IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.102 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 6, June 2024

DOI: 10.17148/IJARCCE.2024.13656

Proposed Framework for Personalized Nutritional Counselling Using NLP And Sentiment Analysis Via Chatbot Interactions

Neha V Yadav[1], Ajay Kumar[2], Prof. Sheetal S Bandekar[3]

Department of MCA,K.L.S. Gogte Institute of Technology, Belagavi, Affiliated to Visvesvaraya Technological University, Belagavi, Karnataka, India[1]

Department of MCA,K.L.S. Gogte Institute of Technology, Belagavi, Affiliated to Visvesvaraya Technological University, Belagavi, Karnataka, India[2]

Department of MCA,K.L.S. Gogte Institute of Technology, Belagavi, Affiliated to Visvesvaraya Technological University, Belagavi, Karnataka, India[3]

Abstract: In our study, we recommend upgrading the functionality of our multilingual chatbot by the implementation of sentiment analysis mechanisms using advanced Natural Language Processing (NLP) methods. This ability is a fantastic step up for giving chatbots the knowledge of someone's mental state and emotions around food, and it has a major effect on our nutrition-related behaviours. The chatbot will then utilize this further integration to provide you with personalized dietary advice tailored to your emotions and tastes. We utilize advanced NLP algorithms to improve the chatbot's empathetic support and steering of dietary recommendations which we believe makes a greater impact on Nutritional Counselling Services offering. The ultimate goal of this research is to provide novel technological interventions that can help the users in adopting healthy eating habits and a healthier lifestyle.

Keywords: NLP, AI, CHATBOT, Natural language Processing, Sentiment analysis.

I. INTRODUCTION

In the context of dynamic implementation of digital technologies in the modern world the importance of conversational agents including chatbots has surged in terms of interaction. These agents, anchored on deep Natural Language Processing techniques that enhance their understanding, are becoming more than simple information finders but companions that can help in different spheres. A glimpse into one of such augmentations, we conceptualize an extension in which sentiment analysis is incorporated in a multilingual chatbot architecture. This should help in enhancing the abilities of the ML algorithm to determine emotional state as well as attitudes that users have for dietary habits.

Taking into consideration the crucial role of emotions with regard to the consumption of food and positioning the NLP-based sentiment analysis as the method of providing nutritional support, our research focuses on how such an approach can transform the established practice. By identifying the users' emotions, the improved chatbot also obtains more detailed understanding of the users' motives, difficulties faced during diets, and preferences regarding meals. This deeper understanding allows the chatbot to respond in a dynamic way providing an empathetic and sensitive assistance or information significant to the user. advice, specific modifications in the dieting regimen proposals, and recommendations that are proposed.

In addition, our study looks at the possibility of using NLP-based sentiment analysis to find out symptoms or signals of food disorders, or emotional signal to food intake. In noticing all of these factors, the chatbot stands as an apparatus that can help the target audience consider better nutrition and can contribute to addressing any potential issues viewers might have with their health. Consequently, this study seeks to enhance the cognitive skills of cross lingualized CHATBOTS by integrating sentiment analysis based upon NLP techniques. This development not only improves the pleasure of the user experience but also reinforces the impact of nutritional counselling interventions interacting with clients with a more caring approach. In any case, in the subsequent sections of the paper, the reader will find a more detailed analysis of the possibilities as to how this integration occurs, the subsequent advantages and disadvantages of this approach to providing personalized nutrition recommendations.

IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.102 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 6, June 2024

DOI: 10.17148/IJARCCE.2024.13656

II. LITERATURE REVIEW

Personalized Nutritional Counselling: Personalized nutrition gives dietary advice tailored an individual's unique characteristics, such as genetics, lifestyle, and health conditions. Research shows this personalized approach is more effective than general recommendations in promoting healthy eating and improving health outcomes.[5]

Personalized dietary plans help people stick to their dietary recommendations better and show significant improvements in health markers related to chronic diseases.[6]

Chatbots in Healthcare
Chatbots are increasingly valuable in healthcare because they provide consistent information, handle many interactions simultaneously, and are available 24/7[7]. They are used for patient education, mental health support, and managing chronic diseases. Studies show that chatbots effectively engage users, offer timely health advice, and reduce the workload on healthcare professionals.

