

Differentiated consumption of services through OTT applications in the framework of the data plan



ANEXOS

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APPENDIX 1

This appendix shows the results of the classifying algorithms with the datasets of 50.000 instances without going through a cleaning process, as well as the datasets of 25.000 instances, with both, the ones that went through a cleaning process and the ones that did not.

As it was explained before, the dataset that went through a cleaning process have less instances than the ones mentioned here. For the training dataset of 25.000 instances the real total of instances are 24.910 with 4.986 for Google, 4.972 for Skype, 5.000 for Spotify, 4.956 for WhatsApp and 4.996 for YouTube. For the test dataset of 25.000 instances the real total is 24.901 with 4.985 for Google, 4.972 for Skype, 5.000 for Spotify, 4.958 for WhatsApp and 4.986 for YouTube.

The results are shown in the same way the results in chapter 5 of this undergraduate thesis were shown.

A. 50.000 instances dataset without the cleaning process

A.1. J48 with CrossValidation

- **Training dataset**

A	B	C	D	E	CLASSIFIED AS
8035	829	0	74	1062	A = Google
807	8875	1	15	302	B = Skype
0	0	9960	40	0	C = Spotify
59	7	82	9821	31	D = Whatsapp
979	317	1	36	8667	E = Youtube

Confusion matrix J48 with CrossValidation, training dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0.813	0.804	0.808
Skype	0.885	0.888	0.886
Spotify	0.992	0.996	0.994
Whatsapp	0.983	0.982	0.983
Youtube	0.861	0.867	0.864
Weighted Avg	0.907	0.907	0.907

Precision, Recall and F-Measures J48 with CrossValidation, training dataset.

Kappa Statistic: 0.884

- **Test dataset**

A	B	C	D	E	CLASSIFIED AS
8097	785	0	66	1052	A = Google

799	8893	1	13	294	B = Skype
0	1	9930	69	0	C = Spotify
59	16	83	9805	37	D = Whatsapp
986	289	1	44	8680	E = Youtube

Confusion matrix J48 with CrossValidation, test dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0.815	0.810	0.812
Skype	0.891	0.889	0.890
Spotify	0.992	0.993	0.992
Whatsapp	0.981	0.981	0.981
Youtube	0.863	0.868	0.865
Weighted Avg	0.908	0.908	0.908

Precision, Recall and F-Measures J48 with CrossValidation, test dataset.

Kappa Statistic: 0.8851

A.2. RandomForest with CrossValidation

- Training dataset**

A	B	C	D	E	CLASSIFIED AS
4990	1707	644	585	2074	A = Google
1117	6956	550	547	830	B = Skype
32	43	9675	237	13	C = Spotify
138	171	1548	7965	178	D = Whatsapp
1368	525	314	320	7473	E = Youtube

Confusion matrix RandomForest with CrossValidation, training dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0.653	0.499	0.566
Skype	0.740	0.696	0.717
Spotify	0.760	0.968	0.851
Whatsapp	0.825	0.797	0.811
Youtube	0.707	0.747	0.727
Weighted Avg	0.737	0.741	0.734

Precision, Recall and F-Measures RandomForest with CrossValidation, training dataset.

Kappa Statistic: 0.6765

- Test dataset**

A	B	C	D	E	CLASSIFIED AS
6370	1480	112	524	1514	A = Google
2023	6915	104	350	608	B = Skype

101	35	8500	1358	6	C = Spotify
322	245	1028	8321	84	D = Whatsapp
2318	345	176	304	6857	E = Youtube

Confusion matrix RandomForest with CrossValidation, test dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0.572	0.637	0.603
Skype	0.767	0.692	0.727
Spotify	0.857	0.850	0.853
Whatsapp	0.766	0.832	0.798
Youtube	0.756	0.686	0.719
Weighted Avg	0.744	0.739	0.740

Precision, Recall and F-Measures RandomForest with CrossValidation, test dataset.

Kappa Statistic: 0.6741

A.3. AdabosstM1 (J48) with CrossValidation

- **Training dataset**

A	B	C	D	E	CLASSIFIED AS
9534	257	0	54	155	A = Google
3763	6195	0	11	31	B = Skype
0	0	9993	7	0	C = Spotify
563	0	67	9369	1	D = Whatsapp
2506	187	1	23	7283	E = Youtube

Confusion matrix AdaboostM1 with CrossValidation, training dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0.583	0.953	0.723
Skype	0.933	0.620	0.745
Spotify	0.993	0.999	0.996
Whatsapp	0.990	0.937	0.963
Youtube	0.975	0.728	0.834
Weighted Avg	0.895	0.847	0.852

Precision, Recall and F-Measures AdaboostM1 with CrossValidation, training dataset.

Kappa Statistic: 0.8094

- **Test dataset**

A	B	C	D	E	CLASSIFIED AS
9755	107	0	27	111	A = Google
3943	6021	2	9	25	B = Skype
0	0	9992	8	0	C = Spotify
168	0	78	9753	1	D = Whatsapp

2070	150	0	24	7756	E = Youtube
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Confusion matrix AdaboostM1 with CrossValidation, test dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0.612	0.976	0.752
Skype	0.959	0.602	0.740
Spotify	0.992	0.999	0.996
Whatsapp	0.993	0.975	0.984
Youtube	0.983	0.776	0.867
Weighted Avg	0.908	0.866	0.868

Precision, Recall and F-Measures AdabosstM1 with CrossValidation, test dataset.

Kappa Statistic: 0.8319

A.4. Bagging (J48) with CrossValidation

- **Training dataset**

A	B	C	D	E	CLASSIFIED AS
7767	1527	0	73	633	A = Google
226	9669	2	11	92	B = Skype
0	0	9990	10	0	C = Spotify
28	2	78	9881	11	D = Whatsapp
423	467	1	33	9076	E = Youtube

Confusion matrix Bagging with CrossValidation, training dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0.920	0.777	0.842
Skype	0.829	0.967	0.893
Spotify	0.992	0.999	0.995
Whatsapp	0.987	0.988	0.988
Youtube	0.925	0.908	0.916
Weighted Avg	0.931	0.928	0.927

Precision, Recall and F-Measures Bagging with CrossValidation, training dataset.

Kappa Statistic: 0.9096

- **Test dataset**

A	B	C	D	E	CLASSIFIED AS
7854	1434	0	57	655	A = Google
244	9643	0	15	98	B = Skype
0	0	9991	9	0	C = Spotify
32	3	89	9856	20	D = Whatsapp
403	533	3	37	9024	E = Youtube

Confusion matrix Bagging with CrossValidation, test dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0.920	0.785	0.484
Skype	0.830	0.964	0.892
Spotify	0.991	0.999	0.995
Whatsapp	0.988	0.986	0.987
Youtube	0.921	0.902	0.912
Weighted Avg	0.930	0.927	0.927

Precision, Recall and F-Measures Bagging with CrossValidation, test dataset.

