

feature_histograms

August 16, 2023

```
[2]: import numpy as np
      import pandas as pd
      import matplotlib.pyplot as plt
```

0.1 TwiBot-20

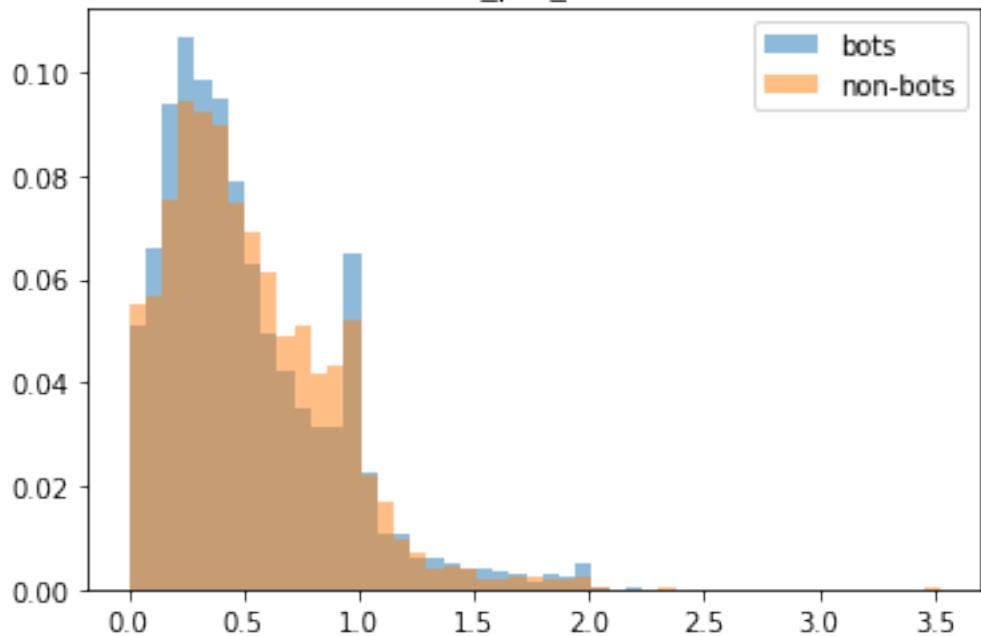
0.1.1 NLP data

```
[50]: nlp = pd.read_csv("twibot_20_nlp.csv")
       for col in nlp.columns[1:-1]:
           x = nlp.loc[nlp["label"] == 1, col]
           y = nlp.loc[nlp["label"] == 0, col]

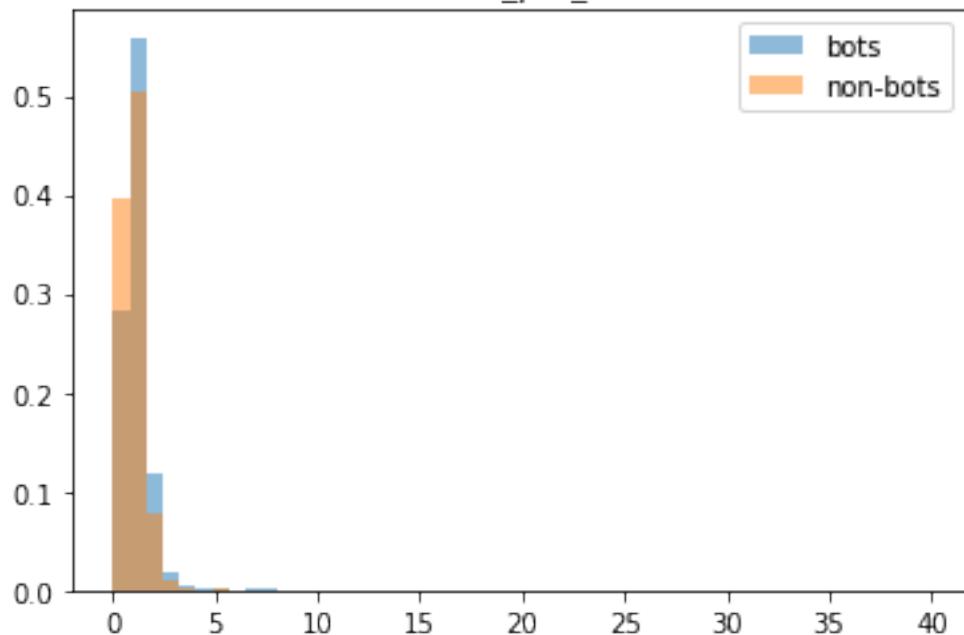
           bins = np.linspace(min(nlp[col]), max(nlp[col]), 50)

           plt.hist(round(x, 5), bins, alpha=0.5, label='bots', weights=np.
           ↵ones(len(x))/len(x))
           plt.hist(y, bins, alpha=0.5, label='non-bots', weights=np.ones(len(y))/
           ↵len(y))
           plt.legend(loc='upper right')
           plt.title(col)
           #plt.savefig(f'./charts/{col}.pdf')
           plt.show()
```

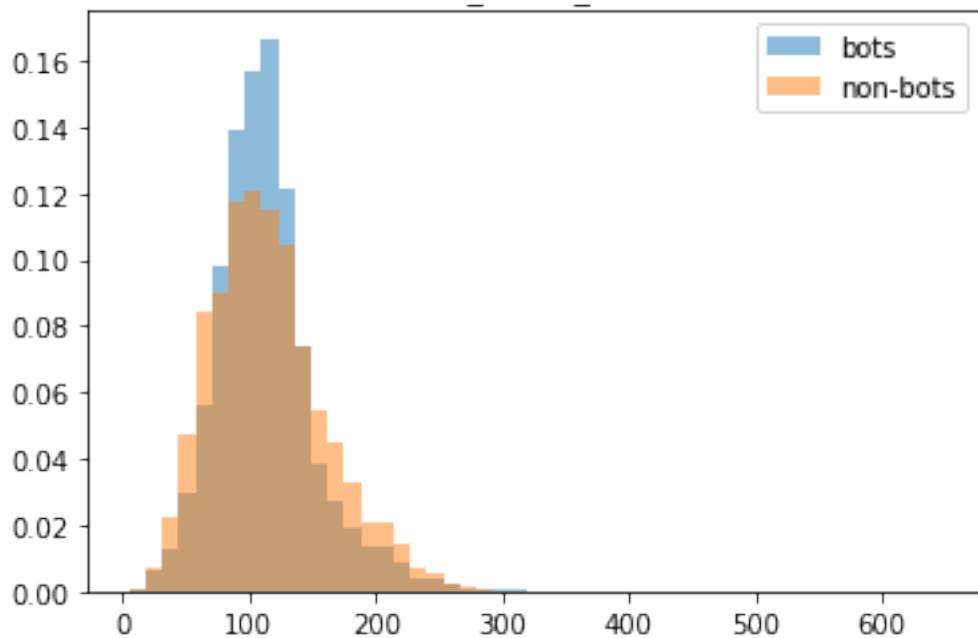
links_per_tweet



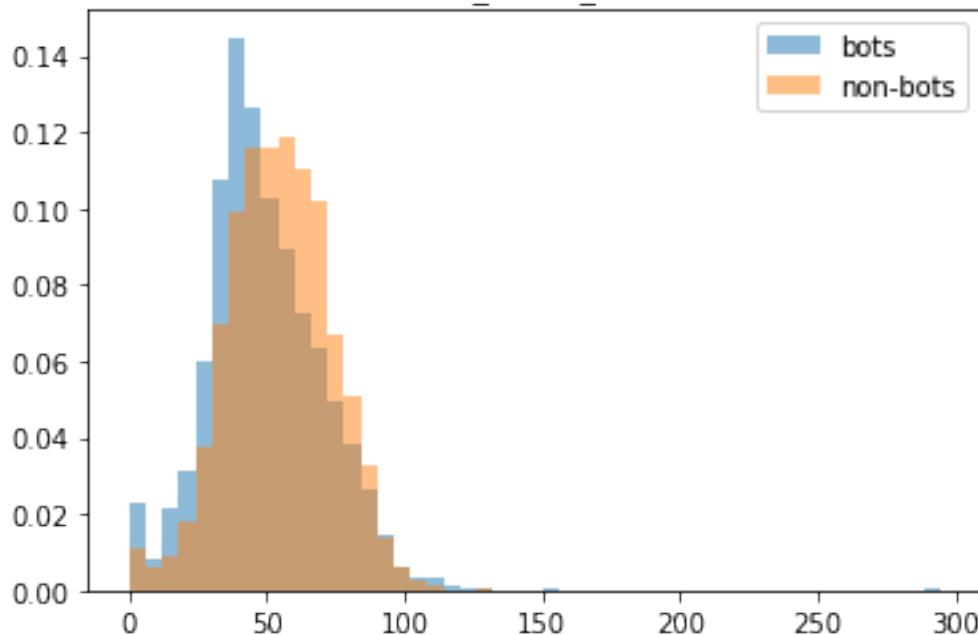
mentions_per_tweet



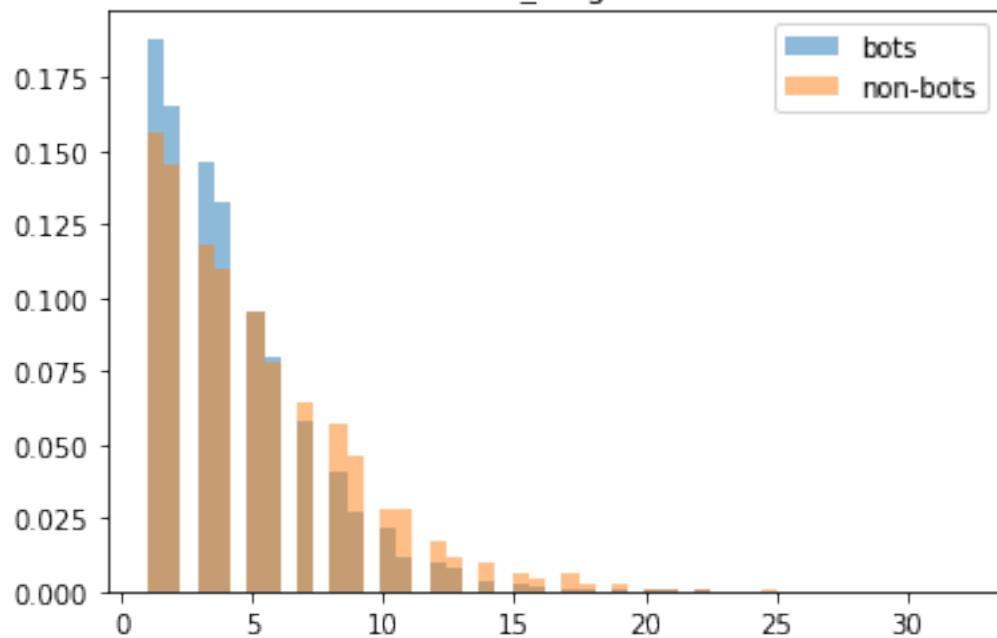
av_tweet_len



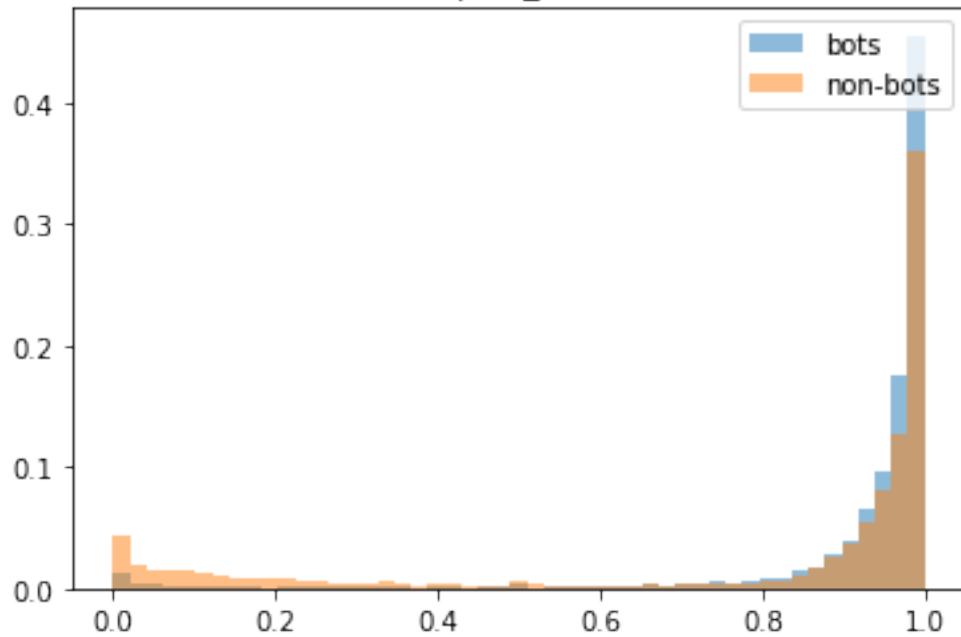
std_tweet_len



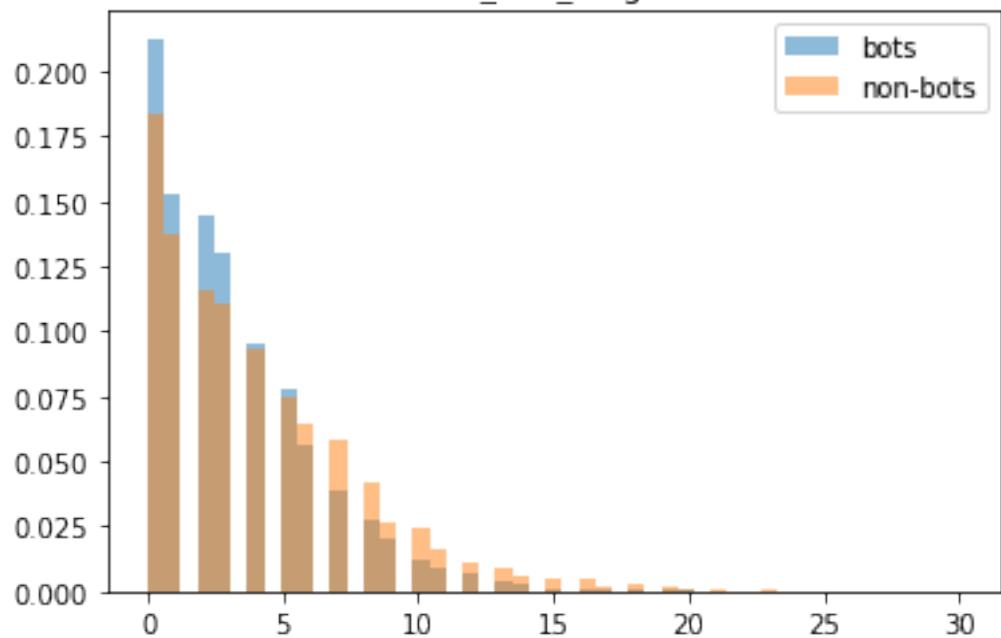
no_langs



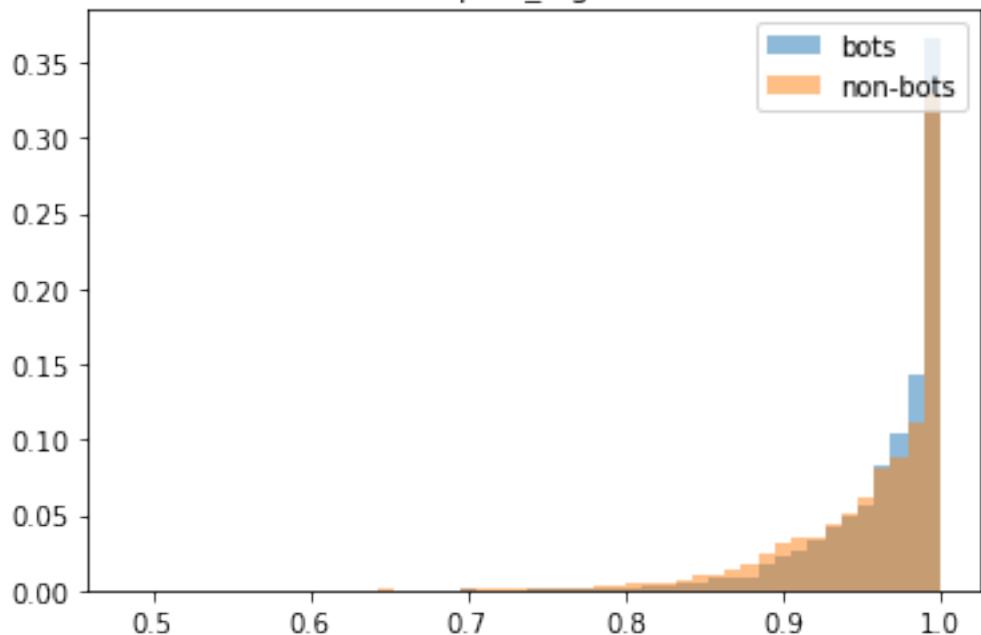
perc_en

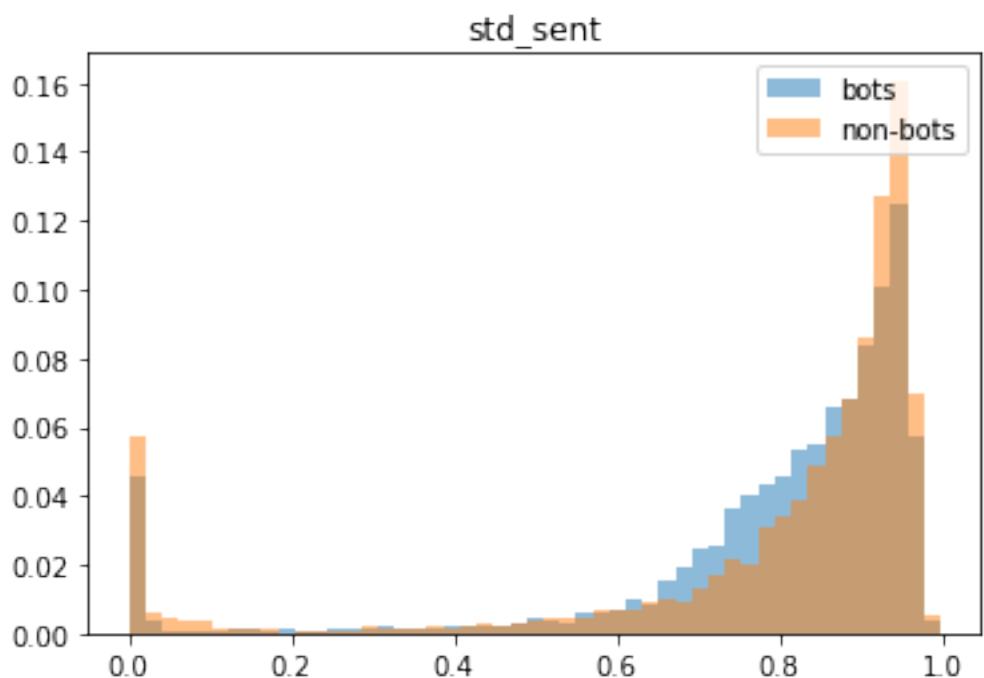
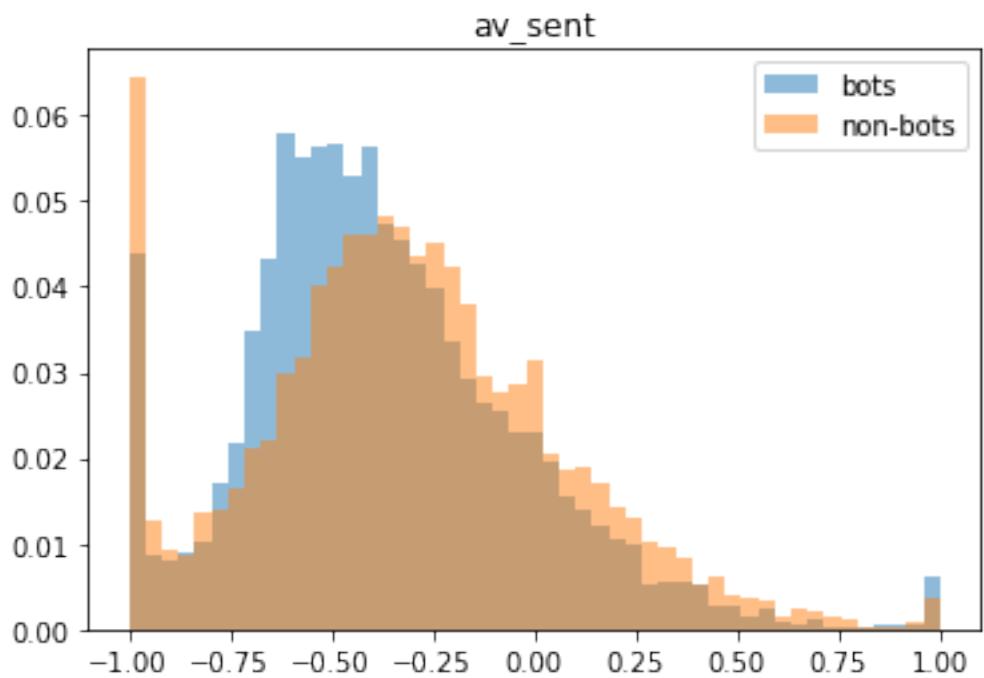


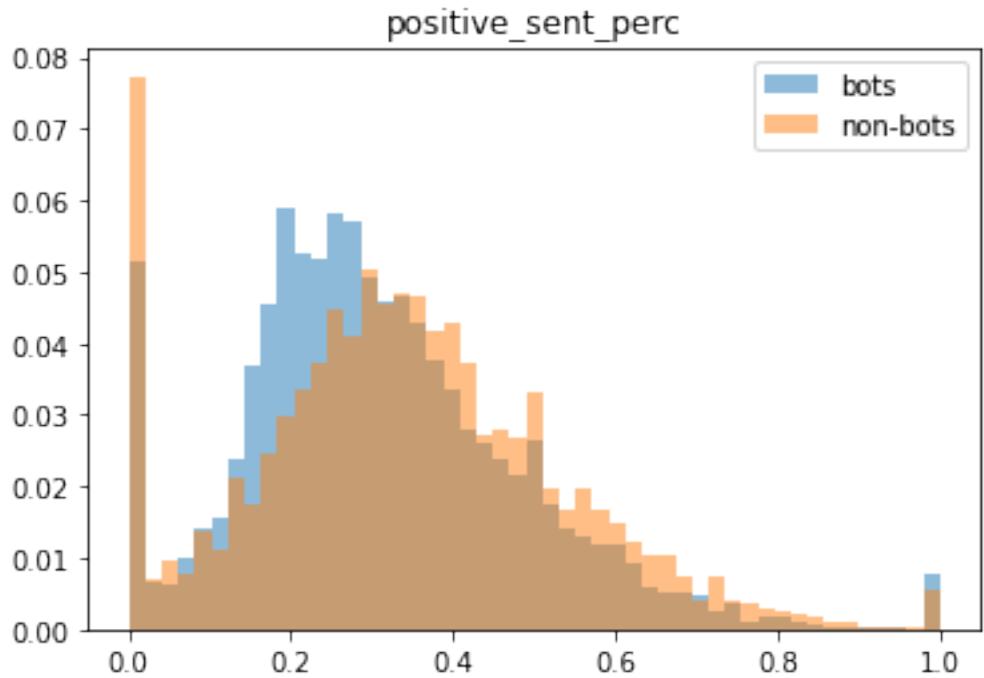
no_odd_langs



perc_legit







0.1.2 node statistics

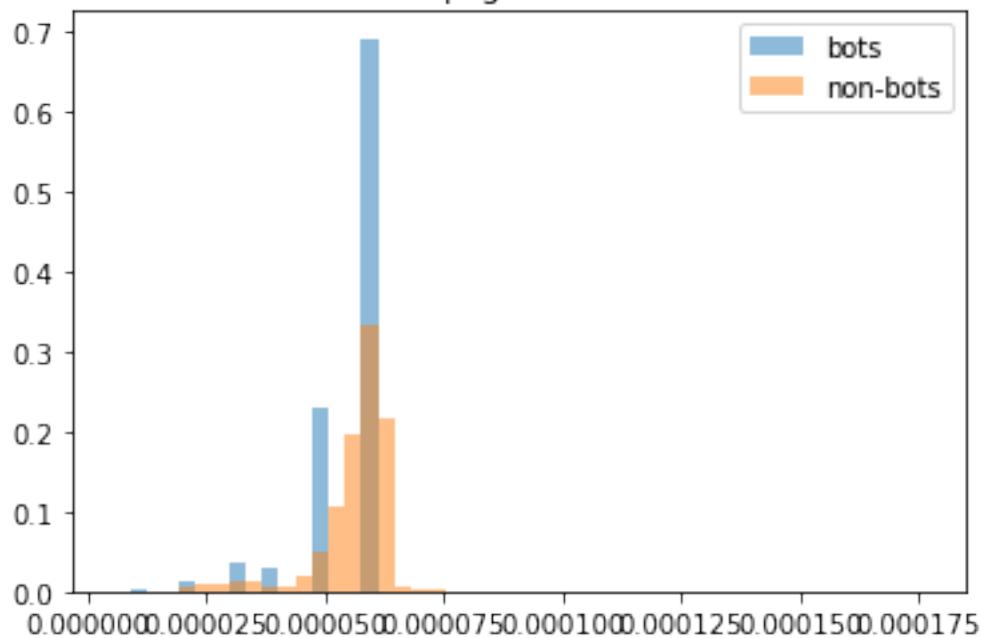
```
[33]: twibot_gf = pd.read_csv("twibot_20_gf.csv")

[75]: twibot_gf = pd.read_csv("twibot_20_gf.csv")
for col in twibot_gf.columns[1:-1]:
    x = twibot_gf.loc[twibot_gf["label"] == 1, col]
    y = twibot_gf.loc[twibot_gf["label"] == 0, col]

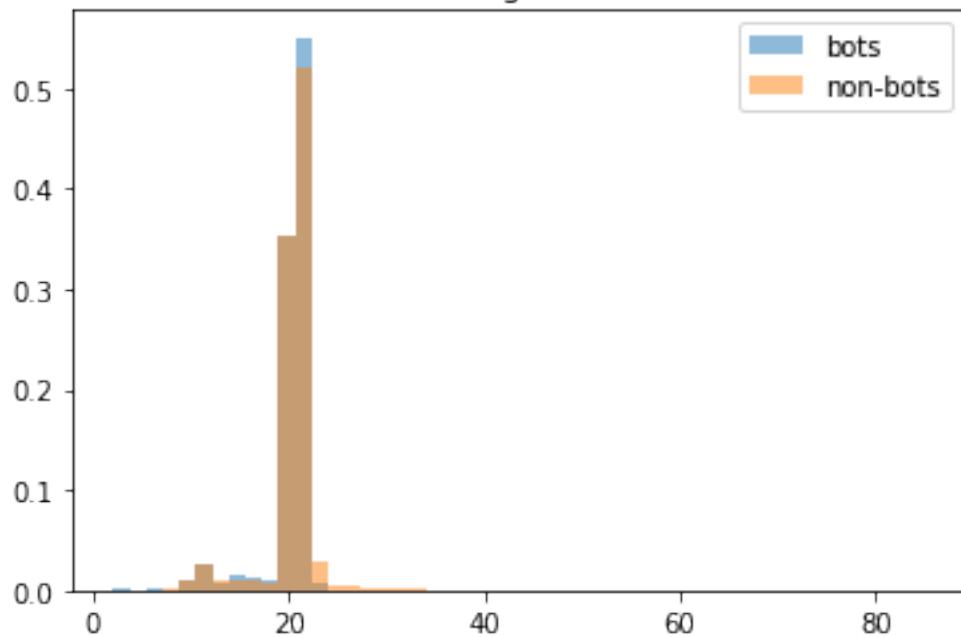
    bins = np.linspace(min(twibot_gf[col]), max(twibot_gf[col]), 50)

    plt.hist(round(x, 5), bins, alpha=0.5, label='bots', weights=np.
    ↪ones(len(x))/len(x))
    plt.hist(y, bins, alpha=0.5, label='non-bots', weights=np.ones(len(y))/
    ↪len(y))
    plt.legend(loc='upper right')
    plt.title(col)
    #plt.savefig(f'./charts/{col}.pdf')
    plt.show()
```

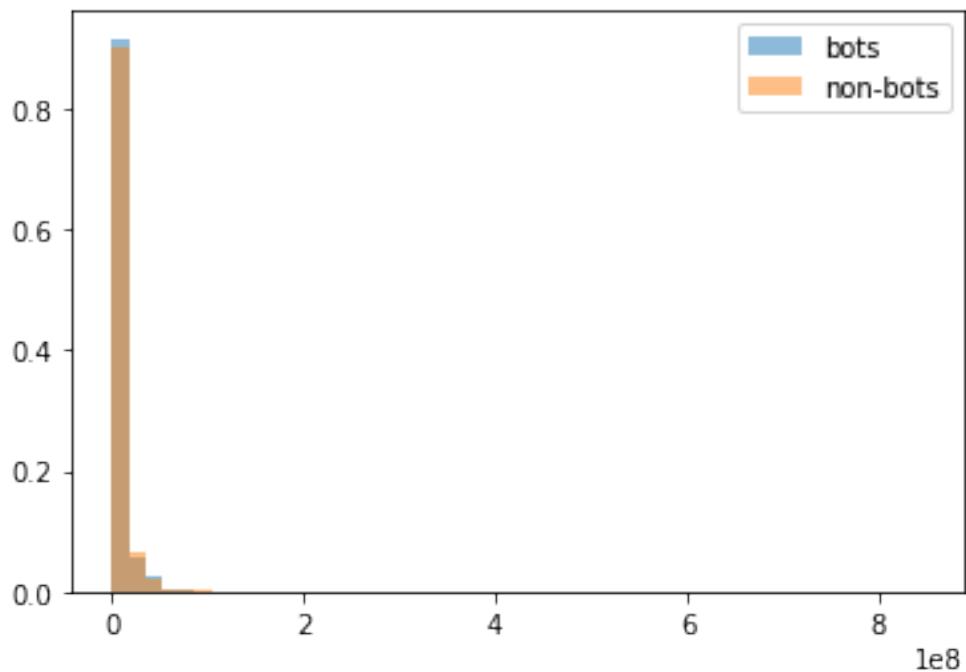
pagerank



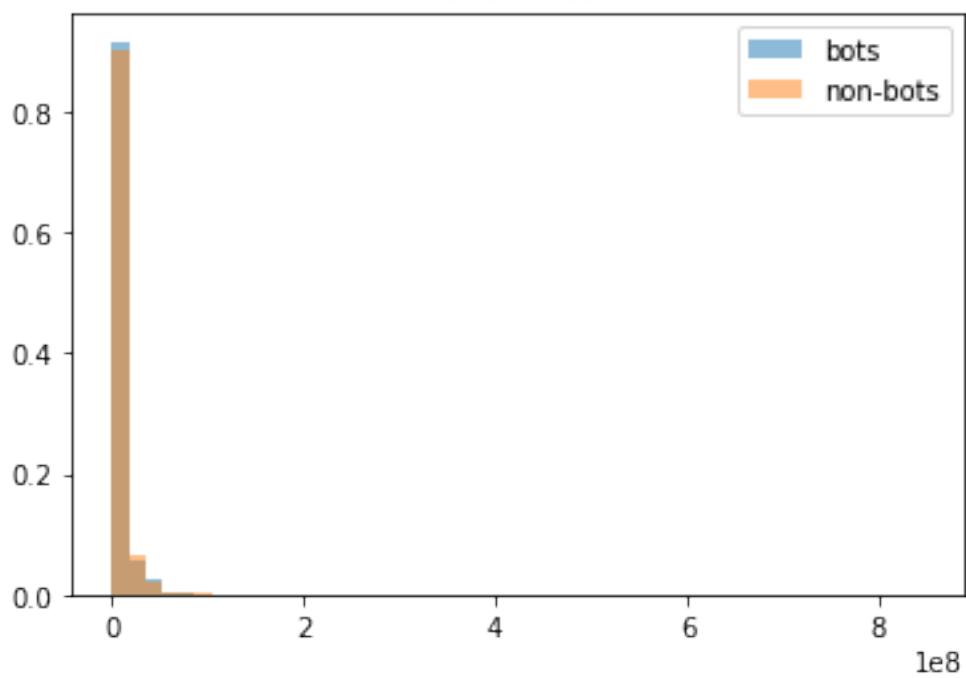
degree



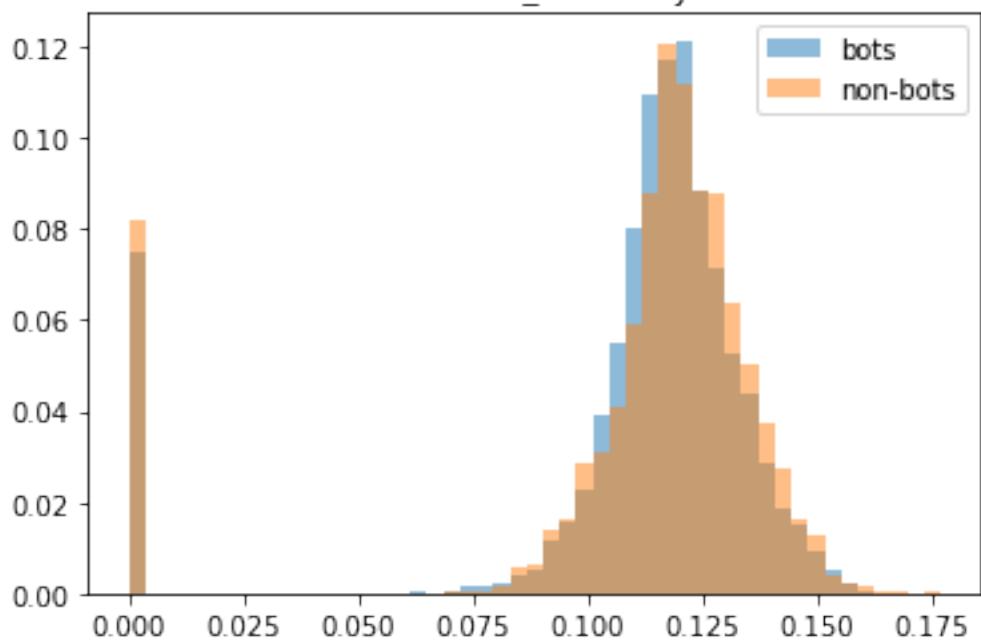
betweenness



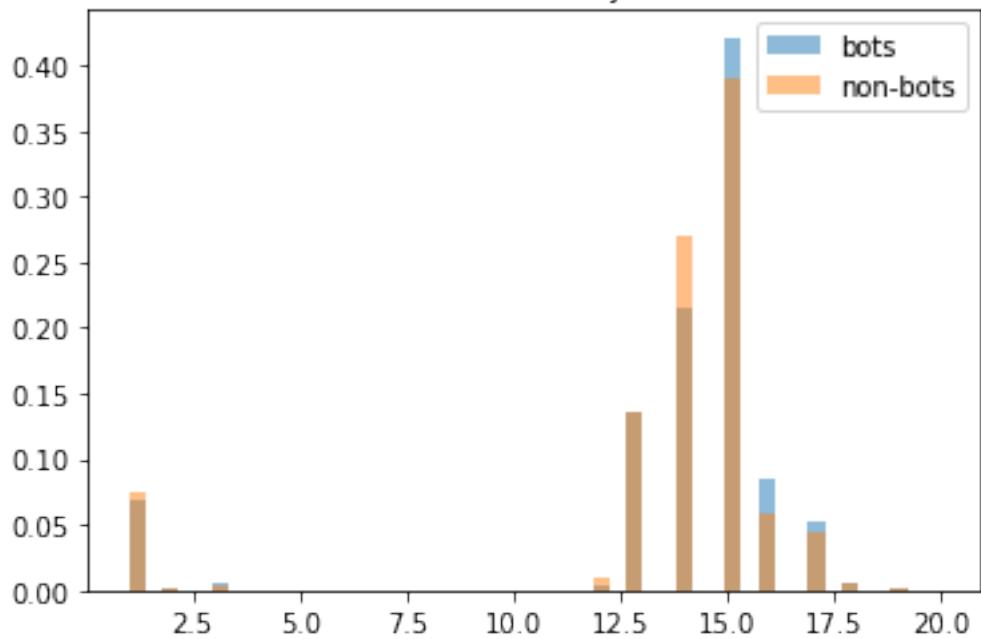
doseness



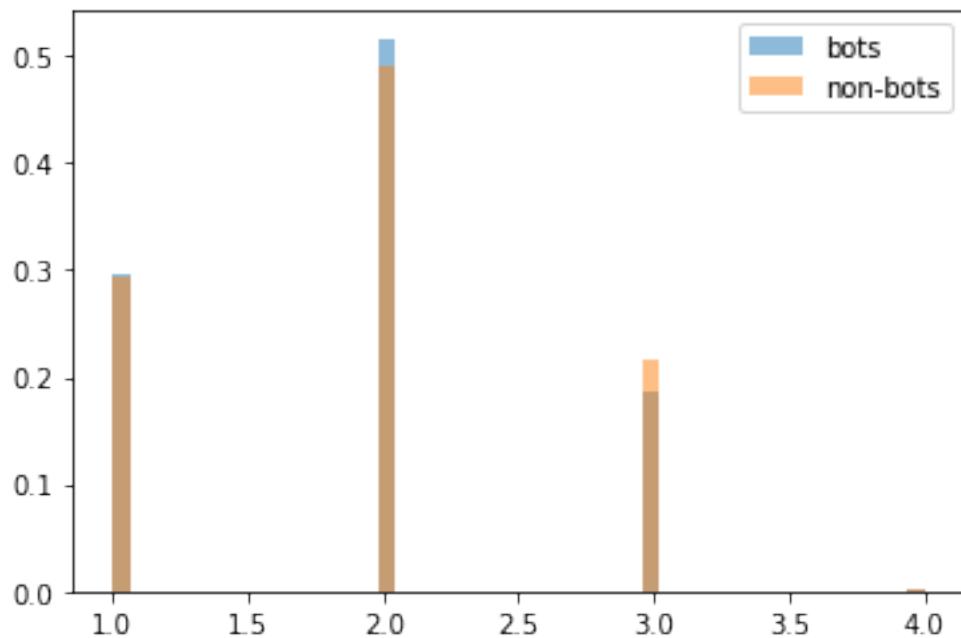
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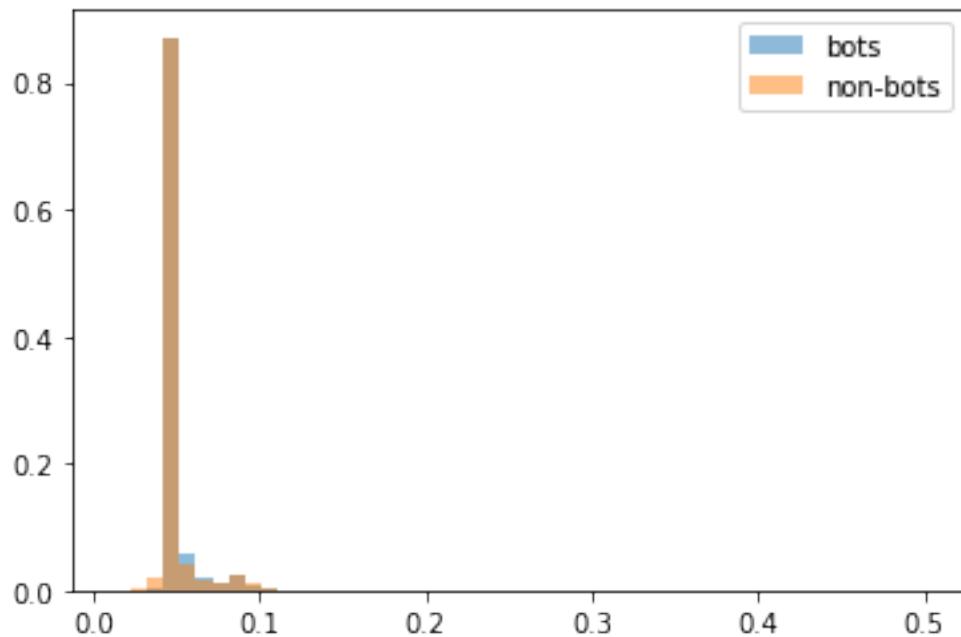
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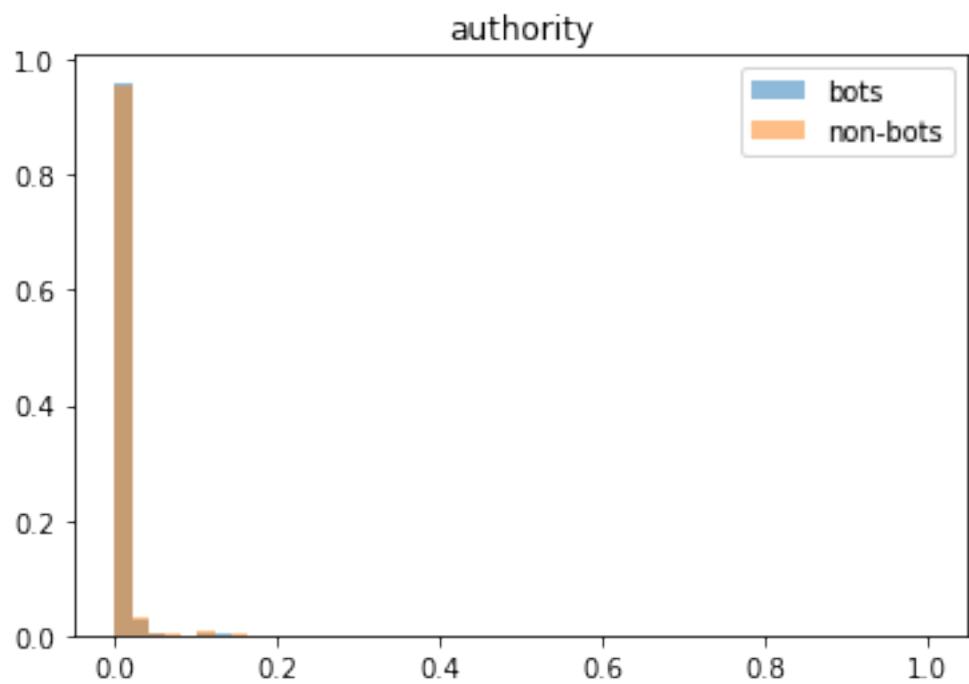
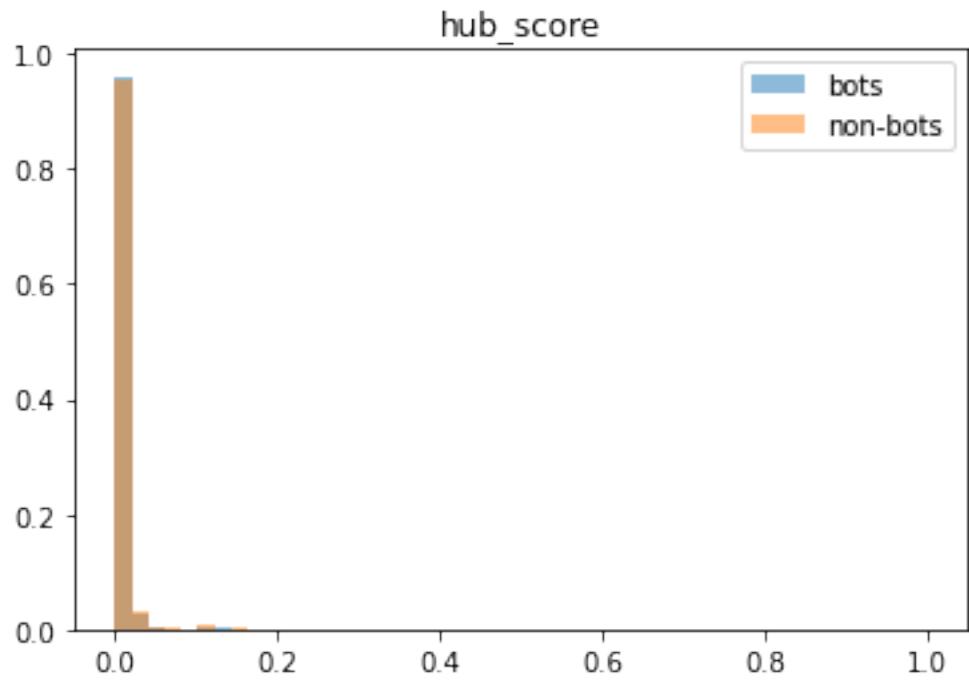


coreness

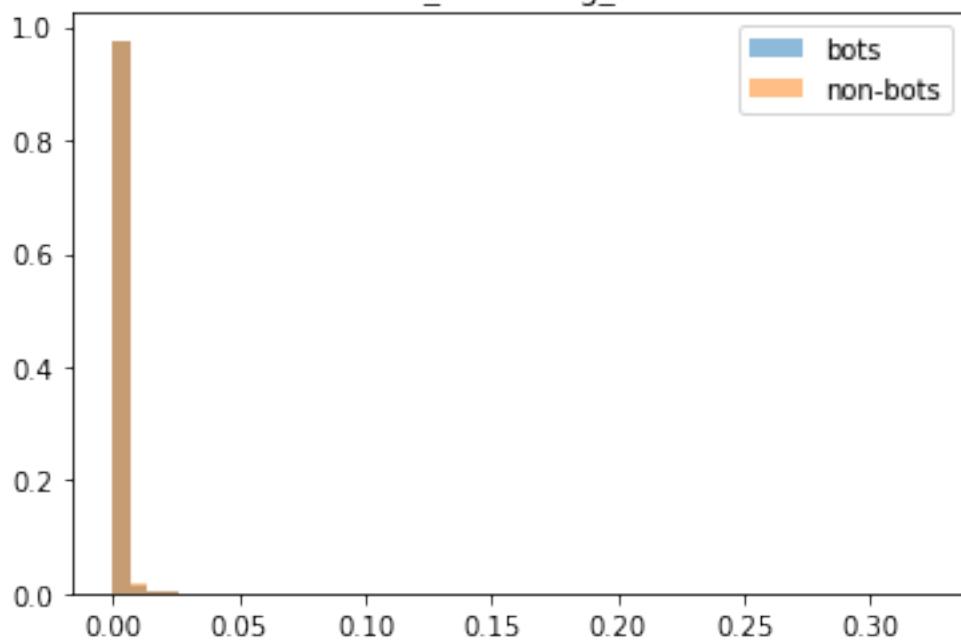


constraint

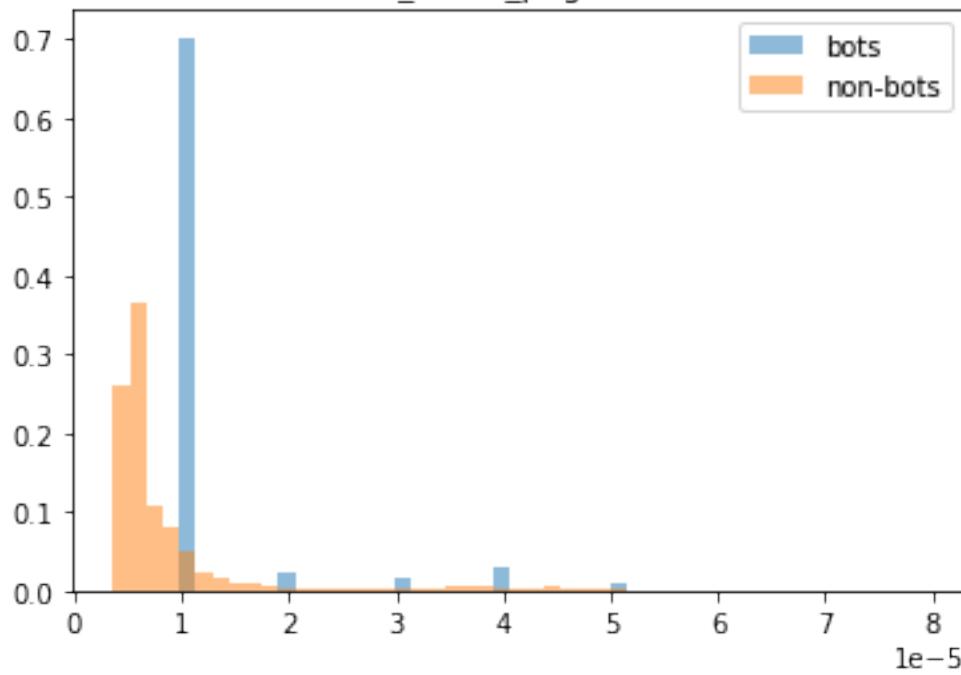


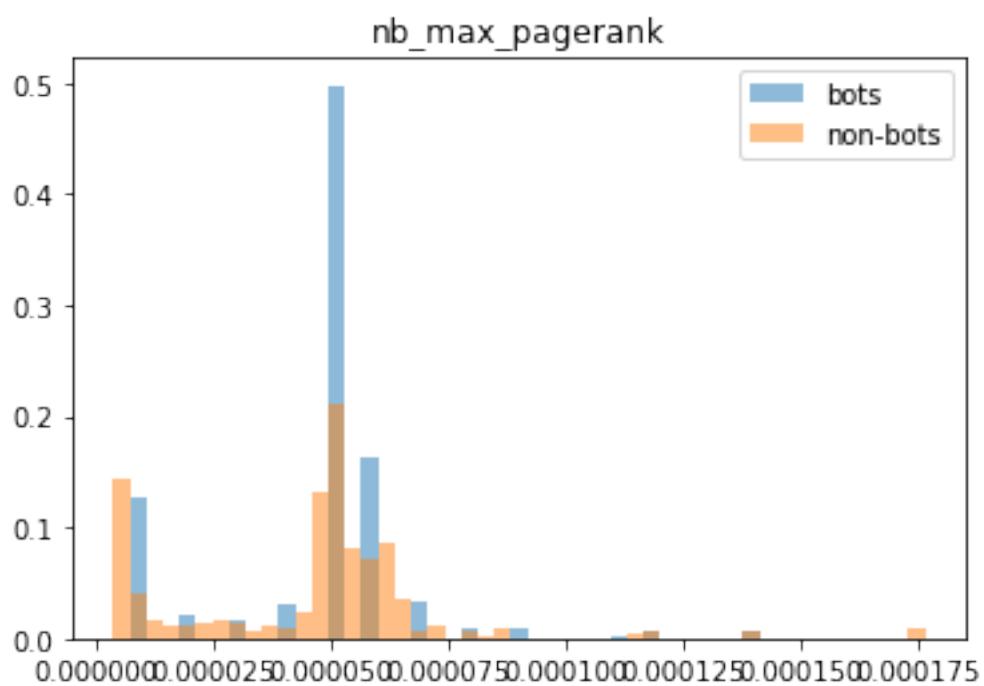
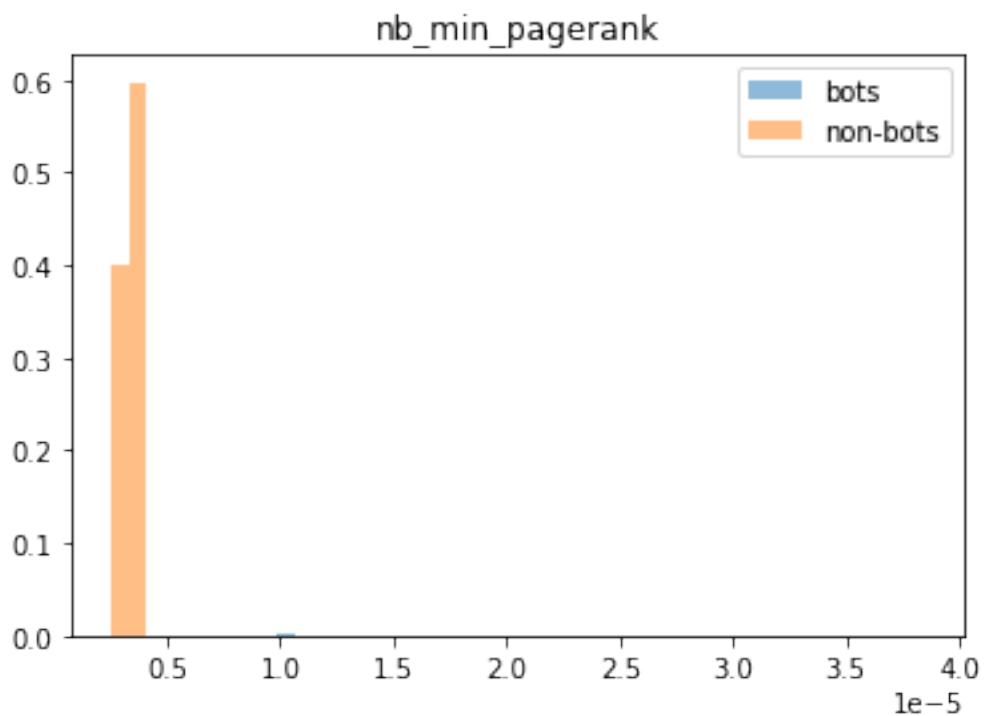


