Forest rainfall characteristics based on heterogeneous computing and influencing factors of athletes’ physical supplement

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Abstract
The advent of the era of big data greatly stimulates the research and application of heterogeneous algorithms. Firstly, based on the characteristics of heterogeneous FPGA computing platform, this paper develops kb-knn heterogeneous algorithm based on KNN. In order to make full use of the heterogeneous platform, this paper classifies the unclassified data and adopts the parallel implementation scheme of flow between devices, so that the master and slave devices in the heterogeneous system can participate in the calculation cycle of global hydrology and material energy. This paper explains the importance of forest rainfall distribution for regional social and economic development and agricultural production, ecological balance, optimal allocation of water resources, and environmental protection. Due to the limited availability of data from multiple sources, there are few studies to analyze the precipitation changes of different time scales in mountainous areas. The forest precipitation data used in this paper usually have low temporal and spatial resolution, and cannot describe the spatiotemporal heterogeneity of precipitation in mountainous areas. In addition, the physical fitness of athletes mainly includes strength training and speed training. The combination of recovery and nutrition is the basic knowledge that coaches must have. The rehabilitation of athletes mainly depends on the amount of exercise, physical therapy, and massage adjustment. Reasonable nutrition is one of the most important factors for athletes to win and ensure their health and sports ability. Heterogeneous computing platform provides a new solution to accelerate the implementation of such algorithms. In the heterogeneous computing platform, this paper discusses the nutrition of athletes’ physical supplement and describes the characteristics of forest rainfall.

Keywords Heterogeneous computing · Forest precipitation · Athletes · Physical supplement

Introduction
With the rapid development of information technology in modern society, people’s methods of obtaining information have become more and more diverse and less complex. The amount of information people receive has increased dramatically. How to obtain heterogeneous algorithms from the rapid growth of massive data or key information? At the same time, database technology is also developing; data storage, query, analysis, and statistical information are also gradually developing. However, with the continuous reduction and integration of IC function size, the possibility of heterogeneous algorithms has gradually reached its limit. Modern computing process has shifted from the traditional era of sequential computing to the era of heterogeneous algorithm based on multicore and multithread (Li et al. 2017). At present, there are mainly algorithms of heterogeneous system, which can be divided into two systems, homogeneous system and heterogeneous system. Heterogeneous algorithm system is composed of subsystems with different architectures, and according to the structural characteristics of each subsystem, different computing tasks are assigned to each subsystem, which can make full use of the computing advantages of various heterogeneous algorithm systems (Mokadem et al. 2018). Due to the rapid development of society and economy and the impact of global climate change, water resources are shrinking day by day, rivers are drying up, water shortage in reservoirs is common, and the contradiction between supply and demand is more and more obvious (Morid et al. 2006). Forest precipitation is a
phenomenon of liquid or solid water in the atmosphere. Under the action of gravity, this phenomenon overcomes the resistance of the air and falls from the air to the ground (Wang et al. 2020). The causes of precipitation in mountainous areas are complex and usually depend on various factors, such as atmospheric circulation and difficult terrain. Studying the long-term spatial-temporal characteristics of precipitation in mountainous areas with complex terrain can effectively reveal the law of climate change, which is of great significance for scientific and rational formulation of water resources management strategy. Therefore, the study of the nature of forest precipitation on different temporal and spatial scales is the basis of a comprehensive understanding of the process and mechanism of forest precipitation on different scales (Quiring 2009; Wu et al. 2001). It is very important to promote meteorological and hydrological monitoring and forecasting, improve the ability to deal with natural disasters, and optimize water management. Sports have become an increasingly important part of people’s social and cultural life (Ncibi et al. 2020). Athletes’ physical fitness mainly includes strength training and speed training. In the development stage, young people should combine rest and nutrition, which is what coaches should do. After mastering the basic knowledge of the athletes, the coach must adjust it in time so that the athletes can compete under better conditions. The change of athletes’ eating habits should start as soon as possible, and an excellent coach must be able to coordinate diet and exercise to ensure a high level of exercise ability. For athletes, a natural diet is more effective than a dietary supplement. Therefore, good functional status depends on proper nutrition and good physical supplement (Tsakiris et al. 2007).

