

New Product Introduction

1. Output of kNN Classifier:

Result showing the label and scores of each new customer as predicted by kNN:

Service_Type	Customer	Monthly_Fee	Budget	Size	Promotion	Interest_Rate	Period	Label	Score
Fund	Student	0.75	0.93	Small	Web&Email	1	5	1	21.542
Fund	Business	1.1	0.93	Small	Web&Email	1	65	1	23.588
Loan	Other	2.17	3.07	Small	Full	1	89	1	27.6459
Mortgage	Business	1.2	1.17	Small	Web	4	10	1	28.1259
CD	Business	1.2	1.09	Small	Web	0	26	0	20.666
Bank_Account	Professional	2.02	0.94	Large	None	3	15	1	21.798
Bank_Account	Doctor	4.11	1.07	Large	Web	1	20	0	21.616
Bank_Account	Student	4.08	0.98	Large	None	0	15	0	19.266
Loan	Business	14.17	4.83	Medium	Web	3	84	1	32.166
Loan	Professional	11.12	5.19	Large	Web	4	103	1	32.078
Mortgage	Professional	10.68	6.01	Large	Web	2	85	1	31.6579
Mortgage	Doctor	12.99	5.21	Medium	Web	3	87	1	33.63
Mortgage	Business	13.65	3.71	Large	None	1	87	1	31.3659
CD	Business	5.63	7.15	Medium	Web	1	88	1	33.2940
CD	Business	6.46	3.69	Large	Web	1	98	1	32.7
Fund	Business	2.19	0.43	Small	Web	0	66	0	16.488
Fund	Business	2.45	0.45	Small	Web	0	74	0	14.35
Fund	Student	2.28	0.79	Small	Full	0	57	0	15.868
Fund	Other	1.97	0.82	Small	None	2	67	0	12.4119
CD	Business	1.71	0.85	Small	Full	0	71	0	15.6420
CD	Business	2.79	0.76	Small	Full	0	69	0	16.308
Loan	Professional	7.97	0.83	Large	Full	2	107	0	16.8360
Loan	Professional	8.99	1.2	Large	Full	1	104	0	21.4979
Loan	Business	7.4	1.3	Large	Full	1	115	0	17.744
Loan	Other	7.36	1.26	Large	Web&Email	1	98	0	16.6100
Loan	Student	8.66	0.73	Medium	Web&Email	0	96	0	17.976
Mortgage	Other	6.57	0.81	Medium	Web&Email	0	88	0	16.81
Mortgage	Student	6.74	0.68	Medium	Web&Email	1	70	0	15.872
Mortgage	Other	5.49	1.01	Large	Full	2	80	0	17.1040
Mortgage	Business	3.9	0.98	Large	Full	0	94	0	17.156
Loan	Professional	5.24	3.68	Small	Web&Email	4	44	1	33.894
Mortgage	Doctor	3.7	5.94	Small	Web	3	47	1	41.232
Fund	Other	4.81	6.35	Small	Web	5	15	1	38.438
CD	Doctor	3.78	4.9	Small	Full	4	53	1	36.8099
Mortgage	Doctor	12.8	5.33	Large	Web	1	92	1	13.844
CD	Business	8.29	4.44	Medium	Full	0	86	1	33.562
CD	Business	1.87	0.74	Small	None	0	69	0	22.9980

Service_Type	Customer	Monthly_Fee	Budget	Size	Promotion	Interest_Rate	Period	Label	Score
Loan	Other	8.46	1.14	Large	Web&Email	1	107	0	16.448
Mortgage	Professional	4.37	0.62	Large	Full	0	98	0	17.466
Loan	Other	4.32	4.97	Small	Full	4	46	1	36.064

Cross – Validation Result:

-----Testing the Product Introduction_Binary file:-----

For 0th test, the correctness is 0.9375

For 1th test, the correctness is 0.9375

For 2th test, the correctness is 0.875

For 3th test, the correctness is 1.0

For 4th test, the correctness is 1.0

For 5th test, the correctness is 1.0

For 6th test, the correctness is 1.0

For 7th test, the correctness is 1.0

For 8th test, the correctness is 0.8125

For 9th test, the correctness is 0.9375

Testing through cross validation, the accuracy is: 0.95

2. Output of the decision tree.

Each new customer here has been labeled as “success or failure” depending on whether or not the new product just out of R&D is expected to be successful by selling over \$20M in year 1.

