

CAP 781

MACHINE LEARNING

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Course Outcome

CO1 :: understand the key concepts and principles of machine learning, including supervised and unsupervised learning techniques, feature extraction, and model evaluation.

CO2 :: analyze machine learning algorithms and models, understanding their strengths, limitations, and applications in various domains

CO3 :: evaluate the performance of machine learning models using appropriate evaluation metrics

CO4 :: develop machine learning solutions for real-world problems, designing and developing effective algorithms and models



Text Books and References

1. TEXT BOOK:
 1. Applied Machine Learning by M. Gopal
2. REFERENCES:
 1. Machine Learning by Ethem Alpaydın
 2. Principles of Soft Computing by S. N. Sivanandam And S. N. Deepa
 3. Machine Learning by Tom Mitchell

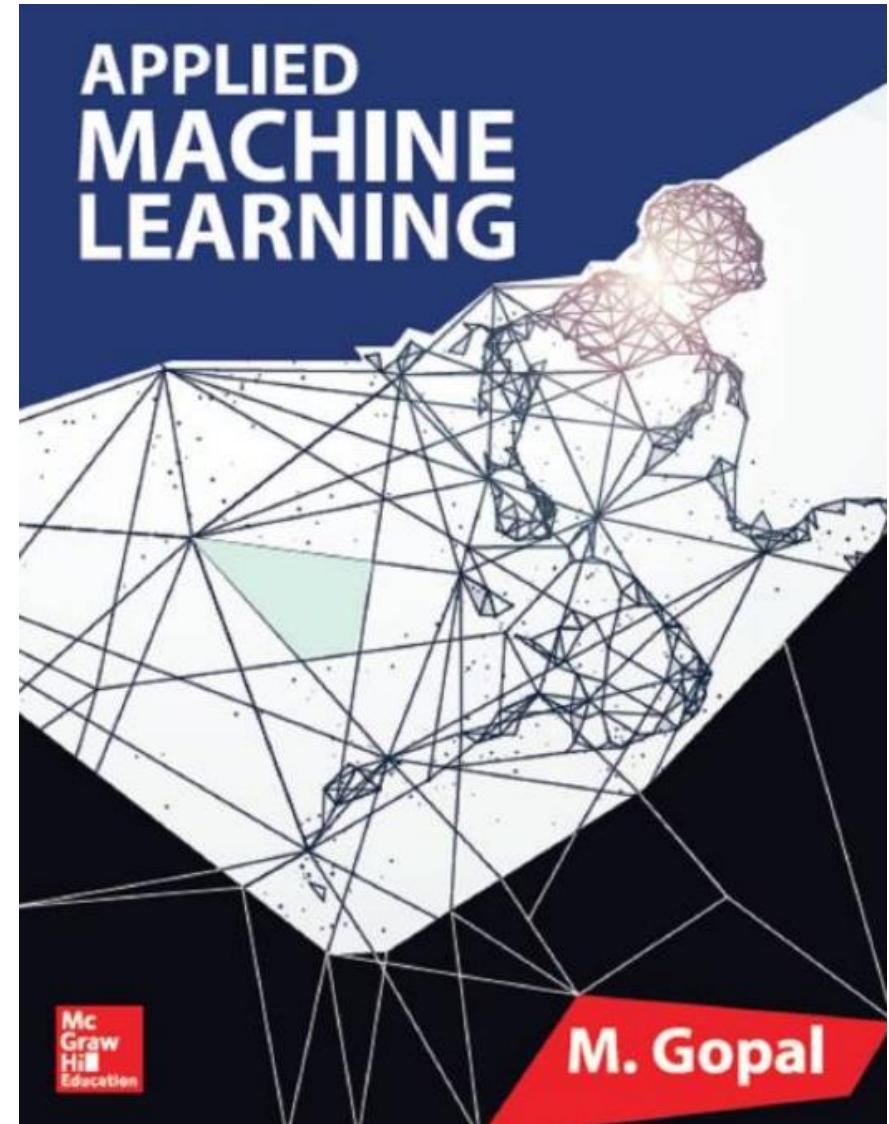


Text Book: Applied Machine Learning

Author: M. Gopal

Download:

<https://chaitanyaserver.com/wp-content/uploads/2024/02/Applied-Machine-Learning-by-M-Gopal.pdf>

