Artificial Intelligence and Wine Fraud

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During the last years, the consumers have been interested in everything related to the characteristics and the quality of food products. The consumers are interested in healthy agri-food products and require food safety and authenticity. It is clear that the guarantee of origin is one of the most characteristic demands for the consumer, being this fact very important in the wine sector.

As it knows, wine is a complex alcoholic beverage and it is one of the most consumed alcoholic beverages in the world. Wine authenticity is guaranteed by national guidelines nevertheless, wine adulteration is a historical common practice (for example diluted with water) but in the last centuries, some practices were improved (mixing practices, for example).

The new analytical techniques for the quality control can be used, such as i) mass spectrometry (GC-MS, ICP-MS, etc.), ii) spectroscopy (NMR, IR, etc.), iii) separation (HPLC, GC, etc.) and iv) other techniques (sensory analysis, etc.). The analysed components obtained by these techniques can form a characteristic “fingerprint”. Different analysis and treatment of data such as i) Cluster Analysis (CA), ii) Principal Component Analysis (PCA), iii) Linear Discriminant Analysis (LDA), iv) K Nearest Neighbour (KNN) or v) Multiple Linear Regression (MLR), can be used to correlated the data analysed with a specific wine property.
Besides these, there are other kinds of methods that can be used to study different wine properties according to the constituent components. An example is the Artificial Neural Networks (ANNs), a kind of Artificial Intelligence method that can be used to determine different wine-making processes \cite{15} but this is not its only chance, on literature can be found different applications focused on classification or in prediction of wine process conditions \cite{16}. An example of this is the research developed by Jurado et al. to differentiate four Spanish white wines under certified brands of origin \cite{17}. Their ANN model obtained a prediction of 100% for all the classes considered \cite{17}. Artificial models were also used to classify seventy commercial rose wines using different variables measured for the certificated brands: Ribera del Duero, Rioja, Valdepeñas and La Mancha \cite{18}. The classification model included different input variables such as metals, classic enological parameters, among others \cite{18}. Even, ANN are capable to classify wines from different countries (Spain, France and Italy) \cite{19}. Nevertheless, neural networks can not only be used to differentiate or classify wines but also to detect problematic wine fermentations using different parameters \cite{20}. In fact, researchers predicted, with accuracy, problematic fermentations with only three parameters (such as sugars, alcohol and density) \cite{20}. A shorter scale study was carried out with Canary Islands wines and the obtained neural model could provide a good prediction ability (over 99%) \cite{21}. ANNs can be used to recognise adulteration practices, in this case in Italian wines, using thin-film multisensory array \cite{22}.

ANNs models could be interesting and beneficial for the wine sector to ensure the quality and safety of wines under a Protected Designation of Origin (PDO) and to improve its trade nationally and internationally.

References

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