

Applications of AI-driven in personal health: monitoring, analysis, and prospect

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Abstract. Personal health includes physical, mental, and other comprehensive health. As personal health reflects the condition of our body, it has always been a concern, directly related to physical well-being. Due to that, technological development is inadequate, with people showing insufficient attention to it. Yet there is no universally recognized and highly effective solution. As a result, with the development of newly emerging AI-driven technology, which can be endowed with the capacity to analyze and make decisions using rules through constructing an AI model, supplying data, and carrying out training, this paper examines multiple articles on applying AI-driven technologies in personal health. By analyzing the methods employed, this study compares the characteristics of various projects, summarizes the contributions of different articles, and ultimately integrates multiple perspectives to review the applications and prospects of AI-driven technologies in mental health, sleep health, and comprehensive health.

Keywords: AI-driven, personal health, application.

1. Introduction

AI-driven is an emerging technology; the principle is that through inputting collected data, AI establishes connections and learns patterns via algorithms, enabling the trained AI model to process information independently, make decisions, and apply the learned patterns to new scenarios. Some standard AI algorithms are machine learning, which enables systems to learn from data, make informed predictions, and adapt their behavior accordingly, and deep learning, which contains the ability to learn problem-solving strategies directly from data through end-to-end learning, without specific assumptions or manual feature engineering [1,2]. In addition, AI can collect users' real-time physiological data such as heart rate and blood oxygen through wearable devices, analyze the data, formulate precise and personalized plans, and efficiently assist in diagnosis to reduce the possibility of misdiagnosis and missed diagnosis. Meanwhile, it can predict health trends based on the health data. Thus, AI-driven has demonstrated its potential across various fields. While in personal health, much research has been conducted. Some papers have studied IoT in personal healthcare, including smart health wearable design and deployment, but accuracy and real-time cannot be guaranteed.[3] There is also a paper searching for the practical applications and benefits of the Personal Health Knowledge Graph (PHKG) in personal healthcare data and utilization. While the PHKG holds great promise, challenges persist, and privacy and data security remain paramount concerns that demand rigorous solutions [4]. AI is suitable for personal health. This paper systematically summarizes AI-driven technological applications in personal health from three dimensions: mental health, sleep health, and comprehensive health monitoring, to evaluate the strengths and weaknesses of different approaches while envisioning future advances led by AI-driven technologies. The paper aims to provide a knowledge framework for existing AI-driven personal health applications, offering practical implementation guidance. By assessing various technical methods, it seeks to advance the development of personalized medicine and enhance public understanding of personal health. This paper aims to bridge the gap between AI innovation and real-world health solutions, ultimately empowering individuals to take a more proactive and informed approach to their well-being.

2. AI-driven Application

2.1 Mental Health

Mental health can be tracked and analyzed using data collected by tools.[5] Whether it is personality traits, emotional regulation, or self-awareness, an AI-driven model that has been newly promoted can analyze and provide solutions. InnerPeaceAI offers a platform to provide personal service for mental health using advanced AI-driven technology. It consists of many layers to ensure that sensitive data cannot be leaked during transmission, and to make the platform user-friendly and convenient. Such layers as the User Interface (UI) Layer provide a user-friendly experience, ensuring users can access the platform effortlessly on both Edge and Chrome browsers.[6] The paper regards the platform's flexibility as a key feature, because whether at home, at work, or traveling, users can access the platform from any device with an internet connection, ensuring uninterrupted access to therapy when they need it most. This flexibility promotes consistent engagement, empowering users to manage their mental health without being constrained by time or location.[7] It has been indicated that InnerPeaceAI significantly reduces the cost of care, making it accessible to people from low-income communities. The platform's AI-driven model also ensures it can serve millions without compromising care quality. Meanwhile, with the developments in wearable technologies, we have more ways to track our physical health, but what about mental health? A novel mobile application integrating smartwatches to monitor physical and mental health has been introduced. The application collects vital data, including heart rate and activity levels, and analyzes this information using a machine learning-based smart stress analysis system [13]. Also, the app combines mental health self-assessment tools for disorders such as depression, post-traumatic stress disorder (PTSD), schizophrenia, addiction, and anxiety. The paper trains the machine learning model using two key inputs, body temperature and step counts from smartwatches. Output is that the predicted stress level is sent back to the mobile application and displayed to the user in real-time. The system architecture comprises Smartwatch Integration, Mobile Application (Frontend), and Flask REST API (Backend). Many users praise this app; 85% find it helpful in tracking their mental health and responding to stress-related alerts. Many users highlighted the simplicity of the user interface, particularly appreciating the real-time data display and the ability to call a friend or specialist with a single tap during stressful situations.[8] Whether InnerPeaceAI or the app, these newly proposed applications are better approaches to addressing mental health issues and represent significant progress in applying AI-driven technology to mental health. Users can be provided with highly convenient real-time solutions through the platform analysis of relevant data. AI models are trained to analyze and handle similar cases by collecting appropriate data via smartwatches, offering optimal mental health solutions in real time. Although there are still some challenges, such as low efficiency in data processing, insufficient accuracy of the proposed solutions, inadequate scalability, and low public trust in the solutions, these problems will be resolved as AI-driven technology develops further.

