Deep Study for Teachers Selection by Students Basing on Gaussian Mixture

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Abstract : The article aims at the issues that the students autonomously select the teachers during the teaching and has further deep study with the related theory of Gaussian Mixture Models. Establishing model for teachers puts the issues students selecting teachers into Gaussian Mixture Models to expect to put a kind of new thinking way for teaching reform with the scientific theory. We believe that the way will effectively be promoted with the development of education reform, improvement of class freedom and evoking of students' self-concept.

Keywords: Gaussian Mixture Models; selecting teachers; teaching reform

1. INTRODUCTION

Educator, the educated and education method are the three basic elements of education, and all teaching activities are all completed under the interactive roles of the three elements of education. In the colleges and universities, the relationship of the three elements mainly embodies in the interactive relationship of students, teachers and lessons. As the main body of the education activities, the students should posses the right how to accept education. If autonomously choosing the method, the students can be motivated more learning interest and can be improved more learning autonomy and positivity. Meanwhile, the teacher listing class can form the competitive mechanism of survival of the fittest, optimize the teacher and staff resource allocation and improve teaching quality and teaching level [1].

With the continuous deepening of education reform, many experts and scholars in the education area put forward their unique understanding for the autonomously selecting teachers by students, but most of the study only involves to the subjective aspect and has no enough scientific theory and basis to evidence. The article has further discussion for the issues that the students autonomously select the teachers with the related theory of Gaussian Mixture Models and plans to provide a new thinking way for teaching

reform. The Gaussian Mixture Models in the article can be used to help the students to select the right teachers and also can provide a theory basis for achievement assessment and intellectual introduction of HR department.

2. Theoretical analysis for Teachers Selection by Students Basing on Gaussian Mixture Models

2.1. Basic Theory of Gaussian Mixture Models

Any shape of possibility distribution is similar to several Gaussian distribution functions, in another word, Gaussian Mixture Models can smooth any shape of possibility distribution [2].

2.1.1 *Single Gaussian Distribution Model GSM*

When subject to Gaussian distribution, the possibility density function PDF of multi-dimension variable x is as follows:

$$N(x;\mu,\Sigma) = \frac{1}{\sqrt{2\pi|\Sigma|}}\exp[-\frac{1}{2}(x-\mu)^T\sum{}^{-1}(x-\mu)]$$

(1)

x is column vector of dimension d, μ is model expectation and Σ is model variance. In fact, μ usually is replaced with sample average value and Σ usually is placed with sample variance. It is easy to judge whether one sample x belongs to category C. Because every category has its owned μ and Σ, puts x into (1) formula. When the possibility is bigger than a threshold value, we believe that x belongs to category C.

In term of geometry, single Gaussian distribution model should be similar to ellipse in the two-dimension space and to ellipsoid in the three-dimension space. It is regretful to the same category of sample points in many category problem don't meet with the characteristics of "ellipse" distribution. So we introduced Gaussian Mixture Models.

2.1.2 *Gaussian Mixture Models GMM*

GMM [3] believe that the data is derived from several GSM, namely

$$\Pr(x) = \sum_{k=1}^{K} \pi_k \, \mathrm{N}(x; \mu_k, \sum_k) \qquad (2)$$

K need be confirmed in advance, just like the K in the K-means. π_k is the factor of weight. Any Gaussian distribution $\mathrm{N}(x; \mu_k, \sum_k)$ is the component of this model. Putting any x into formula (2), and can calculate out the corresponding possibility $\Pr(x)$. Here is one question. Why did we assume the data is composed of several Gaussian distributions, not assume other distributions? Actually whatever any distribution, only if K is big enough, this XX Mixture Model will become complex, so it can be used to approach any continuous possibility density distribution [4]. Gaussian function has good calculation property, so GMM can be widely used. Confirmation of GMM parameter is to look for the right model parameter when training sample is given, which has the likelihood function of GMM model the biggest. Even if only sample exists and sample category isn't known, model parameters $(\pi, \mu, \sum)$ still can be calculated out. It is obvious to solve with EM method, then differentiate sample category with the trained model.

2.2. Transfer of Issues

In the former discussion of students selecting teachers, it is common reflection the teachers' attribution (such as age, education, gender, title and award) can affect the students' selection. On the contrary, the article improves the students' core position in the teaching activities, changes the teacher dependence attribution into the students' self-evaluation and comprehensive assessment for teachers, provides assessment data and compiles into training sample. Thus the samples given by students can be used as training samples and the teachers can be regarded as a GMM whose parameters haven't been confirmed. We transfer the process training GMM with training samples as assessing and evaluating teachers with the score given students. The data training model is the assessment and evaluation model for the teachers, then calculates out the three parameters $(\pi, \mu, \sum)$ asked by the model. Thus one teacher is equal to one model GMM. For the student who need select teacher, he need give one new sample on himself and bring into the formed teacher GMM data.

