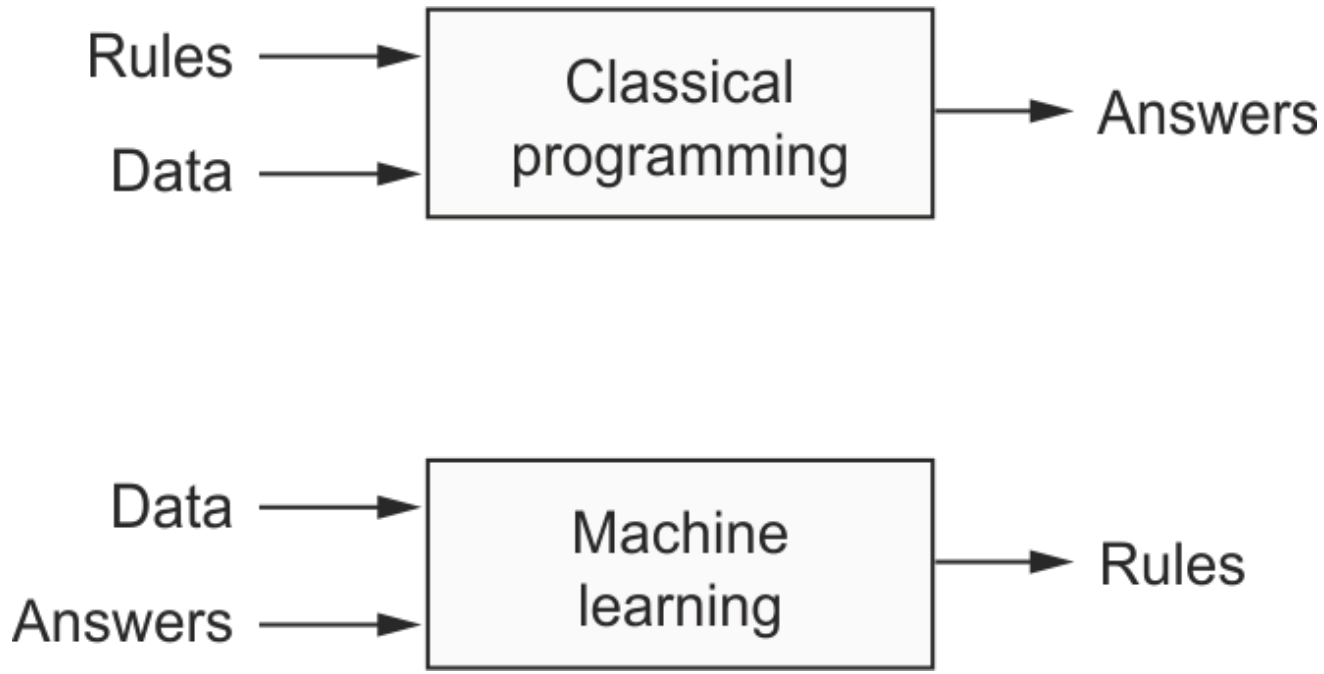
Introduction to Artificial Intelligence

September 20th, 2019

Rule-based System vs. Machine Learning



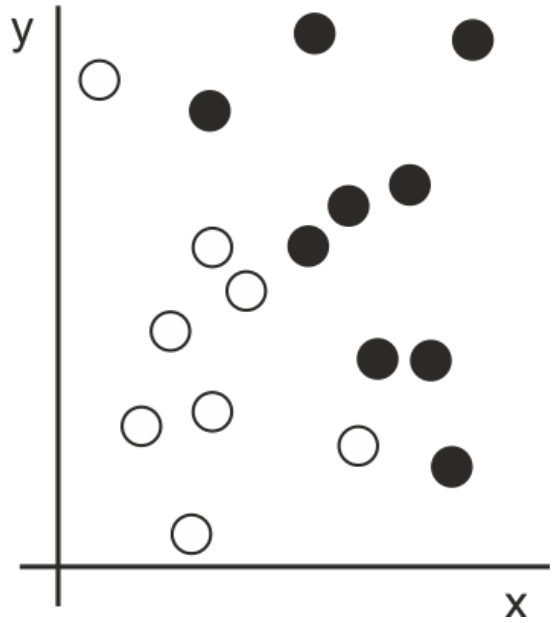
Machine Learning Algorithms – Learns Representations from Data

- To do machine learning, we need three things:
- *Input data points*
  - If the task is speech recognition, data points could be sound files of people speaking. If the task is image tagging, they could be pictures.
- *Examples of the expected output*
  - In a speech-recognition task, these could be human-generated transcripts of sound files. In an image task, expected outputs could be tags such as “dog,” “cat,” and so on.
- *A way to measure whether the algorithm is doing a good job*
  - This is necessary in order to determine the distance between the algorithm’s current output and its expected output. The measurement is used as a feedback signal to adjust the way the algorithm works. This adjustment step is what we call *learning*.

