

Introduction to Neural Networks

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Neural Network

- The concept of the artificial neural network was inspired by human biology and the way neurons of the human brain function together to understand inputs from human senses
- Neural networks are a series of algorithms that mimic the operations of human brain to recognize relationships between vast amounts of data.
- Neural networks are being applied to many real-life problems today, including speech and image recognition, spam email filtering, finance, and medical diagnosis,



Why are neural networks important?

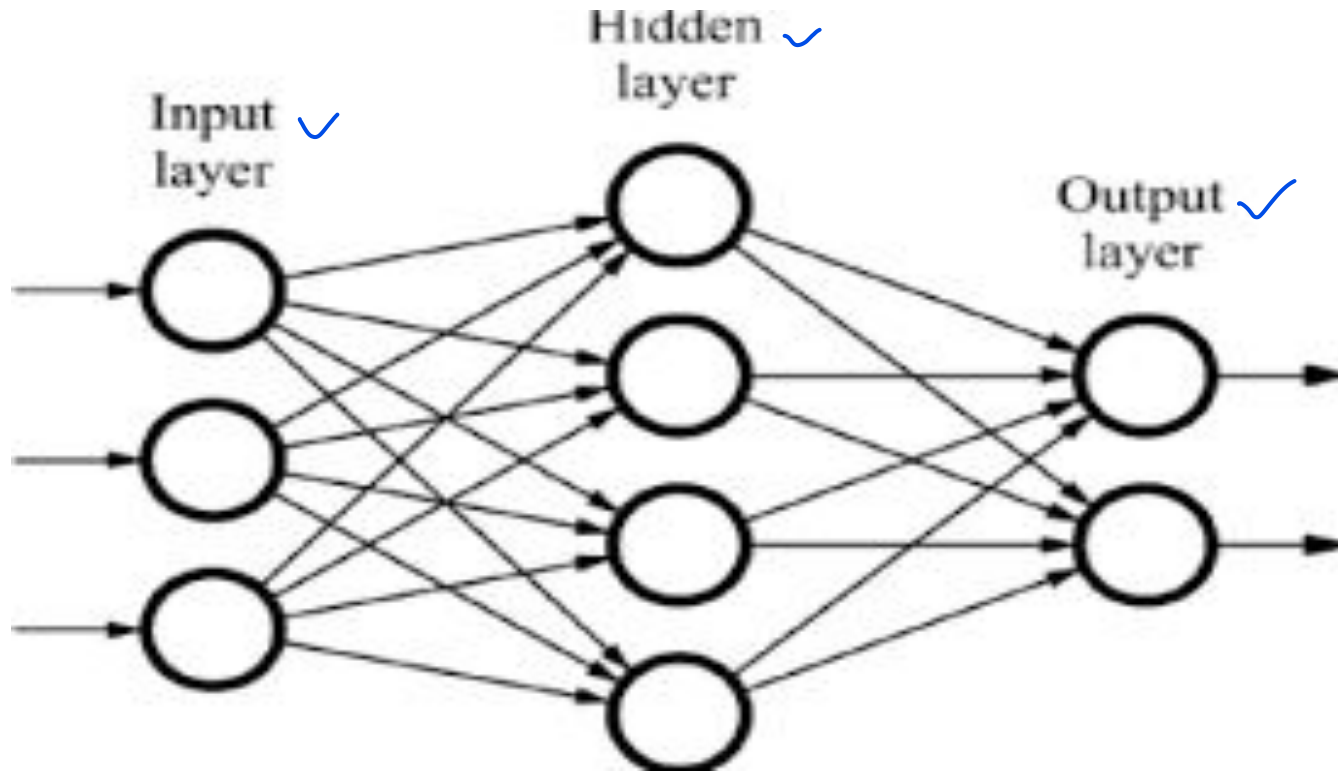
- can help computers make intelligent decisions with limited human assistance.
- they can learn and model the relationships between input and output data that are nonlinear and complex.
- can comprehend unstructured data and make general observations without explicit training.



How do neural networks work?

- The human brain is the inspiration behind neural network architecture. Human brain cells, called neurons, form a complex, highly interconnected network and send electrical signals to each other to help humans process information.
- Similarly, an artificial neural network is made of artificial neurons that work together to solve a problem.
- Artificial neurons are software modules, called nodes, and artificial neural networks are software programs or algorithms that, at their core, use computing systems to solve mathematical calculations.

A Simple Neural Network Architecture



A Simple Neural Network Architecture



Input Layer

Information from the outside world enters the artificial neural network from the input layer. Input nodes process the data, analyze or categorize it, and pass it on to the next layer.

Hidden Layer

Hidden layers take their input from the input layer or other hidden layers. Artificial neural networks can have a large number of hidden layers.

