A Marxist Value Theory Driven Value Assessment Model for Artificial Intelligence Data Mining

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Abstract. This study examines the influence and contribution of Marxist Value Theory (MVT) to value assessment models in Artificial Intelligence (AI)-driven Data Mining. Through an in-depth analysis of the basic elements of Marxist Value Theory, the application of the production, exchange and use of value in the modern economy is identified, and its significance in guiding Data Mining techniques is highlighted. On this basis, combining the basic concepts and processes of data mining, it proposes how artificial intelligence can optimise the data processing process and reveal the potential value. This study deepens the comprehensive analysis of the relationship between the two, constructs a theoretical framework for value assessment based on the Marxist theory of value, and reveals the transformative impact and new challenges of AI technology on the traditional way of value assessment. Combined with practical cases, it proves the applicability and effectiveness of the constructed model in different fields, and demonstrates the way and prospect of data-driven value presentation. However, a series of challenges have been encountered during the implementation of the model, including issues of data quality, ethics and technology maturity. This study not only provides a new perspective for the cross-study of AI and social sciences, but also lays a theoretical foundation for the construction of a dynamic and accurate value assessment model, highlights the importance and practical significance of the Marxist theory of value in the field of modern science and technology, and demonstrates its potential application in guiding economic decision-making and social development.

Keywords: marxist theory of value; artificial intelligence; data mining; value assessment models; labour theory of value; market volatility

1 Introduction

In the current era of rapid development in artificial intelligence and data mining, the evaluation of AI's value faces a significant challenge due to the lack of a theoretical framework. Traditional economic models struggle to explain how algorithms create value, while technology-driven evaluation systems overlook social value and ethical

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considerations. The core concepts of Marxist value theory, such as' socially necessary labor time 'and' labor value theory, 'offer new perspectives for building a scientific evaluation system in the digital economy. However, the current academic research on AI value assessment is characterized by a dual disconnect between technology and theory, leading to significant distortions in the value of corporate AI projects. To address this issue, this study proposes a' Marxist Value Theory-Driven AI Data Mining Value Assessment Model.' This model innovates in three areas: theory, indicator system, and empirical cases, providing both theoretical and practical support for AI value assessment.

2 Overview of the Marxist Theory of Value

2.1 Basic Elements of the Marxist Theory of Value

The basic elements of the Marxist theory of value cover a number of important components, the most central of which is the Labour Theory of Value. This theory suggests that the value of a commodity is determined by the amount of socially necessary labour time required to produce it, which not only establishes the objective basis of value, but also highlights the dominant role of labour in the value creation process. By redefining labour, Marx emphasised the indispensability and initiative of the worker in the production process, which in turn promoted a deeper understanding of commodities.

2.2 Relationship between the Marxist Theory of Value and the Modern Economy

As an important system of economic theory, the relevance of the Marxist theory of value in the contemporary economic context has become more and more prominent. Specifically, Marx's theory of value emphasises the formation of labour value in relation to commodity exchange, pointing out that the value of a commodity is not only reflected in its market price, but is also more deeply related to Socially Necessary Labor Time (SNLT). This theoretical framework provides an important perspective for analysing modern economic phenomena such as Income Inequality and Market Volatility.

3 Overview of Artificial Intelligence Data Mining Technologies

3.1 Basic Concepts and Processes of Data Mining

The basic process of data mining, as an interdisciplinary technology aimed at extracting valuable information and knowledge from massive data, can be considered as the standardised steps described by the Data Mining Process Model (CRISP-DM). The six core phases of the model include: business understanding, data understanding, data preparation, modelling, evaluation and deployment, which in turn form a global

framework for data mining and provide systematic guidance for building effective analytical models.

3.2 Current Status of AI Applications in Data Mining

In today's digital age, Artificial Intelligence (AI) techniques are increasingly being used in the field of Data Mining, which not only drives the efficiency of data analysis, but also significantly improves the accuracy of the results. Using Deep Learning algorithms such as Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs), researchers are able to automatically extract features and identify patterns in complex unstructured data [1]. For example, a financial institution confirmed its effectiveness in credit decision-making by constructing a deep learning-based risk prediction model that successfully reduced the loan delinquency rate by more than 15%.

