EAI Endorsed Transactions
on Scalable Information Systems
Research Article EAI.EU

Visual Knowledge Graph Construction of Self-directed Learning Ability Driven by Interdisciplinary Projects

Xiangying Kou[1,*]

[1] Department of Public Courses Xi'an Traffic Engineering Institute, Xi'an 710300, Shannxi, China

Abstract

INTRODUCTION: The application of interdisciplinary information technology is becoming more and more widespread, and the application of visual knowledge mapping in the process of students' independent learning is also becoming more and more important; therefore, in this context, takes the history discipline as a starting point to study the construction of visual knowledge mapping of students' independent learning ability under the drive of interdisciplinary projects.
OBJECTIVES: To enrich the means of student independent learning aids in China's history discipline and enhance the modernization level of China's history discipline construction; to solve the problem that student independent learning ability under the drive of China's interdisciplinary projects can not be visualized and observed; to further improve China's distance education environment and to enhance the educational capacity of the history discipline.
METHODS: Firstly, the relevant modeling uses a visual knowledge map. Secondly, the neural network model assesses students' independent learning ability in history learning. Finally, the convolutional neural network model is used to assess the efficiency of the knowledge map.
RESULTS: The Sig and Tanh function models have better robustness, and the ReLU and PReLU functions have weaker interdisciplinary driving performance. However, the iterative Knownledge1 and Knownledge2 models have better robustness of the visualized knowledge graph.
CONCLUSION: In studying history, the interdisciplinary, project-driven, and independent learning ability of students could be more vital, and our country should vigorously develop new information network technology to improve the status quo of history discipline education in China.

Keywords: interdisciplinary projects, self-directed learning, visualization, knowledge mapping

Received on 17 October 2023, accepted on 21 February 2024, published on 1 March 2024

doi: 10.4108/eetsis.4920

*Corresponding Author. Email: 18992826326@163.com

1. Introduction

Historical character chronology, as a special kind of biographical material, is essential in studying biographical material. The historical chronology model of character knowledge formed through the research goes against the traditional idea of character chronology research. However, it also expands the scope of the application of character chronology and paves the way for the joint research of literary characters and historical characters(Calligaro et al., 2022). This also has specific theoretical and practical significance. Interdisciplinary research of data association technology and history disciplines is an essential trend in the research of digital history disciplines. Applying digital historicism and knowledge mapping thinking methods to the digital chronology of historical figures is a new attempt to combine knowledge, digital history technology and biography. The new approach proposes to mark the historical knowledge of the chronology, which is further enriched by historical computerization and thematic organization(Fujitani et al., 2023). Supplementing the knowledge map of historical figures by visualizing their biographical resources can effectively increase the usage of historical figures.

On the other hand, digitization research of genealogical data can solve the technical bottlenecks in developing and using genealogical documents. In addition, extracting historical figures and chronologies optimizes the integrity of historical figures, facts, and scientifically compiled temporal genealogy. It realizes the goal of "no-threshold" knowledge sharing of historical figures' development. This is significant for deepening the multidisciplinary research of historical personality chronology. On the other hand, the intellectual mapping of historical figures provides technical imagination for transforming traditional history(Hallinger & Kovaevi, 2022). In this paper, the author analyzes the types of resources, such as regional knowledge, human life and literature, and describes the relationship between the resources in the form of graphs and images to meet the user's demand for convenience and intuition of information services, and further develop the data visualization, data sharing platform and knowledge mapping.

With the advancement of digital history, traditional human resources research is gradually shifting toward digitization and computerization to reinvigorate human resources through historical personalities' knowledge and implications (Dinar et al., 2022). Therefore, digital research and temporal reconstruction of historical figures are crucial for deepening innovative research on historical figures' time series, and data mapping is an essential breakthrough in data reconstruction research. It has a high degree of knowledge organization and semantic compatibility, enabling one to psychologically reconstruct the textual content of historical personages(Ahmadi et al., 2021). In this paper, the author uses case studies and data mapping techniques to reconstruct the historical timeline of characters. Based on analyzing historical resources and user requirements, the construction of a historical persona knowledge map is discussed, including information acquisition, body model construction, and knowledge map recording(Campos et al., 2021). Finally, the practical application of data mapping of historical figures is realized, which provides new insights for digital research on historical figures and personalized information services for users.

The main work of this visual knowledge graph construction is as follows:

(1) This paper focuses on analyzing the attributes of the source data using text analytics methods (e.g., content analysis, social media analysis, etc.). , in-depth analysis of the source data to reveal the characteristics and intrinsic connections of the research case resources(Jafari et al., 2022). Based on this, data units will be selected and standardized to store age resources to create standardized datasets and provide data units for future data mapping modeling.

(2) This work creates an ontological data model of a chronology of historical figures and completes the original graphical model of a chronological map of historical figures. The analysis results based on data features and historical timelines help define the relationships between different data units and describe the OWL language model's hierarchical structure and conceptual connotations. Properties and data attributes defining the relationships between the concepts of the historical timeline of characters complete the character timeline resource description system(Szombara, 2021). An ontological model for the knowledge of historical personality chronicles is introduced and justified.

(3) Analyze users' needs for accessing data resources and biography services, conduct storage and visualization of historical biography knowledge graphs, and create appropriate data access modules together with the query function of the graphic database Cypher to realize a data collection and visualization platform based on the chronology of historical figures, to broaden the channels for researching digital signs and chronological images, to improve the utilization rate of the resources of the chronology of historical signs and chronology, and to promote the resources of historical signs and chronicle in-depth exploration and development.

(4) According to the data requirements for the instantiation of the genealogical data, the text of Zhou Lipo's Annals is selected as the core data source, which is used as the material case for model construction and instantiation, combined with the analysis of data such as character relationship networks and historical activity locations. The Cypher statement of the graph database Neo4j is used to converge the CSV-format annals data into the database to complete the CSV-format data storage, visualization and Knowledge reasoning for Zhou Lipo's Annals(P. et al., 2021). Storage, visualization, Knowledge reasoning, and finally, the construction of the knowledge graph of the annals of historical figures.

