
Customizable Meal Planner

A healthy diet for an individual

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Background

Less Than 3 Percent of Americans Live a 'Healthy Lifestyle'

Depressing statistics from a new study

JULIE BECK | MAR 23, 2016 | HEALTH



TIME

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The Working Person's Diet: Too Busy to Eat Right

By Alice Park | Thursday, Sept. 10, 2009

Canadians have no time for healthy living

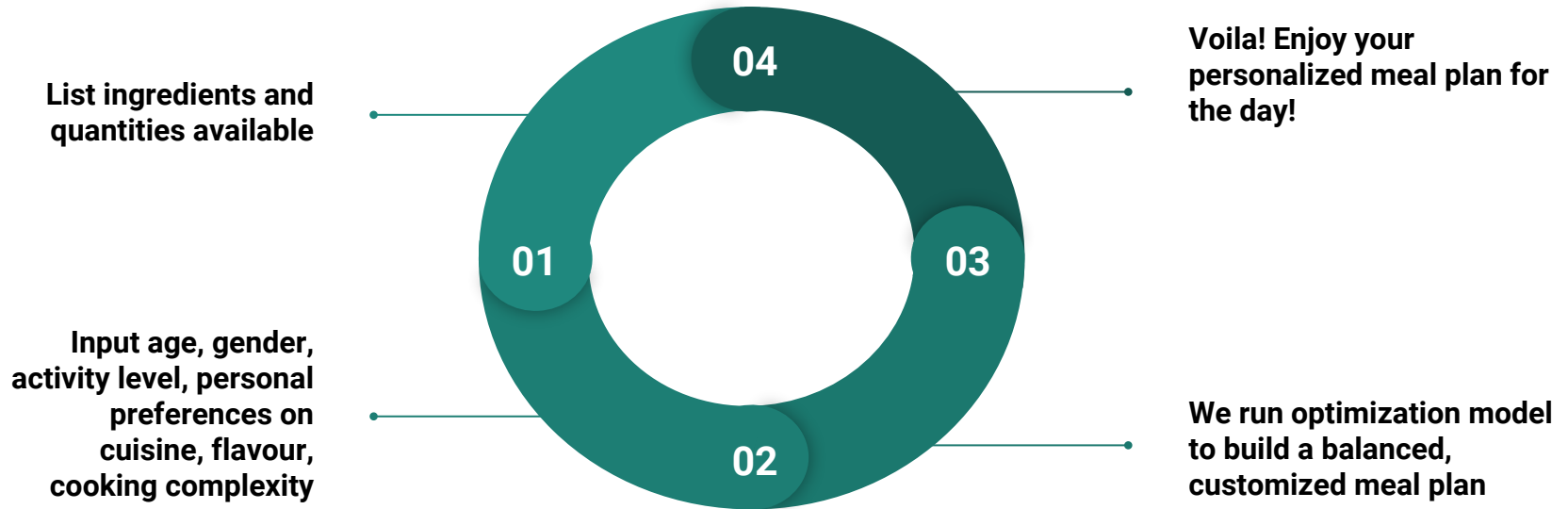
CBC News · Posted: Nov 29, 2011 2:27 AM ET | Last Updated: November 29, 2011

- For single-person households, preparing healthy, balanced meals is a challenge
- University of Minnesota study of over 2000 people found that working longer hours may have adverse implications on eating behaviors among young adults

Source: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3464955/>

Proposed Solution

“Prepare an optimal meal plan for the day made from ingredients readily available from the individual’s household”



What Data is Available?

