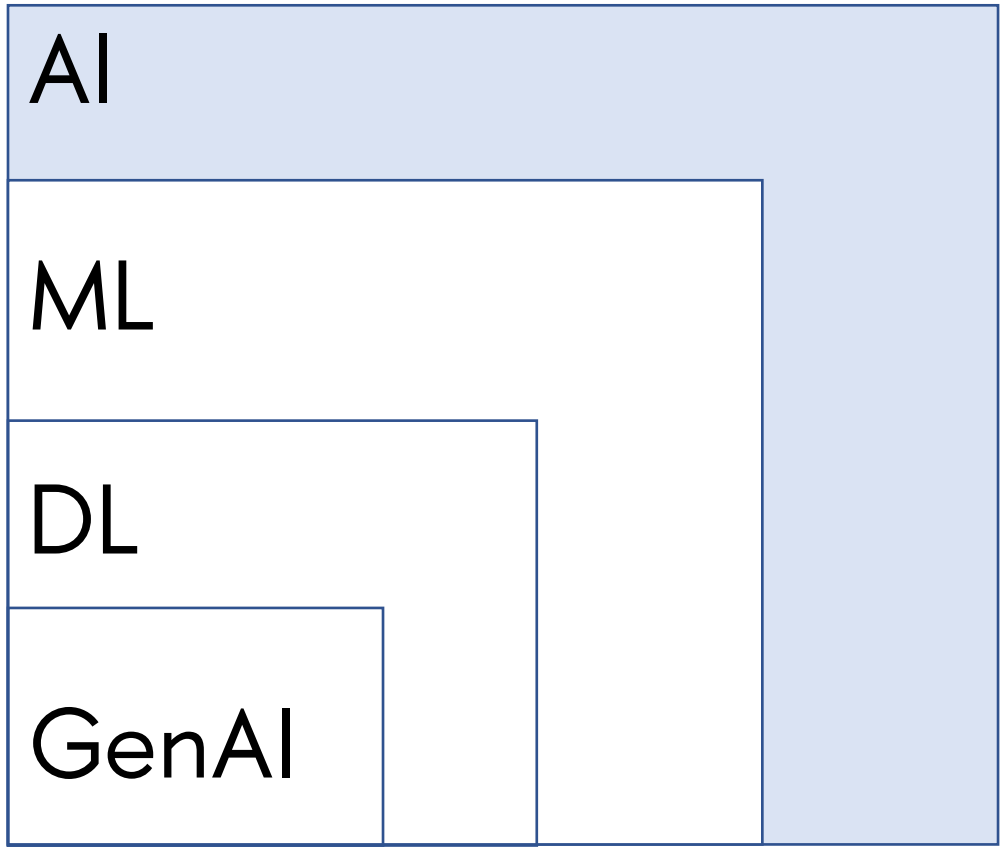
What is AI?

words or phrases

What is AI?





What does AI do?

But how?

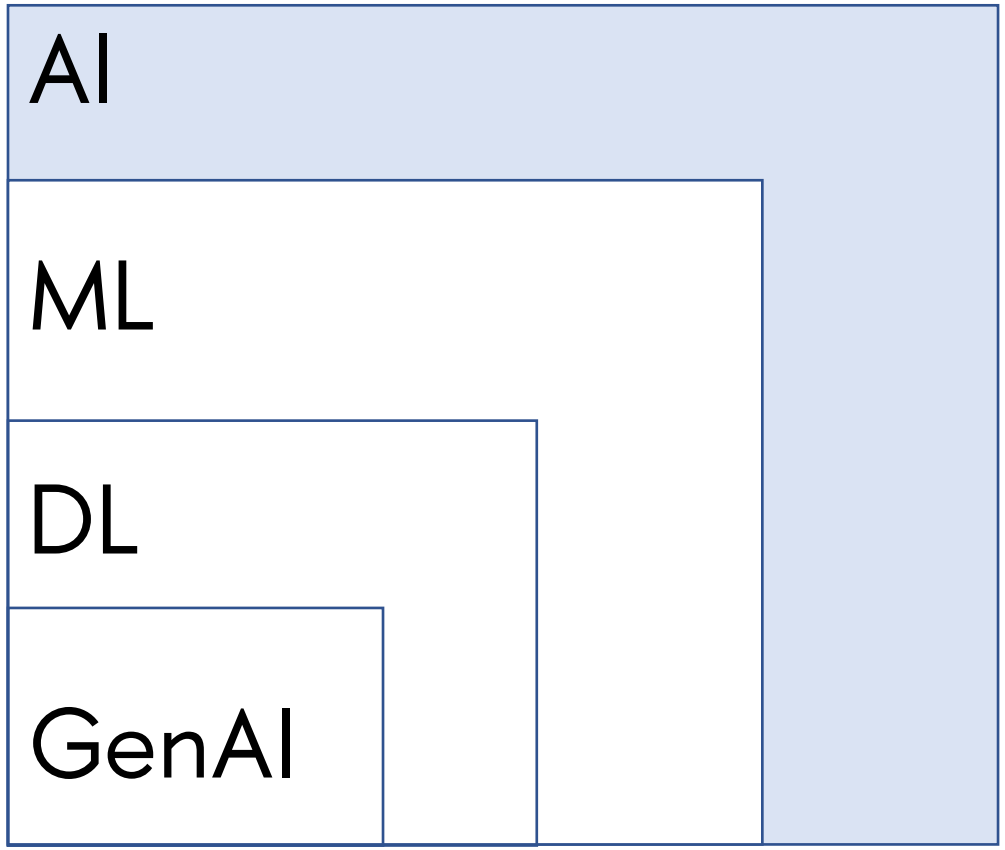
standard pipeline

What is an algorithm?

Activity: Draw a cat

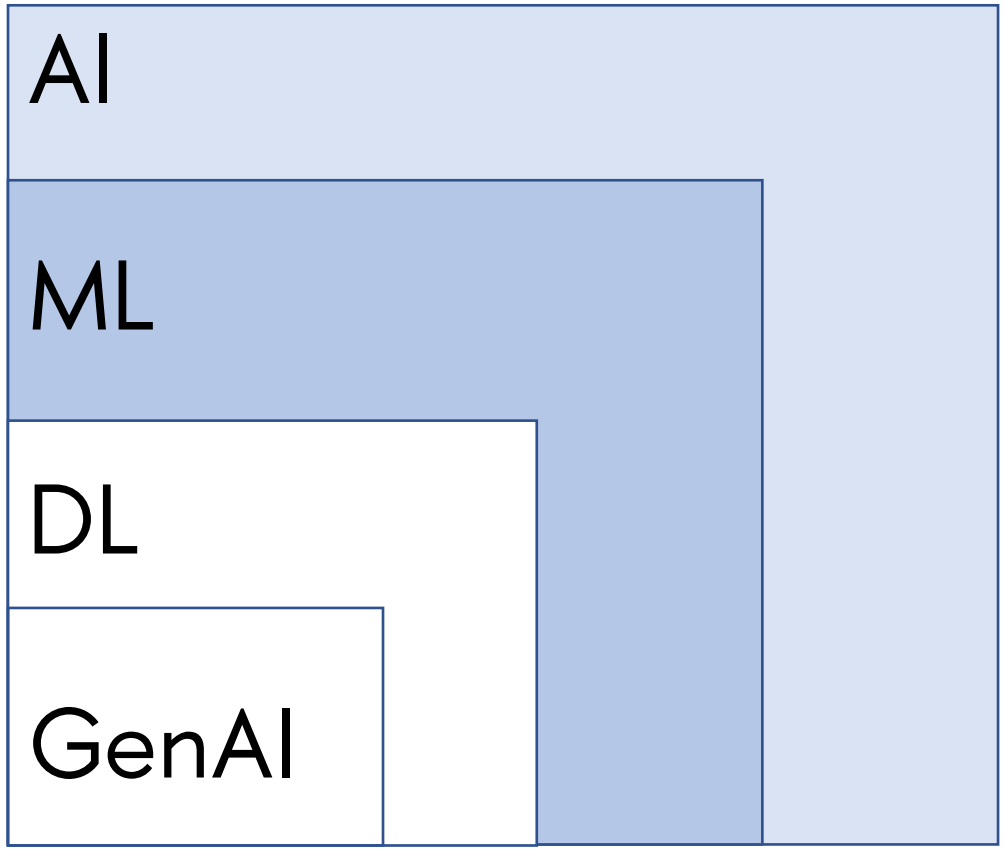
Optimization?

Potential stakeholders and values?

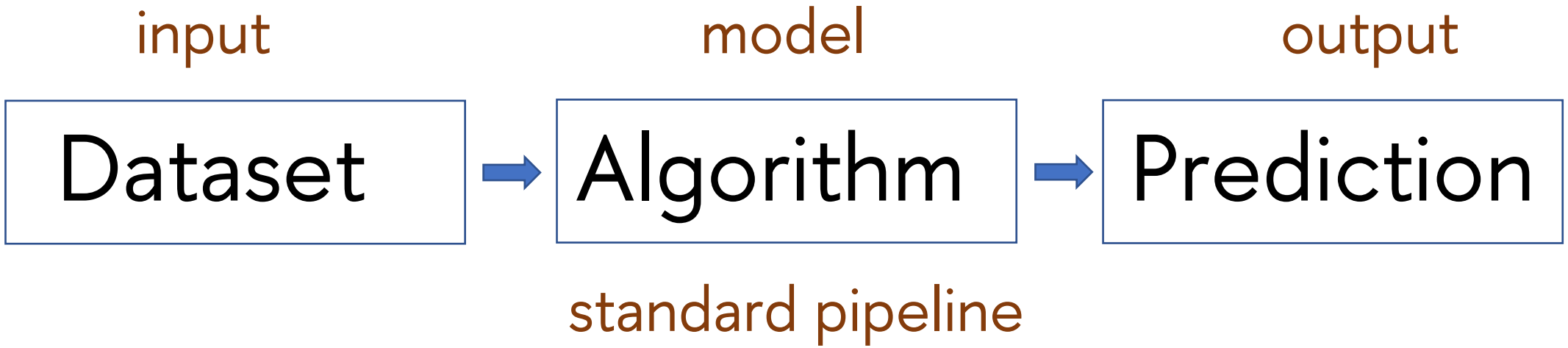


What does AI do?

