X23a Understanding Galaxy Evolution through Machine Learning

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Galaxy evolution is a complicated process that encompasses the evolution of many physical properties in/around a galaxy (e.g., stellar mass, gas mass, SFRs, SFHs, environment). However, the interaction between the individual physical properties are entangled and are too messy to be understood intuitively. With the advent of machine learning techniques, computer algorithms have been able to identify hidden or obscure patterns in the data without any prior information about them (unsupervised). These algorithms can thus aid us in identifying a simpler model for galaxy evolution without any human biases. In this work, we demonstrate a dimensionality reduction/feature selection method to identify a low-dimensional manifold from the high-dimensional galaxy data. We employ a galaxy sample with 11 luminosities of ultraviolet to infrared (FUV, NUV, u, g, r, i, z, Y, J, H, K) from the Reference Catalog of Spectral Energy Distributions (Chilingarian et al. 2016). The discovered manifold lies in the luminosity space and shows a continuous evolution from actively star-forming galaxies to the quenched ones, challenging the existing notions of bi-modal distributions in color-color space.