Research and analysis of a new model of economic development based on the context of big data

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Abstract. Economic growth is usually defined as the change in the level of total output (level of income per capita) of a country or region over a certain period of time and is often used to measure the economic strength of a particular country or region. From classical economic growth theory to endogenous growth theory, the impact of factors such as labour productivity, capital accumulation and technological progress on economic growth has been discussed. With the rapid development of urbanisation and industrialisation, the problems of resource shortage and environmental pollution have gradually come to the fore, and scholars at home and abroad have realised the problems of measuring social progress by GDP. This paper combines a certain amount of research and analysis in this field based on the foundation of big data technology, making a breakthrough and progress in a new research direction. It also lays a solid foundation for the combined research in the western field.

Keywords: Big data support; Economic development; Big data algorithms; A new model for economic development

1 Introduction

Green economic development is characterised by the following features: Firstly, development remains at the heart of green economic development [1]. Although the core of both traditional economic growth theory and green economic growth theory is development, green economic development is a new model of development, and it is a rethinking and adjustment of traditional economic development, for example [2], from pursuing economic growth in quantity to pursuing economic growth in quality, and from a sloppy development mode to an intensive development mode. Secondly, green economic development is a win-win development model for both resources and environment and economic growth [3]. Traditional economic growth theory explores the relationship between factors such as labour, capital accumulation, technological progress and output, and does not adequately consider the relationship between economic growth and resources and the environment [4]. In practice, resource and environmental issues can have a negative impact on economic growth. Green economic development is based on the equal importance of resources and the environment and economic growth, developing the economy in the development of resources and protection of the environment, protecting the environment and improving the efficiency of resource use in economic development, and ultimately achieving green economic development [5]. Finally, people and nature live in harmony. Green economic development is a continuous reflection on

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the relationship between man and nature to propose a new economic development model, whose ultimate goal is to achieve harmony between man and nature [6].

2 Big Data Architecture

2.2 MPP

Database services are provided as a whole, as shown in Figure 1. MPP has higher relational database processing efficiency compared to Hadoop, suitable for relational data migration, for self-service analysis of multidimensional data, and for building partial data marts, while Hadoop is suitable for massive data storage queries, bulk data ETL [7], and non-institutionalized data analysis [8].

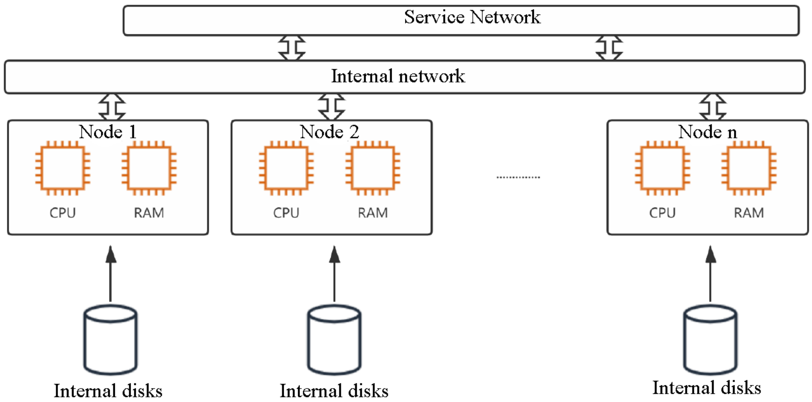

Fig. 1. MPP architecture diagram

2.2 Figure database

A graph database is a NoSQL database that is based on graph theory for its data storage structure and the way data is queried, as shown in Figure 2. Nodes are entities, such as businesses, people, institutions and other specific things, attributes are entities with characteristics, such as the name of a business [9], the ID number of a person, etc., and edges are relationships, concepts, events or things between entities, etc. It is because of these relationships that the data is linked together [10].

