SRM INSTITUTE OF SCIENCE & TECHNOLOGY
(Deemed to be University u/s 3 of UGC Act, 1956)

Minor in Artificial Intelligence and Machine Learning
Offered by Department of Computational Intelligence
School of Computing

Category	Course Code	Course Title	L	T	P	C	Credits to be earned
Preparatory	21MCI001P	AI Programming with Python	3	0	0	0	0
Foundation	21MCI001F	Data Science and analytics	3	0	0	3	3
Foundation	21MCI002F	Machine Learning Techniques	2	1	0	3	3
Foundation	21MCI003F	Deep Learning Algorithms	2	1	0	3	3
Elective*	21MCI001E	Prompt Engineering	2	1	0	3	3
Elective*	21MCI002E	Explainable AI	3	0	0	3	3
Elective*	21MCI003E	Speech Analytics	3	0	0	3	3
Elective*	21MCI004E	Image Processing and Pattern Recognition	3	0	0	3	3
Total							18

21MCI001P, No End Semester exams will be conducted for preparatory and it a fully internal course.
Minor in AIML will be offered only to Non School of Computing Students.
* Any three of Four Elective courses should be carried out.

Course Code	21MCI001P	Course Name	AI Programming with Python	Course Category	P	Preparatory Course	L	T	P	C
							3	0	0	0

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computational Intelligence	Data Book / Codes / Standards	*Nil*		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	Build a logic to construct an algorithm that can be converted into a program
CLR-2:	Gain knowledge about library functions to solve engineering problems in artificial intelligence
CLR-3:	Explore applications for solving Artificial intelligence technique problem

Course Outcomes (CO):	At the end of this course, learners will be able to:	Program Outcomes(PO)											Program Specific Outcomes		
		1	2	3	4	5	6	7	8	9	10	11			
		Engineering Knowledge	Problem Analysis	Design/development of solutions	Conduct investigations of complex problems	Engineering Tool Usage	The engineer and the World	Ethics	Individual & Collaborative Team work	Communication	Project Mgt. & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3
CO-1:	learn to solve problems using Python conditionals, loops and functions	3	-	2	-	-	-	-	-	-	-	-	3	-	-
CO-2:	Gain knowledge about the suitable python library based solutions for solving statistical problems in Artificial intelligence	-	3	2	-	-	-	-	-	-	-	-	-	-	2
CO-3:	Analyze the problem and infer new knowledge using python to solve a real world problem	-	3	2	-	-	-	-	-	-	-	-	3	-	-

Module1 Introduction	**15 Hrs**
Introduction to Python basics- variables, Datatypes and Operators, Coding Standards. Formatting Inputs and Outputs in Python. Collections - Lists, Strings, Tuple, Set, Dictionary. Control Structures. Functions- Definition, Arguments and Recursion	
Module2 AI Libraries in Python	**15 Hrs**
Introduction to essential libraries in Python, NumPy library, operation using NumPy array, Pandas library: Creation of data Frame using pandas, operation on data frames using pandas, sub setting, indexing	
Module3 Visualization Techniques in AI	**15 Hrs**
Libraries for data visualization and AI Model building: Matplotlib- Bar graph, scatterplot, histogram. Seaborn Scikit-learn - Machine learning APIs	

Learning Resources	
	1. Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016. 2. Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017 3. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021. 4. G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021. 5. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data", Third Edition, MIT Press, 2021

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				CLA-3 – (20%)	
		Formative CLA-1 Average of unit test (20%)		Life Long Learning CLA-2 – (60%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%	-	15%	-	15%	-
Level 2	Understand	25%	-	20%	-	20%	-
Level 3	Apply	30%	-	25%	-	25%	-
Level 4	Analyze	30%	-	25%	-	25%	-

Level 5	Evaluate	-	-	10%	-	10%	-
Level 6	Create	-	-	5%	-	5%	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
Mr.S.Ravikumar , President and Managing director , Pine Crow Technologies.	Dr T.Suguna, GCT, Coimbatore	1. Dr T R Saravanan, SRMIST

Course Code	21MCI001F	Course Name	Data Science and analytics	Course Category	F	Foundation Course	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computational Intelligence	Data Book / Codes / Standards	*Nil*		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	Understand the fundamentals of Data Science.
CLR-2:	Acquire knowledge about data analysis and the visualization techniques.
CLR-3:	Explore the strategies for various testing techniques utilizing statistical methods.