Materials and methods

Data source

(1) Chrpsv2.0 is jointly developed by the center of climate disaster of a university and the U.S. Geological Survey Bureau. The main data sources are trmm3b42tir and the National Oceanic and Atmospheric Administration climate prediction system. Chpclim1.0 is the monthly precipitation data, atmospheric model data, and the meteorological station measurement value (Salehnia et al. 2017). The dataset has been developed to version 2.0, and since 1981, the chrps data center has been providing a precipitation grid data set with a global ground resolution of 50°S–50°N.

(2) CDR is developed by the center of hydrology, meteorology, and remote sensing of a university and a branch. Since 1983, CDR has been able to provide 60% of the world °S to 60°. The precipitation estimation is generated by using the perciann algorithm for the gridsat-b1 infrared satellite data.

Data preprocessing

For precipitation data measured at ground station, first, flatness test is performed, and then the value recorded by error is deleted. If a station lacks data for a small amount of time, interpolation is performed using observations from adjacent stations. Then, the ExcelVBA batch program is used to sort and rename the large amount of precipitation data (Shahabfar and Eitzinger 2013). When integrating with satellite precipitation products, the daily precipitation data is processed based on the coordinated world time, while when the light rainfall characteristics analysis is carried out, the Beijing time is taken as the benchmark to process hourly data. The R can be used to transform, rotate, project, cut, and extract the satellite precipitation products, and scan the satellite precipitation products on the same DEM data. Set resolution (0.05°) ensures that the mesh geometry (spatial resolution, space range, and origin) is the same.

Design of heterogeneous computing platform

At present, the popular heterogeneous computer standards include the heterogeneous computer standard CUDA, the heterogeneous computer standard OpenCL formulated by Khronos group and the heterogeneous c++amp (accelerating large-scale parallel) proposed by Microsoft. The model of heterogeneous system is shown in Fig. 1.

All the three heterogeneous computing standards, OpenCL, CUDA, and C++ amp, assume a kind of cooperation between master and slave. As shown in Fig. 1, the master and slave devices can be connected in several ways, such as Ethernet and PCI bus, on chip, etc. The slave device can be accelerated by parallel computing to support the master
device, thus significantly improving the overall performance (Tsakiris and Vangelis 2005).

Calculation of forest water conservation capacity

The water holding capacity of litter was determined by indoor immersion method. A certain number of samples were weighed and put into a 45×30-cm nylon net bag, and then put into a container containing ordinary water to calculate the water loss, water loss rate, and water loss rate at different times. The formula used to calculate specific indicators is as follows.

The natural moisture content of litter is shown in formula (1):

\[ R_0 = \frac{(M_0 - Md)}{Md} \times 100\% \]  

Water holding capacity of litter, such as formula (2):

\[ W_{hold} = M_t - Md \]  

The water holding capacity of litter is shown in formula (3)

\[ R_{hold} = \frac{(M_t - M_d)}{M_d} \times 100\% \]  

The water absorption rate of litter is as follows (4):

\[ V_{hold} = \frac{(M_t - M_d)}{(M_d \times t)} \]  

The rate of litter retention, such as formula (5):

\[ R_{stop} = R_{hold} - R_0 \]  

The maximum storage capacity of litter is shown in formula (6):

\[ W_{stop} = M_d \times R_{stop} \]  

The water loss of litter is shown in formula (7):

\[ W_{lose} = M_{24} - M_o \]  

The water loss rate of litter is shown in formula (8):

\[ R_{lose} = \frac{(M_{24} - M_d)}{M_d} \times 100\% \]  

The water loss rate of litter is shown in formula (9):

\[ V_{lose} = \frac{(M_t - M_d)}{M_d \times t} \]

Results

Analysis of spatial and temporal variation characteristics of forest area precipitation

The spatial distribution of the average long-term precipitation is shown in Fig. 2. It can be seen from the figure that the annual average rainfall in this province is between 917 and 1398 mm, and the annual average rainfall in the area of 1000 to 1300 mm accounts for 86% of the total area. Figure 2 shows the distribution of precipitation in flood and nonflood periods.

