



NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE PLAN – PART I			
Name of the programme and specialization	B.Tech. (Common to 3 rd and 4 th year) <i>ESG</i>		
Course Title	Pattern recognition (Elective course)		
Course Code	ECO15	No. of Credits	3
Course Code of Pre-requisite subject(s)	Nil.		
Session	JULY 2020	Section (if, applicable)	Not applicable
Name of Faculty	Dr.E.S.Gopi	Department	ECE
Official Email	esgopi@nitt.edu	Telephone No.	9500423313
Name of Course Coordinator(s) (if, applicable)	Not applicable		
Course Type	Open Elective course		
Syllabus (approved in BoS)			
<p>Polynomial curve fitting – The curse of dimensionality - Decision theory - Information theory - The beta distribution - Dirichlet distribution-Gaussian distribution-The exponent family: Maximum likelihood and sufficient statistics -Non-parametric method: kernel-density estimators - Nearest neighbour methods.</p> <p>Linear models for regression and classification: Linear basis function models for regression - Bias variance decomposition-Bayesian linear regression-Discriminant functions - Fisher's linear discriminant analysis (LDA) - Principal Component Analysis (PCA) - Probabilistic generative model - Probabilistic discriminative model.</p> <p>Kernel methods: Dual representations-Constructing kernels-Radial basis function networks-Gaussian process-Maximum margin classifier (Support Vector Machine) –Relevance Vector Machines-Kernel-PCA, Kernel-LDA.</p> <p>Mixture models: K-means clustering - Mixtures of Gaussian - Expectation-Maximization algorithm- Sequential models: Markov model, Hidden-Markov Model (HMM) - Linear Dynamical Systems (LDS).</p> <p>Neural networks: Feed- forward Network functions-Network training - Error Back propagation - The Hessian Matrix - Regularization in Neural Network - Mixture density networks – Bayesian Neural Networks</p>			
COURSE OBJECTIVES			
The subject aims to make the students to understand the mathematical approach for pattern recognition.			



MAPPING OF COs with POs	
Course Outcomes	Programme Outcomes (PO) (Enter Numbers only)
At the end of the course student will be able to,	PO1
1. CO1: summarize the various techniques involved in pattern recognition.	PO1
2. CO2: identify the suitable pattern recognition techniques for the particular applications.	PO1, PO11
3. CO3: categorize the various pattern recognition techniques into supervised and unsupervised	PO1
4. CO4: summarize the mixture models based pattern recognition techniques	PO1
5. CO5: summarize the Artificial Neural network techniques	PO1

COURSE PLAN – PART II			
COURSE OVERVIEW			
The subject aims to make the students to understand the mathematical approach for pattern recognition. The subject deals with Polynomial curve fitting, Linear and Non-linear model for regression and classification. Kernel methods. Mixture models and Neural networks.			
COURSE TEACHING AND LEARNING ACTIVITIES			(Add more rows)
S.No.	Week/Contact Hours (4)	Topic	Mode of Delivery
1	1	Linear model for regression and classification. Polynomial curve fitting The curse of dimensionality Decision theory	Lecture using online presentation and power point presentation
2	2	Information theory The beta distribution Dirichlet distribution Gaussian distribution The exponent family	Lecture using online presentation and power point presentation
3	3	Maximum likelihood and sufficient statistics. Non parametric method: kernel density estimators Nearest neighbor methods	Lecture using online presentation and power point presentation
4	4	Linear basis function models for regression Bias variance decomposition Linear basis function models for regression Bias variance decomposition	Lecture using online presentation and power point presentation



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5	5	Bayesian linear regression Discriminant functions.	Lecture using online presentation and power point presentation
6	6	Fisher's linear discriminant analysis (LDA) Principal Component Analysis (PCA) -	Lecture using online presentation and power point presentation
5	7	Probabilistic generative model Probabilistic discriminative model	Lecture using online presentation and power point presentation
6	8	Independent Component Analysis (ICA)	Lecture using online presentation and power point presentation
7	8	Flipped class 1	Think pair share activity, followed by assessment based on Flipped class 1
8	9	Kernel methods: Dual representations (Constructing kernels)	Lecture using online presentation and power point presentation
10	10	Radial basis function networks Gaussian process Maximum margin classifier (Support Vector Machine)	Lecture using online presentation and power point presentation
11	11	Relevance Vector Machines Kernel PCA, Kernel LDA.	Lecture using online presentation and power point presentation
12	11	Flipped class 2	Think pair share activity, followed by assessment based on Flipped class 2
13	12	Neural networks: Feed forward Network functions Network training Error Back propagation The Hessian Matrix	Lecture using online presentation and power point presentation
14	13	Regularization in Neural Network Mixture density networks Bayesian Neural Networks	Lecture using online presentation and power point presentation

COURSE ASSESSMENT METHODS (shall range from 4 to 6)



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S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Online Quiz 1	1 st week of October	1 hour	15%
2.	Online Quiz 2	2 nd week of November	1 hour	15%
3.	Assessment based on flipped class	Contionous assessment	-	10%
4	Min project submission	Contionous assessment (Audio slide presentation)	-	10%
CPA	Compensation Assessment*			
5	Online Quiz 3	3 rd week of November	1 hour	15%
6	Online Final Assessment *	4 th week of November	2 hours	30%
*mandatory; refer to guidelines on page 4				
COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)				
<ol style="list-style-type: none"> 1. Self-assessment feedback by the students. 2. Overall performance of the students in the assessment 				
COURSE POLICY (including compensation assessment to be specified)				
<p>[1] Copying is strictly not allowed for submitting the project audio slide. However discussion with the peers is allowed.</p> <p>[2] The course shall have a final assessment on the entire syllabus with 30% weightage.</p> <p>[3] Those who missed either Quiz 1 or Quiz 2 for genuine reason are allowed to write Quiz 3 as the Compensation Assessment. The syllabus for the Quiz 3 is the combination of Quiz 1 and Quiz 2 portions. (Only genuine cases of absence shall be considered).</p> <p>[4] The passing minimum shall and other policy are as per the regulations.</p>				
ATTENDANCE POLICY (including compensation assessment to be specified)				
<ul style="list-style-type: none"> ➤ At least 75% attendance in each course is mandatory. ➤ Students with less than 75% of attendance shall be prevented from writing the final assessment and shall be awarded 'V' grade. ➤ A maximum of 10% shall be allowed under ONDUTY (OD) Category 				
ACADEMIC DISHONESTY & PLAGIARISM				
<ul style="list-style-type: none"> ➤ Copying from others during an online assessment will be treated as punishable dishonesty. 				



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- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty.
- The report shall be submitted to the Academic office

ADDITIONAL INFORMATION, IF ANY

Interaction through piazza (www.piazza.com) is mostly encouraged.

Essential readings:

1. C.M.Bishop, "Pattern recognition and machine learning", Springer, 2006
2. E.S.Gopi, "Pattern recognition and Computational intelligence using Matlab, Springer, 2020.
3. Sergious Theodoridis, Konstantinos Koutroumbas, Pattern recognition, Elsevier, Fourth edition, 2009
4. J.I.Tou and R.C.Gonzalez, "Pattern recognition and Machine learning", Addison-Wesley, 1977
5. P.A.Devijer and J.Kittler, "Pattern recognition-A statistical Approach", Prentice-Hall, 1990
6. R.Schalkoff, "Pattern recognition-statistical, structural and Neural approaches", John Wiley, 1992
7. Recent literature in Pattern recognition and computational intelligence.

FOR APPROVAL

Course Faculty _____

CC- Chairperson _____

HOD _____