International Journal of Science and Engineering Applications
Volume 12-Issue 08, 240 – 242, 2023, ISSN:- 2319 - 7560
DOI: 10.7753/IJSEA1208.1074

# Algorithm Based on the Mixing Ratio of Road Asphalt Materials: from the Auxiliary Perspective of Computer Vision Image Recognition

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**Abstract**:This paper uses computer image recognition algorithm to predict the dynamic modulus of asphalt mixture. The main parameters of asphalt mixture porosity, effective asphalt content, asphalt viscosity, load frequency, aggregate sieve mass fraction (and aggregate pass rate on 0.075 mm sieve openings, were established based on gene expression programming algorithm). Asphalt mixture dynamic modulus prediction model. Taking dynamic stability as the evaluation index, comprehensively considering its residual stability, creep rate, friction factor, water seepage coefficient and porosity, etc., to propose a functional asphalt pavement mineral material ratio the best optimization plan. Compare the prediction model with Witczak 1999 model, computer vision image recognition prediction model and artificial neural network model).

**Keywords**: Mixing Ratio, Road Asphalt Materials, Auxiliary, Image Recognition

## 1. INTRODUCTION

The dynamic modulus of asphalt mixture is one of the important parameters in the design and analysis of asphalt pavement structure [1]. How to determine the dynamic modulus of asphalt mixture has attracted the attention of road workers. At present [2], indoor test methods are mainly used to determine the dynamic modulus of asphalt mixtures, but indoor tests have disadvantages such as complicated sample preparation process [3], expensive test equipment, and time-consuming materials. Some scholars proposed to determine the dynamic modulus of asphalt mixture through virtual test of discrete element method [4], but it is difficult to determine the meso-parameters of virtual test. In recent years, intelligent methods such as neural networks have achieved good results in material performance prediction [5].

Ceylan et al. used neural network methods to predict the dynamic modulus of asphalt mixtures. Go-palakrishnan et al. proposed a support vector machine-based asphalt mixture dynamic modulus prediction model [6]. It is difficult to determine. In recent years, intelligent methods such as neural networks have achieved good results in material performance prediction. Ceylan et al. used neural [7] network methods to predict the dynamic modulus of asphalt mixtures. Go-palakrishnan et al. proposed a support vector machine-based asphalt mixture dynamic modulus [8] prediction model. It is difficult to take into account various performance indicators, especially for functionality [9]. Asphalt pavement meets the demanding requirements of comprehensive performance, and due to the diversity of its performance factors and the interaction of complex conditions, it is necessary to reasonably use scientific test methods for [10] factor analysis and mixture composition design during the design. Because of the leaping type of highway construction [11]. During the development of large-scale construction, there are inevitably various technical problems in the project quality during the large-scale construction period [12]. With the increase of traffic volume, the increase of road age and the shortage of maintenance funds, the existing roads are far from reaching the designed service life in their operational life. At that time, different degrees and scopes of damage occurred [13].

This kind of damage is equivalent to the depreciation of pavement assets if reasonable maintenance measures are not adopted in time. For our [14] province, this kind of asset depreciation will mean the loss of a huge amount of public assets, and after several years of operation, in order to maintain the normal operation of the expressway network, a huge amount of money not lower [15] than the rate of asset loss is needed to extend the expressway every year. The maintenance and repair of highway life, for our province located in the west, will obviously [16] be affected by this in the future economic development. Network-level pavement maintenance decision-making is a multi-factor and multi-attribute decision-making problem [17], involving many factors such as pavement structure type, environment, traffic load, pavement performance decay law, etc. There are even certain contradictions between different factors, especially benefits [18] the contradiction between costs is the most prominent. The matter-element analysis theory developed in recent years uses formal tools to study the laws and methods for solving contradictory problems from a qualitative and quantitative perspective, and has been successfully applied in many fields [19].

This provides a new method for the determination of the network-level pavement maintenance program. Based on the cost-benefit analysis [20] of pavement maintenance, this paper uses matter-element analysis theory to establish a matter-element model to determine the network-level pavement maintenance decision-making [21], and verifies the correctness of the model through engineering practice. Corresponding to the growth trend of expressway mileage, the changes in my country's traffic volume in recent years have also shown a relatively [22] obvious growth trend. The increase in traffic volume and the increase in pavement load make the test of pavement performance more and more severe. In addition, the frequent [23] overloading phenomenon has caused many highways to have some diseases in the early stage, such as oil flooding, rutting, etc., and then affect the performance, service life [24], and transportation efficiency of the road surface can induce some safety accidents in severe cases. Pavement performance represents a function or ability of the pavement. Better pavement performance should not only ensure that the road surface can guarantee driving safety during its service life, but also provide comfortable services for driving. Therefore, it is very important to people's travel and life. important. In order to improve the performance of the pavement.