According to the combined products, calculate the annual average precipitation of a in the past 40 years, and draw the point chart of precipitation change from 1980 to 2020, as shown in Fig. 3, to analyze the time trend of the past 40 years.

Figure 3 shows that the average annual precipitation in this area is 1174 mm, the maximum precipitation in 2020 is 1382 mm, and the minimum precipitation in 2016 is 849 mm. The maximum and minimum precipitation occurred in 2010, and the difference between them is 1.63 times, which indicates that the interannual variation of precipitation in this area is very significant in the past 40 years, especially since the beginning of 2010.

As shown in Fig. 4, the statistical data of precipitation distribution and slope change before and after sudden change in a given area are collected. The map shows that the maximum and minimum precipitation in the region increase significantly after the sudden change.

Further analysis of the past 40 years during the flood and nonflood annual precipitation changes and precipitation climate trends, and draw its spatial distribution map, as shown in Fig. 5.

As shown in Fig. 5, the spatial distribution of precipitation in climate trend of place a is in the west–east gradient from 1988 to 2020, and the total precipitation is within the range of –71.3–64.2 mm/10a. The annual precipitation is decreasing in southwest and north central and increasing in southeast. The distribution of the intensity of climate precipitation in flood season is similar to that of the whole year. There are also two low value centers for precipitation reduction, with the center points of –50.7 mm/10a and –56.3 mm/10a. The change of annual precipitation is also affected by the change of precipitation in flood season. In Fig. 5, the spatial distribution chart of precipitation in flood season can be seen. All regions, except for the low cost centers in the southwest, are on the rise.

Analysis of precipitation law under complex terrain conditions

In order to study the relationship between precipitation and altitude in a mountainous area, a mountainous area is divided into Pearl River Basin and Yangtze River basin with the boundary of Miaolin basin. The average grid pixels of precipitation products in the altitude range were combined, and the precipitation altitude scatter map was constructed (Fig. 6).

With 1°, the average precipitation of each slope interval is calculated, and the broken line chart of annual precipitation variation of different slopes is drawn (Fig. 7).
Fig. 2  Spatial distribution of precipitation in different time scales in mountainous area

Fig. 3  Linear chart of precipitation change in specific area in the past 40 years
Along 22.5°, the slope direction is divided into 16 directions, and a rose chart is drawn to show the trend of annual precipitation from different slopes (Fig. 8).

**Daily variation characteristics of forest precipitation**

It can be seen from Fig. 9 that the peak daily precipitation in flood season occurs at 4:00 a.m., and the precipitation changes little from 2:00 to 5:00, and lasts for a long time, which is different from the existing research in Southwest China.

Figure 10 shows that the daily precipitation intensity is weak in the flood season, and the periodic variation intensity of daytime precipitation in the nonflood season is from 11:00:00 to 12:00 in the valley.

Figure 11 shows that the daily precipitation frequency changes in flood season and nonflood season show obvious single peak periodic changes.

It can be seen from Fig. 12 that the distribution of daily peak precipitation in flood season is similar to that of multi-year precipitation in flood season, which is mainly concentrated in southwest and southeast regions, and southwest and southeast are low-cost regions. In Northwest China, the distribution of the maximum precipitation in the nonflood season is similar to the long-term average in the nonflood period, which indicates the spatial differentiation of decreasing from east to west.

The maximum precipitation intensity in flood season (Fig. 13) decreases gradually from northeast to southwest, and the minimum value of maximum precipitation intensity in nonflood season (Fig. 13) appears in Chishui River basin to the north of the center of the region. The area with the most rainfall does not necessarily have the highest high-quality area.

As can be seen from Fig. 14, the peak frequency of precipitation is more orderly and even than the intensity of intensity. The peak of flood season repeats from 1:00 to 8:00, and the intermittent flood season repeats from 0:00 to 6:00, which indicates that the most frequent time of rainfall is in the second half of the night. In the early morning, there was no spatial differentiation.