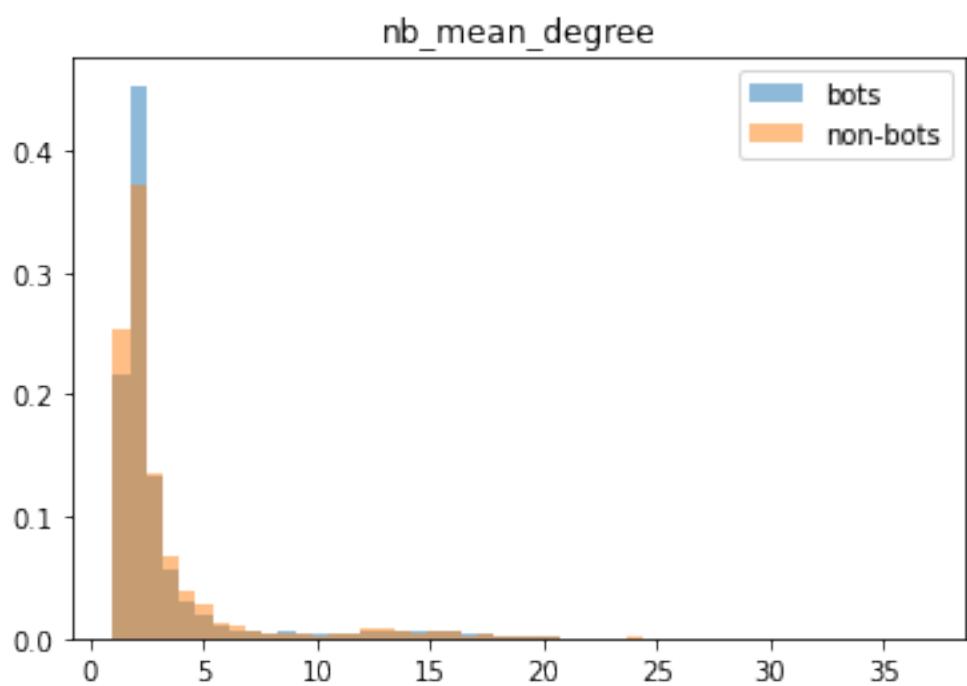
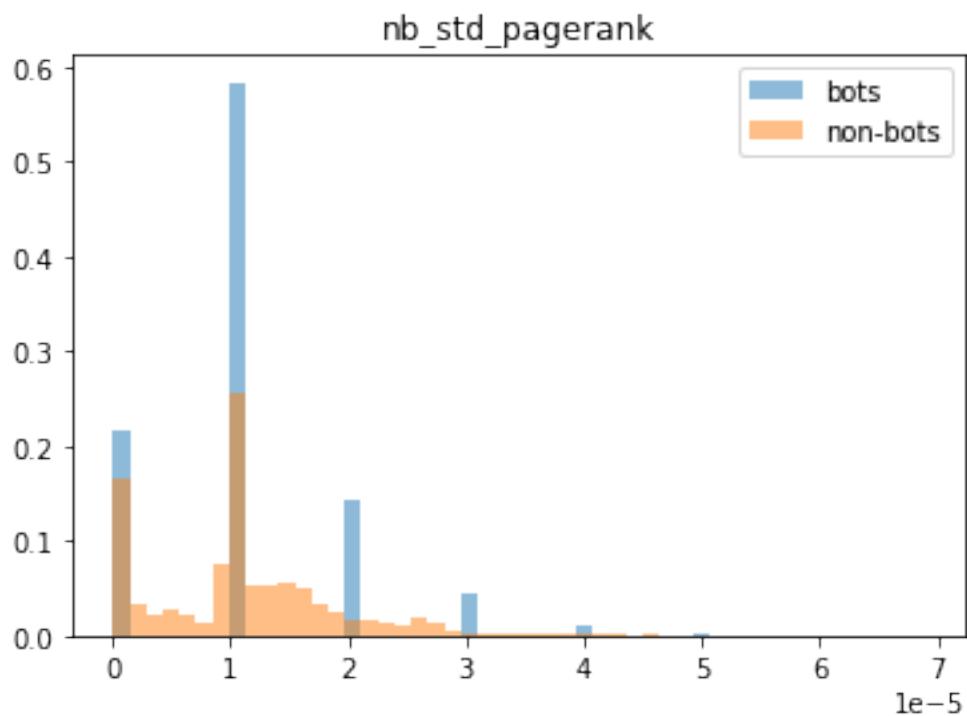
local_clustering_coef

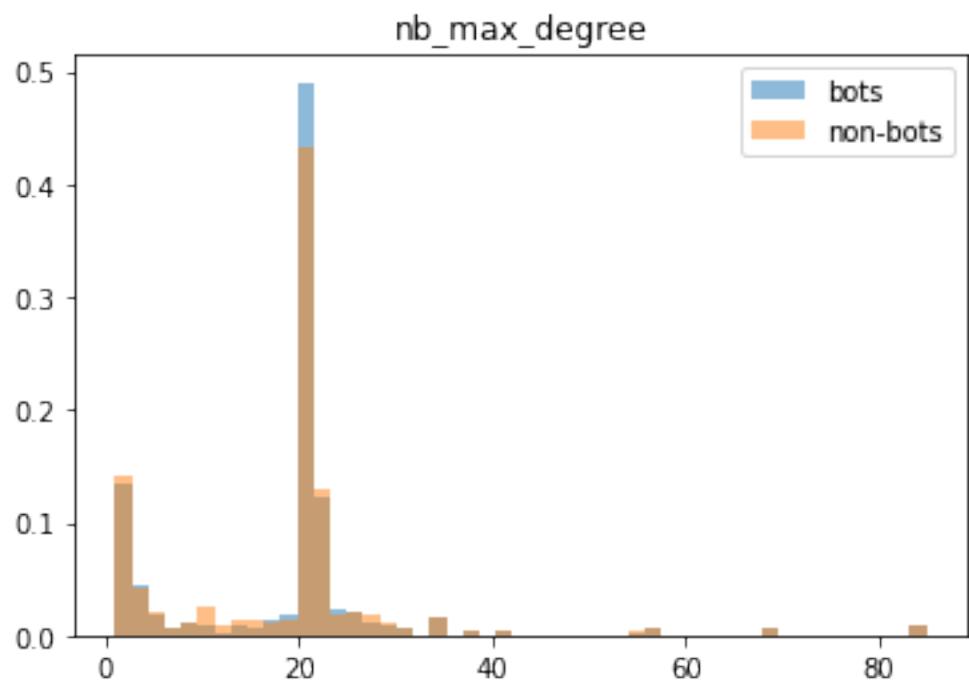
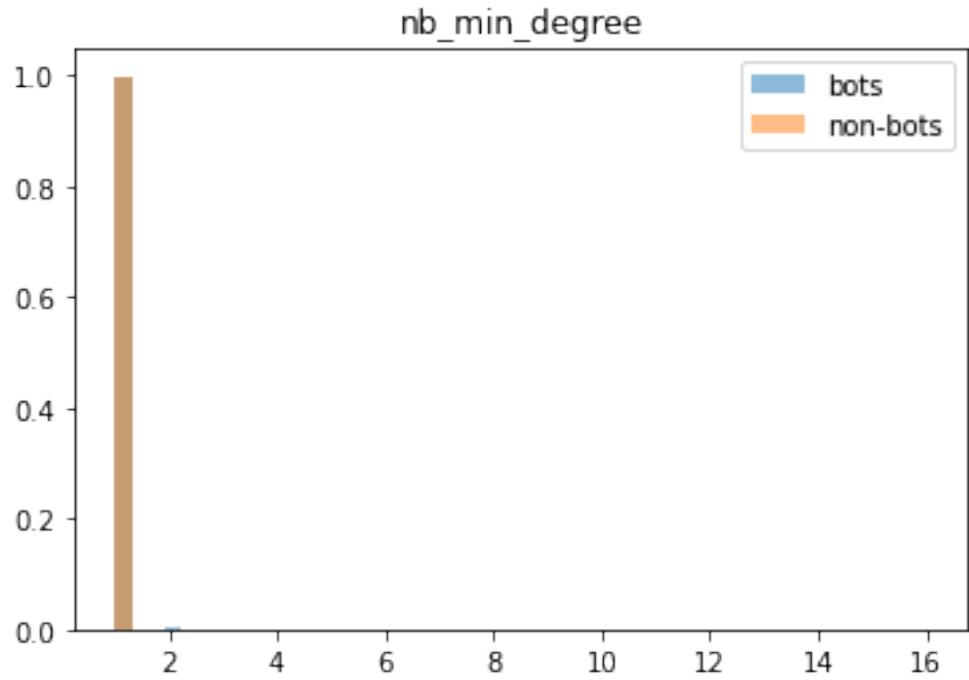


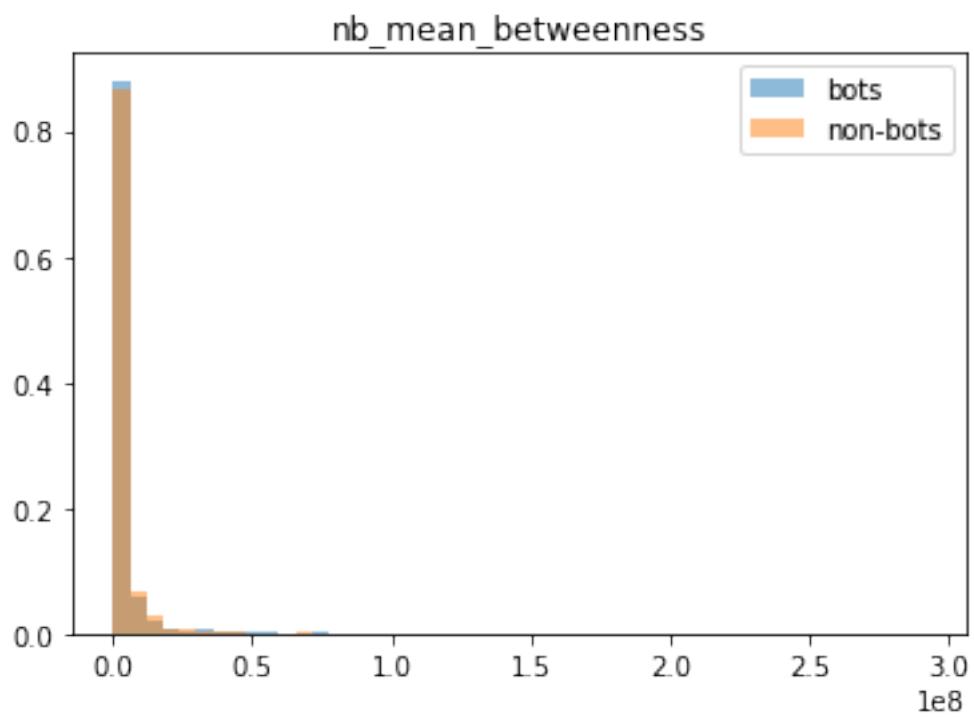
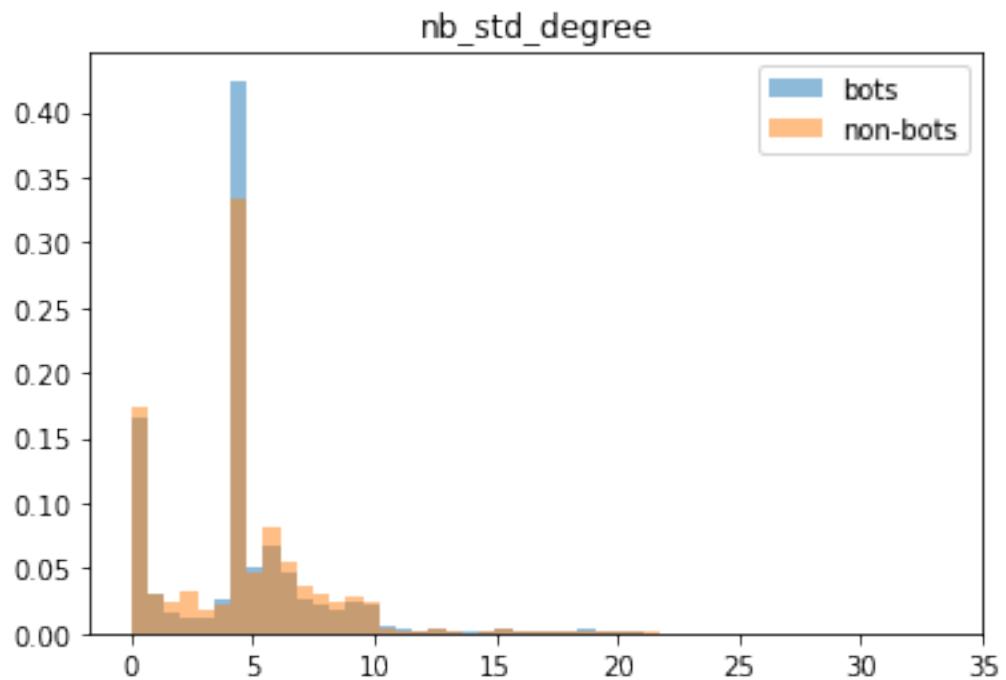
nb_mean_pagerank

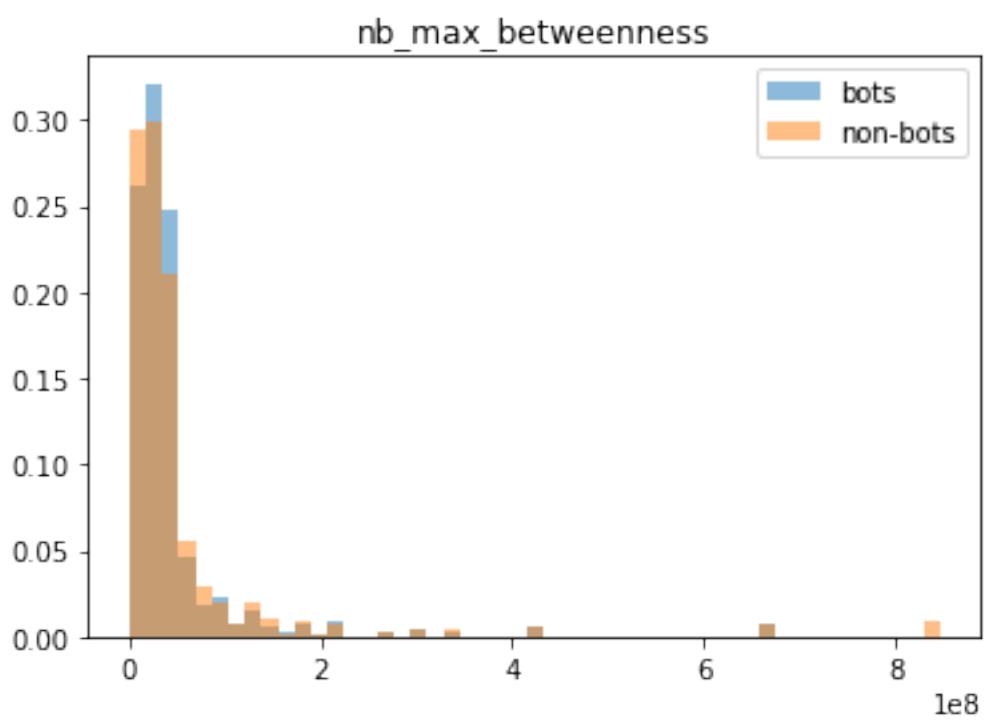
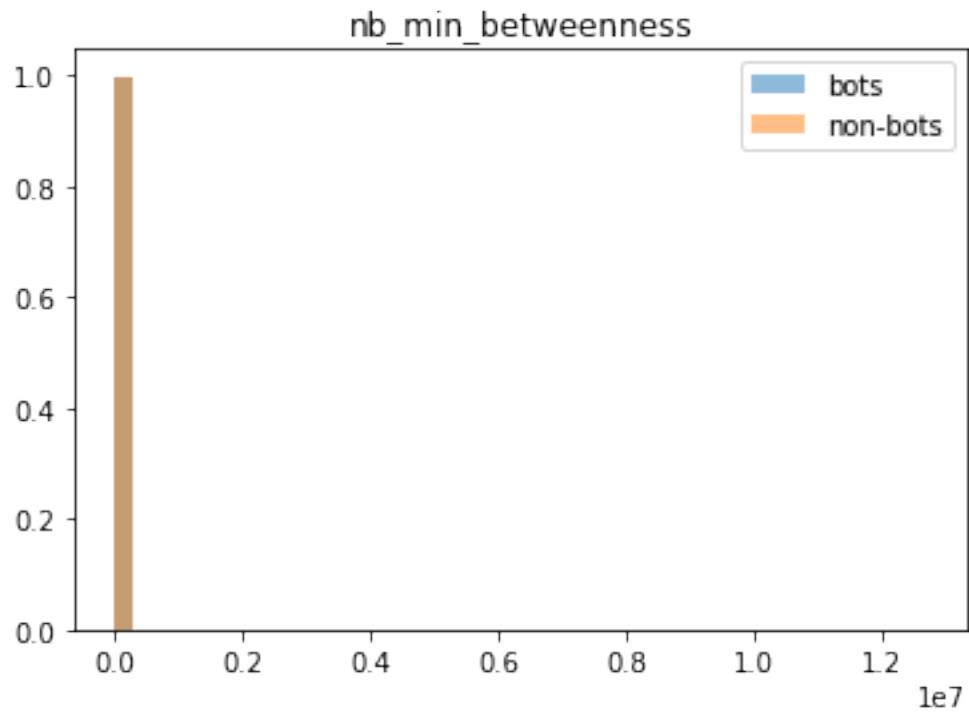


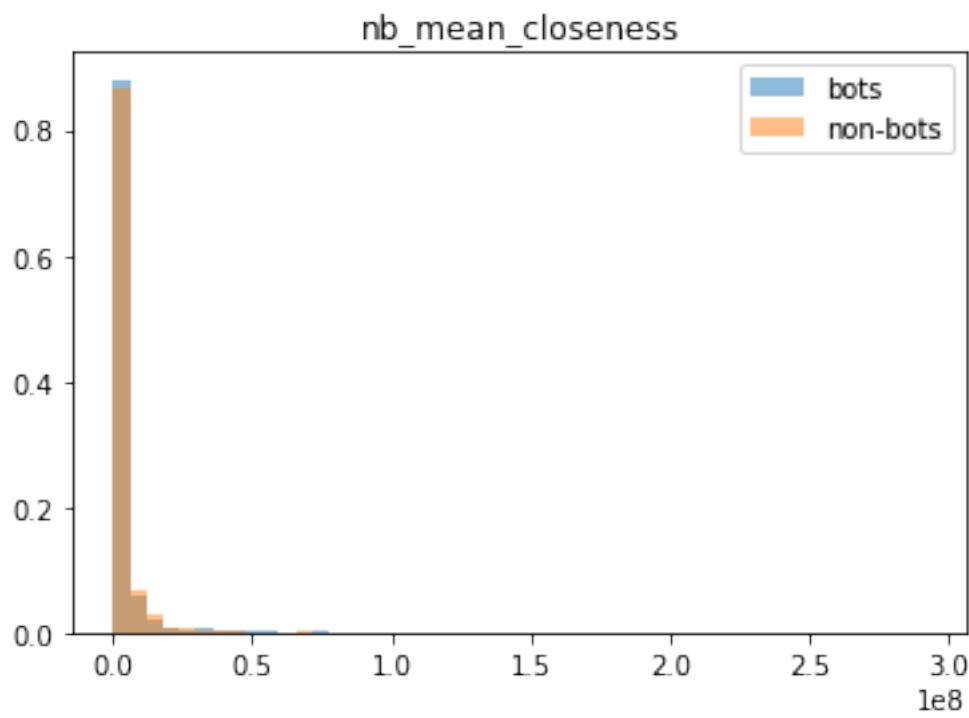
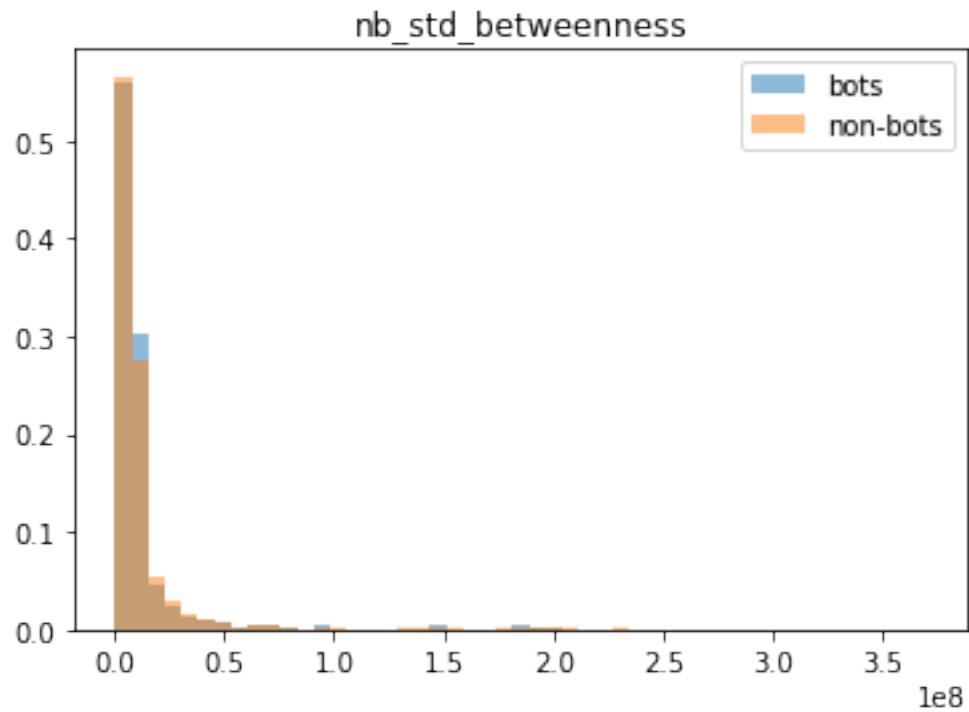


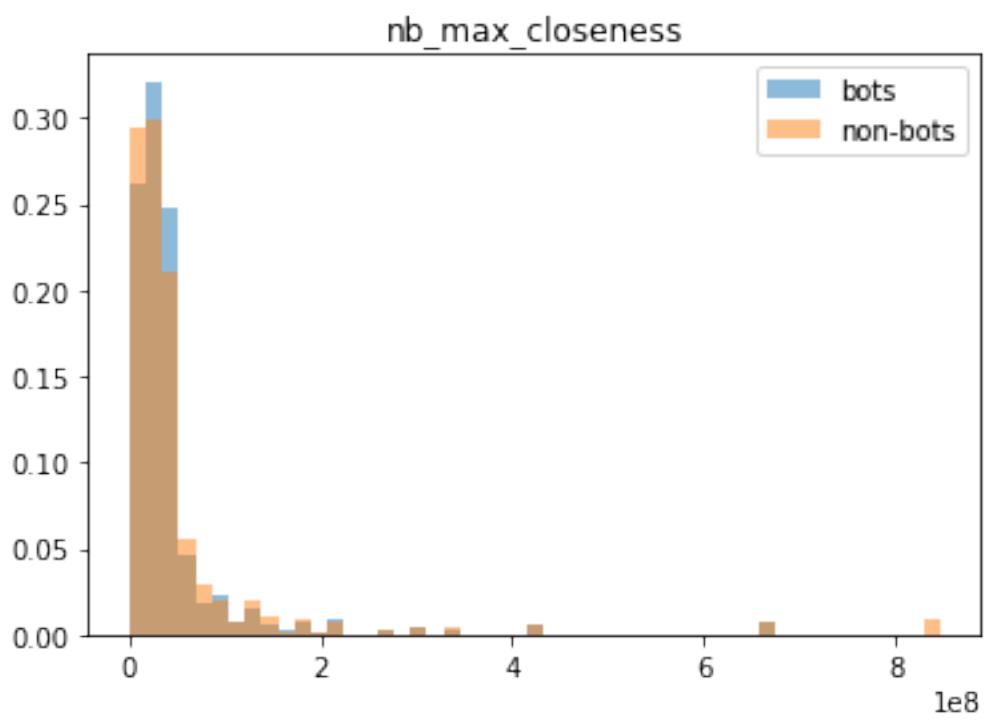
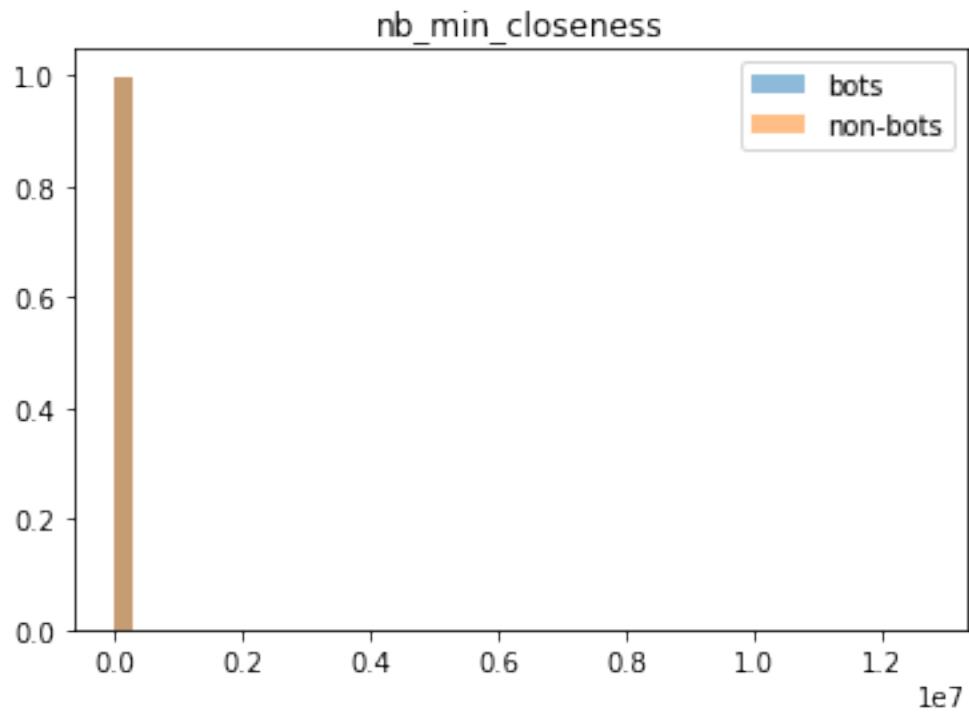


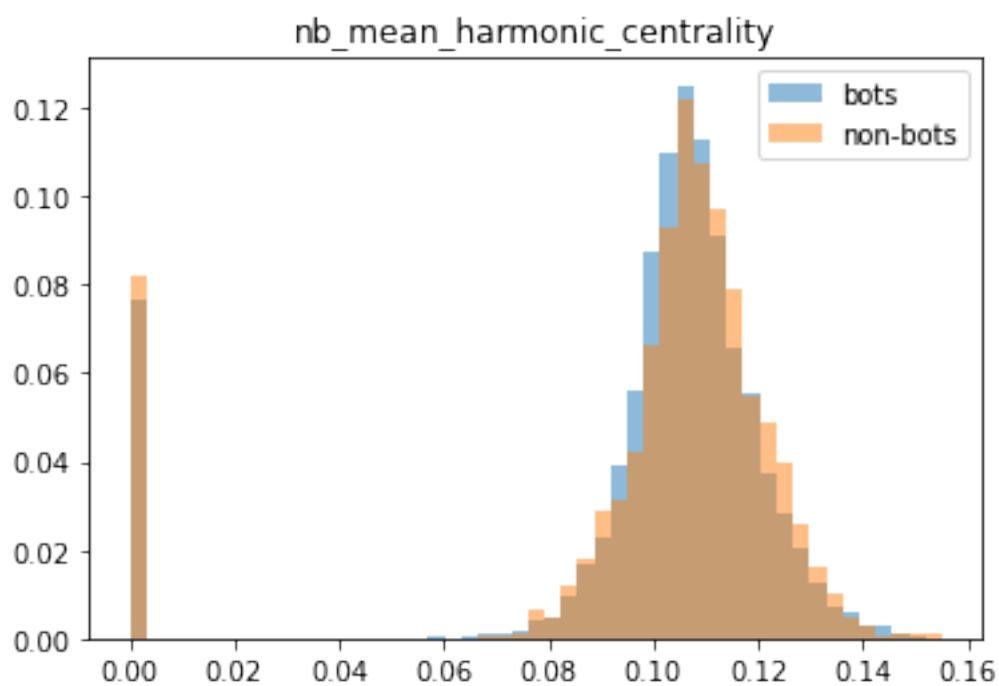
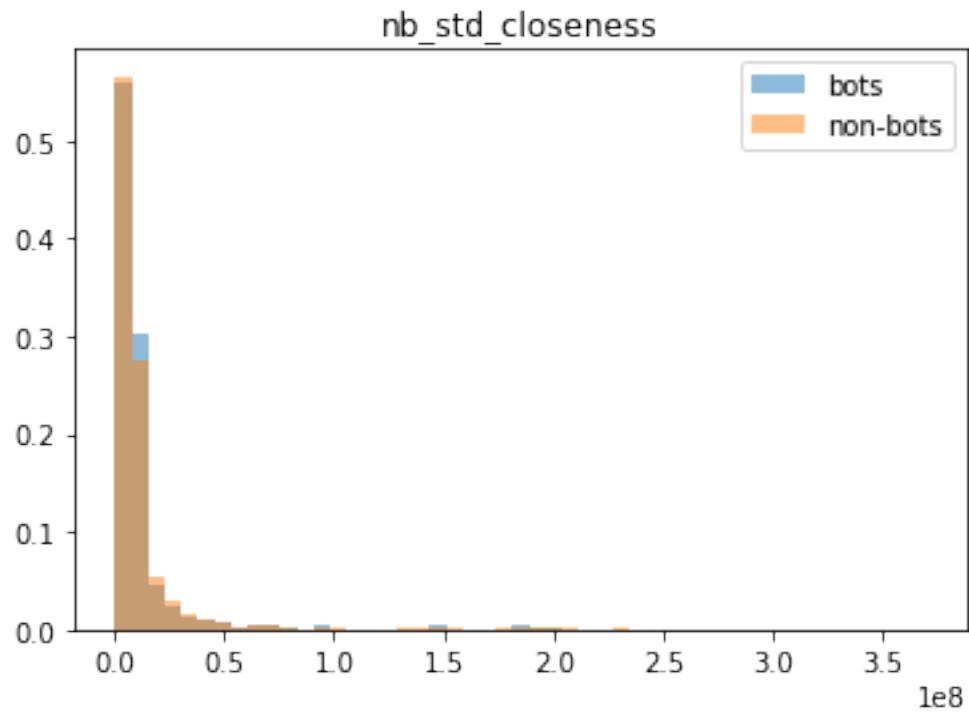




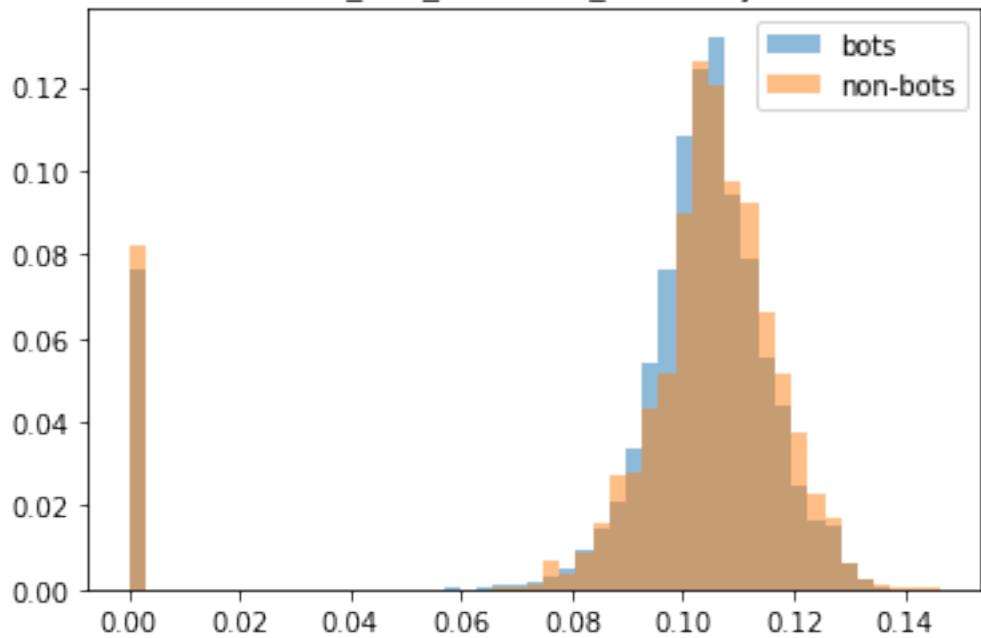




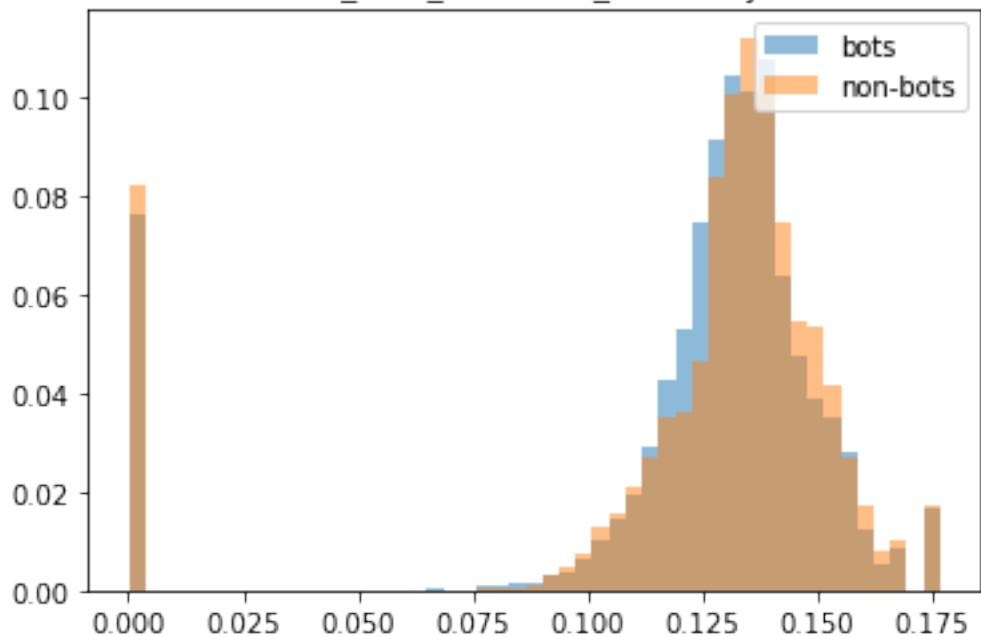




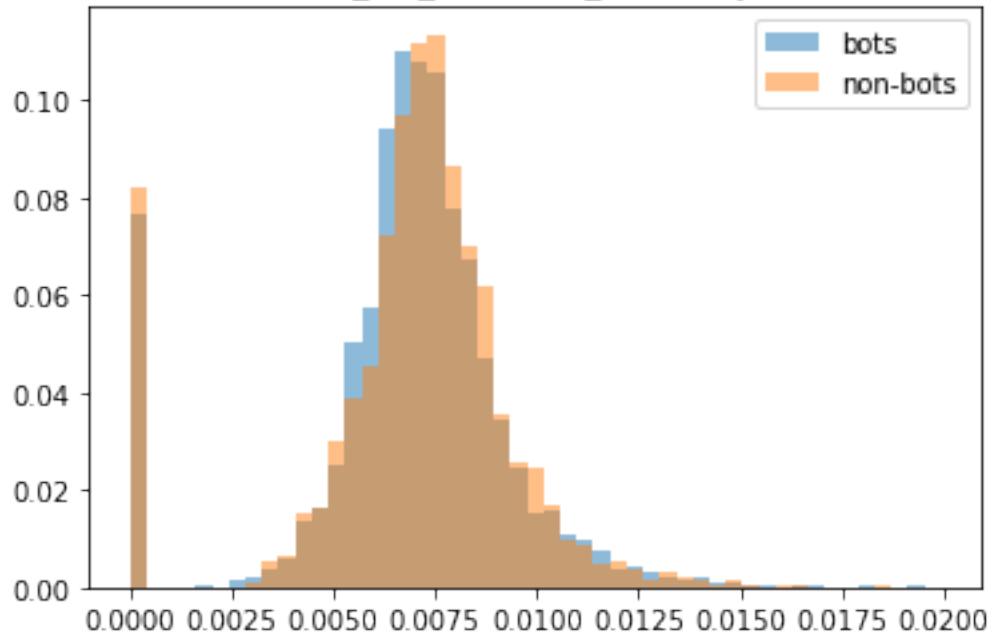
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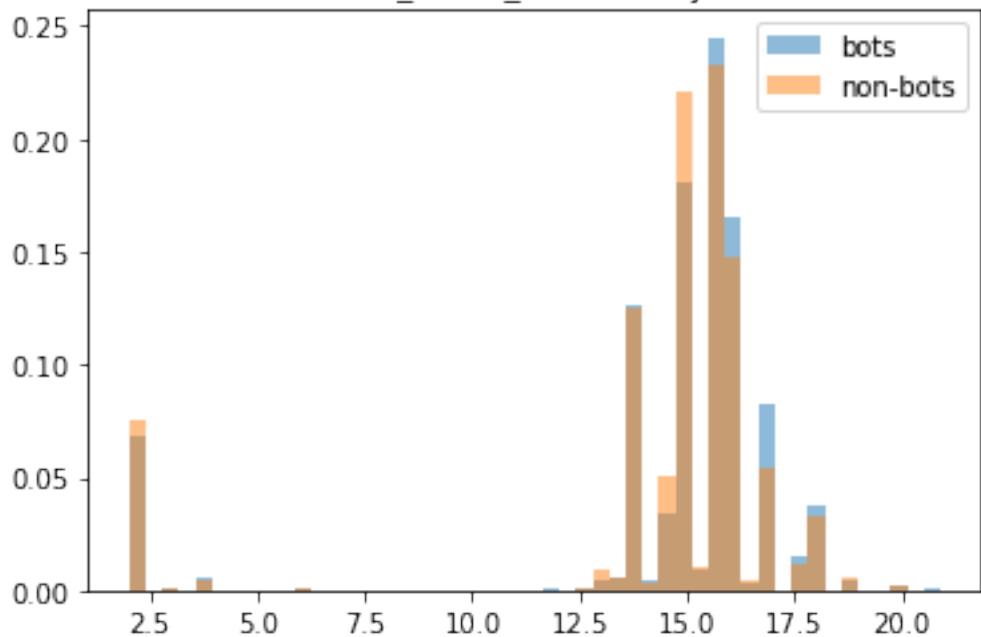
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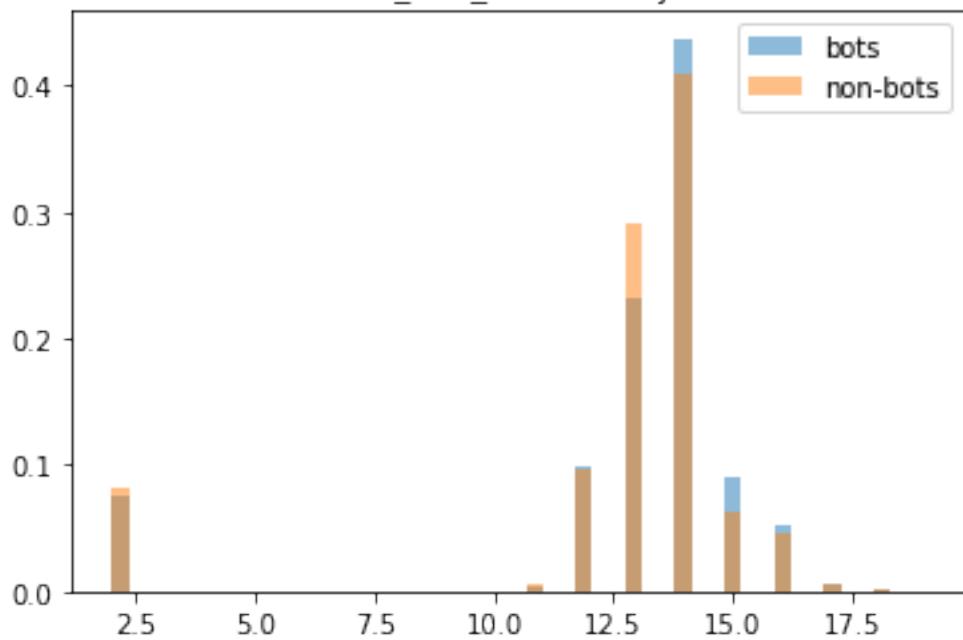
nb_std_harmonic_centrality



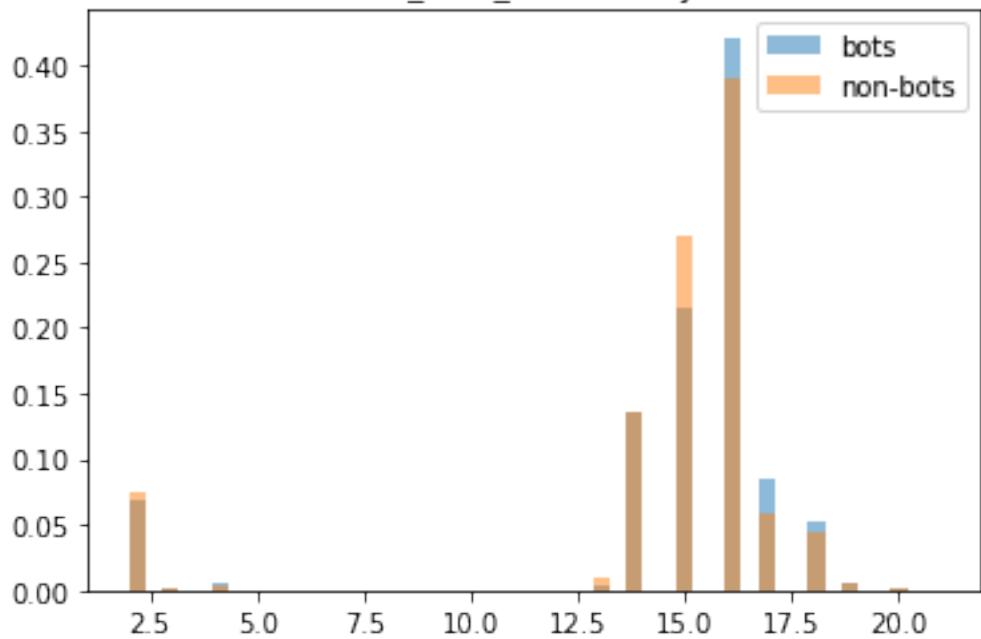
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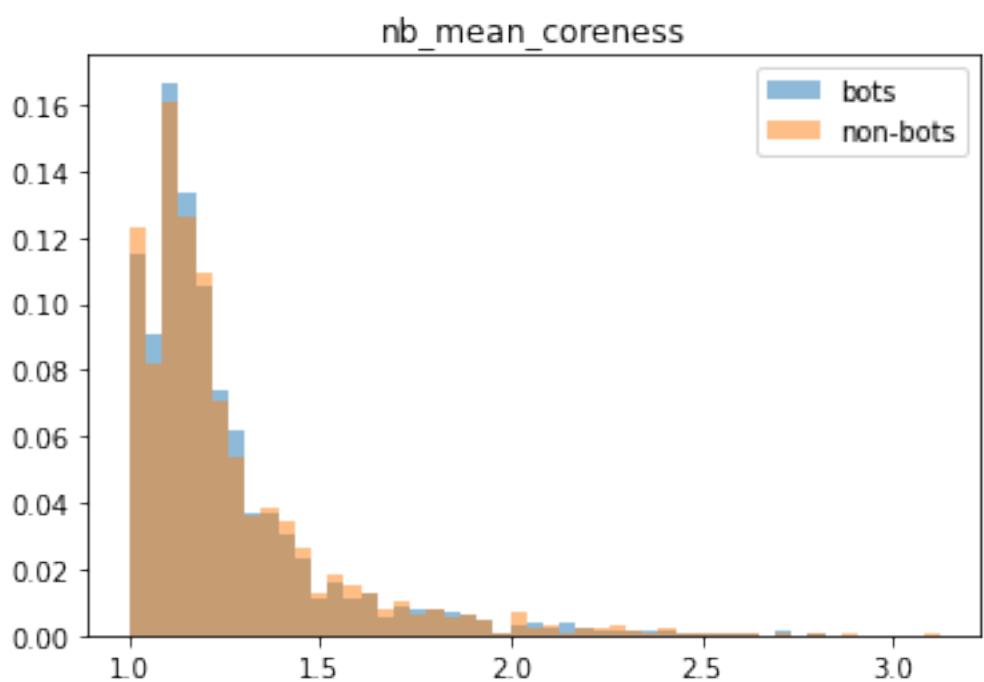
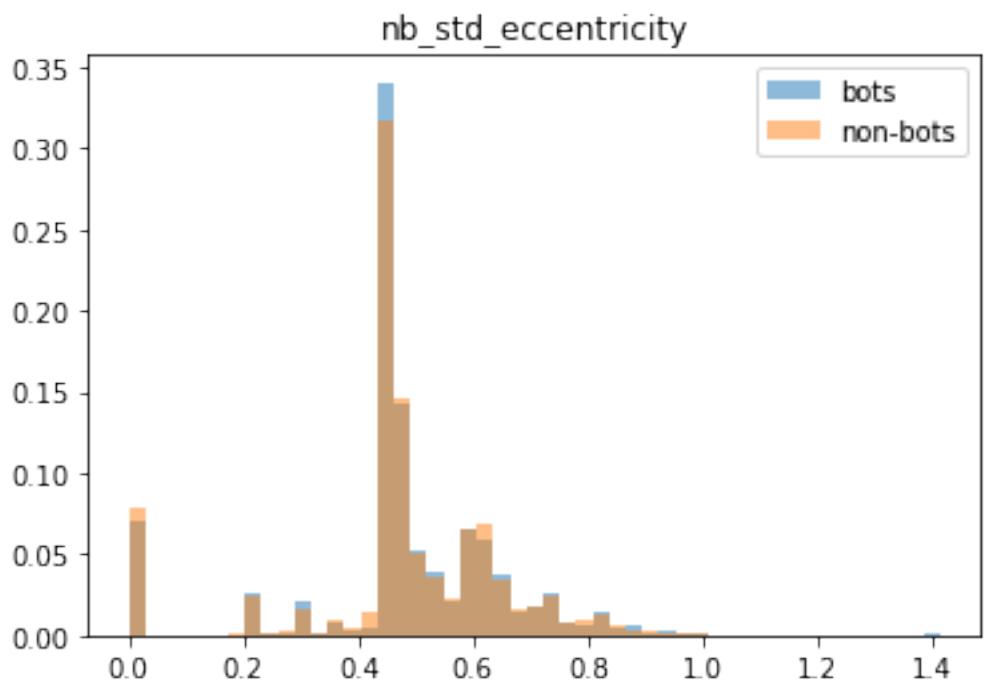