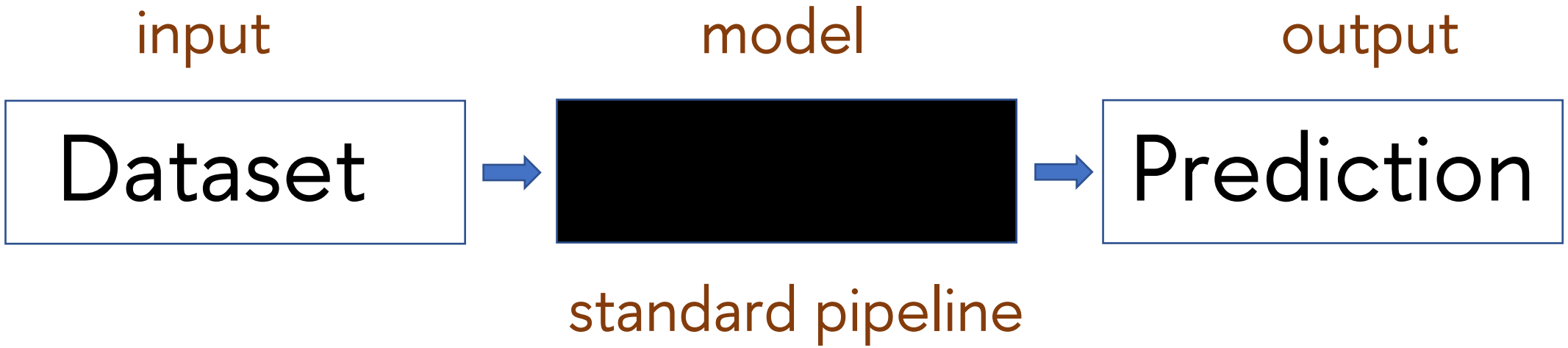
mimics human behavior



What about
Machine Learning?


input
model
output
Dataset
Algorithm
Prediction
standard pipeline

Black Box?



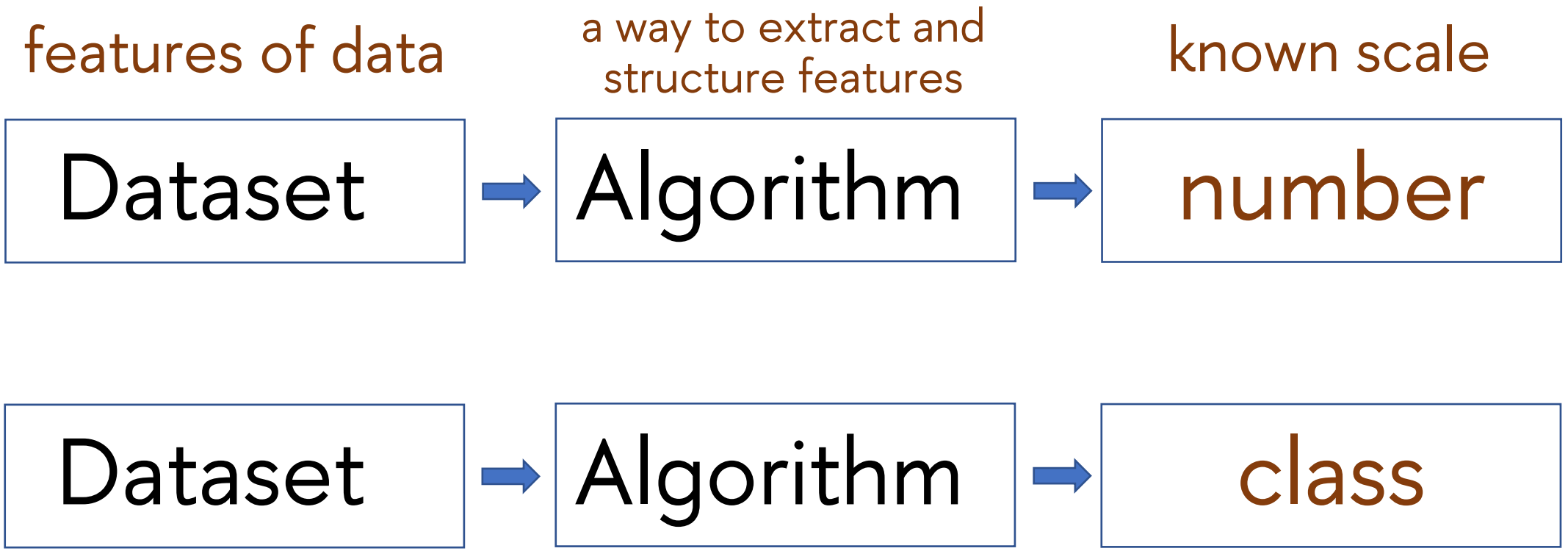
Machine Learning types

task-driven vs. data-driven

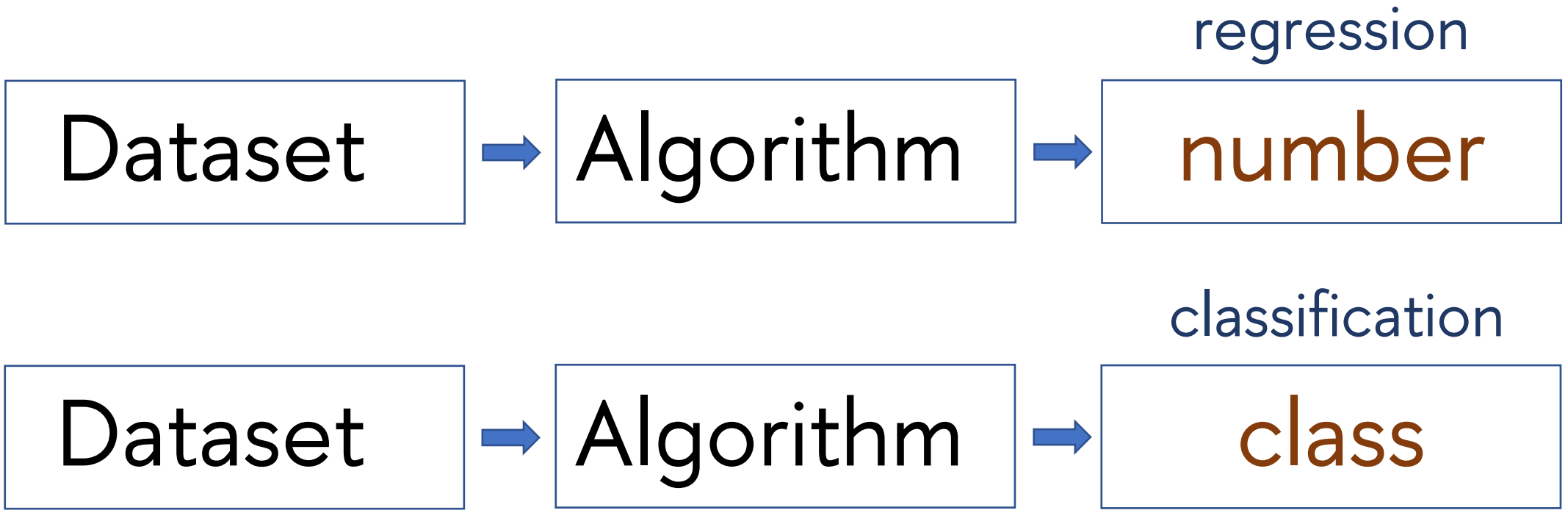
supervised vs. unsupervised

supervised ML

supervised ML



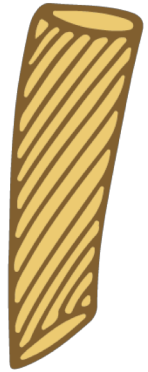
supervised ML



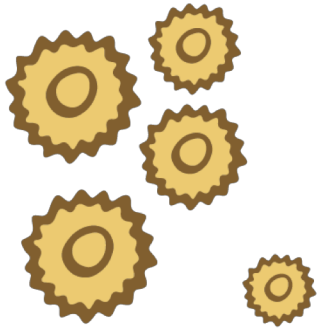
Classic ML algorithm: Decision Tree

stepwise selection of classifying feature(s)

Activity: Make a decision tree



Rigatoni

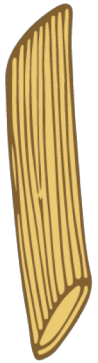


Pastina

Tortellini

Orzo

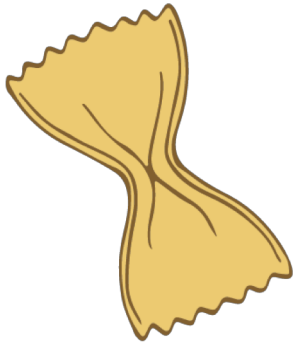
Ravioli



Penne

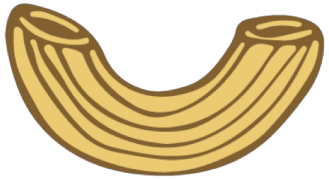
Activity: Make a decision tree

pasta challenge

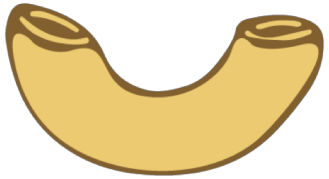


Farfalle

Spaghetti

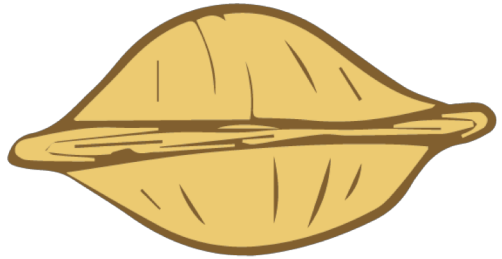


Elbows



Macroni

Gemelli



Shell

Different? What is the best?