Machine-learning models

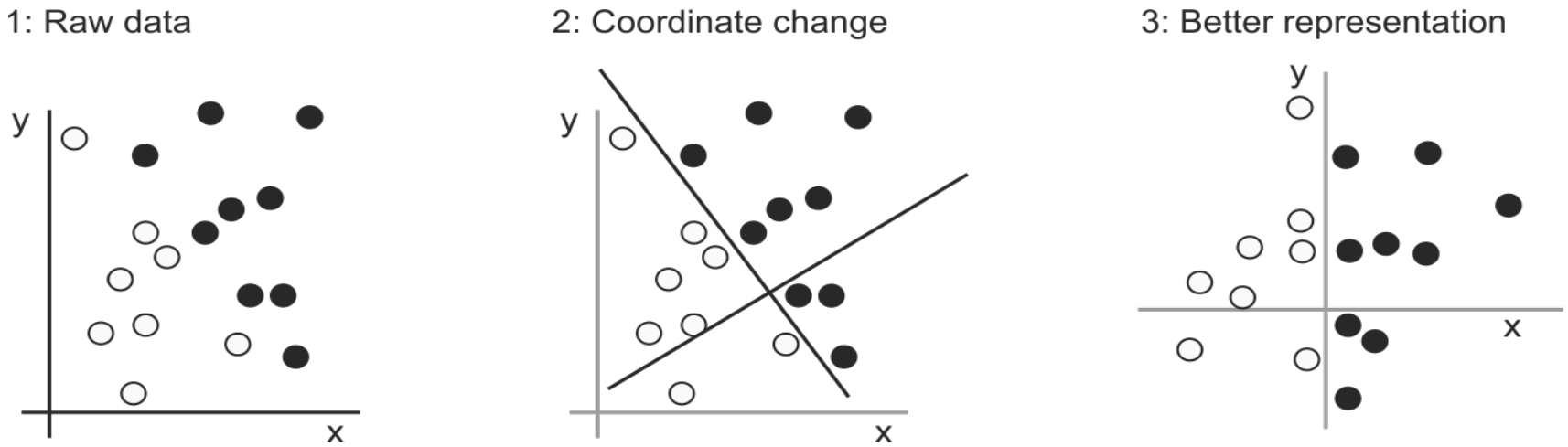
- They are all about finding appropriate representations for their input data—transformations of the data that make it more amenable to the task at hand, such as a classification task

Machine-learning Models Example



- The inputs are the coordinates of our points.
- The expected outputs are the colors of our points.
- A way to measure whether our algorithm is doing a good job could be, for instance, the percentage of points that are being correctly classified.