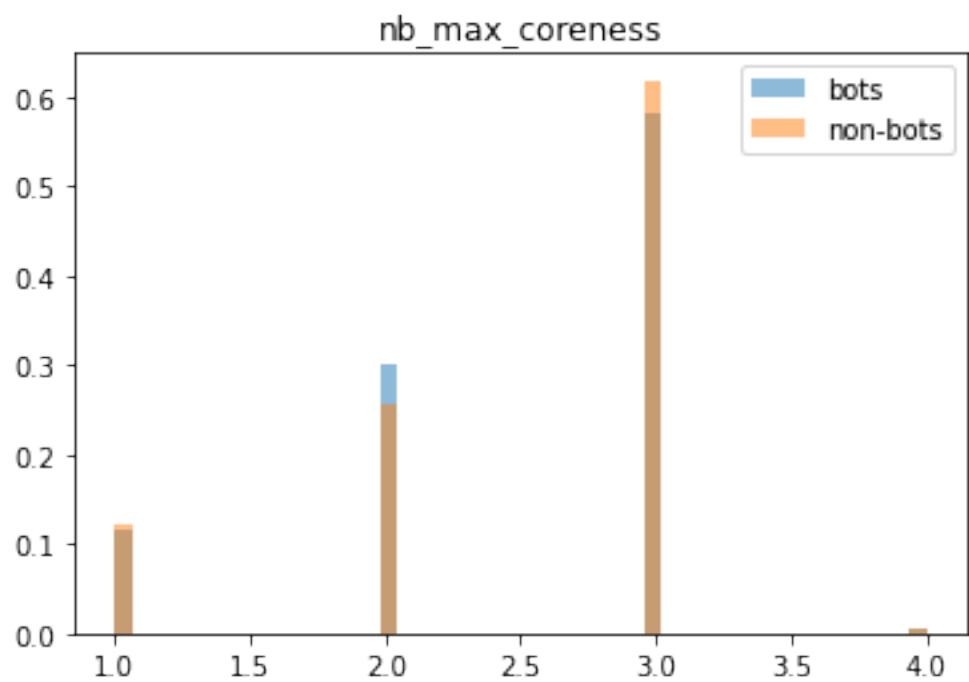
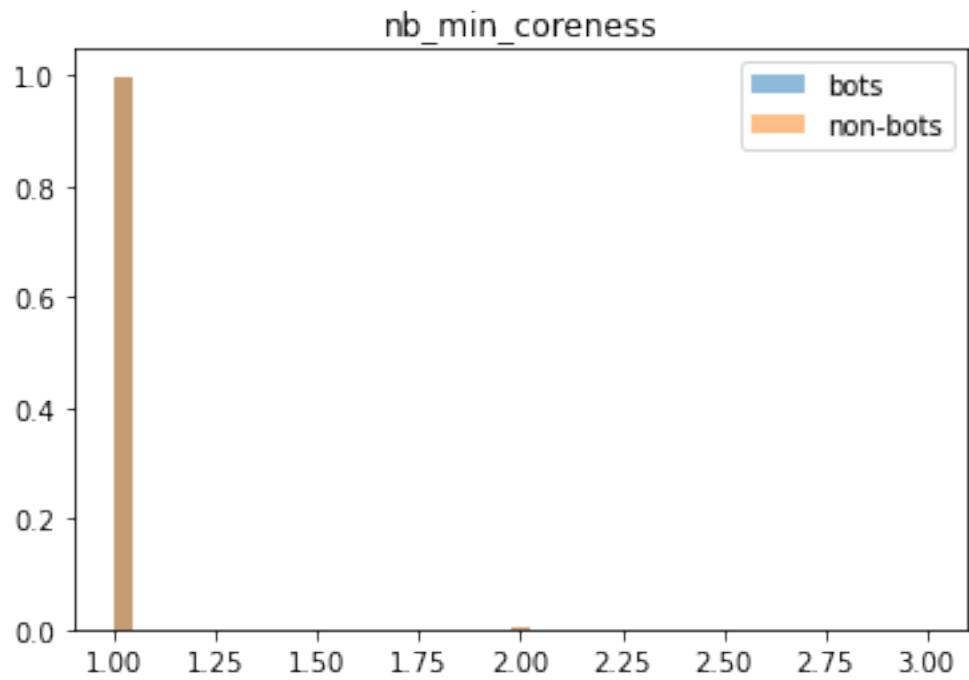
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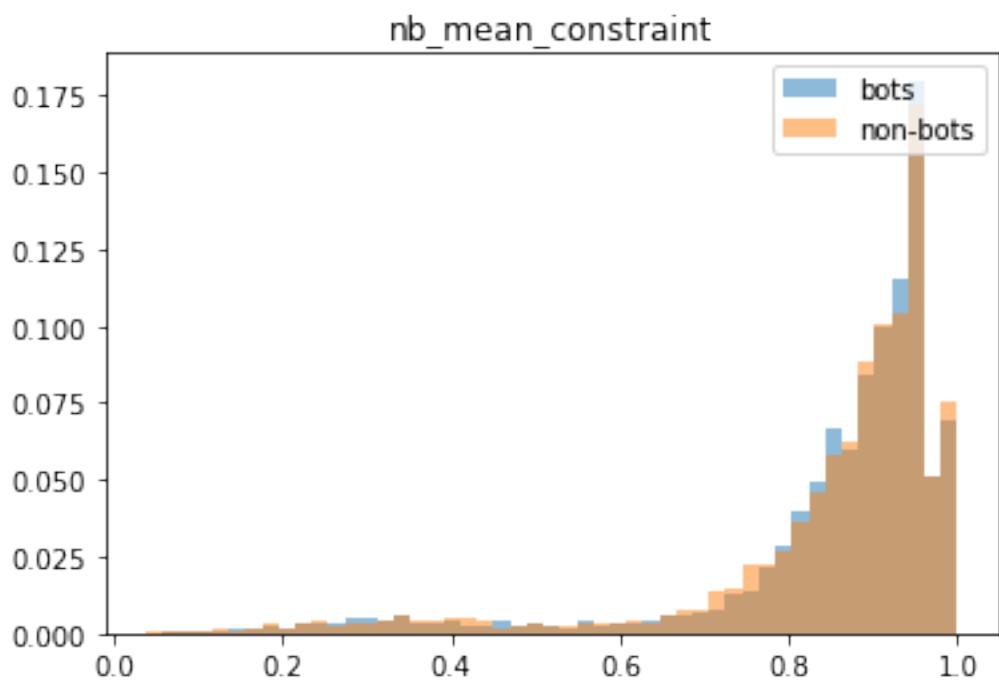
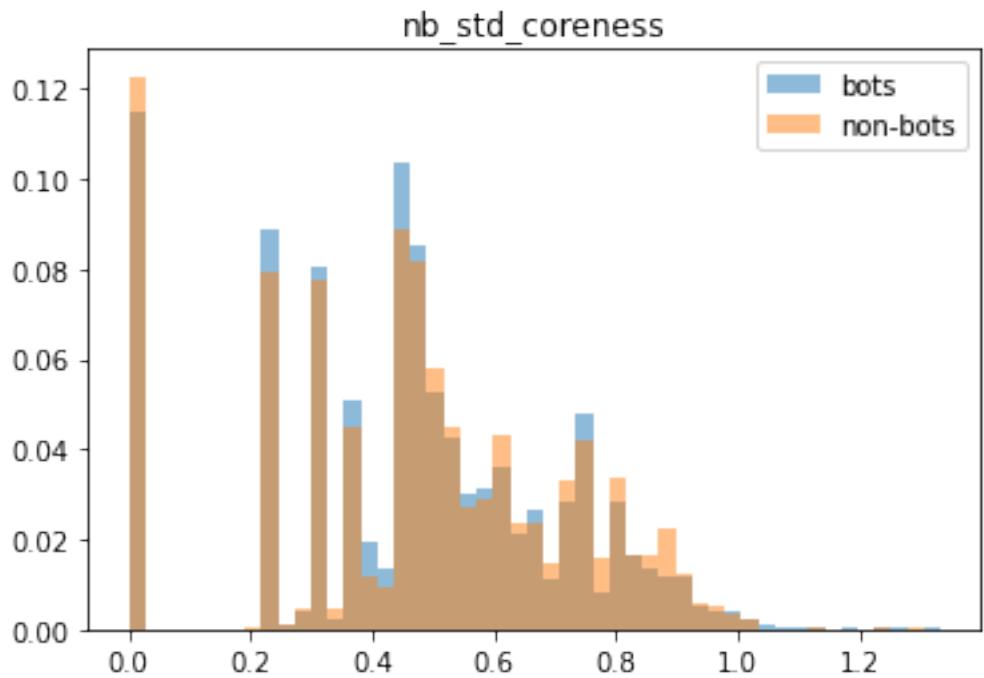


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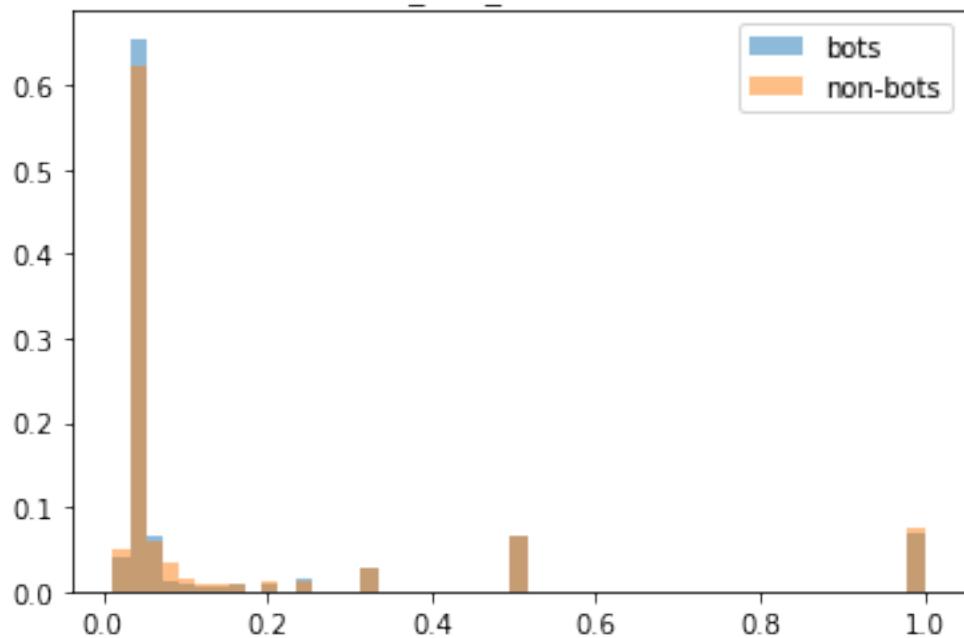




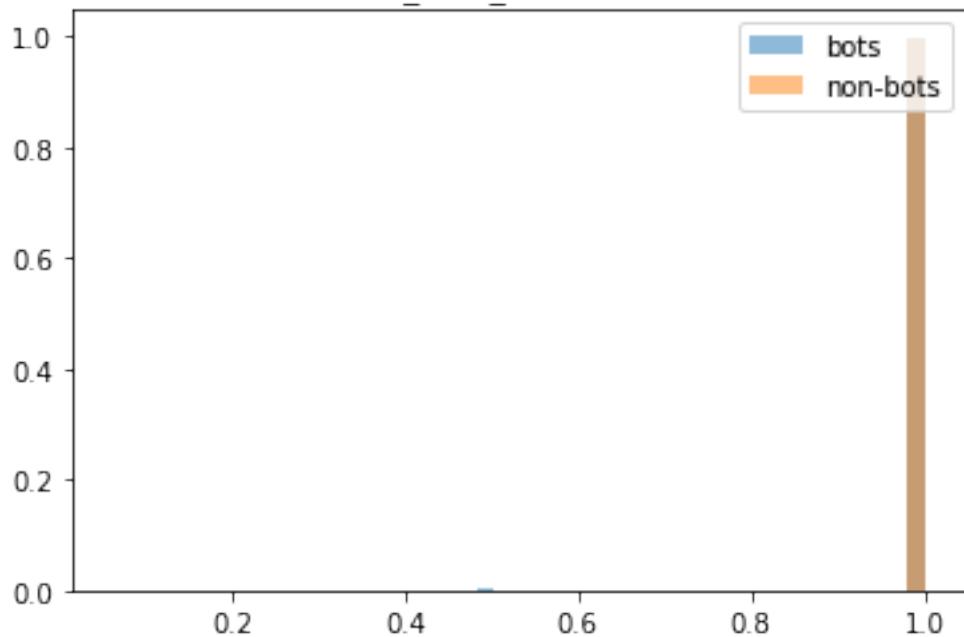


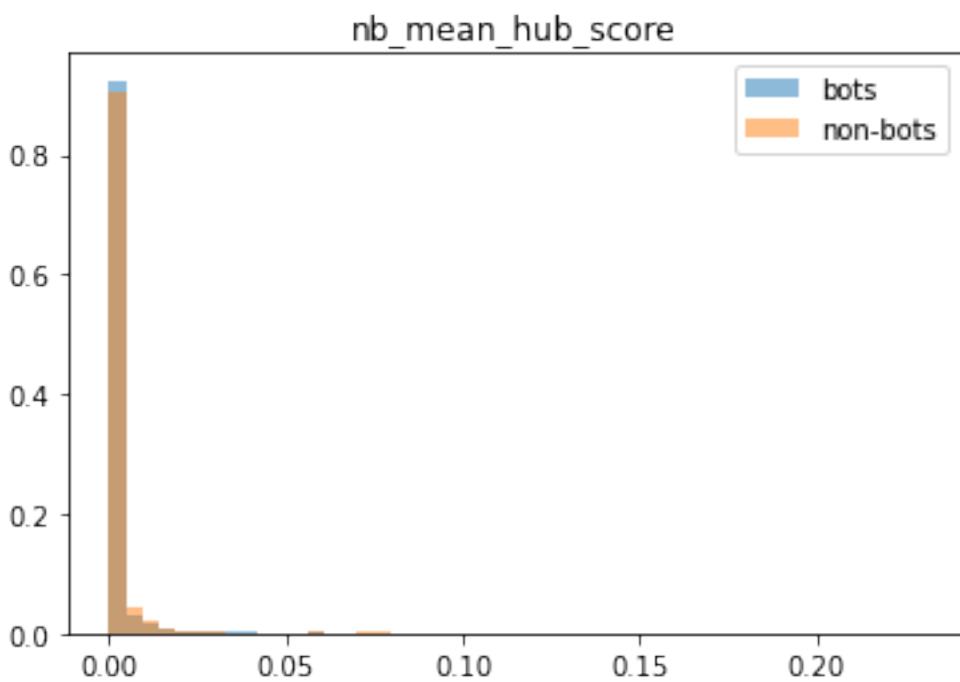
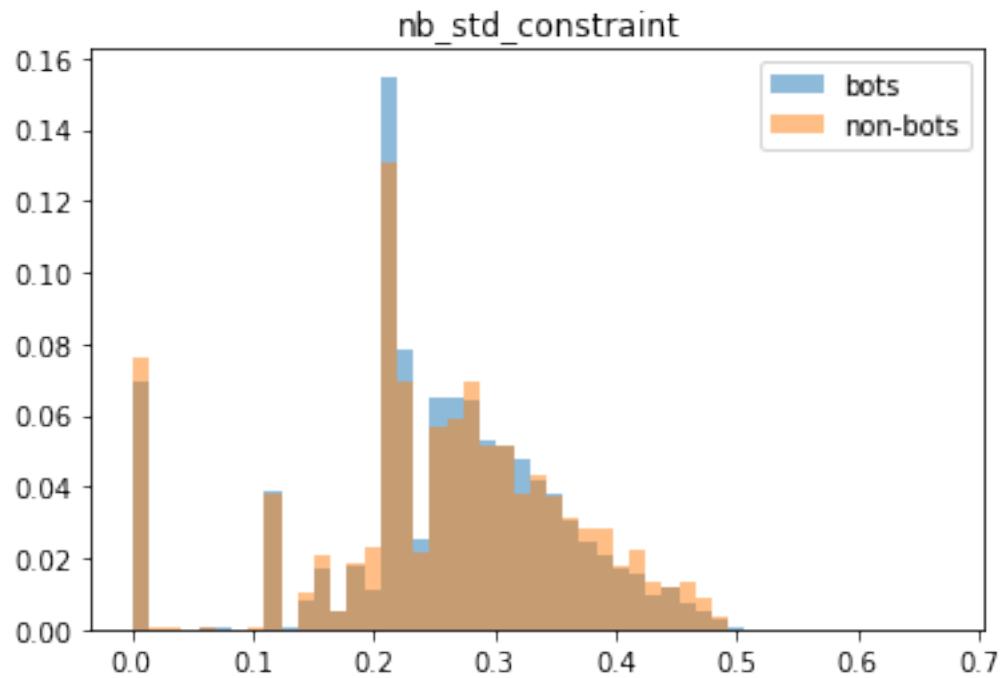


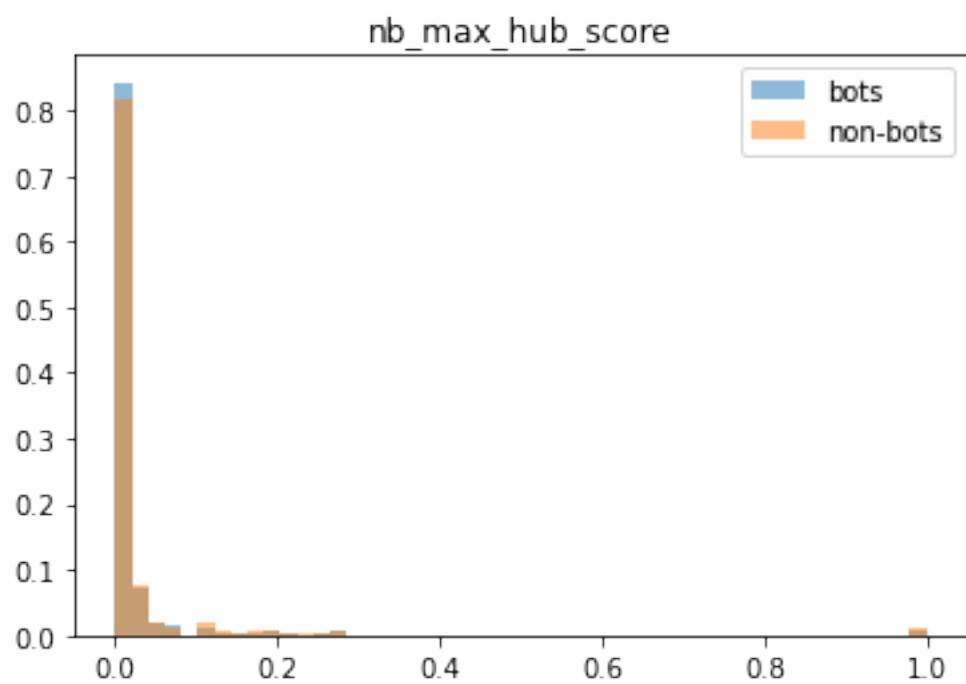
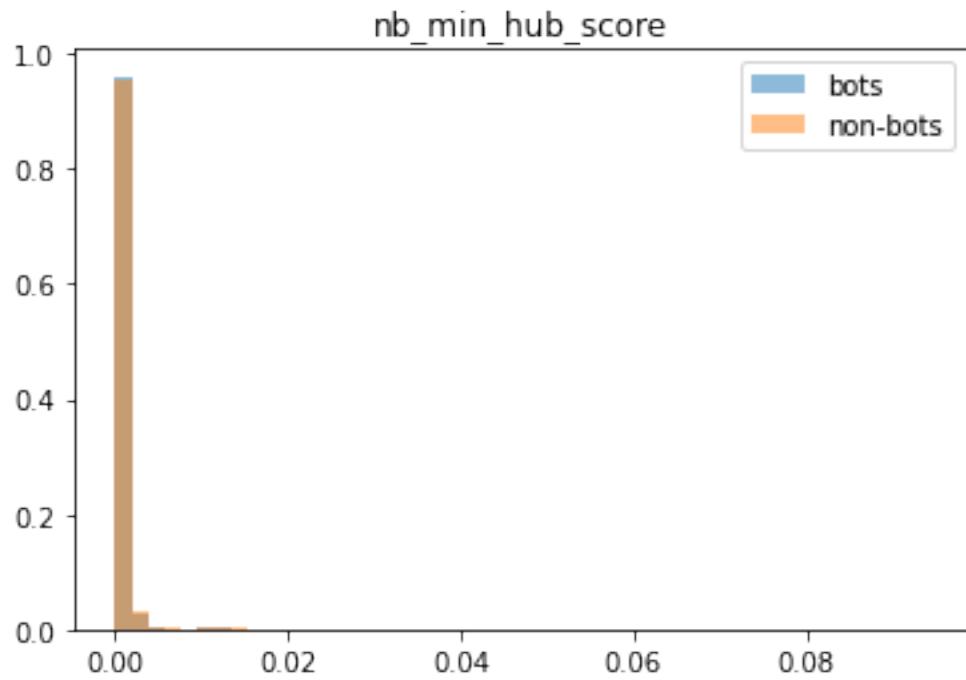
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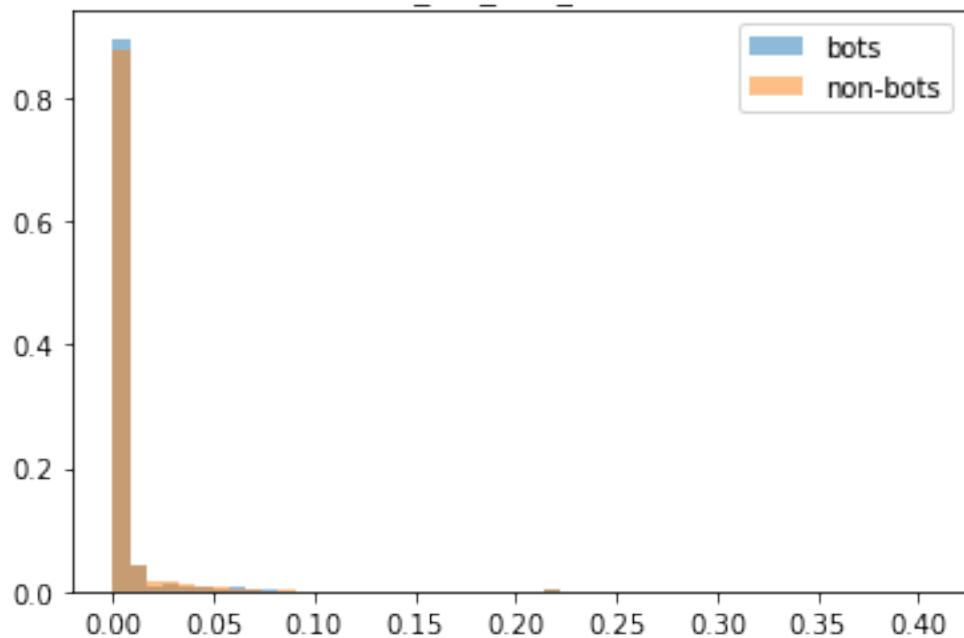
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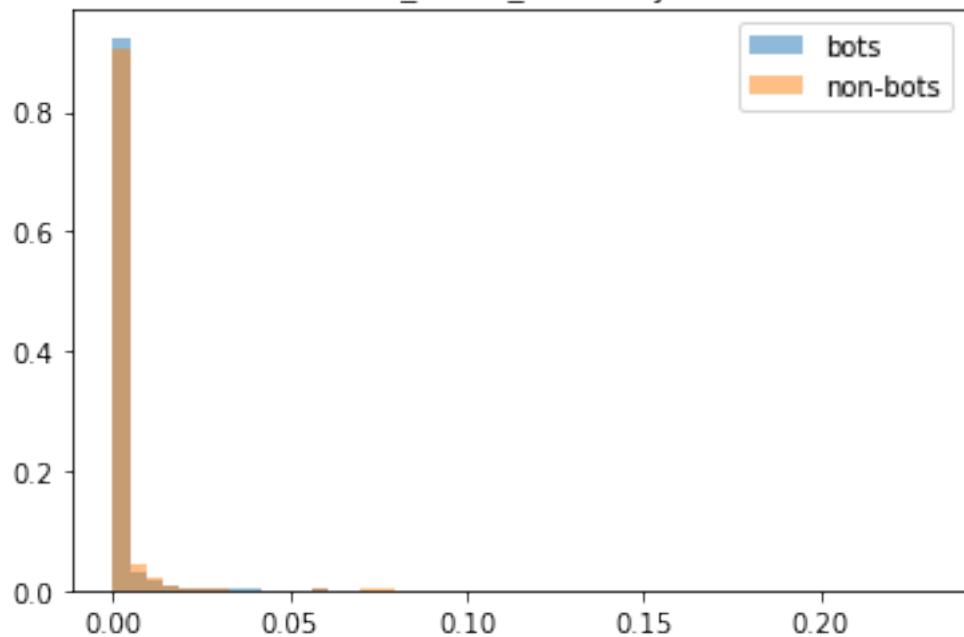


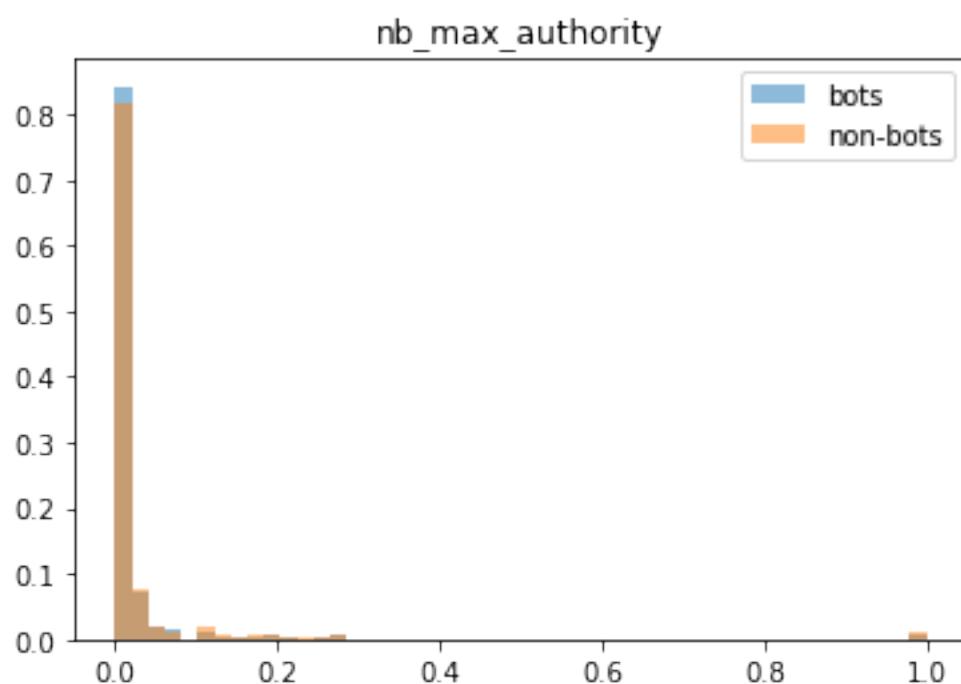
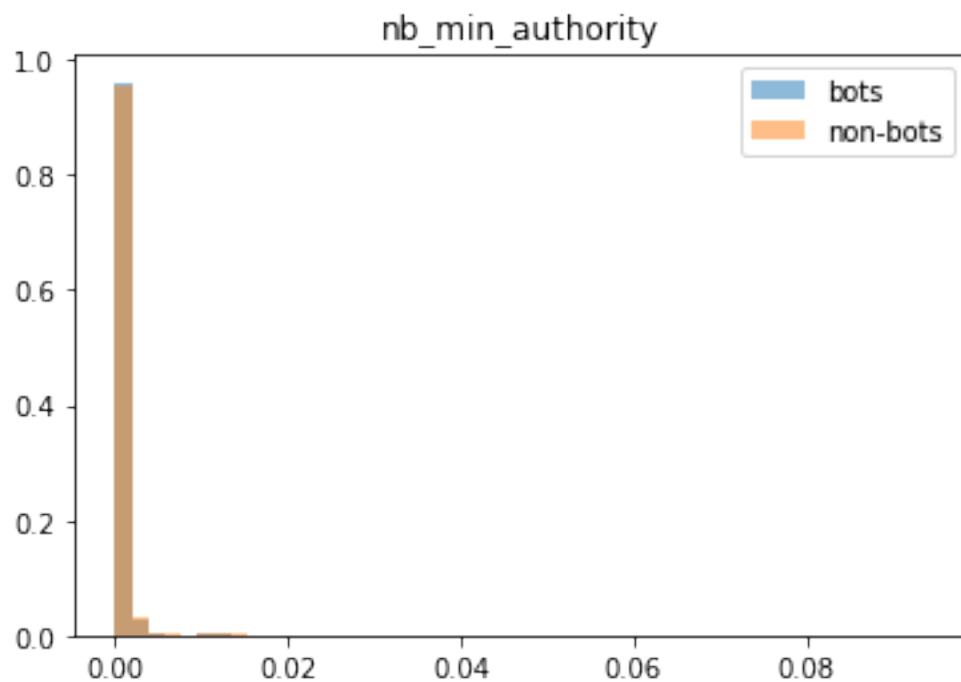


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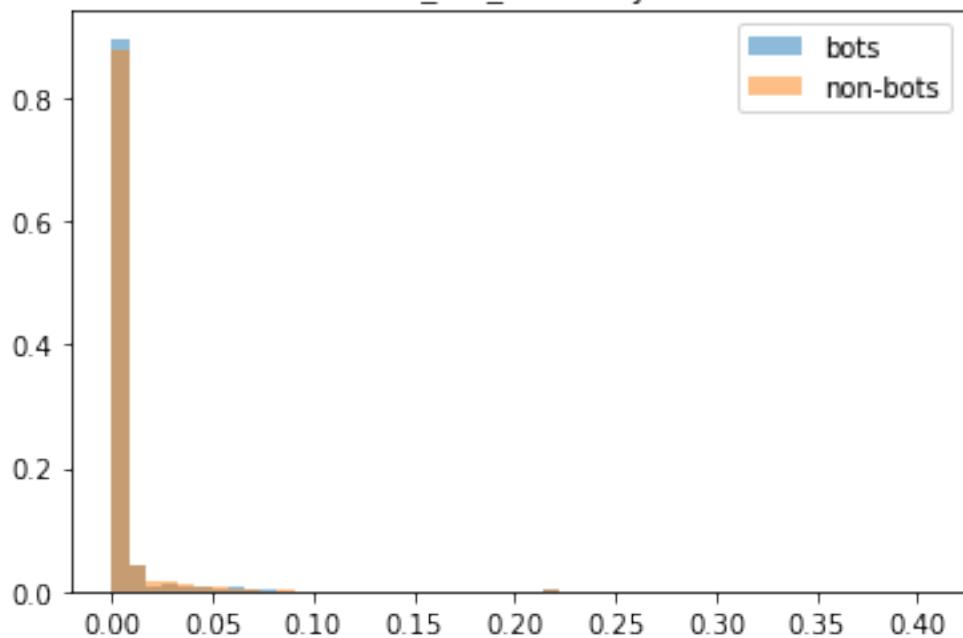


nb_mean_authority

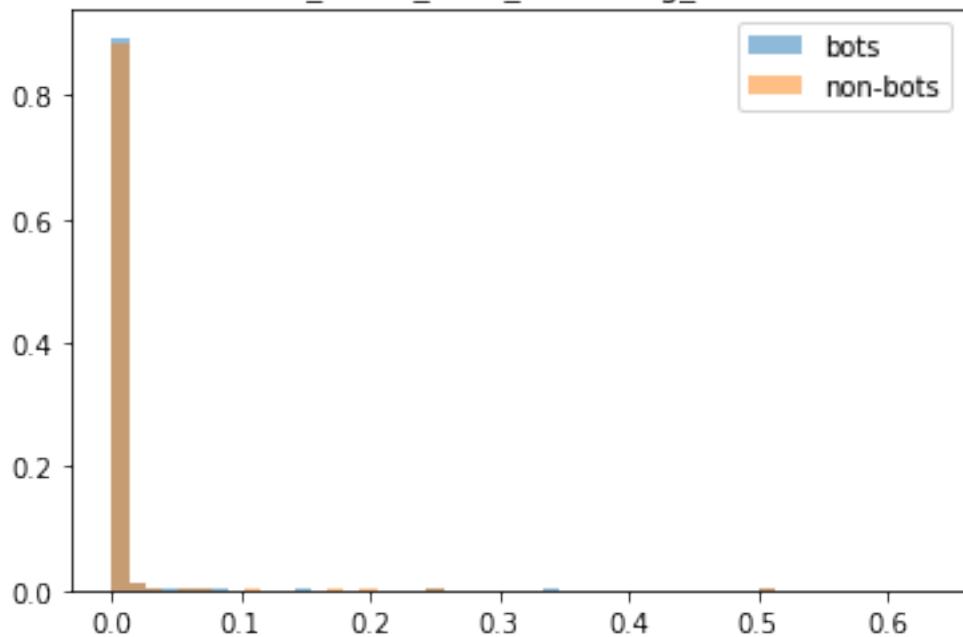




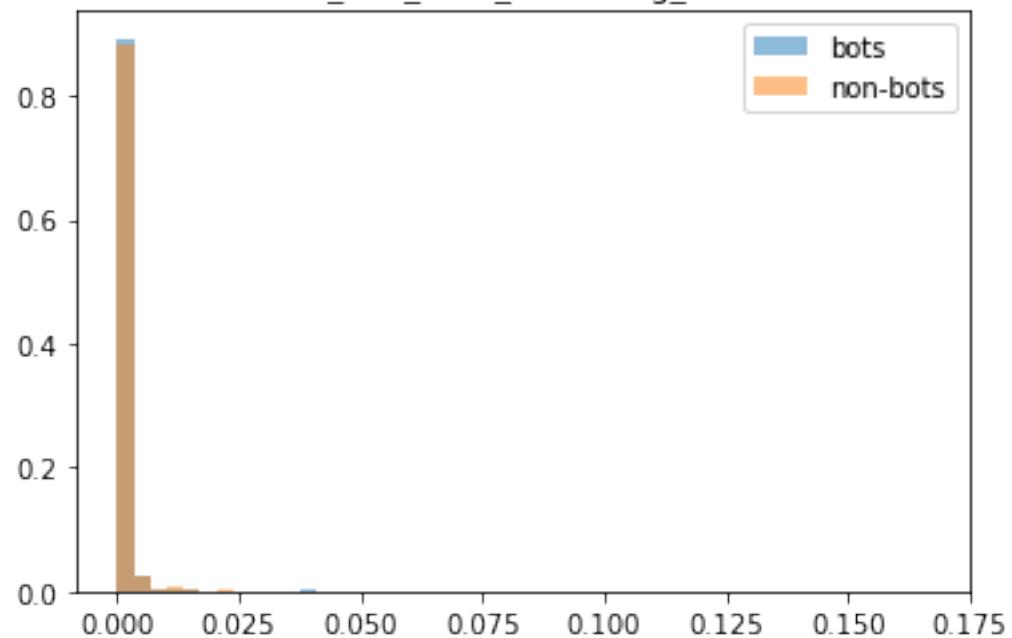
nb_std_authority



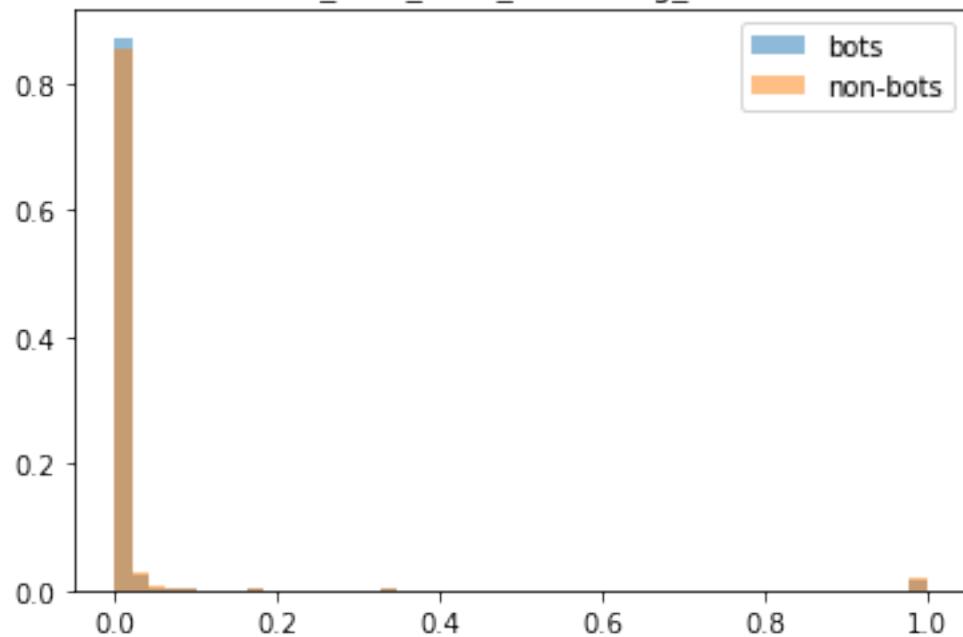
nb_mean_local_clustering_coef



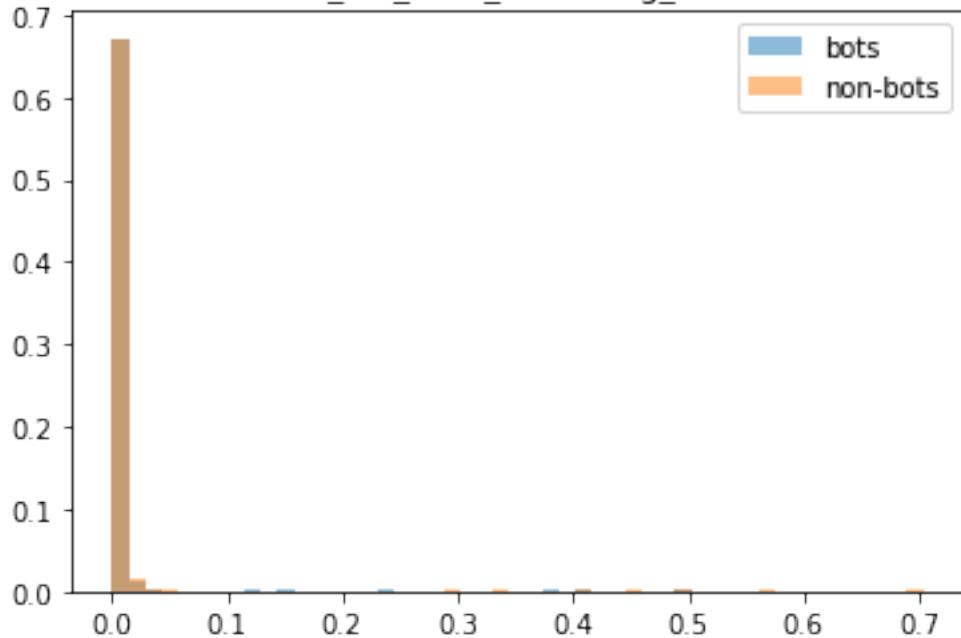
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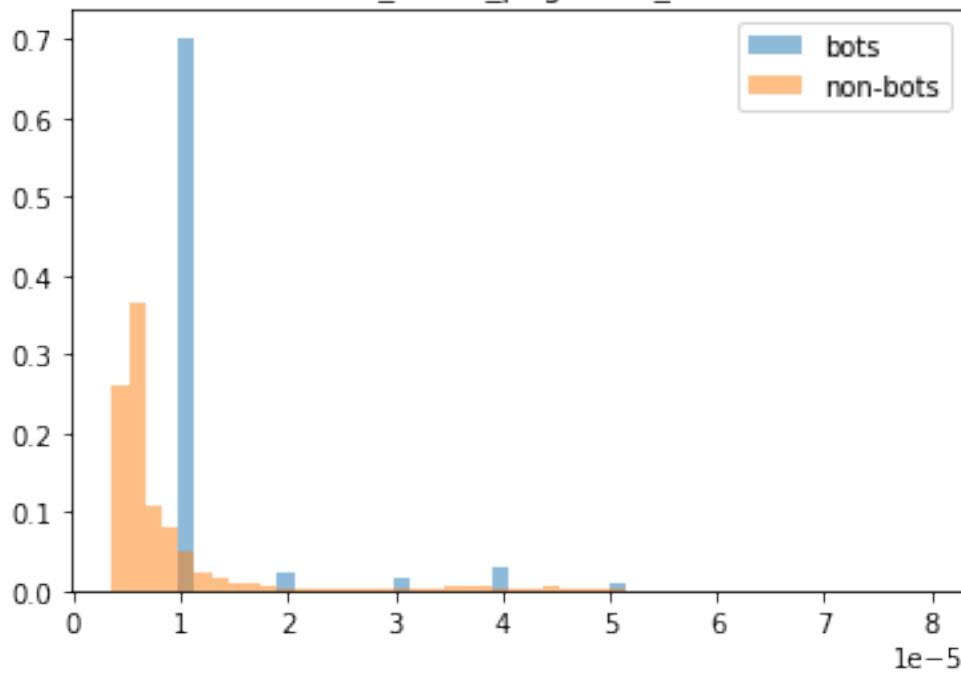
nb_max_local_clustering_coef



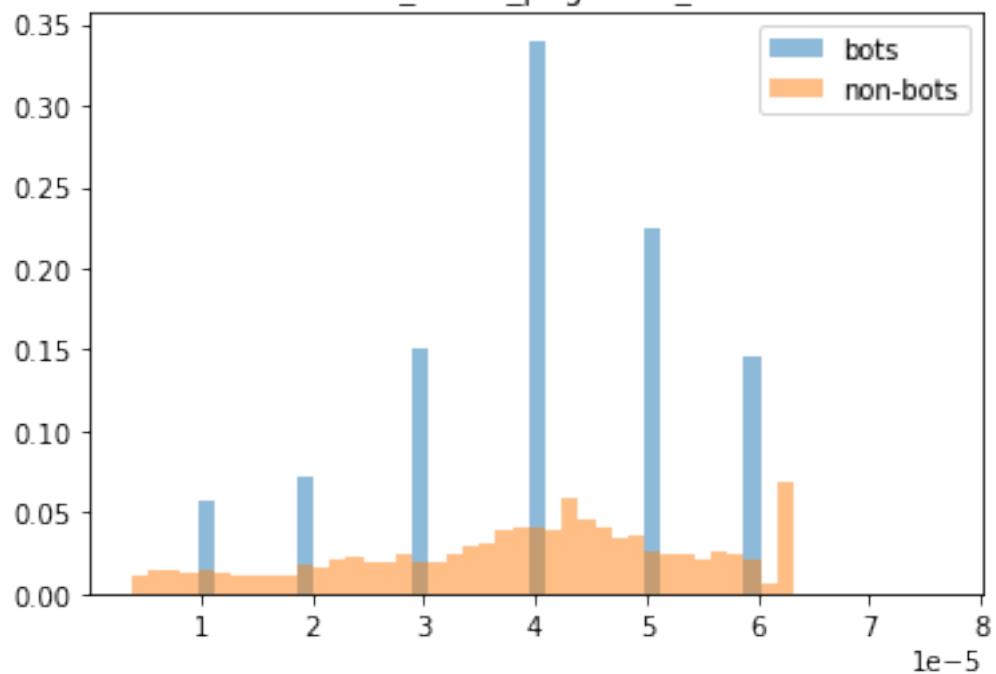
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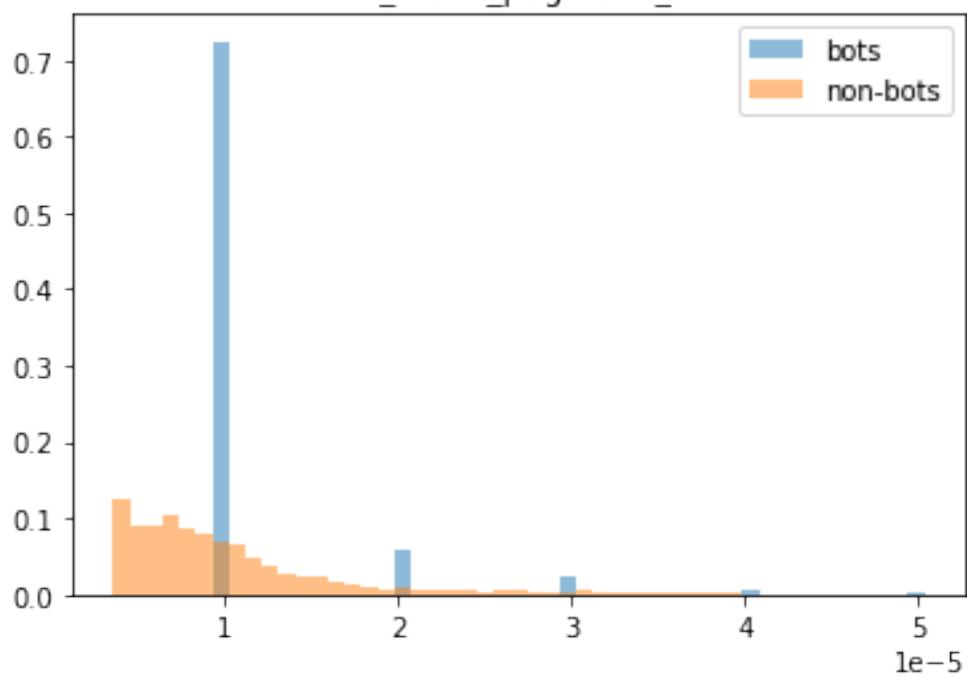
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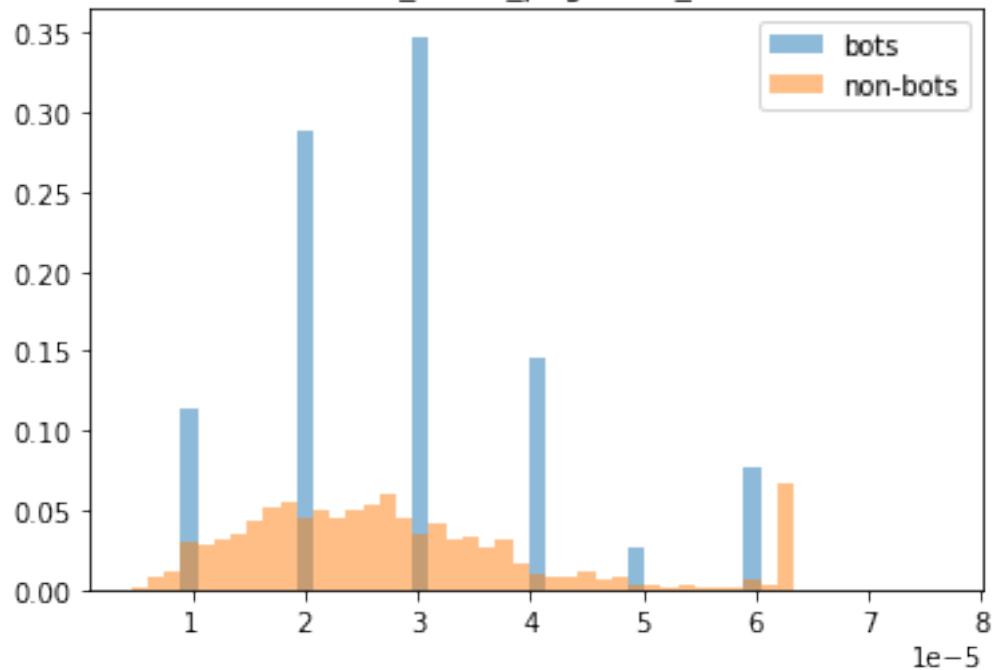
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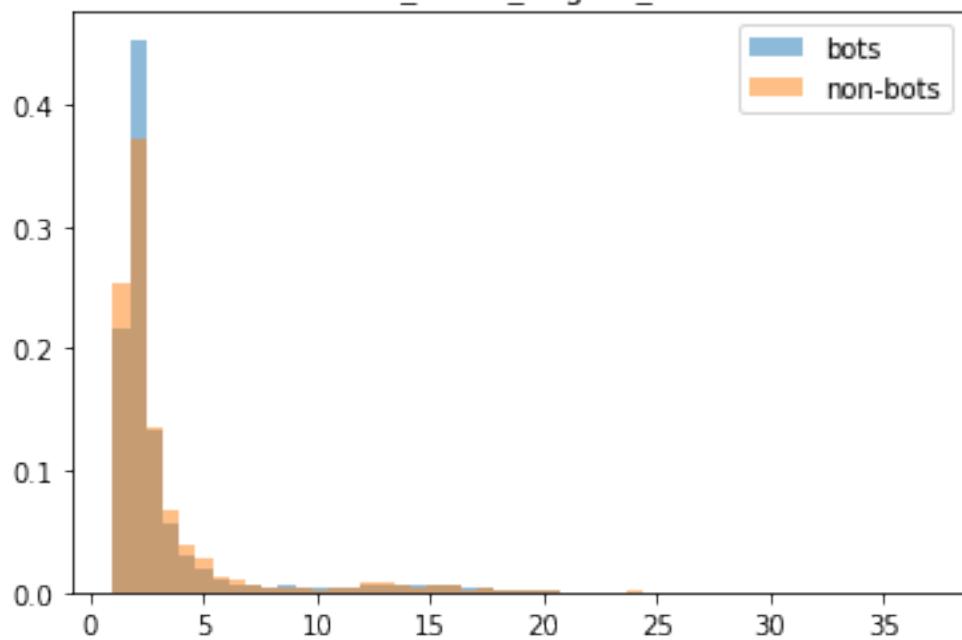
nb_mean_pagerank_3



