

# Optimally Ordered Orthogonal Neighbor Joining Trees for Hierarchical Cluster Analysis (Supplemental Material)

## ABSTRACT

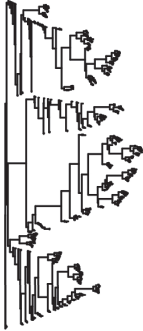
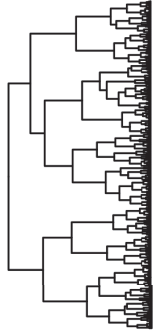
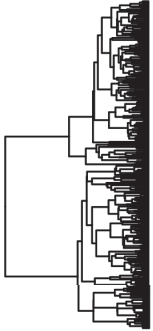
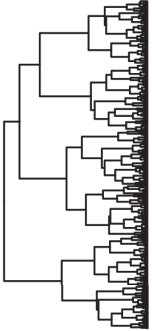
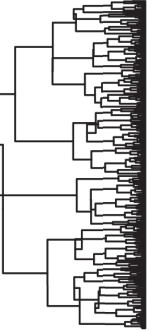
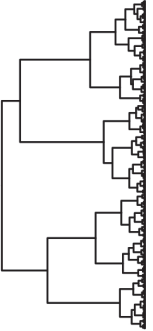
This supplemental file provides additional information for the paper: “Optimally Ordered Orthogonal Neighbor Joining Trees for Hierarchical Cluster Analysis” Specifically, it provides:


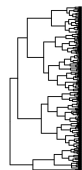
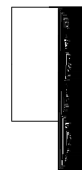
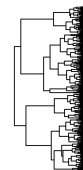
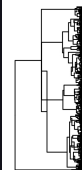

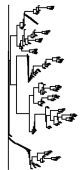
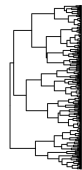

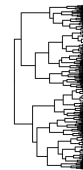
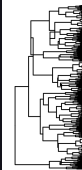
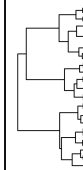
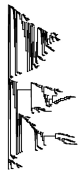
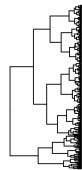
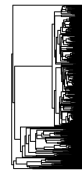
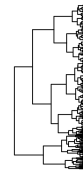
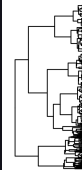
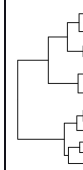
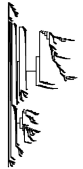
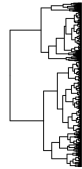

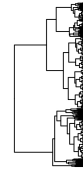

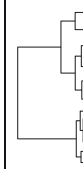
1. Quantitative evaluation on NJ and HC methods along with their generated trees and individual CPC and GKC values;
2. Details of the 52 labeled data sets and all individual NMI and RI values of the clustering results generated by k-means, RCC, HC, and our methods, as well as the screenshots of all the distilled cluster trees and AHC cluster trees.

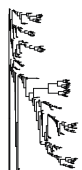
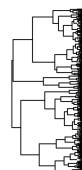

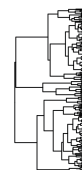
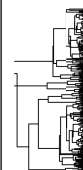
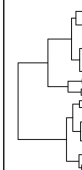
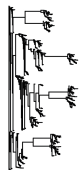
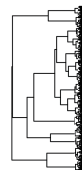

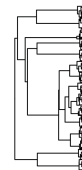
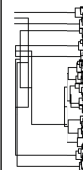
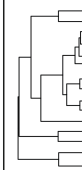
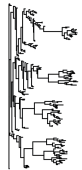
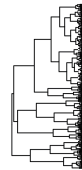
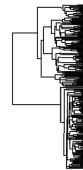
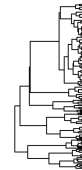
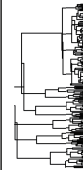
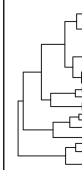

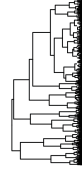

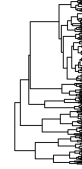
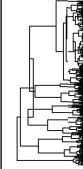

## 1. QUANTITATIVE EVALUATION OF NJ AND HC

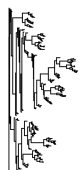
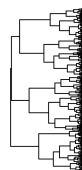
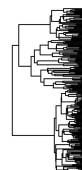
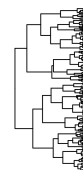
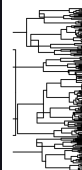

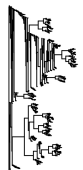
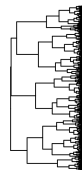

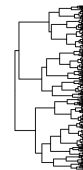
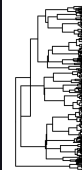
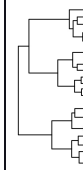