Stable? Optimize?

Classic ML algorithm: Random Forest

simplified: choose classes and max-vote

Random Forest and regression task?

Linear Regression and regression task?

supervised ML

econometrics?
~~supervised ML~~

the two cultures

Data Modeling: econometrics

assumptions on Data
(data come from a generating process)

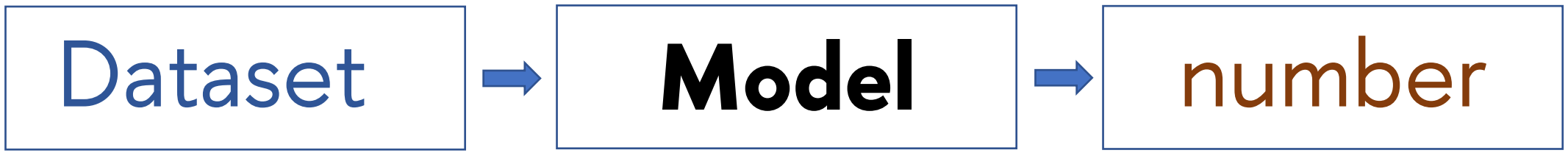
~~assumptions on~~ Data

Algorithmic Modeling: ML

the two cultures

Data Modeling: econometrics

assumptions on Data
(data come from a generating process)



~~assumptions on~~ Data

Algorithmic Modeling: ML

machine learning $\sim$ "lazy" econometrics ?

in the context of linear regression

machine learning is about specific procedure

to learn the model to fit the data

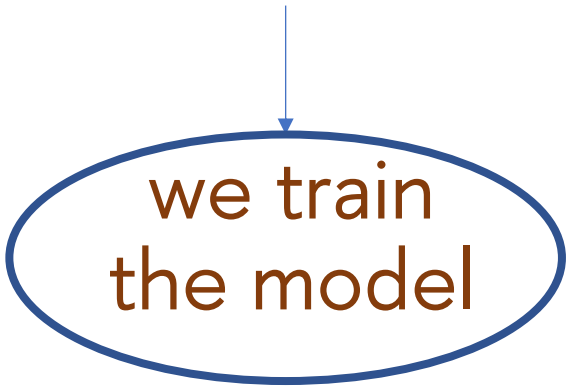
machine learning is about specific procedure

to learn the model to fit the data

we train
the model

machine learning is about specific procedure

to learn the model to fit the data



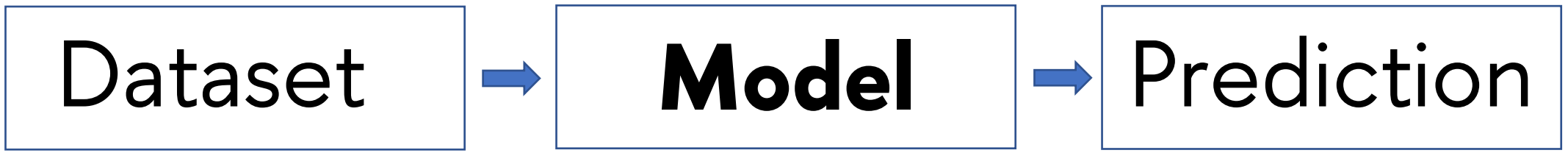
new Algorithm?

