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Article

Industrialization and innovation strategy of event resources in ice and snow sports under the background of big data

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Abstract: This article examines the industrialization and innovative strategy of event resources in ice and snow sports in the context of big data. Based on this analysis, the article proposes a path and development strategy for the Chinese sports industry, which includes encouraging the industrialization of the nation's ice and snow sports industry. It is important to evaluate ice and snow sports in order to improve competitive results and optimize training techniques using big data technologies. Despite using a variety of techniques to evaluate performance, their inability to fully capture the complex patterns found in ice and snow sports events presents difficulties. In order to assess and enhance sports talents, therefore we proposed a new method using ISSE-Apriori algorithms. The pre-processed data gathered before extracting the most important and relevant features. The experiment results section analyzes the resources of ice and snow sports cities. The results examine sports event strategies, taking into account predictions and actual accuracy results, the GDP growth rate, the efficiency of industrial development, and a comparison of Apriori before and after enhancement. The experimental result is validating using measures like recall, accuracy, and precision. In addition, we conducted a comparative analysis with the current approaches to confirm the efficiency and robustness of the proposed methodology. The Suggested approach is implemented with Python Software. The Suggested Approach's performance is measured in terms of RMSE (0.3524), MAE (0.1832), MAPE (4.24) with large dataset. The results stated that the proposed methodology has provided an accuracy of 98.42%.

Keywords: big data; ice and snow sports; strategy; sports industry; ISSE-Apriori algorithm

1. Introduction

In the past few years, China has developed growth plans for ice and snow sports, issued regulations, national policies and steadily advanced the industry's reform. With the promotion of the preparations for the 2022 Winter Olympics, snow and ice sports a significant component of the ice and snow sector—has opened up new development opportunities. The snow and ice sports business is about to enter a new phase of growth as a result of the emergence of snow and ice sports sector. China's snow and ice sports industry is now seeing growth. Utilizing the favorable resources of ice and snow combined with the Olympics in Beijing, we will accelerate the growth of snow and ice sports, fortify the ice and snow sector and create cluster advantages, logically optimize and spearhead the transformation and upgrading of the ice and snow sector structure, raise the as a whole output value of snow and ice sports tourism by delving deeply into the industry's resources and boosting its core competitiveness overall. This will help the integrated growth of snow and ice sports, that currently subject of discussion in the business, political, academic, and sports circle [1].

The term "ice" and "snow" have a lot of meanings attached to them. The project frequently conducts extensive theoretical research and development. Scholars haveproposed numerous ideas to assist the growth of the tourism sector, which in turn creates a solid capital foundation for winter sports. Bigdata is an extremely effective tool that supports the growth of snow and ice sports in a variety of ways [2]. The technology can enhance the growth of snow and ice sports since it analyzes large amount of data associated with the industry. The construction and analysis of the snow and ice sports system model is made possible by big data, which supports deeper multi-factor study on the subject.

These days, term "big data" is used more and more to define and characterize the enormous amounts of data that result from the explosion of information. Big data is a compilation of an enormous amount of data that is gaining public attention because it may include information that is useful. The goal of the leisure sports industry's growth is to meet the demands of consumers for leisure, recreation, and body building. The leisure sports sector has undergone significant changes in the big data age. By utilizing cutting-edge technology, this industry offers a multitude of consumers more personalized and humanized offerings that were before unthinkable [3]. Big data sports first gained popularity in 2013 and marked the beginning of a new age for the sports sector. Since then, big data has become a crucial tool for success in the sports market, generating a lot of debate and heat. An important factor in determining an athlete's excellence is whether or not they can flawlessly demonstrate their lower limb complicated motions. The athlete's lower limb agility is a crucial component in supporting this ability. Athletes can only execute precise, clean, fast motions or shapes in intricate transformations while preserving the body's balance and stability if they possess a high degree of sensitivity [4].

A significant part of the Third-Sector Businesses is the snow and ice sports sector. Among the crucial strategies for advancing the high-quality growth of China sports sector is the growth of the snow and ice sports sector, that is essential in advancing the modernization of sports consumption, industrial growth. In order to further encourage the sports industry's strategic development in China, it is now crucial to investigate the growth of the snow and ice sports sector additionally the direction of supply transformation in industrial upgrading [5]. Furthermore, scientific investigation and discourse hold substantial academic worth and pragmatic implications for deciphering the correlation among several types of snow and ice sports sector, enhancing the sectors chain of supplies, and fortifying sector's service enhancement. The snow and ice sports superpowers have lately highlighted the massive gap among China and these global powerhouses and demonstrated the value of technological innovation through a closer examination of the accomplishments made during the Winter Olympics [6].

The growth of China snow sports has taken on new significance following the country's triumphant hosting of the Olympic Games in Beijing (see **Figure 1**). This has strengthened the athletes' cultural understanding of snow and ice, encouraged the development of winter activities' cultural heritage, and progressively raised China's standing internationally. Athletes that participate in winter sports have the potential to support and pioneer the prevailing spirit of the times while also popularizing and fostering a strongly socialist culture throughout time. With China's political economy still developing, competitive sports have flourished and grown tremendously. To ensure that optimization of snow and ice resources, ideal model states that these resources be wisely distributed and used. New research accomplishments in the creation of an intelligent tourist system of application concepts for snow and ice sports are encouraged by studies on the impact of mobile big data on this infrastructure [7]. Promoting the culture of snow and ice sports is highly valued by governmental authorities, who are becoming more and more worried about the spread of sports culture. This study's approach of using association rules to examine the relation among strategy, sports, and winter sports is makes it distinctive. The foundation of this approach is big data. The upgraded Apriori algorithm is additionally enhanced using k-means clustering to improve the method's performance.

Figure 1. Ice and snow sports pictures in China **(a)** China's ambitious goal of encouraging over Three hundred million participants in snow and ice activities and adopt better lives as a result of the Olympic Winter Games in Beijing in 2022 was sparked by this goal; **(b)** At an open-air rink on Shichahai Lake in Houhai, young speed skaters practice in ice.

