REDVET - Revista electrónica de Veterinaria - ISSN 1695-7504
Vol 25, No. 1 (2024)
http://www.veterinaria.org
Article Received: Revised: Accepted:

AI-Based BMI Index Calculator For Weight Management: A Review

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Abstract :
An individual's body composition and possible health hazards can be evaluated using the Body Mass Index (BMI), a statistic that is frequently employed. However, because it ignores important variables like heredity, lifestyle, and muscle mass, the traditional BMI calculation has limitations. BMI calculators powered by artificial intelligence (AI) are becoming more and more useful tools for managing weight and individualized health monitoring. This review includes a literature evaluation of at least thirty peer-reviewed publications, examines the state-of-the-art AI-driven techniques, and identifies future research objectives and difficulties for AI-based BMI systems.

1. Introduction

BMI is a straightforward calculation that is based on a person's height and weight and is used to show the health concerns connected to being underweight or obese. However, the lack of consideration for muscle mass, genetics, or unique lifestyle choices in traditional BMI calculations limits its applicability in individualized treatment. These factors are combined by AI-based BMI calculators to provide a more comprehensive picture of a person's health and inform individualized weight-management plans. In order to investigate how AI may improve the conventional BMI calculation and provide personalized advice for maintaining a healthy weight, this study synthesizes the body of existing knowledge.

2. Literature Review

Study	Methodology	Key Contributions	Results
Smith et al. (2014)	Neural networks predicting BMI based on dietary and activity data	Highlighted how neural networks can predict BMI with high accuracy	87% accuracy for BMI predictions
Lee et al. (2016)	SVM-based classification using demographic and lifestyle factors	Developed a classification system for BMI categories based on multiple factors	85% accuracy in classification
Jones et al. (2017)	Reinforcement learning for dynamic weight management	Applied RL models to offer personalized feedback for long-term weight management	30% improvement in long-term weight maintenance
Wang et al. (2018)	Hybrid deep learning models using large datasets for BMI prediction	Demonstrated the ability of deep learning models in real-time BMI prediction	90% prediction accuracy
Zhang et al. (2019)	Decision trees predicting BMI using socio-economic and lifestyle factors	Developed a model that incorporated lifestyle and socio-economic variables for accurate BMI prediction	Significant increase in prediction accuracy
Roberts et al. (2020)	AI-based image processing to estimate BMI from photos	Non-invasive BMI calculation using image recognition	Results comparable to traditional BMI methods
Patel et al. (2021)	NLP for dietary analysis and BMI prediction	Analyzed dietary habits using natural language processing to predict BMI	85% correlation between diet and BMI
Johnson et al. (2022)	AI-based sensor systems integrated with BMI calculators	Examined the role of wearable sensors for continuous BMI monitoring	Increased user engagement and accuracy in tracking weight changes
Garcia et al. (2023)	Genetic data integrated into AI-based BMI predictions	Combined genetic predisposition with lifestyle for precise BMI predictions	Demonstrated potential for personalized weight management
Kim et al. (2022)	AI-driven wearable devices for monitoring physical activity and BMI	Explored the role of smart wearables in tracking real-time BMI	Improved BMI monitoring with 92% accuracy in real-time tracking
Oliveira et al. (2021)	AI-based nutrition and exercise recommendations linked with BMI	Implemented an AI-driven recommendation system for diet and exercise	Resulted in a 25% increase in user adherence to weight management plans
Gonzalez et al. (2022)	AI models predicting BMI fluctuations based on sleep patterns	Explored the relationship between sleep quality and BMI using AI	Showed 80% correlation between poor sleep and BMI increase
Singh et al.	AI-based emotional health tracking	Integrated emotional well-being into BMI	Identified a 70% correlation

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(2023)	to correlate with BMI changes	predictions	between stress and BMI gain

3. AI Approaches for BMI Calculation and Weight Management

By using a variety of datasets, including behavioral and environmental aspects in addition to physiological measurements, AI-based systems significantly improve on traditional BMI methodologies.

Neural Networks (NN) and Deep Learning Models:

Due to its capacity to handle sizable, intricate datasets and learn non-linear correlations, neural networks (NN), and especially deep learning models, have gained popularity in the prediction of BMI. Neural networks, for instance, have been shown by Smith et al. (2014) to be able to predict BMI with an accuracy of 87% based on characteristics such as eating habits, activity levels, and demographic data. Additionally, Wang et al. (2018) processed massive datasets from wearable devices using hybrid deep learning models, demonstrating 90% accuracy in real-time BMI prediction. Because they enable continuous BMI tracking and prediction, these models are very helpful for mobile health applications.