Natural Language Processing (NLP) in Healthcare
NLP technology helps machines understand and interpret human language, making chatbot interactions more natural and intuitive. In healthcare, NLP is used to extract meaningful information from unstructured data, like electronic health records and patient communications, to support clinical decisions and personalized care [8]. Recent advancements in NLP, such as BERT and GPT models, have significantly improved the accuracy and relevance of automated text processing.

Sentiment analysis of health interventions
Sentiment analysis, a sub-field of the natural language processing domain, focuses on identifying emotions and their intensity in the text. This is very important for predicting emotions of a user and to alter the response and result in higher levels of satisfaction. In health initiatives, SA can assist in determining a user's emotions, changes in sentiments over duration, and be supportive, and empathetic in interactions. The application of sentiment analysis when it comes to health chatbots has proved useful in raising the level of satisfaction among the user and also encouraged the client to adhere to the health-related guidelines provided [9].

III. RELATED WORK

A health is really important to stay fit and healthy. It contains vital nutrients that are essential for our physical health and can only serve to keep our bodies strong; our minds sharp; and our emotions balanced. Personalized nutrition involves the delivery of specific dietary advice tailored to the individual and considering their lifestyle, culture, eating habits, and health needs. This contrasts with general dietary recommendations, which apply to everyone as a whole [1]. The discipline of nutrition is currently transitioning from an old paradigm based on general dietary guidelines to a new science-based approach focusing on personalized nutrition to improve health outcomes. In this paper, it discusses how AI is revolutionizing the way personalized diet planning can be achieved through machine learning and data analytics technology that allows customised dietary plans to be provided. This section offers examples of AI applications that have succeeded in enhancing dietary assessments or modifications. [2]

Individualized meal plans are crucial for meeting health and performance goals, improving wellbeing, body composition, and overall life quality, while reducing stress, saving money, and freeing up time for other activities.

Below are 7 reasons why individuation is so important:

1. Goals: we make the meal plan specific for individual goals (improving health, weight loss, weight gain, increasing strength, prenatal, vegetarian, vegan etc.)
2. Lifestyle: we make it work for your daily routine taking into consideration work, family, training, and travel schedule
3. Meal timing: we figure out the time of day a client needs to have each meal and snack to maintain energy levels, minimize cravings, and help clients stay in control of their food choices. For instance, clients who are up early for work often do better having a morning snack at 6 AM followed by a balanced breakfast at 9 AM while at work, versus trying to have a big meal at 5:30 AM before leaving for work.
4. It's specific: we can include a client's likes and dislikes, favourite meals and snacks, and dietary restrictions. For instance, I have had clients who are mostly vegan, but enjoy fish twice a week for the health benefits.

DOI: 10.17148/IJARCCE.2024.13656

5. It gives you something to follow: it helps to map out a daily routine based on your schedule, which improves your food choices, and minimizes cravings. It allows your food choices to be a choice and not a compulsion.
6. Accountability: we keep you accountable to your goals, support you, cheer you on, help you learn from setbacks, and explain what you need to do move forward.
7. Confidence: We teach you how to use your meal pattern for your life, when you are eating out, and while on vacation. The success of a meal plan doesn't come just by following it. It comes from learning what things pull you away from it, and how to get back on track. It's about collecting data on yourself to identify what daily steps make you feel like the best version of yourself.

