

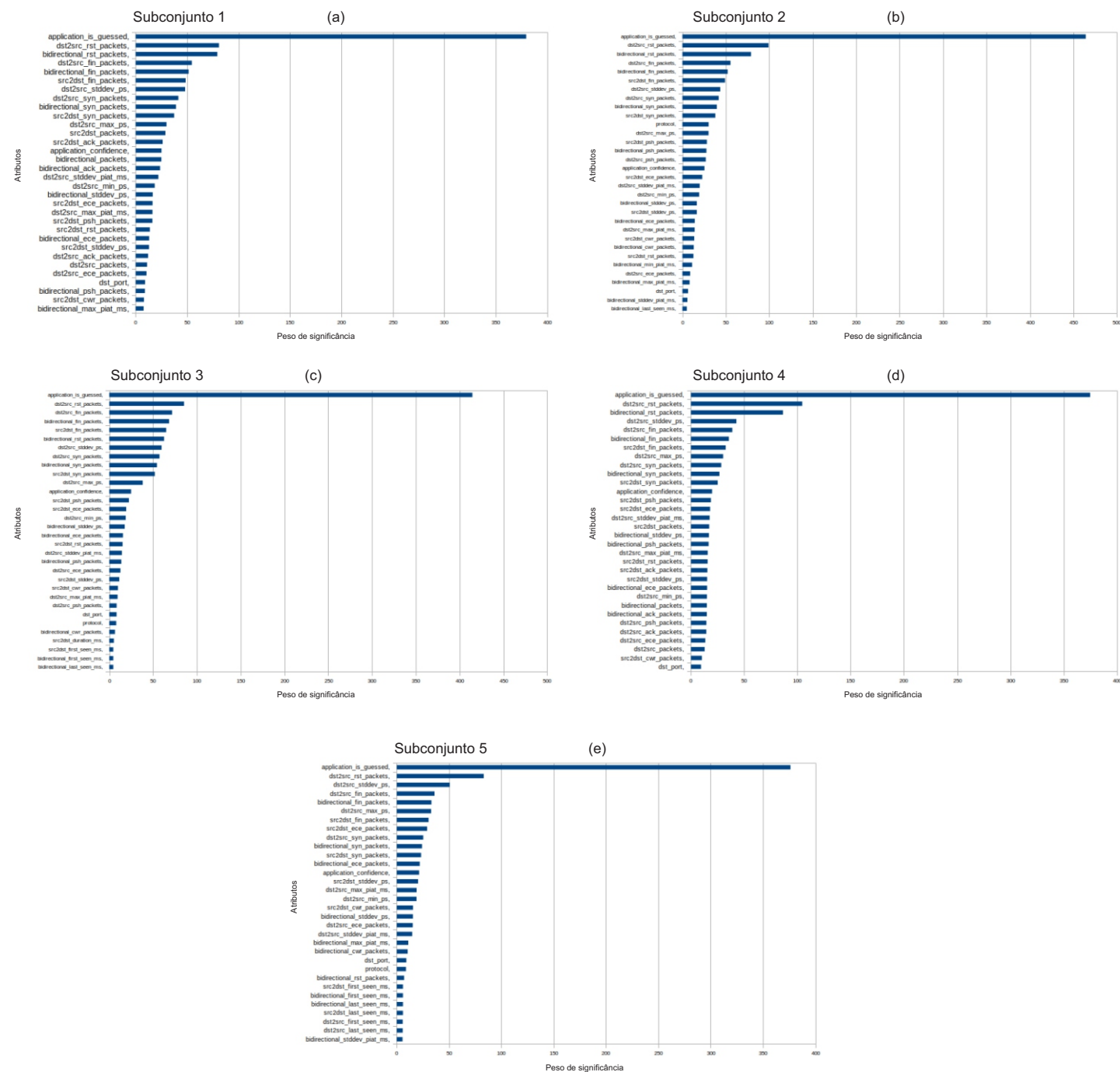
Tabela 1. Pesos de Significância da Intervenção Seleção de Atributos no Conjunto de Dados GenIDS-CIC18

