माधव प्रौद्योगिकी एवं विज्ञान संस्थान, ग्वालियर (म.प्र.), भारत
MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR (M.P.), INDIA
Deemed University
(Declared under Distinct Category by Ministry of Education, Government of India)
NAAC ACCREDITED WITH A++ GRADE

Centre for Artificial Intelligence

Syllabi

of

Departmental Core Courses (DC)

of

B. Tech VI Semester

[Information Technology (Artificial Intelligence and Robotics)/ Artificial Intelligence (AI) and Data Science/ Artificial Intelligence (AI) and Machine Learning]

for batch admitted in 2022-23

(under the flexible curriculum)

Centre for Artificial Intelligence

AI FOR ROBOTICS
(2240621)

COURSE OBJECTIVES

- To study the concepts of Artificial Intelligence in Robotics.
- To learn the methods of solving problems in Robotics using Artificial Intelligence.
- To learn about planning, strategies and algorithms.

Unit I

Introduction to Robotics Engineering and AI Integration: Overview of Robotics Engineering, Laws of Robotics, Types of Robot, Components Needed for Robot, Robot Standards and Safety Regulations, Robot System Analysis, Trends in Robotics System, Requirements of AI for Robot Automation, AI agents, Algorithms used in Robotics, Case Studies: Sofia, ASIMO, IBM Watson.

Unit II

Path Planning and Control in Robotics: Overview of Path Planning and Control, Path Planning Categories: Environment-based, Algorithm-based, Completeness-based, Robot Control Architectures for Path Following, Robot Path Planning Problem, and Complexity.

Unit III

Artificial Intelligence for Global Path Planning: Classical Approaches to Path Planning, Graph Search Approaches: A* and AO* Algorithm, Heuristic Approaches: Tabu Search, Genetic Algorithm, Ant Colony Optimization, Hybrid Approaches in Path Planning, Case studies of AI-powered Path Planning in Robotics.

Unit IV

Simultaneous Localization and Mapping (SLAM): Introduction to SLAM, EKF-SLAM, Graph-based SLAM (G-SLAM), Feature-based Mapping: Feature extraction and matching, FastSLAM algorithm, Comparison of feature-based mapping techniques.

Unit V

Advancements in AI for Robotics: Swarm Robotics and Multi-Robot Systems, Bio-inspired Robotics, Integration of AI and Robotics in Industry 4.0.

Centre for Artificial Intelligence

RECOMMENDED BOOKS

1. Poole, Harry H. "Fundamentals of robotics engineering. Springer Science & Business Media", 2012.
2. Steven M. LaValle, "Planning Algorithms", 2006.
3. Anis Koubaa, Hachemi Bennaceur, Imen Chaari, Sahar Trigui, Adel Ammar, Mohamed-Foued Sriti, Maram Alajlan, Omar Cheikhrouhou, Yasir Javed, "Path Planning and Cooperation: Foundations, Algorithms and Experimentations", 2018.
4. Robin R. Murphy, "Introduction to AI Robotics", second edition, 2019.
5. Dubey, Ashutosh Kumar, Abhishek Kumar, S. Rakesh Kumar, N. Gayathri, and Prasenjit Das, eds. AI and IoT-based Intelligent Automation in Robotics. John Wiley & Sons, 2021.

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1. describe fundamental concepts in robotics engineering and Artificial Intelligence integration in robotics.

CO2. explain the basics of robotics path planning and control.

CO3. utilize various artificial intelligence techniques for effective global path planning solutions in diverse robotic scenarios.

CO4. discover appropriate Simultaneous Localization and Mapping techniques for robots.

CO5. evaluate the strengths, weaknesses, and trade-offs among various Simultaneous Localization and Mapping methods.

CO6. design and propose advanced solutions for addressing complex challenges in the field of Artificial Intelligence for robotics.

CO-PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	2	1	1			1	1	1	3	2
CO2	3	3	3	2	2	2			1				3	2
CO3	3	3	3	3	3	1					2		3	1
CO4	3	3	3	3	3		1		1		1	1	3	1
CO5	3	3	3	3	1	1	1	1		1	1	2	3	2
CO6	3	3	3	3	3	2	1	1	2	2	3	3	3	3

Centre for Artificial Intelligence

IMAGE PROCESSING
(2240622/2270622/2280622)

COURSE OBJECTIVES

- To impart knowledge about the fundamental steps of image processing.
- To study the various image enhancement and segmentation techniques in spatial and frequency domain
- To understand image compression, image segmentation and Color image processing.

