

The SAS System
Plot of Canonical Variables Identified by Cluster

The FASTCLUS Procedure
Replace=FULL Radius=0 Maxclusters=2 Maxiter=10 Converge=0.02

Initial Seeds				
Cluster	SepalLength	SepalWidth	PetalLength	PetalWidth
1	77.00000000	26.00000000	69.00000000	23.00000000
2	45.00000000	23.00000000	13.00000000	3.00000000

Minimum Distance Between Initial Seeds =	67.59438
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Iteration History			
Iteration	Criterion	Relative Change in Cluster Seeds	
		1	2
1	11.0045	0.3169	0.2164
2	5.6161	0.0379	0.0791
3	5.1042	0.0133	0.0306
4	5.0417	0.00348	0.00679

Convergence criterion is satisfied.

Criterion Based on Final Seeds =	5.0390
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Cluster Summary						
Cluster	Frequency	RMS Std Deviation	Maximum Distance from Seed to Observation	Radius Exceeded	Nearest Cluster	Distance Between Cluster Centroids
1	97	5.6779	24.8448		2	39.2879
2	53	3.7050	21.6197		1	39.2879

Statistics for Variables				
Variable	Total STD	Within STD	R-Square	RSQ/(1-RSQ)
SepalLength	8.28066	5.49313	0.562896	1.287784
SepalWidth	4.35866	3.70393	0.282710	0.394137
PetalLength	17.65298	6.80331	0.852470	5.778291
PetalWidth	7.62238	3.57200	0.781868	3.584390
OVER-ALL	10.69224	5.07291	0.776410	3.472463

Pseudo F Statistic =	513.92
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Approximate Expected Over-All R-Squared =	0.51539
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Cubic Clustering Criterion =	14.806
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WARNING: The two values above are invalid for correlated variables.

Cluster Means				
Cluster	SepalLength	SepalWidth	PetalLength	PetalWidth
1	63.01030928	28.86597938	49.58762887	16.95876289
2	50.05660377	33.69811321	15.60377358	2.90566038

Cluster Standard Deviations				
Cluster	SepalLength	SepalWidth	PetalLength	PetalWidth
1	6.336887455	3.267991438	7.800577673	4.155612484
2	3.427350930	4.396611045	4.404279486	2.105525249

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The FREQ Procedure

Frequency Percent Row Pct Col Pct	Table of CLUSTER by Species				
	CLUSTER(Cluster)	Species(Iris Species)			Total
		Setosa	Versicolor	Virginica	
1	0 0.00 0.00 0.00	47 31.33 48.45 94.00	50 33.33 51.55 100.00	97 64.67	
2	50 33.33 94.34 100.00	3 2.00 5.66 6.00	0 0.00 0.00 0.00	53 35.33	
Total	50 33.33	50 33.33	50 33.33	150 100.00	

The SAS System

Plot of Canonical Variables Identified by Cluster

The FASTCLUS Procedure
Replace=FULL Radius=0 Maxclusters=3 Maxiter=10 Converge=0.02

Initial Seeds				
Cluster	SepalLength	SepalWidth	PetalLength	PetalWidth
1	77.00000000	38.00000000	67.00000000	22.00000000
2	57.00000000	44.00000000	15.00000000	4.00000000
3	49.00000000	25.00000000	45.00000000	17.00000000

Minimum Distance Between Initial Seeds =	38.23611
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Iteration History				
Iteration	Criterion	Relative Change in Cluster Seeds		
		1	2	3
1	7.0151	0.3205	0.3151	0.2985
2	3.7097	0.0459	0	0.0317
3	3.6427	0.0182	0	0.0124

Convergence criterion is satisfied.

Criterion Based on Final Seeds =	3.6289
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Cluster Summary						
Cluster	Frequency	RMS Std Deviation	Maximum Distance from Seed to Observation	Radius Exceeded	Nearest Cluster	Distance Between Cluster Centroids
1	38	4.0168	14.9736		3	17.9718
2	50	2.7803	12.4803		3	33.5693
3	62	4.0398	16.9272		1	17.9718

Statistics for Variables				
Variable	Total STD	Within STD	R-Square	RSQ/(1-RSQ)
SepalLength	8.28066	4.39488	0.722096	2.598359
SepalWidth	4.35866	3.24816	0.452102	0.825156
PetalLength	17.65298	4.21431	0.943773	16.784895
PetalWidth	7.62238	2.45244	0.897872	8.791618
OVER-ALL	10.69224	3.66198	0.884275	7.641194

Pseudo F Statistic =	561.63
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The SAS System
Plot of Canonical Variables Identified by Cluster

The FASTCLUS Procedure
Replace=FULL Radius=0 Maxclusters=3 Maxiter=10 Converge=0.02

Approximate Expected Over-All R-Squared =	0.62728
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Cubic Clustering Criterion =	25.021
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WARNING: The two values above are invalid for correlated variables.