N.	Subconjunto 1		Subconjunto 2		Subconjunto 3		Subconjunto 4		Subconjunto 5	
	Atributos	Peso	Atributos	Peso	Atributos	Peso	Atributos	Peso	Atributos	Peso
1	application_is_guessed,	379,67	application_is_guessed,	464,11	application_is_guessed,	414,56	application_is_guessed,	374,97	application_is_guessed,	376,28
2	dst2src_rst_packets,	81,02	dst2src_rst_packets,	99,18	dst2src_rst_packets,	85,39	dst2src_rst_packets,	104,56	dst2src_rst_packets,	83,12
3	bidirectional_rst_packets,	79,41	bidirectional_rst_packets,	79,01	dst2src_fin_packets,	71,72	bidirectional_rst_packets,	86,45	dst2src_stddev_ps,	50,66
4	dst2src_fin_packets,	54,62	dst2src_fin_packets,	55,36	bidirectional_fin_packets,	68,29	dst2src_stddev_ps,	42,70	dst2src_fin_packets,	36,10
5	bidirectional_fin_packets,	51,52	bidirectional_fin_packets,	52,13	src2dst_fin_packets,	65,00	dst2src_fin_packets,	38,91	bidirectional_fin_packets,	33,16
6	src2dst_fin_packets,	48,59	src2dst_fin_packets,	49,08	bidirectional_rst_packets,	62,57	bidirectional_fin_packets,	35,66	dst2src_max_ps,	32,88
7	dst2src_stddev_ps,	48,12	dst2src_stddev_ps,	43,56	dst2src_stddev_ps,	59,70	src2dst_fin_packets,	32,66	src2dst_fin_packets,	30,42
8	dst2src_syn_packets,	41,54	dst2src_syn_packets,	41,81	dst2src_syn_packets,	57,38	dst2src_max_ps,	30,28	src2dst_ece_packets,	29,05
9	bidirectional_syn_packets,	39,25	bidirectional_syn_packets,	39,62	bidirectional_syn_packets,	54,43	dst2src_syn_packets,	28,49	dst2src_syn_packets,	25,33
10	src2dst_syn_packets,	37,44	src2dst_syn_packets,	37,90	src2dst_syn_packets,	52,00	bidirectional_syn_packets,	26,78	bidirectional_syn_packets,	24,16
11	dst2src_max_ps,	30,01	protocol,	30,20	dst2src_max_ps,	38,22	src2dst_syn_packets,	25,16	src2dst_syn_packets,	23,28
12	src2dst_packets,	28,93	dst2src_max_ps,	30,10	application_confidence,	24,94	application_confidence,	19,93	bidirectional_ece_packets,	21,99
13	src2dst_ack_packets,	26,28	src2dst_psh_packets,	28,19	src2dst_psh_packets,	22,43	src2dst_psh_packets,	18,81	application_confidence,	21,37
14	application_confidence,	25,12	bidirectional_psh_packets,	27,64	src2dst_ece_packets,	19,35	src2dst_ece_packets,	18,03	src2dst_stddev_ps,	20,39
15	bidirectional_packets,	25,03	dst2src_psh_packets,	26,93	dst2src_min_ps,	18,78	dst2src_stddev_piat_ms,	17,61	dst2src_max_piat_ms,	18,99