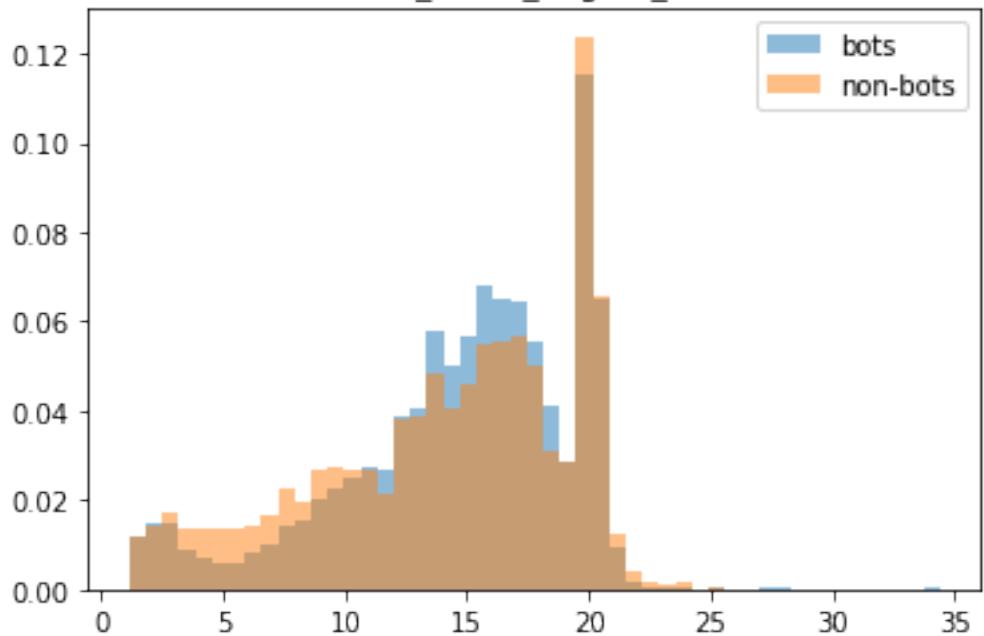
nb_mean_pagerank_4



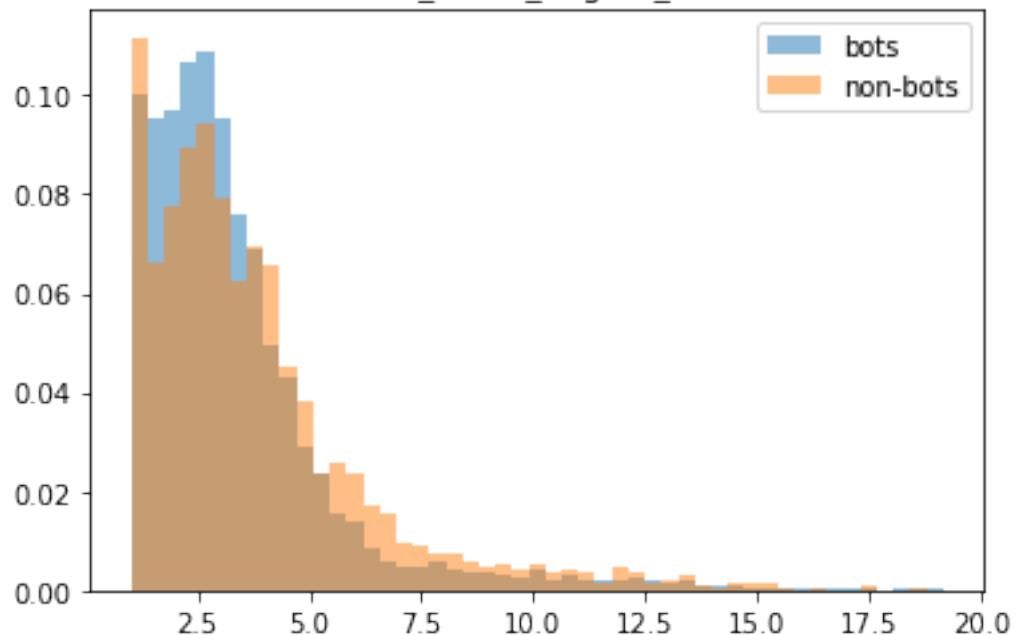
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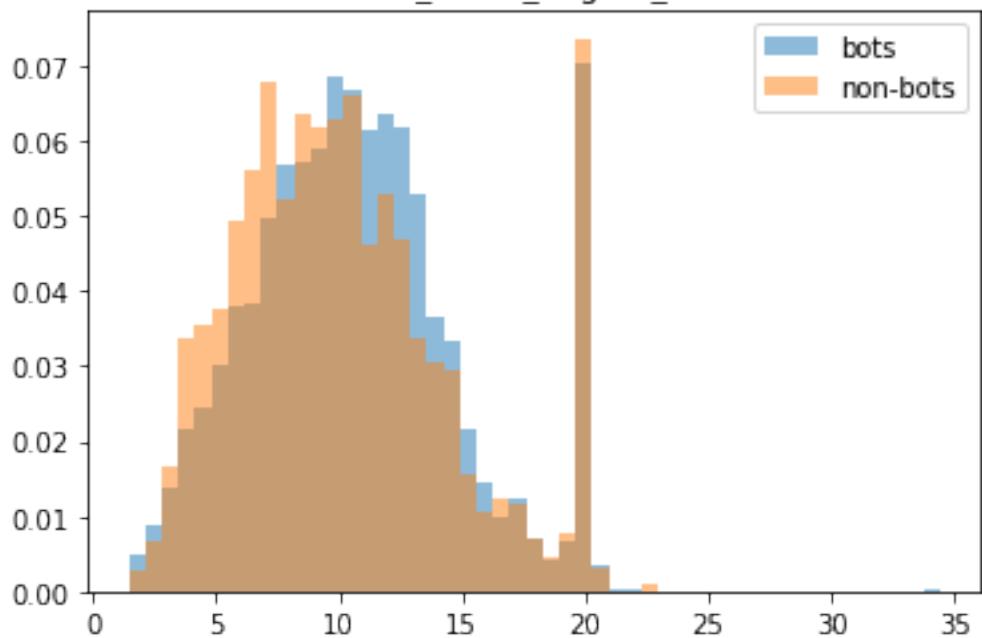
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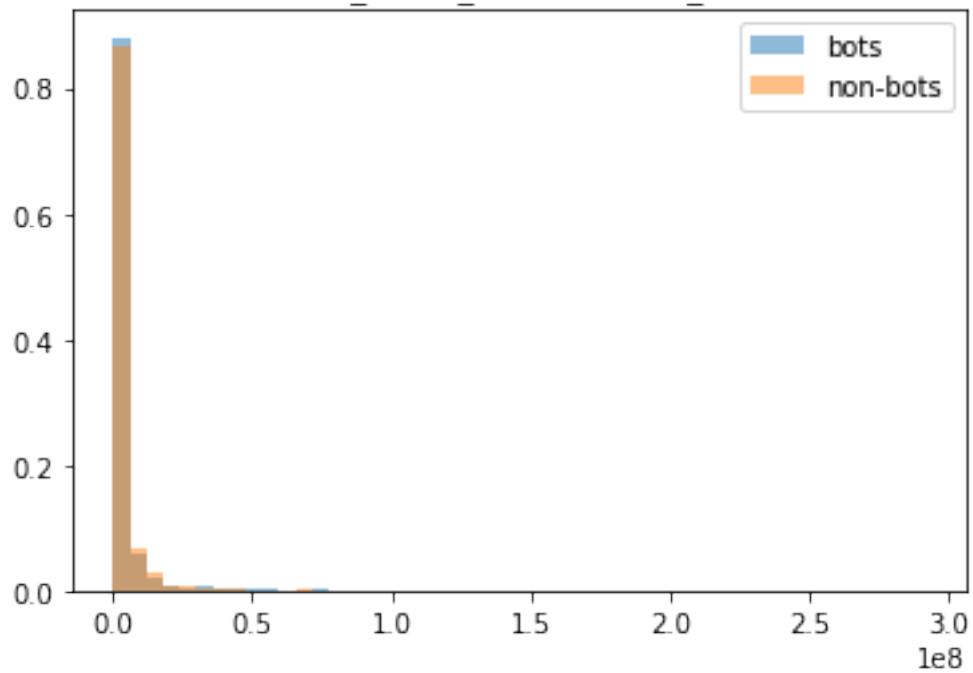
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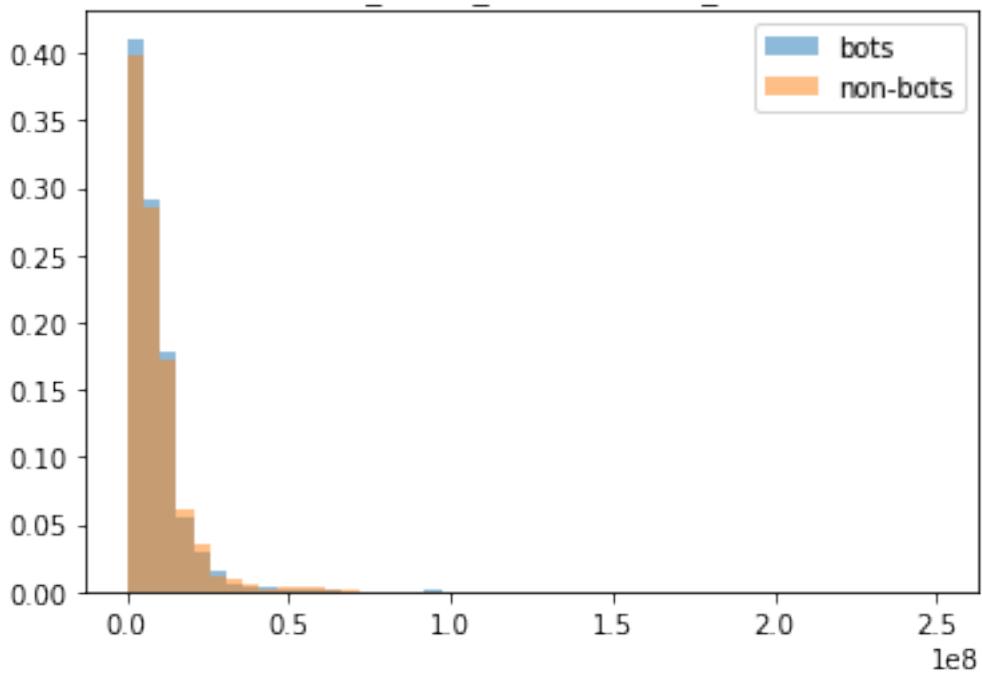
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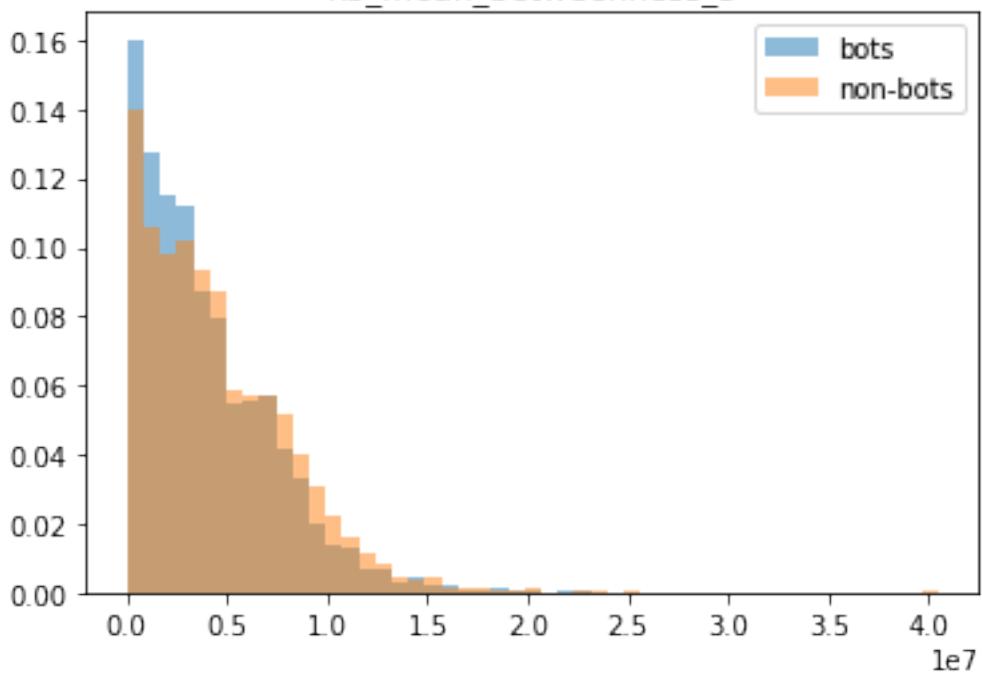
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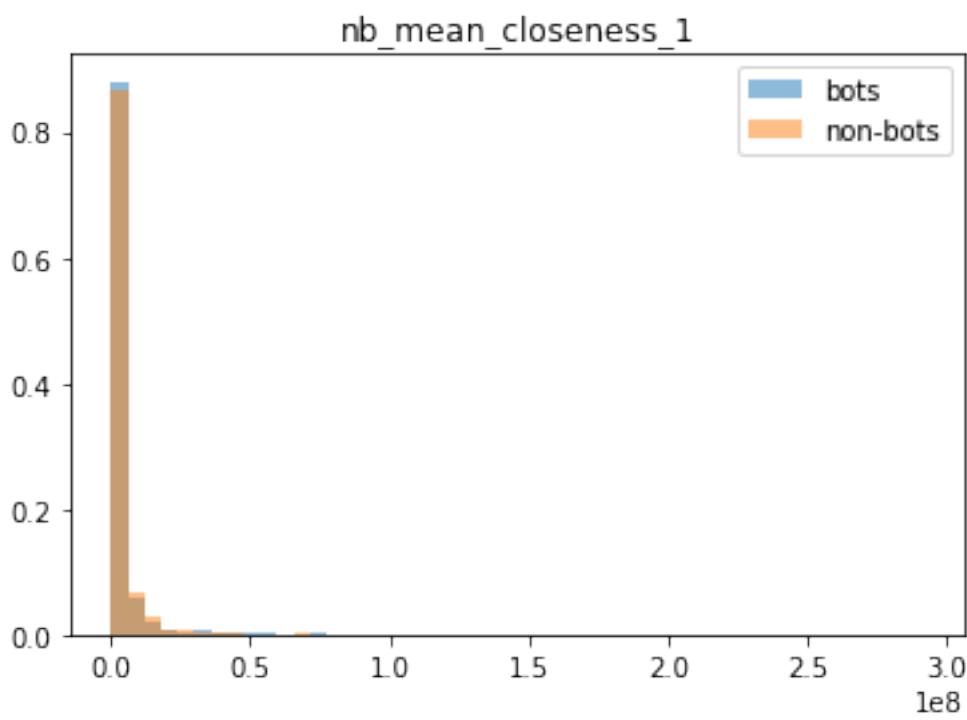
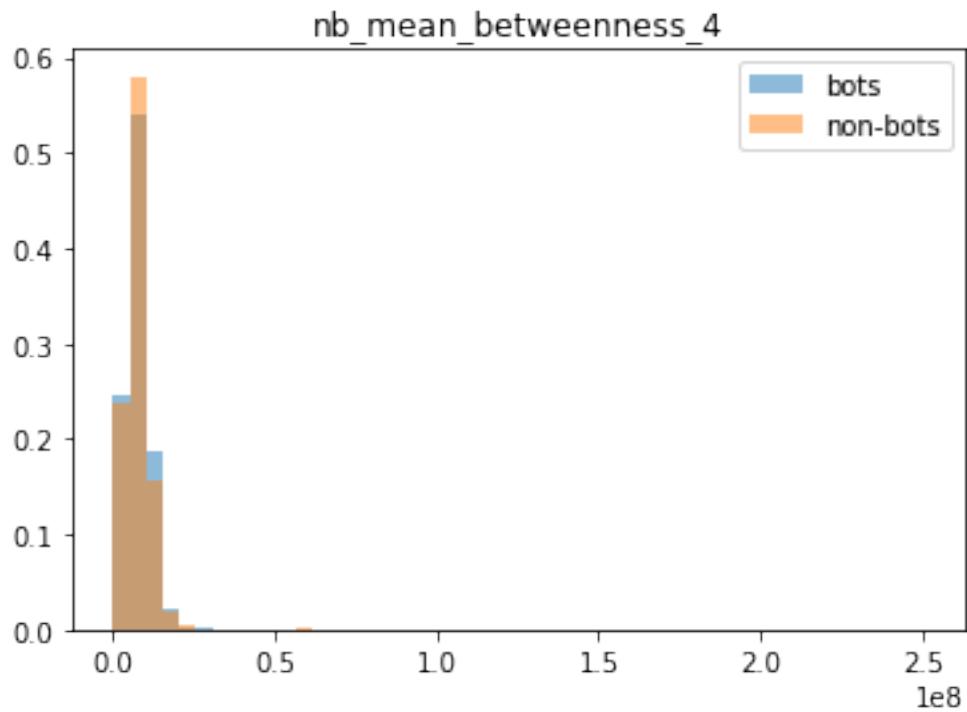


nb_mean_betweenness_2

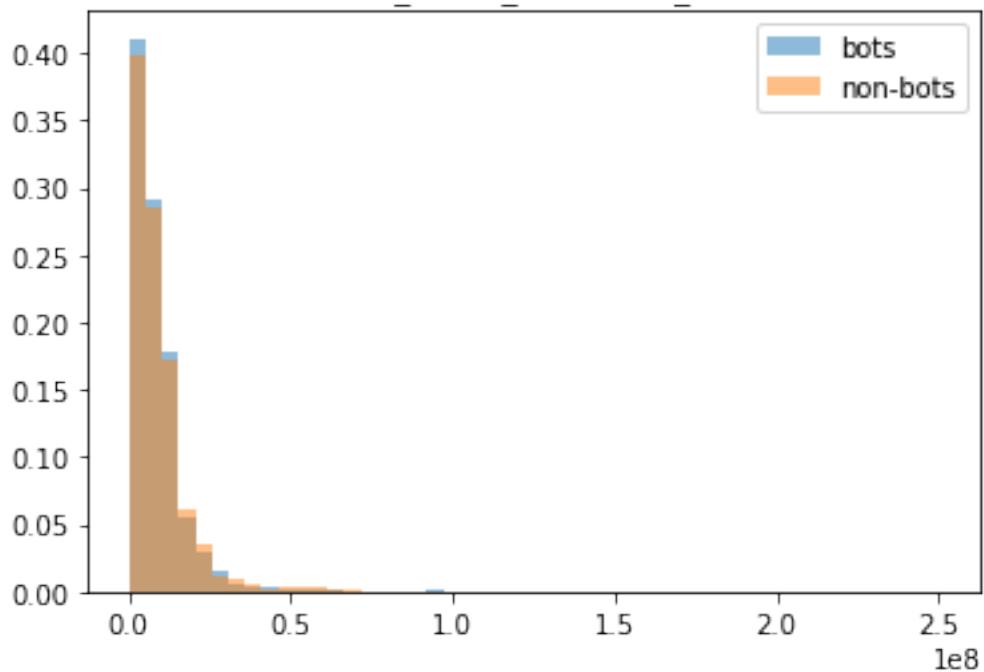


nb_mean_betweenness_3

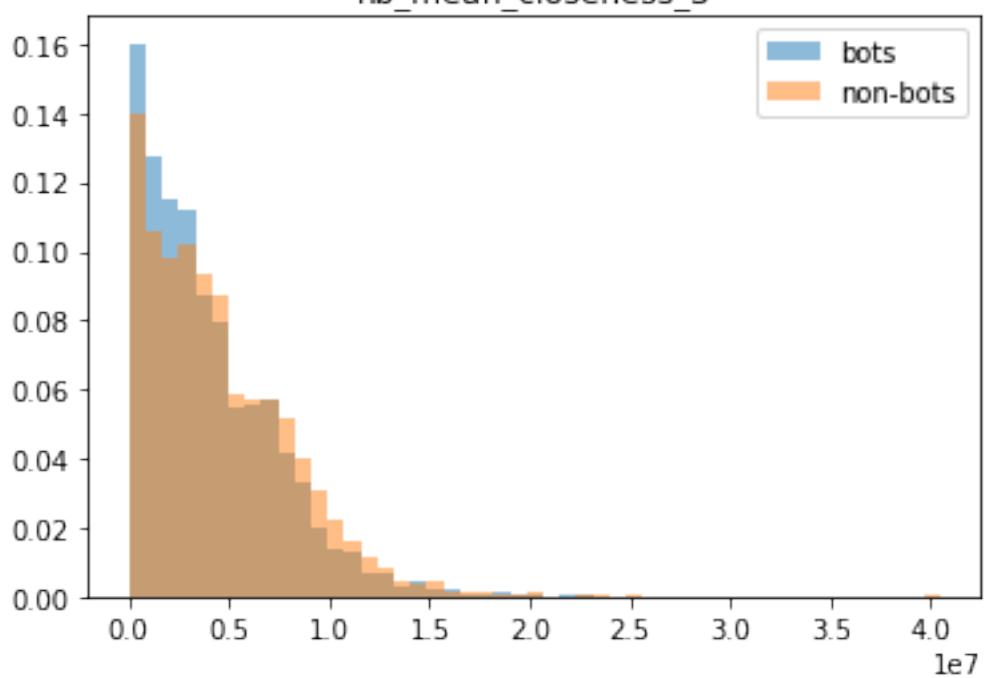


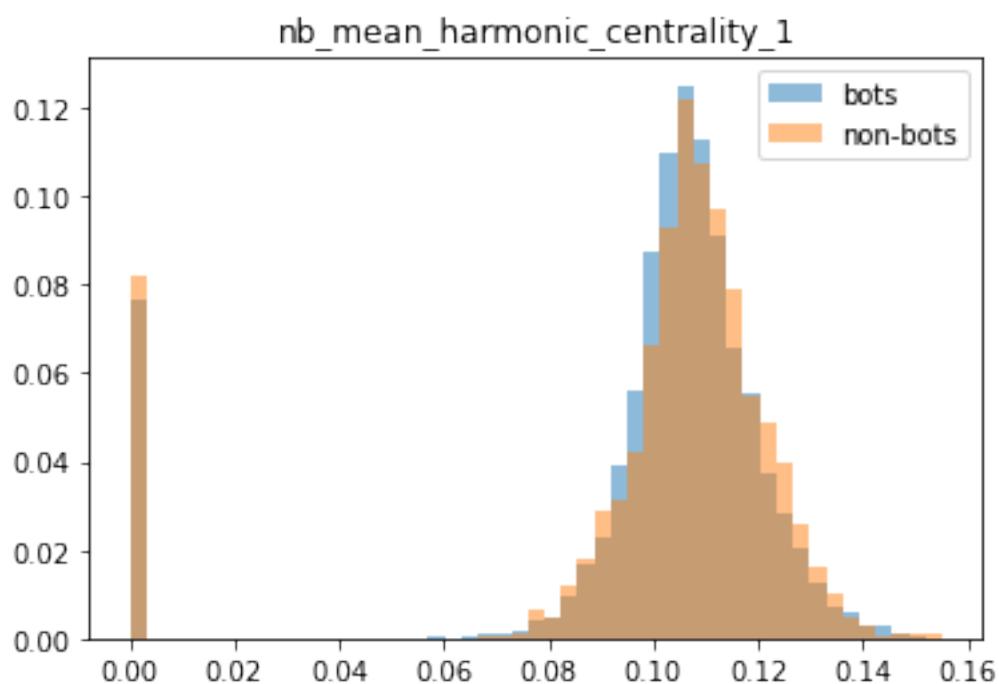
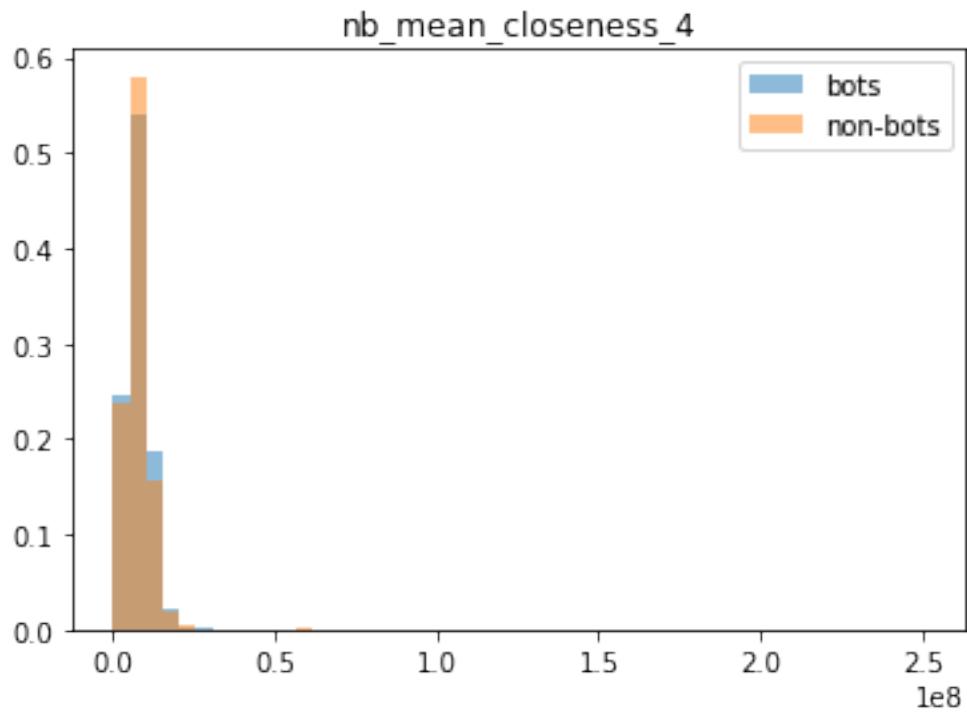


nb_mean_closeness_2

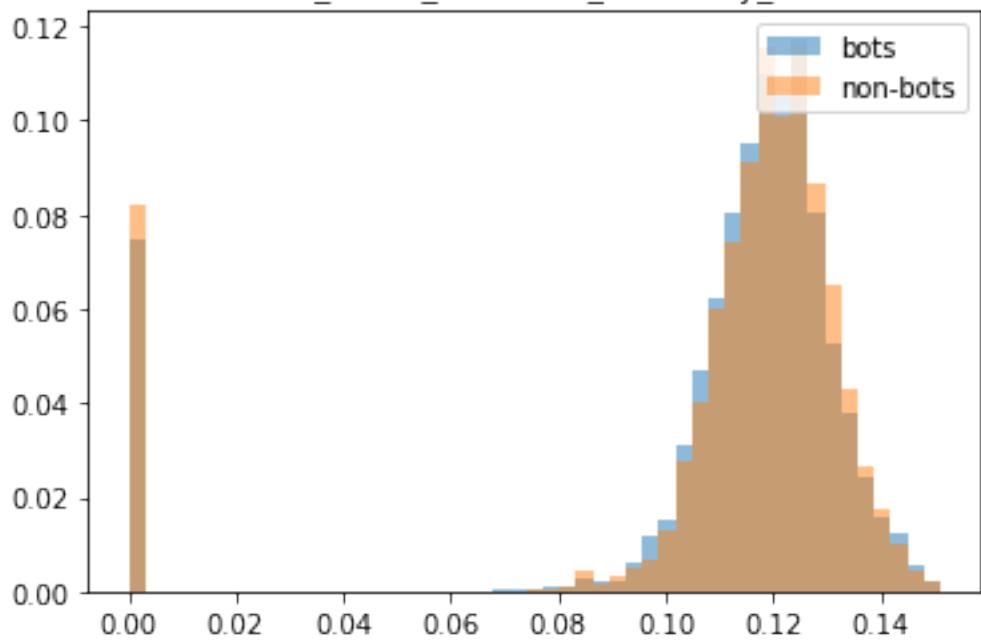


nb_mean_closeness_3

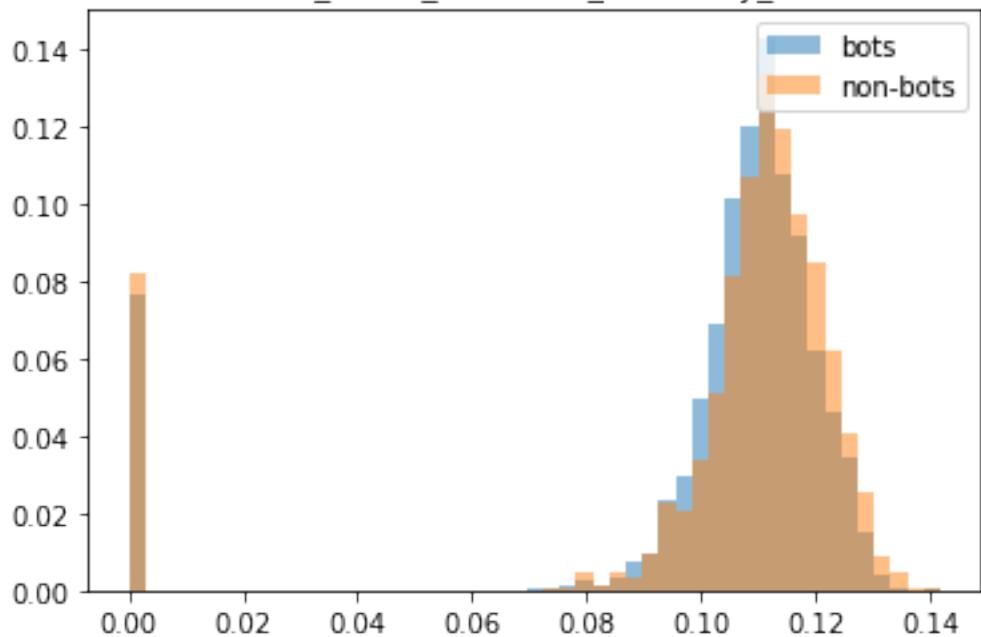




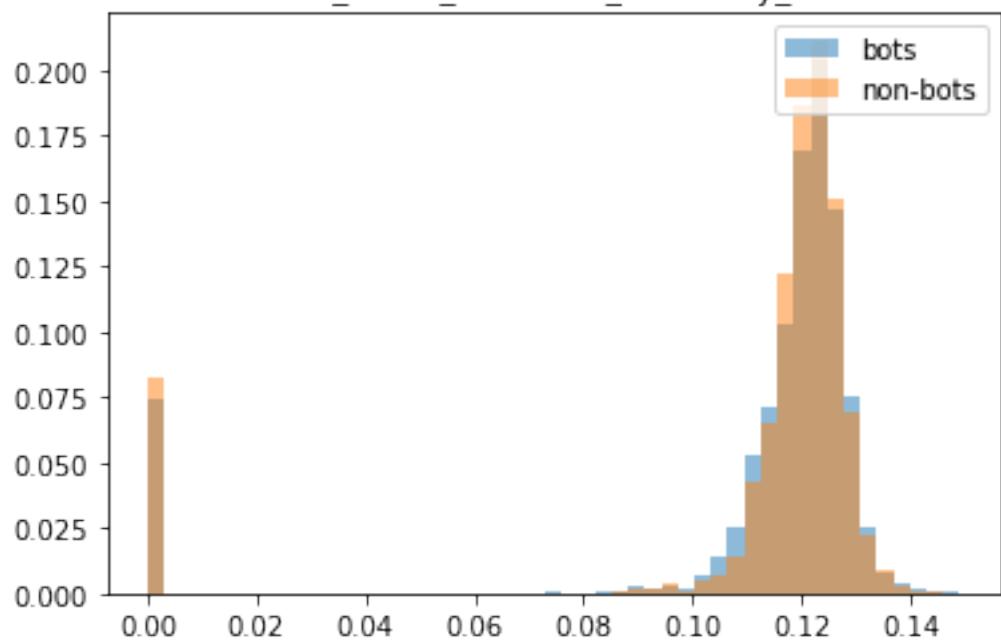
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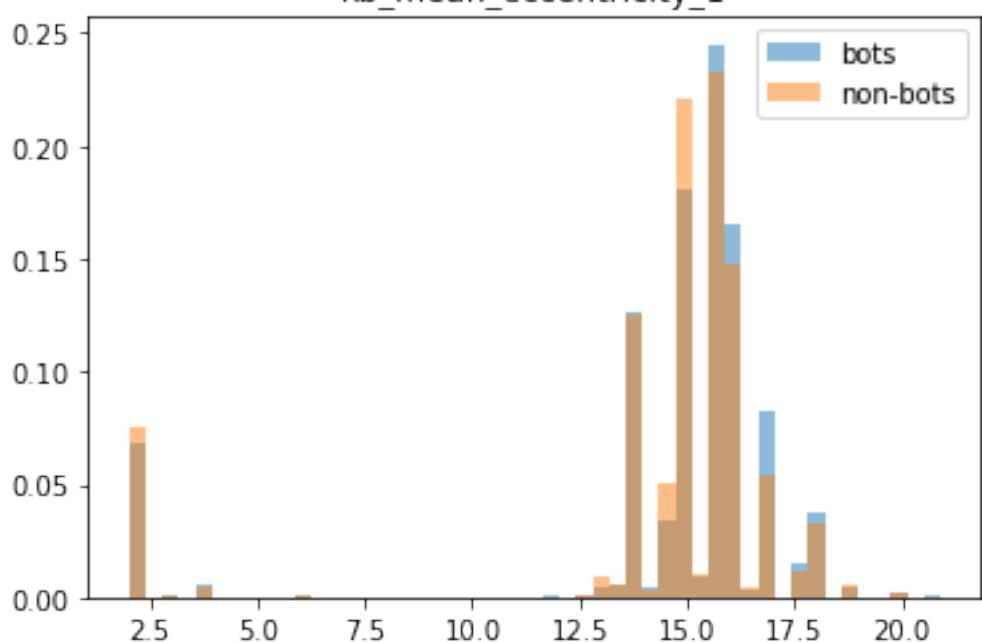
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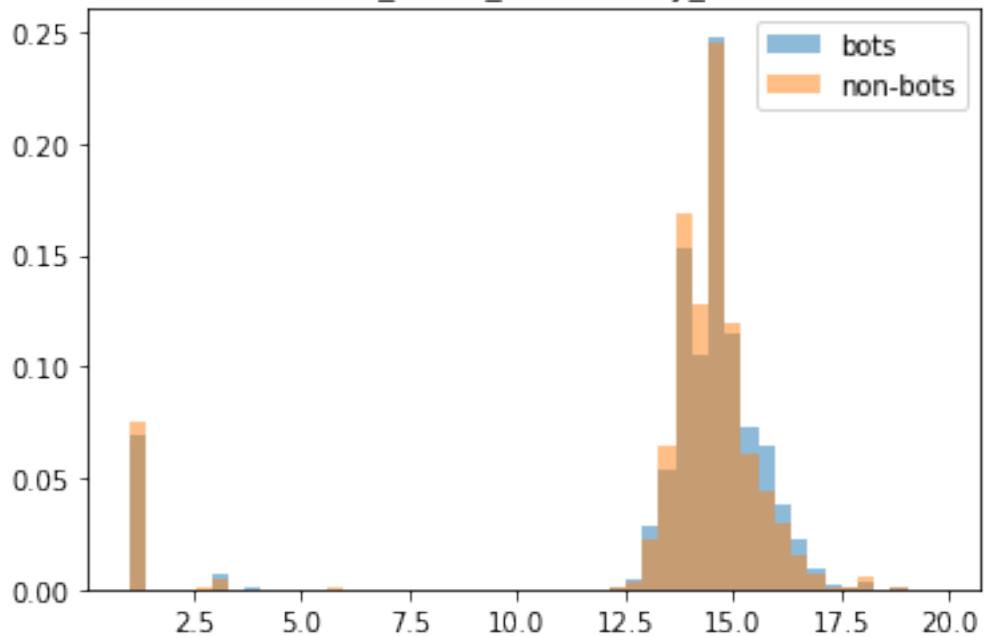
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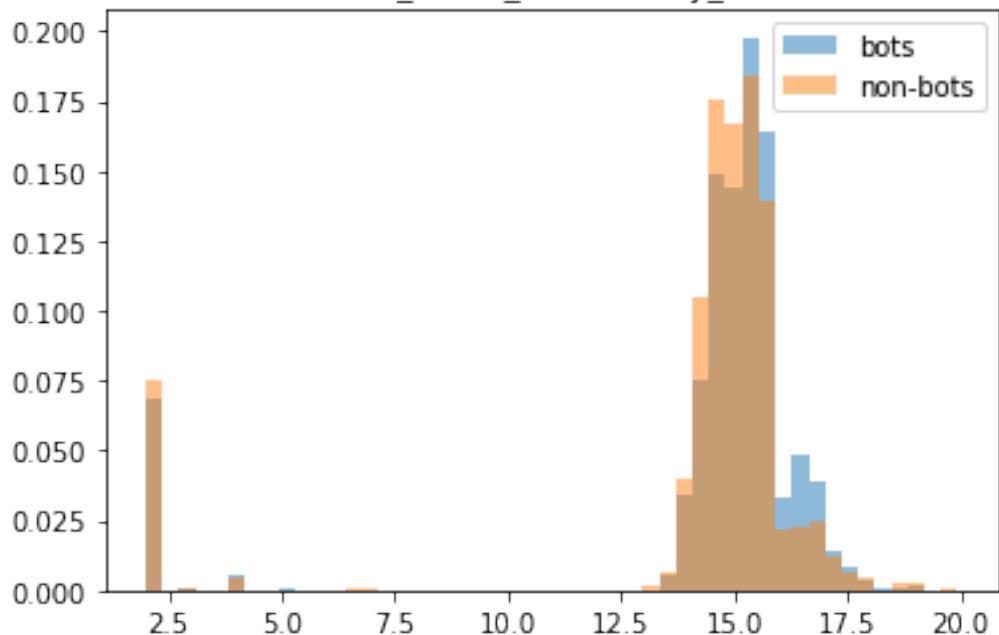
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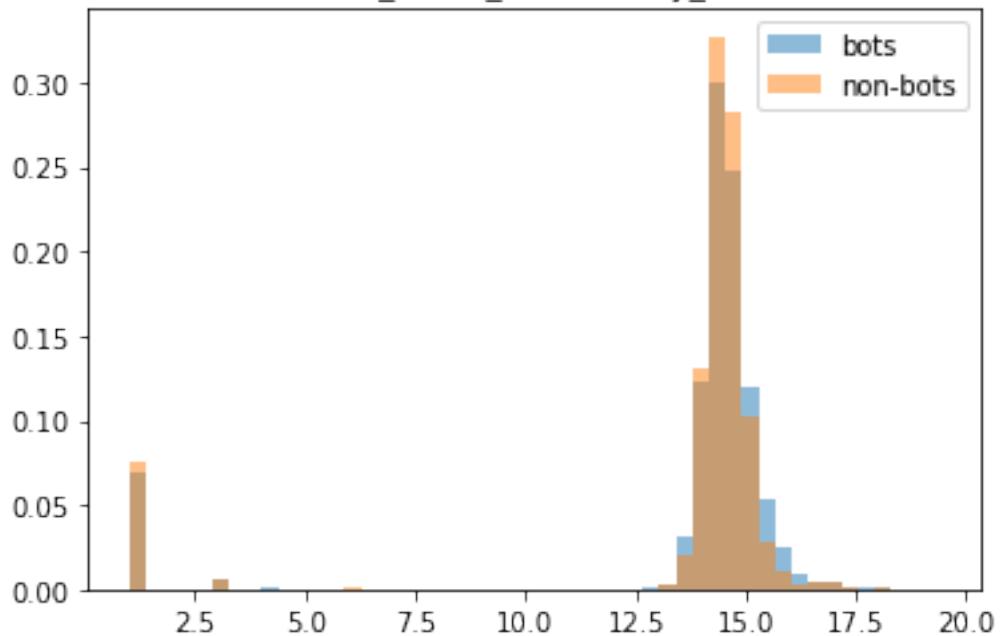
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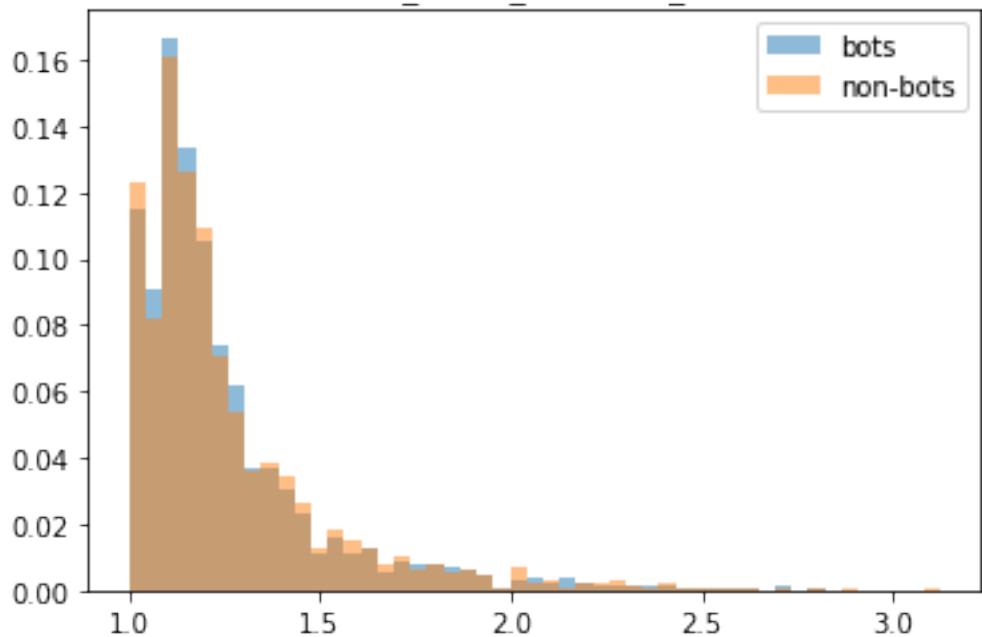
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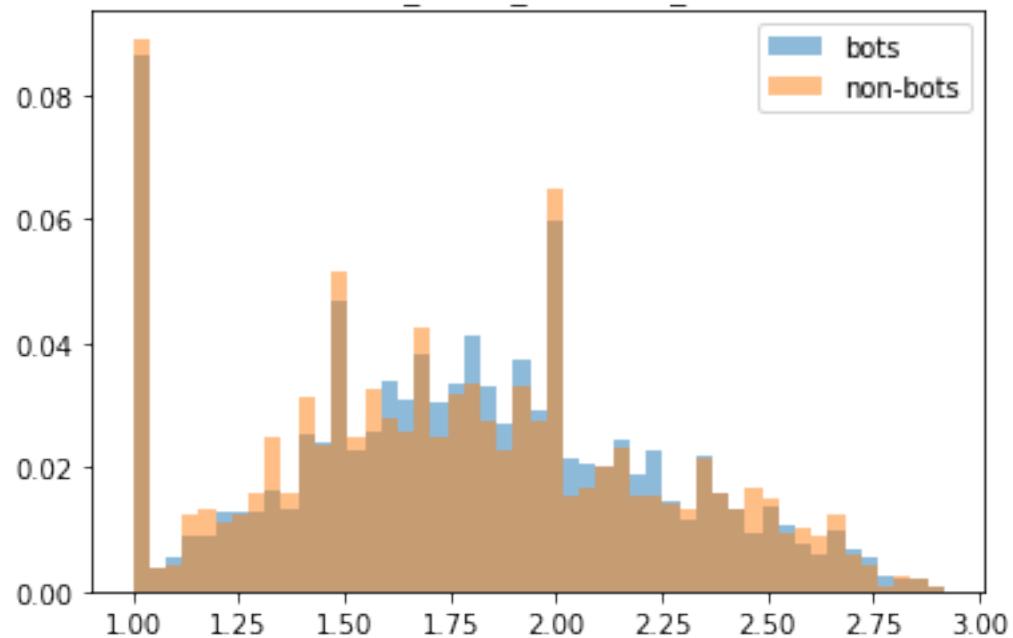
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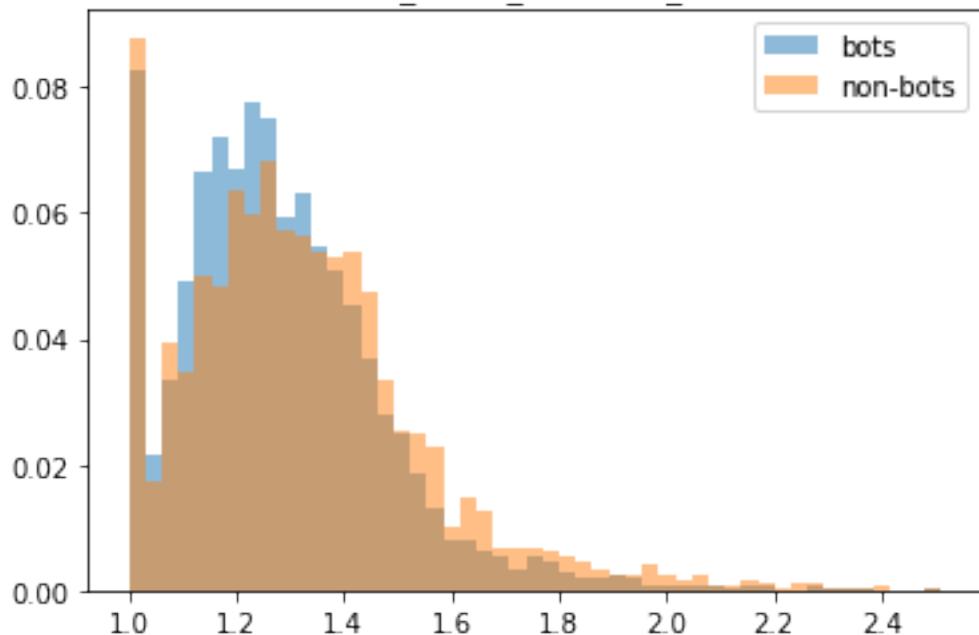
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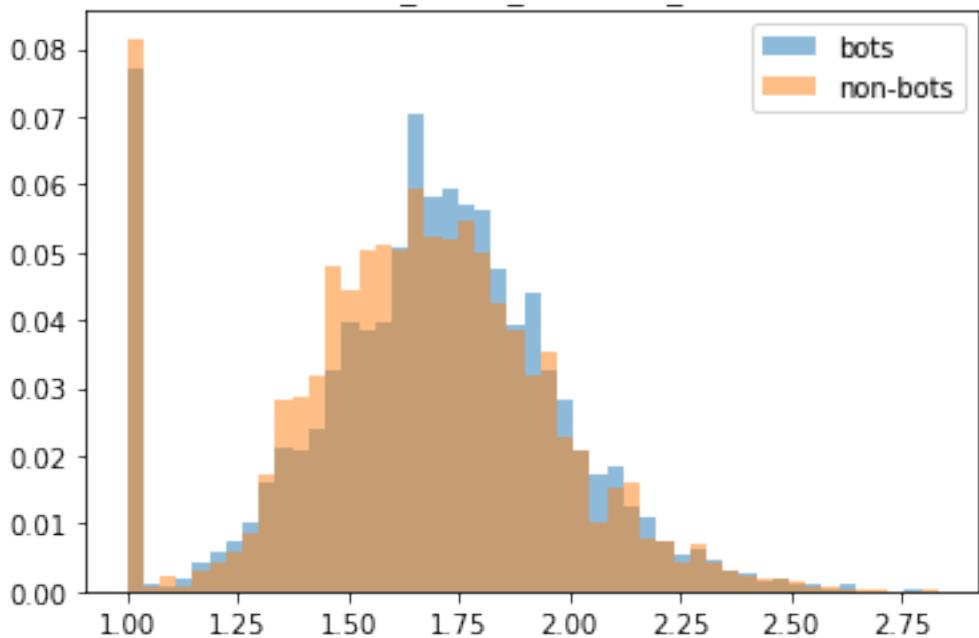
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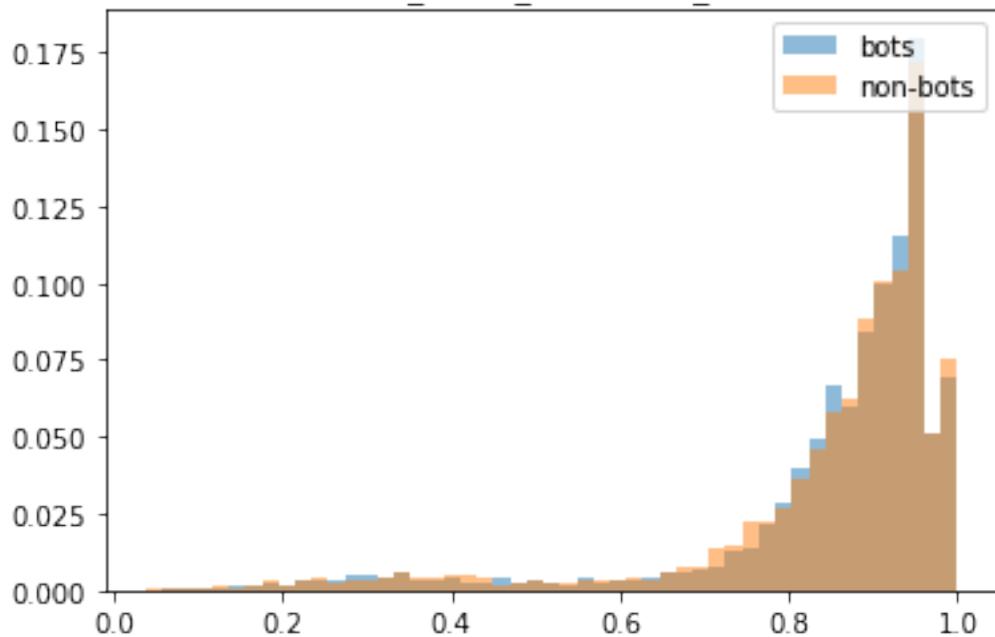
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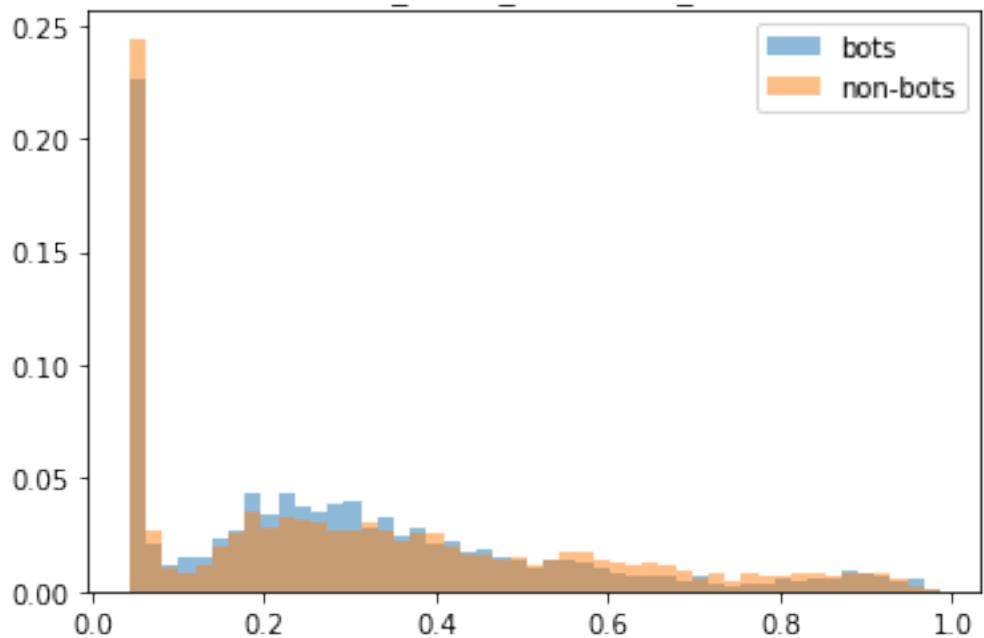
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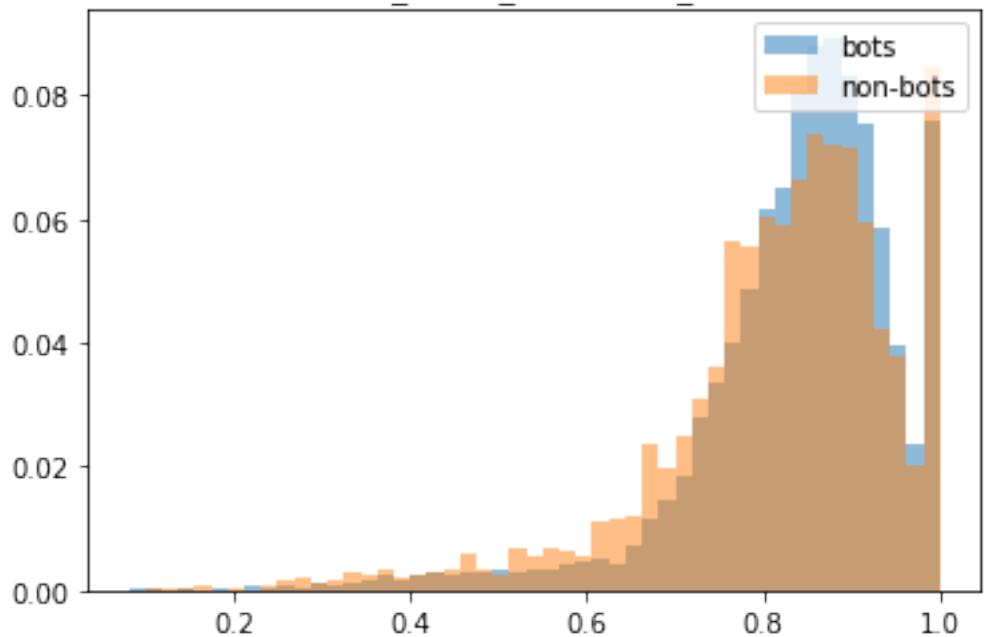
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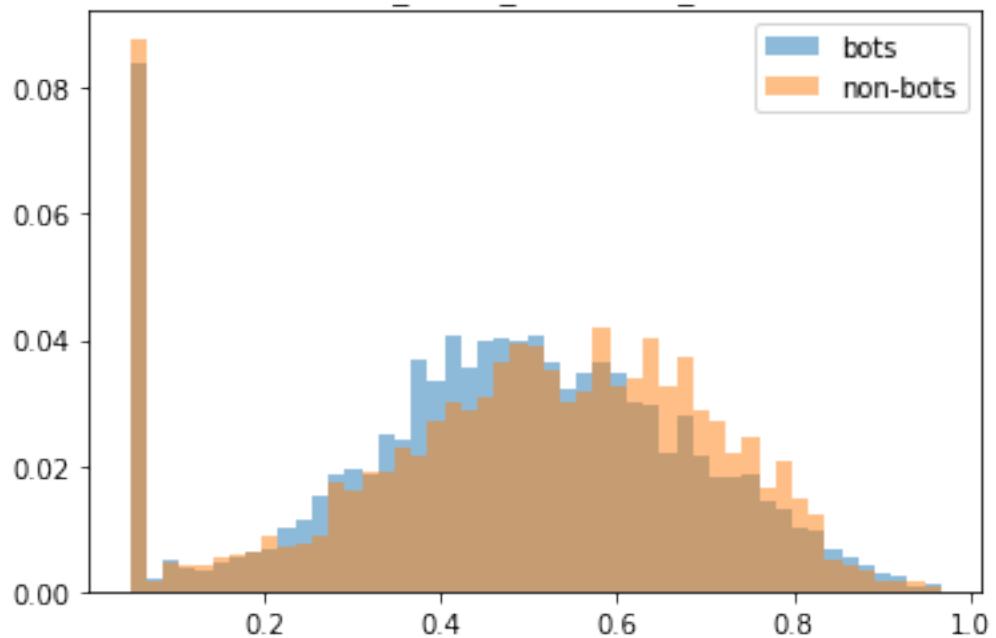
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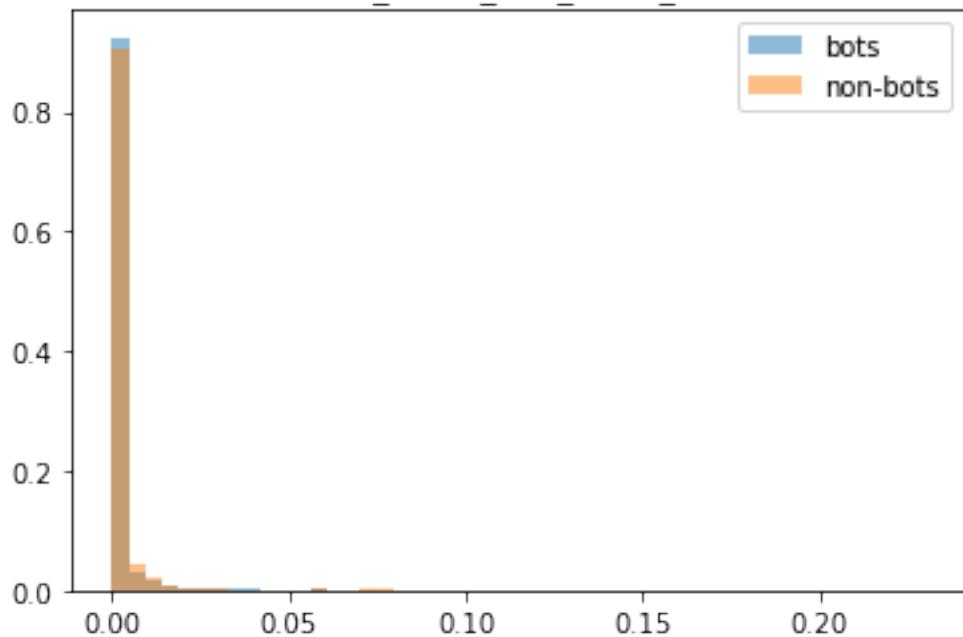
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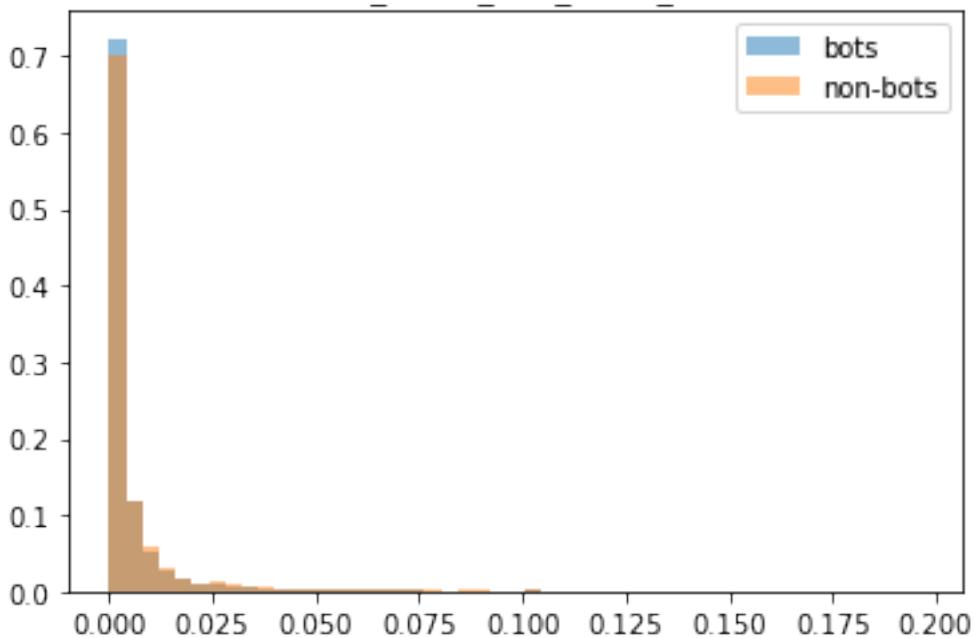
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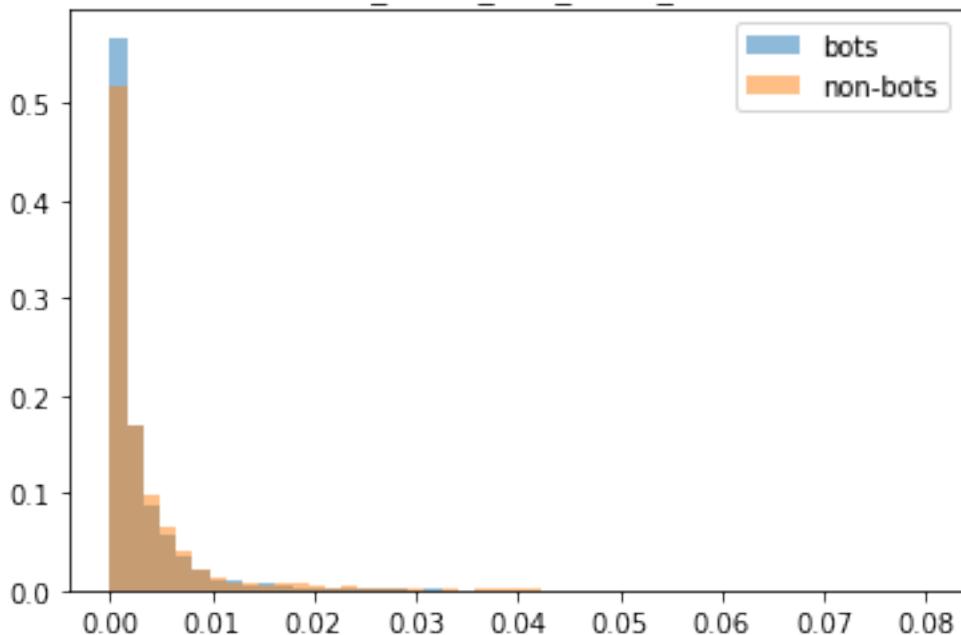
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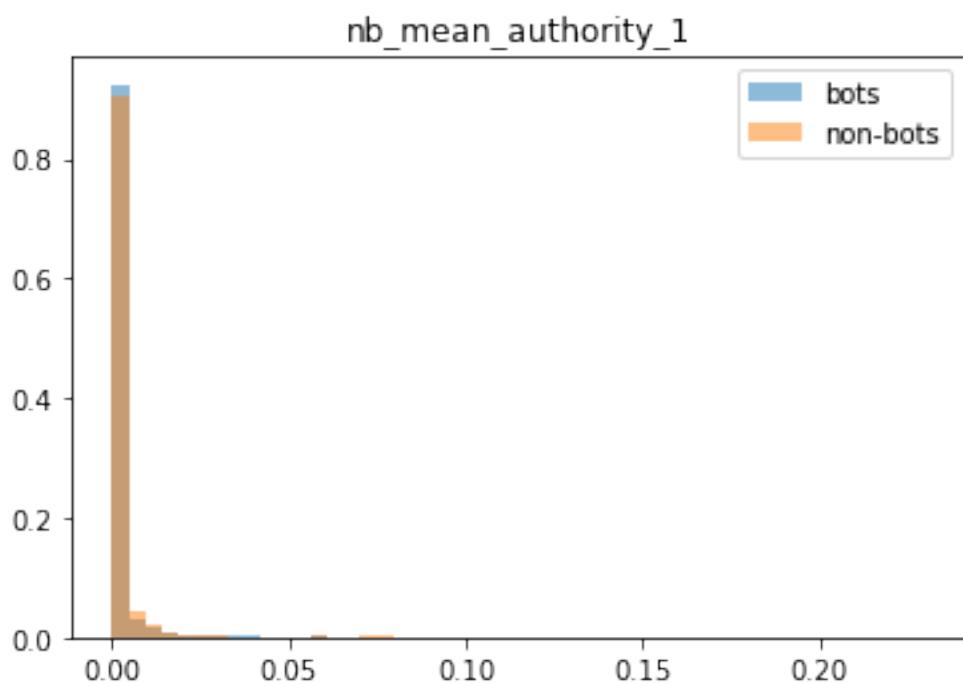
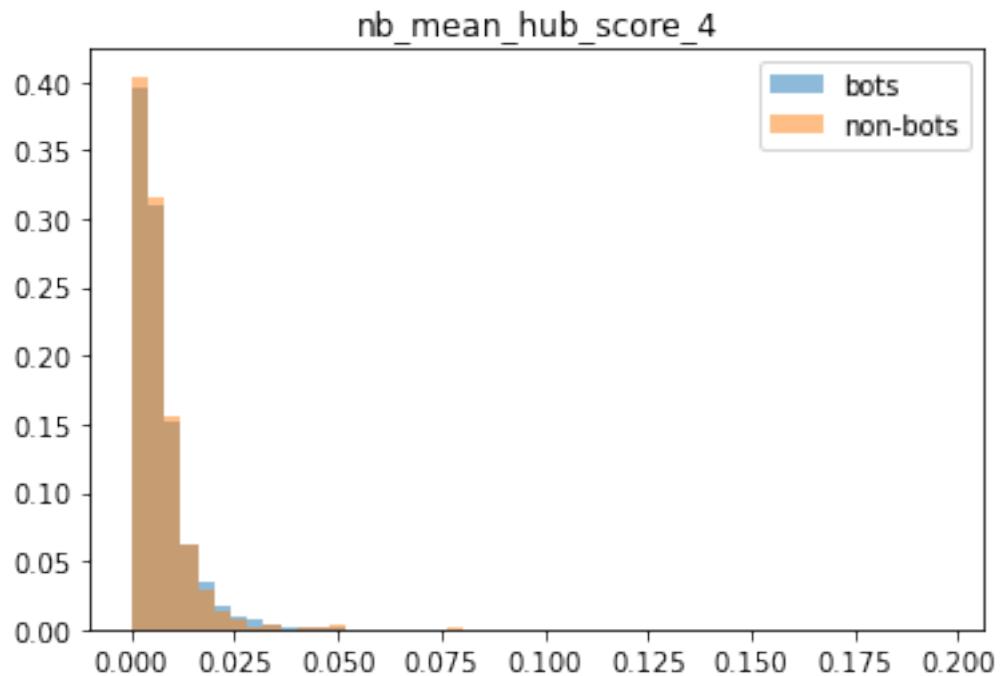


