
amazon
ML
Summer School
Industrial Training


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Before We Started

Supervised Learning
Use labeled datasets to train an algorithm

Unsupervised Learning
Use unlabeled datasets to train an algorithm

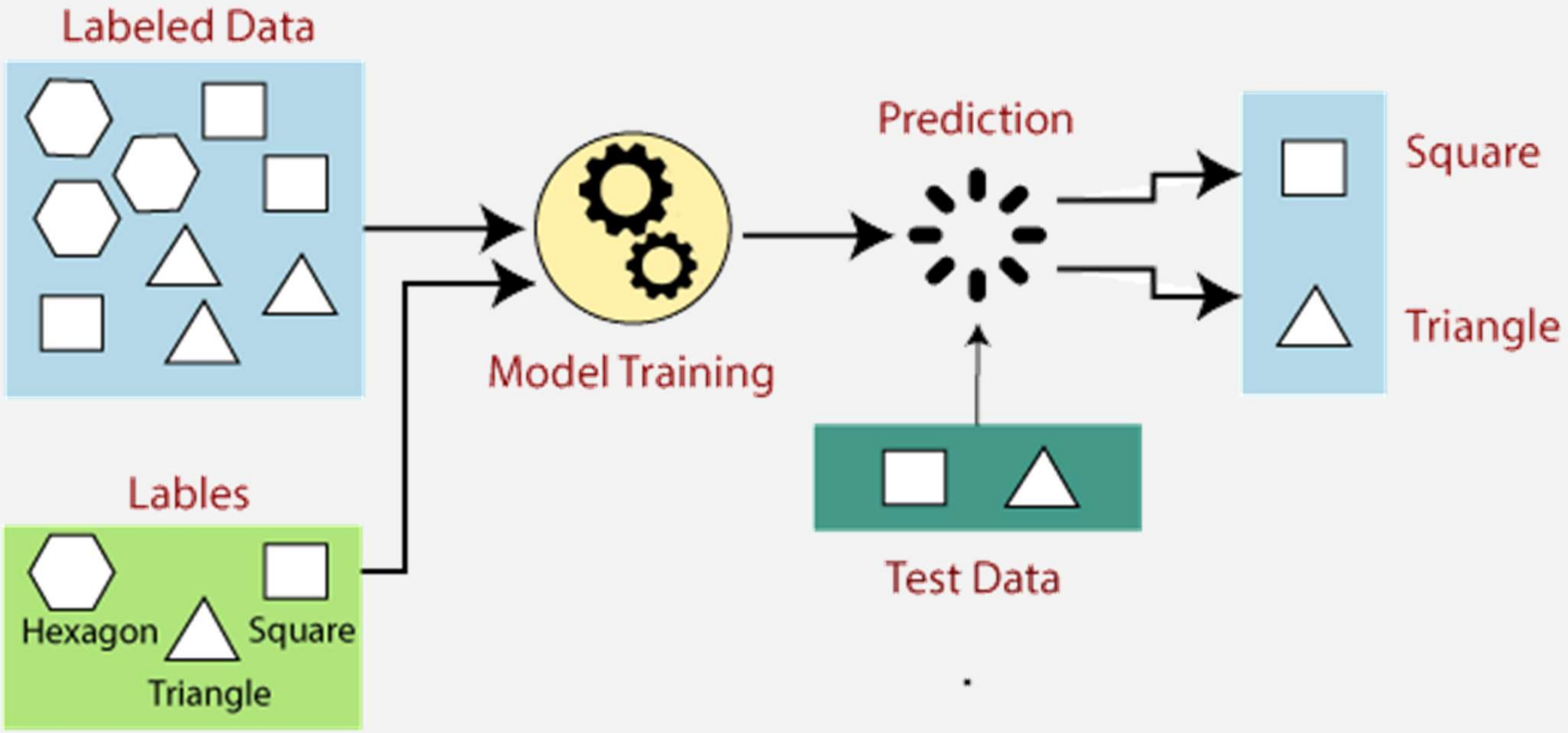
Reinforcement Learning
Hit and trial to train an algorithm

SUPERVISED LEARNING

01

Supervised Learning

Supervised learning, as the name indicates, has the presence of a supervisor as a teacher. Basically supervised learning is when we teach or train the machine using data that is well labelled. Which means some data is already tagged with the correct answer. After that, the machine is provided with a new set of examples(data) so that the supervised learning algorithm analyses the training data(set of training examples) and produces a correct outcome from labelled data.