Service_Type	Customer	Monthly_Fee	Budget	Size	Promotion	Interest_Rate	Period	Label
Fund	Student	0.75	0.93	Small	Web&Email	1	5	1
Fund	Business	1.1	0.93	Small	Web&Email	1	65	0
Loan	Other	2.17	3.07	Small	Full	1	89	1
Mortgage	Business	1.2	1.17	Small	Web	4	10	1
CD	Business	1.2	1.09	Small	Web	0	26	1
Bank_Account	Professional	2.02	0.94	Large	None	3	15	1
Bank_Account	Doctor	4.11	1.07	Large	Web	1	20	0
Bank_Account	Student	4.08	0.98	Large	None	0	15	0
Loan	Business	14.17	4.83	Medium	Web	3	84	1
Loan	Professional	11.12	5.19	Large	Web	4	103	1
Mortgage	Professional	10.68	6.01	Large	Web	2	85	1
Mortgage	Doctor	12.99	5.21	Medium	Web	3	87	1
Mortgage	Business	13.65	3.71	Large	None	1	87	1
CD	Business	5.63	7.15	Medium	Web	1	88	1
CD	Business	6.46	3.69	Large	Web	1	98	1

Fund	Business	2.19	0.43	Small	Web	0	66	0
Fund	Business	2.45	0.45	Small	Web	0	74	0
Fund	Student	2.28	0.79	Small	Full	0	57	0
Fund	Other	1.97	0.82	Small	None	2	67	0
CD	Business	1.71	0.85	Small	Full	0	71	0
CD	Business	2.79	0.76	Small	Full	0	69	0
Loan	Professional	7.97	0.83	Large	Full	2	107	0
Loan	Professional	8.99	1.2	Large	Full	1	104	0
Loan	Business	7.4	1.3	Large	Full	1	115	0
Loan	Other	7.36	1.26	Large	Web&Email	1	98	0
Loan	Student	8.66	0.73	Medium	Web&Email	0	96	0
Mortgage	Other	6.57	0.81	Medium	Web&Email	0	88	0
Mortgage	Student	6.74	0.68	Medium	Web&Email	1	70	0
Mortgage	Other	5.49	1.01	Large	Full	2	80	0
Mortgage	Business	3.9	0.98	Large	Full	0	94	0
Loan	Professional	5.24	3.68	Small	Web&Email	4	44	1
Mortgage	Doctor	3.7	5.94	Small	Web	3	47	1
Fund	Other	4.81	6.35	Small	Web	5	15	1
CD	Doctor	3.78	4.9	Small	Full	4	53	1
Mortgage	Doctor	12.8	5.33	Large	Web	1	92	1
CD	Business	8.29	4.44	Medium	Full	0	86	1
CD	Business	1.87	0.74	Small	None	0	69	0
Loan	Other	8.46	1.14	Large	Web&Email	1	107	0
Mortgage	Professional	4.37	0.62	Large	Full	0	98	0
Loan	Other	4.32	4.97	Small	Full	4	46	1

The decision tree model built by WEKA

J48 pruned tree

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Advertisement_budget <= 1.49
| Period <= 56
| | Customer = Student
| | | Service_type = Fund: 1 (4.0)
| | | Service_type = Loan: 1 (0.0)
| | | Service_type = CD: 1 (0.0)
| | | Service_type = Bank_Account: 0 (3.0)
| | | Service_type = Mortgage: 1 (0.0)
| | Customer = Business: 1 (15.0)
| | Customer = Other: 1 (0.0)
| | Customer = Doctor: 0 (5.0/1.0)
| | Customer = Professional: 1 (4.0)
| Period > 56: 0 (62.0/5.0)
Advertisement_budget > 1.49: 1 (67.0)

```

Number of Leaves : 11

Size of the tree : 15

=== Summary ===

Correctly Classified Instances	153	95.625 %
Incorrectly Classified Instances	7	4.375 %
Kappa statistic	0.91	
Mean absolute error	0.0647	
Root mean squared error	0.2101	
Relative absolute error	13.4711 %	
Root relative squared error	42.8663 %	
Total Number of Instances	160	

Confidence Factor	Correctly Classified Instances (%)
0.05	92.50
0.10	91.875
0.15	94.375
0.20	94.375
0.25	95.625
0.30	95.625
0.35	96.25
0.40	96.25
0.45	96.25
0.50	96.25
0.55	96.25
0.60	96.25
0.65	96.25
0.70	96.25
0.75	96.25
0.80	96.25
0.85	96.25
0.90	96.25
0.95	96.25
1.00	96.25

While tuning the confidence factor we observed minimum prediction error of 3.75% at a value of 0.302. This value of prediction error then became constant for higher values of confidence factor.

Thus we chose **0.302** as the value of the confidence factor to get the minimum prediction error.

The cross validation results for confidence factor of 0.302 is:

=== Stratified cross-validation ===

=== Summary ===

Correctly Classified Instances	154	96.25 %
Incorrectly Classified Instances	6	3.75 %
Kappa statistic	0.9227	
Mean absolute error	0.0487	
Root mean squared error	0.1937	
Relative absolute error	10.1405 %	
Root relative squared error	39.5152 %	
Total Number of Instances	160	

=== Detailed Accuracy By Class ===

	TP Rate	FP Rate	Precision	Recall	F-Measure	ROC Area	Class
	0.984	0.052	0.926	0.984	0.955	0.977	0
	0.948	0.016	0.989	0.948	0.968	0.977	1
Weighted Avg.	0.963	0.03	0.964	0.963	0.963	0.977	

=== Confusion Matrix ===

a b <-- classified as

63 1 | a = 0

5 91 | b = 1