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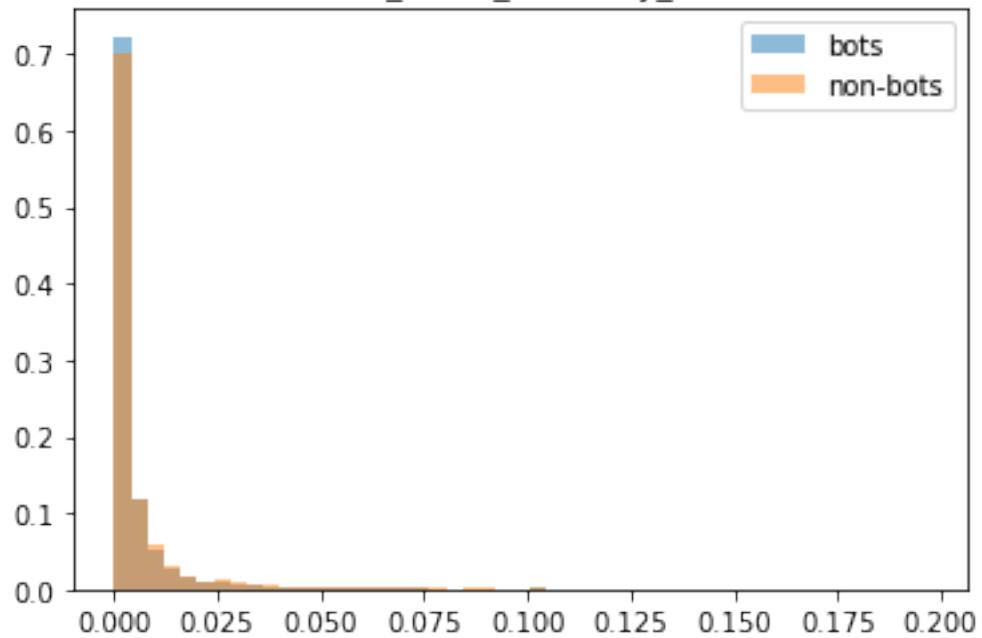


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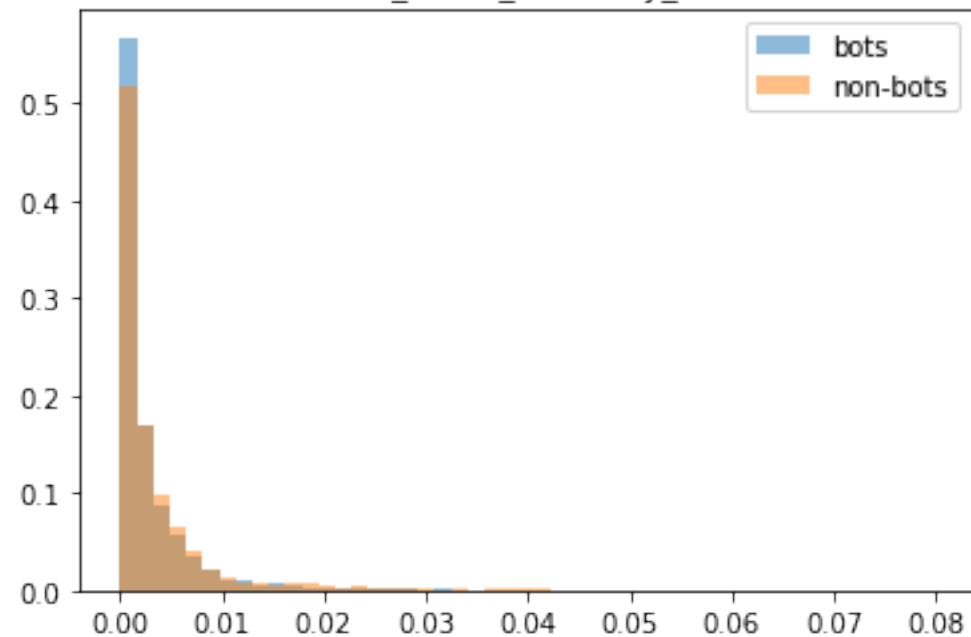




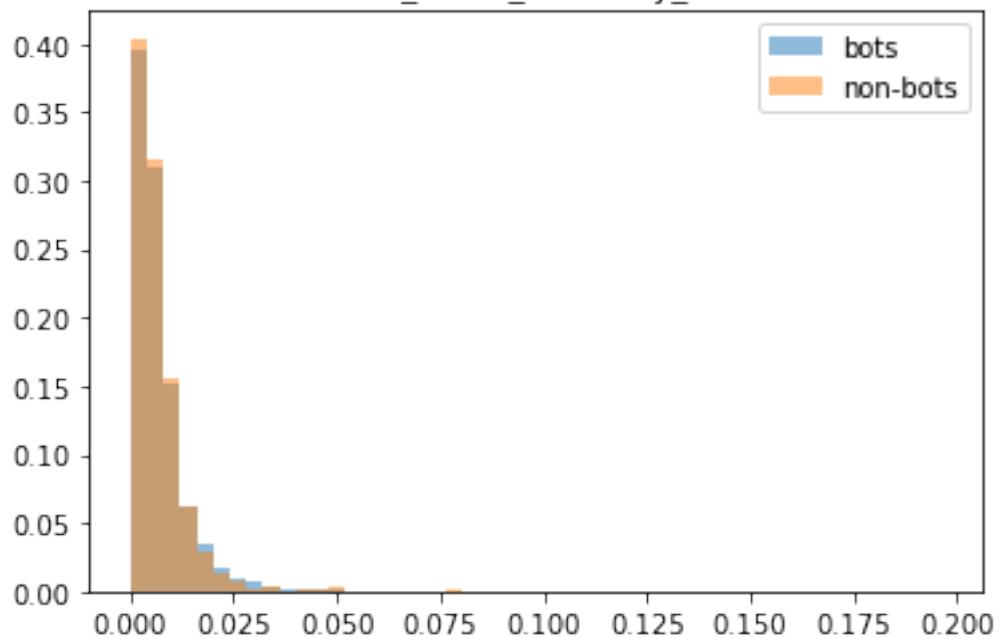
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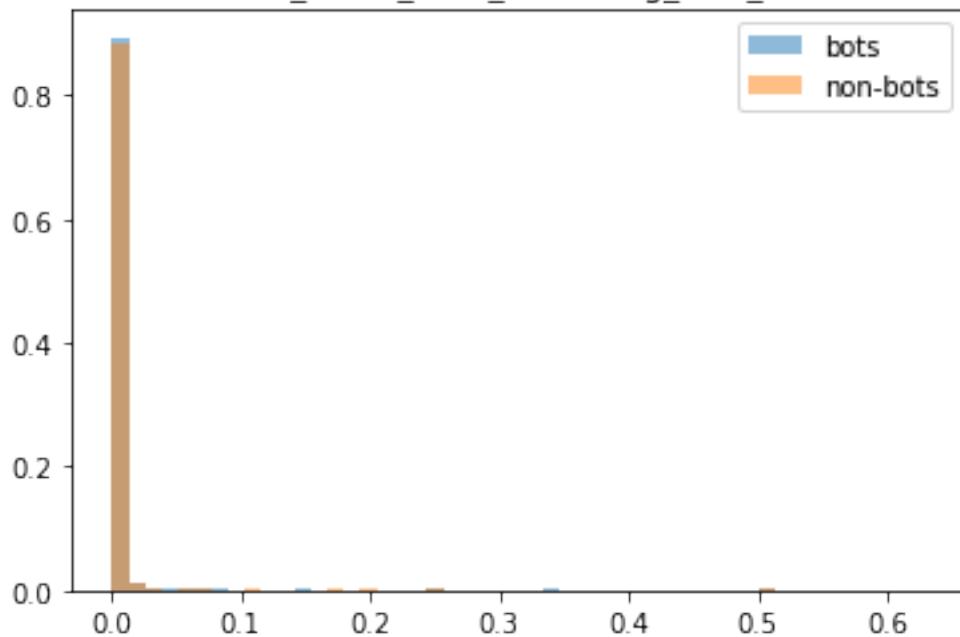
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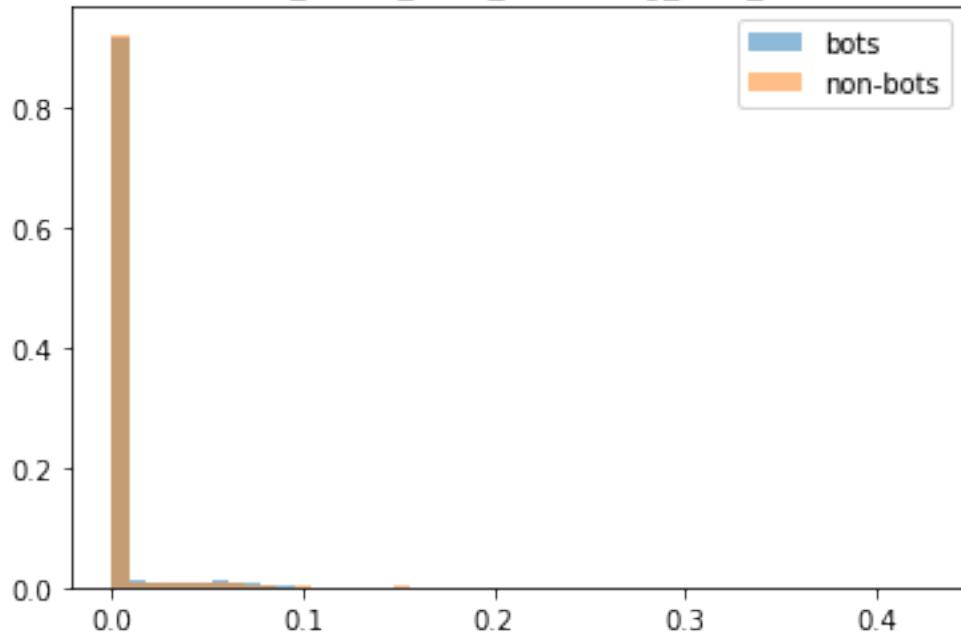
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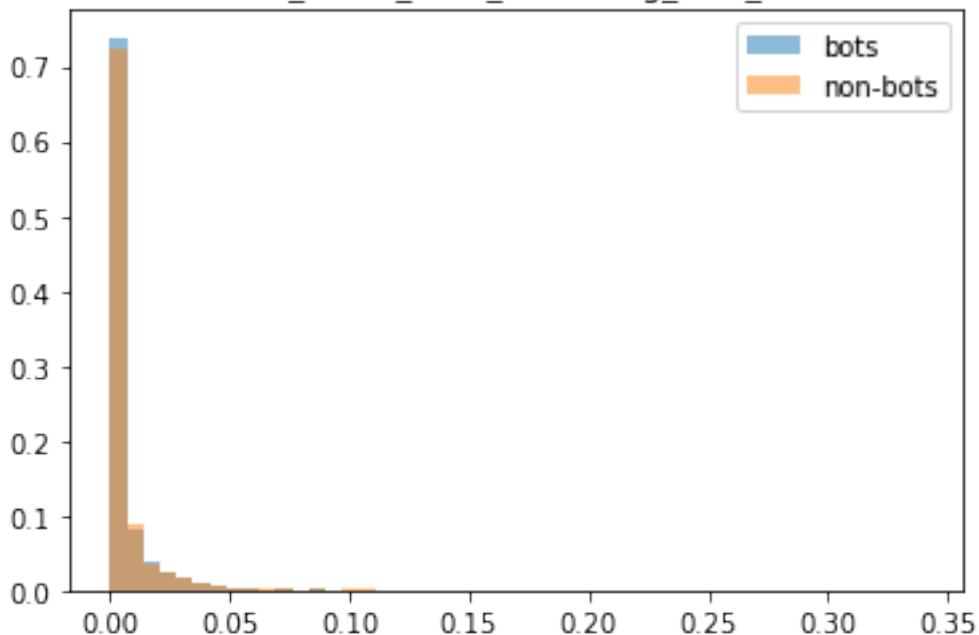
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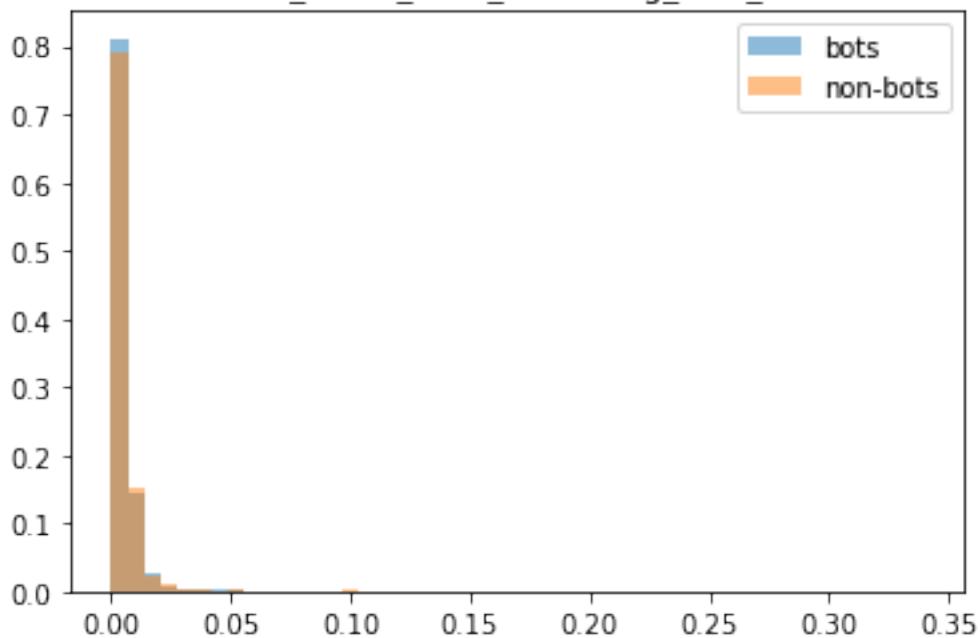
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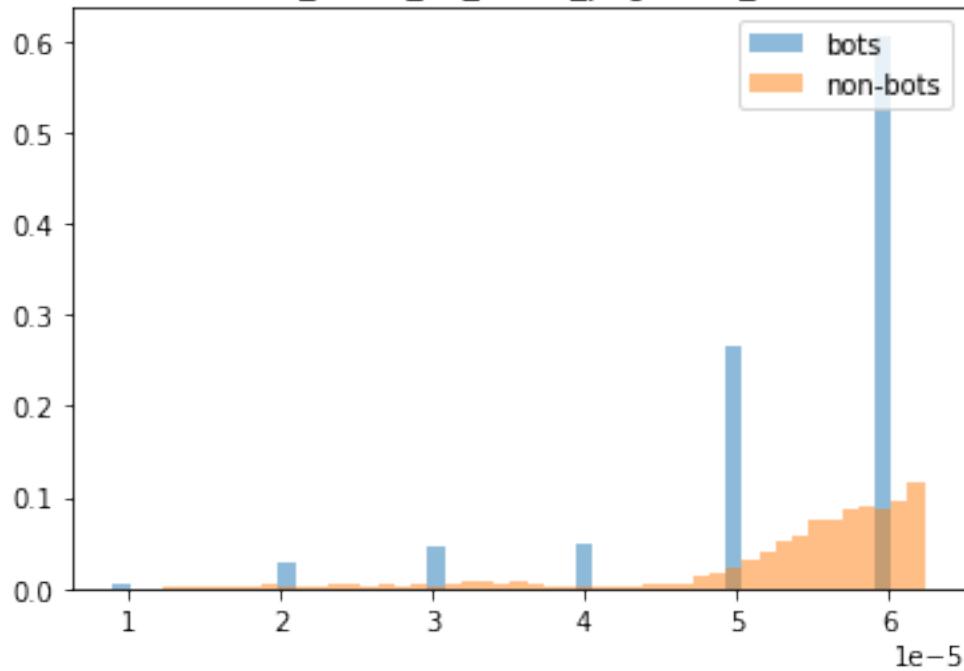
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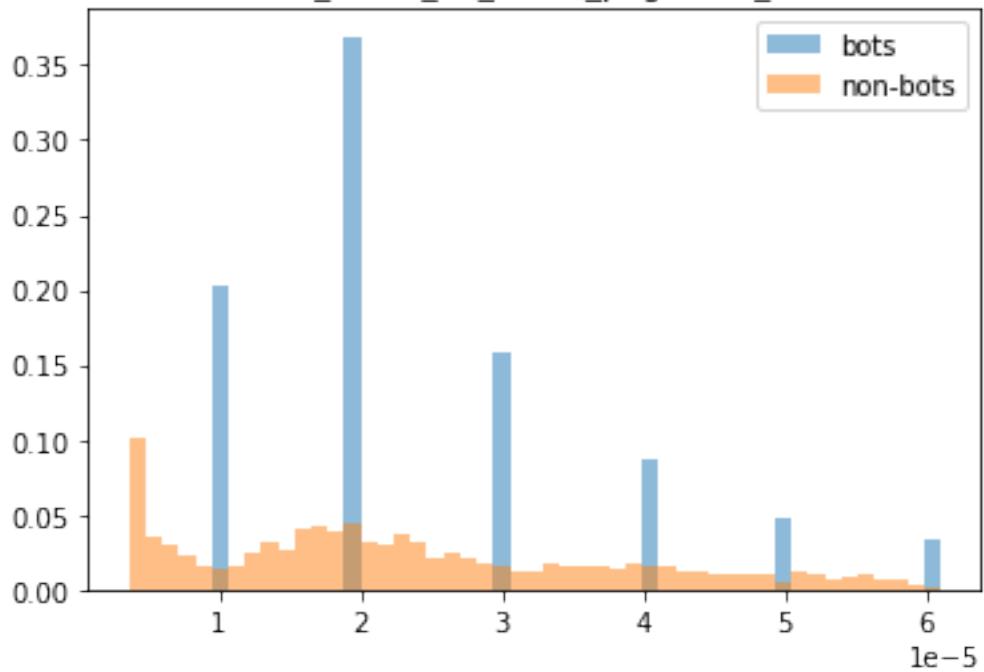
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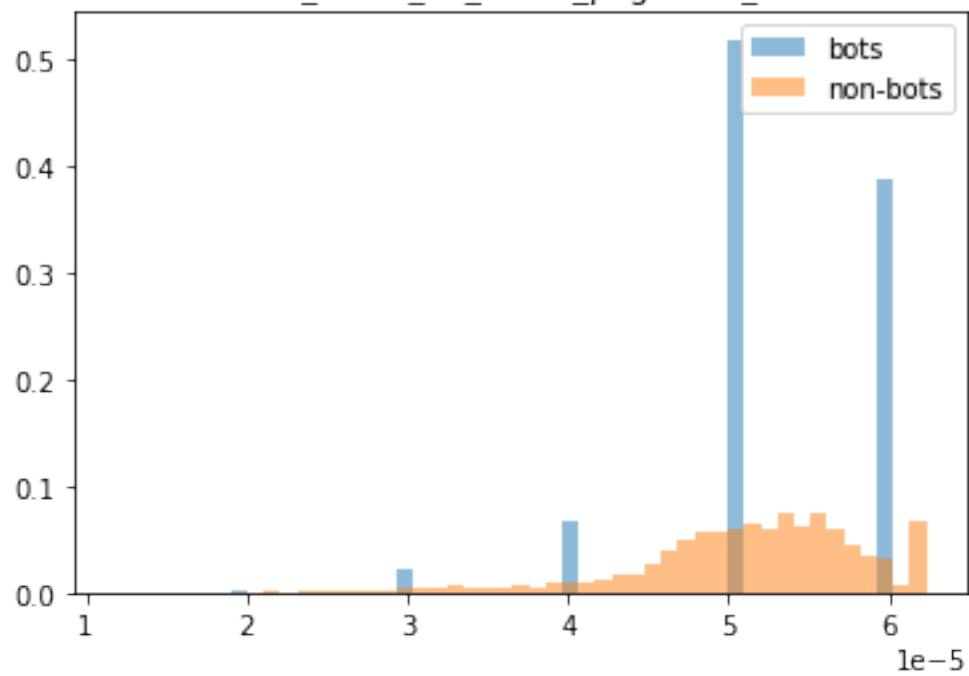
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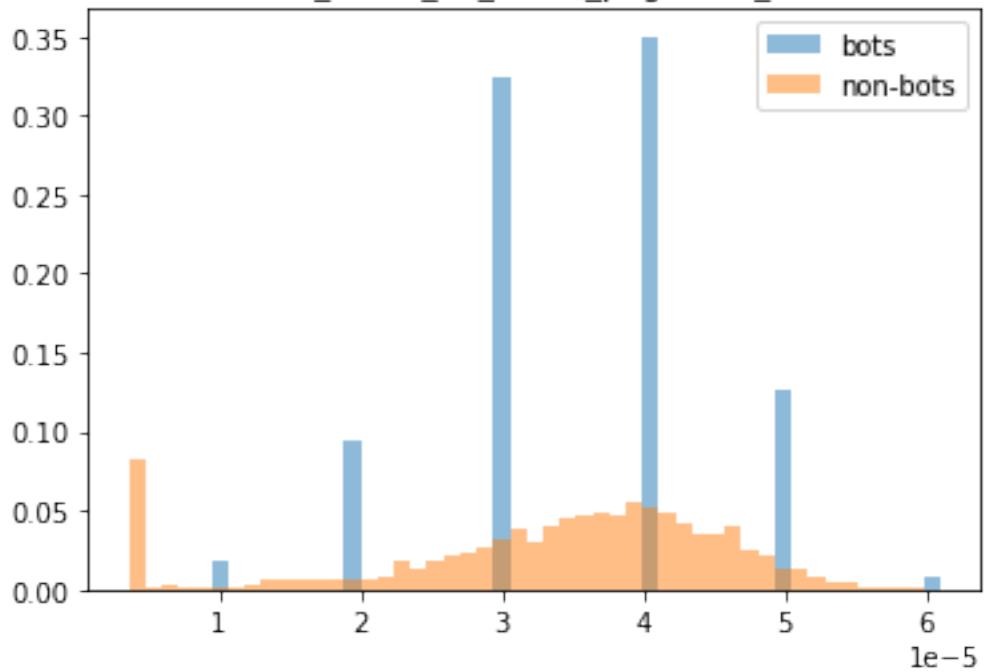
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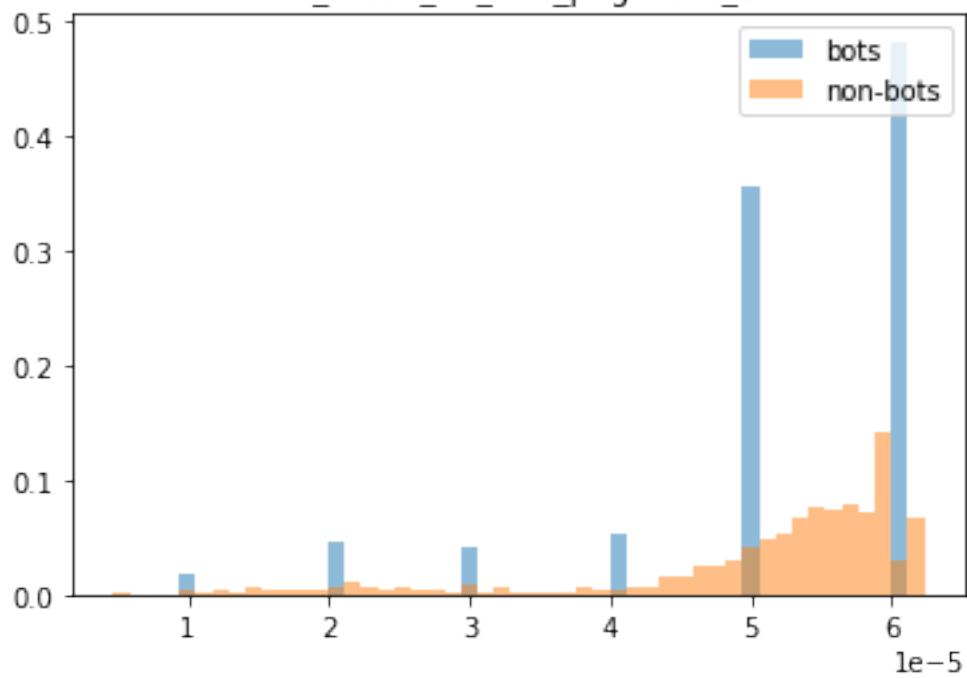
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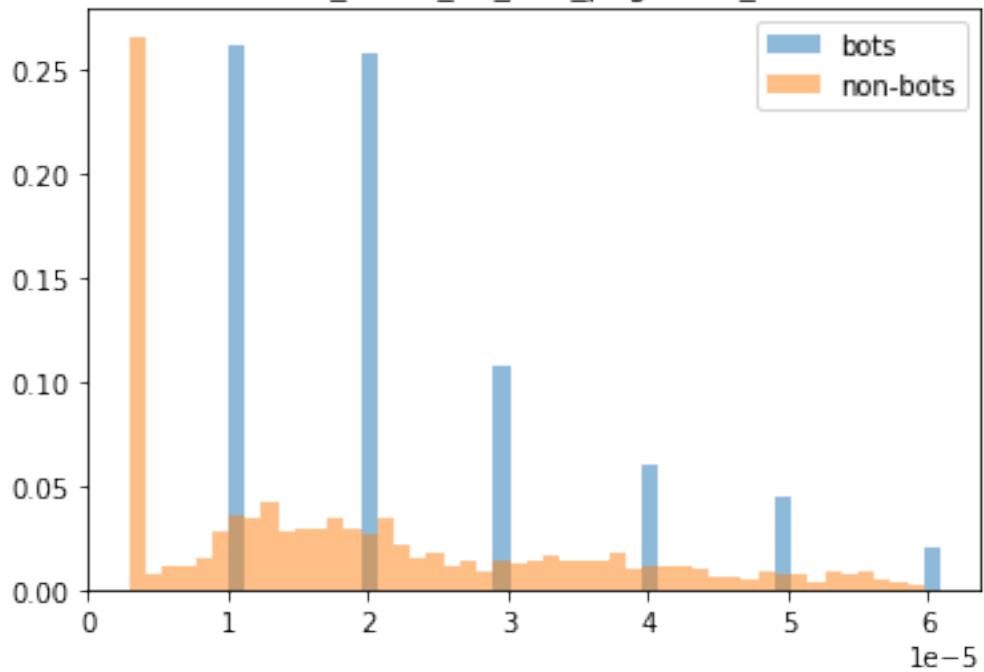
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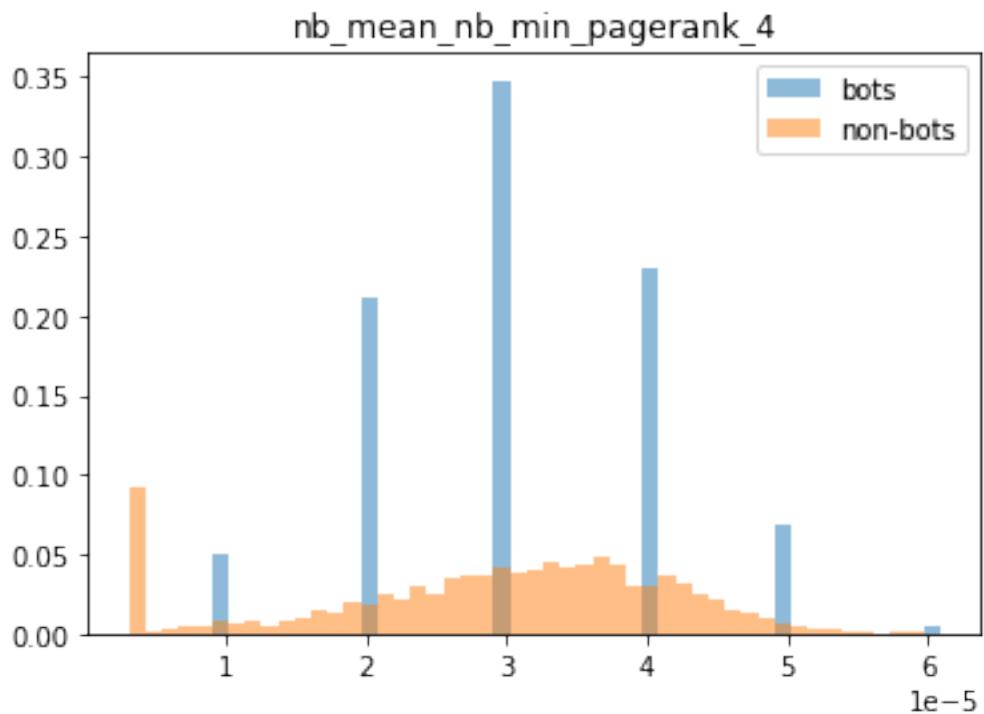


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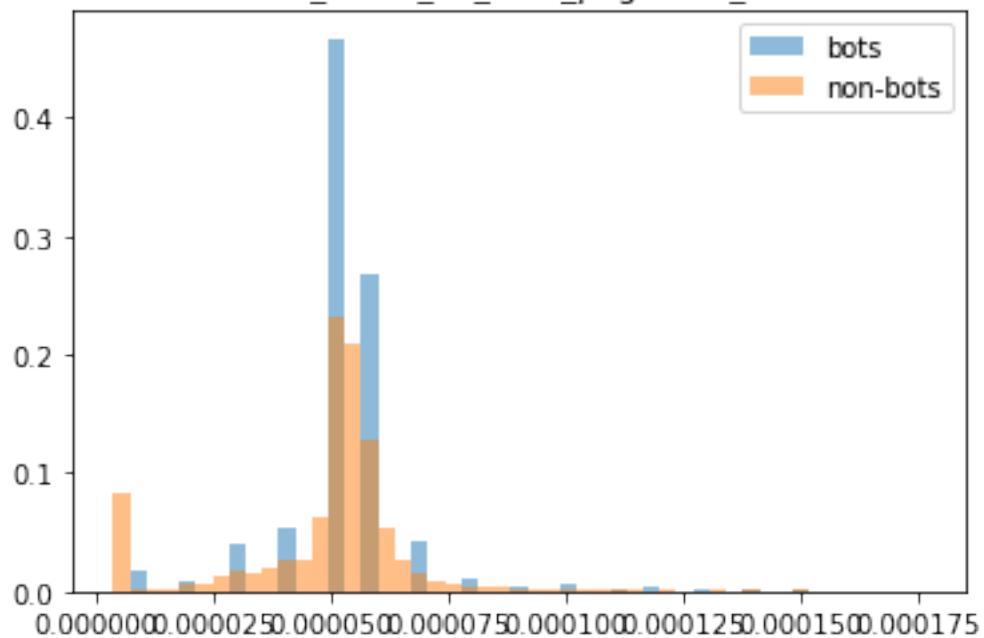


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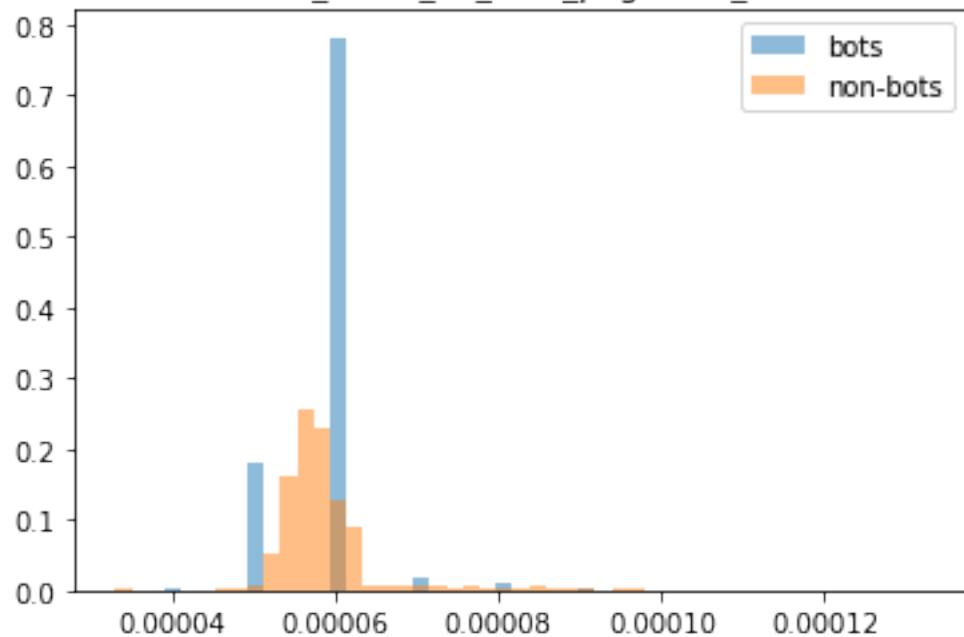




