1 Test results on multiple classifiers

Table 1: Real world data results using KNN classifier

Selection	f-score					
	NIPS	Ionosphere	Musk2	Isolet	Semeion	Advertisement
Full-dimension	0.57	0.70	0.9	0.58	0.1 265	0.73
C4.5	0.58	0.87	0.9	0.63	0.79	0.92
MIC	0.78	0.83	0.86	0.78	0.78	0.91
SFS(KNN)	0.84	0.85	0.91	**	**	**
CFS	0.82	0.81	0.86	0.82	0.9	0.91
ReliefF	0.87	0.79	0.84	0.82	0.87	0.87
mRmR	0.55	0.89	0.9	0.57	0.9	0.9
Doquire	0.56	0.88	0.9	0.56	0.93	0.9
RaR	**0.88**	**0.88**	**0.91**	**0.87**	**0.92**	**0.91**

Table 2: Minimum number of features required to obtain the quality in Table 1

Selection	NIPS	Ionosphere	Musk2	Isolet	Semeion	Advertisement
MIC	11	2	163	11	82	14
SFS(KNN)	5	2	135	**	**	**
CFS	15	2	155	15	119	7
ReliefF	20	4	136	20	173	54
mRmR	5	5	117	2	151	13
Doquire	2	4	117	2	156	15
RaR	**12**	**2**	**16**	**11**	**17**	**9**

Table 3: Real world data results using Naive Bayes classifier

Selection	f-score					
	Madelon	Ionosphere	Musk2	Isolet	Semeion	Advertisement
Full Dimension	0.59	0.82	0.74	0.58	0.81	0.9
MIC	0.60	0.9	0.78	0.61	0.86	0.92
SFS(KNN)	0.60	0.86	0.69	**	**	**
CFS	0.6	0.91	0.7	0.61	0.85	0.94
ReliefF	0.61	0.9	0.72	0.6	0.85	0.92
mRmR	0.57	0.84	0.8	0.57	0.86	0.9
Doquire	0.57	0.82	0.81	0.57	0.86	0.9
RaR	0.71	0.9	0.78	0.61	0.98	0.91

Table 4: Minimum number of features required to obtain the quality in Table 3

Selection	NIPS	Ionosphere	Musk2	Isolet	Semeion	Advertisement
MIC	16	5	8	16	85	994
SFS(KNN)	475	4	4	**	**	**
CFS	4	12	4	4	101	171
ReliefF	2	7	6	2	192	993
mRmR	1	2	20	2	18	18
Doquire	2	2	20	2	9	41
RaR	**3**	**8**	**4**	**1**	**17**	**9**

Table 5: Real world data results using SVM (RBF kernel) classifier

Selection	Fscore					
	Madelon	Ionosphere	Musk2	Isolet	Semeion	Advertisement
Full Dimension	0.53	0.83	0.77	0.59	0.84	0.62
MIC	0.61	0.85	0.78	0.61	0.91	0.89
SFS(KNN)	0.60	0.85	0.79	**	**	**
CFS	0.61	0.86	0.8	0.61	0.9	0.91
ReliefF	0.61	0.85	0.79	0.62	0.9	0.89
mRmR	0.53	0.88	0.81	0.62	0.9	0.8
Doquire	0.54	0.88	0.81	0.62	0.91	0.82
RaR	0.68	0.85	0.81	0.62	0.92	0.88

Table 6: Minimum number of features required to obtain the quality in Table 5

Selection	NIPS	Ionosphere	Musk2	Isolet	Semeion	Advertisement
MIC	2	9	70	2	135	42
SFS(KNN)	2	16	37	**	**	**
CFS	1	8	86	1	72	12
ReliefF	34	18	91	34	105	53
mRmR	6	23	139	1	100	11
Doquire	2	23	139	1	108	11
RaR	**3**	**3**	**52**	**1**	**65**	**4**

2 RaR parameters

Table 7: RaR parameters used to obtain the results

Data	M	k	Number of iterations for estimating Def 1	α
NIPS	1000	5	250	0.15
Ionosphere	800	3	250	0.02
Musk2	1000	4	100	0.03
Isolet	1000	4	250	0.15
Semeion	1500	3	200	0.2
Advertisement	1000	4	100	0.18

3 Proof 1

Given a subspace X and a target Y, $KLD(P(Y|X)||P(Y))$ converges to mutual information.

$$E_X[KLD(P(Y|X) \mid\mid P(Y))] = \sum_X P(X) \sum_Y P(Y|X) log(\frac{P(Y|X)}{P(Y)})$$
$$= \sum_X \sum_Y P(X)P(Y|X) log(\frac{P(Y|X)}{P(Y)})$$

$$= \sum_X \sum_Y P(X,Y) log(\frac{P(Y|X)}{P(Y)}) \ (Rewrite\ P(X,Y) = P(Y|X)P(X))$$
$$= \sum_X \sum_Y P(X,Y) log(\frac{P(X)P(Y|X)}{P(X)P(Y)})$$
$$= \sum_X \sum_Y P(X,Y) log(\frac{P(X,Y)}{P(X)P(Y)})$$
$$= I(X,Y)$$

When relevance is calculated on a data set with n samples, we randomly choose slices with an approximately equal number of samples $m < n$. This way the expected value is estimated as $E_X[KLD(P(Y|X) \mid\mid P(Y))]$. Note that this equality only holds if we use the conditional distribution as the first one and the marginal as second.