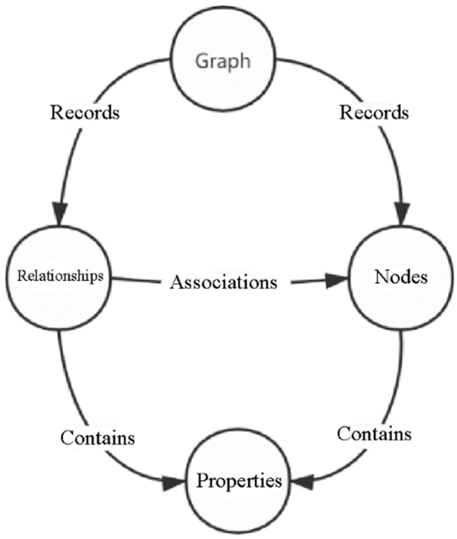

Fig. 2. Figure database storage model

Graph databases prioritise relationships, are fast to query and can be used to visualise relationships, making them very useful for highly interconnected data. The graph model provides a clear and complete picture of the intrinsic associations between nodes, whereas other forms of model link data together implicitly based on. The result is fast and accurate retrieval of even the most complex hierarchies.

3 Data mining

3.1 Common data mining methods

Currently, the more widely used data mining methods are mainly the following:

(1) Regression methods

The main regression methods are linear regression and logistic regression, which have the characteristics of simple modelling shape and easy modelling. The basic situation is given an example $x = (x_1, x_2, \dots, x_n)$ with n attributes described, where x_i is the value of x at the ith attribute, and the linear model makes predictions as a function of a linear combination of attributes, i.e.

$$f(x) = a_1 x_1 + a_2 x_2 + \cdots + a_n x_n + b \quad (1)$$

(2) Decision tree methods; (3) Neural network methods; (4) Rough set methods; (5) Genetic algorithms; (6) Fuzzy logic; (7) Association rules; (8) Clustering methods.

3.2 Overview of complex networks

Figure 3 is a simple basic graph model that can be represented by the set$G = (V, E)$, where V is the set of vertices, i.e. $V = (1,2,3,4)$ is the set of edges, i.e.$E = (a, b, c, d)$. Usually, the vertices are drawn as small circles or a point, and the vertices are connected by lines to indicate whether there are edges between them. As part of applied mathematics, graph theory had already attracted the attention of scholars as early as 1736.

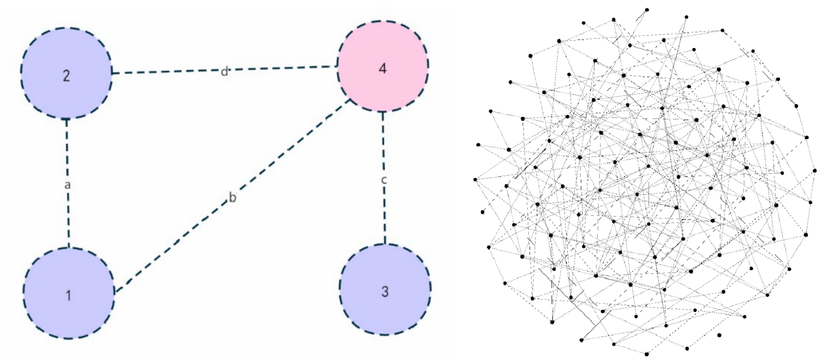

Fig. 3. Figure model.

In recent years, there have been many articles published in international journals on the theory and application of complex networks, which further indicates that complex networks have been actively explored and studied in depth. In the real world, new theories and methods are expected to be used to study complex systems, and the structural and functional relationships of complex systems have become a hot topic of discussion and active research in academia.