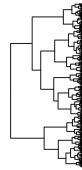
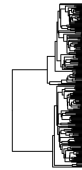
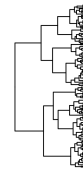
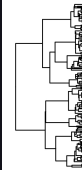
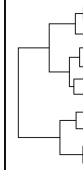

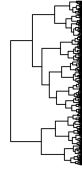
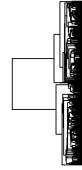
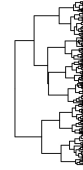
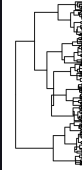
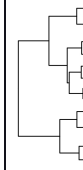
We compared the NJ trees against HC trees generated with five widely used ordinary AHC methods: SL, CL, AL, CenL, and WL. Next we list all these data sets with details and generated trees together with CPC and GKC values.

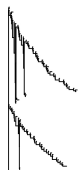
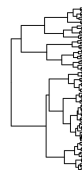
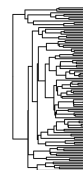
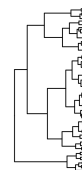
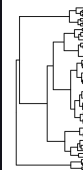
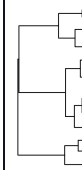
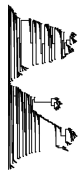
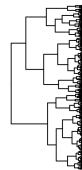

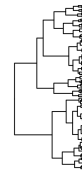
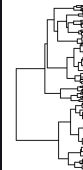
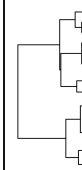
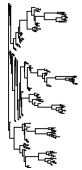
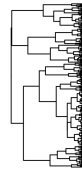
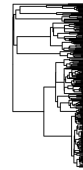
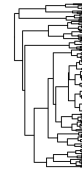
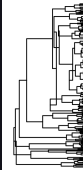
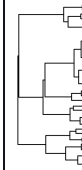
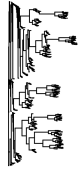
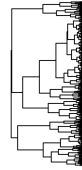

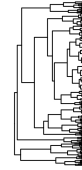
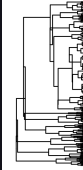
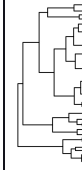
TREES OF SYNTHETIC DATA SETS

NAME	NJ	CL	SL	AL	CenL	WL
twospirals dim: 2 #leaves: 500						
	CPC : 0.733 GKC : 0.568	CPC : 0.472 GKC : 0.106	CPC : 0.072 GKC : 0.090	CPC : 0.689 GKC : 0.578	CPC : 0.660 GKC : 0.504	CPC : 0.650 GKC : 0.591

NAME	NJ	CL	SL	AL	CenL	WL
flame dim: 2 #leaves: 240						
	CPC : 0.725 GKC : 0.568	CPC : 0.642 GKC : 0.592	CPC : 0.18 GKC : 0.330	CPC : 0.691 GKC : 0.603	CPC : 0.668 GKC : 0.509	CPC : 0.638 GKC : 0.579
spiral dim: 2 #leaves: 312						
	CPC : 0.638 GKC : 0.547	CPC : 0.374 GKC : 0.072	CPC : 0.053 GKC : 0.081	CPC : 0.611 GKC : 0.535	CPC : 0.580 GKC : 0.492	CPC : 0.575 GKC : 0.495
jain dim: 2 #leaves: 373						
	CPC : 0.880 GKC : 0.747	CPC : 0.455 GKC : 0.409	CPC : 0.497 GKC : 0.529	CPC : 0.752 GKC : 0.704	CPC : 0.749 GKC : 0.701	CPC : 0.694 GKC : 0.698
compound dim: 2 #leaves: 399						
	CPC : 0.893 GKC : 0.741	CPC : 0.508 GKC : 0.511	CPC : 0.720 GKC : 0.776	CPC : 0.877 GKC : 0.882	CPC : 0.871 GKC : 0.881	CPC : 0.856 GKC : 0.755

NAME	NJ	CL	SL	AL	CenL	WL
pathbased dim: 2 #leaves: 300						
	CPC : 0.889 GKC : 0.736	CPC : 0.424 GKC : 0.254	CPC : 0.221 GKC : 0.539	CPC : 0.790 GKC : 0.728	CPC : 0.779 GKC : 0.710	CPC : 0.702 GKC : 0.718
R15 dim: 2 #leaves: 600						
	CPC : 0.863 GKC : 0.695	CPC : 0.775 GKC : 0.628	CPC : 0.707 GKC : 0.630	CPC : 0.796 GKC : 0.639	CPC : 0.753 GKC : 0.544	CPC : 0.772 GKC : 0.655
bullseye dim: 2 #leaves: 200						
	CPC : 0.847 GKC : 0.684	CPC : 0.751 GKC : 0.627	CPC : 0.490 GKC : 0.430	CPC : 0.772 GKC : 0.632	CPC : 0.758 GKC : 0.560	CPC : 0.745 GKC : 0.617
bullseye dim: 2 #leaves: 500						
	CPC : 0.849 GKC : 0.697	CPC : 0.747 GKC : 0.597	CPC : 0.417 GKC : 0.437	CPC : 0.767 GKC : 0.621	CPC : 0.745 GKC : 0.554	CPC : 0.743 GKC : 0.620