Machine-learning Models Example

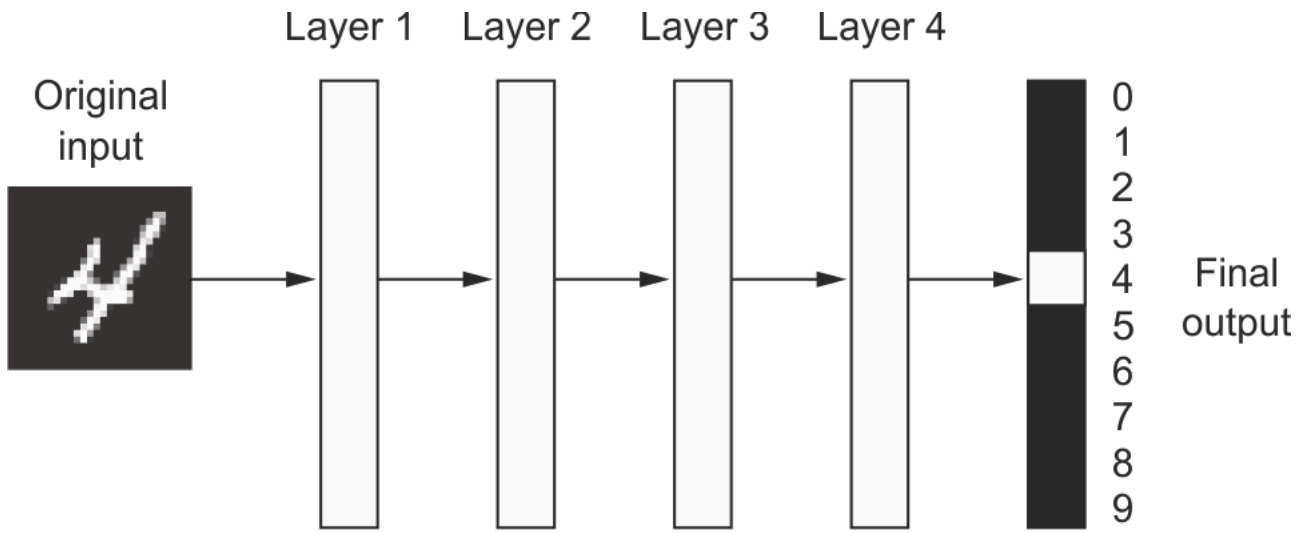


"Black points are such that x > 0," or "White points are such that x < 0."

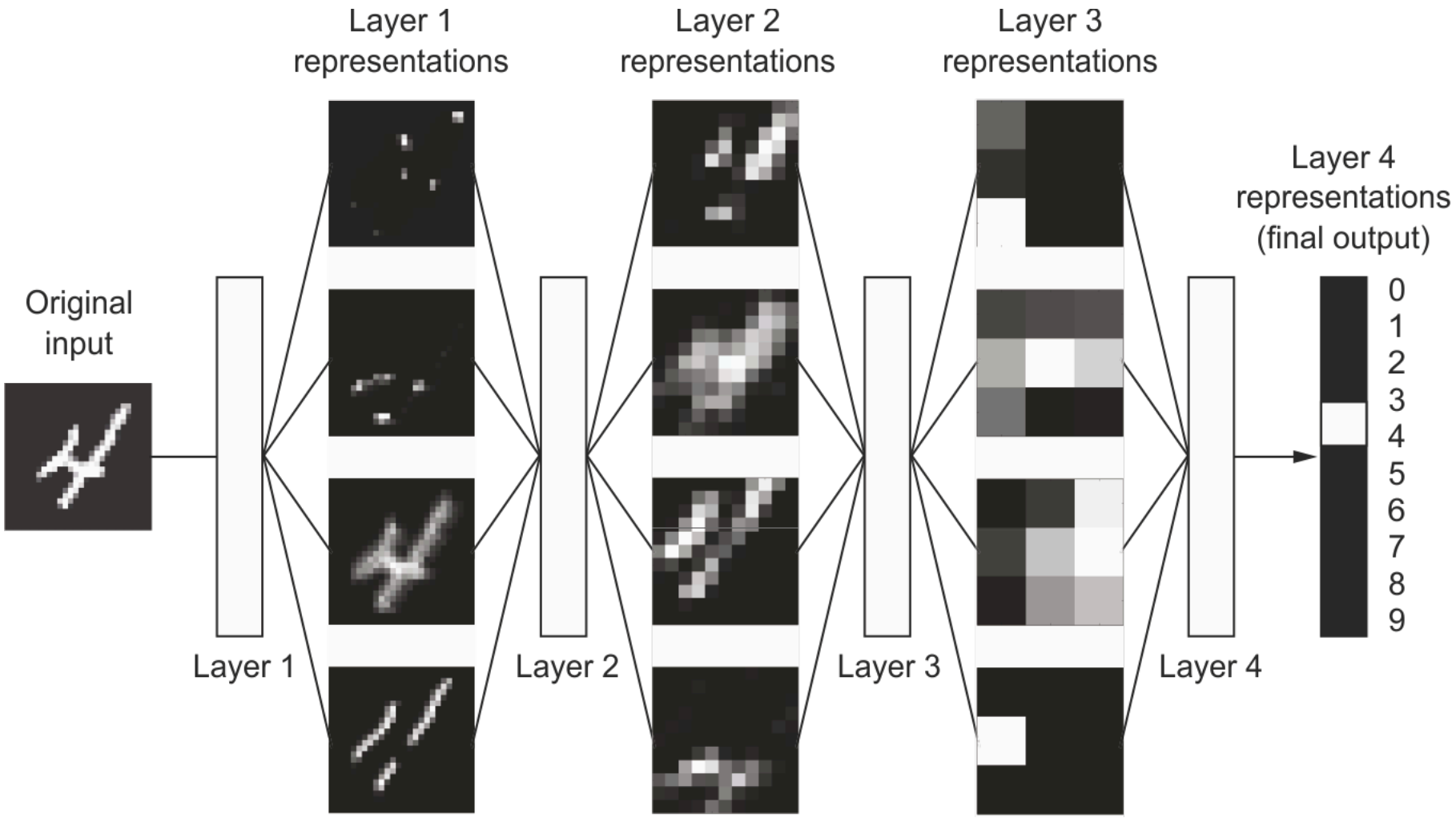
- In this case, we defined the coordinate change by hand.
- But if instead we tried systematically searching for different possible coordinate changes, and used as feedback the percentage of points being correctly classified, then we would be doing machine learning.
- ***Learning*, in the context of machine learning, describes an automatic search process for better representations.**

