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Towards AI-driven Food Science and Society: Opportunities and Challenges

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PROTECTING OUR PLANET STARTS WITH YOU

BIKE MORE DRIVE LESS

reduce REUSE recycle

Cut down on what you throw away. Follow the three "R's" to conserve natural resources and landfill space.

choose sustainable

Learn how to make smart seafood choices at www.FishWatch.gov.

Trees provide food and oxygen. They help save energy, clean the air, and help combat climate change.

PLANT A TREE

EDUCATE

When you further your own education, you can help others understand the importance and value of our natural resources.

CONSERVE WATER

The less water you use, the less runoff and wastewater that eventually end up in the ocean.

Buy less plastic and bring a reusable shopping bag.

Don't send chemicals into our waterways.

Choose nontoxic chemicals in the home and office.

Volunteer!

Volunteer for cleanups in your community. You can get involved in protecting your watershed too!

Long-lasting light bulbs - ARE A - BRIGHT IDEA

Energy efficient light bulbs reduce greenhouse gas emissions. Also flip the light switch off when you leave the room!

oceanservice.noaa.gov

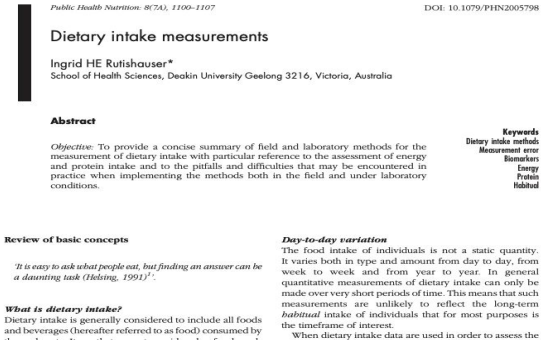
https://oceanservice.noaa.gov/ocean/earthday.html

Food scandals that rocked the foodservice industry

- Horse meat scandal
  - Horse meat burger instead of beef
- Pret A Manger
  - Limited labelling requirements for food
- KFC runs out of chicken
  - Changed their supplier

Big Data + Digitalization

		Staple Foods							
Nutrients (per 100 gm)	**Unit**	**Maize flour**	**Millet Flour**	**Rice**	**Cassava fresh**	**Cassava flour**	***Matooke* (plantain)**	**Beans**	**Groundnut**
Energy	Kilocalories	369	374	360	160	314	122	347	567
Protein	Grams	7.3	10.9	6.6	1.4	2.6	1.3	21.4	25.8
Fat	Grams	1.8	4.2	0.6	0.3	0.7	0.4	1.2	49.2
Carbohydrate	Grams	79.2	72.1	79.3	38.1	76.6	31.9	62.6	16.1
Calcium	Milligrams	3.0	8.0	9.0	16.0	31.0	3.0	113.0	92.0
Iron	Milligrams	1.1	3.0	0.8	0.3	1.9	0.6	5.1	4.6
Zinc	Milligrams	0.7	1.7	1.2	0.3	0.7	0.1	2.3	3.3



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Dietary intake measurements

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Abstract

Objective: To provide a concise summary of field and laboratory methods for the measurement of dietary intake with particular reference to the assessment of energy and protein intake and to the pitfalls and difficulties that may be encountered in practice when implementing the methods both in the field and under laboratory conditions.

Keywords
Dietary intake methods
Measurement error
Biomarkers
Energy
Protein
Habitual

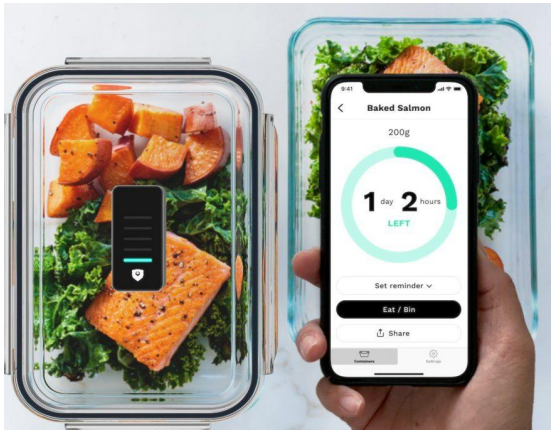
Review of basic concepts

'It is easy to ask what people eat, but finding an answer can be a daunting task (Helsing, 1991)[1].'

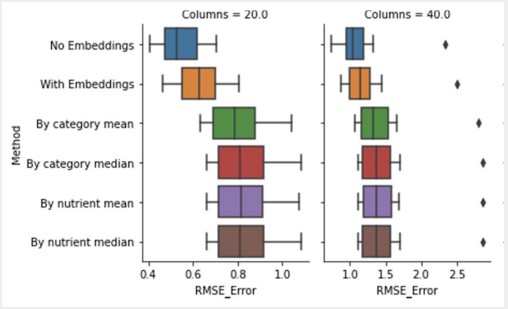
What is dietary intake?
Dietary intake is generally considered to include all foods and beverages (hereafter referred to as food) consumed by

Day-to-day variation
The food intake of individuals is not a static quantity. It varies both in type and amount from day to day, from week to week and from year to year. In general quantitative measurements of dietary intake can only be made over very short periods of time. This means that such measurements are unlikely to reflect the long-term *habitual* intake of individuals that for most purposes is the timeframe of interest.

When dietary intake data are used in order to assess the



Missing value imputation in FCDB



Food information extraction and normalization

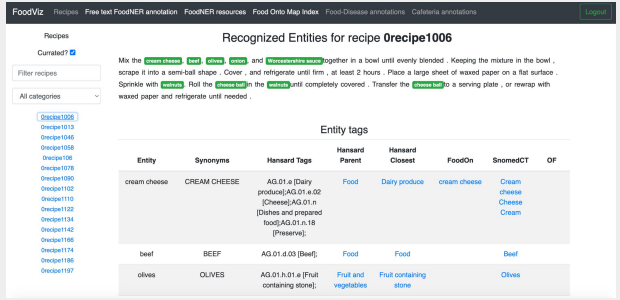
Named-Entity Recognition (NER)

Excessive salt intake has been associated with a higher incidence of heart disease.

