



The potential of employing artificial intelligence and neural networks in the physical training of aikido practitioners

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Abstract

Objective of the study was to creation of a mobile application for Aikido practitioners, utilizing artificial intelligence technologies, and assessing its potential for physical training.

Methods and structure of the study. The academic and methodological literature on the application of artificial intelligence in Aikido, physical education, and sports is examined. A mobile application has been created using AI technology to tailor training programs to individual needs. A theoretical assessment of the potential efficacy of the developed application is conducted.

Results and conclusions. The innovative mobile application has proven its ability to tailor training programs based on data analysis and user self-evaluation. Theoretical analysis has revealed that an application with artificial intelligence can adjust training loads, minimizing the risk of overtraining. The current version of the app has some drawbacks, such as a limited number of exercises. The next stage of development will involve adding automatic exercise counting using computer vision.

Keywords: *physical training, artificial intelligence, mobile application, personalization of training, aikido, GTO standards.*

Introduction. Physical training plays an important role in aikido and is one of the components of effective performance of technical techniques [3]. In this study, aikido is considered as a system of general physical training, including endurance, flexibility, coordination of movements, speed and strength. According to the order of the Ministry of Sports of the Russian Federation dated November 16, 2022 No. 993 "On approval of the federal standard of sports training in the sport of aikido"¹, physical training of aikido practitioners includes both general and special. The standard establishes indicators of physical fitness of practitioners, the level of development of which can also be assessed using the GTO standards.

For the effective organization of aikido classes, it is

necessary to take into account the individual characteristics of the practitioners. At the same time, modern technologies can significantly optimize the process of physical training. The use of artificial intelligence (AI) in mobile applications allows you to create personalized training programs that take into account the individual capabilities of the user [4]. The integration of these technologies into the aikido training process can significantly increase the effectiveness of physical training [1, 2].

The relevance of the study is due to the need for effective tools for independent training, the need to take into account the individual characteristics of the practitioners and an objective assessment of progress based on specific data.

Objective of the study was to creation of a mobile application for Aikido practitioners, utilizing artificial intelligence technologies, and assessing its potential for physical training.

¹Prikaz Ministerstva sporta RF ot 16 noyabrya 2022 g. № 993 «Ob utverzhdenii federalnogo standarta sportivnoy podgotovki po vidu sporta «aykido».



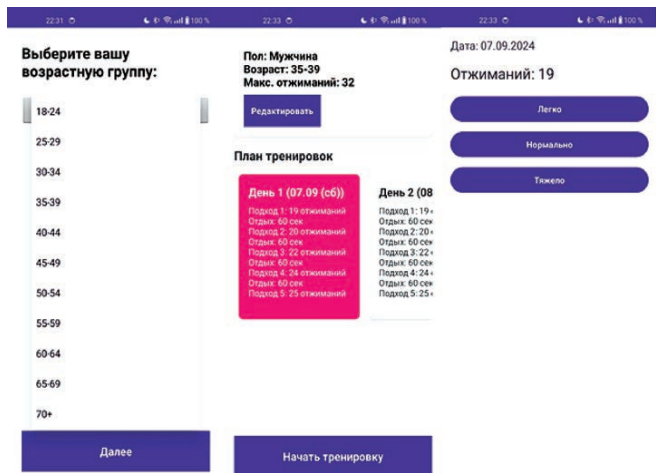
Methods and structure of the study. The following methods were used: analysis of scientific and methodological literature on aikido, physical education and the use of AI in sports; analysis of existing mobile applications using neural network technologies for physical training; development of a mobile application based on AI for aikido. To solve the problem, we have developed a mobile application that allows testing the capabilities of AI in the physical training of aikido practitioners. The current version of the mobile application includes training in only one exercise – «bending and unbending the arms in a prone position». This approach allows us to focus on debugging the algorithms of artificial intelligence and the user interface. This is necessary to create a reliable software platform for further development. The exercise «bending and unbending the arms in a prone position» was chosen for several reasons. Firstly, this exercise is included in both the Federal Standard for Aikido and the GTO complex, which makes it possible to use standardized evaluation criteria. Secondly, this is a basic exercise for developing strength and strength endurance of the upper body, which is important for performing technical techniques in aikido. In the future, the exercise base will be expanded to cover all aspects of physical training in Aikido and will include exercises aimed at developing speed, flexibility and coordination of movements.

The user interface of the application consists of three main screens (Fig. 1):

- Start screen: collects initial information about the user;
- Main screen: displays the current training plan;
- Workout screen: displays the current exercise and the number of repetitions. And also collects feedback after completing the approach.

The application's operation algorithm:

- when the application is first launched, the user is asked to enter initial data about themselves (age, gender, level of physical fitness);
- based on the entered data, a training plan is created taking into account the GTO standards;
- the user is shown the training plan on the main screen;
- in training mode, the user is shown the current task, after each approach, the user must assess the difficulty of the exercises;
- the AI system, if necessary, changes the training plan, depending on the number of exercises per-



Screens of a mobile application for physical training of aikido practitioners

formed, the user's progress and the difficulty ratings of the exercises performed by the user.

Results of the study and discussion. The developed application provides for the principle of gradual addition of functionality. At the current stage, the main focus was on the development of strength qualities. The main task is to integrate artificial intelligence technologies into the training process so that it is responsible for the personalization of training programs, analyzes user progress and adapts to loads.

This approach is in line with modern trends in sports technology. Research shows that the use of AI in fitness applications opens up wide opportunities for optimizing the training process and improving athletic performance [4, 5]. E.L. Tagirova and V.V. Tagirova argue that AI-based information systems will allow more accurate analysis of large volumes of data on athletes and their training [4]. This is especially relevant for our application, which collects large volumes of data on the user and then analyzes the data obtained.

H.A. Tokhoyan notes the potential of AI for personalizing training programs and predicting results [5]. Our application implements this idea by adjusting the training program taking into account individual indicators and the complexity of the exercises.

Analysis of the developed application shows a number of potential opportunities. The creation and adjustment of training programs is individual for each user, this will increase the efficiency of developing physical qualities compared to traditional training programs. Adaptive systems for timely changes in physical activity, based on user feedback, can reduce the risk of overtraining. The application gives users more freedom in choosing a place for training. And artificial



intelligence provides a more accurate and objective assessment of progress by analyzing large amounts of data and indicators that are inaccessible to traditional training methods. Despite these advantages, it is important to critically evaluate the developed application and determine directions for its further development. During the analysis, potential limitations of the developed application were identified. At the current stage, work is implemented with only one exercise and this does not allow developing all the physical qualities necessary in aikido. In addition, the use of AI in sports applications is associated with a number of challenges [7]. In the context of our application, this is the lack of visual control over the technique of performing exercises. It is also important to note that the adaptation of the training program largely depends on the accuracy of the user's self-assessment. To overcome these limitations, it is planned to use automatic repetition counting using computer vision technology. In the study of Yu.V. Churakova and A.V. Mikheeva confirmed the effectiveness of using neural networks for automatic control of physical exercises in mobile applications [6].

Conclusions. As the analysis of the functional capabilities of the developed application for physical training of those involved in aikido shows, it opens up new prospects for further individualization and personalization of training sessions, allows improving control and self-control over the exercises performed and can be considered as a comprehensive tool in the physical training of those involved in aikido. The created application has the ability to further improve its functionality, such as expanding the set of exercises for the development of almost all types of physical qualities: strength, speed, coordination of movements, endurance, necessary for aikido. In the future, it is envisaged to integrate such functionality into the application as computer vision, which will allow evaluating not only the quantitative aspects of the exercises performed, but also the technique.

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