supervised ML

features of data

the way to extract and structure features

known scale

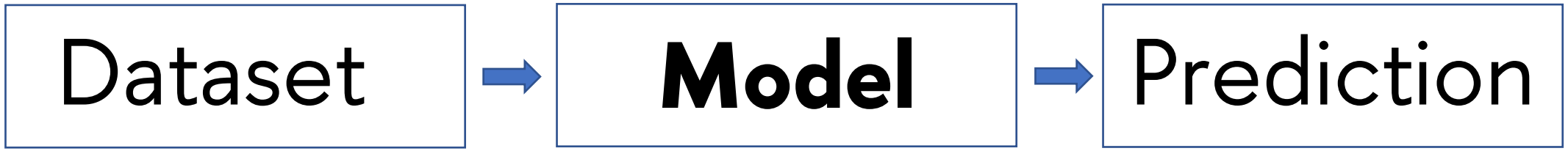


supervised ML

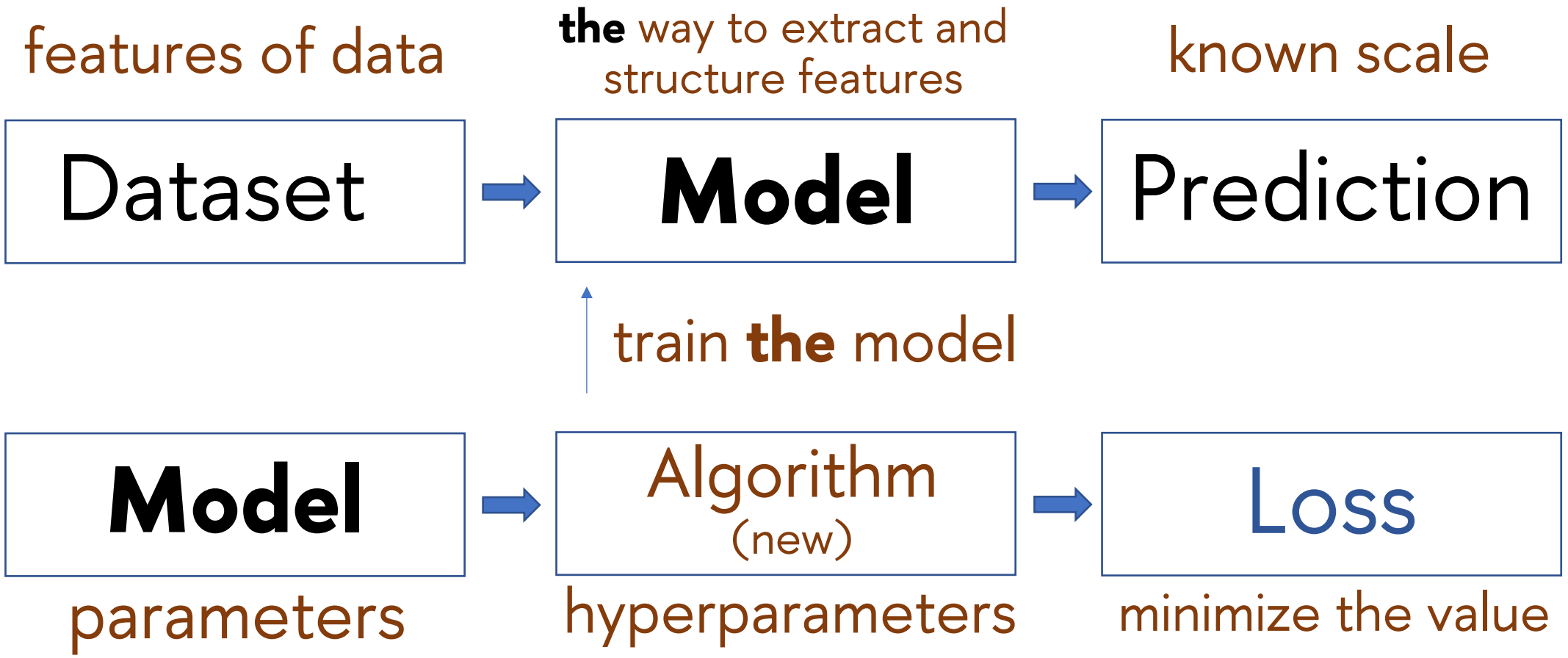
features of data

the way to extract and structure features

known scale

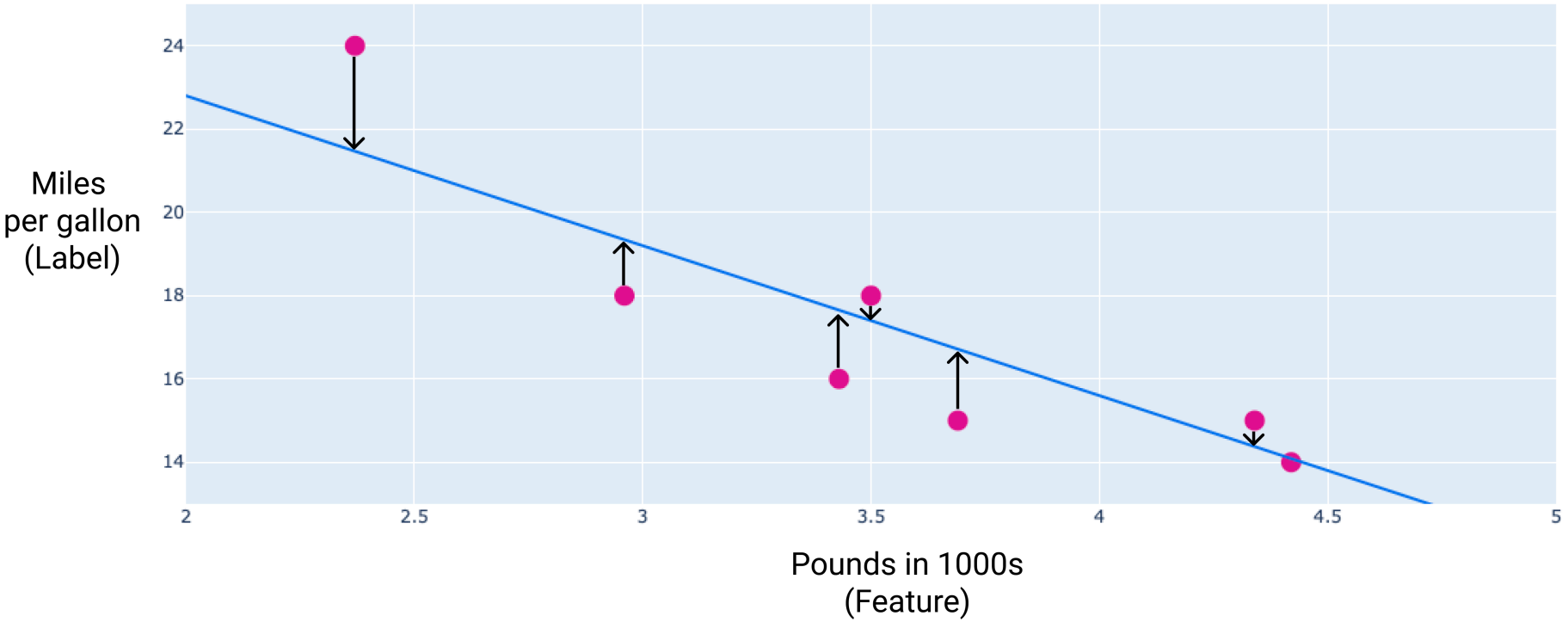


supervised ML



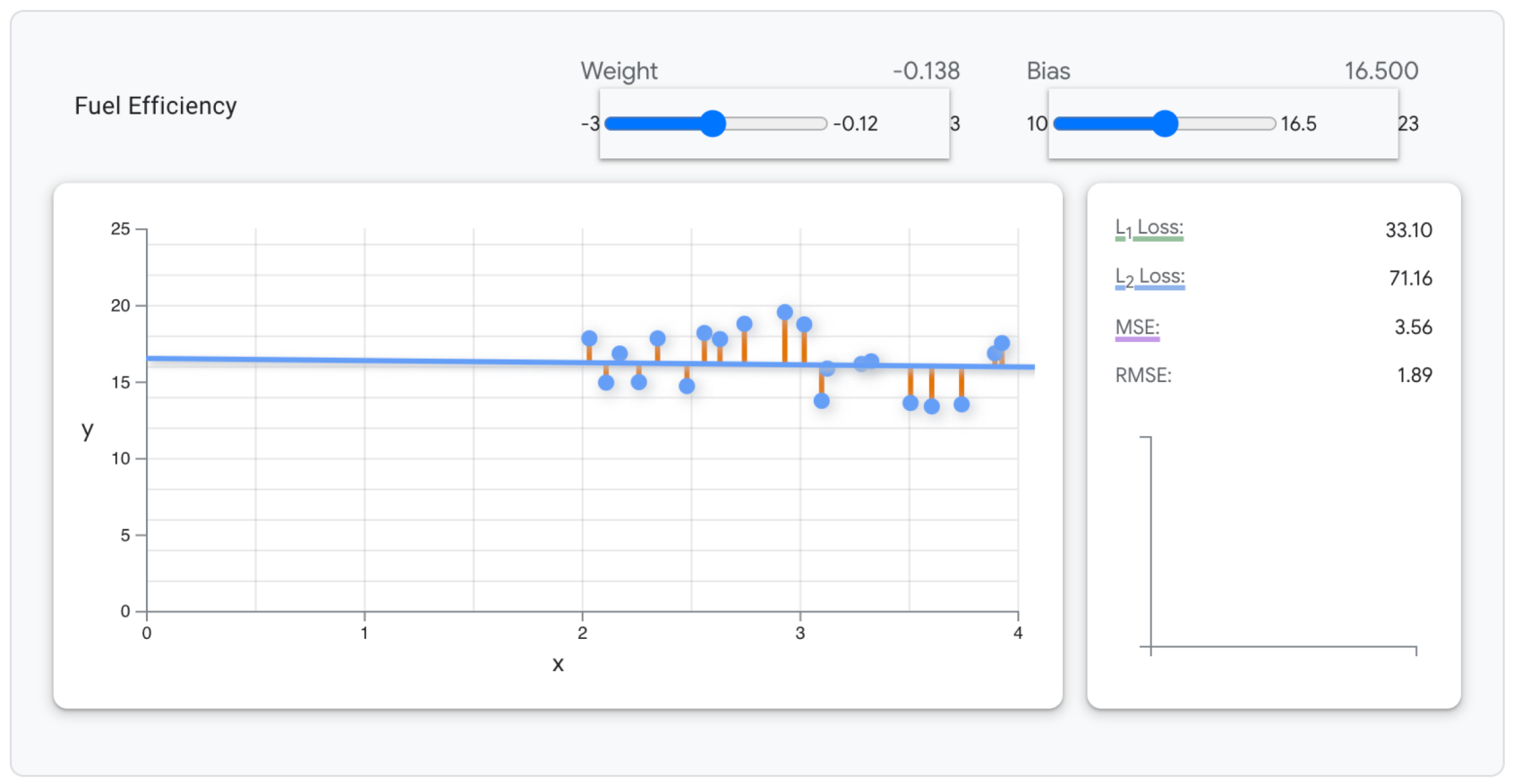
one algorithm inside another algorithm

Loss: sample illustration



https://developers.google.com/machine-learning/crash-course/linear-regression/loss

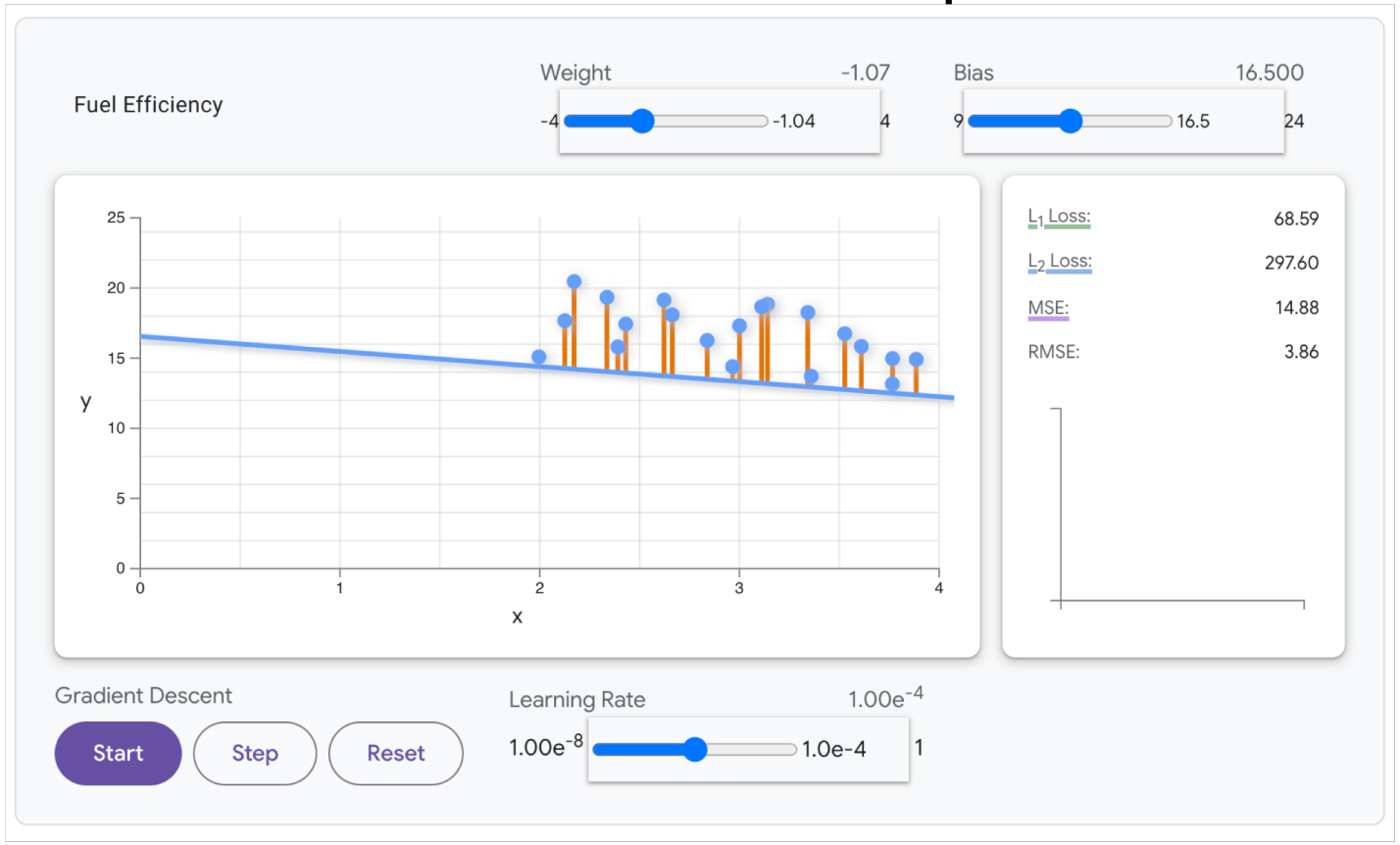
Loss: sample illustration
(interactive example)