NAME	NJ	CL	SL	AL	CenL	WL
circles 2 dim: 2 #leaves: 200						
	CPC : 0.743 GKC : 0.629	CPC : 0.629 GKC : 0.460	CPC : 0.482 GKC : 0.299	CPC : 0.677 GKC : 0.610	CPC : 0.578 GKC : 0.412	CPC : 0.604 GKC : 0.558
circle 2 dim: 2 #leaves: 500						
	CPC : 0.716 GKC : 0.568	CPC : 0.620 GKC : 0.474	CPC : 0.217 GKC : 0.304	CPC : 0.664 GKC : 0.567	CPC : 0.584 GKC : 0.455	CPC : 0.624 GKC : 0.548
twomoon dim: 2 #leaves: 200						
	CPC : 0.750 GKC : 0.680	CPC : 0.738 GKC : 0.699	CPC : 0.570 GKC : 0.567	CPC : 0.744 GKC : 0.767	CPC : 0.662 GKC : 0.659	CPC : 0.698 GKC : 0.701
twomoon dim: 2 #leaves: 500						
	CPC : 0.737 GKC : 0.618	CPC : 0.710 GKC : 0.666	CPC : 0.496 GKC : 0.506	CPC : 0.703 GKC : 0.669	CPC : 0.710 GKC : 0.652	CPC : 0.692 GKC : 0.657

NAME	NJ	CL	SL	AL	CenL	WL
worms dim: 2 #leaves: 100						
	CPC : 0.756 GKC : 0.797	CPC : 0.747 GKC : 0.790	CPC : 0.683 GKC : 0.659	CPC : 0.761 GKC : 0.727	CPC : 0.717 GKC : 0.714	CPC : 0.71 GKC : 0.718
worms dim: 2 #leaves: 500						
	CPC : 0.836 GKC : 0.761	CPC : 0.815 GKC : 0.821	CPC : 0.673 GKC : 0.656	CPC : 0.779 GKC : 0.755	CPC : 0.790 GKC : 0.773	CPC : 0.760 GKC : 0.758
circle 3 dim: 2 #leaves: 204						
	CPC : 0.871 GKC : 0.734	CPC : 0.598 GKC : 0.484	CPC : 0.723 GKC : 0.605	CPC : 0.764 GKC : 0.643	CPC : 0.776 GKC : 0.633	CPC : 0.575 GKC : 0.478
circle 3 dim: 2 #leaves: 504						
	CPC : 0.851 GKC : 0.705	CPC : 0.617 GKC : 0.494	CPC : 0.489 GKC : 0.512	CPC : 0.748 GKC : 0.634	CPC : 0.770 GKC : 0.603	CPC : 0.590 GKC : 0.495

NAME	NJ	CL	SL	AL	CenL	WL
outlier dim: 2 #leaves: 400						
	CPC : 0.915 GKC : 0.748	CPC : 0.875 GKC : 0.739	CPC : 0.862 GKC : 0.684	CPC : 0.894 GKC : 0.735	CPC : 0.891 GKC : 0.789	CPC : 0.827 GKC : 0.795
crested fullmoon dim: 2 #leaves: 500						
	CPC : 0.748 GKC : 0.526	CPC : 0.504 GKC : 0.297	CPC : 0.147 GKC : 0.244	CPC : 0.741 GKC : 0.654	CPC : 0.723 GKC : 0.660	CPC : 0.707 GKC : 0.656
halfkernel dim: 2 #leaves: 500						
	CPC : 0.851 GKC : 0.691	CPC : 0.367 GKC : 0.140	CPC : 0.382 GKC : 0.434	CPC : 0.703 GKC : 0.616	CPC : 0.887 GKC : 0.585	CPC : 0.675 GKC : 0.599
corners dim: 2 #leaves: 500						
	CPC : 0.801 GKC : 0.618	CPC : 0.515 GKC : 0.242	CPC : 0.632 GKC : 0.589	CPC : 0.679 GKC : 0.578	CPC : 0.652 GKC : 0.499	CPC : 0.635 GKC : 0.580