16	bidirectional_ack_packets,	23,80	application_confidence,	25,39	bidirectional_stddev_ps,	17,67	src2dst_packets,	17,18	dst2src_min_ps,	18,89
17	dst2src_stddev_piat_ms,	22,10	src2dst_ece_packets,	22,87	bidirectional_ece_packets,	15,66	bidirectional_stddev_ps,	16,91	src2dst_cwr_packets,	15,54
18	dst2src_min_ps,	18,56	dst2src_stddev_piat_ms,	19,93	src2dst_rst_packets,	15,20	bidirectional_psh_packets,	16,64	bidirectional_stddev_ps,	15,46
19	bidirectional_stddev_ps,	16,60	dst2src_min_ps,	19,35	dst2src_stddev_piat_ms,	14,44	dst2src_max_piat_ms,	15,79	dst2src_ece_packets,	15,29
20	src2dst_ece_packets,	16,45	bidirectional_stddev_ps,	16,62	bidirectional_psh_packets,	13,77	src2dst_rst_packets,	15,73	dst2src_stddev_piat_ms,	14,80
21	dst2src_max_piat_ms,	16,37	src2dst_stddev_ps,	16,61	dst2src_ece_packets,	12,75	src2dst_ack_packets,	15,47	bidirectional_max_piat_ms,	11,01
22	src2dst_psh_packets,	16,30	bidirectional_ece_packets,	14,28	src2dst_stddev_ps,	11,45	src2dst_stddev_ps,	15,24	bidirectional_cwr_packets,	10,48
23	src2dst_rst_packets,	13,84	dst2src_max_piat_ms,	14,13	src2dst_cwr_packets,	9,94	bidirectional_ece_packets,	15,23	dst_port,	9,19
24	bidirectional_ece_packets,	13,18	src2dst_cwr_packets,	13,64	dst2src_max_piat_ms,	9,52	dst2src_min_ps,	15,08	protocol,	8,84
25	src2dst_stddev_ps,	13,03	bidirectional_cwr_packets,	13,11	dst2src_psh_packets,	8,46	bidirectional_packets,	14,98	bidirectional_rst_packets,	7,07
26	dst2src_ack_packets,	12,12	src2dst_rst_packets,	12,73	dst_port,	8,36	bidirectional_ack_packets,	14,93	bidirectional_first_seen_ms,	5,98
27	dst2src_packets,	11,12	bidirectional_min_piat_ms,	11,20	protocol,	7,96	dst2src_psh_packets,	14,51	src2dst_first_seen_ms,	5,98
28	dst2src_ece_packets,	10,56	dst2src_ece_packets,	8,97	bidirectional_cwr_packets,	6,54	dst2src_ack_packets,	14,47	bidirectional_last_seen_ms,	5,98
29	dst_port,	9,16	bidirectional_max_piat_ms,	8,34	src2dst_duration_ms,	5,29	dst2src_ece_packets,	13,51	src2dst_last_seen_ms,	5,98
30	bidirectional_psh_packets,	9,01	dst_port,	6,56	bidirectional_first_seen_ms,	4,62	dst2src_packets,	12,91	dst2src_first_seen_ms,	5,70
31	src2dst_cwr_packets,	8,09	bidirectional_stddev_piat_ms,	5,82	src2dst_first_seen_ms,	4,62	src2dst_cwr_packets,	10,31	dst2src_last_seen_ms,	5,70
32	bidirectional_max_piat_ms,	7,76	bidirectional_last_seen_ms,	5,16	bidirectional_last_seen_ms,	4,62	dst_port,	9,50	bidirectional_stddev_piat_ms,	5,52

