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emi-Supervised Domain Adaptation for Sim-to-Obs Astrophysics: DESI→J-PAS

Modern ML models trained on simulations often degrade on real data because of domain shift. I will present a semi-supervised domain adaptation (SSDA) pipeline that transfers a four-class pseudo-spectral classifier (high-z QSOs, low-z QSOs, galaxies, stars) from abundant DESI→J-PAS mocks (˜1.5M) to real J-PAS observations using only a small labeled J-PAS subset. The method pretrains on mocks, then freezes the classification head and adapts the encoder with balanced cross-entropy, using J-PAS labels to guide class-conditional alignment. On a held-out J-PAS test set, SSDA improves macro-F1 to 0.82 compared to 0.79 (target-only baseline with the same label budget) and 0.73 (zero-shot mocks). Gains concentrate in quasars, e.g., high-z QSO F1 rises to 0.66 (vs. 0.55/0.37), reflecting reduced confusion near z≈2.1 and better separation from compact galaxies. I will discuss why these gains occur, remaining degeneracies in narrow-band pseudo-spectra, and how modest target supervision enables reliable, label-efficient sim-to-obs transfer for target selection and AGN searches. Code and configs will be shared for straightforward reuse.

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