Prediction of PM2.5 concentration in ambient air and safety of sports training based on Android dynamic monitoring

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Abstract
This paper presents a dynamic monitoring solution for Android. It is not invasive and can be deployed quickly. It also uses plug-in technology to create a host application with monitoring behavior. The application can run as a plug-in and monitor the behavior of host app, so as to load the host app monitored by the host application. Based on this, based on the data of PM2.5 concentration in w City from 2018 to 2020, the paper analyzes the time distribution characteristics and obtains its statistical characteristics, such as the highest average of PM2.5 concentration in summer and winter, and concludes that the conclusion is the lowest in summer and the highest in winter. Secondly, the relationship between PM2.5 concentration and other air pollutants and meteorological factors around the environment is studied by the theory of correlation stepwise regression analysis. Finally, the paper makes a systematic study on the safety of sports training of young female athletes in S Province. Nowadays, in S Province, there are few research literature on the safety of young women athletes in sports training. Therefore, the research test combines literature data method and other research methods to conduct descriptive epidemiological investigation on the safety of sports training. The author puts forward the conclusion countermeasures by taking the research of the avoidance behavior into consideration, which is to say, according to the athletes’ technical level, injury, and other factors, and strengthen the application of multimedia teaching, increase interactive teaching discussion, stimulate the interest of athletes’ learning, and improve the influence of tactical learning. In this paper, PM2.5 concentration data based on Android dynamic monitoring is applied to the research of sports training security, so as to promote the development of sports training security research.

Keywords Android dynamic monitoring · Ambient air · PM2.5 concentration · Sports training · Security

Introduction
Dynamic monitoring can effectively analyze the behavior of Android applications. This paper studies the current dynamic monitoring tools and divides them into three implementation methods: (1) custom ROM image; (2) modify the system file or use ptrace technology to inject the target process, and get the root directory of the device code at the same time; (3) repackaging APK (Cheng et al. 2018). These three methods are implemented by intrusion, which depends on the system environment and is difficult to transmit to different devices. In view of the above problems, this paper puts forward a rapid Android dynamic monitoring solution based on plug-in technology (Huang et al. 2019). In this scheme, the main body of the monitoring system is the host application with plug-in function, and the monitoring module is located in the host application. If the application is monitored, the host application loads the application to be monitored into the host environment as a plug-in to run (Jianxi et al. 2018). At the same time, the host application loads the running process monitoring module of the application plug-in, so as to complete the purpose of monitoring the behavior of the application to be monitored. Consistent with this argument, this paper takes w City as an example, selects the daily data of PM2.5 concentration and the influencing factors in recent three years, and preprocesses them as the missing value interpolation and data anomaly detection (Kim et al. 2019). Finally, from the perspective of seasonal change, ambient air pollution, and...
weather conditions, we find out the variation law of PM2.5 concentration and the relationship between them, and find out the important factors affecting PM2.5 concentration, so as to determine the important environmental variables for the next accurate prediction step (Lee et al. 2020). In order to create a more accurate and reliable prediction model, this paper uses the original gray wolf (GWO) algorithm and the improved gray wolf algorithm to optimize the support vector regression (SVR) based on the nonlinear convergence factor and dynamic weight method (Long 2018). Finally, four mixed models of PM2.5 concentration are modeled and predicted in the form of GWO-SVR. Finally, this paper makes a systematic study on the safety of sports training of young female athletes in S Province. Research shows that high intensity sports training, lack of training preparation, and injury training are the three major causes of sports injury (Sun et al. 2018). Excessive strength training can easily lead to athletes’ physical function decline, excessive fatigue, technical action injury, and other phenomena, which shows that they do not pay enough attention to warm-up activities, and if the athletes’ joints and muscles do not meet the requirements of technical action and tactical confrontation training, it will easily lead to strain and strain (Tang 2020). However, weight-bearing training is unprofessional, unprotected, and irrelevant, which can easily lead to injury aggravation or new injury. In view of these problems, this paper puts forward the corresponding preventive measures: according to the characteristics of athletes’ self-quality, strengthen the management of athletes’ physical quality and strengthen the quality training and technical integration. In order to improve the organization’s ability to prevent sports injury, we should actively use the demonstration and education methods of sports injury, emphasize the importance of sports injury prevention, and actively implement preventive training measures (Tuan et al. 2018). Make full use of the indoor and outdoor conditions of the training team, medical equipment, books, and other resources to improve the safety level of special sports training (Vallee et al. 2019).

