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Discussion on Machine Learning Course Design and Experimental Teaching Under the Innovative Talent Cultivation Model

Lu Jiazhong[1*], Yang Min[2]

[1]School of Artificial Intelligence, Chengdu University of Information Technology, Chengdu, 610225
[2]School of Cybersecurity, Chengdu University of Information Technology, Chengdu, 610225, Sichuan, China

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***Corresponding author:** Lu Jiazhong
School of Artificial Intelligence, Chengdu University of Information Technology, Chengdu, 610225

Abstract | **Original Research Article**

With the rapid development of artificial intelligence and machine learning technology, cultivating talents with innovative ability and interdisciplinary comprehensive literacy has become an important goal of modern education. Traditional machine learning courses and teaching models can no longer meet the talent needs of the new era, especially in the combination of theory and practice, cross-disciplinary integration, and docking with industry. Therefore, this study focuses on the innovation of talent training models for machine learning courses, analyzes the advantages and limitations of the existing model, and proposes experimental teaching reform strategies based on project-driven, interdisciplinary integration, and real-world scenario applications. First, the course content should strengthen the combination of theoretical foundation and cutting-edge technology, and cultivate students' innovative thinking and multidisciplinary problem-solving ability through the design of interdisciplinary projects. Secondly, practical teaching should pay more attention to the cultivation of engineering practical ability, and improve students' hands-on ability and practical application ability through projects that connect real data sets with industry needs. Finally, the cultivation of innovative talents also needs to closely integrate classroom learning with industry needs through school-enterprise cooperation and other forms, so as to provide students with a broader practical platform. In summary, the innovative machine learning course design and experimental teaching model can effectively improve students' comprehensive quality and provide high-quality compound talents for industrial development and academic research.

Keywords: machine learning; talent training; course design; experimental teaching.

1. INTRODUCTION

With the rapid development of artificial intelligence technology, machine learning, as one of the core technologies, is gradually penetrating into all walks of life, and has a profound impact on social economy, culture and even scientific research [1]. Machine learning is not only a key area of current scientific and technological innovation, but also a key direction of modern education and talent training. However, in the face of the rapid update and iteration of the knowledge system in the field of machine learning, the diversification of technology applications, and the sharp increase in talent demand, traditional machine learning courses and talent training models can no longer meet the needs of the new era. Therefore, it is particularly important to explore and innovate the talent training model of machine learning courses [2].

The innovation of talent training models is not only related to the adaptability and foresight of the education system, but also involves how to cultivate high-quality talents with innovation ability, interdisciplinary integration ability and practical problem-solving ability. This project will conduct research and discussion on the innovation of talent training models for machine learning courses, analyze the necessity of innovation, the challenges of existing models, and the specific paths of innovative practice.

[1] Rapid technological development and urgent demand-machine learning technology is developing rapidly, and new theories and algorithms are constantly emerging.

Traditional teaching models often focus on static textbooks, ignoring the dynamic nature of technology, resulting in students' lack of contact with cutting-edge technologies during the learning process and unable to adapt to the needs of rapid technological changes. Therefore, it is particularly important to

innovate the talent training model and maintain the timeliness and foresight of the course content [3].

[2] Interdisciplinary integration and wide demand - Machine learning has a wide range of applications, involving multiple disciplines such as data science, computer science, statistics, artificial intelligence, and automation. Teaching limited to a single discipline can no longer meet the needs of interdisciplinary talent training. Machine learning courses must break down disciplinary barriers, integrate knowledge from various disciplines, and cultivate students' interdisciplinary thinking and abilities.

[3] Insufficient practical ability and lagging curriculum setting - Although the theory and algorithms of machine learning are becoming more and more mature, in practical applications, many students face the lack of ability to solve practical problems. Traditional courses often focus too much on the explanation of theoretical knowledge and neglect the cultivation of students' practical ability. Innovative talent training models should pay more attention to practical teaching, and enhance students' engineering ability, ability to solve practical problems, and innovation ability.

[4] Industry needs urgently need compound talents - At present, the field of machine learning urgently needs a large number of compound talents. These talents must not only have a solid foundation in mathematics and computers, but also have strong engineering practice ability and cross-disciplinary knowledge background. Traditional training models are difficult to meet these needs. Therefore, it is necessary to cultivate compound talents who can adapt to the needs of the industry through the innovation of course content and teaching methods.

In summary, the innovation of talent training mode of machine learning courses is not only the update of content and methods, but also the transformation of educational concepts. Through dynamic updating of course content, interdisciplinary integration, strengthening practical teaching, innovative teaching methods and school-enterprise cooperation, we can cultivate high-quality talents with innovation ability, interdisciplinary integration ability and practical ability, and promote the rapid development and widespread application of machine learning technology.

