Big data detection of marine biological characteristics and juvenile swimming based on massive data

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Abstract
With the rapid development of modern information technology, a series of chain reactions have taken place, among which the explosive increase of big data is one of its remarkable characteristics. Data mining is the process of finding the information hidden in the algorithm from a large number of data. How to effectively process and store these large amounts of data to obtain the effective knowledge is a very important task. In this study, we introduce data preprocessing technology, mass storage methods, and so on. The results show that the existence of large-scale algae plays an important role in the habitat and growth of claw algae and Chrysopa. However, there are some differences in the functions of different marine biological characteristics in the formation of biological populations. What causes these differences? Its own diversity is one of the important factors. In today's era of big data flooding, its application scope is also very wide, including swimming. Swimming training in China's young people, has not been able to do very well. In this paper, through the research and analysis of marine biological characteristics and youth swimming big data detection and the results are applied to practical life, in order to achieve its practical significance.

Keywords Marine biological characteristics · Teenagers · Swimming · Big data

Introduction
With the continuous development of the information age, various software and hardware play an increasing role in real life, and they have become an indispensable and important component in people's daily life. This article focuses on the research of marine biological characteristics and the detection of big data for teenagers' swimming sports, and finds that we must adapt to the torrent of the times and face the arrival of big data with a more mature attitude. In the case of data explosion, the demand for data throughput, efficiency, and security is increasing. In the context of the advanced era of big data, there are countless examples of big data being applied to sports (Carvalho and de Vilhena 2005). In an ideal situation, all information about a large amount of data is reliable, but in fact there is a large amount of redundant information, and the data must be preprocessed before a large amount of data can be worked out. Data preprocessing technology is a process of deleting a large amount of data that actually does not work. It usually includes several parts such as data cleaning, data integration conversion, data convention, and conceptual layer. A large amount of data has basic characteristics (Gilman et al. 2002). The growth of data in actual applications is not proportional to the efficiency of data management and transmission, and runs counter to it. And in severe cases, some functions of big data may even be completely lost. The existence of a large amount of data makes data processing technology more demanding. How to improve the demand for large amounts of data in the storage layer, how to scientifically reduce data redundancy and duplication, and how to improve the time and quality efficiency of storing and simultaneously reading and writing data. Therefore, the reasonable processing of large amounts of data will bring new opportunities and challenges to researchers. It is undoubtedly a double-edged sword that can fully reflect the strength of a country. However, in general, swimming is the number one in the Olympic Games. Every major country pays great attention to the development of the...
second largest sports (Lakshmi Narayanan et al. 2017). The emergence of swimming clubs has far-reaching significance for the development of Chinese swimming events, and it can inject great vitality into it. As a game held in the form of a private club for the first time, it has a very strong role in promoting the development of Chinese swimming (Say et al. 2008). We should face it with a positive attitude. We should actively promote the development of all people’s sports and promote fun. The concepts of swimming, healthy swimming, and safe swimming (Meng et al. 2015). At the same time, we must also actively develop young people’s awareness of competition and raise their awareness and awareness of swimming, so as to strengthen the vigorous development of such projects in all aspects.

Materials and methods

Main reagents and instruments

Reagents and preparation

10% KOH solution: Collect 100 grams of solid KOH, add it to ultrapure water, dissolve and fill to 1 liter, cool at room temperature, and then use a glass fiber filter.

30% H202 solution: After filtering through a glass fiber membrane, collect the filtered solution and save it for later use. As shown in Table 1 below:

Table 1: Main experimental reagents and materials

| Reagent name                  | Purity or model | factory                        |
|-------------------------------|----------------|--------------------------------|
| Potassium Hydroxide (KOH)     | Analytical purity (AR) | Sinopharm Chemical Reagent Co., Ltd. |
| 30% hydrogen peroxide (H2O2)  | Analytical purity (AR) | Sinopharm Chemical Reagent Co., Ltd. |
| Absolute ethanol              | Analytical purity (AR) | Sinopharm Chemical Reagent Co., Ltd. |
| Glass fiber membrane          | CF/F            | Whatman, United Kingdom         |

