420237

NATIONAL INSTITUTE OF TECHNOLOGY ANDHRA PRADESH
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
III B. Tech. II Semester Mid Examinations, February, 2023

CS373 – Applied Machine Learning

Date: 16/02/2023

Time: **2 Hours**

Max. Marks: 30

1. Illustrate gradient descent for softmax based classifier for the dataset in Table 1.a and associated parameters in table 1.b (learning rate 1). The label of each example is given as a probability vector instead of one hot vector.   **4**

Table 1.a

X1	1.5	5	3.4	-2.5	-5	8
X2	2.8	6	4.8	3.2	2.3	7.6
Y	0.8,0.1,0.1	0.1,0.7,0.2	0.7,0.2,0.1	0.2,0.2,0.6	0.3,0.1,0.6	0.2,0.6,0.2

Table 1.b

W1	-1.5	2.0	1.0
W2	1.5	-1.5	2.5
W3	1.0	0.5	1.5

2) Consider the following neural network given in figure 1 and obtain the backpropagation updates for each of the weights $w_1, .., w_{12}$. Assume that the first, second, third stage activation functions are tanh, sigmoid and softmax respectively.   **4**

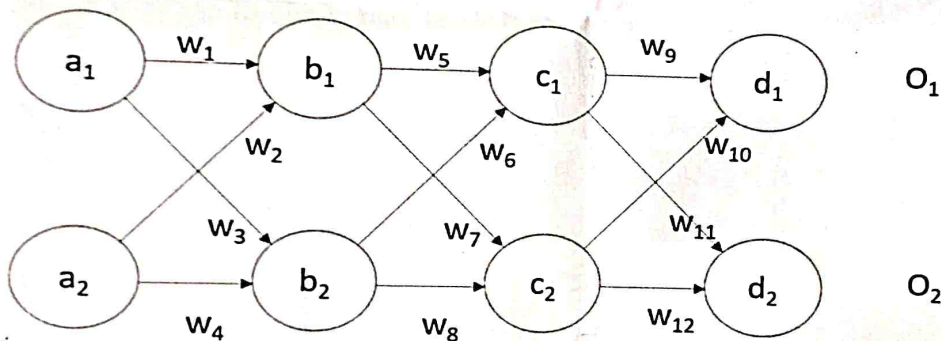

Figure 1 Neural Network

3 a) Illustrate the working of alternating least squares for the following movie rating problem.   **4**

Rating Matrix (5 X 5)

```
[[0. 1. 2. 0. 5.]
 [5. 0. 1. 0. 4.]
 [0. 1. 0. 2. 1.]
 [5. 0. 4. 4. 0.]
 [0. 2. 2. 0. 2.]]
```

User Representations(P)

```
[[-0.15  0.3 ]
 [-0.05 -0.4 ]
 [ 0.25 -0.30]
 [-0.20 -0.50]
 [ 0.5   1.00]]
```

Movie Representations(Q)

```
[[ 1.00 -0.25]
 [-0.50 -0.50]
 [-0.75  0.50]
 [ 0.25 -0.40]
 [-0.25  0.25]]
```

b) Consider a document corpus with words W1 to W4 given in the form of word counts given below: 4

Documents	W1	W2	W3	W4
Doc1	10	9	12	16
Doc2	4	12	14	7
Doc3	2	9	10	12
Doc4	10	11	8	2
Doc5	0	13	12	1

Assuming that these documents belong to 3 classes, Derive the parameters of a naïve Bayesian classification model for this data. If it is known that the documents "Doc1", "Doc2", and "Doc3" belong to class 1, 2, and 3 respectively, how does your derivation of parameters change?

4 a) Consider two independent multi-variate(D-Dimensional) Gaussian distributed random variables x, y.   3

$p(x,y) = p(x)*p(y)$

Let z be a random vaiable defined as $z = x + y$. Obtain the mean and covariance of z.

b) Consider the multi-variate Gaussian distribution $p(x) = N(x|\mu, \Sigma)$ 5
If the variables are divided into two subsets x_1, x_2, it can be observed that $p(x1), p(x2)$, $p(x1|x2), p(x2|x1)$ all are Gaussian distributed. Derive the parameters of $p(x1)$ and $p(x1|x2)$.

5 a) Consider two Gaussian distributions defined over the same event space x.   3
$p(x) = N(x|\mu, \Sigma), q(x) = N(x|m, L)$. Derive the KL-Divergence of these two distributions $(KL(p||q))$ (your answer should simplify the integration involved or integrate out the expressions).

b) Derive the expectation and variance of multi-variate Gaussian distribution   3

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CS374 – Natural Language Processing

Date: 17-02-2023   Time: 9.30 A.M to 11.30 A.M   Max. Marks: 30

Avoid verbosity. Answer all questions in the same order, otherwise they will not be evaluated. Avoid very generic and vague answers. State all your assumptions. Show your steps to arrive at the answers.

