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# Intelligent Skiing Posture Detection and Recognition Through Internet of Bodies

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## ABSTRACT

The training of skiing should start from the control of body posture ability to highlight the characteristics of the sports. Thus, the athletes can have the sports ability in the process of high-speed skiing. This paper establishes a system to automatically recognize the skiing posture which can help athletes grasp the skiing postures. First, the skiing images are collected by distributed camera. Second, the skeleton features are extracted to learn a classification model which is used to recognize and adjust skiing postures. Lastly, the analytical results of posture recognition are returned to athletes through internet of bodies. The framework can effectively recognize the skiing postures and provide athletes with training advice.

## KEYWORDS

Classification Model, Internet of Bodies, Posture Recognition, Skeleton Features

## 1. INTRODUCTION

The technique of skiing, especially alpine skiing, is very difficult, which requires athletes to have a high level of special ability to ensure the exertion of the technique. Special ability refers to various abilities which are suitable for the characteristics of the project and can improve the performance in this project. For skiing, the cultivation of special ability should not only enhance the overall physical quality (Ahmed et al. 2021) based on strength, but also improves the skill to control body posture. The ability to control ability body posture (Horak et al. 2002) is a special ability of skiers. The improvement of this ability has an important impact on the competition.

From the development process of skiing projects, we need to constantly explore new skills and strategies, then combine and improve them. With the progress of sports biomechanics and sports training (Ying & Huang 2021, Pellegrini et al. 2018), the method of sports technology analysis has been greatly improved. The research on posture training and correction (Han et al. 2017, Kashuba et al. 2019) is a hot topic in the scientific research of skiing. The distortion of body posture may lead to skiing failure and induce injury (Rentenberger et al. 2021, Yoshioka et al. 2018). When passing through various uneven areas, the speed of athletes who lose their balance due to large distortion of body posture will be significantly slower than the athletes who maintain a stable skiing posture. It is necessary to pay attention on reducing leaping movements and various leaping body movements during skiing. The key is to keep the balance of body.

In the skiing competition, body posture has a direct impact on competition results. Through the repeated the experimental results in training practice, it is proved that the distortion of posture is induced by the compound participation of posture reflex (Yoshioka et al. 2018, Alhammoud

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2020). For example, an adult athlete who wants to improve his sports performance will raise his hand unconsciously, close his eyes, and cause the excitement of anterior tibial muscle related to joint movement. Therefore, it can be said that the distortion of body posture is directly related to the participation of conditioned reflex. This change in body posture itself is the instinctive physiological mechanism to maintain the best movement. However, in the skiing competition, even if it becomes a physiological mechanism to restore balance, unconscious actions will also cause distortion in posture and affect competition results. This contradiction is mainly solved in training through two methods. One is to train athletes to get used to the conditions of physical changes. The other is to improve the ability to predict physical changes which can be improve with the help of automatic posture recognition and correction system.

Kinect somatosensory device developed by Microsoft can easily collect human joint point data, scene depth information and color images (Li & Xiao 2018, Wang et al. 2019). It has attracted the attention of many researchers due to its excellent performance. The Kinect has been used in many applications, such as robot navigation (Li & Wang 2020), target tracking (Pang & Liang 2019), object recognition (Yang et al. 2021), and 3D modeling (Cai 2019).

Recently, using Kinect to study human behavior and posture recognition has become a hot spot in the field of behavior recognition (Ma & Guo 2019, Li 2020). In this paper, the Kinect is used to collect joint point data of skiing players. The joint point data is used to analyze the posture of skiing players. According to the characteristics of human structure, human structure vector is constructed by using joint point data as human model in three-dimensional space. The posture features are extracted by calculating the vector angle and vector modulus ratio between human structure vectors. Then, the features of skiing player posture is matched and corrected by the dynamic time warping (DTW) algorithm (Permanasari et al. 2019, Yadav & Alam 2018).

## 2. SKIING PLAYER JOINT POINTS FROM KINECT SENSOR AND FEATURE REPRESETATION

When an observer stands toward Kinect camera, the positive direction of X-axis points to the right of the observer, the positive direction of Y-axis points to the observer's head, the positive direction of Z-axis is consistent with the observation direction of Kinect camera, and the Z-axis represents depth information. The Kinect camera can collect 15 joint points to represent different parts of the human body. The distribution of each joint point is shown in Figure 1.

**Figure 1. The architecture of document type recognition framework**