Table 2: The main sources of massive data

| Data category | Source                                      |
|---------------|---------------------------------------------|
| Sensor data   | Perception of the environment from sensors |
| Website clickstream data | Clickstream from users on the Internet |
| RFID data     | Data from a wide range of RFID applications |

Here, k represents the dimension of the small space, u represents the basis of the low-dimensional space, called the basis matrix:

\[
\min_{U,V} \|X - UV^T\|_F^2, \quad \text{s.t.} \quad U \geq 0, V \geq 0
\]  \hspace{1cm} (3)

Here, II represents the Globenius norm, and the\(u\geq0\) and\(v\geq0\) constraints mean that all matrix elements of u and v are not negative. Since the scheduled matrix v can be interpreted as the probability after clustering, the result of data clustering is:

\[
l(X, j) = \arg \max_k y_{jk}
\]  \hspace{1cm} (4)

A low level means that it is different for each perspective. In order to fuse information from multiple perspectives, the competition coefficient matrix must be solved.

\[
D(V^{(t)}, V^{*}) = \|V^{(t)} - V^{*}\|_F^2
\]  \hspace{1cm} (5)

\[
\min : \sum_{t=1}^{T} \|X^{(t)} - U^{(t)}(V^{(t)})^T I_{II} - \sum_{t=1}^{T} \lambda_t \|V^{(t)} - V^{*}\|_F^2 \geq 0
\]  \hspace{1cm} (6)

Parameters are generally used to control the weights between different perspectives and the weights between matrix decomposition reconstruction errors and inconsistencies.

\[
Q^{(t)} = \text{diag}\left( \sum_{i=1}^{M} U^{(t)}_{i1}, \sum_{i=1}^{M} U^{(t)}_{i2}, \ldots, \sum_{i=1}^{M} U^{(t)}_{iK} \right)
\]  \hspace{1cm} (7)

\[
J = \sum_{t=1}^{T} \|X^{(t)} - U^{(t)}(V^{(t)})^T I_{II} - \sum_{t=1}^{T} \lambda_t \|V^{(t)} - V^{*}\|_F^2 \geq 0
\]  \hspace{1cm} (8)

With the rapid development of the Internet, the total amount of global data is increasing every year, and storage units have also developed from GB, TB, PB, and EB to ZB. The main sources of large-scale and massive data are shown in Table 2.
Collection and pretreatment of marine economic organisms

In this study, the method of collecting marine economic organisms was directly purchased. After being purchased at the seafood wholesale market, they were pierced with chaff, marked into bags, and returned to the laboratory for cryopreservation at -20°C for measurement (Chong et al. 2020). When transporting samples over long distances, the transport process can be frozen and stored in ice bags.

The shellfish samples were washed and dried at room temperature. In order to avoid contamination in the cleaning process, close the sheath tightly, follow the direction of the radial ribs on the shell surface, and slowly rinse with a toothbrush; select the sheath sample close to the standard, measure the sheath length, weigh, and avoid mistaking during dissection other organizations (Anirudhan et al. 2012). A mollusk tissue is placed in a 250-ml Erlenmeyer flask, 250 ml of 10% KOH solution is placed, and then sealed with foil. After 5 min of ultrasound, the Erlenmeyer flask was placed in a vibrating culture tank at 60 degrees Celsius and 90 p/min and digested for 24 h. When the digestion is complete, the glass fiber filter (diameter 47 mm, pore diameter 0.7 micron) immediately removes the digestive juice (Groisman et al. 2004).

Identification and analysis of microplastics in marine economic organisms

In order to consider the pollution of marine economic shellfish microplastics, local marine shellfish were collected and investigated at the same time by region, market, and commercial marine economic shellfish in important tourist cities in q city (Ha and Xanthos 2009). Therefore, the pollution status of microplastics in marine economic bivalves in a typical seafood wholesale market is expected to investigate the mountainous areas of five towns and villages in q city, and provide basic data for the assessment and research of pollution of microplastics in coastal waters (Sayed and Burham 2017). The distribution of bi-price sample suppliers of marine economy q-city is shown in Fig. 1(A). Figure 1(B) shows where shellfish samples were purchased in q city in Shandong province and x city in Fujian province.