2. Related work

Historians are an important cultural group reflecting the characteristics and conveying the spirit of the times and have profoundly impacted the study of the historical process(Prokop et al., 2023). French researchers have long believed that literary development is rooted in three factors: race, environment, and time. The chronology of historical figures is a genealogical resource composed of three elements: person, environment and time(Siad & Rabi, 2021). It is a vehicle for the life of a historical figure and a vital scientific resource for studying the evolution of time from an individual's point of view. It enables the reader to view information about historical figures in three dimensions and present their accomplishments in the field from various perspectives.

In today's world of digital ubiquity, historical figures face many challenges, such as popularity, difficulties of digital transformation, and the choice of editions. They will likely be supplemented by catalog-related resources later and secondary digital research development. Research on academic genealogy and digital transformation of bibliographic data is still in the research stage(FreiburgFreiburgGermany, 2021). Research on digitizing literary resources faces technical problems, while a methodological system still needs to be established to research serial text resources. There are difficulties in developing and using textual resources, and new technologies are needed for interpretation and recovery.

The most critical techniques for displaying information are data modeling, integration, retrieval, storage and management. This research focuses on data mapping methods and their interdisciplinary applications(Liu et al., 2021). In 2016, several researchers summarized the most important methods for data mapping, analyzed examples of data mapping applications, such as intelligent research, social media, deep questions and verticals, and suggested that data mapping should consider open topics. In particular, the accuracy of data retrieval, the database's stability and the scenarios' scope (Lapworth, 2021). In addition, some researchers have analyzed approaches related to data mapping inference and Q&A systems to identify development issues related to data mapping inference and Q&A approaches. To effectively present knowledge mapping tables, it is necessary to prioritize data when creating a Q&A system for knowledge mapping tables.

Research on static data distortion in information display technology gradually shifts to large-scale, unstructured, dynamic, algorithmic and intelligent research. Some researchers have comparatively analyzed unstructured multimodal data organization, large-scale dynamic mapping and prefabricated models, data updating, and neural symbolic reasoning and concluded that multimodal knowledge mapping is a general technique(Chen et al., 2021). The data survey shows that applying intelligent systems techniques is an essential trend in scientific and industrial research. In the future, there is a need to combine the techniques of unstructured data, data representation, and modeling algorithms to expand the application scenarios of data representation(Pantiukhin et al., 2021). In addition, some researchers have raised the issues of high error rates and unclear interpretation of information presentation and retrieval, ensuring information presentation stability and accuracy (J. et al., 2021). In addition, some researchers have conducted a joint practical study of knowledge mapping techniques and other digital technologies, proposing a digital system based on formalization, rediscovery and removal of objects, fusion and creation of human subjects with finite elements. He also studied the construction of knowledge maps for the web-based on ontology techniques. Several research organizations have argued that the representation and recognition of information in the semantic web can be achieved through ontological Knowledge (Meadow, 2022). The abstract summarizes the application of CiteSpace software in digitizing old books, using copyright management, database structure, the connection between digital history and the digitization of old books, and the digitization of old books as research paradigms.

3. Introduction to the research methodology

3.1 Construction of visualization maps for the discipline of history

These features are related to the representation of historical memory. They can, therefore, be combined with basic methods for extracting features from domestic and international images to process grayscale samples for theoretical study(Rodríguez et al., 2022). Therefore, a method for extracting historical memory features based on the grayscale coexistence matrix (GLCM) was chosen to separate and analyze the feature vectors of these samples, which provides a theoretical basis for detecting the surface damage of historical memory in the next stage.

Historical memory is a natural property inherent in matter and reflects, to some extent, the division of grayscale and structural knowledge in an image. The gray coexistence matrix method, also known as the transition matrix method, is used to characterize the history of an image record as a probability function of gray structure repetition(Junk & Blatter, 2022). It is defined as follows: the distance between pixels in the *d* direction is *d*, and the prevalence of gray levels i and j is P (i, j, D). The probability of a pixel switching relative to some place in space is computed to obtain a gray parallel matrix, which then gives important statistical properties to describe various historical memory data.

The gray coexistence matrix provides statistical information about the historical memory but cannot be used directly as an attribute of the historical memory. In practical applications, it is necessary to calculate the historical characteristic parameters of stored images based on the gray coexistence matrix (so-called square statistics). This paper selects contrast, entropy, quadratic angle, inverse momentum dispersion, heterogeneity and unity as the characteristic parameters of historical memory. The logarithm p (i, j, d, the) of the labeled gray levels i and j.

$$con = \sum_{j=0}^{n-1}\sum_{i=0}^{n-1}[(i-j)^2 P(i,j,d,\theta)] \tag{1}$$

$$ASM = \sum_{j=0}^{n-1}\sum_{i=0}^{n-1}[p^2(i,j,d,\theta)] \tag{2}$$

Where con is a comparative measure for historical memory statistical information; *ASM* is a judgment of the diagonal triple matrix energy.

Contrast measures image resolution, local data variability, and notch depth and represents the moments of inertia near the main diagonal matrix, where the grayscale layers are parallel. Another angular torque, energy, represents the sum of squares in the conformal matrix. The second aspect reflects the extent to which the historical memory is divided. The energy value is low if a close historical memory changes with some regularity and the elements have similar values. If damage prevents the transformation of a historical memory, the energy value may be higher. Entropy measures the randomness of the historical memory data. The higher the entropy, the more complex the information about the image's historical memory. Entropy is highest in cases where there is no apparent historical memory or excavation; it is weaker in cases where the historical memory changes abruptly due to learning or historical memory changes.