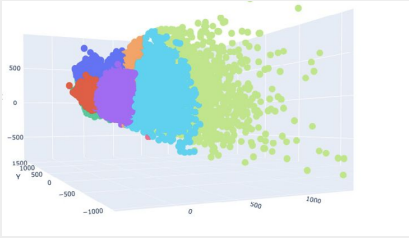
Named-Entity Linking (NEL)

Excessive salt [00002 (FOODB)] intake has been associated with a higher incidence of heart disease [0001 (UMLS)].

Human Computer Interaction Tools for validation of AI results

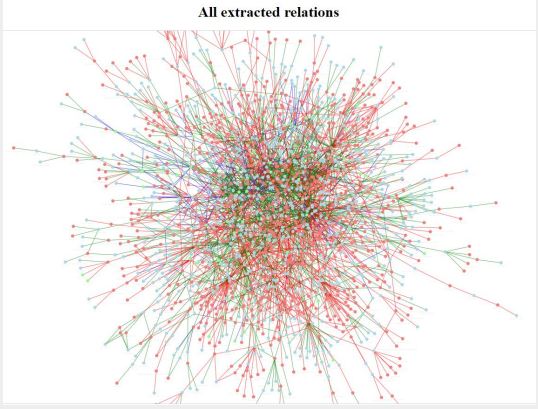


Predicting nutrient values from food consumption data