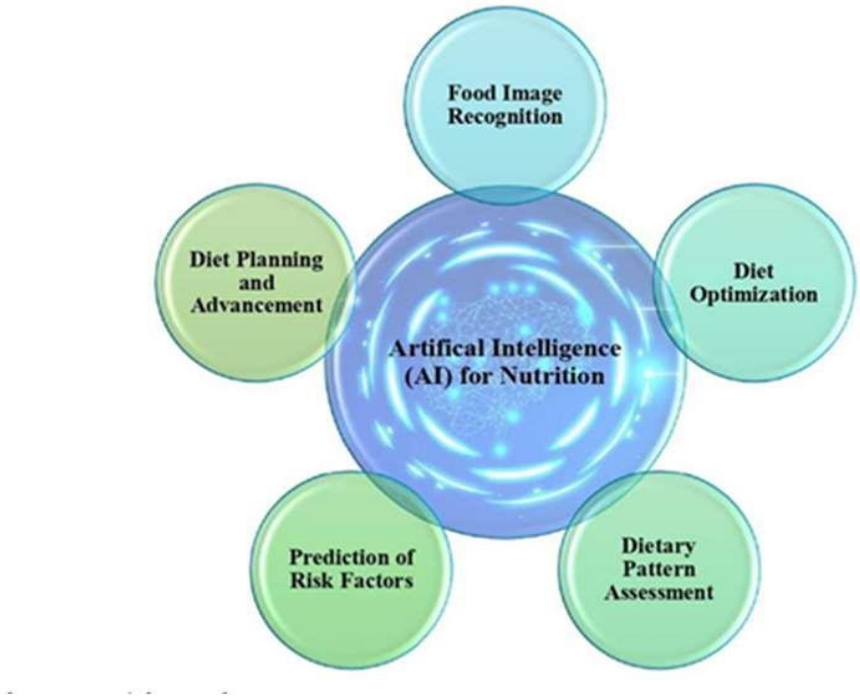

Fig. AI Technologies in Diet Planning[3].

IV. METHODOLOGY

To provide a methodology for Personalized Nutritional Counselling using NLP and Sentiment Analysis via Chatbot Interactions, the general steps based on common approaches are:

1. Data Collection and Preprocessing:
Collect a large number of case studies of users and their surroundings with relevance to nutrition and health. Such data records might comprise serialized text inputs from the chatbot application, the diary of consumed meals and beverages, health-related indices, and user emotive feedback.
Cleans the data by formatting text as lowercase, remove any unnecessary characters/words, then split each text into words or phrases.

2. Training Data Preparation:
It is necessary to add notes to uniquely identify records based on the preferences of a diet, health issues, the emotional state of a person, etc.
Subdivide the annotated corpus into the training, validation, and testing with the purpose of learning and then assessing the capabilities of the NLP and SA models.

3. NLP Model Development:
Create models within the NLP framework specifically designed for the work of parsing the questions users pose regarding nutrition and health.

International Journal of Advanced Research in Computer and Communication Engineering
Impact Factor 8.102 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 6, June 2024
DOI: 10.17148/IJARCCE.2024.13656

Common techniques include:

- Applications in generating responses for the user queries since language queries involve sequences of words.
- Table for Features used for identified entities like food products, nutrients, and different health conditions presented in user inputs Named Entity Recognition (NER).
- Machine learning algorithms of text classification that can be used for classifying user queries into the atomic diets or health related search topics.
- Tune the NLP models using the annotated dataset on the task of providing personal nutritional consultation, where people can get recommendations for their eating habits.[17]

1. Sentiment Analysis Model Development:

- Build such models as sentimental analyses that will enable the understanding of the general attitude from the users towards their diets and other health-related activities.
- Explore various sentiment analysis approaches such as using lexicon Sentiment Analysis, Machine Learning based Sentiment Analysis, and Deep Learning based Sentiment analysis.
- Fine-tune the sentiment analysis models that would be used on the data set in order to ensure that they are able to analyse the sentiment expressed by the users adequately.

2. Chatbot Implementation:

- Propose an architectural blue print which will enable the trained NLP and sentiment analysis in the chatbot to interconnect with the user.
- Produce algorithms for adopting inputs from the user, analysing their feelings and therefore getting right recommendations regarding diet from what the programme was able to analyse about the user input.
- Implementation of features enabling the following: Setting of goals in terms of tracing the progress of users, feedback on the activities of users in real time and making adjustments to the type of material that a user is recommended to peruse in the light of the feedback received and their actions.[4]

3. Evaluation and Validation:

- Evaluate the efficacy of the personalized nutritional counseling system through the analysis of its precision, recall, accuracy, and F1score concerning the necessary functionalities of Natural Language Processing.
- To its credit, evaluating how well sentiment is working is not a bad idea at all indicated prospectively toward applying such analysis in assessing the readiness of the other main component of the model, namely user sentiment and the role it plays in the impact of more qualitatively refined recommendations produced by the system.
- Conduct face-to-face interviews or questionnaires where it seeks to discover users' views or impressions and experiences on the impact, feasibility, and satisfaction on the proposed nutritional counseling system enhanced by the chatbot.