1 a) Consider a corpus of 5 words a, b, c, d and e. The n-gram counts are given in the table. Determine the probability distribution using backoff for $P(w_n|w_{n-1}w_{n-2})$ when $w_{n-1} = c$ and $w_{n-2} = b$.   3

n-gram	count	n-gram	count	n-gram	count
bca	0	ca	2	a	8
bcb	2	cb	4	b	10
bcc	0	cc	0	c	6
bcd	3	cd	4	d	12
bce	0	ce	0	e	4

b) Write a program for spelling correction of non-words (like *graffe* for *giraffe*). Assume the input is in the variable w.   3

2 a) Assume a corpus of m sentences is given to you and the length of a sentence (number of words) is denoted by n. Let N be the number of words in the whole corpus. Derive the formula to compute the perplexity of the whole corpus. Assume each sentence is independent of the other sentences. Use unigram language model to keep it simple. Is there any need for computation trick? Explain.   3

b) Train two models, multinomial naive Bayes and binarized naive Bayes, both with add 1 smoothing, on the following document counts for key sentiment words, with positive or negative class assigned as noted.

doc	"good"	"poor"	"great"	class
D1	3	0	3	Pos
D2	0	1	2	Pos
D3	1	3	0	Neg
D4	1	5	2	Neg
D5	0	2	0	Neg

3

Use both naive Bayes models to assign a class (pos or neg) to this sentence:
A good, good plot and great characters, but poor acting.   3

3 a)

i. Do you prefer accuracy to F1-score for classification? Outline the reasons for the preference.

ii. Consider the result of a multi class classifier as shown in the table. Compute macro F1-score and micro F1-score.

iii. Outline the reasons for preferring one of these two scores over the other. When will these two scores be equal?

| Class	TP	FP	FN
0	10	2	3
1	20	10	12
2	5	1	1

b) You are using model A for sentiment analysis so far. Your friend has come up with model B and claims that it is better than model A. How can you determine if this new model is better than the current one? Outline your approach.   3

4 a) Which static dense vector representation is efficient for text? Summarize the approach followed for learning the embeddings. Mention the loss function and the approach followed to improve the computational efficiency.   3

b) Inspect the differences between Pointwise Mutual Information (PMI) and TF-IDF? Explain the procedure to arrive at these vectors. Discuss their strengths and weaknesses.   3

5 a) Consider a neural network to perform a text classification task. The model is described by $y = softmax(W_2\sigma(W_1 f(x)))$, where $f(x)$ is a vector of features extracted over the input x, V and W are parameter matrices, and σ is a nonlinear function. Identify the role of W_2 and W_1. Determine the model's behavior if σ is replaced by an Identity function.   3

b) Consider the following plot of the number of stochastic gradient descent (with mini batch) iterations required to reach a given loss, as a function of the batch size. Analyze the plot and explain the conclusions that can be drawn from it.

Steps to Reach 0.01 Validation Error

2
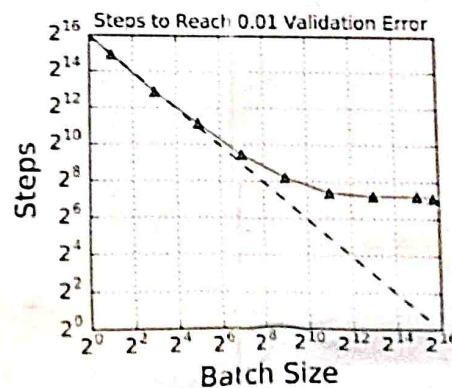
c Identify the least number of layers of a neural network to realize the XOR operation.   1

