Source-Free Multi-Domain Adaptation with Fuzzy Rule-based Deep Neural Networks

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Abstract: Unsupervised domain adaptation deals with a task from an unlabeled target domain by leveraging the knowledge gained from labeled source domain(s). Fuzzy system is adopted in domain adaptation to better tackle the uncertainty caused by information scarcity in the transfer. But existing domain adaptation methods rarely deal with any soft information component due to data imprecision. Besides, fewer methods handle multiple source domains which provide richer transfer information. Thus, in this paper, we propose source-free multi-domain adaptation with fuzzy rule-based deep neural networks (SF-FDN), which takes advantage of a fuzzy system to handle data uncertainty in domain adaptation without source data. To learn source private models with high generality, which is important to collect low noisy pseudo target labels, auxiliary tasks are designed by jointly training source models from multiple domains which share source parameters and fuzzy rules while protecting source data. To transfer fuzzy rules and fit source private parameters to the target domain, self-supervised learning and anchor-based alignment are built to force target data to source feature spaces. Experiments on real-world datasets under both homogeneous and heterogeneous label space scenarios are carried out to validate the proposed method. The results indicate the superiority of the proposed fuzzy rule-based source-free multi-domain adaptation method.

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