The inverse discretization, the reference matrix, reflects the historical memory's brightness, local variations, and regularity. Higher dispersion moments are required if different regions of the historical memory have uniform or optical memories and the memory is clean; otherwise, lower dispersion moments are required. Heterogeneity indicates an image's richness and extent of historical memory data (P 谩 ez Ubieta et al., 2023). The higher the density of historical memories in the historical memory, the more its heterogeneity and data damage (e.g., nail aging and cracks) can significantly alter the heterogeneity. Mean GLCM is the weighted average frequency of the gray values of pixel (i or j) and all pixel combinations, which is the expected value of a separate random variable used primarily to record historical data. It is used to measure the order of knowledge in historical memory. By extracting the historical memory vectors from the images and combining the different parameters of the historical memory attributes, the author determined a common attribute vector corresponding to each image to centralize the historical memory attribute samples. When common feature vectors are obtained for an image sample, the list of common feature vectors is labeled as zero; positive samples are labeled as one and negative samples are labeled as zero.

3.2 History Learning Neural Network Model

The human brain is a complex structure containing billions of nerve cells, including cell bodies, axons and dendrites. The cells communicate with each other through synaptic connections. Inspired by this, an artificial neural network is proposed in which the inputs, intervals and outputs correspond to biological neurons of dendrites, axons and axon heads.

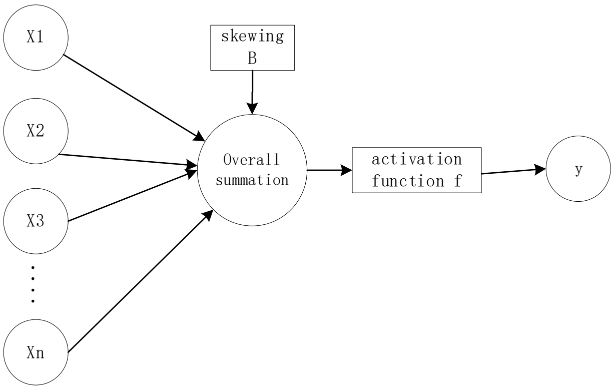

Figure 1. knowledge mapping summation process

The model-specific Equations are as follows:

$$y = f\left(\sum_{i=1}^{n} w_i x_i + b\right) \quad (3)$$

The Equation x_i is specifically the range of the signal output. The weight is the calculated value of TOPSIS $w_1, w_2, w_3, w_4 ...., w_n$,Multiply these inputs by their weights, add the external B, adjust the inputs to the activation function, and finally get the Y output of the neuron through the activation function. The complete neural network consists of several layers of neurons, also known as multilayer sensory neurons (MLP). The MLP consists of three parts: input, protection and output. The input level (often called layer zero) gets input data from the network. Many other hidden layers become challenging and result in the last layer. The sum of these layers represents the depth of the network, and hence, the depth of science exists. The nodes in the same layer are independent of each other, and the nodes in each layer transmit their output to all the nodes in the next layer, forming a tight connection, hence the term complete network neural network.

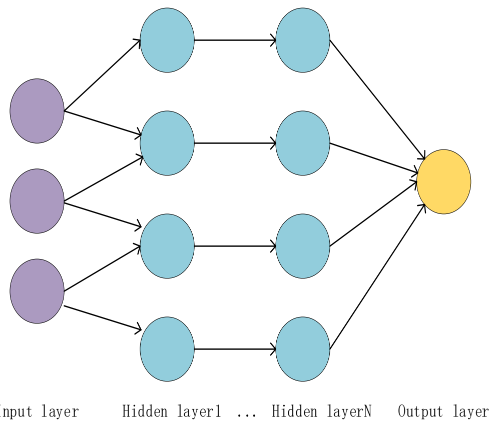

Figure 2. knowledge mapping layer relationships

3.3 Convolutional Neural Networks for History Teaching

When fully connected neural networks process data (e.g., images and speech) due to an overabundance of parameters, the computational load can be too high, eventually leading to overload and other problems. Based on these improvements, collapsible neural networks use folding, aggregation, and other features such as weight distribution and local connectivity to improve the ability to search for network attributes and efficiently identify target attributes. CNNs have been widely used in various imaging areas in recent years due to their efficient data retrieval and processing capabilities. The network structure consists of five main components: the input layer, the troposphere, the connectivity layer, the active function layer and the total connectivity layer.

The folded input layer of the neural network acts like the human eye, using the original image as input. Then, some preprocessing is done at the input, such as normalizing and resizing the image to wrap the neural network to improve the image processing. There is no doubt that the spiral layer is the main component of the whole spiral layer. It is to retrieve data from the input image using the convection function. The neural network algorithm is a filtering process. A filter (also known as a transformation kernel) is multiplied in the localized input region, and then all the multipliers are summed to get a new value. For example, if the input image size is 5 x 5, a convolutional kernel removal function is used where the distance between each slide is 1. The appendix layer is standard in a convolutional neural network and is usually followed by a convolutional layer as a sampling operation. The main task of the PUT level is to reduce the resolution of the functional image, remove unnecessary data, and reduce the parameters related to computation to speed up online learning. There are usually two types of connection functions: maximal and average. The maximal connection function is derived from the maximum number of regions, while the average connection function is derived from the average number of regions. For example, if the fourth input image is 4x4, a 2XLink with two scroll bars and a distance of 2 between each cursor is used.

The activation function cannot be ignored. Its purpose is to improve the network performance by adding non-linear factors. Suppose there is no activation function in the network, regardless of the number of hidden layers. In that case, the output signal of the neuron is a simple linear function, which loses the advantage of deep neural networks that cannot handle more complex data and limits the network performance. For example, if the author performs facial recognition, the network input is a facial image with no function, and the tropospheric output is linear. Modeling complex patterns and image shapes for correct facial recognition is impossible. Four common activation functions are used in neural networks: the S-shaped function, the Tan function, the Reynolds function, and the Prearu function.

$$f_{sigmoid}(x) = \frac{1}{1+e^{-x}} \tag{4}$$

$$f_{\text{Tanh}}(x) = \frac{e^{x}-e^{-x}}{e^{x}+e^{-x}} \tag{5}$$

$$f_{\text{Re}LU}(x) = \max(0, x) \tag{6}$$

$$f_{P\text{Re}LU}(x) = \max(0.01x, x) \tag{7}$$

Equation (4) ~ Equation (7) function expressions for Sigmoid, Tanh, ReLU, and PReLU functions.

