



Research on Teaching Reform of Data Mining and Machine Learning Courses in Applied Universities

Hui Zhang, Yongfeng Zhang, Xiao Zhang, Tongxing Li*, Jiaojiao Zhao

School of Mathematics and Statistics, Taishan University, Tai'an, China

Email: *zh17864810604@163.com

How to cite this paper: Zhang, H., Zhang, Y.F., Zhang, X., Li, T.X. and Zhao, J.J. (2025) Research on Teaching Reform of Data Mining and Machine Learning Courses in Applied Universities. *Open Access Library Journal*, 12: e12758. <https://doi.org/10.4236/oalib.1112758>

Received: December 2, 2024

Accepted: January 6, 2025

Published: January 9, 2025

Copyright © 2025 by author(s) and Open Access Library Inc.

This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).

<http://creativecommons.org/licenses/by/4.0/>



Open Access

Abstract

This article first points out the problems in curriculum teaching: lack of emphasis on interest cultivation and poor internal motivation for learning, the teaching content is disconnected from social needs, aging teaching methods, lack of teaching feedback loop, etc. Then, teaching reform strategies were proposed: optimize teaching content based on enterprise needs, put students at the center and optimize teaching design, adopt an evaluation mechanism, and focus on teaching feedback. Based on the above, we have found a teaching model that can cultivate students' ability to use data mining knowledge to solve practical problems and improve their employment competitiveness. This model has strong application and promotion value.

Subject Areas

Teaching Reform

Keywords

Data Mining and Machine Learning, Applied Universities, Teaching Reform

1. Introduction

With the rapid development of information technology, especially the arrival of the big data era, data is experiencing explosive growth. The explosive growth of data volume requires an effective analytical method to extract valuable information, and the course of data mining and machine learning emerged in this context. Influenced by the wave of artificial intelligence and big data, many application-oriented universities have even begun to include data mining and machine learning in compulsory or elective courses for science, engineering, and finance

majors, aiming to cultivate students' mastery of the basic theories and methods of data mining and machine learning, as well as their ability to analyze, model, and predict big data.

In order to improve the quality of teaching and adapt to the construction of applied universities, it is necessary to reform the courses of data mining and machine learning. We hope to find a new teaching model that can cultivate students' ability to use data mining knowledge to solve practical problems, enhance their employment competitiveness, and improve the quality of talent cultivation.

2. Teaching Issues

As a core course in big data analysis technology, data mining and machine learning have a relatively short history and are basically in the process of exploration. There are many problems in the teaching process.

2.1. Lack of Emphasis on Interest Cultivation and Poor Internal Motivation for Learning

Data mining and machine learning have the characteristics of high abstraction, complex computation, and rigorous logic. The difficulty of learning is high, and the emphasis on learning data mining theory and algorithms is too strong, which makes students lose interest in learning [1].

2.2. The Disconnect between Teaching Content and Social Needs

Most teachers' choice of teaching content is mainly based on textbook content, and the big data industry updates rapidly. Textbook content cannot keep up with social development trends and industry changes for real-time updates, ultimately leading to a disconnect between teaching content and actual social needs [2].

2.3. Aging Teaching Methods [3]-[5]

Firstly, the teaching method mainly relies on imparting knowledge through lectures; Secondly, knowledge is emphasized over ability, and teaching activities and content are implemented within predetermined frameworks and problems. The "formulaic" teaching method hinders students from improving their problem-solving abilities and innovative thinking [3]; the third issue is outdated teaching resources, outdated teaching cases, and outdated data [4]; the fourth is the traditional assessment method [5], which often uses "examination + attendance + lab report + homework" for course assessment.

2.4. Lack of Teaching Feedback Link

Mainly manifested in the lack of feedback in the classroom and no evaluation after the course ends. Teachers often use traditional teaching methods to promote course content in order to complete teaching tasks on time, while ignoring students' feedback on classroom content, pace, and teaching methods; After the completion of the course, most universities lack effective channels for students to

evaluate teachers' teaching.

