Research Article

Innovation Path of Industrialization of Ethnic Minority Culture and Art Resources Based on DM Technology

Qingyi Meng and Hongbo Li

Yantai University, Yantai, Shandong 264005, China

Correspondence should be addressed to Hongbo Li; 2016120067@jou.edu.cn

Received 8 March 2022; Accepted 5 April 2022; Published 28 June 2022

Academic Editor: Song Jiang

Copyright © 2022 Qingyi Meng and Hongbo Li. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

In ethnic minority areas, the rich cultural color has strong attraction and market competitiveness. While making full use of it to promote the local economic development of ethnic minorities, it promotes the inheritance and protection of ethnic culture and the cultural exchange and integration among multiethnic groups. In this case, a new data mining (DM) technology came into being. DM is a new data processing technology for developing information resources. The object of DM is not only a database but also a file system, or any other data collection organized together. Based on DM technology, this paper studies the industrialization innovation of ethnic minority cultural and artistic resources, which carries out DM on the basis of rational utilization of ethnic minority cultural resources, boldly innovates, uses new scientific and technological achievements and new artistic expression means, establishes the people-oriented service concept of cultural and artistic resources, and takes the individual needs of the public and the scientific analysis results of big data as the basis to provide a satisfactory and ideal cultural and artistic feast for the public.

1. Introduction

In recent years, China has paid more and more attention to improving cultural productivity. Since the 18th National Congress, China’s cultural industry has entered a period of rapid development. Under the background of improving national cultural soft power, developing minority cultural industries is also a particularly important issue [1]. In the process of market economy development, China has gradually realized the huge economic potential of the cultural industry and art industry, and the diversity of cultural forms, the richness of content, and the concentration of resources in minority areas are the main advantages to realize industrialization development [2, 3]. In ethnic minority areas, rich cultural colors have strong attraction and market competitiveness. Full development and utilization can promote the local economic development of ethnic minorities and, at the same time, promote the inheritance and protection of ethnic cultures and promote cultural exchange and integration among ethnic groups [4]. Therefore, the development and utilization of minority arts and cultural arts resources industry, especially the development and innovation of characteristic products, can promote the transformation and upgrading of the national cultural arts resources industry structure and industrial content. At present, ethnic minorities in many areas have developed arts, cultural, and artistic resources as industries, but as a result of less experience, single cultural products, and less development and innovation of characteristic products, the cultivation ability of cultural and art industries is generally weak [5, 6]. China is a multiethnic country, and the cultural resources of ethnic minorities are extremely rich. However, from the reality, there are various restrictions and problems in the industrialization development of cultural resources of ethnic minorities. New media technology, which is developing vigorously at present, has played a great role in promoting cultural consumption and communication and then promoted the optimization of cultural industry to a certain extent [7].
In this case, a new technology DM technology came into being. DM is a new data processing technology for developing information resources. This definition defines the object of DM as a database, and more broadly, DM is a decision support process of finding patterns in the collection of some facts or observed data. The object of DM is not only a database but also a file system, or any other data collection organized together. DM is a developing comprehensive interdisciplinary subject, which arose in the late 1980s. It is one of the most popular research fields in the current computer industry [8, 9]. DM theory integrates the technologies of the database, visualization, and parallel computing, and integrates the theoretical knowledge of many disciplines, such as statistics, artificial intelligence, pattern recognition, computer science, and machine learning.

With the development of the times, through the development of mature DM technology, it is an important historic task for literary and art circles and cultural workers to carry forward national traditional culture, enrich cultural, and artistic forms, and vigorously develop industrial innovation of minority cultural and artistic resources [10].