2. The current status and shortcomings of machine learning talent training

At present, the talent training models of the "Machine Learning" course can be divided into five types: (1) theory-oriented talent training model; (2) practice-oriented talent training model; (3) interdisciplinary talent training model; (4) research-oriented talent training model; (5) school-enterprise collaborative talent training model.

(1) Theory-oriented talent training model

Traditional machine learning courses are mainly based on theoretical teaching. For example, the "Machine Learning" course offered by the University of Electronic Science and Technology of China focuses on the explanation of mathematical foundations and algorithms, such as linear algebra, probability statistics, convex optimization and other core knowledge points. This model aims to help students lay a solid theoretical foundation so that they can understand the principles and mathematical logic of machine learning algorithms. However, this model is relatively heavy on theory and light on practice, which may lead to students' insufficient ability in application scenarios [4].

(2) Practice-oriented talent training model

In response to the industry's demand for applied talents, the "Machine Learning" course offered by Chengdu University of Technology focuses on practical teaching. Through experimental courses and project courses, students can master machine learning skills in actual operations. Students may complete the whole process tasks such as data set cleaning, feature engineering, model training and evaluation. This model is suitable for students who want to enter the enterprise and directly engage in engineering practice.

(3) Interdisciplinary integrated talent training model

As an interdisciplinary subject, machine learning has application scenarios covering multiple fields such as computer science, medicine, and social sciences. The interdisciplinary course "Machine Learning" offered by Sichuan University combines machine learning with knowledge in other fields, such as "Machine Learning and Medical Data Analysis" and "Application of Machine Learning in Social Sciences". Students trained in this model have a cross-disciplinary knowledge background and can find solutions to complex problems [5].

(4) Research-oriented talent training model

For example, the "Machine Learning" course offered by Tsinghua University provides students with opportunities to participate in cutting-edge research through scientific research projects or laboratory platforms, and encourages students to pay attention to the cutting-edge directions of machine learning, such as deep learning, reinforcement learning, and federated learning. Under the guidance of their mentors, students complete scientific research papers or innovative projects and accumulate research experience. This model is particularly suitable for students who want to enter the academic field or engage in high-end research and development.

(5) School-enterprise collaborative training model

Finally, school-enterprise cooperation has been a highlight of machine learning courses in recent years. For example, the "Machine Learning" course offered by Chengdu University of Technology cooperates with

enterprises to introduce real enterprise projects as teaching cases, and even provides students with enterprise mentors and internship opportunities. This model enables students to understand industry needs during their studies and improve their practical skills by solving corporate problems.

Although the existing talent training model of the "Machine Learning" course has many advantages, it also has some shortcomings. For example, the theory is out of touch with practice. The single theoretical teaching model cannot meet students' needs for practical skills, and the overly practice-oriented teaching may ignore students' deep understanding of algorithms and mathematical foundations. How to find a balance between theory and practice is the main challenge of current course design; the course content update lags behind. The field of machine learning is developing rapidly, but the course content update often lags behind technological development. For example, some courses still focus on traditional machine learning algorithms (such as support vector machines and K nearest neighbors), lacking in-depth explanations of cutting-edge technologies such as deep learning and generative adversarial networks; interdisciplinary teaching resources are limited. Although interdisciplinary training is an important direction for future development, many universities have deficiencies in resource integration and faculty allocation, making it difficult to effectively carry out high-quality interdisciplinary teaching; personalized training is difficult, and the diversity of student backgrounds and interests requires teaching content to have a certain degree of flexibility and adaptability. However, the large-class teaching model usually cannot meet the personalized learning needs of students, limiting the potential of outstanding students; it is not well connected with industry needs. Although the school-enterprise collaborative training model provides students with practical opportunities, the cooperation between many universities and enterprises is not deep enough, resulting in the inability of trained students to fully match the needs of enterprises.

3. Discussion on the content setting of machine learning courses

3.1 Increase theoretical foundation teaching

The design of the "Machine Learning" course should first consolidate students' theoretical foundation and ensure that they master the core concepts and algorithmic principles of machine learning. The course content needs to cover basic learning models such as supervised learning, unsupervised learning, semi-supervised learning, and reinforcement learning, and deeply explore the mathematical theories behind various algorithms, including linear algebra, probability theory, and statistics. Through the derivation process and computational complexity analysis of machine learning models, students can understand the advantages and limitations of algorithms, so that they can make reasonable choices and adjustments in the innovation process. The focus of the theoretical learning part is to help students establish a scientific way of thinking and a framework for problem solving, laying a solid foundation for subsequent innovation.

