

The graph illustrates the performance of three clustering methods (GMM, EM, K-Means) across different cluster sizes. The x-axis represents the number of clusters (Clustersize), ranging from 5 to 10. The y-axis represents a performance metric, ranging from 0 to 100. For each method, two lines are plotted: a solid line and a dashed line. The solid lines generally show a more significant decrease in the metric as the number of clusters increases, while the dashed lines show a more gradual decline. All methods exhibit a sharp increase in the metric at Clustersize 10, likely due to the small number of data points per cluster.

Clustersize	GMM (Solid)	GMM (Dashed)	EM (Solid)	EM (Dashed)	K-Means (Solid)	K-Means (Dashed)
5	95	100	45	50	35	30
6	85	90	42	48	32	28
7	75	80	40	46	28	25
8	65	70	38	44	25	22
9	55	60	36	42	22	20
10	55	60	40	42	25	20

The graph displays the Type-I error rate for three statistical procedures: ANOVA, MCTP, and Wald, across cluster sizes of 5, 6, 7, 8, 9, and 10. The y-axis represents the Type-I error, ranging from 0.05 to 0.15. The x-axis represents the Clustersize. Each procedure is represented by a solid line (ANOVA), a dashed line (MCTP), and a dotted line (Wald). The ANOVA procedure maintains a relatively stable error rate around 0.08. The MCTP procedure shows a slight increase in error rate as the cluster size increases, starting around 0.12 and reaching approximately 0.14. The Wald procedure shows a more significant increase in error rate, starting around 0.11 and reaching approximately 0.14. All procedures show a sharp drop in error rate at a cluster size of 10.

Clustersize	ANOVA (Solid)	MCTP (Dashed)	Wald (Dotted)
5	0.08	0.12	0.11
6	0.08	0.12	0.11
7	0.08	0.12	0.11
8	0.08	0.12	0.11
9	0.08	0.12	0.11
10	0.08	0.12	0.11

The graph illustrates the performance of different methods across various clustersizes. The 'Proposed' method (red solid line) starts at approximately 0.65 for clustersize 5 and decreases steadily to about 0.1 at clustersize 10. The 'Proposed + L2' method (red dashed line) starts at approximately 0.95 for clustersize 5 and decreases to about 0.3 at clustersize 10. The 'Proposed + L1' method (green solid line) starts at approximately 0.45 for clustersize 5 and decreases to about 0.2 at clustersize 10. The 'Proposed + L2 + L1' method (green dashed line) starts at approximately 0.75 for clustersize 5 and decreases to about 0.4 at clustersize 10. The 'L2' method (blue solid line) starts at approximately 0.35 for clustersize 5 and increases slightly to about 0.4 at clustersize 10. The 'L1' method (blue dashed line) starts at approximately 0.55 for clustersize 5 and increases slightly to about 0.6 at clustersize 10. All methods show a significant change in performance at clustersize 10, with some methods dropping sharply and others rising sharply.

Clustersize	Proposed	Proposed + L2	Proposed + L1	Proposed + L2 + L1	L2	L1
5	0.65	0.95	0.45	0.75	0.35	0.55
6	0.55	0.85	0.40	0.70	0.35	0.55
7	0.45	0.75	0.35	0.65	0.35	0.55
8	0.35	0.65	0.30	0.60	0.35	0.55
9	0.25	0.55	0.25	0.55	0.35	0.55
10	0.10	0.30	0.20	0.40	0.40	0.60

The graph displays the Type-I error rate for three sample sizes (12, 15, and 20) across different cluster sizes (5 to 10). The y-axis represents the Type-I error, ranging from 0.05 to 0.20. The x-axis represents the Clustersize, ranging from 5 to 10. The legend indicates that red lines represent sample size 12, green lines represent sample size 15, and blue lines represent sample size 20. Solid lines represent the mean Type-I error, while dashed lines represent the confidence interval. For sample size 12, the mean Type-I error is consistently below 0.10, and the confidence interval is relatively narrow. For sample sizes 15 and 20, the mean Type-I error is consistently above 0.10, and the confidence interval is wider, especially for sample size 20. The Type-I error for sample size 12 decreases as the cluster size increases, while for sample sizes 15 and 20, it increases.

Clustersize	Sample Size 12 (Mean)	Sample Size 12 (Lower CI)	Sample Size 12 (Upper CI)	Sample Size 15 (Mean)	Sample Size 15 (Lower CI)	Sample Size 15 (Upper CI)	Sample Size 20 (Mean)	Sample Size 20 (Lower CI)	Sample Size 20 (Upper CI)
5	0.100	0.070	0.130	0.070	0.040	0.100	0.130	0.100	0.160
6	0.090	0.070	0.110	0.080	0.050	0.110	0.135	0.105	0.155
7	0.085	0.070	0.105	0.095	0.060	0.130	0.140	0.100	0.150
8	0.075	0.070	0.100	0.105	0.070	0.140	0.145	0.095	0.155
9	0.065	0.070	0.095	0.115	0.080	0.140	0.150	0.090	0.160
10	0.055	0.050	0.090	0.130	0.120	0.155	0.155	0.080	0.185