A

Course File Report

On

"MACHINE LEARNING"

Submitted by

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Department

of

Computer Science & Engineering

CMR ENGINEERING COLLEGE

UGC AUTONOMOUS

(Approved by AICTE-New Delhi, Affiliated to JNTU, Hyderabad)

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(2023-24, II Semester)

CMR ENGINEERING COLLEGE
UGC AUTONOMOUS
(Approved by AICTE - New Delhi. Affiliated to JNTUH and Accredited by NAAC & NBA)
Kandlakoya (V), Medchal (M), Medchal - Malkajgiri (D)-501401

COURSE INSTRUCTOR NAME : MR.MRUTYUNJAYA S YALAWAR
SUBJECT NAME : MACHINE LEARNING
CONTACT NO : 8884242688
SEM START DATE & END DATE: 29-01-2024 TO 07-06-2024 **Academic year :2023-24**

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Submitted By

Mr. Mrutyunjaya S Yalawar

1. DEPARTMENT VISION & MISSION

Vision:

To produce globally competent and industry ready graduates in Computer Science & Engineering by imparting quality education with a know-how of cutting edge technology and holistic personality.

Mission:

M1. To offer high quality education in Computer Science & Engineering in order to build core competence for the students by laying solid foundation in Applied Mathematics, and program framework with a focus on concept building.
M2. The department promotes excellence in teaching, research, and collaborative activities to prepare students for professional career or higher studies.
M3. Creating intellectual environment for developing logical skills and problem solving strategies, thus to develop, able and proficient computer engineer to compete in the current global scenario.

2. LIST OF PEOs AND POs

2.1 Program Educational Objectives (PEO):

PEO 1: Excel in professional career and higher education by acquiring knowledge of mathematical computing and engineering principles.
PEO 2: To provide an intellectual environment for analyzing and designing computing systems for technical needs.
PEO 3: Exhibit professionalism to adapt current trends using lifelong learning with legal and ethical responsibilities.
PEO 4: To produce responsible graduates with effective communication skills and multidisciplinary practices to serve society and preserve the environment.

2.2 .Program Outcomes (PO):

Engineering Graduates will be able to satisfy these NBA graduate attributes:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

2.3 Program Specific Outcomes (PSOs):

13. **PSO1: Professional Skills and Foundations of Software development:** Ability to analyze, design and develop applications by adopting the dynamic nature of Software developments.
14. **PSO2: Applications of Computing and Research Ability:** Ability to use knowledge in cutting edge technologies in identifying research gaps and to render solutions with innovative ideas.

3. LIST OF COURSE OUTCOMES (Action verbs as per blooms with BTL)

CO1• Ability to understand the basic concept of Machine Learning and its application.
CO2• Ability to learn the Artificial Neural Networks concepts with various techniques.
CO3• Ability to analyze and solve problems using Bayesian and other algorithms
CO4• Ability to understand about Genetic Algorithm, Reinforcement Learning techniques.
CO5• Ability to apply the various techniques for the analysis and prediction of data using methods.

REVISED Bloom's Taxonomy Action Verbs

Definitions	I. Remembering	II. Understanding	III. Applying	IV. Analyzing	V. Evaluating	VI. Creating
Bloom's Definition	Exhibit memory of previously learned material by recalling facts, terms, basic concepts, and answers.	Demonstrate understanding of facts and ideas by organizing, comparing, translating, interpreting, giving descriptions, and stating main ideas.	Solve problems to new situations by applying acquired knowledge, facts, techniques and rules in a different way.	Examine and break information into parts by identifying motives or causes. Make inferences and find evidence to support generalizations.	Present and defend opinions by making judgments about information, validity of ideas, or quality of work based on a set of criteria.	Compile information together in a different way by combining elements in a new pattern or proposing alternative solutions.
Verbs	• Choose • Define • Find • How • Label • List • Match • Name • Omit • Recall • Relate • Select • Show • Spell • Tell • What • When • Where • Which • Who • Why	• Classify • Compare • Contrast • Demonstrate • Explain • Extend • Illustrate • Infer • Interpret • Outline • Relate • Rephrase • Show • Summarize • Translate	• Apply • Build • Choose • Construct • Develop • Experiment with • Identify • Interview • Make use of • Model • Organize • Plan • Select • Solve • Utilize	• Analyze • Assume • Categorize • Classify • Compare • Conclusion • Contrast • Discover • Dissect • Distinguish • Divide • Examine • Function • Inference • Inspect • List • Motive • Relationships • Simplify • Survey • Take part in • Test for • Theme	• Agree • Appraise • Assess • Award • Choose • Compare • Conclude • Criteria • Criticize • Decide • Deduct • Defend • Determine • Disprove • Estimate • Evaluate • Explain • Importance • Influence • Interpret • Judge • Justify • Mark • Measure • Opinion • Perceive • Prioritize • Prove • Rate • Recommend • Rule on • Select • Support • Value	• Adapt • Build • Change • Choose • Combine • Compile • Compose • Construct • Create • Delete • Design • Develop • Discuss • Elaborate • Estimate • Formulate • Happen • Imagine • Improve • Invent • Make up • Maximize • Minimize • Modify • Original • Originate • Plan • Predict • Propose • Solution • Solve • Suppose • Test • Theory

Anderson, L. W., & Krathwohl, D. R. (2001). A taxonomy for learning, teaching, and assessing, Abridged Edition. Boston, MA: Allyn and Bacon.

