Advertisement

Predictive Model for Estimating Body Weight Based on Artificial Intelligence: An Integrated Approach to Pre-processing and Evaluation

Conference paper | First Online: 13 August 2024

pp 26–39 | Cite this conference paper

Diana M. Figueiredo, Rui P. Duarte & Carlos A. Cunha

Part of the book series: Advances in Intelligent Systems and Computing (ASC, volume 1459)

Included in the following conference series:
International Conference on Disruptive Technologies, Tech Ethics and Artificial Intelligence

New Trends in Disruptive Technologies, Tech Ethics, and Artificial Intelligence

(DITTEI 2024)

Access this chapter

Log in via an institution

Chapter — EUR 39.95
Price includes VAT (Portugal)

- Available as PDF
- Read on any device
- Instant download
- Own it forever

Buy Chapter

eBook — EUR 154.07

Softcover Book — EUR 213.99

Tax calculation will be finalised at checkout

Purchases are for personal use only

Institutional subscriptions

Sections | References

Abstract
References
Acknowledgements
Author Information
Editor Information
Rights and permissions
Copyright information
About this paper
Publish with us

Abstract

Body weight is much more than just a number on a scale. This value can indicate various diseases, as both excess and insufficient weight have implications for an individual's health. Excess weight is associated with heart disease, obesity, diabetes, high blood pressure, and respiratory disorders, among others. Meanwhile, extreme underweight is associated with problems such as nutritional deficiency, weakened immune system, osteoporosis, and hormonal imbalances. Due to these issues, there is a need to monitor and analyse body changes to adopt a diet and lifestyle balanced with individual needs. The weight control process is complicated and depends on various factors. This paper aims to develop a machine-learning model to predict future weight based on dietary records, physical exercise, and basal metabolic rate to demonstrate three days' impact on future weight. Results of the model's performance show that the coefficient of determination yielded a value of 0.75, which is considered good for this metric. The mean square and absolute errors demonstrate that the model could learn patterns in the data without significant overfitting.

This is a preview of subscription content, log in via an institution to check access.

References

1. Svendsen, M.T., et al.: Associations of health literacy with socioeconomic position, health risk behavior, and health status: a large national population-based survey among Danish adults. BMC Public Health **20**(1), 1–12 (2020)
   Article Google Scholar

2. Blüher, M.: Metabolically healthy obesity. Endocr. Rev. **41**(3), bnaa004 (2020)
   Google Scholar

3. Abhari, S., et al.: A systematic review of nutrition recommendation systems: with focus on technical aspects. J. Biomed. Phys. Eng. **9**(6), 591–602 (2019)
   Article Google Scholar

4. Horta, B.L., Rollins, N., Dias, M.S., Garcez, V., Pérez-Escamilla, R.: Systematic review and meta-analysis of breastfeeding and later overweight or obesity expands on previous study for world health organization. Acta Paediatr. **112**(1), 34–41 (2023)
   Article Google Scholar

5. Buoncristiano, M., et al.: Socioeconomic inequalities in overweight and obesity among 6–to 9–year–old children in 24 countries from the World Health Organization European region. Obes. Rev. **22**, e13213 (2021)
   Article Google Scholar

6. Powell-Wiley, T.M., et al.: Obesity and cardiovascular disease: a scientific statement from the American Heart Association. Circulation **143**(23), e984–e1010 (2021)
   Article Google Scholar

7. Lopez-Jimenez, F., et al.: Obesity and cardiovascular disease: mechanistic insights and management strategies. A joint position paper by the World Heart Federation and World Obesity Federation. Eur. J. Prev. Cardiol. **29**(37), 2218–2237 (2022)
   Article Google Scholar

8. Safaei, M., Sundararajan, E.A., Driss, M., Boulila, W., Shapi'i, A.: A systematic literature review on obesity: understanding the causes & consequences of obesity and reviewing various machine learning approaches used to predict obesity. Comput. Biol. Med. **136**, 104776 (2021)
   Article Google Scholar

