AI-powered Nutrition Analyzer For Fitness Enthusiasts

IBM-LITERATURE SURVEY

UNDER THE GUIDANCE OF

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Abstract

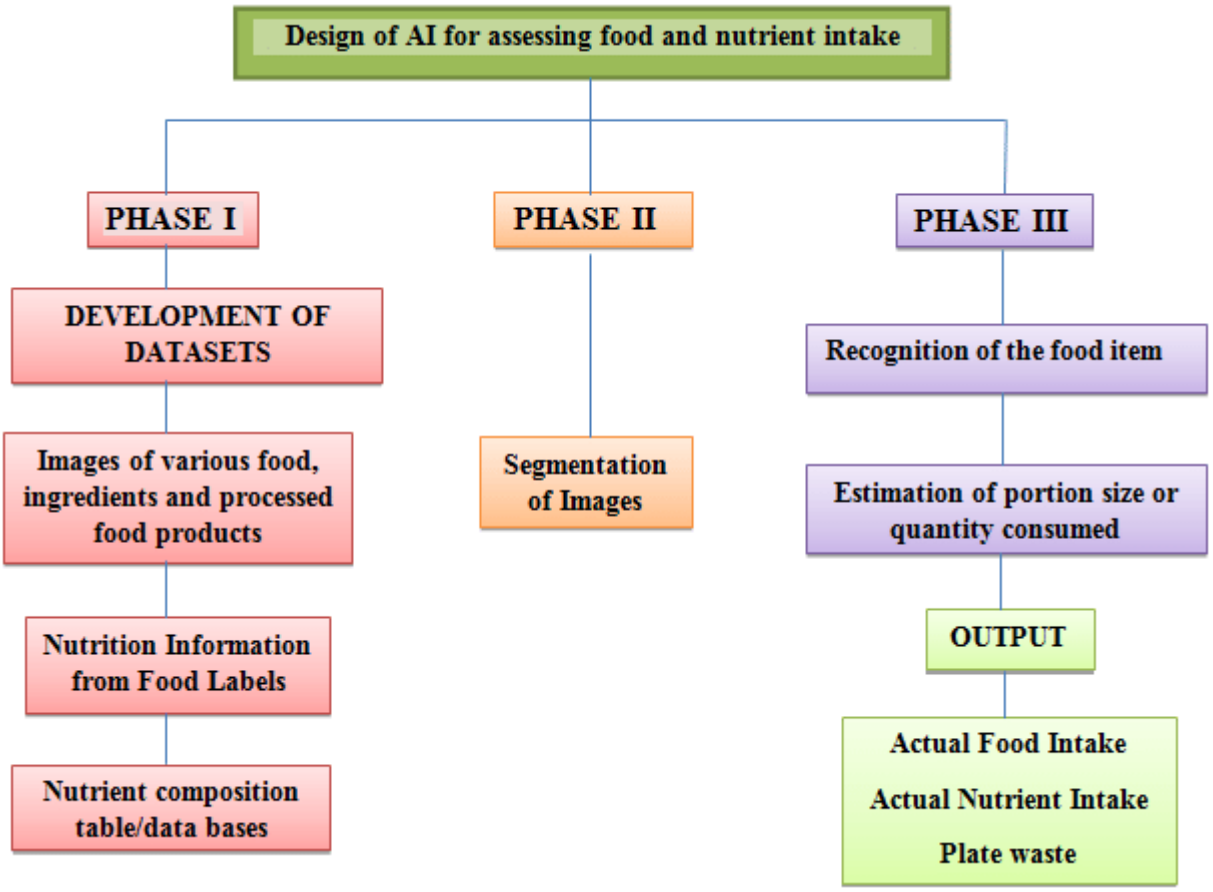
Artificial Intelligence can be applied in multidisciplinary fields, including patient service and care. It enables precise and personalized medical nutrition care by assessing food and nutrient intake, nutritional evaluation. The application of AI for the provision of food services to hospitalized patients is of immense scope. This review details the various ways through which AI can be applied for nutrition assessment. Even though commercial AI-based nutritional assessment systems are available, many do not evaluate the nutrient intake, and the data available through them were not validated. Fat Secret is a commercially available AI-based food and nutrient assessment system that can evaluate the food's calorie content. Also, the major challenge posed by such systems is the availability of locally appropriate data sets. Hence further research and validation are essential in this field.

