CS551H - Natural Language Generation Assessment 3-
Group - MedicalOne

Prototype Notes

Implemented functionality

- The prototype produces two types of reports, one for nutritionists and the other for patients
  - Content and phrasing are adjusted for the two different audiences
  - Client report using informal/non-technical language with only limited details, encouraging phrases and additional resources for further info if required
  - Nutritionist report with all technical in-depth analysis of each patient
- Both reports were planned based on a sample specialised nutrition report [1]
  - Not all information in this report was included in the dataset. We marked the sections that weren't implemented due to lack of relevant information using a grey text.

Used technology

Arria Studio NLG

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[1] https://source-e.net/wp-content/uploads/2017/03/NutritionConsultationReport-2.pdf

Limitations and problems

limitation	problem	workaround
The used client name is generated	Dataset anonymised	set up a random name generator
The provided nutrition suggestions are limited	Dataset did not have diet information for each client (e.g. vegan, allergies, ...)	Generated suggestion based only on unbalanced nutrients
	Dataset needed cleaning and preprocessing	Manual data preparation (e.g. Null values, duplicated information, …)
Data correctness/ completeness issues (e.g. calorie intake impossibly lower than normal)	lack of participants commitment to log their food and/or exercise	In cases of suspected incomplete log, it was marked as possibly insufficient
Some sections have limited information (current eating habits, nutrition goals, purpose of consultation, medical conditions) regarding more precise targets, caloric needs	lack of data	developed a python data scraper form My Fitness Pal using the provided accounts. We faced authentication errors due to inaccurate login data
Meal recommendation functionality is limited	Limited time	Current recommendations are hard coded but ideally would be personalised using the client data and a general-purpose food database api such as [2]

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[2] https://spoonacular.com/food-api

Project File Structure

Project Folder	Description of Contents
Profile	*ProfileText* is the main script that generates basic patient information text: name, age, height, weight, BMI, job
PurposeOfConsultation	*ConsultationText* is the main script that generates a text about the reasons for the consultation making use of three scripts *goalText, activityText* and *nutritionText* which extracts data from the dataset and turn it into readable phrases
NutritionGoals	*NutritionText* is collecting goals related to nutrition for the consultation
MacroDistro	*MacroDistroText* calls the script *MacroTarget* which analyses the patient weight-related goal (lose,gain or keep) and produce a suitable macronutrients break-down based on that.
CaloricNeed	*CaloricNeedText* first calls *BMR()* function to compute the patient's Basal metabolic rate and from that, the *caloric_needs()* computes base caloric intake for sedentary state. *additional_cal_hr()* computes additional calories for three types of activity strengths. *CaloricIntakeState* analyses the energy intake whether it's close to the target or not and by how much (if the logged data is suspected to be incomplete, a foot note will be displayed to show this). And finally, *closest()* generates information about the best day during the two weeks duration.
QualityOfMacronutrients	*QualityOfMacroNutrientsText* calls *chooseRandom* to provide a random assortment of healthier snacks for the patient.
MacroQuantity	*MacroQuantityText* is the main script, which reports on the nutrient intake using the *MacroQuantityPhrase* and *sufficientNutrients* scripts. This section also offers relevant food suggestions through *suggestionPhrase* and *suggestionList*, alongside the caloric targets for the client through *caloricTarget*.
CurrentHabits	*CurrentEatingHabits* reports on the user's average progress towards the nutrition targets. *WeeklyMean* formats the phrasing for the weekly breakdown, and *FortnightMean* covers the two week period.

ExerciseSummary	*exerciseSummaryText* is the main file, which reports on how well the patient's exercise met the set targets. *weekExercisePhrase* formats the content for each week.
Summary	*summaryText* is the main file used to summarise the information across the report, with the helper files *activityLevel*, to transform the raw data into a 3rd person narrative.
util	Contains utility files for across the project, including *notNull* for filtering reported data prior to averaging, *variation* to include variation in the generated text, and *reference* to produce a sensible referencing format for the patient.