9. Zheng, Z., Ruggieri, K.: Using machine learning to predict obesity in high-school students. In: 2017 IEEE International Conference on Bioinformatics and Biomedicine (BIBM), pp. 2132–2138 (2017)
   Google Scholar

10. Akhshak, M., Yu, P., Shen, J., Deng, C.: A review of the application of machine learning in adult obesity studies. Appl. Comput. Intell. **2**(1), 32–48 (2022)
    Article Google Scholar

11. Zhao, H., et al.: Predicting the risk of hypertension based on several easy-to-collect risk factors: a machine learning method. Front. Public Health **9**, 619429 (2021)
    Article Google Scholar

12. Sun, M., Ju, W., Chen, G., Hou, M., Chen, J., Mao, Z.H.: Improved wearable devices for dietary assessment using a new camera system. Sensors **22**(20), 8006 (2022)
    Article Google Scholar

13. Haththotuwa, R.N., Wijeyaratne, C.N., Senarath, U.: Worldwide epidemic of obesity. In: Obesity and Obesitics, pp. 3–8. Elsevier (2020)
    Google Scholar

14. Pellegrini, M., et al.: Effects of time-restricted feeding on body weight and metabolism. A systematic review and meta-analysis. Rev. Endocr. Metab. Disord. **21**, 17–33 (2020)
    Article Google Scholar

15. Hill, J.O., Pagliassotti, M.J., Peters, J.C.: Nongenetic determinants of obesity and body fat topography. In: The Genetics of Obesity, pp. 35–48. CRC Press (2020)
    Google Scholar

16. Zhao, F.Y., et al.: Effects of a 12-week exercise-based intervention on weight management in overweight or obese breast cancer survivors: a randomized controlled trial. Support. Care Cancer **32**(2), 98 (2024)
    Article Google Scholar

17. Van Strien, T.: Causes of emotional-eating and matched treatment of obesity. Curr. Diab. Rep. **18**, 1–8 (2018)
    Google Scholar

18. Alimoradi, Z., Golboni, F., Griffiths, M.D., Broström, A., Lin, C.Y., Pakpour, A.H.: Weight-related stigma and psychological distress: a systematic review and meta-analysis. Clin. Nutr. **39**(7), 2001–2013 (2020)
    Article Google Scholar

19. de Witt Huberts, J.C., Evers, C., de Ridder, D.T.: Double trouble: restrained eaters do not eat less and feel worse. Psychol. Health **28**(6), 686–700 (2013)
    Article Google Scholar

20. Ainhaoucni, P., Jensen, M.D.: Does basal metabolic rate predict weight gain? Am. J. Clin. Nutr. **104**(4), 959–963 (2016)
    Article Google Scholar

21. Khanna, D., Peltzer, C., Kahar, P., Parmar, M.S.: Body mass index (BMI): a screening tool analysis. Cureus **14**(2), e22398 (2022)
    Article Google Scholar

22. Roza, A.M., Shizgal, H.M.: The Harris Benedict equation reevaluated: resting energy requirements and the body cell mass. Am. J. Clin. Nutr. **40**(1), 168–182 (1984)
    Article Google Scholar

23. Jagim, A.R., et al.: Accuracy of resting metabolic rate prediction equations in athletes. J. Strength Conditioning Res. **32**(7), 1875–1881 (2018)
    Article Google Scholar

24. Bendavid, I., et al.: The centenary of the Harris–Benedict equations: how to assess energy requirements best? Recommendations from the ESPEN expert group. Clin. Nutr. **40**(1), 690–701 (2021)
    Article Google Scholar

25. Senawane, I.S., Patil, D.R.: Prediction of heart disease using multilayer perceptron neural network. In: International Conference on Information Communication and Embedded Systems (ICICES 2014), pp. 1–6. IEEE (2014)
    Google Scholar

26. Ferdowsy, F., Rahi, K.S.A., Jabiullah, M.I., Habib, M.T.: A machine learning approach for obesity risk prediction. Curr. Rev. Behav. Sci. **2**, 100093 (2021)
    Article Google Scholar