Yummly API

For a given recipe:

- Servings
- Preparation time
- Rating (0-5)
- Flavour/Cuisine
- Ingredients
- Nutritional value of the recipe



Office of Disease Prevention
and Health Promotion

Dietary Guidelines

Based on the age, gender and activity level of the user, recommended daily intake of:

- Calories
- Carbohydrates
- Protein
- Fats
- Fibre
- Vitamins & Minerals

Data Extraction / Ingredient Cleaning

Data Extraction and Categorization

- Yummly API **data extraction**
- Geographical cuisine **consolidation**
- **Deleting** recipes that were missing time or nutritional data
- **Consistent units** between API and nutritional guidelines

Final Number of Recipes: **8152**

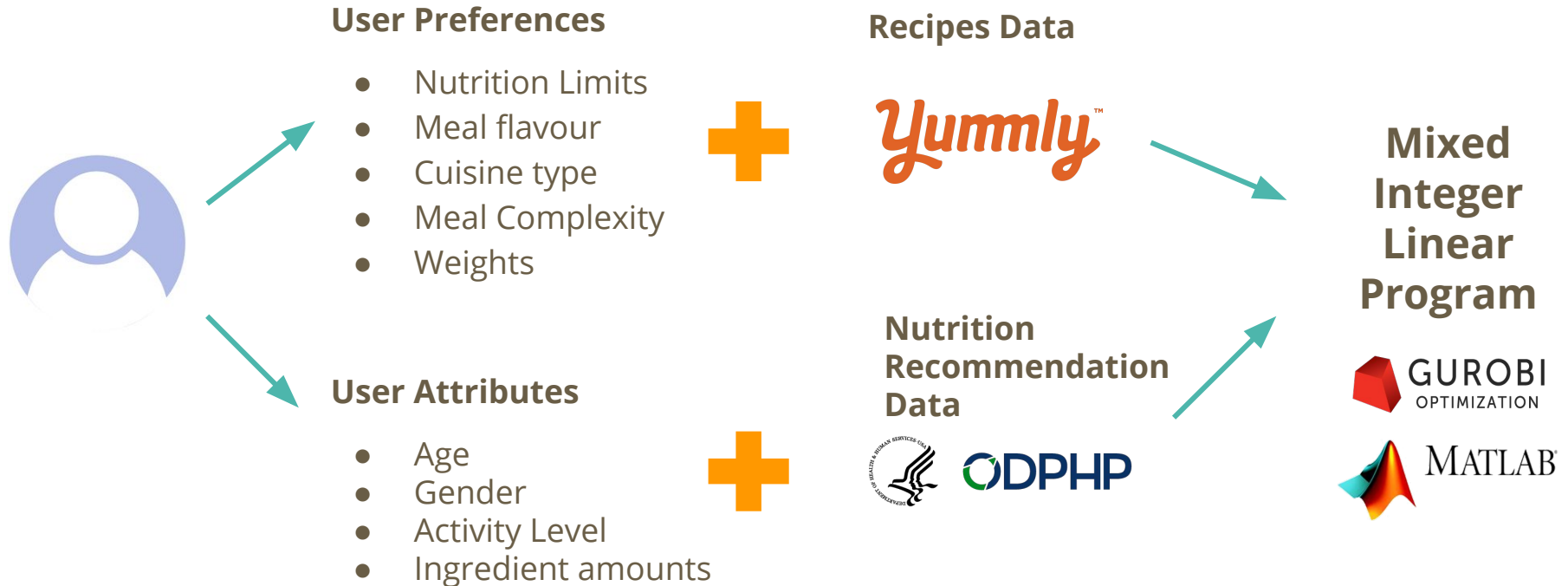
Dealing with Ingredients

- Python: **Fuzzy Wuzzy**
- Rates similarity of two strings and rates from **1 to 100**
- Unique Ingredient Strings: **39,719**
- Compile desired ingredients list: **297 items**
- Map ingredient name to desired list if **fuzzy score > 74**
- **~35,000** ingredients fuzzy sorted!

```
>>> fuzz.ratio("fuzzy wuzzy was a bear", "wuzzy fuzzy was a beaver")
>>> 87

>>> fuzz.partial_ratio("fuzzy was a bear", "fuzzy wuzzy was a bear")
>>> 84
```

Optimization Tool: Overview



Optimization: Parameters, Variables, Objective

User Input Parameters

W_i : weight of preference i

F_f : indicator of preference on meal flavour f

C_c : indicator of preference on cuisine type c

T : cooking time limit

A_k : amount of ingredient k available

M_n : target amount of nutrient n

Decision Variables

r_j : recipe j is selected

b_i : preference i is satisfied

Objective

Maximize weighted preference value: $\sum W_i b_i$

Optimization: Constraints

Hard Constraints

1. Ingredient amount limitation
2. Consumption of each nutrient $> 75\%$ recommended
3. Consumption of protein, carbs, fat, sodium, calories $< 150\%$ recommended

