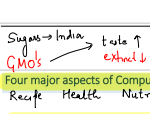
CGAS

$$FPI = \frac{f_1 + f_2 + \cdots + f_n}{n} = \frac{\sum_{i=1}^{n} f_i}{n}$$

RecipeDB → 100000+ recipes
6 continents + 27 regions + 81 countries
Ratatouille → GPT2

Uses of spice → coloring agent, antivirals, brain simulants, aphrodisiacs

spiceRX → evidence based knowledge → health impact of culinary spices.



meSH → Medical Subjects Headings

Disease Cat | Sub Cat | Disease
cat 1 → 2 → 3

Sugar → India
GMOs → taste ↑ life ↑ x price → Advantage
extract ↓ nature keeper → Disadvantage

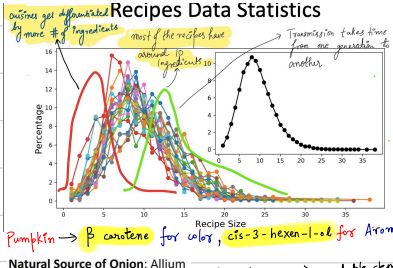
Four major aspects of Computational Gastronomy Data
Recipe Health Nutrition & Flavor

Potential Data-Driven Food Innovations
- Novel Recipes Design:
- Culinary Fingerprints
- De novo design of flavor/taste molecules
- Taste/Odor Prediction
- Healthy and Sustainable Diet Design

Recipes Data Statistics

cuisines get differentiated by more # of ingredients

most of the recipes have around 10 ingredients



Pumpkin → β carotene for color, cis-3-hexen-1-ol for Aroma

Natural Source of Onion: Allium

Fish has maximum ingredients for category → vegetable stem
fruit has maximum unique molecules for category → dish

Smoking meat → guaiacol → flavor, syringol → aroma
Asparagus → Asparagusic Acid
Carrot → carotenemia, BETA-CAROTENE

1. METHANETHIOL
2. DIMETHYL SULFIDE
3. DIMETHYL SULFONE
4. DIMETHYL SULFONE

$$P_{ij} \propto (F_i \cap F_j)$$

The more # of shared flavor molecules, the more probably that they will occur together → western

removed fryd ↑ ⇒ Z-score ↓ ← western

North → Butter
Asia → Soy Sauce
Latin America

$$\chi = \left(\frac{1}{N_c}\sum_c \frac{2}{n_c(n_c-1)}\sum_{i,j \in c,i \neq j} |C_i \cap C_j|\right) - \left(\frac{2\left(\sum_{i \neq j} |C_i \cap C_j|\right)}{N_r(n_R)} \frac{}{\sum_{i \neq j} f_i}\right)$$

↳ Compound contribution

4. Name and briefly describe each of the four random controls created for comparing the average food pairing index of Indian cuisine. Clearly mention the conserved/preserved factors. [$\frac{1}{2}$ x 4 = 2]

1) Random (R_0): Ingredient from a recipe is randomly replaced by ingredient from kitchen basket to create a new recipe, keeping recipe size distribution conserved

2) Frequency controlled (R_1): New recipe was generated by replacing an ingredient from a recipe such that frequency of each ingredient remain preserved.

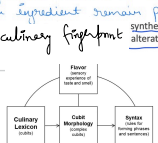
3) Category control (R_2): Ingredient from a recipe is replaced with another ingredient of same category, so that category statistics of each ingredient remain preserved

4) Frequency + category control (R_3): New recipe was generated by replacing ingredient such that both frequency & category of each ingredient remain preserved.

Possible uses of culinary fingerprint: synthesis of novel recipes as well as alterations in existing recipes.

Parts of Cooking (PoC)

S: Culinary Sentence
I: Ingredient Name
P: Processing Action
U: Utensil
Q: Quantity and Unit
F: Form
T: Describes 'P'

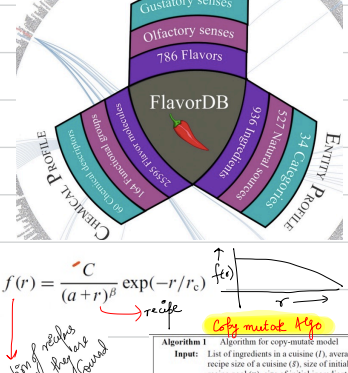


DietRx 21207 food associations, 94 Calories → 22222 ingred info
disease

Benevolence score of turmeric ↑

Tarla Dalal → 2500+ recipes & 194 ingredients

olfactory → smell gustatory → taste

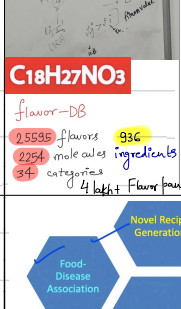


$$f(r) = \frac{C}{(a+r)^{\beta}} \exp(-r/r_c)$$

→ recipe

fraction of recipes in which they are found

Copy mutate Algo



Algorithm 1 Algorithm for copy-mutate model

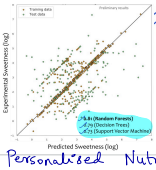
Input: List of ingredients in a cuisine (I), average recipe size of a cuisine ($\bar{s}$), size of initial recipe pool (n), size of initial ingredient pool (m), total number of recipes in cuisine (N), number of mutations (M), and ratio of the total number of ingredients to the total number of recipes in the cuisine (θ).