Kappa Statistic: 0.9092

A.5. IBK (25 neighbors) with CrossValidation

- **Training dataset**

A	B	C	D	E	CLASSIFIED AS
6205	552	1501	1683	59	A = Google
927	5921	1191	1931	30	B = Skype
6	0	9906	88	0	C = Spotify
132	155	4641	5072	0	D = Whatsapp
2344	227	1317	1631	4481	E = Youtube

Confusion matrix IBK with CrossValidation, training dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0.645	0.621	0.633
Skype	0.864	0.592	0.703
Spotify	0.534	0.991	0.694
Whatsapp	0.487	0.507	0.497
Youtube	0.981	0.448	0.615
Weighted Avg	0.702	0.632	0.628

Precision, Recall and F-Measures IBK with CrossValidation, training dataset.

Kappa Statistic: 0.5396

- **Test dataset**

A	B	C	D	E	CLASSIFIED AS
6156	575	1476	1743	50	A = Google
997	5896	1125	1944	38	B = Skype
3	0	9912	85	0	C = Spotify
132	154	4549	5165	0	D = Whatsapp
2276	246	1348	1740	4390	E = Youtube

Confusion matrix IBK with CrossValidation, test dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0.644	0.161	0.629
Skype	0.858	0.590	0.699
Spotify	0.538	0.991	0.698
Whatsapp	0.484	0.517	0.500
Youtube	0.980	0.439	0.606
Weighted Avg	0.701	0.630	0.626

Precision, Recall and F-Measures IBK with CrossValidation, test dataset.

Kappa Statistic: 0.538

A.6. NaiveBayes with CrossValidation

- **Training dataset**

A	B	C	D	E	CLASSIFIED AS
8318	1258	3	15	406	A = Google
317	9559	0	4	120	B = Skype
34	39	9837	84	6	C = Spotify
97	261	814	8770	58	D = Whatsapp
254	221	0	1	9524	E = Youtube

Confusion matrix NaiveBayes with CrossValidation, training dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0.922	0.832	0.875
Skype	0.843	0.956	0.896
Spotify	0.923	0.984	0.953
Whatsapp	0.988	0.877	0.929
Youtube	0.942	0.952	0.947
Weighted Avg	0.924	0.920	0.920

Precision, Recall and F-Measures NaiveBayes with CrossValidation, training dataset.

Kappa Statistic: 0.9002

- **Test dataset**

A	B	C	D	E	CLASSIFIED AS
8326	1247	0	22	405	A = Google
311	9542	0	6	141	B = Skype
32	49	9824	87	8	C = Spotify
106	251	846	8747	50	D = Whatsapp
226	255	0	2	9517	E = Youtube

Confusion matrix NaiveBayes with CrossValidation, test dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,925	0,833	0,876

Skype	0,841	0,954	0,894
Spotify	0,921	0,982	0,951
Whatsapp	0,987	0,875	0,927
Youtube	0,940	0,952	0,946
Weighted Avg	0,923	0,919	0,919

Precision, Recall and F-Measures NaiveBayes with CrossValidation, test dataset.

Kappa Statistic: 0.8989

A.7. T-test with CrossValidation

DATASET	J48	NAIVEBAYES	BAGGING	J48	ADABOSSTM1	IBK
Training dataset	71.06	92.00v	92.86v	90.69v	85.33v	63.19*
	(v/ /*)	(1/0/0)	(1/0/0)	(1/0/0)	(1/0/0)	(0/0/1)

T-Test with CrossValidation.

A.8. J48 with Percentage Split

- **Training dataset**

A	B	C	D	E	CLASSIFIED AS
2704	307	0	29	347	A = Google
284	3011	2	3	100	B = Skype
0	0	3344	28	0	C = Spotify
16	3	36	3317	11	D = Whatsapp
370	123	0	15	2950	E = Youtube

Confusion matrix J48 with Percentage Split, training dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,801	0,798	0,800
Skype	0,874	0,886	0,880
Spotify	0,989	0,992	0,990
Whatsapp	0,978	0,980	0,979
Youtube	0,866	0,853	0,859
Weighted Avg	0,901	0,902	0,901

Precision, Recall and F-Measures J48 with Percentage Split, training dataset.

Kappa Statistic: 0.8769

- **Test dataset**

A	B	C	D	E	CLASSIFIED AS
8097	785	0	66	1052	A = Google
799	8893	1	13	294	B = Skype

0	1	9930	69	0	C = Spotify
59	16	83	9805	37	D = Whatsapp
986	289	1	44	8680	E = Youtube

Confusion matrix J48 with Percentage Split, test dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,815	0,810	0,812
Skype	0,891	0,889	0,890
Spotify	0,992	0,993	0,992
Whatsapp	0,981	0,981	0,981
Youtube	0,863	0,868	0,865
Weighted Avg	0,908	0,908	0,908

Precision, Recall and F-Measures J48 with Percentage Split, test dataset.

Kappa Statistic: 0.8851

A.9. RandomForest with Percentage Split

- **Training dataset**

A	B	C	D	E	CLASSIFIED AS
1820	690	168	188	521	A = Google
264	2573	166	199	198	B = Skype
5	35	2895	434	3	C = Spotify
43	79	535	2632	94	D = Whatsapp
396	160	33	55	2814	E = Youtube

Confusion matrix RandomForest with Percentage Split, training dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,720	0,537	0,615
Skype	0,727	0,757	0,742
Spotify	0,762	0,859	0,808
Whatsapp	0,750	0,778	0,764
Youtube	0,775	0,814	0,794
Weighted Avg	0,747	0,749	0,745

Precision, Recall and F-Measures RandomForest with Percentage Split, training dataset.

Kappa Statistic: 0.6863

- **Test dataset**

A	B	C	D	E	CLASSIFIED AS
6370	1480	112	524	1514	A = Google
2023	6915	104	350	608	B = Skype
101	35	8500	1358	6	C = Spotify
322	245	1028	8321	84	D = Whatsapp

2318	345	176	304	6857	E = Youtube
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Confusion matrix RandomForest with Percentage Split, test dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,572	0,637	0,603
Skype	0,767	0,692	0,727
Spotify	0,857	0,850	0,853
Whatsapp	0,766	0,832	0,798
Youtube	0,756	0,686	0,719
Weighted Avg	0,744	0,739	0,740

Precision, Recall and F-Measures RandomForest with Percentage Split, test dataset.

Kappa Statistic: 0.6741

A.10. AdaboostM1 (J48) with Percentage Split

- **Training dataset**

A	B	C	D	E	CLASSIFIED AS
3248	0	0	22	117	A = Google
2778	611	0	4	7	B = Skype
0	0	3366	6	0	C = Spotify
2	2	21	3353	5	D = Whatsapp
839	10	1	10	2598	E = Youtube

Confusion matrix AdaboostM1 with Percentage Split, training dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,473	0,959	0,634
Skype	0,981	0,180	0,304
Spotify	0,994	0,998	0,996
Whatsapp	0,988	0,991	0,989
Youtube	0,953	0,751	0,840
Weighted Avg	0,878	0,775	0,752

Precision, Recall and F-Measures AdaboostM1 with Percentage Split, training dataset.

