KANNUR UNIVERSITY

(Abstract)

Integrated M.Sc. in Computer Science with Specialization in Artificial Intelligence and Machine Learning Programme under CBCSS, offered at NAS College Kanhangad w.e.f.2020 Admission- Syllabus of 8th Semester Courses with Model Question Papers- Approved - Orders issued.

ACADEMIC C SECTION

Acad/C2/16586/NGCI/2021 Dated: 20.02.2024

Read:-1. U.O Acad/C2/16586/NGCI/2021(I) dated 30.07.2021
2. U.O Acad/C2/16586/NGCI/2021(1) dated 11.08.2021
3. U.O Acad/C2/16586/NGCI/2021 dated 17.03.2022
4. U.O Acad/C2/16586/NGCI/2021 dated 19.10.2022
5. U.O Acad/C2/16586/NGCI/2021 dated 24.05.2023
6. U.O Acad/C2/16586/NGCI/2021 dated 05/10/2023
7. Syllabus & Model Question Papers of VIII semester courses submitted by the Convenor, Expert Committee, vide e-mail dtd. 01/02/2024

ORDER

1. As per paper read (1) above, the Scheme and Syllabus of the Ist and 2nd Semester Core courses and the Pattern of Question Papers of the New Generation programme viz, integrated M.Sc in Computer Science with Specialization in Artificial Intelligence and Machine Learning (CBCSS) , offered at Nehru Arts & Science College, Kanhangad, was approved and implemented w.e.f 2020 admissions.
2. The Syllabus of 3rd , 4th , 5th, 6th and 7th semester Core Courses and Model Question Papers of integrated M.Sc.in Computer Science with Specialization in Artificial Intelligence and Machine Learning (CBCSS) programme was approved and implemented w.e.f 2020 admission vide papers read (2), (3), (4), (5) & (6) above,
3. As per paper read (7) above, the Convenor, Expert Committee submitted the syllabus of 8th Semester Courses & Model Question Papers of Integrated M.Sc.in Computer Science with Specialization in Artificial Intelligence and Machine Learning Programme prepared by the Expert Committee.
4. The Vice-Chancellor, after considering matter in detail and in exercise of the power of the Academic Council conferred under section 11(1) Chapter III of the Kannur University Act 1996, ***accorded sanction to implement the syllabus of 8th Semester Courses & Model Question Paper of Integrated M.Sc.in Computer Science with Specialization in Artificial Intelligence and Machine Learning Programme (CBCSS) , w.e.f 2020 admission***, subject to report to the Academic Council.
5. The Syllabus of VIII th Semester Courses & Model Question Papers for Integrated M.Sc in Computer Science with Specialization in Artificial Intelligence and Machine Learning Programme (CBCSS), w.e.f 2020 admission, are appended and uploaded in the university website (www.kannuruniversity.ac.in).
6. Orders are issued accordingly.

Sd/-
Narayanadas K
DEPUTY REGISTRAR (ACAD)
For REGISTRAR

To: 1.The Principal
Nehru Arts & Science College, Kanhangad
2. The Convener, Expert committee.

Copy To: 1.The Examination Branch (Through PA to CE)
2. PS to VC/PA to Registrar/PA to CE
3. DR/AR I (Acad)
4. EXCI/ EG I/ AR II (Exam)
4.The Web Manager, Computer Programmer (for uploading in the website)
5. SF/DF/FC

KANNUR UNIVERSITY CIVIL STATION P.O. KANNUR Pin-670 002 KERALA

Forwarded / By Order
SECTION OFFICER

KV

8B33ICSC: Mathematical Models of Machine Learning - II

Semester	Course Code	Hours per Week	Exam Hours	Credits
8	8B33ICSC	4	3	3

Course Outcome

CO 1: Understand the concepts of probability and distributions.
CO 2: Understand the optimization techniques.
CO 3: Understand regression and classification techniques.
CO 4: Understand classification using SVM and dimensionality reduction.