Action Words for Bloom's Taxonomy					
Knowledge	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
define	explain	solve	analyze	reframe	design
identify	describe	apply	compare	criticize	compose
describe	interpret	illustrate	classify	evaluate	create
label	paraphrase	modify	contrast	order	plan
list	summarize	use	distinguish	appraise	combine
name	classify	calculate	infer	judge	formulate
state	compare	change	separate	support	invent
match	differentiate	choose	explain	compare	hypothesize
recognize	discuss	demonstrate	select	decide	substitute
select	distinguish	discover	categorize	discriminate	write
examine	extend	experiment	connect	recommend	compile
locate	predict	relate	differentiate	summarize	construct
memorize	associate	show	discriminate	assess	develop
quote	contrast	sketch	divide	choose	generalize
recall	convert	complete	order	convince	integrate
reproduce	demonstrate	construct	point out	defend	modify
tabulate	estimate	dramatize	prioritize	estimate	organize
tell	express	interpret	subdivide	find errors	prepare
copy	identify	manipulate	survey	grade	produce
discover	indicate	paint	advertise	measure	rearrange
duplicate	infer	prepare	appraise	predict	rewrite
enumerate	relate	produce	break down	rank	role-play
listen	restate	report	calculate	score	adapt
observe	select	teach	conclude	select	anticipate
omit	translate	act	correlate	test	arrange
read	ask	administer	criticize	argue	assemble
recite	cite	articulate	deduce	conclude	choose
record	discover	chart	devise	consider	collaborate
repeat	generalize	collect	diagram	critique	collect
retell	give examples	compute	dissect	debate	devise
visualize	group	determine	estimate	distinguish	express
	illustrate	develop	evaluate	editorialize	facilitate
	judge	employ	experiment	justify	imagine
	observe	establish	focus	persuade	infer
	order	examine	illustrate	rate	intervene
	report	explain	organize	weigh	justify
	represent	interview	outline		make
	research	judge	plan		manage
	review	list	question		negotiate
	rewrite	operate	test		originate
	show	practice			propose
	trace	predict			reorganize
	transform	record			report
		schedule			revise
		simulate			schematize
		transfer			simulate
		write			solve
					speculate
					structure
					support
					test
					validate

4. SYLLABUS COPY AND SUGGESTED REFERENCE BOOKS

UNIT - I

Introduction - Well-posed learning problems, designing a learning system, Perspectives and issues in machine learning Concept learning and the general to specific ordering – introduction, a concept learning task, concept learning as search, find-S: finding a maximally specific hypothesis, version spaces and the candidate elimination algorithm, remarks on version spaces and candidate elimination, inductive bias.

Decision Tree Learning – Introduction, decision tree representation, appropriate problems for decision tree learning, the basic decision tree learning algorithm, hypothesis space search in decision tree learning, inductive bias in decision tree learning, issues in decision tree learning..

UNIT - II

Artificial Neural Networks-1– Introduction, neural network representation, appropriate problems for neural network learning, perceptions, multilayer networks and the back-propagation algorithm.
Artificial Neural Networks-2- Remarks on the Back-Propagation algorithm, An illustrative example: face recognition, advanced topics in artificial neural networks.
Evaluation Hypotheses – Motivation, estimation hypothesis accuracy, basics of sampling theory, a general approach for deriving confidence intervals, difference in error of two hypotheses, comparing learning algorithms.

UNIT – III

Bayesian learning – Introduction, Bayes theorem, Bayes theorem and concept learning, Maximum Likelihood and least squared error hypotheses, maximum likelihood hypotheses for predicting probabilities, minimum description length principle, Bayes optimal classifier, Gibs algorithm, Naïve Bayes classifier, an example: learning to classify text, Bayesian belief networks, the EM algorithm.
Computational learning theory – Introduction, probably learning an approximately correct hypothesis, sample complexity for finite hypothesis space, sample complexity for infinite hypothesis spaces, the mistake bound model of learning.
Instance-Based Learning- Introduction, k-nearest neighbour algorithm, locally weighted regression, radial basis functions, case-based reasoning, remarks on lazy and eager learning.

UNIT – IV

Genetic Algorithms – Motivation, Genetic algorithms, an illustrative example, hypothesis space search, genetic programming, models of evolution and learning, parallelizing genetic algorithms.
Learning Sets of Rules – Introduction, sequential covering algorithms, learning rule sets: summary, learning First-Order rules, learning sets of First-Order rules: FOIL, Induction as inverted deduction, inverting resolution.
Reinforcement Learning – Introduction, the learning task, Q–learning, non-deterministic, rewards and actions, temporal difference learning, generalizing from examples, relationship to dynamic programming.

UNIT - V

Analytical Learning-1-Introduction, learning with perfect domain theories: PROLOG-EBG, remarks on explanation-based learning, explanation-based learning of search control knowledge.

Analytical Learning-2-Using prior knowledge to alter the search objective, using prior knowledge to augment search operators.

Combining Inductive and Analytical Learning–Motivation, inductive-analytical approaches to learning, using prior knowledge to initialize the hypothesis.

TEXT BOOK:

1. Machine Learning – **Tom M. Mitchell**, - MGH, **Publisher**: McGraw-Hill Science/Engineering/Math; (March 1, 1997), **ISBN**: 0070428077.

REFERENCES BOOKS:

1. Machine Learning: An Algorithmic Perspective, **Stephen Marshland**, Second Edition, 2015 by **Taylor & Francis Group**, LLC CRC Press is an imprint of Taylor & Francis Group, an Informa business No claim to original U.S. Government works Version Date: 20140826 **ISBN**-13: 978-1-4665-8333-7 (eBook - PDF).