Table 3  Biological indicators of shellfish samples

| Sampling point | Belong to | Species               | Habitat characteristics      | Number | Shell length (cm) | Shell wet weight (g/unit) | Soft tissue wet weight (g/unit) |
|----------------|----------|-----------------------|------------------------------|--------|-------------------|--------------------------|---------------------------------|
| Q              | Mussels  | Blue mussel           | Attached shellfish           | 10     | 7.61±0.97a       | 28.62±4.02               | 9.76±1.91                      |
| Q              | Clam     | Kungren Lawbin Clams  | Buried shellfish             | 10     | 3.65±0.15        | 7.00±1.07                | 2.64±0.47                      |
| Dongying      | Mussels  | Blue mussel           | Attached shellfish           | 10     | 6.15±0.43        | 12.21±2.43               | 4.37±1.05                      |
| Dongying      | Mackerel | Square Mackerel       | Buried shellfish             | 10     | 3.54±0.21        | 12.79±3.43               | 4.75±1.65                      |
for measurement. The sampling area is selected, the image data is collected, and the principal component automatic analysis is completed with the software (Naderi et al. 2018). The type of microchip polymer is determined according to the infrared spectrum image. The prepared spectrum is compared with the standard spectrum library to determine the polymer type and characteristic functional group absorption peak, test method, resolution, spectral range, etc. based on the spectral comparison. Affects the degree of matching between the test sample and the standard spectrum. If the sample spectrum matches > 70%, when the sample spectrum matches 60% and <70%, the data result is considered to be in the confidence interval and needs to be studied one by one. The characteristic of the spectral peak of the infrared spectrum sample; if the sampling spectrum match is less than 60%, the spectrum is regarded as invalid data.

Results

Analysis of the enrichment characteristics of microplastics in marine organisms

Taking the bivalve soft tissues and fish digestive tracts of typical marine economies in Q City and Dongying City of Shandong Province as examples, Table 3 below shows the indicators.

Table 4 Biological indicators of fish samples

| Sampling point | Belong to Species          | Habitats characteristics | Number | Body length (cm) | Body weight (g/piece) | Wet weight of digestive tract (g/piece) |
|----------------|----------------------------|---------------------------|--------|------------------|----------------------|----------------------------------------|
| Q Yellow croaker | Small yellow croaker       | Plankton fish             | 10     | 20.25±0.34       | 156.65±6.97          | 4.81±0.82                              |
| Q Konoha Flounder | Benthic fish              |                           | 10     | 18.28±0.90       | 194.00±24.17         | 13.65±9.71                             |
| Dongying Flatfish | Xu’s flat touch          | Benthic fish              | 10     | 21.82±0.92       | 309.38±19.11         | 25.34±6.20                             |
| Dongying Pseudomonas pike | Benthic fish          |                           | 10     | 20.44±0.82       | 106.20±11.74         | 11.13±1.72                             |

In the Asia-Pacific region, μ-179 microplastics rich in marine economic organisms were discovered. The polymer type of the microplastic is determined by connecting it with the characteristic absorption peak of the functional body. Figure 2 is an infrared spectrum corresponding to a typical sampling area and another grouping.

In the process of excavation, separation, and analysis, it was found that the international law of marine economic microplastic biology was found to varying degrees at two sampling points (Table 5). Among them, the detection rate

Fig. 2 Infrared imaging images of representative sampling areas and infrared spectra corresponding to different components
of individual microplastics in fish is higher than that of individual microplastics in shellfish.

Experiments show that marine economic organisms have four types of microplastics: fiber plastic, split plastic, film plastic and granular plastic (Fig. 3). Fiber plastics have the highest proportion in various marine economic organisms. Among the remaining three types of microplastics, it reaches more than 70%. According to different marine economic organisms, they have different distribution characteristics and low content. In general, fibrous > flakes > film > granular. There are a series of color microchips in marine economic organisms, among which the finest microchips are black, red and blue.