2. Challenges

The ice and snow sports sector has such challenges are:

1) Climate change: Shorter seasons and more difficulty organizing events on snow and ice are two effects of extreme weather.
2) Cost: People from lower-income backgrounds may not be able to participate in snow sports due to the high cost of equipment, lift tickets, and lodging.
3) Geographic barriers: People may find it challenging to travel to locations for snow activities due to factors like terrain and distance.
4) Transportation restrictions: Accessing locations for snow activities may be more difficult due to high transportation expenses and a dearth of dependable public transportation.
5) Participants are worried about their safety.
6) Diversity: Skiing may become more exclusive and less varied as a result of climate change.

The growth of ice and snow sports in China has been gradual, with low rates of widespread adoption. Although the sport was elevated by the Beijing Winter Olympics, there are more superior ski resorts in the north. Because there is less snow and ice in the south naturally, prices are higher. It is difficult to meet market demand for talent training, and resource quality is impacted by global warming. Concerns about the industry's effect on the environment also exist. For the sector to grow, sustainable development must be addressed.

3. Related works

Relevant scientists have conducted the following studies in relation to big data. Big data has unique characteristics that make it challenging to create an extensive array of services and applications. These characteristics include vast array of Internet items, devices, and networks, as well as the high volume of self-generated events.

- The snow and ice sports tourism sector are growing, providing new perspectives on resource utilization and driving economic development in China. However, the sector needs to expand and integrate resources, focusing on long-term development for sustainable growth, market penetration, and business functioning in the industry [8].
- In order to monitor energy consumption and process data efficiently, this research suggests utilizing smart grid technologies to integrate Internet of Things and big data into the smart home. The residential sector's consolidation, that consumes the most energy and produces a vast amount of data, is another significant component of this study [9].
- Activities involving snow and ice sports have a protracted growth cycle. Snow and ice sports journey initiatives must be evaluated throughout this process, considering several factors. By virtue of its own technology, bigdata gathers the huge amount of materials and data pertaining to snow and ice sports travel builds a model of an algorithm regarding the data, ultimately optimizes snow and ice sports by modifying the model [10].
- In order to capture sports-related data for ice and snow activities, this study suggests an Internet of Things (IoT) system that can measure physiological metrics such as blood pressure, oxygen saturation, body temperature, and electrocardiogram. The system consists of a communication unit, data storage, attitude measurement unit, and UWB positioning unit [11].
- With the help of metaverse technology, this study seeks to increase figure skating's visibility and facilitate its change. With the application of metaverse technology, figure skating becomes a unique blend of competitive and ornamental art, satisfying the increasing demands of people from all walks of life. By using sensors, body data analysis, and other techniques, figure skating data analysis will be improved in the future, becoming more accurate to raise athletes' individual performance levels and give figure skating fans pertinent sports support [12].
- This article introduces Internet of Things technology to investigate the additional system in snow and ice sports for training. This document outlines the architecture system in depth prior to system design, taking into account of affordability, elegance and usefulness, stability. In the article, using this additional system, we trained the responsiveness of the lower arms of snow and ice sportsmen. Prior to the experiment, the sensitivity ratings of five athletes were 50, 54, 49, 38, and 35. Following the trial, the scores were 32, 26, 31, 35, and 30, indicating a considerable improvement in sensitivity [13].

- This paper addresses the following issues: inadequate scientific collaboration; a disconnect between supply and demand; a lack of infrastructure; a lack of professional staff and a lack of environmental protection awareness; inadequate management and service quality; a lack of safety precautions; and a constraint bottleneck caused by ambiguous brand characteristics. It also proposes solutions [14].
- This author thought that alternative modes should be used by China snow and ice sports business according to local conditions, in regions with weak promise and a weak foundation, the community mode can be adopted; and in areas with a strong potential and a solid foundation, the government can adopt a hybrid approach to collaborative growth with enterprises [15].
- The sports industry comprises various production and service companies, catering to customer demands for sporting events, activities, performances, and involvement. The main divisions are sports services and sporting goods manufacturing, allowing customers to experience products firsthand through participation in sporting activities [16].

4. Experience and entertain the show with VR technology

The ice and snow sector should prioritize a business with analysis in data, data mining, and integration with resource, while focusing on internet businesses, improving interactive communication, e-commerce platforms, and reducing the gap between businesses and customers. An intelligent model can be formed by integrating cultural industries with full-chain tourism, using big data, cloud computing, and VR technology for sophisticated decision-making.

5. An examination of the state of ice and snow sports technological support at the moment

With an emphasis on scientific study in these fields, curiosity in snow and ice sports has increased in anticipation of the 2022 Winter Olympics in China. The major body of the study team, which consists of national institutes and sports scientists from three northeastern provinces, has made tremendous strides in ice sports, with veteran speed skating. Projects related to ice hockey and curling, however, have gotten less attention. There has been a rise in interest in snow sports like alpine, cross-country, and freestyle skiing. The field of research is constantly growing, shifting moving from not competitive sectors to services for research in science and technology, with an emphasis on raising quality and enhancing athletic performance.

