

## Appendix B. Comparison of data preprocessing techniques in multiclass models of specific Group 1 attacks from the perspective of evaluation metrics for the Nemenyi test.

In general, no technique showed a significant statistical difference, all within the critical distance's limiting margin. The most considerable distance within the critical limit is considered low, presented by the LE\_MM (Data Cleaning, Label Encoder, and MinMax Scaler) techniques, with 59% of the critical distance value from the perspective of the Recall metric. The GD\_SS (Data Cleaning, Get Dummies, and Standard Scaler) techniques showed the most significant distance from the standpoint of the Precision metric, with 33% of the critical distance value. The LE\_SS (Data Cleaning, Label Encoder, and Standard Scaler) and GD\_SS (Data Cleaning, Get Dummies, and Standard Scaler) techniques were aligned with the most significant distance in the F1-Score metric, with 47% of the critical distance value. And the LE (Data Cleaning and Label Encoder) techniques showed the most significant distance from the perspective of the FAR metric, with 26% of the critical distance value. As all distance values are close and within the limiting margin of the critical distance, it is impossible to state which techniques would be considered the best in terms of performance. Below, the results are presented from the perspective of each analyzed metric.

**Precision (Table B.1):** all techniques, when compared, presented a percentage value within the margin of the critical distance limit. The GD\_SS (Data Cleaning, Get Dummies and Standard Scaler) techniques showed the most significant distance when compared to the GD (Data Cleaning and Get Dummies) techniques, with the first greater distance within the limit margin of the critical distance, with 33% of the value of the critical distance. In the second largest distance were the techniques (Data Cleaning, Label Encoder, and MinMax Scaler) compared to the GD techniques, with 28% of the value of the critical distance. The third largest distance is from the GD\_SS techniques compared to the LE\_SS techniques (Data Cleaning, Label Encoder, and Standard Scaler), with 24% of the critical distance value. When compared, all the other techniques presented percentages ranging from 0% to 19% of the critical distance value.

Critical Distance: 2.66						
Group 1	Ranking	Group 2	Ranking	Distance	(%)	Hypotheses
GD_SS	3.06	LE_MM	3.19	0.13	5%	Equal
GD_SS	3.06	LE	3.56	0.50	19%	Equal
GD_SS	3.06	GD_MM	3.56	0.50	19%	Equal
GD_SS	3.06	LE_SS	3.69	0.63	24%	Equal
GD_SS	3.06	GD	3.94	0.88	33%	Equal
LE_MM	3.19	LE	3.56	0.37	14%	Equal
LE_MM	3.19	GD_MM	3.56	0.37	14%	Equal
LE_MM	3.19	LE_SS	3.69	0.50	19%	Equal
LE_MM	3.19	GD	3.94	0.75	28%	Equal
LE	3.56	GD_MM	3.56	0.00	0%	Equal
LE	3.56	LE_SS	3.69	0.13	5%	Equal
LE	3.56	GD	3.94	0.38	14%	Equal
GD_MM	3.56	LE_SS	3.69	0.13	5%	Equal
GD_MM	3.56	GD	3.94	0.38	14%	Equal
LE_SS	3.69	GD	3.94	0.25	9%	Equal

Table B.1: Comparison of data preprocessing techniques in the multiclass models of specific attacks in Group 1, from the perspective of the **Precision metric** for the Nemenyi test.

**Recall (Table B.2):** all techniques, when compared, showed a percentage value within the margin of the critical distance limit. The LE\_MM (Data Cleaning, Label Encoder, and MinMax Scaler) techniques showed the most significant distance when compared to the GD\_MM (Data Cleaning,

Get Dummies, and MinMax Scaler) techniques, with the first greater distance within the limit margin of the critical distance, with 59% of the value of the critical distance. The second largest distance is also for the LE\_MM group when comparing the LE (Data Cleaning and Label Encoder) and GD (Data Cleaning and Get Dummies) techniques, with 52% of the critical distance value. In the third largest distance were the LE\_SS techniques (Data Cleaning, Label Encoder, and Standard Scaler) compared to the GD\_MM techniques (Data Cleaning, Get Dummies, and MinMax Scaler), with a value of 49% of the critical distance value. When compared, all the other techniques presented percentages ranging from 0% to 42% of the critical distance value.

Critical Distance: 2.66						
Group 1	Ranking	Group 2	Ranking	Distance	(%)	Hypotheses
LE_MM	2.62	LE_SS	2.88	0.26	10%	Equal
LE_MM	2.62	GD_SS	3.31	0.69	26%	Equal
LE_MM	2.62	LE	4.00	1.38	52%	Equal
LE_MM	2.62	GD	4.00	1.38	52%	Equal
LE_MM	2.62	GD_MM	4.19	1.57	59%	Equal
LE_SS	2.88	GD_SS	3.31	0.43	16%	Equal
LE_SS	2.88	LE	4.00	1.12	42%	Equal
LE_SS	2.88	GD	4.00	1.12	42%	Equal
LE_SS	2.88	GD_MM	4.19	1.31	49%	Equal
GD_SS	3.31	LE	4.00	0.69	26%	Equal
GD_SS	3.31	GD	4.00	0.69	26%	Equal
GD_SS	3.31	GD_MM	4.19	0.88	33%	Equal
LE	4.00	GD	4.00	0.00	0%	Equal
LE	4.00	GD_MM	4.19	0.19	7%	Equal
GD	4.00	GD_MM	4.19	0.19	7%	Equal

Table B.2: Comparison of data preprocessing techniques in the multiclass models of specific attacks in Group 1, from the perspective of the **Recall metric** for the Nemenyi test.

