A Review of Research on AI Empowering Precise Profiling and Intervention System Construction for College Students' Physical Health

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ABSTRACT Declining physical health among college students and the inefficiency of traditional intervention models require a systematic health-management framework supported by artificial intelligence and multimodal sensing. This review summarizes the technical progress of AI-enabled physical-health profiling and intervention for college students across the full chain of data acquisition, accurate profiling, intelligent diagnosis, personalized intervention, effect evaluation, and iterative optimization. Key technologies are analyzed, including wearable sensing, multimodal data fusion, machine-learning-based health-risk prediction, exercise-prescription generation, intervention-process monitoring, and dynamic feedback control. Existing studies show that AI-supported systems can expand data dimensions, improve risk-warning timeliness, support personalized intervention plans, and strengthen continuous monitoring. However, important bottlenecks remain in data standardization, algorithm generalization, cross-platform compatibility, ethical governance, and long-term campus deployment. Based on these limitations, the study proposes an integrated AI+physical-health framework consisting of a perception layer, data layer, algorithm layer, application layer, and optimization layer. The framework provides a theoretical basis for IoT-enabled physiological monitoring, sensor-network-based health management, and intelligent intervention systems in university environments.

INDEX TERMS artificial intelligence, wearable sensing, physiological signal processing, health profiling, iot sensor networks

I. INTRODUCTION

A. RESEARCH BACKGROUND

AS the core force of national talent reserve and social development, the physical health level of college students is directly related to the future of the nation and its competitiveness. Since 2000, the physical fitness and health status of Chinese college students has shown a continuous decline, and multiple authoritative research data reveal a severe situation. Based on the data from five national student physical fitness surveys from 2000 to 2019 (a sample of more than 240000 college students), the team led by Song Yi from Peking University found that the median comprehensive index of college students' physical fitness decreased from -0.16 to -1.99, and the decline rate of male students was significantly faster than that of female students; The endurance running performance of boys in the 1000 meters and girls in the 800 meters continues to deteriorate, with a median increase of 29 seconds and 21 seconds in time, respectively; The overweight and obesity rate has increased from 3.7% to 14.0%, the high blood pressure rate has increased from 2.2% to 5.2%, and the comorbidity rate has increased fivefold. According to physical examination data from multiple universities across the country, over 60% of college students have abnormal sub-health, while the prevalence of visual impairment has reached over 84%. Problems such as abnormal liver function, anemia, and high cholesterol are generally prevalent, reflecting the significant physiological vulnerability of the contemporary student population, which necessitates a systematic re-evaluation of university health governance[1-3].

B. RESEARCH CONTENT AND FRAMEWORK

1) Core Research Content

1. Systematically sort out the core technology system of AI empowering college students' physical health, covering five core modules: multimodal data collection, accurate portrait modeling, intelligent risk warning, personalized intervention generation, and dynamic effect evaluation;

2. Summarize the research progress at home and abroad, extract key technological achievements, application models,

and practical effects, and analyze the core bottlenecks and practical difficulties in current research;

3. Propose a conceptual full process system framework for AI empowerment of college students' physical health, including precise profiling, intelligent intervention, and closed-loop optimization. Clarify the technical architecture, functional modules, operational mechanisms, and implementation paths; While this framework is currently a theoretical synthesis intended to address identified research gaps, it serves as a strategic model for future empirical validation and pilot implementation.

4. Looking ahead to future research trends, propose key directions such as interdisciplinary integration, technological iteration, system implementation, and ethical governance to provide guidance for subsequent research and practice[4].

2) Research Methods

1. Literature research method: Retrieve core literature from databases such as CNKI, Web of Science, EI, Scopus, etc. from 2018 to 2026, systematically sort out the research context, technological progress, and system construction achievements;

2. Comparative analysis method: Compare the differences in domestic and foreign research, the advantages and disadvantages of traditional and AI models, the characteristics of different technological paths, and extract core advantages and existing problems;

3. Systematic induction method: Integrate existing research results, summarize core technologies, application models, bottleneck problems, and construct an integrated research framework and system model;

4. Logical deduction method: Based on technological development trends and practical needs, deduce future research directions and breakthrough paths, and propose targeted optimization strategies.

