Examining the Limits of an Artificial Neural Network in Predicting the HI Content of Galaxies ()

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The neutral hydrogen (HI) in galaxies provides the gas reservoir out of which stars are formed. The ability to determine the HI masses for statistically significant samples of galaxies can provide information about the connection between this gas reservoir and the star formation that drives galaxy evolution. However, there are relatively few galaxies for which HI masses are known because these measurements are significantly more difficult to make than optical observations. Artificial neural networks are a type of nonlinear technique that have been used estimate the gas masses from their optical properties (Teimoorinia et al. 2017). We present HI observations of 51 galaxies with gas and stellar properties that are rare in the Arecibo Legacy Fast ALFA Survey (ALFALFA, Haynes et al. 2018) which was used to train the Artificial Neural Network developed by Teimoorinia et al. (ANN, 2017). These sources provide a test of the Artificial Neural Network predictions of HI mass and include some rare and interesting systems including galaxies that are extremely massive in both stellar mass (log $M_* > 11.0$) and HI mass (log $M_{HI} > 10.2$) with large HI line widths ($w_{50} > 500$ km/s). We find that this Artificial Neural Network systematically overestimates the gas fraction of the galaxies in our selected sample, suggesting that care must be taken when using these techniques to predict gas masses for galaxies from a broad range of optical properties.

Publication:
American Astronomical Society, AAS Meeting #233, id.260.01

Pub Date:
January 2019

Bibcode:
2019AAS...23326001R