Fonte: Elaborado pelo autor.

A tabela evidencia que a seleção dos atributos e seus respectivos pesos de significância variam conforme o subconjunto de dados. Com base na significância estatística dos atributos originais em relação ao rótulo de classe, observou-se que as diferenças nos pesos tornam-se menos expressivas a partir da inclusão de 32 atributos, ou seja, com aproximadamente 46% (quarenta e seis por cento) dos atributos selecionados, em cada subconjunto do GenIDS-CIC18.

Figura 1. Atributos de Maior Significância da Intervenção Seleção de Atributos no Conjunto de Dados GenIDS-CIC18



Fonte: Elaborado pelo autor.

A figura destaca a diferença significativa variável dos atributos mais relevantes no processo de classificação dos dados. Isso sugere que a redução do conjunto, eliminando os demais atributos, pode simplificar o modelo sem comprometer a robustez de forma significativa. Apesar da variância entre os atributos de maior significância nos subconjuntos, todas as Figuras 1(a), 1(b), 1(c), 1(d) e 1(e) apresentam o atributo '*application_is_guessed*' como sendo o de maior significância.

Tabela 1. Pesos de Significância da Intervenção IN2 (Seleção de Atributos) no Conjunto de Dados GenIDS-CIC17

N.	Subconjunto 1		Subconjunto 2		Subconjunto 3		Subconjunto 4		Subconjunto 5	
	Atributos	Peso	Atributos	Peso	Atributos	Peso	Atributos	Peso	Atributos	Peso
1	dst2src_max_ps	461,14	dst2src_max_ps	485,32	protocol	662,20	protocol	667,64	dst2src_max_ps	504,19
2	src2dst_max_piat_ms	340,09	dst2src_stddev_ps	356,45	bidirectional_max_ps	479,87	dst2src_max_ps	479,10	dst2src_stddev_ps	430,38
3	dst2src_stddev_ps	337,14	bidirectional_stddev_ps	344,66	dst2src_max_ps	479,24	dst2src_stddev_ps	354,34	bidirectional_stddev_ps	336,65
4	bidirectional_max_piat_ms	337,12	src2dst_max_piat_ms	341,31	bidirectional_stddev_ps	354,70	bidirectional_stddev_ps	311,05	dst2src_mean_ps	329,59
5	bidirectional_stddev_ps	323,55	bidirectional_max_piat_ms	339,70	dst2src_stddev_ps	353,08	src2dst_max_piat_ms	300,49	bidirectional_max_ps	309,52
6	bidirectional_rst_packets	308,27	bidirectional_rst_packets	310,74	src2dst_max_piat_ms	334,72	bidirectional_max_ps	300,27	src2dst_max_piat_ms	298,45
7	src2dst_rst_packets	282,43	src2dst_rst_packets	286,78	bidirectional_max_piat_ms	330,34	bidirectional_max_piat_ms	297,96	bidirectional_rst_packets	296,28
8	src2dst_syn_packets	268,89	src2dst_syn_packets	283,38	bidirectional_rst_packets	305,30	dst2src_fin_packets	275,76	bidirectional_max_piat_ms	295,84
9	dst2src_fin_packets	266,93	dst2src_fin_packets	280,56	src2dst_rst_packets	283,45	dst2src_syn_packets	268,29	dst2src_fin_packets	293,29
10	bidirectional_syn_packets	266,28	bidirectional_syn_packets	277,48	dst2src_fin_packets	251,59	bidirectional_rst_packets	265,27	src2dst_rst_packets	276,88
11	dst2src_max_piat_ms	248,12	dst2src_max_piat_ms	253,82	bidirectional_syn_packets	250,87	bidirectional_syn_packets	256,10	bidirectional_syn_packets	256,89
12	protocol	242,88	dst2src_syn_packets	249,22	dst2src_max_piat_ms	245,89	src2dst_rst_packets	248,23	src2dst_syn_packets	252,24
13	dst2src_syn_packets	242,77	bidirectional_max_ps	248,54	dst2src_mean_ps	242,83	src2dst_syn_packets	248,07	dst2src_syn_packets	243,27
14	bidirectional_max_ps	229,67	dst2src_mean_ps	244,51	src2dst_syn_packets	240,09	dst2src_mean_ps	233,11	dst2src_max_piat_ms	229,54
15	dst2src_mean_ps	228,13	protocol	235,72	dst2src_syn_packets	227,71	dst2src_max_piat_ms	224,84	src2dst_duration_ms	210,67
16	dst2src_rst_packets	223,97	dst2src_rst_packets	212,90	bidirectional_mean_ps	193,50	dst2src_duration_ms	221,55	bidirectional_duration_ms	209,89