Kappa Statistic: 0.7189

- **Test dataset**

A	B	C	D	E	CLASSIFIED AS
9755	107	0	27	111	A = Google
3943	6021	2	9	25	B = Skype
0	0	9992	8	0	C = Spotify
168	0	78	9753	1	D = Whatsapp
2070	150	0	24	7756	E = Youtube

Confusion matrix AdaboostM1 with Percentage Split, test dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,612	0,976	0,752
Skype	0,959	0,602	0,740
Spotify	0,992	0,999	0,996
Whatsapp	0,993	0,975	0,984
Youtube	0,983	0,776	0,867
Weighted Avg	0,908	0,866	0,868

Precision, Recall and F-Measures AdaboostM1 with Percentage Split, test dataset.

Kappa Statistic: 0.8319

A.11. Bagging (J48) with Percentage Split

- **Training dataset**

A	B	C	D	E	CLASSIFIED AS
2604	526	0	27	230	A = Google
70	3299	2	2	27	B = Skype
0	0	3362	10	0	C = Spotify
6	0	41	3329	7	D = Whatsapp
167	178	0	14	3099	E = Youtube

Confusion matrix Bagging with Percentage Split, training dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,915	0,769	0,835
Skype	0,824	0,970	0,891
Spotify	0,987	0,997	0,992
Whatsapp	0,984	0,984	0,984
Youtube	0,921	0,896	0,909
Weighted Avg	0,926	0,923	0,922

Precision, Recall and F-Measures Bagging with Percentage Split, training dataset.

Kappa Statistic: 0.9039

- **Test dataset**

A	B	C	D	E	CLASSIFIED AS
7854	1434	0	57	655	A = Google
244	9643	0	15	98	B = Skype
0	0	9991	9	0	C = Spotify
32	3	89	9856	20	D = Whatsapp
403	533	3	37	9024	E = Youtube

Confusion matrix Bagging with Percentage Split, test dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,920	0,785	0,848
Skype	0,830	0,964	0,892
Spotify	0,991	0,999	0,995
Whatsapp	0,988	0,986	0,987
Youtube	0,921	0,902	0,912
Weighted Avg	0,930	0,927	0,927

Precision, Recall and F-Measures Bagging with Percentage Split, test dataset.

Kappa Statistic: 0.9092

A.12. IBK with Percentage Split

- **Training dataset**

A	B	C	D	E	CLASSIFIED AS
2069	182	550	560	26	A = Google
321	1963	426	681	9	B = Skype
3	0	3334	35	0	C = Spotify
45	50	1621	1666	1	D = Whatsapp
774	73	458	595	1558	E = Youtube

Confusion matrix IBK with Percentage Split, training dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,644	0,611	0,627
Skype	0,866	0,577	0,693
Spotify	0,522	0,989	0,683
Whatsapp	0,471	0,492	0,482
Youtube	0,977	0,451	0,617
Weighted Avg	0,697	0,623	0,620

Precision, Recall and F-Measures IBK with Percentage Split, training dataset.

Kappa Statistic: 0.5291

- **Test dataset**

A	B	C	D	E	CLASSIFIED AS
6156	575	1476	1743	50	A = Google
997	5896	1125	1944	38	B = Skype
3	0	9912	85	0	C = Spotify
132	154	4549	5165	0	D = Whatsapp
2276	246	1348	1740	4390	E = Youtube

Confusion matrix IBK with Percentage Split, test dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,644	0,616	0,629

Skype	0,858	0,590	0,699
Spotify	0,538	0,991	0,698
Whatsapp	0,484	0,517	0,500
Youtube	0,980	0,439	0,606
Weighted Avg	0,701	0,630	0,626

Precision, Recall and F-Measures IBK with Percentage Split, test dataset.

Kappa Statistic: 0.538

A.13. NaiveBayes with Percentage Split

- **Training dataset**

A	B	C	D	E	CLASSIFIED AS
2810	427	0	3	147	A = Google
95	3261	0	0	44	B = Skype
11	16	3313	28	4	C = Spotify
32	94	165	3068	24	D = Whatsapp
87	74	0	1	3296	E = Youtube

Confusion matrix NaiveBayes with Percentage Split, training dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,926	0,830	0,875
Skype	0,842	0,959	0,897
Spotify	0,953	0,983	0,967
Whatsapp	0,990	0,907	0,946
Youtube	0,938	0,953	0,945
Weighted Avg	0,930	0,926	0,926

Precision, Recall and F-Measures NaiveBayes with Percentage Split, training dataset.

Kappa Statistic: 0.9079

- **Test dataset**

A	B	C	D	E	CLASSIFIED AS
8326	1247	0	22	405	A = Google
311	9542	0	6	141	B = Skype
32	49	9824	87	8	C = Spotify
106	251	846	8747	50	D = Whatsapp
226	255	0	2	9517	E = Youtube

Confusion matrix NaiveBayes with Percentage Split, test dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,925	0,833	0,876
Skype	0,841	0,954	0,894
Spotify	0,921	0,982	0,951

Whatsapp	0,987	0,875	0,927
Youtube	0,940	0,952	0,946
Weighted Avg	0,923	0,919	0,919

Precision, Recall and F-Measures NaiveBayes with Percentage Split, test dataset.

Kappa Statistic: 0.8989

B. 25.000 instances dataset with the cleaning process

B.1. J48 with CrossValidation

- Training dataset**

A	B	C	D	E	CLASSIFIED AS
3961	425	0	39	561	A = Google
428	4385	0	8	151	B = Skype
0	0	4967	33	0	C = Spotify
27	2	68	4842	17	D = Whatsapp
593	145	0	20	4238	E = Youtube

Confusion matrix J48 with CrossValidation, training dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,791	0,794	0,793
Skype	0,885	0,882	0,883
Spotify	0,986	0,993	0,990
Whatsapp	0,980	0,977	0,978
Youtube	0,853	0,848	0,851
Weighted Avg	0,899	0,899	0,899

Precision, Recall and F-Measures J48 with CrossValidation, training dataset.

Kappa Statistic: 0.8737

- Test dataset**

A	B	C	D	E	CLASSIFIED AS
4028	394	0	33	530	A = Google
395	4404	0	4	169	B = Skype
0	0	4961	39	0	C = Spotify
38	2	49	4846	23	D = Whatsapp
564	140	0	19	4263	E = Youtube

Confusion matrix J48 with CrossValidation, test dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,802	0,808	0,805
Skype	0,891	0,886	0,889

Spotify	0,990	0,992	0,991
Whatsapp	0,981	0,977	0,979
Youtube	0,855	0,855	0,855
Weighted Avg	0,904	0,904	0,904

Precision, Recall and F-Measures J48 with CrossValidation, test dataset.

