Paper ID: 84388
student

IAF SYMPOSIUM ON ONGOING AND NEAR FUTURE SPACE ASTRONOMY AND SOLAR-SYSTEM SCIENCE MISSIONS (A7)
Interactive Presentations - IAF SYMPOSIUM ON FUTURE SPACE ASTRONOMY AND SPACE PHYSICS (IP)

Author: Ms. Neha Upadhyay
India

INTEGRATING MACHINE LEARNING WITH ASTROPHYSICAL TECHNIQUES FOR ENHANCED COSMIC DISTANCE MEASUREMENTS

Abstract

In the pursuit of advancing our understanding of the cosmos, this research proposes a novel approach to determine the distances of deep-space objects, such as nebulae galaxies and other stellar formations, by utilizing their hyperspectral, infrared (IR), and visible spectrum images. Traditional methods for measuring cosmic distances such as parallax, standard candles e.g., Cepheid variables and Type 1a supernovae, and redshift measurements, while foundational, face limitations in accuracy and applicability beyond certain distances. To overcome these challenges, our study aims to integrate these traditional astrophysical concepts with cutting-edge machine-learning techniques. The proposed methodology involves collecting hyperspectral images, IR, and visible images of deep-space nebulae, galaxies, and other stellar formations, mainly focusing on objects with known distances to serve as training data. A critical part of this research will be to develop or adapt existing algorithms capable of analyzing these images to estimate distances. Preliminary analysis indicates the use of Convolutional Neural Networks (CNN) for image analysis to extract relevant features, along with regression models (linear, polynomial) and Random Forest algorithms for the regression tasks to predict distances of celestial objects whose distances are currently unknown. This research seeks to refine the accuracy of cosmic distance measurements and expand the range of objects and distances that can be measured, offering an alternative method to traditional techniques. By leveraging the strengths of machine learning and the rich information contained within hyperspectral, IR, and visible spectrum images, this study aims to enhance our ability to map the universe, verify known distances, and discover new insights into the farthest reaches of space. This research represents a significant leap forward in space exploration and science. By addressing the limitations of current distance measurement techniques and harnessing the power of machine learning, this project paves the way for discoveries and a deeper understanding of the cosmos, marking a milestone in our quest to explore the universe.