Labeled Data
Lables
Hexagon
Square
Triangle
Model Training
Prediction
Test Data
Square
Triangle

DEEP NEURAL NETWORKS

02

Deep Neural Networks

A deep neural network (DNN) is an ANN with multiple hidden layers between the input and output layers. Similar to shallow ANNs, DNNs can model complex non-linear relationships.

The main purpose of a neural network is to receive a set of inputs, perform progressively complex calculations on them, and give output to solve real world problems like classification. We restrict ourselves to feed forward neural networks.

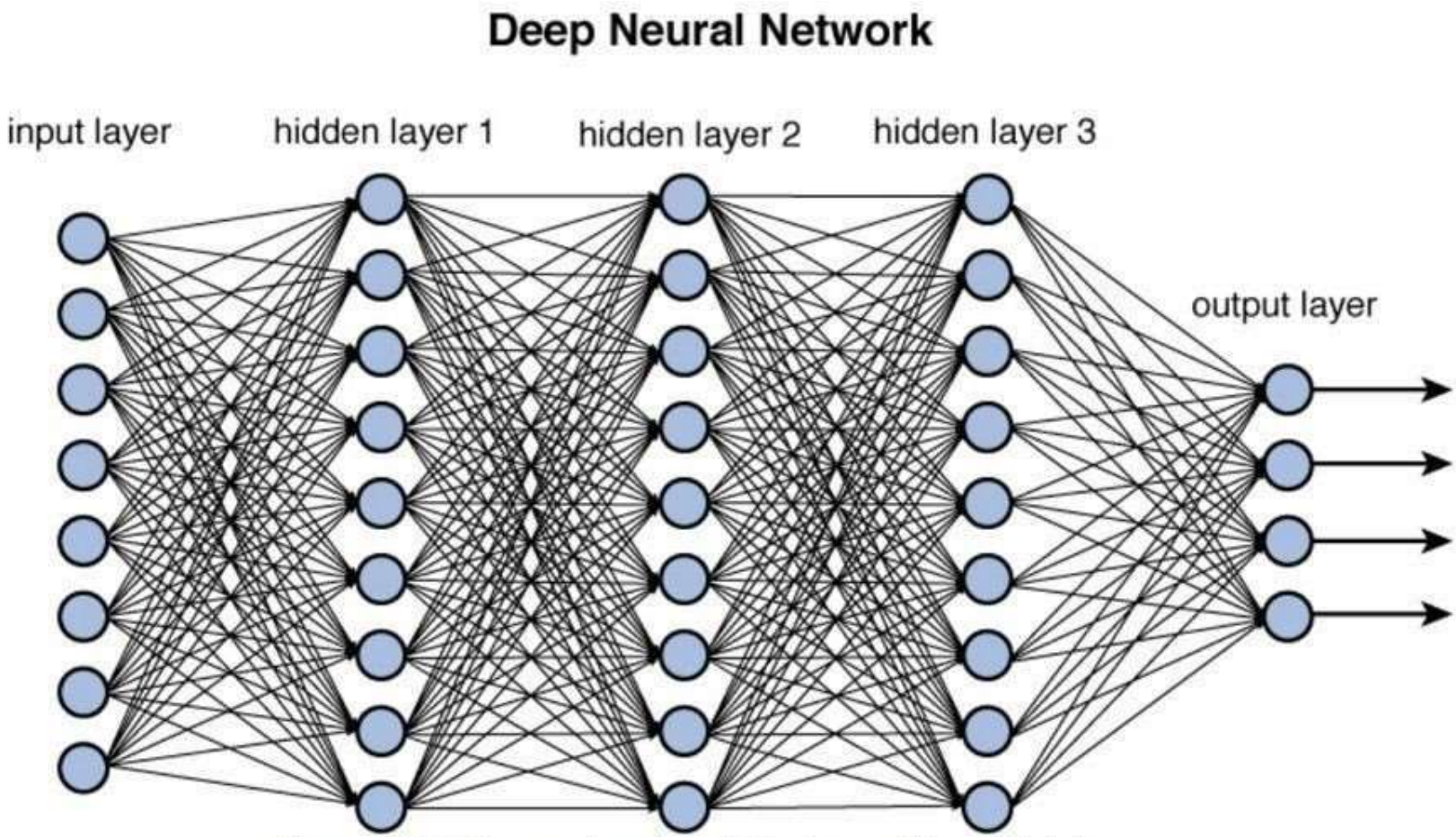


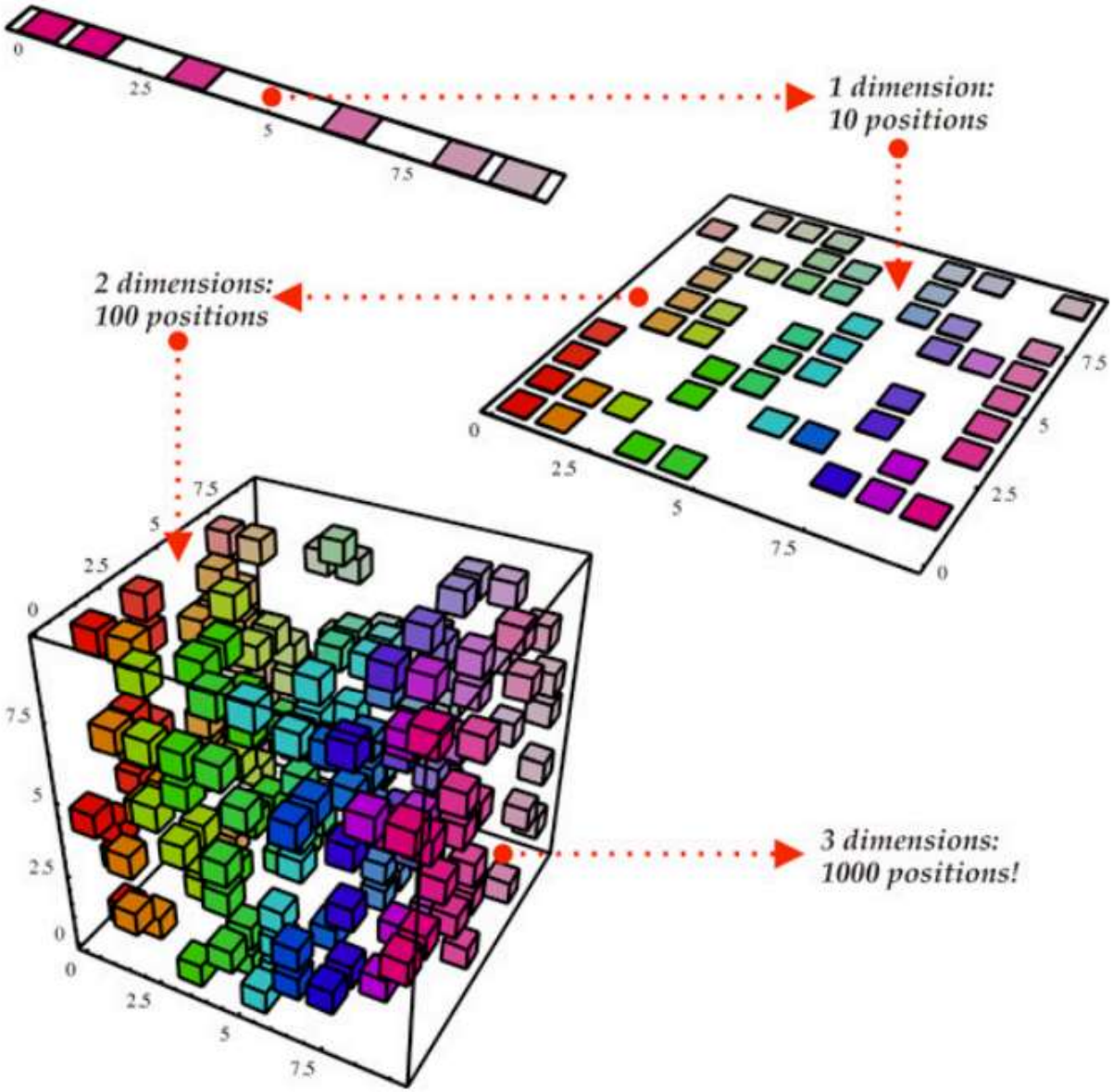
Figure 12.2 Deep network architecture with multiple layers.

DIMENTIONALITY REDUCTION

03

Dimensionality Reduction

In machine learning classification problems, there are often too many factors on the basis of which the final classification is done. These factors are basically variables called features. The higher the number of features, the harder it gets to visualize the training set and then work on it. Sometimes, most of these features are correlated, and hence redundant. This is where dimensionality reduction algorithms come into play. Dimensionality reduction is the process of reducing the number of random variables under consideration, by obtaining a set of principal variables. It can be divided into feature selection and feature extraction.


1 dimension:
10 positions
2 dimensions:
100 positions
3 dimensions:
1000 positions!