Unit I

Probability and Distributions: Construction of probability space, Discrete and continuous probabilities, Sum rule, Product rule and Bayes' Theorem, Summary statistics and Independence.

(10 Hours)

Unit II

Continuous Optimization: Gradient descent, stepsize, gradient descent with momentum, stochastic gradient descent, constrained optimization and Lagrange Multipliers, Convex optimization. Data, models and learning, cross-validation.

(16 Hours)

Unit III

Linear Regression and Classification: Problem formulation, Parameter estimation, assessing the accuracy of coefficient estimates and model, Multiple linear regression. Overview of classification, Logistic regression and KNN introduction.

(16 Hours)

Unit IV

Classification with Support Vector Machines: Hyperplanes, Separating Hyperplanes, primal support vector machine, concept of margin, geometric view, kernels. Introduction to dimensionality reduction.

(12 Hours)

Text Boks

[1] Marc Peter Deisenroth, A Aldo Faisal and Cheng Soon Ong (2021). *Mathematics for Machine Learning*, Cambridge University Press.
https://mml-book.github.io/

[2] Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani (2013). *An Introduction to Statistical Learning*. Springer

References

[1] Shai Ben-David and Shai Shalev-Shwartz (2014). *Understanding Machine Learning: From Theory to Algorithms*. Cambridge University Press.

[2] Aurélien Géron (2019). H*ands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow*. O'Reilly Media, Inc.

Marks Including Choice

Unit	Marks
I	20
II	20
III	20
IV	20

Model Question Paper

8B33ICSC: Mathematical Models of Machine Learning - II

Time: 3 Hours **Max. Marks: 80**

Section A

Answer any 5 questions. Each question carries 4 marks

1. Explain the axioms of probability with respect to the concepts sample space, event space, and probability measure.
2. Explain Probability Density Function.
3. How Gradient descent is used for optimisation?
4. Explain logistic regression in terms of probability theory.
5. Explain how PCA minimises the average reconstruction error.
6. How to maximise the variance of the low-dimensional code using a sequential approach?

(5 x 4 = 20 Marks)

Section B

Answer any 3 questions. Each question carries 8 marks

7. Explain Discrete and Continuous Probabilities with examples.
8. How Cross-Validation is used to assess the generalization performance?
9. Explain how to estimate the regression coefficients in multiple regressions with examples.
10. Find low-dimensional representations to minimize the compression loss.
11. Explain the geometry behind the Separation of Hyper planes.

(3 x 8 = 24 Marks)

Section C

Answer any 3 questions. Each question carries 12 marks

12. Explain Bayes' Theorem as the sequences of product and sum rules.
13. Explain different summary statistics for the random variables.
14. Explain how Lagrange Multipliers used in constrained optimization problems.
15. Explain how to find good parameters and how to evaluate whether a parameter set works well for the model.
16. Explain the different methods to find out the margin of the hyperplane in SVM.

(3 x 12 = 36 Marks)

8B34ICSC: Advanced Artificial Intelligence

Semester	Course Code	Hours per Week	Exam Hours	Credits
8	8B34ICSC	3	3	3

Course Outcome

CO 1: Understand Knowledge-Based Systems and First Order Logic
CO 2: Proficiency in Advanced Planning Techniques and Knowledge Representation:
CO 3: Skills in Ensemble and Statistical Learning
CO 4: Comprehensive Knowledge in Probabilistic Reasoning and Models
CO 5: Foundational Understanding of Robotics and Explainable AI

Unit I

Knowledge reasoning and planning: Knowledge base agents, first order logic, Knowledge engineering in first order logic, Logic-Based Application Example: Financial Advisor, Inference in first order logic: forward chaining, backward chaining, resolution-CNF for FOL, standardise variable, Skolemization, drop universal quantifiers. Practical uses of resolution theorem provers.

