

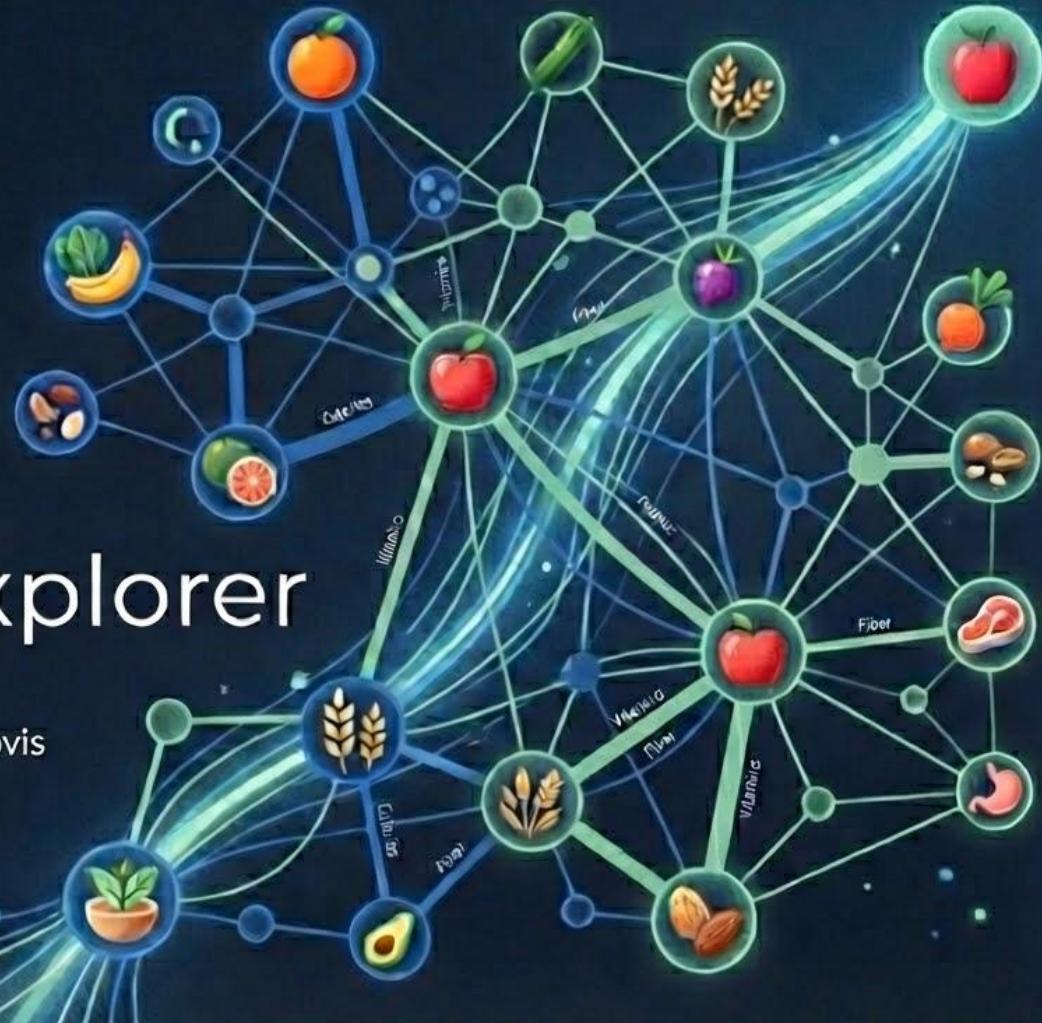
Visual Food: Interactive Preference Explorer

Exploring Nutritional Trade-offs via an Infovis System

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GitHub:

<https://github.com/lpizzi13/VisualFood>



MOTIVATION: WHY FOOD CHOICES ARE HARD

THE PROBLEM: Subjectivity & Hidden Trade-offs



Static labels involve conflicting dimensions whereby 'healthy' is subjective to user needs.



ATHLETE VIEW:
Focus on High Protein

DIABETIC VIEW:
Avoids High Sugar

HYPERTENSIVE VIEW:
Avoids High Sodium



THE GOAL: Visual Analytics for Informed Choices

Shift from universal metrics to user-defined parameters, enabling holistic comparisons through interactive Visual Analytics.