There is an input function in Equation x, and max is the function that takes the maximum value. This S-shaped function is similar to a "narrow" function, which compresses the input signal in the probability range 0-1, making it particularly suitable for binary classification. The Graph shows the S-shaped function in the range 0-1. If the input X is at either end, the output required for retransmission is close to zero, which makes the online learning process more difficult. When the input value is close to zero, the curve is colder than the S-shaped function, which helps to converge during the learning process, but the gradient also disappears. When the feed goes through a region, the neuron is stimulated and acts like a RELU. If the input is less than 0, the neuron is inactive, and the output is always 0. Compared to the first two activation functions, RELU has a fast computational speed and convergence, making it suitable for training large neural networks. The derived function remains constant at point 1 if the input is positive. The disadvantage is that if the input is less than 0, some neurons remain inactive, and the output is always 0, reducing the neural network representation. This bug has been fixed using the preclusion function. Suppose the input value is less than or equal to 0. In that case, the output becomes a linear function skewed towards 0.01, which activates the inhibitory neurons to some extent, improving the network performance and creating more parameters and computational complexity. Therefore, the author must choose the most appropriate activation function according to the specific working environment for better results.

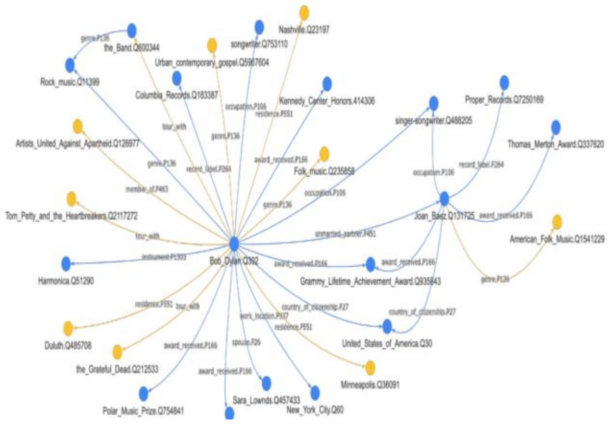

Figure 3. knowledge mapping results of Zhou Lipo's chronology

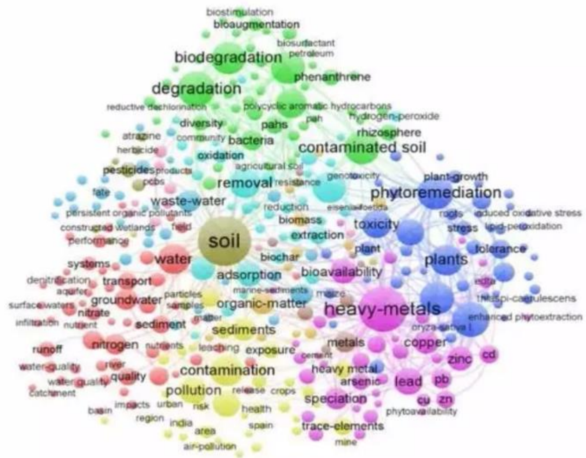

Figure 4. knowledge map of common natural sciences

4. Visualize the results of knowledge graph construction

4.1 The process of constructing a knowledge graph for history visualization

information mapping can be combined with the digital history paradigm as an effective digital technology to allow historical people to re-imagine information as information resources. Based on resources such as historical background, cultural fields, and revolutionary activities, this study utilizes data mapping technology and digital history research methods to integrate the time resources of historical figures and construct an ontological model for presenting the time resources of historical figures. New ideas for studying the chronology of historical figures.

The content and characterization of slow data, chronology of historical figures, field categories and development measurements are condensed mainly through online and literature research. The author developed a methodology for constructing applied sciences that explains in detail the technical means of presenting the information, the framework for presenting the information, and the storage and administration of the graphical database.

By digitizing paper index texts, the author classified index content data units and categorized index texts into categories such as personalities, historical events, friends, and social relations. First, the author analyzes the digitization of historical personality data and the principles of building an ontological model of historical personality and temporal resources. The combination of historical personality traits and calendars. Secondly, the historical personality science conceptual model was constructed chronologically using protected software to determine the ontological model of the historical personality knowledge map in temporal resources regarding temporal order, conceptual order, relational order, and attributes of data objects and data units. An ontological model of the temporal Graph was also developed. Finally, the temporal data were categorized and stored in CSV format, resulting in structured data in a graph database.

Based on the data requirements of the sample data for the period, the appropriate text was selected from the master data source and used as examples and exemplars of the model structure. The CSV time grid data was imported into the Cypher Statement's Neo4j graphical database, which complemented the storage, visualization, and presentation of the CSV-era data, ultimately creating a historical digital data map.

Java was used to create a visualization platform to search historical data formats in chronological order, enabling data integration and semantic thinking and providing a transformative platform for public users without the need to learn professional expressions from surveys. It allows displaying interpretive queries directly in a graphical database and visualizing data by entering it locally in chronological order.

4.2 Integration of history and ontology techniques

With the semantic character of information resources, the discipline of digital history is becoming increasingly mature, and its research fields are gradually expanding into different areas of the history discipline. In semantic research, the ontological approach can provide a more comprehensive and intuitive technical way to study human digital associations. Therefore, this paper applies ontology technology and related theories and combines ontology technology and digital history methods to study the ontology construction of the historical documentary resources model. It can promote the transformation of historical documentary resources to multidimensional three-dimensional digital resources, realize the resourcefulness and computerization of historical marking chronology, further reveal the semantic relationship of historical marking chronological resources, and enrich the temporal connotation of historical marking. Provide new ideas for organizing historical documentary resources. The concept of ontology originates from the field of philosophy and is mainly related to the formalization of the relationship between subjects. The primary ontology category is "existence," which systematically explains objective existence. Generally speaking, ontology is a document that defines the relationship between concepts to reflect the relationship between individuals.

Several studies have been conducted using different classification criteria, both nationally and internationally. In general, the most crucial classification methods are parent, domain, target and application classification:

High-level ontology: used to describe general concepts reflecting general knowledge in the real world, with a wide range of functions that provide a broader exchange of ontologies.