## 2. THE PROPOSED METHODOLOGY

### 2.1 The Computer Vision Image Recognition

In pedagogy, the method of evaluating teaching quality refers to the use of theory and technology to evaluate the quality value judgment of education on whether the teaching process and teaching effect can reach a certain level of teaching. Common evaluation teaching methods include fuzzy comprehensive evaluation method and AHP analytic hierarchy process. The above formula as a whole seems to be a model operator with a large value. Although the weight value and the single-factor evaluation result are multiplied, it is impossible to lose any information. The evaluation results and importance have been well reflected, but since the final model is based on the maximum value, the influence of the main factors is highlighted.) The system can carry out various statistics, comparisons and analyses for classes, grades, colleges, etc. It can be displayed in the form of graphs, making the results clear and clear. The system can use the method of Chapter 3 to conduct certain data mining for evaluation, assist managers and decision makers to educate and manage students in a targeted manner, and provide a reliable reference for the adjustment of talent training programs.

It is processed in the teaching quality business process of the data processing process of the teaching quality evaluation system. Usually, the processing logic is generally described by the judgment table or the judgment number in the detailed design process. Employers and recruiting agencies can enter the system as enterprise users, and can check the results of student evaluations, so that users can understand the overall quality of students, and set up corresponding screening conditions according to the specific needs of talents, so as to select the required needs in a targeted manner. talent. The main functions of the administrator include system settings, basic settings, report printing, data import and export, curriculum, teacher evaluation and announcement information management. System settings mainly include functions such as log management, menu settings, role rights management and other functions.

### 2.2 The Road Asphalt Material

Based on the data of the central combination of experimental results, the GA-ANN method is used to establish a model to predict the optimal mineral material ratio of functional asphalt pavement. The result data of the central combination experiment is randomly divided into three groups: calibration set, test set and prediction set. Among them, the calibration set is used to establish the optimization model, and the test set and prediction set are used to check the adaptability and predictive ability of the model. The degree of approximation (Da) is used to select the appropriate number of hidden nodes. According to the principle of the GEP algorithm, the database is divided into two parts at random when establishing the prediction model: the first part is the training group, with 2000 sets of data, accounting for 72.7% of the total data; the second part is the verification group, with 750 sets of data. Accounting for 27.3% of the total data. After repeated training on 2000 sets of data using the GEP algorithm, the chromosome of the best fitness sample is obtained, namely the asphalt mixture dynamic modulus prediction model, and then the prediction model is placed on the 750 sets of data in the validation group for fitness verification. The GA-ANN method is used to further optimize the mineral material ratio of functional asphalt pavement, and the data of the central combination experiment result is divided into three subsets.

The fitting degree of the GEP algorithm reaches 0.925, which is more accurate than the Witczak 1999 prediction model and the Korean prediction model, but slightly lower than the artificial neural network model.

### 2.3 The Asphalt Mixture Ratio Based on Computer Aided Image Recognition

The 8 influencing factors and the sensitivity analysis results of the dynamic modulus are represented by a histogram, as shown in Figure 5. It can be seen from Figure 5 that the Witczak 1999, AN, GEP prediction model and the measured value of the dynamic modulus have similar correlations to the various influencing factors. Among them, the influencing factors that are positively related to the measured value of the dynamic modulus are aggregate gradation characteristics ρ200, ρ34, ρ38, ρ4, asphalt viscosity and load frequency f; negatively correlated influencing factors are effective asphalt content wbeff and asphalt mixture void ratio Va. In the Korean prediction model, the influencing factors that are positively correlated with the measured values of the dynamic modulus are ρ200, η, f; the influencing factors that are negatively correlated are wbeff, Va, ρ34, ρ38, ρ4. , Where 2 groups are set as the prediction set, 2 groups are set as the test set, and the other 11 groups are set as the correction set, and the dynamic stability is used as the output data to establish a three-layer feedback neural network model.

The R2 of the optimized artificial neural network model is 0.9913, which shows that the model has a satisfactory degree of fit. The root mean square error of the test set (RMSET) and the root mean square error of the prediction set (RMSEP) are 0.027 and 0.024, respectively, indicating that the artificial neural network model has good predictive ability. Another typical development node is the development of PMS. It was first used by the Norwegian Highway Agency, represented by the roughness prediction model, and provided a more comprehensive evaluation model, incorporating factors such as pavement structure, climatic conditions, and traffic. Due to the lack of the model itself, it is required to quickly and accurately modify the model when the influencing factors change.

Other related models have been applied and promoted in subsequent practice. The PSI model is also a representative. First of all, it is used in the United States. Innovative indicators such as service level, pavement data and surface conditions have been added to make the evaluation model more realistic and reliable.

## 3. CONCLUSIONS

Compared with other typical prediction models, the prediction accuracy of the computer vision image recognition model is better than the Witczak 1999 prediction model and the South Korean prediction model, and slightly lower than the artificial neural network model. However, the artificial neural network model cannot obtain the explicit expression of the function, and it is impossible to clarify each the relationship between predictive factors and predicted factors. Therefore, the GEP model effectively overcomes the shortcomings of traditional methods such as artificial neural networks while ensuring the prediction accuracy, thereby providing a new and reliable method for predicting the dynamic modulus of asphalt mixtures.

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