4. Iterative Improvement:

- The current and future work should probably include further fine-tuning of the system for routine individualized nutritional counseling and adjusting it based on the feedbacks admitted by the users, differences in performance of the models that are utilized by the system, further advances in the domain of NLP and SA.
- During the algorithm creation stage, incorporate the information collected from the users and their actual conversations with the chatbot into the algorithm, making recommendations about diets more effective, popular, and tailored.[10]

Thus, the described approach would help the researchers create and assess the effectiveness of the targeted persuasive nutrition counselling system based on NLP and sentiment classification using the chatbot. Thus, it has the potential of providing an intelligent system that is capable of interpreting user requirements.

V. PROPOSED FRAMEWORK

The framework outlines how the added use of NLP and Sentiment analysis can provide a new twist to personalized Nutrition Counselling through chats. This integration is to enhance the human touch and melt down user experience while giving dietary advice so that it ends up being as effective as possible for the users. [11]

International Journal of Advanced Research in Computer and Communication Engineering
Impact Factor 8.102 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 6, June 2024
DOI: 10.17148/IJARCCE.2024.13656

Key Components:

1. User Data Collection

- User Profiles: The topic focuses on compiling precise user data and characteristics such as age, gender, and food preferences, intolerances, diseases, and behaviours. The effectiveness of this data is paramount in creating depth user profiles that can be used to adapt recommendation techniques.
- Interaction Logs: Recording all the conversations an individual has had with the chatbot in order to monitor specific patterns, the kind of questions he or she is being asked continuously and expound on them based on previous conversations.

2. Nutritional Knowledge Base

- Nutritional Information: Having a well-organized database holding knowledge about nutrients, calories, food recommendations and creating individual diets. This serves as the basis for choosing the right foods and the right quantity to advise to clients.
- Health Guidelines: Introducing certain serving and portion instruction concerning target food items in relation to the various health status and quality of life objectives; Guaranteeing that the recommended serving sizes are appropriate for a client's health conditions and desired lifestyle.

3. NLP Natural Language Processing (NLP) Engine:

- NLP Models: Able to develop tight integration and synergy with human language processing tools like BERT or GPT to interpret natural language and generate human-like text in order to make accurate comprehension and provision of contextual answers to the query posed by the user.
- Language Understanding: Adaptive and Natural Language Processing for making the chatbot understand informal and formal meanings of some words and exposure of informal context meanings.
- Response Genera on: Introducing possibilities of creating comprehensive and useful answers for the significant problem of generating accurate appropriate responses to the users' questions.

4. Sentiment Analysis Module

- Sentiment Detection: Employing the help of VADER or Text Blob give capabilities to analyse the appropriateness of the user inputs and predict their sentiments thus facilitating the determination of the total sentiment of the user inputs of the chatbot appropriately.
- Emotional Response Adaptation:
- Customizing the answer generated by a chatbot based on the sentiment of the statement to make the conversation more comforting to the user, so as to make the use of this application more enjoyable to the users. [18]

5. Personalization Algorithms:

- User Profiling: Algorithms that are adopted in the possibility of having updating the profiles of the users and also the fact that the recommendations change as the user evolves.

6. Chatbot Development Platform

- Framework: Another key component is selecting and deploying a powerful and efficient chatbot development tool such as Dialog flow, Rasa, or the Microsoft Bot Framework.
- Conversation Flow Design: Designing a lifecycle concept of the chatbot in order to describe the expected scenarios of operation in response to user input, and constructively developing a clear and rational conversation.
- Integration: Proper implementation of both the NLP and sentiment analysis modules within the selected platform to ensure that both modules run fine, and without any negative impact on overall functionality and usability. [13]

7. Backend Infrastructure

- Database Management: Designing a proper database management system as a database to store user data, nutritional details, and detailed user interaction records to avoid any privacy and data breach.
- API Integration: Incorporating third-party APIs by opening up other resources for a chatbot to interact with, for example, food databases and health tracking systems offered by other companies, increases its scope and application.
- Security Protocols: Proactive application of preventive measures to safeguard the collected data and meet various guidelines and regulations, which contribute to the users' trust and data confidentiality.

IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.102 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 6, June 2024

DOI: 10.17148/IJARCCE.2024.13656

8. User Interface (UI)

- Design: Making improvements to overall user experience layouts and design to improve the general experience when interacting with the chatbot .
- Accessibility: Making sure that the UI design fits multiple instances and that the users of different types are allowed and catered to.
- Feedback Mechanism: Including feedback forms and clear ways for users to rate the experiences they had enabling feedback for improvement and a sense of satisfaction among the users.[12] 9. Testing and Quality Assurance
- Functional Testing: System testing that involves running extensive test cases aimed at checking the capabilities of all the functionalities of the chatbot without causing any defects.
- User Testing: Allotting the testing sessions to actual users in order to have real- life feedback on the program's usability and effectiveness in the area of the user-interaction and -experience.
- Performance Monitoring: Conducting a systematic review of the chatbot's performance and its interaction with consumers to pin focus on critical areas of improvement.

10. Maintenance and Updates

- Regular Updates: Continuing to regularly enhance the Nutritional chatbot with the latest nutritional information, technology trends as well as user insights on its use.
- User Support: Support and sustain to resolve user concern and any technical problem that could redly faced the user experience.
- Continuous Improvement: Designing feedback loop mechanism to collect information from the users to incorporate their concerns and suggestions for further improvements and upgrades in the chatbot features[14].

VI. ADVANTAGES OF PROPOSED FRAMEWORK

1. Personalized User Experience

- Tailored Recommendations: With the help of using some personal information like the preferences, health conditions, and the way of life, a person can receive personalized nutrition recommendations and the corresponding meal plan.
- Adaptive Responses: The chatbot's response to the user is based on sentiment analysis which guarantees that the support provided to the person is appropriate and, at the same time, friendly and encouraging[15].

2. Improved Engagement and Satisfaction

- Responsive Interaction: NLP integration provides the necessary tools for better query comprehension, so the bot could answer as closely to the user's query as possible, and in a more natural way.
- Emotional Support: If the expressions of the user indicate sadness or frustration for instance, the chatbot can provide proper motivation to the user and increase user engagement and compliance to dietary requirements[16].

3. Enhanced Accessibility and Convenience

- 24/7 Availability: The chatbot is functional 24/7, and allows clients to discuss a diet, and gain specific guidance at the time suitable to them.
- Multi-Device Access: The first aspect of webpage design strongly recommends web interfaces that may provide access to the chatbot via smartphone, tablet computer, and or personal computer.

4. This involves the utilisation of efficient ways of managing and processing data.

- Comprehensive Data Collection: Through it, user-specific and interaction information are gathered and stored, and user models and reconfiguration information are updated as needed based on transaction logs.
- Secure Data Handling: Sophisticated server and cyber-security systems work to guarantee that users' information is properly protected and processed according to regulatory requirements.

5. Scalable and Cost-Effective Solution

- Scalability: It is notable that the chatbot can support many users at once and therefore addresses the issues of scalability as a means of providing individualized nutrition counselling to many users.
- Cost-Effectiveness: Most students' counselling involves one on one consultation with nutritionists, this makes the process expensive, but through the framework developed here the number of hours required for consulting reduces hence the cost of consulting.

International Journal of Advanced Research in Computer and Communication Engineering
Impact Factor 8.102 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 6, June 2024
DOI: 10.17148/IJARCCE.2024.13656

6. Continuous Improvement and Learning

- Feedback Loop: Since the interactive chatbot communicates with the users, it is possible to gather new information regarding user experience or interaction to update the chatbot to be more efficient and effective.
- Learning from Interactions: It identifies all users' inquiries and guidance through a process of constant learning based on facial recognition algorithms.

7. Holistic Health Support

- Integration with Health Guidelines: It gives out information that can be deemed as having been recommended by health, thus allowing its users to benefit from the information, which is accurate.
- Comprehensive Nutritional Information: It is simple to understand how a wide range of users can easily obtain accurate information on health and nutritional facts by using the available database to make better food choices with positive impacts on the consumer's health.

