American International University-Bangladesh (AIUB)

Submitted by----

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Section: A

Subject: Data Warehouse and Data Mining

Project on Supervised Learning (vehicle silhouettes)

Submitted to: TOHEDUL ISLAM

Submission Date: 30/04/2018

Problem:

The reason of this project is to classify a given silhouette as one of four types of vehicle using a set of attributes extracted from the silhouette. The vehicle might be seen from one of a wide range of edges. The first design was to discover a strategy for recognizing 3D questions inside a 2D picture by use of an outfit of shape highlight extractors to the 2D outlines of the articles. Proportions of shape highlights extricated from model outlines of articles to be separated were utilized to produce a grouping rule tree by methods for PC acceptance. This item acknowledgment procedure was effectively used to separate between outlines of model cars, vans and buses saw from compelled rise yet all points of turn. The principle center is to locate the best classifier utilizing WEKA for the given informational index.

Dataset Prepare:

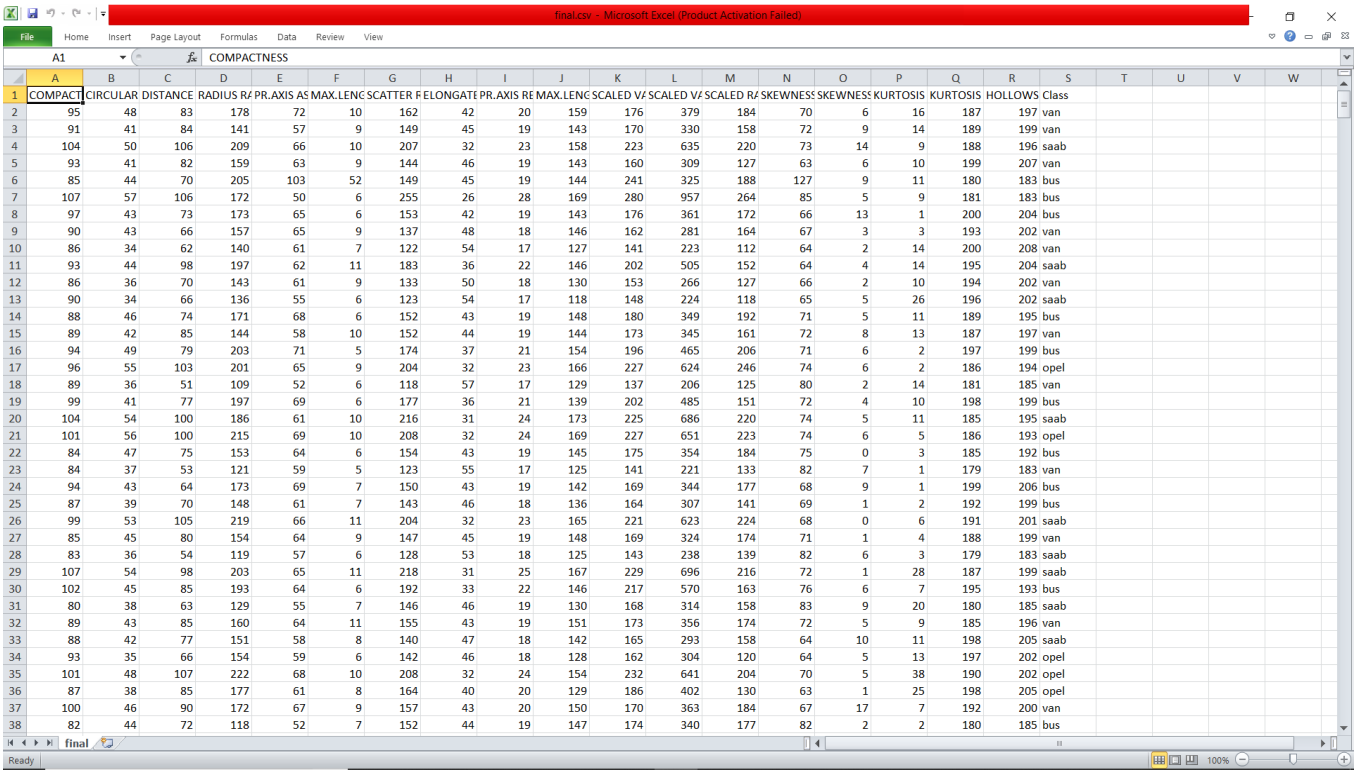
This dataset taken from Turing Institute, Glasgow, Scotland is about the classification of four types of vehicle, using a set of features extracted from the silhouette. In this dataset there are 946 instances and 18 attributes excluding class attribute. Also, there is no missing values in the dataset. I used the attribute “Types of Vehicle” as a decision attribute or class attribute. All the value of class attribute here is numerical. There are 4 types of classes.