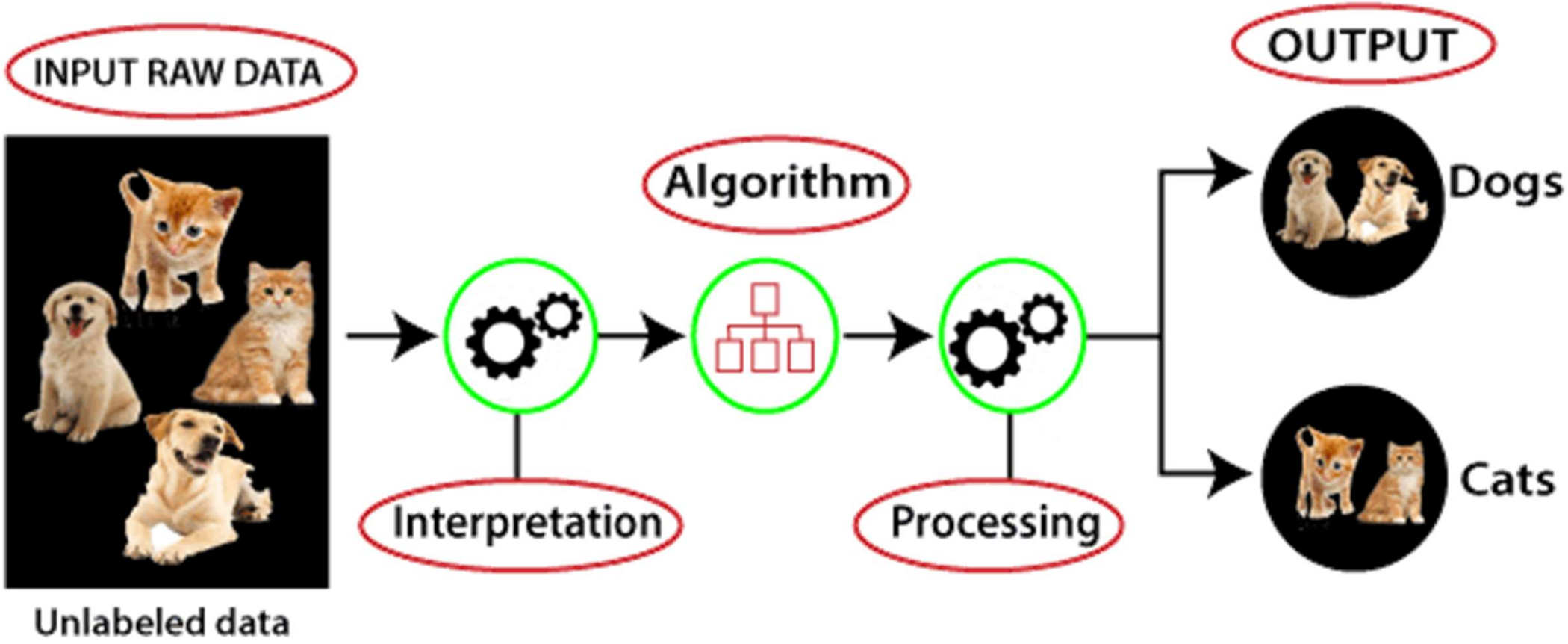
UNSUPERVISED LEARNING

04

Unsupervised Learning

As the name suggests, unsupervised learning is a machine learning technique in which models are not supervised using training dataset. Instead, models itself find the hidden patterns and insights from the given data. It can be compared to learning which takes place in the human brain while learning new things. It can be defined as:

“Unsupervised learning is a type of machine learning in which models are trained using unlabeled dataset and are allowed to act on that data without any supervision.”