5. INDIVIDUAL TIME TABLE ()

	I	II	III		IV	V
MON	ML-A					
TUE		ML-A			ML-A	
WED	ML-A					
THU	ML-A					
FRI						
SAT	ML-A	ML-A				

6. SESSION PLAN/LESSON PLAN

FACULTY NAME : Mr. Mrutyunjaya S Yalawar

SUBJECT NAME : MACHINE LEARNING

YEAR AND SEM : III B.TECH II SEM

S.NO	Topic (JNTU syllabus)	Sub-Topic	NO. OF LECTURES REQUIRED	Suggested Books	Methods
1	UNIT – I Introduction , Concept of Learning, Decision Tree Learning	Introduction to Machine Learning Problems, Designing learning System	L1	T1	M1,M2,M4
2		Perspectives and issues in machine learning	L2	T1	M1,M2,M4
3		Introduction to Concept Learning and Specific Ordering	L3	T1	M1,M2,M4
4		Concept Learning Tasks, find-S, hypothesis	L4	T1	M4,M5
5		Concept Learning algorithms, inductive bias concepts	L5	T1	M1,M2,M4
6		Introduction to Decision Tree Learning Concept	L6	T1	M1,M2,M4
7		Representation and Problems of Decision tree learning	L7	T1	M1,M2,M4
8		Hypothesis Space search in Decision Tree Learning Concept	L8	T1	M1,M2,M4
9		Inductive Bias in Decision tree Learning Concept	L9	T1	M1,M2,M4
10		Issues in Decision tree Learning	L10	T1	M1,M2,M4
11	Unit – II Artificial Neural Networks-1, Artificial Neural Networks-2, Evaluation Hypotheses	Introduction to Neural Network-1	L11	T1	M1,M2,M4
12		Appropriate Problems for Neural Networks, perceptions	L12	T1	M1,M2,M4
13		Concept of Multi Layer Network	L13	T1	M4,M5
14		Concept of Back-propagation Algorithm.	L14	T1	M1,M2,M4
15		Remarks on Back-Propagation algorithm with Examples	L15	T1	M1,M2,M4
16		Concept of Face Recognition and advance topics in Artificial Neural networks	L16	T1	M1,M2,M4
17		Concept of Evaluation hypothesis Accuracy, basic Sampling theory	L17	T1	M1,M2,M4

18		Approach for Confidence intervals Concepts	**L18**	**T1**	M1,M2,M4
19		Concept of Error of two hypotheses	**L19**	**T1**	M3,M5,M4
20		Concept of Comparing Learning algorithms	**L20**	**T1**	M6,M7,M8
21	**Unit - III** **Bayesian Learning, Computational learning theory, Instance-Based Learning**	Introduction to Bayes Theorem and Concept Learning	**L21**	**T1**	M9.M4
22		Introduction to Maximum Likelihood and least squared error hypotheses.	**L22**	**T1**	M2,M4
23		Concept of Maximum likelihood hypotheses for predicting probabilities and minimum description length principle.	**L23**	**T1**	M4,M5
24		Introduction of Bayes optimal classifier	**L24**	**T1**	M1,M2,M4
25		Gibs algorithm, Naïve Bayes classifier.	**L25,L26**	**T1**	M1,M2,M4
26		Describing with an example: learning to classify text, Bayesian belief networks, the EM algorithm.	**L27,L28**	**T1**	M1,M2,M4
27		Introduction and probably learning an approximately correct hypothesis.	**L29**	**T1**	M1,M2,M4
28		Sample complexity for finite hypothesis space.	**L30**	**T1**	M1,M2,M4
29		Sample complexity for infinite hypothesis spaces, the mistake bound model of learning.	**L31**	**T1**	M1,M2,M4
30		Introduction and k-nearest neighbour algorithm.	**L32**	**T1**	M1,M2,M4
31		Locally weighted regression, radial basis functions.	**L33**		M1,M2,M4
32		Case-based reasoning, remarks on lazy and eager learning.	**L34**		M4,M5
33	**Unit – IV** **Genetic Algorithms, Learning Sets of Rules, Reinforcement Learning.**	Motivation and Genetic algorithms, an illustrative example.	**L35,L36**	**T1**	M1,M2,M4
34		Concept of Hypothesis space search, genetic programming.	**L37**	**T1**	M1,M2,M4
35		Models of evolution and learning.	**L38**	**T1**	M1,M2,M4
36		Parallelizing genetic algorithms.	**L39**	**T1**	M1,M2,M4
37		Introduction, sequential covering algorithms, learning rule sets: summary, learning First-Order rules.	**L40**	**T1**	M1,M2,M4
38		Learning sets of First-Order rules: FOIL, Induction as inverted deduction.	**L41**	**T1**	M3,M5,M4
39		Inverting resolution.	**L42**	**T1**	M6,M7,M8
40		Introduction, the learning task, Q–learning.	**L43**	**T1**	M9.M4
41		Non-deterministic, rewards	**L44,L45**	**T1**	M2,M4

		and actions, temporal difference learning.			
42		Generalizing from examples, relationship to dynamic programming.	**L46,L47**	**T1**	M1,M2,M4
43	**Unit – V** **Analytical Learning-1, Analytical Learning-2, Combining Inductive and Analytical Learning.**	Introduction.	**L48**	**T1**	M1,M2,M4
44		Learning with perfect domain theories: PROLOG-EBG.	**L49**	**T1**	M3,M5,M4
45		Remarks on explanation-based learning, explanation-based learning of search control knowledge.	**L50**	**T1**	M6,M7,M8
46		Using prior knowledge to alter the search objective.	**L51**	**T1**	M9.M4
47		Using prior knowledge to augment search operators.	**L52**	**T1**	M2,M4
48		Motivation	**L53**	**T1**	M6,M7,M8
49		Inductive-analytical approaches to learning.	**L54**	**T1**	M9.M4
50		Using prior knowledge to initialize the hypothesis.	**L55**	**T1**	M2,M4

METHODS OF TEACHING:

M1 : Lecture Method	**M4 : Presentation /PPT**	**M7 : Assignment**
M2 : Demo Method	**M5 : Lab/Practical**	**M8 : Industry Visit**
M3 : Guest Lecture	**M6 : Tutorial**	**M9 : Project Based**

NOTE:

1. Any Subject in a Semester is suppose to be completed in 50 to 60 periods.
2. Each Period is of 50 minutes.
3. Each unit duration & completion should be mentioned in the Remarks Column.
4. List of Suggested books can be marked with Codes like T1, T2, R1, R2 etc.