Therefore, the complex pattern of small-scale precipitation distribution in a given area is usually formed by mesoscale weather system, topographic fluctuation, and local microclimate.

**Analysis of forest water conservation function**

The natural water content of the undecomposed layer of various types of forests ranged from 6.13 to 9.82% (Table 1). There was significant difference among evergreen deciduous forest, softwood forest, *Pinus yunnanensis* forest and *Pinus armandii* forest ($P < 0.05$), but there was no significant difference among wax gourd forest ($P > 0.05$).
Table 2 lists the maximum water holding capacity and maximum water holding capacity of litter of various forest types. The water-holding capacity of waste depends on its composition, degree of forest degradation, and microenvironment. The higher the water holding capacity of waste, the higher the water holding capacity, and vice versa.

The maximum water holding capacity and the change trend of water holding capacity of different types of forests are different. Figure 15 shows that the overall trend of the maximum cushion water-holding capacity is similar, but it is not exactly the same as the cushion accumulation.

The results show that the largest amount of waste in the seven types of forest is orderly.

Under the natural conditions affected by water conditions, rainfall characteristics, and terrain conditions, garbage cannot capture all the rainfall falling on the forest surface. Therefore, the maximum capture amount and debris amount may not reflect the capture, and effective interception is used to better reflect the actual interception of sediment by waste.

Table 4 shows that the maximum value is about 4.65 times of the minimum value. The effective interception capacity of undecomposed layer and semidecomposed layer of a forest type is different, but the effective interception capacity of undecomposed layer of litter is very different.

Generally, the ability of debris to capture sediment is also affected by natural water content and debris accumulation. Although the effective interception rate of evergreen larch forest is the highest, it is lower in Pinus armandii forest and coniferous mixed forest because of its high natural water content. Although the effective retention rate of mature Pinus yunnanensis forest was not significantly different from that of mixed coniferous larch forest, its growth was lower than that of mixed coniferous larch forest, and its effective blocking amount was also significantly lower than that of mixed coniferous larch forest.

**Discussion**

**The influence of psychological factors on athletes’ physical fitness supplement**

Besides positive awareness and tolerance factors, the overall scores and coping styles of top athletes in colleges and...
universities are significantly related to all parameters and overall scores, and are significantly related to various parameters and overall stress scores. Regression analysis shows that the failure, suppression of interference, and interpersonal relationship can significantly affect the athletes’ competitive state, which can explain 18.8% of the differences (Abbes et al. 2018). This shows that the stress state and behavior of the top athletes in colleges and universities can predict the competitive state of the athletes well. Emotional stress, mental fatigue, and mental fatigue are positively correlated with the stress in all aspects, that is, the greater the pressure, the stronger the negative psychological response. Emotional stress is a physical nonspecific emotional response caused by various powerful factors. Mental fatigue is commonly referred to in

![Fig. 6 Distribution of precipitation and altitude in different areas](image)

![Fig. 7 Line chart of various slopes and annual precipitation](image)

![Fig. 8 Pink map of annual precipitation distribution in different directions of slope](image)
this paper as “heart fatigue”, which means that this article will feel tired in work or life. Mental exhaustion refers to the limit of mental stress and perseverance, which also means that athletes with high incidence of emotional stress, mental fatigue, and mental fatigue often feel depressed, anxious, and tired due to training or competition, feel physical degradation, and even find it difficult to continue training, which will affect the state of the competition. On the coping style scale, emotional stress, mental fatigue, and mental fatigue were positively correlated with the catharsis, inhibition of interference, seeking religion, escaping, and restraint, while mental exhaustion was negatively correlated with positive views. This shows that negative coping style will aggravate the bad competition, and positive coping style will reduce negative psychological reaction, which will help to improve the competition state. Fatigue has a significant positive correlation with each dimension of the pressure scale, and the correlation coefficient with sports injury and competition failure is the highest (Bento et al. 2018). That is, sports injury and competition failure have the greatest impact on sports fatigue, back pain, or fatigue will affect the state of the game.

