Research Article

Attribution Interpretation of Urban Marathon Events Based on Random Matrix Model

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The arrival of the national fitness boom has enabled the marathon as a large-scale sports event to attract the attention of a sufficient number of sports enthusiasts in a relatively short period of time. These people attracted by the event will have a series of expenses and expenditures also precisely reflect the prominent role of sports events on social and economic effects. In this paper, the AISAS consumption behavior model is used as the theoretical research model, and the survey data of urban marathon participants is used as the basis for analysis. The methods of generating attention, interest surveys, information search methods, actual consumption items and amounts during the action, and postmatch satisfaction and information sharing willingness and methods have been analyzed and counted in detail, and spss21.0 software is used to analyze the statistics. The results are analyzed. In addition, this paper studies the effect of the subspace weighting algorithm based on the singular value of random matrix on the urban marathon. Using the results of the eigenvalues of the sample covariance matrix in random matrix theory, the energy of each subspace is estimated, and then the subspace weighting matrix is constructed with the estimated energy. Through the calculation of the weights of the indicators, the weights of the three-level indicators of the event quality are ranked in the order of participation experience, cooperative media level, enthusiasm of local residents to watch the competition, registration status of the competition, number of sponsors, quality of sponsors, enthusiasm of local residents to participate in the competition, media value, and number of cooperative media algorithm, in which the marathon economic effect is defined as the estimated angle where the deviation between the estimated value and the true value exceeds 20%, that is, the root mean square error of the estimated angle is greater than 10%. In the first-level indicators, the quality of the event to evaluate the impact of the event itself has been added. The quality of the event is the influence of the urban marathon itself, which originates from the quality of the marathon itself. At the same time, the quality of the urban marathon is also the foundation of its economic, social, and environmental impact on the host site, so the quality of the urban marathon is an important impact indicator.

1. Introduction

In the era of national fitness, marathon competition is one of the important activities. The number of competitions is increasing year by year and its influence is increasing, which also drives the development of the sports equipment consumer market. Based on the survey report data of the sports population in 2015, the consumption of sports equipment in that year was more than 3,000 yuan per capita, and the runners included leisure runners, potential runners, and core runners, among which core runners refer to running [1]; runners whose duration lasts more than a quarter and whose frequency is more than twice a week or more. The equipment consumption of core runners is about 4,500 yuan [2]. These consumptions include sportswear, sports shoes, and sports electronic equipment which can better protect the body of the athlete, and at the same time can effectively monitor the amount and health of the exercise [3]. It is worth noting that these fees do not include registration fees and logistical fees for participating in the competition. In addition, under the continuous promotion of computer technology, some sports-related training institutions, social software, and related derivative products and services have shown a diversified development around the hobbies and needs of runners. The running industry has become the first A pivot industry that leverages the “5 trillion market” [4].
The focus attribute and effect of the city marathon itself can influence and drive a series of things related to it, which greatly promotes the economic development and social prosperity of the city. Running is easy to learn and is not limited by venue time. It has gradually developed across the country [5]. Local governments have followed national policies and event development trends to hold marathon events in emerging cities. Various events can attract marathon enthusiasts from all over the country to participate in the competition. Different from professional sports events, in marathon events, amateurs not only watch the race, but also consider the multiple roles of runners, fitness practitioners, and consumers [6].

Whether it is the marketing of urban brands, the development of the running service equipment market, or the promotion of national fitness, they are gradually revealed during the event. The marathon is not only a single sporting event, but also has multiple functions [7]. The traditional DOA estimation algorithm is derived on the premise that the number of snapshots is much larger than the number of array elements. In practical applications, when the number of samples is much larger than the number of array elements, the performance of the traditional method is better [8]. When the number of snapshots is equal to the number of array elements, many statistical inference results obtained according to the traditional asymptotic system have large errors. In the case of low signal-to-noise ratio where the number of snapshots is equal to or even smaller than the number of array elements, the premise that the number of snapshots that traditional algorithms rely on is much larger than the number of array elements no longer holds, resulting in a decrease in DOA estimation performance. In a general sense, consumer behavior refers to a comprehensive reflection of consumers’ demand psychology, purchasing motivation, and consumer willingness psychology, and real actions [9]. This mainly refers to the purchasing behavior of consumers, which is affected by a variety of factors. The first is the application of human needs, which specifically includes the spiritual needs, physical needs, and social needs of athletes, which is also the most direct factor in promoting the consumers to consume [10]. The second is the income level of consumers and the pricing of goods. In general, income and consumption levels are compatible, but for some special commodities, high-income groups will not necessarily promote the development of related commodities. For example, with the continuous increase of residents’ income, the consumption of mid-to-high-end products has been effectively stimulated, while the purchase and consumption of low-end products will decrease. Commodity prices have a direct and significant impact on the consumers’ purchasing motivation [11]. Third, the characteristics of the product itself and the level of after-sales service of the product, the quality of the product and the level of after-sales service will have a direct and far-reaching impact on the market sales of the product. The fourth is the impact of the social environment. Consumer needs, especially social and psychological needs, are more likely to change because of this impact [12].