Ontology Scope: The specific range of data used to describe the relationships between concepts in the domain, to have unique data, and to reuse ontologies from the domain.

Task body: intellectual reasoning used to solve specific tasks. It mainly describes the relationship between concepts in specific tasks.

Application Corpus: is used to describe a specific application, including all terms and relations of the application, as well as the concept of an ontology or task ontology of the defining domain. It is limited in scope to application requirements and is an ontological model for applications and requirements.

The ontological approach to construction varies from discipline to discipline. Standard construction methods include the skeleton method, the seven-segment method, the TOFF method, and the observation method.

4.3 Knowledge Graph Technology Path

The digital historicist approach combines new technologies in the discipline of history, such as information technology, semantic technology and intelligent mapping technology. As a representative of digital history, computer graphics technology contributes to digital history's digitization and the symbiosis of knowledge-sharing and research mechanisms between the "digital" and the "historical" by organizing superior semantic skills. In addition, the field of digital history partly links the creation and transformation of new knowledge to the archiving process of human resources. Intelligent search and mapping technologies can play a role in the logical organization of human resources, which are transformed and developed more rigorously and intelligently. In short, data mapping technologies can explain the relationship between the digital and the historical disciplines and provide technical support to research organizations in various historical disciplines.

The knowledge graph is a structured database of semantic descriptions, a set of related concepts, topics, relationships and events based on a data model. A broadly modular representation of data unit data creates an integrated, coherent, analytical and generalized data structure. Data mapping can also provide structured querying and data analysis, and its semantic properties can be used to interpret and infer data to retrieve data from unstructured data.

The main feature of the Knowledge Graph table is the use of RDF triangles to represent and store data. RDF triangles' interoperability, compatibility and standardization meet knowledge Graph modeling data requirements.RDF and OWL can be converted to simplify large-scale image creation, data integration, recycling, and management functions. The RDF Resource Description Framework can also describe all tagged data and data, making the cell relationships more intuitive. In particular, the RDF resource description structure uses multiple entities, predicates, and objects to represent real-world nodes, entities, and partial relationships.

The creation of knowledge graphs is usually associated with top-down technology systems whose internal structure includes information retrieval, information fusion, and knowledge-based reasoning. Learning requires identifying topics and breaking down relationships. Knowledge integration refers to the uniqueness and integration of heterogeneous knowledge, leading to the integration of knowledge and diversity among knowledge. Intelligent reasoning requires new facts from existing knowledge of relationships between subjects. The entire process of mapping information involves finding new facts.

In particular, the bottom-up building process starts by separating elements, relationships and attributes of unstructured data sources, bringing them into the database to create a data layer, integrating the knowledge into the underlying layer, and finally creating a knowledge graph model. This approach is more suitable for resources with large amounts of static data that eventually bring topics into the knowledge base to store visual information and data.

There are significant differences in the choice of construction methods due to the differences between the Common Knowledge Graph and the Web Knowledge Graph. Standard knowledge graphs are mainly based on bottom-up models with precise, internally relevant data, most of which are static. Knowledge mapping tables in this domain combine top-down and bottom-up models, creating knowledge mapping tables with static and dynamic data that can be used with various data sources. Based on the textual features of historical figures, the authors used a top-down approach to map the knowledge graph of historical figures.

Figure 5. knowledge graph character relationship construction path

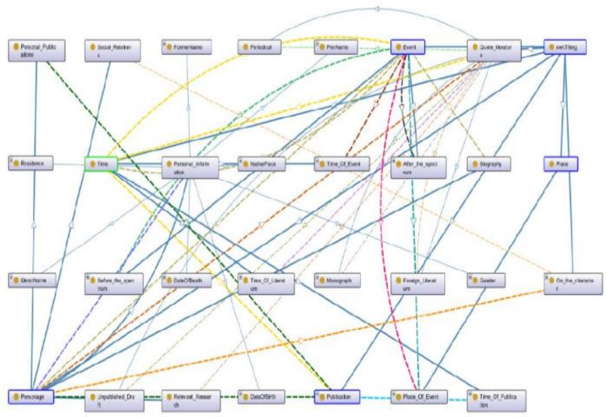

Figure 6. knowledge map visualization path (1)

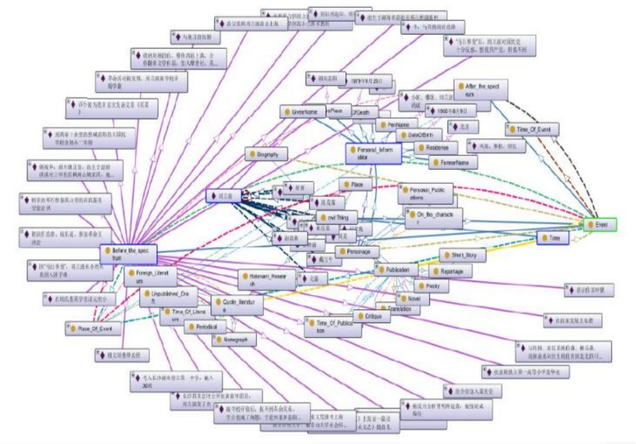

Figure 7. knowledge map visualization path (2)

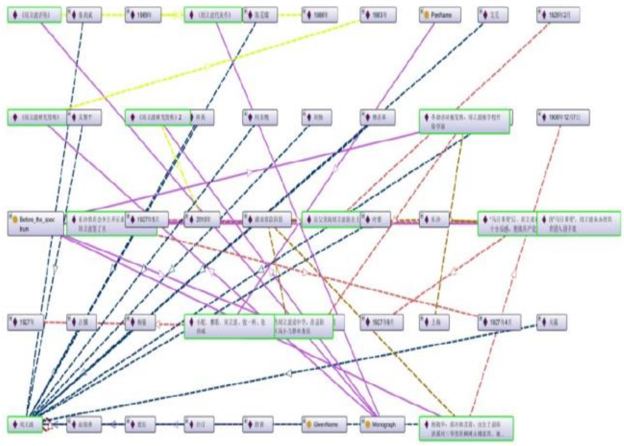

Figure 8. knowledge mapping visualization path (3)