Soft (Preference) Constraints

1. Consumption of fibre, iron, Vitamin C, Calcium $> 100\%$ recommended
2. Consumption of protein, carbs, fat, sodium, calories $< 110\%$ recommended
3. Recipes representative of preferred cuisines
4. Recipes representative of preferred flavours
5. Total cook time $<$ user time limit
6. Number of ingredients

Model Improvements

1. Removed hard constraint on selection of only 3 recipes
2. Added preference constraint for nutrients that should not be consumed in excess (protein, carbs, fat, sodium, calories)
3. Reduced threshold on maximum nutrition amount:
200% of target amount \Rightarrow 150% of target amount
4. Increased threshold on minimum nutrition amount:
50% of target amount \Rightarrow 75% of target amount



Emily, the Vegan
Female, 25 yrs
Moderate Activity Level

Cuisine preference: All
Flavour preference: All except
meaty

Time to cook: 180 minutes
Max. number of ingredients:
30

Ingredient list: All kinds of
vegetables and nuts, no
meats/fish/cheese/dairy

Case Study: Dietary Preferences

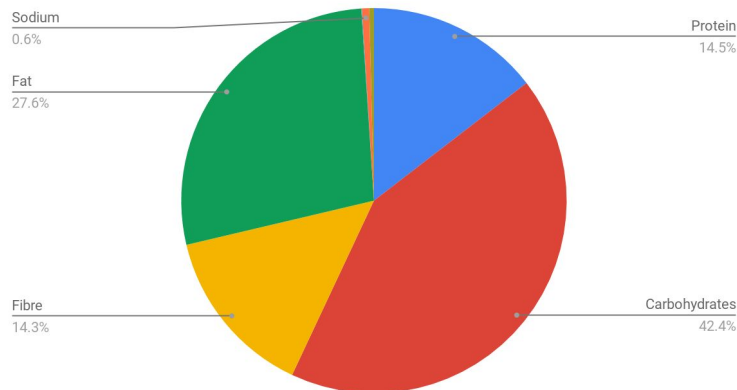
Recipes:

- Mexican Vegan Burrito Bowl Mason Jar Salad
- Vegetable Hummus Wrap
- Scrambled Tofu
- Carrot Cake Oats
- Sweet and Spicy Paleo Potato Chips
- Raw Vegan Carrot and Flax Crackers

Cooking time: **130 minutes**

Calories: **1962.3 cal**

Nutritional Breakdown for the Vegan



Case Study: Dietary Preferences

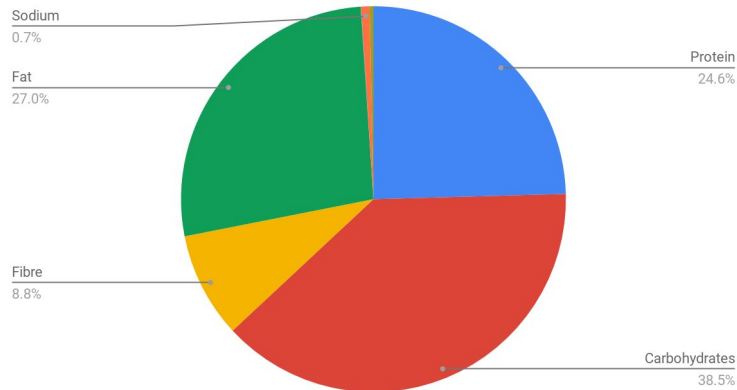
Recipes:

- Turkey Avocado & Feta Combo
- Grilled California Chicken
- Lasagna
- Poached Eggs
- Polish Potato Pancakes
- Soft Pretzels with Cheese Sauce
- Homemade Tortilla Chips

Cooking time: **170 minutes**

Calories: **1971.1 cal**

Nutritional Breakdown for the Meat Lover



Amy, the Meat Lover
Female, 25 yrs
Moderate Activity Level

Cuisine preference: All
Flavour preference: Only
meaty
Time to cook: 180 minutes
Max. number of ingredients:
30