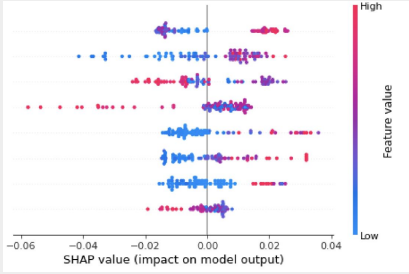


Food image recognition

Food-Chemical-Disease KG



Explainable Food-Health Analysis



From Language Technologies to Decision Support

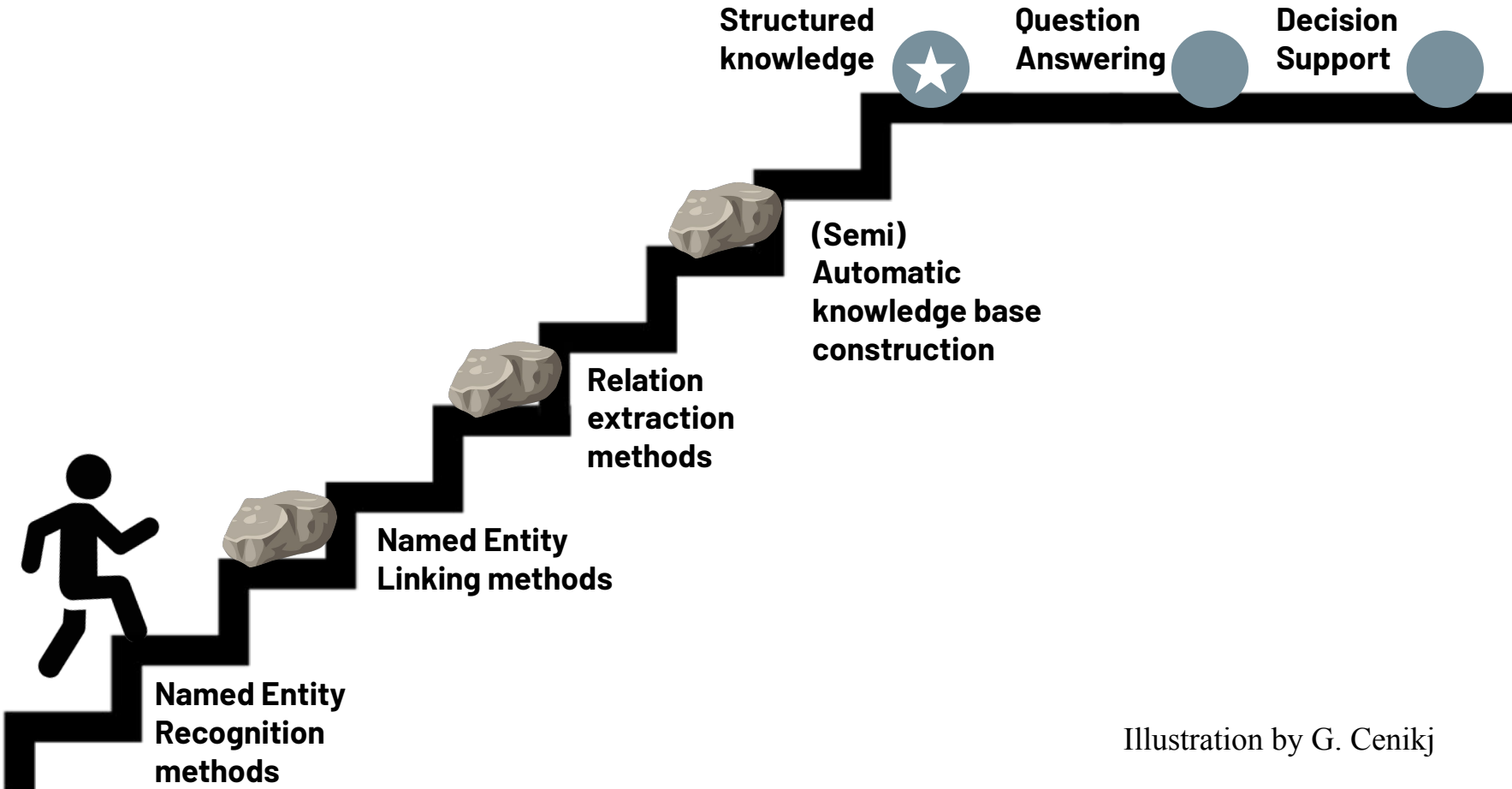


Illustration by G. Cenikj

State in the Biomedical Domain

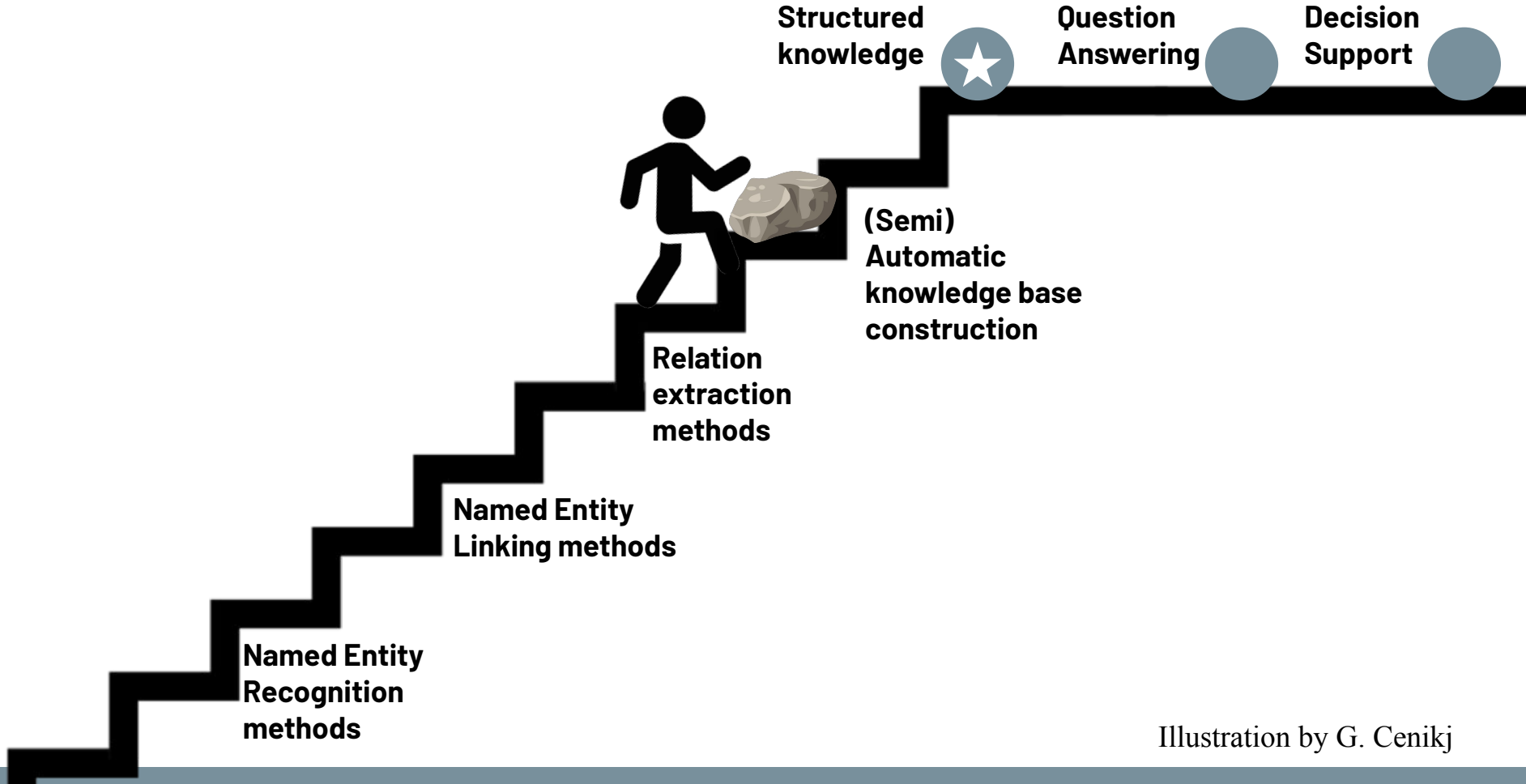
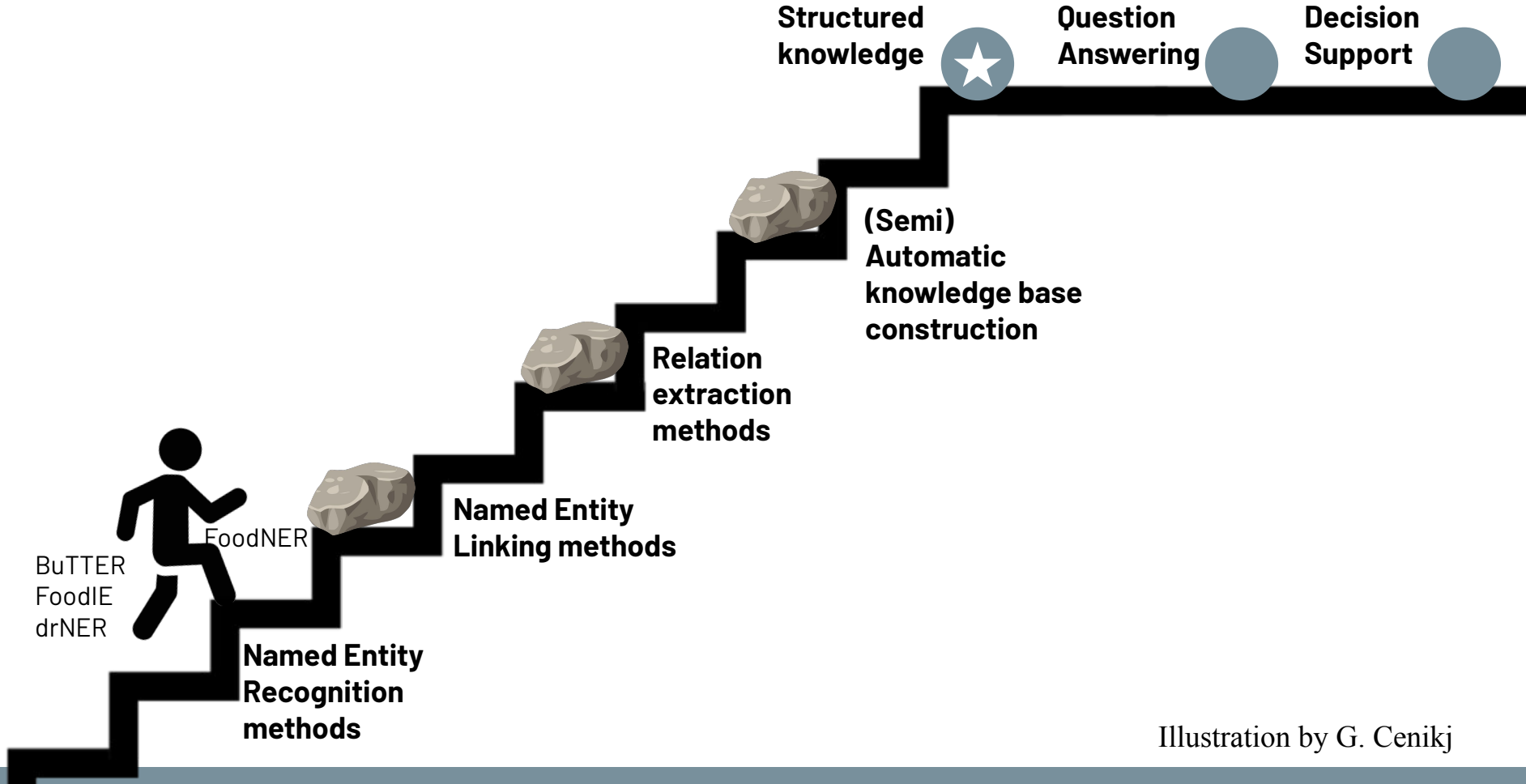


