

Research and Application of Real-time Human Posture Recognition Technology Based on TensorFlow.js and CNN Model

Xiya Yu¹, Yao Tan^{1*}, Shuxian Gao¹, Yuhan Zhang¹, Haiying Fang¹

¹Tongda College of Nanjing University of Posts and Telecommunications, Yangzhou, Jiangsu, China

*Corresponding Author: Yao Tan, E-mail: yuxy@njupt.edu.cn, Yangzhou City, 225100.

Background

With the rapid development of technology, traditional human pose recognition systems often face issues such as high costs and poor real-time performance. To address these problems, this paper introduces a low-cost, high-performance **browser-based** online solution developed using **TensorFlow.js** and **Vue.js**. This system leverages the **PoseNet model** and **WebGL** technology to perform accurate real-time human pose recognition directly in the web browser, reducing dependency on servers and specialized hardware. This approach not only ensures high recognition accuracy but also enhances user accessibility and efficiency.

Research Methods

MVVM Design Pattern

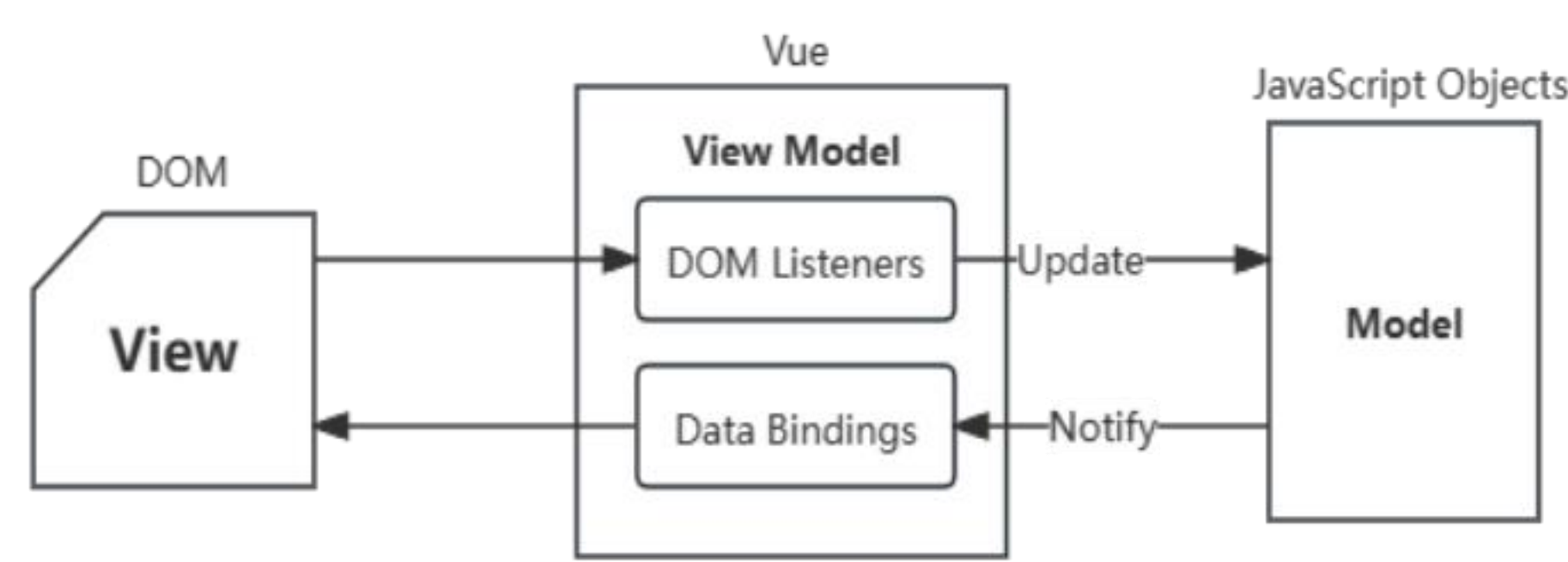


Figure 1 Vue pages using the MVVM design offer dynamic interfaces, efficient performance with virtual DOM, and modular code for better reuse and maintainability. Two-way data binding simplifies synchronization between view and model, while clear separation of view and business logic enhances code clarity and management.