Unit I

Introduction: Digital image representation, Fundamental steps in image processing, Components of Digital Image processing systems, Elements of visual perception, Image Formation model, Image Sampling and quantization, Relationship between pixels – neighbourhood, adjacency connectivity, regions, boundaries and distance measures.

Unit II

Image Enhancement: Enhancement by point processing, Sample intensity transformation, Histogram processing, Image subtraction, Image averaging, Spatial filtering- Smoothing Spatial filters, Sharpening Spatial filters.

Unit III

Image Segmentation: Detection of discontinuities - point, line and edge detection, Edge linking and boundary detection, Thresholding, Region based segmentation - region growing, region splitting and merging, Use of motion in segmentation- Spatial techniques and Frequency domain techniques.

Unit IV

Image Restoration and Compression: A model of the image degradation/restoration process, noise models, restoration in the presence of noise–only spatial filtering, Weiner filtering, constrained least squares filtering, geometric transforms; Introduction to the Fourier transform and the frequency domain, estimating the degradation function. Image Data Compression: Fundamentals, Compression models, Error free compression, Lossy Compression, Image compression standards.

Unit V

Color Image Processing: Color Models, Pseudo color Image Processing, Color Transformations, Smoothing and sharpening, Image Segmentation based on color. Applications of Image Processing: Medical imaging, Robot vision, Character recognition, Remote Sensing.

Centre for Artificial Intelligence

RECOMMENDED BOOKS

1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, Addison-Wesley Publishing Company, 2007
2. Gonzalez R. C, Woods R. E and Eddins S. L;Digital Image Processing using MATLAB, McGraw Hill Education, 2nd edition, 2017.
3. Sonka M. Hlavac V., Boyle R., Image Processing, Analysis and Machine Vision, Cengage Learning, 3rd edition, 2007.
4. A. K. Jain, Fundamentals of Digital Images Processing, Pearson Education India, 2015

COURSE OUTCOMES

After completion of the course students will be able to:

CO1: describe the fundamentals of image processing.

CO2: classify image enhancement techniques in both spatial and frequency domains

CO3: apply image segmentation for object and boundary detection.

CO4: analyze the causes for image degradation and image restoration.

CO5: evaluate image compression techniques.

CO6: implement novel image filtering techniques.

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	2	2	1	1			1	1	1	3	2
CO2	3	3	3	2	2				1				3	2
CO3	3	3	3	2	3	1			1		2		3	3
CO4	3	3	3	3	3		1		1		1	1	3	2
CO5	3	3	3	3	2	1	1			1	1	2	3	2
CO6	3	3	3	3	3	2	1		2	2	3	2	3	3

Centre for Artificial Intelligence

ARTIFICIAL INTELLIGENCE & MACHINE LEARNING
(2240623)

COURSE OBJECTIVES

- To provide the fundamental knowledge of Artificial Intelligence and Machine Learning.
- To present the basic representation and reasoning paradigms used in Artificial Intelligence and Machine Learning.
- To understand the working of techniques used in Artificial Intelligence and Machine Learning.

Unit I

Introducing Artificial Intelligence: Computation, Psychology and Cognitive Science, Perception, Understanding and Action. Artificial Intelligence vs Machine Learning vs Deep Learning., Key Elements of Machine Learning: Representation, Process (Data Collection, Data Preparation, Model Selection, Model Training, Model Evaluation and Prediction), Evaluation and Optimization. Maximum likelihood estimation, Types of Learning: Supervised, Unsupervised and Reinforcement Learning. Regression vs Classification Problems Applications of Artificial intelligence and Machine Learning in the real world.

Unit II

Problem, Problem Space and Search: Production System, Blind Search: BFS & DFS, Heuristic Search, Hill Climbing, Best First Search.

Introduction to Neural Networks: History, Biological Neuron, Artificial Neural Network, Neural Networks Multilayer Perceptron, Back-propagation algorithm and its variants Stochastic gradient descent.