(14 Hours)

Unit II

Planning: classical planning, Algorithm for planning as state space search-forward and backward state space search, Basics of Planning graph, hierarchical planning, Knowledge Representation: Introduction to Ontology, Components, categories and objects, Events, Mental events and mental objects, Reasoning systems for categories, Description logic.

(12 Hours)

Unit III

Learning from example: Ensemble learning, knowledge in Learning Explanation based learning, statistical learning, learning with complete data, uncertain knowledge, combining beliefs and desires under uncertainty, Probabilistic Reasoning: Introduction ,Overview of Probability Theory ,Bayes Networks. Hidden markov model, variant of HMM, autoregressive HMM, factorial HMM, Hierarchical HMM.

(16 Hours)

Unit IV

Introduction to Robotics: Robot Locomotion and its types, Hardware-sensors, range finders, cameras, GPS. Robotic perception, localaization and mapping. Software architecture for a robotic car, other applications. Applications of Robotics Human-Computer Interaction (HCI) and AI, Explainable AI-Methods- SHAP, LIME, Permutation Importance, Partial Dependence Plot, Anchors.

(12 Hours)

Textbook

[1] Norvig, P., Russell, S. J. (2016). *Artificial Intelligence: A Modern Approach*, Pearson.
[2] Daphne, Koller, Friedman Nir, and Bach Francis (2009). *Probabilistic graphical models: principles and techniques*. Adaptive Computation and Machine Learning, MIT Press.

References

[1] Mitchell, Melanie (2020). *Artificial Intelligence: A Guide for Thinking Humans*. Penguin Books.
[2] George. F. Luger, *Artificial Intelligence - Structures and Strategies for Complex Problem Solving*, 6/e, 2021, Pearson Education.
[3] Rich E., Knight K., Nair B. S (2017). *Artificial Intelligence*, Tata McGraw-Hill Publ.

Marks Including Choice

Unit	Marks
I	20
II	20
III	20
IV	20

Model Question Paper

8B34ICSC: Advanced Artificial Intelligence

Time: 3 Hours **Max. Marks: 80**

Section A

Answer any 5 questions. Each question carries 4 marks

1. Define Skolemization .
2. What are the applications of Robotics?
3. Write the Importance of knowledge in Learning
4. Describe FOL in detail.
5. What are the variant of HMM?
6. Write a short note on Components of Ontology.

(5 x 4 = 20 Marks)

Section B

Answer any 3 questions. Each question carries 8 marks

7. Describe Ensemble learning in detail.
8. Represent a Financial advisor as a logic based method.
9. What is planning in AI, What are the components of planning?
10. Explain all inference of FOL with suitable examples
11. How to represent a partial dependable plot?

(3 x 8 = 24 Marks)

Section C

Answer any 3 questions. Each question carries 12 marks

12. Explain Robot and its architecture in detail .
13. Give a detailed account of Importance of probability theory in AI
14. Explain Ontological representation of knowledge in AI
15. Explain importance of Knowledge representation using Logic
16. Compare the algorithm for forward state space search and backward state space search in planning.

(3 x 12 = 36 Marks)

8B35ICSC: Advanced Machine Learning Techniques

Semester	Course Code	Hours per Week	Exam Hours	Credits
8	8B35ICSC	4	3	3

Course Outcome

CO 1: Understand model fitting and performance
CO 2: Understand machine learning for images using Convolutional networks
CO 3: Understand machine learning for text using transformer networks
CO 4: Understand reinforcement learning concepts

Unit I

Deep Neural Networks: Composing neural networks, From composing networks to deep networks, Hyperparameters, General formulation, Large, structured inputs, Training and generalization. Fitting models: Gradient descent, Stochastic gradient descent, Momentum, Adam, Training algorithm hyperparameters. Measuring performance: Noise, bias, and variance, Bias-variance trade-off.

