1 Summary

The standard MMD formulation does not account for changes in class prior distribution. The authors present a Weighted MMD formulation which addresses this issue of class weight bias across domains. Since class labels in target domain is not available, the paper treats these labels as hidden variables and uses classification EM algorithm to estimate these auxiliary class weights and updating model parameters.

2 Strengths

- The construction of reference source distribution $p_{s,\alpha}(x)$ for comparing the discrepancy between source and target domain when there is class weight bias across domains is quite clever.
- Using the kernel trick, exact computation of weighted MMD takes $O(n^2)$ time-complexity which is rather undesirable. The paper uses an unbiased estimate of weighted MMD which can be computed in $O(n)$.

3 Weaknesses

- While analyzing the impact of class weight bias, as expected WDAN performs better than AlexNet across all biases. But it can also be observed that AlexNet is equally robust to class bias as compared to WDAN. The paper does not mention this observation or explain why this happens.
- The paper only mentions that γ hyperparameter is optimized using cross-validation but does not mention how it effects the overall performance.
- Use of unbiased estimate of WMMD in $O(n)$ does lead to faster computation but it also has a higher variance than the $O(n^2)$ exact computation. The paper does not address this issue nor does it talk about its effect on performance.

4 Critique of Experiments

- The authors implement their weighted MMD formulation on various CNN architectures such as AlexNet, GoogLeNet, VGGnet-16. They test its improvement on 4 standard UDA datasets, Office-10+Caltech-10, Office31, ImageCLEF, Digit Recognition. It is found that WMMD beats standard MMD implemented CNNs by significant margin which implies that WMMD can alleviate the effect of class weight bias.
- Plot of λ, relative WMMD weight in total loss, on test accuracy reveals that there exists a λ for which accuracy is maximum indicating that an appropriate balance is important. It is also observed that WDAN beats DAN for all values of λ, demonstrating that mining the class weight bias in MMD is meaningful.
- WDAN, DAN and AlexNet are trained for same datasets under different levels of class weight bias. Its observed that WDAN is significantly more robust to class bias than DAN model, whose performance falls sharply as the bias increases.
- t-SNE visualization of learned features for DAN and WDAN models are analyzed. It is observed that features learned by the proposed WDAN can reserve more class discrepancy distance than ones learned by DAN.

5 Follow Ups/Extensions

- To study the effect of γ hyperparameter, we should vary its value between $[0, 2]$ and plot the validation dataset performance. The paper only varues γ from $[0, 1]$
- We can try annealing γ over epochs to make the network easier to learn classification on source domain first and then slowly getting better at auxiliary label prediction.