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Recommending Learning Path of Student using Machine Learning

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ABSTRACT: There are many emerging fields, technologies in the Engineering field. Many times students do not understand, what is the field they are good? What is the area they can improve? This workdone introduces the adaptive questionnaire, which changes the question based on student's previous answer. It helps student to find depth of knowledge they have in that subject. Hence it helps to understand the nature of the student for what course they are suitable or they can find their correct career path. Adaptive algorithm is used to built the questionnaire. It make sure to fetch the questions based on student's previous response to check depth of student knowledge in particular subject. In this system, Machine Learning algorithm performs the task of recommending courses which can help them in their career, for analyzing their learning path.

KEYWORDS: Adaptive Algorithm, Machine Learning, Fuzzy Classifier

I. INTRODUCTION

Machine Learning is the emerging field. It has the tons of uses in the different fields of research. Many of its techniques shows the tremendous effect on the e-commerce, medical diagnosis [15], education, social media, image processing. Fuzzy classifier has become extremely popular in designing controllers for industrial plants [15], it used by the different areas of research and the education and many more, as in references [13], [14], [15].

There are different classification algorithms. Need to choose the best suitable for the problem addressed in the education system. The idea is to use the proper machine learning algorithm for the classification of the student in the proper class of field. Along with this gives brief idea about how to find the learning path of student based on their previous data, their interest in particular subject on the scale of one to ten as well as adaptive questionnaire. It has different steps:

First need to collect the student history, its interest, courses done. Second The history includes B.tech marks as well. Collected through their profile. Third step lead to analyze all the data which we have previously and currently available. Step fourth by analyzing the history data need to track on current data we can identify the student learning path and in what area he/she is good. What courses we can suggest by observing this data. There are different section in this paper and conclusion followed by publication detail.

II. RELATED WORK

In [1] Zhaoli Wang et al. the resume scanning and then checking in the fields of programming skills and company's requirements we have to match and after matching those we can say the particular candidate is eligible for so and so company by matching it with company profile. The algorithms used in this paper genetic algorithm is used to meet the needs. The algorithm is used for training the data set and it build three kind of resume databases: positive feedback resume database (PosF), negative feedback resume database (NegF), non deterministic resume database (NonF). But the problem here is the student can lie in the resume.

Lakshmi Sreenivasa Reddy. D et al. learning styles vs suitable courses the has considered the learning styles of students and one questionnaire is made. This questionnaire is divided in to four dimensions-active /reflective, global / sequential, sensing / intuitive, visual / auditor. The algorithms are used in this for ILS Attribute value frequency

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algorithm and CRT(classification and regression algorithm) algorithm for generating rules. The CRT tree got the 76\%accuracy in [2].

There is the adaptive question formation discussed in [3] SilviaSabine Graf et al. in the paper Learning Management System is build in which the automatic, dynamic, and global student modelling is done adaptive mechanism aims at being easy to use for teachers by being generic and adaptable for teachers, allowing them to adjust the mechanism to their course structure and preferences. The adaptive modelling is made based on student learning style in [4]. Vaibhav M. Kale et al. in this we can see the question paper generation is for coverage the total syllabus as well as topics are covered. The algorithm presented in this paper attempts to solve the problem of dividing unit wise questions, marks allocated to that and the format of paper by dividing the task of generation of question in [5].

Mohamed Amine Chatti et al. implemented 16 different tag-based collaborative filtering recommendation algorithms, memory based as well as model based, and compare them in terms of accuracy and user satisfaction. The results of the conducted offline and user evaluations reveal that the quality of user experience does not correlate with high-recommendation accuracy. In this paper for recommendation they have used collaborative filtering, content based recommendation and hybrid recommendation. The main technique is the collaborative filtering recommendation. Memory based CF algorithm is used for rating prediction and recommendation in [6].

III. PROPOSED ALGORITHM

A. *Proposed Algorithms:*

There are two algorithms used in this system for the purpose of the taking online test and then for the second part which is recommendation or suggestion based on the performance.

- Adaptive Algorithm
- Fuzzy Classifier

B. *Description of the Proposed Algorithm:*

Aim of the proposed algorithm is to maximize the accuracy of recommending the course based on the student's performance. Other algorithm is for the fetching appropriate question from the questionnaire.