TREES OF REAL-LIFE DATA SETS

NAME	NJ	CL	SL	AL	CenL	WL
bbdm13_OrigClassLabels dim: 14 #leaves: 200						
	CPC : 0.842 GKC : 0.642	CPC : 0.653 GKC : 0.616	CPC : 0.511 GKC : 0.437	CPC : 0.814 GKC : 0.685	CPC : 0.776 GKC : 0.632	CPC : 0.560 GKC : 0.539
boston_OrigClassLabels dim: 14 #leaves: 155						
	CPC : 0.998 GKC : 0.973	CPC : 0.775 GKC : 0.784	CPC : 0.393 GKC : 0.735	CPC : 0.774 GKC : 0.824	CPC : 0.795 GKC : 0.826	CPC : 0.736 GKC : 0.774
breast-cancer-wisconsin_OrigClassLabels dim: 10 #leaves: 454						
	CPC : 0.852 GKC : 0.687	CPC : 0.806 GKC : 0.734	CPC : 0.693 GKC : 0.491	CPC : 0.828 GKC : 0.687	CPC : 0.770 GKC : 0.676	CPC : 0.562 GKC : 0.577
cereal_OrigClassLabels dim: 13 #leaves: 77						
	CPC : 0.915 GKC : 0.781	CPC : 0.595 GKC : 0.501	CPC : 0.659 GKC : 0.519	CPC : 0.771 GKC : 0.680	CPC : 0.781 GKC : 0.676	CPC : 0.584 GKC : 0.541

NAME	NJ	CL	SL	AL	CenL	WL
dermatology dim: 35 #leaves: 259						
	CPC : 0.839 GKC : 0.701	CPC : 0.654 GKC : 0.679	CPC : 0.463 GKC : 0.325	CPC : 0.684 GKC : 0.680	CPC : 0.659 GKC : 0.687	CPC : 0.626 GKC : 0.667
ecoli dim: 8 #leaves: 332						
	CPC : 0.999 GKC : 0.894	CPC : 0.910 GKC : 0.908	CPC : 0.707 GKC : 0.926	CPC : 0.914 GKC : 0.898	CPC : 0.914 GKC : 0.890	CPC : 0.893 GKC : 0.891
fisheries_clusteredByEscapementTarget dim: 13 #leaves: 121						
	CPC : 0.975 GKC : 0.874	CPC : 0.791 GKC : 0.719	CPC : 0.364 GKC : 0.489	CPC : 0.781 GKC : 0.740	CPC : 0.774 GKC : 0.734	CPC : 0.718 GKC : 0.664
fisheries_clusteredByHarvestRule dim: 13 #leaves: 121						
	CPC : 0.975 GKC : 0.874	CPC : 0.789 GKC : 0.720	CPC : 0.353 GKC : 0.487	CPC : 0.760 GKC : 0.741	CPC : 0.769 GKC : 0.730	CPC : 0.705 GKC : 0.665

NAME	NJ	CL	SL	AL	CenL	WL
ForestTypes dim: 28 #leaves: 325						
	CPC : 0.893 GKC : 0.733	CPC : 0.724 GKC : 0.686	CPC : 0.770 GKC : 0.553	CPC : 0.797 GKC : 0.710	CPC : 0.793 GKC : 0.667	CPC : 0.627 GKC : 0.589
hayes-roth dim: 6 #leaves: 132						
	CPC : 0.999 GKC : 0.980	CPC : 0.719 GKC : 0.719	CPC : 0.544 GKC : 0.592	CPC : 0.741 GKC : 0.767	CPC : 0.745 GKC : 0.778	CPC : 0.735 GKC : 0.778
hiv dim: 160 #leaves: 78						
	CPC : 0.997 GKC : 0.950	CPC : 0.978 GKC : 0.950	CPC : 0.972 GKC : 0.905	CPC : 0.981 GKC : 0.949	CPC : 0.977 GKC : 0.936	CPC : 0.591 GKC : 0.761
ionosphere_OrigClassLabels dim: 35 #leaves: 351						
	CPC : 0.918 GKC : 0.767	CPC : 0.749 GKC : 0.589	CPC : 0.723 GKC : 0.551	CPC : 0.886 GKC : 0.736	CPC : 0.804 GKC : 0.666	CPC : 0.493 GKC : 0.427