The weights of the three-level indicators of social impact are the impact on urban residents’ awareness of sports participation, the degree of recognition of long-distance running as an exercise method, the role of publicity on the city’s image, the impact on improving the level of citizens’ civilization, and the impact on the city; the dissemination of local culture, the promotion of the city’s popularity, the impact on urban public sports facilities, the inconvenience of travel caused by traffic control, and the potential safety hazards caused by crowds. Awareness of environmental protection and increased environmental protection efforts. In this paper, DOA estimation algorithms under uniform linear matrix are studied in detail, including MUSIC algorithm, spatial smoothing MUSIC algorithm, weighted subspace algorithm, and DOA estimation algorithm based on compressed sensing. Under the condition of correlated signal source and incoherent signal source, the above algorithm is simulated and analyzed in the case of small snapshot number and low signal-to-noise ratio. At the same time, the Stieltjes transformation and Marčenko–Pastur law, two commonly used tools in random matrix theory, are introduced, the empirical distribution function and limit spectral function of random matrix are introduced in detail, and then the statistical properties of eigenvalues and eigenvectors of sample random matrices are expounded. The methods of generating attention, interest surveys, information search methods, actual consumption items and amounts during the action, and post-match satisfaction and information sharing willingness and methods have been analyzed and counted in detail, and spss21.0 software is used to analyze the statistics.

2. Related Work

Participation in marathon events requires a certain economic cost as support, and people with higher incomes are more enthusiastic to participate in marathon events [13]. In addition, driven by the development of computer technology, the development of marathon events has become more networked and socialized. The countermeasures and suggestions for the economic development of marathon sports events are put forward: to increase the structural adjustment of the marathon event industry, to provide more effective sports consumption supply for the marathon event participants, and to improve the supporting activities of the marathon event economy. Under the current situation, my country’s marathon has fully equipped with the good market basic conditions of government support, enterprise attention, and extensive consumer participation [14]. From the perspective of market supply, my country’s marathon has fully formed around the running consumer group, with hot events. Operation, sports equipment production and sales services, film and television media dissemination, medical condition guarantee, sports nutrition and rehabilitation training, tourism catering and convenient travel, and tourism accommodation are the main suppliers of the main operation market under the complete industrial chain [15]. It is pointed out that from the perspective of the event organizer, the promotion of the event should continue to increase, focus on the cultivation of horse fans, and improve their professional level; at the same time, the organizer
should incorporate the psychological characteristics and lifestyle of consumers into the future consumption and psychological willingness of the event. In the research, we aim to pave the way for further exploration on how to influence consumers’ consumption [16].

The results show that the consumption of participants from outside Sujiang is significantly higher than that of participants in Sujiang, and the characteristics of high-consumption crowds are high family income [17]. Therefore, the managers of the event should fully investigate the characteristics and conditions of the participating athletes, and further formulate appropriate strategies, to provide targeted services, thereby promoting the sustainable development of the relevant market [18]. It is clearly pointed out that the consumption of sports events itself is closely related to the laws of consumer psychology. Before consumers conduct consumption activities or purchase products, they will experience a general psychological process, which generally includes “concerns-interests-expectations- Action - After-taste” five special basic links. The survey found that the proportion of males is higher than that of females among all marathon consumers, and the main groups of sports consumption related to events are young and middle-aged [19].