7. Session Execution Log:

S no	Units	Scheduled started date	Completed date	Remarks
1	I	29/01/24	10/02/24	Completed
2	II	12/02/24	26/02/24	Completed
3	III	28/02/24	16/03/24	Completed
4	IV	16/03/24	22/04/24	Completed
5	V	24/04/24	29/05/24	Completed

8. Lecture Notes – (hand written)

9. ASSIGNMENT QUESTIONS ALONG SAMPLE ASSIGNMENT SCRIPTS

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Department of Computer Science & Engineering

ML Assignment Questions -I

1) What is well posed learning problem. Discuss any three well posed learning problems describing their task, performance and experience? List the basic design issues to machine learning ?[CO1]
   b. Differentiate between Gradient Descent and Stochastic Gradient Descent ?[CO1]

2) a. Write Find-S algorithm and find maximally specific hypothesis for examples [CO1]

Size	Color	Shape	Class
Big	Red	Circle	No
Small	Red	Triangle	No
Small	Red	Circle	Yes
Big	Blue	Circle	No
Small	Blue	Circle	Yes

   b. Define concept learning and version space.

3) a) What is Artificial Neural Networks? Give some of its applications
   b) Explain perceptron model with a neat diagram. What is the need of target function? [CO 2]

4) a Explain Bayes Theorem with an example. [CO1]

   b. Explain the steps in designing a learning system for checkers game ? [CO 1]

5) Derive the Back propagation algorithm for training multi-layer network ? [CO 2]

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Department of Computer Science & Engineering

ML Assignment Questions -II

1) a. What are Bayesian Belief nets? Where are they used? Can it solve all types of problems? [CO3].
   b. Describe k-nearest neighbor algorithm. Why is it called instance based learning? [CO3]

2) a. Describe the Genetic Algorithm (GA) steps using the Population, Fitness function, other necessary data and hypothesis it returns. [CO4]
   b. What are the remarks on Lazy and Eager learning? Discuss Radial Basis Function? [CO3]
3) Explain Learning set of Rules [CO4]
   a) First Order Learning & FOIL
   b) Sequential Covering Algorithm.
4) a) Write short notes on the following: [CO4]
      i. Temporal difference learning.
      ii. Dynamic programming.
   b) Describe the explanation based learning algorithm, PROLOG-EBG.[CO5]

5) a. Explain Reinforcement Learning with an example? [CO5]
   b. Discuss about the Q–learning? [CO5]

10. MID EXAM QUESTION PAPER ALONG SAMPLE ANSWER SCRIPTS

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Department of Computer Science & Engineering

III.B.TECH II SEM - I MID EXAMINATIONS

Subject: MACHINE LEARNING **BRANCH: CSE -C** **Time: 1hr 30 MINUTES** **Marks: 25 M**

III-B.TECH II-SEM- I MID EXAMINATIONS

Time:10:00 AM to11:30 AM

Subject: ML [A, B, C- Section] Branch: CSE ,CSE [AI&ML] **Max.Marks:25 M**

Note: Question paper contains two parts, Part-A and Part- B.

Part-A is compulsory which carries 10 marks.

Answer all questions in part-A.

Answer anyone full question from each unit. Each question carries 5 marks.

PART-A **5 x 2M = 10 M**

		BTL	CO
1.	List some applications of machine learning.	1	1
2.	What is the need of target function?	1	1
3.	List the basic design issues to machine learning.	1	1
4.	Differentiate between Gradient Descent and Stochastic Gradient Descent?	4	2
5.	Define concept learning and version space?	1	3

PART-B **3 x 5M = 15 M**

		BTL	CO
6.	What is well posed learning problem. Discuss any three well posed learning problems describing their task, performance and experience.	**1**	**1**
	(OR)		
7.	Explain the steps in designing a learning system for checkers game.	**2**	**1**
8.	What is Find-S algorithm and Find maximally specific hypothesis for the given training examples	**1**	**2**
	(OR)	**2**	**2**
9.	a) What is Artificial Neural Network? Give some of its applications b) Explain perceptron model with a neat diagram.		

Size	Color	Shape	Class
Big	Red	Circle	No
Small	Red	Triangle	No
Small	Red	Circle	Yes
Big	Blue	Circle	No
Small	Blue	Circle	Yes

10.	Derive the Backpropagation algorithm for training multi-layer network	**2**	**2**
	(OR)		
11.	Explain Bayes Theorem with an example	**1**	**2**

11. Mid-1 Scheme of evaluation

COURSE: **B.Tech**
YEAR**: III**
SEM: **II**
BRANCH**: CSE –C**
A-Y: **2023-24**
NAME OF SUBJECT**: MACHINE LEARNING**

MID: **I**

SET-1

Sl. No.	THEORY	MARKS
PART-A	Each Questions Carries 2 marks, Total 10 Questions, Hence Total Marks= 10M	5*2=10M
PART-B	Each Questions Carries 5 marks, Total 3 Questions, Hence Total Marks= 3*5=15M	3*5=15M
TOTAL		25M

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Department of Computer Science & Engineering

III.B.TECH I SEM - II MID EXAMINATIONS Date:**22-7-2021**

Subject: MACHINE LEARNING **BRANCH: CSE –C** **Time: 1hr 30 MINUTES** **Marks: 25 M**

III-B.TECH II –SEM II-MID EXAMINATIONS

Date: 25-04-2023 **Time:10:00 AM to11:30 AM**

Subject: ML[A, B, C- Section] Branch: CSE ,CSE [AI&ML] **Max.Marks:25 M**

Note: Question paper contains two parts, Part-A and Part- B.

Part-A is compulsory which carries 10 marks.

Answer all questions in part-A.

Answer anyone full question from each unit. Each question carries5 marks.