System Process Design

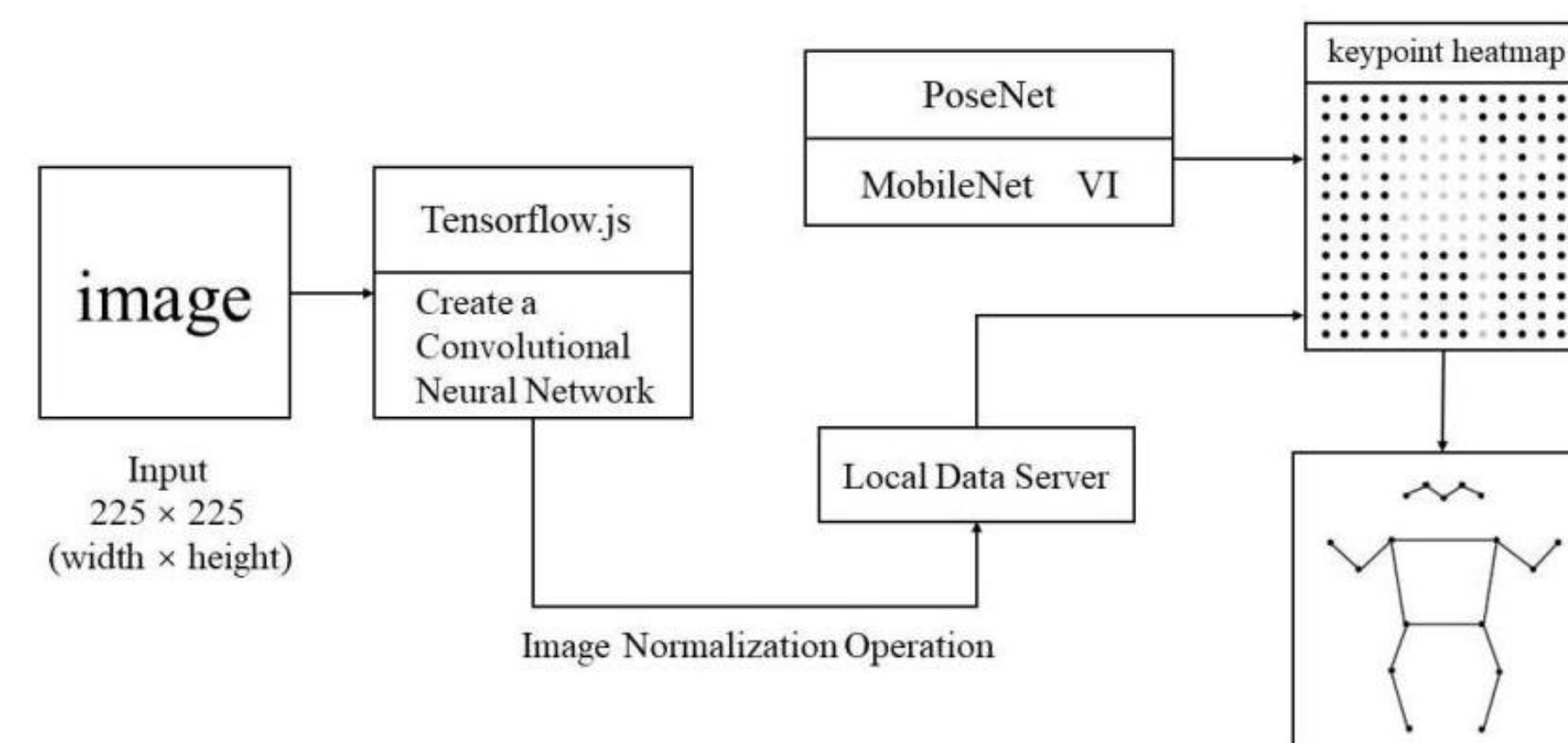


Figure 2 With the help of user-owned camera hardware devices such as smartphones and laptops, the user's overall body state will be automatically identified from real-time and recorded videos. The operation flow of the system is shown in Figure 2