17	bidirectional_fin_packets	181,68	bidirectional_mean_ps	180,52	src2dst_stddev_piat_ms	174,92	src2dst_duration_ms	220,29	dst2src_rst_packets	208,54
18	bidirectional_mean_ps	176,21	dst2src_stddev_piat_ms	178,32	dst2src_stddev_piat_ms	168,70	bidirectional_duration_ms	219,55	dst2src_duration_ms	208,48
19	application_is_guessed	170,76	bidirectional_fin_packets	173,12	application_is_guessed	151,27	bidirectional_fin_packets	183,21	bidirectional_mean_ps	184,05
20	dst2src_stddev_piat_ms	166,82	src2dst_stddev_piat_ms	162,17	bidirectional_fin_packets	148,81	application_is_guessed	163,44	application_is_guessed	183,06
21	src2dst_stddev_piat_ms	156,11	application_is_guessed	151,38	src2dst_duration_ms	139,38	bidirectional_mean_ps	162,61	bidirectional_fin_packets	172,38
22	src2dst_duration_ms	145,60	src2dst_duration_ms	149,69	bidirectional_duration_ms	138,79	dst2src_stddev_piat_ms	155,42	dst2src_stddev_piat_ms	157,50
23	bidirectional_duration_ms	145,12	bidirectional_duration_ms	149,22	dst2src_duration_ms	132,74	src2dst_stddev_piat_ms	143,70	src2dst_stddev_piat_ms	142,77
24	dst2src_duration_ms	139,60	dst2src_duration_ms	145,43	application_name	118,74	application_name	119,37	application_name	132,92
25	application_name	133,56	application_name	118,83	bidirectional_stddev_piat_ms	94,54	src2dst_last_seen_ms	87,82	src2dst_last_seen_ms	88,77
26	bidirectional_stddev_piat_ms	92,87	src2dst_last_seen_ms	94,06	src2dst_last_seen_ms	89,41	bidirectional_last_seen_ms	87,82	bidirectional_last_seen_ms	88,77
27	src2dst_last_seen_ms	91,70	bidirectional_last_seen_ms	94,06	bidirectional_last_seen_ms	89,41	bidirectional_first_seen_ms	87,63	bidirectional_first_seen_ms	88,61
28	bidirectional_last_seen_ms	91,70	bidirectional_first_seen_ms	93,85	bidirectional_first_seen_ms	89,22	src2dst_first_seen_ms	87,63	src2dst_first_seen_ms	88,61
29	bidirectional_first_seen_ms	91,52	src2dst_first_seen_ms	93,85	src2dst_first_seen_ms	89,22	bidirectional_stddev_piat_ms	84,71	bidirectional_stddev_piat_ms	78,25
30	src2dst_first_seen_ms	91,52	bidirectional_stddev_piat_ms	90,81	application_confidence	76,50	application_confidence	72,87	application_confidence	75,19
31	application_confidence	76,46	application_confidence	69,85	application_category_name	55,82	application_category_name	58,21	protocol	68,47
32	application_category_name	60,04	application_category_name	55,02	bidirectional_min_ps	46,60	dst2src_min_ps	56,91	bidirectional_min_ps	62,17
33	bidirectional_min_ps	52,03	bidirectional_min_ps	49,05	dst2src_rst_packets	39,05	dst2src_rst_packets	47,23	application_category_name	55,80
34	dst_port	25,99	dst_port	37,52	dst_port	35,18	bidirectional_min_ps	46,59	src2dst_min_ps	43,18
35	src2dst_fin_packets	23,31	src2dst_fin_packets	25,04	bidirectional_mean_piat_ms	22,39	dst_port	31,01	dst_port	38,38
36	bidirectional_mean_piat_ms	20,95	bidirectional_mean_piat_ms	20,52	src2dst_fin_packets	17,70	src2dst_fin_packets	27,77	src2dst_psh_packets	26,11
37	dst2src_min_ps	18,22	src2dst_psh_packets	18,02	dst2src_min_ps	17,59	bidirectional_mean_piat_ms	20,63	src2dst_fin_packets	21,62
38	dst2src_mean_piat_ms	11,75	dst2src_min_ps	17,61	src2dst_psh_packets	14,91	dst2src_mean_piat_ms	11,91	dst2src_min_ps	19,32
39	src2dst_min_ps	6,93	src2dst_packets	15,76	dst2src_mean_piat_ms	13,90	src2dst_min_ps	6,70	bidirectional_mean_piat_ms	15,70
40	src2dst_min_piat_ms	6,38	bidirectional_psh_packets	13,38	bidirectional_psh_packets	10,01	src2dst_min_piat_ms	5,69	bidirectional_psh_packets	12,55

Fonte: Elaborado pelo autor.