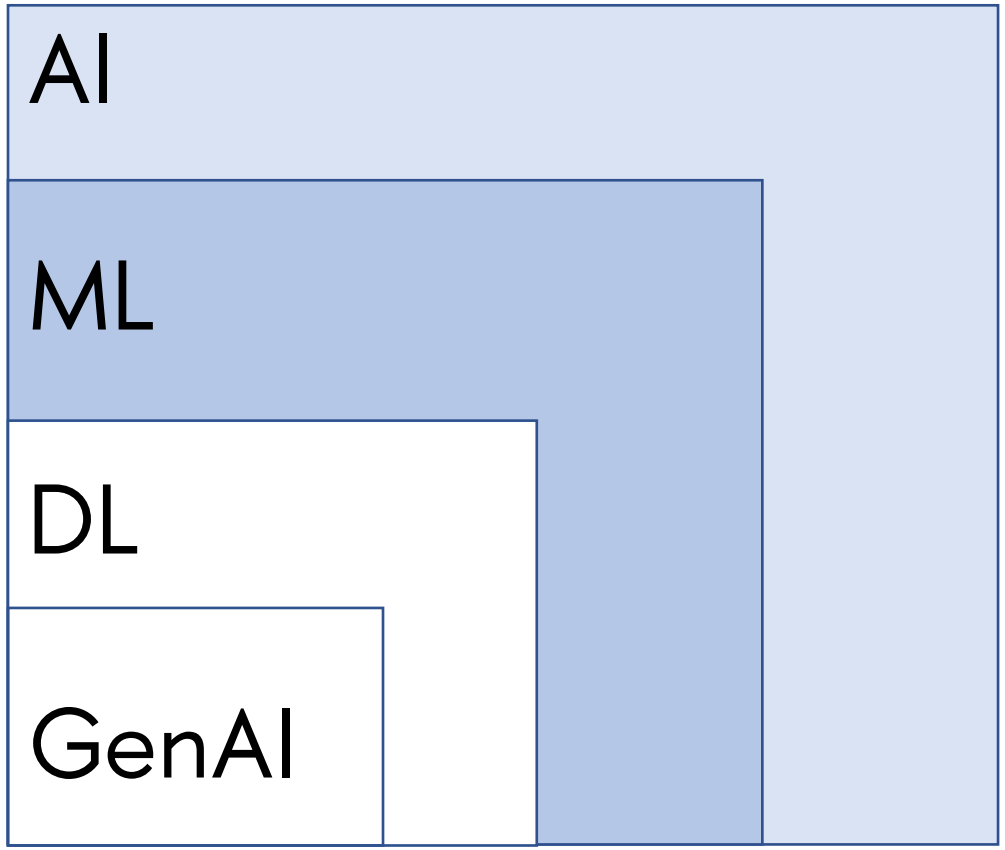
https://developers.google.com/machine-learning/crash-course/linear-regression/parameters-exercise

How to automate?
What new Algorithm?

Gradient Descent: sample illustration
(interactive example)

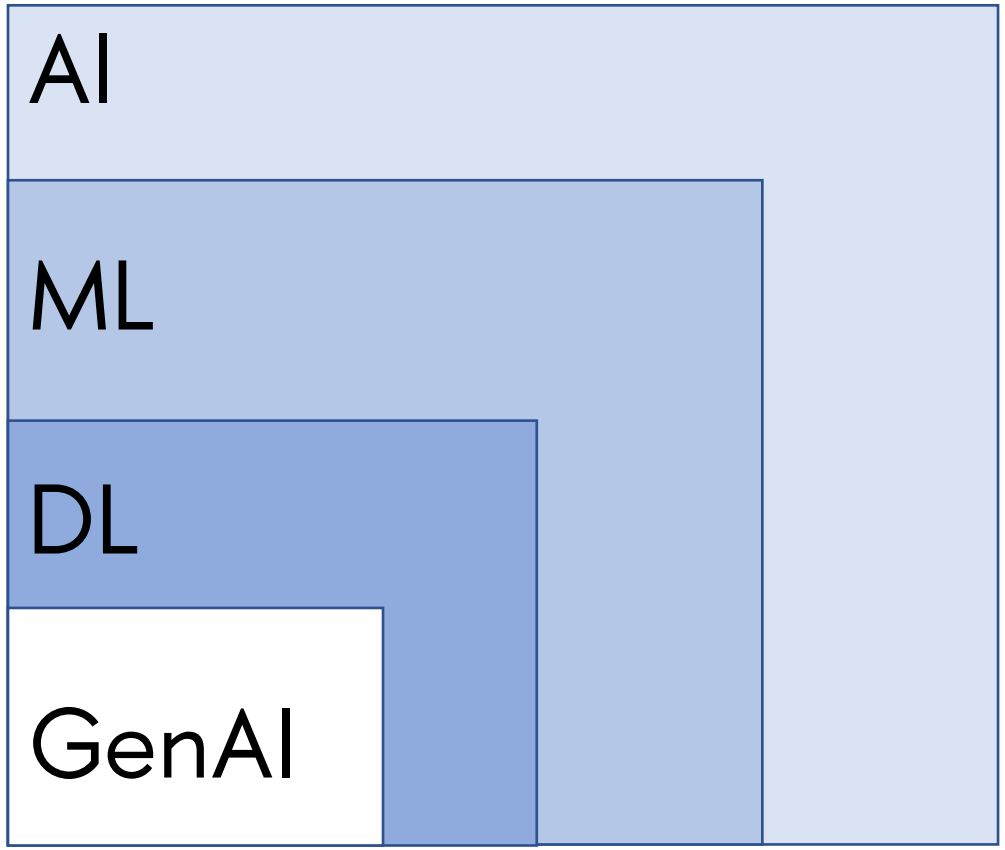


https://developers.google.com/machine-learning/crash-course/linear-regression/gradient-descent-exercise

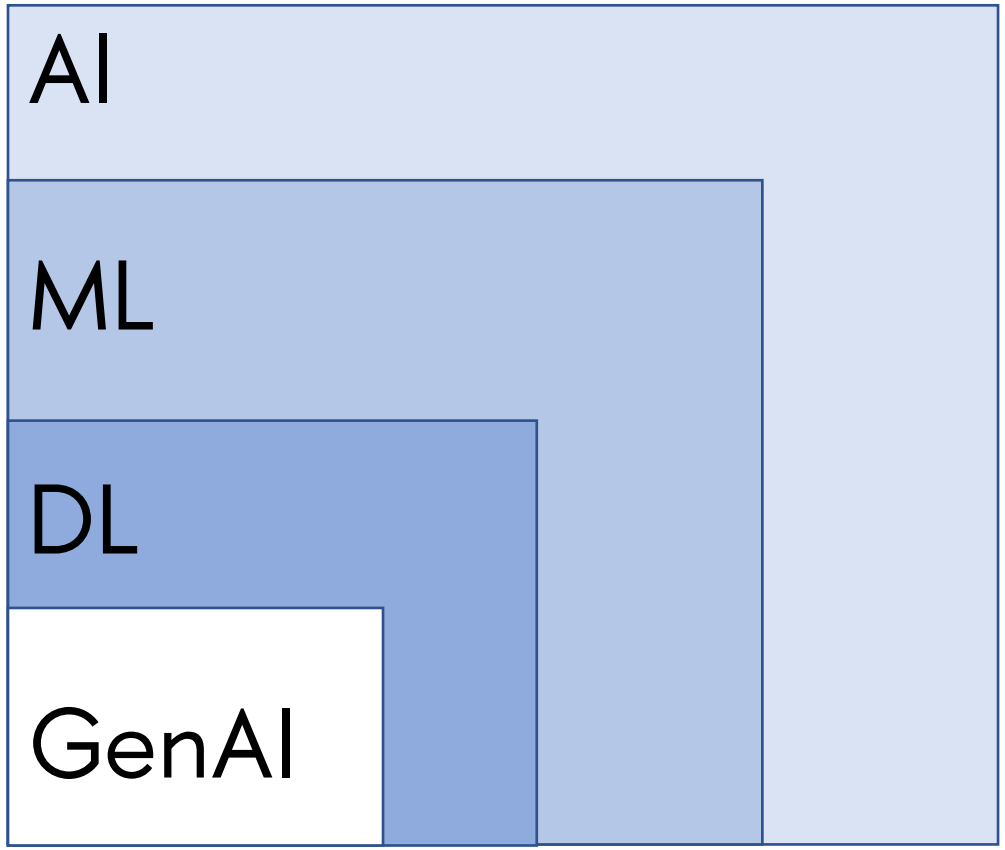


What about Machine Learning?