Ingredient list: all kinds of
meats and fish

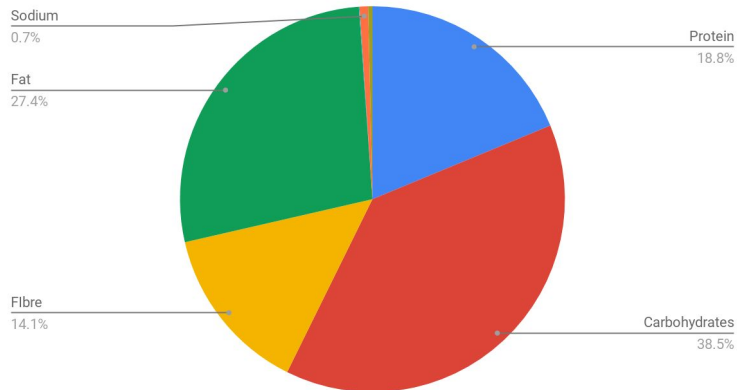
Case Study: Age & Activity Levels

Recipes:

- Crockpot Whole Chicken
- High Protein Stovetop Skillet Pizza
- Lasagna
- Grape Gouda & Arugula Skewers
- Guacamole with Radish Chips
- Baba Ganoush
- Banana Dessert Sushi

Calories: **2600 cal**

Nutritional Breakdown



Matthew, the Young Active Male
Male, 20 yrs
Active Activity Level

Cuisine preference: All
Flavour preference: All
Time to cook: 200 minutes
Max. number of ingredients: 30

Ingredient list: Fully stocked fridge

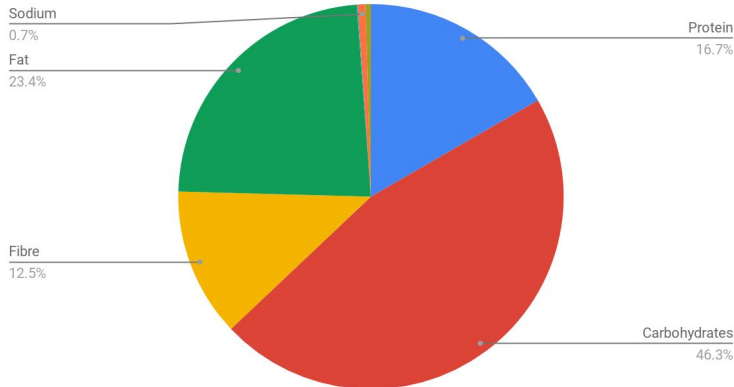
Case Study: Age & Activity Levels

Recipes:

- Crispy Pan-fried Tofu
- Hard-boiled Eggs
- Onion Uttapam
- Jicama Chips
- Creamy Salsa and Black Bean Nachos
- Olive Oil Rice Krispie Treats
- Parmesan Crusted Chicken
- Frozen Fruit Pops

Calories: **1202 cal**

Nutritional Breakdown



Sarah, the Old Sedentary
Female
Female, 70 yrs
Sedentary Activity Level

Cuisine preference: All
Flavour preference: All
Time to cook: 200 minutes
Max. number of ingredients:
30

Ingredient list: Fully stocked
fridge



Jim, the Busy Professional
Male, 40 yrs
Moderate Activity Level

Cuisine preference: All
Flavour preference: All
Time to cook: 60 minutes
Max. number of ingredients: 20

Ingredient list: Fully stocked fridge

Case Study: Lifestyles

Recipes:

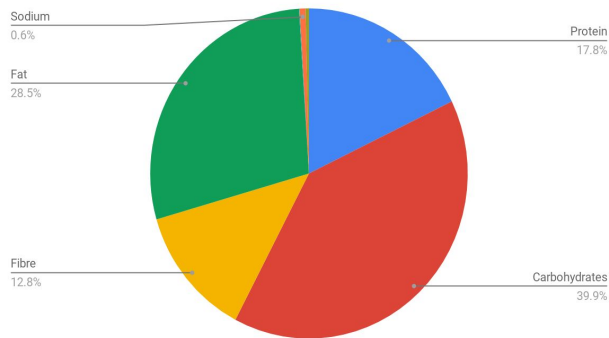
- Avocado Salad with Heirloom Tomatoes
- **Easy** Caprese Mac and Cheese
- **Easy** Homemade Tortilla Chips
- French Omelette
- Sleepy Blueberry Muffin Smoothie