Illustration by G. Cenikj

State in the Food Domain in 2020



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State in the Food Domain

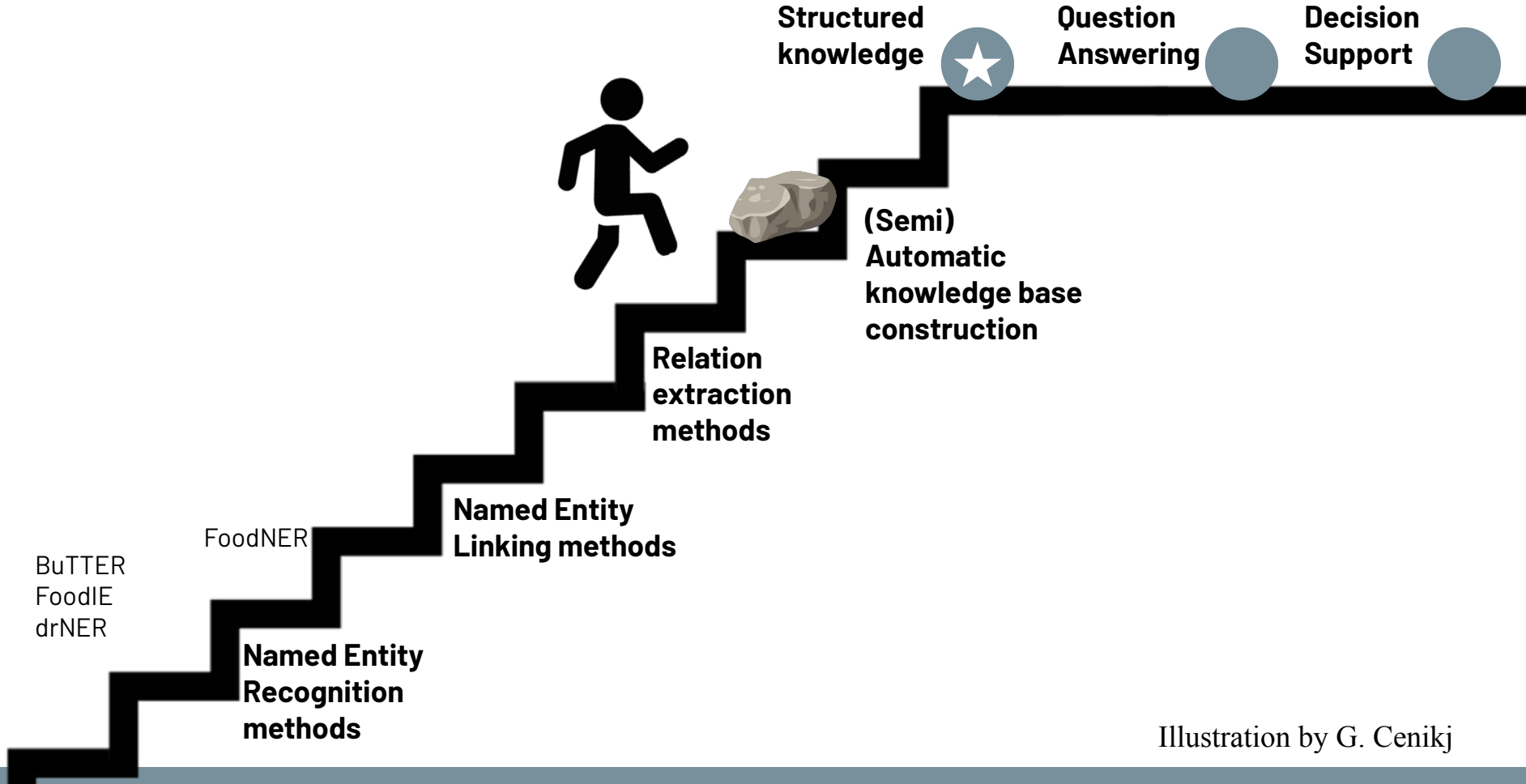
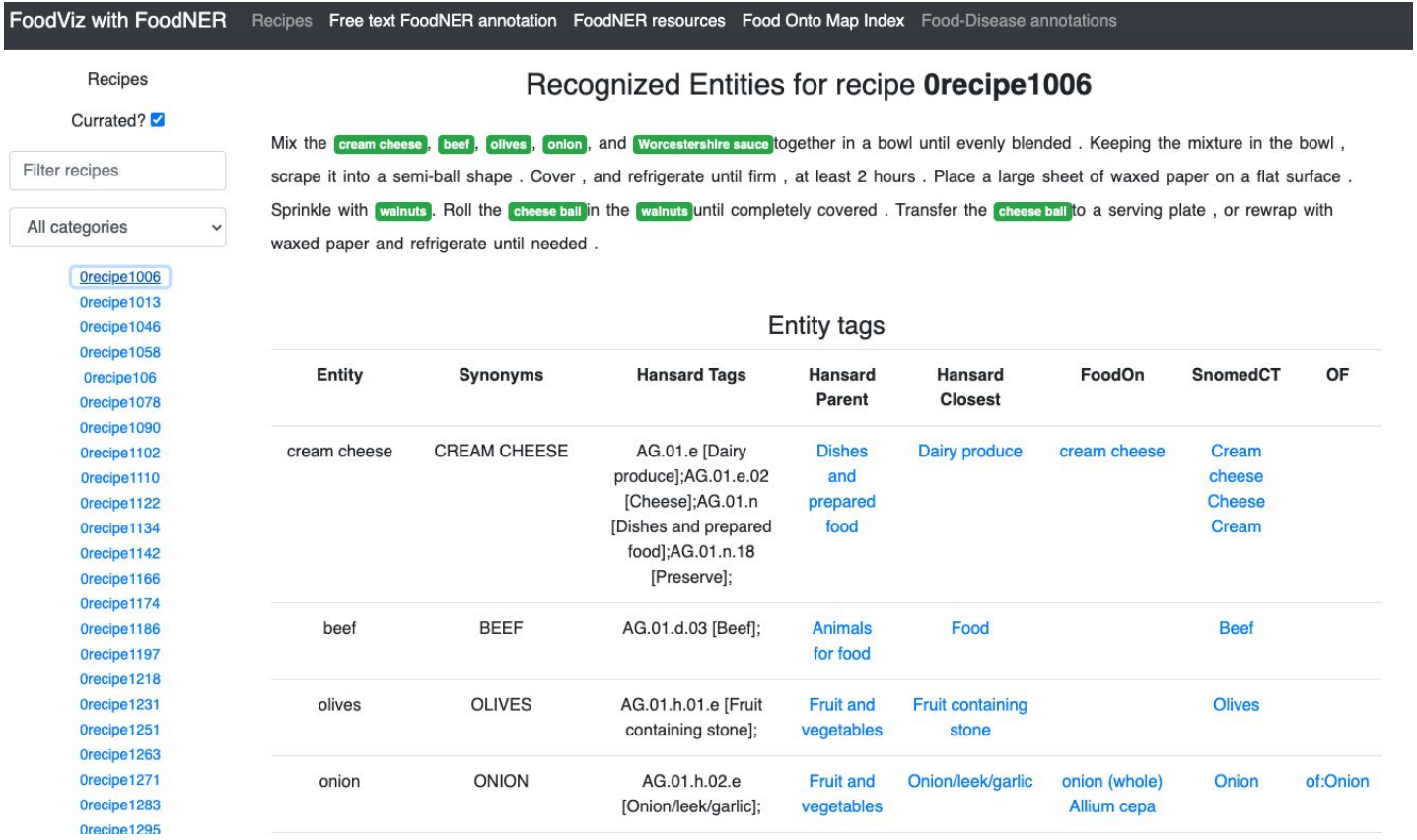
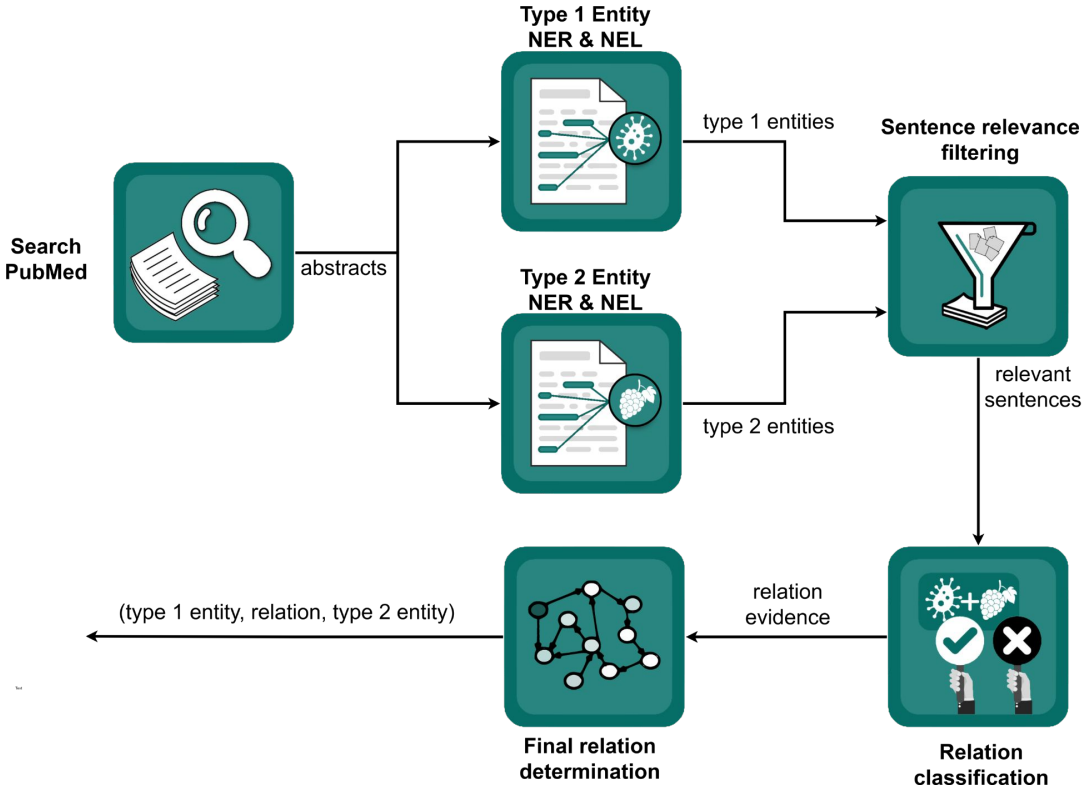