Unit III

Supervised Machine Learning: Linear Regression: Implementation, Applications & Performance Parameters, K-Nearest Neighbour Classification Decision Tree Classifier, Terminology, Classification vs Regression Trees, Tree Creation with Gini Index and Information Gain, IDE3 Algorithms, Applications and Performance Parameters. Random Forest Classifier, Naïve Bayes Classifier, Support Vector Machines Case Study on Regression and Classification for solving real world problems.

Unit IV

Unsupervised Machine Learning: Introduction, Types: Partitioning, Density Based, DBSCAN, Distribution Model-Based, Hierarchical, Agglomerative and Divisive, Common Distance Measures, K-Means Clustering Algorithms, Case Study on Clustering for solving real world problems.

Unit V

Deep Learning Architectures: Machine Learning and Deep Learning, Representation Learning, Width and Depth of Neural Networks, Activation Functions: RELU, LRELU, ERELU, Unsupervised Training of Neural Networks, Restricted Boltzmann Machines, Convolutional Neural Networks: Architectural Overview, Motivation, Layers, Filters, Parameter sharing, Regularization, Popular CNN Architectures, Deep Learning Applications.

Centre for Artificial Intelligence

RECOMMENDED BOOKS:

1. Artificial Intelligence: A Modern Approach by Stuart J. Russell and Peter Norvig, Prentice Hall.
2. Artificial Intelligence: Elaine Rich, Kevin Knight, Mc-Graw Hill.
3. Introduction to AI & Expert System: Dan W. Patterson, PHI.
4. Pattern Recognition and Machine Learning, Christopher M. Bishop
5. Introduction to Machine Learning using Python: Sarah Guido
6. Machine Learning in Action: Peter Harrington

COURSE OUTCOMES

After completing the course, the student will be able to:

CO1. describe the fundamental concepts of Artificial Intelligence and Machine Learning.

CO2: design heuristics driven search solutions for real-world problems.

CO3. identify machine learning based real world problem.

CO4. design Artificial Intelligence enabled intelligent systems for solving real world problems.

CO5. analyze Artificial Intelligence and machine learning algorithms.

CO6. evaluate the performance of Artificial Intelligence and machine learning techniques.

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	2	1	1				1	1	1	3	2
CO2	3	3	3	3	2	2	1	1	2		2	2	3	3
CO3	3	3	3	3	3	2	1		1		1	3	3	2
CO4	3	3	3	3	3	2	1	1	2		3	2	3	3
CO5	3	3	3	3	2	1	1		1	1	1	1	3	2
CO6	3	3	3	3	3	2	1	1	1	1	2	2	3	2

Centre for Artificial Intelligence

NATURAL LANGUAGE PROCESSING
(2270621/2280621)

COURSE OBJECTIVES

- To illustrate the concepts, techniques and application of natural language processing (NLP).
- To understand linguistic phenomena, grammar and their hierarchy.
- To introduce real world problems and solutions of NLP and their relation to linguistics and statistics.

Unit I

Introduction: Brief History, steps, stages and application involved in natural language processing, goals of NLP, issues and challenges in NLP, basic concepts of phases of natural language processing morphological analysis, syntactic analysis, semantic analysis, pragmatic analysis, tools and techniques used for performing this analysis, ambiguities, Homonymy, Hyponymy, Hypernymy, Meronymy, Synonymy, Antonymy, Polysemy ambiguity in nlp.

Unit II

Structure of Words: Words and Their Components, Issues and Challenges, Morphological parsing, Morphological analysis, Inflectional and derivational morphology, Combining FST Lexicon and rules, Regular Expressions and finite Automata.

Unit III

Syntax Analysis: Rule based , stochastic based part of speech tagging, Transformation based tagging. Treebanks: A Data-Driven Approach to Syntax, Parsing with context free grammars, context free grammar, Probabilistic context free grammars, problems with probabilistic context free grammars , multiple tags and words, unknown words, Representation of Syntactic Structure, Parsing Algorithms, Models for Ambiguity Resolution in Parsing, top up and bottom up parsing, Multilingual Issues.

Unit IV

Semantic Analysis and Language Modelling: Semantic Analysis , Relation among lexemes and their senses, Internal Structure of words, Language model Introduction Hidden Markov Models, and the Viterbi Algorithm, N-Gram Models, Language Model Evaluation, Parameter Estimation, Language Model Adaptation, Types of Language Models, Language-Specific Modeling Problems, Multilingual and Cross Lingual Language Modeling.