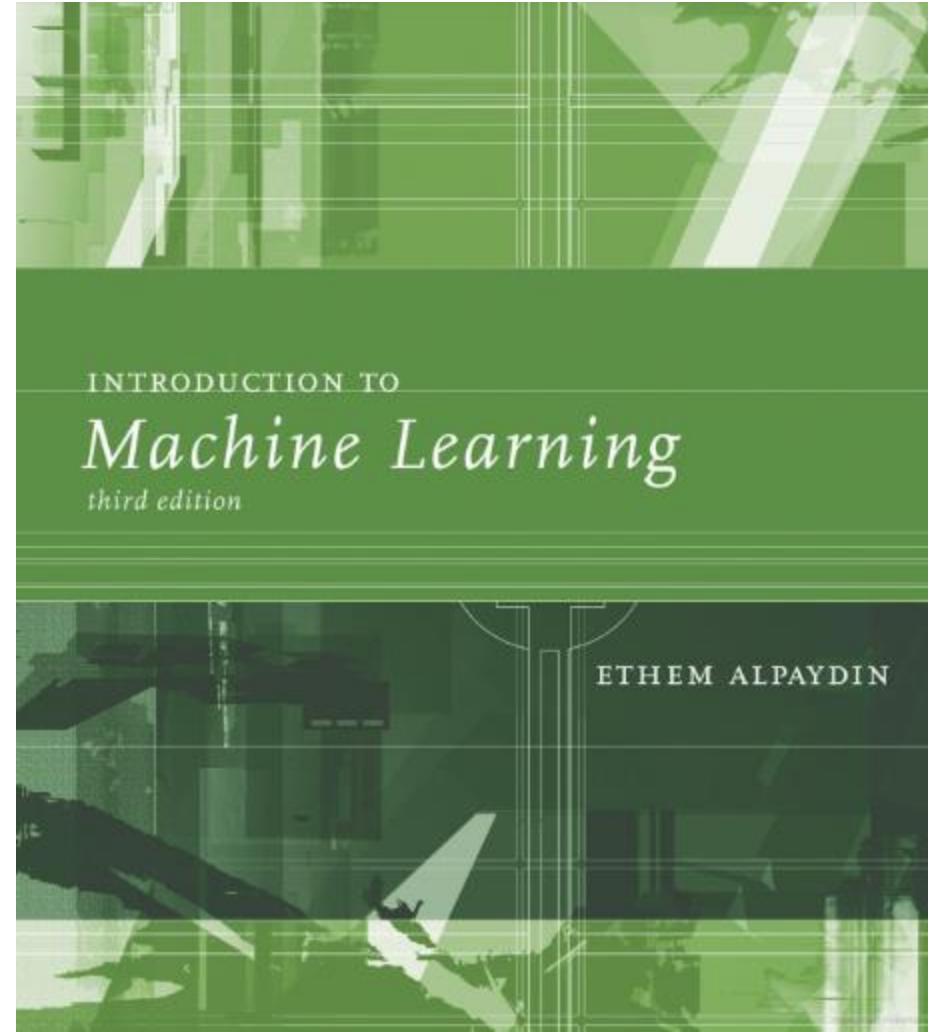


Reference Book: Machine Learning

Author: Ethem Alpaydın

Download:

https://kkpatel7.wordpress.com/wp-content/uploads/2015/04/alpaydin_machinelearning_2010.pdf