Total Cooking Time: **55 minutes**

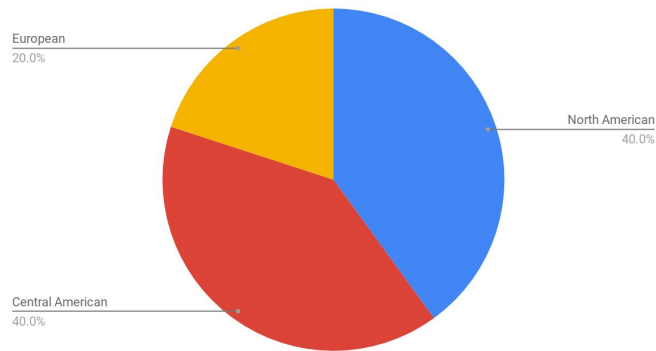
Total Number of Ingredients Used: **20**

Calories: **1951 cal**

Nutritional Breakdown



Cuisine Breakdown for the Busy Professional



Case Study: Lifestyles

Recipes:

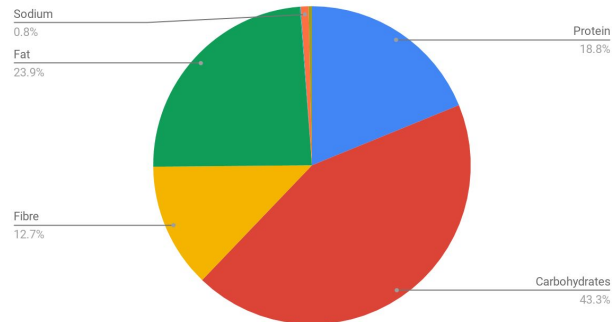
- Spinach and Red Pepper Mini Frittatas
- Garam Masala Tofu Scramble
- Zucchini Noodles with Lemon-Garlic Spicy Shrimp
- Onigiri
- Mexican Street Corn Style Popcorn
- Broiled Grouper with Lemon and Thyme
- Vegetable Hummus Wrap
- French Omelette
- Frozen Fruit Pops
- Italian Tuna Salad
- Homemade Applesauce

Total Cooking Time: **238 minutes**

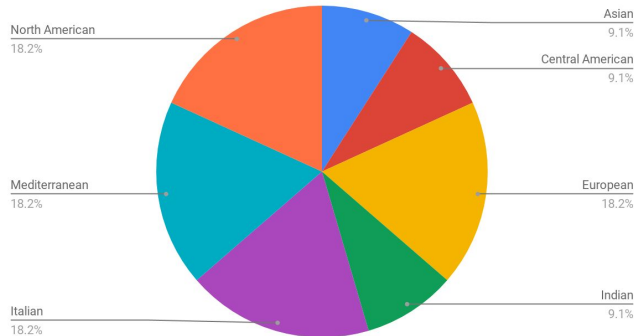
Total Number of Ingredients Used: **47**

Calories: **2087 cal**

Nutritional Breakdown



Cuisine Breakdown for the Foodie



Andrew, the Freelance Food Critic

Male, 40 yrs

Moderate Activity Level

Cuisine preference: All

Flavour preference: All

Time to cook: 300 minutes

Max. number of ingredients: 50

Ingredient list: Fully stocked fridge

Conclusion and Future Work

Optimization results show the model's sensitivity to different parameters including eating habits and lifestyle profiles

Optimization tool generates recipe lists that effectively cater to individual preferences

What can be improved on?

- Better data sources
- Incorporate serving sizes

Where can this be used?

- Mobile/web application (meal planning and grocery shopping apps)
- Incorporate into smart fridges (ingredient tracking and recipe suggestions)