3.3 Common measures of complex networks

(1) Degree

In a complex network, the number of edges connected by a node is defined as the degree of that node, e.g. the adjacency matrix of a complex network is A. The node degree is calculated as:

$$K_i = \sum_j^n a_{ij} \ (i, j = 1,2, \dots, n) \tag{2}$$

(2) Clustering coefficient

It is mainly used to reflect the aggregation of nodes, i.e. the denseness of the network. It is calculated as follows:Suppose the degree of node i in the network is k_i, E_i is the actual number of edges existing between k_i neighbouring nodes of node i,the clustering coefficient formula is:

$$C_i = \frac{2E_i}{k_i(k_i - 1)} \tag{3}$$

(3) Diameter of the network

The network diameter provides a good measure of the propagation effectiveness of a complex network and is the maximum distance between network nodes.

(4) Average path length

The average path length reflects the degree of separation between nodes in a complex network, as well as the degree of aggregation of the overall network. The two node spacing is actually the number of edges that two nodes have in their shortest path. The average distance between each node can be determined along these lines. The calculation formula is:

$$L = \frac{1}{n}\sum_{i,j=1}^{n}\frac{d_{min}(i,j)}{n} \quad (4)$$

3.4 Community discovery and algorithms for complex networks

(1) Community Discovery Algorithm

Society discovery focuses on dividing a complex graph into multiple mutually separated subgraphs by mining the node connectivity relationships in the graph, with the subgraphs being as closely related as possible internally. Two of the more popular algorithms for association discovery in large networks are currently available: splitting and coalescing algorithms.

(2) Louvain's algorithm

Specifically, after the association is divided, the network is compared with the matching zero model and the analysis results are used as a basis for determining the quality of the association division, the Louvain algorithm expresses the degree of community network division in terms of the modularity Q, which takes values in the range [0,1], the higher the value the better the classification degree. The modularity calculations for Louvain's algorithm are publicized as follows:

$$Q = \frac{1}{2m}\sum_{i,j}[A_{ij} - \frac{k_i k_j}{2m}]\delta(c_i, c_j) \quad (5)$$

The incremental value of modularity ΔQ (delta modularity) is a criterion calculated by Louvain's algorithm to determine whether a node will join another community.

In theory, EKC reveals the relationship between economic growth and environmental quality, and in practice, EKC reveals that economic growth is the basis or prerequisite for improving the ecological environment, a theoretical development that underpins the internal logic of this study. Urban land provides essential space for various economic activities.As shown in figure 4.

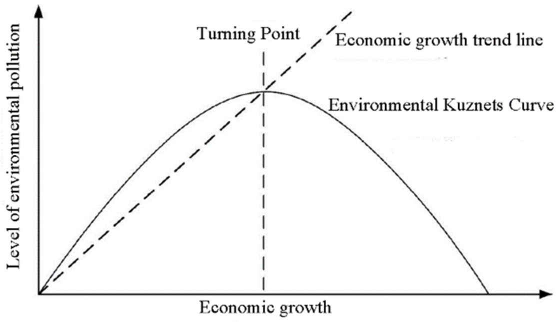

Fig. 4. Environmental Kuznets Curve

4 Conclusion

This paper focuses on the basic theories and related technologies needed for the research, including the theories of big data architecture, data mining and complex networks, and gives a brief introduction to each of them. Green economic development theory.

How can green economic development be achieved? This paper argues that government, business and consumers are the main actors in the process of green economic development, so achieving green economic development is about recognising the roles of government, business and consumers in green economic development.

Firstly, at government level. As the manager of economic activities, the government plays an active role in guiding the development of a green economy. In the process of green economy development, formulate and improve environmental protection laws and regulations and environmental supervision system, improve the green economy development system and sound green economy assessment standards. Secondly, at the corporate level. As the main body of economic and social production activities, there is no doubt that enterprises consume large amounts of energy as well as other resources in the production of their products, producing large amounts of solid waste, gaseous pollutants, carbon dioxide, etc., which have a direct impact on the ecological environment. Finally, at the consumer level. The role of consumers differs markedly from that of government and business. The government is the leading force in driving the development of a green economy, enterprises are the mainstay in driving the development of a green economy, while consumers are the basic force in driving the development of a green economy.

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