4.4 Historical Visualization Knowledge Graph Storage

Currently, OWL and RDF files are the knowledge representation languages used for knowledge graph shape execution, but OWL is not suitable for large-scale data storage. Generally, knowledge graph shape storage is mainly based on relational databases and graph databases, and their combination can provide knowledge graph shape storage. In relational databases that store data in knowledge graph tables, it is necessary to decompose the relationships of the knowledge graph tables, convert them into a tripartite format, i.e., display unit relationships, a tripartite RDF data format represented by topics, predicates, objects, and GTs, and then save them. There are currently four methods for storing relational knowledge mapping tables: data triangles are stored in one table, and all RDF triangles are stored in one table. This method is simple, intuitive, and convenient, but it is unsuitable for storing extensive data, which can lead to degradation of database performance and accuracy. Due to the diversity of unit attributes, horizontal memory can quickly produce many zeros, resulting in asymmetric attribute data, which affects the loading and updating of relational database data. Save multiple attribute tables: Sort objects by attributes and save them in different tables by attribute categories to improve data query performance. Since cell attributes are not independent, multiple attributes may cause problems when merging or consolidating multiple attribute tables; if data is processed similarly and multiple attribute tables are stored in different ways, it is easy to blur these attributes. Vertical Segmented Records: splits the data triangle into tables with only two columns. The first column represents 1, and the second represents the attribute's value. Splitting the data triangle into multiple tables solves the problem of null attribute values. However, due to the large number of tables, the problem of joins between tables still needs to be solved, and it is difficult to change and update fixed list values.

Graph databases are based on relevant data stored in graphical form with intuitive data query and display capabilities. The graph databases used to store data cards are Neo4j, Graph Engine, AllegroGraph, GraphDB (formerly known as Owlim), Gstore, and Virtuoso.Neo4j is user-friendly, and the mapping relationships of the databases do not require the reconstruction of entity-attribute relationship tables to convert ontology model data. In addition, it can convert Neo4j graph database Cipher queries to SPARQL queries, which is very convenient for researchers familiar with SPARQL queries. In this paper, the author uses the Neo4j graph database to store and visualize knowledge graphs of historical figures. The interactive Neo4j interface and Cypher query language perform database search and intelligent reasoning functions.

In the era of big data, the application of knowledge graphs has transcended traditional disciplines. Generally speaking, the first purpose of the knowledge graph table application is to improve the productivity and efficiency of downloading, ensure the efficient use of unstructured and structured data and data resources, and reduce the burden of downloading users. With the development of knowledge graph technology and artificial intelligence technology, knowledge graphs can realize large-scale data storage and management more conveniently and efficiently, breaking the technical bottleneck in traditional research fields. Knowledge graph tables can store and utilize resources such as genealogy platforms, cultural heritage relationships and business information organizations.

A knowledge mapping table is a block of data combined with graphics and images, forming a network of data units in the field. It will be combined with technological tools such as digital search technology, deep learning and geographic information systems to organize and modify the entire information resource according to actual needs, helping to discover and explore new information from the information resource and deepening the discovery of new information.

Logical reasoning and argumentation functions in charts can show relationships between people on a small scale in vector space. Comparing and analyzing the vector space can be used to determine correlations between units. The integrity function of the knowledge graph provides a basis for the semantic units of information integration, provides a reasonable data structure, solves the problem of data heterogeneity, and avoids data loss due to structural differences in information integration.

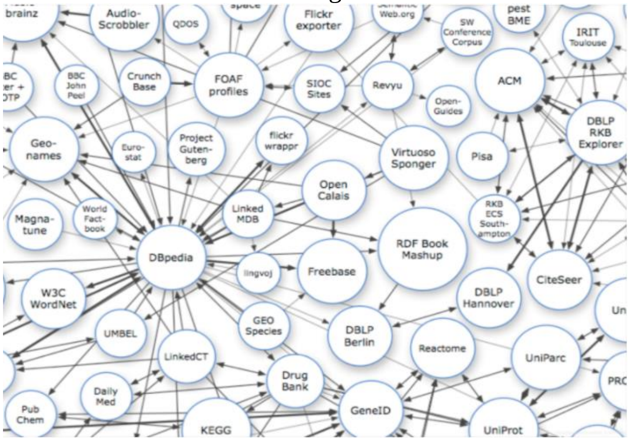

Figure 9. results of knowledge mapping visualization (1)

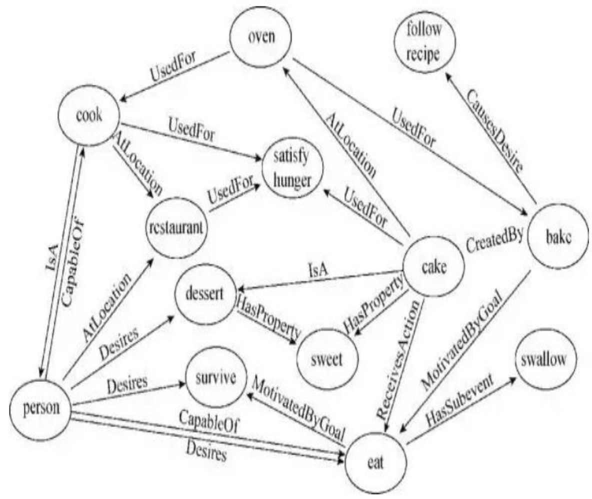

Figure 10. results of knowledge mapping visualization (2)

4.5 Implementation of the Historical Knowledge Graph

A knowledge graph table is a data storage method based on a graphical data structure, which differs from traditional relational databases. Using graphical databases to store knowledge graphs of historical figures helps in the deep digital development of knowledge graphs, such as displaying, asking for, answering, and obtaining information. Based on the storage and visualization of historical knowledge graphs, the consistency and structure of data storage in some graph databases and the representation of query functions.