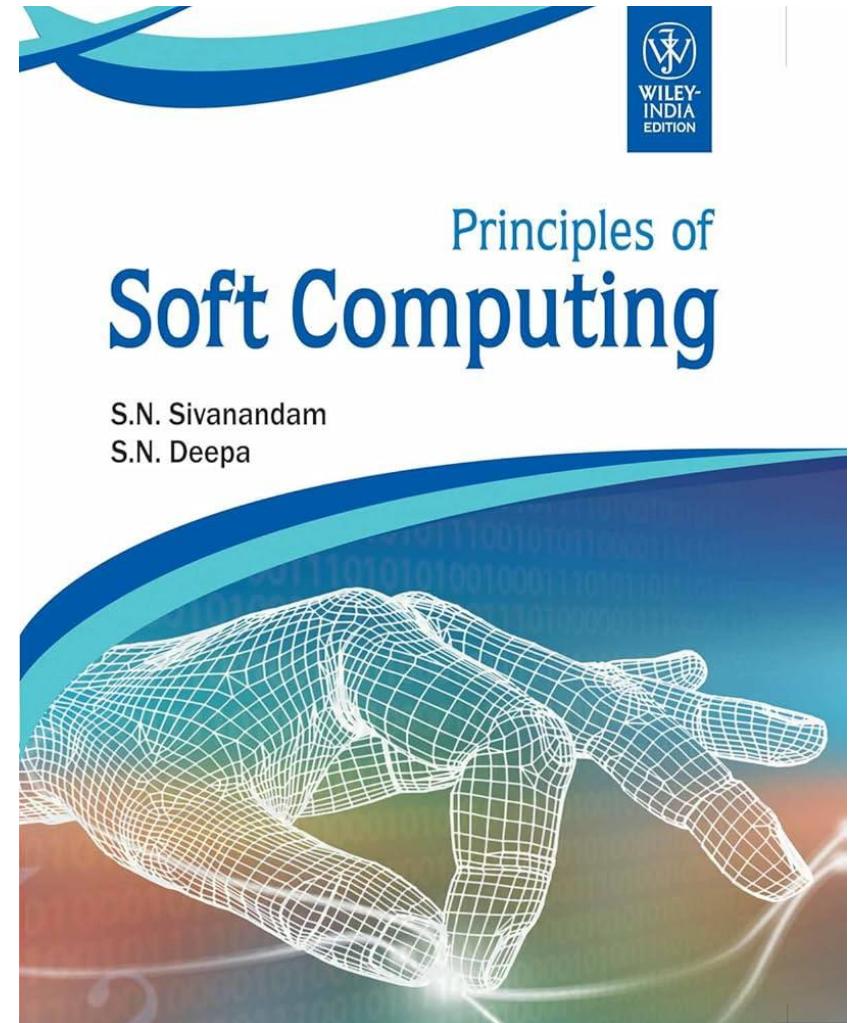


Reference Book: Principles of Soft Computing

Author: S. N. Sivanandam
And S. N. Deepa

Download:

<https://pg.its.edu.in/sites/default/files/MCAKCA032-PRINCIPLES%20OF%20SOFT%20COMPUTING-SN%20SIVNANDAM%20AND%20DEEPA%20SN.pdf>

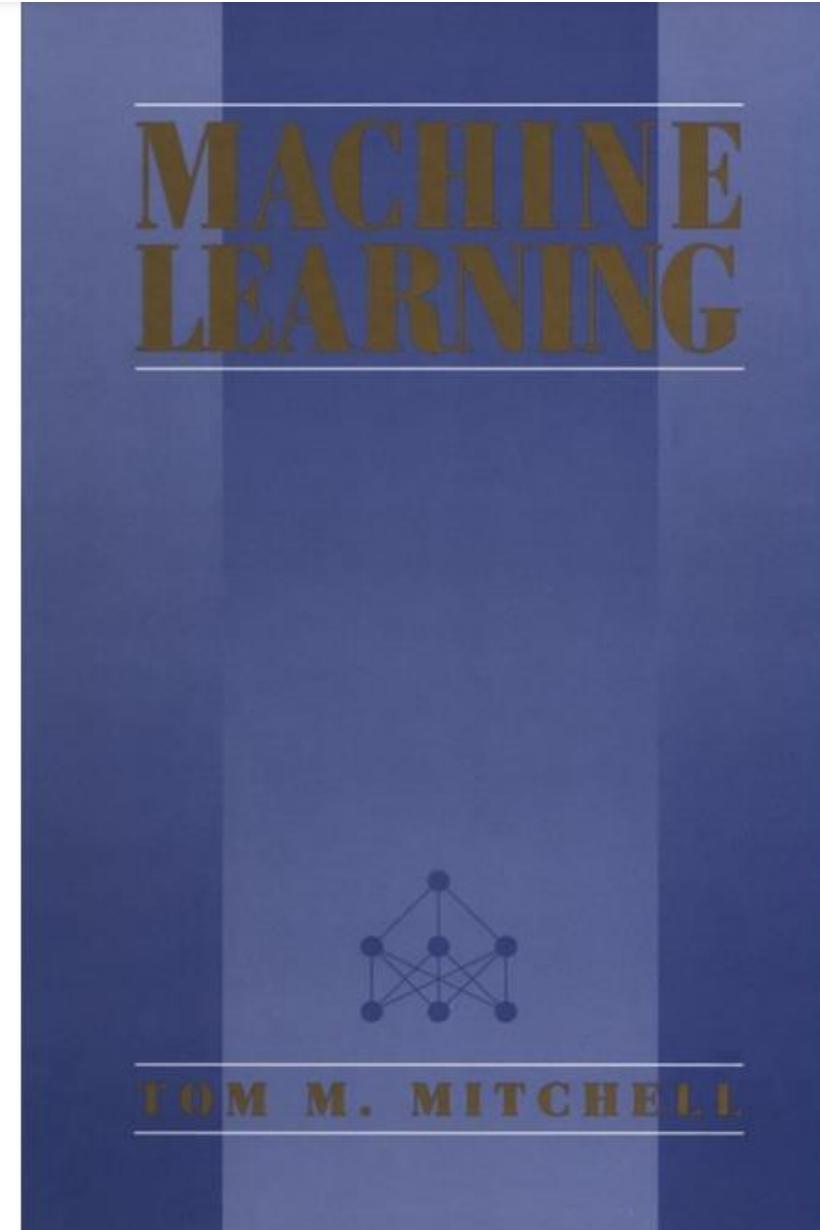


Reference Book: Machine Learning

Author: Tom Mitchell

Download:

[https://www.cs.cmu.edu/~tom/files/MachineLearning
TomMitchell.pdf](https://www.cs.cmu.edu/~tom/files/MachineLearningTomMitchell.pdf)