And the classes and no. in each class are:

No.	Type	Total No.
1.	OPEL	240
2.	SAAB	240
3.	BUS	240
4.	VAN	226

Dataset Conversion:

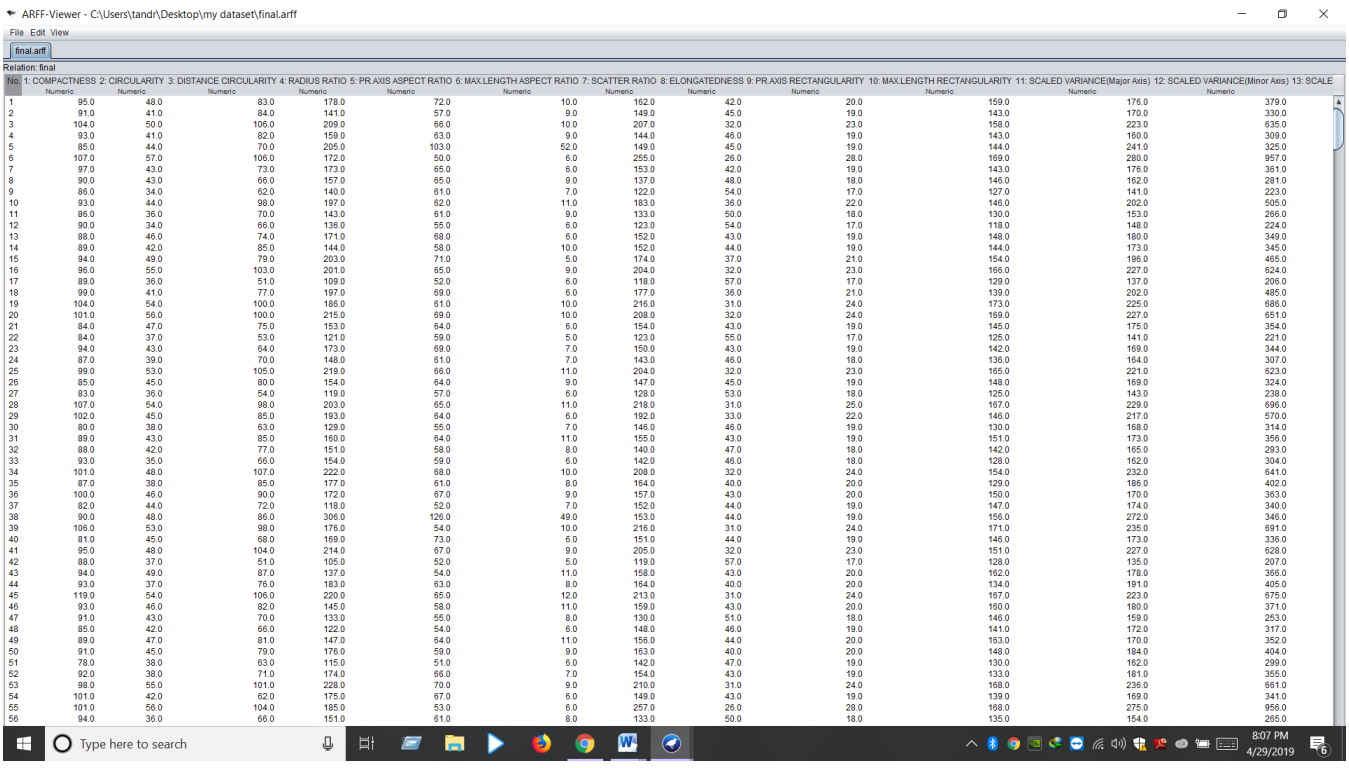
There was total 9 parts of that dataset. And all of them were in ‘.dat’ format. At first I have merged them and save them in ‘.csv’ format. Then I converted that ‘.csv’ file into ‘.arff’ formal. Then I worked on that ‘.arff’ file.



final.csv - Microsoft Excel (Product Activation Failed)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1	COMPACT	CIRCULAR	DISTANCE	RADIUS RA	PR.AXIS AS	MAX.LENG	SCATTER R	ELONGATE	PR.AXIS RE	MAX.LENG	SCALED VA	SCALED VA	SCALED RA	SKEWNESS	SKEWNESS	KURTOSIS	KURTOSIS	HOLLOWS	Class
2	95	48	83	178	72	10	162	42	20	159	176	379	184	70	6	16	187	197	van
3	91	41	84	141	57	9	149	45	19	143	170	330	158	72	9	14	189	199	van
4	104	50	106	209	66	10	207	32	23	158	223	635	220	73	14	9	188	196	saab
5	93	41	82	159	63	9	144	46	19	143	160	309	127	63	6	10	199	207	van
6	85	44	70	205	103	52	149	45	19	144	241	325	188	127	9	11	180	183	bus
7	107	57	106	172	50	6	255	26	28	169	280	957	264	85	5	9	181	183	bus
8	97	43	73	173	65	6	153	42	19	143	176	361	172	66	13	1	200	204	bus
9	90	43	66	157	65	9	137	48	18	146	162	281	164	67	3	3	193	202	van
10	86	34	62	140	61	7	122	54	17	127	141	223	112	64	2	14	200	208	van
11	93	44	98	197	62	11	183	36	22	146	202	505	152	64	4	14	195	204	saab
12	86	36	70	143	61	9	133	50	18	130	153	266	127	66	2	10	194	202	van
13	90	34	66	136	55	6	123	54	17	118	148	224	118	65	5	26	196	202	saab
14	88	46	74	171	68	6	152	43	19	148	180	349	192	71	5	11	189	195	bus
15	89	42	85	144	58	10	152	44	19	144	173	345	161	72	8	13	187	197	van
16	94	49	79	203	71	5	174	37	21	154	196	465	206	71	6	2	197	199	bus
17	96	55	103	201	65	9	204	32	23	166	227	624	246	74	6	2	186	194	opel
18	89	36	51	109	52	6	118	57	17	129	137	206	125	80	2	14	181	185	van
19	99	41	77	197	69	6	177	36	21	139	202	485	151	72	4	10	198	199	bus
20	104	54	100	186	61	10	216	31	24	173	225	686	220	74	5	11	185	195	saab
21	101	56	100	215	69	10	208	32	24	169	227	651	223	74	6	5	186	193	opel
22	84	47	75	153	64	6	154	43	19	145	175	354	184	75	0	3	185	192	bus
23	84	37	53	121	59	5	123	55	17	125	141	221	133	82	7	1	179	183	van
24	94	43	64	173	69	7	150	43	19	142	169	344	177	68	9	1	199	206	bus
25	87	39	70	148	61	7	143	46	18	136	164	307	141	69	1	2	192	199	bus
26	99	53	105	219	66	11	204	32	23	165	221	623	224	68	0	6	191	201	saab
27	85	45	80	154	64	9	147	45	19	148	169	324	174	71	1	4	188	199	van
28	83	36	54	119	57	6	128	53	18	125	143	238	139	82	6	3	179	183	saab
29	107	54	98	203	65	11	218	31	25	167	229	696	216	72	1	28	187	199	saab
30	102	45	85	193	64	6	192	33	22	146	217	570	163	76	6	7	195	193	bus
31	80	38	63	129	55	7	146	46	19	130	168	314	158	83	9	20	180	185	saab
32	89	43	85	160	64	11	155	43	19	151	173	356	174	72	5	9	185	196	van
33	88	42	77	151	58	8	140	47	18	142	165	293	158	64	10	11	198	205	saab
34	93	35	66	154	59	6	142	46	18	128	162	304	120	64	5	13	197	202	opel
35	101	48	107	222	68	10	208	32	24	154	232	641	204	70	5	38	190	202	opel
36	87	38	85	177	61	8	164	40	20	129	186	402	130	63	1	25	198	205	opel
37	100	46	90	172	67	9	157	43	20	150	170	363	184	67	17	7	192	200	van
38	82	44	72	118	52	7	152	44	19	147	174	340	177	82	2	2	180	185	bus