The syntax module will import the data ontology model into the map database. Import all occurrence data to create a complete datastore model, then install the syntax plugin using semantics. Introduction to RDF: Import RDF data into a graph database, define nodes and relationships using graph data request commands, and perform backups and visualizations of historical digital knowledge graph tables. When importing data, it is easy to detect classification errors in object attributes. If the data objects and attributes are incorrectly categorized, the data is deleted and re-imported, and the corresponding relationships are removed, which requires copying a large amount of data.

Data mappings are saved using the Neo4j Import Manager tool. The historical graph-based ontology data model uses CSV files from physical units to create relational tables for each node and uses import commands to store the historical graph knowledge map in a graph-specific database. It offers better performance than the first option and is more suitable for the average user. Data validation can also be performed directly from an Excel spreadsheet, which reduces the data error rate and makes importing CSV files more effortless to understand and implement. It can also be used to supplement the ontological model with categories that are not included in the object and data attributes of the ontology model and have missing roles.

Based on the above comparative analysis, the authors chose another option to supplement the Historical Marker Chronology data table. First, CSV relationships are constructed in the table, and ontology classes, example names, and object attributes are explained in terms of how they correspond to ontology relationships. For example, a character's attitude toward a song is "personality" and "hate," while a character's attitude toward an event is "personality" and "hate.". "The corresponding data attributes are "identification," "identification," "release," "identification," etc. Here is an example of boundary table data, where type denotes the name type/boundary, and end denotes the beginning of the node, which is the identifier given when searching for the object above.

The digital history research paradigm provides new research ideas for traditional resources in the era of historical figures, or various technical means can be used to realize human data's rich spatial characteristics and semantic relations. The construction of online platforms for digital chronographs has gradually begun, and the use, academic value and dissemination value of digital chronographs have significantly increased. However, most existing websites are primitive platforms from which users can only extract digital resources and cannot provide graphical interpretations. Therefore, this paper creates a knowledge graph of historical figures, showing their semantic relationships and data networks so that users can intuitively discover the information hidden behind the timelines of historical figures. Users can search and download data without learning specialized database survey terminology and obtain practical and intuitive information about the chronology of historical figures in the digital age.

The platform was developed using Java algorithms. It can act as a local data store and browser port to retrieve time-based data and visualize raw data for local users. There are some limitations in using this feature since the downloadable platform focuses on collecting chronologically mapped knowledge graphs and visualizing the use of knowledge domains and models to learn the knowledge graphs.

First, using the data science and knowledge graph models, create an input field to serve as the controller node for request categorization. People can view Cyper query expressions corresponding to the graph database through the appropriate nodes (e.g., People, Events, Jobs, Quotes, and Locations) to ensure the database is stored on the graph display. Users can enter relevant content through the page and display the appropriate Cyper request in the conversion window, which then goes to the graph database for upload. The final learning result is displayed in the graphical database. This feature only allows navigating to the graphics database, i.e., clicking the last button on the menu and then going directly to the graphics database for download. However, the graph database must first be run in the background, which does not allow the graph database to be loaded internally. The concept of consistent relationship recovery is consistent with the concept of node recovery. The path to build a knowledge graph of character relationships is shown in Figure 11.

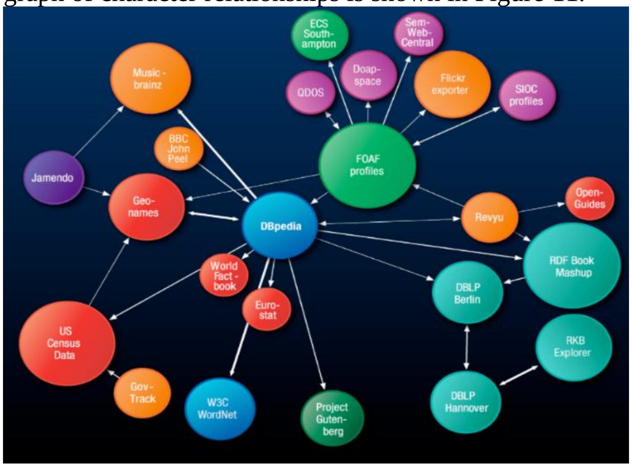

Figure 11. the path of constructing the knowledge graph of character relationship

5. Conclusion

With the development of digital human skills, the integration of human resources and information technology is getting closer and closer. How to transform China's human resources into digital resources and create an efficient information distribution chain is a profound question. Firstly, the prospect of the development of knowledge mapping technology is given. At present, the research on mapping information technology is very mature. Some researchers even break the original technical path, enhance the technical strength of knowledge mapping and promote the intelligent transformation of knowledge mapping technology. Secondly, knowledge mapping and human resources will be integrated. Due to the impact of digital history, knowledge mapping is gradually becoming an essential technical support in digital history due to its robust data compatibility and ability to reconstruct and interpret rich knowledge. More and more researchers in the discipline of history are studying the integration of the discipline of history with knowledge graphs. The third area is HRT research. Currently, mapping history needs to be deeper, but historical data mapping technologies play an essential organizational role in deepening historical knowledge and data. This could lead to technological breakthroughs in history, improving digital interpretation and traditional human resources. Finally, the digital transformation of historical figures.

As resources from the era of historical figures continue to be developed, biographical material from different dynasties has attracted new attention, making resources from the era of historical figures a featured object of digital historical research. It makes possible the study of knowledge-painting techniques in digital historicism and the development of historical temporal and stylistic resources. This paper aims to create timeline information about historical figures. Based on the research mentioned above and problem-solving, the information about the temporal resources of historical figures was reconstructed and digitized. Starting from the historical timeline of the characters, the ontological reference model, data timeline and data recovery platform are constructed based on new ideas. In the data acquisition and data analysis study, content analysis is combined with social media analysis to determine the study case's data sources and identify the text cloud map, social media relationship map, and historical character development map. This paper analyzes and interprets the raw data of the revised case, which is complete for the selected years. It defines the units of human knowledge, the unit relationships and attributes of the Historical Figures Data Map, constructs the data layer of the Historical Figures Data Map, and explains the unit structure of the Historical Figures Knowledge Map. It lays the foundation for building a scientific model of knowledge and mapping the data model in the form of a data almanac.