A tabela evidenciam que seleção dos atributos e seus respectivos pesos de significância variam conforme o subconjunto de dados. Com base na significância estatística dos atributos originais em relação ao rótulo de classe, observou-se que as diferenças nos pesos tornam-se menos expressivas a partir da inclusão de 40 atributos, ou seja, com aproximadamente **58% (cinquenta e oito por cento)** dos atributos selecionados, em cada subconjunto do GenIDS-CIC17.

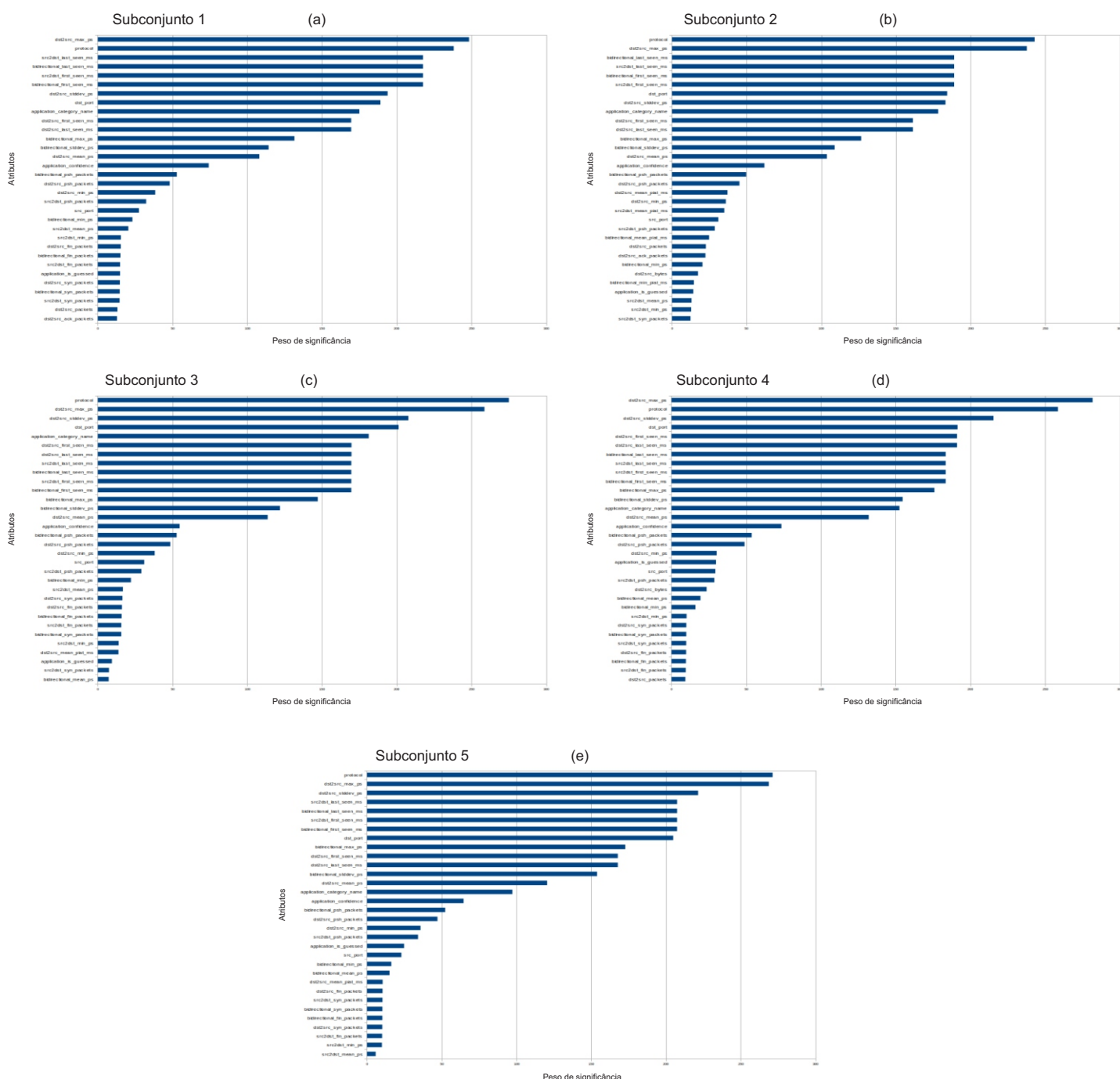
Tabela 2. Pesos de Significância da Intervenção IN2 (Seleção de Atributos) no Conjunto de Dados GenIDS-NB15