Since the eigenvalues can better capture the signal correlation, the spectrum sensing algorithm can use the random matrix theory to count the distribution of different eigenvalues of the sample covariance matrix in the decision-making process, and at the same time, it does not need the prior of the main user signal in practical applications and information. Using random matrix theory, new algorithms of Maximum Eigenvalue Detection (MED) and Enhanced Energy Detection (EED) are derived. At the same time, because the covariance matrix can better capture the signal correlation, the correlation signal will outperform the EED algorithm [20]. The traditional method of target parameter estimation in MIMO radar is carried out on the premise that the number of observations is much larger than the number of array elements. However, for MIMO radars with large arrays and insufficient observation data, the estimation performance of target parameter estimation will degrade [21]. Therefore, the literature proposes a high-performance DOA estimation method in non-Gaussian noise environment under the condition that the product of the number of transmit and receive elements and the number of observations in bistatic MIMO radars grows at the same rate. The method uses $M$ estimator to estimate the covariance matrix, and then uses random matrix theory and polynomial rooting algorithm to estimate DOA under large MIMO radar.

3. Distribution Characteristics of Eigenvalues of Event Effects Based on Random Matrix

3.1. Content Construction of Impact Indicators of Urban Marathon Events. According to the analysis of many literature and case data, this study divides the urban marathon impact assessment system into four first-level indicators (including the evaluation of the quality of the event itself, the economic impact, social impact, and environmental impact of the external impact of the event), 14 secondary indicators, and 28 tertiary indicators. In view of the difficulty in obtaining data for some marathon events, the possibility of data acquisition should be considered as much as possible when designing the index content. In addition, this study mainly uses the expert scoring method in the establishment of the index weight. Although this method is more convenient and quicker in practical application, the expert scoring method mainly relies on the theoretical analysis and practice of experts and lacks major data support. Therefore, in order to ensure in the scientific nature of the follow-up research, more objective research methods can be adopted. Figure 1 shows the preliminary conception of the urban marathon impact index evaluation system formed by me through detailed literature theoretical research and case data analysis, according to the triple bottom line evaluation framework system, combined with the actual situation of urban marathon events.

Starting from the event itself, the impact of the event itself has an important impact on the long-term development of the event and the development of the venue where the event is held. Marathon events with good quality and reputation will attract more runners to participate. Cities bring more economic and social benefits. Therefore, while the urban marathon is developing rapidly, it is necessary to pay more attention to the improvement of the quality of the event. Large-scale sports events and urban marathon events that have a significant impact on the host city have first-class reputation and high event evaluation. Therefore, the quality of urban marathon events is an important factor. The quality of the event refers to the service quality of the marathon event itself, the reputation of the event as well as sponsor value and media value, this research mainly focuses on 4 secondary indicators (event organization and management, the level of support and recognition of local residents, the quality of event sponsors, and event-related media coverage), 9 tertiary indicators for “events’ quality” is explained in detail. The quality of the event is the influence of the urban marathon itself, which originates from the quality of the marathon itself. At the same time, the quality of the city marathon is also the foundation of its economic, social, and environmental impact on the host site. The following will analyze the secondary and tertiary indicators through the sorting and analysis of relevant cases.

Event organization and management is one of the important dimensions of event quality, which reflects the level of marathon events. The holding of a marathon event is inseparable from the organization and management of the event organizing committee. To ensure the smooth development of the marathon event, attract runners to participate in the competition, promote the long-term development of the event, and bring maximum benefits to the city. The reasons why this study uses participation experience and registration as two major measurement indicators for event organization and management are as follows. First, the participant’s participation experience is the most direct measure of the organization and management of the event. Participants participate in the entire event and have personal experience with the event organization. Many events conduct satisfaction surveys after the competition, which can be measured by
standard questions. To obtain the satisfaction of the event experience, the participation experience is listed as a measure index. For the event organizer, the event mainly serves the participants, so the evaluation of the quality of the event organization can be analyzed from the participants’ event experience. In the specific measurement, the event experience can be divided into the starting point experience, the track experience, the finish experience, the participating social and interaction, and the prerace and postrace experience. The feedback of the participants after the race has an important influence on the development of the marathon event. For contestants, whether to participate in this event or not and whether they are satisfied with the experience of participating in the event is an important factor.