**F1-Score (Table B.3):** all techniques, when compared, presented a percentage value within the margin of the critical distance limit. The LE\_SS (Data Cleaning, Label Encoder, and Standard Scaler) and GD\_SS (Data Cleaning, Get Dummies, and Standard Scaler) techniques were aligned and presented the most significant distances within the limit margin of the critical distance when compared to the GD (Data Cleaning and Standard Scaler) techniques. Get Dummies), both at 47% of the critical distance value. In the second largest distance were the LE\_MM techniques (Data Cleaning, Label Encoder, and MinMax Scaler) compared to the GD techniques, with 45% of the value of the critical distance. In the third largest distance, the LE\_SS and GD\_SS techniques were also aligned when compared to the GD\_MM techniques (Data Cleaning, Get Dummies, and MinMax Scaler), with a value of 35% of the critical distance value. When compared, all the other techniques presented percentages ranging from 0% to 33% of the critical distance value.

Critical Distance: 2.66						
Group 1	Ranking	Group 2	Ranking	Distance	(%)	Hypotheses
LE_SS	3.06	GD_SS	3.06	0.00	0%	Equal
LE_SS	3.06	LE_MM	3.12	0.06	2%	Equal
LE_SS	3.06	LE	3.44	0.38	14%	Equal
LE_SS	3.06	GD_MM	4.00	0.94	35%	Equal
LE_SS	3.06	GD	4.31	1.25	47%	Equal
GD_SS	3.06	LE_MM	3.12	0.06	2%	Equal
GD_SS	3.06	LE	3.44	0.38	14%	Equal
GD_SS	3.06	GD_MM	4.00	0.94	35%	Equal

GD_SS	3.06	GD	4.31	1.25	47%	Equal
LE_MM	3.12	LE	3.44	0.32	12%	Equal
LE_MM	3.12	GD_MM	4.00	0.88	33%	Equal
LE_MM	3.12	GD	4.31	1.19	45%	Equal
LE	3.44	GD_MM	4.00	0.56	21%	Equal
LE	3.44	GD	4.31	0.87	33%	Equal
GD_MM	4.00	GD	4.31	0.31	12%	Equal

Table B.3: Comparison of data preprocessing techniques in the multiclass models of specific attacks in Group 1, from the perspective of the **F1-Score metric** for the Nemenyi test.

**FAR (Table B.4):** all techniques, when compared, showed a percentage value within the margin of the critical distance limit. The LE (Data Cleaning and Label Encoder) techniques showed the most significant distance within the limit margin of the critical distance when compared to the GD\_MM (Data Cleaning, Get Dummies, and MinMax Scaler) techniques, with 26% of the critical distance value. In the second largest distance were the LE\_MM (Data Cleaning, Label Encoder, and MinMax Scaler) techniques compared to the GD\_MM (Data Cleaning, Get Dummies, and MinMax Scaler) techniques, with a value of 24% of the critical distance value. The LE techniques were also in the third largest distance compared to the GD (Data Cleaning and Get Dummies) techniques, with 23% of the value of the critical distance. When compared, all the other techniques presented percentages ranging from 2% to 21% of the critical distance value.

Critical Distance: 2.66						
Group 1	Ranking	Group 2	Ranking	Distance	(%)	Hypotheses
LE	3.81	LE_MM	3.75	0.06	2%	Equal
LE	3.81	GD_SS	3.69	0.12	5%	Equal
LE	3.81	LE_SS	3.44	0.37	14%	Equal
LE	3.81	GD	3.19	0.62	23%	Equal
LE	3.81	GD_MM	3.12	0.69	26%	Equal
LE_MM	3.75	GD_SS	3.69	0.06	2%	Equal
LE_MM	3.75	LE_SS	3.44	0.31	12%	Equal
LE_MM	3.75	GD	3.19	0.56	21%	Equal
LE_MM	3.75	GD_MM	3.12	0.63	24%	Equal
GD_SS	3.69	LE_SS	3.44	0.25	9%	Equal
GD_SS	3.69	GD	3.19	0.50	19%	Equal
GD_SS	3.69	GD_MM	3.12	0.57	21%	Equal
LE_SS	3.44	GD	3.19	0.25	9%	Equal
LE_SS	3.44	GD_MM	3.12	0.32	12%	Equal
GD	3.19	GD_MM	3.12	0.07	3%	Equal

Table B.4: Comparison of data preprocessing techniques in the multiclass models of specific attacks in Group 1, from the perspective of the **FAR metric** for the Nemenyi test.