Self-regulation is a dynamic mechanism of cognitive development from unbalanced to balanced. On the competitive state scale, self-regulation is positively related to seeking support, active response, venting emotion, positive consciousness, and disease inhibition. That is, the more often a person uses the active survival method, the stronger his or her ability to maintain a good competitive state. Usually, this article can really motivate myself before the game and do what I can. In the process of practice, this paper sets a clear goal for myself, calmly dealing with the mistakes in the game or the difficulties in longevity, and self-regulation is a way to actively maintain the best state of the game. Happiness, self-efficacy and the relaxation of competitive status are not related to one of the stress parameters, but related to the positive perception of coping style. This shows that there is no causal relationship between the possibility of actively adapting to the competition and the pressure, and only adopting positive coping mode can we guarantee the competitive state. The analysis of various scales shows that stress can cause negative emotions and affect the competition. However, using appropriate coping techniques
can help reduce the impact of stress on competition (Besser et al. 2018).

In terms of total score, the correlation coefficient between competitive state and pressure scale is greater than that of coping style scale, which indicates that the influence of pressure on competition state is the most important. Among them, the correlation coefficient between the total score of competitive state and the loss in the game and interpersonal relationship is the highest. Regression analysis also confirms this point, which means that in many stress factors, the main factors are the loss in the competition and the influence of interpersonal stress on the athletes’ competitive state (Chang et al. 1994). However, game failure, interference inhibition, and interpersonal relationship can only explain 18.8% of the competition state differences, which indicates that there are many other factors that will affect the competitive state of top college students’ athletes.

(1) Life stress: because in some family environments, children may not have enough room for growth, helping them exercise is an effective option. Usually, these athletes have been trained in professional sports since they were young. At this point, their world outlook has not been fully developed, so they have weak psychological endurance when they encounter difficulties and are prone to psychological problems such as anxiety and depression. At the same time, these young athletes have strong attachment with their families. Any changes in the family, such as the broken marriage of parents, the illness of relatives and even misfortune, some interpersonal conflicts, family economic burden, etc., will have a great impact on athletes and affect the competition. As athletes age, they are under double pressure from family and training, and they may need to take on more responsibility to improve their family financial situation or solve school problems for younger siblings (Dubrovsky et al. 2006).

(2) Psychological quality: the person who wins the championship does not have to be the strongest, but he must be the best performer, in other words, the one with the best psychological quality. The reason why the competition in the competition is rising is that competition has become the most important achievement of the athletes, and the competition performance is usually reflected in...
the way that athletes control their mental health. Until now, the attention of the continuous development of competitive sports, the gap between athletes in technology and fitness is gradually narrowing, the success or failure often depends on their psychological level. Therefore, psychological quality has become an important factor affecting the state of the competition.

(3) Lack of competition: one of the reasons for psychological quality is the lack of experience in participating in the competition (Escalante-Sandoval and Nuñez-Garcia 2017). Training helps to enhance the basic skills of athletes, and competition is the key to learn and improve their own skills and quality. In recent years, with the development of competitive sports in large international sports events in China, especially through the remarkable achievements of competitive training, more and more national events have been held. Similarly, the number of sports activities for family students is increasing gradually, which shows that participating in sports events plays an important role in improving the level of competition among athletes. Sports competition is a test of athletes’ normal physical exercise (Hamed et al. 2018). Through the competition, they can find their current problems, how to improve their psychological state and experience at home and abroad. In addition, sports are still being held for coaches. Test the regular training plan and training methods, set the goal for the next stage of training, and also check the trainer performance standard (Jain et al. 2015). This paper can say that sports events can help to achieve the goals of coaches and athletes, and can make them both on the right path.

(4) Teaching contradiction: This paper knows that the high-level athletes in colleges and universities enter the university through special choices, and the achievements of cultural courses are not very good. However, this does not mean that the level of intelligence or education of athletes is lower than that of others. For example, mathematicians think more logically and mathematically than others, scientists’ creativity is more important than others, artists’ expressive power is more important than others, and athletes’ sports wisdom is more important than ordinary people. Special treatment is a good way to choose talents, but it does not mean that other aspects of training have been abandoned. After athletes enter colleges and universities, on the one hand, there are inherent deficiencies in the accumulation of sports culture; on the other hand, higher education needs higher education, which is the contradiction between cultural education and sports training. College athletes must first obtain credits and keep up with their academic achievements,
and face double pressure, which directly affects the competitiveness of some college athletes.