Kappa Statistic: 0.8796

B.2. RandomForest with CrossValidation

- **Training dataset**

A	B	C	D	E	CLASSIFIED AS
3039	904	22	276	745	A = Google
645	3964	40	155	168	B = Skype
0	2	4937	60	1	C = Spotify
50	28	532	4314	32	D = Whatsapp
751	301	19	134	3791	E = Youtube

Confusion matrix RandomForest with CrossValidation, training dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,678	0,610	0,642
Skype	0,762	0,797	0,779
Spotify	0,890	0,987	0,936
Whatsapp	0,873	0,870	0,872
Youtube	0,800	0,759	0,779
Weighted Avg	0,801	0,805	0,802

Precision, Recall and F-Measures RandomForest with CrossValidation, training dataset.

Kappa Statistic: 0.7559

- **Test dataset**

A	B	C	D	E	CLASSIFIED AS
2758	976	70	208	973	A = Google
799	3682	147	103	241	B = Skype
1	0	4941	58	0	C = Spotify
62	42	123	4657	74	D = Whatsapp
770	276	8	82	3850	E = Youtube

Confusion matrix RandomForest with CrossValidation, test dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,628	0,553	0,588
Skype	0,740	0,741	0,740

Spotify	0,934	0,988	0,960
Whatsapp	0,912	0,939	0,925
Youtube	0,749	0,772	0,761
Weighted Avg	0,793	0,799	0,795

Precision, Recall and F-Measures RandomForest with CrossValidation, test dataset.

Kappa Statistic: 0.7484

B.3. AdabosstM1 (J48) with CrossValidation

- **Training dataset**

A	B	C	D	E	CLASSIFIED AS
4475	343	0	27	141	A = Google
1727	3234	0	6	5	B = Skype
0	0	4998	2	0	C = Spotify
22	0	58	4873	3	D = Whatsapp
962	169	0	15	3850	E = Youtube

Confusion matrix AdaboostM1 with CrossValidation, training dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,623	0,898	0,735
Skype	0,863	0,650	0,742
Spotify	0,989	1,000	0,994
Whatsapp	0,990	0,983	0,987
Youtube	0,963	0,771	0,856
Weighted Avg	0,885	0,860	0,863

Precision, Recall and F-Measures AdaboostM1 with CrossValidation, training dataset.

Kappa Statistic: 0.8254

- **Test dataset**

A	B	C	D	E	CLASSIFIED AS
4886	5	0	14	80	A = Google
3134	1826	0	3	9	B = Skype
0	0	4990	10	0	C = Spotify
20	0	42	4893	3	D = Whatsapp
1214	17	0	5	3750	E = Youtube

Confusion matrix AdaboostM1 with CrossValidation, test dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,528	0,980	0,686
Skype	0,988	0,367	0,535
Spotify	0,992	0,998	0,995

Whatsapp	0,994	0,987	0,990
Youtube	0,976	0,752	0,850
Weighted Avg	0,895	0,817	0,811

Precision, Recall and F-Measures AdabosstM1 with CrossValidation, test dataset.

Kappa Statistic: 0.7713

B.4. Bagging (J48) with CrossValidation

- **Training dataset**

A	B	C	D	E	CLASSIFIED AS
3898	661	0	37	390	A = Google
147	4769	1	6	49	B = Skype
0	0	4995	5	0	C = Spotify
22	1	79	4852	2	D = Whatsapp
250	257	0	20	4469	E = Youtube

Confusion matrix Bagging with CrossValidation, training dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,903	0,782	0,838
Skype	0,838	0,959	0,895
Spotify	0,984	0,999	0,992
Whatsapp	0,986	0,979	0,983
Youtube	0,910	0,895	0,902
Weighted Avg	0,924	0,923	0,922

Precision, Recall and F-Measures Bagging with CrossValidation, training dataset.

Kappa Statistic: 0.9033

- **Test dataset**

A	B	C	D	E	CLASSIFIED AS
3930	682	0	25	348	A = Google
129	4768	0	5	70	B = Skype
0	0	4989	11	0	C = Spotify
15	0	54	4884	5	D = Whatsapp
256	267	2	18	4443	E = Youtube

Confusion matrix Bagging with CrossValidation, test dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,908	0,788	0,844
Skype	0,834	0,959	0,892
Spotify	0,989	0,998	0,993
Whatsapp	0,988	0,985	0,987
Youtube	0,913	0,891	0,902

Weighted Avg	0,926	0,924	0,924
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Precision, Recall and F-Measures Bagging with CrossValidation, test dataset.

Kappa Statistic: 0.9053

B.5. IBK (25 neighbors) with CrossValidation

- **Training dataset**

A	B	C	D	E	CLASSIFIED AS
3079	266	778	837	26	A = Google
506	2718	675	1065	8	B = Skype
8	0	4948	44	0	C = Spotify
61	60	2354	2481	0	D = Whatsapp
1123	102	759	825	2187	E = Youtube

Confusion matrix IBK with CrossValidation, training dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,645	0,618	0,631
Skype	0,864	0,547	0,670
Spotify	0,520	0,990	0,682
Whatsapp	0,472	0,501	0,486
Youtube	0,985	0,438	0,606
Weighted Avg	0,697	0,619	0,615

Precision, Recall and F-Measures IBK with CrossValidation, training dataset.

Kappa Statistic: 0.5234

- **Test dataset**

A	B	C	D	E	CLASSIFIED AS
3110	210	797	846	22	A = Google
458	2798	635	1061	20	B = Skype
2	0	4946	52	0	C = Spotify
64	62	2369	2463	0	D = Whatsapp
1086	102	713	869	2216	E = Youtube

Confusion matrix IBK with CrossValidation, test dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,659	0,624	0,641
Skype	0,882	0,563	0,687
Spotify	0,523	0,989	0,684
Whatsapp	0,466	0,497	0,481
Youtube	0,981	0,444	0,612
Weighted Avg	0,702	0,624	0,621

Precision, Recall and F-Measures IBK with CrossValidation, test dataset.

Kappa Statistic: 0.5297

B.6. NaiveBayes with CrossValidation

- **Training dataset**

A	B	C	D	E	CLASSIFIED AS
4338	461	0	11	176	A = Google
236	4677	1	2	56	B = Skype
20	10	4938	31	1	C = Spotify
59	96	176	4598	27	D = Whatsapp
154	96	0	0	4746	E = Youtube

Confusion matrix NaiveBayes with CrossValidation, training dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,902	0,870	0,886
Skype	0,876	0,941	0,907
Spotify	0,965	0,988	0,976
Whatsapp	0,991	0,928	0,958
Youtube	0,948	0,950	0,949
Weighted Avg	0,936	0,935	0,935

Precision, Recall and F-Measures NaiveBayes with CrossValidation, training dataset.

Kappa Statistic: 0.9191

- **Test dataset**

A	B	C	D	E	CLASSIFIED AS
4315	485	0	9	176	A = Google
206	4701	0	3	62	B = Skype
23	16	4922	37	2	C = Spotify
69	96	162	4598	33	D = Whatsapp
137	115	0	0	4734	E = Youtube

Confusion matrix NaiveBayes with CrossValidation, test dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,908	0,866	0,886
Skype	0,868	0,945	0,905
Spotify	0,968	0,984	0,976
Whatsapp	0,989	0,927	0,957
Youtube	0,945	0,949	0,947
Weighted Avg	0,936	0,935	0,935

Precision, Recall and F-Measures NaiveBayes with CrossValidation, test dataset.