Users & Tasks

Target Users



- Health-conscious consumers



- Nutrition-aware users



- Dietitians exploring food data

Main Tasks



- Compare foods across multiple nutrients



- Identify healthier alternatives



- Explore nutritional trade-offs interactively

Food Nutrition Dataset



Source: USDA FoodData Central
(Standardized per 100g)



Items: 5431 cleaned items across 6 macro categories



Attributes: 15 numerical values (Macro & Micro-nutrients)

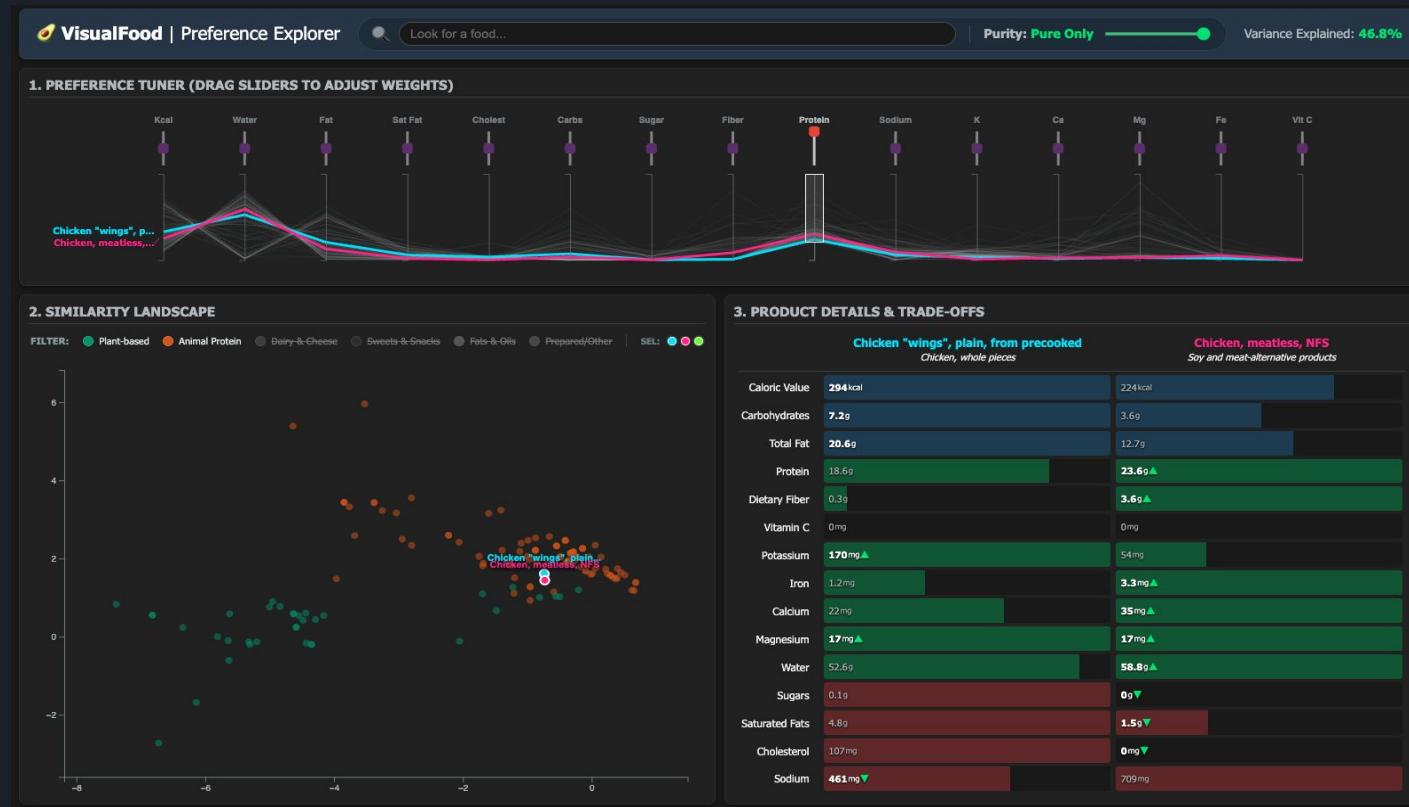


Preprocessing: starting from the relational USDA database, the data were extracted, merged across relevant tables, cleaned of duplicates and inconsistencies and standardized using z-normalization to produce the final analysis-ready dataset.