Fig: final.csv file



ARFF-Viewer - C:\Users\tandr\Desktop\my dataset\final.arff

File Edit View

final.arff

Relation: final

No.	1: COMPACTNESS	2: CIRCULARITY	3: DISTANCE CIRCULARITY	4: RADIUS RATIO	5: PR.AXIS ASPECT RATIO	6: MAX.LENGTH ASPECT RATIO	7: SCATTER RATIO	8: ELONGATEDNESS	9: PR.AXIS RECTANGULARITY	10: MAX.LENGTH RECTANGULARITY	11: SCALED VARIANCE(Major Axis)	12: SCALED VARIANCE(Minor Axis)	13: SCALE
	Numeric	Numeric	Numeric	Numeric	Numeric	Numeric	Numeric	Numeric	Numeric	Numeric	Numeric	Numeric	
1	95.0	48.0	83.0	178.0	72.0	10.0	162.0	42.0	20.0	159.0	176.0	379.0	
2	91.0	41.0	84.0	141.0	57.0	9.0	149.0	45.0	19.0	143.0	170.0	330.0	
3	104.0	50.0	106.0	209.0	66.0	10.0	207.0	32.0	23.0	158.0	223.0	635.0	
4	93.0	41.0	82.0	159.0	63.0	9.0	144.0	46.0	19.0	143.0	160.0	309.0	
5	85.0	44.0	70.0	205.0	103.0	52.0	149.0	45.0	19.0	144.0	241.0	325.0	
6	107.0	57.0	106.0	172.0	50.0	6.0	255.0	26.0	28.0	169.0	280.0	957.0	
7	97.0	43.0	73.0	173.0	65.0	6.0	153.0	42.0	19.0	143.0	176.0	361.0	
8	90.0	43.0	66.0	157.0	65.0	9.0	137.0	48.0	18.0	146.0	162.0	281.0	
9	86.0	34.0	62.0	140.0	61.0	7.0	122.0	54.0	17.0	127.0	141.0	223.0	
10	93.0	44.0	98.0	197.0	62.0	11.0	183.0	36.0	22.0	146.0	202.0	505.0	
11	86.0	36.0	70.0	143.0	61.0	9.0	133.0	50.0	18.0	130.0	153.0	266.0	
12	90.0	34.0	66.0	136.0	55.0	6.0	123.0	54.0	17.0	118.0	148.0	224.0	
13	88.0	46.0	74.0	171.0	68.0	6.0	152.0	43.0	19.0	148.0	180.0	349.0	
14	89.0	42.0	85.0	144.0	58.0	10.0	152.0	44.0	19.0	144.0	173.0	345.0	
15	94.0	49.0	79.0	203.0	71.0	5.0	174.0	37.0	21.0	154.0	196.0	465.0	
16	96.0	55.0	103.0	201.0	65.0	9.0	204.0	32.0	23.0	166.0	227.0	624.0	
17	89.0	36.0	51.0	109.0	52.0	6.0	118.0	57.0	17.0	129.0	137.0	206.0	
18	99.0	41.0	77.0	197.0	69.0	6.0	177.0	36.0	21.0	139.0	202.0	485.0	
19	104.0	54.0	100.0	186.0	61.0	10.0	216.0	31.0	24.0	173.0	225.0	686.0	
20	101.0	56.0	100.0	215.0	69.0	10.0	208.0	32.0	24.0	169.0	227.0	651.0	
21	84.0	47.0	75.0	153.0	64.0	6.0	154.0	43.0	19.0	145.0	175.0	354.0	
22	84.0	37.0	53.0	121.0	59.0	5.0	123.0	55.0	17.0	125.0	141.0	221.0	
23	94.0	43.0	64.0	173.0	69.0	7.0	150.0	43.0	19.0	142.0	169.0	344.0	
24	87.0	39.0	70.0	148.0	61.0	7.0	143.0	46.0	18.0	136.0	164.0	307.0	
25	99.0	53.0	105.0	219.0	66.0	11.0	204.0	32.0	23.0	165.0	221.0	623.0	
26	85.0	45.0	80.0	154.0	64.0	9.0	147.0	45.0	19.0	148.0	169.0	324.0	
27	83.0	36.0	54.0	119.0	57.0	6.0	128.0	53.0	18.0	125.0	143.0	238.0	
28	107.0	54.0	98.0	203.0	65.0	11.0	218.0	31.0	25.0	167.0	229.0	696.0	
29	102.0	45.0	85.0	193.0	64.0	6.0	192.0	33.0	22.0	146.0	217.0	570.0	
30	80.0	38.0	63.0	129.0	55.0	7.0	146.0	46.0	19.0	130.0	168.0	314.0	
31	89.0	43.0	85.0	160.0	64.0	11.0	155.0	43.0	19.0	151.0	173.0	356.0	
32	88.0	42.0	77.0	151.0	58.0	8.0	140.0	47.0	18.0	142.0	165.0	293.0	
33	93.0	35.0	66.0	154.0	59.0	6.0	142.0	46.0	18.0	128.0	162.0	304.0	
34	101.0	48.0	107.0	222.0	68.0	10.0	208.0	32.0	24.0	154.0	232.0	641.0	
35	87.0	38.0	85.0	177.0	61.0	8.0	164.0	40.0	20.0	129.0	186.0	402.0	
36	100.0	46.0	90.0	172.0	67.0	9.0	157.0	43.0	20.0	150.0	170.0	363.0	
37	82.0	44.0	72.0	118.0	52.0	7.0	152.0	44.0	19.0	147.0	174.0	340.0	
38	90.0	48.0	86.0	306.0	126.0	49.0	153.0	44.0	19.0	156.0	272.0	346.0	
39	106.0	53.0	98.0	176.0	54.0	10.0	216.0	31.0	24.0	171.0	235.0	691.0	
40	81.0	45.0	68.0	169.0	73.0	6.0	151.0	44.0	19.0	146.0	173.0	336.0	
41	95.0	48.0	104.0	214.0	67.0	9.0	205.0	32.0	23.0	151.0	227.0	628.0	
42	88.0	37.0	51.0	105.0	52.0	5.0	119.0	57.0	17.0	128.0	135.0	207.0	
43	94.0	49.0	87.0	137.0	54.0	11.0	158.0	43.0	20.0	162.0	178.0	366.0	
44	93.0	37.0	76.0	183.0	63.0	8.0	164.0	40.0	20.0	134.0	191.0	405.0	
45	119.0	54.0	106.0	220.0	65.0	12.0	213.0	31.0	24.0	167.0	223.0	675.0	
46	93.0	46.0	82.0	145.0	58.0	11.0	159.0	43.0	20.0	160.0	180.0	371.0	
47	91.0	43.0	70.0	133.0	55.0	8.0	130.0	51.0	18.0	146.0	159.0	253.0	
48	85.0	42.0	66.0	122.0	54.0	6.0	148.0	46.0	19.0	141.0	172.0	317.0	
49	89.0	47.0	81.0	147.0	64.0	11.0	156.0	44.0	20.0	163.0	170.0	352.0	
50	91.0	45.0	79.0	176.0	59.0	9.0	163.0	40.0	20.0	148.0	184.0	404.0	
51	78.0	38.0	63.0	115.0	51.0	6.0	142.0	47.0	19.0	130.0	162.0	299.0	
52	92.0	38.0	71.0	174.0	66.0	7.0	154.0	43.0	19.0	133.0	181.0	355.0	
53	98.0	55.0	101.0	228.0	70.0	9.0	210.0	31.0	24.0	168.0	236.0	661.0	
54	101.0	42.0	62.0	175.0	67.0	6.0	149.0	43.0	19.0	139.0	169.0	341.0	
55	101.0	56.0	104.0	185.0	53.0	6.0	257.0	26.0	28.0	188.0	275.0	956.0	
56	94.0	36.0	66.0	151.0	61.0	8.0	133.0	50.0	18.0	135.0	154.0	265.0	

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Fig: final.arff file

Run information:

Scheme: weka.classifiers.bayes.NaiveBayes

Relation: final

Instances: 846

Attributes: 19

COMPACTNESS

CIRCULARITY

DISTANCE CIRCULARITY

RADIUS RATIO

PR.AXIS ASPECT RATIO

MAX.LENGTH ASPECT RATIO

SCATTER RATIO

ELONGATEDNESS

PR.AXIS RECTANGULARITY

MAX.LENGTH RECTANGULARITY

SCALED VARIANCE(Major Axis)

SCALED VARIANCE(Minor Axis)

SCALED RADIUS OF GYRATION

SKEWNESS ABOUT(Major Axis)

SKEWNESS ABOUT(Minor Axis)

KURTOSIS ABOUT(Minor Axis)

KURTOSIS ABOUT(Major Axis)