Kappa Statistic: 0.9181

B.7. T-test with CrossValidation

DATASET	J48	RANDOMFOREST	ADABOOSTM1	BAGGING	NAIVEBAYES	IBK
Training dataset	89.78	85.93*	86.38	92.33v	93.54v	61.98*
	(v/ /*)	(0/0/1)	(0/1/0)	(1/0/0)	(1/0/0)	(0/0/1)

T-Test with CrossValidation.

B.8. J48 with Percentage Split

- **Training dataset**

A	B	C	D	E	CLASSIFIED AS
1368	130	0	16	202	A = Google
133	1531	0	3	54	B = Skype
0	0	1674	16	0	C = Spotify
6	2	18	1661	4	D = Whatsapp
186	51	0	4	1410	E = Youtube

Confusion matrix J48 with Percentage Split, training dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,808	0,797	0,803
Skype	0,893	0,890	0,891
Spotify	0,989	0,991	0,990
Whatsapp	0,977	0,982	0,980
Youtube	0,844	0,854	0,849
Weighted Avg	0,902	0,903	0,902

Precision, Recall and F-Measures J48 with Percentage Split, training dataset.

Kappa Statistic: 0.8782

- **Test dataset**

A	B	C	D	E	CLASSIFIED AS
4028	394	0	33	530	A = Google
395	4404	0	4	169	B = Skype
0	0	4961	39	0	C = Spotify
38	2	49	4846	23	D = Whatsapp
564	140	0	19	4263	E = Youtube

Confusion matrix J48 with Percentage Split, test dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,802	0,808	0,805

Skype	0,891	0,886	0,889
Spotify	0,990	0,992	0,991
Whatsapp	0,981	0,977	0,979
Youtube	0,855	0,855	0,855
Weighted Avg	0,904	0,904	0,904

Precision, Recall and F-Measures J48 with Percentage Split, test dataset.

Kappa Statistic: 0.8796

B.9. RandomForest with Percentage Split

- **Training dataset**

A	B	C	D	E	CLASSIFIED AS
752	401	258	40	265	A = Google
404	893	215	59	150	B = Skype
36	5	1634	14	1	C = Spotify
25	114	1267	251	34	D = Whatsapp
240	150	63	18	1180	E = Youtube

Confusion matrix RandomForest with Percentage Split, training dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,516	0,438	0,474
Skype	0,571	0,519	0,544
Spotify	0,475	0,967	0,637
Whatsapp	0,657	0,148	0,242
Youtube	0,724	0,715	0,719
Weighted Avg	0,588	0,556	0,522

Precision, Recall and F-Measures RandomForest with Percentage Split, training dataset.

Kappa Statistic: 0.4453

- **Test dataset**

A	B	C	D	E	CLASSIFIED AS
2758	976	70	208	973	A = Google
799	3682	147	103	241	B = Skype
1	0	4941	58	0	C = Spotify
62	42	123	4657	74	D = Whatsapp
770	276	8	82	3850	E = Youtube

Confusion matrix RandomForest with Percentage Split, test dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,628	0,553	0,588
Skype	0,740	0,741	0,740
Spotify	0,934	0,988	0,960

Whatsapp	0,912	0,939	0,925
Youtube	0,749	0,772	0,761
Weighted Avg	0,793	0,799	0,795

Precision, Recall and F-Measures RandomForest with Percentage Split, test dataset.

Kappa Statistic: 0.7484

B.10. AdaboostM1 (J48) with Percentage Split

- **Training dataset**

A	B	C	D	E	CLASSIFIED AS
1494	174	0	13	35	A = Google
62	1654	0	3	2	B = Skype
0	0	1690	0	0	C = Spotify
4	0	21	1666	0	D = Whatsapp
277	70	0	2	1302	E = Youtube

Confusion matrix AdaboostM1 with Percentage Split, training dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,813	0,871	0,841
Skype	0,871	0,961	0,914
Spotify	0,988	1,000	0,994
Whatsapp	0,989	0,985	0,987
Youtube	0,972	0,789	0,871
Weighted Avg	0,926	0,922	0,921

Precision, Recall and F-Measures AdaboostM1 with Percentage Split, training dataset.

Kappa Statistic: 0.9021

- **Test dataset**

A	B	C	D	E	CLASSIFIED AS
4886	5	0	14	80	A = Google
3134	1826	0	3	9	B = Skype
0	0	4990	10	0	C = Spotify
20	0	42	4893	3	D = Whatsapp
1214	17	0	5	3750	E = Youtube

Confusion matrix AdaboostM1 with Percentage Split, test dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,528	0,980	0,686
Skype	0,988	0,367	0,535
Spotify	0,992	0,998	0,995
Whatsapp	0,994	0,987	0,990
Youtube	0,976	0,752	0,850

Weighted Avg	0,895	0,817	0,811
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Precision, Recall and F-Measures AdaboostM1 with Percentage Split, test dataset.

Kappa Statistic: 0.7713

B.11. Bagging (J48) with Percentage Split

- **Training dataset**

A	B	C	D	E	CLASSIFIED AS
1327	246	0	14	129	A = Google
56	1645	0	3	17	B = Skype
0	0	1690	0	0	C = Spotify
6	0	31	1652	2	D = Whatsapp
90	92	1	7	1461	E = Youtube

Confusion matrix Bagging with Percentage Split, training dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,897	0,773	0,831
Skype	0,830	0,956	0,888
Spotify	0,981	1,000	0,991
Whatsapp	0,986	0,977	0,981
Youtube	0,908	0,885	0,896
Weighted Avg	0,920	0,918	0,917

Precision, Recall and F-Measures Bagging with Percentage Split, training dataset.

Kappa Statistic: 0.8976

- **Test dataset**

A	B	C	D	E	CLASSIFIED AS
3930	682	0	25	348	A = Google
129	4768	0	5	70	B = Skype
0	0	4989	11	0	C = Spotify
15	0	54	4884	5	D = Whatsapp
256	267	2	18	4443	E = Youtube

Confusion matrix Bagging with Percentage Split, test dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,908	0,788	0,844
Skype	0,834	0,959	0,892
Spotify	0,989	0,998	0,993
Whatsapp	0,988	0,985	0,987
Youtube	0,913	0,891	0,902
Weighted Avg	0,926	0,924	0,924

Precision, Recall and F-Measures Bagging with Percentage Split, test dataset.