6. Methodology

Figure 2 represents the proposed method of the study. Despite, Apriori algorithm is have some weakness and it is simple, straight forward, easy to understand and very expensive to large number of datasets. The example for Apriori algorithm is 104 frequent data set with 1-item sets in the pattern of frequent data sets must have 107 frequent 2-item sets in the candidate sets and are tested and accumulated. The frequent dataset pattern with size 100 datasets, such as {a1, a2…, a100}, it generates 2–100 candidate itemsets in total. In Apriorialgorithm implementation method is installed to inherit the cost of candidate generation. There are different types of problems and they are identified as follows:- K-Means algorithm. K-Means algorithm based on dividing [4,5] is a kind of cluster algorithm, and it is proposed by J.B.MacQueen. This algorithm which is unsupervised is usually used in data mining and pattern recognition. Aiming at minimizing cluster performance index, square-error and error criterion are foundations of this algorithm. To seek the optimalizing outcome, this algorithm tries to find K divisions to satisfy a certain criterion. Firstly, choose some dots to represent the initial cluster focal points(usually, we choose the first K sample dots of income to represent the initial cluster focal point); secondly, gather the remaining sample dots to their focal points in accordance with the criterion of minimum distance, then we will get the initial classification, and if the classification if unreasonable, we will modify it(calculate each cluster focal points again), iterate repetitively till we get a reasonable classification. K-Means algorithm based on dividing is a kind of cluster algorithm, and has advantages of briefness, efficiency and celerity. However, this algorithm depends quite much on initial dots and the difference in choosing initial samples which always leads to different outcomes. What's more, this algorithm based on target function always uses gradient method to get extremum. The direction of search in gradient method is always along the direction in which energy decreases, which will lead to the fact that when the initial cluster focal point is not proper, and then the whole algorithm will easily sink into local minimum point. K-Means algorithm K-Means algorithm based on dividing [4,5] is a kind of cluster algorithm, and it is proposed by J.B. MacQueen. This algorithm which is unsupervised is usually used in data mining and pattern recognition. Aiming at minimizing cluster performance index, square-error and error criterion are foundations of this algorithm. To seek the optimalizing outcome, this algorithm tries to find K divisions to satisfy a certain criterion. Firstly, choose some dots to represent the initial cluster focal points(usually, we choose the first K sample dots of income to represent the initial cluster focal point); secondly, gather the remaining sample dots to their focal points in accordance with the criterion of minimum distance, then we will get the initial classification, and if the classification if unreasonable, we will modify it(calculate each cluster focal points again), iterate repetitively till we get a reasonable classification. K-Means algorithm based on dividing is a kind of cluster algorithm, and has advantages of briefness, efficiency and celerity. However, this algorithm depends quite much on initial dots and the difference in choosing initial samples which always leads to different outcomes. What's more, this algorithm based on target function always uses gradient method to get extremum. The direction of search in gradient method is always along the direction in which energy decreases, which will lead to the fact that when the initial cluster focal point is not proper, and then the whole algorithm will easily sink into local minimum point.

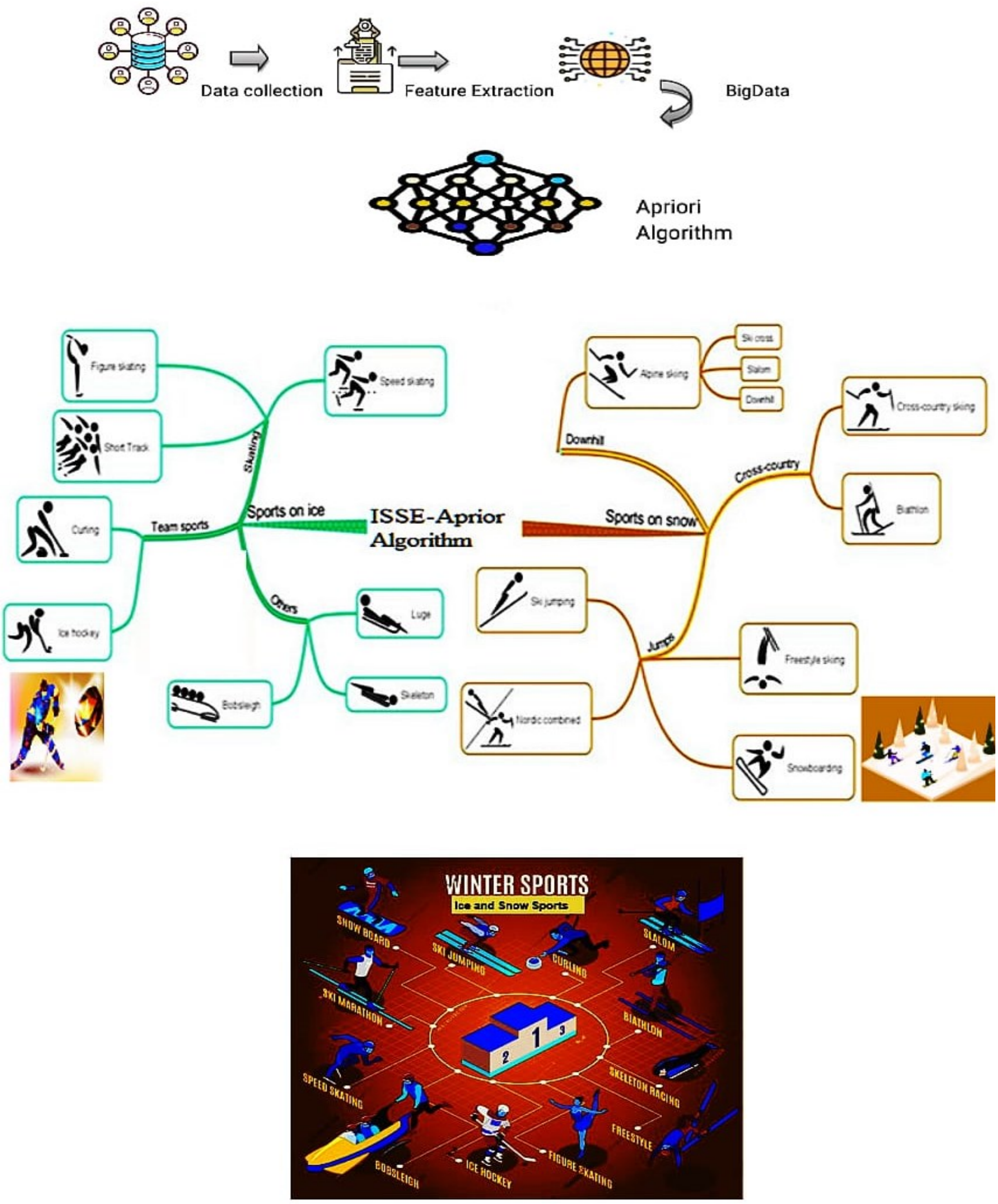


Figure 2. Proposed method.

7. K-Means clustering algorithm

In order to choose the first clustering centers, this thesis employs an enhanced snow and ice sports approach to identify items with a great quantity that are simpler to use as central cluster.

The following is the Equation (1) to find the Euclidean distance:

$$d(x_a, x_b) = \sqrt{\sum_{t=1}^{n} (x_{at} - x_{bt}).^2} \quad (1)$$

x_a , x_b is the sports object with data, x_{at} is the characteristicofx_a, x_{bt} is the characteristic of x_b.

Core of cluster are employed in data modeling. While K-means clustering locates cluster centers with spatial extents in game, the expectation-maximization sports approach permits the cluster centers to have varying shapes.