INTRODUCTION IBM defined Artificial intelligence (AI)

human-like intelligence exhibited by a computer, robot, or other machines".[1] Artificial intelligence enables computer programs to learn from datasets that indicate cases and knowledge, identify substances, and help in decision-making by solving the problems. AI has a vast area of applications, including the provision of health and nutrition care.[2] Precision Medicine and personalized nutrition are the areas where AI can contribute a lot. Precision medicine uses datasets of earlier interventions using advanced diagnostics and tailoring better and economically personalized treatments. Corinne et al.[3] proposed to define personalized nutrition as "a field that leverages human individuality to drive nutrition strategies that present, manage and treat disease and optimize health." Nutritional status assessment of the patients can be determined by using lab tests and general and specific nutritional assessment tools such as Malnutrition Screening Tool (MST),[4,5] Mini Nutritional Assessment-Short Form(MNA-SF), [6] Nutritional Risk Screening(NRS),[7] Short Nutritional Assessment Questionnaire (SNAQ),[8] Simplified Nutritional Appetite Questionnaire(SNAQ),[9] Generated Subjective Global Assessment(PG-SGA),[10] Nutrition Risk in The Critically Ill (NUTRIC),[11,12] Modified Nutrition Risk in The Critically Ill (NUTRIC) [11] and American Society for Parenteral and Enteral Nutrition(ASPEN).[13.14] The different datasets brought out after the application of these nutritional assessment tools include demographic data, anthropometry, and its changes, details of food and supplement intake and appetite, changes in taste and satiety, level of physical activity, metabolic demands, data concerning physical activity, Acute Physiology, Age, Chronic Health Evaluation II(APACHE II), SOFA(Sequential Organ Failure Assessment(SOFA) Score15.However, the physicians' effective use of these data to address the issue of development of malnutrition at hospitals is reported to be very low.[14] In this regard, artificial intelligence can play a more significant role in personalized nutrition and the assessment of individualized nutritional recommendations and meal plans that can improve the patients' food and nutrient intake. Furthermore, it can identify patients at risk of malnutrition and can provide advice to enhance nutritional status. Assessment of Food and nutrient intake by using AI Twenty-four-hour recall of food

intake, food diary, and three-day food weighment survey are the globally accepted methods to assess food and nutrient intake of a person. These methods are time-consuming and require skilled persons to interview the patients and collect the data. They primarily rely on the memory of the person to be investigated.[15] Hence the accuracy of the data is minimal, especially if the person is elderly or affected with diseases that can affect memory, such as dementia and Alzheimer's disease

Pharmaceutical and Medical Research 171 safeguards well-being and lessens the functional decline due to ageing[16] and disease conditions. Reliable and accurate food and nutrient intake data are essential to plan and assess the effect of therapeutic menus for a patient under medical care. Earlier studies reported that the reliability of the data obtained through traditional methods might be biased due to incorrect estimation of the food intake data.[17] Moreover, the data does not provide any evidence or truthfulness of the menu consumed. Yulika and Alex[18] used face recognition or a vision-based system to recognize the food items and portions consumed to solve the issue. Earlier, the technique of face recognition was applied in specific user interfaces for cell phones and was used for the development of food recognition and portion estimation.[19] Face recognition images will form the datasets for such systems. Similar datasets of images of diff



Accurate dietary assessment and food and nutrient intake information may lead to healthier diets and better clinical outcomes. This is particularly important for providing

nutritional care to those with obesity and diet-related non-communicable diseases. In such cases, precise evaluation of food and nutrient intake enables glycemic and lipidemic control. Miscalculations in carbohydrate intake and counting can affect the dose fixing of insulin.[22]

Furthermore, proper nutrition data is essential to manage immune-compromised conditions. Algorithms developed based on the data sets such as food and ingredient images, nutrition information from food labels, and nutrient composition databases enable the nutritional