II. THE CORE TECHNOLOGY SYSTEM OF AI EMPOWERING COLLEGE STUDENTS' PHYSICAL HEALTH

AI empowers precise profiling and intervention of college students' physical health, relying on a four layer technical architecture of "data algorithm model application", covering the entire process of data collection, cleaning, analysis, profiling, warning, intervention, evaluation, and optimization. The core technical system includes five modules[5].

A. MULTIMODAL GLOBAL DATA ACQUISITION AND PERCEPTION TECHNOLOGY

Multimodal data is the foundation of accurate profiling, breaking through the limitations of traditional single static physical measurements and achieving comprehensive, dynamic, and seamless collection of physical health data for college students.

Behavior and life data collection: relying on campus apps, mini programs, and one card systems, collect behavior data such as diet, daily routine, exercise, learning, and social interaction; Record the types of food and calorie intake through intelligent canteens and nutrition plates; Collect sleep patterns through sleep monitoring and analysis of mobile phone usage.

Health records and medical data: Integrate medical and health data such as enrollment physical examinations, school hospital visits, mental health assessments, past medical history, and sports injury history to form a complete health record[6].

Multi source data fusion technology: using data alignment, normalization, and feature extraction techniques, integrating structured (physical testing, physiology) and unstructured (text, image) data to construct a unified standard dataset of college students' physical fitness and health. Implementing a unified metadata dictionary prior to sharing to ensure syntactic and semantic consistency. Using blockchain technology to achieve encrypted storage and verifiable traceability of standardized datasets, ensuring that data shared across nodes remains interoperable.

B. ACCURATE PROFILING AND FEATURE MODELING TECHNOLOGY FOR PHYSICAL HEALTH

Based on multi-source data, an AI algorithm is used to construct accurate physical and health portraits of college students, achieving precise characterization of physical characteristics, health levels, risk status, and weak links[7].

Health risk warning model: Based on algorithms such as LSTM, XGBoost, Transformer, etc., construct risk prediction models for obesity, hypertension, hyperlipidemia, sports injuries, psychological anxiety, etc. By inputting historical data and real-time indicators, preliminary research models can predict the probability of health risks in the next 1-3 months. While reported accuracy rates in controlled studies range from 85% to 92%, these results are often contingent on high-quality datasets and may fluctuate significantly when applied to broader, more diverse student populations due to challenges in small-sample generalization. To account for acute environmental shocks like academic stress or dietary fluctuations, the system incorporates a 'dynamic weighting' layer that increases the influence of short-term behavioral data during exam periods, thereby mitigating the accuracy degradation caused by life-cycle volatility.

Dynamic portrait iteration technology: Real time access to new data, dynamically updating portrait models through online learning algorithms, achieving real-time tracking and dynamic adjustment of physical health status, ensuring portrait accuracy and timeliness[8].

C. INTELLIGENT DIAGNOSIS AND ROOT CAUSE ANALYSIS TECHNOLOGY

Based on accurate profiling, AI systems automatically diagnose physical health problems, analyze root causes, and locate weak links, providing scientific basis for intervention.

Individual difference analysis: Analyze the health differences among students of different genders, grades, majors, and physical foundations to provide support for stratified and classified interventions[9].

D. INTELLIGENT GENERATION TECHNOLOGY FOR PERSONALIZED INTERVENTION PLANS

Based on the diagnostic results, the AI system generates a four-dimensional personalized intervention plan of “exercise nutrition sleep psychology”, achieving “one person, one prescription, precise adaptation” as shown in Table 1[10].

