Machine Learning (CS 306)
Machine Learning Lab (CS 360)

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Syllabus

Supervised learning algorithms: linear and logistic Regression, gradient descent, support vector machines, kernels, decision trees, ML and MAP Estimates, K-nearest neighbor, Naive Bayes, Bayesian networks; Unsupervised learning algorithms: K-means clustering, Gaussian mixture models, learning with partially observable data (EM); Artificial Neural Networks: Self-organizing feature map neural networks, Recurrent neural networks, Feed-forward neural networks; Basic concept for deep learning, convolutional neural networks; Dimensionality reduction and principal component analysis; Model selection and feature selection; Introduction to Markov decision processes; Application of ML techniques in computer vision, natural language processing, image processing etc.

Texts:

1. T. M. Mitchell, Machine Learning, McGraw-Hill, 1997.
2. S. Haykin, Neural Networks: A Comprehensive Foundation. Prentice-Hall of India, 2007.
3. I. Goodfellow, Y. Bengio, and A. Courville, Deep Learning, MIT Press, 2016.

References:

1. S. Theodoridis and K. Koutroumbas, Pattern Recognition, Academic Press, 2009.
2. B. Yegnanarayana, Artificial Neural Networks, PHI Learning Pvt. Ltd, 2009.
3. C. M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.
4. R. O. Duda, P. E. Hart, and D. G. Stork, Pattern Classification, Wiley, 2001

Machine Learning (CS 306)
Assessment

- Term I-IV Examinations (Subjective and MCQ) : 70% (best three)
- Class Performance **:** 30%

Marks of class performance will be shared and updated regularly.

Components for random evaluation of class performance:

Active participation in class

Performance in Q&A sessions

Class assignments

Machine Learning Lab (CS 360)
Assessment

- Assignments : 60%
- Mini-projects: 40%

Programming platform: Python (Google colab)

Instructions for evaluation of assignments

- There will be two different types of assignments: practice assignment (not for marking) and evaluation assignment.
- There will be multiple practice labs/assignment (not for evaluation) for the first two months (but your progress will be randomly monitored by screen sharing on the codetantra platform and all your doubts will be addressed).
- All the cases, the assignments (practice and evaluation) will be circulated in the lab.
- For the evaluation assignment, the evaluation will start from 10.30 A.M and will be completed in the same lab.

Machine Learning Lab (CS 360)
Assessment

- Assignments : 60%
- Mini-projects: 40%

Programming platform: Python (Google colab)

Instructions for evaluation of Mini-projects:

1. Mini-projects are related to some application domains where the machine learning strategies (studied in class) can be applied and their performance can be evaluated.
2. Topics (along with the relevant datasets) will be circulated within two weeks.
3. The progress of mini-projects will be monitored and evaluated regularly.
4. Finally, the students need to submit the comparative results analysis for the datasets related to the application domain.
5. Lab examination will be conducted on mini-projects (viva).

Major Topics

- Introduction to Machine Learning
- Polynomial curve fitting problem
- Linear regression
- Gradient descent algorithm
- Logistic regression
- Regression vs. classification
- K-fold cross validation (train, test, validation set)
- Introduction to artificial neural networks
- Singlelayer perceptron
- Multilayer perceptron
- Supervised vs. unsupervised learning

(Continued…)

Major Topics

- Clustering algorithms (hard and soft clustering)
- Elbow method for k means clustering
- Different evaluation matrices for clusters (Silhouette Coefficient)
- Self-organizing feature maps neural networks
- Decision Trees
- K-nearest neighbor classifier and Min distance classifier
- Bayesian classifier and Bayesian networks
- Gaussian mixture models and EM algorithm
- Support vector machine
- Radial basis function neural networks
- Dimensionality reduction and principal component analysis
- Statistical significance test: T test
- Introduction to Markov decision process