Data Recognition and Analysis

$$f_{ij} = \sum_m \sum_n I_i + m, j + n \cdot K_{mn}$$

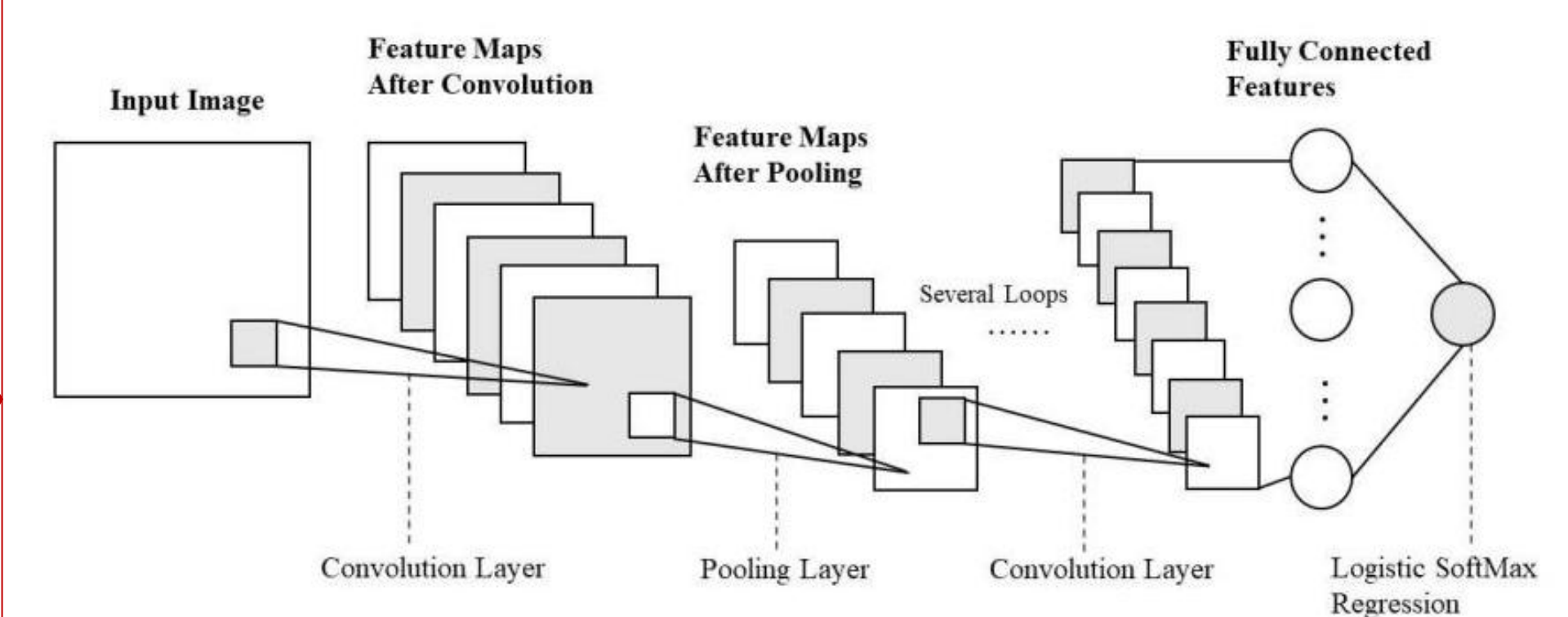
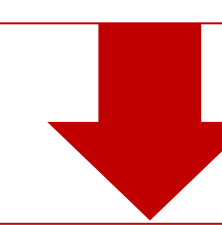


Figure 3 Using convolutional neural networks and the Adam optimization algorithm to improve learning performance, achieve human key point and pose recognition. Sliding convolutional kernels capture local features, enhance image spatial understanding, and improve spatial recognition capabilities.



