Tentative weekly teaching plan is as follows:

Week	Content
1	Introduction to Data Mining , Challenges , Data Mining Origins, Data Mining Tasks, Applications
2-3	Types of data, Data Quality, Data Pre-processing, Measures of similarity and dissimilarity
5-8	Classification - Preliminaries, General Approach to Solving a Classification Problem, Decision Tree Induction , Evaluating the Performance of a Classifier
8-9	Rule Based Classifier , Nearest Neighbor Classifiers, Bayesian Classifiers
10-11	Association Rules -Problem definition, Frequent item-set generation (Apriori algorithm), Rule generation
11-12	Clustering - Basic concepts of clustering analysis, K-Means
13-14	Agglomerative Hierarchical Clustering, DBSCAN
15	Quality of clustering

Assessment Methods

Written tests, assignments, quizzes, presentations as announced by the instructor in the class.

Keywords

data mining, classifiers, data pre-processing, metrics.

Advanced Algorithms (BHCS17C) Discipline Specific Elective - (DSE)

Credit: 06

Course Objective

This course focuses on the study of advanced data structures and algorithms for solving problems efficiently and their theoretical behavior. The course also includes study of network flow algorithms, NP completeness and backtracking.

Course Learning Outcomes

On successful completion of this course, the student will be able to:

1. Implement and empirically analyze advanced data-structures like tries, suffix trees.
2. Apply amortized analysis.
3. Develop more sophisticated algorithms using techniques like divide and conquer, dynamic programming, greedy strategy, and augmentation
4. Prove that certain problems are too hard to admit fast solutions.
5. Develop algorithms using backtracking for the hard problems.

Detailed Syllabus

Unit 1

Advanced Data Structures: Skip Lists, Red-Black trees, Splay Trees, Mergeable heaps (Fibonacci heaps), DS for sets - Union-Find Data Structure, Dynamic Tables, Dictionaries, Data structures for strings - Tries, Suffix trees.

Unit 2

Divide and Conquer: Counting Inversions, Closest pair of points, Integer Multiplication,

Unit 3

Greedy Algorithm: Interval Scheduling, Huffman Code, Correctness and Analysis,

Unit 4

Dynamic Programming: Segmented Least Squares, Shortest Paths, Negative Cycles in Graphs

Unit 5

Network Flows: Max-flow problem, Ford Fulkerson Algorithm, Maximum flows and Minimum Cuts in a network, Bipartite Matching.

Unit 6

NP Completeness: Polynomial time reductions, Efficient Certification and Definition of NP, NP Complete problems, Sequencing problems, Partitioning problems, co-NP and asymmetry of NP.

Backtracking: Constructing All Subsets, Constructing All Permutations, Constructing All Paths in a Graph.

Practical

Tutorials based on Theory**.**

References

1. Cormen, T.H., Leiserson,C.E., Rivest, R.L., & Stein,C.(2010). *Introduction to Algorithms*. 3rd edition. Prentice-Hall of India Learning Pvt. Ltd.

2. Kleinberg, J., & Tardos, E. (2013). *Algorithm Design*. 1st edition. Pearson Education India.

Additional Resources

1. Basse, S., & Gleder, A. V. (1999). *Computer Algorithm – Introduction to Design and Analysis*. 3rd edition. Pearson Education.

2. Dasgupta, S., Papadimitriou,C., & Vazirani, U. (2017). *Algorithms*. 1st edition. TataMcGraw Hill.

3. Skiena, S. S. (2008). *The Algorithm Design Manual*. 2nd edition. Springer-Verlag London

Course Teaching Learning Process

- Use of ICT tools in conjunction with traditional class room teaching methods
- Interactive sessions
- Class discussions

Tentative weekly teaching plan is as follows:

Week	Content
1-4	Advanced Data Structures: Skip Lists, Red-Black trees, Splay Trees, Mergeable heaps (Fibonacci heaps), DS for sets - Union-Find Data Structure, Dynamic Tables, Dictionaries, Data structures for strings - Tries, Suffix trees
5	Divide and Conquer: Counting Inversions, Closest pair of points, Integer Multiplication
6-7	Greedy Algorithm: Interval Scheduling, Huffman Code, Correctness and Analysis
8-9	Dynamic Programming: Segmented Least Squares, Shortest Paths, Negative Cycles in Graphs
10-11	Network Flows: Max-flow problem, Ford Fulkerson Algorithm, Maximum flows and Minimum Cuts in a network, Bipartite Matching

12-13	NP Completeness: Polynomial time reductions, Efficient Certification and Definition of NP, NP Complete problems, Sequencing problems, Partitioning problems, co-NP and asymmetry of NP
14-15	Backtracking: Constructing All Subsets, Constructing All Permutations, Constructing All Paths in a Graph

Assessment Methods

Written tests, assignments, quizzes, presentations as announced by the instructor in the class.

Keywords

Algorithms, Analysis, Network Flows, NP Completeness.

Machine Learning (BHCS18A) Discipline Specific Elective - (DSE)

Credit: 06

Course Objective

The course aims at introducing the basic concepts and techniques of machine learning so that a student can apply machine learning techniques to a problem at hand.

Course Learning Outcomes

On successful completion of this course, the student will be able to:

1. Differentiate between supervised and unsupervised learning tasks.
2. Differentiate between linear and non-linear classifiers.
3. Describe theoretical basis of SVM
4. Implement various machine learning algorithms learnt in the course.

Detailed Syllabus