In [1]:

```
#convert txt to csv
import pandas as pd
import matplotlib.pyplot as plt
```

In [2]:

```
dfg = pd.read_csv('wat-good-time-interval-1000.csv')
```

In [3]:

```
dfm = pd.read_csv('wat-mal-time-interval-1000.csv')
```

In [4]:

```
dfg.head()
```

Out[4]:

	time_intervals	r0	r1	r2	r3	r4	r5	r6	r7	r8	...	inport_north	inport_south	inport_eas
0	1000	65	20	6	4	46	27	22	19	21	...	69	100	14
1	2000	68	24	10	7	43	12	8	0	21	...	76	65	15
2	3000	47	10	9	1	31	1	2	2	31	...	65	65	13
3	4000	54	6	2	2	48	9	5	7	43	...	115	50	23
4	5000	60	12	3	1	36	13	12	6	26	...	65	55	13

5 rows × 32 columns

In [5]:

```
dfm.head()
```

Out[5]:

	time_intervals	r0	r1	r2	r3	r4	r5	r6	r7	r8	...	inport_north	inport_south	inport_eas
0	1000	66	86	22	12	47	70	29	26	27	...	164	146	33
1	2000	77	91	15	10	51	61	10	4	28	...	172	109	37
2	3000	53	69	14	4	31	35	4	4	31	...	154	106	28
3	4000	62	55	9	2	50	43	6	7	45	...	190	63	40
4	5000	69	66	7	3	49	54	29	18	32	...	132	88	27

5 rows × 32 columns

In [6]:

```
df = dfg.append(dfm, ignore_index=True)
```

In [7]:

```
df.head()
```

Out[7]:

	time_intervals	r0	r1	r2	r3	r4	r5	r6	r7	r8	...	inport_north	inport_south	inport_eas
0	1000	65	20	6	4	46	27	22	19	21	...	69	100	14
1	2000	68	24	10	7	43	12	8	0	21	...	76	65	15
2	3000	47	10	9	1	31	1	2	2	31	...	65	65	13
3	4000	54	6	2	2	48	9	5	7	43	...	115	50	23
4	5000	60	12	3	1	36	13	12	6	26	...	65	55	13

5 rows × 32 columns

In [8]:

```
df = df.sort_values('time_intervals')
```

In [9]:

```
df.head(50)
```

Out[9]:

	time_intervals	r0	r1	r2	r3	r4	r5	r6	r7	r8	...	inport_north	inport_south	inport
0	1000	65	20	6	4	46	27	22	19	21	...	69	100	
3152	1000	66	86	22	12	47	70	29	26	27	...	164	146	
3153	2000	77	91	15	10	51	61	10	4	28	...	172	109	
1	2000	68	24	10	7	43	12	8	0	21	...	76	65	
2	3000	47	10	9	1	31	1	2	2	31	...	65	65	
3154	3000	53	69	14	4	31	35	4	4	31	...	154	106	
3	4000	54	6	2	2	48	9	5	7	43	...	115	50	
3155	4000	62	55	9	2	50	43	6	7	45	...	190	63	
4	5000	60	12	3	1	36	13	12	6	26	...	65	55	
3156	5000	69	66	7	3	49	54	29	18	32	...	132	88	
3157	6000	69	80	19	10	56	42	8	9	44	...	163	104	
5	6000	61	11	5	3	49	5	7	8	38	...	85	70	
3158	7000	66	77	12	8	32	51	14	7	20	...	134	82	
6	7000	59	16	7	6	26	3	1	0	20	...	50	45	
3159	8000	61	95	34	15	39	40	6	8	34	...	131	102	
7	8000	60	22	10	3	38	11	6	8	33	...	77	71	
3160	9000	77	115	35	15	37	63	23	13	13	...	107	123	
8	9000	73	49	30	12	23	6	6	0	6	...	27	79	
3161	10000	75	91	34	16	53	62	50	21	26	...	132	153	
9	10000	66	24	23	9	45	23	36	20	25	...	66	111	
3162	11000	88	104	39	25	53	42	19	1	23	...	136	103	
10	11000	84	37	25	12	38	5	18	0	19	...	64	59	
3163	12000	79	110	77	45	62	28	14	3	39	...	134	172	
11	12000	72	29	28	15	44	6	13	3	27	...	81	92	
12	13000	71	38	31	12	33	17	24	0	5	...	41	82	
3164	13000	91	107	50	12	53	52	30	0	12	...	71	109	
13	14000	73	34	33	3	38	22	22	13	17	...	58	106	
3165	14000	83	125	75	23	44	48	31	15	11	...	115	163	
14	15000	77	44	31	12	34	23	6	6	24	...	46	64	
3166	15000	79	95	39	15	40	65	22	14	24	...	119	113	
3167	16000	80	76	28	20	35	44	14	8	17	...	112	104	
15	16000	84	37	24	19	33	12	10	7	10	...	42	87	
16	17000	48	12	5	1	38	17	21	6	16	...	61	57	
3168	17000	61	57	17	8	50	34	19	7	16	...	96	94	

	time_intervals	r0	r1	r2	r3	r4	r5	r6	r7	r8	...	inport_north	inport_south	inport
17	18000	36	5	3	1	31	2	2	1	31	...	75	45	
3169	18000	37	42	7	3	32	33	14	8	37	...	121	66	
18	19000	42	20	13	7	16	6	0	1	5	...	25	50	
3170	19000	49	68	25	13	17	34	6	7	6	...	101	85	
19	20000	42	10	9	7	32	12	13	13	21	...	51	58	
3171	20000	60	76	27	7	33	26	13	13	22	...	67	76	
20	21000	42	9	2	1	21	1	1	1	21	...	60	30	
3172	21000	49	92	44	31	27	21	19	13	21	...	82	92	
3173	22000	67	106	51	31	35	56	19	24	5	...	111	103	
21	22000	60	37	31	18	23	0	1	6	5	...	26	46	
22	23000	73	20	7	0	41	18	13	6	24	...	52	46	
3174	23000	92	91	39	19	41	35	12	7	30	...	98	86	
3175	24000	98	92	27	3	69	65	33	18	36	...	135	105	
23	24000	77	22	15	2	55	32	33	12	30	...	98	85	
24	25000	73	38	25	12	17	18	0	0	0	...	16	46	
3176	25000	73	116	50	18	18	70	19	6	1	...	107	86	

50 rows × 32 columns

In [10]:

```
df['tot_packets']= df.iloc[:, 1:16].sum(axis=1)
```

In [11]:

```
df['tot_mean']= df.iloc[:, 1:16].mean(axis=1)
```

In [12]:

```
df
```

Out[12]:

```
      time_intervals  r0  r1  r2  r3  r4  r5  r6  r7  r8  ...  inport_east  inport_west  outport_l
   0            1000  65  20   6   4  46  27  22  19  21  ...           14           20
3152            1000  66  86  22  12  47  70  29  26  27  ...           33           34
3153            2000  77  91  15  10  51  61  10   4  28  ...           37           44
   1            2000  68  24  10   7  43  12   8   0  21  ...           15           16
   2            3000  47  10   9   1  31   1   2   2  31  ...           13           10
 ...             ...  ...  ...  ...  ...  ...  ...  ...  ...  ...  ...          ...          ...
6301         3150000  77  24  18  18  41  12   6  12  35  ...           54           42
3149         3150000  81  39  30  18  42  26  24  24  24  ...           70           87
6302         3151000  73  36  30  18  36  12  18   6  30  ...           66           66
3150         3151000  69  15   6   6  42  16   6  12  36  ...           62           27
3151         3152000  78  42  36  18  36  12  22   6  30  ...           77           78

6303 rows × 34 columns
```

In [13]:

```
df.to_csv('wat-time-interval-1000.csv',index=False)
```

In [14]:

```
df = pd.read_csv('wat-time-interval-1000.csv')
```

In [15]:

```
df.head(50)
```

Out[15]:

	time_intervals	r0	r1	r2	r3	r4	r5	r6	r7	r8	...	inport_east	inport_west	outport_lo
0	1000	65	20	6	4	46	27	22	19	21	...	14	20	
1	1000	66	86	22	12	47	70	29	26	27	...	33	34	
2	2000	77	91	15	10	51	61	10	4	28	...	37	44	
3	2000	68	24	10	7	43	12	8	0	21	...	15	16	
4	3000	47	10	9	1	31	1	2	2	31	...	13	10	
5	3000	53	69	14	4	31	35	4	4	31	...	28	23	
6	4000	54	6	2	2	48	9	5	7	43	...	23	10	
7	4000	62	55	9	2	50	43	6	7	45	...	40	22	
8	5000	60	12	3	1	36	13	12	6	26	...	13	11	
9	5000	69	66	7	3	49	54	29	18	32	...	27	42	
10	6000	69	80	19	10	56	42	8	9	44	...	30	36	
11	6000	61	11	5	3	49	5	7	8	38	...	17	14	
12	7000	66	77	12	8	32	51	14	7	20	...	27	25	
13	7000	59	16	7	6	26	3	1	0	20	...	10	9	
14	8000	61	95	34	15	39	40	6	8	34	...	50	36	
15	8000	60	22	10	3	38	11	6	8	33	...	25	25	
16	9000	77	115	35	15	37	63	23	13	13	...	31	57	
17	9000	73	49	30	12	23	6	6	0	6	...	15	29	
18	10000	75	91	34	16	53	62	50	21	26	...	48	74	
19	10000	66	24	23	9	45	23	36	20	25	...	34	56	
20	11000	88	104	39	25	53	42	19	1	23	...	68	72	
21	11000	84	37	25	12	38	5	18	0	19	...	40	50	
22	12000	79	110	77	45	62	28	14	3	39	...	70	80	
23	12000	72	29	28	15	44	6	13	3	27	...	48	54	
24	13000	71	38	31	12	33	17	24	0	5	...	22	36	
25	13000	91	107	50	12	53	52	30	0	12	...	44	60	
26	14000	73	34	33	3	38	22	22	13	17	...	14	38	
27	14000	83	125	75	23	44	48	31	15	11	...	51	85	
28	15000	77	44	31	12	34	23	6	6	24	...	44	50	
29	15000	79	95	39	15	40	65	22	14	24	...	68	64	
30	16000	80	76	28	20	35	44	14	8	17	...	32	58	
31	16000	84	37	24	19	33	12	10	7	10	...	15	41	
32	17000	48	12	5	1	38	17	21	6	16	...	14	13	
33	17000	61	57	17	8	50	34	19	7	16	...	25	27	

	time_intervals	r0	r1	r2	r3	r4	r5	r6	r7	r8	...	inport_east	inport_west	outport_lo
34	18000	36	5	3	1	31	2	2	1	31	...	15	9	
35	18000	37	42	7	3	32	33	14	8	37	...	25	20	
36	19000	42	20	13	7	16	6	0	1	5	...	5	10	
37	19000	49	68	25	13	17	34	6	7	6	...	46	33	
38	20000	42	10	9	7	32	12	13	13	21	...	15	26	
39	20000	60	76	27	7	33	26	13	13	22	...	24	49	
40	21000	42	9	2	1	21	1	1	1	21	...	12	12	
41	21000	49	92	44	31	27	21	19	13	21	...	25	52	
42	22000	67	106	51	31	35	56	19	24	5	...	71	83	
43	22000	60	37	31	18	23	0	1	6	5	...	16	50	
44	23000	73	20	7	0	41	18	13	6	24	...	39	22	
45	23000	92	91	39	19	41	35	12	7	30	...	64	72	
46	24000	98	92	27	3	69	65	33	18	36	...	73	67	
47	24000	77	22	15	2	55	32	33	12	30	...	57	39	
48	25000	73	38	25	12	17	18	0	0	0	...	8	40	
49	25000	73	116	50	18	18	70	19	6	1	...	79	72	

50 rows × 34 columns

```
In [16]:
```

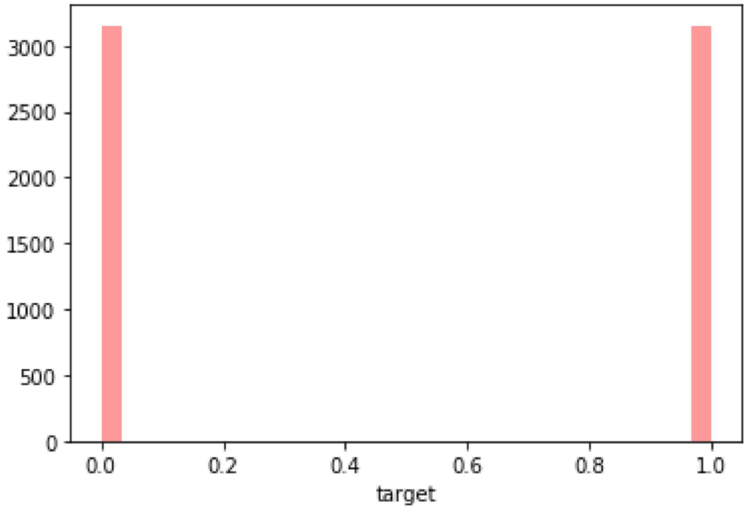
```python
import seaborn as sns
```

In [17]:

```
sns.distplot(df['target'], kde = False, bins=30, color='red')
```

Out[17]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x10ae967e248>
```



In [18]:

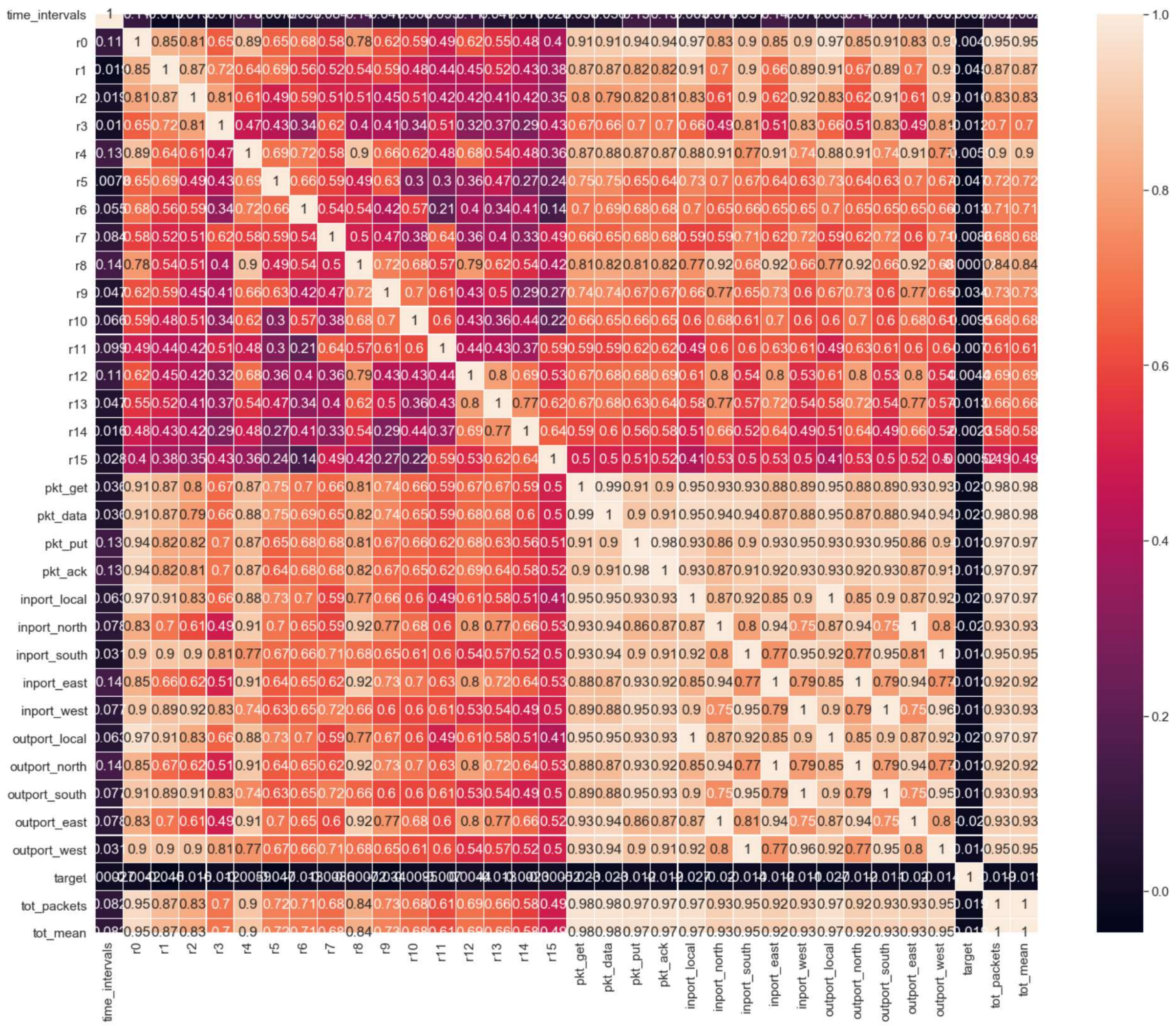
```
df.isnull().sum()
```

Out[18]:

```
time_intervals    0
r0                0
r1                0
r2                0
r3                0
r4                0
r5                0
r6                0
r7                0
r8                0
r9                0
r10               0
r11               0
r12               0
r13               0
r14               0
r15               0
pkt_get           0
pkt_data          0
pkt_put           0
pkt_ack           0
inport_local      0
inport_north      0
inport_south      0
inport_east       0
inport_west       0
outport_local     0
outport_north     0
outport_south     0
outport_east      0
outport_west      0
target            0
tot_packets       0
tot_mean          0
dtype: int64
```

In [19]:

```
plt.figure(figsize=(25,20))
plt.rcParams["axes.labelsize"] = 20
sns.set(font_scale=1.4)
sns.heatmap(df.corr(), annot = True ,linewidths=.1)
plt.show()
```



In [20]:

```
df_corr = df.corr()
df_corr
```

Out[20]:

	time_intervals	r0	r1	r2	r3	r4	r5	
time_intervals	1.000000	0.110224	-0.019140	0.018825	0.010450	0.129934	0.007815	0.0
r0	0.110224	1.000000	0.852018	0.813404	0.646446	0.888406	0.654695	0.6
r1	-0.019140	0.852018	1.000000	0.873634	0.723998	0.644690	0.685840	0.5
r2	0.018825	0.813404	0.873634	1.000000	0.811143	0.612568	0.491640	0.5
r3	0.010450	0.646446	0.723998	0.811143	1.000000	0.471697	0.432813	0.3
r4	0.129934	0.888406	0.644690	0.612568	0.471697	1.000000	0.693032	0.7
r5	0.007815	0.654695	0.685840	0.491640	0.432813	0.693032	1.000000	0.6
r6	0.055179	0.679588	0.564432	0.586711	0.337859	0.717216	0.664308	1.0
r7	0.084233	0.584164	0.521348	0.511068	0.615132	0.581269	0.587628	0.5
r8	0.141078	0.782763	0.542039	0.514305	0.401173	0.897094	0.493682	0.5
r9	0.047256	0.617532	0.592191	0.451041	0.408251	0.656349	0.625944	0.4
r10	0.065532	0.590443	0.483425	0.513602	0.335397	0.620614	0.304694	0.5
r11	0.099359	0.488456	0.435956	0.415162	0.510764	0.482547	0.302953	0.2
r12	0.111450	0.622318	0.446197	0.415544	0.316622	0.679061	0.356530	0.3
r13	0.047216	0.550734	0.516775	0.408336	0.366959	0.541399	0.466598	0.3
r14	0.015741	0.482100	0.434187	0.415857	0.287473	0.480264	0.270893	0.4
r15	0.028107	0.404000	0.381611	0.349589	0.426415	0.356925	0.242108	0.1
pkt_get	0.035693	0.911264	0.871099	0.795793	0.671809	0.870101	0.748074	0.6
pkt_data	0.035742	0.913187	0.865286	0.787608	0.664987	0.878399	0.745534	0.6
pkt_put	0.129560	0.942025	0.824803	0.820122	0.701583	0.865698	0.648290	0.6
pkt_ack	0.128733	0.940803	0.815239	0.811896	0.697444	0.873775	0.642601	0.6
inport_local	0.063283	0.974349	0.913271	0.827226	0.655528	0.880717	0.732460	0.6
inport_north	0.078012	0.833455	0.699022	0.607399	0.488633	0.911157	0.696336	0.6
inport_south	0.031100	0.898754	0.899875	0.895105	0.811946	0.767514	0.674658	0.6
inport_east	0.142564	0.847267	0.664602	0.620687	0.505624	0.905884	0.636526	0.6
inport_west	0.076559	0.904626	0.886241	0.915244	0.833711	0.742168	0.625827	0.6
outport_local	0.063065	0.974841	0.912469	0.826627	0.655636	0.882161	0.731828	0.6
outport_north	0.142849	0.847766	0.665922	0.621955	0.506490	0.905030	0.637258	0.6
outport_south	0.076888	0.905310	0.886324	0.914432	0.832323	0.742644	0.626732	0.6
outport_east	0.078017	0.833451	0.699477	0.608194	0.489444	0.911574	0.697044	0.6
outport_west	0.031097	0.898482	0.900332	0.896239	0.813263	0.766928	0.674018	0.6
target	0.000275	-0.004230	-0.044867	-0.015658	-0.012170	-0.005857	-0.047133	-0.0
tot_packets	0.082014	0.954266	0.871225	0.827053	0.698062	0.899537	0.723469	0.7
tot_mean	0.082014	0.954266	0.871225	0.827053	0.698062	0.899537	0.723469	0.7

34 rows × 34 columns

In [21]:

```
df_corr['target']
```

Out[21]:

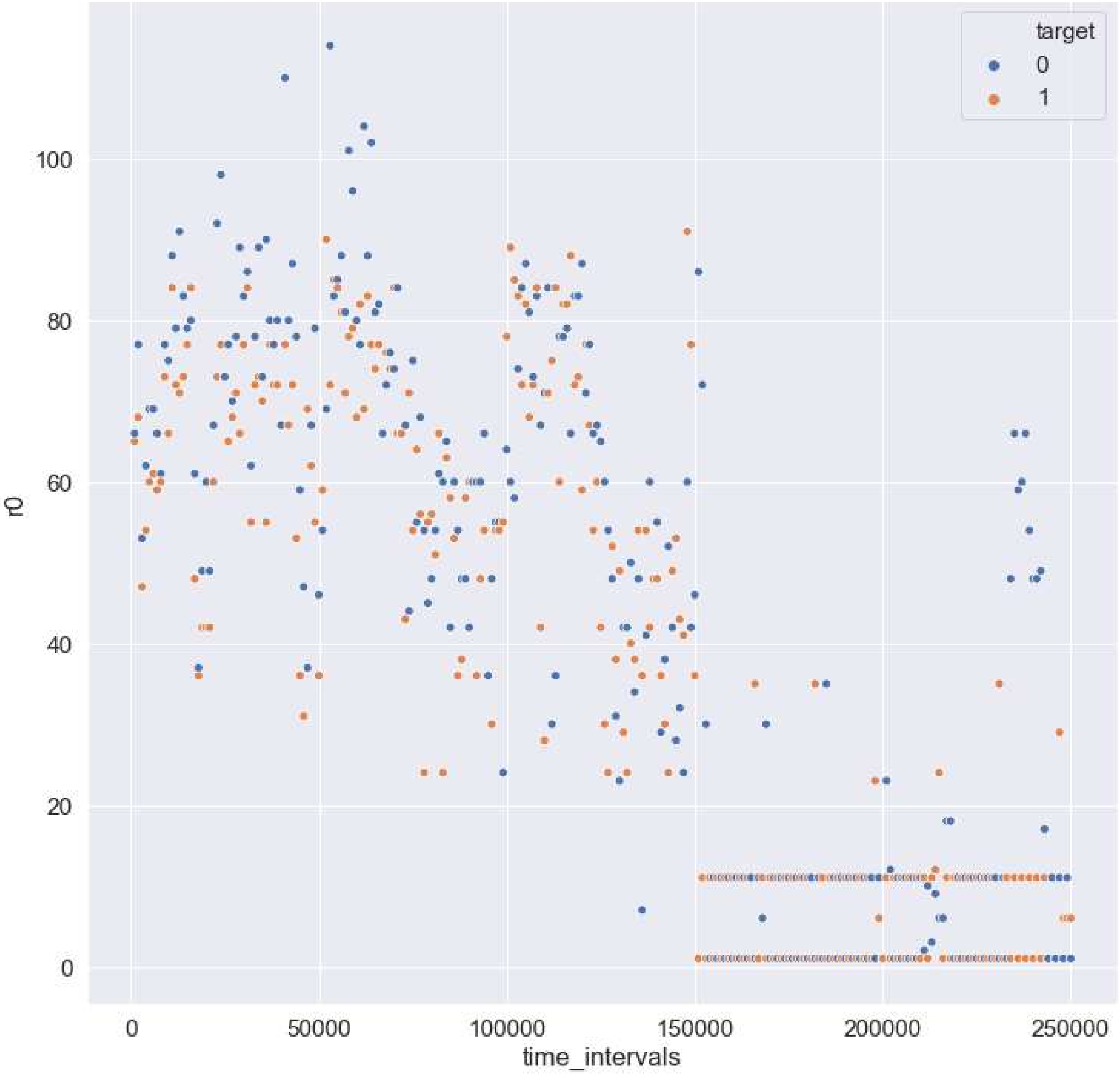
```
time_intervals    0.000275
r0               -0.004230
r1               -0.044867
r2               -0.015658
r3               -0.012170
r4               -0.005857
r5               -0.047133
r6               -0.013411
r7               -0.008642
r8               -0.000724
r9               -0.034100
r10              -0.009480
r11              -0.007039
r12               0.004404
r13              -0.012644
r14              -0.002295
r15              -0.000516
pkt_get          -0.023265
pkt_data         -0.023362
pkt_put          -0.011660
pkt_ack          -0.011682
inport_local     -0.026651
inport_north     -0.020379
inport_south     -0.013906
inport_east      -0.011612
inport_west      -0.011441
outport_local    -0.026574
outport_north    -0.011610
outport_south    -0.011498
outport_east     -0.020381
outport_west     -0.013906
target            1.000000
tot_packets      -0.018716
tot_mean         -0.018716
Name: target, dtype: float64
```

In [22]:

```
dff = pd.read_csv('wat-time-interval-1000.csv',nrows=500)
```

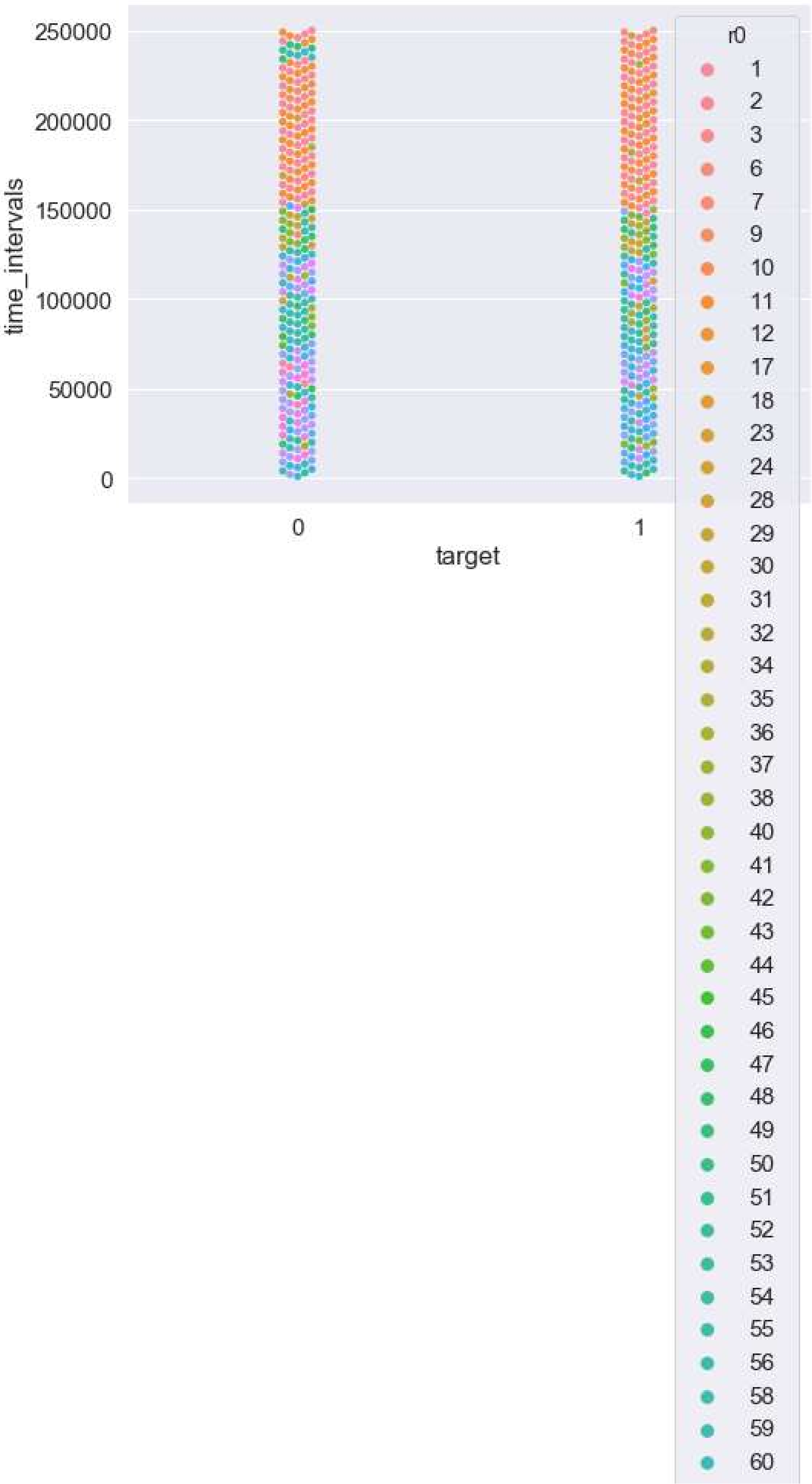
In [23]:

```
plt.figure(figsize=(12,12))
sns.scatterplot(x='time_intervals',y='r0',data=dff, hue='target')
plt.show()
```



In [24]:

```
plt.figure(figsize=(8,6))
sns.swarmplot(x='target',y='time_intervals',data=dff, hue='r0')
plt.show()
```


250000
200000
150000
100000
50000
0
time_intervals
0
1
target
r0
1
2
3
6
7
9
10
11
12
17
18
23
24
28
29
30
31
32
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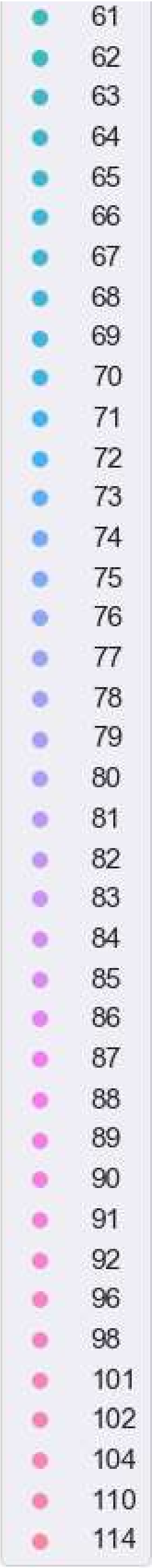
59
60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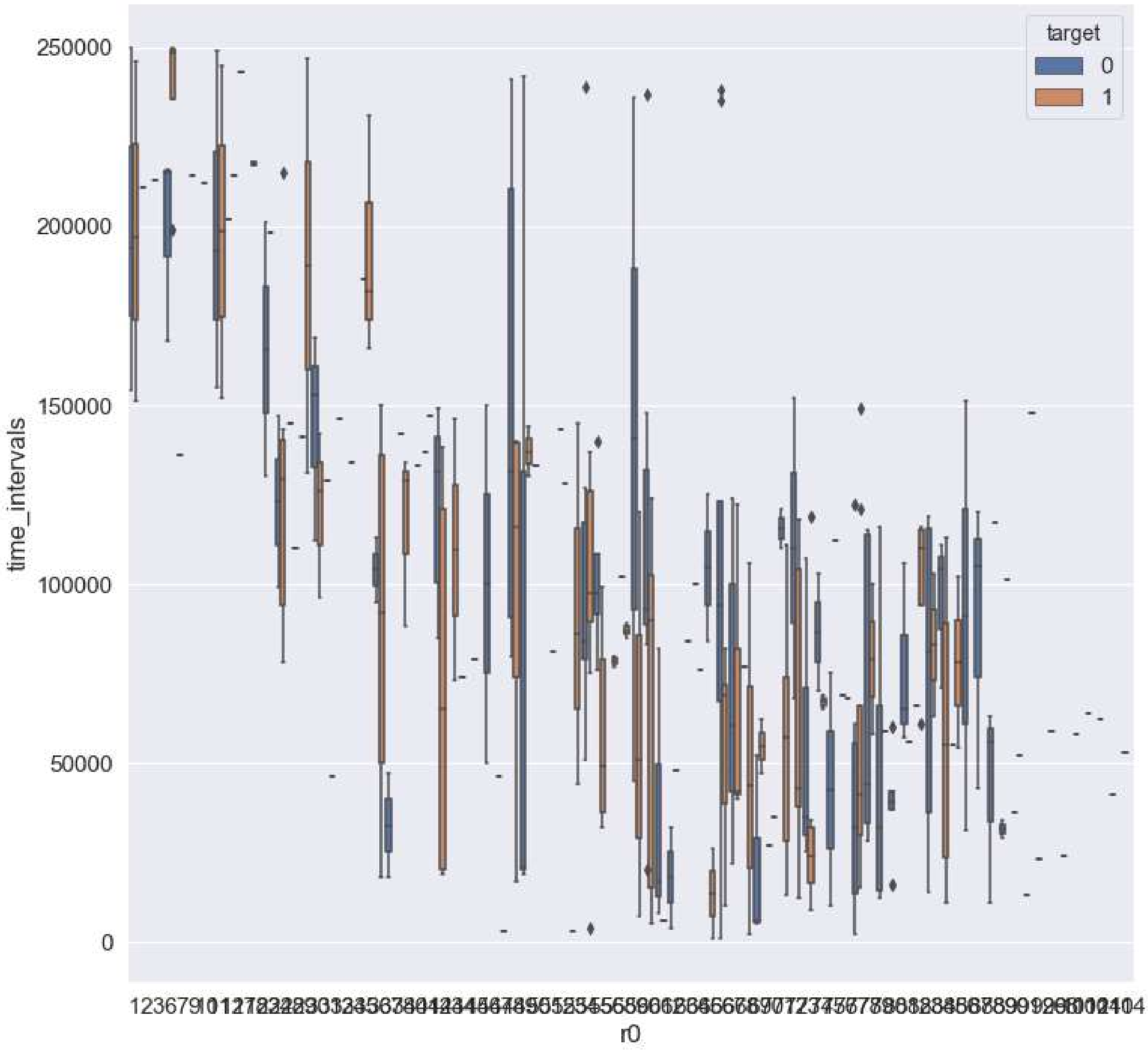
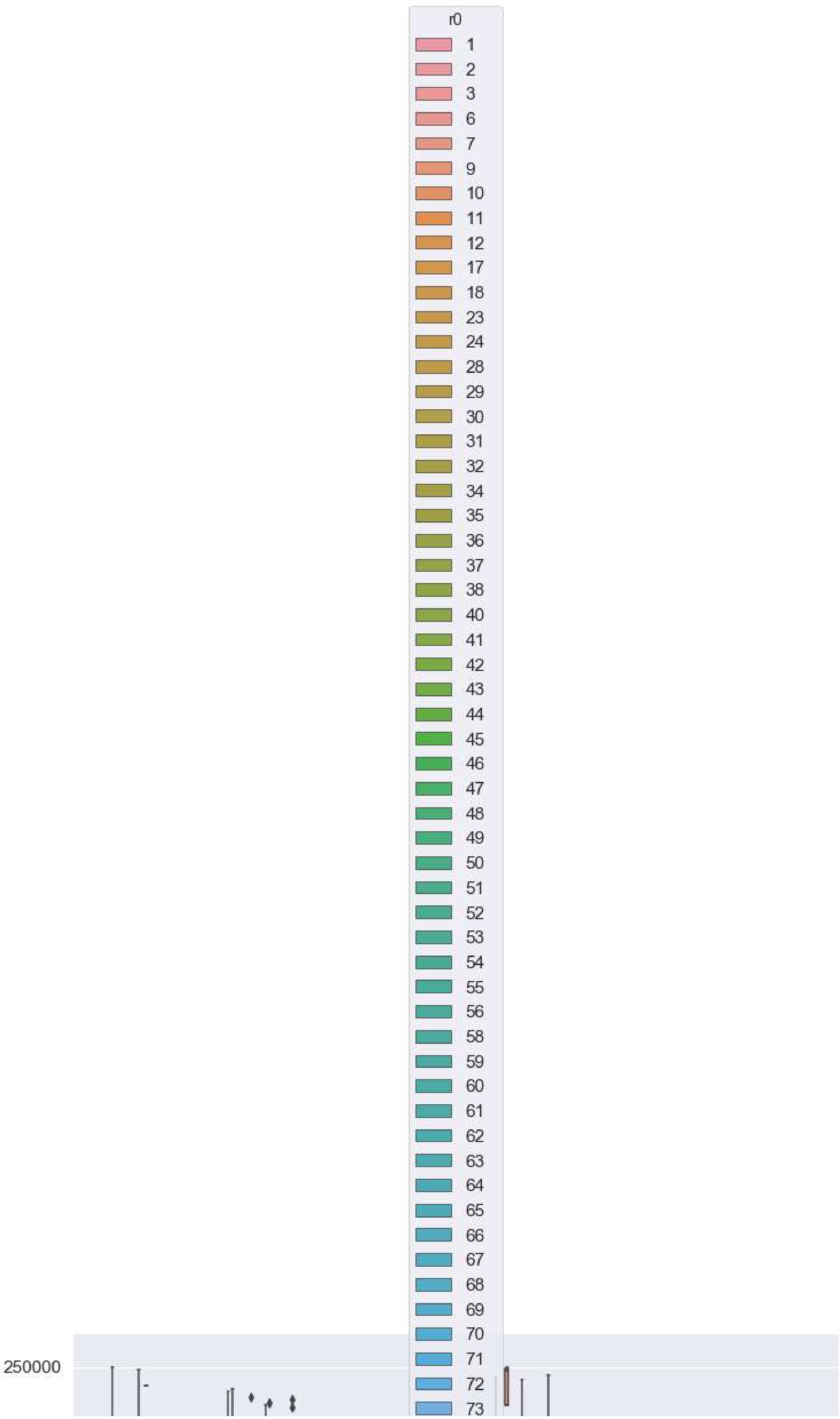
In [25]:

```
plt.figure(figsize=(12,12))
sns.boxplot(x='r0',y='time_intervals',data=dff, hue='target')
plt.show()
```



In [26]:

```
plt.figure(figsize=(12,12))
sns.boxplot(x='target',y='time_intervals',data=dff, hue='r0')
plt.show()
```


r0
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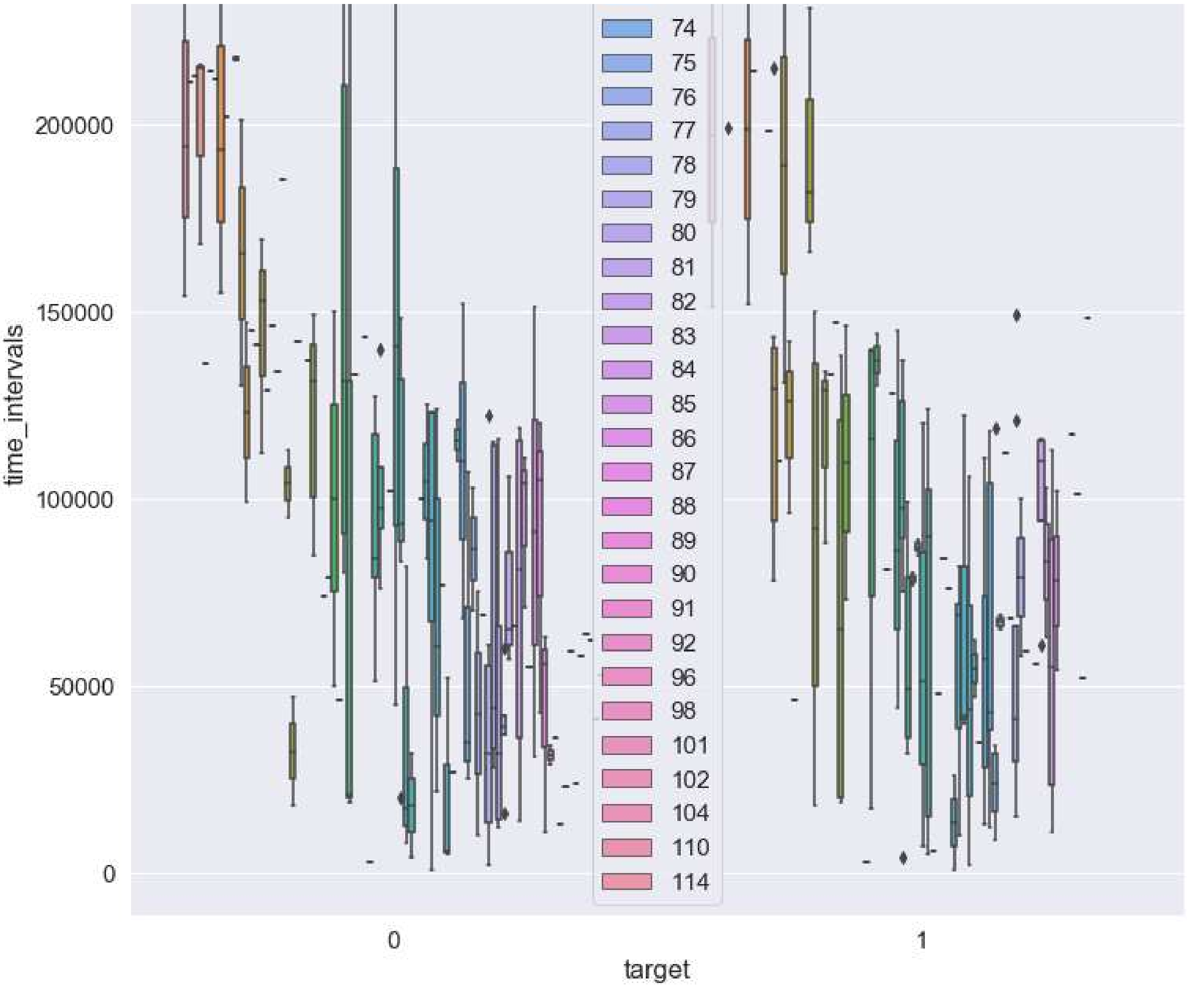
time_intervals
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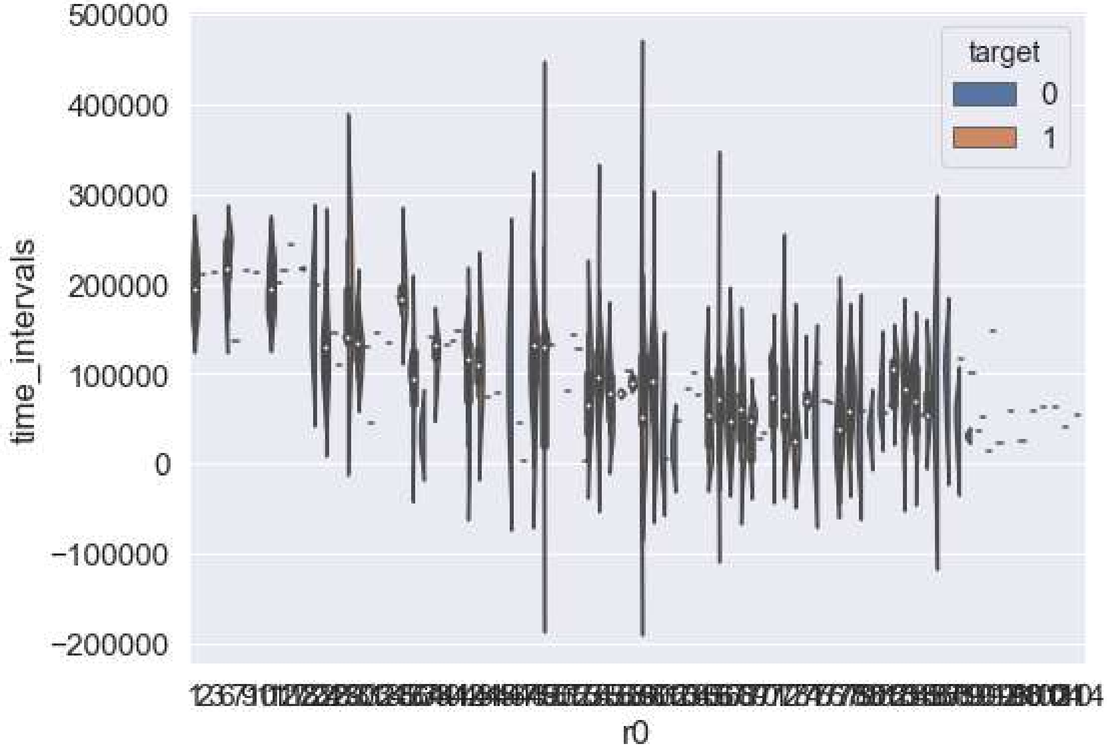
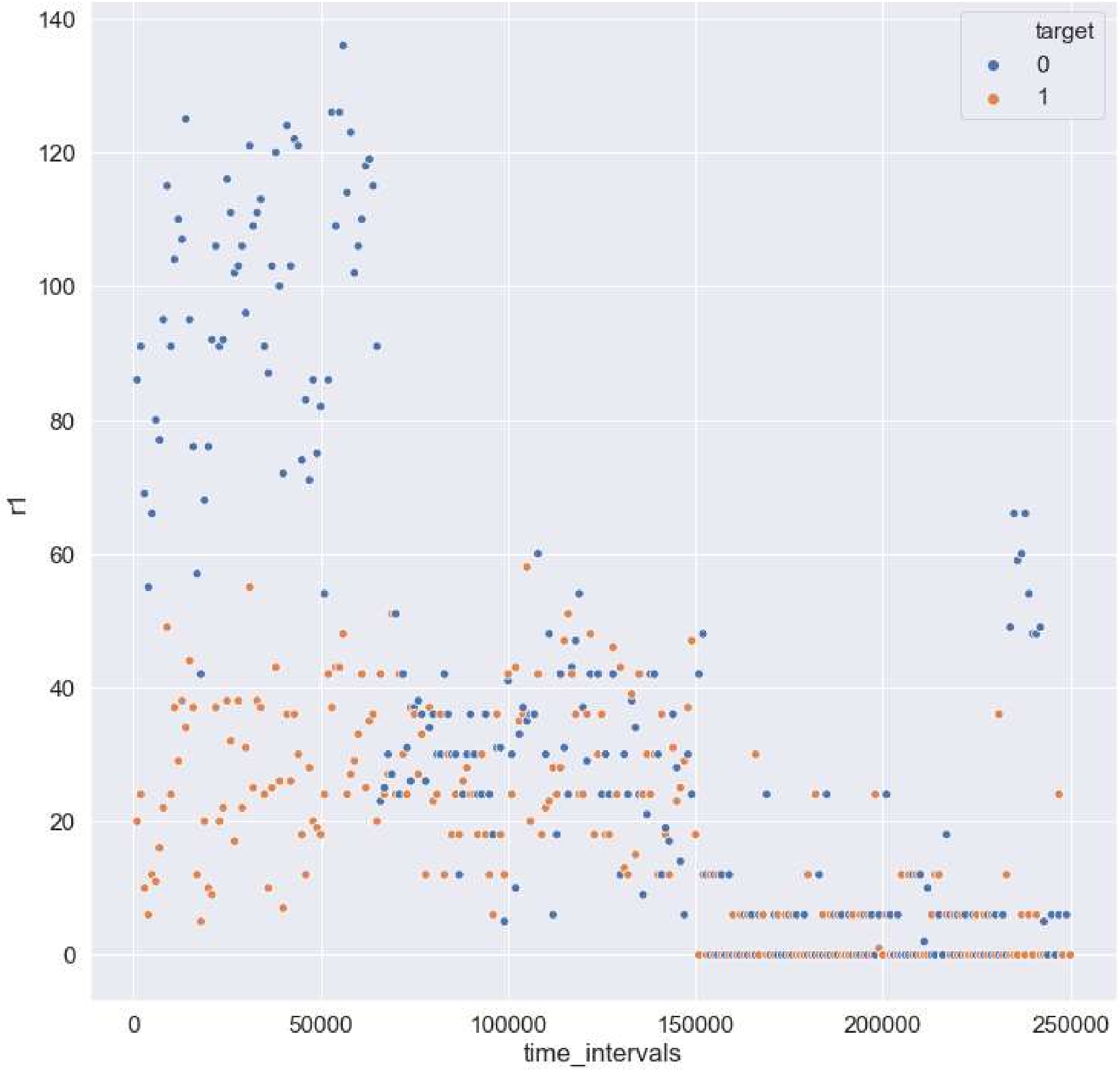
In [27]:

```
plt.figure(figsize=(8,6))
sns.violinplot(x='r0',y='time_intervals',data=dff, hue='target', split=True)
plt.show()
```



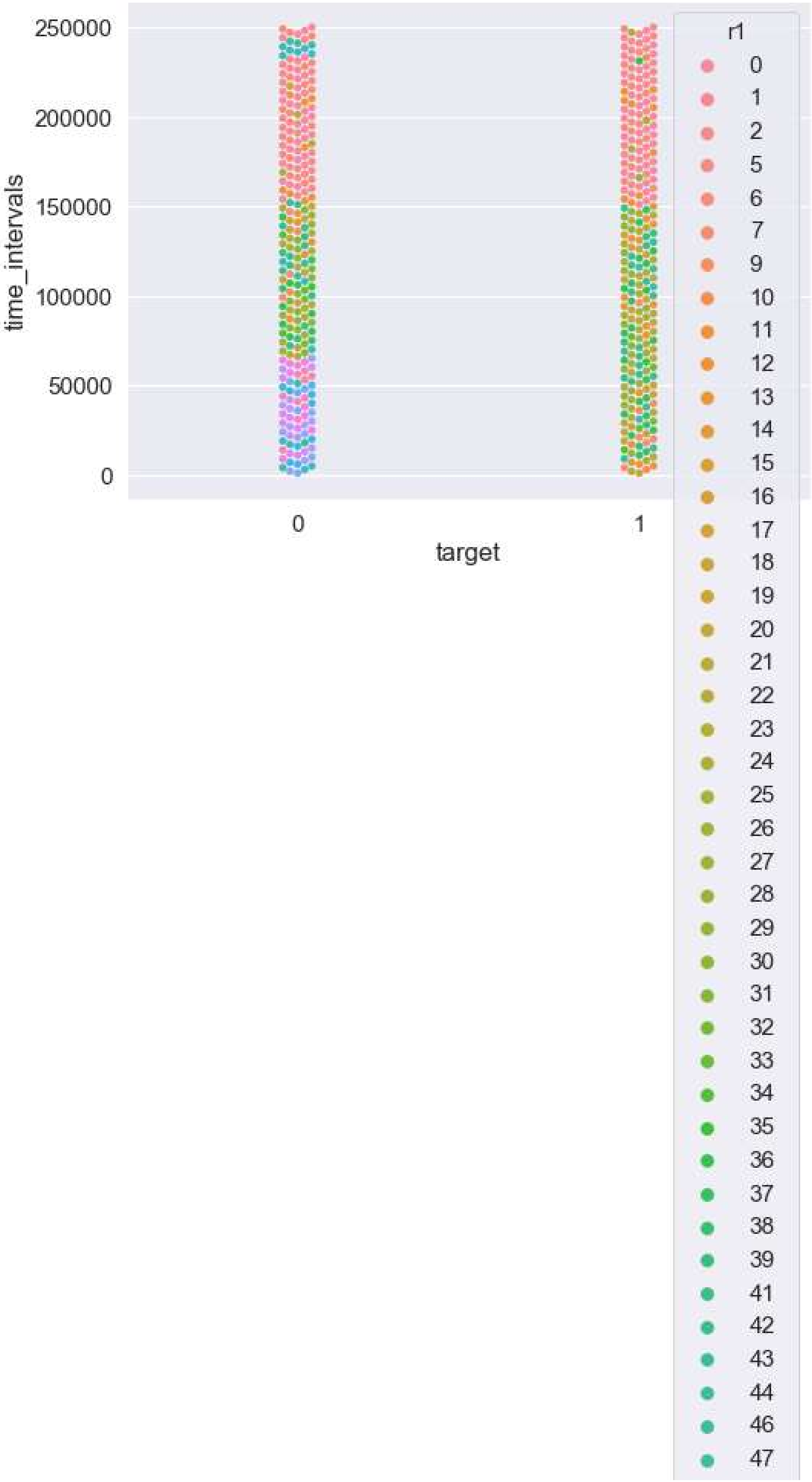
In [28]:

```
plt.figure(figsize=(12,12))
sns.scatterplot(x='time_intervals',y='r1',data=dff, hue='target')
plt.show()
```



In [29]:

```
plt.figure(figsize=(8,6))
sns.swarmplot(x='target',y='time_intervals',data=dff, hue='r1')
plt.show()
```


time_intervals
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target
r1
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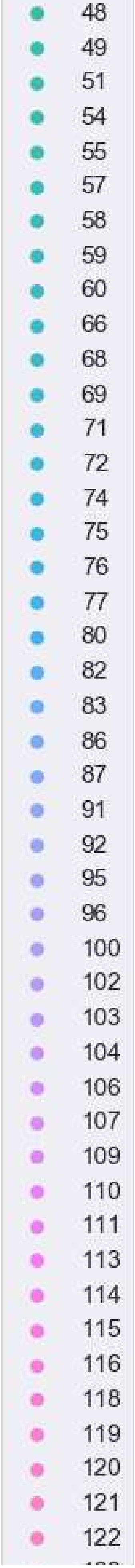
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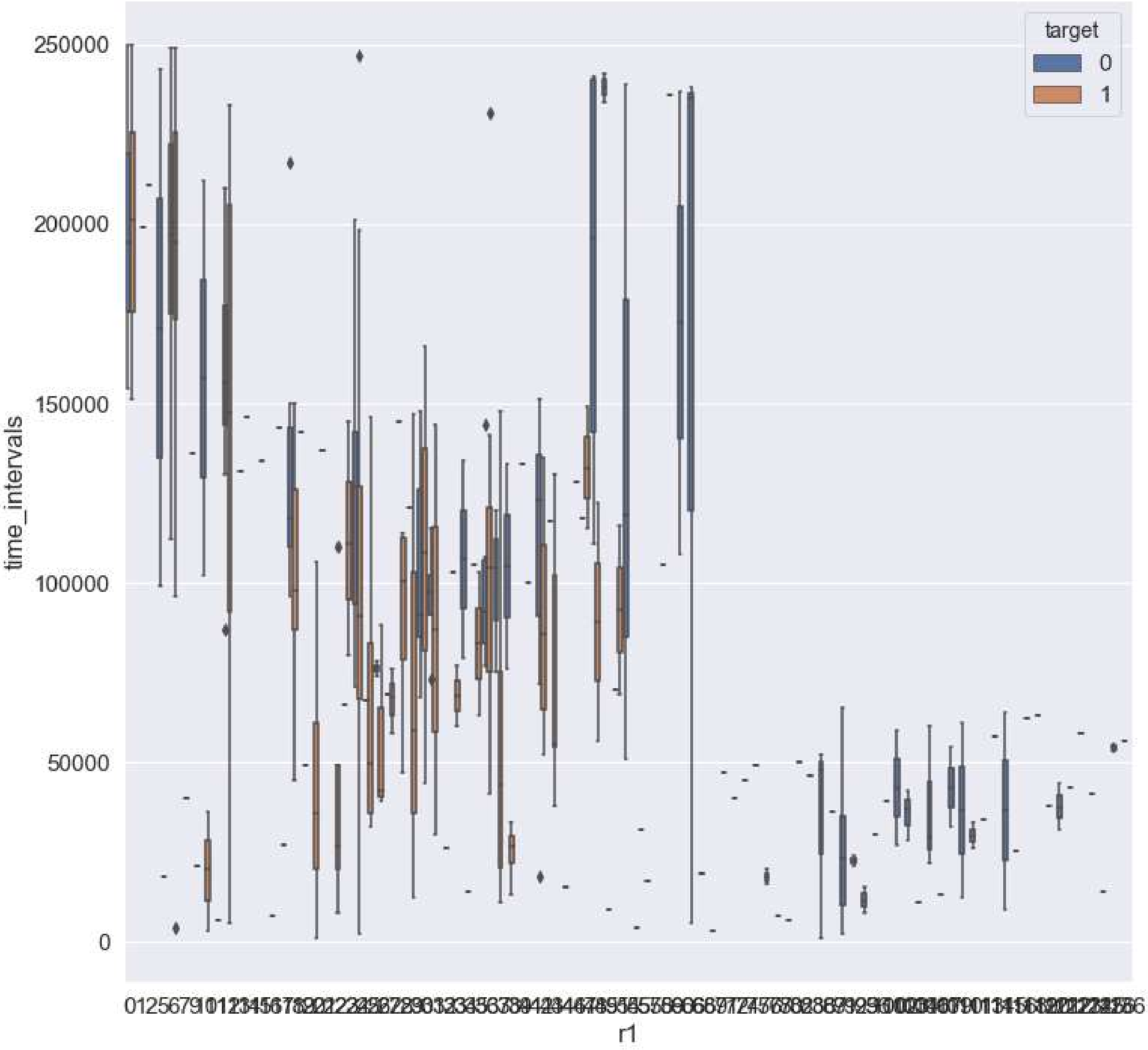
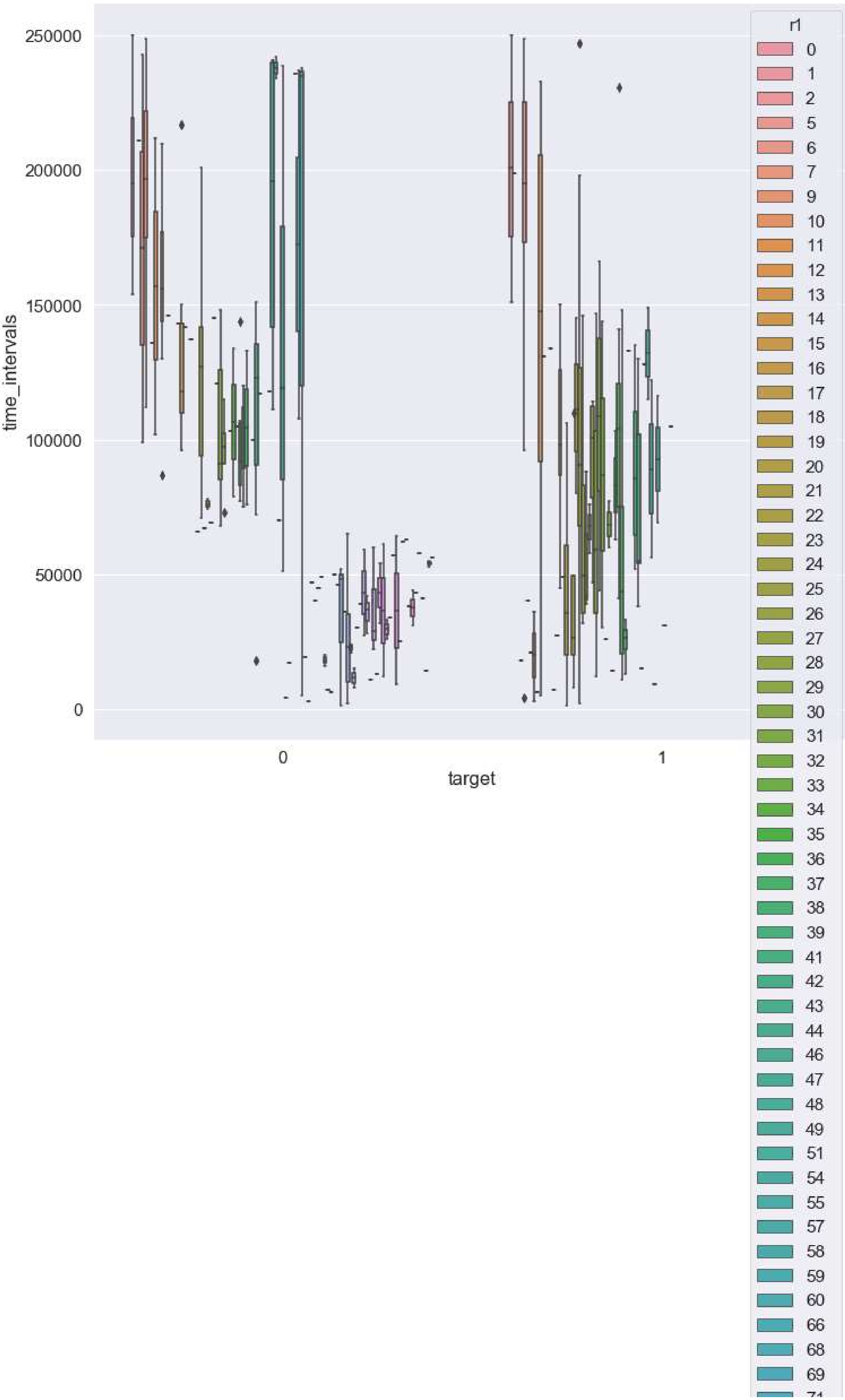
In [30]:

```
plt.figure(figsize=(12,12))
sns.boxplot(x='r1',y='time_intervals',data=dff, hue='target')
plt.show()
```



In [31]:

```
plt.figure(figsize=(12,12))
sns.boxplot(x='target',y='time_intervals',data=dff, hue='r1')
plt.show()
```


time_intervals
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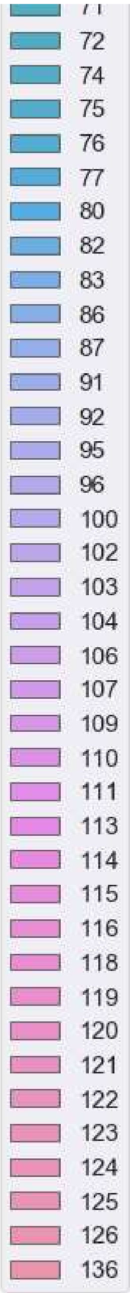
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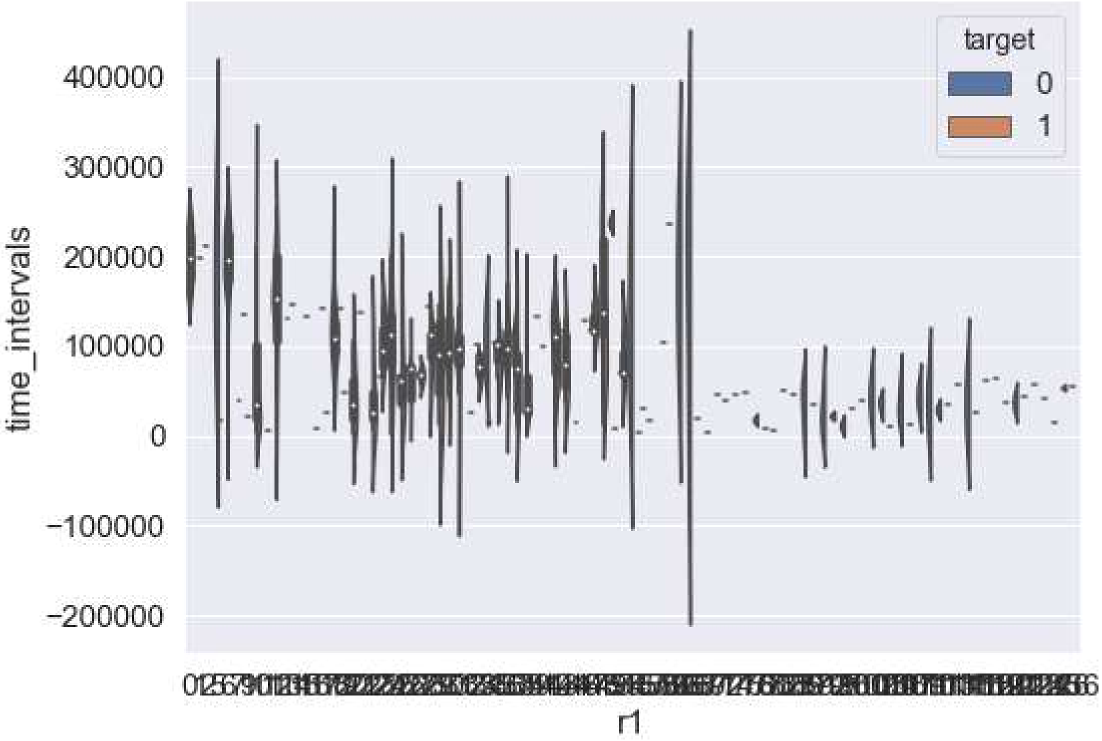
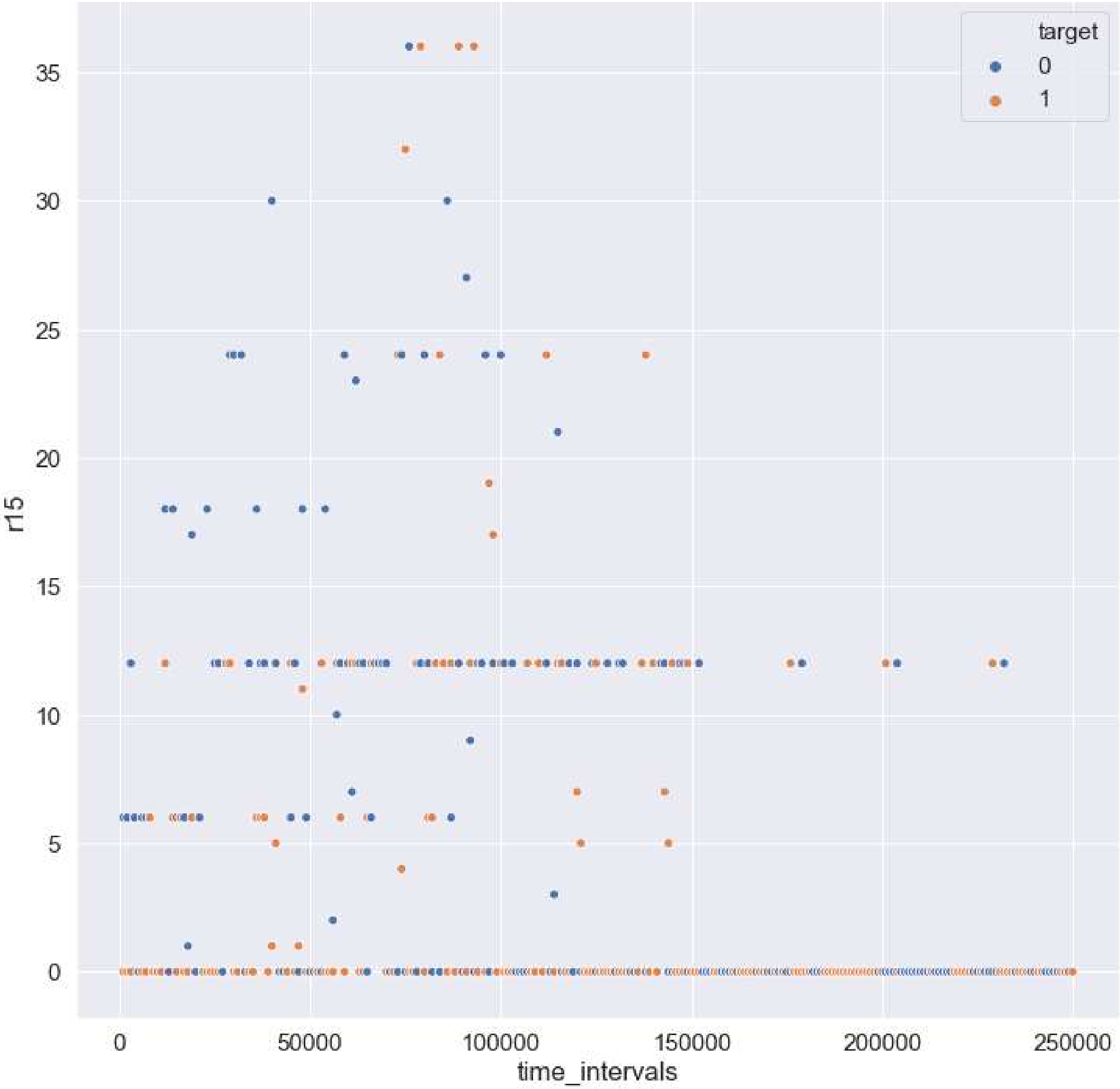
In [32]:

```
plt.figure(figsize=(8,6))
sns.violinplot(x='r1',y='time_intervals',data=dff, hue='target', split=True)
plt.show()
```



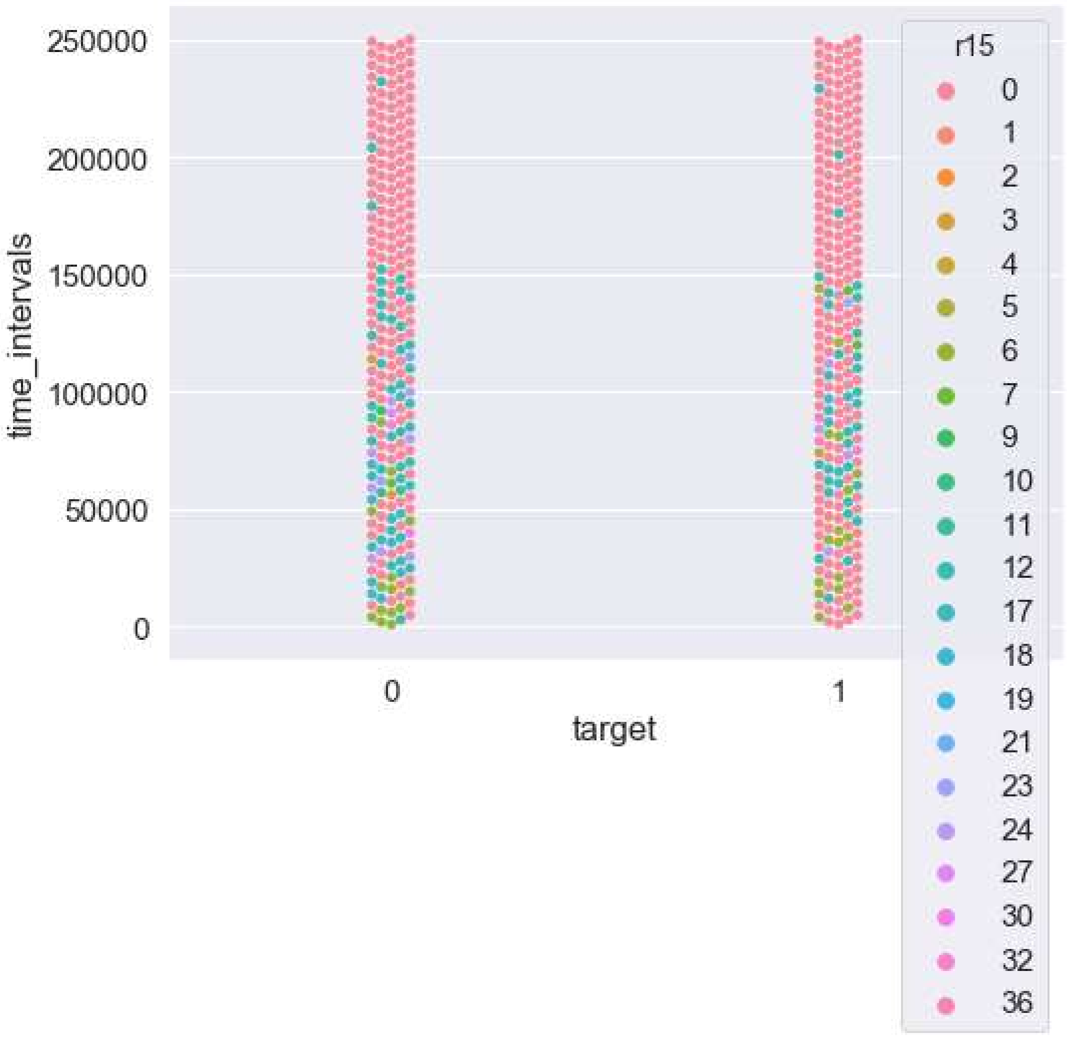
In [33]:

```
plt.figure(figsize=(12,12))
sns.scatterplot(x='time_intervals',y='r15',data=dff, hue='target')
plt.show()
```



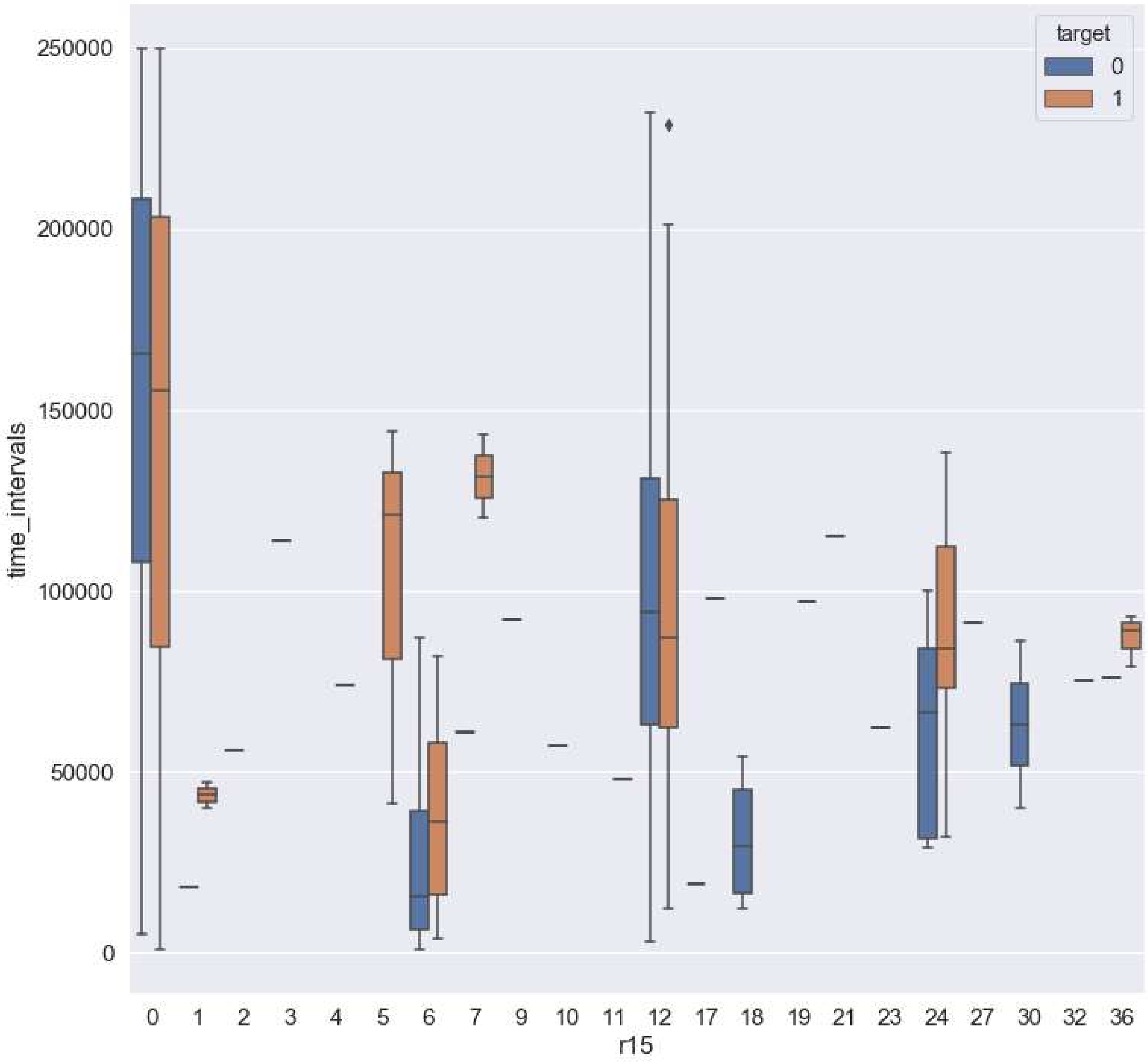
In [34]:

```
plt.figure(figsize=(8,6))
sns.swarmplot(x='target',y='time_intervals',data=dff, hue='r15')
plt.show()
```



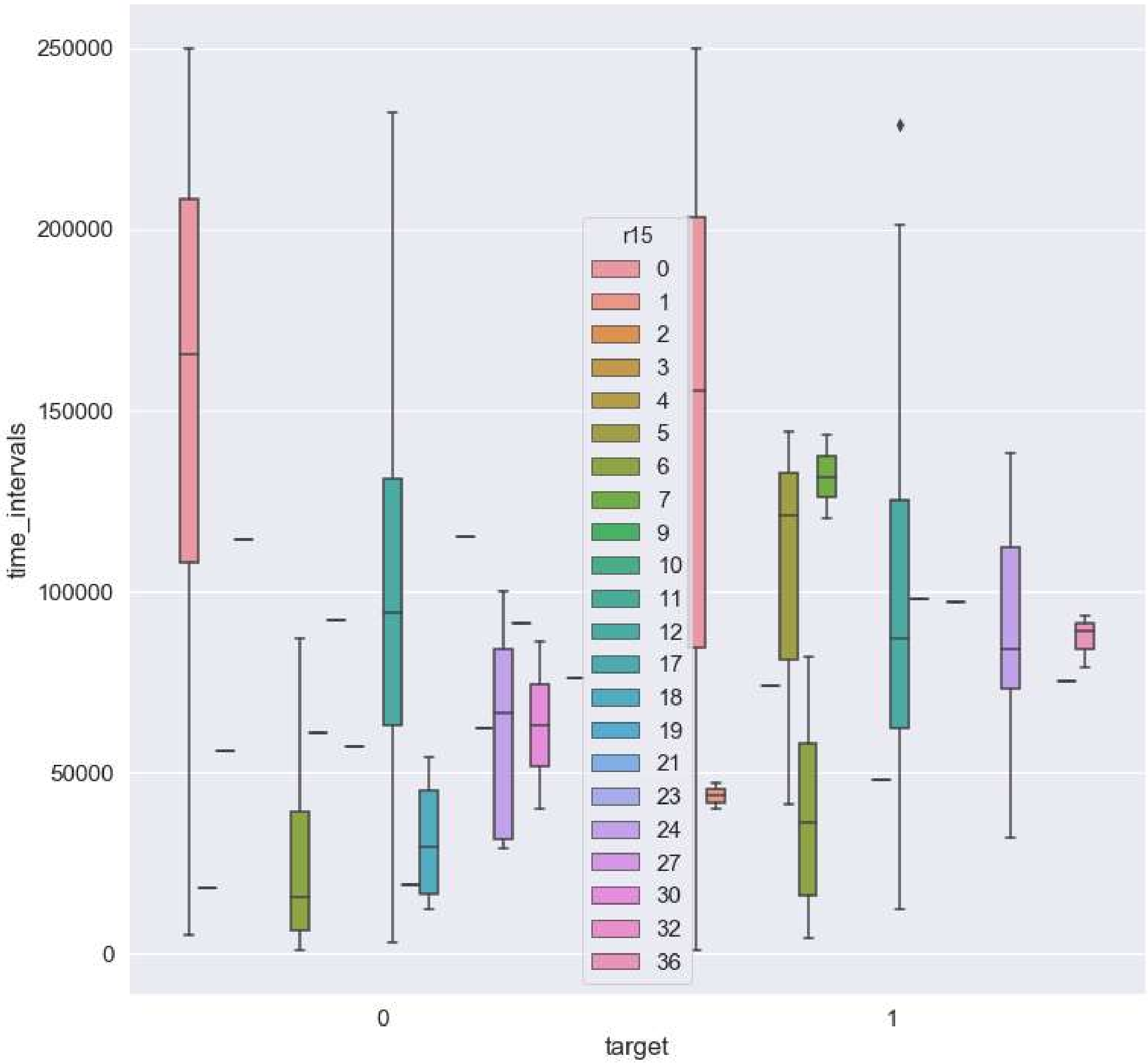
In [35]:

```
plt.figure(figsize=(12,12))
sns.boxplot(x='r15',y='time_intervals',data=dff, hue='target')
plt.show()
```



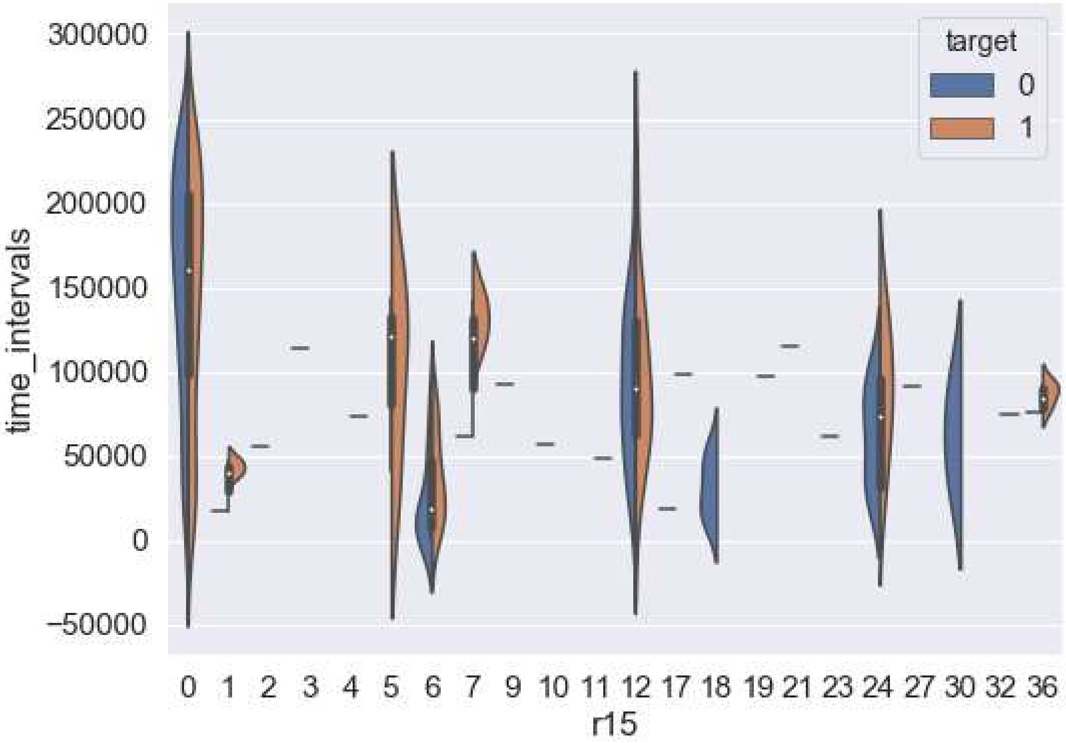
In [36]:

```
plt.figure(figsize=(12,12))
sns.boxplot(x='target',y='time_intervals',data=dff, hue='r15')
plt.show()
```



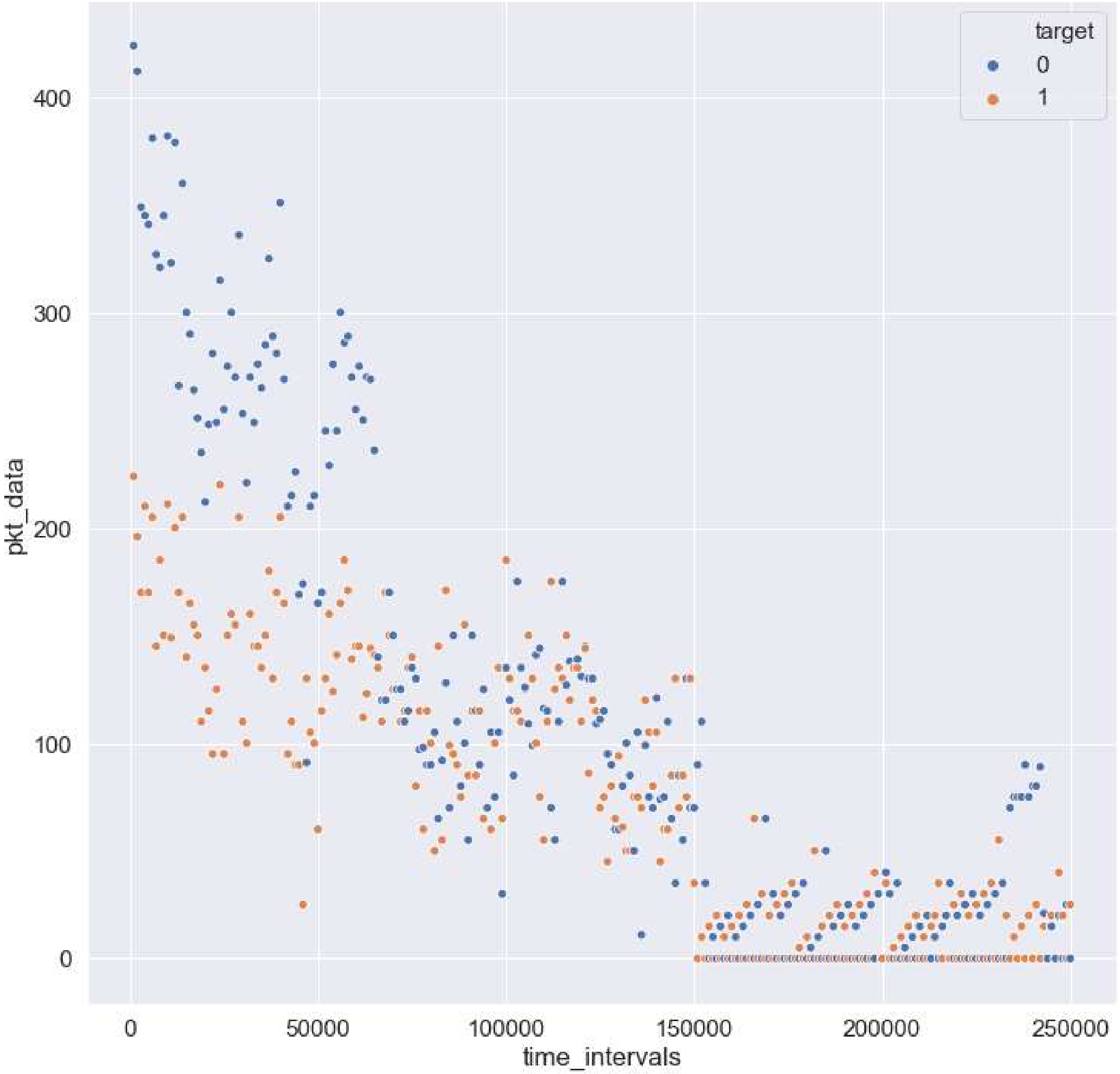
In [37]:

```
plt.figure(figsize=(8,6))
sns.violinplot(x='r15',y='time_intervals',data=dff, hue='target', split=True)
plt.show()
```



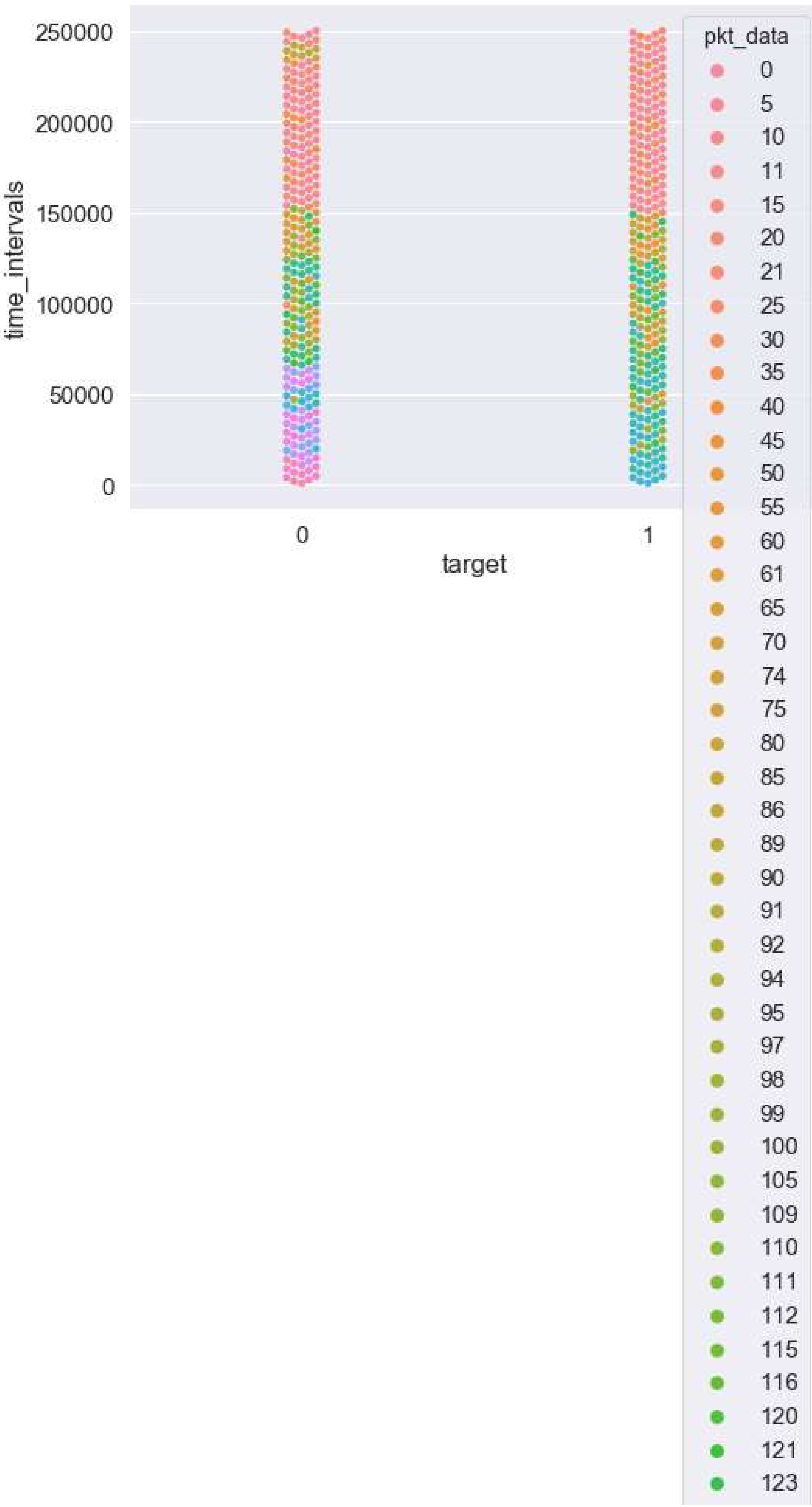
In [38]:

```
plt.figure(figsize=(12,12))
sns.scatterplot(x='time_intervals',y='pkt_data',data=dff, hue='target')
plt.show()
```



In [39]:

```
plt.figure(figsize=(8,6))
sns.swarmplot(x='target',y='time_intervals',data=dff, hue='pkt_data')
plt.show()
```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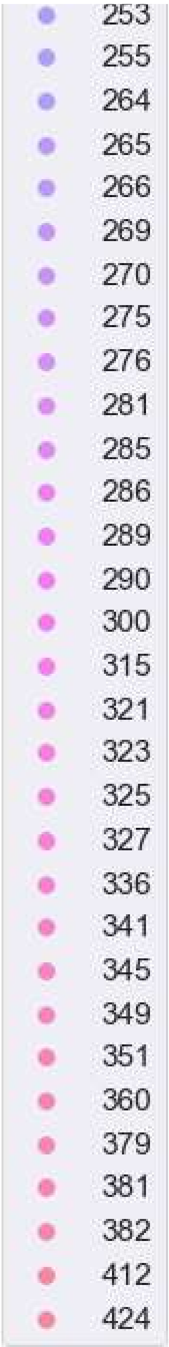
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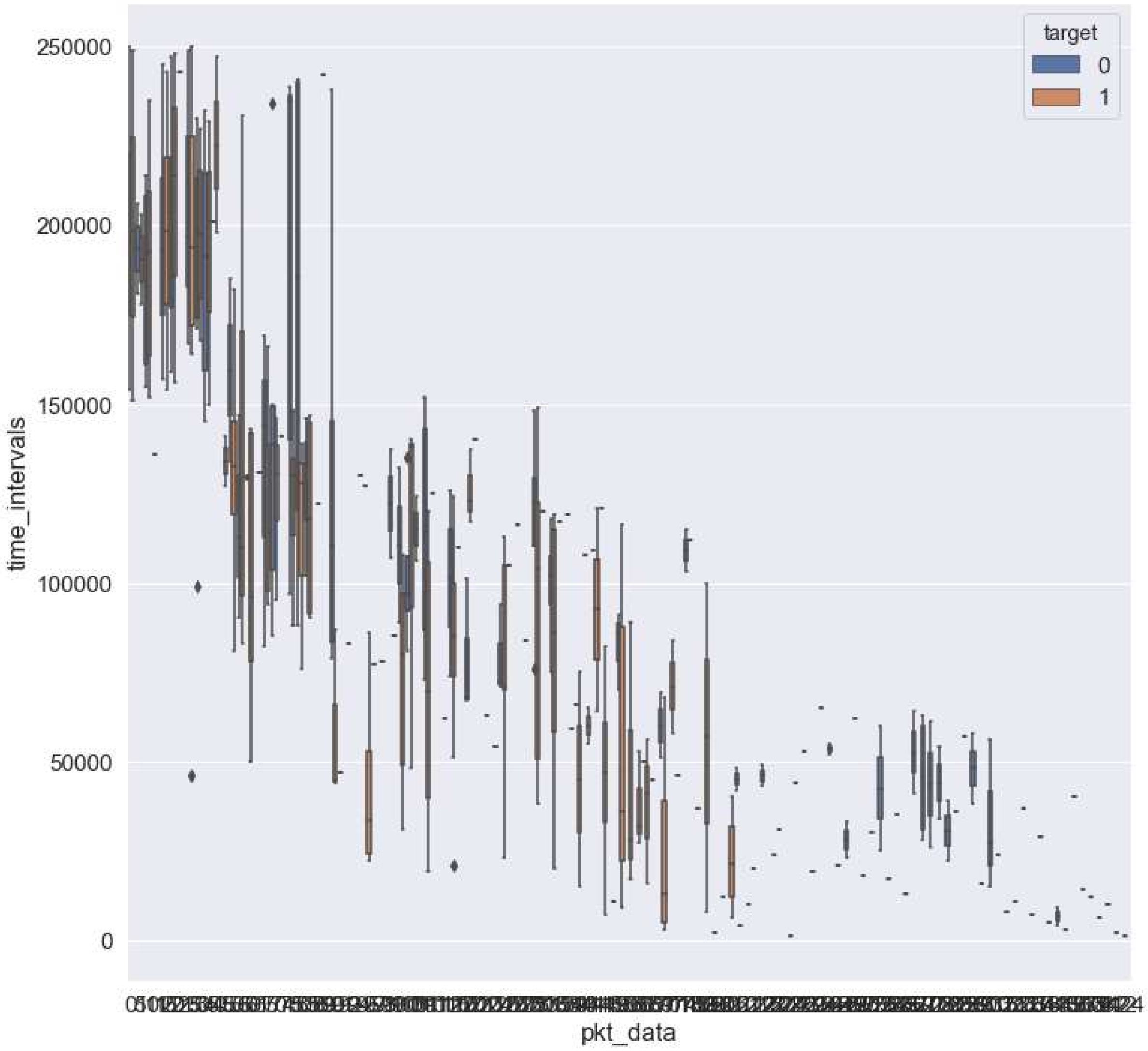
424

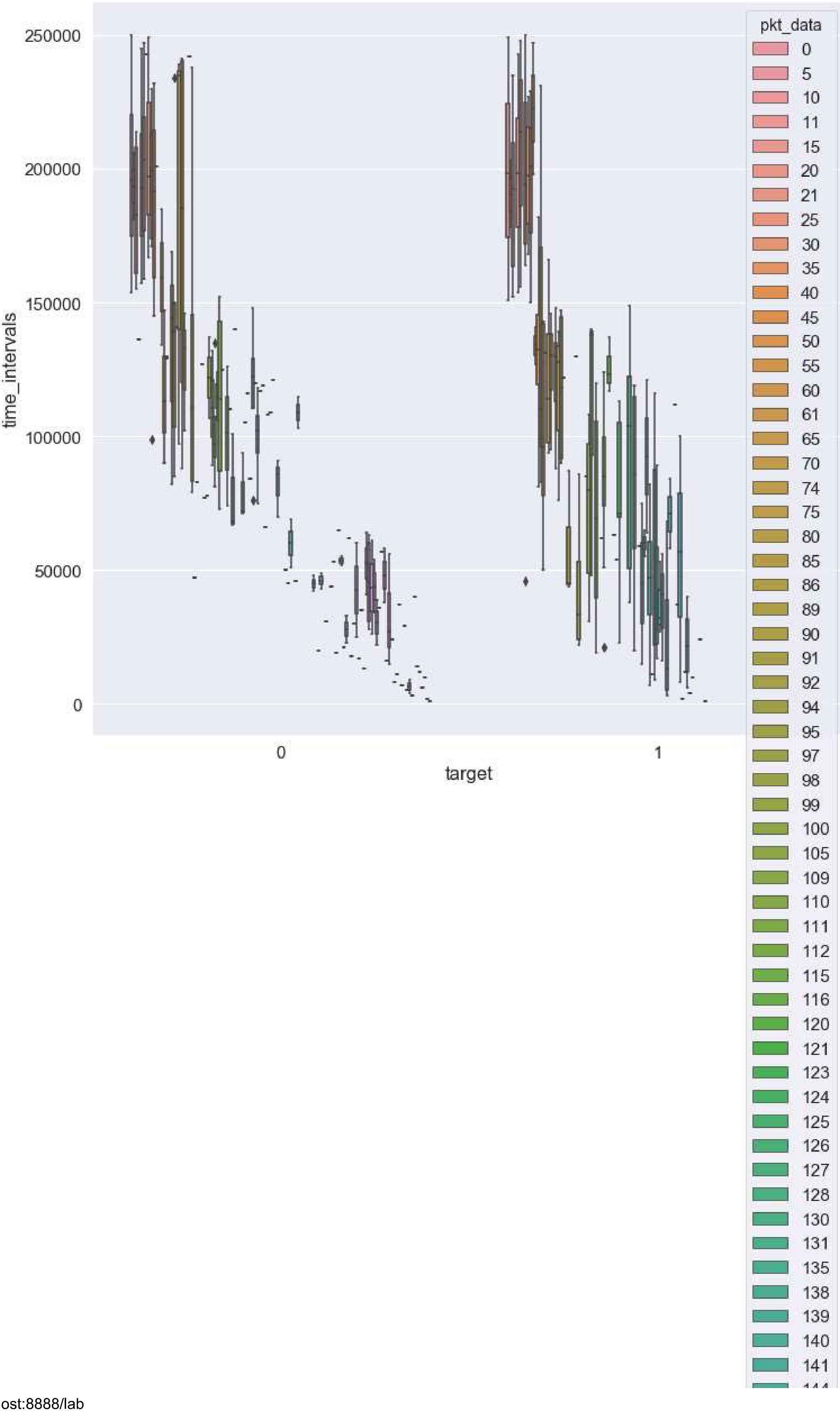
In [40]:

```
plt.figure(figsize=(12,12))
sns.boxplot(x='pkt_data',y='time_intervals',data=dff, hue='target')
plt.show()
```



In [41]:

```
plt.figure(figsize=(12,12))
sns.boxplot(x='target',y='time_intervals',data=dff, hue='pkt_data')
plt.show()
```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target
pkt_data
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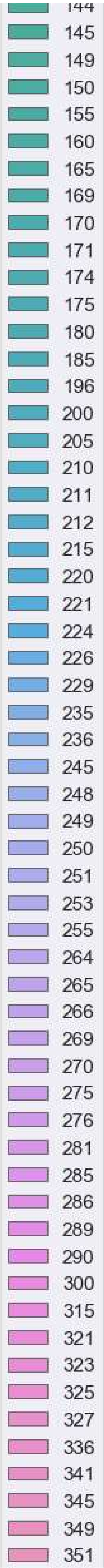
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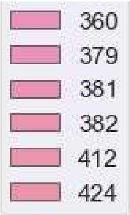
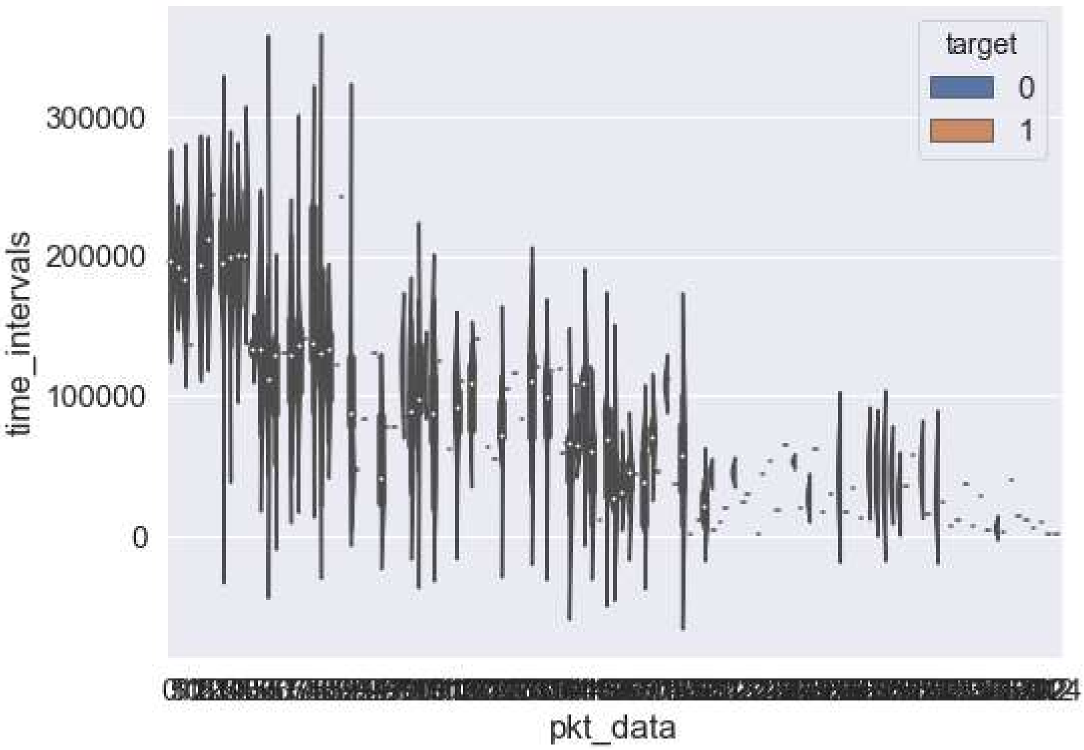


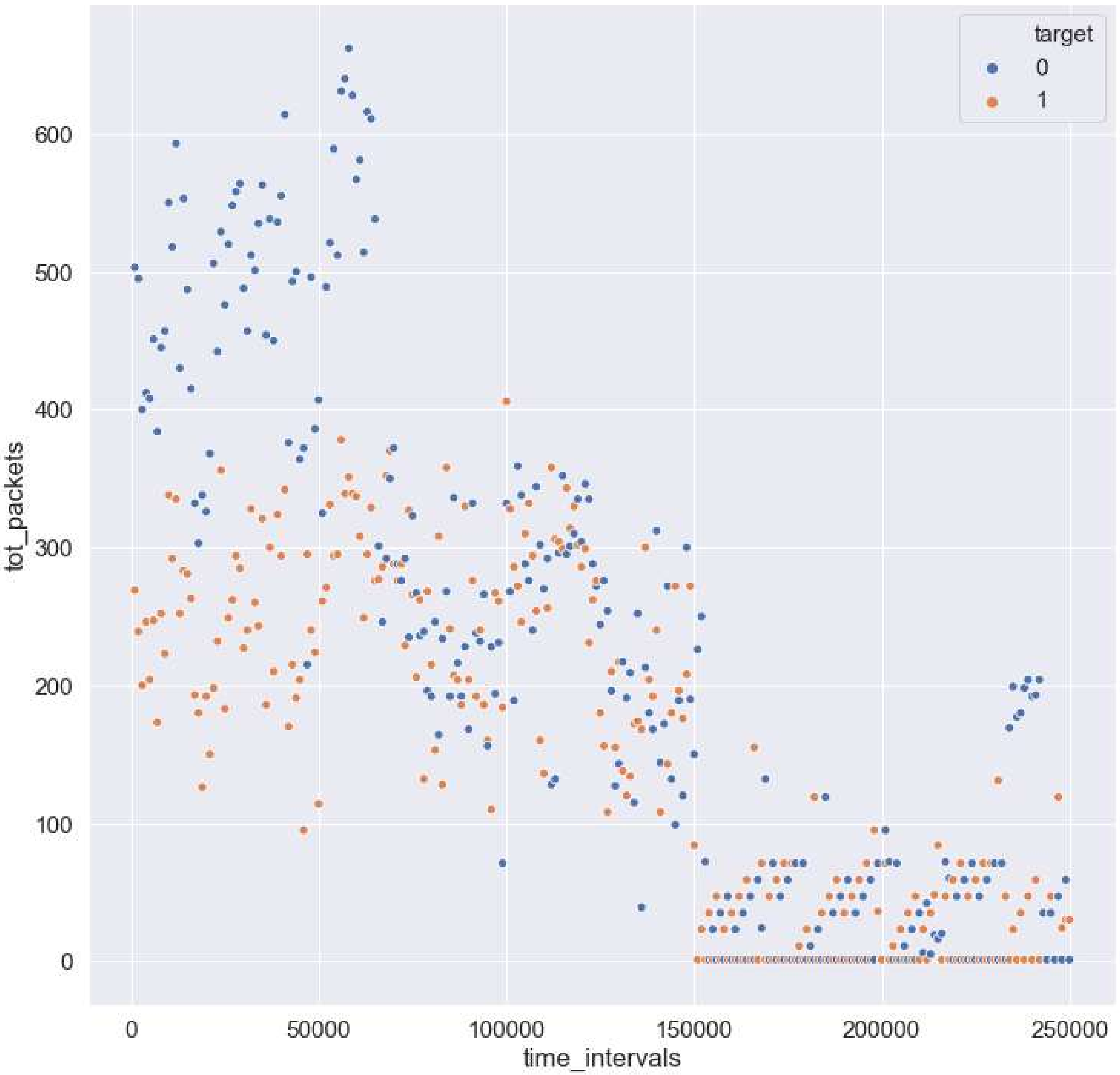
In [42]:

```
plt.figure(figsize=(8,6))
sns.violinplot(x='pkt_data',y='time_intervals',data=dff, hue='target', split=True)
plt.show()
```



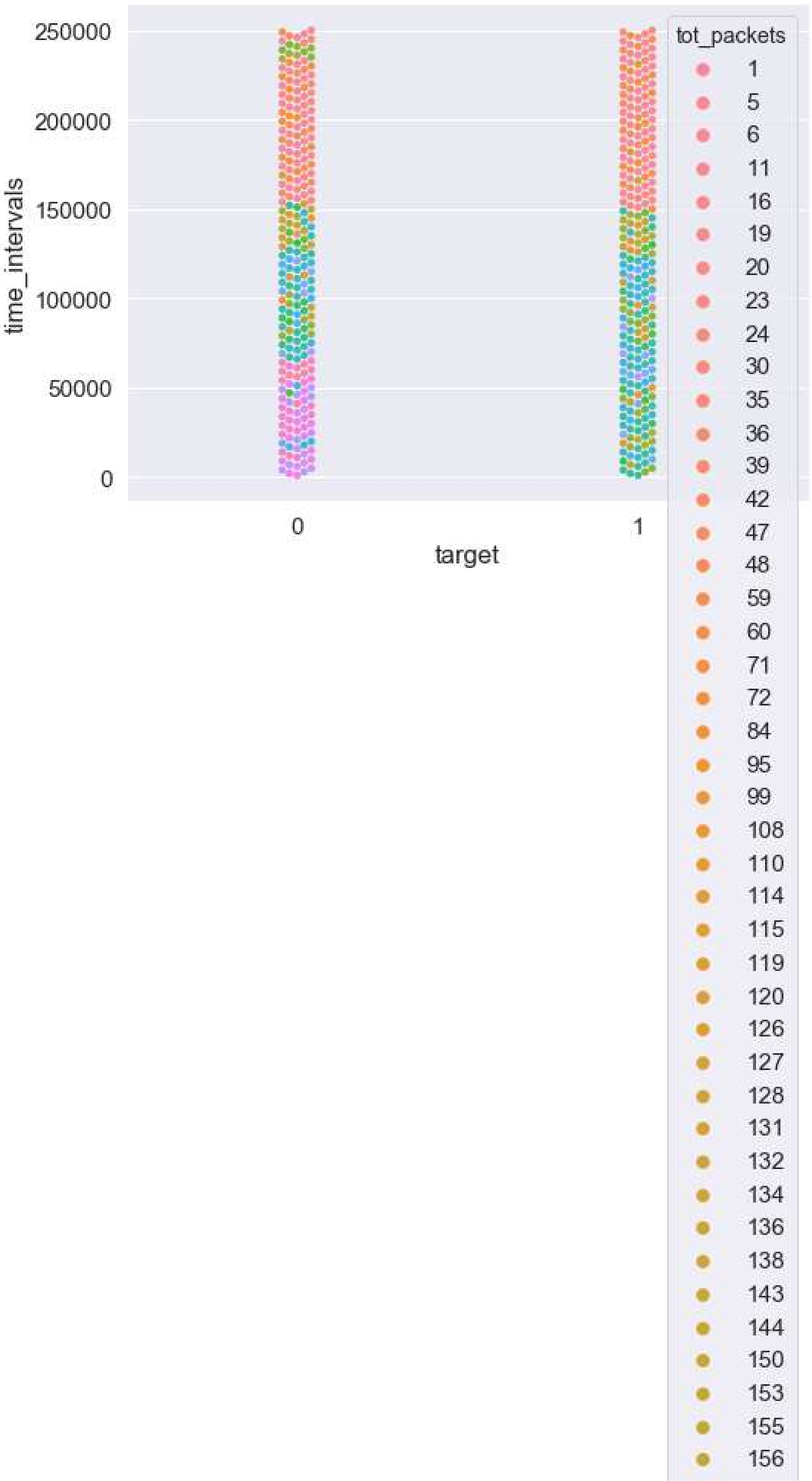
In [43]:

```
plt.figure(figsize=(12,12))
sns.scatterplot(x='time_intervals',y='tot_packets',data=dff, hue='target')
plt.show()
```



In [44]:

```
plt.figure(figsize=(8,6))
sns.swarmplot(x='target',y='time_intervals',data=dff, hue='tot_packets')
plt.show()
```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target
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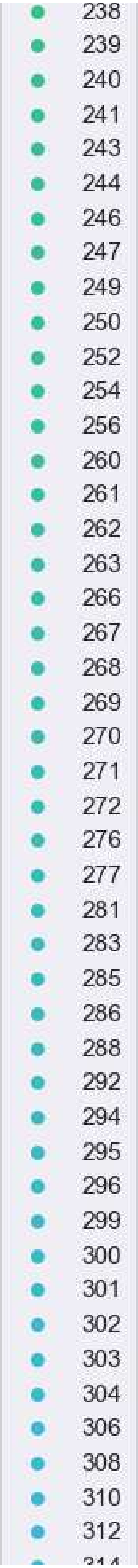
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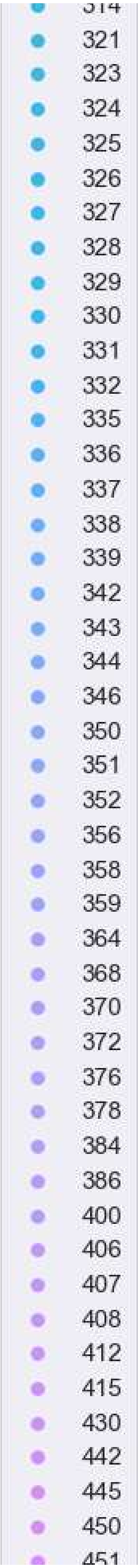
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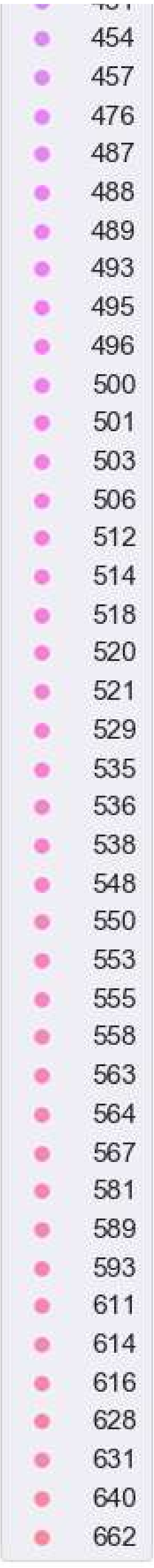
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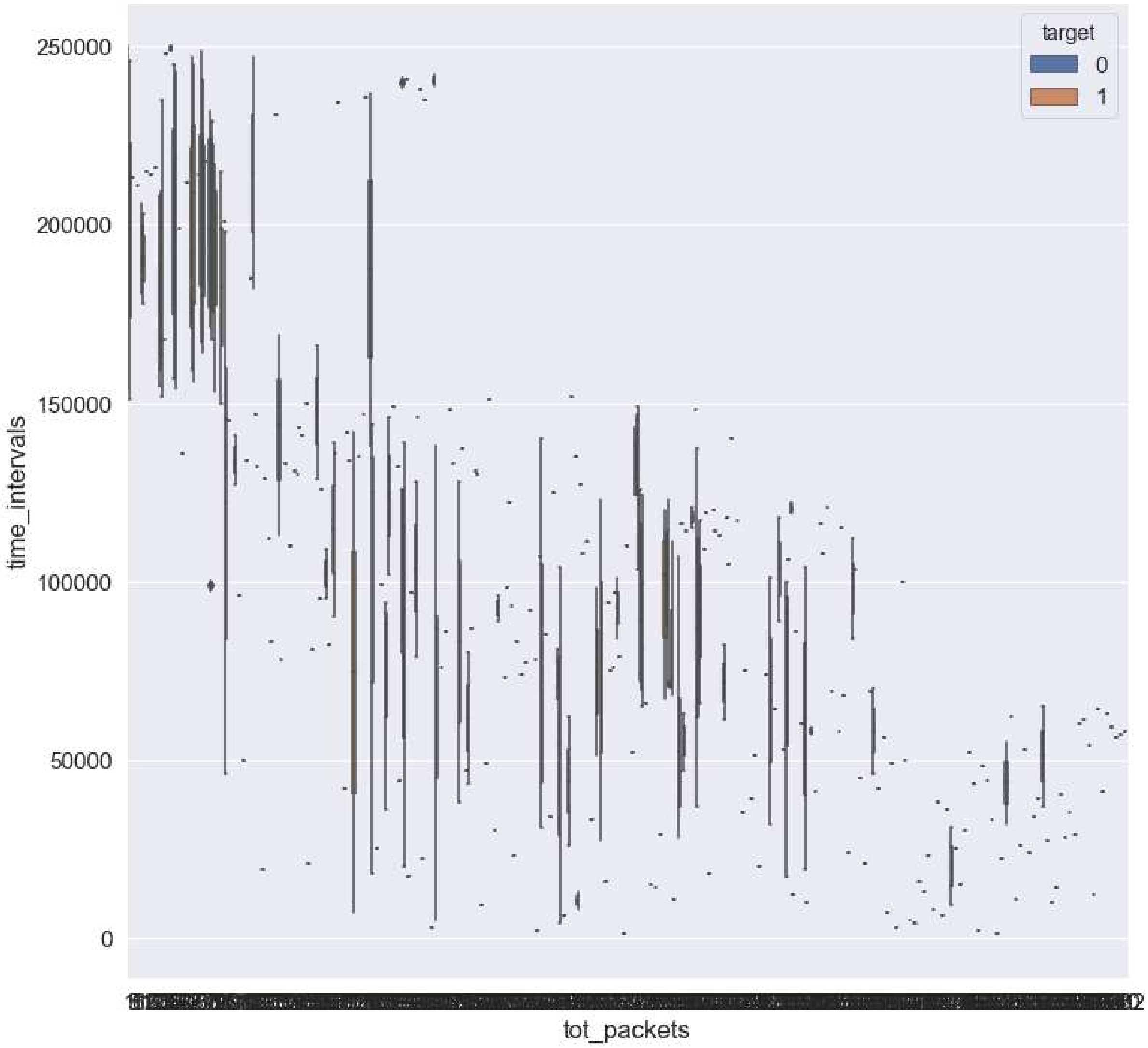
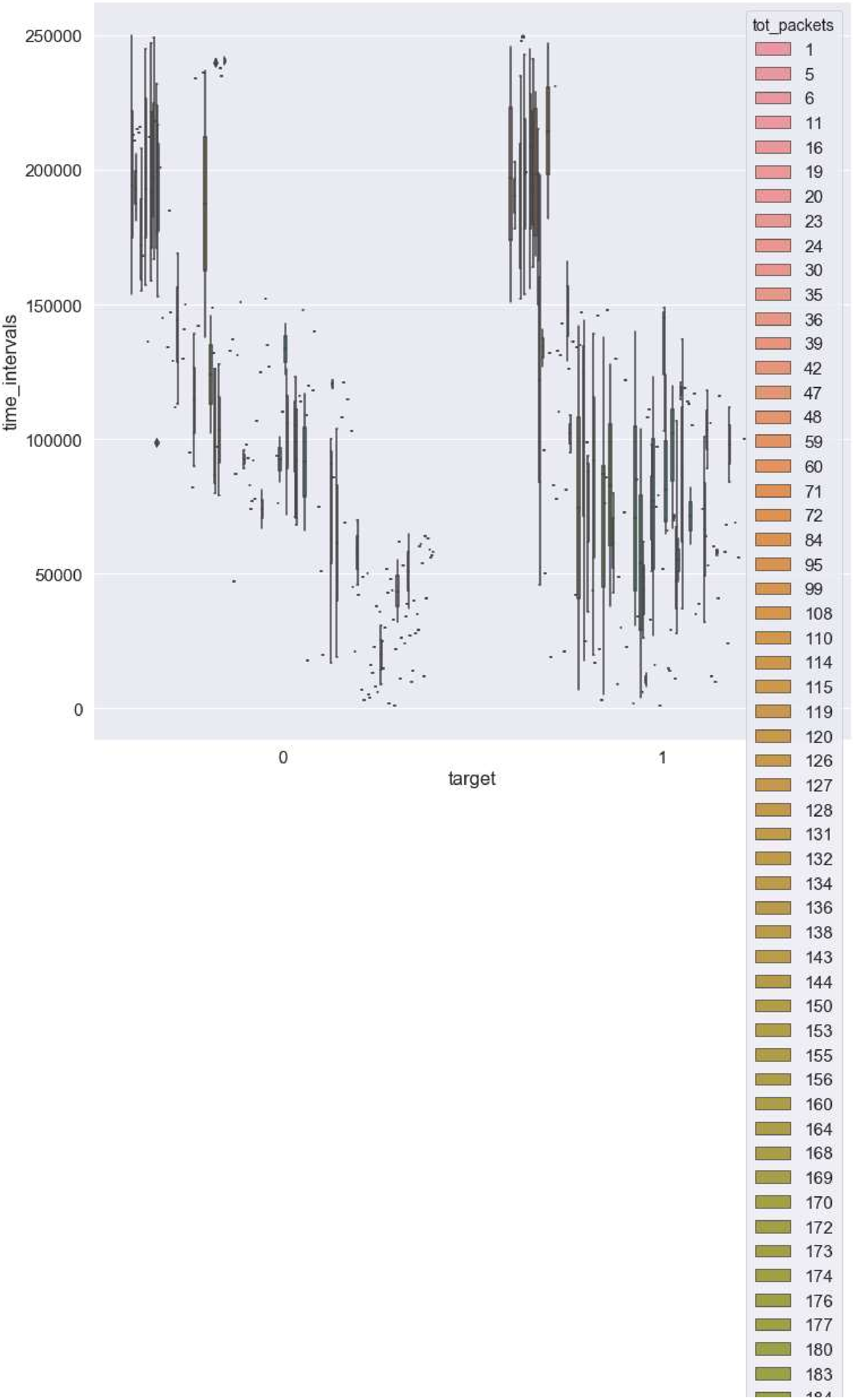
In [45]:

```
plt.figure(figsize=(12,12))
sns.boxplot(x='tot_packets',y='time_intervals',data=dff, hue='target')
plt.show()
```



In [46]:

```
plt.figure(figsize=(12,12))
sns.boxplot(x='target',y='time_intervals',data=dff, hue='tot_packets')
plt.show()
```


tot_packets
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184
250000
200000
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100000
50000
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time_intervals
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target

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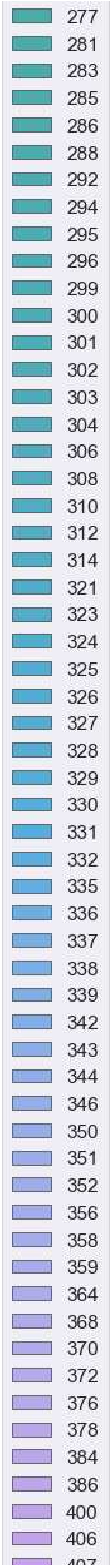
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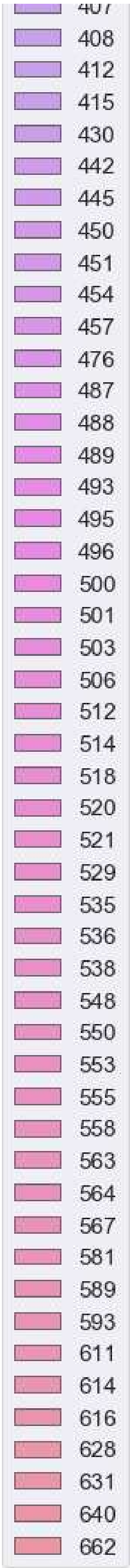
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