

The Syllabus of Artificial Intelligence and Machine Learning

Linear Algebra

Basics of vector spaces, Linear independence, span, and basis, Linear transformations, Matrix algebra, Dot products and Orthogonality, Eigen values and Eigen vectors. Random variables. Uniform, normal, exponential, Poisson and binomial distributions. Mean, median, mode and standard deviation.

Probability & Statistics

Conditional probability, Bayes' theorem, Discrete and continuous random variables and probability distributions, Joint probability distributions, Maximum likelihood and Maximum a posteriori (MAP) estimation, Correlation analysis.

Research Methodology

Research Statistics like measures of central tendency, dispersion and correlation and regression, Sampling distributions, Design of Experiment.

Data Structures and Algorithms

Programming in C. Recursion. Arrays, stacks, queues, linked lists, trees, binary search trees, binary heaps, graphs, Algorithms: Searching, sorting, hashing.

Databases

Relational model: RDBMS and SQL, Integrity constraints, normal forms. File organization, indexing (e.g., B and B+ trees). Transactions and concurrency control. Data mining techniques and data ware housing, De-normalization, Big Data basics, No-SQL basics.

Supervised Machine Learning

Regression and Prediction - Basics, Dependent variables, Independent variables, Correlation, Covariance, Ordinary Least Square method. Linear Regression with one Variable using Gradient Descent. Classification and Prediction: Linear Classifiers- Logistic Regression, Binomial classification, Multiclass Classification Support vector machine, ANN. Non-linear classifiers-KNN, Bayes Rule and Naive Bayes Model, Decision Tree Classifier, random forests.

Unsupervised Machine Learning

Clustering Algorithms and their selection: Clustering Patterns and techniques- static and incremental clustering algorithms, k-means, agglomerative, Partitioned Clustering and types, Hierarchical Clustering and types. Performance evaluation measures in clustering techniques. Computational issues with clustering algorithms and how different clustering implementations try to overcome them. Comparison and Selection of algorithm based on applications.

Computer Networks

Concept of layering. LAN technologies (Ethernet). Flow and error control techniques, switching. IPv4/IPv6, routers and routing algorithms (distance vector, link state), Subnetting, TCP/UDP and sockets, congestion control. Application layer protocols (DNS, SMTP, POP, FTP, HTTP). Basics of Wi-Fi. Network security: authentication, key cryptography, digital signatures and certificates, firewalls.

Programming Skills

C, C++, Python, Basics of statistical programming languages like R and Matlab.