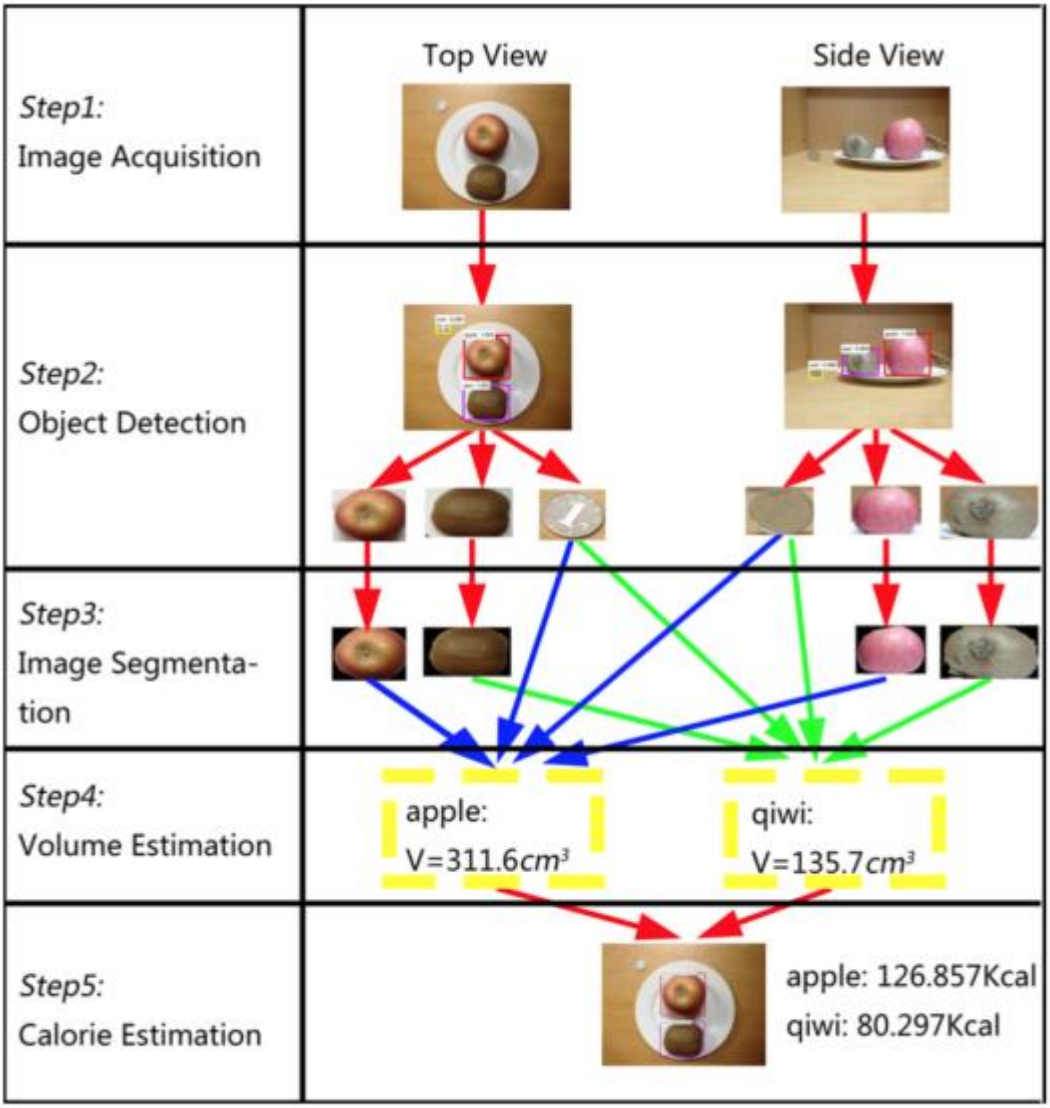
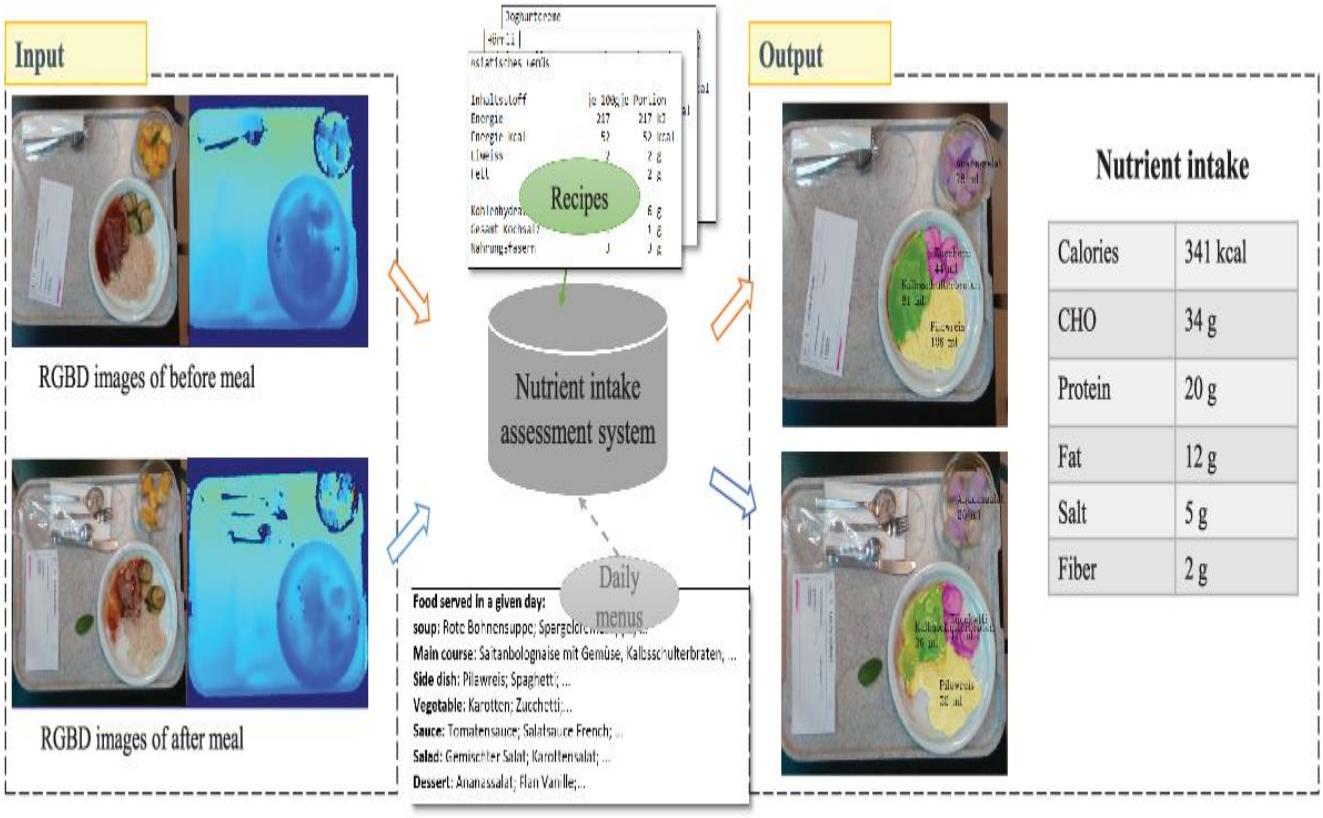


Figure 1: Calorie Estimation Flowchart

Challenges in the application of AI for Nutrition

The major challenge for applying AI-based food and nutrient intake monitoring data is that a specific program is not fit for all cuisines and meal patterns across the world. The regional differences in the gastronomy of the

populations pose a real challenge in the development of appropriate necessary data sets for deep learning Moreover, even within a region; the food items served to a patient differ from hospital to hospital. Standardization of meals served in hospitals under the same management is recommended to ease the task



CONCLUSION

Hospital food services are in continuous search for providing ways and means to provide high-quality patient care and service through food and nutrition service. AI-based nutrient intake assessment system is of immense value to obtain and assess food intake data in isolation wards and for the follow-up without contact. Further research and developments in the application of AI on nutrition assessment and management are recommended.

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