PART-A **5 x 2M = 10 M**

		BTL	CO
1.	Mention GIBS algorithm.	**1**	**3**
2.	What is Temporal difference learning.	**1**	**4**
3.	What are the remarks on Lazy and Eager learning?	**1**	**4**
4.	Give three comparisons Between Inductive Learning and analytical learning.	**4**	**5**
5.	Explain Radial Basis Function.	**1**	**4**

PART-B **3 x 5M = 15 M**

		BTL	CO
6.	What are Bayesian Belief nets? Where are they used? Can it solve all types of problems?	**1**	**3**
	(OR)		
7.	Describe k-nearest neighbor algorithm. Why is it called instance based learning?	**2**	**3**
8.	Explain following Learning set of Rules. a)First Order Learning & FOIL b)Sequential Covering Algorithm.	**1**	**4**
	(OR)	**2**	**4**
9.	Discuss the Genetic Algorithm (GA) steps using the Population, Fitness function, other necessary data and hypothesis it returns.		
10.	A) Explain Reinforcement Learning with an example? b) Write about the Q–learning?	**2**	**4**
	(OR)		
11.	Interpret step by step PROLOG-EBG learning algorithm.	**1**	**5**

DEPARTMENT OF CSE

COURSE: **B.Tech** YEAR**: III** SEM: **II** A-Y: **2023-24**

NAME OF SUBJECT**: MACHINE LEARNING** MID: **II**

SCHEME OF EVALUATION

Sl. No.	THEORY	MARKS
PART-A	Each Questions Carries 2 marks, Total 10 Questions, Hence Total Marks= 10M	5*2=10M
PART-B	Each Questions Carries 5 marks, Total 3 Questions, Hence Total Marks= 3*5=15M	3*5=15M
TOTAL		25M

12.Mapping of Course Objectives, Course Outcomes with PEOs and Pos

Course Outcomes	**Relationship of Course Outcomes (CO) to Program Outcomes (PO)**											
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-								1	1	
CO2	3	3	2	2					2	1		1
CO3	3	3	2	2					2	1		1
CO4	3	2	2	2					2	1		1
CO5	3	2	2	2					2	1		1

13.CO'S,PO'S ,PSO'S JUSTIFICATION

Course Outcomes	**Relationship of Course Outcomes (CO) to Program Outcomes (PO)**											
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-								1	1	
CO2	3	3	2	2					2	1		1
CO3	3	3	2	2					2	1		1
CO4	3	2	2	2					2	1		1
CO5	3	2	2	2					2	1		1

Justification:

CO1.: Explain the types of the data to be mined and present a general classification of tasks and primitives to integrate a data mining system
Correlated with PO1 moderately: Because it contributes the knowledge on fundamentals of Data Mining which makes students get engineering knowledge and student can categorize different utilities. So, overall the correlation of CO1 to PO1 is good.
Correlated with PO10 moderately: Because it provides communication in complex activities with effective reports and design documentation. So Correlation of CO1 with PO10 is low.
Correlated with PO11 moderately: Because it demonstrates knowledge and understanding of the Engineering and management Principles. So Correlation of CO1 with PO11 is low.

CO2.: Apply preprocessing methods for any given raw data and extract interesting pattern from large amounts of data
Correlated with PO1 moderately: Because it provides fundamentals of computer science. So, correlation is good.
Correlated with PO2 moderately: Because it Apply preprocessing methods for any given raw data. So, correlation is good.
Correlated with PO3 moderately: Because it provides solutions for complex engineering problems. So, correlation is good.
Correlated with PO4 moderately: Because it provides Analyses and Interpretation of data. So, correlation is good.
Correlated with PO9 moderately: Because it provides function effectively as an individual for data. So, correlation is average.

Correlated with PO10 moderately: An ability to communicate effectively with a range of audiences
Correlated with PO12 moderately: Recognition of the need for and an ability to engage in continuing professional development.

CO3.: Discover the role played by data mining in various fields.
Correlated with PO1 moderately: Because it provides an engineering specialization to the solution of complex engineering problems. So, correlation is good.
Correlated with PO2 moderately: An ability to analyze a problem, and identify and formulate the computing requirements appropriate to its solution.
Correlated with PO3 moderately: An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations.
Correlated with PO4 moderately: An ability to design and conduct experiments, as well as to analyze and interpret data.
Correlated with PO9 moderately: An ability to function effectively individually and on teams, including diverse and multidisciplinary, to accomplish a common goal.
Correlated with PO10 moderately: An ability to communicate effectively with a range of audiences
Correlated with PO12 moderately: Recognition of the need for and an ability to engage in continuing professional development.

CO4.: Choose and employ suitable data mining algorithms to build analytical applications
Correlated with PO1 moderately: An ability to apply knowledge of computing, mathematics, science and engineering fundamentals appropriate to the discipline.
Correlated with PO2 moderately: An ability to analyze a problem, and identify and formulate the computing requirements appropriate to its solution.
Correlated with PO3 moderately: An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations.
Correlated with PO4 moderately: An ability to design and conduct experiments, as well as to analyze and interpret data.
Correlated with PO9 moderately: An ability to function effectively individually and on teams, including diverse and multidisciplinary, to accomplish a common goal.
Correlated with PO10 moderately: It is an ability to communicate effectively with a range of audiences.
Correlated with PO12 moderately: Recognition of the need for and an ability to engage in

continuing professional development.

CO5.: Evaluate the accuracy of supervised and unsupervised model and algorithms
Correlated with PO1 moderately: To apply knowledge of computing, mathematics, science and engineering fundamentals appropriate to the discipline.
Correlated with PO2 moderately: To analyze a problem, and identify and formulate the computing requirements appropriate to its solution.
Correlated with PO3 moderately: To design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations.
Correlated with PO4 moderately: To design and conduct experiments, as well as to analyze and interpret data.
Correlated with PO9 moderately: to function effectively individually and on teams, including diverse and multidisciplinary, to accomplish a common goal.
Correlated with PO10 moderately: To communicate effectively with a range of audiences.
Correlated with PO12 moderately: An ability to engage in continuing professional development.