N.	Subconjunto 1		Subconjunto 2		Subconjunto 3		Subconjunto 4		Subconjunto 5	
	Atributos	Peso	Atributos	Peso	Atributos	Peso	Atributos	Peso	Atributos	Peso
1	dst2src_max_ps	248,41	protocol	242,92	protocol	275,04	dst2src_max_ps	281,76	protocol	271,37
2	protocol	238,15	dst2src_max_ps	237,69	dst2src_max_ps	258,72	protocol	258,59	dst2src_max_ps	268,83
3	src2dst_last_seen_ms	217,60	bidirectional_last_seen_ms	189,03	dst2src_stddev_ps	207,83	dst2src_stddev_ps	215,45	dst2src_stddev_ps	221,52
4	bidirectional_last_seen_ms	217,60	src2dst_last_seen_ms	189,03	dst_port	201,30	dst_port	191,43	src2dst_last_seen_ms	207,46
5	src2dst_first_seen_ms	217,60	bidirectional_first_seen_ms	189,03	application_category_name	181,28	dst2src_first_seen_ms	191,07	bidirectional_last_seen_ms	207,46
6	bidirectional_first_seen_ms	217,60	src2dst_first_seen_ms	189,03	dst2src_first_seen_ms	169,75	dst2src_last_seen_ms	191,07	src2dst_first_seen_ms	207,46
7	dst2src_stddev_ps	193,93	dst_port	184,37	dst2src_last_seen_ms	169,75	bidirectional_last_seen_ms	183,48	bidirectional_first_seen_ms	207,46
8	dst_port	189,12	dst2src_stddev_ps	183,21	src2dst_last_seen_ms	169,62	src2dst_last_seen_ms	183,48	dst_port	204,86
9	application_category_name	175,02	application_category_name	178,34	bidirectional_last_seen_ms	169,62	src2dst_first_seen_ms	183,48	bidirectional_max_ps	172,82
10	dst2src_first_seen_ms	169,55	dst2src_first_seen_ms	161,41	src2dst_first_seen_ms	169,62	bidirectional_first_seen_ms	183,48	dst2src_first_seen_ms	167,84
11	dst2src_last_seen_ms	169,55	dst2src_last_seen_ms	161,41	bidirectional_first_seen_ms	169,62	bidirectional_max_ps	175,93	dst2src_last_seen_ms	167,84
12	bidirectional_max_ps	131,58	bidirectional_max_ps	126,73	bidirectional_max_ps	147,21	bidirectional_stddev_ps	154,67	bidirectional_stddev_ps	153,93
13	bidirectional_stddev_ps	114,31	bidirectional_stddev_ps	108,99	bidirectional_stddev_ps	121,93	application_category_name	152,54	dst2src_mean_ps	120,51
14	dst2src_mean_ps	108,10	dst2src_mean_ps	103,79	dst2src_mean_ps	113,68	dst2src_mean_ps	131,98	application_category_name	97,25
15	application_confidence	74,24	application_confidence	61,93	application_confidence	54,78	application_confidence	73,55	application_confidence	64,61
16	bidirectional_psh_packets	52,88	bidirectional_psh_packets	49,73	bidirectional_psh_packets	52,77	bidirectional_psh_packets	53,68	bidirectional_psh_packets	52,33
17	dst2src_psh_packets	48,13	dst2src_psh_packets	45,23	dst2src_psh_packets	48,54	dst2src_psh_packets	48,91	dst2src_psh_packets	47,13
18	dst2src_min_ps	38,45	dst2src_mean_piat_ms	37,21	dst2src_min_ps	38,08	dst2src_min_ps	30,27	dst2src_min_ps	35,81
19	src2dst_psh_packets	32,39	dst2src_min_ps	36,14	src_port	31,09	application_is_guessed	29,82	src2dst_psh_packets	34,14
20	src_port	27,56	src2dst_mean_piat_ms	35,09	src2dst_psh_packets	29,18	src_port	29,36	application_is_guessed	24,83
