Ratatouille - Autoencoders as chef and nutritionist

Graduate

Joel Erzinger

Introduction: Artificial intelligence is rarely used in current cooking recipe processing and management. Large recipe databases such as food.com, cookbooks.com or chefkoch.de do currently not offer such services. When using music streaming services such as Spotify, for example, we are used to receiving music suggestions from algorithms. When it comes to cooking, however, we still rely on classic recipes that are usually maintained by laborious manual work. This thesis addresses this gap and aims to process recipes and their ingredients with the help of neural networks.

Whenever we buy a cookbook and cook the recipes described in it, we are used to the fact that we will like most or some of them. Although everyone's taste is individual, some combinations of ingredients seem to go better together than others. The theory is that there is a way to statistically determine which ingredients fit together better and which ones less well.

"There's a scientific reason certain foods pair well and others don't."

Conclusion: Recipe databases are sparse and international recipe databases do not even exist yet. Most of them originate from the North American culture and are therefore geographically bounded. Imperial units and different packaging sizes (cans and jars) require additional preprocessing efforts to standardize all quantities into SI units.

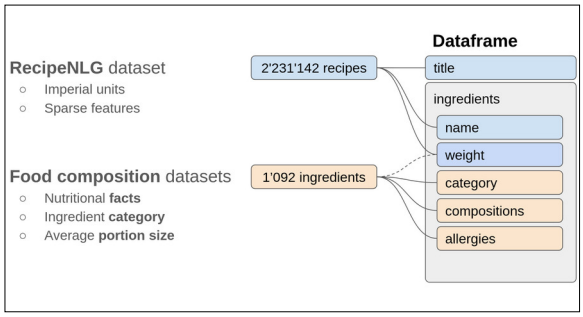
Well-maintained nutrition datasets for data enrichment are widely available. This enables deep insights into the available ingredients. The difficulty comes when merging a recipe database with a corresponding composition database. This causes problems due to the lack of language models trained on recipes.

We use standard and variational autoencoders as generative models for new recipes and as the basis for an online recommender system to generate new recipes based on ingredients one finds at home. When training the recipe data, a vanishing gradient can be observed depending on the network architecture. This is due to the extremely diverse dataset and smooth transitions between recipes.

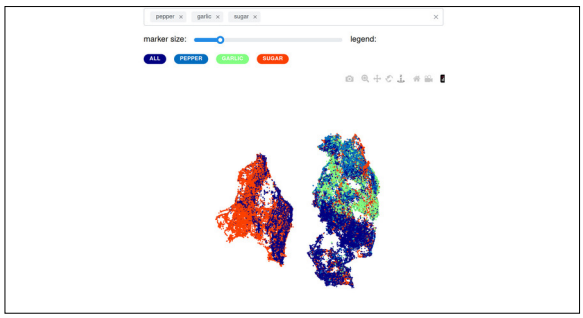
Despite the challenging situation, it is still possible to create a meaningful latent space. The corresponding embeddings can be used in a variety of ways.

Result: One of the trained models is selected and used to create an interactive web-app as an example of how such networks can be applied and implemented. There is still a lot of work to be done to achieve a fully functional product, but the approach in this thesis works surprisingly well and there is plenty of room for further experimentation.

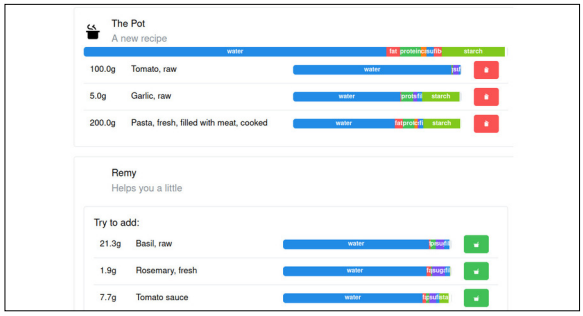
Data engineering concept in which various datasets are used and merged.
Own presentment



UMAP visualization of recipe embeddings.
Own presentment



Simple ingredient finder using a trained autoencoder.
Own presentment



Advisor
Prof. Dr. Christoph Würsch

Co-Examiner
Prof. Dr. Klaus Frick, Berufsmittelschule Liechtenstein, Vaduz

Subject Area
Data Science