The core of clusters is illustrated as in Equation (2):

$$center_s = \frac{1}{|c_s|} \sum_{x_a \in c_s} x_a \tag{2}$$

Center s is the core of the s th sports clustering, c_s is the s th clustering, and $x_a \in c_s$ is all objects of data is c_s.

Equation (3) expresses the distance between the point samples, which is separated between the object of sports and the instance data set.

$$distance = \sum_{x_a \in D'} d\left(x_a, \text{center } Y_y\right) \tag{4}$$

The following is the expression (5) for the total distance between object of data x_a and alternative groups empty of this item:

$$sum = \sum_{x_a \in c_s} d(x_a, x_b)(x_a \in D) \tag{5}$$

8. Ice and Snow Sports industry discuss on big data with proposed Ice and Snow Sports Enhanced (ISSE)-Apriori Algorithm

The drawback of the Traditional Aprior algorithm is that it repeatedly scans databases and creates intermediary processes, which puts a heavy load on computers. Large databases are not suitable for the apriori process. The only things this algorithm defines are whether an item is present or not. There is a consistent minimum support level allowed for this algorithm. It can only handle tiny databases. To calculate frequent items, the transaction database needs to be scanned more thoroughly. In order to lessen these problems, this work suggests an ISSE-Apriori Algorithm that uses matrix compression, partitioning, and subsumption. Experiments are conducted to evaluate the snow and ice sports event strategy effectiveness of the improved algorithm.

1) matrix compression-based ISSE-Apriori method:

In order to address the influence of big data volumes on computer performance and probable crashes if typical systems cannot correctly finish the task, this study modifies traditional-apriori algorithm by introducing matrix compression.

Boolean transaction matrix sports: From the database for transactions$d$, the transaction matrix *M* is obtained. The precise conversion rules are as follows: the dataset is first organized from small to big; for every transaction is then organized in accordance with the guide; if the jth transmit is present in the i group set, from the value of transmit matrix dij's row and column is 1, otherwise it is zero. Such a transmit matrix *M* is known as the database for transactionsd's Boolean transaction matrix.

$$M = \begin{array}{c} \\ I_1 \\ I_2 \\ \vdots \\ I_m \end{array} \begin{array}{c} \begin{array}{cccc} T_1 & T_2 & \vdots & T_n \end{array} \\ \begin{bmatrix} d_{11} & d_{12} & \dots & d_{1n} \\ d_{21} & d_{22} & \dots & d_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ d_{m1} & d_{m2} & \dots & d_{mn} \end{bmatrix} \end{array} \quad (6)$$

The sports event data groups that correspond to M were $Im = \{I1, I2, \cdots, Im\}$., as can be observed from Equation (6). The row $(di1, di2, \cdots, din)$ where item set Ii is situated, referred as Ii, is the row's snow matrix that represents Ii, and the column vector relating to Tj is the column $(d1j, d2j, \cdots, dmj)$ wherever strategy Tj exists. Thus, a snow event d with n as ice events $(T1, T2, \cdots, Tn)$and m object sets ($I1$, $I2$, …, Im). can be turned into the sports event matrix. The event matrix M i-th row indicator is Ii, while its j-th section vector is Tj. The dataset of items created by selecting any k rows from a total number of row in M the sports event matrix M is known as the k dataset as $Ck = \{Ii1, Ii2, \cdots, Iik\}$support. The equation is:

$$s(C_k) = \sum_{j=1}^{n} (d_{i1j} {}^{\wedge} d_{i2j} {}^{\wedge} \dots d_{ikj}) \quad (7)$$

Each iteration of the ISSE-Apriori algorithm calculates the matching sports candidate itemsets, and the support for each itemset is tracked in this index relationship table.

2) ISSE-Apriori approach based on subsumption and segmentation:

Consequently, this paper adopts the idea of strategy, that can split the data according to specific winter sports parameters and separates the resulting different and unrelated datasets the entire snow sports database for transaction d, to lower this usage and make it easier for multitasking processes to be parallelized. The modern computer can benefit from this partitioning concept by parallelizing multi-threaded operations. Given that every split database is less in size than the database for transaction, d, there will be less area above in bigdata. This segmentation event idea is advantageous to the recent computer as it allows the bigdata to be parallelized through multithreading operations, this can significantly increase sports strategy and computation efficiency.

The sports transactional strategy database d can be partitioned to produce independent, unrelated n-partitioned databases:

$$d = \{d_1, d_{2,\dots} dn\} \quad (8)$$

A complete snow and ice sports transactional database S is formed by all of the partitioned databases Si $(i = 1, 2, \cdots, n)$ since they are independent and uncorrelated. Put differently, $S = S1 \cup S2 \cup \cdots \cup Sn, S1 \cap S2 \cap \cdots \cap Sn = \Phi$. An ISS Enhanced- Apriori method is utilized to mine and analyze candidate behavior for each strategy segmentation database Si $(i = 1,2, \cdots, n)$. One can determine the ultimate outcome of n frequent itemsets, represented as$Lk(k = 1,2, \cdots, n)$. The end outcome is the unification of all present frequent itemsets using the concept of subsumption.

3) The algorithm is based on the average of weights:

As previously mentioned, the measures similarity, and the mean weighted –based on ISSE-Apriori algorithm in the clusters technique aims to allocate sports objects for data to the cluster with the effective similarity. This is accomplished by comparing each snow and ice sports data object's Euclidean distance with the mean weighted of all event sports. Density-based clustering leads to a superior first grouping center. To obtain it, compute the mathematical value for every sample collection independently; each mathematical is the starting clustering centroid.

The entire count of objects with data in collection d is denoted by $j = 1,2,\ldots,Ni,N,$ and the Euclidean distance in Euclidean among xi and yi is distance (xj, yj). The mass of sports data object with data in collection d can be stated as follows in Equations (9)–(11):

$$N = \sum_{j=1}^{k} N_j \tag{9}$$

$$\lambda_j = \frac{\sum_{j=1} distance(x_j, y_j)}{N} \tag{10}$$

$$\lambda_j = \frac{\lambda_j}{\sum_{j=1}^{N} \lambda_j} \tag{11}$$

In contrast to the objective with conventional function, the enhanced method uses a threshold value, represented by formula: δi, to represent the weights as shown in Equation (12).

$$\delta_i = \frac{N_i}{N} \tag{12}$$

As can be seen, the ratio of the count of clustering to the total objects with count that has data for every cluster is the threshold coefficient in this case. As a result, the objective criteria function's final expression can be found and computed in Equation (13).

$$I = \sum_{i=1}^{k} \delta_i \sum_{x_a \in c_i} distance(x_{b,} c_i) \tag{13}$$

distance (xa, $Ci*$) indicates xj and $Ci*$.