Output: N mutated recipes

```
for all ingredients i in I do
    sample a value from Uniform (0,1)
    assign it to i
end for
I_0 ← randomly sample (without
      replacement) m ingredients from I
I ← I − I_0
R_0 ← randomly sample s̄ ingredients n
      times from I_0
for l = 1 to N − n do
    θ ← m/n
    if θ ≥ θ then
        r ← randomly choose a recipe from R_0
        for g = 1 to M do
            sample an ingredient i from r
            sample an ingredient j from I_0
            if fitness of j > fitness of i then
                replace i with j in r
            end if
        end for
        R_0 ← R_0 + r
        n ← n + 1
    else
        choose an ingredient p randomly from I
        I_0 ← I_0 + p
        m ← m + 1
        I ← I − p
    end if
end for
```

$C_{18}H_{27}NO_3$

flavor-DB
2,5935 flavors, 936 ingredients
2254 molecules
34 categories
4 Hight Flavor pairing



→ Blood test
→ Questionare
→ BMI
→ food diary

Personalised Nutrition → gut microbes

Data driven food innovations
- Food-Beverage Pairing
- Taste/Odor Prediction
- Culinary Fingerprinting
- Dietary Interventions
- Food & Beverages Design
- Sustainable Food Innovations

food → hot, cold, dry, wet

Processed food
Roasted meat → 1.8 mg
Lab grown Meat → 2013

Cooking Innovation → Refrigerator, LPG, Mixer, Pressure cooker

Indian Subcontinent (INSC)	10531	462	Cayenne, Masala
Italy (ITA)	23179	506	Olive, Pa

Kidney Beans
↳ Phyhemagglutanin
70K HAU → 20 - 400 HAU

Symptoms of Kidney Bean poisoning.
NAUSEA, VOMITING, DIARRHEA, ABDOMINAL PAIN

PECTINASE
Breaks down plant cell walls—softening the fruit's flesh.
AMYLASE
Breaks down carbohydrates, forming the sugars that make fruit taste sweet.
CHLOROLASE
Breaks down chlorophyll, causing the change in coloration associated with ripening.

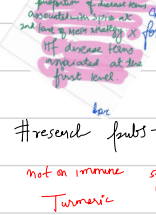
PubMed
PubChem

MYRISTICIN
main hallucinogenic compound present in nutmeg

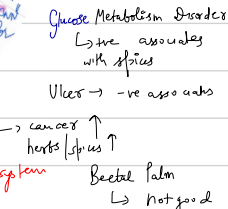
ELEMICIN - SAFROLE

Scurvy → citric, malic, ascorbic
E 330 E 296

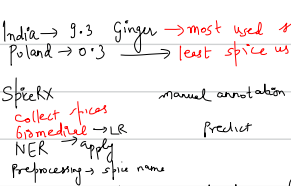
The average number of ingredients used in a recipe is around eight



N_s → # shared flavor mol b/w 2 ingredients



$\Delta N_s = N_s^{cuisine} - N_s^{random}$



India → 9.3 Ginger → most used spice
Poland → 0.3 → least spice used

SpiceRX — manual annotation — RCM
Collect spices
Biomedical → LR — Predict
NER → apply
Preprocessing → spice name

Phenol Explorer + Knapsack → Phytochemicals

Benevolence factor → +ve association of recipe

CNN based model

Spectrum 360
Computes the sum of proportion of disease terms associated with spices and food, weighted by score for the disease term associated at the first level

GG → -ve association
Allicin → +ve association

Glucose Metabolism Disorder
↳ +ve associates with spices

Ulcer → -ve associates

resemed foods → cancer ↑
herbs | spices ↑
not an immune system
Turmeric
Betel Palm
↳ not good
Rattle berry
↳ good

Bacopa Monnie → lowest Benevolence score
Herb | Spices & Turmeric → highest
0 — 729 Benevolence score range

27 categories of diseases
Bitter-sweet

Molecular feature extraction
ChemoPy, Dragon2D, Dragon2D/3D, Canvas, ECFP
Premise: Chemical features encode taste