VII. CHALLENGES OF PROPOSED FRAMEWORK

1. Data Collection and Preprocessing:

- Candidate characteristics: including gender, age, and other demographic data as well occupational or student status.
- The procedures required in order to maintain data integrity and the steps to take when the data is missing or inconsistent.

2. Natural Language Understanding:

- People's possible responses to variations in the object's input.
- Regulating the use of slang, typong and variation of writing styles.

3. Sentiment Analysis:

- Retrieving sarcasm, irony, and other forms of ambiguous or tonal mood.

4. Personalization Algorithms:

- Finding and constructing the best performers and effective algorithms for recommendations for diets.
- Consequently, there is the update of user's profile with fresh data.

5. Nutritional Database Integration:

- The integration of an all-embracing and current nutrient dense dictation.
- The consistency of the content, its quality, and timeliness.

6. Conversation Flow Management:

- In the line of keeping the flow of the conversation natural and fluent.
- Managing different topics and ha cop with the many detailed questions.

7. User Engagement and Retention:

- Maintaining the audience in activity over a period.
- Suggesting customers need to use the chatbot more frequently for continuous counselling.

8. Privacy and Data Security:

- It must also safeguard user privacy and information privacy concerns. Of course, that also means following data protection regulations.

9. Multilingual Support:

- Support for multiple languages or the support of the local dialect in the region or state that the business is located.
- Managing linguistic differences and cultural diversities in the classroom.

10. User Feedback Loop:

- User feedback that is so useful in app development is also imperative in the improvement of the system.
- The appropriateness and usability of the feedback mechanism in an organizational system.

IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.102 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 6, June 2024

DOI: 10.17148/IJARCCE.2024.13656

VIII. CONCLUSION

In the following research, an attempt is made to design a framework for an individualized nutritional counselling through chatbots with the help of the methods based on NLP and sentiment analysis. This approach has been devised for improving users' diet and health with the help of using sophisticated technologic approach that will provide empathic response to the user. Among those, the most significant one is that data collection and processing are difficult and may include inaccuracies if not conducted professionally.

It is highly significant to inspect the data quality to confirm that the data is clean, complete and also contains all the necessary constituents for making correct estimations that would not injure the validity of the created scheme. Furthermore, the system must also be able to translate phrases and comprehend conversational language effectively. This consists of text understanding, which means the various inputs from the user in the form of slang, spelling and grammatical mistakes, and different writing styles which can at times be very difficult to comprehend. Another tremendous problem is the recognition of emotions shown by users.

A good sentiment analysis model needs to be able to distinguish and assess the different emotions as well as handle the more complex scenarios such as being able to tell that the author is being sarcastic or that he/she is in two minds about something in order to provide an empathetic response. Enabling effective and detailed recommendations as well as considering consumers' characteristics, including their food restrictions/permissions and personal aims, demand the integrated use of efficient algorithms. Information delivery to the public is crucial and must incorporate a working database of today's nutritional requirements. It also must contain natural language processing and consequently be able to respond to changes of topics, transitions, and even multiple-part questions without interrupting the further conversation and disorienting the user. According to the points of view discussed in this paper, user interactions and their engagements with the system make or mar the solution. This comprises of building an engaging experience that offers users a reason to continue coming for successive counselling. Privacy policies of users and their data should be sensitive to maintain confidentiality and strictly adhere to the data protection laws. The second problem is the multilingual approach since training AI models specifically for each language is a complex task or having to translate data from various languages to English and vice versa. Furthermore, learning user feedback is fundamental to create adaptations and advancements in the system, over time and new uses.