14.ATTAINMENT OF CO's, PO's AND PSO's (EXCEL SHEET):

Relationship of Course outcomes to Program Outcomes (PO AVG)													
PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2

ASSESSMENT OF POs THROUGH THE COURSE			
PO	CO	Value	AVG PO (mid)
PO1	CO1		
	CO3		
	CO4		
	CO5		
	CO6		
PO2	CO1		
	CO2		
	CO3		
	CO4		
	CO5		
PO3	CO1		
	CO2		
	CO3		
	CO4		
	CO5		
	CO6		
PO4	CO2		
	CO3		
	CO6		
PO5	CO5		
PO12	CO2		
PSO1	CO2		
	CO3		
PSO2	CO1		
	CO2		
	CO3		
	CO4		
	CO6		

15. Previous Question Papers or Question Bank.

Question Model papers-JNTUH ML-2021.zip

Code No: 57055 **R09**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech IV Year I Semester Examinations, October/November - 2020
MACHINE LEARNING
(Computer Science and Engineering)

Time: 2 Hours **Max. Marks: 75**

Answer any Five Questions
All Questions Carry Equal Marks

---

1. Explain the sequence of design choices made for checkers program in detail with illustrations. [15]

2. Discuss the limitations of FIND-S algorithm and how Candidate Elimination algorithm addresses these limitations. [15]

3. Examine the hypothesis space search performed by ID3 algorithm and contrast it with List and then eliminate algorithm. [15]

4. Describe the derivation of the gradient descent rule. [15]

5.a) How does the deviation between sample error and true error depend on the size of the data sample?
b) Discuss central limit theorem. [8+7]

6. Explain how to use Bayesian classifier to learn text classification with an example. [15]

7. Describe k-nearest neighbor algorithm for approximating a discrete-valued function. [15]

8.a) What is explanation based learning? Compare it with instance-based learning.
b) Demonstrate usage of prior knowledge to reduce the sample complexity. [8+7]

--ooOoo--

Code No: 57055 **R09**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech IV Year I Semester Examinations, November/December - 2018
MACHINE LEARNING
(Computer Science and Engineering)

Time: 3 Hours **Max. Marks: 75**

Answer any Five Questions
All Questions Carry Equal Marks

1.a) What is meant by well posed learning problem? Explain with appropriate example.
b) Discuss the influence of information theory and psychological disciplines on machine learning. [7+8]

2.a) State the version space representation theorem.
b) Describe about bias free learning. [8+7]

3. Explain in brief about hypothesis space search in Decision tree learning show that ID3 searches for just one consistent hypothesis. [15]

4.a) Explain in brief about Back propagation learning. What are its limitations?
b) Discuss a general approach for defining confidence intervals. [8+7]

5.a) Define the following:
i) Sample complexity ii) Computational complexity
iii) Mistake bound iv) True error of hypothesis
b) Describe in brief about over fitting and cross validation. [7+8]

6.a) Discuss maximum likelihood hypothesis for predicting probabilities in Bayesian based learning.
b) Describe in brief about Gibbs algorithm. [8+7]

7.a) Differentiate between lazy learners and eager learners.
b) Explain in brief about case based reasoning. [8+7]

8.a) Discuss explanation based learning of search control knowledge.
b) How learning can be done with perfect domain theories? [8+7]

—ooOoo—

Code No: 57055 **R09**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech IV Year I Semester Examinations, April/May - 2018
MACHINE LEARNING
(Computer Science and Engineering)

Time: 3 Hours **Max. Marks: 75**

Answer any Five Questions
All Questions Carry Equal Marks

---

1. What do you meant by features? What are the different properties of features? Explain the advantages of machine learning? [15]

2. Describe these terms in brief:
   a) PAC Hypothesis b) Mistake bound model of learning [15]

3. What do you mean by Gain and Entropy? How is it used to build the Decision tree in algorithm? Illustrate using an example. [15]

4. Consider a multilayer feed forward neural network. Enumerate and explain steps in back propagation algorithm use to train network. [15]

5. Describe multiplicative rules for weight tuning. [15]

6. What are Bayesian Belief nets? Where are they used? Can it solve all types of problems? [15]

7. Describe k-nearest neighbor algorithm. Why is it called instance based learning?[15]

8. Describe the Genetic Algorithm (GA) steps using the Population, Fitness function, other necessary data and hypothesis it returns. [15]

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Code No: 57055 **R09**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech IV Year I Semester Examinations, October/November - 2020
MACHINE LEARNING
(Computer Science and Engineering)

Time: 2 Hours **Max. Marks: 75**

Answer any Five Questions
All Questions Carry Equal Marks

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16. PPTs AND PRESENTATION

Introduction

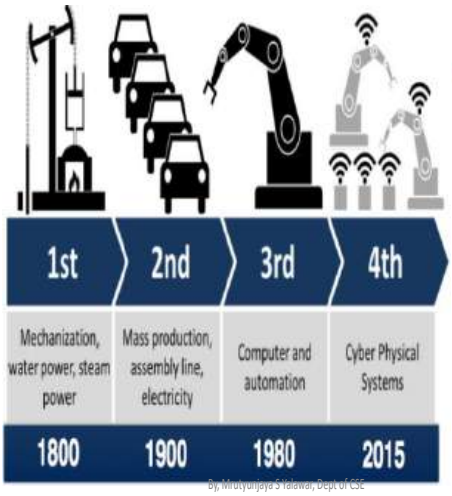
- Machine Learning algorithms enable the computers to learn from data, and even improve themselves, without being explicitly programmed.
- Any field that needs to interpret and act on data can benefit from machine learning techniques.
- The goal of this course is to present key algorithms and theory that form the core of machine learning with a balanced presentation of both theory and practice.

By, Mrutyunjaya S Yalawar, Dept of CSE

Machine Learning

- **Learning ↔ Intelligence**
  (Def: Intelligence is the ability to learn and use concepts to solve problems.)
- **Machine Learning ↔ Artificial Intelligence**
- **Def: AI** is the science of making machines do things that require intelligence if done by men (Minsky 1986)
- **Def: Machine Learning** is an area of AI concerned with development of techniques which allow machines to learn.
- **Why Machine Learning? ↔ Why Artificial Intelligence?**

By, Mrutyunjaya S Yalawar, Dept of CSE



By, Mrutyunjaya S Yalawar, Dept of CSE

- Learning ↔ Intelligence

  (Def: Intelligence is the ability to learn and use concepts to solve problems.)