NAME	NJ	CL	SL	AL	CenL	WL
iris dim: 5 #leaves: 147						
	CPC : 0.842 GKC : 0.642	CPC : 0.653 GKC : 0.616	CPC : 0.511 GKC : 0.437	CPC : 0.814 GKC : 0.685	CPC : 0.776 GKC : 0.632	CPC : 0.560 GKC : 0.539
italianwines dim: 7 #leaves: 102						
	CPC : 0.998 GKC : 0.973	CPC : 0.775 GKC : 0.784	CPC : 0.393 GKC : 0.735	CPC : 0.774 GKC : 0.824	CPC : 0.795 GKC : 0.826	CPC : 0.736 GKC : 0.774
lenses dim: 6 #leaves: 24						
	CPC : 0.852 GKC : 0.687	CPC : 0.806 GKC : 0.734	CPC : 0.693 GKC : 0.491	CPC : 0.828 GKC : 0.687	CPC : 0.770 GKC : 0.676	CPC : 0.562 GKC : 0.577
movement_ libras dim: 91 #leaves: 360						
	CPC : 0.915 GKC : 0.781	CPC : 0.595 GKC : 0.501	CPC : 0.659 GKC : 0.519	CPC : 0.771 GKC : 0.680	CPC : 0.781 GKC : 0.676	CPC : 0.584 GKC : 0.541

NAME	NJ	CL	SL	AL	CenL	WL
music netgroups dim: 10 #leaves: 171						
	CPC : 0.999 GKC : 0.947	CPC : 0.979 GKC : 0.921	CPC : 0.949 GKC : 0.858	CPC : 0.988 GKC : 0.919	CPC : 0.985 GKC : 0.901	CPC : 0.752 GKC : 0.846
parkinsons_ abs_cropped dim: 12 #leaves: 195						
	CPC : 0.897 GKC : 0.777	CPC : 0.865 GKC : 0.828	CPC : 0.852 GKC : 0.661	CPC : 0.891 GKC : 0.750	CPC : 0.883 GKC : 0.719	CPC : 0.461 GKC : 0.510
processed. cleveland dim: 14 #leaves: 303						
	CPC : 0.853 GKC : 0.644	CPC : 0.571 GKC : 0.457	CPC : 0.684 GKC : 0.437	CPC : 0.729 GKC : 0.613	CPC : 0.784 GKC : 0.595	CPC : 0.428 GKC : 0.500
seeds dim: 8 #leaves: 210						
	CPC : 0.894 GKC : 0.746	CPC : 0.741 GKC : 0.705	CPC : 0.634 GKC : 0.609	CPC : 0.752 GKC : 0.735	CPC : 0.750 GKC : 0.743	CPC : 0.751 GKC : 0.733

NAME	NJ	CL	SL	AL	CenL	WL
tse300 dim: 50 #leaves: 244						
	CPC : 0.990 GKC : 0.900	CPC : 0.752 GKC : 0.722	CPC : 0.780 GKC : 0.672	CPC : 0.816 GKC : 0.76	CPC : 0.785 GKC : 0.752	CPC : 0.512 GKC : 0.645
wine_ orig ClassLabels dim: 14 #leaves: 178						
	CPC : 0.999 GKC : 0.974	CPC : 0.795 GKC : 0.793	CPC : 0.776 GKC : 0.740	CPC : 0.802 GKC : 0.820	CPC : 0.801 GKC : 0.818	CPC : 0.748 GKC : 0.777
world_9d dim: 13 #leaves: 151						
	CPC : 0.999 GKC : 0.836	CPC : 0.987 GKC : 0.867	CPC : 0.980 GKC : 0.809	CPC : 0.990 GKC : 0.871	CPC : 0.990 GKC : 0.866	CPC : 0.665 GKC : 0.776
world_11d dim: 11 #leaves: 151						
	CPC : 0.998 GKC : 0.835	CPC : 0.973 GKC : 0.831	CPC : 0.980 GKC : 0.726	CPC : 0.990 GKC : 0.875	CPC : 0.990 GKC : 0.836	CPC : 0.677 GKC : 0.820

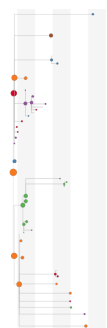
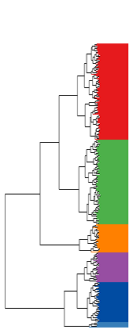
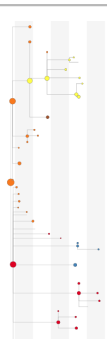
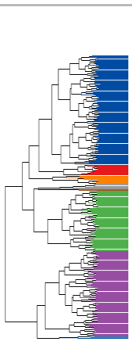
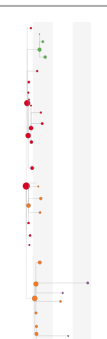
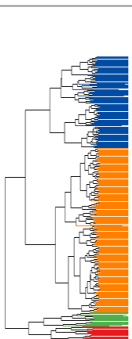
NAME	NJ	CL	SL	AL	CenL	WL
worldmap_ orig ClassLabels dim: 4 #leaves: 192						
	CPC : 0.873 GKC : 0.733	CPC : 0.794 GKC : 0.722	CPC : 0.693 GKC : 0.662	CPC : 0.845 GKC : 0.748	CPC : 0.864 GKC : 0.770	CPC : 0.819 GKC : 0.691
zoo dim: 17 #leaves: 101						
	CPC : 0.910 GKC : 0.851	CPC : 0.891 GKC : 0.865	CPC : 0.767 GKC : 0.842	CPC : 0.854 GKC : 0.822	CPC : 0.851 GKC : 0.808	CPC : 0.718 GKC : 0.686

