1 Summary

Rather than minimizing the naive euclidean distance, the paper addresses the issue of domain adaptation by minimizing the geodesic distances between covariance matrices of source and target domains. The authors also minimize the distances between mean vectors of source and target so as to capture first-order statistic as well. It is shown experimentally that this Deep LogCORAL approach beats Deep CORAL approach on Office Dataset.

2 Strengths

- Unlike in Deep CORAL, instead of only minimizing the distances between covariance matrices, the paper also includes minimizing the distances between mean vectors of source and targets. This captures both first and second order data statistic which improves performance.
- Log operation on eigenvalues of PSD matrices make the riemannian manifold to be flat. The euclidean distance on this transformed space is a better distance metric than the naive euclidean distance between covariances.

3 Weaknesses

- The paper only includes first and second order statistic. If source and target domain data are distinguishable only in a higher order dimensional space, the method would not work.
- The paper does not give any specific reason as to why it chose fc7 layer for aligning the first order statistic between target and source domains. Why not choose fc8 layer for this purpose also ?

4 Critique of Experiments

- For stable training, the covariance matrix and mean vector are computed as moving averages of current batch statistics. This gives an estimator which doesn't vary much as batch changes.
- The authors take pre-trained AlexNet model and implement their LogCORAL approach on Office dataset. The performances are compared with CORAL and naive fine tuned CNN models. It is found that LogCORAL + Mean approach beats CORAL by 1.07%.
- Ablation study reveals that both first and second order statistics individually improve performance over baseline naive CNN model. Also, replacing CORAL loss by logCORAL loss improves performance by 0.68%.
- When optimizing only the mean loss, logCORAL loss remains stable over the training epochs but if we only optimize the logCORAL loss, the mean loss goes up. This shows that these losses have very weak correlation and optimizing over both would achieve better results.

5 Follow Ups/Extensions

- It would be interesting to see the performance if this LogCORAL approach is incorporated to models that use gaussian kernels for domain alignment like DAN, JAN-A.
- We can try see the impact of aligning the first order statistic from different layers also. For example, instead of using fc7, we can use activations from fc8 to align mean vectors as well as covariance matrices from source and target domains.