- Machine Learning ↔ Artificial Intelligence

  Def: AI is the science of making machines do things that require intelligence if done by men (Minsky 1986)

  Def: Machine Learning is an area of AI concerned with development of techniques which allow machines to learn

- **Why Machine Learning? ↔ Why Artificial Intelligence?**

  To build machines exhibiting intelligent behaviour (i.e., able to reason, predict, and adapt) while helping humans work, study, and entertain themselves.

- Machine Learning ↔ Artificial Intelligence
- Machine Learning ← **Biology** (e.g., Neural Networks, Genetic Algorithms)
- Machine Learning ← **Cognitive Sciences** (e.g., Case-based Reasoning)
- Machine Learning ← **Statistics** (e.g., Support Vector Machines)
- Machine Learning ← **Probability** Theory (e.g., Bayesian Networks)
- Machine Learning ← **Logic** (e.g., Inductive Logic Programming)
- Machine Learning ← **Information Theory** (e.g., used by Decision Trees)

Applications

- The highly complex nature of many real-world problems, though, often means that inventing specialized algorithms that will solve them perfectly every time is impractical, if not impossible.
- Examples of machine learning problems include, "Is this cancer?", "What is the market value of this house?", "Which of these people are good friends with each other?", "Will this rocket engine explode on take off?", "Will this person like this movie?", "Who is this?", "What did you say?", and "How do you fly this thing?".
- All of these problems are excellent targets for an ML project, and in fact ML has been applied to each of them with great success.

Well-posed learning problems

Well-posed learning problems.

- Def 1 (Mitchell 1997): A computer program is said to learn from experience E with respect to some class of tasks T and performance measure P, if its performance at tasks in T, as measured by P, improves by experience E.
- Def 2 (Hadamard 1902): A (machine learning) problem is well-posed if a solution to it exists, if that solution is unique, and if that solution depends on the data / experience but it is not sensitive to (reasonably small) changes in the data / experience.

Continuation.....

- **A checkers learning problem**

  Task T : playing checkers.

  Performance measure P : percent of games won against opponents.

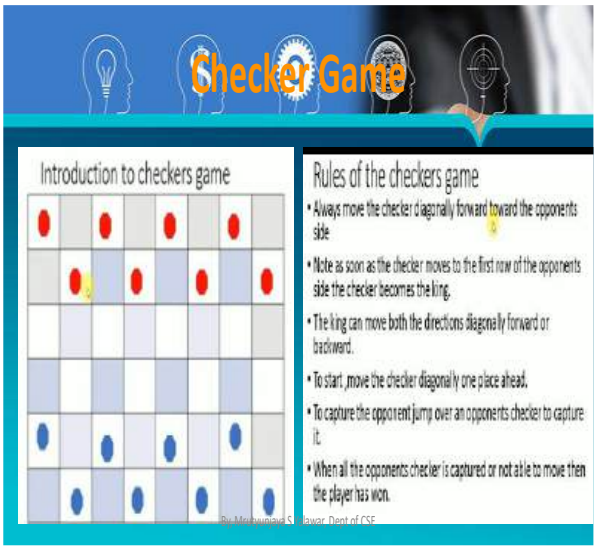
  Training experience E : playing practice games against itself.

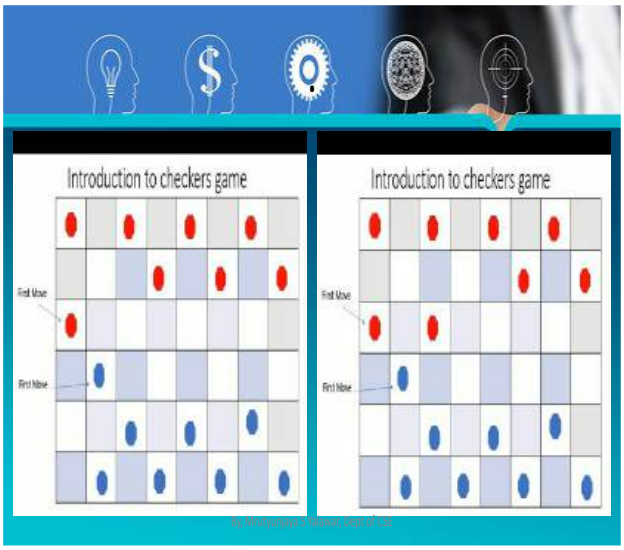
- **A handwriting recognition learning problem**

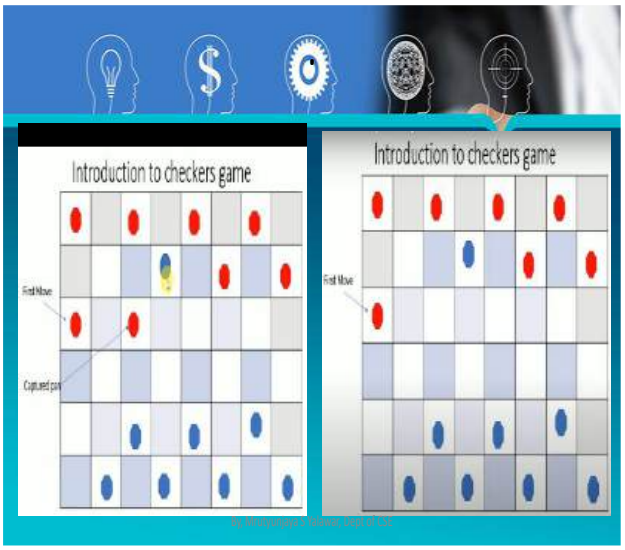
  Task T : recognizing and classifying handwritten words within images.