TABLE 1. Comparison Between Traditional and AI-enabled College Students' Physical Health Management

Management Dimension	Traditional Mode	AI-enabled Precision Mode	Improvement Rate
Data Collection	Single static physical test data; manual entry; low efficiency	Multi-modal dynamic data (physical, physiological, behavioral); automatic collection; 24h monitoring	+80% efficiency; Significant expansion of data dimensions (transitioning from single-source physical test scores to multi-modal behavioral and physiological streams)
Health Assessment	Empirical judgment; unified standard; one-size-fits-all	AI precision profiling; multi-dimensional quantitative evaluation; individual classification	+90% accuracy; personalized classification
Risk Warning	Post-discovery; passive response; low timeliness	Real-time prediction; early warning (1-3 months in advance); active intervention	+85% warning accuracy; 3-6 months ahead
Intervention Program	Unified prescription; rough guidance; poor pertinence	Personalized “one person one plan”; sports + nutrition + psychology integration	+70% pertinence; +40% compliance
Process Management	Manual supervision; irregular tracking; poor continuity	Intelligent real-time monitoring; dynamic feedback; whole-process control	+60% management efficiency; full coverage
Effect Evaluation	Single index; post-test only; subjective statistics	Multi-dimensional quantitative evaluation; before-after comparison; iterative optimization	+50% evaluation comprehensiveness
Long-term Effect	Poor sustainability; high rebound rate; short validity	Closed-loop optimization; long-term tracking; continuous improvement	+60% sustainability; -50% rebound rate

E. DYNAMIC INTERVENTION CONTROL AND EFFECT EVALUATION TECHNOLOGY

Realize full process tracking, real-time feedback, quantified effects, iterative optimization of the intervention process, and form a closed-loop management system.

Real time monitoring of intervention process: Wearable devices and apps track exercise execution, dietary compliance, and daily routines in real-time, automatically recording completion rate, compliance rate, and execution deviation[11-13].

Intelligent feedback and real-time guidance: Real time feedback on heart rate, intensity, and movement norms during exercise, with voice reminders in case of abnormalities; Generate a daily report after training, analyze the execution status, progress, and shortcomings.

Quantitative evaluation of effectiveness: Construct an intervention effectiveness evaluation index system (physical fitness improvement, index improvement, compliance, health behavior changes), and quantify the intervention effectiveness through before and after comparison and statistical analysis.

Dynamic iterative optimization of the plan: Based on the execution effect and physical changes, the intervention plan is automatically adjusted through reinforcement learning algorithms to strengthen effective measures and correct ineffective content, achieving continuous optimization, as shown in Table 2 below.

TABLE 2. Core AI Technologies and Applications in College Students' Physical Health

Technology Category	Specific Algorithms/Methods	Application Scenarios	Accuracy/Efficiency
Data Fusion	Blockchain, data alignment, normalization	Multi-source data integration, secure storage	+95% data consistency; tamper-proof
Health Profiling	K-means, Random Forest, CNN, LSTM	Physical classification, health scoring, weakness identification	85%-92% classification accuracy
Risk Prediction	XGBoost, Transformer, LSTM	Obesity, hypertension, sports injury risk warning	85%-90% prediction accuracy
Intervention Generation	Generative AI, Reinforcement Learning, CBR	Personalized exercise/nutrition/psychology prescription	+78% compliance; 10s generation speed
Action Recognition	3D vision, pose estimation, deep learning	Movement standard detection, posture assessment	90%-95% recognition accuracy
Dynamic Optimization	Online learning, adaptive algorithm	Real-time profile update, program iteration	+30% optimization efficiency

III. RESEARCH PROGRESS ON AI EMPOWERING PRECISE PROFILING AND INTERVENTION OF COLLEGE STUDENTS' PHYSICAL HEALTH

A. RESEARCH PROGRESS ON DATA COLLECTION AND PERCEPTION SYSTEM

Domestic research has established a three in one data collection system of “terminal+wearable+platform”. At the hardware level, we are developing AI intelligent body measurement all-in-one machines, 3D body posture assessment devices, smart wristbands, and other equipment to achieve comprehensive collection of static body measurements, dynamic physiology, and body posture. The intelligent body testing system developed by Beijing Sport University integrates more than 20 detection functions, supporting unmanned testing and automatic data uploading; Donghua University has developed a 3D posture recognition device that accurately detects posture issues such as head retraction, high and low shoulders, scoliosis, and pelvic tilt, with an accuracy rate of 93%[14].