CS351- SOFTWARE ENGINEERING

Date: 13-02-2023

Max. Marks: 30

Answer All Questions
Answer all sub questions at a single place

Marks

S.No	Question	
1a)	Consider the requirements of a project named as "**Security 360**" to improve the security by installing cameras in city premises. Propose the architecture of a solution that should capture the movements of people and identify their activities. If any activity is found to be abnormal, a message along with photo of abnormal activity should be sent to the nearest police station. Your model should track the movement of the identified person Apply incremental model and spiral model to develop above project, List out the challenges, whatever you may face.	3
1b)	Illustrate Rapid Application development model and Agile model.	3
2a)	Identify functional and non- functional requirements for the following scenario: Online bidding is an application which allows new users to register in the system through an online process. By registering, a user agrees to abide by different pre-defined terms and conditions as specified. Any registered user can access the different features of the system authorized to him / her, after he authenticates himself through the login screen. An authenticated user can put items in the system for auction. Authenticated users can place bid for an item. Once the auction is over, the item will be sold to the user placing the maximum bid. Payments are to be made by third party payment service, which, of course, is guaranteed to be secure. The user selling the item will be responsible for its shipping. If the seller thinks he's getting a good price, he can, however, sell the item at any point of time to the maximum bidder available. Suggest a model to extend it for trusted transaction between seller and buyer [Seller can sell faulty goods, if the buyer releases money he will be loser. If the buyer does not release the money even after getting quality goods, seller will be at risk]	4
2b)	Illustrate the requirement engineering process.	2
3a)	Illustrate how the requirements engineer has to contrast functional and non- functional requirements while designing SRS.	2
3b)	Develop a set of use cases that could serve as a basis for understanding the requirements for an ATM system.	2
3c)	Illustrate Agility for software projects.	2
4a)	Indian Railways has launched its new UTS on mobile application in order to promote paperless ticket. This mobile ticketing app enables booking unreserved paperless journey ticket; issue/renew season ticket and platform ticket. It has introduced two modes of booking mobile tickets-Paper Ticket and Paperless Ticket. The user has to register by using his mobile number. When the user chooses the paperless ticket, the user should be in range of 5KM radius from the railway station. User can use internet banking, credit/ debit card or UPI methods to make a payment. Apply structural modelling on the given scenario with neat diagram.	3
4b)	Draw an activity diagram and sequence diagram for above scenario.	3
5a)	"FTPS" is one of the "e-commerce" application. User can find the desired product, add into the cart, ca redirect to the payment. After payment, user can track delivery status. Draw use case diagram and list th major use cases for this system, along with the goals, preconditions, and exception scenarios.	4
5b)	Compare generalization, composition and aggregation with an example.	2

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CS352 – Computer Networks
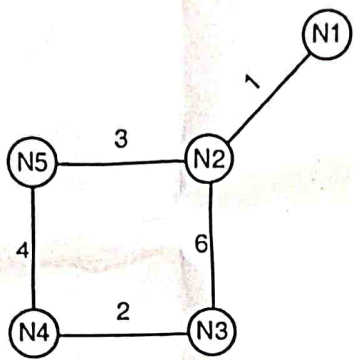
Date: 14-02-2023   Time: 2 Hours   Max. Marks: 30

1	a) How 2 dimensional parity and checksum are useful for detecting errors .What is the general set of circumstances under which 4-bit errors will be undetected.	2M
	b) Let G(x) be the generator polynomial used for CRC checking. What is the condition that should be satisfied by G(x) to detect odd number of bits in error?	1M
	c) The message 11001001 is to be transmitted using the CRC polynomial $x^3 + 1$ to protect it from errors. The process that can be carried at sender and receiver side is:	3M
2	a) 5 stationsA, B, C,D,E are connected to a channel using bus topology. suppose A wants to send a frame to E. How A senses the channel using CSMA access control mechanism.	3M
	b) A bit stream 10011101 is transmitted using the standard CRC method . The generator polynomial is 1001. Show the actual bit string transmitted. Suppose that the third bit from the left is inverted during transmission. Show that this error is detected at the receiver's end. Give an example of bit errors in the bit string transmitted that will not be detected by the receiver	3M
3	a) A bit-stuffing based framing protocol uses an 8-bit delimiter pattern of 01111110. If the output bit-string after stuffing is 01111100101, then the input bit-string is	1M
	b) The following data fragment occurs in the middle of a data stream for which the byte stuffing algorithm described in the text is used: A B ESC C ESC FLAG FLAG D. What is the output after stuffing	2M
	c) A bit string, 0111101111101111110, needs to be transmitted at the data link layer. What is the string actually transmitted after bit stuffing	2M
	d) A wants to send a message to B. A contains the IP address of B. He needs the MAC address of B. How can he get the MAC address of B.	1M

4	a) Consider a network with five nodes, N1 to N5, as shown below.	2M

N1

N5 — 3 — N2   1 → N1

N5   4   6   N2

N4 — 2 — N3

Fig.1

The network uses a Distance Vector Routing protocol. Once the routes have stabilized, the distance vectors at different nodes are as following. N1: (0, 1, 7, 8, 4) N2: (1, 0, 6, 7, 3) N3: (7, 6, 0, 2, 6) N4: (8, 7, 2, 0, 4) N5: (4, 3, 6, 4, 0). After the next round of updates, what will be the new distance vector at node, N3.