Illustration by G. Cenikj

FoodViz Tool



Food, Chemical, Disease Knowledge Graph



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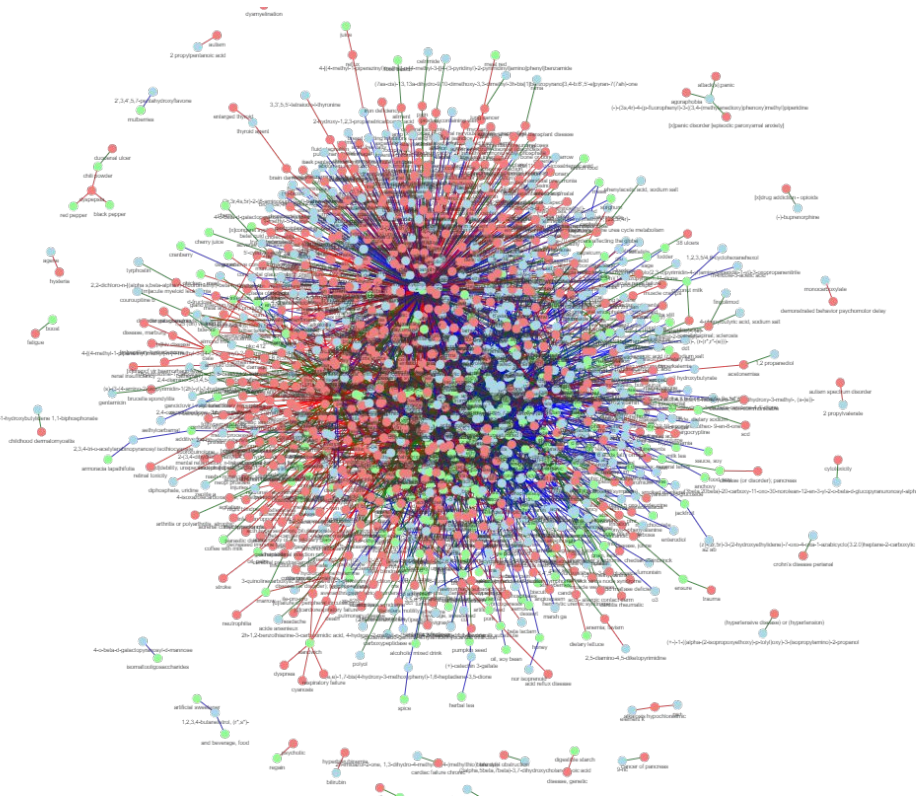
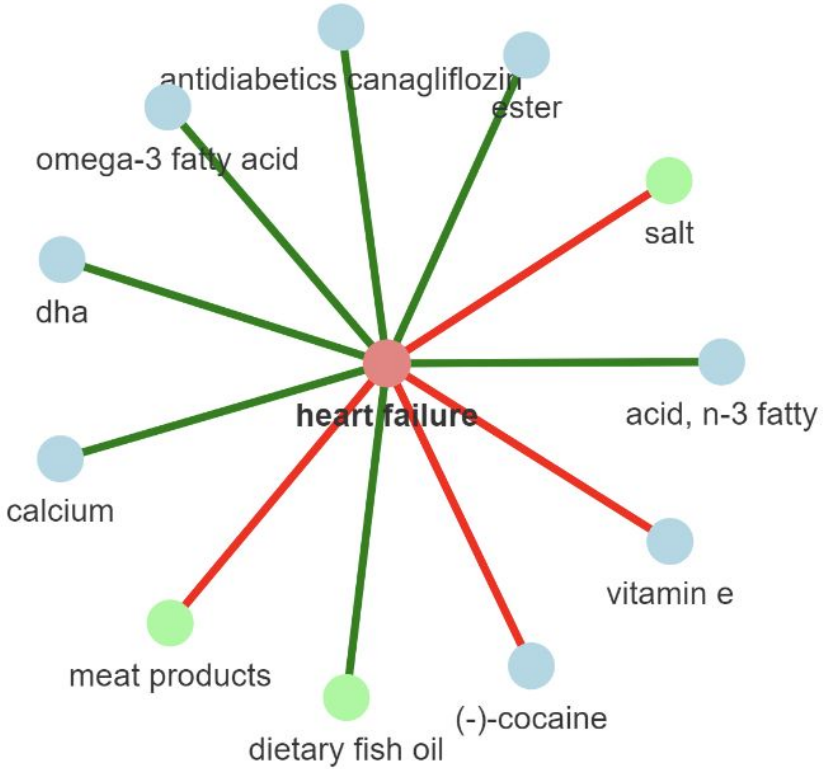
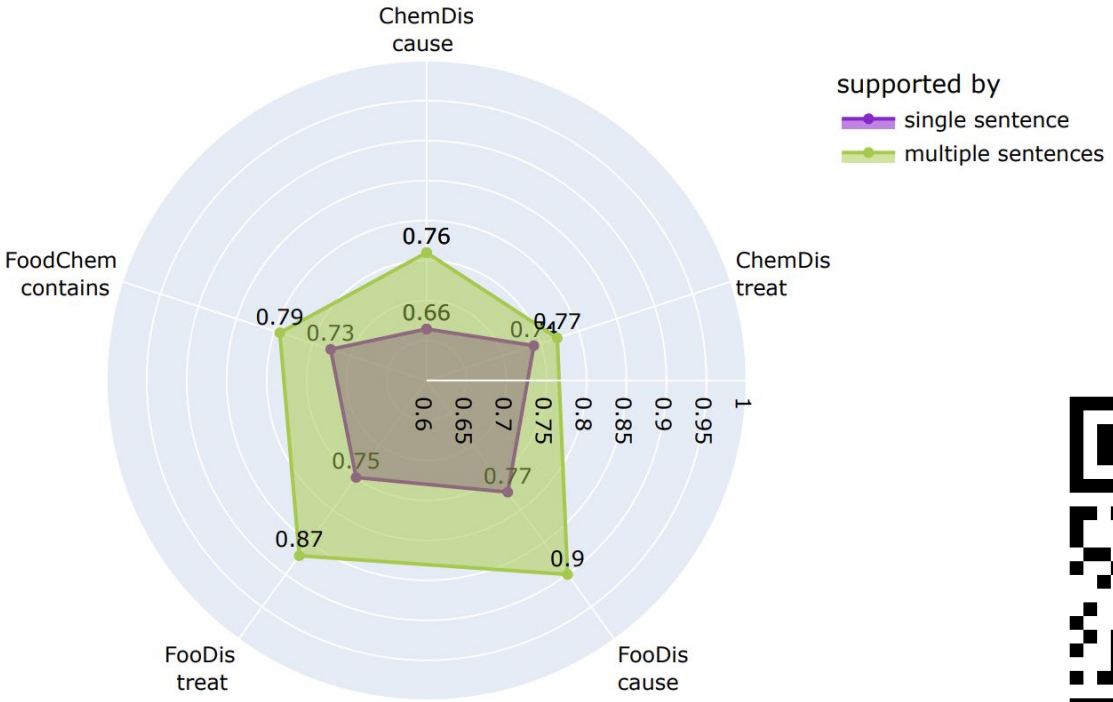