Employment factor: the golden age of elite athletes who are ready to graduate from university has passed, and few compete in their lives (Li et al. 2014). This paper has discussed the conflict between teaching and training, because the school athletes must invest a lot of energy and time in physical training, which makes their study in cultural class relatively weak. When hiring companies, employers often regard cultural quality as a strict indicator, which is the basis of these sports qualities.

The influence of nutritional factors on athletes’ physical supplement

Energy demand of athletes

The level of heat and energy exchange of athletes depends on different types of training, which is affected by three factors: intensity, density, and training duration. The intake of 1kcal (male) and 0.9kcal (female) per minute can be used to roughly calculate the athletes’ basal metabolic rate. Due to the different sports equipment and amount of exercise, the heat consump-

| Table 1 | Natural water and natural litter water of different forest types |
|---------|---------------------------------------------------------------|
| Vegetation types | Natural water content/t-hm² | Natural moisture content/% |
| Undecomposed layer | Semidecomposed layer | Average | Undecomposed layer | Semidecomposed layer | Average |
| Huashan pine forest | 0.65±0.14 | 0.78±0.07 | 1.43±0.21 | 6.13±1.44 | 12.26±1.51 | 9.20±1.47 |
| Dry winter melon forest | 0.32±0.05 | 1.00±0.25 | 1.32±0.31 | 7.31±1.24 | 14.08±2.26 | 10.69±1.75 |
| Mature Yunnan pine forest | 0.51±0.21 | 0.64±0.11 | 1.14±0.30 | 6.03±1.69 | 11.18±2.08 | 8.61±1.88 |
| Yinjinglin | 0.48±0.06 | 0.81±0.06 | 1.29±0.12 | 9.76±1.84 | 14.24±1.27 | 12.00±1.55 |
| Coniferous and broad-leaved mixed forest | 0.63±0.08 | 1.50±0.06 | 2.13±40.13 | 7.90±0.51 | 15.92±0.67 | 11.91±0.08 |
| Young Yunnan pine forest | 0.20±0.03 | 0.14±0.01 | 0.34±0.05 | 6.92±0.56 | 7.35±0.51 | 7.13±0.53 |
| Evergreen broad-leaved forest | 0.47±0.07 | 1.81±0.32 | 2.28±0.42 | 9.82±1.82 | 17.8±1.65 | 13.82±1.73 |

| Table 2 | Maximum water holding capacity and maximum water holding capacity of different types of forest litter |
|---------|---------------------------------------------------------------|
| Vegetation types | Maximum water holding capacity/t-hm² | Maximum water holding rate /% |
| Undecomposed layer | Semi-decomposed layer | Sum | Undecomposed layer | Semi-decomposed layer | Sum |
| Huashan pine forest | 17.33±0.70 | 13.75±0.15 | 32.18±0.05 | 165.47±8.03 | 215.96±6.76 | 189.72±8.39 |
| Dry winter melon forest | 8.10±0.08 | 14.58±0.74 | 22.41±0.91 | 185.24±3.66 | 207.58±8.77 | 196.41±2.56 |
| Mature Yunnan pine forest | 12.03±0.77 | 12.09±0.39 | 25.10±1.67 | 143.48±4.90 | 212.35±9.68 | 177.91±2.39 |
| Yinjinglin | 8.14±0.69 | 11.03±0.57 | 19.06±1.28 | 164.29±4.08 | 192.74±5.57 | 178.57±4.83 |
| Coniferous and broad-leaved mixed forest | 12.11±0.32 | 20.22±1.42 | 31.87±1.59 | 151.35±4.83 | 214.19±1.74 | 182.77±3.21 |
| Young Yunnan pine forest | 3.57±0.26 | 3.24±0.12 | 7.05±0.42 | 124.13±0.12 | 172.80±1.73 | 148.47±0.93 |
| Evergreen broad-leaved forest | 9.71±0.07 | 21.95±1.94 | 31.29±1.78 | 204.62±6.10 | 217.15±0.99 | 210.88±2.55 |
tion in the process of exercise is different from that of women, and the range of exercise heat is 400 to 2600 kcal. During training, the heat consumption of athletes is usually about 1000 kcal, accounting for about 40% of the total daily heat consumption. Athletes’ extracurricular activities are mostly static activities with low metabolic rate. The specific motivation of food intake of athletes is higher than that of normal people, which is related to the higher protein intake of athletes, which can be calculated as 15% of the total calories (Keyantash and Dracup 2002).