At the level of data fusion, form a data architecture of “campus intranet+cloud platform”. Universities represented by Shanghai University of Finance and Economics and Peking University integrate physical testing systems, wearable devices, campus apps, and medical record data to build standardized health databases and achieve data exchange and sharing. However, there are problems in the research, such as inconsistent data standards, insufficient depth of multi-source data fusion, low coverage of dynamic data collection, and weak

privacy protection. Different university devices and platforms cannot communicate with each other, forming data islands.

B. RESEARCH PROGRESS ON ACCURATE PORTRAIT AND EVALUATION MODELS

The research on portrait models is transitioning from a single dimension to multiple dimensions, from static to dynamic, and from experience to intelligence. Early research focused on evaluating single indicators such as BMI and body fat percentage; Constructing a two-dimensional model of "physical fitness+physiological function" in the mid-term; Currently forming a comprehensive evaluation model of "five dimensions in one"[15,16].

However, many existing models still face limitations regarding generalization across small or imbalanced samples. As a result, while high accuracy is achievable in specific pilot studies, maintaining such performance across the diverse physiological profiles of the general Chinese college student population remains a significant technical hurdle. There are few exclusive algorithm models for Chinese college students, and many foreign models are transplanted, which limits the accuracy.

C. RESEARCH PROGRESS ON INTELLIGENT INTERVENTION SYSTEM AND APPLICATION

Intervention research has evolved from "standardization" to "personalization", from "single movement" to "multidimensional integration", and from "phased" to "full cycle".

However, intervention research has problems such as homogenization of plans, poor implementation, insufficient compliance control, and lack of long-term effect verification. Most of them are short-term experiments, lacking long-term tracking for more than one year, and there are relatively few large-scale campus application cases[17].

D. PROGRESS IN PLATFORM SYSTEM DEVELOPMENT AND PILOT PRACTICE

Domestic universities and enterprises have developed multiple AI based physical health management platforms, forming a system architecture of "cloud management+mobile applications+intelligent terminals".

Representative platforms include: "Smart Sports" platform (Shanghai University of Finance and Economics), "Healthy Campus" system (Peking University), "AI Sports Manager" (Beijing Haoyan Health), and "Campus Health Cloud" (Donghua University). The platform covers functions such as data collection, portrait evaluation, prescription generation, process control, effect analysis, teacher management, and home school communication, and supports PC and mobile operations. The pilot results show that AI platforms can improve teacher management efficiency by 50%, achieve 100% coverage of student intervention, and increase physical fitness compliance rates by 8-12 percentage points.

However, the platform has problems such as poor compatibility, incomplete functions, poor user experience, high operation and maintenance costs, and insufficient adaptation of teacher technology, making it difficult for grassroots universities to fully promote it.

IV. THE CORE BOTTLENECKS AND PRACTICAL DIFFICULTIES IN CURRENT RESEARCH

A. TECHNICAL BOTTLENECKS

1. Data quality and standardization issues: Multiple sources of data have inconsistent formats and standards, resulting in missing values, outliers, and noisy data; The coverage rate of dynamic data collection remains uneven across institutions. While top-tier universities have begun integrating IoT solutions, a significant portion of higher education institutions still lack the infrastructure to popularize wearable devices for daily health monitoring, primarily due to high equipment costs and data integration difficulties; The phenomenon of data silos is severe, and data cannot be exchanged between schools and departments.

2. Insufficient accuracy and adaptability of algorithms: Existing models are mostly based on small sample training, with weak generalization ability; There are few exclusive algorithms targeting the physical characteristics of Chinese college students, and the accuracy of prediction and classification is relatively low (80%-85%); The algorithm has poor robustness and insufficient dynamic intervention optimization ability in complex scenarios.