3.2. Distribution Function. The development of the current stage pursues the Internet economy and pays attention to the participation of the whole people. Therefore, the current market economic effect communication is dominated by the Internet, which is a brand-new communication method, and the communication effect is also better. A consumer-centric communication mode has been formed. In addition to passively accepting some information, consumers can also actively seek their own demand information with the help of network resources, which greatly improves the efficiency and quality of information collection. At the same time, consumers are also a media unit, which can not only formulate the quality of information collection. At the same time, consumers are also a media unit, which can not only formulate the quality of information collection. At the same time, consumers are also a media unit, which can not only formulate the quality of information collection. At the same time, consumers are also a media unit, which can not only formulate the quality of information collection. At the same time, consumers are also a media unit, which can not only formulate the quality of information collection. At the same time, consumers are also a media unit, which can not only formulate the quality of information collection. At the same time, consumers are also a media unit, which can not only formulate the quality of information collection.

In the Stieltjes transform domain, \( m \frac{YY^H(z)}{z} \) needs to be estimated, therefore, the value of each diagonal element of \( YY^H-zI \) needs to be obtained. Due to the symmetric structure of \( YY^H-zI \), only the asymptotic properties of the first diagonal element need to be investigated.

\[
\frac{1}{nN} \left( \frac{1}{zIN} \right) = -z - y^H Y - z I_n.
\]

In the case of the Marchenko–Pastur law, \( m(z)YY^H(z) \) can be expressed as

\[
mYY^H(z) \equiv \left(1 - z - z m YY^H(z) \right)^{-1}.
\]

This formula is equivalent to a second-order polynomial in \( m YY^H(z) \). After inverse Stieltjes transformation, the limit spectrum of \( YY^H \) can be obtained, and its density function \( f(x) \) is

\[
f(x) = \left(1 - \frac{1}{c} \right) + \delta(x) + \frac{\sqrt{(x - 1)(x - a)}}{2 \pi c},
\]

where \( a=(1-c)^2, b=(1+c)^2, \) and \( c=N/n \). However, \( n \) must be much larger than \( N \) to get results to be credible.

In this section, simulation experiments are carried out on the Marathon algorithm, the weighted subspace (WSF) algorithm, and the weighted subspace (RMT_E) algorithm based on random matrix singular values. The simulation uses 15 uniform linearly arranged sensor array elements to receive signals, and the number of signal sources is 3.
Incident from the 20°, 40°, and 70° directions on the same plane as the linear array, respectively, and the number of simulation tests is 10,000 times. Three signal sources with zero mean Gaussian distribution are randomly generated, the noise power is set to 1, and the target source signal is not correlated with the noise signal. Correlation sources are used in this simulation. The correlation coefficient between the first signal source and the second signal source is 0.6, and the third signal source is independent from the first two signal sources. The number of snapshots is 10 and the SNR is −8 dB. Under the conditions of the three algorithms of Marathon, WSF, and RMT_E, the heat change map of the marathon event is shown in Figure 2, where the search angle range is [−90, 90].

When the signal source is correlated, the MUSIC algorithm also has peaks at other angles than the true arrival angle. Currently, if these peaks are too large, it is easy to cause misjudgment. In the actual DOA estimation, the MUSIC algorithm is easy to cause errors in the sentence. At the same time, the MUSIC algorithm has a large deviation of the peak value in the 40° and 70° directions, which will lead to a large estimation error. The angles corresponding to the three peaks of the RMT_E algorithm are all near the true angle of arrival and the peaks are obvious. The spatial spectrum change trend of the WSF algorithm is roughly similar to the RMT_E algorithm, but it is slightly lower than the RMT_E algorithm in the 40° and 70° directions. The deviation of the peak is significantly smaller than that of the MUSIC algorithm, as shown in Figure 3. The price of supplies is also a major factor that can affect the consumers’ sports-related consumption. The method of questionnaire survey was used to investigate the sports consumption behavior of more than 2000 households in urban and rural areas in different cities and regions across the country, and a basic concept of sports consumption behavior of domestic residents was established.

