LEARNING DOMAIN ADAPTATION THROUGH STATISTICAL INVARIANT REPRESENTATION

Author's: J. Shifana[1], G. Thilipkumar[2], K. Sujith[3], N. Vanjulavalli[4]

Abstract

Domain adaptation has emerged as a critical research direction in machine learning due to the growing demand for deploying predictive models across varying data environments. In real-world applications, models trained on a labeled source domain often experience significant performance degradation when applied to a target domain with different statistical characteristics. This performance gap arises primarily due to domain shift, where the feature distributions between the source and target domains differ in terms of mean, variance, and higher-order statistics. To address this challenge, this study proposes a statistical invariant learning framework for effective domain adaptation.The core objective of the proposed approach is to reduce domain discrepancy by aligning statistical properties between source and target domains without requiring labeled target data. Specifically, the method leverages second-order statistical alignment using Correlation Alignment (CORAL), which minimizes the Frobenius norm distance between source and target covariance matrices. By transforming the target feature space through whitening and re-coloring operations, the approach ensures that the covariance structure of the target domain matches that of the source domain. This statistical alignment enables the learned classifier to generalize more effectively across domains.