specific procedure and algorithms to match input with output

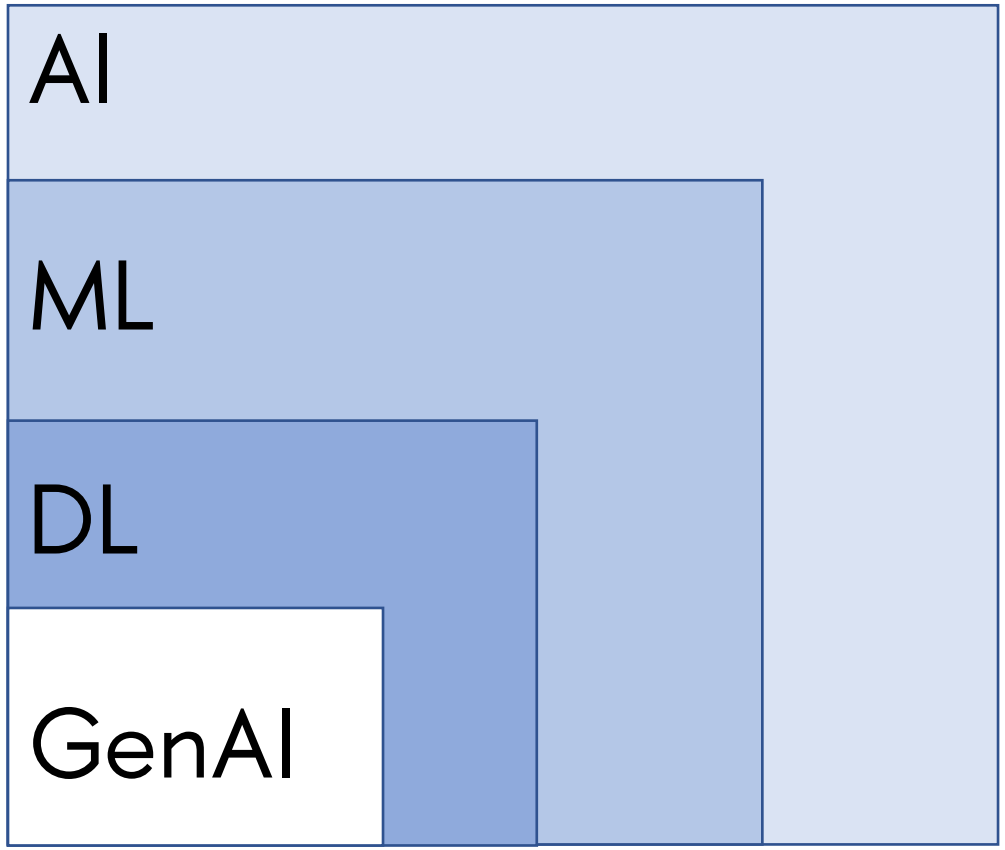


What about
Deep Learning?



What about Deep Learning?

Neural Networks

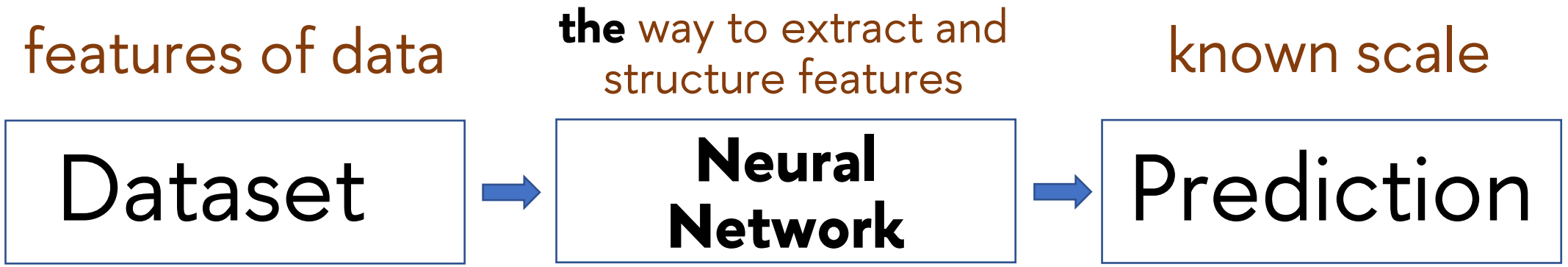


What about Deep Learning?

Deep
Neural Networks

What is a Neural Network?

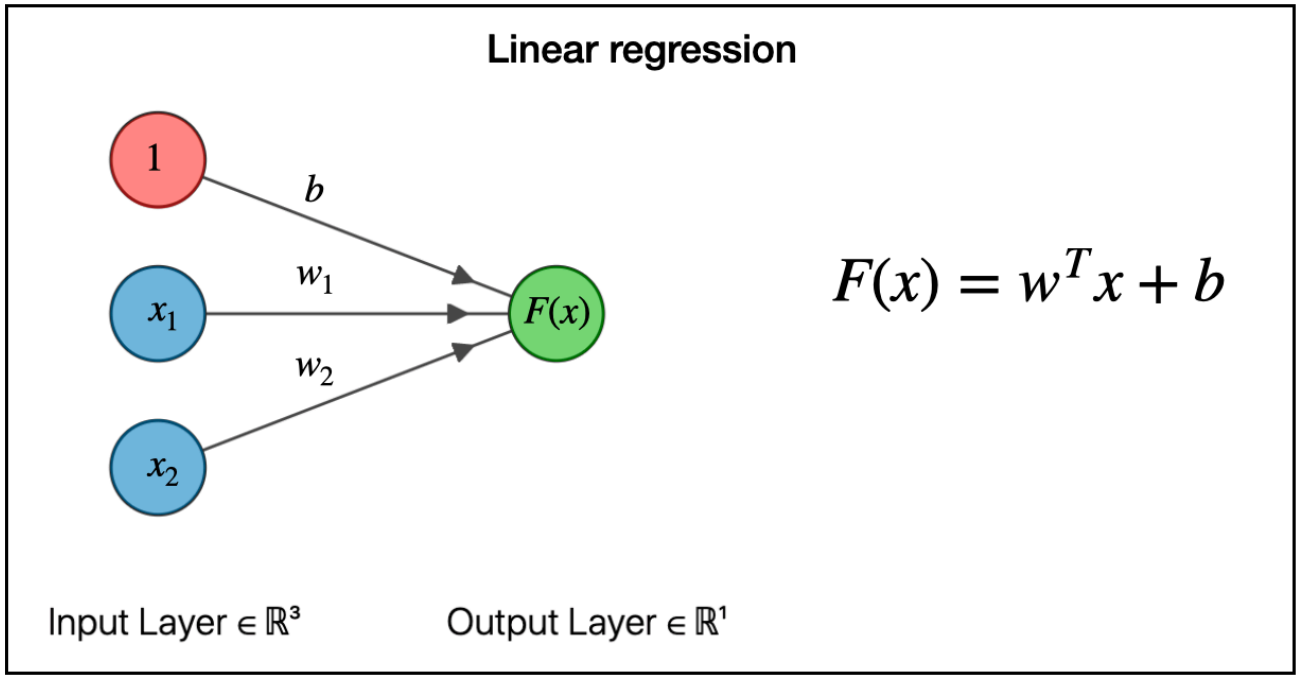
Neural Network ~ "the laziest" algorithm in ML?


features of data
the way to extract and structure features
known scale
Dataset
Neural Network
Prediction

linear regression as Neural Network?