Relevant Websites

| S. No | Web Address | Salient Features |
|-------|---|---|
| 1 | https://pythonprogramming.net/k-nearest-neighbors-intro-machine-learning-tutorial/ | Introduction to Classification, Working of KNN model |
| 2 | https://pythonprogramming.net/support-vector-machine-fundamentals-machine-learning-tutorial/ | SVM Model |
| 3 | https://pythonprogramming.net/neural-networks-machine-learning-tutorial/ | Introduction to Artificial Neural Networks |
| 4 | https://pythonprogramming.net/reading-csv-files-python-3/ | Reading a CSV file in python |
| 5 | https://nptel.ac.in/courses/106105152 | Online Machine Learning Video Lectures |

Syllabus / Course Outline



UNIT I:
Introduction to
Machine Learning



UNIT II:
Supervised
Learning



UNIT III:
Unsupervised
Learning



UNIT IV: Image
Processing



UNIT V: Neural
Networks and Deep
Learning



UNIT VI:
Advanced Topics in
Machine Learning

UNIT I:

Introduction to Machine Learning

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- History of Machine Learning,
 - Programs vs learning algorithms,
 - Basic definitions,
 - Supervised Learning,
 - Unsupervised Learning,
 - Reinforcement Learning,
 - Issues in machine learning,
 - Different Applications of Machine learning.

UNIT II:

Supervised Learning

- Regression,
- Linear Regression,
- Polynomial Regression,
- Classification,
- Logistic Regression,
- k-Nearest Neighbors (k-NN),
- Support Vector Machines (SVM),
- Decision Trees and Random Forests,
- Ensemble Methods,
- Bagging, Boosting,
- Model Evaluation Techniques,
- Cross Validation,
- Hyperparameter Tuning,
- Introduction to Scikit-learn,
- Hands-on with Real-world Datasets

UNIT III:

Unsupervised Learning

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- Clustering, k-Means,
 - Hierarchical Clustering,
 - Dimensionality Reduction,
 - Principal Component Analysis (PCA),
 - Anomaly Detection,
 - Autoencoders and Feature Learning,
 - Case Studies and Applications of Unsupervised Learning

UNIT IV:

Image

Processing

- Introduction to Digital Image Processing,
- Image Enhancement Techniques,
- Histogram Equalization,
- Contrast Stretching, Filtering,
- Image Segmentation,
- Thresholding,
- Region Based Segmentation,
- Feature Extraction from Images,
- Edge Detection,
- Corner Detection,
- Blob Detection,
- Case Studies and Applications of Image Processing in Computer Vision

UNIT V: Neural Networks and Deep Learning

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- Introduction to Neural Networks,
 - Perceptron and Multilayer Perceptron (MLPs),
 - Activation Functions: Sigmoid, ReLU, and others,
 - Convolutional Neural Networks (CNNs) for Image Recognition,
 - Recurrent Neural Networks (RNNs) for Sequence Data,
 - Transfer Learning and Pre-trained Models

UNIT VI: Advanced Topics in Machine Learning

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- Reinforcement Learning,
 - Q-Learning,
 - Deep Q Networks (DQNs),
 - Model Compression and Optimization,
 - Recent Advances in Machine Learning,
 - Future Trends and Challenges in Machine Learning

Practical

| Practical No | Practical |
|---------------------|---|
| Practical 1 | |
| Practical 2 | Importing and Exporting Data in python, Data wrangling, Exploratory Data Analysis |
| Practical 3 | |
| Practical 4 | |
| Practical 5 | Implementation and performance analysis of Linear Regression, Multi Regression, Non Linear Regression |
| Practical 6 | |
| Practical 7 | |
| Practical 8 | Implementation and performance analysis of KNN, SVM and Logistic Regression |

Practical



| Practical No | Practical |
|--------------|--|
| Practical 9 | Implementation and performance analysis of k-Means and Hierarchical Clustering |
| Practical 10 | |
| Practical 11 | Implement and compare any two ensemble-based machine learning approaches on different datasets |
| Practical 12 | |
| Practical 13 | Design of an Artificial Neural Network for given dataset |
| Practical 14 | Implement and compare the performances of any three-machine learning based classification models on different datasets |

Tools and Language

- Python 3.10
- Docker 27.3
- PyCharm Professional
- GitHub
- Jupyter Notebook / Lab



Grading policy

- Attendance – 5%
- CA - (o2)– 25%
- Mid Term – 20%
- End Term Practical – 25%
- End Term Test – 25%
- CA Category : A02o2 (Total 2 / Best of 2)

GitHub Classroom

- All assignments and study materials will be available in the GitHub repository.
- To access the repository, you must have a GitHub account.
- An invitation will be sent to the email linked to your GitHub account.
- Simply accept the invitation to gain access to:
 - All lecture materials
 - All lab materials