21	bidirectional_min_ps	23,19	src_port	31,09	bidirectional_min_ps	22,22	src2dst_psh_packets	28,67	src_port	22,99
22	src2dst_mean_ps	20,45	src2dst_psh_packets	28,69	src2dst_mean_ps	16,81	dst2src_bytes	23,51	bidirectional_min_ps	16,27
23	src2dst_min_ps	15,48	bidirectional_mean_piat_ms	24,91	dst2src_syn_packets	16,49	bidirectional_mean_ps	19,40	bidirectional_mean_ps	15,08
24	dst2src_fin_packets	15,42	dst2src_packets	22,75	dst2src_fin_packets	16,18	bidirectional_min_ps	16,05	dst2src_mean_piat_ms	10,48
25	bidirectional_fin_packets	15,18	dst2src_ack_packets	22,47	bidirectional_fin_packets	15,97	src2dst_min_ps	10,14	dst2src_fin_packets	10,41
26	src2dst_fin_packets	14,94	bidirectional_min_ps	20,47	src2dst_fin_packets	15,76	dst2src_syn_packets	9,94	src2dst_syn_packets	10,37
27	application_is_guessed	14,93	dst2src_bytes	17,47	bidirectional_syn_packets	15,74	bidirectional_syn_packets	9,90	bidirectional_syn_packets	10,30
28	dst2src_syn_packets	14,78	bidirectional_min_piat_ms	14,73	src2dst_min_ps	13,98	src2dst_syn_packets	9,87	bidirectional_fin_packets	10,27
29	bidirectional_syn_packets	14,70	application_is_guessed	14,33	dst2src_mean_piat_ms	13,86	dst2src_fin_packets	9,81	dst2src_syn_packets	10,22
30	src2dst_syn_packets	14,61	src2dst_mean_ps	13,13	application_is_guessed	9,45	bidirectional_fin_packets	9,68	src2dst_fin_packets	10,13
31	dst2src_packets	13,17	src2dst_min_ps	12,89	src2dst_syn_packets	7,50	src2dst_fin_packets	9,55	src2dst_min_ps	9,98
32	dst2src_ack_packets	12,89	src2dst_syn_packets	12,45	bidirectional_mean_ps	7,30	dst2src_packets	9,28	src2dst_mean_ps	5,79

Fonte: Elaborado pelo autor.

A tabela evidenciam que seleção dos atributos e seus respectivos pesos de significância variam conforme o subconjunto de dados. Com base na significância estatística dos atributos originais em relação ao rótulo de classe, observou-se que as diferenças nos pesos tornam-se menos expressivas a partir da inclusão de 32 atributos, ou seja, com aproximadamente **46% (quarenta e seis por cento)** dos atributos selecionados, em cada subconjunto do GenIDS-NB15.

Figura 3. Atributos de Maior Significância da Intervenção Seleção de Atributos no Conjunto de Dados GenIDS-NB15



Fonte: Elaborado pelo autor.

A figura destaca a diferença significativa variável dos atributos mais relevantes no processo de classificação dos dados. Isso sugere que a redução do conjunto, eliminando os demais atributos, pode simplificar o modelo sem comprometer a robustez de forma significativa. Apesar da variância entre os atributos de maior significância nos subconjuntos, as Figuras 1(a) e 1(d) apresentam o atributo '*dst2src_max_ps*' como sendo o de maior significância. Por outro lado, as Figura 1(b), 1(c) e 1(e) destacam o atributo '*protocol*' como mais relevante.