**Energy source of sports nutrients**

The human body is a very complex body; every minute, there are billions of cells in change; the human body’s metabolic activities can be carried out smoothly. Sugar in food provides

| Vegetation types                        | Maximum storage capacity/t-hm² | Maximum blocking rate/% |
|-----------------------------------------|-------------------------------|-------------------------|
|                                         | Undecomposed layer         | Semidecomposed layer   | Sum          | Undecomposed layer | Semidecomposed layer | Sum          |
| Huashan pine forest                     | 16.68±0.59                  | 12.97±0.20             | 29.65±0.41   | 157.34±8.80       | 203.69±5.50        | 180.52±7.15   |
| Dry wintermelon forest                  | 7.78±0.03                   | 13.58±0.49             | 21.36±0.52   | 177.93±2.41       | 195.50±9.02       | 185.72±4.31   |
| Mature Yunnan Pine Forest              | 11.52±0.60                  | 11.45±0.31             | 22.97±0.90   | 137.45±6.43       | 201.17±7.95       | 169.31±1.21   |
| Yinjinglin                              | 7.66±0.75                   | 10.21±0.63             | 117.88±1.37  | 154.53±5.92       | 179.59±6.83       | 166.56±6.38   |
| Coniferous and broad-leaved mixed forest| 11.48±0.26                  | 18.72±1.36             | 30.19±1.58   | 143.45±5.31       | 198.27±1.06       | 170.86±3.15   |
| Young Yunnan pine forest               | 3.37±0.23                   | 3.10±0.10              | 6.47±0.32    | 117.21±0.45       | 165.45±1.23       | 141.33±0.39   |
| Evergreen broad-leaved forest          | 9.24±0.04                   | 20.13±1.62             | 29.37±1.59   | 194.79±7.92       | 199.34±0.66       | 197.07±4.29   |

![Fig. 15 Waste accumulation and maximum water holding capacity of different forest types](image.png)
about 60% of the energy needed by the human body. Recent sports nutrition research has confirmed that carbohydrates can help athletes to exercise best. It is important for athletes to carry out endurance training. At the same time, the important role of dietary nutrition in the formation of adequate energy reserve in the body is emphasized. Generally, the energy consumption time of normal balanced diet is about 115 min, and the content of muscle glycogen is 1.75g/100g. The energy consumption time of high fat and protein diet is 60 min, and the content of muscle glycogen is 0.63g/100g. The energy consumption time of high sugar diet is 170 min, and the content of muscle glycogen is 3.75g/100g. The human body will accelerate the consumption of muscle glycogen and liver glycogen in the human body, so as to reduce the athletic ability of athletes for high-intensity exercise (Kostopoulou and Karatassiou 2017).

Dietary guidelines designed for the best exercise ability

Monitor energy intake, maintain a relatively stable ideal weight (suitable for different sports and different groups of people), and choose wise eating habits.

1. Control fat intake (25–30%), especially saturated fat, such as butter, margarine, animal fat, and organ meat.
2. Try to cut down on alcohol and coffee.
3. Make sure you have enough blood sugar, muscle glycogen, and liver glycogen for exercise training.
4. Vitamin and mineral tablets can be added if necessary.
5. Develop good eating habits; in order to ensure that a variety of nutrients from the diet, do not nitpick and excessively consume. The change of athletes’ eating habits should be started as soon as possible. Therefore, good results can be obtained through proper nutrition, which is also conducive to good sports performance.

