



Contribution ID: 530

Type: **Talk in a parallel session**

## **Deep Learning for Identification and Characterization of Ca II Absorption Lines: A Multi-Task CNN Approach**

*Friday, 12 July 2024 17:00 (20 minutes)*

Quasar absorption line is a powerful tool for studying the universe, enabling us to probe distant gas, dust, and galaxy formation and evolution. However, detecting Ca II absorbers is particularly challenging, requiring significant time and effort. Existing deep learning methods often produce a high number of false positives and still require extensive manual verification, achieving an precision of only 20.3%. To address this issue, we propose a multi-task convolutional neural network (CNN) architecture. We compare three different CNN structures and find that the ResNet-CBAM model, which incorporates residual modules and an attention mechanism, performs best. Results demonstrate that the ResNet-CBAM model achieves an accuracy of 99.53% in detecting Ca II absorbers. Additionally, it excels in predicting critical parameters such as equivalent width (EW) and full width at half maximum (FWHM), with correlation coefficients of 0.964 and 0.849, respectively. Furthermore, it exhibits excellent generalization ability, boosting detection precision on new data from a mere 20.3% to 90.5%, significantly reducing the need for manual inspection and paving the way for automated Ca II absorber search. In real-world applications on SDSS Data Release 7 (DR7) and DR12, our model successfully identified 743 known Ca II absorbers and discovered potential candidates in approximately 400 spectra.

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**Session Classification:** Machine learning in astronomy: AGN, transient events, cosmology and others

**Track Classification:** Artificial Intelligence Methods (AI): Machine learning in astronomy: AGN, transient events, cosmology and others