Course Outcomes (CO):	At the end of this course, learners will be able to:	Program Outcomes (PO)											Program Specific Outcomes		
		1	2	3	4	5	6	7	8	9	10	11			
		Engineering Knowledge	Problem Analysis	Design/development of solutions	Conduct investigations of complex problems	Engineering Tool Usage	The engineer and the World	Ethics	Individual & Collaborative Team work	Communication	Project Mgt. & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3
CO-1:	Understand the fundamentals of Data Science, Data Science Process and the Data preparation methods.	3	-	-	-	1	-	-	-	-	-	-	2	-	-
CO-2:	Investigate the visualization methods for several types of input data formats.	3	-	-	-	2	-	-	-	-	-	-	-	-	2
CO-3:	Examine the methodologies for diverse testing techniques employing statistical approaches.	3	-	-	-	3	-	-	-	-	-	-	-	3	-

Module1 Introduction to Data science	**15 Hrs**
Introduction to Data Science, Facets of Data, Data Science process, Data Cleaning and Preparation – Handling Missing Data, Data Transformation, String Manipulation, Data Handling – Problem faced when handling large data, General techniques for handling large volume of data, General Programming tips for dealing large datasets.	
Module2 Exploratory Data Analysis	**15 Hrs**
Data Wrangling, Hierarchical indexing and combining and merging datasets, Reshaping and Pivoting – Plotting and Visualization – Line Plots, Bar Plots, Histograms and Density Plots, Scatter or Point Plots, Facet Grids and Categorical Data.	
Module3 Statistical Data Analysis	**15 Hrs**
Hypothesis and Inference – Statistical hypothesis Testing, Example Flipping a Coins, Confidence Intervals, P-hacking, Running an A/B Test, Bayesian Inference- Introduction to t-statistics, t-test for two independent samples, t-test for two related samples –Introduction to Analysis-of-Variance (ANOVA) – Introduction, logic of ANOVA, ANOVA notation and formulas, Distribution of F-Ratios, Examples of Hypothesis testing and effect size with ANOVA, Post Hoc Tests, relationship between ANOVA and t-tests.	

Learning Resources	
	1. Wes McKinney, Python for Data Analysis, DATA WRANGLING WITH PANDAS, NUMPY, AND IPYTHO, O'Reilly Media, 3rd edition 2022.
	2. Gravetter, F. J., Wallnau, L. B., Forzano, L.-A. B., &Witnauer, J. E. (2020). *Essentials of Statistics for the Behavioral Sciences* (10th ed.). Cengage Learning.
	3. R. Lyman Ott, Michael Longnecker, An Introduction to Statistical Methods and Data Analysis, Edition: 7, 2016, Brooks/Cole

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life Long Learning CLA-2 – (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%	-	15%	-	15%	-
Level 2	Understand	25%	-	20%	-	25%	-
Level 3	Apply	30%	-	25%	-	30%	-
Level 4	Analyze	30%	-	25%	-	30%	-
Level 5	Evaluate	-	-	10%	-	-	-
Level 6	Create	-	-	5%	-	-	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
Balamurali Shankar, Chief Knowledge Officer, IITM Pravartak Technologies Foundation, Chennai.	1.G. Venkateswaran, Professor ,Department of CSIS, BITS, Pilani, Rajasthan.	Dr. R. Usharani, Assistant Professor, SRMIST
	2.Dr. G.S. Mahalakshmi, Associate Professor, Dept. of CSE, Anna University, Chennai	

Course Code	21MCI002F	Course Name	Machine Learning Techniques	Course Category	F	Foundation Course	L	T	P	C
							2	1	0	3

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computational Intelligence	Data Book / Codes / Standards	*Nil*		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	Build a strong conceptual foundation in machine learning principles, processes, and tools.
CLR-2:	Learn supervised learning techniques for classification and regression with model evaluation.
CLR-3:	Explore unsupervised learning methods like clustering and dimensionality reduction.