Performance Optimization

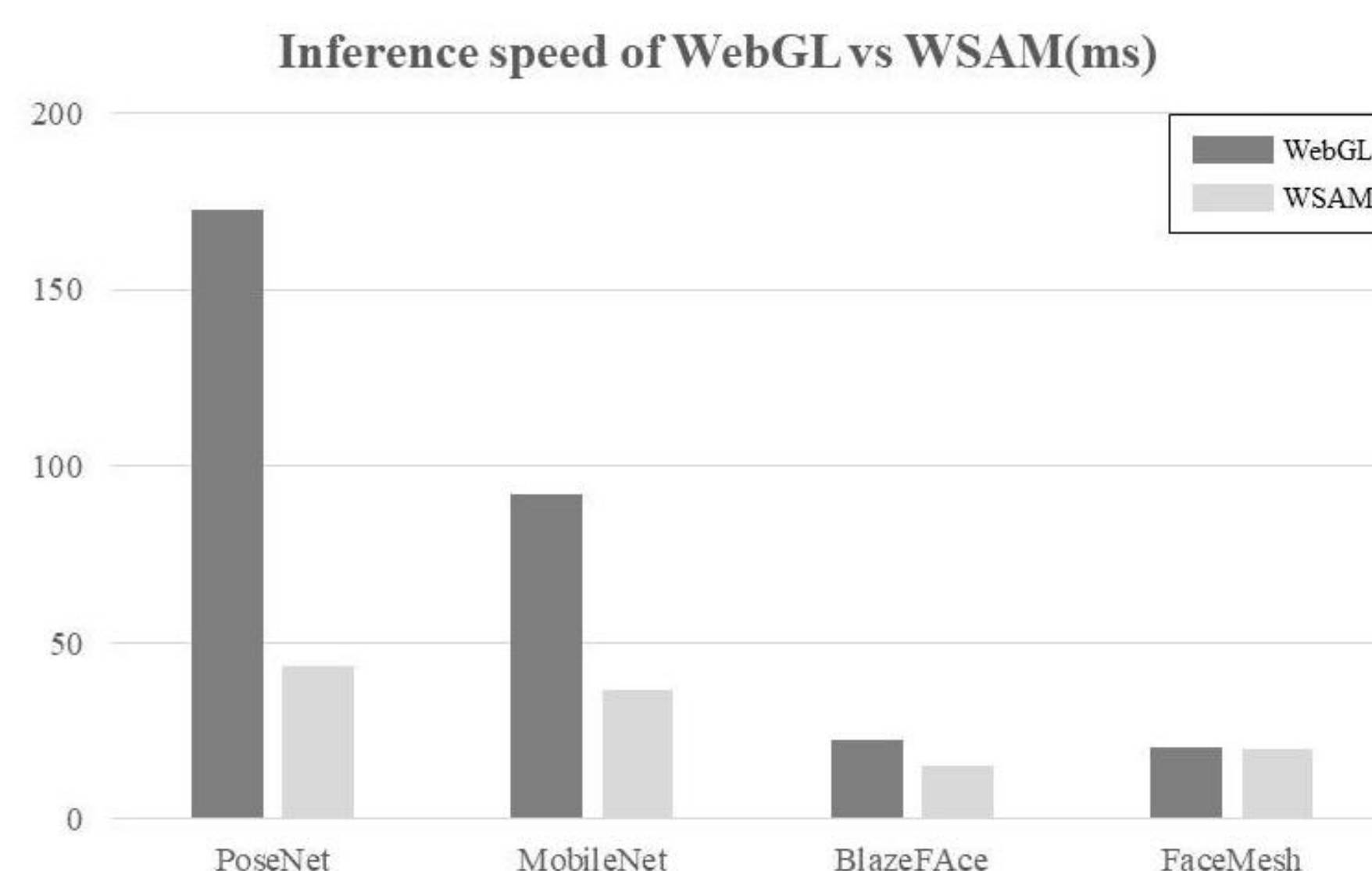


Figure 5 By utilizing WebGL as the backend and invoking the GPU for parallel computing, the system can execute hundreds of computational tasks simultaneously, distributing these tasks to the GPU. This enables smoother human pose recognition.

