

Synthetic Data Experiments With Random Cov Matrix Per Domain

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In Theorem 4.4 we have shown a theoretical generalization result, but under the limitation of shared covariance structure across domains (up to a scaling factor). Our results in the synthetic data experiment, presented in section 5.1 empirically support this result. In this section we want to test whether the generalization to new domains can hold also in DGPs where the covariance between domains does not share exactly same structure. To this end, we recall the DGP presented in section 5.1:

$$\begin{aligned} Z_e &\sim U[u_{\text{low}}, u_{\text{high}}] \\ Y &\sim \text{Bernoulli}(0.5) \\ X &\sim Y(\mu + Z_e\nu) + N(0, \Sigma) \end{aligned}$$

In the following experiment we change the covariance matrix to be domain-specific in the following way:

1. We sample for each domain a diagonal matrix, D_e , with diagonal values sampled from a normal distribution with $\mu = \sigma$ and $std = 0.05$ (this process generates std values, which are then squared to form the diagonal values of D_e). σ values are the same as set in the original experiment from section ??.

$$\begin{aligned} D_e &= \text{diag}([D_{e,1}^2, \dots, D_{e,d}^2]) \\ \forall 1 \leq i \leq d \quad D_{e,i} &\sim N(\sigma, 0.05) \end{aligned}$$

2. For each domain we sample uniformly a rotation matrix Q_e .
3. For each domain we set the covariance matrix $\Sigma_e = Q_e^T D_e Q_e$

All other experiments' hyper-parameters are the same as the original experiment from section 5.1. The results are presented in Figure 1 and Table 1.

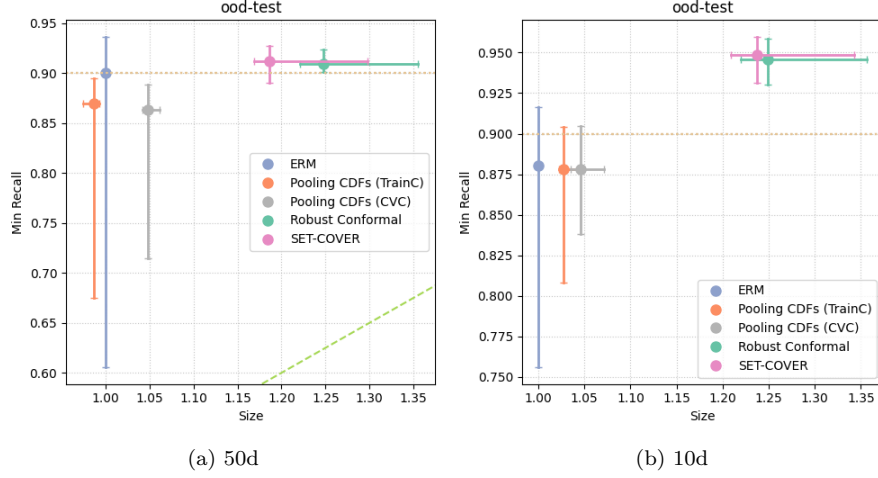


Figure 1: Min Recall distribution VS Mean Set Size distribution. **Blue** represents ERM model, **Orange** represents Pooling CDFs (TrainC), **Grey** represents Pooling CDFs (CVC), **Green** represents robust conformal, and **Pink** represents SET-COVER. The horizontal solid line represents the 90% recall target value.

Table 1: OOD Performance on synthetic Datasets

(a) 10d

Model	Median Min Recall \uparrow	Median Avg Size \downarrow	Recall $\geq 90\%$ Pctg \uparrow
ERM	0.88	1.0	0.39
CDF Pooling- (TrainC)	0.87	1.02	0.30
CDF Pooling- (CVC)	0.87	1.04	0.32
Robust- Conformal	0.94	1.24	0.94
SET-COVER	0.94	1.23	0.92

(b) 50d

Model	Median MinRecall \uparrow	Median Avg Size \downarrow	Recall $\geq 90\%$ Pctg \uparrow
ERM	0.90	1.0	0.52
CDF Pooling- (TrainC)	0.86	0.98	0.19
CDF Pooling- (CVC)	0.86	1.04	0.27
Robust- Conformal	0.90	1.24	0.71
SET-COVER	0.91	1.18	0.68