4 Integrated Analysis of Marxist Value Theory and Artificial Intelligence

4.1 Theoretical Framework for Value Assessment

In exploring the "Marxist value theory-driven value assessment model for AI data mining", it is important to clarify the "theoretical framework for value assessment" [2]. This framework not only involves how to quantify the value of the application of AI technology in data mining, but also needs to be combined with the Marxist theory of value to assess the impact of this technology on the productivity of society as well as the overall value of society. According to the Marxist theory of value, the value of a commodity is determined by its socially necessary labour time [3]. Therefore, when constructing an AI model, we need to consider the labour time it saves in data mining versus the new value it creates [4].

On this basis, we can introduce a mathematical formula to describe the value assessment of AI data mining. Setting the value-added generated by the AI model in the data mining process asV,it can be expressed as:

$$[V = \sum_{i=1}^{n} (P_i - C_i)]$$

where P_i represents the market price of thei th data mining result, andC_i represents the cost invested in that result. This formula is effective in helping us quantify the value of data mining to assess its contribution to society and economy[5].

By establishing such a theoretical framework, we will not only be able to gain a deeper understanding of the application of Marxist value theory in the contemporary technological context, but also provide theoretical support for the ethical and social implications of AI [6].

4.2 Impact of Artificial Intelligence Technology on Value Assessment

In today's data-driven era, the rapid development of Artificial Intelligence (AI) technology has had a profound impact on the field of Value Assessment (VA) [7]. Especially in the perspective of Marxist Value Theory (MVT), AI technology can not only help the accuracy of value assessment, but also prompts us to re-examine the connotation and extension of value, and provides new ideas and methods for the construction of value assessment models.

Notably, AI technologies give new dimensions to the value assessment process through their algorithmic models and data processing capabilities. For example, Deep Learning (DL) algorithms are able to effectively analyse unstructured data, maximising its utility in value assessment. Taking Sentiment Analysis (SA) as an example, this technology can extract consumers' true sentiment towards a product or service from social media data, which in turn reflects its market value. Thus, this AI-based Data Mining (DM) method provides strong support for value assessment in both quantitative and qualitative aspects.

Further, decision support systems and predictive analytics of AI play an equally important role in value assessment [8]. By constructing Regression Model and Classification Algorithm, AI can identify important factors affecting the value in a huge dataset [9]. This data-based value assessment model not only improves the accuracy of the assessment, but also makes the assessment results more practical guidance value. Taking the financial market as an example, AI technology can predict the future market performance of stocks by analysing historical stock prices, trading volume and industry dynamics, thus providing investors with an effective basis for value judgement.

Within the framework of the Marxist theory of value, the rapid development of artificial intelligence has led to new thinking about the concept of "labour value" [10]. Marxism stresses that the value of a commodity is determined by the socially necessary labour time required to produce it [11]. However, in the context of AI intervention, how will the creation and production of AI redefine the value of labour, especially in the process of automation (Automation), which may lead to the extinction of certain types of labour, and consequently trigger the depreciation of labourers' value. In this regard, the search for a balance between the "intangible value" conferred by AI and the value of traditional labour has become an important issue for research today.

It must be emphasised that although AI technology shows great potential in value assessment, the ethical challenges and data bias issues (Data Bias) it faces cannot be ignored. In the process of data mining, if there are problems such as underrepresentation or data source discrimination, it may lead to the unfairness of the assessment results, and at the same time, it also violates the core concepts of justice and equality pursued by the Marxist theory of value. Therefore, when constructing AI-based value assessment models, researchers not only need to pay attention to the advancement and practicability of the technology, but should also explore in depth the long-term impacts that may be triggered at the ethical, social and economic levels.

Artificial intelligence technologies are reshaping the practice of value assessment in unique ways, while in-depth analyses based on Marxist theories of value provide theo-

retical support and reflective depth to this emerging field, driving our ongoing exploration of future models of value assessment.

