Application of Engineering Mathematics in Big Data Learning

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Abstract

In today's society where information technology is developing rapidly, with the explosive growth of data in various fields and fields, the popularity of big data is increasing day by day, and its application plays an increasingly important role in related fields. People's information on Internet activities will form data. Through the collection, collation, mining, analysis and in-depth application of data, we can innovate technology, thinking, products, marketing and risk management. Big data plays a very important role in precision marketing, credit evaluation, asset pricing, risk management and indexing.In the postgraduate study period, following the tutor's learning is the direction of big data. In the process of learning, many engineering mathematics related problems are often encountered. It is found that the application of engineering mathematics in the process of big data research is everywhere. This article will mainly Engineering mathematics teaches the importance of professional learning, the main engineering mathematics knowledge related to big data, and the application of engineering mathematics in big data.

1. The Importance of Engineering Mathematics to Professional Learning

We know that human activities can not be separated from thinking, Professor Qian Xuesen once pointed out: "The ultimate wisdom of education lies in the thinking process of the human brain." The research of thinking activity is the basis of teaching research. Mathematics and thinking are closely related. The development law of mathematical thinking has fundamental guiding significance for the practical activities of Engineering mathematics. The importance of Engineering Mathematics for professional learning is self-evident.

1.1 Engineering Mathematics is a ladder and bridge for the construction and development of professional courses

Discussing from the construction system of professional courses, engineering mathematics is the ladder and bridge for the construction and development of professional courses. From freshman to postgraduate, it is easy to see that engineering mathematics is always better than professional courses, usually in the first year, second year or graduate school. Professional courses are generally ranked in junior, senior or graduate school. Why, it may be illustrated by examples: the optimization of attitude matrix and position matrix of industrial robots in the course of mechanical principles can not be separated from the learning of linear algebra; the normal distribution of product processing quality in the basis of mechanical manufacturing technology can not be separated from the learning of probability and statistics courses; and the transfer function of control system in control engineering can not be separated from integral. Change course learning. From the above examples, it is found that the construction and development of professional courses can not be separated from the study of Engineering mathematics. In other words, it is the cultivation of Engineering Mathematics quality. The essence of engineering mathematics quality cultivation is the cultivation of mathematical logical thinking ability. Mathematical logical thinking ability, that is, the ability to extract, transform, process and transmit external and intrinsic information by using mathematical ideas and methods. In the whole process, it is required to be logical, not contrary to common sense, and to achieve the ultimate goal. At the same time, it should be stated correctly and convincingly. Logical thinking ability is the core of mathematical ability. Mathematics is a logical system closely related to each part. In the field of mathematics, only the conclusion that has been proved rigorously can be recognized as

correct. Mathematical proof is inseparable from deductive reasoning, and deductive reasoning ability is an important part of logical thinking ability. It can be seen that the construction and development of engineering courses can not be separated from the cultivation of mathematical logical thinking ability. It can be seen that the importance of engineering mathematics quality training in engineering colleges and universities.

1.2 Engineering mathematics, as a basic subject and a thinking subject, is one of the main channels to cultivate students′innovative consciousness and practical ability.

From the cultivation of college students' thinking to explore the importance of engineering mathematics quality training. As a basic subject, engineering mathematics is one of the main channels for cultivating students' innovative consciousness and practical ability. It is necessary to stimulate students' subjective consciousness, and let students actively and actively participate in the whole process of university study and life, conduct independent thinking, and improve the ability to solve problems independently. It is necessary to cultivate students' spirit of bold innovation, courage to seek differences, and courage to explore, to form a good quality of thinking, and to provide high-quality innovative talents for the society. The cultivation of college students' thinking is from the beginning of the freshman year. It is the higher mathematics that comes into contact with the first mathematical thinking training.

It is not difficult to find out the information sent by the mathematics modeling contest for college students every year: The importance of the cultivation of engineering mathematics quality. Mathematical modeling is a manifestation of a mathematical way of thinking. It is “a representation of reality through the mental activity to construct a representation that captures its important and useful features, often as visual or symbolic representations.” From science, engineering From the perspectives of economics and management, mathematical modeling is to use mathematical language and methods to simplify and build a powerful engineering mathematical tool that can approximate and "solve" practical problems. Modeling is a very complicated creative labor. Mathematical modeling is also an competitive platform for testing the logical thinking ability of college students' engineering mathematics. It can be seen that the importance of engineering mathematics quality training.

2. Major engineering mathematics related to big data

Engineering mathematics is a general term for several mathematics. Our undergraduate students study "integral transformation", "complex function", "linear algebra", "probability theory", "field theory" and other mathematics. These are all engineering mathematics. Engineering mathematics is to enable engineering students to deal with common engineering problems with more convenient theoretical tools. In this mathematical system, the basic mathematics that is closely related to big data technology mainly has the following categories.

2.1 Probability Theory and Mathematical Statistics

This part is closely related to the development of big data technology, basic concepts such as conditional probability and independence, random variables and their distribution, multidimensional random variables and their distribution, analysis of variance and regression analysis, stochastic processes (especially Markov), parameter estimation. Bayes theory and so on are very important in big data modeling and mining. Big data has natural high-dimensional features. Designing and analyzing data models in high-dimensional space requires a certain multi-dimensional random variable and its distribution basis. Bayes' theorem is one of the foundations of classifier construction. In addition to these basic knowledge, conditional random field CRF, hidden Markov model, n-gram, etc. can be used for analysis of vocabulary and text in big data analysis, and can be used to construct predictive classification models.