This paper proves that this feature is still adaptable when the matrix dimension is not very large. Then, a weighted subspace (RMT_V) algorithm based on random matrix eigenvectors is proposed, and the weighted matrix under the algorithm is calculated, and the MUSIC algorithm, the weighted subspace (WSF) algorithm, and the weighted subspace based on the singular value of the random matrix are drawn. In the (RMT_E) algorithm and random matrix eigenvector-based weighted subspace (RMT_V) algorithm in the case of correlated signal sources and low signal-to-noise ratio and small number of snapshots, the results show that the in the WSF algorithm, RMT_E algorithm, and RMT_V algorithm, the trend of change is roughly the same, but the magnitude of RMT_V algorithm is slightly higher than that of RMT_E algorithm and WSF algorithm. Under the condition of correlated signal source and uncorrelated signal source, the above four algorithms are simulated with the change of signal-to-noise ratio of estimation error and flying point probability in the case of small snapshot number, and under the condition of correlated signal source, the four algorithms are simulated. Under the condition of low signal-to-noise ratio, the estimation error and the probability of flying point are simulated with the change of snapshot number. The simulation results show that the performance of the RMT_V algorithm is higher than that of the RMT_E algorithm when the signal-to-noise ratio is low, and the number of snapshots is small under the condition of the relevant signal source. Under the condition of uncorrelated signal sources, the performance of the RMT_V algorithm is roughly the same as that of the RMT_E algorithm, but both are higher than the MUSIC algorithm and the WSF algorithm.

3.3. Attribution Strategy of Marathon Consumption Event Effect. At a time when the role of traditional media is weakening and network information is growing exponentially, it is not easy to attract the consumers’ attention. Marathon event information has also shifted from traditional media to new media. First of all, attach importance to the brand effect, create an exclusive marketing account for
the city marathon, design and hold the exclusive logo of the city marathon according to the preferences and needs of consumers, and promote the city marathon, so that it can quickly and effectively attract the attention of the participants in a short time. Secondly, through the research on the living habits of the contestants and the understanding of the trajectory, around the main attention methods of the contestants, a wrap-around and seamless media promotion is carried out, and the advertising coverage area is enhanced as much as possible. Information channels are dominated by social groups and new media, so the host city should focus on integrating traditional media and new media, infiltrating the marathon into the life of the participants, and attracting the wide attention of the participants.

Finally, interpret the brand with precise scenes to create audience memory points. In modern marketing theory, it has become a consensus that scenes have a huge influence on consumers, and effective memory points are the key to forming brand recognition. The new generation of consumers often learns about marathon events through new media such as Weibo, WeChat, QQ, and Tiega. When the organizer promotes through new media, it can choose representative pictures. The publicity pictures that represent the city image and the characteristics of the marathon are more likely to attract the attention of the participants. The youth of the form of attention and the popularization of social software have forced image promotion from passive sales to word-of-mouth communication and information collection, as shown in Figure 4. This also highlights the importance of promoting the image of the city where the marathon is held. The content of promotion is very extensive, and the forms of promotion are also diversified, such as billboards in the competition area, brochures, in addition to word-of-mouth of tourists, film and television, which will stimulate the consumption and promote the participation of the masses in the competition. Therefore, event organizers should increase the breadth and depth of publicity, attract wide attention through advertising creativity, and expand consumer groups.

The international marathon is a sports feast facing the world, which brings a good image of the city, brand promotion, and tourism revenue. Therefore, the marketing and service of the host city should be participated by many parties, and the government, units, enterprises, and non-governmental organizations should work together to achieve the goal and fully cooperate to promote the completion of the entire goal. In the specific division of work, the government and tourism management departments and enterprises should assume the role of management and leadership, fully combine their own resources and advantages to carry out active marketing and construct a good marketing environment. They are important participants and the largest the beneficiaries, therefore, have the greatest responsibility. Therefore, in the process of holding the event, it is necessary to give full play to the advantages and synergy of the two to achieve a win-win situation. According to the AISAS consumption behavior model, it can be further expanded and developed into a collaborative marketing model of the marathon industry chain. This model analyzes consumers' consumption needs and characteristics with the help of Internet technology, and then uses this as an entry point for online search and sharing. In this method, the operability is strong, and the operation effect is good. The marathon event has risen from a niche sports competition in the past to an industrial model that organically combines public welfare and business with "sports and fitness, life and tourism, health and green" under the background of national fitness. The government and enterprises can only join forces, relying on the strong development of network technology and big data technology, fully realize the consumption mode of "everyone participates, and everyone shares" in marathon events, and strive to push the marathon consumption boom to a new height.