Under the DM technology, the cultural and artistic resources of ethnic minorities are material resources, which are the process and results of their activities of food, clothing, housing, and transportation and are visible material resources on the surface of culture and art. Creating, collecting, and sorting out cultural and artistic resources that are popular with the masses and show national characteristics have become important measures to promote cultural development. On the basis of rational use of minority cultural resources, we should make bold innovations in DM, make use of new scientific and technological achievements and new means of artistic expression, and make necessary screening, transformation, and processing of existing minority cultural products, so as to create excellent products and brands of western minority cultural industries [11]. These patterns refer to extracting knowledge that people are interested in from large databases or data warehouses. Of course, this knowledge is implicit, unknown in advance, and potentially useful information. The extracted knowledge can generally be expressed as concepts, rules, laws, patterns, and other forms [12, 13]. Based on DM technology, the materials, structure, shape, style, space utilization, functional zoning, decoration technology, and other aspects of the daily life of all ethnic groups can all reflect the wisdom and ability of ethnic minorities to perceive, recognize, imagine, conquer, and transform the universe and nature, and show their keen and delicate perception ability, observation ability, cognitive ability, and aesthetic creativity of adapting to local conditions and local materials [14–18].

This paper studies and innovates the above problems from the following aspects:

1. This paper puts forward an innovation model of industrialization of ethnic minority cultural and art resources based on data mining technology. At the same time, cultural shaping should also be based on the characteristics of contemporary social development and market demand. We should make good use of the situation and choose the appropriate development route based on the existing advantages. This requires us to integrate the existing cultural resources and choose the resources and development mode with comparative advantages when disseminating relevant content [19–21].

2. Create an innovation system for the industrialization of ethnic minority cultural and art resources based on data mining technology. The system uses data mining technology to analyze the collected ethnic minority cultural resources. With the development of data mining technology, everyone can become the disseminator and publisher of information. Second, data mining technology has low sales cost of national cultural products. The emergence of TikTok and microblog software has reduced the cost of sales of ethnic cultural products and can also achieve more effective publicity in reducing costs and expenditures. Third, data mining technology has designed a new national cultural industry [22–24].

The paper is divided into five parts, and the organizational structure is as follows: Section 1 introduced the research background and current situation of the industrialization and innovation of ethnic minority cultural and art resources, and put forward and summarized the main tasks of this paper. Section 2 introduces the work related to the industrialization and innovation of ethnic minority cultural and art resources. Section 3 introduces the principle and algorithm of data mining technology. Section 4 introduces the innovative development ideas and enlightenment of the industrialization of ethnic minority culture and art resources, and compares the performance of the model through experiments. Section 5 is the summary of the full text.

2. Related Work

2.1. Research Status at Home and Abroad. Lee E B, Kim J, and Lee sg put forward the research on the digital protection of Wa culture in Yunnan, digitized and catalogued the collected Wa entity cultural resources, integrated with the tourism service system, and constructed a huge virtual interactive system to enhance the expansion of minority culture. Angeli C, Howard s, and Ma J put forward that the current situation of ethnic minority cultural resources is worrying. With the continuous advancement of industrialization and modernization, it is bound to be accompanied by an impact on traditional culture. The development of ethnic minority cultural resources is redeveloped on the basis of the long history and culture of all ethnic groups and the rich accumulation of ethnic culture. Chen m s, Hwang C P, and Ho T y put forward that in the development process of cultural diversity, the cultural and artistic resources of many ethnic minorities in China have disappeared. Due to the small population of ethnic minorities, there are few talents who inherit and innovate folk customs, literature, and art. Shen Y C, Lin g, and Lin J r put forward the research on the construction
3. Principle and Algorithm of DM Technology

DM algorithm is a concrete implementation of DM method, which is generally composed of three parts. The model in the following refers to the model found from the database.

(i) Model representation: The model used to describe the discovery is a language. If the description ability of language is strong, it will help to find an accurate mathematical model. However, the description language with too strong ability may lead to the over generalization of the discovered model and reduce the accuracy of prediction. The commonly used model representation methods include decision tree, nonlinear regression, case-based reasoning, Bayesian network, and inductive programming.

(ii) Model evaluation criteria: Make a quantitative evaluation on the extent to which a discovered model meets the purpose and requirements of discovery. For the prediction model, some test datasets can be used to evaluate its accuracy. The model of description class can be evaluated in many aspects, such as accuracy, novelty, practicability, and comprehensibility.

