**AI, ML and DL Algo Classification**

Here’s a classification of **AI**, **ML**, and **DL** algorithms, grouped by their functionalities and applications:

**1. Classification of AI Algorithms**

AI algorithms include traditional, rule-based systems and those driven by learning. They are designed to mimic cognitive functions and problem-solving abilities.

**Knowledge-Based (Rule-Based) Algorithms**

* **Expert Systems**: Use if-then rules for decision-making (e.g., MYCIN, DENDRAL).
* **Logic-Based Algorithms**: Use propositional or first-order logic (e.g., Prolog).

**Search Algorithms**

* **Uninformed Search**: Breadth-First Search (BFS), Depth-First Search (DFS).
* **Informed Search**: A\*, Greedy Best-First Search.

**Optimization Algorithms**

* Genetic Algorithms (GA)
* Simulated Annealing
* Particle Swarm Optimization

**Game-Playing Algorithms**

* Minimax Algorithm
* Alpha-Beta Pruning

**Reasoning and Planning**

* STRIPS (Stanford Research Institute Problem Solver)
* SAT Solvers

**Natural Language Processing Algorithms**

* Sentence Parsing (CFG, CYK Algorithm).
* Semantic Analysis (WordNet).

**2. Classification of Machine Learning (ML) Algorithms**

ML algorithms are categorized based on their learning paradigms.

**Supervised Learning Algorithms**

* **Regression**:
  + Linear Regression
  + Logistic Regression
  + Support Vector Regression (SVR)
* **Classification**:
  + Decision Trees
  + Random Forests
  + Support Vector Machines (SVM)
  + Naive Bayes
  + K-Nearest Neighbors (KNN)

**Unsupervised Learning Algorithms**

* **Clustering**:
  + K-Means
  + DBSCAN
  + Hierarchical Clustering
* **Dimensionality Reduction**:
  + Principal Component Analysis (PCA)
  + t-SNE (t-Distributed Stochastic Neighbor Embedding)
  + Autoencoders

**Reinforcement Learning Algorithms**

* **Value-Based**:
  + Q-Learning
  + Deep Q-Networks (DQN)
* **Policy-Based**:
  + Policy Gradient Methods
  + Actor-Critic Methods
* **Model-Based**:
  + Dyna-Q

**Ensemble Methods**

* Bagging: Random Forests, Extra Trees
* Boosting: Gradient Boosting, AdaBoost, XGBoost

**3. Classification of Deep Learning (DL) Algorithms**

DL algorithms leverage neural networks and can be categorized by architecture or application.

**Feedforward Neural Networks**

* Multi-Layer Perceptron (MLP)

**Convolutional Neural Networks (CNNs)**

* For image processing, object detection (e.g., AlexNet, ResNet).

**Recurrent Neural Networks (RNNs)**

* Vanilla RNNs, Long Short-Term Memory (LSTM), Gated Recurrent Unit (GRU).
* For sequence data like time series, speech, or text.

**Generative Models**

* Generative Adversarial Networks (GANs)
* Variational Autoencoders (VAEs)

**Reinforcement Learning with Deep Networks**

* Deep Q-Networks (DQN)
* AlphaGo (Policy Networks + Monte Carlo Tree Search).

**Transformers**

* BERT, GPT, and their variants for NLP tasks.

**Hybrid Models**

* Attention Mechanisms (e.g., Attention in transformers).
* Neural Turing Machines.

**Comparison Table**

| **Category** | **Examples** | **Applications** |
| --- | --- | --- |
| **AI Algorithms** | A\*, Genetic Algorithms, Prolog | General AI tasks, problem-solving, planning. |
| **ML Algorithms** | SVM, Random Forest, Q-Learning | Predictive modeling, clustering, recommendation. |
| **DL Algorithms** | CNN, RNN, Transformers, GAN | Image recognition, NLP, speech processing. |

This classification showcases the diversity and specific strengths of these algorithms in addressing various computational problems.