3. Teaching Reform Content

Based on the above issues, this article proposes teaching reform methods in combination with actual teaching content.

3.1. Optimize Teaching Content Based on Enterprise Needs

The course content of Data Mining and Machine Learning mainly provides technical preparation for the direction of Data Mining and Data Analysis, and the teaching content of the course should be consistent with the needs of enterprises in this direction [2] [6].

Before determining the teaching content, 300 data related recruitment positions were selected and analyzed on platforms such as 51job, Fresh Graduates, and Qilu Talent Network using keywords such as "data mining", "data analysis", and "big data". Familiarity with SQL language, proficiency in data querying and cleaning techniques, and familiarity with data mining and statistical analysis tools such as R, Spark, Python, SAS, etc. are commonly required. In addition, theoretical knowledge related to professional statistical analysis and data modeling, such as logistic regression, decision trees, clustering analysis, SVM, neural networks, etc., is also required.

Therefore, in addition to retaining traditional teaching content such as clustering, classification, and association analysis, this course also adds content such as neural networks, logistic regression, and principal component analysis. In the experimental section, the mainstream language Python is used. The above makes the teaching content more in line with the needs of enterprises.

3.2. Putting Students at the Center and Optimizing Teaching Design

In response to the issue of aging teaching methods [3]-[5], taking classification analysis as an example, this course mainly carries out the following teaching design.

Firstly, guide students to achieve "learning by doing, learning by doing" in practical social problems. When teaching classification analysis, we first introduce the issue of shop renewal, allowing students to learn classification analysis algorithms with the problem in mind. Finally, we have students solve shop renewal problems based on the theoretical algorithms they have learned.

Secondly, transform traditional rote learning into a student-centered and experiential learning model. After completing the learning of each classification algorithm, let the group independently search for excellent papers related to decision tree classification and naive Bayes algorithm, and report the results in class.

Thirdly, focus on cultivating practical skills. After the algorithm experiment class, let the students find projects by themselves in the way of group discussion, complete the selection of topics, data collection, pre-processing, model building and algorithm programming, and analyze and evaluate the results, which can improve the practical ability of all students, such as breast cancer disease prediction

cases based on naive Bayes [7]-[9].

Fourthly, the assessment methods should be diversified [10]. Add group discussions, chapter quizzes, in class exercises, and other methods to comprehensively assess students' learning progress. The group discussion was graded by setting scoring criteria and distributing scoring questionnaires on Wenjuanxing, with student and teacher ratings each accounting for 50%.

Fifth, update teaching resources. Actively search for new projects and data on websites such as Kaggle, well-known blogs, CSDN, etc., and introduce teaching cases. In the computer experiment of the classification algorithm, the heart disease prediction case from Kaggle was introduced.

3.3. Adopt Evaluation Mechanism and Focus on Teaching Feedback

The school has always attached great importance to the assessment and evaluation of teachers' teaching quality, and has developed a system of evaluation feedback through student assessment, expert and leadership evaluation, but the effect is not very obvious.

Course evaluation helps improve teaching. To this end, self-evaluation has been added to this course. In addition to daily classroom questioning of students' learning situation, a survey questionnaire or interview will be used for mid-term and final evaluation. The main content should include whether the teacher's quality is competent for teaching work, whether the teaching ideas are clear and the key and difficult points are prominent, whether the teaching content meets the knowledge needs, whether the teaching methods and means are flexible and diverse, whether the teaching environment is comfortable, whether the teaching management is appropriate, and whether the practical arrangements are reasonable.

4. Conclusions

In order to improve the quality of teaching and adapt to the construction of applied universities, it is necessary to conduct in-depth analysis and reform of data mining and machine learning courses based on cutting-edge ideas and concepts. We hope to find a teaching model that can cultivate students' ability to use data mining knowledge to solve practical problems and improve their employment competitiveness.