(14 Hours)

Unit II

Convolutional networks: Invariance and equivariance, Convolutional networks for 1D inputs, Convolutional networks for 2D inputs, Downsampling and upsampling, Applications. Residual networks: Sequential processing, Residual connections and residual blocks, Exploding gradients in residual networks, Batch normalization, ResNet, DenseNet.

(12 Hours)

Unit III

Transformers: Processing text data, Dot-product self-attention, Extensions to dot-product self-attention, Transformers, Transformers for natural language processing, BERT, GPT3, Transformers for long sequences, Transformers for images, ImageGPT.

(16 Hours)

Unit IV

Reinforcement learning - Markov decision processes, returns, and policies, Expected return, Tabular reinforcement learning, Fitted Q-learning, Policy gradient methods, Offline reinforcement learning.

(12 Hours)

Textbook

[1] Simon J.D. Prince (2023). *Understanding Deep Learning*. MIT Press. https://udlbook.github.io/udlbook/

References

[1] Chris Bishop, Hugh Bishop (2024). Deep Learning: Foundation and Concepts. Springer International Publishing AG. https://www.bishopbook.com/
[2] K. Murphy (2012), *Machine Learning: A Probabilistic Perspective*, MIT Press.
[3] Brett Lantz, *Machine Learning with R*, Packt Publishing, 2nd Edition.
[4] Tom Micheal (1997), *Machine Learning*, Mcgraw Hill
[5] Simon Rogers, Mark Girolami, *A First course in Machine Learning*, CRC Press, First Indian reprint, 2015.
[6] E. Alpayidin, *Introduction to Machine Learning*, Prentice Hall of India (2005)
[7] T. Hastie, RT Ibrashiran and J. Friedman, *The Elements of Statistical Learning*, Springer 2001
[8] https://www.coursera.org/learn/machine-learning

Marks Including Choice

Unit	Marks
I	20
II	20
III	20
IV	20

Model Question Paper

8B35ICSC: Advanced Machine Learning Techniques

Time: 3 Hours **Max. Marks: 80**

Section A

Answer any 5 questions. Each question carries 4 marks

1. Why are hyper parameters crucial in the training process?
2. Define the terms noise, bias, and variance in the context of evaluating the performance of a machine learning model.
3. Compare ResNet and DenseNet architectures.
4. Explain Positional encoding.
5. Explain Bellman equations.
6. Briefly explain Role of Fitted Q-learning in reinforcement learning.

(5 x 4 = 20 Marks)

Section B

Answer any 3 questions. Each question carries 8 marks

7. Explore the evolution of neural network architectures from shallow to deep.
8. Explain strategies to find an optimal balance between bias and variance
9. Explain the role of CNN in spatial processing.
10. Explain Dot-product self-attention.
11. Explain Tabular reinforcement learning.

(3 x 8 = 24 Marks)

Section C

Answer any 3 questions. Each question carries 12 marks

12. Explain how to visualize the multivariate inputs.
13. Explain the role of convolutional networks 1D inputs.
14. Explain how transformers are worked in NLP.
15. Explain Markov process in reinforcement learning.
16. Explain the optimization algorithms used in training deep neural networks.

(3 x 12 = 36 Marks)

8B36ICSC: Data Mining

Semester	Course Code	Hours per Week	Exam Hours	Credits
8	8B36ICSC	4	3	3

Course Outcome

CO 1: Understand Data Mining Concepts and Ethics
CO 2: Learn Data Preprocessing and Distributed File Systems
CO 3: Familiarity with Distance Measures and Mining Data Streams
CO 4: Familiarize Clustering Techniques and Recommendation Systems

Unit I

What is Data Mining - Modeling, Statistical Modeling, Machine Learning, Computational Approaches to Modeling, Feature Extraction. Statistical Limits on Data Mining - Total Information Awareness, Bonferroni's Principle, An Example of Bonferroni's Principle. Applications - The weather problem, Irises. Data mining and ethics.