Course Outcomes (CO):	At the end of this course, learners will be able to:	Program Outcomes (PO)											Program Specific Outcomes		
		1	2	3	4	5	6	7	8	9	10	11			
		Engineering Knowledge	Problem Analysis	Design/development of solutions	Conduct investigations of complex problems	Engineering Tool Usage	The engineer and the World	Ethics	Individual & Collaborative Team work	Communication	Project Mgt. & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3
CO-1:	Understand machine learning concepts, types, processes, and evaluation methods.	3	-	-	3	-	-	-	-	-	-	-	3	-	-
CO-2:	Implement supervised learning techniques and assess model performance.	3	-	-	3	-	-	-	-	-	-	-	-	3	-
CO-3:	Apply unsupervised learning methods for clustering and dimensionality reduction.	3	-	-	3	-	-	-	-	-	-	-	-	-	3

Module1 Introduction	**15 Hrs**
Introduction to Machine Learning: Examples of Machine Learning applications -Training versus Testing - Positive and Negative Class - ML Process: Data Preprocessing, Overfitting, Underfitting, Cross validation,Error and noise - Parametric vs. non-parametric models - Linear Algebra for machine learning.	
Module2 Supervised Machine Learning	**15 Hrs**
Supervised learning- Types of Supervised Learning: Regression - Linear Regression, Polynomial Regression, Classification: Logistic Regression, Naïve Bayes, Support Vector Machines, Decision Trees – Performance metrics - Applications of supervised learning	
Module3 Unsupervised Machine Learning	**15 Hrs**
Unsupervised learning – Types of Unsupervised Learning: Dimensionality Reduction: Principal Component analysis, Association Rule Mining: Apriori, FP Growth, Clustering: K-Means Clustering, Agglomerative Clustering-Divisive Clustering, Applications of Unsupervised learning	
Tutorial	

1. Case study on real life applications using Supervised Learning
2. Case study on real life applications using UnSupervised Learning

Learning Resources	1.Introduction To Machine Learning 4th Edition – 2020, MIT Press, Cambridge, London by Ethem Alpaydin 2.Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016	3.Sebastain Raschka, Vahid Mirjalili , "Python Machine Learning", Packt publishing 3rd Edition, 2019. 4.Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, "Foundations of Machine Learning", Second Edition, MIT Press 2018

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life Long Learning CLA-2 – (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%	-	15%	-	15%	-
Level 2	Understand	25%	-	20%	-	25%	-
Level 3	Apply	30%	-	25%	-	30%	-
Level 4	Analyze	30%	-	25%	-	30%	-
Level 5	Evaluate	-	-	10%	-	-	-
Level 6	Create	-	-	5%	-	-	-
	Total	100 %		100 %		100 %	

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. Raja Jaganathan Senior Software Associate , Uber technologies	Dr. T. Sudhakar Anna University, MIT Campus, Chennai	Dr.G.Maragatham, SRMIST Dr. N. Kanimozhi SRMIST

Course Code	21MCI003F	Course Name	Deep Learning Algorithms	Course Category	F	Foundation Course	L	T	P	C
							2	1	0	3

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computational Intelligence	Data Book / Codes / Standards	*Nil*		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	To understand and apply fundamental concepts of deep neural networks.
CLR-2:	To impart knowledge on Convolutional Neural Networks (CNN) architectures and its variants.
CLR-3:	To understand LSTM and Autoencoders.