5 Data Mining Value Assessment Model Based on Marxist Value Theory

5.1 Principles and Methods of Modelling

Table 1. AI data mining value assessment model components

constituent element	Detailed description		
element	theoretical foundation	Examples of applications	
Selection of innovative algorithms	Selection of flexible and efficient algorithms	Marxist theory of value	Natural Language Processing
	Convolutional neural networks combined with recurrent neural networks	Social labour productivity	Improved accuracy of information extraction
Reliability of data sources	Ensure that data are authentic, comprehensive and valid	Marx's emphasis on the value of commodities	Multidimensional data quality assessment
Construction of the value assessment indicator system	Comprehensive consideration of interpretability and fairness	Marxist theory of value	Model performance and social value
	Diversified evaluation dimensions	Value formation and realisation	Integration of ethical standards
In-depth discussion of application cases	Validation of model feasibility and validity	Practical case studies	User behaviour prediction and risk assessment

In today's Big Data era, our increasing reliance on Artificial Intelligence Data Mining Technology (AIDM) makes the need to assess its core value more and more prominent [12]. This assessment not only needs to rely on advanced algorithms and Models, but also needs to be integrated into the deep theoretical background of Marxist Value Theory (Marxist Value Theory), in order to form a scientific and systematic Value Assessment Model (Value Assessment Model) [13]. After in-depth analysis and summary, the components of the model can be divided into the following aspects: the selection of innovative algorithms, the reliability of data sources, the construction of the value assessment index system and the in-depth discussion of application cases.As shown in Table 1, this view is confirmed.

The choice of innovative algorithms is crucial in model construction. With the continuous development of Machine Learning (Machine Learning) and Deep Learning (Deep Learning) technology, the traditional Data Mining Methods (Data Mining Methods) can no longer adapt to complex application scenarios . In this context, we can draw on the concept of Social Productive Forces (SPF) in Marxist value theory to encourage more flexible and efficient algorithmic choices. For example, in the field of

Natural Language Processing, by applying the combination of Convolutional Neural Networks and Recurrent Neural Networks, the accuracy of Information Extraction can be effectively improved. Information Extraction .

The reliability of data sources is directly related to the final result of value assessment. Just as Marx stressed that the essence of "commodity value" lies in its Socially Necessary Labour Time, AI needs to ensure that the data is real, comprehensive and effective when conducting data mining. For data from different sources, strict screening and pre-processing must be carried out, and multi-dimensional and multi-level data quality assessment standards (Data Quality Assessment Standards) must be established to ensure the reliability and validity of the model.

When establishing the value assessment index system, the Interpretability and Fairness of the machine learning model need to be considered comprehensively. The core of Marxist value theory is to explore the formation and realisation of values, which requires us to pay attention not only to model performance metrics, such as Precision, Recall, etc., but also based on Social Value and Ethical Standards when constructing indicators . Standards) . By setting diversified evaluation dimensions, a more comprehensive and scientific evaluation system can be constructed to fully reflect the role and significance of the model in the real society.

The in-depth exploration of application cases is crucial to validate the feasibility and effectiveness of the model. At this stage, the combination of actual case study analysis, such as User Behavior Prediction in the e-commerce field or Risk Assessment in the financial industry, can effectively demonstrate the application effect and value of the model . Through the in-depth discussion of the connection between Data Analysis and theory, it helps the effective interaction between academia and practice and promotes the further development of AI field.

The construction of the value assessment model of AI data mining based on Marxist value theory is an important academic exploration with both theoretical depth and practical guidance, and its effectiveness is not only related to the development direction of academic research, but also has a far-reaching impact on practical applications .

This code presents an application case study using a Marxist value theory driven value assessment model for AI data mining. The function `ai_value_assessment` performs a computational assessment based on the data and returns the assessment results. The function `analyze_case` calls the assessment model and constructs the analysis results of the case. In the main function, the model and the case are constructed and the `analyze_case` function is called to analyse the case and convert the results to json format for output.

6 Assessment and Practical Implications of the Model

6.1 Criteria for Assessing Model Validity

In assessing the effectiveness of a Marxist value theory-driven value assessment model for AI data mining, it is crucial to construct a scientific and reasonable effectiveness assessment index system. This study will focus on three core dimensions: Accuracy, Interpretability and Usability.

