P.38.- Application of Support Vector Machine (SVM) as chemometric model on NIRS data base to classify compound feedingstuffs contaminated with animal meals

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Near Infrared Spectroscopy is demonstrating considerable potential for screening of compound feedingstuffs in order to detect the presence/absence of meat and bone meal. Nowadays NIRS applications on feeds ingredients and compound feedingstuffs are going beyond the limits of the theory of diffuse reflectance, of agro-food products, which claims the need for a fine milling particularly for so heterogeneous matrices as compound feedingstuffs. Several papers have demonstrated the viability of the NIR analysis of unground commercial compound feedingstuffs for ingredients identification and quantification. However, robustness of the predictive models may be evaluated using linear and non-linear algorithms. Support Vector Machines are learning machines that can perform binary classification (pattern recognition) and regression estimation and are being applied with significant success in numerous real-world learning applications. The aim of the present work is the development of NIRS chemometric models using a Support Vector Machine (SVM) for detecting the presence of animal origin meals in compound feedingstuffs.

In this study were considering two populations: population A containing 151 contaminated samples, with different proportions of meat and bone meal (MBM), fish meal (FM) and blood meal (BM), and population B with 151 non-contaminated. The two populations were scanned in unground form using a FOSS NIRSystems 6500. The log 1/R from 400 to 2500 nm, every 2nm, have been used as input for developing a classification method induced with a SVM : a state-of-the-art technique of artificial intelligence specially devised to obtain accuracy classifiers in data sets whose objects are described by a large set of attributes (absorbances). Prior to start with the development of the NIRS chemometrics models it was needed to normalize all the spectrum data.
Using the training samples labeled either "yes" (containing MBM, FM or BM) or "no" (free of animal meals), the algorithms are able to learn a maximum-margin hyperplane which separates the region of positive and negative samples. We used Joachims' SVM^{light} with a linear kernel, thus the resulting classification procedure consists in checking the sign of an inner product, and its implementation is straightforward in any computer platform. In all the experiments reported, we used a cross validation procedure with 10 groups. In our experiment, 1050 data points were used as inputs to describe each sample belonging to the training set. In that case, the classification accuracy achieved was 80% when we stressed algorithm to reduce as much as possible the proportion of false negatives that was only of 1.08%. It is necessary to remark that the most relevant wavelengths range in order to classify the samples is those above 2050 nm. In fact, it is possible to learn a decision procedure with only 9 attributes without penalizing the classification scores. Thus, in this case, the global accuracy is 79.14% while the proportion of false negatives is just 1.11%.

Keywords

Compound feedingstuffs, NIR, animal origin meal, classification algorithms.