Materials and methods

Data sources

In this paper, PM2.5 concentration data of w City in recent years and daily data of various meteorological and air pollution factors are selected, and combined with the hybrid prediction model, in order to obtain PM2.5 concentration prediction data in a certain period of time in the future (Wang and Ma 2018).

The climate of w City has obvious seasonal characteristics, cold in winter and warm in summer. W City has 13 municipal districts, covering a wide area and a large population. In recent years, with the rapid economic growth and the rapid development of industrial production, the air quality of W city continues to decline, and the pollution problem continues to worsen (Wang et al. 2018).

Generally, most of the air pollution can be fully understood from the ambient air quality data. The adjacent air quality data used in this paper are from China online air quality monitoring platform (Wu et al. 2018). The selected time period is the data of previous years, in which the environmental quality index data is the daily average data, which is obtained from the daily average hourly data of the monitoring station (Xia et al. 2018).

The value of meteorological index also determines the air quality to some extent. The meteorological index data in this paper are from the global weather forecast network (Xue et al. 2018a). At the same time, in order to ensure the timeliness of meteorological index data and ambient air quality data, the selected meteorological data are all in recent years (Xue et al. 2018b).

Data preprocessing

In the actual data processing, the data is often lost; that is, the subject value in the variable is empty, which means that the complete data set almost does not exist, and the amount of data to be processed is too much. Due to data collection or storage, there are often unexpected errors or errors that cannot retrieve data information. For example, for the collection of time data, time is obviously irreversible. If it happens at a specific time, if the data is not successfully collected or saved, the lost data cannot be recovered; that is, the specific information is often lost in the end (Yang and Lu 2018). At this point, if it is obviously unreasonable to store a piece of data or use a specific statistical analysis method to fill in the original real data, then emptying is the best way to deal with the data. On this basis, we should reasonably use the corresponding methods to process the data (Yuanzhe et al. 2018).

Generally speaking, the most common method to deal with missing values is interpolation, which is based on the principle of operation function. However, there are many interpolation methods. In essence, the principles of these interpolation methods are very similar. Almost all of them use the function method to estimate the amount of loss (Zhou et al. 2018). The air quality data and meteorological index data in this paper contain missing data, and the lost time is not the same, so Lagrange interpolation method is used to link the missing data together.

From a mathematical point of view, if several known observation points have different values, Lagrange interpolation method will find a polynomial function, so that the function will pass through all known observation points. This polynomial function is called Lagrange interpolation polynomial.
Now, we will introduce Lagrange function in detail according to formula subdivision. Based on the mathematical theory, we find the polynomial function \( f(x) \) of \( n-1 \) degree for \( n \) points in the plane, as shown in the following formula:

\[
L(x) = f(x) = a_0 + a_1x + a_2x^2 + \cdots + a_{n-1}x^{n-1}
\]  

Replacing \( L(x) \) with formulas with known points \((x_1, y_1), (x_2, y_2), \ldots, (x_n, y_n)\), you can get \( n \) equations, because \( a_0, a_1, a_2, \ldots, a_{n-1} \); using the determinant to solve, the function of Lagrange interpolation polynomial can be obtained:

\[
L(x) = \sum_{i=0}^{n} f(x) \prod_{j=0, j \neq i}^{n} \frac{x - x_j}{x_i - x_j}
\]

Usually, there are outliers in the data set that are beyond the normal coverage. Some do not match their true meaning, while others exceed the upper limit of the order. We call it an outlier, which means some extreme values; these values are far from the range of values and the general level. There are many reasons for abnormalities, and most of them are uncontrollable. It can be summarized as accidental man-made circumstances and uncontrollable factors, such as external conditions.