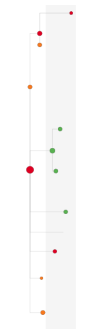
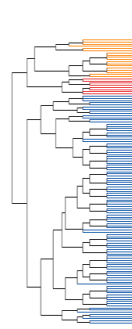
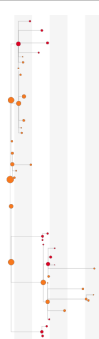
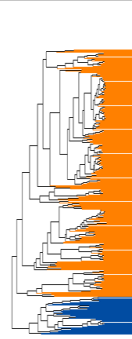
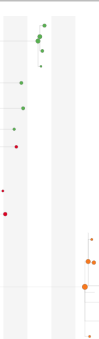
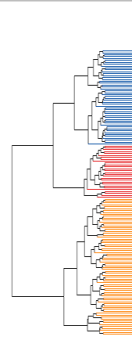


## 2. QUANTITATIVE COMPARISON OF OUR METHOD AGAINST OTHER CLUSTERING METHODS

We quantitatively compared our method against three widely used clustering methods: the AHC method with complete linkage, k-Means and the state-of-the-art robust continuous clustering (RCC) method. We chose NMI and RI as measures. Next we list all the NMI and RI values of the clustering results generated with the selected clustering methods of all data sets, as well as the screenshots of all the distilled cluster trees and AHC cluster trees.

Real Data Sets

dermatology	# instance: 366 # attr: 34 # class: 6	ours	0.82	ours	0.53		
		HC	0.694	HC	0.21		
		k-Means	0.706	k-Means	0.3		
		RCC	0.845	RCC	0.42		
ecoliproteins	# instance: 336 # attr: 7 # class: 8	ours	0.75	ours	0.61		
		HC	0.846	HC	0.62		
		k-Means	0.773	k-Means	0.6		
		RCC	0.793	RCC	0.61		
forestTypes	# instance: 325 # attr: 27 # class: 4	ours	0.71	ours	0.45		
		HC	0.643	HC	0.39		
		k-Means	0.727	k-Means	0.37		
		RCC	0.547	RCC	0.31		

hayes_roth	# instance: 132 # attr: 4 # class: 3	ours	0.65	ours	0.19		
		HC	0.764	HC	0.18		
		k-Means	0.714	k-Means	0.19		
		RCC	0.599	RCC	0.29		
ionosphere	# instance: 351 # attr: 34 # class: 2	ours	0.55	ours	0.33		
		HC	0.542	HC	0.22		
		k-Means	0.589	k-Means	0.24		
		RCC	0.486	RCC	0.32		
iris	# instance: 150 # attr: 4 # class: 3	ours	0.75	ours	0.66		
		HC	0.837	HC	0.64		
		k-Means	0.88	k-Means	0.63		
		RCC	0.86	RCC	0.68		

movement_libras	# instance: 240 # attr: 90 # class: 10	ours	0.92	ours	0.69	
		HC	0.725	HC	0.32	
		k-Means	0.711	k-Means	0.49	
		RCC	0.816	RCC	0.63	
seeds	# instance: 210 # attr: 7 # class: 3	ours	0.71	ours	0.54	
		HC	0.796	HC	0.59	
		k-Means	0.874	k-Means	0.58	
		RCC	0.829	RCC	0.61	
wine	# instance: 178 # attr: 13 # class: 3	ours	0.7	ours	0.39	
		HC	0.715	HC	0.37	
		k-Means	0.719	k-Means	0.37	
		RCC	0.587	RCC	0.4	

zoo	# instance: 101 # attr: 16 # class: 7	ours	0.85	ours	0.75	
		HC	0.816	HC	0.71	
		k-Means	0.824	k-Means	0.77	
		RCC	0.881	RCC	0.77	
isolet	# instance: 169 # attr: 617 # class: 10	ours	0.91	ours	0.86	
		HC	0.862	HC	0.73	
		k-Means	0.928	k-Means	0.82	
		RCC	0.942	RCC	0.85	
balance-scale	# instance: 625 # attr: 4 # class: 3	ours	0.58	ours	0.29	
		HC	0.54	HC	0.06	
		k-Means	0.57	k-Means	0.09	
		RCC	0.42	RCC	0.1	