3. Insufficient depth of technological integration: AI has shallow integration with sports science, medicine, and nutrition, and intervention plans lack scientific and professional rigor; VR, AR, The application of new technologies such as digital twins lags behind, and there is a lack of immersive intervention scenarios.

4. High hardware equipment costs: High end intelligent testing terminals and wearable devices have high unit prices, and grassroots universities have limited funds, making it difficult to fully configure them; The development of lightweight and low-cost equipment lags behind, which hinders the large-scale implementation.

B. DIFFICULTIES IN SYSTEM CONSTRUCTION

1. Fragmentation of the entire chain system: monitoring, profiling, intervention, evaluation, and optimization links are disconnected and have not formed a closed loop; Lack of a collaborative mechanism between school, family, and society makes it difficult to extend intervention to after-school and family settings[18].

2. Lack of hierarchical and classified intervention: differentiated plans have not been designed for students of different grades, physical fitness, majors, and health conditions, and there is still a "one size fits all" phenomenon; There is insufficient precise intervention for key groups such as those with weak physical constitution, obesity, and sub-health.

3. Lack of long-term operation mechanism: Lack of sustainable operation mode, mostly project-based pilot, difficult to normalize after completion; Not included in the daily management and assessment of universities, with insufficient institutional guarantees.

C. OBSTACLES TO PRACTICAL IMPLEMENTATION

1. High resistance to campus promotion: Some universities do not attach enough importance to it and have not included it in the focus of sports reform; Teachers lack technical skills and insufficient operational and application abilities; Students have privacy concerns and low acceptance.

2. Difficulty in controlling intervention compliance: College students have strong autonomy, and it is difficult to supervise the implementation of after-school interventions;

Lack of effective incentive and constraint mechanisms, with intervention completion rates of only 50%-60%.

3. The effectiveness evaluation system is incomplete: the evaluation indicators are single, focusing on physical fitness indicators, neglecting health behaviors, psychological states, and long-term benefits; Lack of unified evaluation criteria and insufficient scientificity in effectiveness verification.

D. ETHICAL AND SAFETY HAZARDS

1. Data privacy and security risks: Physical, physiological, and behavioral data involve personal privacy, and there is a risk of leakage during storage and transmission; The data authorization, usage, and sharing mechanisms are not sound, and compliance is insufficient[19].

2. Algorithm fairness and bias issues: Training data bias may lead to algorithm discrimination, resulting in unfair evaluation and intervention of specific groups (such as physically weak students).

3. Lack of ethical norms in health: The boundaries of AI intervention are unclear, and excessive reliance on technology may overlook individual differences; The commercial application of health data lacks ethical constraints, as shown in Table 3 below.

TABLE 3. Current Bottlenecks and Breakthrough Directions of AI-enabled Physical Health Research

Research Dimension	Core Bottlenecks	Future Breakthrough Directions
Technology Level	Non-standard data; low algorithm accuracy; high hardware cost	Localized large models; lightweight low-cost tech; multi-tech fusion
System Level	Fragmented modules; weak synergy; short-term mechanism	Whole-chain closed-loop system; multi-stakeholder collaboration; long-term mechanism
Practice Level	Poor campus promotion; low intervention compliance; difficult landing	Game-based design; incentive mechanism; scalable promotion path
Ethical Level	Privacy risks; algorithm bias; lack of norms	Privacy protection system; ethical review; standardized governance

E. RESEARCH GAPS AND SYNTHESIS

Based on the systematic review in Sections 3 and 4, three critical research gaps are identified: (1) Fragmented technical chains where data collection, profiling, and intervention are disconnected; (2) Lack of localized, high-precision algorithms specifically for Chinese college students; and (3) Absence of long-term, closed-loop operation mechanisms in campus settings. To address these gaps, this paper proposes an integrated AI-enabled precision profiling and intervention system framework in Section 5. Unlike the independent platforms discussed in Section 3.4, the proposed framework emphasizes the seamless integration of multi-modal data with dynamic reinforcement learning to achieve a continuous, self-optimizing health management loop.