2.2 Sleep Health

Sleep health plays an essential role in our body. Good sleep health should include adequate sleep duration, regular sleep rhythm, and good sleep quality. Some tools are needed to judge whether our sleep health is good. Till now, many papers have highlighted the potential of AI for sleep health. Among them is LSTM. Large datasets of sleep variables train the long Short-Term Memory (LSTM) model to provide suggestions and analysis to enhance sleep quality and control sleep disorders. Data includes Total Sleep Time (TST), Heart Rate (HR), Pulse Oximetry Saturation, Total Wake Time After Sleep Onset (WASO), and so on. The first step is data processing, cleaning, normalization, and segmentation. Then, the cleaned-up data will be used to train the LSTM model. Based on the analysis, the algorithm proposes practical suggestions to enhance sleep quality. Sleep schedule adjustments, sleep environment improvements, and behavioral modifications like cutting down on coffee or practicing relaxation methods before bed may all be on the list of suggestions.[9] The paper also emphasizes feedback from users. People who have used the model express its pros and cons; these

opinions can be input to improve the LSTM model. Compared to other standard models, LSTM gets the highest accuracy, 87%, and the precision is 0.82, the recall is 0.80, while the F1 score is 0.81; all of these are higher than those of other models. Thanks to AI's powerful learning ability, this model can continuously update its functions based on user feedback and identify similarities in a large amount of personal data to formulate personalized plans. Thus, LSTM is effective because it can process sequential input and remember relationships over time. The model provides actionable and customized recommendations for improving sleep health, such as reducing coffee use and increasing physical exercise. This method will enhance the area of personalized sleep treatment for future studies. The effective use of LSTM showcases its versatility and opens new possibilities for AI-driven health solutions.[9] Another AI model also needs to gather data first. Then, the model is constructed, and several AI methods, including CNNs, RNNs, and transformer models, are examined to identify temporal relationships and trends in the sleep data. After that, the model is trained using the gathered data while considering the input from doctors and patients to improve the model's applicability and user experience.[10] The results are divided into five parts. The first is Diagnosis of Sleep Disorders, the AI algorithm for sleep apnea diagnosis shows a sensitivity of 92% and specificity of 88%, indicating its promise as a dependable screening tool. The second is Sleep Quality Assessment. The AI-based sleep quality assessment system accurately classifies sleep quality as poor, fair, or reasonable with an overall accuracy of 78%. The third is Sleep Monitoring. The computer's vision system has a mean accuracy of 91% in identifying sleep-related movement irregularities. The fourth is Individualized sleep counseling. 80% of patients who undergo AI-driven personalized sleep treatment sessions have a substantial improvement in their sleep quality. The last is risk identification and predictive models, which are built with AI models that correctly predict the risk of developing sleep apnea in an area under the receiver operating characteristic curve (AUC-ROC) of 0.85. These results indicate that AI-driven technology can better identify people at risk of developing sleep disorders, diagnose sleep disorders, evaluate sleep quality, track sleep behavior, and offer personalized therapy.[10] The application of artificial intelligence (AI) in treating sleep disorders has demonstrated infinite promise for promoting precision, effectiveness, and individualized care.

