Data Mining Approach for the Analysis of Performance Based Appraisal System of Selected Teachers in Kolhapur City

1Miss. Vrunda Suryaji Warke.
M.Phil Research Student,
Chhatrapati Shahu Institute of Business Education & Research,
Kolhapur

2Dr. R. S. Kamath
Associate Professor,
Dept. of Computer Studies,
Chhatrapati Shahu Institute of Business Education & Research,
Kolhapur

Abstract:
Proposed research portrays Data Mining Approach for the Analysis of Performance Based Appraisal System of selected Teaching Staff. The Performance Based Appraisal System is a systematic process that assesses teachers' academic performance and productivity in connection to certain pre-established criteria. The performance appraisal process helps in achieving high quality education. Data mining technology is widely used in educational field to retrieve useful information. It is the method of obtaining hidden, unknown and probably significant knowledge from huge amount of data. In this paper, authors have proposed data mining model for the Analysis of Performance Based Appraisal System of Selected Teachers in Kolhapur City. The results can be utilized in design of curriculum, teacher assignment to courses, in awarding the teachers'.

Introduction:
The Performance Based Appraisal System (PBAS) provides teachers with meaningful appraisals that encourage professional learning and growth. In Higher Educational Universities performance of teachers is measured on the basis of some factors like students feedback, teaching-learning and evaluation related activities, professional development activities such as research work, attending national and international conferences, arranging workshops, publishing research papers. The process is designed to foster teacher development, promotions and identify opportunities for further support where required [16].

Data mining, the extraction of hidden knowledge from huge databases, is a powerful new technology with great potential used in various commercial applications. It uses a combination of a vast knowledge base, advanced analytical skills, and domain knowledge to unveil hidden trends and pattern. It is the knowledge of process by analyzing the large volumes of data from various perspectives and presenting it into useful information. Proposed research deals Analysis of Performance Based Appraisal System of Selected Teachers in Kolhapur City using Data Mining techniques. It focuses on the application of data mining and methods for acquiring new knowledge from PBAS dataset.

Literature Survey: It is worthwhile at the outset to take a stock of recent development related to the proposed research. As per specification of problem, the related literature has collected and studied. This review is supplemented by referring about 20 research papers. Some selected references for broad overview are taken here.
Sona MARDIKYAN and Bertan BADUR have discussed the data mining techniques in analyzing teaching performance of instructors [3]. The student evaluations of classes and instructors are widespread in higher education. The relationship between student evaluations and the teaching performance of instructors has been debated. This study deals with key factors affecting the teaching performance of the instructors in MIS (Management Information Systems) at Bogazici University. KDD (Knowledge Discovery in Databases) methodology was followed throughout the study. For the purpose of data reduction and variable selection two widely used data mining techniques such as stepwise regression and decision trees were applied. Authors revealed some important aspects that the instructor attitudes that are measured by the evaluation process are an important factor to explain instructors’ teaching performance.

Ajay Kumar Pal and Saurabh Pal proposed data mining method to evaluate teachers’ performance on the basis of different factors [4]. Authors aim was to forecast the quality, productivity and potential of faculty members across different disciplines. This will enable higher level authorities to take decisions and make certain patterns of teachers’ motivation, satisfaction, growth and decline. Authors have met their objective of evaluating teachers’ performance by classification algorithms on Weka. Result concludes that Naïve Bayes Classifier has the potential to notably improve the conventional classification methods.

Randa Kh. Hemaid and Alaa M. El-Halees, discussed improving the teacher performance, predicting result of training course that deals with highest level of quality in Teacher performance [5]. For the purpose this data analysis the real data is collected from teachers of Ministry of Education and Higher Education in Gaza City. It contains the academic qualifications of teachers, their experience and answer given by teachers for questionnaire. Authors have applied data mining algorithms like association, classification to discover knowledge. Reported research signifies by better serving the educational process and helps in improving teachers’ performance.

Edin Osmanbegović and Mirza Suljić, have developed a data mining model to derive the conclusion on students’ academic success [6]. Data collected from the conducting surveys the summer semester at the University of Tuzla, the Faculty of Economics, and academic year 2010-2011. For prediction of success in a course and the performance of the learning methods, different supervised data mining algorithms were applied on the preoperative assessment data. Evaluation of learning methods performance carried out based on their predictive accuracy, ease of learning and user friendly characteristics. The result indicates that the Naïve Bayes classifier gives good result in prediction when compared with decision tree and neural network methods. Yet another paper by Nirmala G and P. B. Mallikarjuna, reported that Assessment a dynamic process considered as a performance indicator for an individual [7]. Authors have developed a model to analyze performance by considering number of prediction indicators needed for faculty performance assessment, evaluation and monitoring. Authors plan was to predict the quality, productivity and potential of teaching staff in an educational organization. K means Clustering algorithm was applied for the design of prominent clusters.
As a prologue of this literature survey, it has been found that there is still a great scope for development of Data Mining application for Teaching Staff Performance Evaluation. With the gaps revealed from the extensive literature review, the problem statement for the research is formulated and research is proposed. Performance Appraisal is the systematic assessment of performance of employees to identify the abilities for further development. The approach adopted by the sixth pay commission for evaluation of teaching staff performance considers evaluation areas such as Teaching, Learning, Extension, Research, Publication etc [17]. The proposed project stands out mainly in *Data Mining Approach for the Analysis of Performance Based Appraisal System of Selected Teachers in Kolhapur City.*

**Objectives:** Proposed research is on extraction of the hidden knowledge from the teachers’ appraisal dataset. The objective of the research is to develop a data mining model with classification, clustering and association techniques.