(14 Hours)

Unit II

Data preprocessing - Data cleaning - Sparse data, Missing values, Inaccurate values, Data transformation, Data reduction, Discretization and generating concept hierarchies. Distributed File Systems - Physical Organization of Compute Nodes, Large-Scale File-System Organization, MapReduce - The Map Tasks, Grouping by Key, Combiners, Details of MapReduce Execution, Coping With Node Failures. Algorithms Using MapReduce.

(12 Hours)

Unit III

Distance Measures - Euclidean Distances, Jaccard Distance, Cosine Distance, Hamming Distance, Mahalanobis distance. Mining Data Streams - The Stream Data Model, Sampling Data in a Stream, Filtering Streams. Frequent Itemsets - The Market-Basket Model, Market Baskets and the A-Priori Algorithm, FPGrowth Algorithm.

(16 Hours)

Unit IV

Clustering - Introduction to Clustering Techniques, Hierarchical Clustering, The CURE Algorithm. Clustering in Non-Euclidean Spaces. Recommendation Systems - A Model for Recommendation Systems, Content-Based Recommendations, Collaborative Filtering. Dimensionality Reduction - UV-Decomposition, Root-Mean-Square Error, Incremental Computation of a UV-Decomposition, Building a Complete UV-Decomposition Algorithm, The Netflix Challenge.

(12 Hours)

Textbook

[1] Ullman, Jeffrey D., and Jure Leskovec (2020). *Mining of massive datasets*. 3rd Edition. http://www.mmds.org/
[2] Ian H. Witten, Eibe Frank, and Mark A. Hall. 2011. *Data Mining: Practical Machine Learning Tools and Techniques* (3rd. ed.). Morgan Kaufmann Publishers.

References

[1] Bertrand Clarke, Ernest Fokoue, Hao Helen Zhang (2009); *Principles and Theory for Data Mining and Machine Learning*, Springer Publishing.
[2] Tan, Steinbach & Kumar (2016), *Introduction to Data Mining*, Pearson.

Marks Including Choice

Unit	Marks
I	20
II	20
III	20
IV	20

Model Question Paper

8B36ICSC: Data Mining

Time: 3 Hours **Max. Marks: 80**

Section A

Answer any 5 questions. Each question carries 4 marks

1. Compare and contrast statistical modelling with other modelling approaches used in data mining.
2. How does sparse data affect the quality of data analysis? Provide an example of a real-world scenario
3. Outline two common techniques for handling missing data and their advantages.
4. Explain the significance of selecting an appropriate distance measure based on the nature of the data
5. Compare and contrast agglomerative and divisive hierarchical clustering.
6. Explain the Stream Data Model.

(5 x 4 = 20 Marks)

Section B

Answer any 3 questions. Each question carries 8 marks

7. Explore different techniques used for data cleaning in data preprocessing
8. Discuss the concepts of shuffling and sorting in MapReduce in detail
9. Explain Bonferroni's Principle with an example.
10. Explain the market basket analysis problem.
11. Define Clustering? Explain about Types of Data in Cluster Analysis?

(3 x 8 = 24 Marks)

Section C

Answer any 3 questions. Each question carries 12 marks

12. a) Explain different phases of map reduce
    b) Explain different types of distance measures used for measuring similarity or difference between pair of objects
13. a) Explain about the Apriori algorithm for finding frequent itemsets with an example
    b) You are given the transaction data shown in the Table below from a fast food restaurant. There are 9 distinct transactions (order:1 – order:9). There are a total of 5 meal items that are involved in the transactions. For Simplicity meal items are assigned short names (M1 – M5) rather than the full descriptive names

Meal Item	List of Item IDs
Order: 1	M1, M2, M5
Order: 2	M2, M4
Order: 3	M2, M3
Order: 4	M1, M2, M4

Order: 5	M1, M3
Order: 6	M2, M3
Order: 7	M1, M3
Order: 8	M1, M2, M3, M5
Order: 9	M1, M2, M3

Compute the following :

i) Apply the Apriori algorithm to the dataset of transactions and identify all frequent itemsets with minimum support count as 2. Clearly explain the step by step procedure of the algorithm.

ii) Find all strong association rules of the form: $X \ Y \rightarrow Z$ and note their confidence values.