Course Outcomes (CO):	At the end of this course, learners will be able to:	Program Outcomes (PO)											Program Specific Outcomes		
		1	2	3	4	5	6	7	8	9	10	11			
		Engineering Knowledge	Problem Analysis	Design/development of	Conduct investigations of complex	Engineering Tool Usage	The engineer and the World	Ethics	Individual & Collaborative Team work	Communication	Project Mgt. & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3
CO-1:	Gain knowledge about fundamental neural network concepts.	3	-	-	3	-	-	-	-	-	-	-	3	-	-
CO-2:	Understand and apply knowledge of concepts and variants of CNN architectures.	3	-	-	3	-	-	-	-	-	-	-	-	3	-
CO-3:	Understand sequence data and RNN networks and its variants.	3	-	-	3	-	-	-	-	-	-	-	-	-	3

Module1 – Introduction **15 Hrs**

Introduction to Neural Networks – Basic concept of Neurons – Biological neurons and Artificial neurons - Perceptron Algorithm –Back Propagation Networks – Activation Functions – ReLU, sigmoidal, Tanh – Loss Functions – Mean Square Error ,Data Augmentation..
Module2 - Convolutional Neural Network **15 Hrs**
Convolutional Neural Networks (CNN)- The Convolution Operation, Motivation, CNN Architecture- Pooling- Variants of the Basic Convolution Model – Popular CNN Architectures: ResNet, AlexNet, VGGNet - Transfer learning
Module3 - Recurrent Neural Network **15 Hrs**
Sequence Modelling –Recurrent Neural Networks, Bidirectional RNNs – Encoder-decoder sequence to sequence architectures Recursive Neural Networks - Long Short-Term Memory Networks –Autoencoders.
Tutorial : 1.To learn Real world neural network concepts of deep learning 2. To learn and study Transfer learning applications 3. To learn and study about applications of Auto encoders

Learning Resources	1. Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2017. 2. Josh Patterson, Adam Gibson, "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017. Deep learning Manel Martinez Ramon,Meenu Ajith, Aswathy Rajendra kurup, Deep learning , A practical Introduction, Wiley 2024	3. Charu C. Aggarwal, "Neural Networks and Deep Learning: A Textbook", Springer International Publishing, 1st Edition, 2018.

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life Long Learning CLA-2 – (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%	-	15%	-	15%	-
Level 2	Understand	25%	-	20%	-	25%	-
Level 3	Apply	30%	-	25%	-	30%	-
Level 4	Analyze	30%	-	25%	-	30%	-
Level 5	Evaluate	-	-	10%	-	-	-
Level 6	Create	-	-	5%	-	-	-
	Total	100 %		100 %		100 %	

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr.D.SherlinPaul,Sr Project Manager,Cognizant Technology Solutions Pvt Limited	Dr. Jothi Prabha Appadurai,Kakatiya Institute of Technology & Science Warangal	Dr. Abijah Roseline , SRMIST

Course Code	21MCI001E	Course Name	Prompt Engineering	Course Category	E	Elective	L	T	P	C
							2	1	0	3

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computational Intelligence	Data Book / Codes / Standards	*Nil*		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	Understand the fundamentals of Prompt Engineering.
CLR-2:	Gain knowledge about designing and refining prompts for Large Language Models (LLMs).
CLR-3:	Study the techniques for building AI-driven applications using LLM APIs.

Program Outcomes(PO)											Program Specific Outcomes		
1	2	3	4	5	6	7	8	9	10	11			
Engineering Knowledge	Problem Analysis	Design/development	Conduct investigations of	Engineering Tool	The engineer	Ethics	Individual & Collaborati	Communication	Project Mgt. &	Life Long Learning	PSO-1	PSO-2	PSO-3

Course Outcomes (CO):	At the end of this course, learners will be able to:														
CO-1:	Understand the fundamentals of text generation models, the evolution of language models, and the principles of crafting effective prompts for Large Language Models (LLMs).	3	-	3	-	-	-	-	-	-	-	-	3	-	-
CO-2:	Gain knowledge about prompt structuring, dynamic content assembly, and techniques for evaluating and iterating on prompts to optimize outputs.	3	-	2	-	-	-	-	-	-	-	-	-	3	-
CO-3:	Develop practical expertise in using LLM APIs to build real-world applications like chatbots, interactive quizzes, and AI-driven customer support systems.	3	-	3	-	-	-	-	-	-	-	-	-	-	3