Sample nutritionist report with section explanation

Nutrify - Nutritionist Report	**Description**
Name: Chris **Age:** 18 **Gender:** Female **Height:** 1.56m **Weight:** 48kg **BMI:** 19.72 Body Fat%: 11% **Job Field:** Science and pharmaceuticals **Employment Status:** Unemployed and studying Job: Teaching Assistant **Days of exercise per week:** 3 Sports or activities: Cyclo-cross, road cycling, mountain cycling	Profile: Contains basic information about the client: name, age, computed BMI, …
Purpose of consultation: Chris's goal is to maintain her current weight. Currently, she is lightly active, spending a good part of the day on her feet. The nutrients Chris is interested in are carbohydrates, protein, sugar, fat, and sodium. She provided the following reason(s) for a nutrition consultation: "Learn about my nutrition and how I can improve and be generally more healthy". She stressed the importance of finding healthier snack options and wanted to make sure she was getting the proper amount of macro and micronutrients throughout the day. Overall fitness is excellent, this is more of fine tuning her nutritional strategy. Chris also stressed need for pre and post race nutrition strategy for optimal performance and recovery.	Information regarding the reasons for the dietitian consultation: ·Do they want to lose/gain/keep their weight? ·What is their activity level? ·What are additional personal reasons if any?
Identified Nutrition Goals: - Monitor intake of sodium and protein - Optimize nutrition/ supplementation strategy through discovering what her needs are. - Avoid weight gain with reduction of training volume - Learn how to optimally fuel her workouts for training as well as racing.	Goals regarding nutrition aspect: ·What macro nutrients to monitor? ·Special goals for the client.

Approximate Macronutrient Distribution:

She has a target breakdown of approximately 25-35% protein, 25-35% fat and 30-50% carbs.

A two-week analysis showed an average of 48% carbohydrate/ 28% Protein/ 24% fat

·Macronutrients break-down computed for the client depending on their goals.
·The current break-down from the food diary

Caloric And Macronutrient estimated needs:
- Estimated BMR: 1,204
- Estimated caloric needs w/o activity: 1,445 kcals
- Additional Caloric needs from Exercise:
    - ~ 100 kcals/hr of light exercise/day
    - 200 - 300 kcals/hr of moderate exercise/day
    - 300 - 600 kcals/hr of continuous strenuous Exercise/day

The two weeks food log conveyed the recommendation for a higher amount of protein and complex carbohydrates, to take the place of some simple sugar snacks that she consumes throughout the day. The total caloric amount will only be slightly lower but the quality ofthe foods will be more nutrient dense and elicit less fat storage and augment greatersatiety to avoid overeating.

Daily Caloric amount consumed was consistently considerably lower (by 72%) * than her estimated need (1,656 kcals) on non-training days.

However, her closest day to the caloric intake target was on week 2 where she consumed %93.44 of the target (equivalent to 1,547 kcals).

this estimation may not be accurate due to lack of logged intake

·Computed estimate of the calorie intake target based on the goal and the patient's body measurements.
·Estimated additional calorie intake in training days with different intensities.
·Current calorie sources analysis with suggestions.
·Current state of calorie intake.
·If logged data is suspected to be incomplete, a footnote is displayed to clarify this.

Quality of Macronutrients:

Improving the macronutrients quality in the body is essential to improve the nutrition status.

In order to increase the quality of micronutrients, she should find a healthier alternative for her snacks as those are a main factor in determining the micronutrients. Such healthier snacks include:

Apples: Rich in vitamins and minerals. Helps avoiding heart diseases

Nuts: Rich with fibers, vitamin E, and plant sterols.

Carrots: Good source of beta carotene, fibre, and vitamin K1.

Hummus: Low in carbs. Rich with protein and fibre.

Avocado: Great source for vitamins C, E, and K..

·Suggestions for healthier macronutrients sources
·Currently, hard-coded general advice but can be tailored to the client once the data regarding the food log is available.

Quantity of Macronutrients

By analysing the food log, Chris's macronutrients intake has:

- Sodium intake was less than the target.
- Protein intake was less than the target.
- Carbohydrates, sugar and fat intake was routinely sufficient .

Recommendation:

In order to meet her need, Chris should seek to ensure a source of sodium. Sodium healthy resources include salted nuts, olives and cheese. Also, she should seek to

ensure a source of protein. Protein healthy resources include meat and meat products, fish and eggs, while plant-based options include soy and tofu products, beans and nuts. The daily caloric needs change based on whether she is exercising on that day. Given her desire to keep her actual weight, she should seek to hit a target of ~1,660 kcals on non-training days, and 1,860 to 1,960 kcals on training days. The specific recommendations for how many calories to add depends on workout intensity and duration.

·The unbalanced macronutrients and their state (above/below) target.
·The balanced macros
·Recommendations regarding what to eat more and what to avoid based on the analysed macronutrient status.
·Suggested calorie intake into lose/gain/keep weight with variations for training days.
·The previous calorie delta (how much less/more from base value) computed based on the BMI. For an obese patient it's 40% of their base value and for 20% non-obese.