4. Competition Model Simulation Experiment

Only by forming attention and maintaining ideological attention can consumers participate in the marathon and make purchases. This is also the driving force for the organizers of the event. At the same time, it can also drive urban consumption and promote the image of the city. The "attention" stage is a process in which the host city transmits the information about the event or the event to the contestants through the media, and the contestants continuously internalize the information they receive. In the Internet age, consumers' attention behaviors are gradually manifested as activities that actively seek to meet their own consumption needs. MUSIC algorithm, weighted subspace (WSF) algorithm, random matrix singular value-based weighted subspace (RMT_E) algorithm, and random matrix eigenvector-based weighted subspace (RMT_V) algorithm are used for simulation experiments. The sensor array element receives signals, and the number of signal sources is 3, which are incident from the 20°, 40°, and 70° directions on the same plane as the linear array, and the number of simulation tests is 10,000 times. Three signal sources with zero mean Gaussian distribution are randomly generated, the noise power is set to 1, and the target source signal is not correlated with the noise signal. This simulation uses
correlated signal sources. The correlation coefficient between the first signal source and the second signal source is 0.6, the third signal source is independent from the first two signal sources, the SNR is $-3\,\text{dB}$, and the number of snapshots ranges from 4 to 18. The root mean square error curve and the flying point probability curve of the four algorithms are obtained when the number of snapshots changes, as shown in Figure 5.

When the four algorithms change with the number of snapshots, the trend of estimation error and flying point probability is roughly the same. When the number of snapshots is lower than 10, the estimation error and flying point probability of the RMT_V algorithm are lower than those of the MUSIC algorithm, the WSF algorithm, and the RMT_E algorithm. Currently, the performance of the RMT_V algorithm is better than that of the RMT_E algorithm, and when the number of snapshots is greater than 10, the estimation error and flying point probability of the RMT_E algorithm are lower than those of the other three algorithms. At this time, the performance of the RMT_E algorithm is the best. The four algorithms have roughly the same trend of estimation error and flying point probability when the signal-to-noise ratio changes. The estimation error of the RMT_V algorithm is lower than that of the MUSIC algorithm and the WSF algorithm, and slightly lower than that of the RMT_E algorithm, but its flying point probability is slightly lower than that of the WSF algorithm, which roughly coincides with the RMT_E algorithm. Since the flying point refers to the estimated angle whose deviation between the estimated angle and the real angle exceeds 0.5°, and the calculation of the flying point probability only considers the proportion of the root mean square error of the estimated angle greater than 0.5, which shows that the RMT_V algorithm and the RMT_E algorithm have the difference of the flying point. The number is roughly the same. Therefore, the performance of the RMT_V algorithm is slightly higher than that of the RMT_E algorithm, and both are higher than that of the WSF algorithm. In this simulation, an uncorrelated signal source is used and the number of fixed snapshots is 8. The SNR varies from $-14\,\text{dB}$ to $-8\,\text{dB}$, and the root mean square error of the algorithm and the probability of flying spots with the signal-to-noise ratio under the uncorrelated signal source are obtained as shown in Figure 6. The selection of the three-level indicators is mainly based on various aspects of macroeconomic indicators, and the measurement indicators that can best show the impact of macroeconomics, and the indicators that are not easy to obtain have been deleted. Finally, the three-level indicators are designated as government investment attraction.

The number of cooperative media can directly reflect the popularity and influence of the marathon. Taking the Sujiang Marathon as example, the Sujiang Marathon is a marathon gold-label event sponsored by the Athletics Association and the Sujiang Sports Federation and has a high reputation and influence in the industry. Including special support media, online live broadcast cooperative media, exclusive cooperative media, cooperative self-media, there are many cooperative media. The Sujiang Marathon has been held for a short period of time, and its influence and popularity are not as good as those of the Sujiang Marathon. In 2019, the number of cooperative media was only 6, and the number of cooperative media was relatively small, indicating that the number of cooperative media can show the influence and popularity of the marathon event. The marathon race is long, and the track covers a wide range. The number of spectators around the track passing through the residential area has increased significantly, and the atmosphere is warm. The cheering team organized by the residents has enhanced the atmosphere of the event. Compared with domestic marathon audiences, foreign marathon audiences participate more enthusiastically. For example, in addition to being the marathon event with the largest number of participants in the world, the Marathon also has 2
million live audiences. One of the most influential marathon events, it attracts more than 20,000 participants every year, with hundreds of thousands of spectators. This simulation uses correlated signal sources. The correlation coefficient between the first signal source and the second signal source is 0.6, the third signal source is independent from the first two signal sources, the fixed SNR is $-3\,\text{dB}$, and the number of snapshots ranges from 4 to 18 changes, and the root mean square error curves of the three algorithms with the number of snapshots are shown in Figure 7. From the overall trend, the estimation errors of the three algorithms decrease with the increase of the number of snapshots. The estimation errors of the RMT_E algorithm are lower than those of the MUSIC algorithm and the WSF algorithm. When the number of snapshots is extremely low, the estimation errors of the three algorithms are lower than those of the MUSIC algorithm and the WSF algorithm. Approaching the same, but with the increase of snapshot number, the error of RMT_E algorithm will be significantly lower than that of MUSIC algorithm and WSF algorithm.