Unit V

Application: Word net, fastext, CBOW , Skip gram, word sense disambiguation, information retrieval system, machine translation, question answer system, text categorization system, sentiment analysis , text summarization system.

Centre for Artificial Intelligence

RECOMMENDED BOOKS

1. Language processing An introduction to Natural Language Processing, Computational Linguistics and speech Recognition by Daniel Jurafsky and James H. Martin
2. Natural Language Processing with Python by Steven Bird, Ewan Klein, Edward Lopper Multilingual
3. Natural Language Processing Applications: From Theory to Practice – Daniel M. Bikel and Imed Zitouni, Pearson Publication
4. Natural Language Processing and Information Retrieval: Tanvier Siddiqui, U.S. Tiwary.

REFERENCE BOOK

1. Handbook of Natural Language Processing, Second Edition—NitinIndurkhya, Fred J. Damerau, Fred J. Damera.

COURSE OUTCOMES

After completion of the course students will be able to:

CO1 : explain the fundamentals of natural language processing

CO2: analyse the structure of word in NLP

CO3: differentiate between different types of ambiguities in NLP.

CO4: evaluate the role of syntactic and semantic of sentences in nlp

CO5: design different language modelling Techniques

CO6: create NLP based solutions to real world problems.

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	1	1	1	1	2	2		1	2	1
CO2	3	3	3	3	1	1	1	1	2	1	1	1	2	2
CO3	3	3	3	3	1	2	2	1	2	1		1	2	1
CO4	3	3	3	3	3	1	3	3	3	1	1	3	2	2
CO5	3	3	3	3	3	2	3	3	3	1	2	3	2	1
CO6	3	3	3	3	3	1	3	3	3	1	3	3	3	3

Centre for Artificial Intelligence

DEEP LEARNING
(2270623/ 2280623)

COURSE OBJECTIVES

- To understand the theoretical foundations, algorithms and methodologies of neural networks
- To design and develop an application using specific deep learning models
- To provide practical knowledge in handling and analyzing real world applications.

Unit I

Fundamentals about Deep Learning. Perception Learning Algorithms. Early Neural Networks. How Deep Learning is different from Machine Learning. Building Blocks of Neural Network. Optimizers. Activation Functions. Loss Functions. Data Pre-processing for neural networks, Feature Engineering. Overfitting and Underfitting. Hyperparameters.

Unit II

Deep Learning Architectures: Machine Learning and Deep Learning, Representation Learning, Width and Depth of Neural Networks, Activation Functions: RELU, LRELU, ERELU, Unsupervised Training of Neural Networks, Restricted Boltzmann Machines, Auto Encoders, Deep Learning Applications

Unit III

Convolutional Neural Networks: Architectural Overview, Motivation, Layers, Filters, Parameter sharing, Regularization, Popular CNN Architectures: ResNet, AlexNet – Applications; Transfer learning Techniques, Variants of CNN: DenseNet, PixelNet.

Unit IV

Sequence Modeling – Recurrent and Recursive NETS: Recurrent Neural Networks, Bidirectional RNNs, Encoder-decoder sequence to sequence architectures - BPTT for training RNN, Long Short Term Memory Networks.

Unit V

Auto Encoders: Under complete Auto encoder, Regularized Autoencoder, stochastic Encoders and Decoders, Contractive Encoders; DEEP GENERATIVE MODELS: Deep Belief networks, Boltzmann Machines, Deep Boltzmann Machine, Generative Adversarial Networks.

Centre for Artificial Intelligence

RECOMMENDED BOOKS

1. Ian Goodfellow, YoshuaBengio and Aaron Courville, " Deep Learning", MIT Press, 2017
2. Josh Patterson, Adam Gibson, Deep Learning: A Practitioner's Approach, O'Reilly Media, 2017
3. Umberto Michelucci "Applied Deep Learning. A Case-based Approach to Understanding Deep
4. Neural Networks" A press, 2018.
5. Giancarlo Zaccone, Md. Rezaul Karim, Ahmed Menshawy, Deep Learning with TensorFlow:
6. Explore neural networks with Python, Packt Publisher, 2017
7. Antonio Gulli, Sujit Pal Deep Learning with Keras Packt Publishers, 2017.
8. Francois Chollet, Deep Learning with Python, Manning Publications, 2017.

COURSE OUTCOMES

After completion of the course students will be able to:

CO1: illustrate the concepts of neural networks, activation functions and optimization algorithms.