	b)How distance vector routing is dynamic and how the distance vectors are interchanged between routers if the topology is as shown in Fig.1 (explain with routing tables at each router.)	4M

5)	a)In order to transmit data from one LAN to another LAN there is a need of a router and a switch. What are the functionalities of these devices .	1M
	b) In a sliding window ARQ scheme, the transmitter's window size is N and the receiver's window size is M. The minimum number of distinct sequence numbers required to ensure correct operation of the ARQ scheme is M+N.	2M
	c) The distance between two stations M and N is L kilometers. All frames are K bits long. The propagation delay per kilometer is t seconds. Let R bits/second be the channel capacity. Assuming that processing delay is negligible, the minimum number of bits for the sequence number field in a frame for maximum utilization, when the sliding window protocols used, is	3M

NATIONAL INSTITUTE OF TECHNOLOGY ANDHRA PRADESH

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

III B. Tech II Semester Mid Examinations, February 2023

CS353 – Web Application Development

Date: 15-Feb-2023

Marks: 30 M.

1. Construct a HTML, CSS and Javascript code to keep track (log report) of onclick mouse event in the specified regions of the html page. Each region is coloured with some background colour. The following html page(s) may help you in understanding the initial status and status after performing the event in the html page. The right side html page consists of a table and each entry defines where (on which region event is performed) and when (date and time) this event is performed. In addition to that construct a DOM tree structure for the elements used in your HTML page. **[4 M]**

| You clicked on: One Sat Feb 11 2023 17:50:10 GMT-0530 (India Standard Time) |
| You clicked on: Three Sat Feb 11 2023 17:50:11 GMT-0530 (India Standard Time) |
| You clicked on: Two Sat Feb 11 2023 17:50:12 GMT-0530 (India Standard Time) |
| You clicked on: One Sat Feb 11 2023 17:50:15 GMT-0530 (India Standard Time) |

Figure: Initial HTML page   Figure: HTML page after performing events

2. Construct a HTML, CSS and Javascript code to implement "choose your Category and Number" game. A HTML page consists of choose your category and number as a tag, followed by two dropdown lists which consists of image category (Fruits, Animals, and Vehicles) in first drop down list and numbers from 1 to 5 in second list. The initial value of dropdown lists are "choose your category" and "choose your choice". After choosing values from dropdown lists, images must be displayed at random places in the HTL page from the chosen category and chosen number of images. Overlapping images is strictly not allowed while displaying images in a HTML page. These images chosen from a directory named as "images/Chosen_Category" and the image file names are from 1.jpg to 100.jpg. Each image must be displayed clearly and the size of each image is 224×224 pixels. Suppose if you chose category as fruits and number 3 from the dropdown lists, then your implementation must display three images from fruits at random positions without overlapping with other images as well. If you choose another number from dropdown list, then page need to be update as described earlier. **[6 M]**

3. Construct a HTML, CSS and Javscript code to implement the Registration page with the following fields and while submitting the form must validate data with the constraints: **[10 M]**
   A) First name and Second name of the user must contains only alphabets, must starts with capital letter, minimum length is 4 characters and maximum length is 25 characters.
   B) Username must be a valid email id.

C) Password and conform password data must be matched and password must contains one capital letter, one small letter, one digit, one special character and minimum of 8 character length.

D) A randomly generated 6 digits captcha will be displayed and user need to submit the same captcha. Validate the captcha entered by the user and randomly generated will be same or not.

E) If any constraint is violated by the user your code must show an alert message with the proper violation.

F) For better user experience, user current interacting element must change its background colour to yellowgreen.

4. Construct XML, DTD and XML Schema documents for following requirements. The xml document contains data regarding various projects. Each project includes the following information: title of the project, started date, duration in number of days, number of teams, team details, nature of the project (commercial, social or technological), and client organization. Some of the above stated information is trying to explain in detail such as team details (team name, team size, location at which currently the team is working), client organization (organization name, founder name, contact info (contact number, emailed)). The xml document may hold minimum one project information and maximum 25 projects information. Some of these projects were not yet started so they may need not include start date. While constructing xml document mention your assumptions clearly if needed. [5 M]

5.
A) Both the vertical-align property and relative positioning can be used to move an inline box vertically. Give a style rule for each approach that could be used to move an inline box up a distance of 1 cm. In addition to moving the box up, what other display change(s) might occur if the vertical-align approach is used? [2 M]

B) Suppose a group of people are working on same project from different locations. How to facilitate a good working environment among them. What are most frequent operations they may perform by making use of provided environment? Illustrate with suitable example. [3 M]