![Fig. 3 Photographs of microchips of various shapes in biological samples. A–D is fiber microchips, E–F is microchip splitting, g is film, such as microchips, and H–I is granular microchips, with a ratio of 100μm](image)

Table 5  The detection rate of individual microplastics and the abundance of microplastics in different biological samples at different sampling points

| Sampling point | Species            | Habitat characteristics | Detection rate of individual microplastics (%) | Average abundance of microplastics (items/individual) | Average mass concentration of microplastics (items/g) |
|---------------|--------------------|-------------------------|-----------------------------------------------|-----------------------------------------------------|-----------------------------------------------------|
| Q             | Blue mussel        | Attached shellfish      | 70                                            | 1.40±1.20a                                          | 0.16±0.13                                           |
| Q             | Philippine clams   | Buried shellfish        | 90                                            | 1.80±1.40                                          | 0.70±0.53                                           |
| Dongying      | Blue mussel        | Attached shellfish      | 80                                            | 1.70±1.19                                          | 0.40±0.29                                           |
| Dongying      | Square Mackerel    | Buried shellfish        | 70                                            | 1.20±0.97                                          | 0.31±0.27                                           |
| Q             | Small yellow croaker | Plankton fish          | 100                                           | 2.40±0.66                                          | 0.51±0.16                                           |
| Dongying      | Xu’s flat touch    | Benthic fish            | 90                                            | 3.80±2.27                                          | 0.57±0.84                                           |
| Dongying      | pike               | Benthic fish            | 90                                            | 2.00±1.48                                          | 0.34±0.25                                           |

RETRACTED ARTICLE
In the process of particle size measurement, the actual length of the fiber microchips of various shapes is measured, while the split, film, and solid particle microchips are statistically recorded on their maximum inner diameter length. According to statistics, the particle size of the detected microchips ranges from 57 to 4740 microns. Among various marine economic organisms, microplastics smaller than 1 mm account for 50.0 to 78.6% (Fig. 4C).

Figure 5 shows the infrared infrastructure of the six polymer types found in this study. The type of polymer determines the transportation of waste plastics in the marine environment and affects the affinity of microplastics with other chemical pollutants.

The granular flakes have been separated from the digestive tract of graphite powder. When the surface morphology of the granular flakes is placed under the seed, and compared with the surface morphology of the new foam particles, it is found that the surface morphology of the new foam particles is rough, with a pore distribution of about 50 μm in diameter (Fig. 6); compared with the surface morphology of the new foam particles, there are pores with a diameter of about 300 microns on the surface, which are significantly larger than the pores on the surface of the new foam; delamination is observed on the surface of the microplastics. It can be seen that the granular microplastics eaten by fish have a higher degree of aging.

SEM-EDS provide high-resolution microplastic surface photographic images, but element f is a characteristic element of fluorine compounds, and fluorine compounds can be distinguished by element f. The EDS spectrum of EDS polyethylene is shown in Fig. 7 (B2).

Fig. 4 The shape (A), color (B), particle size (C), and polymer type (D) distribution characteristics of microplastics in biological samples at different sampling points
Research on the distribution characteristics of microplastics in typical economic bivalve molluscs in coastal waters

The individual test results of the microplastics in the digestive system of different bivalves in different cities and rural areas are shown in Table 6. The detection rate of individual microplastics in mussels is the highest, reaching more than 90%. The detection rate of individual microplastics of scallops is 80–100%; the detection rate of individual microplastics of oyster oysters is 66.7–100%, and the detection range of individual microplastics of Philippine clams is 62.5–100%.

There are differences in the number of microplastics and the characteristics of large-scale concentration of microplastics between different types in the same city and countryside. For example, the abundance of scallop microplates in Nanshi and Huangsima City is significantly higher than that of Murazaki mussels, Pacific oysters, and Philippine clams (p < 0.05); Plastics were significantly higher than scallops, queen ants and Philippine clams (p < 0.05); there was no significant difference in the abundance of four bivalve microplastics in Beikou.
and Ichikitaward markets (Page et al. 1982). The concentration of microplastics in Philippine clams available in North Dakota was significantly higher than that of Chlamys farreri, oyster oysters and blue mussels ($p < 0.05$) in this urban area; Fig. 8 shows the concentration of microplastics in different urban and rural areas. The mass concentration distribution of shells, faults, and microplastics.