V. AI EMPOWERS COLLEGE STUDENTS WITH PRECISE PHYSICAL HEALTH PROFILING AND INTERVENTION SYSTEM CONSTRUCTION

A. PRINCIPLES OF SYSTEM CONSTRUCTION

1. Principle of scientificity: Following the theories of sports science, medicine, and nutrition, the application of technology conforms to the physiological laws of the human body and the logic of promoting health[20].

2. Precision principle: With individual data as the core, achieve one person, one portrait, one prescription, precise matching, and precise intervention.

3. Full cycle principle: covering the entire process of "collection profiling diagnosis intervention evaluation optimization", running through the entire four-year university cycle.

4. Principle of Collaboration: Integrate the forces of schools, families, society, and students to build a diverse collaborative governance system.

5. Security principle: Ensure data privacy, algorithm security, intervention security, and adhere to the bottom line of health ethics.

6. Principle of practicality: Adapt to the actual situation of universities, reduce costs, simplify operations, facilitate promotion, and adapt to normalized applications.

B. OVERALL SYSTEM FRAMEWORK

This paper proposes a conceptual system framework for an AI-powered accurate portrait and intervention system for college students' physical health. The proposed architecture is designed as a theoretical blueprint to resolve the fragmentation issues identified in current literature. It consists of one platform, five modules, three synergies, and a fully closed-loop system.

One platform: AI based intelligent management cloud platform for college students' physical fitness and health (core hub)

Five modules: multimodal data acquisition module, accurate profiling and evaluation module, intelligent diagnosis and warning module, personalized intervention module, dynamic evaluation and optimization module

Three synergies: school management synergy, teacher-student interaction synergy, and home school community linkage synergy

Full loop: data-driven - precise profiling - intelligent intervention - process control - effect evaluation - iterative optimization, as shown in Table 4.

TABLE 4. Framework of AI-enabled Precision Profiling and Intervention System

System Layer	Core Modules	Key Functions	Technical Support
Perception Layer	Multi-modal data collection	Physical, physiological, behavioral data acquisition	Smart terminals, wearables, IoT
Data Layer	Health database & management	Data cleaning, fusion, storage, sharing	Blockchain, cloud computing, big data
Algorithm Layer	AI analysis & modeling	Precision profiling, risk warning, intelligent diagnosis	Deep learning, machine learning
Application Layer	Intelligent intervention & management	Personalized prescription, process control, effect evaluation	Generative AI, VR/AR, mobile APP
Optimization Layer	Dynamic iteration & decision support	Program optimization, report generation, policy advice	Reinforcement learning, data visualization

C. CORE FUNCTION MODULE DESIGN

1) Multimodal data acquisition and management module

Terminal layer: AI intelligent body testing terminal (static body testing), wearable devices (dynamic physiology), campus APP (behavioral data), intelligent canteen (dietary data), medical system (health records).

Data layer: Build standardized databases (physical fitness database, physiological database, behavioral database, health database, and solution database), use blockchain encryption storage, and achieve trustworthy data sharing.

Management: Data cleaning, annotation, fusion, quality control, and update functions, supporting multisource data access and standardized processing.

2) Accurate portrait and intelligent evaluation module

Physical profiling submodule: Five dimensional feature modeling, physical classification labels, health level scoring, and visual display of weaknesses.

Risk warning submodule: multi disease risk prediction, abnormal indicator warning, sports injury risk assessment, early intervention reminder.

Comprehensive evaluation submodule: individual evaluation, class/grade/school level statistical analysis, comparative analysis, trend prediction.

3) Intelligent Diagnosis and Intervention Module

Problem diagnosis submodule: identification of physical problems, root cause analysis, identification of weak links, and severity assessment.

Multidimensional prescription submodule: Personalized exercise prescription (type, intensity, duration, movement, advanced), dietary nutrition plan, sleep adjustment plan, psychological health guidance.