4) ISSE- Apriori Algorithm on sports training decision-making pattern:

To explain the information in the data, an association rule must be built as part of the process of applying BigData technology to develop a sports training pattern decision-making system. In order to create a set of criteria of association for training in sports modes, the author uses an adaptive weighting technique. The bigdata final weighting coefficients important rules is as follows in Equation (14):

$$\omega_{s_{xy}}(n_0 + 1) = \omega_{s_{xy}}(n_0) - n_{\mathrm{sxy}} \frac{\partial I}{\partial y_{sxy}} \tag{14}$$

Performing comparison analysis on the connected the sports in the data practice mode decision-making system yields the following results for the adaptive learning process:

$$\alpha_{desira}^{x} = \alpha_x \frac{Density_x}{\epsilon_x \cdot Density_x} + \alpha_2 \frac{AP_x}{AP_{xinit}} \tag{15}$$

To find the bigdata probability density function, reorder the related data that is stored in the system as six tuples:

$$s_P = s_{2B}^{k}(1 - s_{2B}) \sum_{i=1}^{I \to -k^{\infty}} \lambda_i^i = \frac{\lambda_i}{1 - \lambda_i} \tag{16}$$

λ_i,s_{2B}^{k} reflect the possibility that the data can be successfully discovered as well as the correlation dimension of the data.

9. Results and discussion

9.1. Data source

This study presents a participation ice and snow sports consumer demand questionnaire that was subjected to presurvey item analysis, confirmatory factor analysis, exploratory factor analysis, and other factors in order to verify its validity and reliability. Six of the 500 questionnaires distributed through network surveys and street encounters were deemed invalid owing to confusion during the presurvey. 50 genuine questionnaires were acquired after duplicates were removed; 450 respondents were urged to proceed the study. Using the drop duplicates function in the Pandas library in Python, duplicate rows and columns were removed, and Boxplot with outliers was used to handle the missing values.

Advantages: The enormous benefits of science and technology should be fully utilized by China's ice and snow sports, which should also follow the technology-driven strategy founded on the ideas of task orientation, reform, innovation, and development. The suggested algorithm will be put to use in creating a strong nation for ice and snow sports.

9.2. Analysis of China ice and snow cities' resources

The resources for China's 4 comparatively growth in snow and ice sports cities are displayed in **Table 1**. Harbin, Beijing, Changchun, and Shenyang are the four cities.

Table1. Ice and snow cities.

Place	Ice and snow sources	Temperature	period
Beijing	Mainly Artificial	−8 ℃–5 ℃	5 months
Harbin	Natural	−30 ℃–15 ℃	2months
Changchun	Natural	−20 ℃–15 ℃	3months
Shenyang	Mainly natural, supplemented by Artificial	−20 ℃–5 ℃	3months

9.3. Strategy for ice and snow sports event resources

The national sports system reform in China has not clarified the training methods for coaches, instructors, players, officiators, and scientists studying ice and snow sports. Issues like insufficient reserve talents, there is still trouble getting in touch with academic and technological resources, as well as challenges with scientific research centers. To overcome these challenges, innovative ideas have been implemented in the snow and ice sports industry as shown in **Table 2**.

Table 2. Strategy for event sports.

Index	Features in Strategy	Training set (N=300)	Test data (N = 150)	Prediction (%)	Actual Accuracy (%)
S1	Experimental	40	24	67	63
S2	Entertainment	50	43	73	84
S3	Learning	34	14	65	57
S4	Task oriented steam	87	78	73	86
S5	reform	66	49	69	74
S6	Innovative & development	89	73	73	87

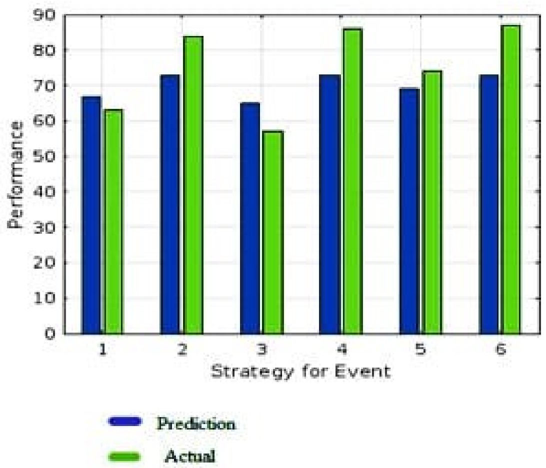


Figure 3. Strategy performance in trained and tested data.

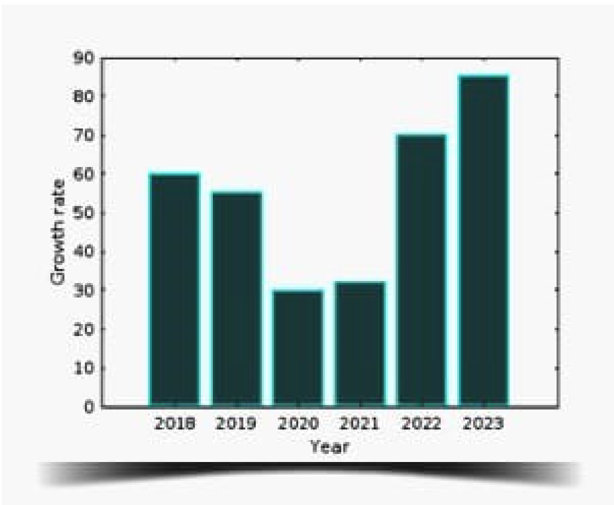


Figure 4. The development growth rate of ski sports with the GDP growth rate in sports industry.