2.3 Comprehensive Health

Comprehensive health incorporates comprehensive physical data, functioning as an integration of all health indicators. Through comprehensive health, we can quickly and easily evaluate physical conditions. Now, with the development of AI-driven technology, comprehensive health can be tracked and analyzed better. The Smart Health Monitoring App (SHMA) uses real-time physiological data like heart rate, body temperature, and step count to do speech analysis and facial recognition to detect stress and tiredness using AI-driven technology. Such data can be collected by wearable smartwatches or smartphones, which use an IoT platform to store and compare. Health24, a data collection framework running on Android and iOS, with support from the Korea National Institute of Health (KNIH), has been used by a research team. Currently, they are collecting data from 300 participants for 60 days. The dataset allows them to perform future research identifying the relationship between activity derived from smart devices and human cognition captured by a survey. Furthermore, the dataset has the potential for cohort analysis, such as the activity level analysis according to age, gender, BMI, emotion, and context. After the data collection phase, the study can be extended, for example, to measure the effectiveness of smartphone data for human activity recognition compared to reference data collected from a smartwatch.[11] This is one sample of the data collection. SHMA has the potential to make full use of them. This app uses many AI models. SVM model achieves an accuracy of 86% and this level of accuracy is considered high for medical diagnosis applications. Random Forest achieves a remarkable accuracy of 98%, demonstrating its effectiveness in classifying various physical activities. The accuracy of the CNN model was achieved at 97%, which indicates that it was very good at detecting moods in speech. SHMA is significantly linked to smartwatches; it needs the user's permission to collect data. If the user enables these permissions, the wearable device could become a comprehensive personal health monitor by giving

accurate feedback and monitoring their conditions, including photos, videos, and other parameters. This then improves general performance or usability by any user, according to what has been found while testing it so far into its development [12].

3. Future Prospects

3.1 Multilingual Support and Culturally Adaptive AI Models

Currently, wearable devices are used worldwide, covering most countries and regions. Therefore, language and cultural differences have become essential factors affecting user experience. However, due to technical limitations, systems cannot yet encompass all cultures and languages. In terms of language, multilingual support is not simply about translation; it involves an in-depth understanding of different languages. For example, when dealing with dialects, it is necessary to consider the context for comprehension, and attention should also be paid to the reading habits of different languages.

Regarding culture, AI should respect the cultural customs of other regions. Cultural connotations need to be considered when it comes to health monitoring. For instance, emphasis should be placed on personalized health data monitoring in areas that value individualism. In contrast, in regions where collectivism prevails, the focus should be on sharing family health data. Such in-depth adaptation can significantly enhance the user experience.

3.2 Compatibility of Diverse Wearable Devices

Different wearable devices require different hardware parameters and sensor types. Currently, most devices are smartwatches, smart bracelets, and smart glasses. Other parameters and sensors can be adjusted according to application scenarios to achieve the diversity of wearable devices, enabling bright clothing, smart insoles, etc. Regarding personalized health, bright clothing monitors human physiological conditions, smart glasses capture human focus data, and smart insoles record foot characteristics. All these data are uploaded to the platform in real time to generate personalized methods, facilitating accurate diagnosis.

3.3 High-Precision Monitoring

Monitoring accuracy is the core foundation for exerting practical value on wearable devices. Especially in medical and health care, even a tiny error may lead to misjudgment. The breakthrough in high-precision monitoring technology can improve the efficiency of daily health monitoring and enable the application of wearable devices in other professional fields such as clinical diagnosis and rehabilitation treatment, providing a more efficient monitoring solution for the medical industry. With the development of technology, one paper indicates that through integrating multimodal data, including genomics, medical imaging, clinical histories, and real-time wearable device data, AI offers comprehensive patient profiles that move beyond the traditional “one-size-fits-all” model [13].

4. Conclusion

This study aims to analyze, compare, and summarize the applications of AI-driven approaches in personal health in recent years from three aspects: mental health, sleep health, and comprehensive health. By examining the methods and theories proposed in various studies, this paper demonstrates the progress and development of AI-driven technologies in personal health in recent years, injecting more vitality into AI and presenting powerful and practical solutions to individuals' personalized health issues. This study identifies the advantages and disadvantages of AI-driven approaches in different health domains. However, a new question emerges: can AI-driven technologies be more efficiently applied to more health domains to unleash greater potential? To better understand the role of AI-driven approaches in personal health, future research needs to focus on language and cultural adaptation to enhance user experience through in-depth customization; expand the possibilities of wearable devices to make health solutions more specific and personalized; and improve the accuracy

of data monitoring to ensure that generated solutions are more scientific and practical. Based on the conclusion, this paper will provide more inspiration to the medical community, enabling more efficient application of AI in real-world cases and offering better monitoring technologies and personalized solutions for people's physical and mental health.

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