桌球競賽標記系統開發暨建置智慧桌球館

The development of table tennis competition labeling system and construction of intelligent table tennis stadium

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Information collection and analysis plays a crucial role in sports competition. Both the coach and athlete rely on the analyzed statistic or visualization charts to better understand the rivals' habits and the limitations of the athletes themselves. Many sports organizations have employed advanced information systems to assist the athlete's training [1]. However, in Taiwan, we still rely on human laborers to watch the video and record the data in Excel via typing. In light of this, we propose an intelligent sports information system, which is highly customizable, supports cloud storage and management, offers a user-friendly annotation interface, and leverages advanced AI technologies to analyze the players' actions, gestures, and postures. These manual and computer labels are then integrated automatically via the system to generate visual charts for later efficient training processes.
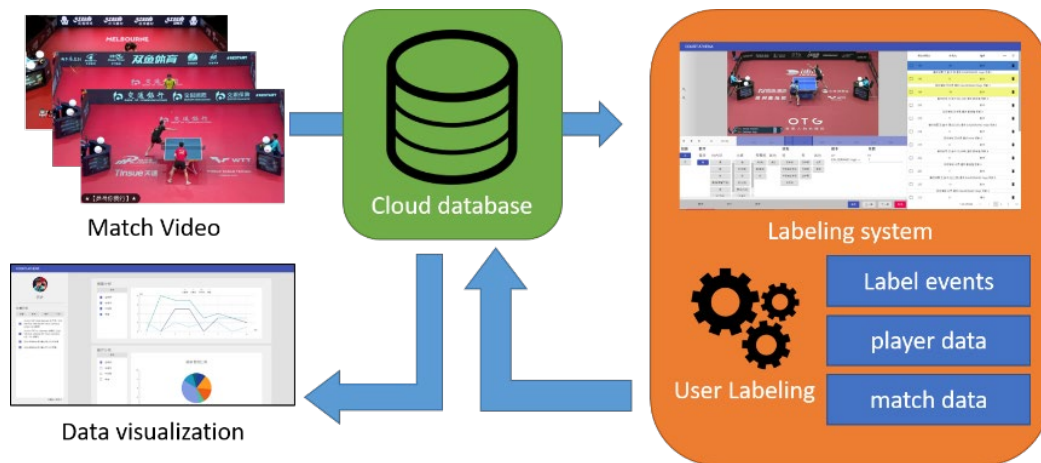

Figure 1: System overview.

Figure 1 illustrates the proposed system architecture, which contains several components as follows:

1. **Player and match database**
   We provide an interface to upload the player's profile, match videos, and match

information such as the player list of two teams, competition group, score in each set, etc. All these data are stored in a cloud database.

2. **Customized labeling system**

   We conducted user studies with several experts (coaches and elite athletes) across different sports fields and designed a web-based labeling system with an intuitive and friendly user interface, as shown in Figure 2 (Left). Our system abstracts and formats the event with different label types, including single-select, multi-select, court position, number, and player to support customizable events for different sports. The user can then tag the event along a timeline.

3. **Data visualization**

   The article on sports data visualization [2] observed that most traditional graphs only show one player's data. However, players may change their strategy when they face different opponents. To visualize the difference, we visualize the data between the target player and their opponents (see Figure 2, Right).

Figure 2: (Left) Labeling system: Down left part is the label block. According to the need of the different groups, the block will show customed label events and corresponding labels. (Right) Data visualization page: We use experts' needs to design the visual charts. When the user selects the target player and the matches they want to observe, the system automatically arranges information to form the charts.

We demonstrate the effectiveness of our system via conducting a user study with 30 participants and labeling over 150 match videos. All participants gave positive feedbacks, saying that our system is intuitive, and the user interface can not only shorten the label time but also increase the connection between the event and video screen.

References

[1] Internal And External Analysis In Sports,
https://www.ipl.org/essay/Sports-Strategy-Analysis-FCZ5VBQSQG
[2] Charles Perin and Romain Vuillemot and Charles D. Stolper and John T. Stasko and Jo Wood and M. Sheelagh T. Carpendale, 2018, State of the Art of Sports Data Visualization, Computer Graphics Forum