Usually, the problematic data will not exceed the true characteristics and laws of the sequence, resulting in weaker ability to build models, and the prediction effect of the test data is lower than that of the training data, which ultimately makes the system uncertain. Therefore, it is necessary to identify and replace outlier data before performing statistical analysis and establishing a prediction model to minimize the breakdown of system outliers and improve the performance of the prediction and reliability. Therefore, before analyzing the original data, the data should be processed for outliers to avoid learning the wrong information, so that the model system can be built on a more reliable database.

Since the development of statistical information collection, there have been many ways to identify and handle abnormal data. The extended processing in this article is mainly to detect and fill in the maximum data value, while the Laida criterion is used to identify abnormal data and Lagrangian interpolation.

Laida scale is a statistical test method based on standard distribution. Assuming that the X data that should be tested for independence follow a normal distribution, then:

\[
P(|x - \mu| > 3\delta) \leq 0.003
\]

In formula (3), \( \mu \) is the expected population X, and \( \delta \) is the standard deviation of the population X.

Overall architecture of Android dynamic monitoring system

The problematic program in the Android dynamic monitoring application is partly based on the initial modification of system files or obtaining root permissions on the mobile device to complete the installation of environmental monitoring, but it is difficult to apply it to different devices. Take the Xposed framework as an example. To install the Xposed framework environment, you must obtain root permissions on the device to replace the app_process file system.

With the development of Android applications, the emergence of plug-in technology makes modular programming possible. The four main components are contained in separate plug-in modules, and the plug-in components are loaded and run by the host application. If the complete monitored application has been installed and run as a plug-in, before the host loads the application and runs the application to be monitored, a window can be added to load the monitoring module so that the application to be monitored can be monitored. The loading logic of the monitoring window module is executed by the host application, without changing the Android system and application. When faced with model changes, only need to adapt to the host application, this method can easily achieve the monitoring function.

Based on the above basic knowledge, this article implements an AndroidMonitor dynamic monitoring system compatible with the VirtualApp plug-in sandbox environment, as shown in Figure 1.

Design of PM2.5 concentration prediction model based on ARIMA

To observe the autocorrelation coefficient and part of the autocorrelation coefficient graph in the original order, use the auto.arima() function in the R language to automatically select the order of the ARIMA model and estimate the parameters, and finally obtain the average concentration of the daily PM2.5 ARIMA model (ARIMA The model is (1,1,2)):

\[
(1 + 0.5846B)(1-B)y_t = (1 + 0.7141B + 0.2161B^2)(1-B)c_t,
\]

Entering a BP neural network usually involves several variables. If the values of these variables change greatly, the speed of model convergence may be reduced during training, thereby reducing the predictive performance of the model. Therefore, these input variables need to be normalized, and normalization will not affect its own change trend and amplitude, but will make it impossible to measure and map in the same space so that it can be compared. In this article, the variance deviation method is used to normalize the value of
the input variable [0,1]. The specific calculation method of the commonly used method is as follows:

$$z = \frac{x - \text{min}}{\text{max} - \text{min}}$$

Choosing the right number of hidden layer neurons is more important, because the more neurons hidden in the layer, the more problems can be described, but more neurons will increase the number of counts and other problems. There are several empirical formulas that can be used to select the number of neurons in the latent layer. This paper uses the empirical formula given in formula (6) to estimate its estimation range to be [3, 13], and set the parameters according to the conditions.

$$n_1 = \sqrt{n + m + a}$$

Among them, $n_1$, $n$, and $m$ are the number of neurons in the hidden layer, input layer, and output layer, respectively. $a$ represents a constant whose value ranges from 1 to 10.

**Research on the safety of sports training**

The characteristics and preventive measures of sports injuries of young judo athletes in S province are the contents of the research. A survey of 428 young judo athletes from local and municipal sports schools was conducted.

Use spss software to perform statistical analysis on survey data.