HOLLOWS RATIO

Class

Test mode: 10-fold cross-validation

=== Classifier model (full training set) ===

I used the following classifier in WEKA to find the best classifier for this data set:

1.Naive Bayes Classifier:

=== Stratified cross-validation ===

=== Summary ===

Correctly Classified Instances	379	44.7991 %
Incorrectly Classified Instances	467	55.2009 %
Kappa statistic	0.2697	
Mean absolute error	0.2826	
Root mean squared error	0.462	
Relative absolute error	75.4027 %	
Root relative squared error	106.7136 %	
Total Number of Instances	846	

=== Detailed Accuracy By Class ===

	TP Rate	FP Rate	Precision	Recall	F-Measure	MCC	ROC Area	PRC Area	Class
	0.874	0.411	0.395	0.874	0.545	0.393	0.821	0.529	van
	0.392	0.119	0.531	0.392	0.451	0.304	0.712	0.494	saab
	0.147	0.027	0.653	0.147	0.240	0.224	0.843	0.609	bus
	0.415	0.172	0.447	0.415	0.430	0.249	0.702	0.449	opel
Weighted Avg.	0.448	0.177	0.510	0.448	0.413	0.291	0.769	0.521	

=== Confusion Matrix ===

a	b	c	d	<-- classified as

174 7 14 4 | a = van

67 85 3 62 | b = saab

135 8 32 43 | c = bus

64 60 0 88 | d = opel

2.IBK Classifier:

=== Stratified cross-validation ===

=== Summary ===

Correctly Classified Instances	591	69.8582 %
Incorrectly Classified Instances	255	30.1418 %
Kappa statistic	0.598	
Mean absolute error	0.1519	
Root mean squared error	0.3872	
Relative absolute error	40.5184 %	
Root relative squared error	89.4389 %	
Total Number of Instances	846	

=== Detailed Accuracy By Class ===

	TP Rate	FP Rate	Precision	Recall	F-Measure	MCC	ROC Area	PRC Area	Class
	0.894	0.048	0.852	0.894	0.873	0.833	0.927	0.795	van
	0.498	0.170	0.502	0.498	0.500	0.329	0.669	0.391	saab
	0.931	0.037	0.898	0.931	0.914	0.884	0.952	0.871	bus
	0.481	0.148	0.520	0.481	0.500	0.342	0.666	0.396	opel
Weighted Avg.	0.699	0.101	0.691	0.699	0.694	0.594	0.802	0.611	

=== Confusion Matrix ===

a	b	c	d	<-- classified as
178	10	6	5	a = van
13	108	11	85	b = saab
8	3	203	4	c = bus
10	94	6	102	d = opel

3.Kstar Classifier:

=== Stratified cross-validation ===

=== Summary ===

Correctly Classified Instances	604	71.3948 %
Incorrectly Classified Instances	242	28.6052 %
Kappa statistic	0.6186	
Mean absolute error	0.1492	
Root mean squared error	0.353	
Relative absolute error	39.8121 %	
Root relative squared error	81.5301 %	
Total Number of Instances	846	

=== Detailed Accuracy By Class ===

TP Rate	FP Rate	Precision	Recall	F-Measure	MCC	ROC Area	PRC Area	Class
0.955	0.042	0.876	0.955	0.913	0.887	0.992	0.973	van
0.493	0.173	0.495	0.493	0.494	0.320	0.789	0.447	saab

	0.991	0.016	0.956	0.991	0.973	0.964	0.999	0.998	bus
	0.429	0.151	0.487	0.429	0.456	0.290	0.788	0.463	opel
Weighted Avg.	0.714	0.096	0.701	0.714	0.707	0.612	0.891	0.717	

=== Confusion Matrix ===

a	b	c	d	<-- classified as
190	5	0	4	a = van
13	107	5	92	b = saab
2	0	216	0	c = bus
12	104	5	91	d = opel

4.JRIP Classifier:

=== Stratified cross-validation ===

=== Summary ===

Correctly Classified Instances	584	69.0307 %
Incorrectly Classified Instances	262	30.9693 %
Kappa statistic	0.5868	
Mean absolute error	0.1914	
Root mean squared error	0.3323	
Relative absolute error	51.0598 %	
Root relative squared error	76.7524 %	
Total Number of Instances	846	

=== Detailed Accuracy By Class ===

	TP Rate	FP Rate	Precision	Recall	F-Measure	MCC	ROC Area	PRC Area	Class
	0.864	0.043	0.860	0.864	0.862	0.820	0.927	0.861	van
	0.484	0.146	0.533	0.484	0.507	0.349	0.793	0.501	saab
	0.940	0.099	0.768	0.940	0.845	0.792	0.940	0.812	bus
	0.481	0.126	0.560	0.481	0.518	0.374	0.785	0.545	opel
Weighted Avg.	0.690	0.105	0.677	0.690	0.680	0.580	0.860	0.677	

=== Confusion Matrix ===

a	b	c	d	<-- classified as
172	15	8	4	a = van
11	105	27	74	b = saab
5	6	205	2	c = bus
12	71	27	102	d = opel

5.OneR Classifier:

=== Stratified cross-validation ===

=== Summary ===

Correctly Classified Instances	426	50.3546 %
Incorrectly Classified Instances	420	49.6454 %
Kappa statistic	0.3391	
Mean absolute error	0.2482	
Root mean squared error	0.4982	
Relative absolute error	66.2212 %	
Root relative squared error	115.083 %	

