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Some Thoughts about the Teaching of Mathematics Foundation Courses

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Abstract

Artificial intelligence is a hot research field in theory and application recently. Mathematics, as a basic subject, is an important foundation of machine learning algorithms. In the current teaching of the basic mathematics course, we should increase the infiltration of artificial intelligence, so that students can master certain mathematical basis, and at the same time, strengthen the training of data thinking and the ability of algorithm programming, in order to adapt to the mathematics specialized students' new request.

Key words: Artificial intelligence, Mathematics foundation courses, machine learning.

0. Preface

Mathematical analysis, advanced algebra, probability theory and mathematical statistics are related professional foundation courses of mathematics and statistics. These courses aim to cultivate students rigorous logical thinking, innovative and comprehensive ability. The study can help students use all kinds of mathematical knowledge to address practical problems, cultivate students to form dialectical materialism viewpoint and statistical point of view. Logical thinking ability, analytical judgment ability, innovation ability and application ability play an important role for an excellent student of science. These professional foundation courses learning can help students learn other subsequent course.

Traditional mathematics teaching pays more attention to the theoretical derivation and rigorous training of thinking, and less to the knowledge of artificial intelligence technology in big data time today. The disadvantage of such teaching is that students majoring in mathematics and statistics have strong theoretical knowledge and weak practical application ability, and they are subject to fear the difficulty of artificial intelligence technology. In recent years, intelligent products emerge in endlessly, and new things constantly impact the sensitive nerve of college students. A computer can recognize objects in pictures, understand human instructions, and help us with shopping.Lacking of proficiency in computer technology makes it difficult for students majoring in mathematics to better apply their strong mathematical knowledge in solving practical problems. Under the current background, teachers should integrateAI ideas into related application casesin the foundation course of mathematics in teaching. It can further enhance the students' mathematical quality.In the subsequent course,the ability of practical application of using artificial intelligence technology can help studentsmasterthe innovative solutions to practical problems.

1. the feasibility of integrating data science thinking into mathematics basic course teaching

In fact, many researchers have pointed out that artificial intelligence theory and technology have the

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characteristics of universality, mobility and permeability. Institutions of higher learning should take the initiative to combine the students' interest in learning and social demand, attach great importance to the artificial intelligence and computer, control, mathematics, statistics and other disciplines cross integration of professional education, explore "artificial intelligence + X" talent training mode. The construction of "artificial intelligence +" composite characteristic major should not only closely combine the specialized courses of "new engineering" construction with artificial intelligence, but also attach importance to and lay a solid foundation of students' artificial intelligence algorithm and technology in the basic mathematics courses.

These three basic courses of mathematics and statistics major have their distinctive emphasis.Mathematical analysis helps artificial intelligence algorithm to realize multi-dimensional data analysis, such as the partial derivative, differential and extreme value, which is conducive to students' establishment of high-dimensional data point. Matrix, vector and other theories and properties inadvanced algebra become an essential tool of intelligent calculation. It can effectively analyze and process a large number of data based on this, which is helpful for students to establish an overall data view. With the rise of the connectivity of AI, probability theory and mathematical statistics have replaced mathematical logic and become the mainstream tool in the field of artificial intelligence research, which is conducive to the establishment of students' view of random data.

New era of artificial intelligence in the teaching of the course to join the simplified related to the professional basis of artificial intelligence, machine learning, neural networks, pattern recognition, computer vision, knowledge engineering, natural language processing, for students understand the basic concepts of the artificial intelligence algorithm and theory and using the method of artificial intelligence and ideological analysis and solving practical problems with basic fundamental role. At the same time, the basic knowledge of mathematical analysis, advanced algebra, probability theory and mathematical statistics is sorted out to analyze its application in various algorithms of artificial intelligence, which can enhance the attractiveness of students' theoretical learning. On the other hand, the acquisition of a large number of practical cases in the field of artificial intelligence can help students understand what they have learned, clarify the use of college mathematical knowledge, effectively improve their interest in learning, and consolidate the basic skills of mathematics for undergraduates majoring in mathematics and statistics.

2.Some ways to integratedata mining ideas into in mathematics basic course teaching

Many educational researchers have reiterated the theoretical significance of the integration of AI into college mathematics, and many mathematics teaching workers have realized the significance of the integration of artificial intelligence into the curriculum and carried out preliminary practice. However, revealing the relevance between the basic mathematics course for mathematics and statistics majors and the core foundation of artificial intelligence, as well as how to integrate the theories and methods of artificial intelligence into the teaching of professional course is a difficult task.Several ideas are given in the following.

(1) Teachers should search for the combination of artificial intelligence technology and mathematical knowledge. Built on the combination, teachers can design the teaching application cases. These project cases can train students of mathematics and statistics of intelligent attainment and innovation ability. Suitable teaching material system which putting forward structure foundation course of mathematics in data mining, builds a perfect professional course teaching system. This paper seeks for the breakthrough point of artificial intelligence thoughts and methods in professional courses, discusses how artificial intelligence cases are integrated into the classroom of basic mathematics courses as the research content, discusses the cultivation

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method of intelligent thinking + mathematical foundation training for science students, and forms the unique college mathematics intelligent thinking infiltration talent cultivation mode for science majors. Such teaching reform can not only improve the theoretical system of intelligent talent training for science students, but also be beneficial to further develop the general quality training of new engineering students under the mode of AI +. It is of great significance to improve the teaching quality of basic course of mathematics major and the training of compound intelligent talents.