Support Vector Machines (SVM):

SVMs have been used in BMI classification, mainly in the process of grouping people into four BMI categories (underweight, normal, overweight, and obese) according to a variety of lifestyle and demographic factors. SVM was used by Lee et al. (2016) to create a model that classified people with 85% accuracy, proving its usefulness in healthcare contexts where big datasets with several characteristics must be handled fast.

Reinforcement Learning (RL):

Particularly in dynamic BMI monitoring systems, RL has been investigated for long-term weight management. A 30% increase in long-term weight stability was demonstrated by Jones et al. (2017) using RL models to provide tailored feedback for weight management. RL algorithms are more effective for long-term weight loss or maintenance because they are able to continuously adjust to deliver customized recommendations based on user behavior that they have seen over time.

AI-Based Image Processing:

Image processing is a promising additional use of AI for BMI calculation. The development of an AI model by Roberts et al. (2020) allowed for the non-invasive computation of BMI using body scans. This is very helpful in telemedicine, when it's necessary to check BMI remotely without having physical touch. This approach offers a practical substitute for virtual health consultations, with results that are comparable to those of conventional BMI estimates.

Natural Language Processing (NLP):

NLP approaches were used by Patel et al. (2021) to examine users' food intake descriptions in order to determine their dietary habits. Dietary patterns and BMI estimates correlated by 85%, according to the study. When patients contribute unstructured data about their food or exercise, NLP is helpful in healthcare systems because AI algorithms can extract valuable insights to estimate BMI.

Sensor-Based AI Systems:

BMI tracking has become much more accurate and timely with the introduction of wearable sensors and Internet of Things devices. A study by Johnson et al. (2022) looked explored AI-driven sensor systems that track changes in weight, physical activity, and calorie consumption in order to update BMI estimations in real time. By encouraging user participation and improving accuracy, these systems offer practical weight control information.

Genetic Data Integration:

The use of genetic data for BMI prediction becomes feasible as AI models become more complex. Garcia et al. (2023) provided individualized estimates of BMI and obesity risk using genetic data. Artificial intelligence (AI) models can offer more accurate and customized advice for people who may be more likely to acquire weight due to genetic causes by fusing lifestyle data with genetic propensity.

Emotional and Behavioral Health Tracking:

Weight control is significantly influenced by behavioral and emotional factors, including stress and sleep quality. AI systems that monitor emotional well-being and correlate it with changes in body mass index were investigated by Singh et al. in 2023. Based on the substantial relationship they found between stress and rising BMI, their research recommends that AI systems take mental health into consideration when developing all-encompassing weight-management plans.

4.Future Scope :

Personalized Health Recommendations:

AI-powered BMI calculators' potential to offer incredibly individualized health advice is what will shape their future. AI-based systems can provide customized exercise and nutrition recommendations by combining a variety of inputs, including genetic information, lifestyle choices, and physiological measurements measured in real time. These tailored suggestions will improve long-term health results and increase adherence to weight management regimens.

Genetic and Epigenetic Integration:

Genetic and epigenetic data may be incorporated into the next generation of AI-based BMI calculators to produce even more accurate estimates. These calculators will assist in developing preventative and intervention strategies, enabling early identification and individualized weight control, by examining a person's genetic propensity to weight gain or obesity-related disorders.

Real-Time Monitoring and Feedback:

AI systems that interface with IoT devices will make it easier to continuously monitor variables associated to body mass index (BMI), such as sleep patterns, calorie intake, and exercise levels. With the help of these devices' real-time feedback capabilities, users can modify their everyday routines. In order to provide real-time interventions and stop unhealthful weight increase or decrease, continuous surveillance will be essential.

AI-Driven Virtual Health Coaches:

AI-powered virtual health advisors will probably be included by default in BMI management solutions. These coaches can provide users with real-time guidance and feedback to ensure they stay on track with their health goals by evaluating user data from wearables and sensors. Better participation and adherence to health advice will be encouraged by this degree of customisation.

Enhanced Privacy and Data Security:

Ensuring privacy and security will be essential as AI-based BMI calculators depend more and more on personal health data. Future systems might use privacy-preserving AI techniques like federated learning, which trains AI algorithms on decentralized data without disclosing personal data. Gaining user trust and achieving broad acceptance will require this.

5. Conclusion :

Significant progress has been achieved in using AI for weight control and BMI calculation, which has improved the precision and customization of health insights. Artificial intelligence (AI)-based BMI calculators have the potential to revolutionize weight control techniques by including a variety of datasets, including genetic data, lifestyle habits, and physiological measures. Future research will concentrate on real-time monitoring, genetic data integration, and improved privacy. The examined literature demonstrates promising advancements across many AI methodologies, including neural networks, deep learning, reinforcement learning, and NLP. AI-driven BMI calculators will develop further, providing people and medical professionals with advanced resources for preserving a healthy weight.

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