# Intelligent Food Recommendation System

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## Introduction

Are you bored of cooking the same meals over and over? Do you get to 6pm and have no idea what to make for dinner? If so, then this is what you’ve been looking for!

This project will create an intelligent food recommendation system that assists the user in choosing what to eat for dinner. It will take many things into consideration such as health information and ingredients of the food, user’s preferences and allergies as well as the age and gender of the user and present a list of recommended foods for them to choose from.

## Problem Description

Dinner, for most people, is the main meal of the day but trying to ensure that what you cook is healthy and exciting can be difficult. A lot of people struggle deciding what to eat and don’t have the time to search through websites or recipe books to find something healthy and satisfying. This can lead to them ordering fast food which is not a good habit as doing this regularly causes many health conditions such as obesity [1].

Eating a healthy, balanced diet is an important part of maintaining good health, and can help you feel your best [2]. The exact amount of calories and nutrients you need depends on a range of factors including, your age, sex, height and how active you are [3] which is why this project will use majority of these factors to decide if a meal is healthy or not.

Athletes, or people that lead a very active lifestyle, tend to be very busy around dinnertime as they may be rushing to eat something quick before going to training. Good nutrition is essential for achieving and maintaining optimal athletic performance [4] so having a quick and easy way of deciding what to eat for dinner is vital.

### Existing Approaches and Solutions

There are many different Food Recommendation Systems out there with different focuses and approaches below are a few that I found interesting.

The first approach I’d like to talk about is one that finds similar users **based** on user evaluation on **food** expanded with **food features**, and products Top-N **recommendations** for the target user [5]. This approach may be successful at finding foods similar to that of which the user normally eats but it won’t be able to recommend food that could improve the user’s diet.

Another approach that has been proposed involves recommending various recipes based on the available raw food [6]. Whilst this is a good idea in theory it will either take up a lot of the users time in submitting their available food or, as proposed in [6], the use of an NIR system consisting of sensors to measure the food.

A different project decided to focus on preventing and treating cancer through nutrition. It created a model able to predict the cuisine from a set of ingredients and then estimated the probability of negative recipe-drug interactions based on the predicted cuisine [7].

An approach proposed by the *ICT-ISPC* [8]takes a set of the user’s favourite dishes and recommends meals based off ingredients extracted from these dishes. This approach uses an integration of a deep neural network with a recommendation system with Thai food as the test domain. An interesting part of this proposal is that the system also collects history of selected dishes along with user profile in a database so that it can then use a temporal prediction model on the profile and eating history to make the next recommendation [8].

The current food recommendation approaches out there are successful at predicting food for certain situations. The first one, for instance, can recommend food that the user is accustomed to and will enjoy; the second will be able to recommend something that the user has the ingredients for; and the third can identify a cuisine that the user will enjoy.

The system suggested by[8]is the one that I think is the best approach but for their proposal they had to limit themselves to just recommending Thai food which is not a limit I want to have on my system.

### My Approach

The system that I would like to design is one that is able to recommend healthy food, that suits the users’ preferences and is also able to be used by a wide range of people.

To ensure that the system recommends healthy food, a machine learning model will be created that is able to predict if a food is healthy or not. As suggested by[8]*,* I think that the best way to predict the next dinner that the user would like to eat would be by using a temporal prediction model on the users’ profile and eating history. Unfortunately, with the time constraints on this project preventing me from being able to collect the historical data needed through user interaction with my system and with no readily available dataset of user eating history I have to take a different approach. The approach that I have decided to take is to create a user preference profile from a questionnaire that the user will take on creation of an account. This user profile will be used alongside the machine learning model to recommend a healthy, personalised list of recommendations for the user.

I will also be saving the users’ selections so that the that user history will be available for future development of the system.

## Goals and Requirements

This project aims at providing healthy recommendations for dinner so that people can improve their diet. There are 2 main goals that need to be achieved in order to do this:

1. Create an **intelligent algorithm** that predicts healthy meals for different age groups, using the meals’ ingredients and nutritional information.
2. Build a **web application** that allows the user to enter their preferences and that displays the recommendations along with detailed information about the meal

### Intelligent Algorithm Requirements

* Train a dataset
  + Gather a dataset of recipes that includes ingredients, nutritional information, method and an image
  + Label recipes in the dataset (healthy/not healthy) for different age groups
  + Split the dataset into training and testing images
* Run algorithm on dataset
* Evaluate accuracy of model

### Web Application Requirements

* Display list of food
  + Show a list of the top 10 recommendations alongside images of the food
* Display detailed food information
  + Allow the user to see more information about the food such as nutritional information, ingredients and method
* User Preferences
  + Allow the user to input some of their preferences such as allergies or food they don’t like

### Nice to Haves

* Advanced search were the user will be able to enter more specific data such as nutritional goals that they are looking for in the food (e.g. high protein) or what type of meat/carbs they would like to eat (e.g. chicken/pasta).
* Saving user history so they can keep track of what they have eaten previously

### System Architecture

The project will be created on the IntelliJ IDE and will use a range of different software, hardware and programming languages.

MAMP is the local server environment that will be used with MySQL for the database.

The backend service will be a spring boot application written in java that communicates with the front-end UI through a RESTful API.

The frontend will be made with Angular that uses typescript and HTML to create the UI.

Diagram

Description automatically generated

Diagram

Description automatically generated

Feature Breakdown

## Success Criteria

Achieve the two main goals: creation of an intelligent algorithm that can predict if a food is healthy; a web application to display recommendation

* Create an accurate machine learning model
  + Measured by evaluating metrics of the model such as accuracy
* Display the list of food and more detailed food information in an user-friendly way
  + Assessed through user acceptance testing at the end of the project and will be achieved if the user finds the application easy to navigate
* Recommend food that is healthy
  + Assessed through user testing at the end of the project were a user from each of the age groups will determine if they have been recommended healthy food
* Recommend food that is specific to the user’s preferences
  + Evaluated through user testing

## Development Plan

To develop this application I will use an agile software development methodology this means that I will use short cycles of work that allow for rapid production and constant revision, if necessary.

### Key Milestones

Initial Project Description and Work Plan ------------------------------------------- 23/10/2020

First Prototype of App ------------------------------------------------------------------- 08/12/2020

Interim Demo to supervisor ------------------------------------------------------------ 11/12/2020

Problem Description, Solution Approach and Work Plan ----------------------- 08/01/2021

First Prototype of Model ---------------------------------------------------------------- 21/02/2021

Second Prototype of App --------------------------------------------------------------- 21/03/2021

Final Dissertation ------------------------------------------------------------------------- 23/04/2021

Video Demonstration -------------------------------------------------------------------- 28/04/2021

Table, calendar

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Plan for 2nd Increment 11th Jan – 21st Mar

Plan for 1st Increment 2nd Nov – 10th Jan

1st Prototype

2nd Prototype

1st Prototype

Example of Sprint In Progress 16th Nov – 29th Nov

# Graphical user interface, application Description automatically generated

## Current Progress

I am currently approaching the end of the first increment and the work that has been completed so far is:

Machine Learning Algorithm

* + - Dataset has been gathered will all the relevant information
    - Data has been cleaned and labelled
    - Data has been split into training and testing sets

Web Application

* + - First prototype completed
    - Able to pull recipes from the dataset into the service
    - Can display 10 random recipes on the UI
    - Can display the selected recipes’ information

### Miro Board Link

<https://miro.com/app/board/o9J_kguFV0E=/>

# References

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