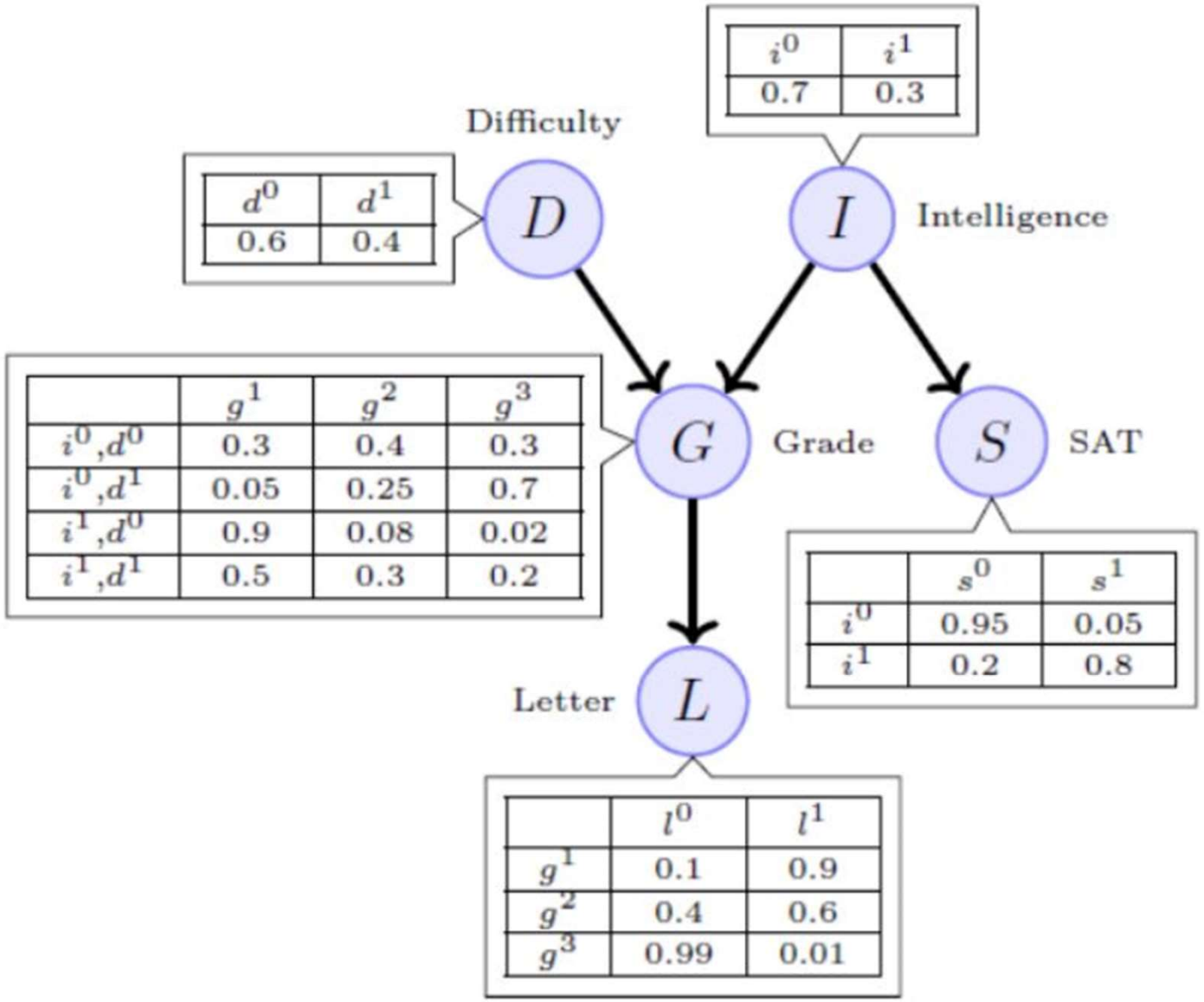

INPUT RAW DATA
Unlabeled data
Interpretation
Algorithm
Processing
OUTPUT
Dogs
Cats

PROBABLISTIC GRAPHICAL MODEL

05

Probabilistic Graphical Model

Statistical models that encode complex joint multivariate probability distributions using graphs. In other words, PGMs capture conditional independence relationships between interacting random variables. This is beneficial since a lot of knowledge on graphs has been gathered over the years in various domains, especially on separating subsets, cliques and functions on graphs. This knowledge can be reused in PGMs. Furthermore, one can easily visualize PGMs and get a quick overview of the model structure.

