DLiP - ChefGPT

December 2024

1 Introduction

For the ChefGPT project, we've designed a loss function to balance two critical aspects of ingredient recommendation: **flavour compatibility** and **nutritional adequacy**. The loss function combines these components into a weighted formula, ensuring that the recommendations align with both taste preferences and health considerations.

2 flavour Loss

The flavour loss, L_{flavour}, measures the (miss)match in flavour compatibility. For this, we use the chemical components/molecules. It is defined as:

$$L_{\text{flavour}} = 1 - \frac{1}{n} \sum_{i=1}^{n} p_i$$

where:

- n: Total number of flavour molecules.
- p_i: Overlap percentage for the i-th atom.

3 Nutritional Loss

The nutritional loss, $L_{\text{nutrition}}$, measures the difference between the proportions of observed macronutrients and the target. We selected a macronutrient distribution of 50% carbohydrates, 30% protein, and 20% fat. It is defined as:

$$L_{\text{nutrition}} = \sum_{j=1}^{m} |o_j - t_j|$$

where:

- o_j: Observed proportion for the j-th macronutrient.
- t_j: The target proportion (ideal) for the j-th macronutrient.
- m: Total number of macronutrient categories.

4 Weighted Total Loss

The total loss function combines flavour and nutritional losses. The corresponding weights decide is deemed as 'most important'. Also, log-transforming the individual terms eliminates scale-differences:

$$L = w_f \cdot \log\left(L_{\text{flavour}}\right) + w_n \cdot \log\left(L_{\text{nutrition}}\right)$$

where:

- w_f: Weight (scalar) for the flavour component.
- w_n: Weight (scalar) for the nutrition component.

5 Summary

The loss function balances flavour compatibility and nutritional adequacy, with weights controlling their relative importance. This framework allows for adaptable ingredient recommendations tailored to individual needs.