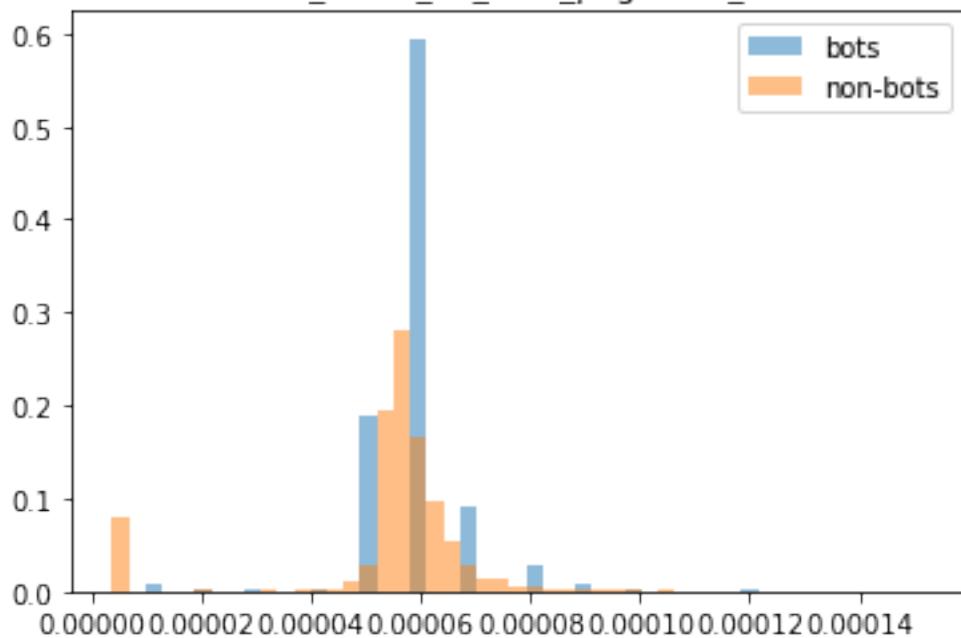
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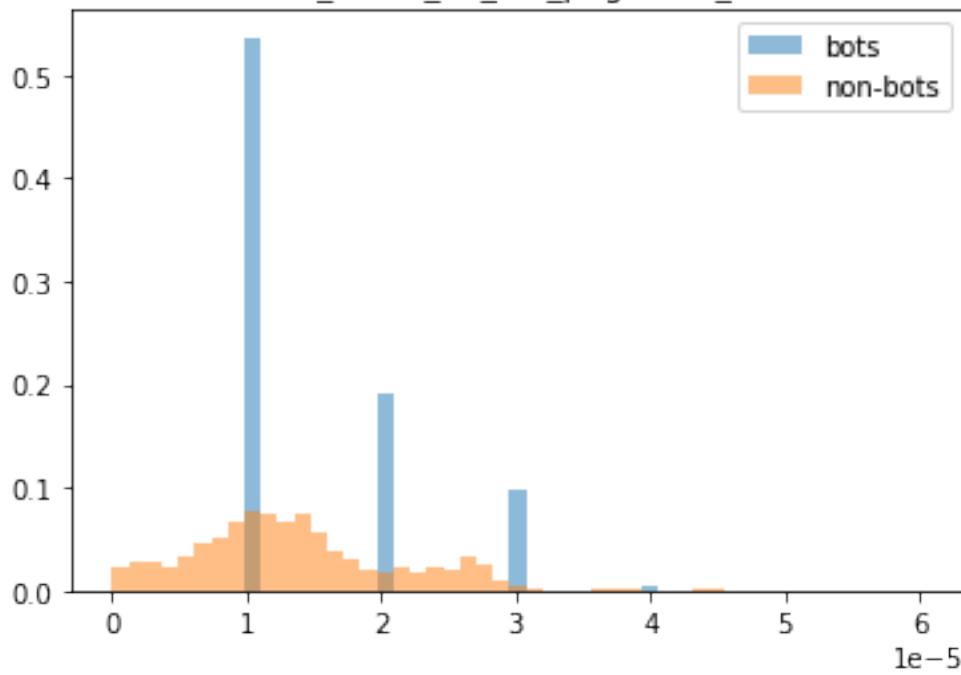
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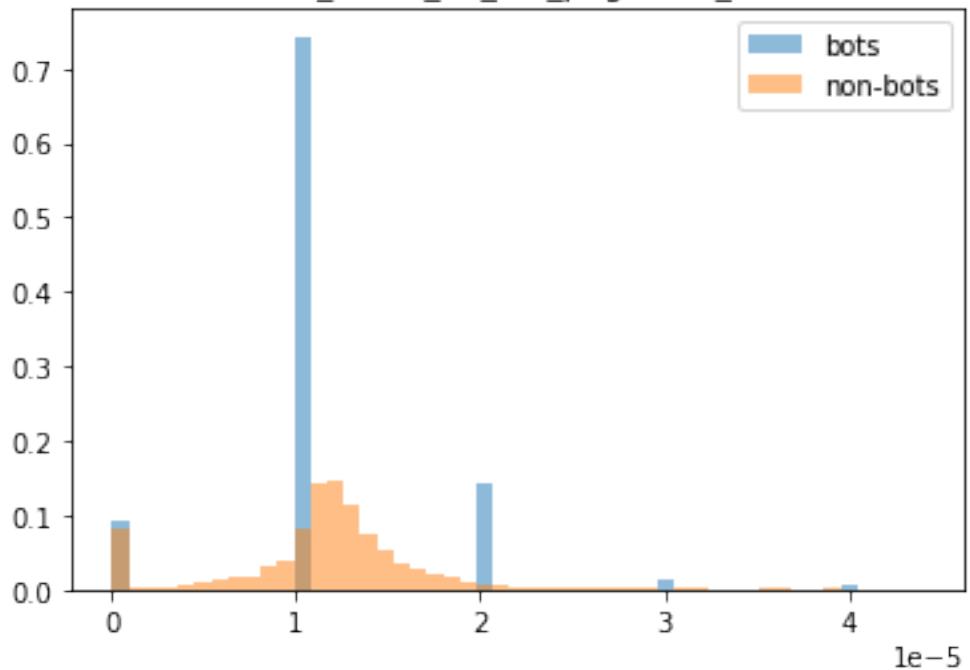
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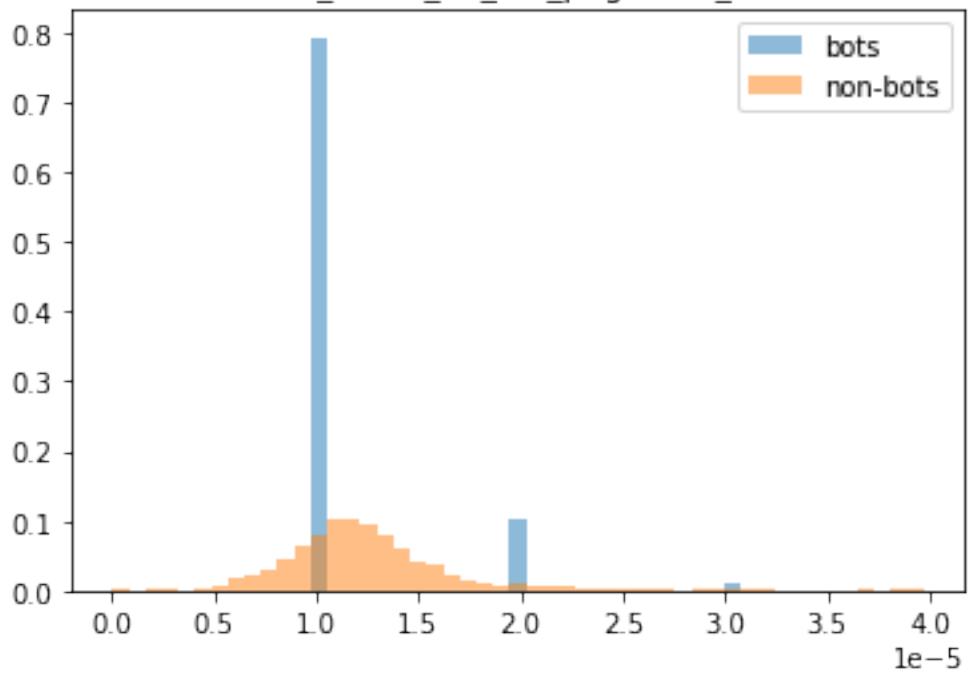
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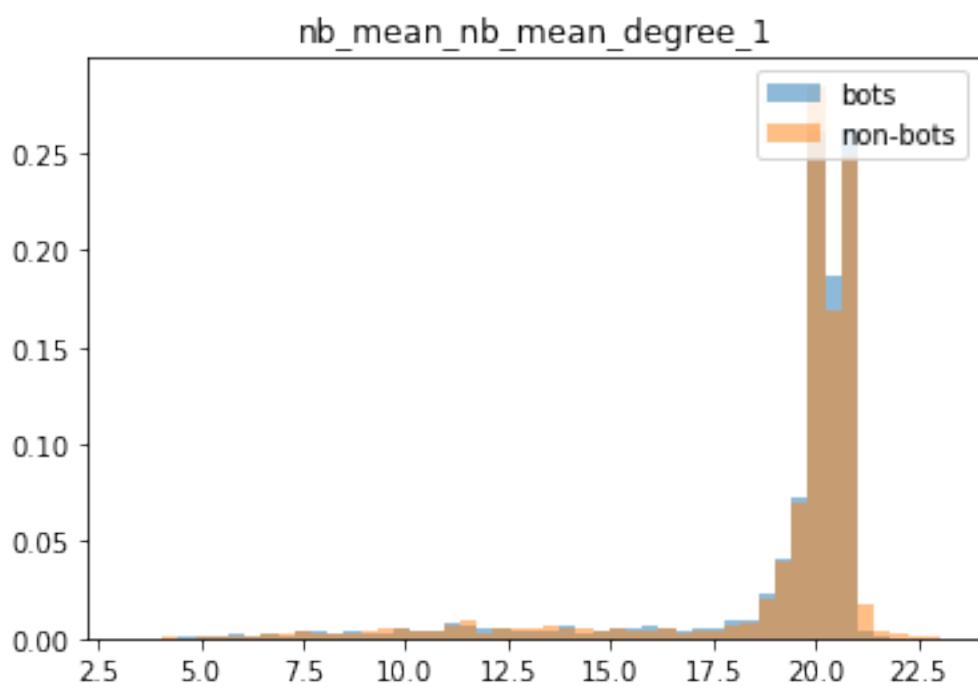
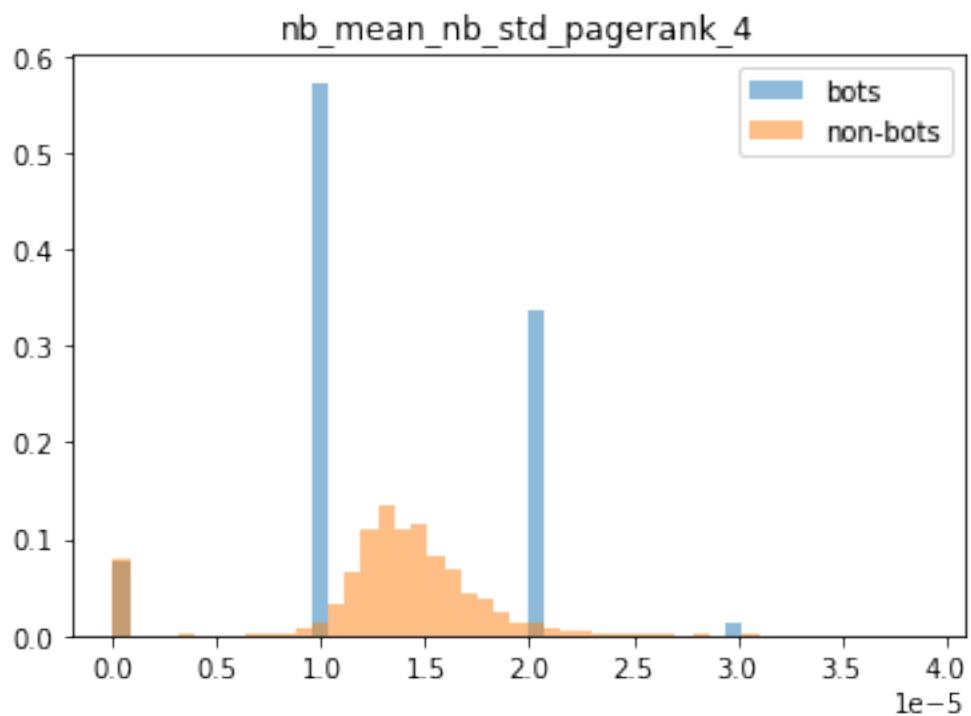


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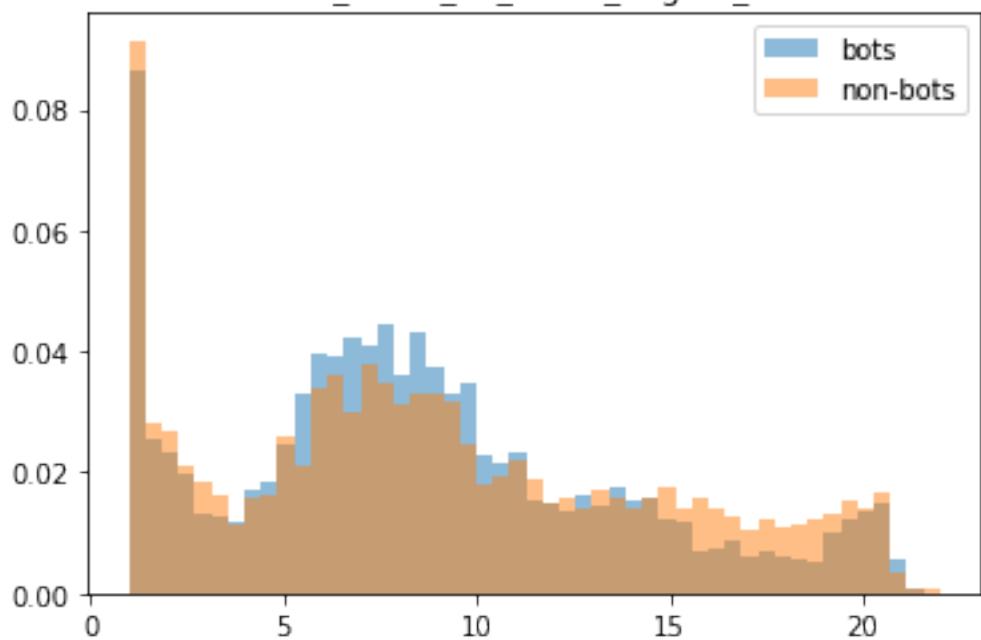


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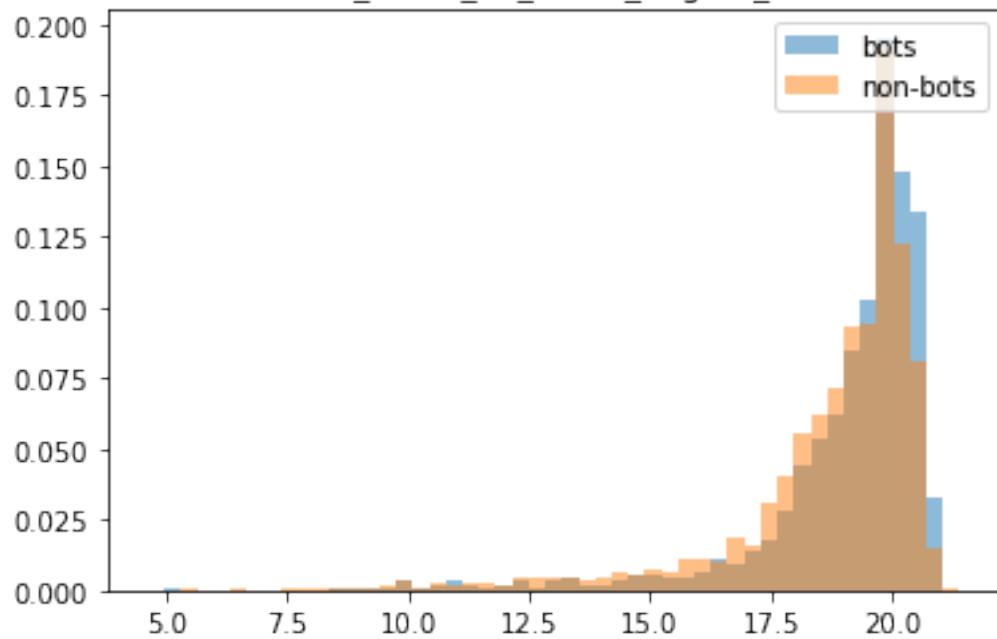




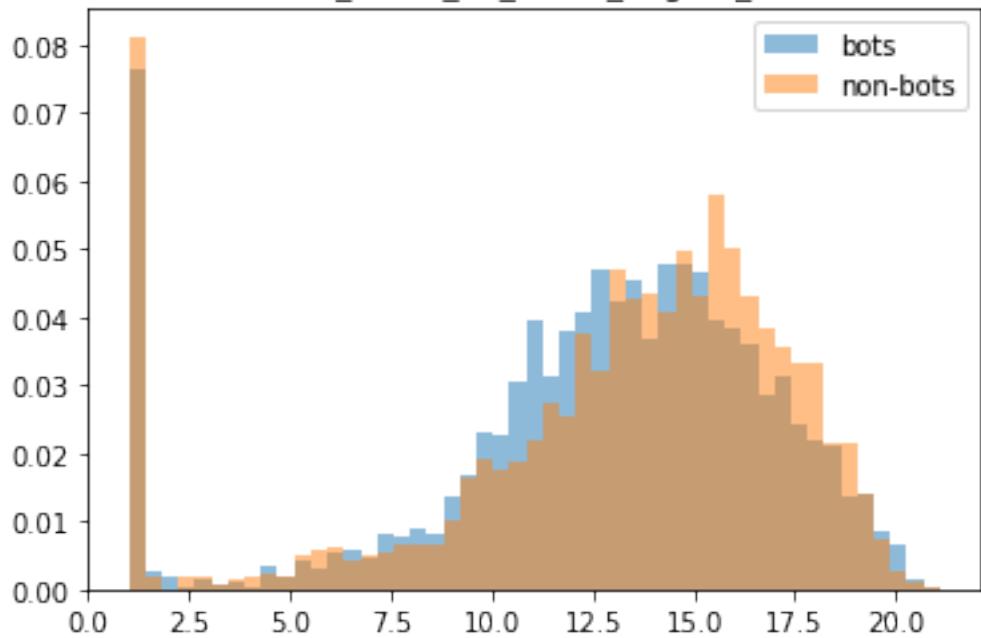
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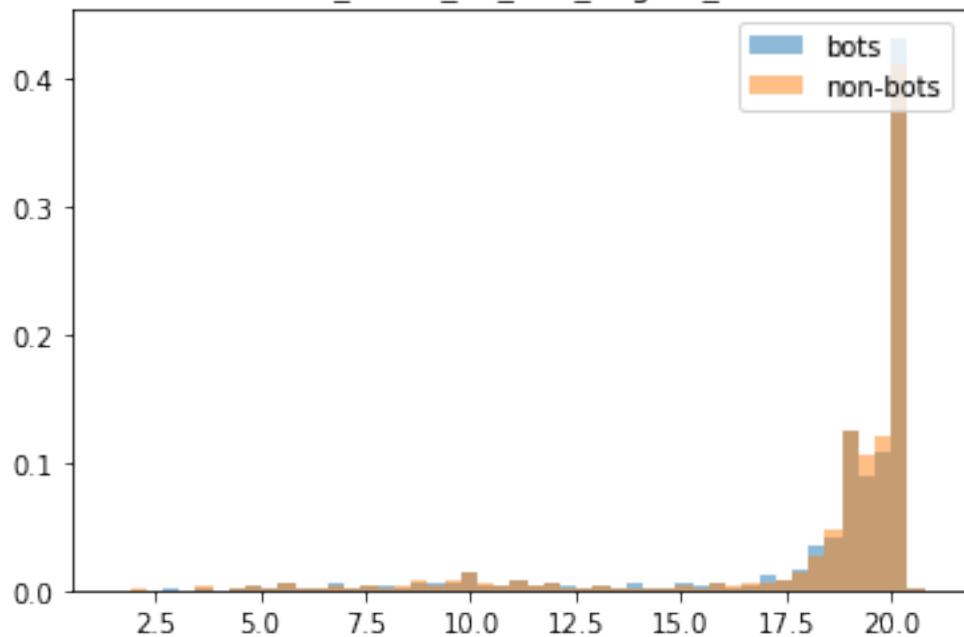
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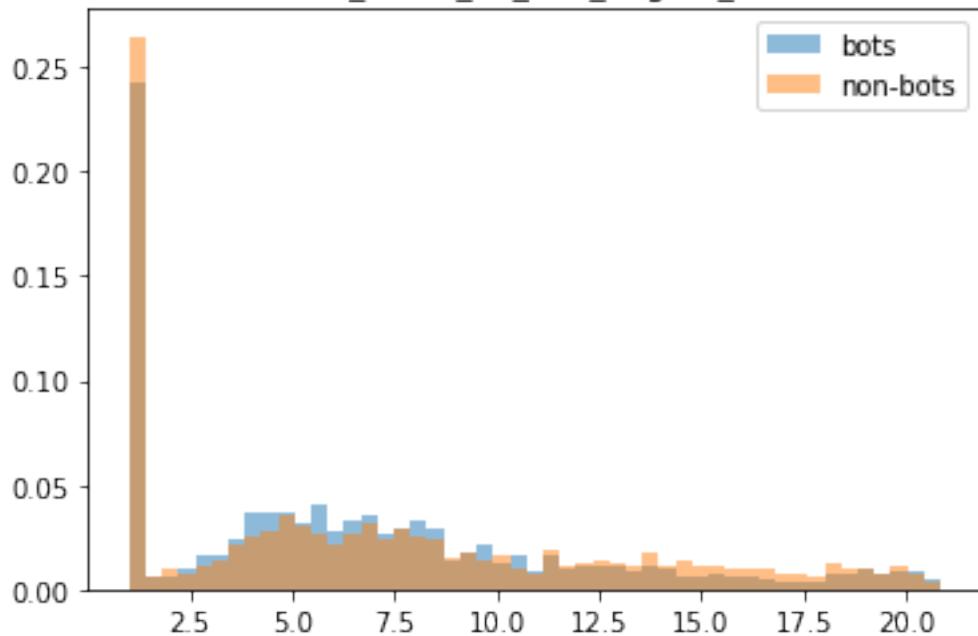
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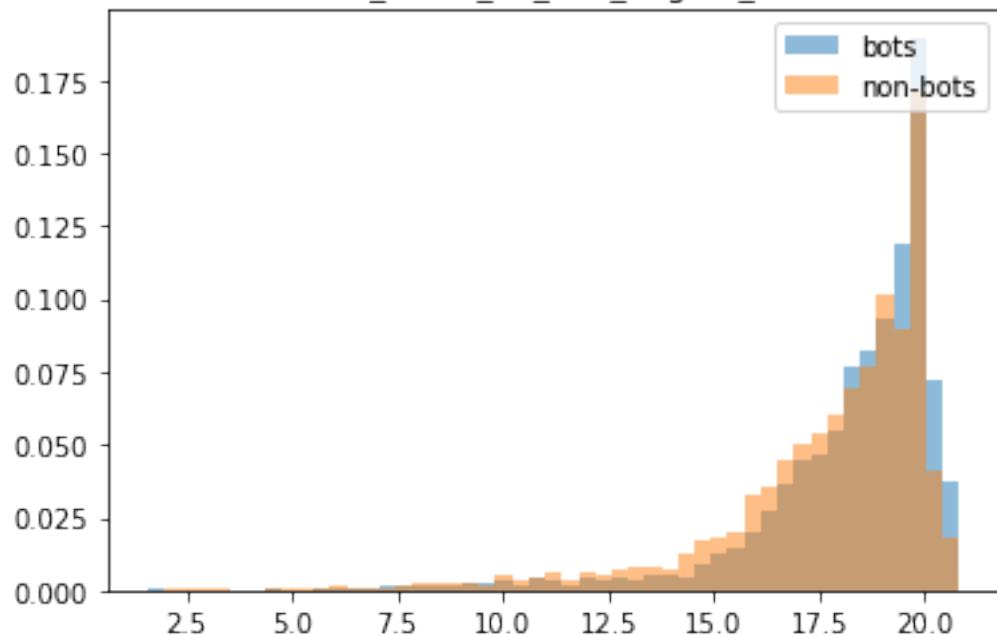
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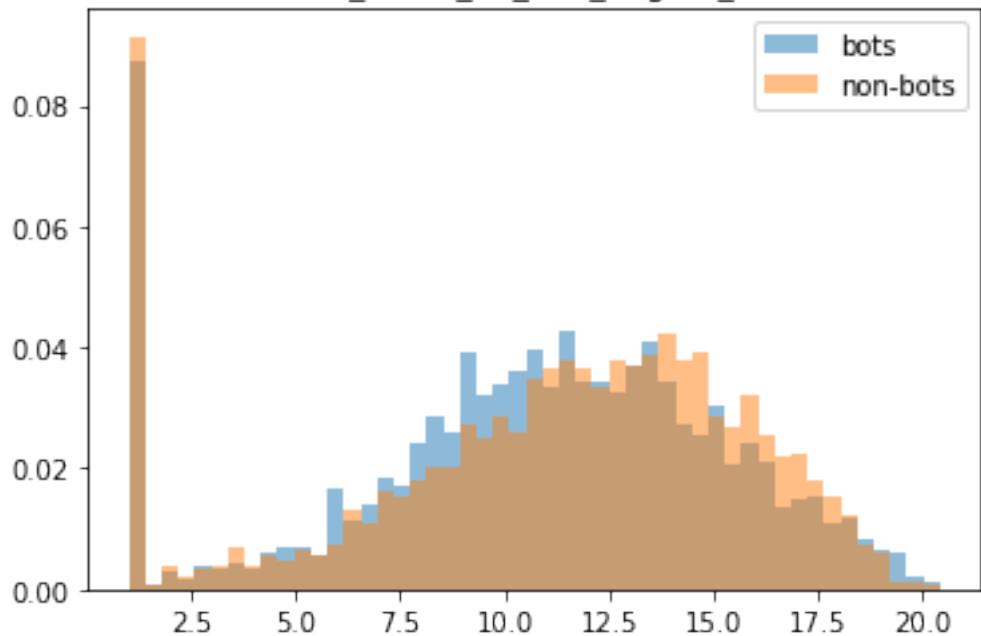
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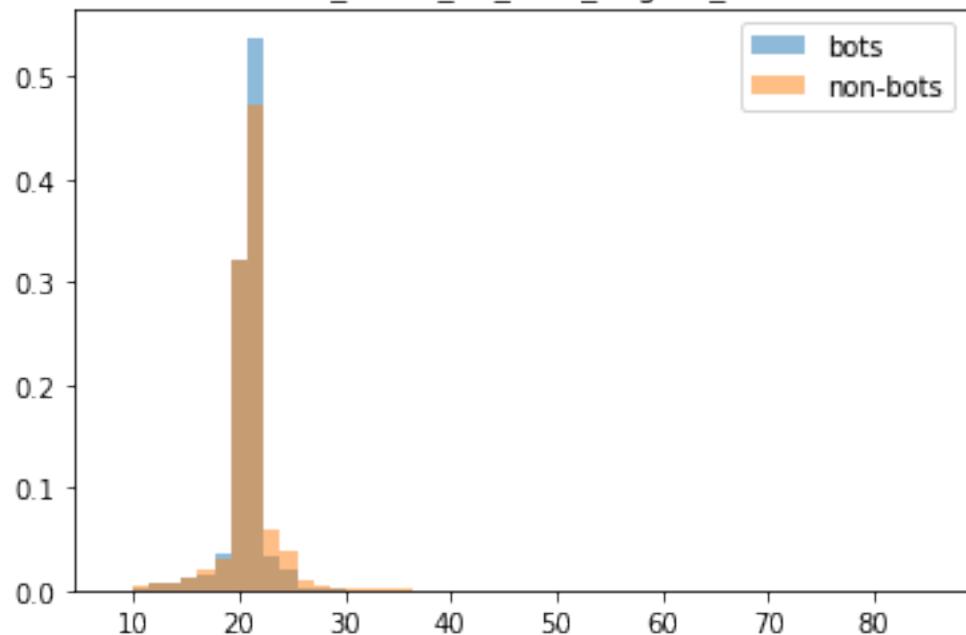
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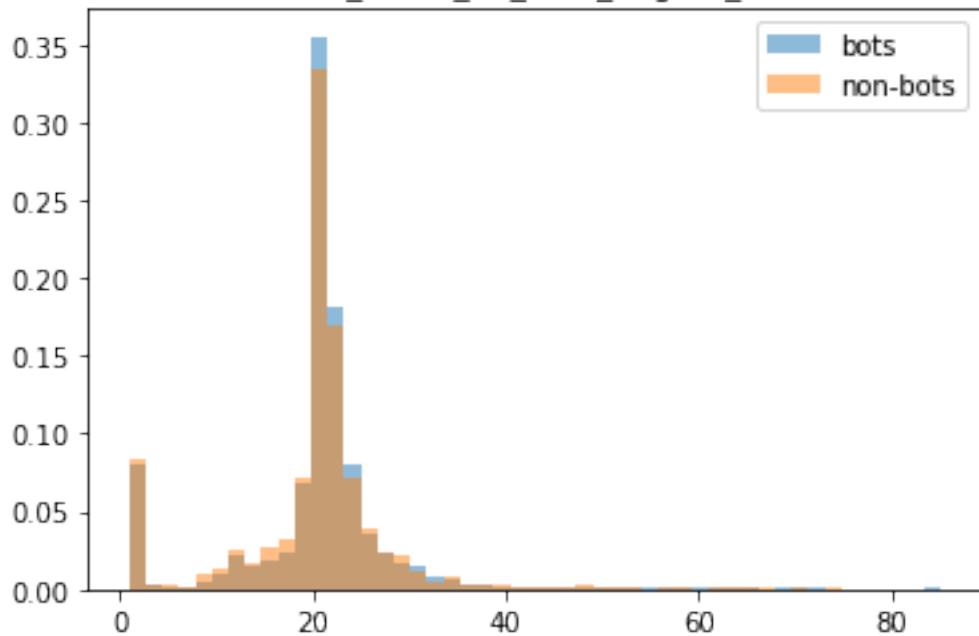
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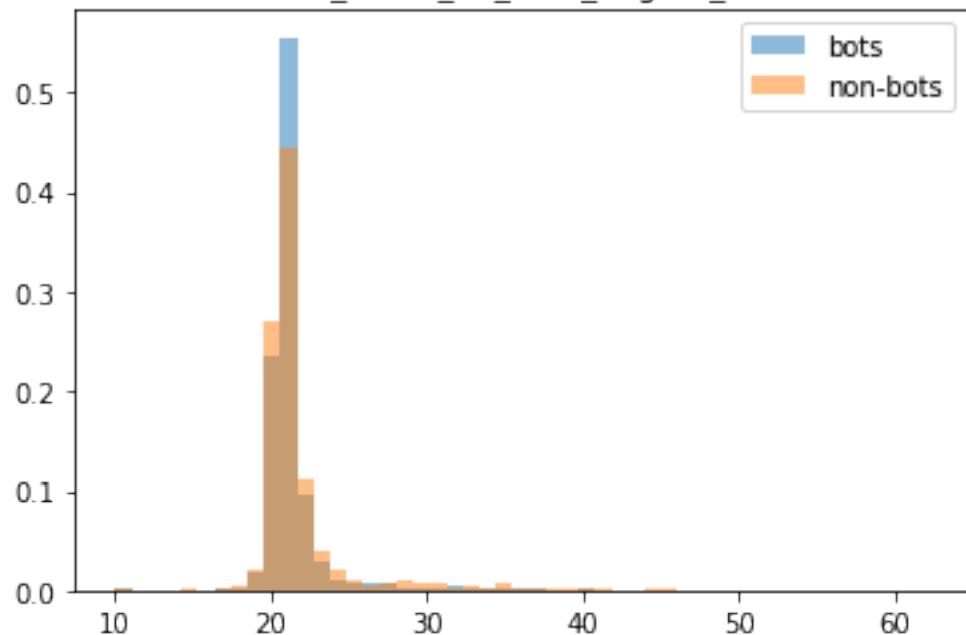
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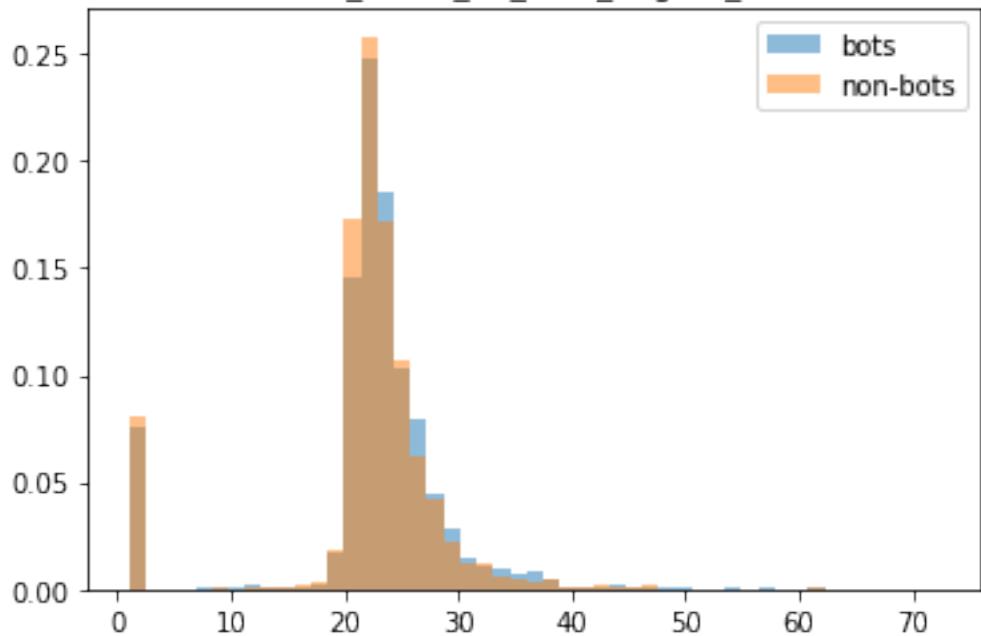
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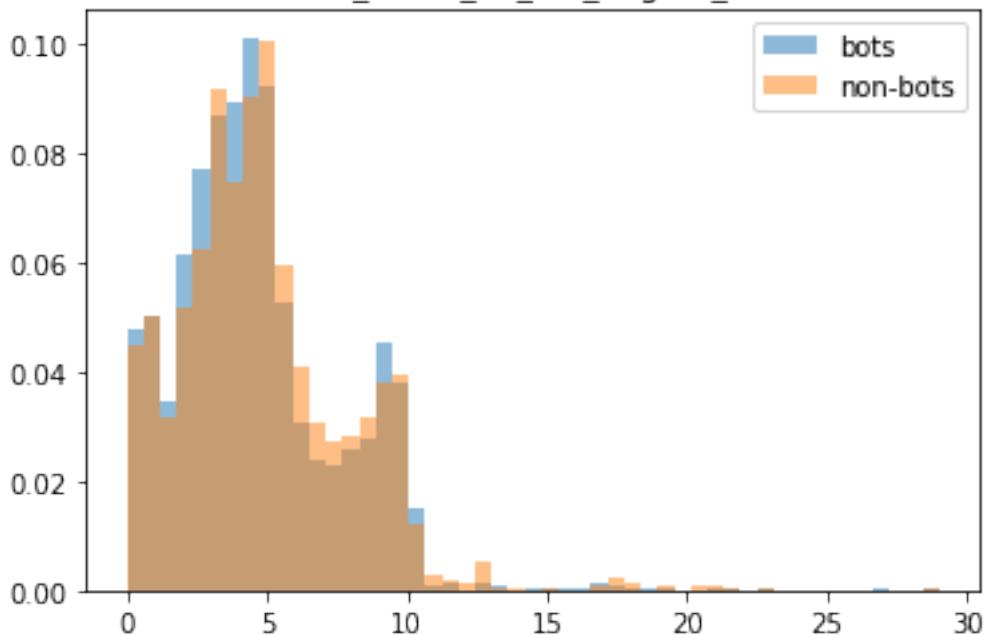
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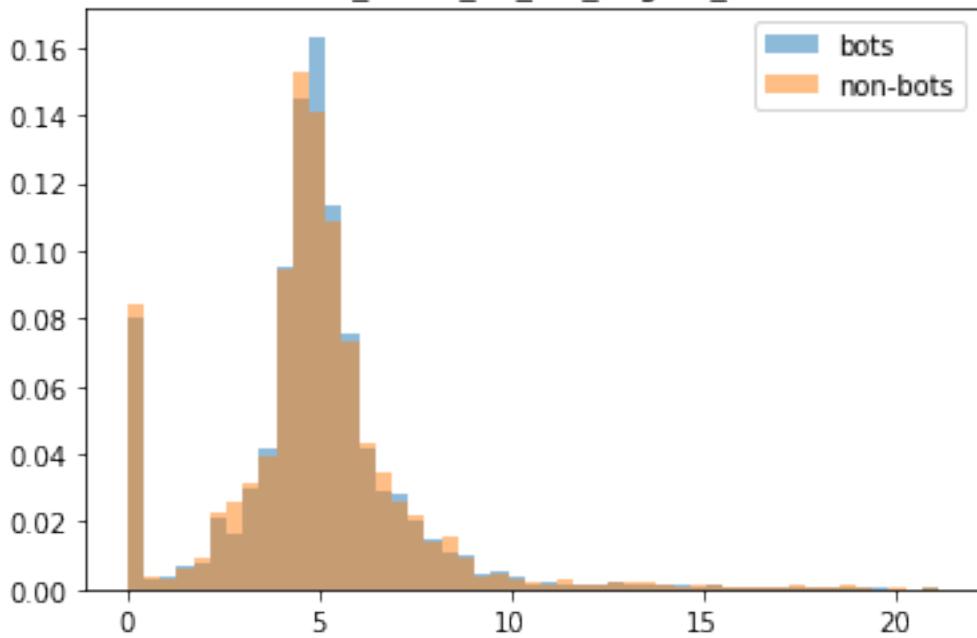
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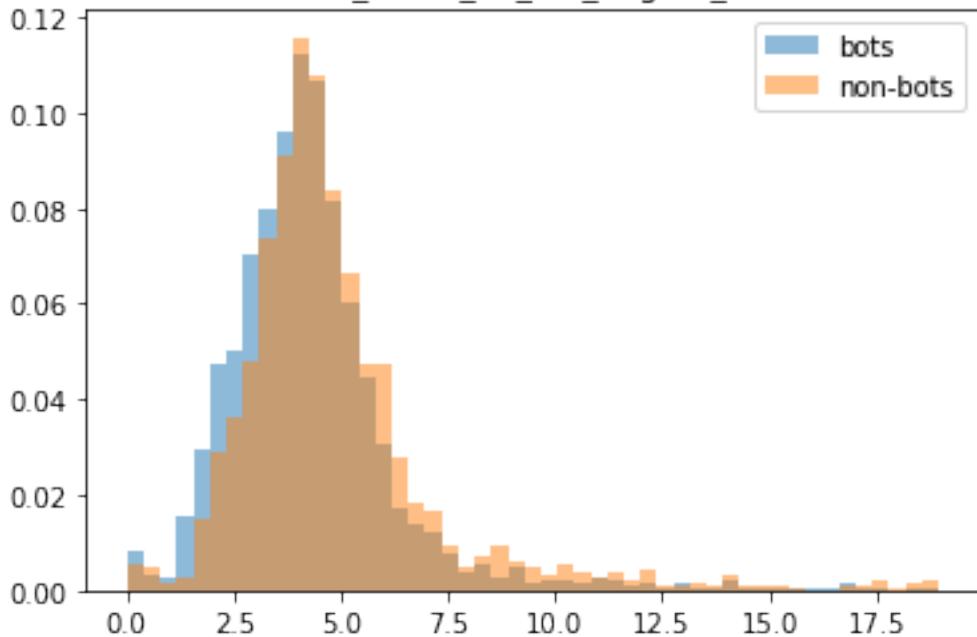
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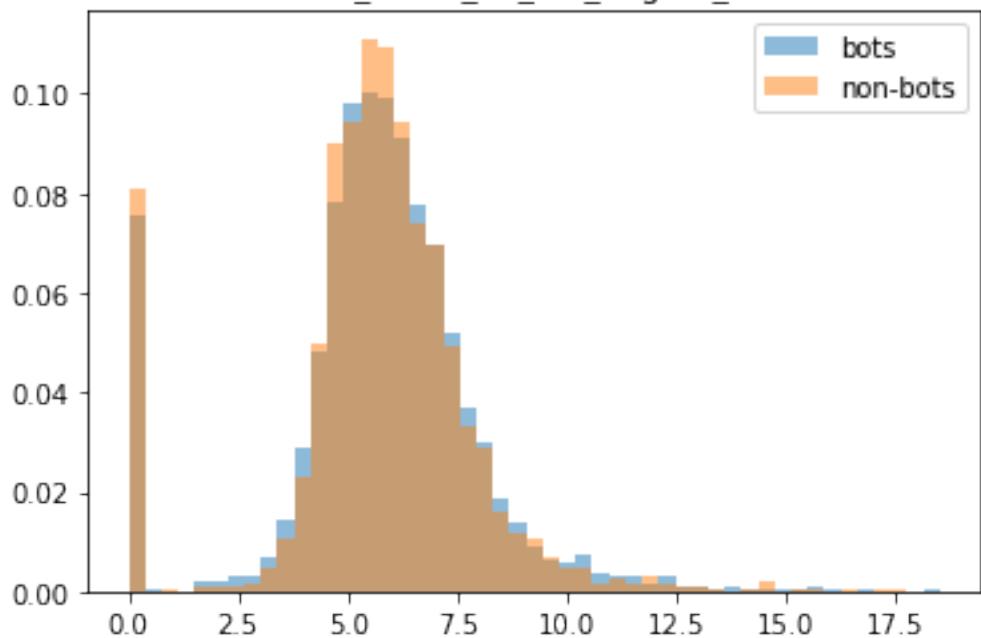
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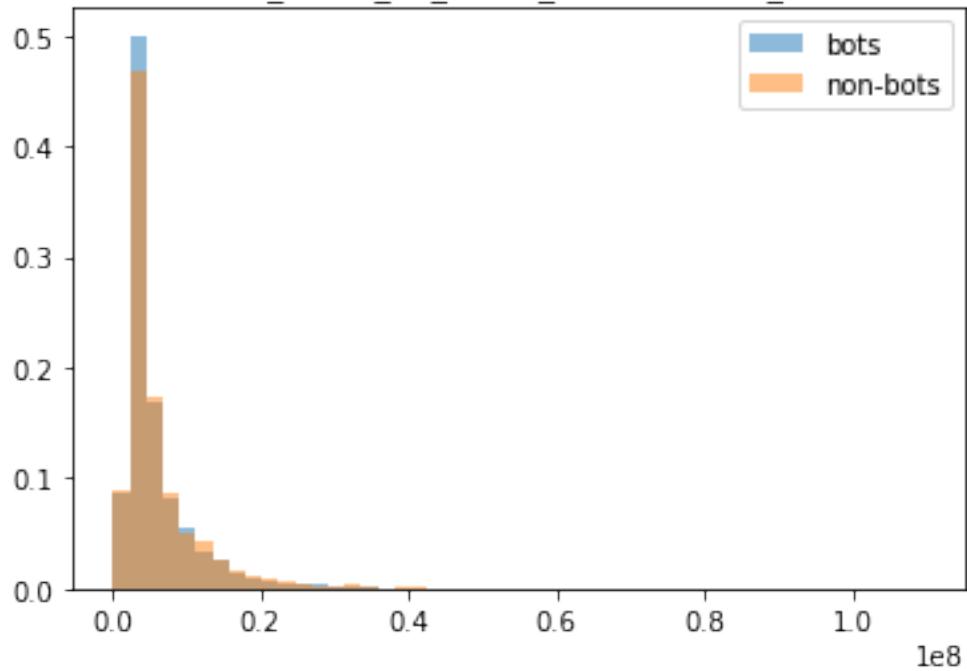
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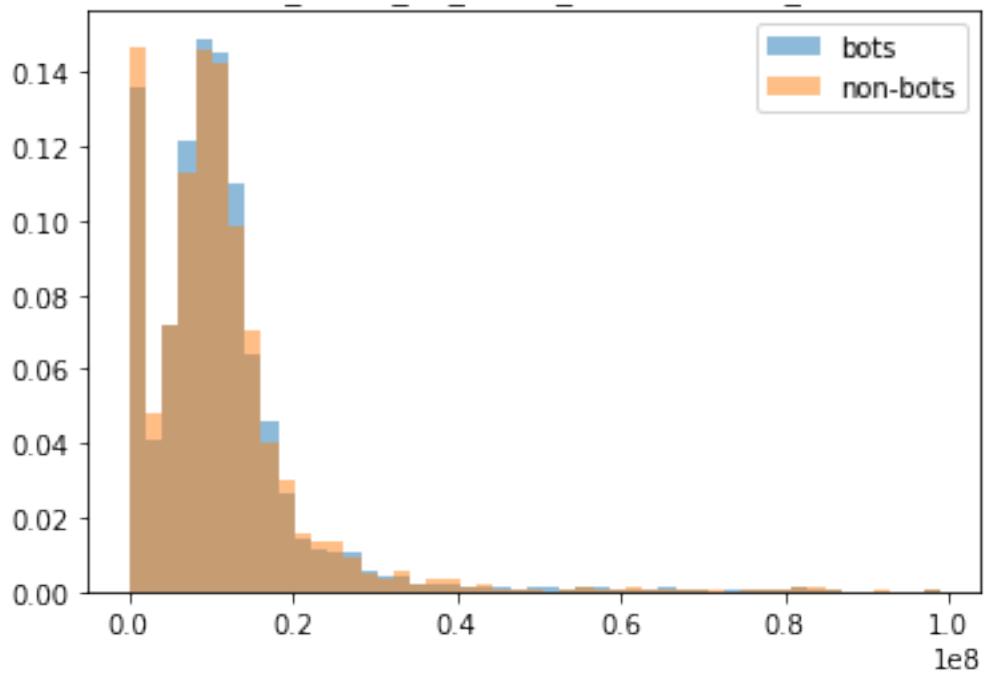
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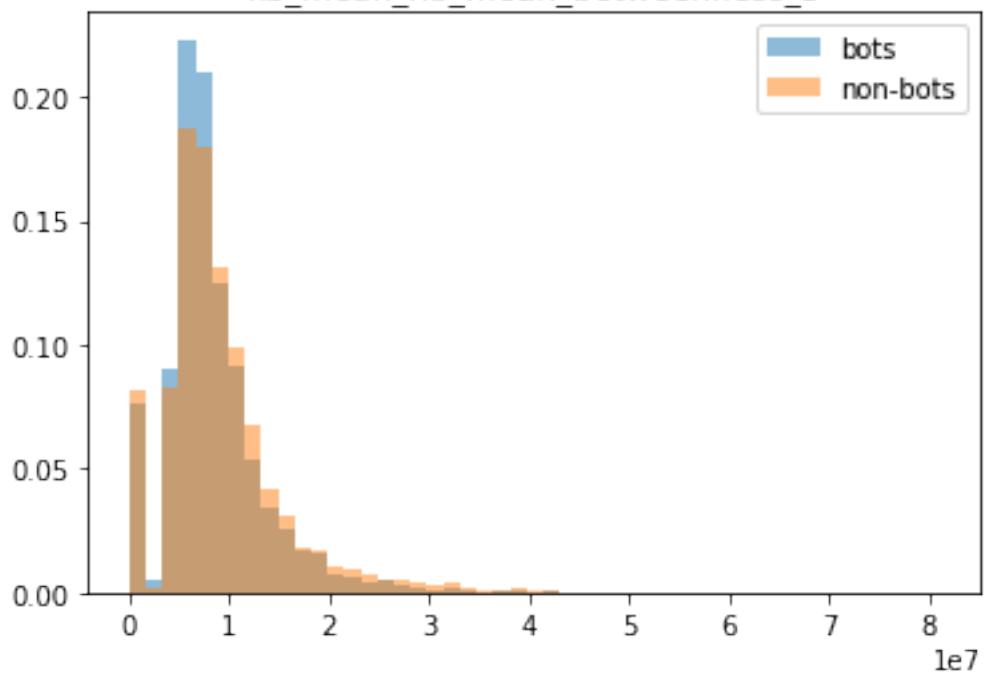
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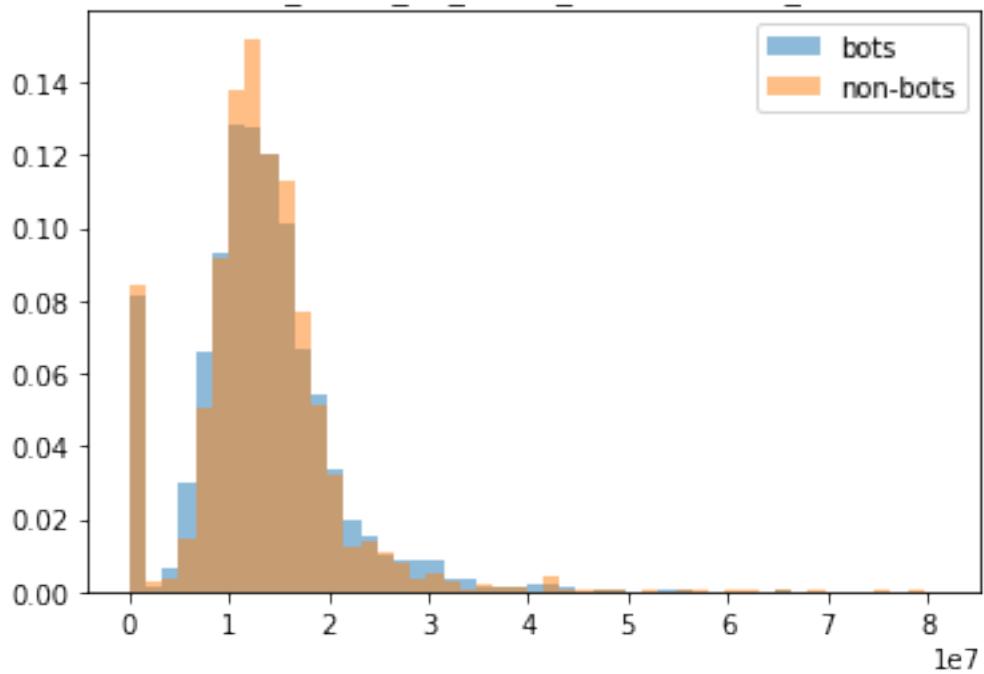
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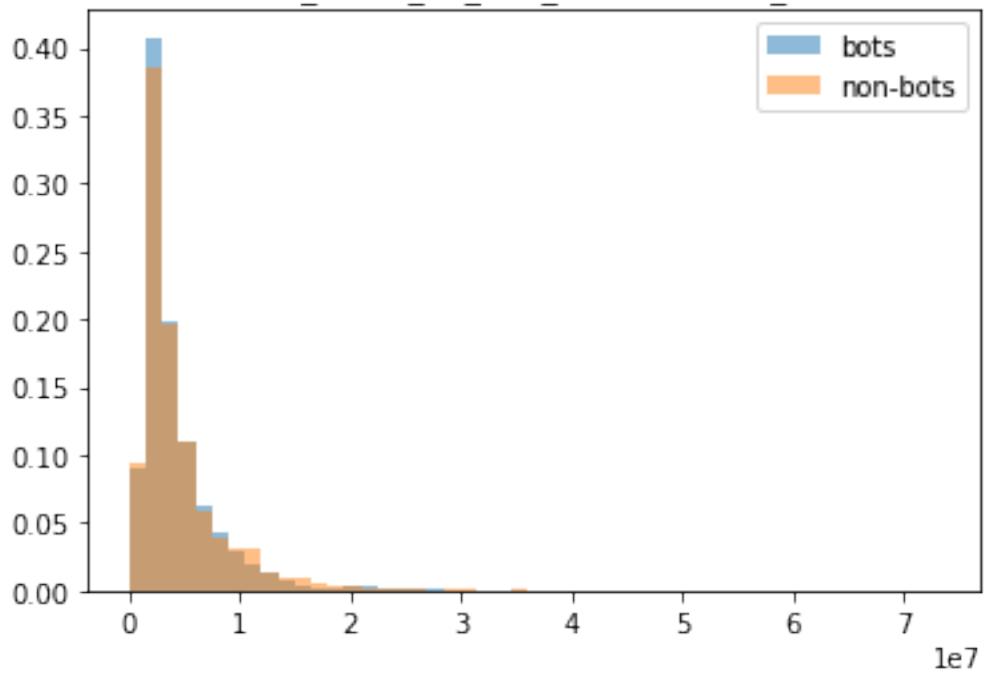
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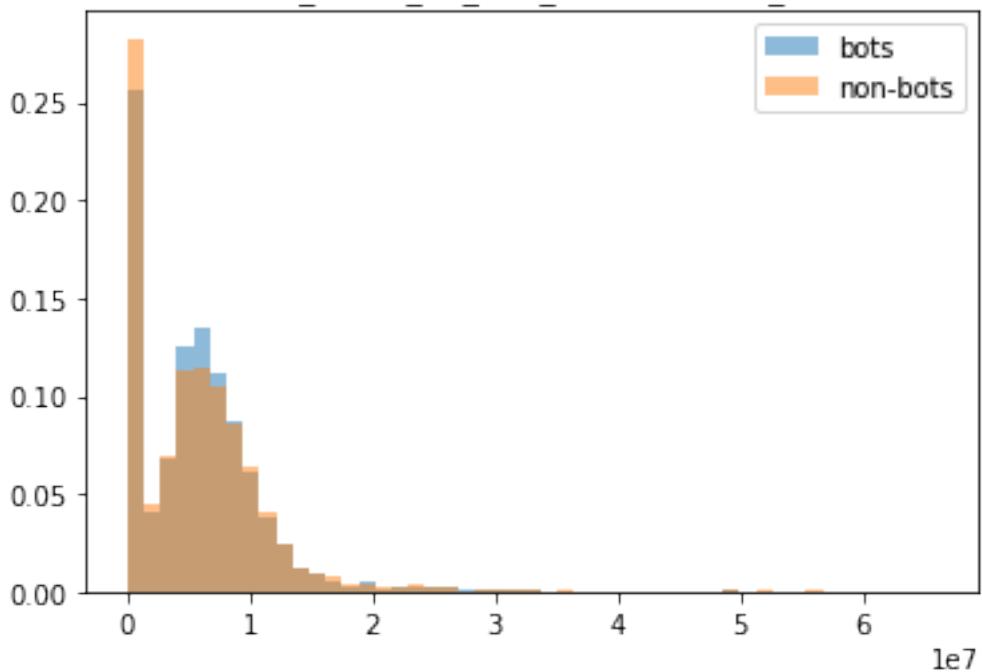
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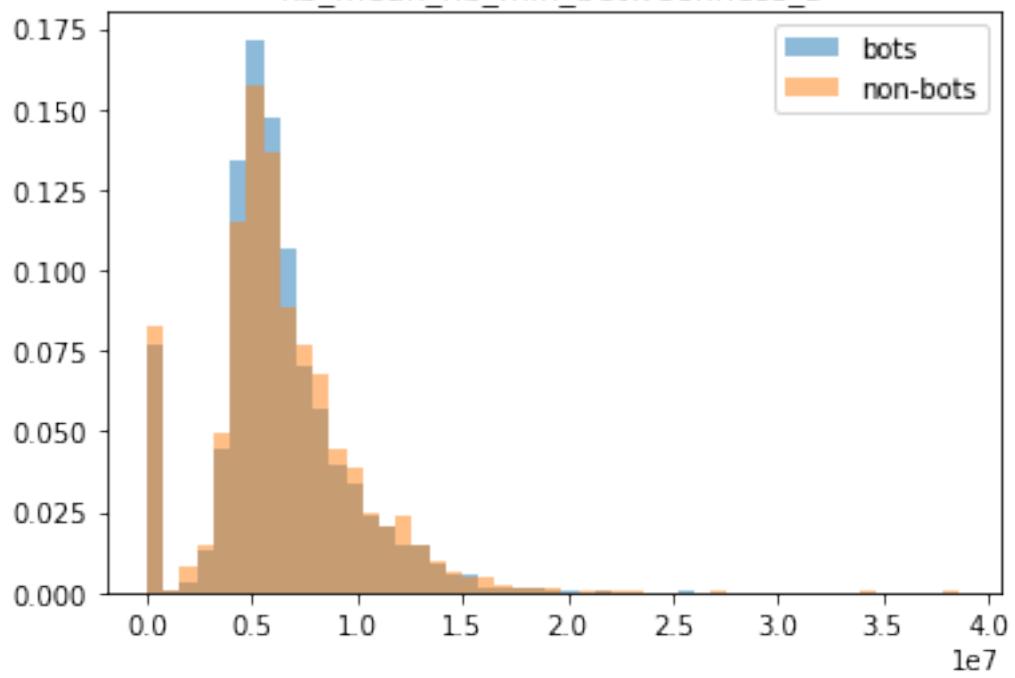
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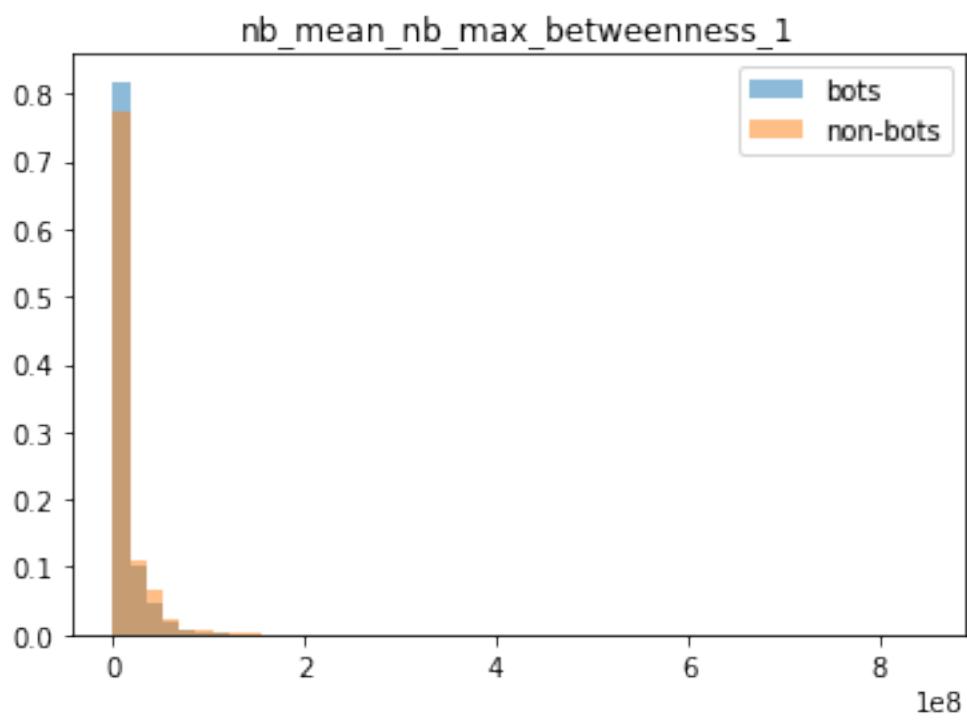
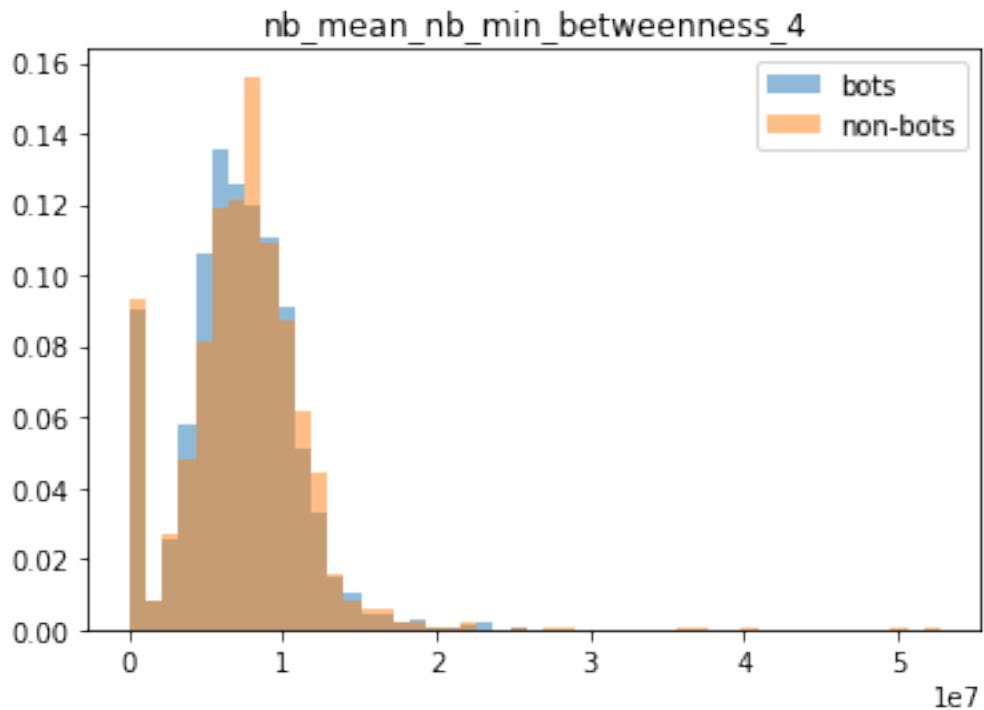


