Automated determination of stellar population parameters in galaxies using active instance-based learning

Thamar Solorio[1], Olac Fuentes[1], Roberto Terlevich[1], Elena Terlevich[1], and Alessandro Bressan[2]

[1] Instituto Nacional de Astrofísica, Óptica y Electrónica,
Luis Enrique Erro 1,
72840 Puebla, México
[2] Osservatorio Astronomico di Padova
Vicolo dell' Osservatorio 5
1-35122 Padova, Italy

Abstract. The availability for the first time of huge astronomical spectroscopic surveys such as the SDSS and 2Df, with more than 10^5 spectra each, will allow the accurate determination of intrinsic physical parameters of a large number of galaxies, including the age distribution and metallicity of their stellar populations.
The importance of the accurate knowledge of these parameters for cosmological studies and for the understanding of galaxy formation and evolution cannot be overestimated. Template fitting has been used to carry out estimates of the distribution of age and metallicity from spectral data. Although this technique achieves good results, it is very expensive in terms of computing time and therefore can be applied only to small samples.
Starting from a grid of theoretical population synthesis models we constructed a set of fully theoretical model galaxies with a distribution of ages, metallicities and intrinsic reddening. Using this set we have explored a new method that maximizes speed and accuracy. Our proposed technique combines standard least-squares fitting with an active instance-based machine learning algorithm. Experimental results show that this method can estimate with high speed and accuracy the physical parameters of the stellar populations. Based on empirical evidence we believe that this method can be applied with equal success to other astronomical problems, reducing the computational cost and thus providing the capability of analyzing larger quantities of astronomical data.