bbdm13	# instance: 200 # attr: 13 # class: 5	ours	0.49	ours	0.34	
		HC	0.48	HC	0.09	
		k-Means	0.46	k-Means	0.11	
		RCC	0.46	RCC	0.22	
boston	# instance: 155 # attr: 13 # class: 3	ours	0.71	ours	0.55	
		HC	0.65	HC	0.46	
		k-Means	0.74	k-Means	0.46	
		RCC	0.7	RCC	0.41	
cereal	# instance: 77 # attr: 12 # class: 7	ours	0.75	ours	0.32	
		HC	0.69	HC	0.23	
		k-Means	0.7	k-Means	0.19	
		RCC	0.65	RCC	0.29	

fisheries	# instance: 121 # attr: 12 # class: 11	ours	0.76	ours	0.27	
		HC	0.81	HC	0.2	
		k-Means	0.82	k-Means	0.24	
		RCC	0.55	RCC	0.19	
italianwines	# instance: 102 # attr: 6 # class: 13	ours	0.85	ours	0.32	
		HC	0.73	HC	0.26	
		k-Means	0.85	k-Means	0.32	
		RCC	0.75	RCC	0.15	
lenses	# instance: 24 # attr: 5 # class: 3	ours	0.48	ours	0.1	
		HC	0.5	HC	0.06	
		k-Means	0.5	k-Means	0.06	
		RCC	0.5	RCC	0.1	

olive	# instance: 572 # attr: 8 # class: 3	ours	0.75	ours	0.5	
		HC	0.66	HC	0.3	
		k-Means	0.67	k-Means	0.37	
		RCC	0.79	RCC	0.6	
parkinsons	# instance: 195 # attr: 11 # class: 2	ours	0.51	ours	0.27	
		HC	0.5	HC	0.1	
		k-Means	0.61	k-Means	0.12	
		RCC	0.43	RCC	0.13	
pima	# instance: 768 # attr: 8 # class: 2	ours	0.55	ours	0.17	
		HC	0.54	HC	0.1	
		k-Means	0.55	k-Means	0.12	
		RCC	0.5	RCC	0.15	

processed	# instance: 303 # attr: 13 # class: 5	ours	0.65	ours	0.25	
		HC	0.56	HC	0.02	
		k-Means	0.59	k-Means	0.03	
		RCC	0.52	RCC	0.03	
soybean	# instance: 562 # attr: 36 # class: 15	ours	0.91	ours	0.67	
		HC	0.88	HC	0.67	
		k-Means	0.91	k-Means	0.67	
		RCC	0.9	RCC	0.68	
tse300	# instance: 244 # attr: 49 # class: 8	ours	0.86	ours	0.62	
		HC	0.75	HC	0.53	
		k-Means	0.85	k-Means	0.68	
		RCC	0.72	RCC	0.49	

twosquare	# instance: 968 # attr: 3 # class: 4	ours	0.76	ours	0.49	
		HC	0.75	HC	0.45	
		k-Means	0.77	k-Means	0.45	
		RCC	0.83	RCC	0.67	
UnEvenDensity	# instance: 905 # attr: 3 # class: 2	ours	0.6	ours	0.5	
		HC	0.6	HC	0.5	
		k-Means	0.58	k-Means	0.53	
		RCC	0.6	RCC	0.4	
world_9d	# instance: 151 # attr: 10 # class: 5	ours	0.77	ours	0.48	
		HC	0.32	HC	0.07	
		k-Means	0.7	k-Means	0.33	
		RCC	0.71	RCC	0.29	

worldmap	# instance: 192 # attr: 3 # class: 13	ours	0.86	ours	0.67	
		HC	0.79	HC	0.58	
		k-Means	0.89	k-Means	0.64	
		RCC	0.46	RCC	0.46	
cmc	# instance: 1473 # attr: 9 # class: 3	ours	0.65	ours	0.12	
		HC	0.55	HC	0.02	
		k-Means	0.56	k-Means	0.03	
		RCC	0.55	RCC	0.03	
Connectionist	# instance: 990 # attr: 13 # class: 11	ours	0.92	ours	0.62	
		HC	0.82	HC	0.18	
		k-Means	0.83	k-Means	0.19	
		RCC	0.9	RCC	0.47	