Module1 Introduction	**15 Hrs**
History of Language Models, LLMs in the Market, Five Principles of Prompting, Introducing LLM Prompts, Types of Prompts, Components of Prompt, Defining Personality in Prompts, Mix and Match Strategic Combination for Enhanced Prompts, Challenges and Limitations of Using Prompts	
Module2 Prompt Design Techniques	**15 Hrs**
Prompt Content- Sources of content, Static content, Dynamic Content, Assembling the Prompt- Anatomy of the Ideal Prompt, Formatting snippets, Elastics Snippets, Relationships among prompt elements, Anatomy of the Ideal Component	
Module3 Applications of Prompt engineering	**15 Hrs**
Use of GPT-4 APIs and other LLM APIs to create chatbots, Use of AI for customer support, Case study- a chatbot using AI to assist users in ordering products, Case study- creating interactive quizzes/assessments and deploying them as chatbot flows.	
Tutorial 1.To Study live applications of language models 2. To Study Real world applications of prompt elements 3. To learn industrial impact of Prompt engineering	

Learning Resources	1.James Phoenix, Mike Taylor, "Prompt Engineering for Generative AI", O'Reilly, To Release in May 2024 https://www.oreilly.com/library/view/prompt-engineering-for/9781098153427/ 2.Gilbert Mizrahi, "Unlocking the Secrets of Prompt Engineering: Master the Art of Creative Language Generation to Accelerate Your Journey from Novice to Pro", January 2024 https://www.packtpub.com/en-in/product/unlocking-the-secrets-of-prompt-engineering9781835083833	3.John Berryman, Albert Ziegler, "Prompt Engineering for LLMs",O'Reilly Media, Inc., November 2024 https://learning.oreilly.com/library/view/prompt-engineering-for/9781098156145/Michael Ferguson, "Prompt Engineering: The Future of 4.Language Generation", January 2023https://books.apple.com/us/book/prompt-engineering-the-future-of-languagegeneration/id6445529200

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life Long Learning CLA-2 – (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%	-	15%	-	15%	-
Level 2	Understand	25%	-	20%	-	25%	-
Level 3	Apply	30%	-	25%	-	30%	-
Level 4	Analyze	30%	-	25%	-	30%	-
Level 5	Evaluate	-	-	10%	-	-	-
Level 6	Create	-	-	5%	-	-	-
	Total	100 %		100 %		100 %	

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. S. Smilin Sam, Principal Engineer, Athenahealth Pvt Ltd.	Dr. R. Gayathri, Professor, Sri Venkateswara College of Engineering, Sriperumbudur.	Dr.Annie Uthra , Professor, SRMIST Dr. C. Sherin Shibi, Assistant Professor, SRMIST

Course Code	21MCI002E	Course Name	Explainable AI	Course Category	E	Elective	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil

Course Offering Department	Computational Intelligence	Data Book / Codes / Standards	*Nil*

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	Learn the fundamentals of Explainable AI (XAI), its significance, types, and real-world applications.
CLR-2:	Understand how Explainable AI improves transparency and makes AI models easier to interpret.
CLR-3:	Explore the techniques and tools used to explain complex AI systems in a simple and understandable way.

Course Outcomes (CO):	At the end of this course, learners will be able to:	Program Outcomes (PO)											Program Specific Outcomes		
		1	2	3	4	5	6	7	8	9	10	11			
		Engineering Knowledge	Problem Analysis	Design/development of solutions	Conduct investigations of complex problems	Engineering Tool Usage	The engineer and the World	Ethics	Individual & Collaborative Team work	Communication	Project Mgt. & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3
CO-1:	Understand the concepts, importance, and challenges of Explainable AI (XAI).	3	-	3	-	-	-	-	-	-	-	-	3	-	-
CO-2:	Implement XAI techniques like SHAP, LIME, and Attention Mechanisms to interpret AI models.	3	-	2	-	-	-	-	-	-	-	-	-	3	-
CO-3:	Evaluate explanations using metrics, sensitivity analysis, and human-centric methods.	3	-	3	-	-	-	-	-	-	-	-	-	-	3

Module1 INTRODUCTION OF EXPLAINABLE AI **15 Hrs**

Overview of Explainable AI – Importance of XAI in AI Systems – Challenges in Achieving Explainability – Model-Agnostic Explanation Methods –Model-Specific Explanation Methods - Global vs. Local Explanations – Feature Importance and Contribution – SHapley Additive Explanations(SHAP)–Local Interpretable Model-agnostic Explanations (LIME)