Cluster Means				
Cluster	SepalLength	SepalWidth	PetalLength	PetalWidth
1	68.50000000	30.73684211	57.42105263	20.71052632
2	50.06000000	34.28000000	14.62000000	2.46000000
3	59.01612903	27.48387097	43.93548387	14.33870968

Cluster Standard Deviations				
Cluster	SepalLength	SepalWidth	PetalLength	PetalWidth
1	4.941550255	2.900924461	4.885895746	2.798724562
2	3.524896872	3.790643691	1.736639965	1.053855894
3	4.664100551	2.962840548	5.088949673	2.974997167

The SAS System
Plot of Canonical Variables Identified by Cluster

The FREQ Procedure

Frequency Percent Row Pct Col Pct	Table of CLUSTER by Species				
	CLUSTER(Cluster)	Species(Iris Species)			Total
		Setosa	Versicolor	Virginica	
	1	0	2	36	38
		0.00	1.33	24.00	25.33
		0.00	5.26	94.74	
		0.00	4.00	72.00	
	2	50	0	0	50
		33.33	0.00	0.00	33.33
		100.00	0.00	0.00	
		100.00	0.00	0.00	
	3	0	48	14	62
		0.00	32.00	9.33	41.33
		0.00	77.42	22.58	
		0.00	96.00	28.00	
	Total	50	50	50	150
		33.33	33.33	33.33	100.00

The CANDISC Procedure

Total Sample Size	150	DF Total	149
Variables	4	DF Within Classes	147
Classes	3	DF Between Classes	2

Number of Observations Read	150
Number of Observations Used	150

Class Level Information				
CLUSTER	Variable Name	Frequency	Weight	Proportion
1	_1	38	38.0000	0.253333
2	_2	50	50.0000	0.333333
3	_3	62	62.0000	0.413333

The CANDISC Procedure

Univariate Test Statistics								
F Statistics, Num DF=2, Den DF=147								
Variable	Label	Total Standard Deviation	Pooled Standard Deviation	Between Standard Deviation	R-Square	R-Square / (1-RSq)	F Value	Pr > F
SepalLength	Sepal Length (mm)	8.2807	4.3949	8.5893	0.7221	2.5984	190.98	<.0001
SepalWidth	Sepal Width (mm)	4.3587	3.2482	3.5774	0.4521	0.8252	60.65	<.0001
PetalLength	Petal Length (mm)	17.6530	4.2143	20.9336	0.9438	16.7849	1233.69	<.0001
PetalWidth	Petal Width (mm)	7.6224	2.4524	8.8164	0.8979	8.7916	646.18	<.0001

Average R-Square	
Unweighted	0.7539604
Weighted by Variance	0.8842753

Multivariate Statistics and F Approximations					
S=2 M=0.5 N=71					
Statistic	Value	F Value	Num DF	Den DF	Pr > F
Wilks' Lambda	0.03222337	164.55	8	288	<.0001
Pillai's Trace	1.25669612	61.29	8	290	<.0001
Hotelling-Lawley Trace	21.06722883	377.66	8	203.4	<.0001
Roy's Greatest Root	20.63266809	747.93	4	145	<.0001
NOTE: F Statistic for Roy's Greatest Root is an upper bound.					
NOTE: F Statistic for Wilks' Lambda is exact.					

The CANDISC Procedure

	Canonical Correlation	Adjusted Canonical Correlation	Approximate Standard Error	Squared Canonical Correlation	Eigenvalues of $\text{Inv}(E)^*H = \text{CanRsq}/(1-\text{CanRsq})$			
					Eigenvalue	Difference	Proportion	Cumulative
1	0.976613	0.976123	0.003787	0.953774	20.6327	20.1981	0.9794	0.9794
2	0.550384	0.543354	0.057107	0.302923	0.4346		0.0206	1.0000

Test of H0: The canonical correlations in the current row and all that follow are zero						
	Likelihood Ratio	Approximate F Value	Num DF	Den DF	Pr > F	
1	0.03222337	164.55	8	288	<.0001	
2	0.69707749	21.00	3	145	<.0001	

The CANDISC Procedure

Total Canonical Structure			
Variable	Label	Can1	Can2
SepalLength	Sepal Length (mm)	0.831965	0.452137
SepalWidth	Sepal Width (mm)	-0.515082	0.810630
PetalLength	Petal Length (mm)	0.993520	0.087514
PetalWidth	Petal Width (mm)	0.966325	0.154745

Between Canonical Structure			
Variable	Label	Can1	Can2
SepalLength	Sepal Length (mm)	0.956160	0.292846
SepalWidth	Sepal Width (mm)	-0.748136	0.663545
PetalLength	Petal Length (mm)	0.998770	0.049580
PetalWidth	Petal Width (mm)	0.995952	0.089883

Pooled Within Canonical Structure			
Variable	Label	Can1	Can2
SepalLength	Sepal Length (mm)	0.339314	0.716082
SepalWidth	Sepal Width (mm)	-0.149614	0.914351
PetalLength	Petal Length (mm)	0.900839	0.308136
PetalWidth	Petal Width (mm)	0.650123	0.404282

The CANDISC Procedure

Total-Sample Standardized Canonical Coefficients			
Variable	Label	Can1	Can2
SepalLength	Sepal Length (mm)	0.047747341	1.021487262
SepalWidth	Sepal Width (mm)	-0.577569244	0.864455153
PetalLength	Petal Length (mm)	3.341309573	-1.283043758
PetalWidth	Petal Width (mm)	0.996451144	0.900476563

Pooled Within-Class Standardized Canonical Coefficients			
Variable	Label	Can1	Can2
SepalLength	Sepal Length (mm)	0.0253414487	0.5421446856
SepalWidth	Sepal Width (mm)	-.4304161258	0.6442092294
PetalLength	Petal Length (mm)	0.7976741592	-.3063023132
PetalWidth	Petal Width (mm)	0.3205998034	0.2897207865

Raw Canonical Coefficients			
Variable	Label	Can1	Can2
SepalLength	Sepal Length (mm)	0.0057661265	0.1233581748
SepalWidth	Sepal Width (mm)	-.1325106494	0.1983303556
PetalLength	Petal Length (mm)	0.1892773419	-.0726814163
PetalWidth	Petal Width (mm)	0.1307270927	0.1181359305

Class Means on Canonical Variables		
CLUSTER	Can1	Can2
1	4.931414018	0.861972277
2	-6.131527227	0.244761516
3	1.922300462	-0.725693908