**Results**

**Distribution characteristics of PM2.5 concentration**

Figure 2 shows the daily average amount of PM2.5 concentration in the past 3 years. It can be seen that the PM2.5 concentration in city C is generally the highest in winter and the lowest in summer, and the change in PM2.5 concentration in spring is more abundant than in summer and autumn. In the past 3 years, the highest concentration of PM2.5 appeared on January 5, 2020, at 313 μg/m³, and the lowest concentration of PM2.5 appeared on September 13, 2020, at only 4 μg/m³.

Current research shows that meteorological factors such as temperature, relative humidity, and wind speed also affect the changes in PM2.5 concentration, because they affect the secondary formation of PM2.5 and the migration and diffusion between different regions. Therefore, it is necessary to study the relationship between meteorological factors and PM2.5. This article mainly uses the simultaneous changes of PM2.5 concentration and meteorological factors and Pearson’s correlation theory to study the relationship between the two.

Figure 3 shows the simultaneous changes between the daily average PM2.5 concentration and the daily average temperature in City C from 2018 to 2020. It can be seen that there is an inverse relationship between them: if the temperature increases with time, the PM2.5 concentration decreases, the temperature reaches the lowest value in winter, and the PM2.5 particle concentration reaches the highest value in winter.

Figure 4 shows similar changes between the average daily PM2.5 concentration and average wind speed in City C from 2018 to 2020. It can be seen initially that there is an inverse relationship between them.

**Analysis of PM2.5 concentration prediction results in ambient air**

Then, use the ARIMA model (1,1,2) shown in formula (1) to predict the average daily concentration of PM2.5 between November 2 and December 31, 2020. The graphical comparison of the difference between the actual value and the estimated value is shown in Figure 5.

It can be seen from the figure that the predicted one-step value in the ARIMA model has the same variability and magnitude as the actual observation, which more closely reflects the actual average daily concentration change of PM2.5. After calculation, the expected RMSE is 18.51 μg/m³, MFA is 14.89 μg/m³, and MAPE is 30.34%. Since the daily average concentration of PM2.5 is slightly affected by factors such as PM10 and other air pollutants, weather conditions, and the
ARIMA model only considers the daily average concentration of PM2.5, there are differences between the detected amounts. It can be seen that there is a certain hysteresis between the two.

It can be seen from Figure 6 that in addition to the average wind speed, for the other five influencing factors, the ARIMA model’s gradual estimated value is also equal to the number and size of actual observations, and further reflects the changes in observations and their corresponding actual values. The ARIMA average wind speed model can predict the estimated trend of its true value, but it cannot describe the change in its true value range well.

Use training samples to retrain the established long network, and then use the trained network to test the sample set to be tested, and finally obtain the PM2.5 neural network prediction model, as shown in Figure 7.

If the true value of the influencing factors on the next day is unknown, in addition to making predictions as in model 2, historical observations of influencing factors can also be used to build a BP neural network to compare the performance of the two prediction methods. Consider a comparison model, BP neural network penetration rate is PM10, CO, NO2, average temperature, average humidity, and average wind speed delay 1st-order historical value and PM2.5 delay concentration 1st to 5th order historical value; that is, the input layer contains 11 neurons, and training. The other settings of the network parameters are the same as those in model 2. After training the long neural network as the training set data recorded by model 3, the final model is obtained. Using model 3, the step p test set prediction can be used to obtain the comparison between the predicted value and the re-value as shown in Figure 8. It can be seen from Figure 8 that the predicted value of model 3 is better. The fluctuation of the actual value and the effect of the forecast are much better.

In order to compare the predictions made in the three models, Figure 8 plots the predicted values in model 1 and model 2 at the same time, and Figure 9 shows the absolute change in error between the predicted values.

Observing the two figures, we can find that in most samples, model 1 has the highest error prediction, model 2 has the lowest error prediction, and its prediction value is closer to the true value.