CO2: explain the principles of backpropagation and gradient descent.

CO3: select an appropriate deep learning model for problem solving.

CO4: evaluate the performance of deep learning models.

CO5: compare the applicability of deep learning architectures across the problem domain.

CO6: develop novel deep learning architectures for specific applications.

CO-PO Mapping Matrix														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	3	3	3	1	1	1	1	1	3	3	3
CO2	3	3	3	3	3	2	2	1	1	1	2	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	1	2	3	3	3
CO5	3	3	3	3	3	3	2	3	3	1	3	3	3	3
CO6	3	3	3	3	3	3	3	3	3	3	3	3	3	3

माधव प्रौद्योगिकी एवं विज्ञान संस्थान, ग्वालियर (म.प्र.), भारत
MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR (M.P.), INDIA
Deemed University
(Declared under Distinct Category by Ministry of Education, Government of India)
NAAC ACCREDITED WITH A++ GRADE

Centre for Artificial Intelligence

Syllabi

of

Open Category Courses (OC)

B. Tech VI Semester

[for the students of other department]

for batch admitted in 2022-23

(under the flexible curriculum)

Centre for Artificial Intelligence

INFORMATION SECURITY (OC-1)

COURSE OBJECTIVES

- To provide conceptual understanding of information security principles, issues, challenges and mechanisms.
- To understand encryption techniques for securing data in transit across data networks.

Unit-I

Security: Principles and Attacks, Basic Number Theory, Fundamentals of Cryptography, Steganography, Cryptanalysis, Code Breaking, Block Ciphers and Steam Ciphers, Substitution Ciphers, Transposition Ciphers, Caesar Cipher, Play-Fair Cipher, Hill Cipher

Unit-II

Cryptography: Symmetric Key Cryptography, Public Key Cryptography, Principles of Public Key Cryptosystem, Classical Cryptographic Algorithms: RC4, RSA, Distribution of Public Keys and Key Management, Diffie-Hellman Key Exchange.

Unit-III

Hash Functions: Hash Functions, One Way Hash Function, SHA (Secure Hash Algorithm). Authentication: Requirements, Functions, Kerberos, Message Authentication Codes, Digital Signatures, Digital Certificates.

Unit -IV

IP Web Security Overview: SSL (Secure Socket Layer), TLS (Transport Layer Security), SET (Secure Electronic Transaction). IDS (Intrusion detection system), Firewalls: Types, Functionality and Polices.

Unit -V

Phishing: Attacks and its Types, Buffer Overflow Attack, Session Hijacking, Hacker: Hacking and Types of Hackers, FootPrinting, Scanning: Types: Port, Network, Vulnerability), Sniffing in Shared and Switched Networks, Sniffing Detection Prevention, Spoofing.

Centre for Artificial Intelligence

RECOMMENDED BOOKS

1. Cryptography and Network Security, William Stallings, Pearson Education.
2. Cryptography and Network Security, Atul Kahate, McGraw Hill Education.
3. Incident Response and Computer Forensics, Kevin Mandia, Chris Prosise, Tata McGraw Hill.

COURSE OUTCOMES

After completion of the course students would be able to:

CO1: determine symmetric and public key cryptography, classical algorithms, and basic number theory.

CO2: explain the working of various cryptographic algorithms.

CO3. apply firewall, IDS, and security protocols like SSL, TLS, and SET.

CO4: build secure systems using digital signatures, message authentication, and certificates.

CO5: examine the strengths and weaknesses of IP and web security.

CO6: select strategies for detecting and preventing attacks like sniffing, spoofing, and hacking.

CO-PO Mapping Matrix												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	2	3	1			1	1	2	2
CO2	3	3	2	2	3				1	1	2	2
CO3	3	3	3	2	3	1	1	1	2	2	2	3
CO4	3	3	3	3	3	2		1	1	2	2	3
CO5	3	3	2	2	3	2	1	1		2	2	3
CO6	3	3	3	3	3	3	1	1	1	2	3	3

Centre for Artificial Intelligence

DATA MINING & WAREHOUSING (OC-1)

COURSE OBJECTIVES

- To understand the significance of data mining in a real-world perspective. and gain the understanding of data mining techniques, algorithms and commonly used tools.
- To develop the ability for applying data mining techniques and tools for solving real-world problems.