an example

Neural Network as linear regression

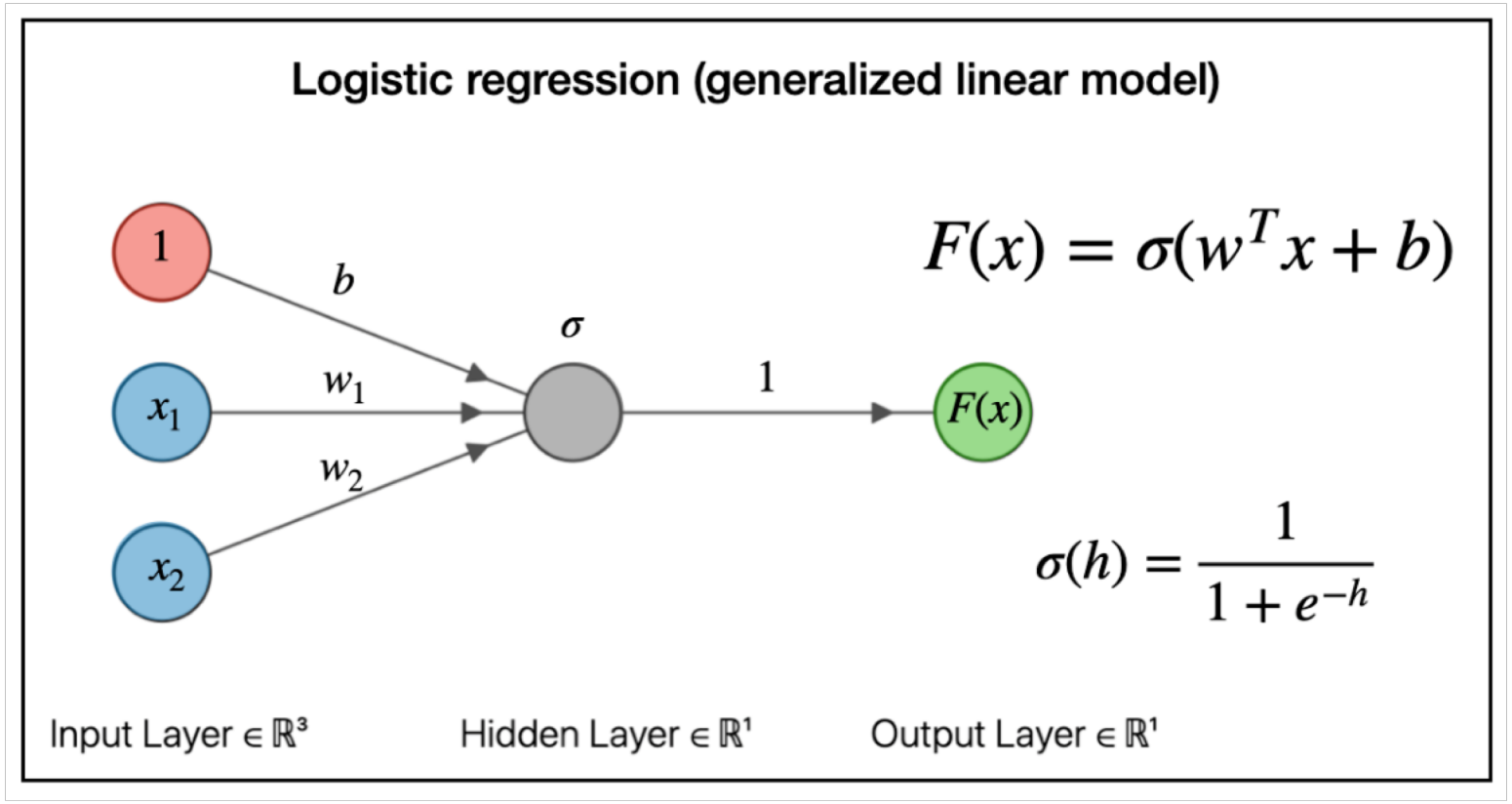


$$F(x) = w^T x + b$$

$$F(x) = w_1 \cdot x_1 + w_2 \cdot x_2 + 1 \cdot b$$

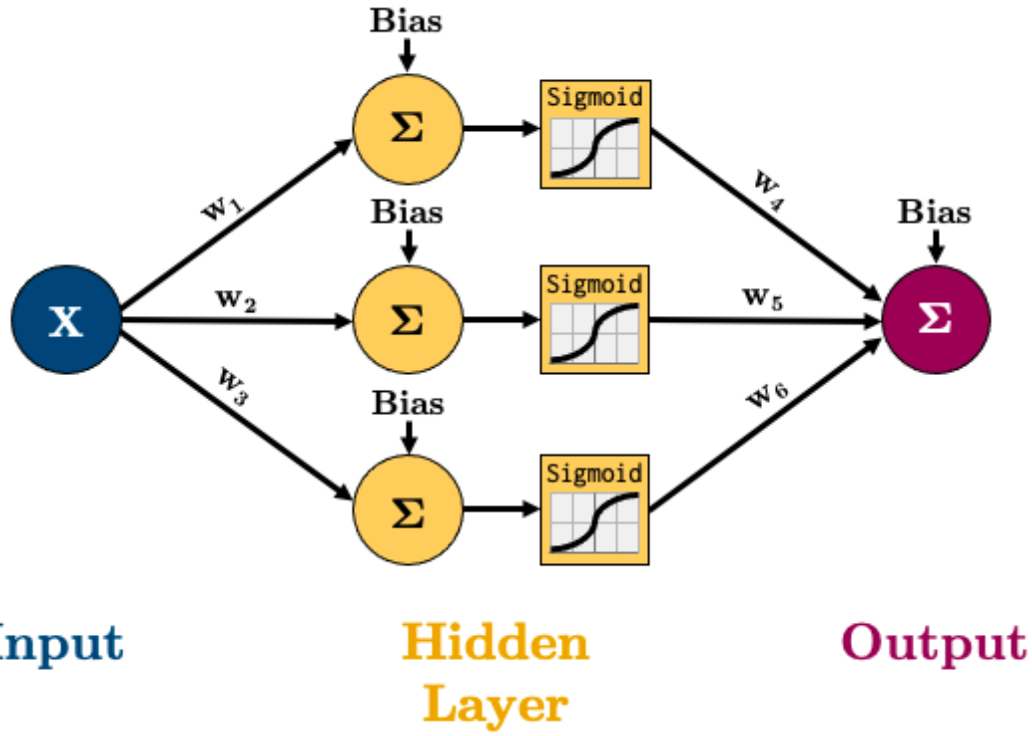
https://joshuagoings.com/2020/05/05/neural-network/

Neural Network as logistic regression



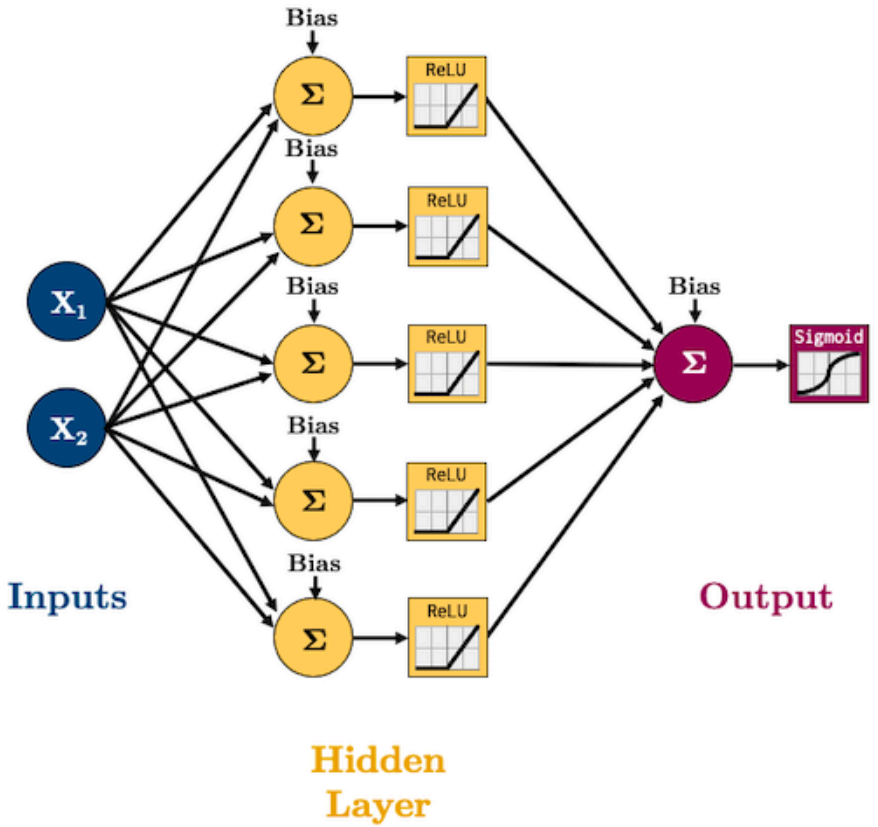
https://joshuagoings.com/2020/05/05/neural-network/

Neural Network with one hidden layer



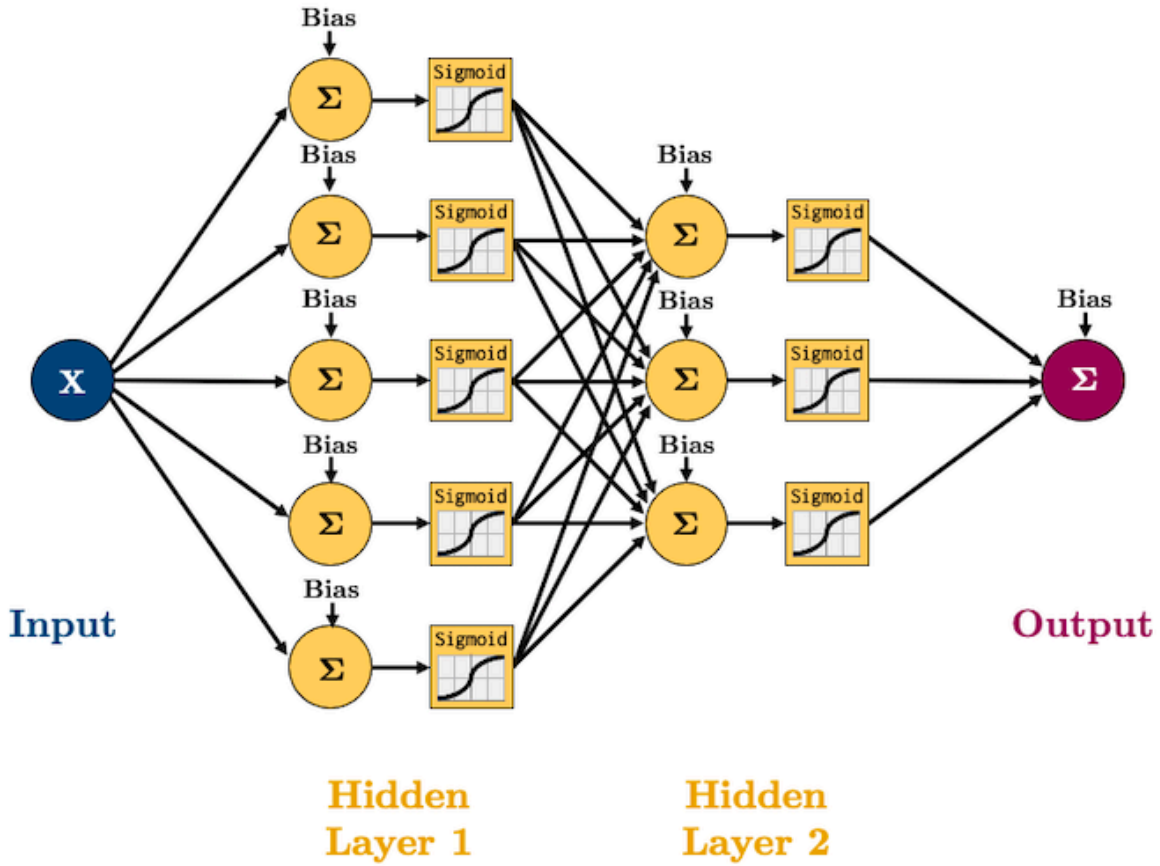
https://www.tomasbeuzen.com/deep-learning-with-pytorch/chapters/chapter3_pytorch-neural-networks-pt1.html