**Research results on risk factors of sports training**

Based on the existing research literature and personal experience in teaching and training, this research focuses on the data
ratios of vulnerable joints, such as shoulders, necks, elbows and wrists, lower back, chest, and legs. The data shows (see Table 1) that the most vulnerable parts are the shoulders and elbows, which are 164 and 94, respectively, accounting for 24.4% and 14% of the total. There were 187 cases of lower limb knee joints, accounting for 27.9% of the total number of injuries. In addition, the proportions of the wrist, lower back, and ankle joints were 8.3%, 8.2%, and 6.4%, respectively. The damage rate of other parts is less than 4%.

The data of this study shows that among young judo athletes in S province, knee joints, shoulder joints, and elbow joints are injured most frequently. In the national statistics of judo sports injury data, the number of knee joint injuries is the highest, followed by shoulder joints and ankle joints. This study is similar to the comprehensive characteristics of the injury rate of the national judo team athletes. Analysis believes that because judo techniques must quickly affect the opponent’s center of gravity, many joints are always in repetitive motion, advancement, and strength maintenance during this process, especially on the knees, shoulders, and elbows. The joints undergo repeated angular rotations, and the muscles, elbow joints, ligaments, etc. are in a long-term pressure loading stage. From an anatomical point of view, forces beyond the normal bearing range of joints and muscles may cause joints and muscles to be injured. Therefore, if the load on the body is too high, or if it cannot recover in time after exercise, if you continue to perform high-load strength training, it is easy to cause joint injuries.

According to the hospital’s diagnostic criteria, the study divided sports injuries into 7 categories, including strains, sprains, strains, contusions, bruises, and dislocations. The statistics are carried out separately. Table 2 lists the table of sports intensity injury categories:

According to the nature of sports injuries, they are divided into acute injuries and chronic injuries. Acute injury refers to damage caused immediately by direct or indirect violence. Its characteristics are as follows: acute onset and short course of disease. Chronic injury refers to the damage caused by the accumulation of local pressure caused by improper management of compression, and the damage caused by multiple cumulative minor injuries or premature injuries. It is characterized by slow onset, gradual onset of symptoms, and a long course of disease. This study found that athletes suffered more acute injuries than chronic injuries, accounting for 52.9% and 47.1%,
respectively. Among them, the first 5 items are knees, shoulders, elbows, fingers, wrists, and back. Acute injuries are more than chronic injuries (see Table 3). This is especially important for the characteristics of women’s judo. On the one hand, because girls are between 13 and 16 years old and are in the developmental stage, their physical strength, speed, explosive power, endurance, support, and other abilities are not yet fully mature, while judo is a force against sports, which is important for athletes. The physical fitness requirements are very high. Under the extreme conditions of fierce confrontation, the athlete’s functional state will be reduced, and injuries are prone to occur. On the other hand, in the fierce confrontation stage, judo requires the accumulation of the knee and back joints, the grip of the joints, and the cuddle behavior of the shoulders and elbows. This is an important part of the skills and tactics used in the confrontation phase. Therefore, the resulting deterioration of the characteristics is more obvious.

According to survey statistics, the training factors ranked in descending order of score are high training intensity, insufficient preparation for special activities, injury training, insufficient special sports quality, or insufficient rehabilitation training (see Table 4). The specific analysis is as follows.

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**Fig. 6.** Comparison of predicted values and true values of influencing factors based on ARIMA model (one-step prediction)

**Fig. 7.** Comparison of PM2.5 neural network predicted value and true value based on influencing factor prediction (one-step prediction)
Discussion

Sources of hidden dangers of sports training safety

Excessive physical fatigue

This study found through investigation that the recognition of physical fatigue caused by sports injuries by coaches and athletes were 7 points and 7.1 points, respectively, indicating that physical fatigue is the main factor that easily causes sports injuries.

Sports fatigue refers to an event that causes a decline in physical function due to excessive exercise. The body cannot maintain its functions at a certain level or cannot maintain certain exercise intensity. If the human body is in a state of fatigue, it cannot reasonably eliminate and restore fatigue, and continuous training in a state of fatigue will also lead to accumulation of fatigue, which will lead to excessive fatigue. All kinds of body functions are rapidly weakened, the cerebral cortex is in poor condition, and the reaction ability is slow. Carrying out strong skills training will increase the possibility of muscle damage and easily lead to acute and chronic injuries to the body. In the process of judo training, if the body is overworked, muscles, ligaments, or joints are prone to pain and sprains during high-load training.