Unit I

Introduction: Motivation, importance, Data types for Data Mining: Relational Databases, Data Ware-Houses. Transactional Databases, Advanced Database System and Its Applications, Data Mining Functionalities, Concept/Class Description, Association Analysis Classification & Prediction, Cluster Analysis, Outliner Analysis, Classification of Data Mining Systems, Major Issues in Data Mining.

Unit II

Data Pre-processing: Data Cleaning, Data Integration and Transformation and Data Reduction. Discretization and Concept Hierarchy Generation. Data Mining Primitives Languages and System Architectures, Concept Description, Characterization and Comparison Analytical, Characterization. Data Warehouse and OLTP Technology for Data Mining: Differences between Operational Database Systems & Data Warehouse, Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, Data Cube Technology

Unit III

Mining Association Rules in Large Databases: Association Rule Mining: Market Basket Analysis, Basic Concepts, Mining Single Dimensional Boolean Association Rules from Transactional Databases: The Apriori Algorithm, Generating Association Rules from Frequent Items, Improving the Efficiency of Apriori, other Algorithms & their Comparison, Mining Multilevel Association Rules, Multidimensional Association Rules, Constraint Based Association Rule Mining.

Unit IV

Classification & Prediction and Cluster Analysis: Issues Regarding Classification & Prediction, Different Classification Methods, Prediction, Cluster Analysis, Major Clustering Methods, Currently Available Tools.

Unit V

Introduction to data warehousing, need and significance, challenges & issues in warehousing, difference between data mining & warehousing, case studies- stock market, super market etc. , implementation of current applications involving data mining.

Centre for Artificial Intelligence

RECOMMENDED BOOKS

1. Data Mining: Concepts and Techniques, Han and Kamber, Morgan Kaufmann Publications.
2. Data Mining Techniques, A. K. Pujari, Universities Press Pvt. Ltd.
3. Data Warehousing in the Real World, Sam Anahory, Pearson Publication.

COURSE OUTCOMES

After completion of the course students will be able to:

CO1: explain fundamental concepts of data mining and data warehousing.

CO2: classify database systems and data models of data warehouses.

CO3: compare methods for storing & retrieving data from different data sources.

CO4: apply data mining techniques for knowledge extraction from large amounts of data.

CO5: predict trends to make informed decisions.

CO6: develop real world applications using data mining techniques.

CO-PO Mapping Matrix												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	3	2	2	2	1	1	1	1	3
CO2	3	3	3	3	3	3	2	1	1	2	1	3
CO3	3	3	3	3	3	3	2	2	2	1	2	3
CO4	3	3	3	3	3	3	3	3	3	2	3	3
CO5	3	3	3	3	3	3	3	2	2	2	2	3
CO6	3	3	3	3	3	3	3	3	3	2	3	3

माधव प्रौद्योगिकी एवं विज्ञान संस्थान, ग्वालियर (म.प्र.), भारत
MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR (M.P.), INDIA
Deemed University
(Declared under Distinct Category by Ministry of Education, Government of India)
NAAC ACCREDITED WITH A++ GRADE

Centre for Artificial Intelligence

Experiment list/ Lab manual/ Skill Based Mini-Project List of Laboratory Courses offered for B. Tech VI Semester [Information Technology (Artificial Intelligence and Robotics)/ Artificial Intelligence (AI) and Data Science/ Artificial Intelligence (AI) and Machine Learning]

for batch admitted in 2022-23

(under the flexible curriculum)

Centre for Artificial Intelligence

IMAGE PROCESSING (2240622/2270622/2280622)

LIST OF PROGRAMS

1. Study of Image Processing:
    a. Image Acquisition
    b. Image Enhancement
    c. Color image Processing
    d. Image resizing
2. Write a program for Image resampling.
3. Write a program for color detection.
4. Write a program for image Segmentation.
5. Write a program for object Detection.
6. Write a program for hand Gesture Recognition.
7. Write a program for object Tracking.
8. Image enhancement and spatial operation- Convolution, correlation, linear filtering,edge detection.
9. Implement i) Edge Detection, ii) Line Detection.
10. Implement Smoothing and Sharpening of an eight bit color image.

COURSE OUTCOMES

After completing the course, the student will be able to:

CO1: develop the ability to write programs for color detection.

CO2: analyze color information in digital images.