Acknowledgements.

This project is the research for the first-class course of college English in Xi'an Traffic Engineering Institute,Shaanxi Province, the industry-university cooperation and collaborative education project of the Ministry of Education of Xi'an Traffic Engineering Institute in 2024 "Application and Research of College English Blended Teaching Mode Based on Diagnostic Assessment" and the key teaching reform project in 2023 "Research on the Cultivation of College Students' Self-directed Learning Ability by Learning Input Intervention Integrating Diagnostic Assessment in Blended Teaching Mode"(XJY231015) .

References

[1] Ahmadi, A., Darni, D., & Yulianto, B. (2021). The Techniques of Qualitative Data Collection in Mapping Indonesian

Litterateurs in East Java: An Initial Design. International Journal of Multicultural and Multireligious Understanding (IJMMU), 8, 67–99.

[2] Calligaro, Thomas., Banas, Agnieszka., Banas, Krzysztof., Radovi, I. Bogdanovi., Brajkovi, Marko., Chiari, Massimo., Forss, A. Maija., Hajdas, Irka., Krmpoti, Matea., & Mazzinghi, Anna. (2022). Emerging nuclear methods for historical painting authentication: AMS-. Forensic Science International, 336, 111327.

[3] Campos, F. O., Orini, M., Arnold, R., Whitaker, J., & Bishop, M. J. (2021). Using computational modeling to assess the ability of substrate mapping techniques to guide ventricular tachycardia ablation. Computers in Biology and Medicine, 77(78), 104214. https://doi.org/10.1016/j.compbiomed.2021.104214

[4] Chen, Y., Liu, L., Liu, H., & Sun, Y. (2021). Study on the Formalized Development of the Street Stall Economy based on Domestic and International Experiences and Perspectives. Economic reserch, 4(4), 326a.

[5] Dinar, A., Bradford, J., Castelan, E., Gavino, J., González, J., Jantz, A., Li, Y., Iii, F. M., & Parmer, M. (2022). Domestic Interests and International Negotiations. World Scientific Book Chapters, 66(66), 66–88.

[6] FreiburgFreiburgGermany, S. straub@unifr chUniversität. (2021). Literary Reviewing and the Velocity of Book Histories in Times of Digitization. Anglia, 139(1), 224–241. https://doi.org/10.1515/ang-2021-0011

[7] Fujitani, R., Hattori, M., Yasuda, Y., & Hoshi, T. (2023). Domestic and international effects of economic policy uncertainty on corporate investment and strategic cash holdings: Evidence from Japan. Social Science Electronic Publishing, 55(44), 234–259.

[8] Hallinger, P., & Kovaevi, J. (2022). Mapping the intellectual lineage of educational management, administration and leadership, 1972–2020: Educational Management Administration & Leadership, 50(2), 192–216. https://doi.org/10.1177/17411432211006093

[9] Jafari, M., Fathian, M., Akhavan, P., & Fesharaki, M. N. (2022). Mapping Network Warfare Techniques to KM: Applying Lessons and Theories from the Most Demanding Arena of All. 455(445), 66–97.

[10] Junk, J., & Blatter, J. (2022). Transnational attention, domestic agenda-setting and international agreement. 33, 33(45), 44.

[11] Kim, J. C., Marilyn Lee. (2021). When do you trust AI? The effect of number presentation detail on consumer trust and acceptance of AI recommendations. Psychology & Marketing, 38(7), 77–99. https://doi.org/10.1002/mar.21498

[12] Kim, P., & Yoo, Y. (2021). Domestic and international competitiveness of Korea’s information security industry. Journal of Korea Technology Innovation Society, 77(77), 25–76. https://doi.org/10.35978/jktis.2021.12.24.6.1163

[13] Lapworth, E. (2021). Assessing large-scale digitization using Web analytics. Digital Library Perspectives, ahead-of-print(ahead-of-print), 12–65.

[14] Liu, Q., Li, T., Zang, Q., & Hao, X. (2021). Research on key technology of 3D digitization for a secondary power grid system based on model application analysis. Journal of Physics: Conference Series, 34(34), 66–99.

[15] Meadow, C. M. (2022). Correspondences and Contradictions in International and Domestic Conflict Resolution: Lessons From General Theory and Varied Contexts. 56(56), 24336.

[16] Pantiukhin, D., Piepenburg, D., Hansen, M. L. S., & Kraan, C. (2021). Data-driven bioregionalization: A seascape-scale study of macrobenthic communities in the Eurasian Arctic. Journal of Biogeography, 45(34), 223–258. https://doi.org/10.1111/jbi.14247

[17] Prokop, V., Stejskal, J., Merickova, B. M., & Odei, S. A. (2023). Revealing the importance of international and domestic cooperation using artificial neural networks: Case of European radical and incremental innovators. European Journal of Innovation Management, 45(45), 56–88. https://doi.org/10.1108/EJIM-02-2021-0104

[18] Pez Ubieta, I. de L., Velasco, E. P., Puente Mndez, S. T., & CandelasHeras, F. A. (2023). Detection and depth estimation for domestic waste in outdoor environments by sensor fusion. 5(5), 43. https://doi.org/10.1016/j.ifacol.2023.10.211

[19] Rodríguez, A., Hernández, V., & Nieto, M. J. (2022). International and domestic external knowledge in firms' innovation performance from transition economies: The role of institutions. Technological Forecasting and Social Change, 176, 67–99. https://doi.org/10.1016/j.techfore.2021.121442

[20] Siad, F. M., & Rabi, D. M. (2021). Harassment in Medicine: Cultural barriers to psychological safety. 33(33), 777–787. https://doi.org/10.1016/j.cjco.2021.08.018

[21] Szombara, S. (2021). Using different mapping techniques and GIS programs to analyze and visualize mental maps. Polish Cartographical Review, 53, 91–104. https://doi.org/10.2478/pcr-2021-0008