Image Output

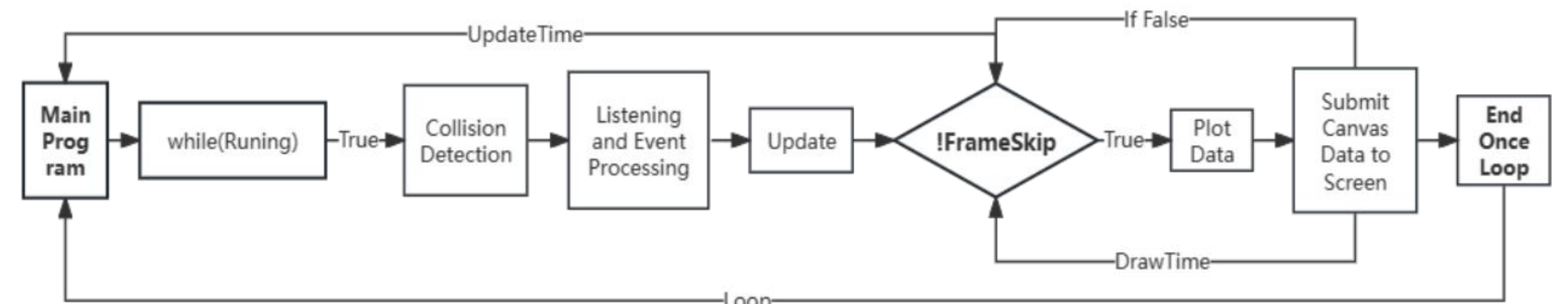
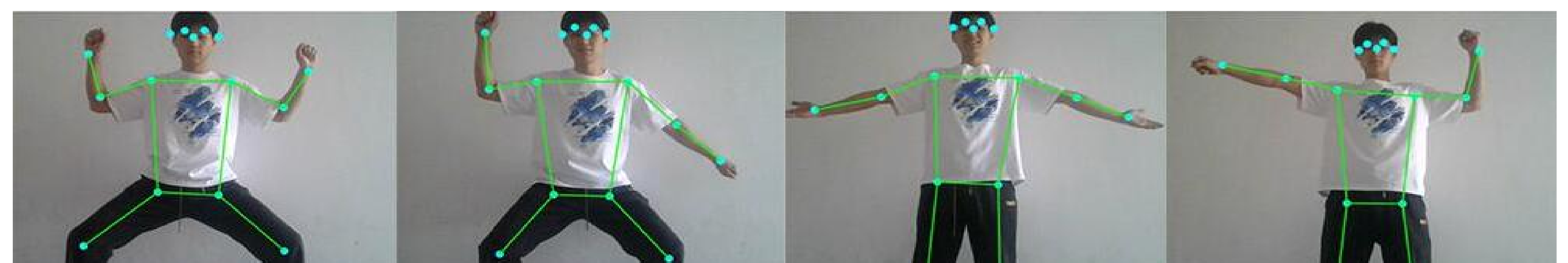


Figure 4 The system first converts the data processed by TensorFlow.js into graphical information, and then uses the Canvas API to dynamically render this data on the front-end page. Additionally, a generalized canvas protocol has been introduced, proposing a formal model to enhance the security and availability of WSN protocols.

Conclusions

The research and implementation of a real-time online human posture recognition system based on TensorFlow.js and browser technology demonstrate the integration of artificial intelligence and front-end technology. With the rapid proliferation of the internet and mobile devices, the performance of browsers and mobile terminals is continuously being optimized. Currently, browser-based real-time online systems offer cross-platform and convenience advantages, providing users with more personalized and intelligent services. In the future, with the increasing demand from users and the continuous improvement in browser performance, these systems will become indispensable intelligent assistants in daily life, driving societal development and progress. Moreover, with the ongoing development and optimization of machine learning technology, the accuracy and real-time performance of the system's recognition capabilities will improve. By continuously optimizing algorithms and enhancing model performance, the system is expected to achieve widespread adoption and application in more fields.

Acknowledgment

Fund Project: Jiangsu Provincial Undergraduate Innovation and Entrepreneurship Training Program

Project Name: Design and Implementation of a Human Pose Recognition System Based on TensorFlow.js

Project No.: 202313989040Y

Establishment Time: 2023.5