### Table 4: Effective capture rate and effective capture rate of debris in different types of forest

| Vegetation types                          | Effective interception volume/t-hm² | Effective blocking rate/% |
|------------------------------------------|------------------------------------|----------------------------|
|                                          | Undecomposed layer | Semidecomposed layer | Sum       | Undecomposed layer | Semidecomposed layer | Average   |
| Huashan pine forest                      | 14.08±0.48          | 10.91±0.18            | 24.99±0.33| 132.82±7.30       | 171.30±4.50         | 152.06±5.90 |
| Dry winter melon forest                  | 6.57±0.02           | 11.39±0.38            | 17.96±0.40| 150.15±1.86       | 162.36±9.71         | 156.26±9.39  |
| Mature Yunnan pine forest                | 9.71±0.49           | 9.64±0.24             | 19.35±0.73| 115.93±5.69       | 169.32±6.51         | 142.62±1.02  |
| Yinjinglin                               | 6.44±0.64           | 8.56±0.54             | 14.99±1.18| 129.89±5.31       | 149.67±5.99         | 139.78±5.65  |
| Coniferous and broad-leaved mixed forest | 9.66±0.21           | 15.68±1.15            | 25.34±1.32| 120.75±4.59       | 166.14±0.80         | 143.45±2.66  |
| Young Yunnan pine forest                 | 2.83±0.19           | 2.62±0.08             | 5.45±0.27 | 98.59±0.47        | 139.53±0.97         | 119.06±0.25  |
| Evergreen broad-leaved forest            | 7.78±0.05           | 16.84±1.33            | 24.62±1.29| 164.10±6.99       | 166.76±0.80         | 165.43±3.90  |

### Conclusion

In view of the continuous in-depth research and application of heterogeneous data mining algorithm, as well as the rapid growth of the amount of processed data, the rapid implementation of data mining algorithm is facing severe challenges. At the same time, the heterogeneous platform also proposed that precipitation is the key factor of climate change, as well as information about time and time process. Accurate recording of the spatial distribution of precipitation is the key to effective analysis of hydrological and climatic processes. Due to the interaction between monsoon climate and difficult terrain, the spatiotemporal heterogeneity of forest precipitation in highlands is very large. Improving the function of rainfall monitoring is one of the main challenges in the development and utilization of water resources in the region. The existing research on precipitation characteristics in this area only uses a single data with low spatial-temporal resolution. Through the extensive use of ground precipitation stations, meteorological satellite remote sensing, and weather radar, as well as other networks of information related to precipitation from multiple sources, the characteristics of precipitation and precipitation fusion based on data from multiple sources have been conveyed. Data are generated from multiple sources suitable for a specific region, and the characteristics of precipitation variation and its influencing factors in different time and space are
displayed. This paper discusses the shortcomings of traditional ground weather stations in estimating the temporal and spatial distribution of precipitation and the disadvantages of satellite remote sensing precipitation products, and discusses the disadvantages of using random precipitation model to integrate precipitation meteorological data between weather stations and satellites in forest. This paper reveals the characteristics of precipitation in mountainous areas and its influencing factors in different time and space scales, as well as the research on the physical recovery and nutritional status of athletes. The recovery of athletes largely depends on adjusting the amount of training, physical therapy, massage, and so on. Adequate nutritional supplements are one of the most important factors for athletes to win, which can ensure their health and sports ability. Fitness supplements are closely related to athletes’ training, functional status, fitness, rehabilitation, and sports diseases. For some athletes, it is very important to have a basic understanding of nutritional supplements for their health. The following three kinds of nutritional problems are known to occur: (1) the amount of energy and calories consumed by athletes every day is reasonable. (2) In order to maximize the functions of various parts of the human body in competitions or sports, it is best to consume a certain amount of nutrients. (3) In order to balance the body components that enter the body during exercise and eliminate fatigue as soon as possible, it is suggested to absorb a certain amount of nutrition.

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**Declarations**

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

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