(iii) Discovery method: It is divided into parameter discovery and model discovery. After the model representation and model evaluation criteria are determined, DM has completely become an

2.2. Research Status of Industrialization of Minority Cultural and Artistic Resources Based on DM Technology. Based on DM technology, this paper studies the industrialization innovation of minority cultural and artistic resources. The application of DM technology will organically combine science and technology with culture and art, provide accurate and reliable data support for the promotion of culture and art, provide substantial basis for the reform of cultural industrialization system, and make the development of culture and art move towards new glory. Therefore, many ethnologists, folklorists, and anthropologists lamented that the production and life of ethnic minorities showed us their attitude and lifestyle of “artistic existence” in a simple and pure way. On the basis of protecting and developing minority cultures and arts, the construction of literature and art industry is a strategic decision for China to promote scientific development and social harmony. Without the prosperity of minority cultures and arts, the development of socialist culture cannot be reflected, and there is no way for socialist cultural industry to carry out in depth construction and socialist cultural undertakings to reach a new peak. Culture is the root of a country and a nation, and it is the guide and spiritual motivation on its way forward. This is especially true of national culture and national art. The decline of culture will also symbolize the decline of a nation. Only by building minority arts and cultural industries can minority arts and cultures maintain lasting vitality and innovation, and can minority cultures be integrated with Chinese culture and be invincible in the impact of the world and the international economic war. To sum up, DM technology has achieved fruitful results, but the research on DM of minority cultural resources started late. Although some progress has been made at present, there is still a long way to go before the problem of DM can be truly solved.
optimization task, that is, to find the most suitable parameters or models from the description of data.

In the process of industrialization and innovation of ethnic culture and art resources, DM algorithm completes the update of its speed and location by assuming a kind of data without quality, and each data searches for the optimal solution separately in the search space. According to this idea, the flow of the algorithm is designed, as shown in Figure 1.

DM is a multidisciplinary field, which draws nutrition from many disciplines and involves many fields, such as database technology, artificial intelligence, machine learning, neural network, pattern recognition, inductive reasoning, statistics, database, data visualization, information retrieval, high-performance computing, and so on. Actually, DM and knowledge discovery are two overlapping concepts. There is a view that DM and knowledge discovery are equivalent concepts, but they are called differently in different fields. The concept of knowledge discovery is often used in the field of scientific research, while DM is often used in the field of engineering application. Another view is that DM is a core stage of knowledge discovery. According to this view, knowledge discovery is defined as the process of extracting people’s interesting knowledge from the data of large databases, which is implicit, unknown in advance, and potentially useful information. The structure of the DM system is shown in Figure 2.

DM algorithms focus on the feature of maximum information gain. Information gain is a way of information measurement, which is similar to the definition of entropy in physics; that is, the higher the uncertainty, the more chaotic resulting in the greater the entropy. Therefore, the final choice of DM algorithm is the rule with the minimum entropy for decision-making.

Let $D$ be the division of training tuples by category, then the empirical entropy of $D$.

$$\text{info}(D) = -\sum_{i=1}^{m} p_i \log_2(p_i). \quad (1)$$

Similarly, PI represents the probability that the $i$th category appears in the whole data group. Now let’s assume that data group $D$ is divided according to attribute $a$, then the empirical conditional entropy of $a$’s division of $D$.

$$\text{info}_A(D) = \sum_{j=1}^{r} \frac{|D_j|}{|D|} \text{info}(D_j). \quad (2)$$

The information gain is represented by $G(D, a)$, and the information gain is the difference between the above two.

$$g(D, A) = \text{info}(D) - \text{info}_A(D). \quad (3)$$

DM algorithms often choose features with more attributes, which makes the division more pure and meaningless. Therefore, the DM algorithm introduces the information gain ratio as the division criterion and usually selects the one with large information gain ratio as the division criterion. The relevant formula is as follows:

$$\text{gain ratio}(A) = \frac{\text{gain}(A)}{\text{split info}_A(D)}. \quad (4)$$

![Figure 1](image1.png)

For $P$ independent variables $x = (x_1, x_2, \ldots, x_p)$, let the conditional probability $P(Y = 1|x) = p$ be the probability of occurrence of the event to be analyzed according to the observation. The corresponding logistic regression model can be expressed as

$$P(Y = 1|x) = \pi(x) = \frac{1}{1 + e^{-g(x)}}. \quad (5)$$

Next, we introduce four common cluster distance measurement methods of clustering algorithms.