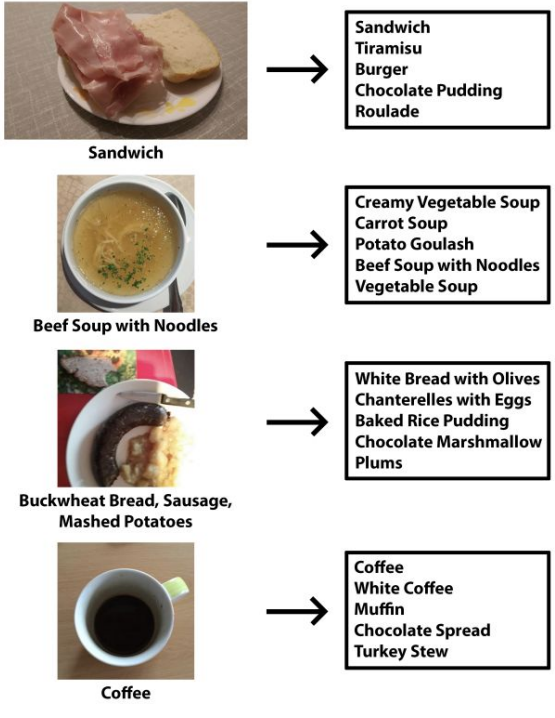


Food, Chemical, Disease Knowledge Graph



Food Image recognition

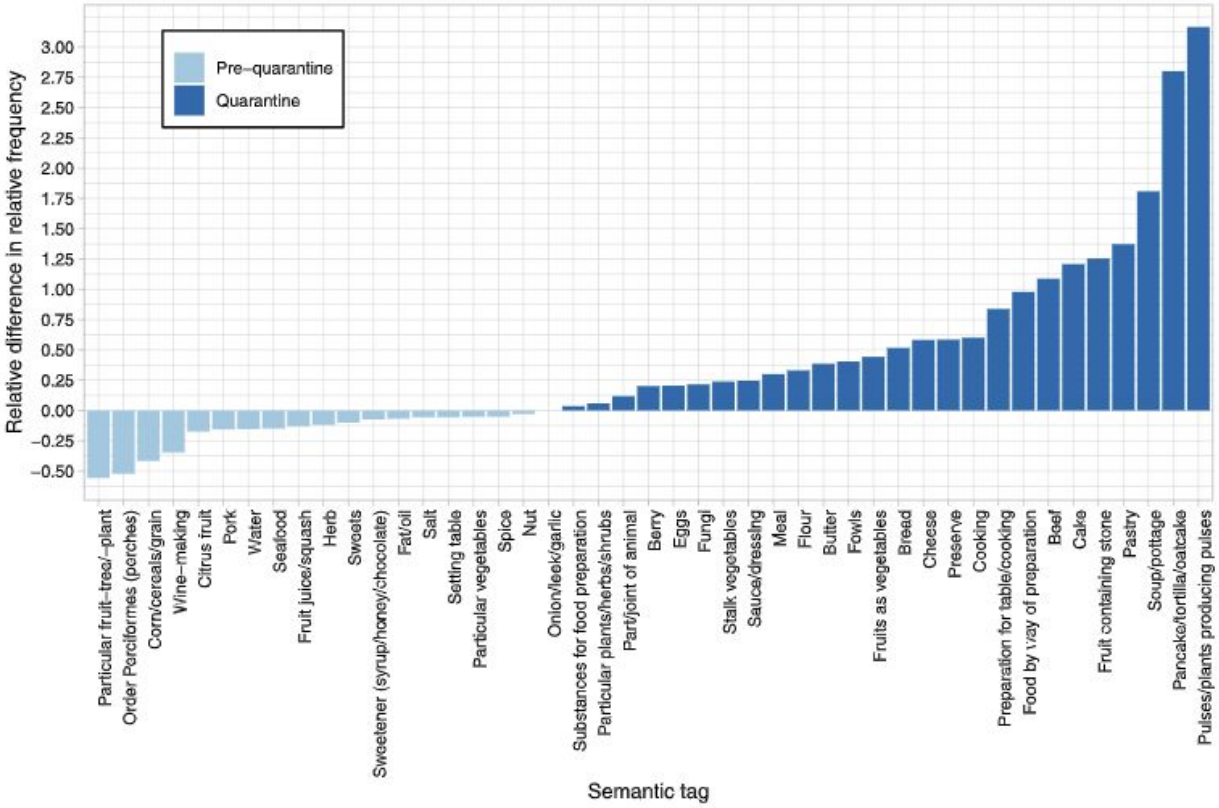
NutriNeet
86.72% accuracy across 512 different drinks and foods