14. a) What are the different types of Hierarchical Clustering
    b) Explain CURE algorithm with example
15. a) Write the steps for generating frequent itemsets using FP-Growth algorithm
    b) Generate frequent itemsets for the following data using FP-Growth algorithm with min support=5

TID	Items
1	1,2,3,5
2	2,5,7,9
3	1,3,5,7
4	2,4,6,8
5	1,2,3,4
6	2,3,4,5
7	3,4,5,6
8	4,5,6,7
9	5,6,7,8,9
10	9,1,2,5
11	8,2,9,7
12	5,6,3,2

16. Write a Short note on
    a) UV-Decomposition
    b) Utility matrix
    c) Content based recommendation system

(3 x 12 = 36 Marks)

8B37ICSC: Research Methodology

Semester	Course Code	Hours per Week	Exam Hours	Credits
8	8B37ICSC	1	2	1

Course Outcome

CO 1: Understand Fundamentals of Research Methodology
CO 2: Develop Skills in Observation and Literature Review
CO 3: Learn Basic Statistical Analysis and Academic Writing
CO 4: Learn Technical Writing and Document Formatting with LaTeX

Unit I

Research Methodology: Research, Types of Research, Research and Scientific Method-Observation, Questions, Hypothesis, Experimentation, Critical Communication, Formulation of Research Problem. Scientific Methods- Empiricism- induction and deduction, Positivism, Falsification, objectivity and subjectivity.

(4 Hours)

Unit II

Where to study? Making observations: direct and indirect observations, controlled and uncontrolled observations, human and machine observations. Research questions – Source of ideas, hypothesis and predictions, types of research reports- literature review, theory article and empirical article.

Exploring past research - Online scholarly research databases, electronic search resources,

(4 Hours)

Unit III

Basic Statistical Measurements - Measures of central tendency- Arithmetic mean, median, mode, Geometric mean and harmonic mean.
Data collection: Data collection methods - Sampling Techniques.
Statistical inference: Null and Research hypothesis, Type I and Type II errors, t Test and F test.
Article and Thesis Writing Guidelines: Fundamentals of good writing - Clarity, Acknowledging the work of others, Active versus Passive voice, Report formatting.
Organization of the report – Title page, Abstract, Body of the paper, References, Appendix, Footnotes, Tables, Figures.
Use of headings, Citing and Referencing styles, Abbreviations, Style of reporting number and statistics. Basics of Paper and poster presentation.

(6 Hours)

Unit IV

*This unit is for assignment purposes only.
Technical Writing in Latex: Latex compilation, formatting, writing books as chapters, designing header and footer, designing chapters and sections, creating lists, tables, inserting images, setting

labels and reference, index, list of figures and tables, math formulae, hyperlinks, bookmarks, bibliography

(4 Hours)

References

[1] Paul C. Cozby, Scott C. Bates (2017). *Methods in Behavioural Research*., 13th Edition, McGraw-Hill.

[2] Gieryn, T.f. *Cultural Boundaries of Science*. Univ. Chicago Press, 1999.

[3] Collins H. and T. Pinch. *The Golem: What Everyone should know about Science*, Cambridge Univ Press, 1993

[4] Kothari, C.R., 1990. *Research Methodology: Methods and Techniques*. New Age International.Publishers (Second revised edition)

[5] S.P Satarkar, S.V., 2000. *Intellectual Property Rights and Copyright*. Ess Publications.

[6] Lamport, L. (1994). *Latex: A Document Preparation System, 2/E. (1994)*. India: Pearson Education.