Step 1: Perform the Online Test:

Firstly we collected the questions from the different websites. It has the 14 subjects of engineering field. The questions are divided in to three levels and stored in the database. The Adaptive Algorithm has the randomized function. Function pick question adaptively based on the previous answer. If the answer is correct question will be picked from the high level else from low level set randomly.

Step 2: Fuzzy logic:

Fuzzy Classifier is used for the recommendation. Fuzzy Classifer work on the rules. Rules are created by the different Rule generation algorithm by providing dataset in the form of csv file. Fuzzy control system is made up of these rules. There are 14 subject treating them as a feature. There are different classes like Machine Learning, Application Development, Android Development near about 10 classes. Each feature has three qualities like low, medium, high. These is decided in the Control System.

The following function i=1...c where c is class. M is for membership function j and k stands for the subject and x1 and x2, x3 are features. Which will support the class x in that case to get picked.

$$T_i(X) = M_j(x1) \wedge M_k(x2)$$

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X is the class label then the membership values having the membership values $g_l(X) \in [0,1]$ where l =1,2...c, where c is number of classes. Let i→l denote rule i is in favor of class l the

$$g_l(X) = max_{i \to l} T_i$$

Step 3: Recommendation of Area:

This work is done by the fuzzy classifier the above formula will tell the class which have maximum favor with the help of rules states by the different algorithms. The algorithms we used for the rule generation are JRip, PART, oneR. For the rule generation used the WEKA tool. The results for the different algorithms correctness is given in the table in the result section. This rules are then used in the fuzzy classifier control system for the recommendation.

IV. PSEUDO CODE

```
Adaptive Algorithm:
Step 1:Initialize NumberofQuestion=0;
Step 2:Initialize SubjectID = 0
Step 3:  If QuestionLevel equal to 0
           levels = Easy\\
           Else if QuestionLevel equal Easy
             If Marks >0 level = Medium
             Elsel evel = Easy
           Else if QuestionLevel = Medium
              if Marks > 0 level = Hard
             else level = Easy
           Else if QuestionLevel = Hard
              if Marks < 0level = Hard
              else  level = Medium
         increase SubjectID
Step 4: Repeat Step 3 until NumberofQuestions=100 and SubjectID=14
          .
```

V. RESULTS AND DISCUSSION

The algorithms we compared with Fuzzy Rule Based Classifier are Naive Bayes, Decision Tree which includes J48, CART tree. For the Statistics check the Table. 1. The algorithm we used for the Rule generation JRip which gives maximum Recall and hence the accuracy. Other algorithm such as PART, oneR, zeroR gives the different accuracy as shown in the Table. 2 . The algorithm we choose to generate rule is having the maximum recall of all. As shown in the following tables the fuzzy classifier gives 89% accuracy over the other algorithms. The rules generated by the algorithms are shown in Table. 3.

Sr. No.	Algorithm	Accuracy
1	Naive Bayes	45%
2	CART	62%
3	Fuzzy Classifier	89%
4	J48	57.9%

Table.1 Comparison of Algorithms

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Sr. No.	Algorithm	TP Rate	FP Rate	Precision	Recall
1	JRip	0.452	0.1	0.343	0.452
2	PART	0.415	0.054	0.391	0.415
3	oneR	0.282	0.233	0.108	0.282
4	zeroR	0.273	0.273	0.075	0.273

Table 2. Comparison of the Algorithm used for Rule Generation

Table 3. Rules generated

VI. CONCLUSION AND FUTURE WORK

Many systems which used for the student suggesting course are sometimes have complicated structure of the site. This system is simple and user friendly. In this work student don't have to wait for result. It gives the result after successful completion of test. The result shown in the form of visualization is understandable for any individual. In this system we worked on two algorithms which can help students to know their career path based on their performance and interest accurately. The algorithm which produces the adaptive questionnaire is accurate and deliver the cognitive questions based on the students previous answer. This is generic model, in the future work this system can be used anywhere by modifying the questions for any fields. This system fails for some cases like student can score marks with

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guessing answers in online test. This work considers the limited courses and only restricted to the Computer Engineering branch. Which only useful to the Computer Engineering field student about their path. In future this system can be used to develop for the different branches in broader way. Adaptive algorithm of this work can extend and improve such a way that it can itself suggest the course to the student.

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BIOGRAPHY

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