Table 1. The clustering performance comparison between reparameterization and nuclear norm regularization on Θ.

Metric	ACC ↑	NMI ↑	ARI ↑	PUR ↑	F1S ↑	Time ↓	Rank	ACC ↑	NMI ↑	ARI ↑	PUR ↑	F1S ↑	Time ↓	Rank
	NGs							3Sources						
Reparameterization	**0.986**$_{\pm 0.00}$	**0.953**$_{\pm 0.00}$	**0.965**$_{\pm 0.00}$	**0.986**$_{\pm 0.00}$	**0.972**$_{\pm 0.00}$	0.052	**5**	0.776$_{\pm 0.00}$	**0.693**$_{\pm 0.00}$	**0.666**$_{\pm 0.00}$	0.805$_{\pm 0.00}$	**0.736**$_{\pm 0.00}$	**0.021**	**6**
Nuclear Norm	0.978$_{\pm 0.00}$	0.928$_{\pm 0.00}$	0.945$_{\pm 0.00}$	0.978$_{\pm 0.00}$	0.956$_{\pm 0.00}$	0.816	500	**0.783**$_{\pm 0.00}$	0.652$_{\pm 0.00}$	0.614$_{\pm 0.01}$	**0.872**$_{\pm 0.00}$	0.711$_{\pm 0.01}$	0.385	169
	WebKB							NUS-WIDE						
Reparameterization	**0.977**$_{\pm 0.00}$	**0.798**$_{\pm 0.00}$	**0.901**$_{\pm 0.00}$	**0.977**$_{\pm 0.00}$	**0.965**$_{\pm 0.00}$	**0.033**	2	**0.378**$_{\pm 0.01}$	**0.237**$_{\pm 0.00}$	**0.168**$_{\pm 0.00}$	0.428$_{\pm 0.01}$	**0.266**$_{\pm 0.00}$	**0.136**$_{\pm 0.05}$	8
Nuclear Norm	ER	ER	ER	ER	ER	ER	ER	0.129$_{\pm 0.00}$	0.004$_{\pm 0.00}$	0.000$_{\pm 0.00}$	**0.996**$_{\pm 0.00}$	0.221$_{\pm 0.00}$	1.142$_{\pm 0.04}$	1600
	BBCSport							100Leaves						
Reparameterization	**0.985**$_{\pm 0.00}$	**0.949**$_{\pm 0.01}$	**0.957**$_{\pm 0.01}$	**0.985**$_{\pm 0.01}$	**0.967**$_{\pm 0.00}$	**0.054**	5	**0.918**$_{\pm 0.01}$	**0.959**$_{\pm 0.00}$	**0.879**$_{\pm 0.01}$	**0.941**$_{\pm 0.01}$	**0.881**$_{\pm 0.01}$	**0.844**	100
Nuclear Norm	0.895$_{\pm 0.00}$	0.821$_{\pm 0.00}$	0.849$_{\pm 0.00}$	0.930$_{\pm 0.00}$	0.886$_{\pm 0.00}$	1.264	537	0.630$_{\pm 0.04}$	0.840$_{\pm 0.02}$	0.509$_{\pm 0.07}$	0.835$_{\pm 0.01}$	0.515$_{\pm 0.07}$	4.913	1600
	Youtube							ALOI						
Reparameterization	**0.461**$_{\pm 0.00}$	**0.308**$_{\pm 0.00}$	**0.244**$_{\pm 0.00}$	**0.507**$_{\pm 0.01}$	**0.322**$_{\pm 0.01}$	**0.244**	10	**0.890**$_{\pm 0.00}$	**0.848**$_{\pm 0.00}$	**0.773**$_{\pm 0.00}$	**0.888**$_{\pm 0.00}$	**0.796**$_{\pm 0.00}$	**0.089**	10
Nuclear Norm	0.275$_{\pm 0.00}$	0.158$_{\pm 0.00}$	0.082$_{\pm 0.00}$	0.389$_{\pm 0.01}$	0.194$_{\pm 0.00}$	103.065	1997	0.586$_{\pm 0.00}$	0.620$_{\pm 0.02}$	0.488$_{\pm 0.03}$	0.832$_{\pm 0.01}$	0.550$_{\pm 0.03}$	0.254	630
	Mfeat							BBCNews						
Reparameterization	**0.889**$_{\pm 0.00}$	**0.898**$_{\pm 0.00}$	**0.851**$_{\pm 0.00}$	**0.893**$_{\pm 0.02}$	**0.866**$_{\pm 0.01}$	**0.202**	10	**0.917**$_{\pm 0.00}$	**0.818**$_{\pm 0.00}$	**0.822**$_{\pm 0.00}$	**0.917**$_{\pm 0.00}$	**0.864**$_{\pm 0.00}$	**0.059**	5