Marks Including Choice

Unit	Marks
I	15
II	15
III	20
IV	0

Model Question Paper

8B37ICSC: Research Methodology

Time: 3 Hours **Max. Marks: 50**

Section A

Answer any 1 questions. Each question carries 2 marks

1. What are Type I and Type II errors?
2. What are the elements of IPR/
3. How does sample size affect the interpretation of survey results?

(1 x 2 = 2 Marks)

Section B

Answer any 2 questions. Each question carries 4 marks

4. Define and distinguish between
    a) hypothesis, theory and law
    b) induction and deduction
    c) objectivity and subjectivity
    d) Positivism, Falsification
5. Why are samples used in research?
6. Distinguish between literature reviews, theory articles, and empirical research articles.
7. What information does the researcher communicate in each of the sections of a research article?

(2 x 4 = 8 Marks)

Section C

Answer any 2 questions. Each question carries 8 marks

8. Distinguish between probability and nonprobability sampling techniques. What are the implications of each?
9. Why is it important for anyone in our society to have knowledge of research methods?
10. How to cite and reference the sources in a research report

(2 x 8 = 16 Marks)

Section D

Answer any 2 questions. Each question carries 8 marks

11. How does basic research differ from applied research? Explain with examples.
12. Distinguish between simple random, stratified random, quota sampling and cluster sampling.
13. Make a short note on the organisation of a report.

(2 x 12 = 24 Marks)

8B38ICSC: Lab-11: Case Study (Data Mining)

Semester	Course Code	Hours per Week	Exam Hours	Credits
8	8B38ICSC	4	3	4

The goal of this case study is to cultivate self-learning skills in mastering data mining tools and techniques. Students are required to use Python or R as data mining tools. The teacher-in-charge will introduce the selected data mining tools. A flipped classroom approach has to be used, wherein students will be directed by the teacher to explore and utilize online tutorials and courses as a means to independently enhance their understanding of data mining techniques prior to class discussions and activities. A series of lab assignments will be prepared by the teacher. Each student is expected to apply data mining techniques to solve a specific problem using the selected tools. Students will be required to submit a comprehensive report including the problem statement, solution description, code (if any), and output for end semester evaluation.

Evaluation Scheme for ESE

Report	10
Demonstration of Data Mining Techniques	20
Viva on Data Mining Tool and Techniques	10
Model Performance and Analysis	15
Data Exploration and Visualization	15
Overall Presentation and Communication	10

8B39ICSC: Lab-12: Advanced Machine Learning

Semester	Course Code	Hours per Week	Exam Hours	Credits
8	8B39ICSC	5	3	4

Course Outcome

CO 1: Ability to Compose Multiple Neural Network Modules for Complex Models
CO 2: Understanding the Role of Hyperparameters in Machine Learning Models
CO 3: Appreciation of the Importance of Tokenization in Natural Language Processing
CO 4: Knowledge of 1D Convolutional Neural Networks and Their Application in Sequence Processing
CO 5: Observation of the Impact of Dimensionality Reduction on SVM Model Performance

Exercises

1. Implement the gradient descent algorithm for linear regression.
2. Implement the stochastic gradient descent algorithm for logistic regression.
3. Use the MNIST dataset and compose a neural network with layers suitable for image classification.
4. Implement a Support Vector Machine for classification using the MNIST dataset with feature extraction using Principal Component Analysis to reduce the dimensionality of the data.
5. Implement a 1D Convolutional Neural Network for sequence classification.
6. Implement a 2D convolutional network using the CIFAR-10 dataset for image classification.
7. Evaluate the trained model on the Fashion MNIST dataset and analyze bias, variance, and the trade-off.
8. Build a ResNet model with residual connections and Batch Normalization using the SVHN dataset (Street View House Numbers)
9. Implement a transformer for sentiment analysis using the IMDB movie review dataset.
10. Implement the Markov Decision Processes algorithm to find the optimal policy using the given environment actions, transitions, and rewards. Print the optimal policy for each state.
11. Implement a Q-learning algorithm to solve a tabular reinforcement learning problem using the OpenAI Gym environment.