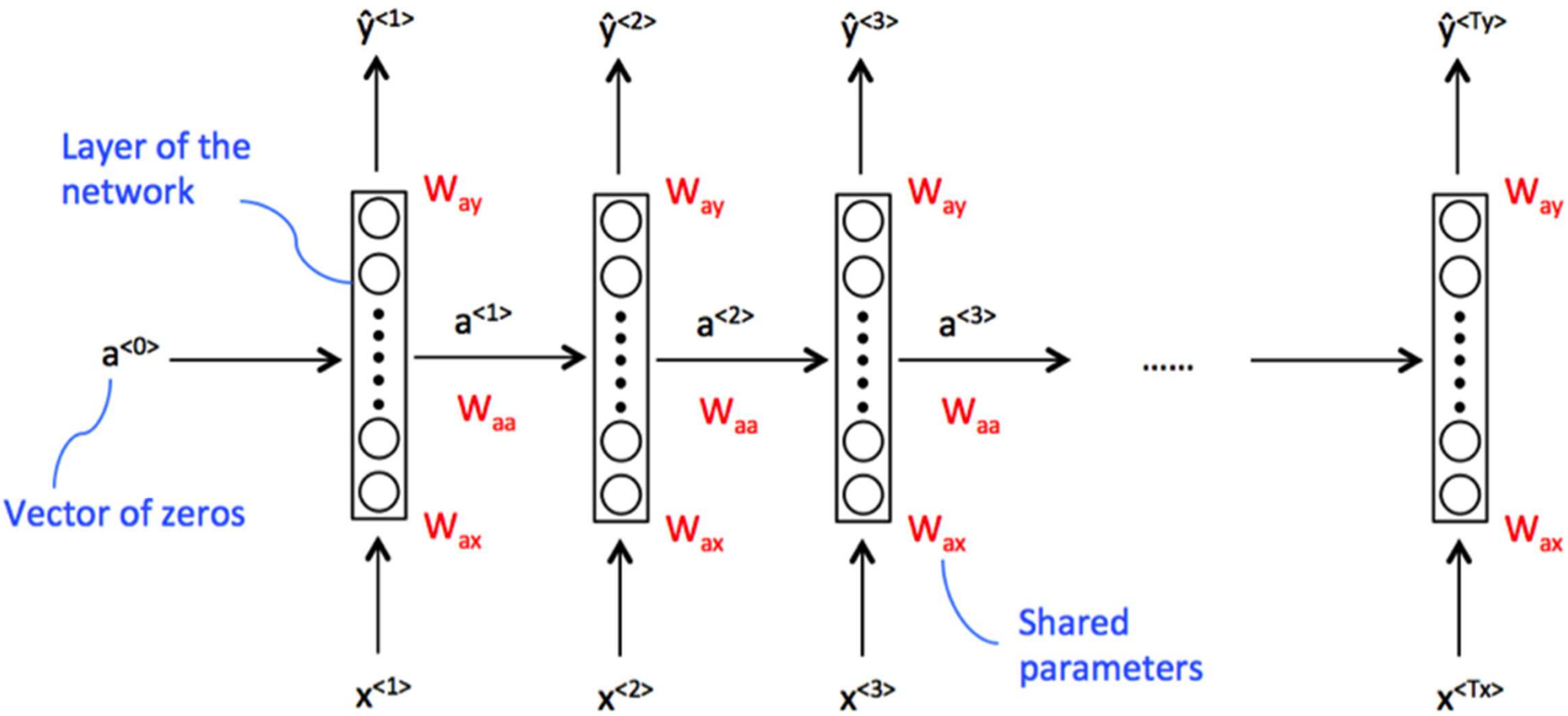

Difficulty
D
Intelligence
I
Grade
G
SAT
S
Letter
L
d^0 d^1
0.6 0.4
i^0 i^1
0.7 0.3
g^1 g^2 g^3
i^0,d^0 0.3 0.4 0.3
i^0,d^1 0.05 0.25 0.7
i^1,d^0 0.9 0.08 0.02
i^1,d^1 0.5 0.3 0.2
s^0 s^1
i^0 0.95 0.05
i^1 0.2 0.8
l^0 l^1
g^1 0.1 0.9
g^2 0.4 0.6
g^3 0.99 0.01

SEQUENTIAL LEARNING

06

Sequential Learning

Machine learning models that input or output data sequences are known as sequence models. Text streams, audio clips, video clips, time-series data, and other types of sequential data are examples of sequential data. Recurrent Neural Networks (RNNs) are a well-known method in sequence models. The analysis of sequential data such as text sentences, time-series, and other discrete sequence data prompted the development of Sequence Models. These models are better suited to handle sequential data, whereas Convolutional Neural Networks are better suited to treat spatial data.