CO3: apply image segmentation techniques to partition images into meaningful regions.

CO4: demonstrate competence in writing a program for object detection.

CO5: integrate image processing techniques to interpret and respond to hand gestures.

CO6: track movement of objects in a sequence of images.

Centre for Artificial Intelligence

IMAGE PROCESSING (2240622/2270622/2280622)

SKILL BASED MICRO PROJECTS

1. Write a program to implement linear point operation and clipping,
2. Write a program to implement thresholding and negation
3. Write a program to implement non-linear mapping and intensity slicing,
4. Write a program to implement image histogram and histogram equalization
5. Write a program to implement data compression

SKILL BASED MACRO PROJECTS

1. Write a program to Implement Smoothing and Sharpening of an eight bit color image
2. Write a program to Implement Low Pass Filter
3. Write a program to Implement High Pass Filter
4. Write a program to Implement Arithmetic Mean Filter
5. Write a program to Implement Geometric Mean Filter

SKILL BASED MINI PROJECTS

1. Color image processing - color models, color enhancement, color thresholding.
2. Frequency domain operations- fourier transform, freq domain filtering
3. Implement the spatial image enhancement functions on a bitmap image –Mirrorin (Inversion)
4. Implement the spatial image enhancement functions on a bitmap image –Rotation (Clockwise)
5. Implement the spatial image enhancement functions on a bitmap image –Enlargement (Double Size)

Centre for Artificial Intelligence

ARTIFICIAL INTELLIGENCE & MACHINE LEARNING (2240623)

LIST OF PROGRAMS

1. Introduction to python programming, its advantages/disadvantages and Libraries.
2. Implement classification problem using ANN.
3. Write a python program to perform BFS.
4. Write a python program to perform DFS.
5. Study and implement various Dimensionality reduction, Feature selection and Normalization techniques in Python
6. Implement Linear Regression model in Python
7. With the help of Support vector machine algorithm classify any suitable dataset
8. available over the trusted repository.
9. Implement the Decision tree Algorithm for a given dataset.
10. Implement the Random Forest Algorithm for a given dataset.
11. Implement the k-means clustering Algorithm for a given dataset.
12. Implement the DBSCAN Algorithm for a given dataset.
13. Design and implementation of Classification using CNN with the help of available libraries in python.

COURSE OUTCOMES

After completing the course, the student will be able to:

CO1: apply concepts of python programming to implement artificial intelligence based algorithms.

CO2: implement ML models in Python using machine learning libraries such as Scikit-Learn.

CO3: build k-means and hierarchical clustering model.

CO4: use the functions of NLTK and spaCy Python libraries for text classification and sentiment analysis.

CO5: perform feature engineering and optimize machine learning models.

CO6: apply AI and ML techniques to solve real world problems.

Centre for Artificial Intelligence

ARTIFICIAL INTELLIGENCE & MACHINE LEARNING (2240623)

SKILL BASED MINI PROJECTS

1. Design and implement Handwritten Digits Recognition system.
2. Design and implement a Spam classification system using Machine Learning algorithm.
3. Design and implement a Music Recommendation App.
4. Design and implement heart disease prediction using different classification algorithms and analyze the best over the dataset.
5. Design and implementation of Animal Kingdom Classification using CNN with the help of available libraries in python.
6. Apply the classification algorithms over the time series dataset by transforming the dataset into static values.
7. With the help of random forest classifier, classify any suitable dataset available over the trusted repository.
8. Design a program for Number Guessing using a random number generator library. Make a play game with the defined library.
9. Implement a movie recommendation system using any algorithm over the dataset from
10. trusted repository.
11. Optimize the performance of your classification algorithm using the applicable optimization algorithm like swarm based, genetic algorithm.

SKILL BASED MACRO PROJECTS

1. Apply PCA for dimensionality reduction in a given dataset.
2. Apply LDA for dimensionality reduction in a given dataset.
3. Implement Filter method for feature selection
4. Implement Wrapper method for feature selection
5. Plot correlation matrix using MATPLOTLIB
6. Identify the missing value in a given dataset and replace it with mean value
7. Identify the missing value in a given dataset and replace it with median value
8. Identify the distribution properties (skewness, standard deviation etc.) in a given dataset.
9. Write a program to identify the outliers in a given dataset.
10. Write a program to plot the confusion matrix of a classifier.

