



# Module 2

## Foundational Theories and Their Application

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### ▼ What are some subcategories of ML?

- informed and uninformed search
- symbolic planning and reasoning
- rule-based systems
- formal logic systems

### ▼ What applications and use-cases does AI encompass?

- expert systems
- decision support systems
- robotics
- game and video game AI
- automated systems
- integrated AI products

### ▼ What is an AI system?

a system that solves problems or performs tasks that once required human intelligence

### ▼ What is ML?

a set of techniques used in developing AI systems that involves the ability of the machine to analyze data and make predictions based on that data

▼ What is deep learning?

- a subset of ML that uses layers on top of layers of networks to increase the depth of the network, increase complexity and more closely imitate biological neural networks
- uses ANN (artificial neural networks)

▼ What is symbolic reasoning also known as?

Good Old Fashioned AI

▼ What is the physical symbol systems hypothesis? (1960s)

the hypothesis posits that many aspects of intelligence can be achieved with the manipulation of symbols

▼ How do symbolic techniques define problems?

- In the form of physical symbols
- AI can represent objects, concepts and ideas as symbols
- This strategy lends itself to the use of deduction and induction

▼ What are expert systems? (1980s)

these systems represent knowledge symbolically and reference this knowledge using manually programming sets of rules to parse the knowledge to solve problems and assist human decision making

▼ What are ANNs?

- artificial neural networks are connectionist systems inspired by biological nervous systems based on a collection of nodes or “neurons”
- neurons are arranged in interconnected layers

▼ What are the 3 types of ANN layers?

- Input layer: receives the input
- Output layer: relays the model output

- Hidden layers: layers between input and output, with more layers being a deeper network
- ▼ How do neurons represent signals?  
with real numbers
- ▼ How does a neuron calculate its output?  
using the activation function—a nonlinear function such as Sigmoid, Tanh, or ReLU
- ▼ What is an edge?  
a connection between nodes
- ▼ What do neurons and their edges adjust with an input?  
their weights
- ▼ Weight increases the steepness of the activation function. What does this mean?  
Weights decide how rapidly the function will trigger
- ▼ What is bias?  
a type of parameter that delays the triggering of the activation function
- ▼ What is the loss function?
  - it tries to calculate and compensate for error and minimize loss and bias
  - **It's a method of evaluating how well your algorithm models your dataset.**  
If your predictions are totally off, your loss function will output a higher number.  
If they're pretty good, it'll output a lower number.
- ▼ What is gradient descent using backpropagation used for?  
to converge on local minima and produce a result
- ▼ What is supervised learning?
  - a supervised learning algorithm uses defined sets of input data and associated responses to the data (output) to better learn regression/classification tasks
  - it inputs are example input-output pairs

- Examples
  - image classification
  - speech recognition
  - natural language processing

▼ What is unsupervised learning?

- the use of classified and unlabeled information to train an AI algorithm and allowing the algorithm to act without guidance on that information
- holds promise for integrating symbolic and connectionist approaches
- It uses the following techniques to extrapolate relationships between data points:
  - principal component analysis (PCA)
  - cluster analysis
- Conditions qualifying a model as unsupervised
  - when there is an absence of task labels (or well-defined tasks); and
  - when there is an absence of external supervision such as class labels, regression targets, or external rewards

▼ What is reinforcement learning?

- a type of ML model that detects patterns in unlabeled data with little or no human supervision
- it uses a predefined reward function during the training process to learn the proper sequences of output; the more accurate the output the greater the reward

▼ What is self-supervised learning?

- it uses labeled data that has been labeled artificially by the model itself
- though it is a form of supervised learning, its more closely related to unsupervised learning (both involve autonomous self-learning)