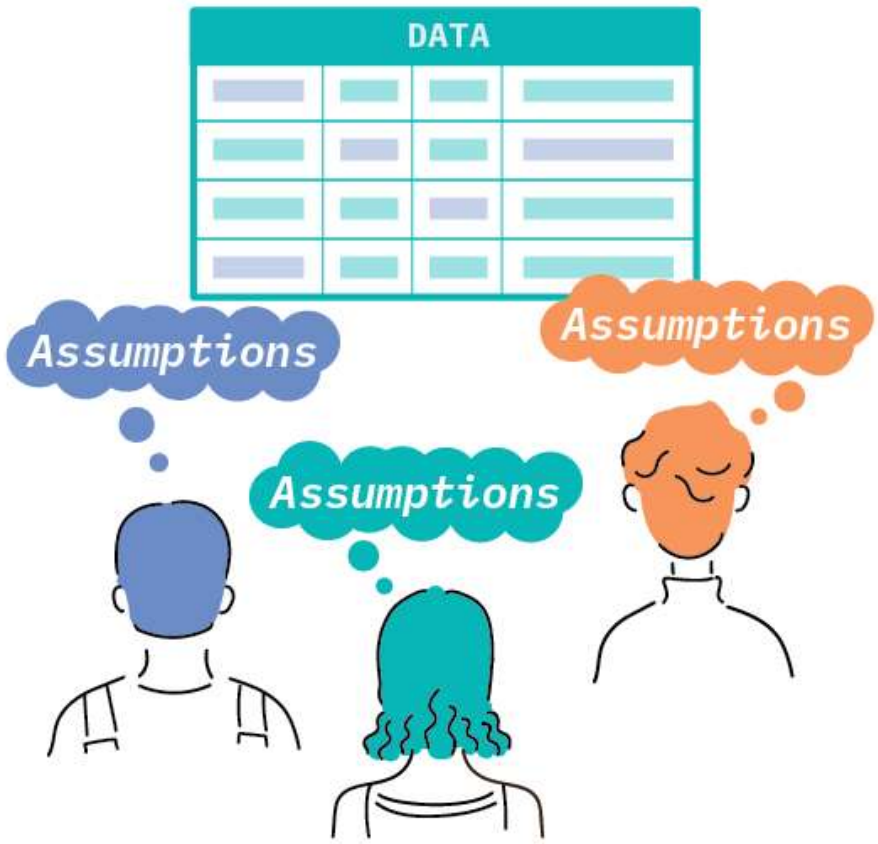

Layer of the network
Vector of zeros
Shared parameters
$\hat{y}^{<1>}$
$\hat{y}^{<2>}$
$\hat{y}^{<3>}$
$\hat{y}^{<Ty>}$
W_{ay}
$a^{<0>}$
$a^{<1>}$
$a^{<2>}$
$a^{<3>}$
W_{aa}
W_{ax}
.....
$x^{<1>}$
$x^{<2>}$
$x^{<3>}$
$x^{<Tx>}$

Causal Inference

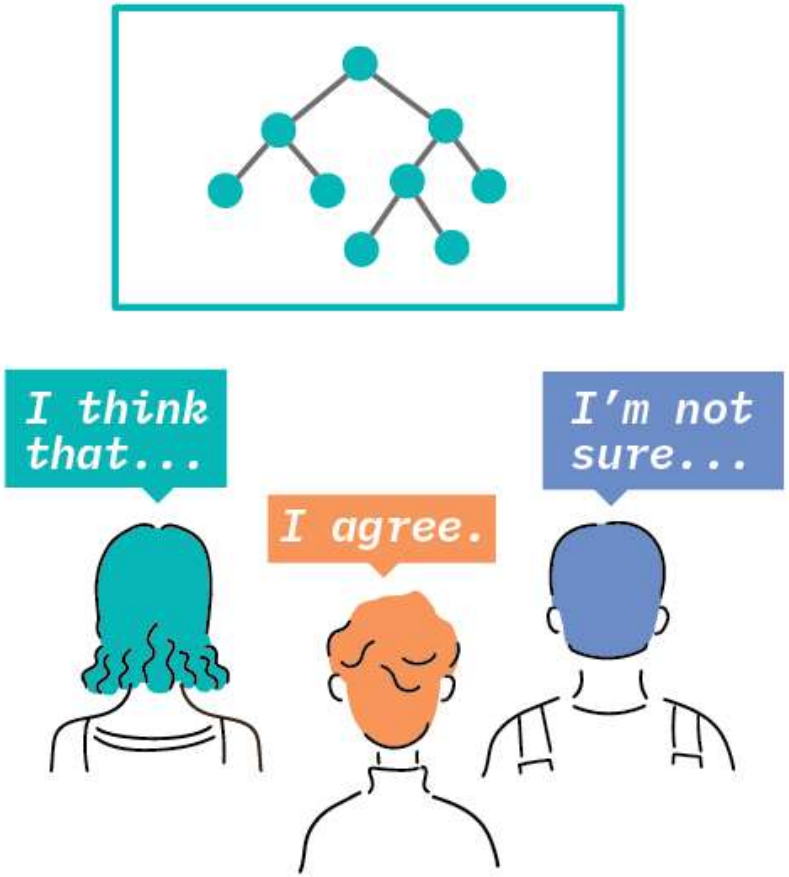
07

Causal Inference

Causality influence by which one event, process or state, a cause, contributes to the production of another event, process or state, an effect, where the cause is partly responsible for the effect, and the effect is partly dependent on the cause. First of all, it is key to better define this term. As humans, we often think in terms of cause and effect — if we understand why something happened, we can change our behavior to improve future outcomes. In other words, our goal is trying to learn causality from data (what was the cause and what was the effect).



We all make causal assumptions when looking at data.