The microplastics found in the double shell come in various colors. Fiber microplates have many black, blue, red, and transparent colors; fragmented microchips are mainly blue, white, and red (Fig. 9), and granular microchips are mainly black, blue and red (Venkatesan and Rajagopalan 2016). Among them, the colors of microplastics found in Chlamys farreri and purple mussels are mainly black, blue and red, accounting for more than 87.0% of the total number of microplastics. Bright colors are mainly 77.8%. The microplastics found in Philippine clams are mainly white, transparent and black, accounting for 83.7%.

|                          | Chlamys scallop (%) | Blue mussel (%) | Long oyster (%) | Philippine clams (%) |
|--------------------------|---------------------|-----------------|-----------------|----------------------|
| Chengyang District       | 90                  | 100             | 80              | 62.5                 |
| Huangdao District        | 90                  | 90              | 100             | 80                   |
| Shinnan District         | 100                 | 90              | 66.7            | 100                  |
| Shibe District           | 90                  | 90              | 100             | 100                  |
| Laoshan District         | 80                  | 100             | 100             | 100                  |
| Average value (%)        | 90                  | 94              | 89.3            | 88.5                 |
of the total number of microplastics. The proportion of dark microplastics found in shellfish is higher than that of light microplastics.

The particle size of microplastics found in the double-shell digestion system ranges from 20 to 4875 μm, among which the microchips below 500 μm in various double shells are 37.3 to 64.7%, and the microchips are between 500 and 1000. The microplastics in the various double-shell layers between μm 1 usually decrease continuously in quantity. See Fig. 10.

As shown in Fig. 11, the absorption peak of chlorinated polyethylene found in this study is about 1700 cm⁻¹, and the absorption peak of the main functional groups appearing on the top from the bottom of the chlorinated polyethylene spectrum gradually becomes stronger.

When the fiber microplates found in the double layer were observed under SEM, the surfaces of different fiber microplates showed different weathering forms. The surface of the fiber microplate in Fig. 12 is not uniform. It is found that the fiber surface has slight cracks and some visual expansion.
cracks. The fiber surface is relatively smooth, and obvious scratches can be seen on the partially enlarged fiber surface.

**Regional differences in the distribution characteristics of microplastics in typical marine economic shellfish**

Table 7 is the biological index of shellfish samples collected in cities q and x. Due to differences in environmental characteristics in different regions; there are also differences in the biological indicators of shellfish samples. Among them, the wet weight of the sazae conch digestion system in the q city market is 5.45 g/tablet, while the wet weight of the sazae conch digestion system in the x city market is only 0.57 g/tablet.

Figure 13 shows the detection rate of each microplastic in various q and x city shellfish samples. Through the analysis of the microplasticity detection index of the shellfish digestive system, it is found that the detection level of the individual microplasticity of the oyster and shellfish collected in q is higher than that in the x city.

Figure 14 shows that the average range of microchips in city q is 1.2-4.1 items/individual and 0.8-4.4 items/g, and the average abundance of shellfish in city x ranges from 1.3-6.0 items/individual and 2.1-4.0 items/g.

The quantity abundance (items/individual) and mass concentration (items/g) of shellfish microplastics in Q city and X city; C, D are the quantity abundance and mass concentration of shellfish microplastics purchased in X city. Figures 15 and 16 show the shape, color, and particle size distribution characteristics of shellfish in cities q and x, respectively (Wanigasekara et al. 2010). Statistical analysis of the shape of the detected microplates showed that all microplates in the oyster oysters in different regions were mainly fragmentary; divided by region, the percentage of parental microplastics in bee molting samples was the highest; the jade shell content purchased by xcheng was the highest. It is split; the proportion of fiber plastic in the remaining shellfish samples is 36.4-97.6%.