Synthetic Data Sets

digits5_8	# instance: 898 # attr: 64 # class: 5	ours	0.81	ours	0.57		
		HC	0.74	HC	0.37		
		k-Means	0.8	k-Means	0.55		
		RCC	0.91	RCC	0.85		
world_11d	# instance: 151 # attr: 12 # class: 5	ours	0.79	ours	0.45		
		HC	0.31	HC	0.07		
		k-Means	0.71	k-Means	0.34		
		RCC	0.65	RCC	0.29		
yeast	# instance: 1452 # attr: 7 # class: 10	ours	0.78	ours	0.3		
		HC	0.61	HC	0.2		
		k-Means	0.75	k-Means	0.26		
		RCC	0.67	RCC	0.29		

bullseye_200	# instance: 200 # attr: 2 # class: 2	ours	0.6	ours	0.51		
		HC	0.559	HC	0.24		
		k-Means	0.497	k-Means	0.2		
		RCC	0.51	RCC	0.38		
bullseye_500	# instance: 500 # attr: 2 # class: 2	ours	0.53	ours	0.45		
		HC	0.576	HC	0.27		
		k-Means	0.522	k-Means	0.04		
		RCC	0.568	RCC	0.36		
circle2_200	# instance: 200 # attr: 2 # class: 2	ours	0.61	ours	0.43		
		HC	0.506	HC	0.04		
		k-Means	0.498	k-Means	0.15		
		RCC	0.623	RCC	0.41		

circle2_500	# instance: 500 # attr: 2 # class: 2	ours	0.56	ours	0.44		
		HC	0.499	HC	0		
		k-Means	0.499	k-Means	0		
		RCC	0.612	RCC	0.38		
circle3_200	# instance: 204 # attr: 2 # class: 3	ours	0.72	ours	0.54		
		HC	0.575	HC	0.2		
		k-Means	0.614	k-Means	0.27		
		RCC	0.687	RCC	0.51		
circle3_500	# instance: 504 # attr: 2 # class: 3	ours	0.75	ours	0.53		
		HC	0.59	HC	0.21		
		k-Means	0.555	k-Means	0.02		
		RCC	0.681	RCC	0.49		

compound	# instance: 399 # attr: 2 # class: 6	ours	0.8	ours	0.61		
		HC	0.916	HC	0.7		
		k-Means	0.791	k-Means	0.61		
		RCC	0.881	RCC	0.73		
flame	# instance: 240 # attr: 2 # class: 4	ours	0.79	ours	0.69		
		HC	0.725	HC	0.58		
		k-Means	0.704	k-Means	0.5		
		RCC	0.716	RCC	0.61		
mcorners	# instance: 500 # attr: 2 # class: 4	ours	0.85	ours	0.7		
		HC	0.749	HC	0.5		
		k-Means	0.93	k-Means	0.9		
		RCC	0.77	RCC	0.61		

mcresecentfullmoon	# instance: 500 # attr: 2 # class: 2	ours	0.47	ours	0.41	
		HC	0.503	HC	0.17	
		k-Means	0.508	k-Means	0.3	
		RCC	0.404	RCC	0.38	
mhalfkernal	# instance: 500 # attr: 2 # class: 2	ours	0.57	ours	0.47	
		HC	0.499	HC	0.1	
		k-Means	0.499	k-Means	0.2	
		RCC	0.539	RCC	0.45	
mtwospirals	# instance: 500 # attr: 2 # class: 2	ours	0.54	ours	0.44	
		HC	0.504	HC	0.1	
		k-Means	0.513	k-Means	0.1	
		RCC	0.51	RCC	0.41	

pathbased	# instance: 300 # attr: 2 # class: 3	ours	0.71	ours	0.54	
		HC	0.698	HC	0.4	
		k-Means	0.759	k-Means	0.53	
		RCC	0.735	RCC	0.57	
R15	# instance: 550 # attr: 2 # class: 14	ours	0.96	ours	0.89	
		HC	0.698	HC	0.4	
		k-Means	0.94	k-Means	0.88	
		RCC	0.96	RCC	0.89	
spiral	# instance: 312 # attr: 2 # class: 3	ours	0.69	ours	0.33	
		HC	0.556	HC	0.1	
		k-Means	0.554	k-Means	0.1	
		RCC	0.719	RCC	0.59	

twomoon_200	# instance: 200 # attr: 2 # class: 2	ours	0.73	ours	0.61	
		HC	0.697	HC	0.44	
		k-Means	0.71	k-Means	0.33	
		RCC	0.523	RCC	0.41	
twomoon_500	# instance: 500 # attr: 2 # class: 2	ours	0.54	ours	0.46	
		HC	0.699	HC	0.44	
		k-Means	0.64	k-Means	0.21	
		RCC	0.512	RCC	0.38	
worms_200	# instance: 200 # attr: 2 # class: 2	ours	0.7	ours	0.52	
		HC	0.743	HC	0.44	
		k-Means	0.765	k-Means	0.43	
		RCC	0.554	RCC	0.48	

worms_500	# instance: 500 # attr: 2 # class: 2	ours	0.67	ours	0.52	
		HC	0.762	HC	0.43	
		k-Means	0.762	k-Means	0.42	
		RCC	0.527	RCC	0.42	