Absolute distance, also known as “chessboard distance” or “city block” distance.

$$d_{ij}(1) = \sum_{k=1}^{p} (x_{ik} - x_{jk}). \quad (6)$$

Euclidean distance is also the most common distance.

$$d_{ij}(2) = \sqrt{\sum_{k=1}^{p} (x_{ik} - x_{jk})^2}. \quad (7)$$

Minkowski metrics:

$$d_{ij}(q) = \left[\sum_{k=1}^{p} (x_{ik} - x_{jk})^q\right]^{1/q}. \quad (8)$$

It can be seen from the above formula that the absolute distance and Euclidean distance are special cases of Minkowski distance.

Chebyshev Distance:

$$d_{ij}(\infty) = \max_{1 \leq i \leq p} |x_{ik} - x_{jk}|. \quad (9)$$

It is the case of $q \rightarrow \infty$ in Minkowski distance.

At present, DM algorithms have been widely used in different disciplines, such as machine learning, statistics, and neurobiology, and have become an important branch of these fields. Of course, the DM algorithm is also widely used in the field of banking and finance. The credit customer segmentation model often uses a clustering algorithm to solve the corresponding problems. The commonly used DM algorithms of customer segmentation model, include hierarchical data algorithm, partition based data algorithm, graph theory based data algorithm, and density based data algorithm. The application of association rules in DM technology in practical engineering has achieved good results. At the same time, Internet mining technology is also applied in network search and e-commerce and shows excellent results. In China, the research of DM technology has also attracted great attention in academic circles and has become a hot topic in the field of information science. DM research has broad application.
prospects because the knowledge generated by DM can be used in many fields, such as decision support, information management, and scientific research. The realization of various DM functions mainly depends on DM methods; that is, the algorithms used in the process of DM. According to the disciplines involved in DM algorithms, DM methods can be roughly divided into four categories: methods based on statistics, methods based on machine learning, methods based on neural networks, and methods based on data warehouses.

Classification according to the types of discovery knowledge.

3.1. Statistical Based Method. Statistical method is a method to infer the possible regularity of a thing from its external quantitative performance.

3.2. Method Based on Machine Learning. Machine learning is the research of computer algorithm, which can make the
machine improve its performance according to the actual task on the basis of previous experience. Machine learning has become one of the main technical fields of computer data analyses, which is closely related to DM methods.

3.3. Method Based on Data Warehouse. DM method based on data warehouse mainly refers to online analytical mining, that is, DM based on OLAP, which effectively combines OLAP technology and DM technology of data warehouse. Generally speaking, there is no universally applicable algorithm. An algorithm is very effective in one field, but it may not be suitable in another. Therefore, in practical application, we should carefully select effective DM algorithms for specific fields. In other words, the actual development work often turns into formalization of domain knowledge and discovery tasks, instead of optimizing the selected DM algorithm in detail. The DM function is used to specify the pattern type to be found in the DM task. DM tasks are generally divided into two categories: descriptive and predictive. Descriptive mining tasks are used to characterize the general characteristics of data in the database, while predictive mining tasks are based on the current data to predict new data. According to the task of mining, the functions of DM mainly include concept/class description, association analysis, classification, prediction, clustering, and deviation analysis. The DM method based on neural network is based on the self-learning neural network model, and can be used for many DM functions, such as using feedforward BP network, RBF network for classification, prediction, and pattern recognition, and using competitive self-organizing feature mapping Kohonen network model for clustering, prediction and deviation analysis, etc.