3. Implementation Method for Teachers Selection by Students Basing on Gaussian Mixture Models Theory

3.1. D-Dimension Sample Selection

Number of D-dimension sample is the number of data to be evaluated by students. The former Gaussian Mixture Mod-

els mostly is used to treat image and sound message, so the sample dimension number is big and the corresponding complexity of system training and calculation is big. But in the model of the article, with many years of teaching experience of writers, the dimension number can be confirmed for 5. Namely selection of D-dimension number about the students' class effect can be considered the following five aspects: the students' like extent for lesson, the students' acceptance extent for the teachers, the students' difference of intelligence, the students' knowledge basis and the students' indefinite factors. This behavior provides convenience for the students to give assessment data, which not only greatly utilizes Gaussian Mixture Models theory to have prediction, but also avoids a complex training process and calculation.

3.1.1 *The Students' Like Extent for Lessons*

The students' interests are inconsistent. For example, some students like some lesson, but the other students don't like. It is common. It has something with the students' character, thinking, practice and etc. So this factor needn't been considered.

3.1.2 *The Students' Acceptance for the Teachers*

The students' acceptance extent for the teachers is different. The same lesson is taught by the same teacher, some students accept well, but some students learn badly; the same lesson is taught by different teachers, and the students' accept extent is different; the some teacher teaches different lessons, but the students' accept extent is almost same, so this is a factor to be considered.

3.1.3 *The Students' Intelligence Difference*

It has no doubt that the students' intelligence is different. The teaching process is an interactive process of teaching and learning. During the process, some students learn well and some students improve limitedly [5]. Except for all of the external factors, the intelligence difference between students should not be neglected.

3.1.4 *The Students' Learning Basis*

With the deepening of lessons, the successive lessons have something to do with the former lessons to some extent. If the other variables almost are same, the students' basic knowledge usually decides the learning effect, especially some professional lessons. It is easy for those students whose basis is good. The students with low basis not only learn the former knowledge, but also need compensate for the former omission, so the knowledge basis will produce teaching effect difference.

3.1.5 *The Students' Indefinite Factor*

The students have many indefinite factors that should be considered, such learning length, adjustment of individual status and many indefinite factors to affect teaching effect.

The above mentioned five assessment data basically is obtained through the students' subjective methods or some objective methods. Namely every student gives the score of

the five assessments for every teacher. Thus we can obtain a group of data, and form the initial data sample. Subsequently we can simulate these data into multi-dimension training sample accepted by Gaussian Mixture Models.

3.2. The Weighted Treatment of Training Samples

The raw data of training samples can be obtained through questionnaires for students or other scientific methods. The scores can be set. Finally it only need simulate into the data type right for Gaussian Mixture Models. It should be paid attention to the weighted approach issue of training sample. The writer it is important. An definite and standard calculation method can't provided, but the writer thinks the initial data of assessment from students can't directly be used and should have weighted treatment. Because different colleges and universities, different teachers and different students pay different attention to different sciences, it can't be treated with one method. For example, teaching professional class involves to the former learning effect of the students to a big extent, namely the students expand and extend on the basis of the former professional knowledge. So we should rightly improve the weight of "students' basic knowledge". Also if some public basic lesson is important for the future study of the students, but lots of students don't like the lesson which doesn't benefit for their development. This time we should decrease the weight of "students' likelihood extent for this lesson". For one more example, lots of out-class knowledge extends some challenging lessons which should greatly refer to the two items of "students' intelligence difference" and "students' indefinite factors". So it is important to adjust initial data. It value selection should be flexible and also it can be pretreated with the other data treatment technology and data exploration knowledge. The training samples play a vital role for the training of model, so it should be paid attention.

3.3. The Value on the K of component

Usually the value of K is 3 to 5. But if the relevance of the initial data is too small, the number of K need be added to simulate. If the number of K is big, it has the situation of too much simulation. So the number of K in the model should accord to the actuality. After times of trial and comparison, it can be correctly chosen.

3.4. Fresh Samples Test Result

We need choose several teachers for the students to establish GMM and have every student to have the above assessment for initial data for every teacher. Initial data is pretreated to be training model as GMM parameters, that time we obtain the whole parameters of GMM model of every teacher. When new students need select teachers, the assessment is done again for new sample. New sample is calculated into the model of every teacher and the corresponding post-inspection possibility value is obtained. Due to limited number, we needn't set up the related threshold value to judge and only need compare the post-inspection possibility.

4. Conclusion

The colleges and universities' students, teachers and teaching environment are always variable, so the model established by us can't be used for a long time and need be updated time and time. Additionally the parameters in the model can't be defined without difference and need be judged with the actual situation of different schools.

Although inefficiency of models, Studying teaching reform with quantity analysis method is becoming the hot point of the study, but indefinite behavior method brings lots of difficulties for quantity analysis. The article is trying to analyze the issue the students selecting teachers with Gaussian Mixture Models and its results can be used as reference that the students select teachers which provides a new thinking way for reform of teaching method reform with knowledge of technology.

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