  Performance measure P : percent of words correctly classified

  Training experience E : a database of handwritten words with given classifications.

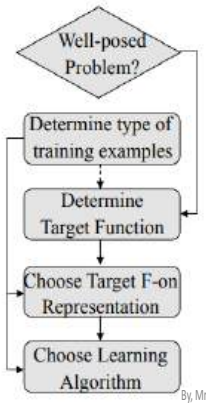






Designing a learning system.

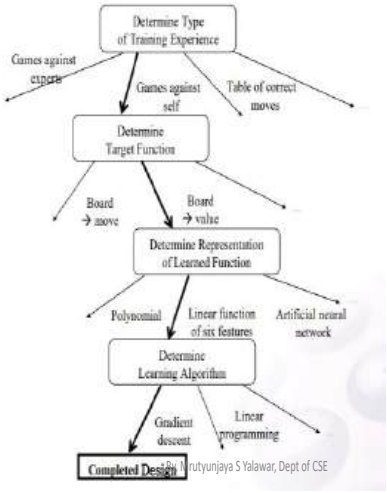
Designing a learning system.



- **In other ways like.....**

1) Choosing the Training Experience.
2) Choosing the Target Function.
3) Choosing a Representation for the Target Function.
4) Choosing a Function Approximation Algorithm.
5) The Final Design.

Designing a learning system (Conti....)



Perspectives and Issues in Machine Learning

- What algorithms exist for learning general target functions from specific training examples ?
- How does the number of training examples influence accuracy ?
- When and how can prior knowledge held by the learner guide the process of generalizing from examples ?

Issues in Machine Learning (cont.)

- What is the best strategy for choosing a useful next training experience, and how does the choice of this strategy alter the complexity of the learning problem ?
- What is the best way to reduce the learning task to one or more function approximation problems ?
- How can the learner automatically alter its representation to improve its ability to represent and learn the target function ?

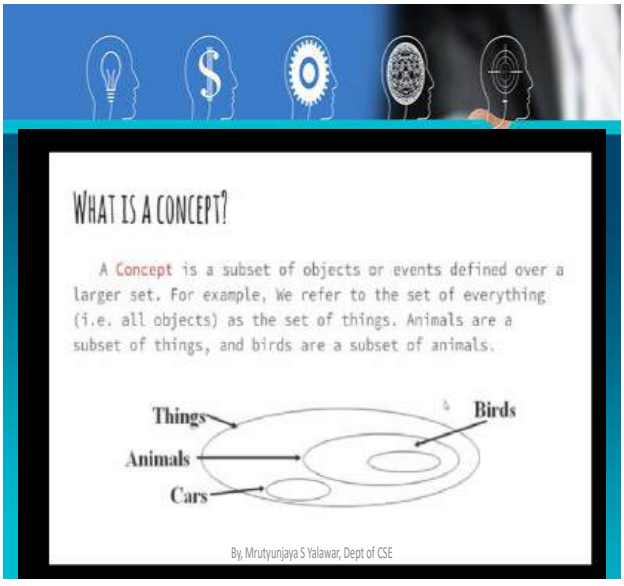
Concept Learning

Concept learning

Concept learning

- supervised, eager learning
- target problem: whether something belongs to the target concept or not.
- target function: V: D → {true, false}
- Underlying idea: Humans acquire general concepts from specific examples (e.g., concepts: beauty, good friend, well-fitting-shoes) (note: each concept can be thought of as Boolean-valued function)
- Concept learning is inferring a Boolean-valued function from training data

→ concept learning is the prototype binary classification.



17. Innovative Teaching Method if any (Attached Innovative Assignment Questions).

1.Design a Mind Map representation of Decision tree and its calculation on Entropy, Information Gain.

2.Write a research paper on Machine Learning Applications.

3.Read any three Research papers on ML domain.

18. References (Text Book/Websites/Journals)

1) https://nptel.ac.in/courses/106/106/106106139/
2) https://nptel.ac.in/courses/106/105/106105152/
3) https://aws.amazon.com/training/learn-about/machine-learning/
4) https://www.coursera.org/learn/machine-learning?ranMID=40328&ranEAID=OyHlmBp2G0c&ranSiteID=OyHlmBp2G0c-cz6ad8GRJACggXck8c1Z.g&siteID=OyHlmBp2G0c-cz6ad8GRJACggXck8c1Z.g&utm_content=10&utm_medium=partners&utm_source=linkshare&utm_campaign=OyHlmBp2G0c
5) https://matlabacademy.mathworks.com/?s_tid=gn_trg_cosp
6) https://www.edx.org/course/machine-learning?source=aw&awc=6798_1615460556_1400acc8805550b9f6981da90913e481&utm_source=aw&utm_medium=affiliate_partner&utm_content=text-link&utm_term=315645_LearnDataSci
7) https://www.futurelearn.com/courses/big-data-machine-learning
8) https://course18.fast.ai/ml
9) https://www.udacity.com/course/intro-to-machine-learning--ud120
10) https://ai.google/
11) https://www.geeksforgeeks.org/how-to-start-learning-machine-learning/#:~:text=Machine%20Learning%20involves%20the%20use,human%20hand%20holding!!!)
12) https://machinelearningmastery.com/start-here/
13) https://elitedatascience.com/learn-machine-learning
14) https://www.udemy.com/course/machine-learning-and-ai-with-hands-on-projects/?utm_source=adwords&utm_medium=udemyads&utm_campaign=MachineLearning_v.PROF_la.EN_cc.INDIA_ti.6594&utm_content=deal4584&utm_term=_._ag_81684916782_._ad_437560508873_._kw__._de_c_._dm__._pl__._ti_dsa-774930044809_._li_9040231_._pd__._&matchtype=b&gclid=Cj0KCQiAnKeCBhDPARIsAFDTLTI46ef6uRtJpZ13OeMw9j4LvB4FbrfYoQgztu9wTAOnFMqBC33mpi8aAp3xEALw_wcB