Unlocking The Flavor Network

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Process

1. Start with an ingredient

2. Get a list of ingredients related by shared flavor compounds

3. Use a recipe matrix to introduce ingredients that occur together in recipes

4. Voila, go invent a new dish!

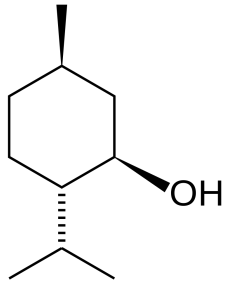
The Flavor Network

more shared flavor compounds = better flavor pairing

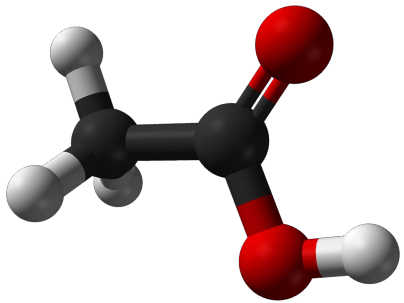
What is a flavor compound?

Compounds that contribute to flavor in food

Examples:



menthol



acetic acid

Data: shared flavor compounds

- 221,777 pairs of ingredients with number shared compounds

- Made into 1507x1507 matrix

Implementation:
Flavor Generator

Input Ingredient

Shares 3 flavor compounds with

Shares 52 flavor compounds with

Shares 14 flavor compounds with

Shares 17 flavor compounds with

jamaican rum

Explanation:

Flavor Generator

weighted choice

Input Ingredient

3 shared compounds

coriander
8 shared compounds

marjoram
4 shared compounds

celery
5 shared compounds

Our ingredients relate in the following way:

Shared Compounds

	fennel	enokidake	feta cheese	cherimoya	jamaican rum
fennel		3	1	1	6
enokidake	3		52	17	56
feta cheese	1	52		14	79
cherimoya	1	17	14		17
jamaican rum	6	56	79	17	

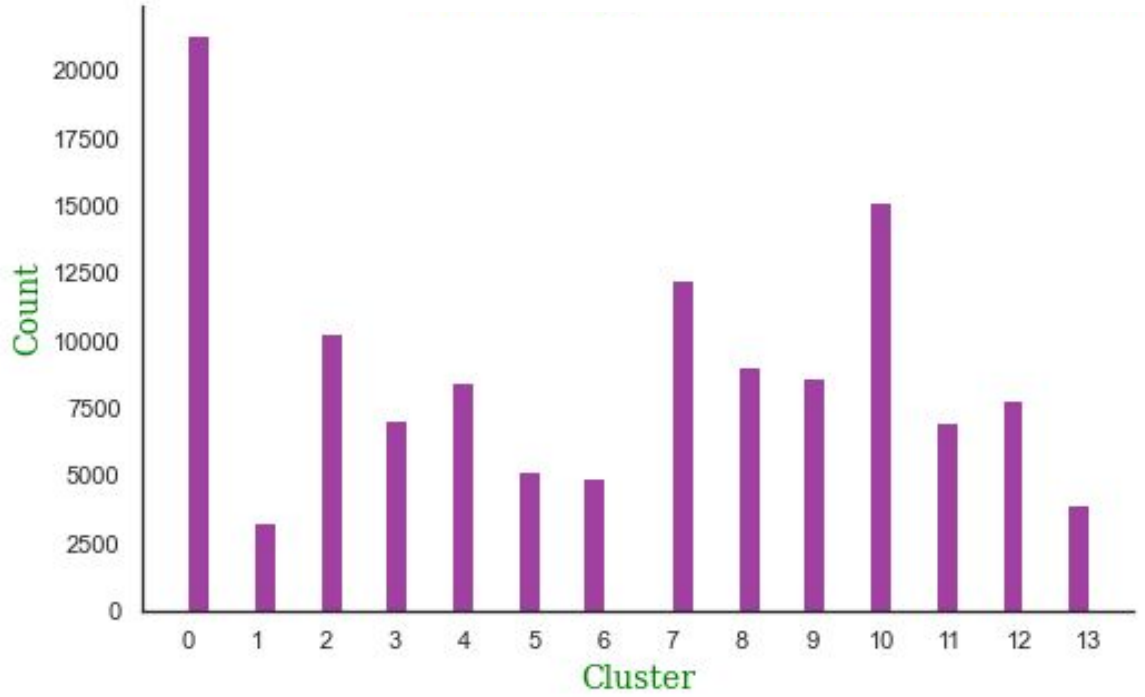
We’ve now got a piece of the flavor network

- How can we implement this in an actual dish?
- What sorts of recipes might use ingredients like these?
- We need some sort of template for these ingredients

Data: Recipe Matrices

- 122k recipes scraped from the internet
- Cleaned, TFIDF Vectorized, Kmeans clustered
- 14 clusters made into recipe matrices
- The values in each matrix are the number of times that ingredients appear together in recipes in the cluster