As shown in Fig. 15, the relatively high polymer types found in shellfish samples in city q are rayon (41.5%), polyethylene terephthalate (16.4%), chlorinated polyethylene (11.8%), and polyvinyl chloride (10.3%). The higher abundance polymer type detected in the shellfish samples in X city is rayon (44.4%), polyvinylidene fluoride (24.2%), and chlorinated polyethylene (14.0%). The microplastic polymer types in this area are as...
follows: shown in Fig. 16. The content of rayon in shellfish samples from different regions is similar, but the type of microplastic polymer with the second highest content is different. Therefore, it is still necessary to consider the reason why a large number of vinyl polyvinyl fluoride microplastics were detected from shellfish samples in x city. Figure 17 shows the infrared spectra, spectral correlation, and related optical micrographs of five types of abundant microplastics found in shellfish.

The results found that when high-performance polyimide fibers and rayon fibers are selected as shown in Fig. 18 (a, b), the surface morphology characteristics of these two fibers are expressed in SEM and synthetic fibers, and the surface morphology characteristics of semi-thin fibers are expressed completely different. Compared with povidone fiber, the surface of rayon fiber is the point of many small fibers in the bag in Fig. 18 (B1), while the surface of synthetic fiber is smoother and is made of only one bundle of fiber (Fig. 18 (A1)).

### Table 7  Biological indicators of shellfish samples sold in Q and X cities

| Species             | Number | Shell length (cm) | Shell wet weight (g/piece) | Wet weight of digestive system (g/piece) |
|---------------------|--------|-------------------|----------------------------|-----------------------------------------|
| Q                   |        |                   |                            |                                         |
| Blue mussel         | 10     | 9.26±0.49         | 39.55±5.64                 | 0.96±0.18                               |
| Philippine clams    | 10     | 3.99±0.40         | 7.65±0.95                  | 0.62±0.12                               |
| Long oyster         | 10     | 8.66±0.98         | 46.87±7.31                 | 2.26±0.54                               |
| Clam                | 10     | 6.41±0.27         | 11.30±1.57                 | 1.25±0.031                              |
| Cockles             | 10     | 4.93±0.44         | 23.31±6.47                 | 0.77±0.17                               |
| Clam                | 10     | 5.37±0.31         | 30.43±4.83                 | 0.94±0.32                               |
| Conch               | 10     | 6.70±0.55         | 49.92±8.31                 | 5.45±1.77                               |
| X                   |        |                   |                            |                                         |
| Emerald Mussel      | 10     | 8.30±0.34         | 21.15±2.80                 | 0.72±0.21                               |
| Philippine clams    | 10     | 3.88±0.28         | 7.83±1.84                  | 0.65±0.16                               |
| Long oyster         | 10     | 9.56±0.82         | 120.13±15.60               | 2.70±0.57                               |
| Clam                | 10     | 6.10±0.49         | 11.28±1.90                 | 0.82±0.16                               |
| Cockles             | 10     | 3.01±0.19         | 7.91±1.22                  | 0.34±0.09                               |
| Clam                | 10     | 4.66±0.30         | 22.15±3.14                 | 1.10±0.20                               |
| Conch               | 10     | 3.84±0.23         | 6.74±1.38                  | 0.57±0.10                               |
Discussion

The necessity and urgency of big data technology for the development of youth swimming

I personally experienced part of the training process of the national team and grassroots youth training, and found some big problems and differences. In contrast, the operation of scientific and technological facilities in countries such as Europe, the US, and Australia is different. For example, the Hogan Wanda Youth Swimming Club in Eindhoven, the Netherlands, uses data analysis equipment to train young athletes (Yu et al. 2017). They develop swimming data glasses and conventional chips to implement one-to-one training, thereby improving training efficiency and achieving high efficiency.