The number of event sponsors can reflect the influence of the event on the surface. In 2018, there were 29 gold-label marathon events of the Athletics Association, with an average number of sponsors of 18.3; a total of 17 silver-label events with an average number of sponsors of 14.8; it can be clearly seen in Figure 8 that the higher the level of the marathon event sponsors, the more the bronze-label events are. Through the statistics and sorting of the number of sponsors of the gold, silver, and bronze medal events on the official website of the Marathon, it is found that the largest number of sponsors is the gold-label event, followed by the silver label event, and finally the bronze label event.

The selection of the three-level indicators is mainly based on various aspects of macroeconomic indicators, and the measurement indicators that can best show the impact of macroeconomics, and the indicators that are not easy to obtain have been deleted. Finally, the three-level indicators are designated as government investment attraction. There are three aspects: increasing the number of jobs, promoting the optimization, and upgrading of the urban industrial structure. First, the local government used the marathon to attract investors to bring in new investment and promote the local government’s investment promotion work. Secondly, the event brings many people to the city, so many staff and service personnel are needed to meet the various needs of the participants and related groups during the event, including hotels, restaurants, and other places, bringing more jobs to the city, and part of the employment pressure in the host city has been relieved. Finally, the holding of the marathon event puts forward higher requirements on the service level of the host city. The holding of the event can improve the operation level of the city and organize the coordinated development of various industries, thereby optimizing the industrial structure of the city, as shown in Figure 9. Brand events
promote the development of cities into new type cities and promote the transformation and upgrading of cities.

5. Conclusion

Based on the WSF weighting matrix principle, this paper focuses on the weighted subspace algorithm based on the singular value of the random matrix. The energy of the subspace is used to replace the eigenvalues of the signal subspace in the WSF weighting matrix, and the weighted matrix based on the singular value of the random matrix is obtained. Under the condition of related signal sources, the changes of the MUSIC algorithm, the weighted subspace algorithm, and the weighted subspace algorithm based on the singular value of the random matrix with the signal-to-noise ratio at a small number of snapshots and the signal-to-noise snapshot at a low signal-to-noise ratio are compared. The simulation and performance comparison of the above three algorithms are carried out in the case of small snapshot number and signal-to-noise ratio change under the condition of uncorrelated signal sources. The main research result of this research is “Indicator Evaluation System of Urban Marathon Impact”, the evaluation system consists of four first-level indicators (including the quality of the event itself, and three main impacts: economic impact, social impact, and environmental impact), 14 secondary indicators, and 28 tertiary indicators. And take the Sujiang Marathon as an empirical case to verify that the index system consists of four first-level indicators (including the quality of the event itself, and three main impacts: economic impact, social impact, and environmental impact), 14 secondary indicators, and 28 tertiary indicators. And take the Sujiang Marathon as an empirical case to verify that the index evaluation system has good feasibility and can comprehensively capture the impact level of the event in terms of event quality, economy, society, and environment. Through the calculation of the weights of the indicators, the weights of the three-level indicators of the event quality are ranked in the order of participation experience, cooperative media level, enthusiasm of local residents to watch the competition, registration status of the competition, number of sponsors, quality of sponsors, enthusiasm of local residents to participate in the competition, media value, number of cooperative media; the weights of the three-level indicators of economic impact are the increase in the number of tourists, the driving effect on the sports industry, the increase in tourism revenue, the driving effect on other industries, the government’s investment attraction, the number of new jobs, and the promotion of industrial structural upgrade. In the future, the largest number of sponsors is the gold-label event, followed by the silver label event, and finally the bronze label event.

Data Availability

The data used to support the findings of this study are included within the article.

Conflicts of Interest

The author declares no conflicts of interest.

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