(2) Teachers should attempt to form a "mathematical foundation course + artificial intelligence" teaching innovation team. It encourages teachers abstract data mining ideas from the basic course teaching of mathematics, reconstructs mathematics teaching method from the data mining system, which train students of mathematics and statistics in cross science research interest in artificial intelligence, enhance data science theory knowledge, improve students' ability of applied mathematics. With OBE's concept as the guide, we set the students' graduation requirements. It will dock recessive character ability training dominant talent training plan of all the courses and teaching, set up standard of talent training quality, reshape the personnel training quality, and to further update teaching methods.

(3) Teachers should add experimental course of mathematical analysis, advanced algebra, probability theory and mathematical statistics, and optimize the teaching content on subsequent course of mathematical modeling, mathematical application software and mathematical experiment. Maximize the rate of knowledge imparting as far as possible without additional class hours. Teachers should pay attention to the mathematics major student's data actual operation ability, and enhance the student's employment competition ability.

3. Specific cases of basic mathematics teaching

There are lots of cases of AI classical algorithms ideas in traditional classroom teaching of mathematical analysis, advanced algebra and probability theory and mathematical statistics. Classical teaching cases should emphasize the inner link of theory knowledge and algorithm application, the widely processing method of many algorithms, and the easy understanding of the students. It provides theoretical guidance and technical support for the research on the infiltration training channel, training mode and training mechanism of general education on the intelligence literacy of mathematics and statistics majors, and lays a solid foundation for the cultivation of the innovation ability of science students.

The basic math concepts of artificial intelligence mainly include calculus knowledge,matrix theory and probability theory. We should pay attention to the ubiquitous mathematical thought method behind it when we see its splendid achievements. Mathematical analysis is the synthesis of classical mathematical ideas, in which the limit idea, the definition and solution of derivative and gradient, as well as the idea of upper and lower limits have a profound impact on artificial intelligence algorithms. For example, the calculation of derivatives to find the extreme values of functions is a conventional method in data mining. Newton method and quasi-Newton method are conventional algorithms for unconstrained optimization problems. In class teaching, when the gradient-based algorithms are inserted into the teaching of gradient teaching, the dynamic state demonstration of these real methods will give students the direct theoretical solution of the gradient concept, and thus the integrality of students' learning will be improved. Another example is the k-nearest neighbor method, which is the primary reality of the data mining technique. The basic idea of k-NN algorithm is described as a sample point of an unknown class, and the class value of the sample point can be assigned according to the class of the adjacent known class sample. The theorem of nested interval is an important content of the theory of real number completion in mathematical analysis. The conventional teaching of mathematical analysis is to prove the validity of theorem result by the system of equal value. In fact, teachers can use the dichotomy method, the golden division method and other classics linear searching

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algorithms to show the theorem.

Advanced algebra has been called the mathematics of the 21st century. In artificial intelligence, advanced algebra is ubiquitous.Matrices play a central role in advanced algebra,which means we can process data in a holistic view. Concepts in advanced algebra allow us to define angles,lengths and distances, which we will use for feather selection, feather abstraction, and similarity analysis. Many machine learning algorithms, such aslinear regression and principal component analysis, use matrixcharacterization namely determinants, eigenspectra, and eigenspaces to mine the information. This extends to all forms of representations of data, as well as judging the numerical stability of computationaloperations on such matriceslow-rank approximations.In machine learning, we are often interested inmaking inferences of unobserved (latent) random variables given that wehave observed other random variables.Artificial intelligence needs the basis of mathematical statistics and probability theory knowledge including combinatorial mathematics, probability rules & justice, Bayes' theorem, random variables and variance and mean, conditions, and joint distribution, the standard distribution (Bernoulli, binomial, multiple, and Gaussian), moment generating function and large likelihood estimation (MLE), a priori and a posteriori, large posterior estimation (MAP) and sampling method.

The foundation of various artificial intelligence algorithms will be mined in the three basic mathematics course, and the mode of integrating artificial intelligence ideas and methods into university mathematics and the in-depth classroom mode will be explored.

4.Conclusion

As an ancient subject, mathematics is in full swing today, and the traditional teaching of mathematics should follow the trend of the times and make changes in order to cultivate top innovative talents who can use information technology. Teachers should sort out the internal relationship between projects, practical training and competitions and the cultivation of top innovative talents in information technology of university students. Student-centered, based on the combination of theory and practice, the information technology project teaching case base and training case base are established to carry out innovation training for students and cultivate their innovation ability. Through scientific system construction and mechanism guarantee, the cultivation strategy of information technology top-notch innovative talents for university students is perfected, the effect evaluation model of information technology top-notch innovative talents for university students is constructed, and the method of training it top-notch innovative talents in projects, practical training and competitions is given.

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