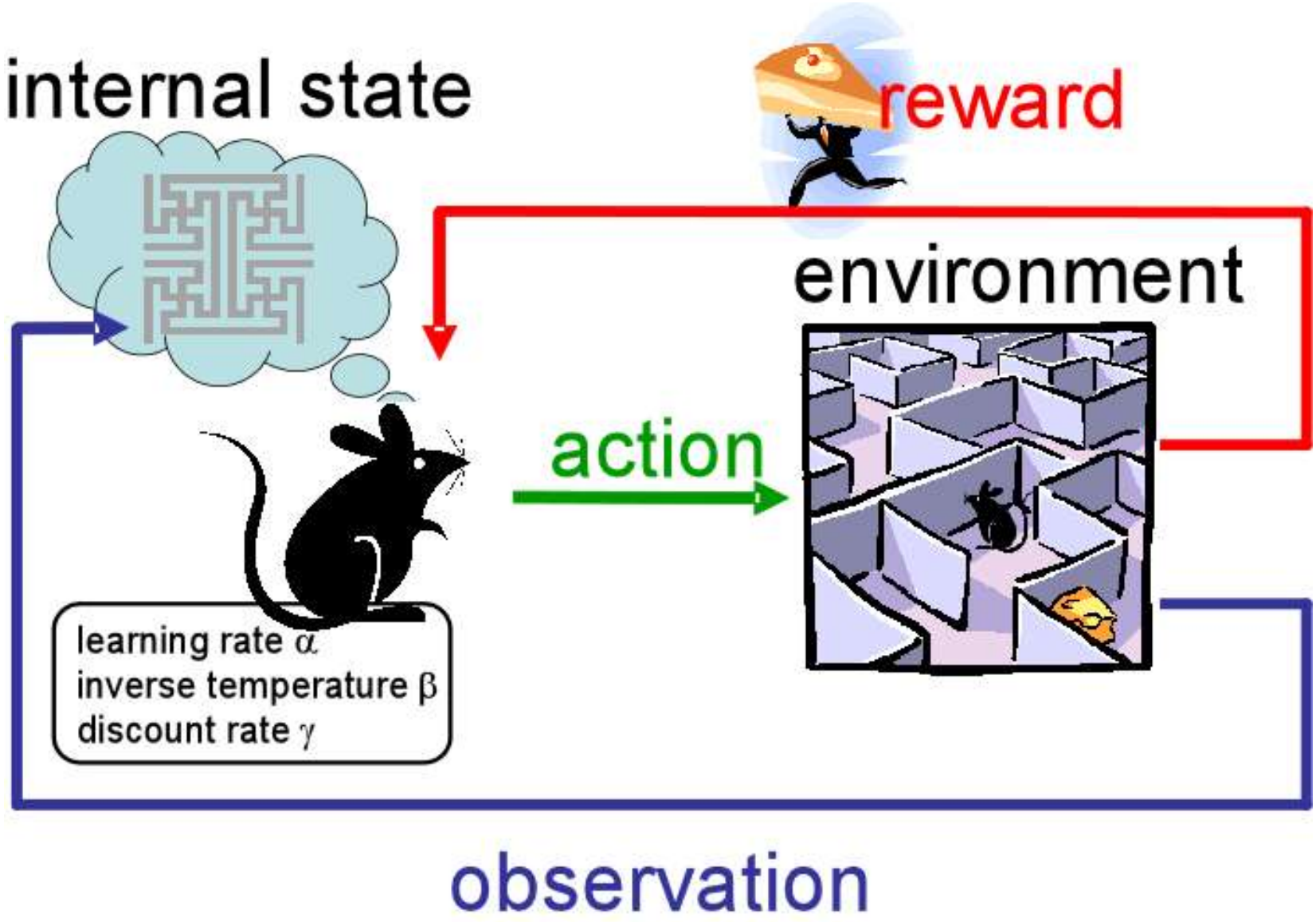
Making a causal graph makes those assumptions explicit.

Reinforcement Learning

08

Reinforcement Learning

Reinforcement learning is an area of Machine Learning. It is about taking suitable action to maximize reward in a particular situation. It is employed by various software and machines to find the best possible behavior or path it should take in a specific situation. Reinforcement learning differs from supervised learning in a way that in supervised learning the training data has the answer key with it so the model is trained with the correct answer itself whereas in reinforcement learning, there is no answer but the reinforcement agent decides what to do to perform the given task. In the absence of a training dataset, it is bound to learn from its experience.


internal state
reward
environment
action
learning rate α
inverse temperature β
discount rate γ
observation


“Predicting the future isn’t magic, it’s artificial intelligence”


THANKS!