According to the survey of athletes’ training fatigue, 26.2% of people think that they are tired from time to time, and 68.2% of people think that they are tired from time to time. This shows that there is more physical fatigue in judo training. Field investigation found that after 4–5 sets of intense training (10 s test heart rate more than 30 times), athletes will soon feel tired. The body is prone to fatigue, the strength of the legs, waist, and arms is also very tired, and even muscle cramps occur. At this time, athletes tend to relax their minds during the training process. In order to improve their physical health as soon as possible or achieve good results in the competition, athletes neglect the idea of protecting their bodies, and coaches sometimes cannot take care of tired athletes. Under this condition, sports injuries are easy to form.

Technical factors

The study of technical factors involves three aspects: a deep understanding of the principles of technology and tactics, incorrect use of technical movements, and unstable technical and tactical applications.
Psychological factors

According to the survey, the scores of self-defense awareness in confrontation training and distraction in confrontation training both exceed 6 points, but are less than 7 points, and have a certain degree of recognition.

Guarantee factors

According to the survey, the highest score for “sports injury health insurance conditions is not perfect” is 7 points, and the score for insufficient education in sports injury education is less than 7 points and more than 6 points.

Sports training strategies based on safety

Personalized strengthening of special physical fitness training for vulnerable parts

Nowadays, the physical fitness of athletes does not meet the technical requirements, and the focus must be placed on strengthening the athlete’s specific quality. The special quality level of young judo athletes has common characteristics and individual differences. Training must be based on differences, and targeted training for weak joints must be strengthened, which will help prevent and minimize sports injuries. Therefore, it is necessary to understand the specific health of athletes, especially the knees, elbows, and important parts of the waist and abdomen, as well as the health of finger joints, foot joints, and ankle joints. Collect relevant data accurately and efficiently, and then conduct targeted training based on the characteristics of the technical structure. For example, J City Sports School now regularly uses this data to test athletes’ weight, 3000m performance, and other physical fitness data to guide athletes on how to continue training. In addition, for young judo athletes, the collection of specific body data should not only pay attention to the recording of basic data, but also the record of dynamic data, especially in the case of muscle weakness, cramps, and injuries. The nature of the special quality data in this case is designed to prevent the injury from intensifying or the occurrence of new injuries.

After collecting the athlete’s special quality data, each special quality program can be designed according to the technical characteristics of each athlete and the special technical level of judo can be improved by combining quality and technology. To a certain extent, sports injuries caused by poor special quality should be minimized.

Combined with the special experience of training judo, it is believed that designing a special training plan according to the technical characteristics of the athlete can introduce the athlete into the design process. On the one hand, it can enable athletes to understand the standards, content, and form of special quality training, and combine their own characteristics to provide coaches with specific data. If athletes participate in the design process, they can form and design their own special training

### Table 1 Statistics of sports injury parts of athletes

| Serial number | Injury site  | Number of damages | Damage ratio |
|---------------|-------------|-------------------|--------------|
| 1             | Knee        | 187               | 27.90%       |
| 2             | Shoulder    | 164               | 24.4%        |
| 3             | Elbow       | 94                | 14.00%       |
| 4             | Finger wrist| 56                | 8.30%        |
| 5             | Low back    | 55                | 8.20%        |
| 6             | Ankle       | 43                | 6.4%         |
| 7             | Toes        | 24                | 3.60%        |
| 8             | Calf        | 18                | 2.70%        |
| 9             | Thigh       | 11                | 1.60%        |
| 10            | Chest       | 9                 | 1.30%        |
| 11            | Cervical spine | 7            | 1.00%        |
| 12            | Other       | 3                 | 0.4%         |