However, pure theoretical teaching is not enough to stimulate students' innovative thinking. The course should also combine practical problems to guide students to think about problems from multiple disciplines and perspectives. For example, when teaching deep learning, you can introduce its application cases in natural language processing, computer vision, medical imaging, and other fields, and analyze and discuss the background, challenges, and current technical bottlenecks of each application. By constantly guiding students to understand and solve problems from the perspective of multiple disciplines, we can cultivate their innovative thinking, so that they can not only master existing technologies, but also propose new solutions when facing new problems.

Innovation is not limited to the algorithm itself, but more importantly, it is able to innovatively integrate existing theories to solve complex problems in interdisciplinary fields.

3.2 Increase classroom experimental

teaching Machine learning is a highly practical subject. Relying solely on theoretical learning cannot effectively cultivate students' engineering practice ability. Therefore, in the course setting, the practical link needs to occupy an important position. By designing a series of project tasks based on real data sets, students can deeply understand the algorithm application and engineering implementation of machine learning in practice. For example, design a complete project from data collection, cleaning, feature engineering to model training and optimization. Students will participate in it throughout the process and master the actual process of data processing and modeling. In the project, you can choose some challenging problems, such as building a spam recognition system, an image classification system, or a prediction model based on time series, so that students can debug the model themselves, select appropriate evaluation indicators, and optimize the model performance. This can not only improve students' hands-on ability, but also enhance their comprehensive ability in solving practical problems and cultivate students' engineering thinking when facing complex problems.

In addition to basic project training, the course should also focus on docking with the industry and cutting-edge technologies, and guide students to pay attention to the latest developments and applications of machine learning. In practice, we can combine the current hot issues in the field of artificial intelligence, such as autonomous driving, medical diagnosis, smart finance, etc., design relevant application scenarios, and encourage students to try to use different machine

learning technologies to solve practical problems. For example, in the autonomous driving project, students can design a target detection system based on computer vision and deep learning. In the medical diagnosis project, students can try to use machine learning algorithms to build disease prediction models. Through these challenging application projects, students will be able to truly experience the engineering application of machine learning technology, while exercising teamwork ability, problem-solving ability and innovative thinking in practice.

3.3 Combination with real life

As a discipline with broad application prospects, machine learning cannot be limited to the framework of traditional computer science, but should focus on interdisciplinary integration and cultivate compound talents with interdisciplinary vision. Therefore, the design of the course should pay special attention to the improvement of interdisciplinary capabilities. In classroom teaching, knowledge from multiple fields related to machine learning can be introduced, such as data science, artificial intelligence, computer vision, natural language processing, sociology, economics, etc., and explore how these fields can be combined with machine learning technology to solve complex problems in reality. For example, in the financial field, machine learning is widely used in algorithmic trading, credit assessment, risk prediction, etc.; in the medical field, machine learning is used in disease prediction, genome analysis, etc. By introducing cases and applications from different disciplines, students can not only understand the diverse application scenarios of machine learning, but also cultivate their ability to think and solve problems across disciplines.

In order to further promote interdisciplinary integration, course design can encourage students to solve problems from different disciplinary perspectives through interdisciplinary project cooperation. For example, an interdisciplinary team can be organized to allow students from computer science, economics, medicine and other majors to complete a machine learning project together. Through teamwork, students can learn how to discuss and solve problems with experts in other fields. This interdisciplinary cooperation can not only help students broaden their academic horizons, but also enable them to pay more attention to analyzing problems from multiple dimensions and levels when facing complex problems in actual work, and provide innovative solutions. In addition, by inviting experts from different industries to hold special lectures, students can understand the current status and challenges of machine learning applications in various industries, and further promote their disciplinary integration and innovative thinking ability.

Through the above course design, students will not only master the theoretical and practical skills of machine learning, but more importantly, they will be able to flexibly apply interdisciplinary knowledge when solving complex problems, and cultivate compound talents with both a deep theoretical foundation and strong engineering practice ability and innovative thinking. This will lay the foundation for them to play an important role in academic research or industry applications in the future, and promote them to become innovative leaders in the ever-changing scientific and technological environment.

4. Reform and exploration of experimental teaching methods

4.1 Strengthen students' hands-on ability based on project drive

The experimental teaching of the "Machine Learning" course should adopt a project-driven approach, and through the design of challenging practical projects, let students deeply understand the principles and applications of machine learning in hands-on practice. Each project can be carried out from data acquisition, preprocessing, feature extraction, model selection, training and optimization, and requires students to complete project tasks independently or in teams. For example, you can design a project based on image recognition, requiring students to build a convolutional neural network (CNN) model and perform classification tasks on common image data sets; or design a text classification project, requiring students to use natural language processing (NLP) technology for data preprocessing, feature engineering, and sentiment analysis through machine learning algorithms.