4. Innovative Development Ideas and Enlightenment of the Industrialization of Ethnic Minority Cultural and Art Resources

4.1. Technology Innovation and Development Path Based on DM. DM technology is a concept of continuous innovation and optimization, and it is also deriving new forms. From mobile phone TikTok to microblog, jitter and other social and video communication platforms, they all belong to the DM technology. Ethnic minorities have condensed into characteristic national culture in their long-term production and life. Different from Han culture, different ethnic minorities have their own cultural forms and cultural characteristics in different regions. Objects, including utensils and buildings, have national styles and the values and ways of behavior in ethnic minority regions, also have their own characteristics. The inheritance of ethnic minority aesthetic culture is very unique. There are neither professional schools nor professional teachers. Intergenerational inheritance of family and society is the main way. Taking learning embroidery as an example, embroidery is very exquisite art and craft, that is both practical and ornamental. The teaching and learning of embroidery skills is actually the aesthetic education of ethnic minorities. The DM prototype system of ethnic cultural resources is composed of three modules, including data acquisition module, data processing module, and DM module. The data collection module is mainly the data resources collected from the national cultural heritage network, the national website, and the WA dictionary. The data processing module is to segment the collected data, remove stop words, and generate the word vector model to prepare for data clustering analysis. The DM module applies the improved algorithm to cluster the data processing module. The system uses DM technology to analyze the collected ethnic minority cultural resources. With the development of DM technology, everyone can become the disseminator and publisher of information. Second, DM technology has low sales cost of national cultural products. The emergence of TikTok and microblog software has reduced the cost of sales of ethnic cultural products and can also achieve more effective publicity in reducing costs and expenditures. Third, DM technology has designed a new national cultural industry. In the development of the changeable new media industry, mobile games, information promotion services, and other products are designed.

The aesthetic education resources with minority art as the core show the characteristics of nationality, diversity, and primitiveness in its material form and inner spirit and have infinite resource advantages in inspiring and enlightening people’s aesthetic insight, perception, imagination, and rich emotions. The development and prosperity of cultural industries in ethnic minority areas cannot be separated from the support of national policies. With China paying more and more attention to the development of cultural industries, ethnic minority areas have issued relevant cultural and economic policies, aiming at promoting the formation of cultural industrial chains in ethnic minority areas through policy support. There are rich ethnic resources, and these ethnic resources with a long history are our precious resource wealth. The rational use of DM technology can provide a way for the outside world to know our minority cultures. Ethnic minorities are distributed in different remote mountainous areas, and people’s awareness of cultural protection is not enough. A large part of resources...
is mainly distributed in some local forums or government websites, lacking unified management, and presented in different ways. If the scattered ethnic resources can be reasonably distributed and managed in a unified way and presented to the outside world in a new way, it will help to protect and inherit the cultural data resources of ethnic minorities. Ethnic minorities want to constantly improve the construction and management of cultural markets and promote the development and prosperity of cultural industries. They also need to constantly adjust their cultural industry policies according to the development situation and current situation of specific ethnic groups and make targeted policy adjustments according to the cultural industries of ethnic groups, so as to further liberate and develop cultural productivity, enhance the vitality of innovative cultural industries, and activate cultural and economic factors in ethnic minority areas.

4.2. Experimental Results and Analysis. According to the hardware equipment of the key laboratory of the ministry of education for national education informatization, in order to meet the basic configuration requirements of DM parallel computing framework, three Lenovo desktops are used to build a cluster environment, and the master node and slave node are connected through 100 m network. The hardware configuration is shown in Table 1.

To build a DM cluster environment, software compatibility is very important, and a compatible version must be selected. The detailed configuration of each software is shown in Table 2.

Verify the advantages of distributed cluster for traditional stand-alone environment, and experimentally test the performance of DM algorithm in spark of 8 cluster nodes and spark of one node. By comparing and analyzing 8 data sets of different sizes, the time consumed by clustering is analyzed. With the increase of the amount of data and the change of the running time of particle swarm optimization algorithm, the running time trend of DM algorithm on 8 data sets with different sizes is given. Three experiments were conducted for comparison, as shown in Figures 3–5.

The results from Figures 3–5 show that with the increase of data volume, the time cost is getting higher and higher, no matter in parallel environment or traditional single machine condition. However, in the parallel environment, the growth of time slows down, while in the single-machine environment, due to the lack of memory, the speed increases sharply. When the amount of data continues to increase, the advantages of parallelization can be better displayed when dealing with massive data. The development of culture industry cannot be separated from the construction and improvement of infrastructure. Only when the infrastructure is gradually improved can the national culture industry have the power of sustainable development. According to the data, in the process of promoting the development of minority culture and art industry in China, the investment in infrastructure is increasing year by year. Although the infrastructure and economic situation in China’s minority areas are still at a backward level, I believe that in the near future, the infrastructure will be improved and the popular cultural facilities will be gradually improved.