In China, swimming is the most market-oriented program for youth sports courses. However, due to the gap in the non-professionalization of adult sports, compared with football and other high-professional sports, its general security is not enough (Atwood and Steed 2004). For swimming activities, because of its non-professionalization at the top, for most administrative investors, most of its funds are concentrated in adult teams. For youth sports schools, and even for various youth training clubs, it is difficult to have sufficient funds. So how do we solve this problem? First of all, the National Sports Supervisory Bureau should gradually complete the construction of the youth database, and the personnel responsible for the local sports system must continue to advance in the concept of “digitalization” (Babel and Kurniawan 2003). Coaches are encouraged to cooperate with market-oriented data providers and complete the foundation by helping each other’s
product promotion. In order to promote its development, many youth swimming club markets can increase investment and construction digitalization, and increase their charging costs, and increase their productivity through digitalization, increase club income and recruit students, thus forming a virtuous circle.

Analysis of the fit of big data technology to the operation and management model of youth swimming clubs

Liu Qing suggested that the efficiency of sports competitions should be further improved to realize the popularity of sports competitions. The competition process should be divided into selection phase, application phase, preparation phase, progress phase and end phase. In 2005, Lin Peng divided sports competition project management into sports competition initiation, sports project planning, sports project implementation and control, and sports project management (Haixia et al. 2007). Xiao Yi divided the sports competition management stage into five stages: selection, application, preparation, development and final stage. The basic process is divided into three stages: before the game, during the game and after the game.

The business management of swimming competitions can achieve high efficiency through the integration of resources and data and the integration of interconnection technology. We need to optimize the allocation of resources to ensure accurate, fast and efficient organization of competition, and scientific and reasonable arrangements for competitions the content of events and results announcements has changed the time when manual stopwatches and paper results announcements were lengthy and error rates were high in the past.

The enlightenment of big data technology on the operation and management model of youth swimming clubs

The government and the market work together to promote the reform and innovation of the competition

The state has formulated a series of strategic and supreme policies, including the “13th Five-Year Plan,” “National Sports Plan,” and Article 46, to gradually regulate the sports industry market. Premier Li Keqiang advocated speeding up the development of the sports industry and abolishing the commercial and popular selection system for competitions (Cruz-Guzman et al. 2006). He pointed out that the state promotes extensive and comprehensive fitness activities for private social organizations and promotes the overall promotion and construction of projects. The swimming club league organization has maintained good
cooperation with the China Swimming Association, China Rescue Service Association and various provincial and municipal swimming associations (Rusmin et al. 2017). Government agencies have provided strong security guarantees for the success of the top league games and acted as the guidance and support organization for the games.

Internet information platforms can use huge mass data processing systems and mobile terminal infrastructure to clarify user needs and collect, accumulate and analyze user information (Bergaya et al. 2012). At present, the swimming industry accounts for a small proportion of the total sports market, but by using various theories on the online platform, the marginal cost can be reduced to almost nothing, and commercial products can be introduced with more users (Lagadic et al. 2001). In addition to tangible products, information service items such as accommodation and mobility can also use Internet technology to collect data and organize classification. Sponsors, contractors, value brands, and consumers of swimming-related competitions have been provided with high-quality and fast supporting services for the competitions. The development of swimming competitions can improve economic efficiency and market development through the intervention of the Internet.

Innovative use of Internet thinking, advanced technology, and means

As the main player in the top league championships and the designated official brand of the top league swimming championships, Stomo Sports has successfully developed the third generation of semi-automatic electronic equipment, winning the welcome of the organizing committee and contestants for the first time in the top league championships (Jamal et al. 2018). The accuracy, stability, and safety of the system far exceed the service technical standards stipulated by the International Swimming Federation. It can be quickly installed and recorded within a thousandth of a second. At the same time, the results are automatically recorded in real time, and the results can be directly recorded. It is published on the big screen, and the evaluation data can be directly queried in the software application “Sciences of the World” (Darvishi and Morsali 2011).

The swimming club building competition big data center is an important part of the national swimming competition industry application big data platform construction. As the core unit of the top league and an important builder of the national swimming competition information platform, it can provide
comprehensive and detailed big data information for the league in terms of information dissemination and other aspects.