Figures 3 and **4** present data related to strategy performance and growth rates in the sports industry. Figure 3 illustrates the comparison between predicted and actual performance across different strategies for various events, showing how closely predictions align with actual results. In contrast, Figure 4 highlights the growth rate of ski sports from 2018 to 2023, indicating a steady increase, especially in 2023, where it peaked. This figure also provides insight into the relationship between ski sports development and the GDP growth rate in the sports industry, showing trends that could be indicative of broader economic impacts within the sports sector.

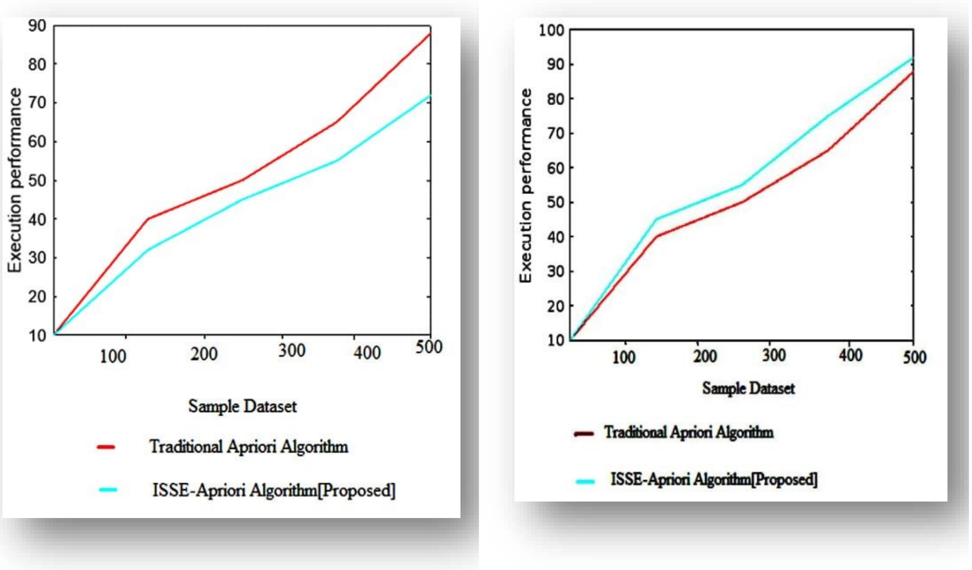
9.4. Industrial development efficiency: A static analysis

The data from China's regions from 2018 to 2023 are analyzed year-by-year based on the proposed model, yielding the measured findings of the industry's development efficiency value. When viewed in the context of the provinces as a whole, Liaoning, Shanxi, and Hebei's sports tourism industries exhibit a declining tendency in terms of overall development efficiency. The industry's total development efficiency is trending upward in the remaining cities, with Jilin and Heilongjiang exhibiting the highest average value at 89%.

9.5. Experimental comparison of proposed algorithm before and after improvement

This research analyzed trials to demonstrate the efficacy and execution efficiency of the ISSE-Apriori algorithm. The PC system environment serves as the basis for this investigation. Simultaneously, 450 snow sports facility data records were chosen for the study.

Figure 5 displays the efficiency and running time that were determined through experiments.



(a) **(b)**

Figure 5. (a) Before; **(b)** After.

As displayed in **Figure 5**: The Apriori algorithm's running time before and after the improvement are not significantly different, as shown in **Figure 5a**. However, as the transaction set grows, the difference between the two methods' running times gradually increases. The proposed algorithm's efficiency has increased, as seen in **Figure 5b**, and it has become more evident as the transaction set has grown. When compared to the traditional Apriori algorithm, the ISSE-Apriori method mines rules more quickly and with a comparatively large progress.

9.6. Performance comparison

In this part, the developed algorithm's results were compared to those of the conventional models. Here, approaches like Convolutional Back propagation Neural (CBP) [17], k-Means Algorithm, weighted centroid Algorithm (WCA) [18], and ISSE-Apriori Algorithm[proposed] are evaluated using performance metrics including accuracy, precision and recall as shown in **Table 3**. Real-time data collecting and processing made possible by big data technologies allows for scientific planning in the recreational ice and snow sports industry. Through the integration of consumption, resource allocation, and consumer group characteristics, it ensures equity, simplifies industry communication, and offers an automatic governance model.

Table 3. Outcome value of accuracy, precision and recall.

Algorithm	Accuracy (%)	Precision (%)	Recall (%)
K-Means cluster algorithm	93.45	90.23	91.84
Convolutional BP (CBP)	81.62	80.93	81.13
Weighted Centroid algorithm (WCA)	85.89	83.07	84.62
ISSE-Apriori Algorithm [Proposed]	98.42	96.34	97.21

The proposed ISSE-Apriori Algorithm outperforms traditional models in predicting event resource strategies in ice and snow sports under BigData performance. **Figure 6** shows as the algorithm achieves accuracies of K-means as 93.45%, CBP as 81.62%, WCA as 85.89%, and the proposed model achieves the highest 98.42% when data volume is 2000, demonstrating its scalability and adaptability over real-time data.

The study compared the precision performance of the designed methodology with existing techniques and **Figure 7** revealing the proposed algorithm ISSE-Apriori, outperformed existing algorithms like K-mean, CBP, and WCA in predicting correct positive instances, with a highest precision of ISSE –Apriori as 96.34%.

The developed system's recall performance is compared to existing models, **Figure 8** demonstrating an enhanced recall rate of ISSE-Apriori algorithm as 97.21% compared to other models like K-Means, CBP and WCA. This performance is based on a 2000 data volume, indicating superior accuracy.

As shown in **Figure 9**, the Ice and Snow Sports with Enhanced (ISSE)-Apriori Algorithm improves prediction performance and scalability, making it effective for real-time strategy in ice and sports performance prediction using BigData.