Number of recipes in each cluster



Vectorize the ingredients





Find a matrix that deals with ingredients like these by looking at cosine similarity

0	1	2	3	4	5	6	7	8	9	10	11	12	13
.098	.026	.017	.115	.320	.048	.046	.041	.031	.029	.065	.042	.019	.052

Number 4 looks promising

Two ways to approach interaction with recipe matrices

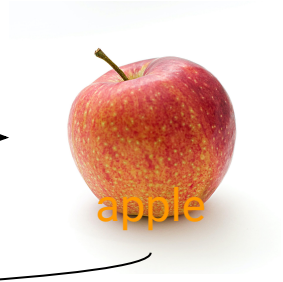
1. We can take off from an ingredient in our list and wander around the recipe matrix, aping ingredient combinations from the cluster.

2. We can force all new ingredients to be related to the ingredients in our list. We only want the recipe matrix to add ingredients that have been combined with the ingredients that we already have.

First approach: cluster 4 chooses feta as its initial ingredient

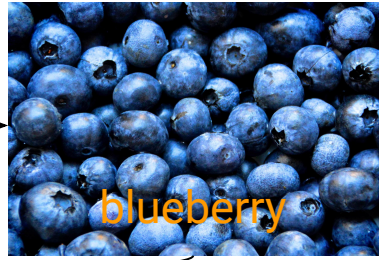
Seems like a salad

First approach: cluster 3 also chooses feta as its initial ingredient



Seems like a main course

First approach: cluster 0 chooses fennel as its initial ingredient



Seems like a dessert
(with sausage)