Of course, the theory of information based on probability theory also plays a role in big data analysis. For example, information gain, mutual information and other methods for feature analysis are concepts in information theory.

2.2 Linear algebra

The relationship between mathematics knowledge and big data technology development is also very close. Matrix, transpose, rank block matrix, vector, orthogonal matrix, vector space, eigenvalues and eigenvectors are also used in big data modeling and analysis. Commonly used technical means.

In Internet big data, many analysis objects of application scenarios can be abstracted into matrix representations. A large number of Web pages and their relationships, Weibo users and their relationships, text-to-vocabulary relationships, etc. can be represented by a matrix. For example, when a web page and its relationship are represented by a matrix, the matrix element represents the relationship between page a and another page b. This relationship can be a pointing relationship, 1 means that there is a hyperlink between a and b, and 0 means a, There are no hyperlinks between b. The famous PageRank algorithm is based on this matrix to quantify the importance of the page and prove its convergence.

Matrix-based operations, such as matrix decomposition, are the way to extract object features, because the matrix represents a transformation or mapping, so the matrix obtained after decomposition represents some new features of the analysis object in the new space. . Therefore, the application of singular value decomposition SVD, PCA, NMF, MF, etc. in big data analysis is very extensive.

2.3 Discrete mathematics

The importance of discrete mathematics is self-evident. It is the foundation of all branches of computer science. Naturally, it is also an important foundation of big data technology. It will not be developed here.

3. The application of engineering mathematics in big data

In today's era, data has become a resource. How to deal with massive data, mining information, discovering laws and exploring potential value has become a key issue in scientific research and practical application. The research and exploration of big data cannot be separated from the theoretical basis of mathematics. The corresponding processing methods and analysis methods of big data need to have the theoretical backing of mathematics. Large-scale collection and storage of data, formal research and analysis of data processing, and data mining, regular analysis, evaluation and scoring, predictive analysis, etc., all require engineering mathematics to provide ideas and methods.

3.1 Application of Engineering Mathematics in Data Processing

When studying practical problems, we need to deal with the original data set, and because of the timeliness of big data, data processing must be completed within the expected time, so we must balance the effects and efficiency. If the initial data contains noise, incompleteness, or inconsistency, pre-processing must be performed prior to conducting research and analysis to clean, integrate, and select the data to improve the efficiency and accuracy of data research and analysis. Sometimes we are faced with the problem of too large data sets or indicator sets, and we need to select some important data and key indicators.

In data processing, many methods in statistics are classic and commonly used, such as descriptive statistical analysis, correlation analysis, regression analysis and so on. Regression analysis is often based on the correlation analysis, the general relationship of the quantitative changes between two or more related variables is determined, and then through the corresponding mathematical model, another unknown can be inferred by a known amount. The main task of regression analysis is to estimate the parameters based on the sample data, establish a regression model, test and judge the parameters and models, and make predictions.

In addition to classic, commonly used methods, there are many new mathematical theories that can be applied to data processing. For example, in the measure theory, two or a finite monotonic measure can be combined by operation to construct a new monotonic measure. We can apply this research to

the dimensionality reduction of data, compared with the previous method of selecting the main factor. More than enough to ensure the integrity and validity of the data, retain more information.

3.2 Application of Engineering Mathematics in Data Mining

In the era of big data, in the face of massive information, it is undoubtedly the best research direction and technology choice to obtain effective information and obtain potential value from seemingly complicated and irregular data. Throughout the research process, the generation and collection of data is the basis, while data mining is the key, its characteristics can be summarized as: application, engineering, collection, cross. In the overall analysis method and implementation of data mining, mathematics plays an important role.

Neural network, association analysis, cluster analysis, and decision tree methods are commonly used methods in data mining. Let us take the fuzzy clustering analysis as an example to briefly introduce its ideas and methods. The clustering analysis follows the principle of "minimizing the similarity between classes and maximizing the similarity within the class". According to certain criteria, the objects with relatively large correlations are divided into one class, and the classification should try to make objects belonging to different classes as much as possible. The difference between the two is maximized, whereby the data set can be divided into groups. In the fuzzy clustering analysis, we first standardize the data, and then perform calibration, that is, corresponding to the fuzzy relationship, establish a fuzzy similarity matrix, and then perform direct clustering or clustering based on the fuzzy equivalence matrix, or use the maximum tree method or edit Net method, get clustering results. The determination of the optimal threshold can be determined by experienced experts, and the optimal value can be determined statistically. As one of the most widely used and most active branches in fuzzy mathematics, fuzzy clustering analysis plays an important role in practical life applications and related research in various subject areas. Its application research is relatively mature, and it is a solution to clustering problem. Very good way.

4. Conclusion

In today's era, data has become a resource. How to deal with massive data, mining information, discovering laws and exploring potential value has become a key issue in scientific research and practical application. Through the above discussion on the application of engineering mathematics in big data, it can be seen that the research and exploration of big data cannot be separated from the theoretical basis of engineering mathematics. The corresponding processing methods and analysis methods of big data all need the theoretical backing of engineering mathematics. Large-scale collection and storage of data, formal research and analysis of data processing before analysis, and information mining, regular analysis, evaluation, scoring, predictive analysis, etc., all require mathematics to provide ideas and methods, so, to better To develop big data technology and related research, we must pay attention to the research and development of engineering mathematics theory, make it better combined with practice, and pay attention to advancing with the times, improve and innovate the theory according to the actual application situation, through practical needs To promote the progress and improvement of the theory.

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