Module2 EVALUATION IN XAI **15 Hrs**

Effectiveness of explanations.– Metrics for Explainability – Human-Centric Evaluation of XAI – Accuracy of explanations – Sensitivity Analysis in XAI – Comparative Evaluation of Explanation Methods – Visual Analytics for Evaluating Explanations – Cognitive Load in Understanding Explanations - Uncertainty in Explanations - Explainability vs. Performance

Module3 TOOLS AND FRAMEWORKS FOR XAI **15 Hrs**

Overview of tools and libraries - Alibi Framework – Interpret ML – Captum - AIX360 (AI Explainability 360) - What-If Tool – DeepSHAP – Fairlearn - ExplainLikeImFive (ELI5) - SHAP vs. LIME in Practice - Tooling for XAI in TensorFlow - Model Interpretability in H2O.ai - XAI Integration in Cloud Platforms

Learning Resources	1.Wojciech Samek, Thomas Wiegand, and Klaus-Robert Müller, "Explainable AI: Interpreting, Explaining and Visualizing Deep Learning", Springer International Publishing, 2019 2.Witold Pedrycz, Shyi-Ming Chen, Interpretable Artificial Intelligence: A Perspective of Granular Computing: 937 (Studies in Computational Intelligence), Springer, First Edition, 2021	3.Christoph Molnar, "Interpretable Machine Learning: A Guide For Making Black Box Models Explainable",Kindle Edition,2022

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life Long Learning CLA-2 – (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%	-	15%	-	15%	-
Level 2	Understand	25%	-	20%	-	25%	-
Level 3	Apply	30%	-	25%	-	30%	-
Level 4	Analyze	30%	-	25%	-	30%	-
Level 5	Evaluate	-	-	10%	-	-	-
Level 6	Create	-	-	5%	-	-	-
	Total	100 %		100 %		100 %	

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Dr Adithya PothanRaj ,CTS,Canada	Dr. Chitra S , Associate Professor, MIT Campus, Anna university	Dr.Antony Sophia N , SRMIST

Course Code	21MCI003E	Course Name	Speech Analytics	Course Category	E	Elective	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	School of Computing	Data Book / Codes / Standards	*Nil*		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	To acquire the fundamentals of the digital signal processing that allows them to assimilate the concepts related to the speech processing.
CLR-2:	To introduce the fundamentals of speech signal processing.
CLR-3:	To present basic principles of speech analysis.

Course Outcomes (CO):	At the end of this course, learners will be able to:	Program Outcomes(PO)											Program Specific Outcomes		
		1	2	3	4	5	6	7	8	9	10	11			
		Engineering Knowledge	Problem Analysis	Design/development of solutions	Conduct investigations of complex problems	Engineering Tool Usage	The engineer and the World	Ethics	Individual & Collaborative Team work	Communication	Project Mgt. & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3
CO-1:	Illustrate the fundamental concepts of Speech Processing.	3	-	2	-	-	-	-	-	-	-	-	3	-	-
CO-2:	Apply various Speech analysis & Modeling techniques used for building speech processing modules.	2	-	2	-	-	-	-	-	-	-	-	-	2	-
CO-3:	Understand natural language processing basics	2	-	2	-	-	-	-	-	-	-	-	-	-	3

Module1 Introduction, Basics of Speech Processing **15Hrs**

Speech Fundamentals: Articulatory Phonetics – Production and Classification of Speech Sounds; Acoustic Phonetics – acoustics of speech production; Review of Digital Signal Processing concepts; Short -Time Fourier Transform, Filter-Bank and LPC Methods.