Similar to the educational reform proposed in this article, in order to solve the contradiction between college student training and industry demand, the School of Computer Science at Beijing Institute of Technology has designed an innovative talent training model jointly built by schools and enterprises, the "Enterprise Learning Innovation" integrated development platform. In the process of talent cultivation, the school, company, and brand jointly determine the training objectives, develop training plans, and jointly implement practical teaching in the enterprise stage. The platform constructs a complete system architecture with five mechanisms as the core: "school base construction, enterprise participation mechanism, school enterprise curriculum co construction, operation guarantee

mechanism, and supervision and evaluation mechanism.” After verification, the teaching effect is significant [11].

In addition, Dalian Neusoft Information College has optimized the teaching objectives, theoretical and practical content design, and case study design of courses based on the knowledge points, skill points, and professional qualities required for job competencies. Based on the OBE education teaching philosophy, blended learning practices have been implemented, and achievements have been made in subject competitions, college student innovation and entrepreneurship projects, and other aspects [6].

This article proposes teaching reform strategies based on the existing problems in the curriculum: firstly, optimizing teaching content according to the needs of enterprises; secondly, putting students at the center and optimizing teaching design; thirdly, adopting an evaluation mechanism and focusing on teaching feedback. When teaching any course, the teaching strategies proposed in the article can be adopted, such as investigating the needs of enterprises and designing teaching content that closely follows the needs of the times; emphasis is placed on classroom evaluation and timely modification of teaching methods. Therefore, the teaching reform strategy in this article can be applied to any university and course, with strong applicability and can be promoted.

Acknowledgements

The authors would like to thank the associate editor and the reviewers for their constructive comments and suggestions, which improved the quality of the paper. This work was supported by the 15th batch of teaching reform projects of Mount Taishan University: research on teaching reform of data mining and machine learning courses in applied universities (JG202227).

Conflicts of Interest

The authors declare no conflicts of interest.

References

- [1] Lin, H.L., Ding, J., Zhuo, L., *et al.* (2020) Exploration and Reflection on the Reform of “Data Mining” Course in Applied Undergraduate Education. *Journal of Fujian Financial Management Cadre College*, No. 4, 58-62.
- [2] Gao, Y.Z., Hou, Y. and Luo, Z.J. (2022) Research on Teaching Reform of Data Mining Course in Engineering Application Oriented Colleges. *Fujian Computer*, **38**, 63-66.
- [3] Zhou, C.M., She, Z.M. and Yang, G.L. (2022) Exploration of Teaching Methods for Applied Undergraduate Data Mining Technology Course. *Journal of Kaili College*, **40**, 104-108.
- [4] Li, S.S. and Li, Z. (2017) Reflection and Reform on Undergraduate Data Mining Course Teaching under the New Situation. *New Campus: Weekly Issue*, No. 6, 2.
- [5] Lü, Q.S., Yang, Y., Gong, Y.H., *et al.* (2024) Research on Teaching Reform of Data Mining Course Based on “Teaching Competition Collaboration”. *Higher Education Journal*, **10**, 136-139.

-
- [6] Chu, N. and Chen, M.H. (2024) Reform of Practical Teaching of Data Mining Course Integrating “Specialized and Creative Thinking”. *Computer Education*, No. 7, 92-97+102.
- [7] Xia, H. (2024) Exploration and Practice of “Data Mining and Analysis” Course Reform for Big Data Talent Cultivation. *Journal of Jingdezhen University*, **39**, 99-103.
- [8] Han, K.S. and Liu, B.F. (2024) The Impact of Case-Based Teaching Reform on the Teaching Effectiveness of Data Mining Courses. *University Education*, No. 4, 37-40.
- [9] Guo, J. (2023) Research on Teaching Plan of Data Mining Course Based on Project Mainline Method. *Intelligence*, No. 33, 76-79.
- [10] Qin, H. (2023) Exploration of Multidimensional Teaching Reform in Data Analysis and Mining Courses. *Higher Education Journal*, **9**, 111-115.
- [11] Xinhua News Agency (2022) Research on the Connection Method between University Engineering Education and Enterprise Demand.
<http://www.xinhuanet.com/tech/20220404/cfacefb8aa1412984eac9c4c3546c6a/c.html>