

An Implementation of “Adversarial Discriminative Domain Adaptation”

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1 Introduction

While methods based on deep learning have achieved state-of-the-art results on numerous tasks, most of these methods are based on the assumption that the data used to train the model is drawn from the same distribution that the data used to test the model is drawn from. This assumption can be violated in the real world, where AI models should be able to adapt themselves to new environments with little human supervision. In order to address this problem, methods based on *single-source unsupervised domain adaptation* utilize labeled data from a *source domain* to achieve satisfactory performance on unlabeled data from a different, but related *target domain* [1].

In this document, we discuss our implementation of “Adversarial Discriminative Domain Adaptation” [2]. In addition to documenting our implementation of the paper, we provide the results of our replications of the performed experiments. Furthermore, we comment on the result of each replicated experiment, and offer possible reasons for the success or failure of every experiment.

1.1 Overview of the Method

In [2], the authors propose a framework for single-source unsupervised domain adaptation on a classification task that is trained in three stages. The assumptions of the method are those of single-source unsupervised domain adaptation presented earlier in the introduction, as well as the assumption that the source domain and the target domain share the same set of classes.

Firstly, a *source encoder* and a *classifier* are jointly trained on labeled data from the source domain. Secondly, a *target encoder* is trained adversarially against a *discriminator*. This is performed in a way that given unlabeled data from the target domain, the target encoder can generate representations that are similar to the representations generated by the source encoder, given data from the source domain. In this sense, the second stage of training in the framework proposed by [2] can be understood like the training of a Generative Adversarial Network [3]. In this analogy, the target encoder is the generator, and the ‘real data’ that the target encoder is trying to forge consists of representations generated by the source encoder from data belonging to the source domain. In the beginning of the second stage of training, the weights of the target encoder are initialized from the weights of the source encoder trained on the source domain in the first stage. During the second stage, the weights of the source encoder are fixed, and only the target encoder and the discriminator are trained. Finally, the weights of the tar-

get encoder trained in the second stage and the classifier trained in the first stage are fixed, and given unlabeled data from the target domain, the target encoder and the classifier attempt in conjunction to predict class labels for the unlabeled target data [2]. The intuitive justification behind this framework is that if the source encoder and the classifier are trained well on the source domain in the first stage, then given representations generated by the source encoder from data belonging to the source domain, the classifier can accurately predict class labels for data from the source domain. Consequently, if the target encoder can receive data from the target domain and generate similar representations to those that the source encoder can create from source data, then we can give the representations generated by the target encoder to the classifier and expect a reasonably accurate classification performance on the unlabeled target data. Figure 1 illustrates the three stages of the framework.

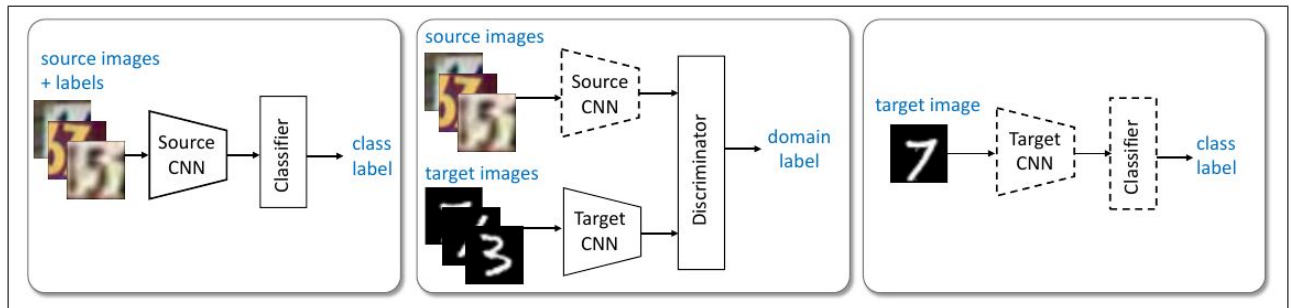


Figure 1: The framework proposed in [2]. This figure belongs to [2].

References

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