Fig. 17 Infrared spectrum, spectrum matching degree and microscope pictures of microplastics with relatively high abundance in shellfish. From top to bottom: A. Rayon; B. Polyethylene terephthalate; C. Chlorinated polyethylene; D. Polyvinyl chloride; E. Polyvinylidene fluoride

The entry threshold is low and convenient, and the number of participants is huge

As an aerobic exercise, swimming contributes to physical health, and sports injuries are relatively small, and can meet the exercise requirements of people of different age groups from children to old age (Sarkar et al. 2013). It can also bring about social topics with a high degree of attention, which can increase the enthusiasm of the masses. The top league of the swimming club hosted a popular charity competition, mainly for children and youth. Unlike the traditional government-sponsored championships and provincial and local city-level competitions, there are no level requirements and restrictions on athletes’ participation (Feng 2020). Since the beginning of this year, swimming enthusiasts have also been increasing. Specifically for beginner children, we adopted some simple measures, such as allowing assistive tools, etc., to change the entry ideas of beginner children, and also lower the barriers and requirements for athletes to participate in swimming competitions.

Big data technology’s development countermeasures and suggestions for the operation and management of youth swimming clubs

Integrate online and offline resources to promote management efficiency

Big data adjustments provide a scientific basis for competition time, events, number of people, and traffic plan, enabling
contestants to register before the competition to understand information and verify the results after the competition. Simply put, online swimming is an innovative combination of “Internet and swimming” (Zehhaf et al. 2015). Internet-based digital intelligent technology not only makes swimming more convenient, but also allows more people to participate in swimming competitions, and allows swimming in limited time and space.

**Build the brand value of the event and improve the level of the event**

Every swimming activity includes transportation, tourism, media, medical care, safety, and other links. Each is a test of the organizer’s work ability and efficiency, and cultivates a full range of talents who need to understand the Internet How to provide service needs and how to use each resource to improve the quality of the game. Swimming is a sport for the majority of participants, and the risks during the competition must be reduced through the safety mechanism supporting the organizing committee to effectively avoid risks. In addition, in order to strengthen Internet management and ensure user information security, we must improve the reliability of the Internet, establish a management system, strengthen supervision and control, and provide a safer and more effective Internet environment for all online swimmers.

**Make full use of the network platform to enhance event participation**

At present, tools such as sports applications and smart sports processing devices are the main online methods for online swimming data monitoring. It is necessary to further promote the diversity of public participation methods. There is still a lot of room for development on the Internet platform. Swimming competitions have made a big difference through Internet technology (Lagalya and Dekanyb 2013). The online video live broadcast function maximizes the participation of the masses invisibly. Through the development and development of software on mobile devices such as Weibo, WeChat, and social platforms on the Digital Smart Match App. Devotion effectively provides participants with a means of interaction and entertainment. Increase the advertising and communication of peripheral activities of the swimming competition, enrich the competition style, and increase the number of participating athletes.

**Focus on scientific and technological means and increase market development**

There is a great demand for swimmers’ equipment, including swimming suits, swimming goggles, and auxiliary training equipment. In addition to equipment, services in areas such as swimming training, underwater rehabilitation, and swimming fitness for the elderly also show considerable demand for swimming fitness. We should improve the game, change the resistance of the contestants to the water in the game, so as to improve the results.

Combine scientific and innovative advanced technology with Internet technology to develop products needed for swimming events, develop the swimming industry, and promote the promotion of swimming events.

**Conclusion**

In the research of massive data processing and deduplication technology, among the problems of massive data processing, it is necessary to improve the quality of effective data through data preprocessing technology and reduce the cost and consumption of data processing. Technically compare data compression, staged backup and data deduplication techniques, and then focus on deduplication techniques. The successful experience of the top league club swimming management mode game under the background of big data: the government and the market jointly promote game reform and innovation. Internet thinking and operation are novel and technological means are advanced. The integrity of the industry organization chain is high, the construction of its cultural connotation is emphasized, and the concept of healthy sports is promoted. Clearly the needs of users, cultivate the uniqueness of swimming competitions and the diversity of products, and through the deep integration of the sports industry with network thinking and technology, it is the basis for the intelligent, green, and fixed design of the system.

**Declarations**

**Conflict of interest** The authors declare that they have no competing interests.

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