Under different datasets, the average running time of the improved DM algorithm has been improved. When the dataset increases, the improvement effect is more obvious. Two experiments were conducted to compare the results, and the change trend of time comparison is shown in Figures 6 and 7.

As can be seen from Figures 6 and 7, with the increase of the amount of data, the time consumption rate of the improved algorithm becomes smaller and smaller. This method can effectively reduce the execution time of the algorithm. DM technology aims to discover the hidden knowledge in a large amount of data, so as to solve the problem of “rich data and poor knowledge.” In recent years, with the wide application of database and network technology and the use of advanced automatic data generation and collection tools, the amount of data owned by people have increased sharply, creating necessary conditions for the application of DM technology.
Figure 4: Running time of DM in different datasets.

Figure 5: Running time of DM in different datasets.

Figure 6: Time comparison chart of DM and improved DM.
5. Conclusions

As a part of DM, text mining still faces many problems, especially with the rapid growth of data, some DM algorithms are insufficient. In this paper, the research on DM of minority resources based on DM technology is proposed, and the mining algorithm is parallelized and improved by the integration of various algorithms. Ethnic minority culture and art are rare resources for us to know and sublimate the content and character of human nature, among which the aesthetic education resources are particularly worthy of attention, which is an irreplaceable frame of reference for modern and contemporary people to know and improve human nature through the aesthetic dimension, and also a rare and rich source for developing national aesthetic education. Ethnic minority areas are faced with the important task of cultivating art and cultural industries. Only by correctly changing the development direction of cultural industries and art industries and deeply integrating art and culture can we gain more profit space in the process of economic development and cultural inheritance. They also need to constantly adjust their cultural industry policies according to the development situation and current situation of specific ethnic groups and make targeted policy adjustments according to the cultural industries of ethnic groups, so as to further liberate and develop cultural productivity, enhance the vitality of innovative cultural industries and activate cultural and economic factors in ethnic minority areas.

Data Availability

The figures and tables used to support the findings of this study are included in the article.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

References

[1] L. Y.-Y. Kwan, A. K.-Y. Leung, and S. Liou, "Culture, creativity, and innovation," Journal of Cross-Cultural Psychology, vol. 49, no. 2, pp. 165–170, 2018.
[2] Z. Khawla and S. Riki, "Cultural identity and intervention strategies of arab minority social workers in Israel," British Journal of Social Work, vol. 47, no. 2, pp. 1–17, 2017.
[3] D. Meredith, "Institutions, innovation and industrialization: essays in economic history and development," in English Historical Review, A. Greif, L. Kiesling, V. John, and C. Nye, Eds., vol. 132, no. 554, pp. 208–210, 2017.
[4] S. Ranadheera, S. Maghsudi, and E. Hossain, "Minority games with applications to distributed decision making and control in wireless networks," IEEE Wireless Communications, vol. 24, no. 5, pp. 184–192, 2017.
[5] V. P. Dewitty and T. A. Murray, "Influence of climate and culture on minority faculty retention," Journal of Nursing Education, vol. 59, no. 9, pp. 483–484, 2020.
[6] H. Kil, K. A. Noels, D. I. Vargas Lascano, and O. Schweickart, "English Canadians’ cultural stereotypes of ethnic minority groups: implications of stereotype content for acculturation ideologies and immigration attitudes," International Journal of Intercultural Relations, vol. 70, pp. 104–118, 2019.
[7] J. Balakrishnan and M. D. Griffiths, "Social media addiction: what is the role of content in YouTube?" Journal of Behavioral Addictions, vol. 6, no. 3, pp. 364–377, 2017.
[8] C. Z. Cohen, "Book review: art for animals: visual culture and animal advocacy, 1870-1914," Cultural Geographies, vol. 26, no. 2, pp. 266-267, 2019.
[9] Y. Guo and G. Zheng, "Recombinant capabilities, R&D collaboration, and innovation performance of emerging market firms in high-technology industry," IEEE Transactions on Engineering Management, no. 99, pp. 1–16, 2022.
[10] G. Moisés and S. S. Jacob, "The Brazilian Ministry of Health and science, technology, and innovation policy," Cadernos de Saúde Pública, vol. 22, no. 3, pp. 471–470, 2006.
[11] L. Wang and S. Wu, “The National Center for Nanoscience and Technology, China(NCNST): an international innovation engine for nano research,” National Science Review, vol. 03, no. 4, pp. 222–231, 2017.
[12] Q. Zhou, H. Yabar, T. Mizunoya, and Y. Higano, “Exploring the potential of introducing technology innovation and regulations in the energy sector in China: a regional dynamic evaluation model,” *Journal of Cleaner Production*, vol. 112, no. JAN, pp. 1537–1548, 2016.