### Table 2 Types of sports injuries of athletes

|       | Severe | Moderate | Mild |
|-------|--------|----------|------|
| Strain| 22     | 157      | 65   |
|       | 3.30%  | 23.4%    | 9.70%|
| Sprain| 17     | 132      | 61   |
|       | 2.50%  | 19.7%    | 9.10%|
| Strain| 7      | 78       | 46   |
|       | 1.00%  | 11.60%   | 6.90%|
| Contusion| 0  | 14       | 19   |
|       | 0.00%  | 2.10%    | 2.80%|
| Abrasions| 0  | 11       | 15   |
|       | 0.00%  | 1.60%    | 2.20%|

### Table 3 Types of sports injuries of athletes

| Location     | Severe | Moderate | Mild |
|--------------|--------|----------|------|
| Knee         | 104    | 15.50%   | 83   |
|              | 12.40% |
| Shoulder     | 89     | 13.30%   | 75   |
| Elbow        | 48     | 7.20%    | 46   |
| Finger wrist | 31     | 4.60%    | 25   |
| Low back     | 26     | 3.90%    | 29   |

### Table 4 Statistical table of training factors prone to injury in judo sports

| Content                                | Athlete | Coach |
|----------------------------------------|---------|-------|
| Training intensity                     | 8.1±2.86| 8.2±0.62|
| Insufficient special preparation activities | 7.6±1.82| 7.4±1.39|
| Injury training                        | 7.4±0.47| 7.4±0.75|
| Inadequate rehabilitation (injury) training | 7.0±1.42| 6.8±1.26|
ability methods, and fully understand the dynamic changes of athletes’ special qualities. On the other hand, while the athletes participate in the process of providing necessary information to the coaches, the coaches can learn about the athletes in a short time, so as to adjust the overall training arrangement to avoid the disadvantages of the athletes in their own characteristics from affecting the sport.

In order to design special quality training, it is necessary to combine the technical characteristics of the athletes, pay special attention to their weaknesses, and combine the technical characteristics for the designated training. For example, some athletes have insufficient flexibility in the hip joint. The ultimate strength of judo is to transfer the power of the lower or upper limbs to the legs by twisting the hips. If the flexibility of the hip joint is weak, it is easy to cause the force transmission of the limbs to deteriorate, and it is easy to increase the load on the knee joint, thereby damaging the ligaments and cartilage of the knee joint. It solves the problem of insufficient flexibility of the hip joint of athletes, and combines various techniques commonly used by athletes to design a plan to enhance the strength of the gluteal muscles.

Sports injury prevention and rehabilitation in various forms of strengthening training

Today, most women’s judo teams do not have a doctor. In terms of knowledge about sports injuries, prevention, and rehabilitation training, coaches and athletes have insufficient knowledge reserves. Therefore, physical education and advertising activities need to be strengthened. On the one hand, coaches and athletes need to strengthen the learning of sports accidents, strengthen self-education, and improve knowledge reserves. On the other hand, experts and scholars from Qilu Hospital of S Province, S Province Sports College, etc. should invite them to listen to special lectures to help coaches and athletes identify the physiological structures of common sports injuries, such as knees, elbows, and shoulders, and perform biological activities, and conduct in-depth exchanges in biomechanical sports, muscle and ligament rehabilitation, physical fatigue recovery, rehabilitation medicine, etc., to improve the knowledge reserve of coaches and athletes on Judo Athletes’ sports injury. At the same time, if conditions permit, a mechanism can be created to share knowledge about sports injuries in hospitals and universities, and effectively solve the problem of injuries in daily learning and training. In the network resources, you can conduct online consultation and face-to-face answers.

Pay attention to individual differences among athletes and implement confrontation training scientifically

Relevant studies have shown that athletes have their own “personal skills”, and the formation of technical characteristics is not only related to their own physical ability, technical, and tactical level, but also related to the athlete’s personality, ability to withstand pressure, psychological endurance, and other factors. If coaches do not pay attention to these factors in athlete training, they will easily develop a “one size fits all” training model, and some unsuitable athletes are easily affected by this model. Therefore, in order to determine the basic condition of the athlete, it is necessary to create training files. Training data should be configured from the beginning of the athlete’s entry into the team, so that the coach can have a more comprehensive understanding of the athlete’s growth, especially the injuries they have suffered and how to recover, sports injuries, and new injuries that have occurred.