Kappa Statistic: 0.9053

B.12. IBK with Percentage Split

- **Training dataset**

A	B	C	D	E	CLASSIFIED AS
1045	79	299	285	8	A = Google
179	894	260	386	2	B = Skype
2	0	1671	17	0	C = Spotify
24	15	813	839	0	D = Whatsapp
345	34	244	308	720	E = Youtube

Confusion matrix IBK with Percentage Split, training dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,655	0,609	0,631
Skype	0,875	0,519	0,652
Spotify	0,508	0,989	0,671
Whatsapp	0,457	0,496	0,476
Youtube	0,986	0,436	0,605
Weighted Avg	0,696	0,610	0,607

Precision, Recall and F-Measures IBK with Percentage Split, training dataset.

Kappa Statistic: 0.5128

- **Test dataset**

A	B	C	D	E	CLASSIFIED AS
3110	210	797	846	22	A = Google
458	2798	635	1061	20	B = Skype
2	0	4946	52	0	C = Spotify
64	62	2369	2463	0	D = Whatsapp
1086	102	713	869	2216	E = Youtube

Confusion matrix IBK with Percentage Split, test dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,659	0,624	0,641
Skype	0,882	0,563	0,687
Spotify	0,523	0,989	0,684
Whatsapp	0,466	0,497	0,481
Youtube	0,981	0,444	0,612
Weighted Avg	0,702	0,624	0,621

Precision, Recall and F-Measures IBK with Percentage Split, test dataset.

Kappa Statistic: 0.5297

B.13. NaiveBayes with Percentage Split

- **Training dataset**

A	B	C	D	E	CLASSIFIED AS
1494	169	0	4	49	A = Google
78	1618	0	2	23	B = Skype
4	3	1672	10	1	C = Spotify
16	41	71	1552	11	D = Whatsapp
54	33	0	0	1564	E = Youtube

Confusion matrix NaiveBayes with Percentage Split, training dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,908	0,871	0,889
Skype	0,868	0,940	0,903
Spotify	0,959	0,989	0,974
Whatsapp	0,990	0,918	0,952
Youtube	0,949	0,947	0,948
Weighted Avg	0,934	0,933	0,933

Precision, Recall and F-Measures NaiveBayes with Percentage Split, training dataset.

Kappa Statistic: 0.916

- **Test dataset**

A	B	C	D	E	CLASSIFIED AS
4315	485	0	9	176	A = Google
206	4701	0	3	62	B = Skype
23	16	4922	37	2	C = Spotify
69	96	162	4598	33	D = Whatsapp
137	115	0	0	4734	E = Youtube

Confusion matrix NaiveBayes with Percentage Split, test dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,908	0,866	0,886
Skype	0,868	0,945	0,905
Spotify	0,968	0,984	0,976
Whatsapp	0,989	0,927	0,957
Youtube	0,945	0,949	0,947
Weighted Avg	0,936	0,935	0,935

Precision, Recall and F-Measures NaiveBayes with Percentage Split, test dataset.

Kappa Statistic: 0.9181

C. 25.000 instances dataset without the cleaning process

C.1. J48 with CrossValidation

- **Training dataset**

A	B	C	D	E	CLASSIFIED AS
3919	450	0	46	585	A = Google
457	4386	1	9	147	B = Skype
0	0	4956	44	0	C = Spotify
32	5	70	4873	20	D = Whatsapp
588	139	1	19	4253	E = Youtube

Confusion matrix J48 with CrossValidation, training dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,784	0,784	0,784
Skype	0,881	0,877	0,879
Spotify	0,986	0,991	0,988
Whatsapp	0,976	0,975	0,975
Youtube	0,850	0,851	0,850
Weighted Avg	0,895	0,895	0,895

Precision, Recall and F-Measures J48 with CrossValidation, training dataset.

Kappa Statistic: 0.8694

- **Test dataset**

A	B	C	D	E	CLASSIFIED AS
4051	388	0	33	528	A = Google
387	4425	0	4	184	B = Skype
0	0	4957	43	0	C = Spotify
38	3	49	4887	23	D = Whatsapp
557	143	0	19	4281	E = Youtube

Confusion matrix J48 with CrossValidation, test dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,805	0,810	0,808
Skype	0,892	0,885	0,889
Spotify	0,990	0,991	0,991
Whatsapp	0,980	0,977	0,979
Youtube	0,853	0,856	0,855
Weighted Avg	0,904	0,904	0,904

Precision, Recall and F-Measures J48 with CrossValidation, test dataset.

Kappa Statistic: 0.88

C.2. RandomForest with CrossValidation

- **Training dataset**

A	B	C	D	E	CLASSIFIED AS
2596	1081	139	251	933	A = Google
588	3911	118	110	273	B = Skype
4	7	4680	307	2	C = Spotify
58	33	616	4259	34	D = Whatsapp
683	277	74	145	3821	E = Youtube

Confusion matrix RandomForest with CrossValidation, training dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,661	0,519	0,581
Skype	0,737	0,782	0,759
Spotify	0,832	0,936	0,881
Whatsapp	0,840	0,852	0,846
Youtube	0,755	0,764	0,759
Weighted Avg	0,765	0,771	0,765

Precision, Recall and F-Measures RandomForest with CrossValidation, training dataset.

Kappa Statistic: 0.7134

- **Test dataset**

A	B	C	D	E	CLASSIFIED AS
3085	864	63	237	751	A = Google
877	3156	285	247	435	B = Skype
0	4	4991	5	0	C = Spotify
82	259	652	3959	48	D = Whatsapp
863	224	21	67	3825	E = Youtube

Confusion matrix RandomForest with CrossValidation, test dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,629	0,617	0,623
Skype	0,700	0,631	0,664
Spotify	0,830	0,998	0,906
Whatsapp	0,877	0,792	0,832
Youtube	0,756	0,765	0,761
Weighted Avg	0,758	0,761	0,757

Precision, Recall and F-Measures RandomForest with CrossValidation, test dataset.

Kappa Statistic: 0.7008

C.3. AdabosstM1 (J48) with CrossValidation

- **Training dataset**

A	B	C	D	E	CLASSIFIED AS
4315	531	0	31	123	A = Google
969	4009	0	8	14	B = Skype
0	0	5000	0	0	C = Spotify
17	0	65	4917	1	D = Whatsapp
886	232	0	13	3869	E = Youtube

Confusion matrix AdaboostM1 with CrossValidation, training dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,697	0,863	0,771
Skype	0,840	0,802	0,821
Spotify	0,987	1,000	0,994
Whatsapp	0,990	0,983	0,986
Youtube	0,966	0,774	0,859
Weighted Avg	0,896	0,884	0,886

Precision, Recall and F-Measures AdaboostM1 with CrossValidation, training dataset.

Kappa Statistic: 0.8555

- **Test dataset**

A	B	C	D	E	CLASSIFIED AS
4761	192	0	20	27	A = Google
576	4412	0	5	7	B = Skype
0	0	4996	4	0	C = Spotify
23	0	52	4923	2	D = Whatsapp
1580	68	0	6	3346	E = Youtube

Confusion matrix AdaboostM1 with CrossValidation, test dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,686	0,952	0,797
Skype	0,944	0,882	0,912
Spotify	0,990	0,999	0,994
Whatsapp	0,993	0,985	0,989
Youtube	0,989	0,669	0,798
Weighted Avg	0,920	0,898	0,898

Precision, Recall and F-Measures AdabosstM1 with CrossValidation, test dataset.