[13] Z. Xie, J. Hall, I. P. McCarthy, M. Skitmore, and L. Shen, “Standardization efforts: the relationship between knowledge dimensions, search processes and innovation outcomes,” *Technovation*, vol. 48–49, pp. 69–78, 2016.

[14] A. T. Kurzych, L. R. Jaroszewicz, Z. Krajewski, M. Dudek, K. P. Teisseyre, and J. K. Kowalski, “Two correlated interferometric optical fiber systems applied to the mining activity recordings,” *Journal of Lightwave Technology*, vol. 37, no. 18, pp. 4851–4857, 2019.

[15] E.-B. Lee, J. Kim, and S.-G. Lee, “Predicting customer churn in mobile industry using data mining technology,” *Industrial Management & Data Systems*, vol. 117, no. 1, pp. 90–109, 2017.

[16] C. Angeli, S. K. Howard, J. Ma, J. Yang, and P. A. Kirschner, “Data mining in educational technology classroom research: can it make a contribution?” *Computers & Education*, vol. 113, no. oct, pp. 226–242, 2017.

[17] M.-S. Chen, C.-P. Hwang, T.-Y. Ho et al., “Driving behaviors analysis based on feature selection and statistical approach: a preliminary study,” *The Journal of Supercomputing*, vol. 75, no. 4, pp. 2007–2026, 2019.

[18] Y. C. Shen, G. Lin, J. R. Lin, and C. H. Wang, “A cross-database comparison to discover potential product opportunities using text mining and cosine similarity,” *Journal of Scientific & Industrial Research*, vol. 76, no. 1, pp. 11–16, 2017.

[19] C. Tanner, E. K. Fishman, K. M. Horton, and S. Sheth, “How technology is changing news and our culture: lessons from elections 2016 and davos 2017: tech, media, and the newsroom of the future,” *Journal of the American College of Radiology*, vol. 14, no. 12, pp. 1632–1634, 2017.

[20] N. Agarwal, M. Grottke, S. Mishra, and A. Brem, “A systematic literature review of constraint-based innovations: state of the art and future perspectives,” *IEEE Transactions on Engineering Management*, vol. 64, no. 1, pp. 1–13, 2017.

[21] M. Bonart, A. Samokhina, G. Heisenberg, and P. Schaer, “An investigation of biases in web search engine query suggestions,” *Online Information Review*, vol. 44, no. 2, pp. 365–381, 2019.

[22] S. Altuntas, O. Cinar, and S. Kaynak, “Relationships among advanced manufacturing technology, innovation, export, and firm performance,” *Kybernetes*, vol. 47, no. 9, pp. 1836–1856, 2018.

[23] B. B. M. Shao and W. T. Lin, “Assessing output performance of information technology service industries: productivity, innovation and catch-up,” *International Journal of Production Economics*, vol. 172, no. Feb, pp. 43–53, 2016.

[24] J. Nordensvard, Y. Zhou, and X. Zhang, “Innovation core, innovation semi-periphery and technology transfer: the case of wind energy patents,” *Energy Policy*, vol. 120, no. SEP, pp. 213–227, 2018.