SPORTS TRAINING SESSION SCHEDULING USING THE BAT ALGORITHM

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Abstract:

For coaches, organizing effective sports training has always been a very difficult assignment. Accordingly, they must nearly two unique skills: first, extensive prior expertise in sports training; and second, a thorough understanding of their athletes' potential. As mobile and ubiquitous technology have advanced, new approaches to sports training planning have surfaced. One of the most practical features of a typical sports watch these days is a GPS receiver, which allows players to follow the. The key features of standard sports watches allow athletes to monitor the length of their physical activities and later analyze them on digital devices with GPS capabilities. In addition, many sports watches can track an athlete's heart rate while they are active. Both types of measurements provide dependable data that coaches can utilize to plan training sessions. In this paper, we present an innovative intelligent planning technique for sports training sessions, in which the bat algorithm is used to create training programs on digital computers based on trustworthy data gathered from sports watches. Promising outcomes from real-world experiments motivated us to continue this research in the future.

Introduction:

Today's athletes have several opportunities to enhance their training performance, which will help them be more competitively ready. These days, training technology play a significant role in every athlete's athletic life [1]. These technologies consist of:

- Various types of heart rate monitors,
- smart sport watches,
- power and cadence meters,
- music players,
- and many more are available.

The most crucial components of these technologies are most likely sport watches. When the Finnish manufacturer Polar introduced extremely powerful sport watches with a heart rate monitor and a timer to measure the length of time spent participating in sports, the initial interest in sport watches began in the mid-

1990s. The following are the functions of these watches:

observing the length of a sporting event,

- tracking the current and maximum heart rates,
- tracking the elevation and total ascent,
- keeping an eye on the temperature,
- and recording events on Sport Watch.

Furthermore, bikers have acquired sensors that can track speed and have been installed on their bikes. Additionally, subsequent models of these watches allowed for online analysis of workouts and connectivity to digital computers.

In the past, these sports timepieces were among the most crucial training aids for all athletes, professional and amateur. The training technology then advanced significantly. Numerous businesses were able to create sports watches with GPS receivers thanks to advancements in GPS technology [2]. These watches

offer a lot of advantages over earlier models since they use a GPS receiver to measure training characteristics data with extreme precision. As a result, runners and cyclists may determine their speed, altitude, and activity duration without the usage of any specialized sensors. To satisfy the demands of athletes around the world, businesses like Suunto, Polar, and Garmin are now working hard to create more possibilities for these watches.

The biggest advancement of modern sport watches is undoubtedly their ability to connect to digital computers and analyze training sessions online. For example, the Garmin Connect web service created a magnificent online training program that allows customers to evaluate their exercises following their completion of tasks. In order for athletes to perform better in the formal events, the web service also pushes them to train more. However, the outcomes of these exercises can also be exported in XML format to a computer for further analysis.

This work aims to provide a digital computer-based intelligent sports training planning system based on trustworthy data output by sports watches as XML activity files [3]. In essence, two metrics are crucial for this planning: the average heart rate and the length of the activity. Sports watches that save information about particular activities in their internal memory and can be downloaded onto a digital computer for additional analysis are used to assess both metrics precisely. A bat algorithm is used to carry out the sports training plan for a particular athlete based on this exported data.

The bat algorithm is a member of the Swarm Intelligence (SI) class [4, 5, 6]. In 2010, Yang [7] developed a novel optimization algorithm that was influenced by the behavior of microbats, who employ a unique process known as echolocation. Bats utilize echolocation to make their way around and locate prey. Several benchmark functions were subjected to the original bat algorithm, which produced reliable results.

In the study [8], the scientists hybridized the original bat algorithm with differential evolution methods (HBA) to increase the system's convergence rate.In the work [9], the same scientists used a random forests machine learning method (HBARF) and differential evolution strategies [11] to hybridize the bat algorithm. [12] has the full survey about the bat algorithm.

The suggested method for scheduling sports training sessions can generate a training schedule for a particular athlete for a specified training term. It begins with a series of foundational exercises with varying lengths and average intensities based on heart rate. The coaches choose the fundamental training sessions based on previously acquired XML activity data. Long-duration training sessions are therefore seen to be better suited for the beginning phases of training, whereas the more intense short-duration training sessions must be carried out during the more advanced training phase, when the athlete is already in good shape. It's true that there aren't many entirely intense training sessions.

Despite the fact that there are numerous commercial programs available for tracking sports activities, there is currently no system in place for intelligently arranging sports training on a digital computer. Therefore, the primary purpose of our suggested methodology is to assist coaches in determining the best training schedule for each individual athlete getting ready for a competition. There are many opportunities for additional development because the algorithm's outcomes meet the standards of professional coaches.

This paper is organized as follows. The fundamentals of sport training are covered in Section 2. Here, a mathematical model for scheduling sports training is created. The bat algorithm used to schedule the athletic training sessions is covered in depth in Section 3. Section 4 discusses the experiments and findings. In the conclusion, which is provided in Section 5, our work is summed up and the next directions are described.

Original Research Article

Section Snippets:

Sports Training:

Sports training is defined as a procedure based on pedagogical and scientific concepts that uses organized and structured training sessions to improve an athlete's performance and enable him or her to aim for the greatest accomplishments [13]. An athlete's improved form, higher physical ability, or, in the worst case scenario, overtraining are the ultimate results of the sports training process. Regarding the anticipated competitive

Bat algorithms and swarm intelligence:

Due to their time and space complexity, the most difficult optimization problems—also known as NP-hard problems [15]—cannot be precisely resolved. As a result, meta-heuristic algorithms have gained popularity as a rough solution to these issues. These algorithms typically draw inspiration from nature to function. There are two main categories of nature-inspired algorithms, i.e., evolutionary algorithms [16] and swarm intelligence [5]. The former imitates a Darwin's evolutionary theory

Experiments and results:

Our experiment's goal was to demonstrate that the sports training algorithm can provide training session plans that are on par with or better than those made by coaches. The studies were based on data collected over a period of more than four years during an amateur cyclist's actual training regimen. The sport watches were used to create over a thousand files during this time, which were then moved to the computer as XML activity files. Arranging the

Conclusion:

All facets of human life are incorporated into contemporary technology. This was unavoidable in the athletic domain as well. These days, it is impossible to envision a sports training session without the use of

technology. Sport watches, for example, can measure the average heart rate an athlete achieves throughout a training session, how long it lasts, and even specific information about the athlete's position during the training. The average speed, the terrain's configuration, and the movement's precise route can be

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