SKILL BASED MICRO PROJECTS

1. Apply MAX-MIN normalization in a given dataset
2. Apply standardization in a given dataset
3. Apply binary hot encoding in a given dataset
4. Apply multiclass encoding in a given dataset
5. Plot a histogram plot of a given dataset
6. Plot a bar, box and scatter plot and heat map of a given dataset
7. Provide statistical description (mean, median, mode etc.) of a given datasets

Centre for Artificial Intelligence

DEEP LEARNING (2270623/ 2280623)

List of Programs

1. Train a Deep learning model to classify a given image using pre trained model
2. Object detection using Convolution Neural Network
3. Recommendation system from sales data using Deep Learning
4. Improve the Deep learning model by tuning hyper parameters
5. Perform Sentiment Analysis in network graph using RNN
6. Image generation using GAN
7. Develop a model by using AUTO ENCODERS.
8. Implement an LSTM based Autoencoder in TensorFlow/Keras.
9. Perform Sentiment Analysis using RNN
10. Using a pre-trained model on Keras for Transfer Learning.
11. Getting started with the python 3.x and installing libraries of Tensorflow, Keras, Pytorch.
12. Write a python program to perform tokenization by word and sentence using nltk
13. Create a python based application to eliminate stopwords using nltk.
14. Perform stemming using nltk in python.
15. Write a python program to perform lemmatization using nltk.
16. Perform Parts of Speech tagging using Hidden Markov Model
17. Perform Parts of Speech tagging using Viterbi Decoding
18. Implement chunking using nltk in python.
19. Implement Named Entity Recognition using nltk
20. Create an application which finds all unigrams, bigrams and trigrams present in the given corpus.

Course Outcomes of Lab:

After completion of the course students will be able to:

CO1: recognize the characteristics of deep learning models that are useful to solve real-world problems

CO2: design Convolution Neural Network for solving various problems pertaining to image processing.

CO3: apply deep learning model variants for implementing NLP based applications

CO4: examine the working mechanism of different deep learning algorithms.

CO5: solve real world problems using NLP techniques

CO6: develop autoencoders and generative models for suitable applications.

Centre for Artificial Intelligence

DEEP LEARNING (270603/ 280603)

List of Skill based Mini Projects

List of Micro Projects:

1. Implement a regression model in Keras.
2. Explain existing and emerging deep learning architectures for text and speech processing.
3. Hyper-Parameter Tuning in Multilayer Perceptron
4. Deep learning Packages Basics: Tensorflow, Keras, Theano and PyTorch
5. Classification of MNIST Dataset using CNN
6. Parameter Tuning in CNN
7. Implement a perceptron in TensorFlow/Keras Environment.

List of Macro Projects:

1. Implement simple vector addition in TensorFlow.
2. Implement an Image Classifier using CNN in TensorFlow/Keras.
3. Face recognition using CNN
4. Object detection using Transfer Learning of CNN architectures
5. Recommendation system using Deep Learning
6. Dimensionality Reduction using Deep learning
7. Language Modeling using RNN

List of Mini Projects:

1. Classification with Multilayer Perceptron using Scikit-learn (MNIST Dataset)
2. Time Series Prediction using RNN
3. Sentiment Analysis using LSTM
4. Image generation using GAN
5. Deep Learning using H2O
6. Deep Learning using DL4J
7. Use deep learning to solve real-life problem
8. Predictive analysis using H2O tool
9. Using a pre trained model on Keras for Transfer Learning
10. Recommendation system from sales data using Deep Learning.

Centre for Artificial Intelligence

11. Build a Python-based summarization tool to condense lengthy documents while retaining key information.
12. Develop a model using TensorFlow to classify news articles as reliable or fake.
13. Create a spam filter that classifies SMS messages as spam or legitimate using Python.
14. Design a system to identify abusive language or hate speech in online comments.
15. Implement a Python-based NER system to identify and categorize entities like names, dates, and locations.
16. Build a tool that generates effective and unique research paper titles using NLP techniques.
17. Develop a Python program to identify and correct spelling and grammatical errors in text.
18. Create a predictive text tool to suggest the next word or phrase in a sentence using context.
19. Implement a chatbot capable of engaging in natural, human-like conversations using NLP models.
20. Develop a Python-based sentiment analysis to classify text as positive, negative, or neutral.