27. Iwendi, C., Khan, S., Anajemba, J.H., Bashir, A.K., Noor, F.: Realizing an efficient IoMT-assisted patient diet recommendation system through machine learning model. IEEE Access **8**, 28642–28654 (2020)
    Article Google Scholar

28. Nagari, S.S., Inayati, L.: Implementation of clustering using k-means method to determine nutritional status. J. Biometrika dan Kependud **9**(1), 62 (2020)
    Article Google Scholar

29. Rostami, M., Oussalah, M., Farrahi, V.: A novel time-aware food recommender-system based on deep learning and graph clustering. IEEE Access **10**, 52508–52524 (2022)
    Article Google Scholar

30. Raut, M., Prabhu, K., Fatehpuria, R., Bangar, S., Sabu, S.: A personalized diet recommendation system using fuzzy ontology. Int. J. Eng. Sci. Invention **7**(3), 51–55 (2018)
    Google Scholar

31. Chapman, P., et al.: The CRISP-DM user guide. In: 4th CRISP-DM SIG Workshop in Brussels in March, vol. 1999 (1999)
    Google Scholar

32. CHRISBOW: 2018 calorie, exercise and weight changes (2018). https://www.kaggle.com/datasets/chrisbow/2018-calorie-exercise-and-weight-changes/data

Download references

Acknowledgements

This work is funded by National Funds through the FCT – Foundation for Science and Technology, I.P., within the scope of the project Ref. UIDB/05583/2020. Furthermore, we would like to thank the Research Centre in Digital Services (CISeD), under the internal project PEDUCISeD/2022/007 and the Polytechnic of Viseu for their support.

Author information

Authors and Affiliations

Polytechnic Institute of Viseu, Viseu, Portugal
Diana M. Figueiredo, Rui P. Duarte & Carlos A. Cunha

CISeD – Research Center in Digital Services, Viseu, Portugal
Rui P. Duarte & Carlos A. Cunha

Corresponding author

Correspondence to Rui P. Duarte .

Editor information

Editors and Affiliations

Faculty of Science, University of Salamanca, Salamanca, Spain
Daniel H. de la Iglesia

Faculty of Science, University of Salamanca, Salamanca, Spain
Juan F. de Paz Santana

Faculty of Informatics, Pontifical University of Salamanca, Salamanca, Spain
Alfonso J. López Rivero

Rights and permissions

Reprints and permissions

Copyright information

© 2024 The Author(s), under exclusive license to Springer Nature Switzerland AG

About this paper

Cite this paper

Figueiredo, D.M., Duarte, R.P., Cunha, C.A. (2024). Predictive Model for Estimating Body Weight Based on Artificial Intelligence: An Integrated Approach to Pre-processing and Evaluation. In: de la Iglesia, D.H., de Paz Santana, J.F., López Rivero, A.J. (eds) New Trends in Disruptive Technologies, Tech Ethics, and Artificial Intelligence. DITTEI 2024. Advances in Intelligent Systems and Computing, vol 1459. Springer, Cham. https://doi.org/10.1007/978-3-031-66635-3_3

Download citation

.RIS ↓ .ENW ↓ .BIB ↓

DOI	Published	Publisher Name
https://doi.org/10.1007/978-3-031-66635-3_3	13 August 2024	Springer, Cham

Print ISBN	Online ISBN	eBook Packages
978-3-031-66634-6	978-3-031-66635-3	Intelligent Technologies and Robotics Intelligent Technologies and Robotics (R0)

Publish with us

Policies and ethics

Discover content
Journals A-Z
Books A-Z

Publish with us
Publish your research
Open access publishing

Products and services
Our products
Libraries
Societies
Partners and advertisers

Our imprints
Springer
Nature Portfolio
BMC
Palgrave Macmillan
Apress

Your privacy choices/Manage cookies | Your US state privacy rights | Accessibility statement | Terms and conditions | Privacy policy | Help and support | Cancel contracts here

94.152.6.42

Not affiliated

© 2024 Springer Nature