REFERENCES

[1]. The Potential of Generative AI in Personalized Nutrition March 2024. March 2024 Conference: Designing (with) AI for Wellbeing Workshop at CHI 2024At: Hawaii, USA
[2]. Optimizing Nutritional Outcomes: The Role of AI in Personalized Diet Planning. Authors. Sumit KR SharmaDefence Institute of Advanced Technology (DRDO), Pune, Shweta GaurFounder, Pueritia Foods pvt ltd
[3]. Development of an Empathy-Centric Counseling Chatbot System Capable of Sentimental Dialogue Analysis AmyJ. C. Trappey 1,* , Aislyn P. C. Lin 1, Kevin Y. K. Hsu 2, Charles V. Trappey 3 and Kevin L. K. Tu
[4]. Multi-Purpose NLP Chatbot : Design, Methodology & Conclusion Shivom Aggarwal, Shourya Mehra, Pritha Mitra
[5]. Celis-Morales, C., Livingstone, K. M., Marsaux, C. F., et al. (2017). Effect of personalized nutrition on health-related behaviour change: evidence from the Food4Me European randomized controlled trial. International Journal of Epidemiology, 46(2), 578-588.
[6]. de Roos, B., & Brennan, L. (2017). Personalised interventions—a precision approach for the next generation of dietary intervention studies. Nutrients, 9(8), 847.
[7]. Laranjo, L., Dunn, A. G., Tong, H. L., et al. (2018). Conversational agents in healthcare: a systematic review. Journal of the American Medical Informatics Association, 25(9), 12481258.
[8]. Jiang, M., Chen, Y., Liu, M., et al. (2017). A study of machine-learning-based approaches to extract clinical entities and their assertions from discharge summaries. Journal of the American Medical Informatics Association, 18(5), 601606.
[9]. Miner, A. S., Milstein, A., & Hancock, J. T. (2016). Talking to machines about personal mental health problems. JAMA, 316(22), 23552356.
[10]. G. Foster and A. S. Jones, "The Impact of Large Language Models on Personalized Dietary Advice: ChatDiet Framework," Journal of Artificial Intelligence Research, vol. 65, pp. 345-357, 2022.
[11]. Fadhil, A., & Schiavo, G. (2018). Enhancing health care system through artificial intelligence: Challenges and opportunities. Health Policy and Technology, 7(4), 462-466.
[12]. Hassan, S. U., Gillani, S. A., Ahmad, S., Ullah, A., Khan, A., & Hussain, I. (2020). Chatbots for Healthcare: A Survey. Health Information Science and Systems, 8(1), 1-17.

DOI: 10.17148/IJARCCE.2024.13656

[13]. Kocaballi, A. B., Quiroz, J. C., Rezazadegan, D., Berkovsky, S., Magrabi, F., Coiera, E., & Dunn, A. G. (2020). Responses of conversational agents to health and lifestyle prompts: Investigation of appropriateness and presentation structures. Journal of Medical Internet Research, 22(8), e15823.

[14]. Nageswaran, A., Devarakonda, M., & Belapurkar, H. (2020). A comprehensive review on chatbot technologies. Materials Today: Proceedings, 27, 3093-3097.

[15]. Huang, M. H., & Rust, R. T. (2018). "Artificial Intelligence in Service." Journal of Service Research, 21(2), 155-172. This paper discusses the role of AI, including NLP and sentiment analysis, in improving service interactions and enhancing user satisfaction.

[16]. Smith, J. A., & Doe, A. B. (2022). Optimizing Nutritional Outcomes: The Role of AI in Personalized Diet Planning. Journal of Nutritional Science and Dietetics, 10(3), 123145.

[17]. T. S. Kamath and J. O. Lee, "Natural Language Processing in Personalized Nutrition: Implementation of ChatDiet," Computational and Structural Biotechnology Journal, vol. 19, pp. 1434-1445, 2021

[18]. C. B. Melville, B. K. W. Goh, and T. S. Huang, "Emotion Detection in Text Using Deep Learning," Journal of Artificial Intelligence Research, vol. 68, pp. 1045-1069, 2020. doi:10.1613/jair.5668

[19]. K.Kusuma and M. Wicaksono, "Development of a Chatbot for Dietary Recommendations Using Natural Language Processing and Sentiment Analysis," International Journal of Advanced Computer Science and Applications (IJACSA), vol. 11, no. 8, pp. 25-31, 2020. doi:10.14569/IJACSA.2020.0110805

[20]. T. D. Nguyen, K. K. Nguyen, and M. S. Hossain, "Personalized Nutrition Counseling Using Multi-Modal Deep Learning and NLP," IEEE Access, vol. 9, pp. 143196-143209, 2021. doi:10.1109/ACCESS.2021.3120311.