Confrontation training is an important training method to improve the technical and tactical level of female judo players, and it is also the main cause of sports injuries. In order to effectively avoid sports injuries, it is very important to improve the effect of tactical training preparation (Oparin et al. 2018). Coaches should emphasize the importance of warm-up activities in face-to-face training, treat warm-up activities as part of face-to-face training, and design special warm-up activities in a scientific and technical way. Prepare for the athlete’s strength, speed, endurance, flexibility, and other qualities to prepare for the warm-up, and prepare for the combination of quality and technique to help their body perform its best during training and avoid various injuries.

Improve the effect of technical and tactical learning

Young judo athletes are in a period of rapid physical development and have a strong interest in learning and understanding knowledge and skills. In order to further transform their interest in learning into the mastery of a series of skills and strategies, it is necessary to enhance their learning ability by highlighting intuitive and interactive teaching methods. The key points of training make technology and tactics learning from complex to simple, and easy to understand, so that they can understand the key and difficult points of technology and tactics, and avoid wrong actions in practical applications and cause sports injuries. When training athletes, it is necessary to configure multimedia teaching equipment. And for training issues, it can be demonstrated to athletes through multimedia at an appropriate time, especially in some typical women’s judo techniques and tactics application cases. The latest developments of the game can be displayed to the athletes intuitively, so that they can better understand the action and conduct training. At the same time, the use of multimedia to analyze the athlete’s technical and tactical image, so that the athletes understand their easy to make mistakes in the sports, and then continue to carry out targeted auxiliary training to improve the technical level and tactical accuracy.

It is necessary to continue the interactive teaching of multi-discussion and skills and tactics, and change the traditional
training method based on “one size fits all.” The coaching team members need to discuss and analyze the problems encountered by skills and tactics, focusing on discovering, analyzing and solving problems, and enhancing the learning effect. It is necessary to actively try the “combination of learning and teaching” comprehensive teaching strategy, so that in addition to learning skills and tactics, athletes also need to understand and learn tactics professors. In the training process, it is necessary to maintain an active training exchange learning method, timely absorb the good experience of other provinces and cities, or send team members for training to improve the learning effect. The purpose of improving the learning effect is not only to improve the application level of skills and tactics, but also to avoid sports injuries caused by improper use of skills and tactics in athlete training and competition.

Conclusion

Based on the air pollutants and meteorological data of W city in recent years, this paper firstly studies the temporal distribution characteristics and influencing factors of PM2.5 concentration, and establishes a single-step model for predicting PM2.5 concentration. Through analyzing the correlation, it is found that except for O3 which is negatively correlated, PM2.5 concentration is positively correlated with the other four air pollutants. Among them, the correlation coefficient between PM2.5 and PM10 is 0.976, and it is inferred that the source of PM10 is dust, which is also the main source of PM2.5. The correlation coefficient between PM2.5 and CO is 0.843, and the source of CO combustion is also the main source of PM2.5. Therefore, the goal of effectively reducing the concentration of PM2.5 can be achieved by reducing the content of pollutants such as PM10 and CO in the air. Finally, this article conducts a systematic study on the safety of sports training for young female athletes in Province S. Research shows that the injury rate of young judo athletes in S province is 1.57, and there is no significant difference between cities. The shoulder and elbow joint is the most common case of upper limb injuries, accounting for 38.4% of the total; the knee joint is the most common case of lower limb injuries, accounting for 27.9% of the total. Strains and sprains accounted for the majority, accounting for 87.2% of the total. Moderate injuries accounted for the highest proportion, accounting for 60.4% of the total, and serious injuries accounted for the smallest proportion, accounting for 7.3% of the total. Acute injury is 5.8% higher than normal injury. Confrontation training and the pre-competition period are usually the main source of sports injuries. The basic characteristics of sports injuries are related to the physical development of young athletes and the requirements of judo techniques and tactics.

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