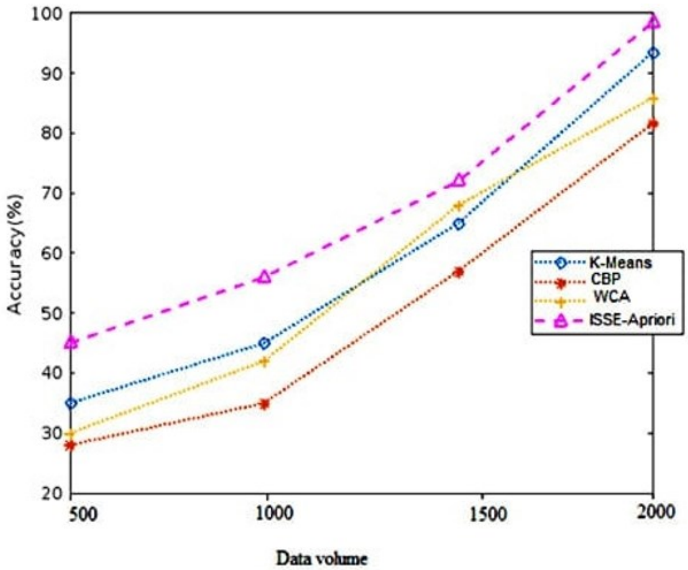


Figure 6. Outcome of accuracy.

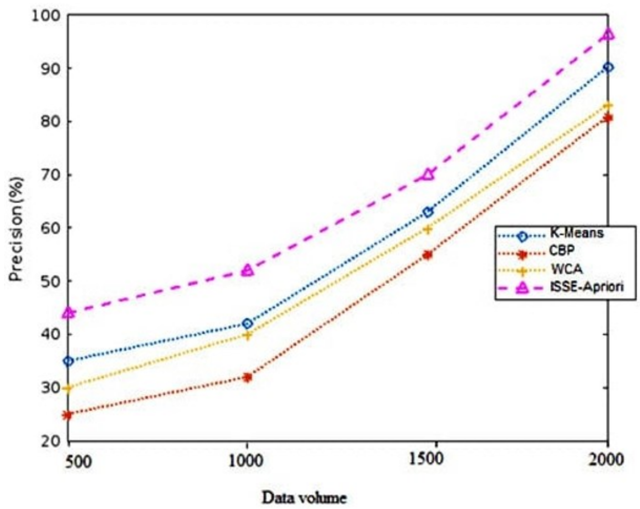


Figure 7. Outcome of precision.

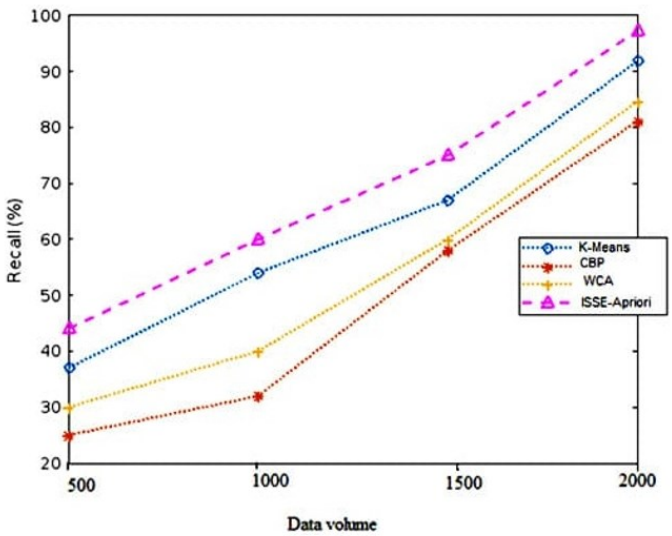


Figure 8. Outcome of recall.

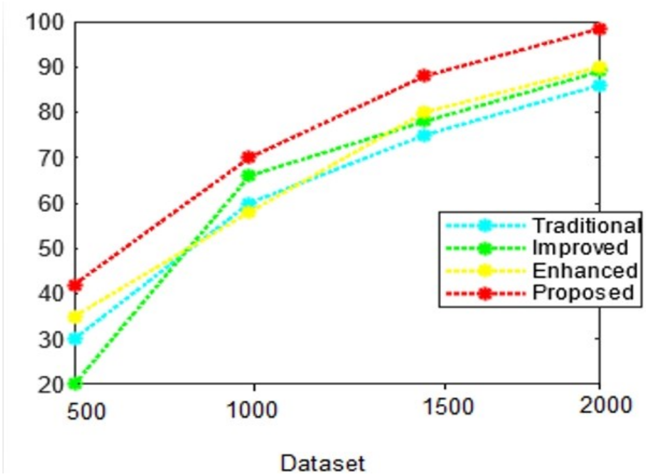


Figure 9. Comparison of Apriori Algorithm performance in large scale dataset.

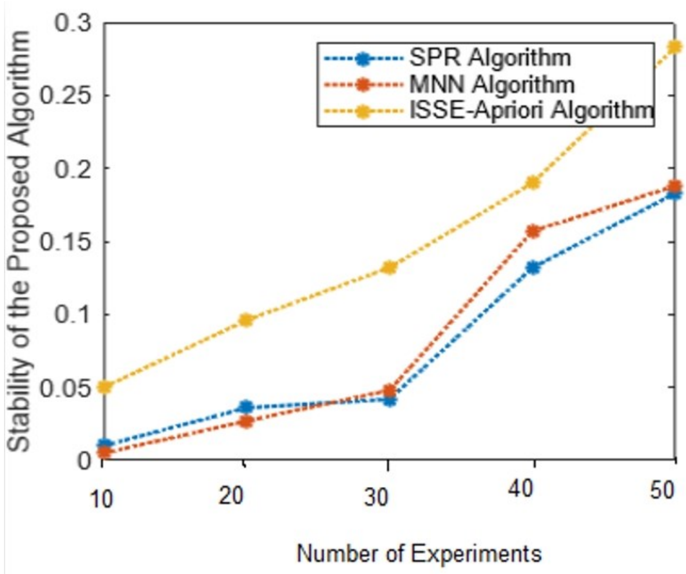


Figure 10. Stability of the experimental result.

As more tests are conducted in **Figure 10**, incorrect data is removed from computations and analysis, improving the overall path planning's stability. Conventional detection devices use hardware-stored data for immediate contact detection and feature extraction. To identify critical detecting nodes, a standard assessment model is predetermined. In this work, the processing object based on changes in the spatial positions of balls from various targets is studied. It is observed that low numerical differences resulting from great structural similarity indicate good accuracy when comparing real-time analytical models with large data systems.