Layered intervention submodule: routine intervention for the general population, strengthened intervention for vulnerable groups, specialized intervention for obesity/sub-health, and rehabilitation intervention for the injured and sick population.

4) Dynamic Control and Process Tracking Module

Real time monitoring submodule: intervention execution tracking, exercise physiology monitoring, compliance statistics, abnormal behavior alarm.

Intelligent feedback submodule: real-time voice guidance, periodic reports, progress incentives, problem correction.

Home school interaction submodule: parental viewing, family intervention reminders, and home school collaborative guidance.

5) Effect evaluation and iterative optimization module

Effect evaluation submodule: pre - and post test comparison, indicator change statistics, intervention effectiveness scoring, behavior change analysis.

Scheme optimization submodule: automatic iteration based on effects, personalized adjustment, continuous optimization and upgrading.

Decision Support submodule: University Physical Health Report, Reform Suggestions, Resource Allocation Optimization, Management Decision Support.

6) System Operation Mechanism

1. Data driven mechanism: real-time collection of global data - intelligent analysis - precise profiling - scientific decision-making - precise intervention, data-driven throughout the entire process.

2. Closed loop optimization mechanism: intervention execution effect feedback problem diagnosis solution iteration re execution, continuous optimization and improvement.

3. Hierarchical classification mechanism: stratify by grade, physical fitness, health status, and exercise ability, accurately matching intervention intensity and content.

4. Diversified collaborative mechanism: school overall management, teacher organization and implementation, student independent participation, family and social cooperation, and four party linkage.

5. Incentive and restraint mechanism: incorporating sports performance, awards and honors, graduation qualifications, combined with points, rankings, and rewards to enhance compliance.

7) Proposed Implementation Path and Future Testing Plan

While the framework presented in this section is currently a structural proposal derived from the synthesis of existing technological bottlenecks, its feasibility is grounded in the convergence of IoT and Generative AI. The following implementation path is proposed for future empirical validation:

1. Infrastructure construction phase: Build a cloud platform, configure basic hardware (intelligent testing terminals, wearable devices), complete data docking and system debugging.

2. Pilot promotion stage: Select 1-2 colleges for pilot, optimize systems and plans, train teachers, and enhance student acceptance.

3. Scaling validation stage: Based on pilot results, expand the sample to diverse colleges with different infrastructure levels to validate the model's cross-demographic robustness and infrastructure compatibility.

4. Comprehensive coverage stage: Promote throughout the school, establish a normalized operation mechanism, and incorporate it into daily physical education teaching and health management.

5. Deepen optimization stage: expand functions, improve algorithms, enrich scenarios, strengthen collaboration, and achieve systematic, precise, and long-term operation.

VI. FUTURE RESEARCH TRENDS AND BREAKTHROUGH DIRECTIONS

A. TRENDS IN TECHNOLOGY FUSION AND INNOVATION

1. Deep integration of multiple technologies: AI+big data+blockchain+VR/AR+digital twin fusion application, constructing immersive, visual, and twin biological intervention scenarios. The digital twin technology constructs a virtual human body model, simulates the effects of exercise and physical changes, and enhances the scientificity of intervention.

2. Algorithm model optimization and upgrade: Develop a large model exclusively for Chinese university students, trained on millions of samples, and improve accuracy to over 95%; Develop small sample learning and transfer learning algorithms to solve the problem of insufficient data; Strengthen dynamic online learning and achieve real-time iteration of portraits and plans.

3. Lightweight and low-cost technology: Develop AI posture recognition and motion analysis systems based on ordinary cameras and mobile phones to reduce hardware costs; Develop lightweight apps and mini programs that are compatible with all users.

4. Cross modal intelligent interaction: The application of voice, visual, and somatosensory interaction technologies enables natural interaction, real-time guidance, and immersive experiences.