- To discover the hidden knowledge from PBAS dataset following objectives are indentified this proposed research:
- To study and analyze teachers’ performance applying data mining techniques.
- To obtain prominent clusters from the collected data set by applying clustering techniques.
- To find relationship among the attribute and generating hidden patterns apply association rule mining.
- To develop classification models for teachers’ performance evaluation.

**Methodology:** The methodology will be followed for the present study is explained in this section. Logical flow of methodology is presented diagrammatically as follows in Figure 1. Data mining a computational method of processing data will be applied in to obtain useful knowledge from PBAS dataset.

![Figure 1: Logical Flow of Methodology](image-url)
Sample Design and Data Collection

Sample Frame: The first step of the proposed research is to finalize sample and gather PBAS data. It has been decided to collect 200 selected teachers PBAS data using UGC Proformas for PABS. The Academic Performance Indicators as per U.G.C. Notification approved by Govt. of Maharashtra State are [18]:

Category I: Teaching, learning and evaluation related activities:
- Lectures, Seminars, tutorials, practical, contact hours undertaken taken as percentage of lectures allocated
- Lectures or other teaching duties in excess of UGC norms
- Preparation & Imparting of knowledge / instruction as per curriculum; syllabus enrichment by providing the additional resources to students
- Use of participatory & innovative teaching learning methodologies; updating of subject content, course improvement, etc.
- Examination duties as per allotment.

Category II: Co-curricular, Extension, Professional Development Related Activities:
- Institutional Co-curricular activities, Positions held/ Leadership role played in organization, Students and Staff Related Socio-Cultural and Sports Programme, Community work
- Contribution to Corporate life, Institutional Governance responsibilities, Participation in committees, Responsibility for Students Welfare, Counseling and Discipline Organization of Conference/Training
- Membership in Profession related committees at state and national level, Participation in subject associations, conferences, Participation in short term training courses, Membership in education Committees, Publication of articles in newspapers, magazines

Category III: Research, Publications and Academic Contributions:
- Published Papers in Referred Journals, Non refereed but recognized, indexed and reputed Journals, Full Papers published in Conference Proceedings
- Other Research Publications, Research Monographs, Text Books, Reference Books, Chapters contributed to edited knowledge, Editing of the proceedings of the Seminar
- Research Projects, Ongoing and Completed Research Projects, Consultancy Projects
- Research Guidance

Sample Size

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Category of Teachers</th>
<th>Teachers Strengths</th>
<th>Sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Principle</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Heads of Departments</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>Associate Professor</td>
<td>15</td>
<td>14</td>
</tr>
<tr>
<td>4</td>
<td>Assistant Professor (Lecturer)</td>
<td>180</td>
<td>165</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>216</strong></td>
<td><strong>200</strong></td>
</tr>
</tbody>
</table>

Table 1: Category of Teachers’ and their Strengths
In the survey according to the above selected college a data set of 200 selected teachers are considered. Total 4 categories of teachers’ have been selected from this college and from each category of teachers’ data will be collected.

**Data Preprocessing:** Preprocessing includes finding incorrect or missing data. Erroneous data may be corrected or removed, whereas missing data must be supplied. Next step is to transforming the data into a common format for processing. Data reduction, dimensionality reduction and data transformation method can be used to lessen the number of possible values being considered.

**Data Mining:** After preprocessing the data, research applies data mining techniques - association, classification, clustering etc, for the analysis of educational data. In each of these tasks, research will present the extracted knowledge and describes its importance in educational domain. Data mining techniques are briefly explained for the better understanding:

- **Classification** utilizes a set of pre-classified examples to design a learning model that can classify the population of large size of records. This approach will employ various classifiers such as decision tree, neural network, Naïve Bayes to classify the data. Comparative study of algorithms for various models will carried out to select the efficient one.
- **Clustering** is an identification of similar classes of objects. It identifies dense and sparse regions in data space and can find out overall distribution pattern and correlations amongst data attributes. Various clustering techniques including k-means clustering, hierarchical clustering and density-based clustering will be applied to find out prominent clusters.
- **Association rule mining** will be applied to find frequent item set findings among large data sets. This type of finding helps to make certain decisions.

**Knowledge Presentation:** The discovered knowledge will report teachers’ performance, useful suggestion to teachers and constructive recommendation higher authorities of educational universities.

**R Data Mining Tool:** Present research attempts to design data mining model in R, a free software environment [15]. R is a simple, but very powerful statistical data mining processing tool for research. There are thousands of contributed packages for R, written by many different authors available for download from CRAN, Comprehensive R Archive Network, http://CRAN.R-project.org and its mirrors. R has a number of mining procedures, useful for modeling for a dataset.

**Significance and Scope of the Study:** The proposed research presents Data Mining techniques can be used for the analysis of teaching staff Performance Appraisal evaluation based on realistic data. For performance assessment and adequate support in decision making this research can produce significant bases. The primary aim of this proposed research is to motivate the teachers to improve their work performance. This proposed model intents in the evaluation of teaching staffs performance and can be used for judgmental purposes in order to make good administrative decisions. The high potential of data mining applications for teachers'
performance management can be revealed. Regardless of origin, data mining techniques show automated discovery of new associations and dependencies of attributes in the observed data.

Reference

1. “Performance Based Appraisal System”, retrieved from www.ugc.ac.in
2. DATA MINING TUTORIAL Simply Easy Learning by tutorialspoint.com
9. Randa Khalil Hemaid, “Ways to Improving Teacher Performance Using Data Mining (Case Study Training In Ministry Of Education)”