Now we've got some ideas



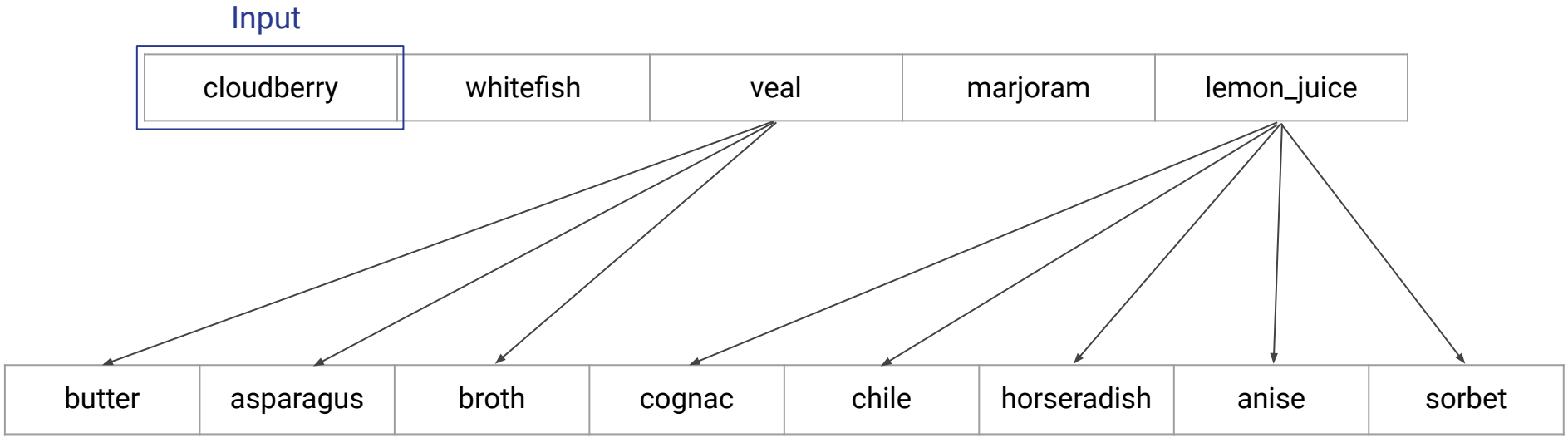


1. Salad: anchovies, parmesan, arugula, ciabatta, balsamic, cheddar, ranch, bagel

2. Main course: asparagus, veal, butter, vidalia onions, apple, chutney, cayenne, jalapeno

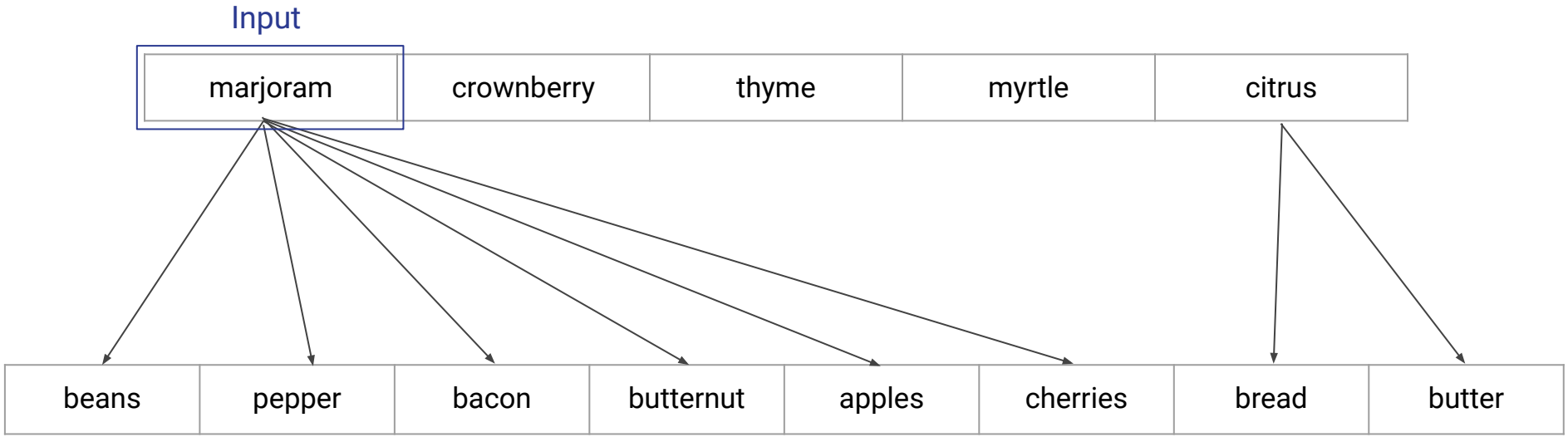
3. Dessert: sugar, blueberry, flowers, mint, yogurt, breadcrumbs, sausage, anise

Example of the second approach (new input):



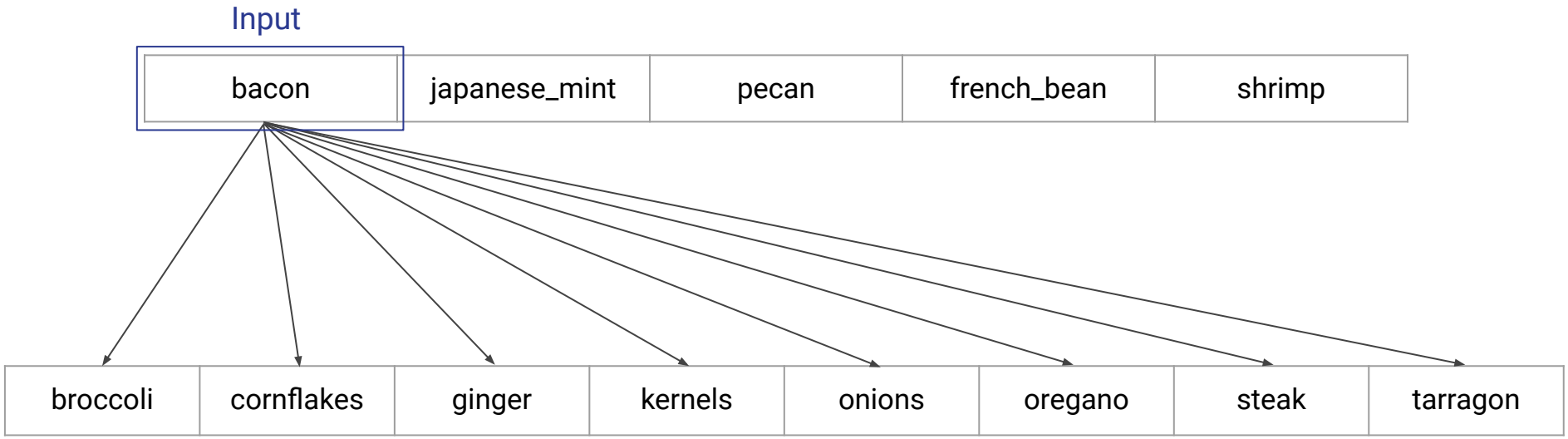
(Cluster 11)

Another example of the second approach:



(Cluster 8)

And again:



(Cluster 3)


bacon

Review

1. Started with fennel

2. Got a list of ingredients related to fennel by flavor compounds

3. Got ingredients that might round out a dish from our flavor matrices

4. Where can I find cherimoya around here?

To conclude:

- Exploring new flavor combinations can be immensely rewarding and these tools make it easy to find and try new things

- Check out my Flask app for your piece of the flavor network

Thank you for your attention

Tools

numpy, pandas, scikit-learn, matplotlib, seaborn, flask

Data sources

Flavor network and the principles of food pairing

https://www.nature.com/articles/srep00196

Recipe Box

https://eightportions.com/datasets/Recipes/