Each hidden layer analyzes the output from the previous layer, processes it further, and passes it on to the next layer.



A Simple Neural Network Architecture



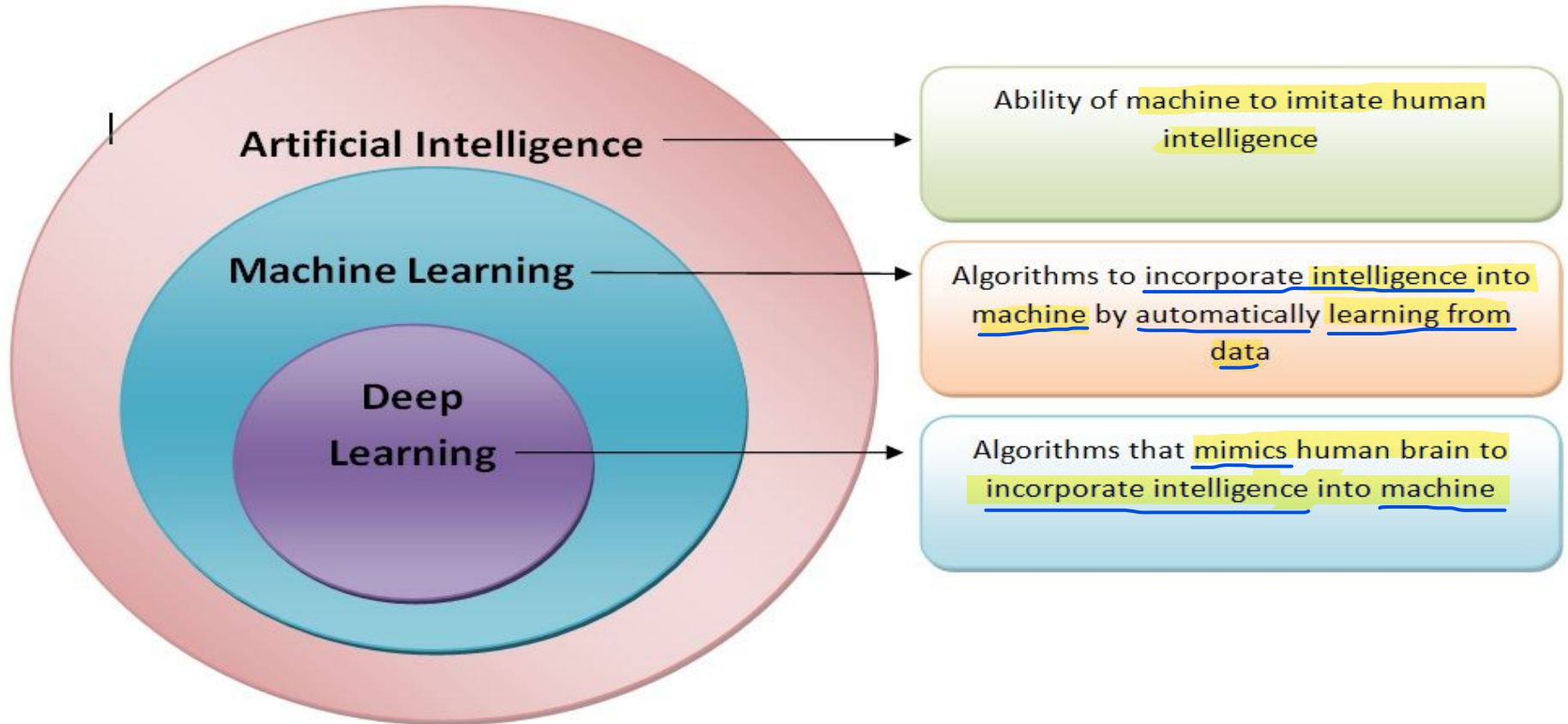
Output Layer

The output layer gives the final result of all the data processing by the artificial neural network.

It can have single or multiple nodes. For instance, if we have a binary (yes/no) classification problem, the output layer will have one output node, which will give the result as 1 or 0.

However, if we have a multi-class classification problem, the output layer might consist of more than one output node.

AI vs. ML vs. DL





Applications of Neural Network

- Neural networks can be applied to a broad range of problems and can assess many different types of input, including images, videos, files, databases, and more.
- Some common applications of neural networks today, include -
 - image/pattern recognition
 - self driving vehicle trajectory prediction
 - facial recognition
 - data mining,
 - email spam filtering
 - medical diagnosis, and cancer research.



Suggested Books

1. Fuzzy and Neural Approaches in Engineering - Lefteri H. Tsoukalas, Robert E. Uhrig
2. Pattern Recognition and Machine Learning - Christopher M. Bishop