Module2 Natural Language Processing **15Hrs**

Foundations of natural language processing-Language Syntax and Structure-,Text tokenization-Stemming, Lemmatization-Removing stop -words-Feature Engineering for Text Representation-Bag of words model-Bag of N-Grams model-TF-IDF model

Module3 Speech Analytics tools and techniques, **15Hrs**

Text -to-Speech Synthesis: Concatenative and waveform synthesis methods, Introduction Speech Processing using Deep learning, Recurrent neural networks, parameter learning with backpropagation, vanishing and exploding gradients., Amazon Transcribe, Google Speech-to-Text, Azure Speech Service

Learning Resources	1.Soumya Sen , Anjan Dutta, Nilanjan Dey, "Audio Processing and Speech Recognition, Concepts, Techniques and Research Overviews,"Springer briefs in Applied sciences and technology,2019	2.Tanveer Siddiqui, Tiwary U S, "Natural Lanuguage Processing and Information Retrieval", Oxford University Press, 2008. 3.Dong Yu, Li Deng, "Automatic Speech Recognition, A Deep Learning Approach",1st ed. Springer, 2014.

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life Long Learning CLA-2 – (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%	-	15%	-	15%	-
Level 2	Understand	25%	-	20%	-	25%	-
Level 3	Apply	30%	-	25%	-	30%	-
Level 4	Analyze	30%	-	25%	-	30%	-

Level 5	Evaluate	-	-	10%	-	-	-
Level 6	Create	-	-	5%	-	-	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
Mr.K.Babinlal,Senior Software Engineer,TRILInfopark,Chennai	Dr Chitra S , Associate Professor ,Anna university	Dr.S.P.Angelin Claret

Course Code	21MCI004E	Course Name	Image Processing and Pattern Recognition	Course Category	E	Elective	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computational Intelligence	Data Book / Codes / Standards	*Nil*		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	Build a solid understanding of image processing techniques for computer vision.
CLR-2:	Learn the techniques used for image pre-processing.
CLR-3:	Discuss the various object recognition techniques and Image understanding.

Course Outcomes (CO):	At the end of this course, learners will be able to:	Program Outcomes(PO)											Program Specific Outcomes		
		1	2	3	4	5	6	7	8	9	10	11			
		Engineering Knowledge	Problem Analysis	Design/development of solutions	Conduct investigations of complex problems	Engineering Tool Usage	The engineer and the World	Ethics	Individual & Collaborative Team work	Communication	Project Mgt. & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3
CO-1:	Understand the basics of image processing techniques for computer vision.	2	-	-	3	-	-	-	-	-	-	-	-	3	-
CO-2:	Implement the techniques used for image pre-processing.	2	-	-	3	-	-	-	-	-	-	-	-	-	3
CO-3:	Develop various object detection techniques and Image understanding.	2	-	-	3	-	-	-	-	-	-	-	3	-	-

Module1 – Introduction **15Hrs**

Introduction to Image Processing- Digital image properties- Color images- Data structures for image analysis- Levels of image data representation- Traditional image data structures- Hierarchical data structures.

Module2 - Image Processing **15Hrs**

Local pre-processing- Image smoothing- Edge detectors- Zero-crossings of the second derivative- Scale in image processing- Canny edge detection- Parametric edge models- Edges in multi-spectral images- Local pre-processing in the frequency domain

Module3 – Pattern Recognition **15Hrs**

Object recognition– Knowledge Representation-Statistical Pattern Recognition-Syntactic Pattern Recognition-Recognition as graph Matching-Image understanding control Strategies-Pattern recognition methods in image understanding.

Learning Resources		
	1.Milan Sonka, Vaclav Hlavac, and Roger Boyle "Image Processing, Analysis, and Machine Vision", Fourth Edition – 2015, Cengage Learning, USA. 2. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision", 4nd edition, Thomson Learning, 2013	3. Scott E Umbaugh , Computer Vision and Image Analysis 4th edition, CRC press 2024 4.Yao Wang, Jorn Ostermann and Ya Qin Zhang, "Video Processing and Communications", Prentice Hall Publishers, 2002.

Learning Assessment

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Level 4	Analyze	30%	-	25%	-	30%	-
Level 5	Evaluate	-	-	10%	-	-	-
Level 6	Create	-	-	5%	-	-	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
Dr Kodai Nathan,DataScientist,Elpis IT solutions pvtLtd.Chennai	Dr. E. Shanmuga Priya,College of Engineering Guindy Campus,Anna university, Chennai-25	Dr. AR.Arunarani SRMIST