Total Number of Instances 846

=== Detailed Accuracy By Class ===

TP Rate	FP Rate	Precision	Recall	F-Measure	MCC	ROC Area	PRC Area	Class
0.709	0.196	0.526	0.709	0.604	0.467	0.756	0.441	van
0.392	0.173	0.438	0.392	0.414	0.227	0.609	0.328	saab
0.569	0.137	0.590	0.569	0.579	0.437	0.716	0.447	bus
0.358	0.155	0.437	0.358	0.394	0.219	0.602	0.317	opel
Weighted Avg. 0.504	0.165	0.498	0.504	0.496	0.336	0.669	0.383	

=== Confusion Matrix ===

a	b	c	d	<-- classified as
141	15	35	8	a = van
46	85	26	60	b = saab
37	27	124	30	c = bus
44	67	25	76	d = opel

6.ZeroR Classifier:

=== Stratified cross-validation ===

=== Summary ===

Correctly Classified Instances 217 25.6501 %

Incorrectly Classified Instances 629 74.3499 %

Kappa statistic -0.0014

Mean absolute error 0.3748

Root mean squared error 0.4329

Relative absolute error 100 %

Root relative squared error 100 %

Total Number of Instances 846

=== Detailed Accuracy By Class ===

TP Rate	FP Rate	Precision	Recall	F-Measure	MCC	ROC Area	PRC Area	Class
0.000	0.000	?	0.000	?	?	0.496	0.234	van
0.097	0.100	0.250	0.097	0.140	-0.005	0.494	0.254	saab
0.899	0.901	0.257	0.899	0.400	-0.003	0.495	0.256	bus
0.000	0.000	?	0.000	?	?	0.493	0.248	opel
Weighted Avg. 0.257	0.258	?	0.257	?	?	0.495	0.248	

=== Confusion Matrix ===

a	b	c	d	<-- classified as
0	20	179	0	a = van
0	21	196	0	b = saab
0	22	196	0	c = bus
0	21	191	0	d = opel

7.J48 Classifier:

=== Stratified cross-validation ===

=== Summary ===

Correctly Classified Instances 614 72.5768 %

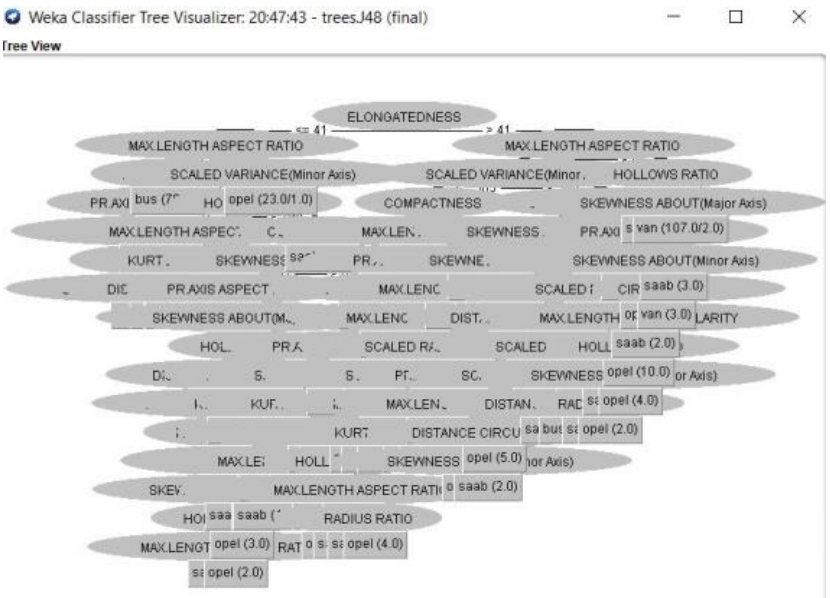
Incorrectly Classified Instances	232	27.4232 %
Kappa statistic	0.6343	
Mean absolute error	0.1415	
Root mean squared error	0.3355	
Relative absolute error	37.7493 %	
Root relative squared error	77.4887 %	
Total Number of Instances	846	

=== Detailed Accuracy By Class ===

TP Rate	FP Rate	Precision	Recall	F-Measure	MCC	ROC Area	PRC Area	Class
0.894	0.040	0.873	0.894	0.883	0.847	0.932	0.793	van
0.461	0.141	0.529	0.461	0.493	0.335	0.758	0.473	saab
0.950	0.024	0.932	0.950	0.941	0.920	0.977	0.945	bus
0.608	0.161	0.558	0.608	0.582	0.435	0.784	0.544	opel
Weighted Avg. 0.726	0.092	0.721	0.726	0.723	0.631	0.862	0.687	

=== Confusion Matrix ===

a	b	c	d	<-- classified as
178	11	6	4	a = van
16	100	6	95	b = saab
4	4	207	3	c = bus
6	74	3	129	d = opel



8.RandomTree Classifier:

=== Stratified cross-validation ===

=== Summary ===

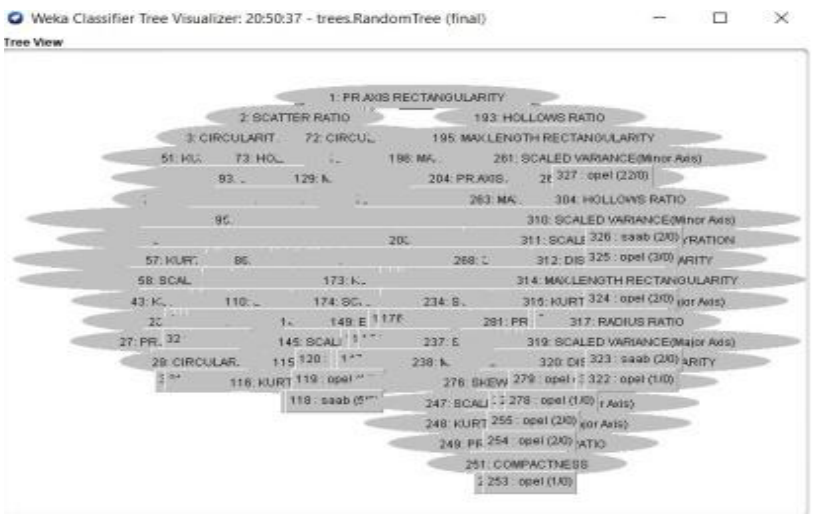
Correctly Classified Instances	602	71.1584 %
Incorrectly Classified Instances	244	28.8416 %
Kappa statistic	0.6152	
Mean absolute error	0.1442	
Root mean squared error	0.3797	
Relative absolute error	38.4714 %	
Root relative squared error	87.7165 %	
Total Number of Instances	846	

=== Detailed Accuracy By Class ===

TP Rate	FP Rate	Precision	Recall	F-Measure	MCC	ROC Area	PRC Area	Class
0.874	0.040	0.870	0.874	0.872	0.833	0.917	0.790	van
0.576	0.180	0.525	0.576	0.549	0.385	0.698	0.411	saab
0.894	0.029	0.915	0.894	0.905	0.872	0.933	0.846	bus
0.509	0.137	0.554	0.509	0.531	0.383	0.686	0.405	opel
Weighted Avg. 0.712	0.097	0.714	0.712	0.712	0.615	0.807	0.611	