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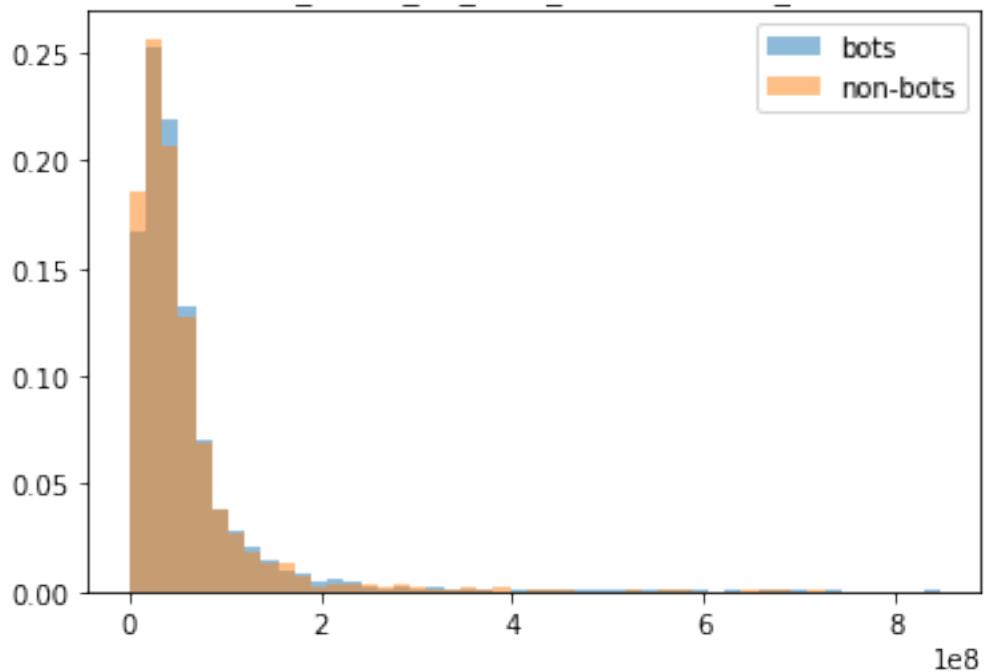


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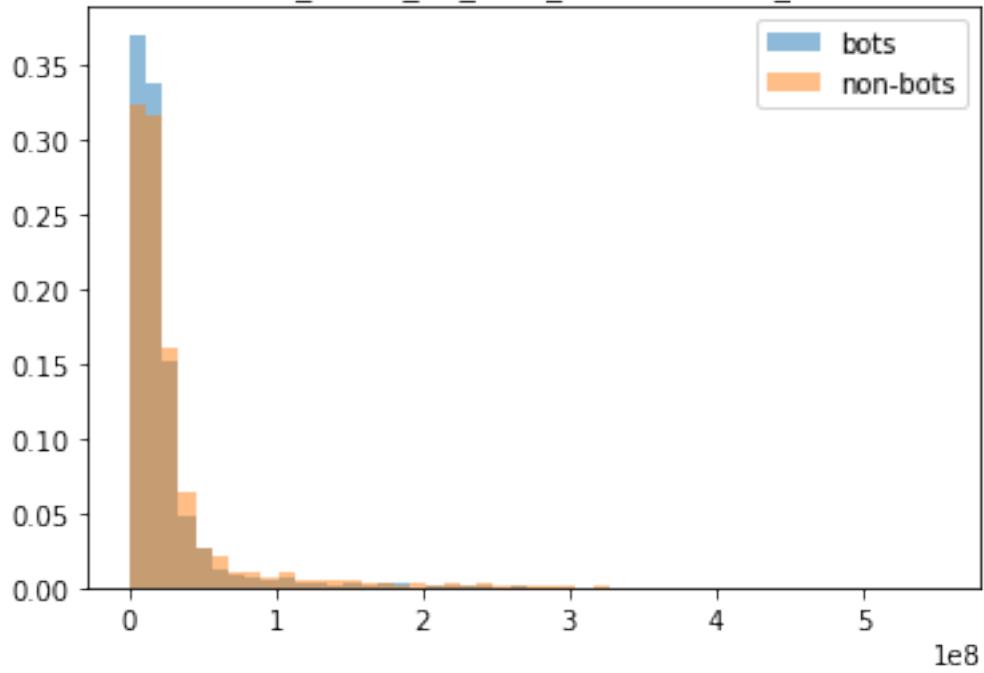




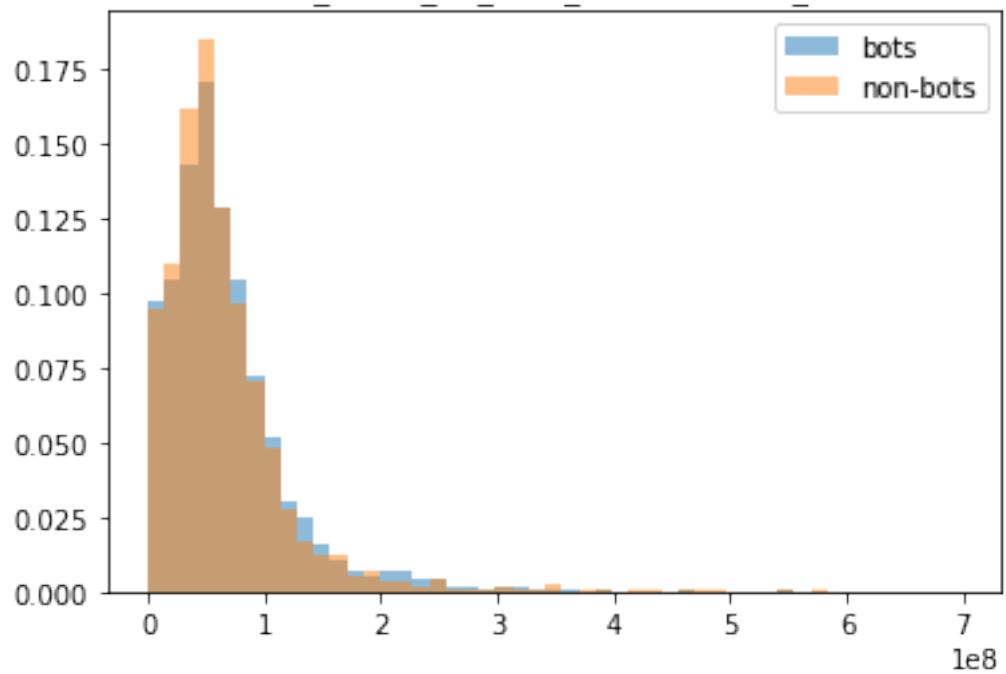
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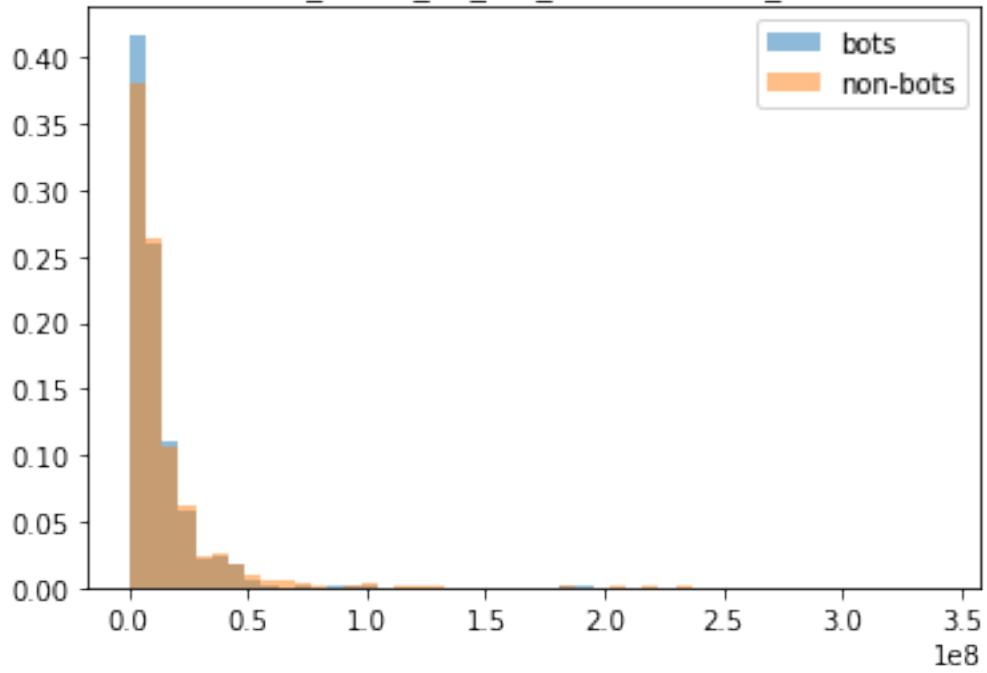
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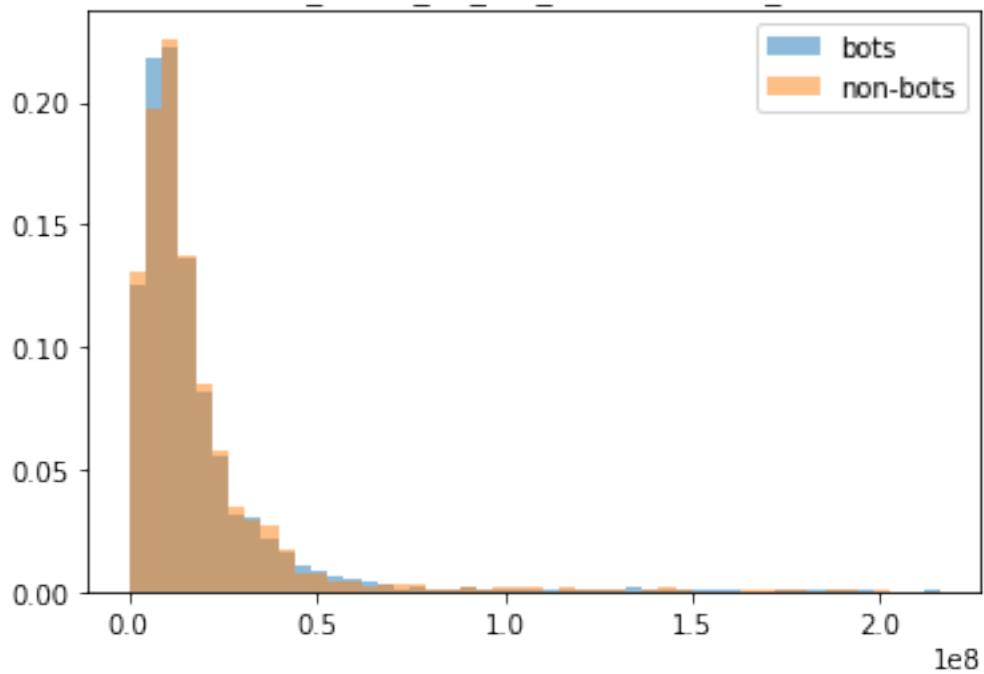
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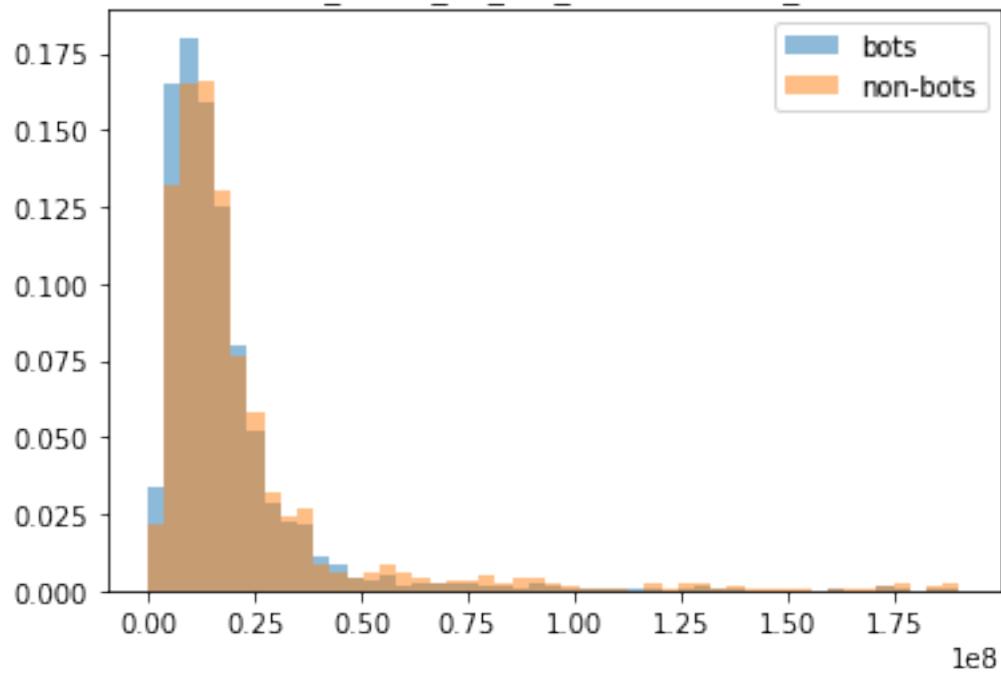
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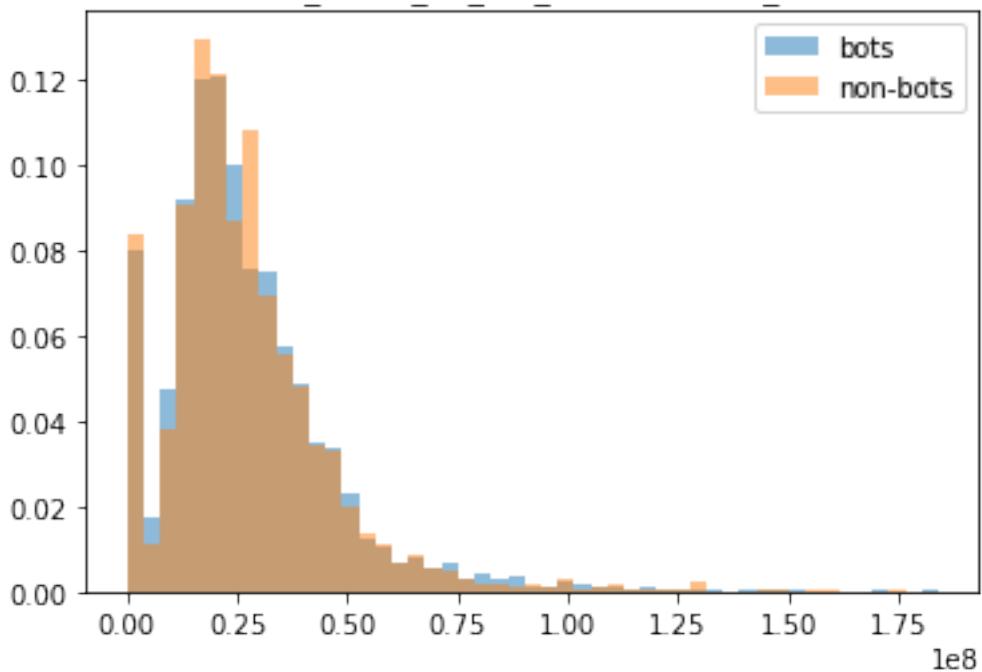
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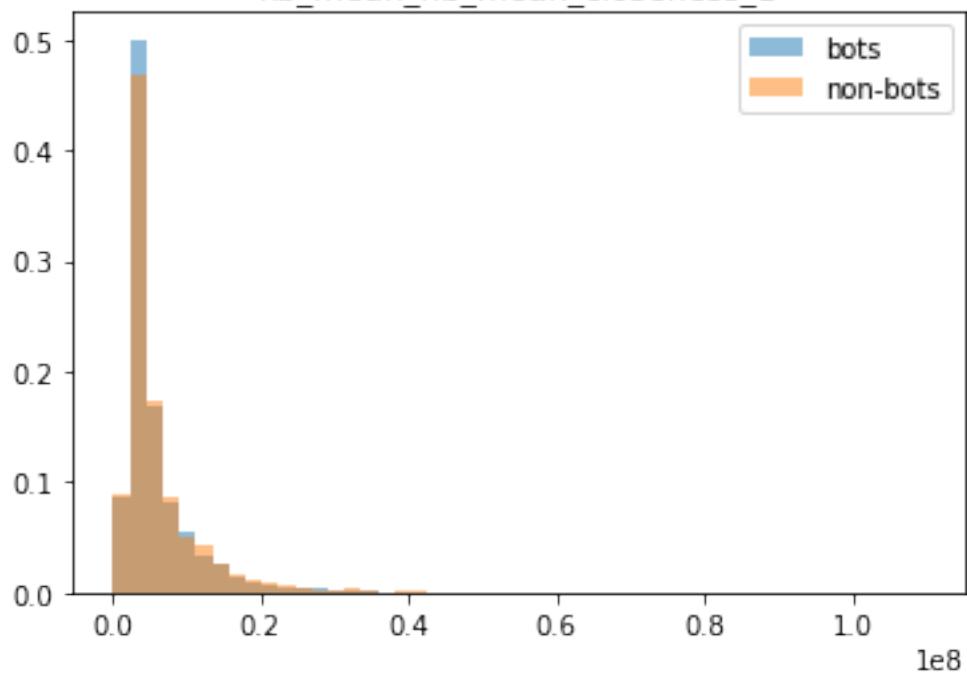
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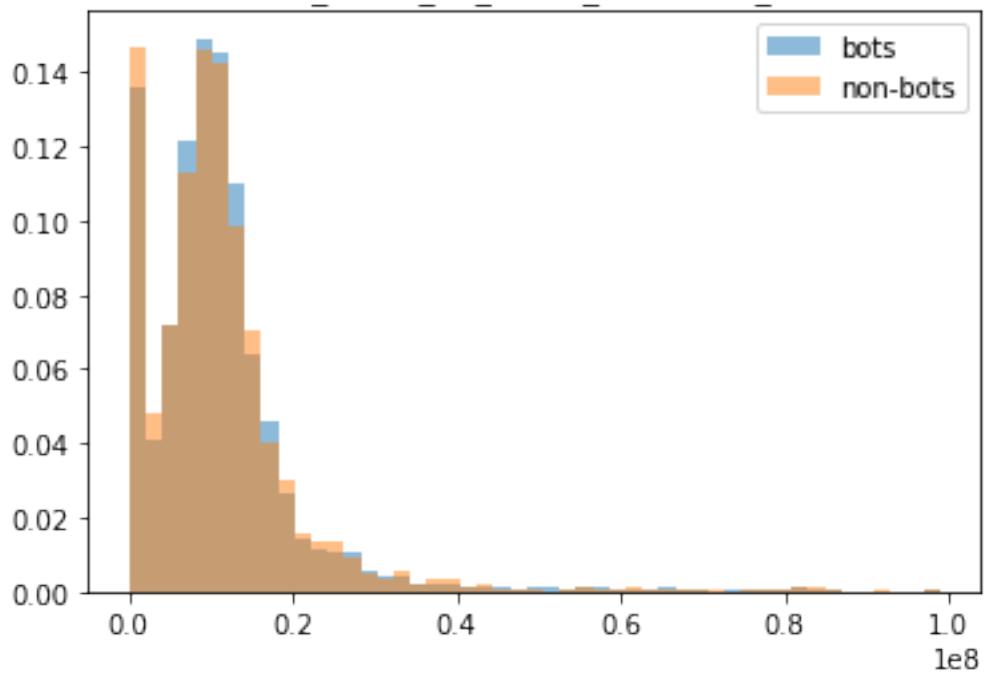
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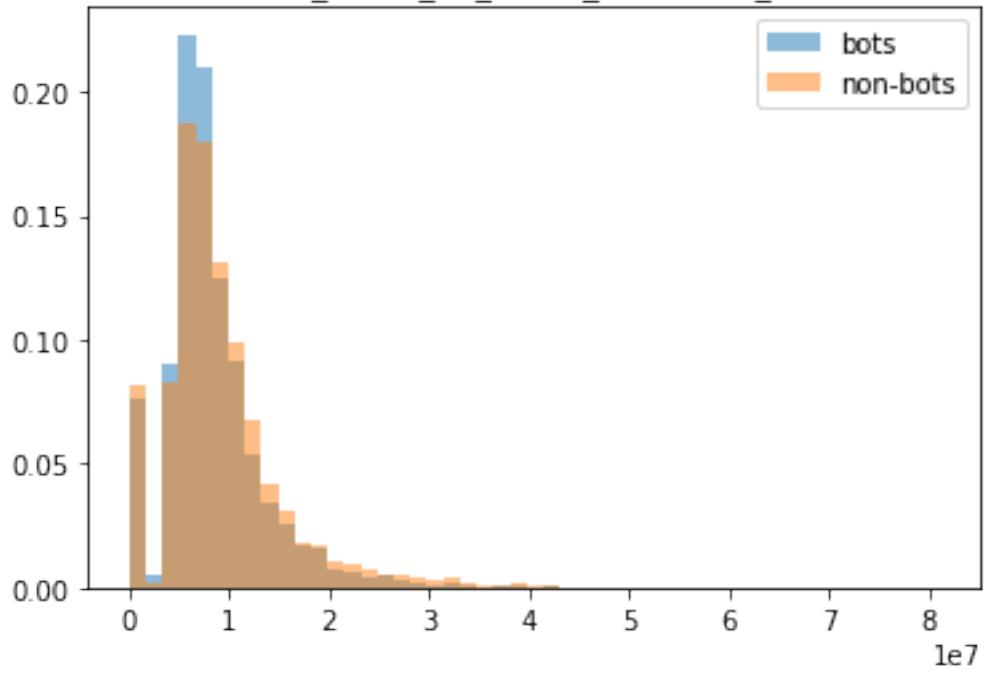
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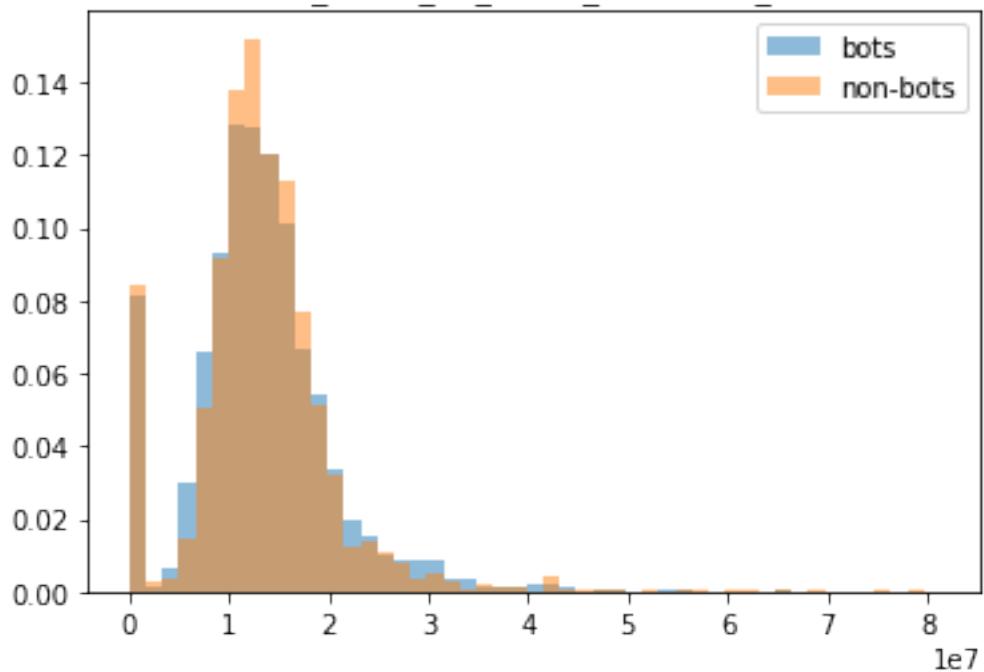
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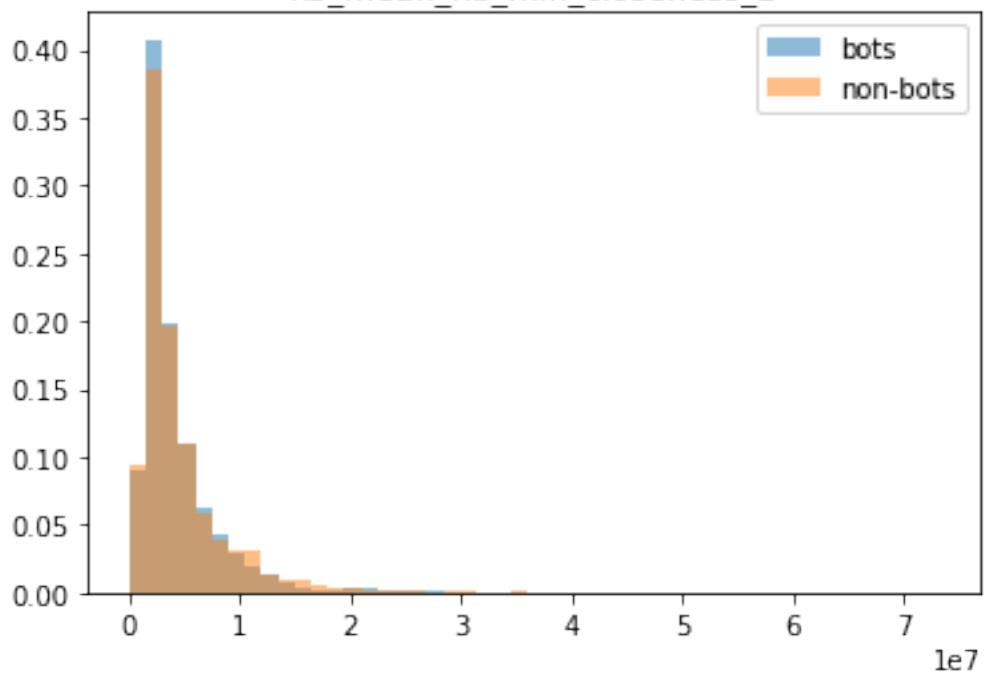
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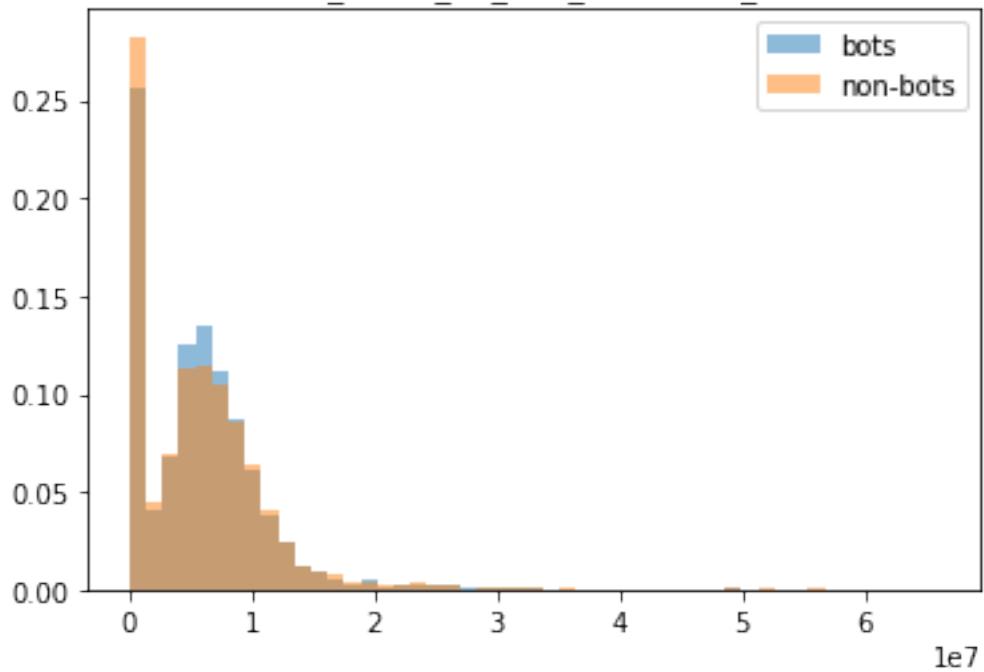
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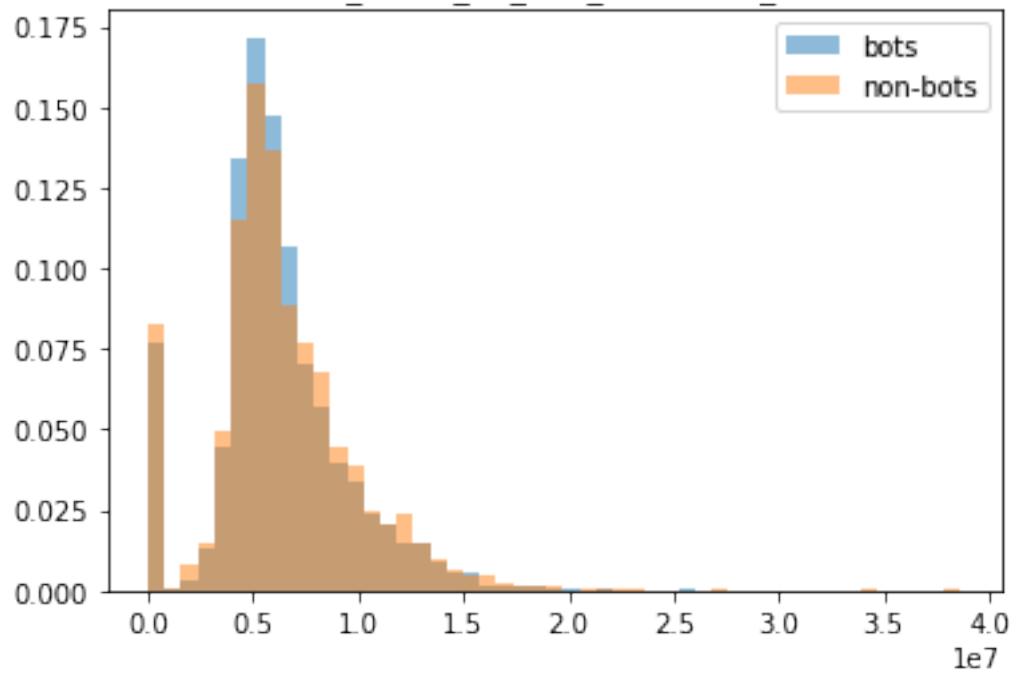
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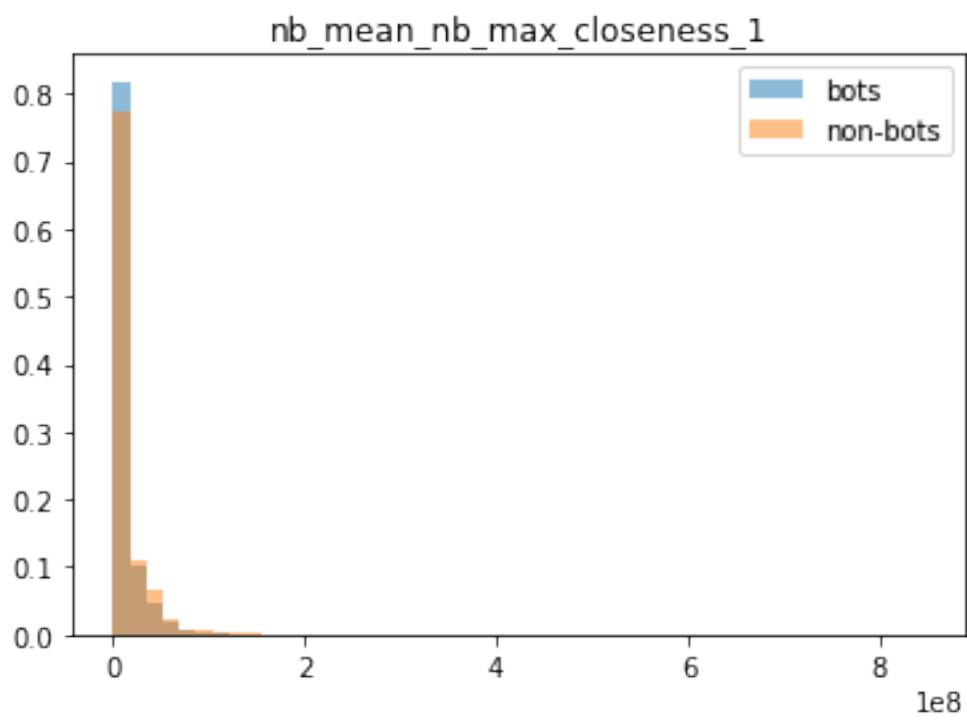
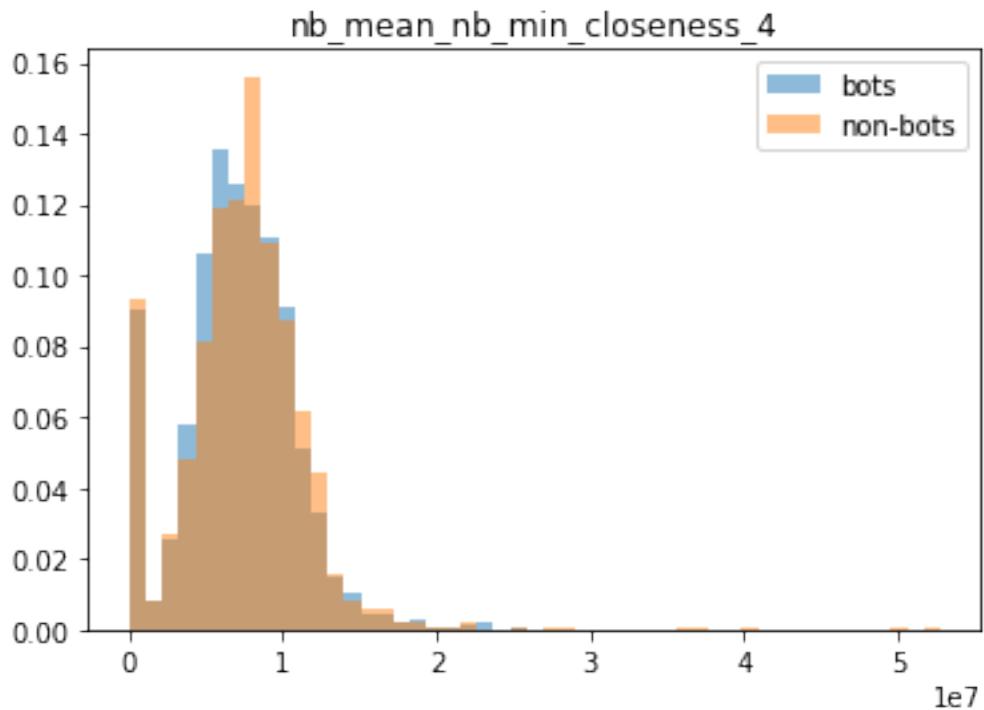


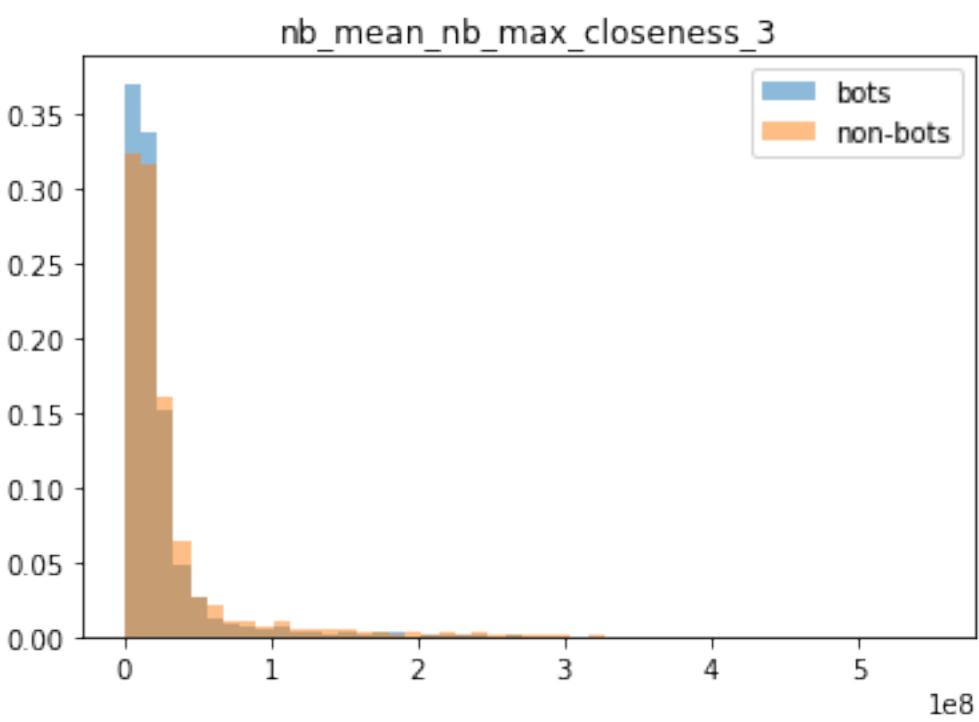
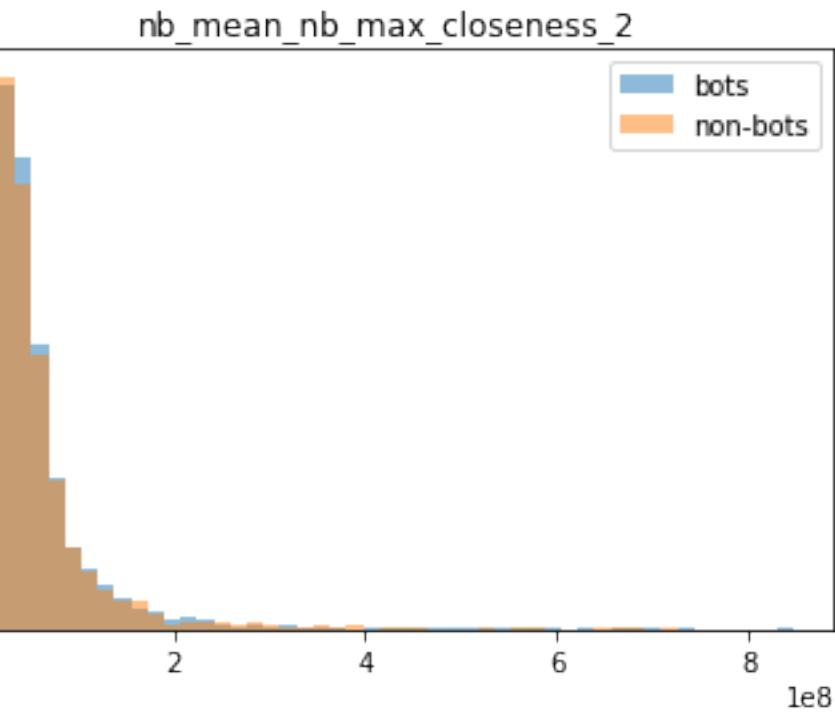
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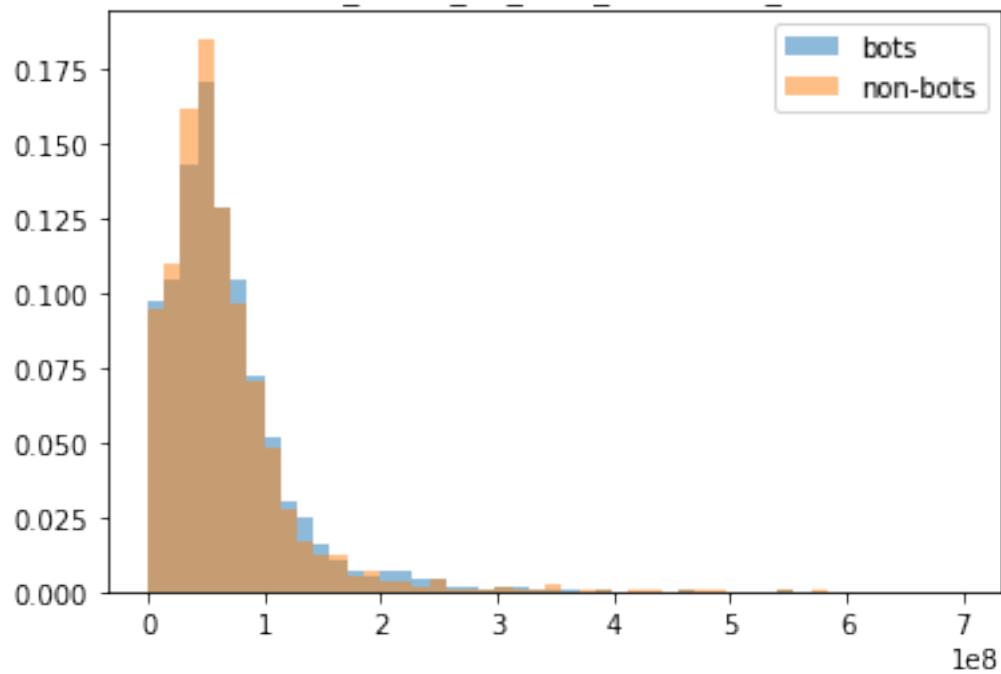
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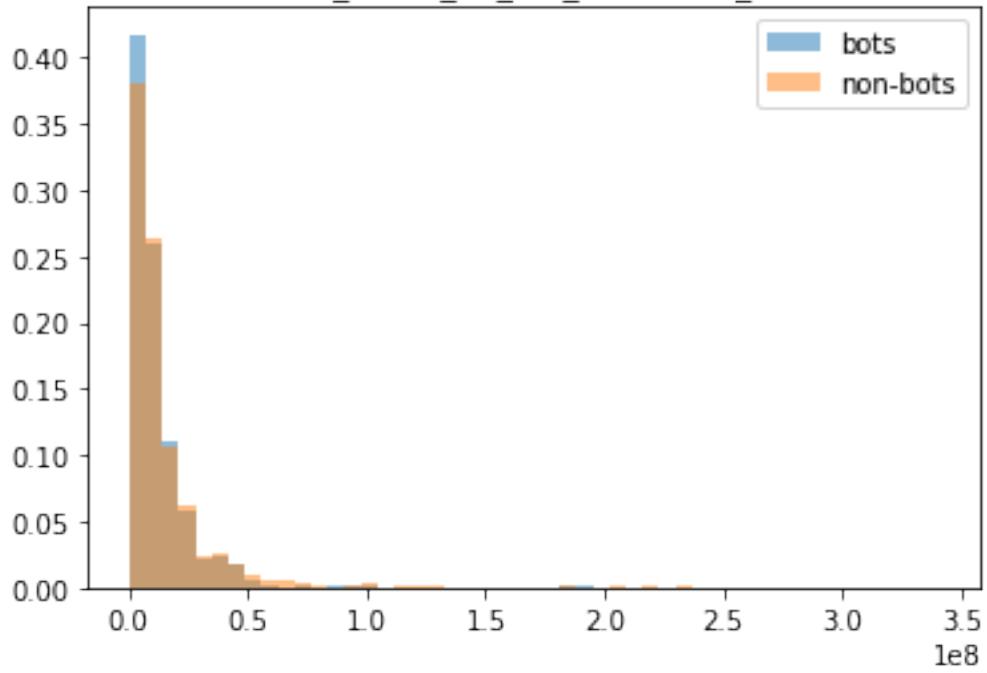




