

Poster G-1

An Integrated Strategy In 2DE Maps Analysis For The Identification Of Potential Discriminants Between Different Clinical Conditions



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Short Abstract: Through techniques of dimensionality reduction, the gels, described in terms of features opportunely defined to be informative and to tackle the problem of the intrinsic variability of the 2DE technology, are represented as items in a three dimensional space, where it is possible to appreciate segregations, coherent in respect of clinical conditions.

Long Abstract:

Two-dimensional gel electrophoresis (2DE) is an experimental technique that represents an indispensable tool in proteomics for the analysis of protein expression in complex biological systems such as whole cells and tissues. It provides a proteome mapping of the sample through the orthogonal combination of charge separation (isoelectric point, pI) with size separation (relative molecular mass, Mr). The automatic extraction of information from gel images is still a challenging task.

Recently it was proposed an approach where overall quantitative image descriptors, extracted on the basis of pixel intensities quantified in the different zones in which the image is partitioned, are analyzed with techniques of dimensionality reduction (such as principal component analysis, PCA) to discriminate different clinical conditions [1].

We started from this approach to develop an integrated strategy for the automatic classification of gel images, within the framework of a study about peripheral neuropathies. We introduced a significant improvement in the definition of the descriptors, essentially through two novel aspects: features are extracted from the quantification of image areas segmented as spots, thus there is an improvement in the signal to noise ratio; and more, features are based on positions that are expressed, after an ad hoc calibration, in terms of pI and Mr, not merely in pixel. This kind of improvements leads to the chance of properly classify gel images that otherwise had to be excluded, because of the lack of the necessary homogeneity in respect of the other samples. Considering features in the new space of the biochemical properties, indeed, allows to bypass the problems that intervene comparing real samples, that in general present sensible differences in protein migration, due to the intrinsic variability of this technology.

Through the application of this strategy, based on PCA of the features so obtained, it was possible to see the gels of the dataset as items in a three dimensional space segregating according to their clinical conditions: pathological samples and control were confined in different zones and, very interesting, among pathological samples it was possible to

distinguish subjects with algic symptomatology from subjects without pain.

The method developed can be very useful and close to the real lab process, because it is very fast and does not need any a priori information; thus it may represent an effective and repeatable classification approach.

The accurate information extraction in gel images processing is an important topic in computational biology and the treatment of patterns emerging from separation images intended as fingerprints of the correspondent clinical conditions may provide an interesting point of view.

[1] Marengo E, Robotti E, Righetti PG, Antonucci F. New approach based on fuzzy logic and principal component analysis for the classification of two dimensional maps in health and disease - Application to lymphomas. *Journal of Chromatography A* 1004: 13-28, 2003.