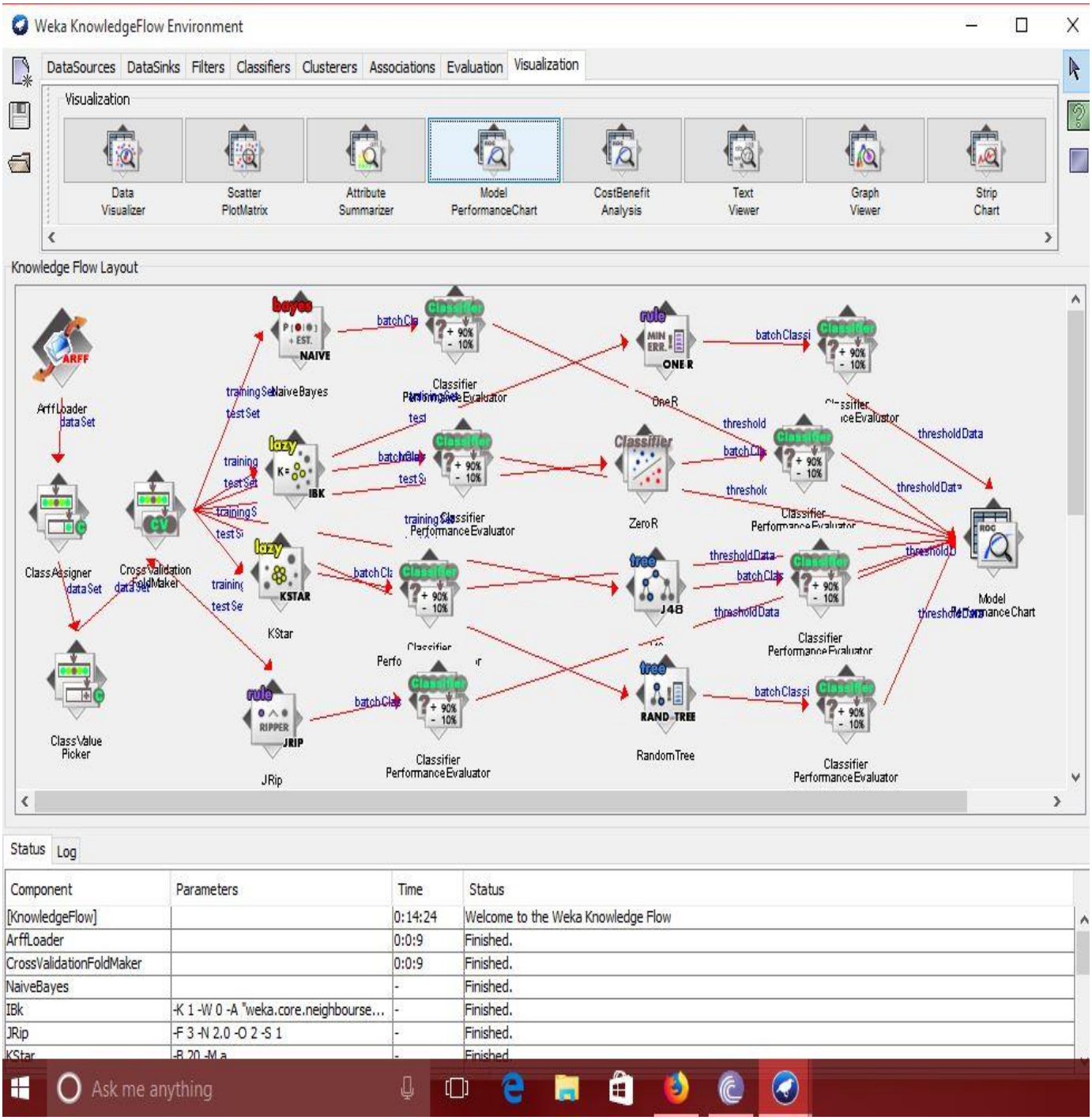
=== Confusion Matrix ===

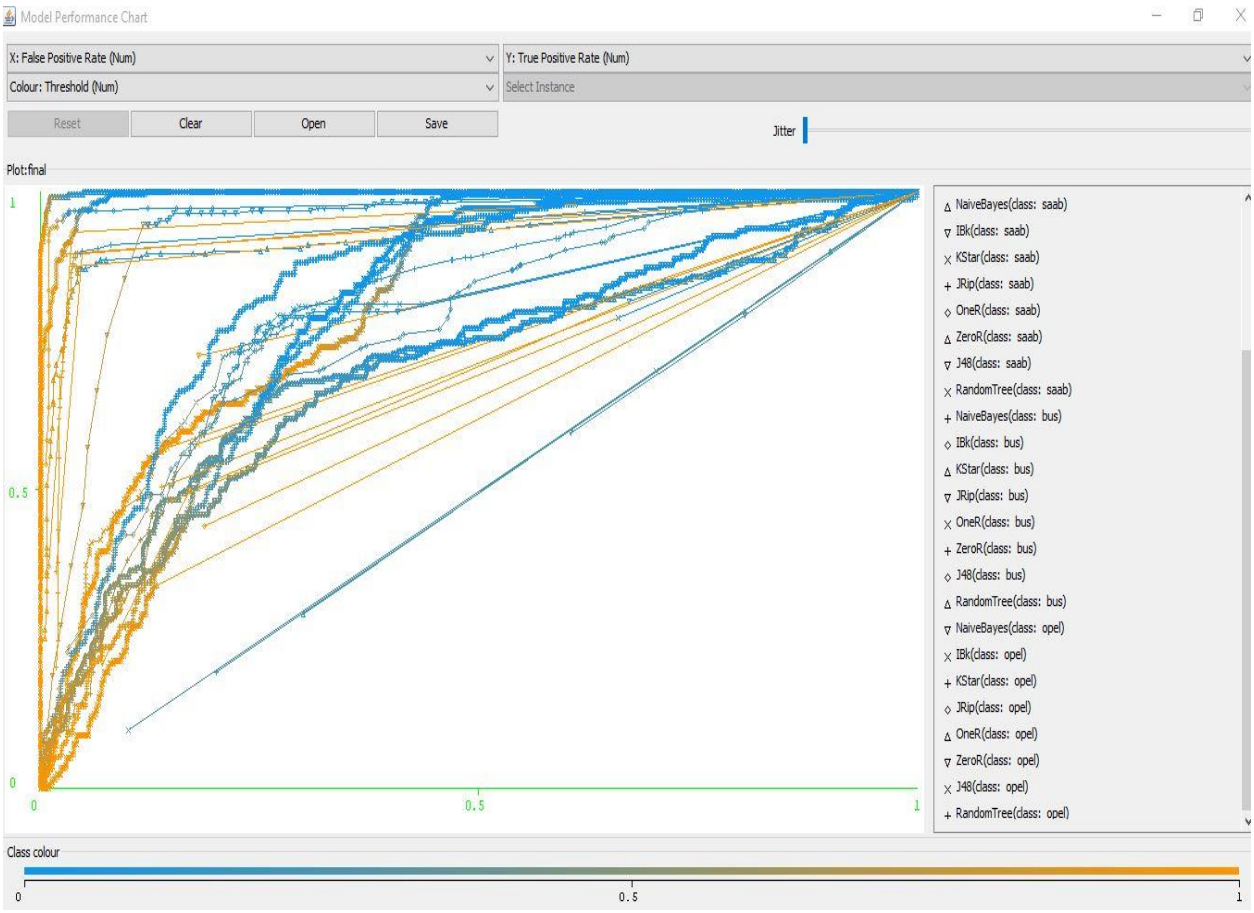
a	b	c	d	<-- classified as
174	14	2	9	a = van
15	125	11	66	b = saab
3	8	195	12	c = bus
8	91	5	108	d = opel



ROC Curve:

Here I draw the ROC curve for the eight classifier I used above and for all four classes.





Analysis the Result:

Analyzing all 8 different algorithms for the given specification and data set was tested**,** it has been seen that Jrip is the best classifier for this dataset. According to analysis **Jrip** has the highest correctly Classified Instances Correctly Classified Instances is 614 which is = 72.5768 % and Incorrectly Classified Instances is 232 which is 27.4232 %.

Now 2nd nearest best algorithm Correctly Classified Instances for **Kstar** is 604 which is 71.3948 % and Incorrectly Classified Instances=242 which is 28.6052 %.

Now 3rd nearest best algorithm Correctly Classified Instances for **Random Tree** is 602 which is 71.1584 % and Incorrectly Classified Instances=244 which is 28.8416 %.

ZeroR and **NaiveBayes** classifiers are worst for this dataset. ZeroR correctly classified only 217 instance and NaïveBayes only 379 instances.

So, any of these three classifier (Jrip, Kstar, Random Tree) can be chosen as the best classifier because other of the five classifiers points are comparatively away from best point.

So, for this dataset **Jrip** is the best classifier.