

## Sensory panel data analysis: An information theory oriented approach.

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Sensory panel surveys are an important tool to obtain a description of sensory properties for food products. Consumer surveys are subjective by nature, due to impossibility of: a) reproducing the same conditions in every human test; and b) the different sensory saturation levels and scale perception of each consumer<sup>1</sup>. This study proposes the use on the information theory concepts to determine existence and quantify the sensory attribute interactions. This research work was performed independently on two different products a regular margarine and a reduced-fat margarine in order to assess the main sensory interactions detected by the consumers.

The study was based on a simple difference test, where the consumer has to select which of the two samples has a stronger attribute. The survey quiz contains a total of 12 questions in which the consumer is inquired on attributed related with: colour, odour, texture (spread and mouth) and taste. For the regular margarine, 28 sensory tests were performed between 9 different product samples (produced on different days) and for the reduced-fat margarine, 32 sensory tests were performed between 9 different product samples.

The symbolic scale used to measure consumer responses hinders the direct application of numerical computations. By treating each response as a symbol allows the application of entropy and mutual information concepts<sup>2</sup> to determine the interactions between the different sensory attributes, for each product. Based on the use of the Mântaras distance<sup>3</sup> it is possible to determine a distance map between all the survey questions and by the application of a multidimensional scaling technique project it on a two dimensional map in order to visualize these interactions.

The study shows different sensory profiles for the two products. For these two products, the consumer sensitivity differences are statistically relevant for the attributes of brightness, colour homogeneity and odour.

The interactions between each attribute (measured by the mutual information between each pair of attributes) are also different for the two products. For regular margarine, there are two groups with statistical relevant binary interactions: a) odour strength and mouth viscosity (texture); b) pleasant odour, pleasant taste and taste strength. For the reduced-fat margarine, there is a group of sensory attributes composed by: texture and visual properties.

The study shows the interpretability gains due to the quantification sensory attribute interaction and proposes the use of multidimensional scaling techniques for its visualization.

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### References

- <sup>1</sup> Monrozier, R.; Danzart, M.; Food quality and preference, **2001**, *12*, 393-406.
- <sup>2</sup> Jakulin A.; Bratko I.; Smrke S.; Demsar J.; Zupan B.; AIME 2003, **2003**, *2780*, 229-238.
- <sup>3</sup> López de Mantaras, R.; Machine Learning, **1991**, *6*, 81-92.