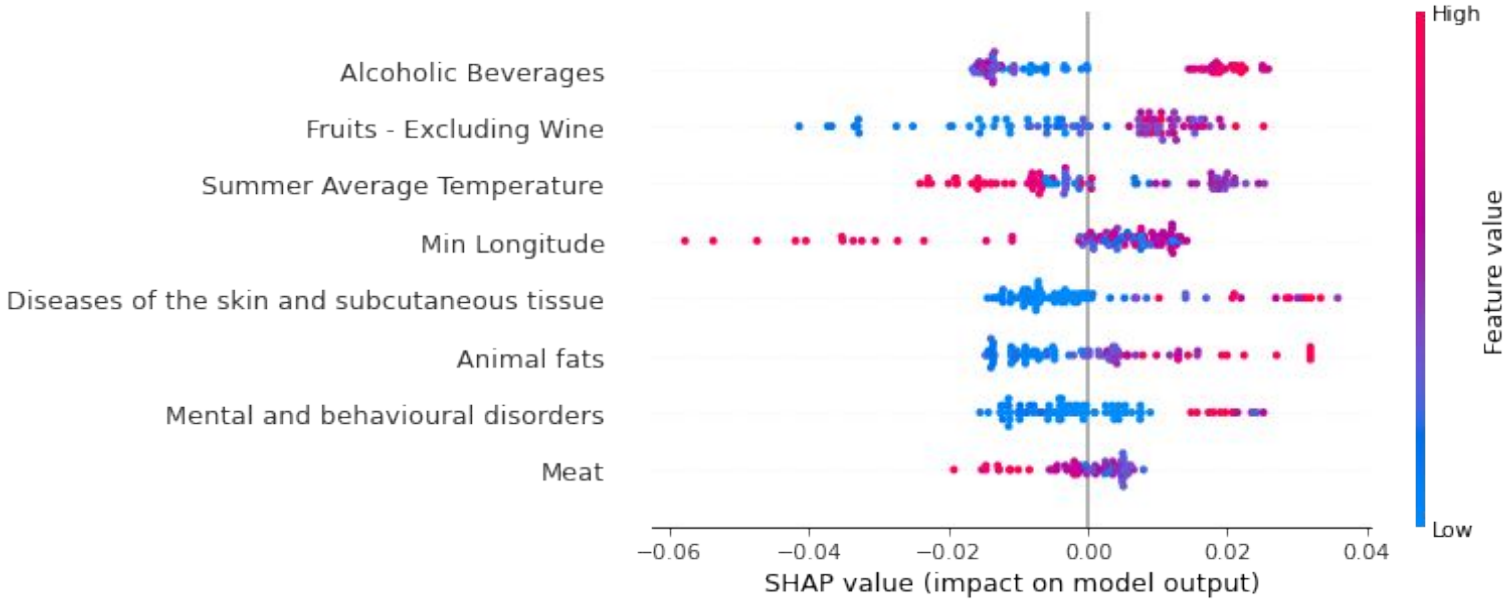
Food segment recognition
92.18% accuracy - 124 study participants

EU-organic and NutriScore logo recognition for packed foods
94% accuracy on NutriGreen dataset

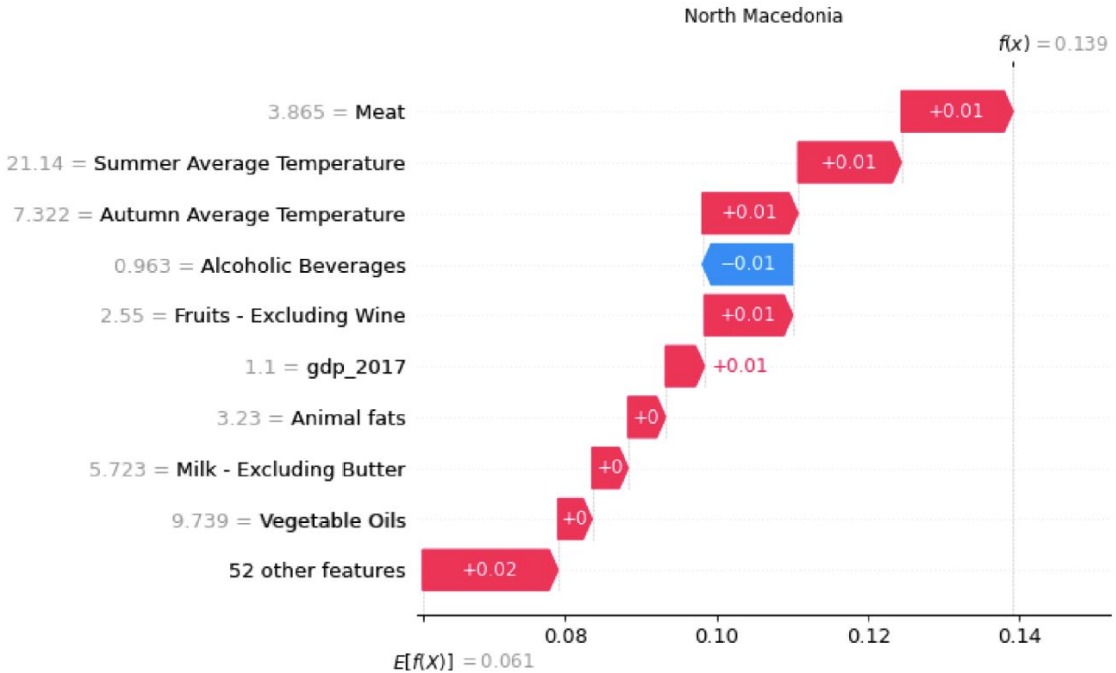
COVID-19 Impact on Food Consumption Patterns



FAO + WHO + Socio-economic Data for COVID-19 Mortality Prediction



COVID-19 mortality rate



Take Home Messages

- Limited food related data that is publicly available for learning
  - Support open science

- Instead of simile statistics let's use explainable AI

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