Kappa Statistic: 0.8719

C.4. Bagging (J48) with CrossValidation

- **Training dataset**

A	B	C	D	E	CLASSIFIED AS
3925	668	0	38	369	A = Google
144	4802	1	6	47	B = Skype
0	0	4998	2	0	C = Spotify
15	2	82	4896	5	D = Whatsapp
258	253	1	20	4468	E = Youtube

Confusion matrix Bagging with CrossValidation, training dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,904	0,785	0,840
Skype	0,839	0,960	0,895
Spotify	0,983	1,000	0,991
Whatsapp	0,987	0,979	0,983
Youtube	0,914	0,894	0,904
Weighted Avg	0,925	0,924	0,923

Precision, Recall and F-Measures Bagging with CrossValidation, training dataset.

Kappa Statistic: 0.9044

- **Test dataset**

A	B	C	D	E	CLASSIFIED AS
3958	671	0	25	346	A = Google
139	4774	0	5	82	B = Skype
0	0	4994	6	0	C = Spotify
11	1	57	4930	1	D = Whatsapp
250	275	1	20	4454	E = Youtube

Confusion matrix Bagging with CrossValidation, test dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,908	0,792	0,846
Skype	0,834	0,955	0,891
Spotify	0,989	0,999	0,994
Whatsapp	0,989	0,986	0,987
Youtube	0,912	0,891	0,901
Weighted Avg	0,926	0,924	0,924

Precision, Recall and F-Measures Bagging with CrossValidation, test dataset.

Kappa Statistic: 0.9055

C.5. IBK (25 neighbors) with CrossValidation

- **Training dataset**

A	B	C	D	E	CLASSIFIED AS
3101	255	780	840	24	A = Google
512	2727	657	1097	7	B = Skype
6	0	4947	47	0	C = Spotify
62	51	2367	2520	0	D = Whatsapp
1112	111	770	837	2170	E = Youtube

Confusion matrix IBK with CrossValidation, training dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,647	0,620	0,633
Skype	0,867	0,545	0,670
Spotify	0,520	0,989	0,681
Whatsapp	0,472	0,504	0,487
Youtube	0,986	0,434	0,603
Weighted Avg	0,698	0,619	0,615

Precision, Recall and F-Measures IBK with CrossValidation, training dataset.

Kappa Statistic: 0.5232

- **Test dataset**

A	B	C	D	E	CLASSIFIED AS
3119	211	800	849	21	A = Google
452	2825	636	1067	20	B = Skype
3	0	4944	53	0	C = Spotify
61	58	2365	2516	0	D = Whatsapp
1073	106	721	882	2218	E = Youtube

Confusion matrix IBK with CrossValidation, test dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,662	0,624	0,643
Skype	0,883	0,565	0,689
Spotify	0,522	0,989	0,684
Whatsapp	0,469	0,503	0,485
Youtube	0,982	0,444	0,611
Weighted Avg	0,704	0,625	0,622

Precision, Recall and F-Measures IBK with CrossValidation, test dataset.

Kappa Statistic: 0.5311

C.6. NaiveBayes with CrossValidation

- **Training dataset**

A	B	C	D	E	CLASSIFIED AS
4344	457	0	12	187	A = Google
241	4702	1	2	54	B = Skype
20	10	4943	26	1	C = Spotify
59	96	175	4645	25	D = Whatsapp
159	94	0	0	4747	E = Youtube

Confusion matrix NaiveBayes with CrossValidation, training dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,901	0,869	0,884
Skype	0,877	0,940	0,908
Spotify	0,966	0,989	0,977
Whatsapp	0,991	0,929	0,959
Youtube	0,947	0,949	0,948
Weighted Avg	0,936	0,935	0,935

Precision, Recall and F-Measures NaiveBayes with CrossValidation, training dataset.

Kappa Statistic: 0.919

- **Test dataset**

A	B	C	D	E	CLASSIFIED AS
4333	484	0	9	174	A = Google
212	4722	0	3	63	B = Skype
23	16	4925	34	2	C = Spotify
69	98	162	4639	32	D = Whatsapp
138	116	0	0	4746	E = Youtube

Confusion matrix NaiveBayes with CrossValidation, test dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,907	0,867	0,887
Skype	0,869	0,944	0,905
Spotify	0,968	0,985	0,977
Whatsapp	0,990	0,928	0,958
Youtube	0,946	0,949	0,948
Weighted Avg	0,936	0,935	0,935

Precision, Recall and F-Measures NaiveBayes with CrossValidation, test dataset.

Kappa Statistic: 0.9182

C.7. T-test with CrossValidation

DATASET	NAIVEBAYES	BAGGING	J48	ADABOOSTM1	RANDOMFOREST	IBK
Training dataset	93.55	92.33*	89.82*	87.18*	85.56*	62.00v
	(v/ /*)	(0/0/1)	(0/0/1)	(0/0/1)	(0/0/1)	(0/0/1)

T-Test with CrossValidation.

C.8. J48 with Percentage Split

- **Training dataset**

A	B	C	D	E	CLASSIFIED AS
1306	143	0	10	214	A = Google
150	1492	0	0	47	B = Skype
0	0	1701	19	0	C = Spotify
13	2	17	1669	8	D = Whatsapp
226	41	0	10	1432	E = Youtube

Confusion matrix J48 with Percentage Split, training dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,771	0,781	0,776
Skype	0,889	0,883	0,886
Spotify	0,990	0,989	0,990
Whatsapp	0,977	0,977	0,977
Youtube	0,842	0,838	0,840
Weighted Avg	0,894	0,894	0,894

Precision, Recall and F-Measures J48 with Percentage Split, training dataset.

Kappa Statistic: 0.8676

- **Test dataset**

A	B	C	D	E	CLASSIFIED AS
4051	388	0	33	528	A = Google
387	4425	0	4	184	B = Skype
0	0	4957	43	0	C = Spotify
38	3	49	4887	23	D = Whatsapp
557	143	0	19	4281	E = Youtube

Confusion matrix J48 with Percentage Split, test dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,805	0,810	0,808
Skype	0,892	0,885	0,889
Spotify	0,990	0,991	0,991

Whatsapp	0,980	0,977	0,979
Youtube	0,853	0,856	0,855
Weighted Avg	0,904	0,904	0,904

Precision, Recall and F-Measures J48 with Percentage Split, test dataset.

Kappa Statistic: 0.88

C.9. RandomForest with Percentage Split

- **Training dataset**

A	B	C	D	E	CLASSIFIED AS
1008	323	6	38	298	A = Google
235	1307	0	35	112	B = Skype
1	0	1705	14	0	C = Spotify
50	51	35	1529	44	D = Whatsapp
248	111	3	16	1331	E = Youtube

Confusion matrix RandomForest with Percentage Split, training dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,654	0,603	0,627
Skype	0,729	0,774	0,751
Spotify	0,975	0,991	0,983
Whatsapp	0,937	0,895	0,915
Youtube	0,746	0,779	0,762
Weighted Avg	0,809	0,809	0,809

Precision, Recall and F-Measures RandomForest with Percentage Split, training dataset.