Project tasks not only allow students to apply the learned theories in practice, but also improve their engineering practice and problem-solving abilities. In the project, students will face practical problems such as data noise, overfitting, and underfitting. They need to flexibly adjust the model architecture, select appropriate evaluation indicators, and perform optimization, so as to cultivate students' innovative thinking and independent problem-solving abilities. At the same time, in team projects, students can cooperate with each other to jointly explore algorithm selection and model optimization strategies, and exercise team collaboration and communication skills. This project-driven teaching with practice as the core can not only deepen students' understanding of theory, but also cultivate their innovative ability to solve complex problems and cultivate compound talents with practical capabilities.

4.2 Integration of interdisciplinary experiments to improve students' comprehensive abilities

In order to promote the improvement of interdisciplinary abilities, experimental teaching should design interdisciplinary joint projects to encourage students to combine machine learning with other subject knowledge to solve complex practical problems. For example, a project combining biology and machine learning can be designed, requiring students to use

machine learning models to analyze genetic data and predict disease risks; or a project combining sociology and machine learning can be designed, requiring students to analyze social network data and build user behavior prediction models. These interdisciplinary projects not only help students gain practical experience in the application of machine learning, but also enable them to improve their innovative thinking in the intersection of different disciplinary knowledge.

When implementing interdisciplinary projects, experimental teaching should provide students with sufficient resources and support, invite experts from other disciplines to participate in guidance, and help students understand how to effectively apply machine learning methods to other disciplines. In addition, by organizing interdisciplinary teams, students can work together from different disciplinary perspectives to complete projects together. In this kind of cooperation, students can absorb ideas and methods from different disciplines and improve their multi-dimensional thinking ability to analyze problems. This interdisciplinary experimental design can not only enhance students' comprehensive ability, but also cultivate their ability to respond flexibly when facing complex real problems, laying a solid foundation for their future academic research or industry application.

4.3 Real-world scenario application to stimulate students' industry sensitivity

In order to enhance students' understanding of the application of machine learning technology in real scenarios, experimental teaching should design application-oriented tasks based on industry needs. These tasks require students to not only master the basic principles of machine learning, but also be customized in combination with specific industry needs, such as intelligent manufacturing, financial risk control, autonomous driving, medical health, etc. For example, in the financial field, a credit card fraud detection project can be designed, requiring students to build a machine learning model, analyze transaction data and predict abnormal behavior; in the medical field, a disease diagnosis project can be designed, requiring students to use medical imaging data to build a deep learning model for automatic disease identification and diagnosis. These real-life experimental tasks can not only help students understand industry needs, but also improve their ability to apply machine learning technology to actual scenarios.

Through this industry-based experimental design, students can not only learn the technical details of machine learning, but also cultivate their industry sensitivity and innovation capabilities. In the face of actual industry challenges, students need to flexibly use machine learning technology to select, tune and deploy models, while considering how to combine with actual industry problems to provide practical and effective solutions. This industry-driven experimental teaching model not only improves students' practical ability, but also cultivates their innovative thinking, allowing students to propose more forward-looking and creative new ideas in the process of solving problems, and become innovative talents that adapt to future technological development and industry changes.

5. CONCLUSION

In general, the innovation of talent training models for machine learning courses is an important measure to adapt to scientific and technological progress and industrial needs. With the continuous evolution of machine learning technology, traditional teaching models can no longer meet the ever-changing discipline requirements and market demands. By promoting the timely updating of course content, strengthening practical teaching, promoting interdisciplinary integration, and strengthening the connection with the industry, we can cultivate compound talents with both a solid theoretical foundation and engineering practice ability and innovative thinking. This will not only help promote the application and development of artificial intelligence technology, but also provide students with the ability to think independently and solve problems in a complex and changing technical environment. In the future, with the continuous optimization of the education model and the integration of teaching resources, talent training in the field of machine learning will usher in a more innovative and diverse situation, providing more powerful support for scientific and technological innovation and industrial upgrading.

REFERENCES

1. Goodfellow, I., Bengio, Y., & Courville, A. (2022). *Deep Learning (Adaptive Computation and Machine Learning Series)* (Revised Edition). MIT Press.
2. Géron, A. (2023). *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow* (3rd Edition). O'Reilly Media. Aggarwal, C. C. (2023). *Neural Networks and Deep Learning: A Textbook* (2nd Edition). Springer.
3. Burkov, A. (2022). *Machine Learning Engineering*. True Positive Inc.
4. Kelleher, J. D. (2023). *Fundamentals of Machine Learning for Predictive Data Analytics: Algorithms, Worked Examples, and Case Studies* (2nd Edition). MIT
5. Press.