“Deep” in Deep Learning

A deep neural network for digit classification

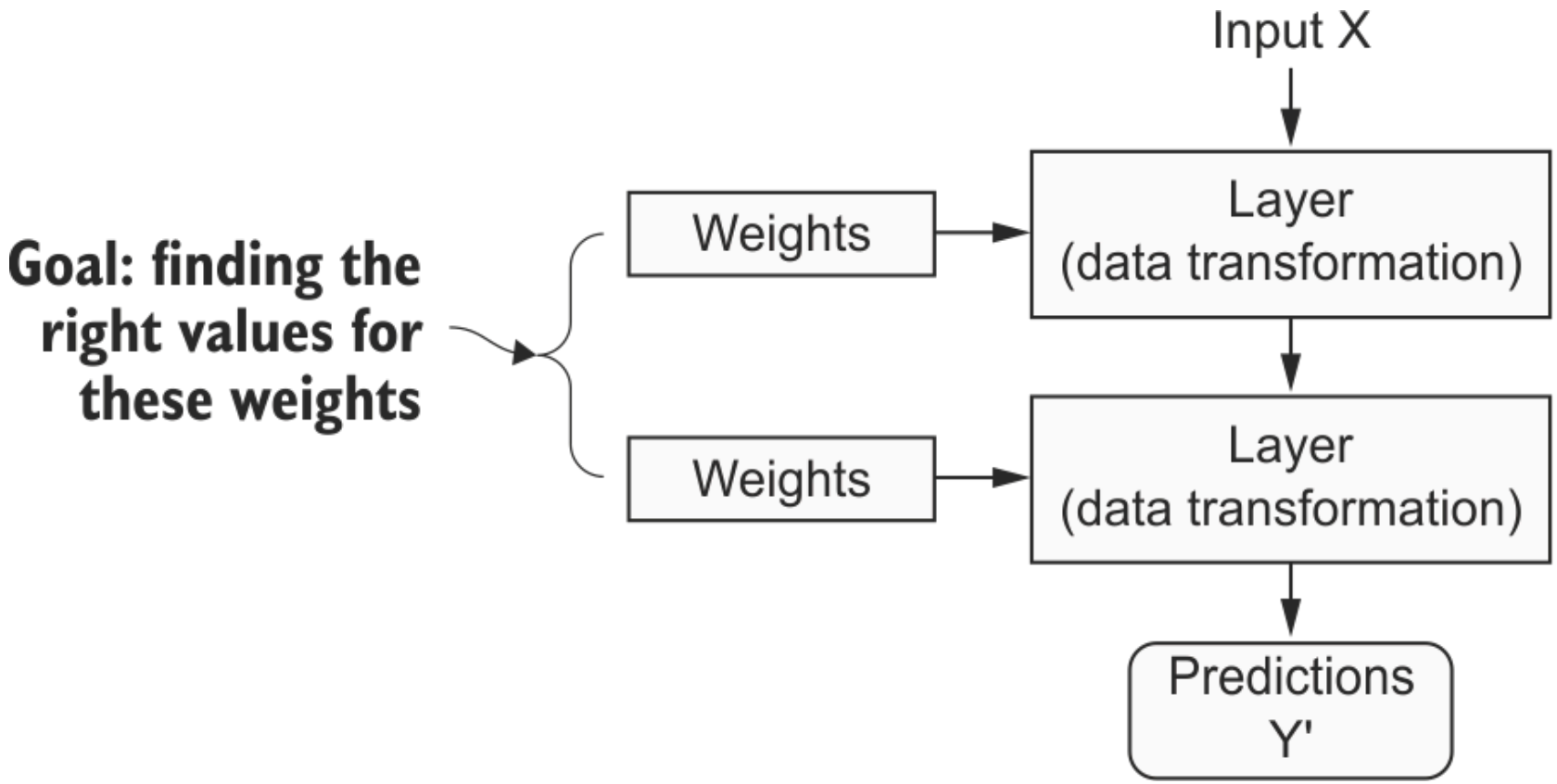


“Deep” in Deep Learning - a multistage way to learn data representations.



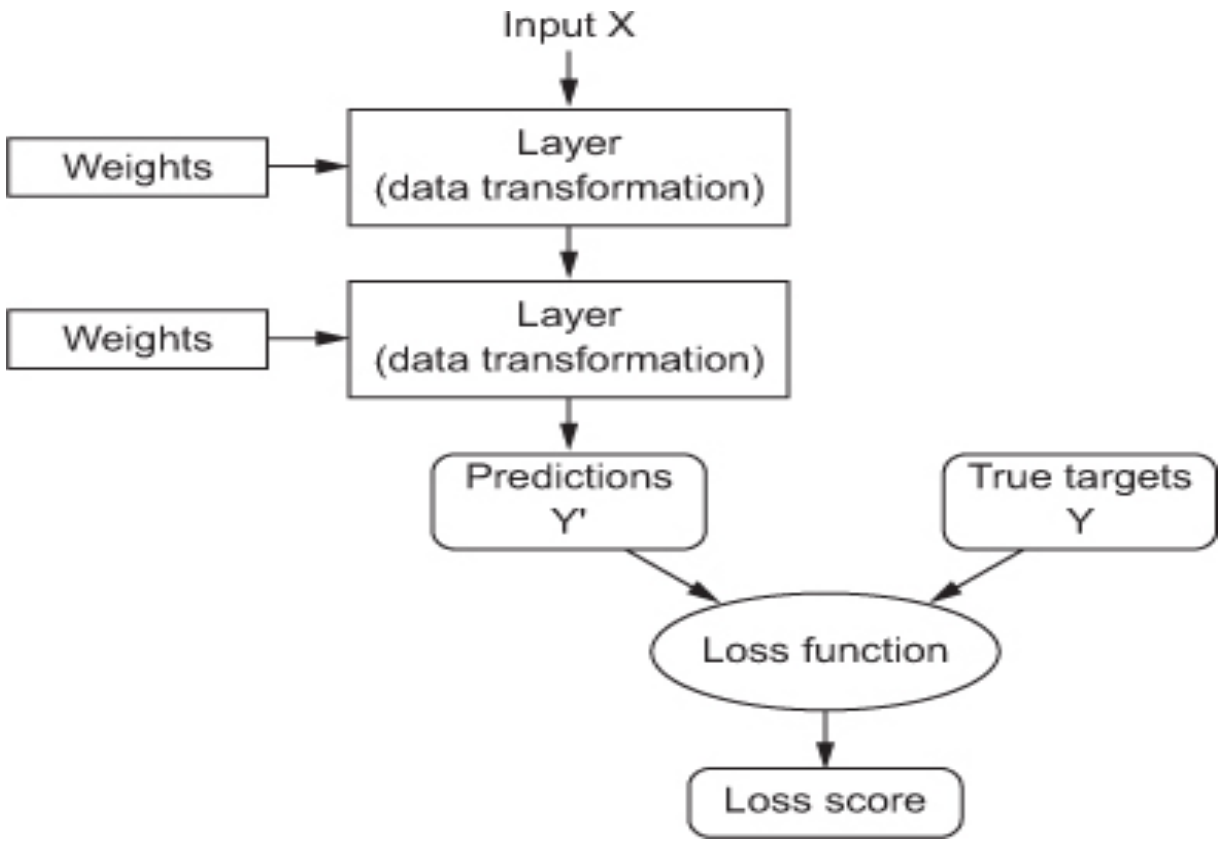
Understanding How Deep Works

1. A neural network is parameterized by its weights.



Understanding How Deep Works

2. A loss function measures the quality of the network's output.



Understanding How Deep Works

3. The loss score is used as a feedback signal to adjust the weights.