Kappa Statistic: 0.7617

- **Test dataset**

A	B	C	D	E	CLASSIFIED AS
3085	864	63	237	751	A = Google
877	3156	285	247	435	B = Skype
0	4	4991	5	0	C = Spotify
82	259	652	3959	48	D = Whatsapp
863	224	21	67	3825	E = Youtube

Confusion matrix RandomForest with Percentage Split, test dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,629	0,617	0,623
Skype	0,700	0,631	0,664
Spotify	0,830	0,998	0,906
Whatsapp	0,877	0,792	0,832
Youtube	0,756	0,765	0,761

Weighted Avg	0,758	0,761	0,757
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Precision, Recall and F-Measures RandomForest with Percentage Split, test dataset.

Kappa Statistic: 0.7008

C.10. AdaboostM1 (J48) with Percentage Split

- **Training dataset**

A	B	C	D	E	CLASSIFIED AS
1521	71	0	15	66	A = Google
189	1495	0	2	3	B = Skype
0	0	1719	1	0	C = Spotify
1	0	18	1689	1	D = Whatsapp
146	65	0	7	1491	E = Youtube

Confusion matrix AdaboostM1 with Percentage Split, training dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,819	0,909	0,862
Skype	0,917	0,885	0,901
Spotify	0,990	0,999	0,995
Whatsapp	0,985	0,988	0,987
Youtube	0,955	0,872	0,912
Weighted Avg	0,934	0,931	0,932

Precision, Recall and F-Measures AdaboostM1 with Percentage Split, training dataset.

Kappa Statistic: 0.914

- **Test dataset**

A	B	C	D	E	CLASSIFIED AS
4761	192	0	20	27	A = Google
576	4412	0	5	7	B = Skype
0	0	4996	4	0	C = Spotify
23	0	52	4923	2	D = Whatsapp
1580	68	0	6	3346	E = Youtube

Confusion matrix AdaboostM1 with Percentage Split, test dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,686	0,952	0,797
Skype	0,944	0,882	0,912
Spotify	0,990	0,999	0,994
Whatsapp	0,993	0,985	0,989
Youtube	0,989	0,669	0,798
Weighted Avg	0,920	0,898	0,898

Precision, Recall and F-Measures AdaboostM1 with Percentage Split, test dataset.

Kappa Statistic: 0.8719

C.11. Bagging (J48) with Percentage Split

- **Training dataset**

A	B	C	D	E	CLASSIFIED AS
1305	210	0	17	141	A = Google
40	1630	0	1	18	B = Skype
0	0	1720	0	0	C = Spotify
11	0	27	1669	2	D = Whatsapp
89	68	0	9	1543	E = Youtube

Confusion matrix Bagging with Percentage Split, training dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,903	0,780	0,837
Skype	0,854	0,965	0,906
Spotify	0,985	1,000	0,992
Whatsapp	0,984	0,977	0,980
Youtube	0,906	0,903	0,904
Weighted Avg	0,927	0,926	0,925

Precision, Recall and F-Measures Bagging with Percentage Split, training dataset.

Kappa Statistic: 0.9069

- **Test dataset**

A	B	C	D	E	CLASSIFIED AS
3958	671	0	25	346	A = Google
139	4774	0	5	82	B = Skype
0	0	4994	6	0	C = Spotify
11	1	57	4930	1	D = Whatsapp
250	275	1	20	4454	E = Youtube

Confusion matrix Bagging with Percentage Split, test dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,908	0,792	0,846
Skype	0,834	0,955	0,891
Spotify	0,989	0,999	0,994
Whatsapp	0,989	0,986	0,987
Youtube	0,912	0,891	0,901
Weighted Avg	0,926	0,924	0,924

Precision, Recall and F-Measures Bagging with Percentage Split, test dataset.

Kappa Statistic: 0.9055

C.12. IBK with Percentage Split

- **Training dataset**

A	B	C	D	E	CLASSIFIED AS
1054	75	278	261	5	A = Google
183	916	237	352	1	B = Skype
5	0	1699	16	0	C = Spotify
21	16	843	829	0	D = Whatsapp

Confusion matrix IBK with Percentage Split, training dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,642	0,630	0,636
Skype	0,881	0,542	0,671
Spotify	0,507	0,988	0,670
Whatsapp	0,473	0,485	0,479
Youtube	0,992	0,415	0,585
Weighted Avg	0,698	0,613	0,608

Precision, Recall and F-Measures IBK with Percentage Split, training dataset.

Kappa Statistic: 0.5155

- **Test dataset**

A	B	C	D	E	CLASSIFIED AS
3119	211	800	849	21	A = Google
452	2825	636	1067	20	B = Skype
3	0	4944	53	0	C = Spotify
61	58	2365	2516	0	D = Whatsapp
1073	106	721	882	2218	E = Youtube

Confusion matrix IBK with Percentage Split, test dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,662	0,624	0,643
Skype	0,883	0,565	0,689
Spotify	0,522	0,989	0,684
Whatsapp	0,469	0,503	0,485
Youtube	0,982	0,444	0,611
Weighted Avg	0,704	0,625	0,622

Precision, Recall and F-Measures IBK with Percentage Split, test dataset.

Kappa Statistic: 0.5311

C.13. NaiveBayes with Percentage Split

- **Training dataset**

A	B	C	D	E	CLASSIFIED AS
1443	171	0	4	55	A = Google
74	1594	0	0	21	B = Skype
10	3	1694	13	0	C = Spotify
21	32	66	1580	10	D = Whatsapp
43	28	0	0	1638	E = Youtube

Confusion matrix NaiveBayes with Percentage Split, training dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,907	0,863	0,884
Skype	0,872	0,944	0,906
Spotify	0,963	0,985	0,974
Whatsapp	0,989	0,925	0,956
Youtube	0,950	0,958	0,954
Weighted Avg	0,936	0,935	0,935

Precision, Recall and F-Measures NaiveBayes with Percentage Split, training dataset.

Kappa Statistic: 0.919

- **Test dataset**

A	B	C	D	E	CLASSIFIED AS
4333	484	0	9	174	A = Google
212	4722	0	3	63	B = Skype
23	16	4925	34	2	C = Spotify
69	98	162	4639	32	D = Whatsapp
138	116	0	0	4746	E = Youtube

Confusion matrix NaiveBayes with Percentage Split, test dataset.

CLASS	PRECISION	RECALL	F-MEASURE
Google	0,907	0,867	0,887
Skype	0,869	0,944	0,905
Spotify	0,968	0,985	0,977
Whatsapp	0,990	0,928	0,958
Youtube	0,946	0,949	0,948
Weighted Avg	0,936	0,935	0,935

Precision, Recall and F-Measures NaiveBayes with Percentage Split, test dataset.

Kappa Statistic: 0.9182