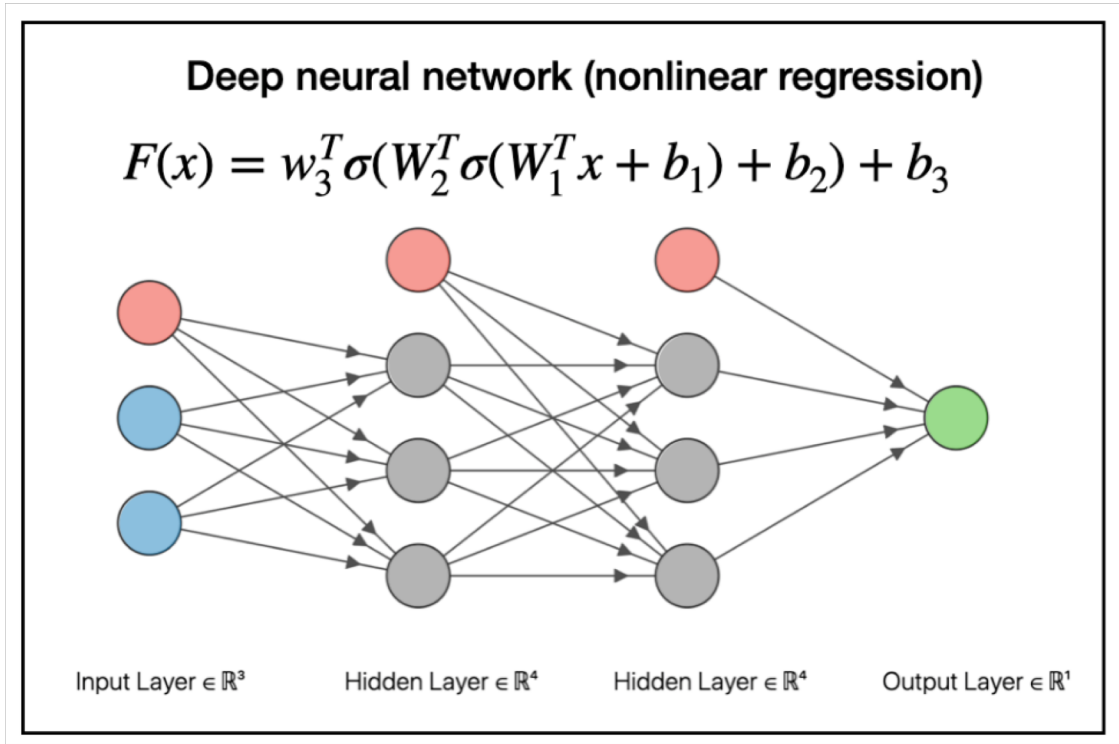
Neural Network with one hidden layer



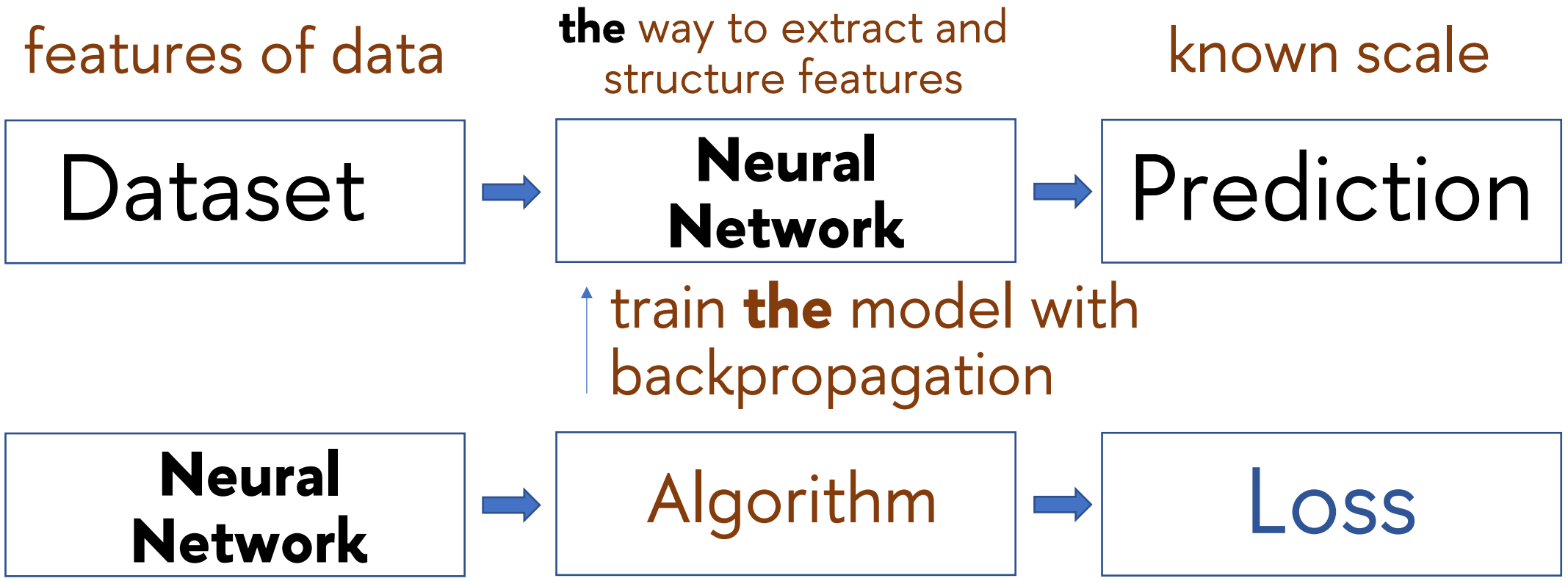
https://www.tomasbeuzen.com/deep-learning-with-pytorch/chapters/chapter3_pytorch-neural-networks-pt1.html

Deep Neural Network





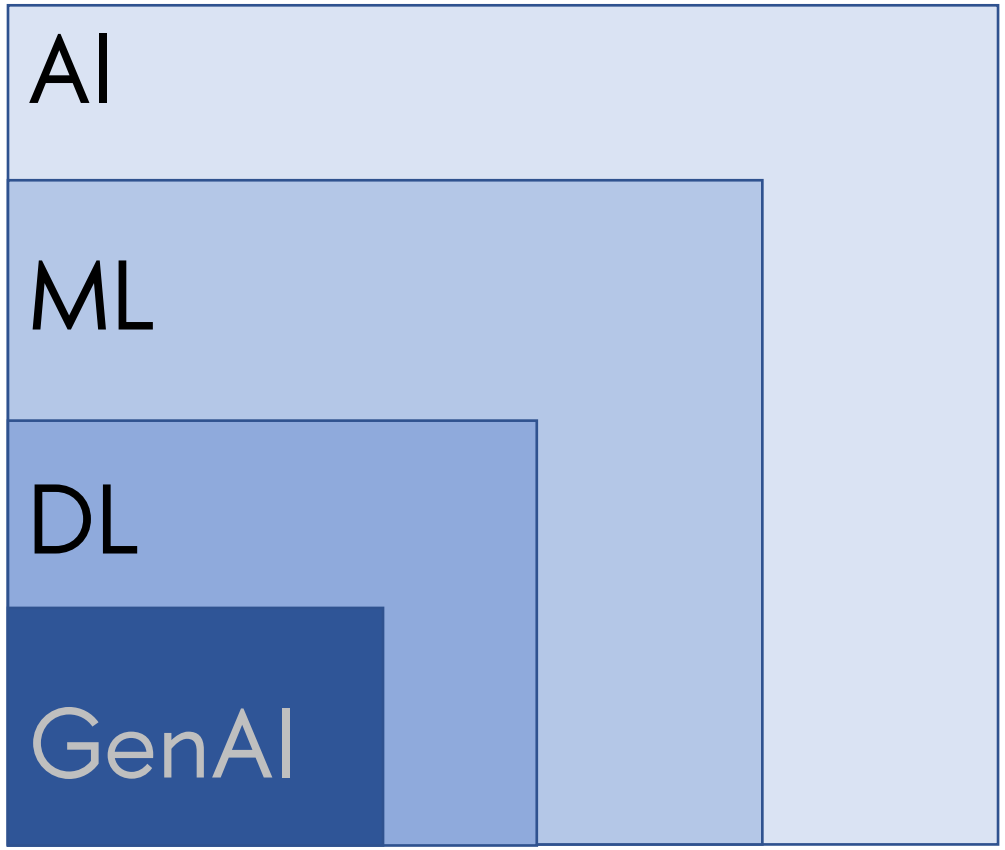
Ibid



Detailed view: https://www.tomasbeuzen.com/deep-learning-with-pytorch/chapters/chapter4_neural-networks-pt2.html

Neural Network
(interactive exercises)

https://developers.google.com/machine-learning/crash-course/neural-networks/interactive-exercises



What about Generative AI?