All the ETL process is available in the backend/data.py

System Overview



Parallel Coordinates (Preference Tuner)



Each line represents a food item across multiple nutrient dimensions



Semantically ordered axes make nutritional trade-offs easy to read

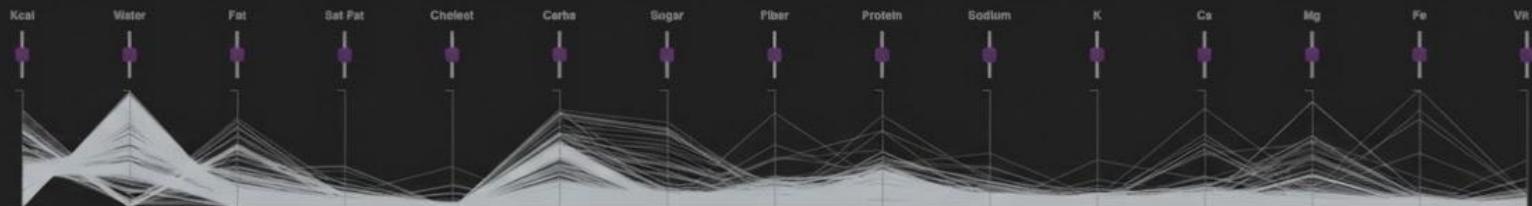


Brushing defines nutritional constraints and filters all linked views



Per-axis weight steer the **weighted PCA** enabling interactive preference-driven analysis

1. PREFERENCE TUNER (DRAG SLIDERS TO ADJUST WEIGHTS)



Weighted PCA Scatterplot (Similarity Landscape)



2D projection of nutritional similarity



Distance reflects overall nutritional differences



User-defined weights steer the PCA projection



Points are color-encoded by high-level food macro-categories



Clusters and outliers emerge under different priorities

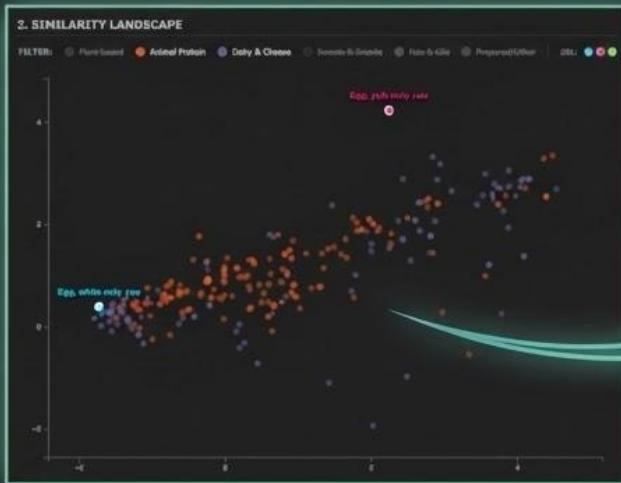


Possibility of filtering according to the categories



Selection is coordinated with all other views

PCA giving
the highest
weight to
fats and
saturated
fats



PCA giving
the highest
weight to
protein and
fiber



Detail Panel: Nutritional Comparator



Side by side comparison of up to 3 selected foods (detail-on-demand)



Juxtaposed micro-bars + numeric labels for quick ratios and precise reading



Row-wise normalization to handle heterogeneous nutrient scales



Semantic color logic (green: good nutrients, red: caution, blue: neutral) to avoid cognitive conflicts



Adaptive layout: responsive row height, scrolling only when needed for legibility

3. PRODUCT DETAILS & TRADE-OFFS

	Milk, whole Milk, whole	Milk, reduced fat (2%) Milk, reduced fat	Milk, fat free (skim) Milk, nonfat
Caloric Value	61 kcal	50 kcal	34 kcal
Carbohydrates	4.6g	4.9g	4.9g
Total Fat	3.2g	1.9g	0.1g
Protein	3.3g	3.4g	3.4g
Dietary Fiber	0g	0g	0g
Vitamin C	0mg	0.2mg ▲	0mg
Potassium	150mg	159mg	167mg ▲
Iron	0mg	0mg	0mg
Calcium	123mg	126mg	132mg ▲
Magnesium	12mg ▲	12mg ▲	12mg ▲
Water	88.1g	89.1g	90.8g ▲
Sugars	4.8g ▼	4.9g	5.1g
Saturated Fats	1.9g	1.1g	0g ▼
Cholesterol	12mg	8mg	3mg ▼
Sodium	38mg ▼	39mg	41mg

Insight Enabled & Live Demo

Insight enabled by VisualFood



Identify nutritionally similar foods with healthier trade-offs



Reveal explicit nutritional trade-offs



Support goal-driven analysis through user-defined nutrient priorities

Live Demo



Adjust nutrient weights to reflect personal goals



Select foods to trigger details-on-demand comparison



Observe coordinated updates across all views

Conclusions



Integrated Visual Analytics Workflow

VisualFood integrates data analytics, visualization, and interaction into a single visual analytics workflow.



Multi-Criteria & Trade-off Balancing

Supports multi-criteria exploration of nutritional data, balancing similarity and health-related trade-offs.



User-Steerable & Goal-Driven Insights

Demonstrate how user-steerable analytics enable more interpretable and goal-driven insight.



THANK YOU FOR THE ATTENTION

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