9.10. Performance analysis

In comparison to BP Neural Network Algorithm [17], MNN Algorithms [19], IOT [20], SPR Algorithm [20], and ISSE-Apriori Algorithms with Large datasets, the most popular forms of assessment metrics are RMSE, MAE, and MAPE.

Table 4. RMSE, MAE, MAPE outcome result.

Model	RMSE	MAE	MAPE (%)
MNN Algorithm	0.5938	0.4983	8.64
IOT	0.8865	0.5924	10.12
SPR Algorithm	0.5782	0.4553	8.41
BP Neural Network Algorithm	0.8433	0.4527	9.65
ISSE-Apriori Algorithm	0.3524	0.1832	4.24

9.11. Root Mean Squared Error (RMSE)

As shown in **Figure 11**, the square root of MSE is called RMSE. It calculates the error's standard deviation mathematically. Like MSE, RMSE is frequently employed in model estimations and regressions that call for numerical performance forecasts in ice and snow sports.

$$\text{RMSE} = \sqrt{MSE} = \sqrt{\frac{1}{n}\sum_{i=1}^{n}\left(y_i - \hat{y}_i\right)^2}$$

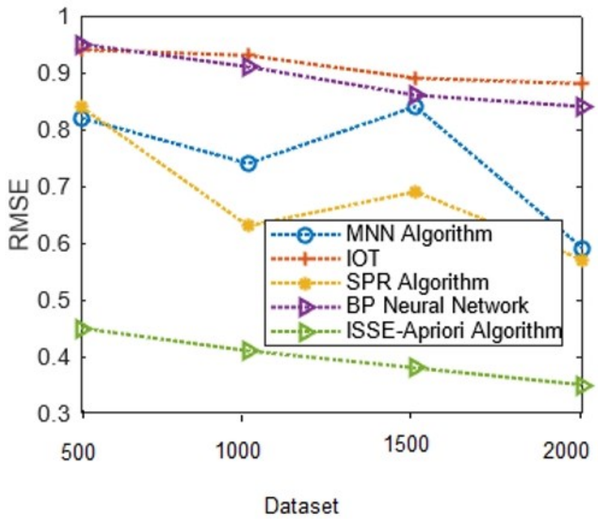


Figure 11. RMSE outcome value of result.

9.12. Mean Average Error (MAE)

As shown in **Figure 12**, the mean absolute error (MAE) measures the average amount of error in the expected performance demand volume. It calculates the discrepancy between experiment forecast values and actual outcomes.

$$\text{MAE} = \frac{1}{n}\sum_{i=1}^{n}\left(y_i - \hat{y}_i\right)$$

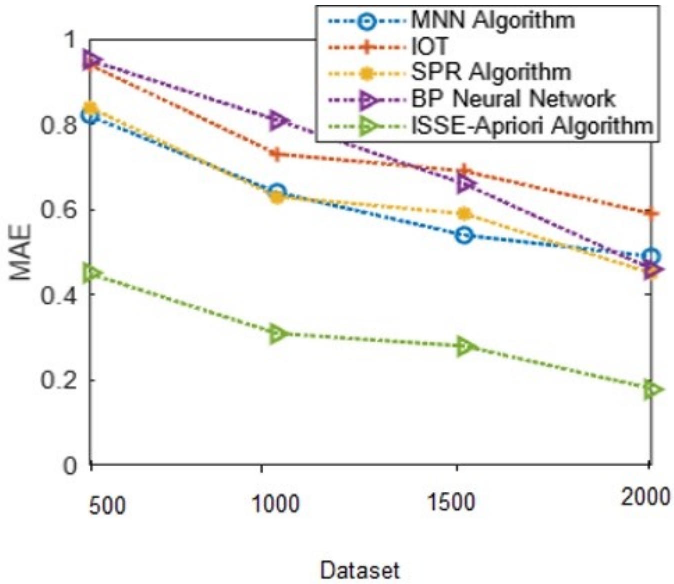


Figure 12. MAE outcome value of result.

9.13. Mean Absolute Percentage Error (MAPE)

As shown in **Figure 13**, the average of the absolute percentage discrepancies between the actual data and the model's predictions is determined by MAPE. As a result, the average error is expressed by this metric as a percentage of the actual number.

$$\mathrm{MAP}E = \frac{100}{n}\frac{1}{n}\sum_{i=1}^{n}\left(y_i - \hat{y}_i\right)$$

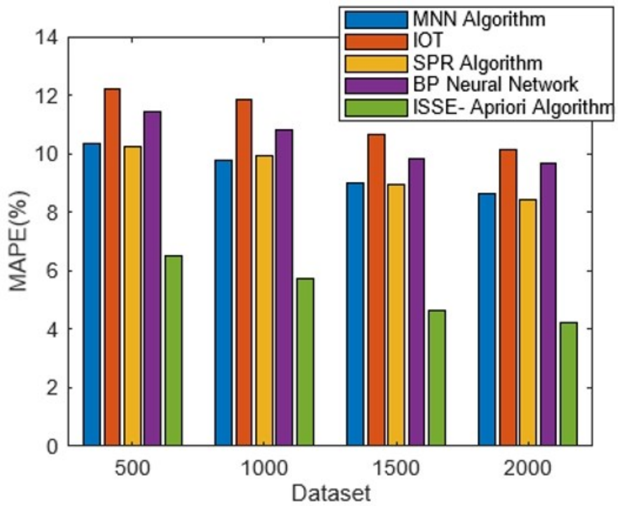


Figure 13. MAPE outcome value of result.

10. Conclusion

This article explores the industrialization and innovation of the ice and snow sports industry, focusing on task orientation, reform, innovation, and development. It compares the Apriori algorithm with other clustering existing techniques and develops the ISSE-Apriori algorithm to improve traditional association analysis. Results show that the proposed training system improves ice and snow sports strategy. However, challenges like interpretability and adaptation need to be addressed, and future studies should focus on other sports domains. The Suggested Approach's performance is measured in terms of RMSE (0.3524), MAE (0.1832), MAPE (4.24) with large dataset. The finding revealed that the suggested predictive model achieves a highest performance in real time scenarios and displays a minimal reduction compared to traditional approach.

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Conflict of interest: The author declares no conflict of interest.

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