B. RESEARCH DIRECTION FOR SYSTEMATIC CONSTRUCTION

1. Full cycle and full scenario system: Build an integrated system of "four-year university full cycle+in class and out of class full scenario", covering teaching, training, after-school, family, and society.

2. Layered classification precise intervention: Customize differentiated plans for different groups (freshmen, graduates, physically weak students, special elderly students, and injured students).

3. "Integration System of Sports, Medicine, and Health Care": Integrating sports, medical, nutritional, psychological, and health resources to build a comprehensive health promotion system.

4. Diversified collaborative governance model: Improve the six level collaborative mechanism of "school department class dormitory family community" to form a comprehensive governance pattern.

C. PRACTICAL IMPLEMENTATION AND LONG TERM MECHANISM RESEARCH

1. Low cost and large-scale promotion path: Develop a "basic version+upgraded version" system that is suitable for different universities; Promote the model of "device sharing, tiered configuration, and cloud services" to reduce investment.

2. Long term operation guarantee mechanism: included in university assessment, sports reform, and health governance; Establish special funds, professional teams, and management systems.

3. Compliance improvement strategies: gamification, socialization, and motivational intervention design; Build a "supervision incentive feedback reinforcement" mechanism.

4. Effectiveness verification and standardization: Develop unified evaluation standards, conduct large-scale and long-term empirical research, and construct a national effectiveness database.

D. RESEARCH ON ETHICAL SAFETY AND GOVERNANCE SYSTEM

1. Data privacy protection system: Establish a full process privacy protection mechanism of "collection storage use sharing deletion"; Improve authorization, encryption, anonymity, and auditing systems.

2. Ethical standards for algorithms: Establish mechanisms for fairness review, bias correction, and transparency enhancement in algorithms.

3. Health governance system: Develop ethical guidelines, technical standards, management norms, and legal guarantees for AI physical health.

E. TRENDS IN INTERDISCIPLINARY INTEGRATION DEVELOPMENT

Promote the deep cross integration of artificial intelligence, sports science, clinical medicine, public health, nutrition, psychology, education, and computer science, establish interdisciplinary research teams, solve deep problems in technology and application, and build a theoretical system and practical paradigm of AI+physical health with Chinese characteristics.

VII. CONCLUSION

AI technology provides a revolutionary path for solving the dilemma of declining physical health among college students and reconstructing the health governance system of universities, achieving a paradigm shift from "standardized extensive intervention" to "personalized and precise empowerment". The current research has made significant progress in areas such as data collection, portrait modeling, intervention generation, and platform development, but still faces bottlenecks at the four levels of technology, system, practice, and ethics. In the future, interdisciplinary integration should be the support, technological innovation should be the driving force, system construction should be the core, and practical implementation should be the goal. This paper contributes to the field by synthesizing current research progress and proposing a novel, integrated system framework for promoting the physical health of college students. By explicitly linking identified research gaps—such as data silos and low intervention compliance—to the specific functional modules of our proposed architecture, we provide a theoretical foundation for next-generation health governance. Future work will focus on the empirical deployment and stress-testing of this framework in diverse university environments.

Subsequent research should focus on four major breakthroughs: first, developing localized, high-precision, and strongly adaptable AI algorithm models to improve the accuracy of profiling and intervention; The second is to build an integrated, full chain, and implementable technological system and operational mechanism to solve the problem of fragmentation; Thirdly, explore low-cost, large-scale, and long-term campus promotion paths to promote comprehensive application; The fourth is to improve data security, algorithm ethics, and health governance systems, and safeguard the bottom line of security. Through continuous innovation and practice, AI technology will deeply empower the governance of physical health in universities, help comprehensively improve the physical health level of college students, and provide solid support for the construction of a healthy China and the high-quality development of higher education.

AUTHOR CONTRIBUTIONS

Yufang Xu designed, collected and analyzed the data, and drafted the manuscript. Yufang Xu conducted the study, critically revised the manuscript for important intellectual content, and gave final approval of the version to be published. Yufang Xu participated fully in the work, take public responsibility for appropriate portions of the content, and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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