Current Eating Habits

Based on the last 7 days, Chris:
- Didn't increase intake of sodium from the previous week. Sodium intake is less than the recommended intake.
- Improved intake of protein from the previous week. Protein intake is below the prescribed intake.

Over the last 2 weeks, she:
- Did not meet suggested intake of sodium by 49.58%.
- Didn't reach advised intake of protein by 58.06%.

·A detailed analysis of week-to-week macronutrient improvement
·The percentage of deficiency/surplus over the two weeks

Exercise summary

By analysing the two-weeks exercise log, she didn't meet her exercising targets of 180 min per week:

·On week 1, she exercised 4 mins on average

·On week 2, she exercised 10 mins on average

·Exercise target duration
·Whether the patient has met the target on both weeks
·Duration for each week

Summary:

Chris's main aim is to maintain her current weight.

After analysing her food logs, the following is observed:

- Her sodium intake was under the target.
- Her protein intake was lower than the target.

Chris's daily caloric amount consumed was consistently considerably lower (by 72%) than her estimated need (1,656 kcals) on non-training days. However, her closest day to the caloric intake target was on week 2 where she consumed 93.44% of the target (equivalent to 1,547 kcals).

Chris is Lightly active, meaning that she is physically lightly active. We define "active" as spending a good time of the day on her feet but with no dedicated time for exercise. It is our advice that she should plan more physical activities through out the week to stay in better shape

A brief summary of the most important information from the report containing:
·The state on macronutrients
·The state of caloric intake
·Activity level status

Sample patient report with section explanation

Nutrify - Client Report	Description
Hi Sam, This report was created and tailored especially for you to help you understand your diet more and assess you to reach your health goals.	A friendly informal intro
Basic facts: Based on your provided height (1.81m) and weight (86kg), we've computed your BMI and it's 26.25 which looks a bit higher than the healthy range and we suggest that you aim to lose some weight. You've specified that you wanted to keep your actual weight and in order for you to achieve your goals, it is advised that your food intake has the following break-out throughout the day: 25-35% protein, 25-35% fat and 30-50% carbs Additionally, you should monitor your caloric intake. Since you are active and you spend a good part of the day doing some physical activity , your daily calories should be at 2,923 kcals on non-training days if you want to keep your actual weight. You can consume additional: • 100 - 300 kcals for an hour of light exercise	·basic information about the client ·BMI with a suggestion to lose/gain/keep weight based on that ·recommended macro nutrient distribution based on the client wish. ·caloric intake basic computations

- 300 - 500 kcals for an hour of moderate exercise
- 500 - 1,000 kcals for an hour of continuous strenuous Exercise

How you were doing over the last two weeks?

Your Energy intake:

Your daily caloric consumed was consistently considerably lower (by 67%) * than your estimated need (2,923 kcals) on non-training days.

However, your closest day to the caloric intake target was on week 2 where you consumed %92.61 of the target, well done!

* this estimation may not be accurate due to lack of logged intake

Your nutrients intake:

By analysing your food log, it looks that your:

- Sugar intake was below the target.
- Carbohydrates intake was under the target.
- Protein, fat and sodium intake was routinely sufficient .

To fix this, you should seek to ensure a source of sugar. Sugar healthy resources include dark chocolate and honey. Also, you are advised to make sure to consume more carbohydrates. Carbohydrates healthy resources include whole grain breads and cereals and starchy vegetables. Your daily caloric needs change based on whether you are exercising on that day. Given your desire to keep your actual weight, you should seek to hit a target of ~2,920 kcals on non-training days, and 3,220 to 3,420 kcals on moderate training days. The specific recommendations for how many calories to add depends on workout intensity and duration (refer to the previous section for more details).

·Information on the current calorie intake
·the best day over the two weeks
·current macronutrient intake
·suggestion to fix problems in the current status
·suggestion for the calorie intake for weight goals achievement.
·variations for calorie intake on training days.

Exercise summary

When we examined your two-weeks exercise log, we found that you didn't meet your exercising targets of 300 min per week:

- On week 1, you exercised 7 mins on average
- On week 2, you exercised 0 mins on average

·Exercise target duration
·Whether the patient has met the target on both weeks
·Duration for each week

Need help with it?

Here are some nutrition resources if you would like some further information:

- Good introductory advice that is more than good if you have no background: here
- For more information on getting complete protein for vegans/vegetarians: here
- If you find it difficult to meet your protein daily target, this article suggests some protein supplements that are healthy and easy to digest.
- And finally, if you'd like to know more about how your macronutrients were calculated, this is a good introduction to the topic.

·additional links to help and educate the client in some nutrition concepts that some people may be unfamiliar with but has been mentioned in the report