Nuclear Norm	0.776$_{\pm 0.01}$	0.715$_{\pm 0.00}$	0.638$_{\pm 0.00}$	0.776$_{\pm 0.01}$	0.674$_{\pm 0.00}$	1.024	1994	0.872$_{\pm 0.00}$	0.706$_{\pm 0.00}$	0.751$_{\pm 0.00}$	0.885$_{\pm 0.00}$	0.814$_{\pm 0.00}$	2.609	682
	Cifar10							Cifar100						
Reparameterization	0.991$_{\pm 0.00}$	0.974$_{\pm 0.00}$	0.980$_{\pm 0.00}$	0.991$_{\pm 0.00}$	0.982$_{\pm 0.00}$	**11.827**	10	**0.958**$_{\pm 0.01}$	**0.989**$_{\pm 0.00}$	**0.959**$_{\pm 0.01}$	**0.989**$_{\pm 0.00}$	**0.959**$_{\pm 0.01}$	**25.148**	100
Nuclear Norm	**0.994**$_{\pm 0.00}$	**0.984**$_{\pm 0.00}$	**0.986**$_{\pm 0.00}$	**0.994**$_{\pm 0.00}$	**0.988**$_{\pm 0.00}$	20690.036	49994	0.906$_{\pm 0.01}$	0.970$_{\pm 0.00}$	0.853$_{\pm 0.02}$	0.972$_{\pm 0.00}$	0.854$_{\pm 0.02}$	22716.224	49986
	YTF-10							YTF-20						
Reparameterization	**0.788**$_{\pm 0.01}$	**0.828**$_{\pm 0.01}$	**0.741**$_{\pm 0.02}$	**0.837**$_{\pm 0.02}$	**0.769**$_{\pm 0.02}$	**3.638**	10	**0.763**$_{\pm 0.04}$	**0.790**$_{\pm 0.02}$	**0.637**$_{\pm 0.03}$	**0.794**$_{\pm 0.02}$	**0.658**$_{\pm 0.03}$	**7.252**	20
Nuclear Norm	0.751$_{\pm 0.01}$	0.800$_{\pm 0.00}$	0.701$_{\pm 0.01}$	0.820$_{\pm 0.00}$	0.734$_{\pm 0.01}$	495.227	36896	0.691$_{\pm 0.01}$	0.759$_{\pm 0.00}$	0.565$_{\pm 0.01}$	0.769$_{\pm 0.00}$	0.611$_{\pm 0.01}$	15206.441	60051
	YTF-50							YTF-100						
Reparameterization	**0.755**$_{\pm 0.02}$	**0.849**$_{\pm 0.00}$	**0.659**$_{\pm 0.01}$	**0.798**$_{\pm 0.01}$	**0.667**$_{\pm 0.01}$	**34.716**	50	**0.691**$_{\pm 0.01}$	**0.837**$_{\pm 0.01}$	**0.585**$_{\pm 0.03}$	**0.737**$_{\pm 0.01}$	**0.590**$_{\pm 0.03}$	**94.086**	100
Nuclear Norm	OOM	OOM	OOM	OOM	OOM	OOM	OOM	OOM	OOM	OOM	OOM	OOM	OOM	OOM
	YTF-200							YTF-400						
Reparameterization	**0.635**$_{\pm 0.02}$	**0.831**$_{\pm 0.01}$	**0.498**$_{\pm 0.04}$	**0.686**$_{\pm 0.01}$	**0.501**$_{\pm 0.04}$	**367.938**	200	**0.558**$_{\pm 0.00}$	**0.817**$_{\pm 0.00}$	**0.373**$_{\pm 0.02}$	**0.622**$_{\pm 0.00}$	**0.376**$_{\pm 0.02}$	**921.626**	400
Nuclear Norm	OOM	OOM	OOM	OOM	OOM	OOM	OOM	OOM	OOM	OOM	OOM	OOM	OOM	OOM

†:Best results are in bold. ↑ following a metric indicates that a higher value corresponds to better clustering performance whereas ↓ vice versa.
ER indicates ill-conditioned matrix occurs when performing SVD. OOM indicates the method suffers out-of-memory error.

Table 2. The memory usage (MB) comparison between reparameterization and nuclear norm regularization on Θ.

Datasets	Cifar10	Cifar100	YTF10	YTF20	YTF50	YTF100	YTF200	YTF400
Reparameterization	**1371.003**	**1405.335**	**790.940**	**1312.318**	**2617.790**	**4135.350**	**6266.856**	**9332.602**
Nuclear Norm	20440.674	20440.674	12187.311	32451.088	OOM	OOM	OOM	OOM

†: Best results are in bold. OOM indicates that the method suffers out-of-memory error.