6.2 Challenges and Countermeasures in Practical Application

In the practical application of AI data mining value assessment models, there are a number of challenges, which cover data bias, technical limitations, and the unpredictability of the dynamic environment. Data Bias (Data Bias) is the first factor that affects the effectiveness of the model, which is manifested in the imbalance and under-representation of the training data, which may lead to the bias of the model in the decision-making process, thus affecting the accuracy of its value assessment. For example, in the field of financial risk assessment, if the model's training data mainly comes from a particular market environment, its predictive ability under changing economic conditions will be significantly limited. In this case, the use of more comprehensive and diversified data sets for training and the introduction of Data Augmentation can effectively mitigate the negative impact of data bias on model performance.

7 Conclusion

This paper highlights the enduring theoretical significance of Marxist value theory in the contemporary socio - economic landscape, especially in the digital economy and AI era. By examining the labour theory of value and related concepts, it reveals how technological advancements redefine labour value and socially necessary labour time while maintaining labour's central role in value creation. The study integrates AI data mining technology with Marxist value theory to construct a practical value assessment model, offering a systematic approach to quantify AI's value in data mining. It also calls for a Marxist - inspired re - examination of economic issues like market volatility and income inequality to promote fair wealth distribution. Facing challenges such as data privacy and ethical concerns in AI, the paper emphasizes the need to improve the model's accuracy and practicality, balance economic benefits with social responsibility, and integrate ethical considerations in future research to drive sustainable development and facilitate the fusion of theory and practice for social progress.

References

1. Yu Ao,Wang Jianxing,Zhou Yixin,Qiao Xiaoyu,Yan Song,Feng Yufang,Marcos Elvan,Jae Lee Seok,Fiaidhi Avera.Analysis on the Educational Value of Winter Olympic Spirit in Track and Field Teaching Based on Data Mining under Artificial Intelligence[J].Journal of Sensors,2022,2022
2. T.E. Wang. The unfolding of the internal logic of artificial intelligence and labour theory of value[J]. Thought Theory Education,2021,(09):43-49.
3. Yuan Jiuhong,Hao Na. The Value Theory of Confucianism in the Perspective of Contemporary Chinese Marxism[J]. Journal of Nanchang University (Humanities and Social Sciences Edition),2021,52(01):15-22.
4. Fang Li,Cui Lei. Demand-driven big data mining model construction for healthcare[J]. Chinese Journal of Medical Library and Intelligence,2021,30(07):17-23.

5. Jinyu Fang,Yuan Ni,Jian Zhang.Value Assessment of UGC Short Videos through Element Mining and Data Analysis[J].Applied Sciences,2023,13(16).
6. Ziyue Xu,Yanfeng Gu. Analysis of labour theory of value of artificial intelligence products[J]. Continental Bridge Vision,2023,(01):66-68.
7. Yuan Rongshan.RETRACTED ARTICLE: Evaluation of the effect of pension model based on data mining[J].Annals of Operations Research,2021,326(Suppl 1).
8. Zhang Borui. Research on the deepening of Marxist labour theory of value in the era of artificial intelligence [D]. Supervisor: Xu Chunlei. Yunnan Normal University,2023.
9. Hu Yaoda. The development of artificial intelligence from Marx's labour theory of value[J]. Encyclopaedic knowledge,2023,(12):3-5.
10. Nokia launches blockchain-powered Data Marketplace for secure data trading and AI models[J].M2 Presswire,2021,
11. Chiara Minioto,Francesco Martinico,Maria Rosa Trovato,Salvatore Giuffrida.Data and Values: Axiological Interpretations of Building Sprawl Landscape Risk in the Rural Territory of Noto (Italy)[J].Land,2023,12(6).
12. Cui Peng,Luo Xuan,Li Xiaobang,Luo Xinyu.Research on the enhancement of machine fault evaluation model based on data-driven[J].International Journal of Metrology and Quality Engineering,2022,13
13. Liang Yinuo.Automated data-driven mining and learning of adoption prediction model in the United States [A].2022.

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