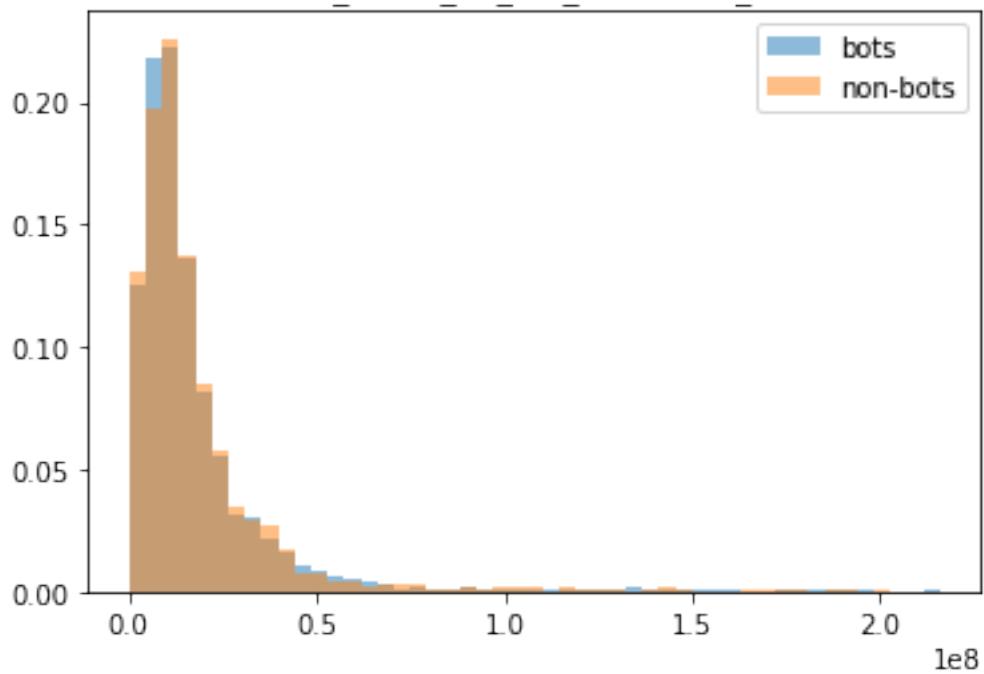
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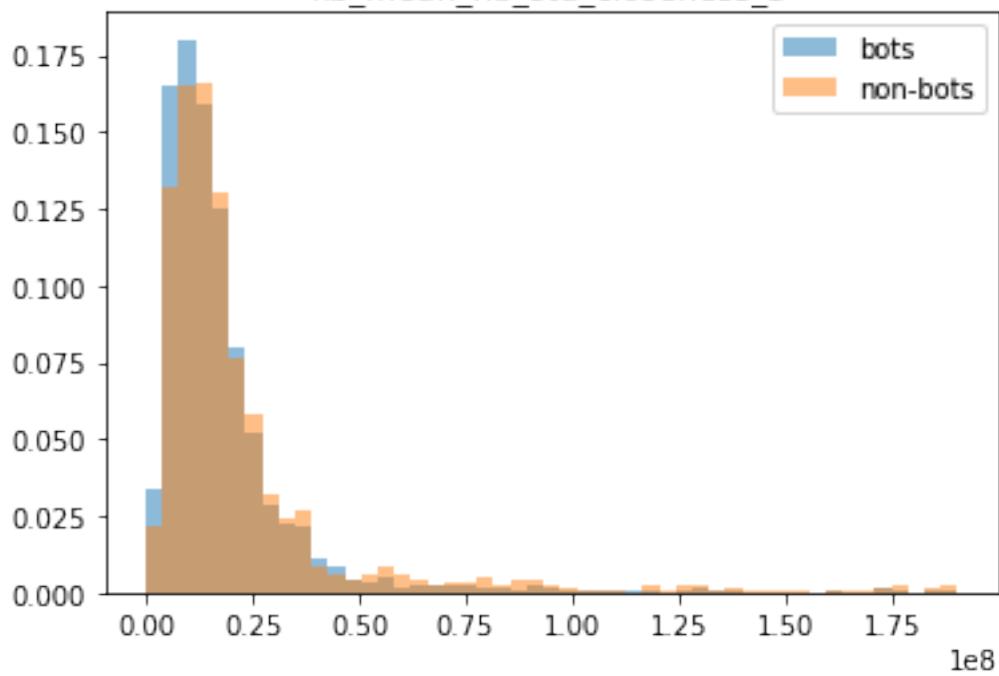
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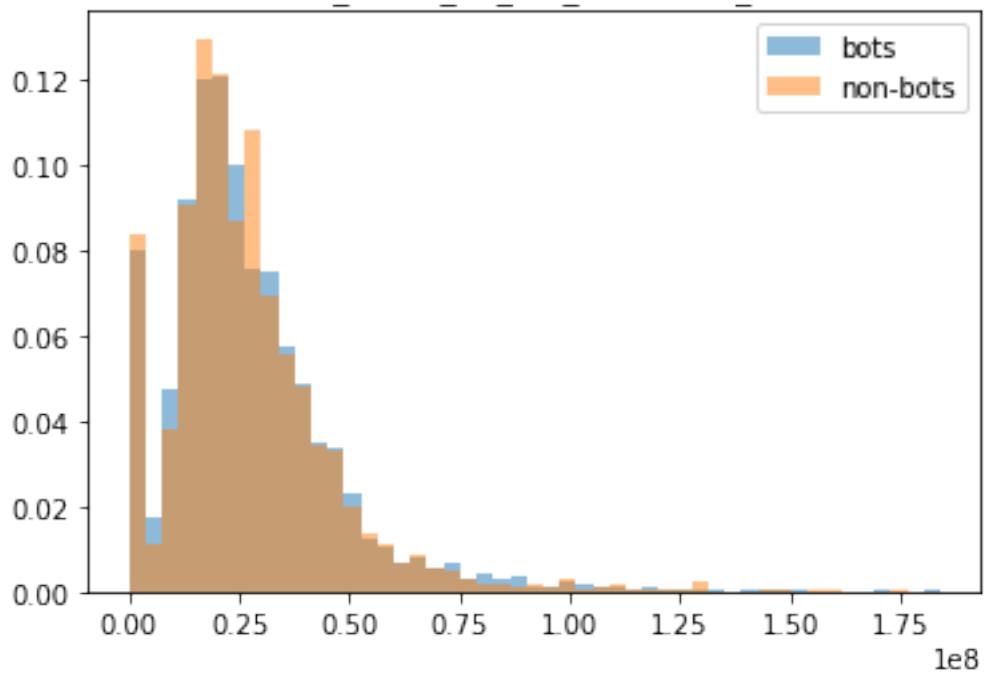
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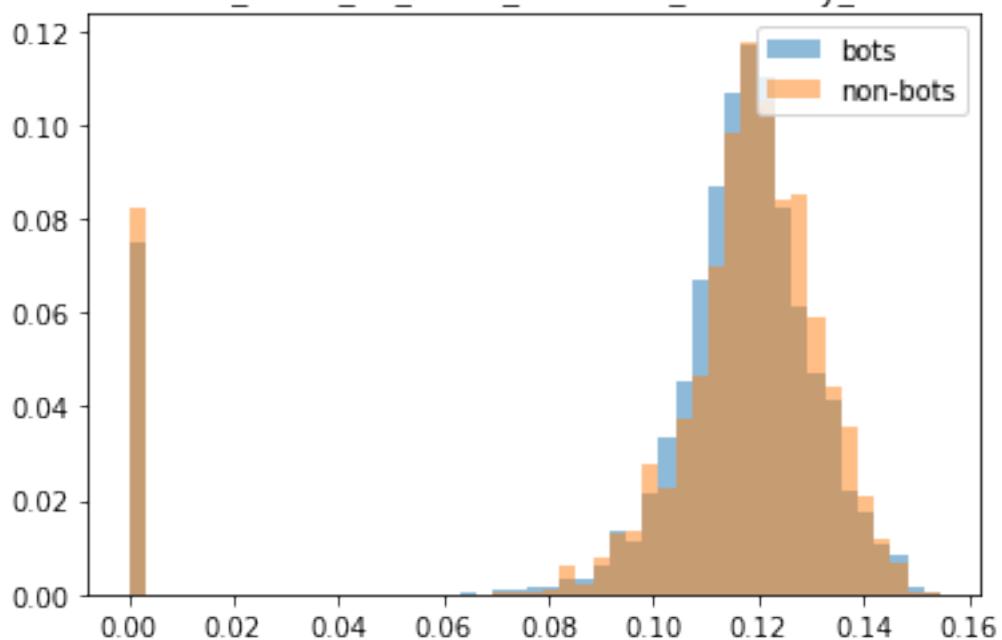
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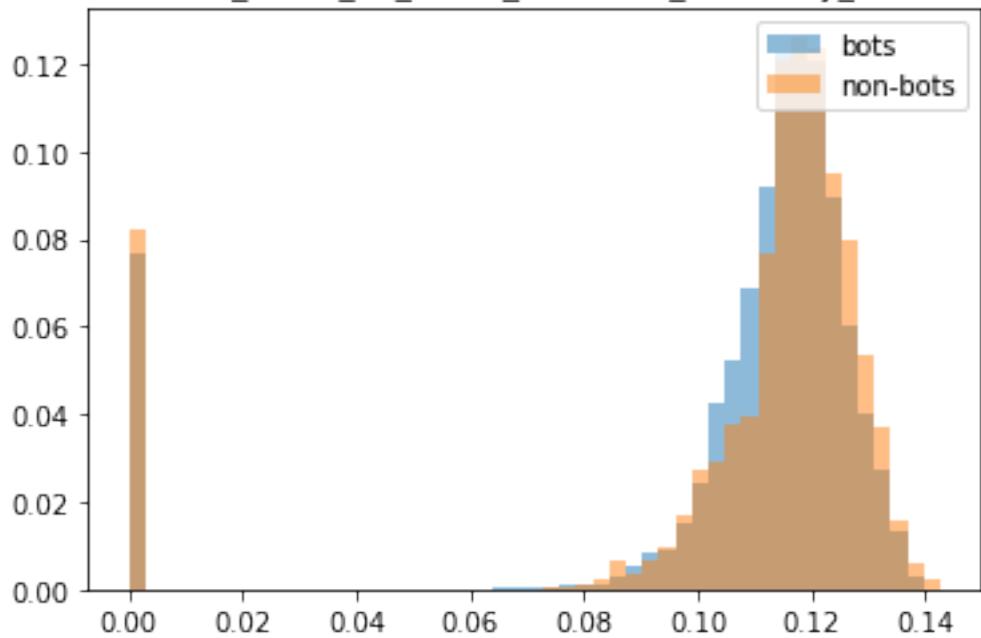
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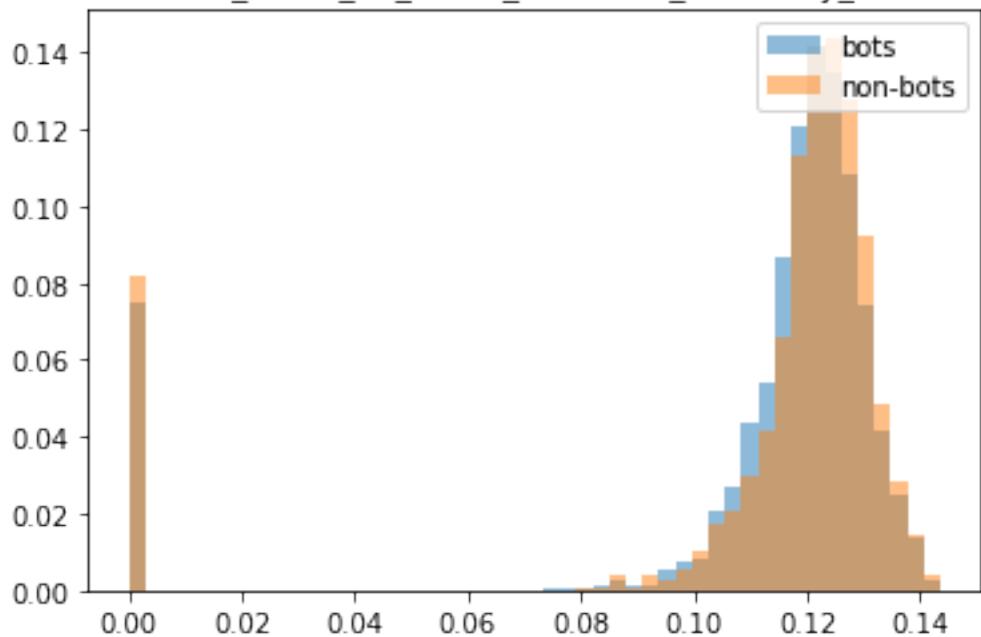
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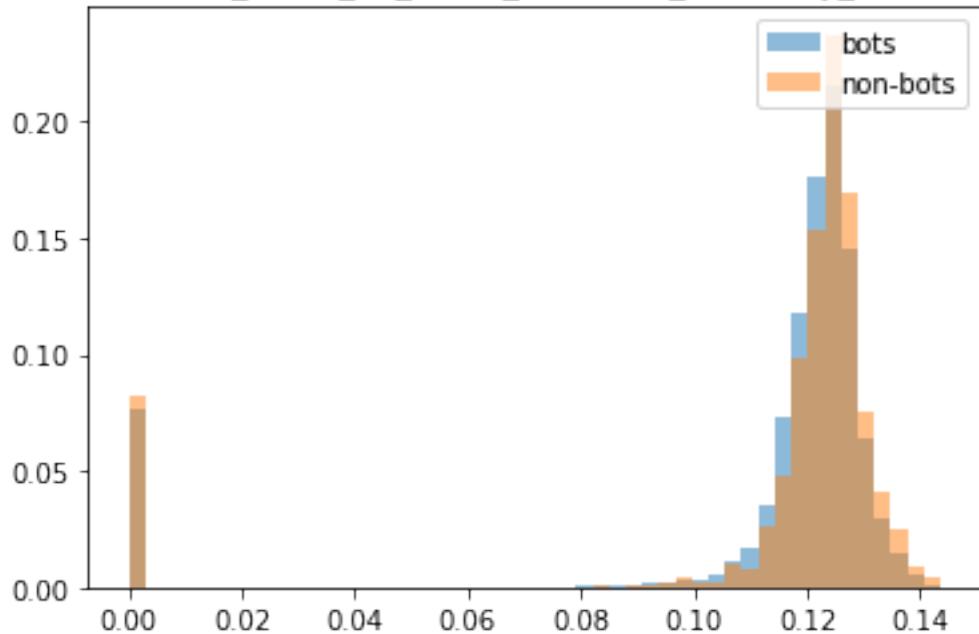
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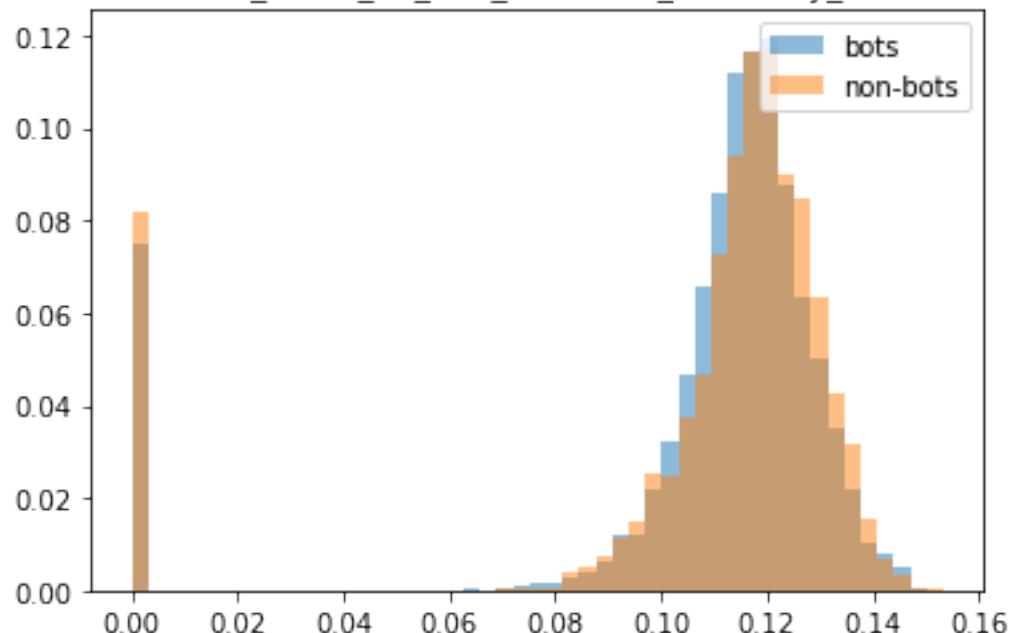
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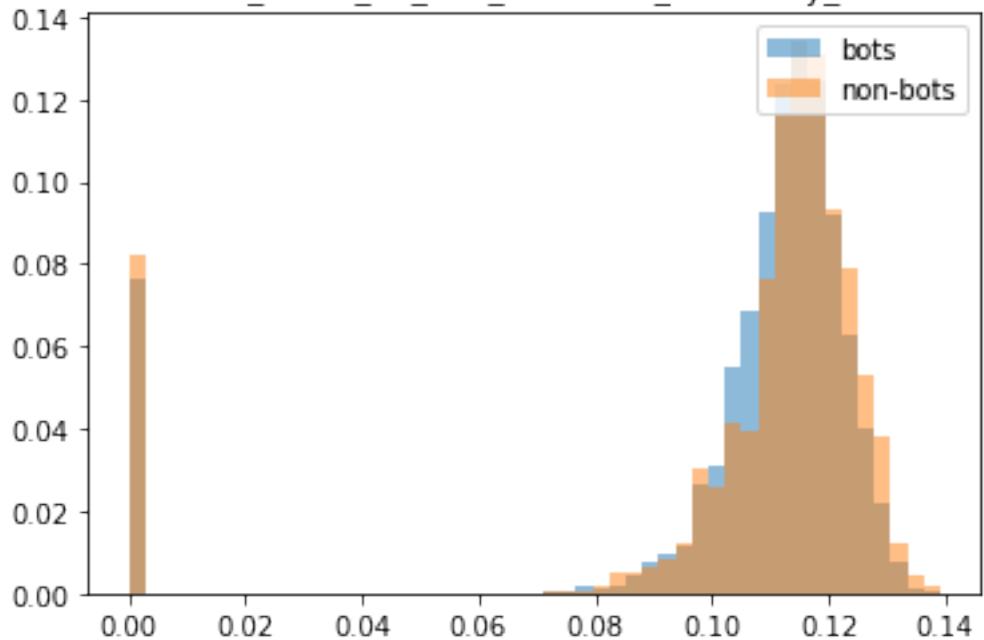
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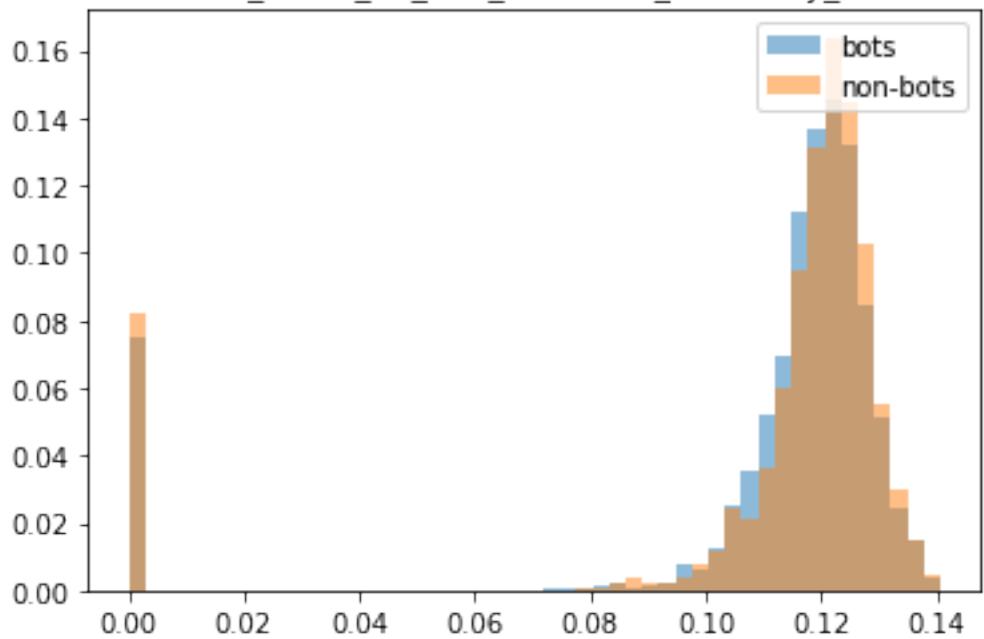
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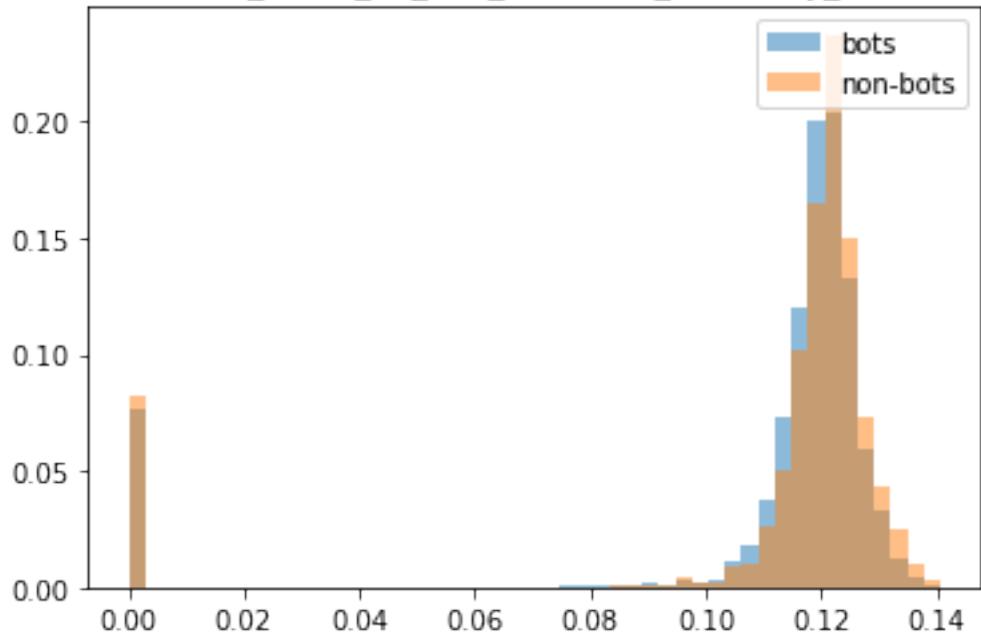
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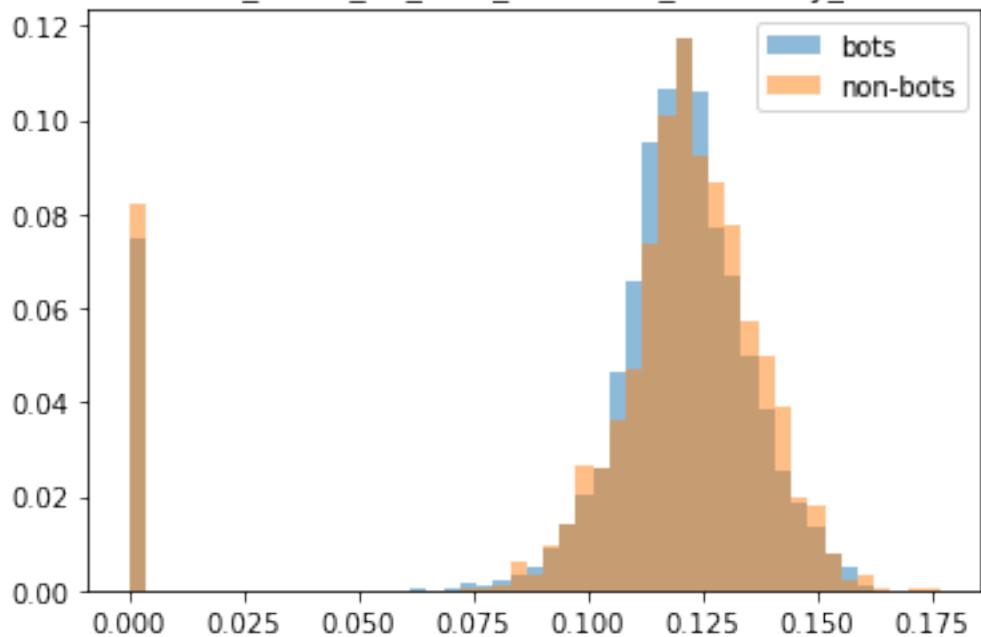
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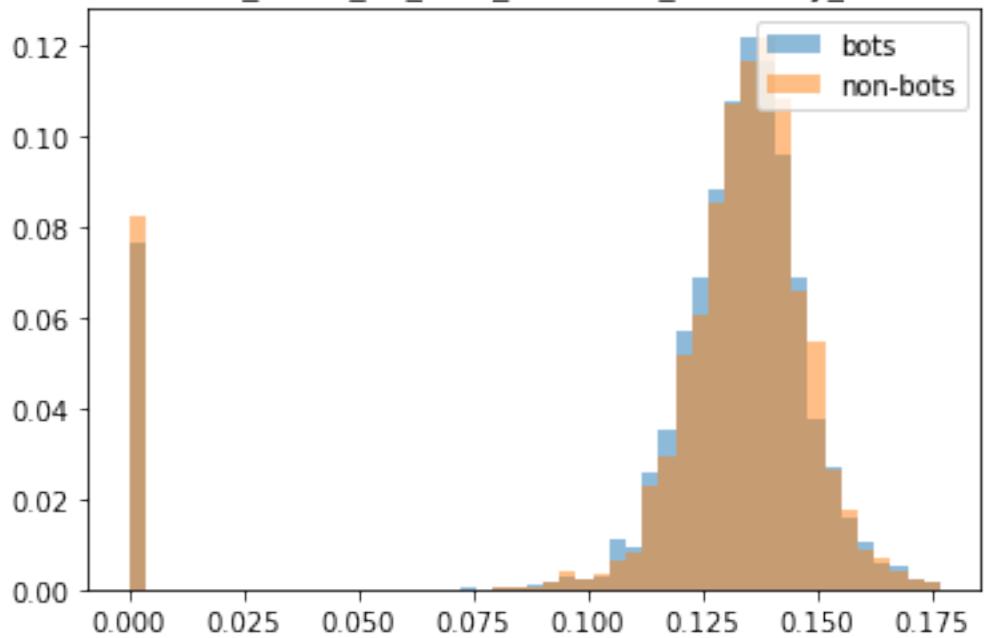
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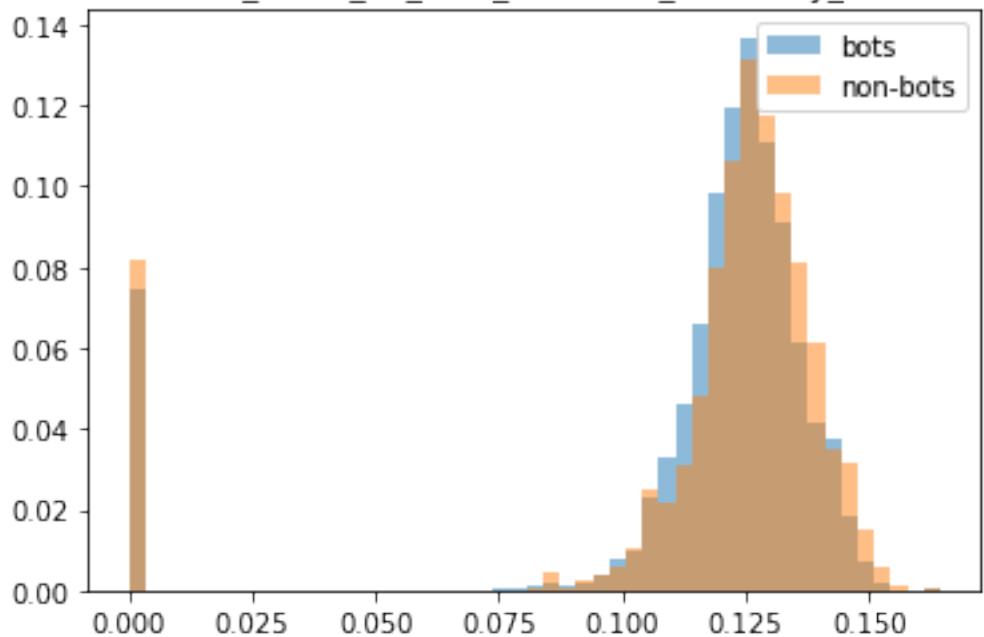
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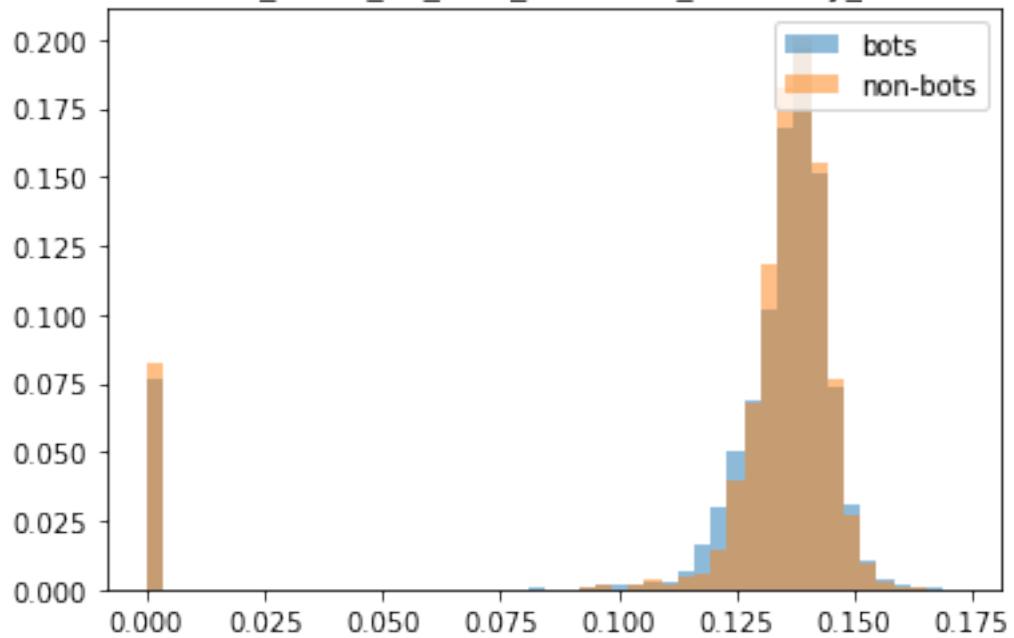
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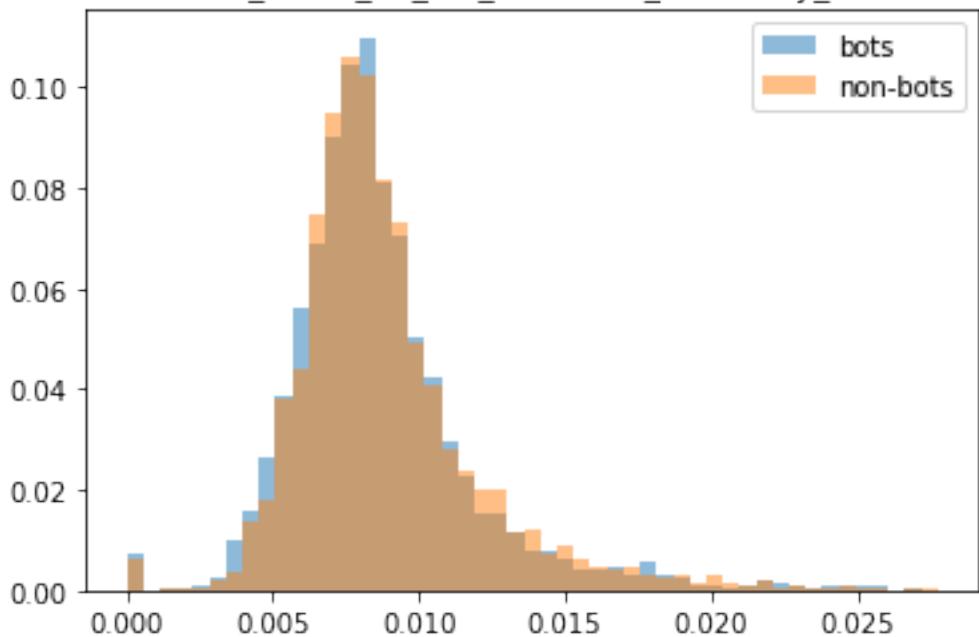
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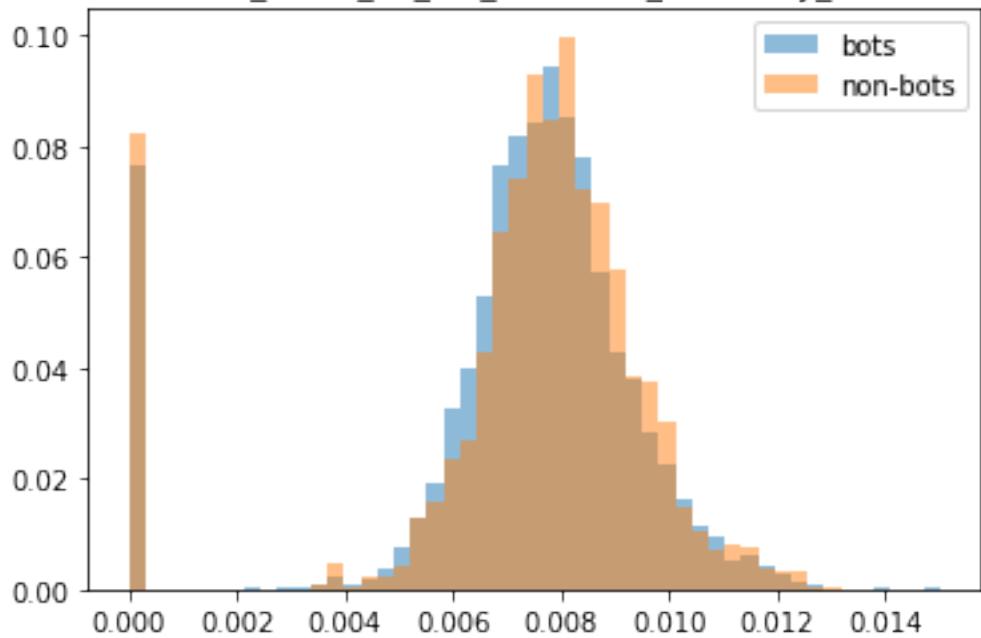
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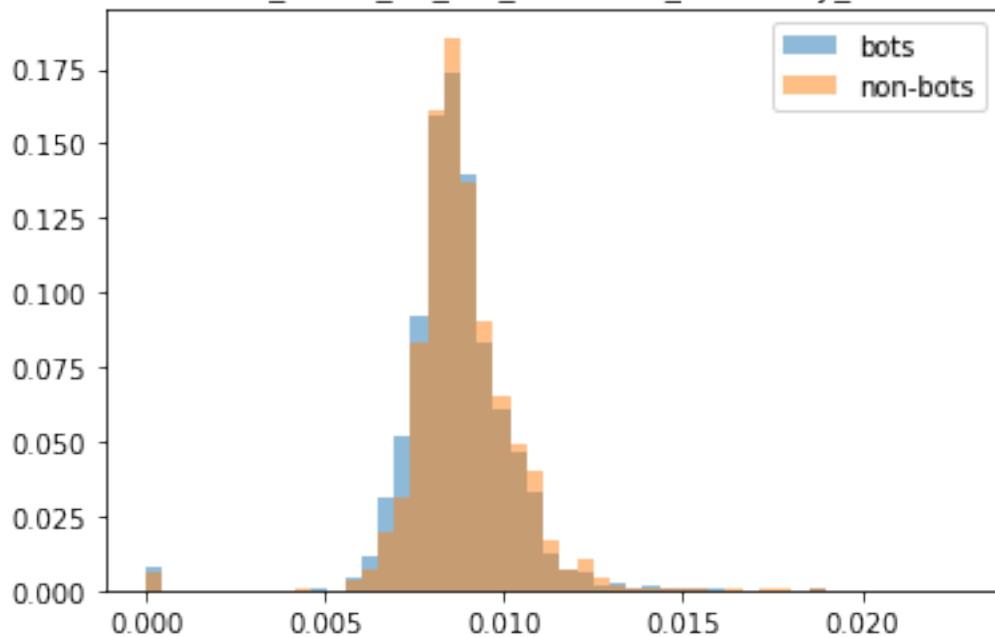
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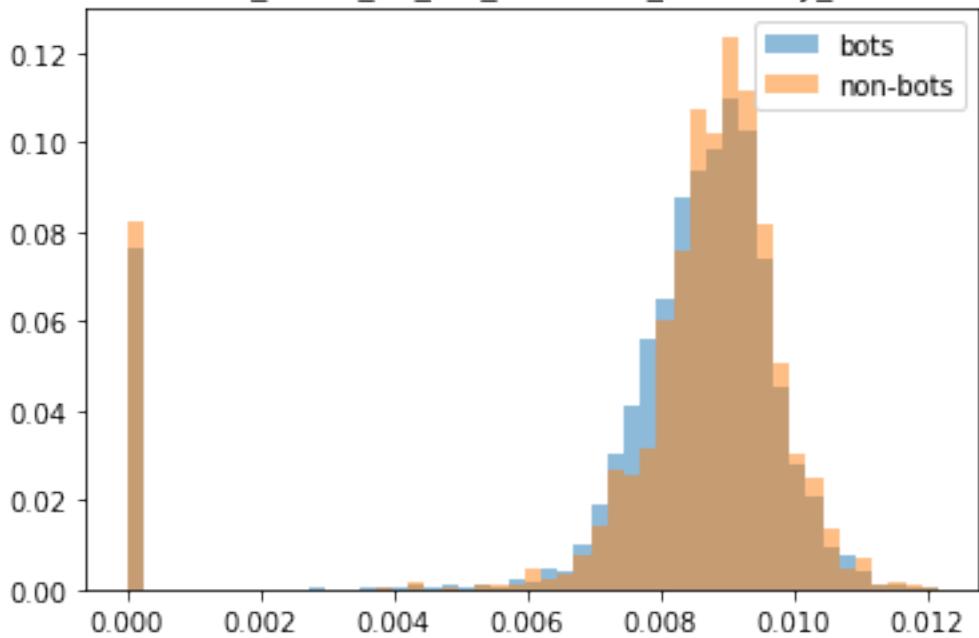
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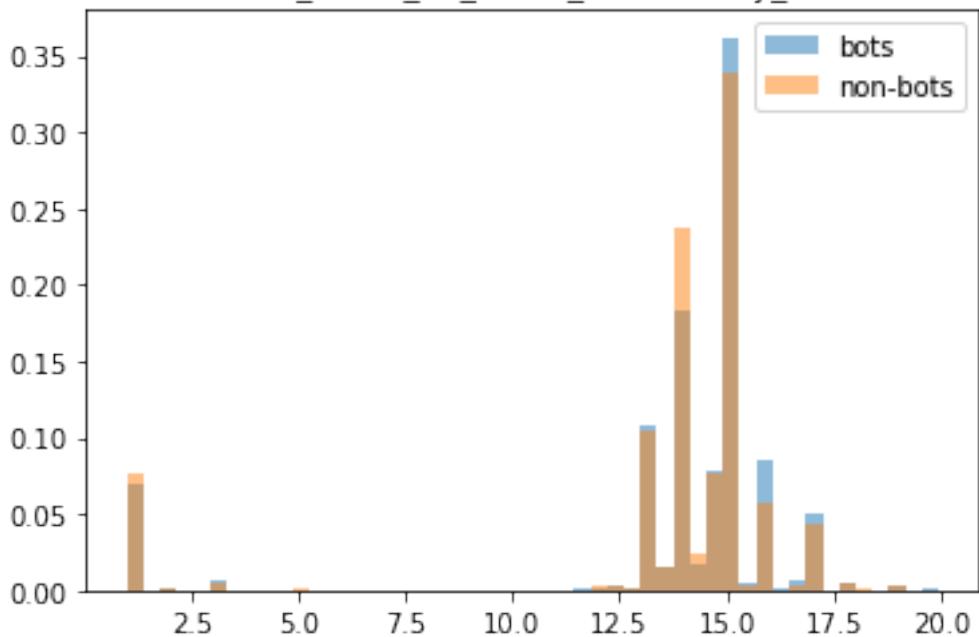
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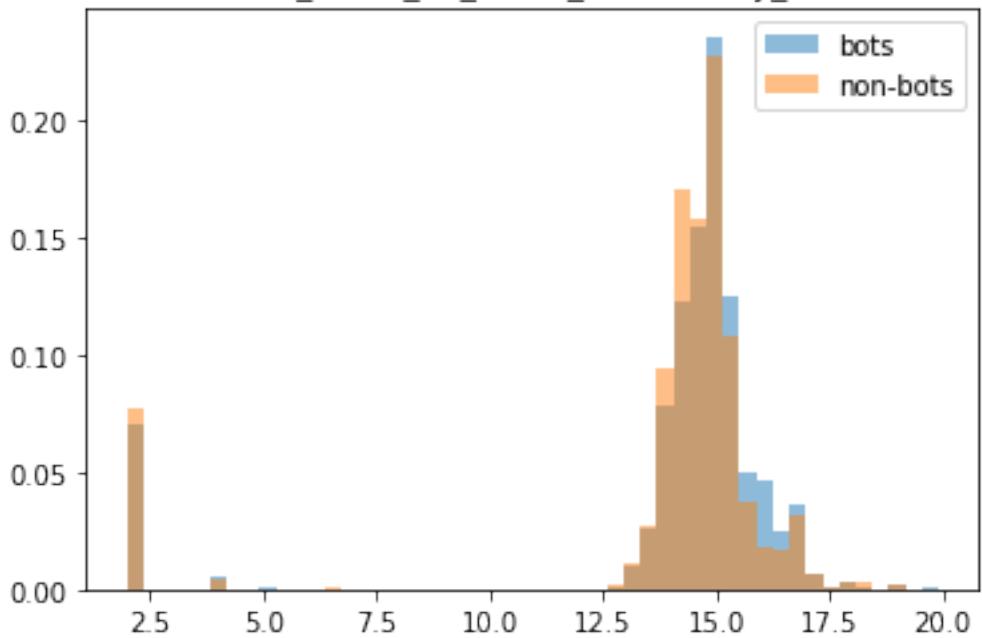
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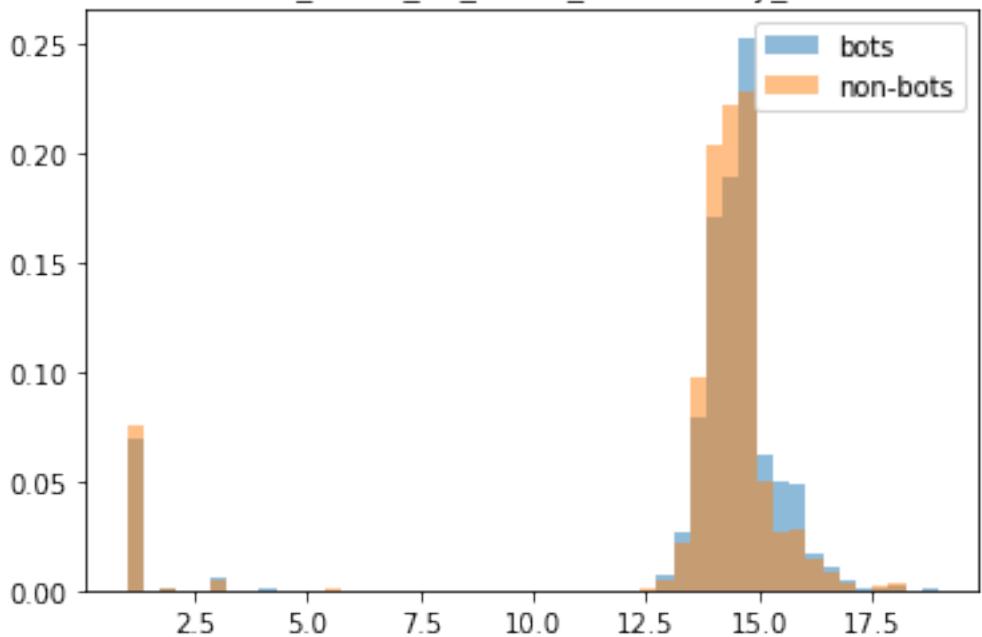
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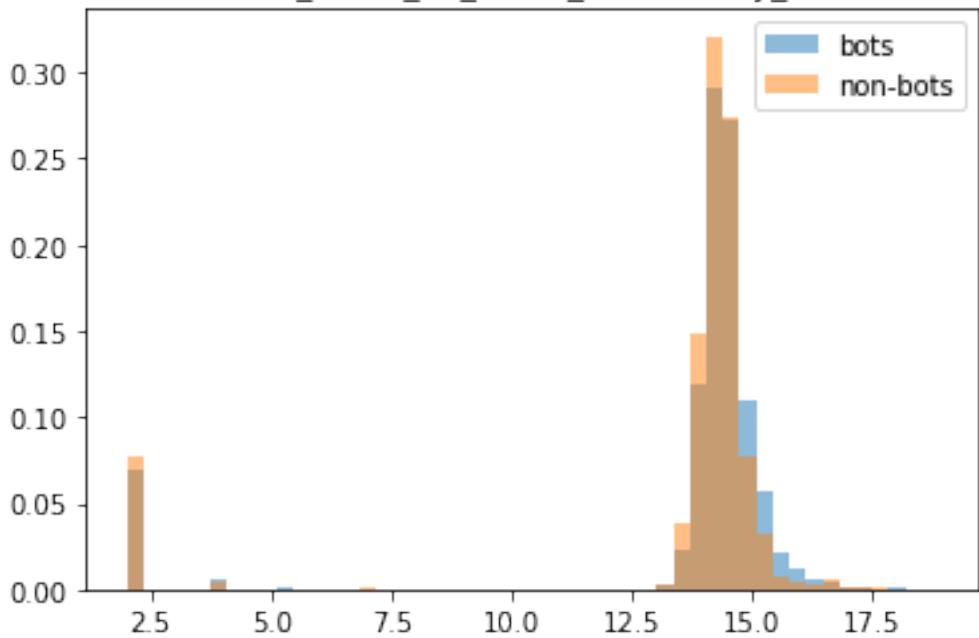
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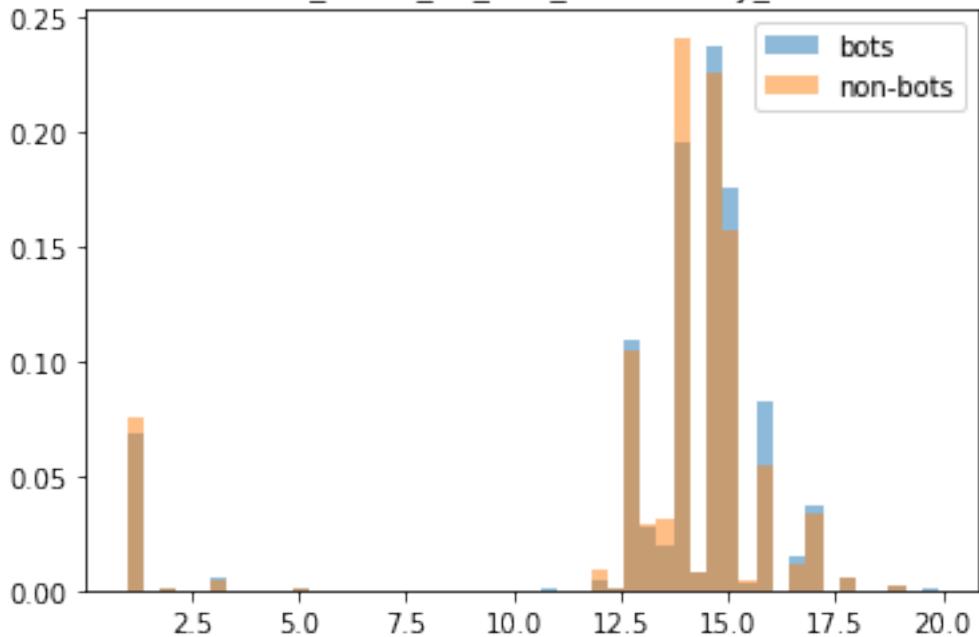
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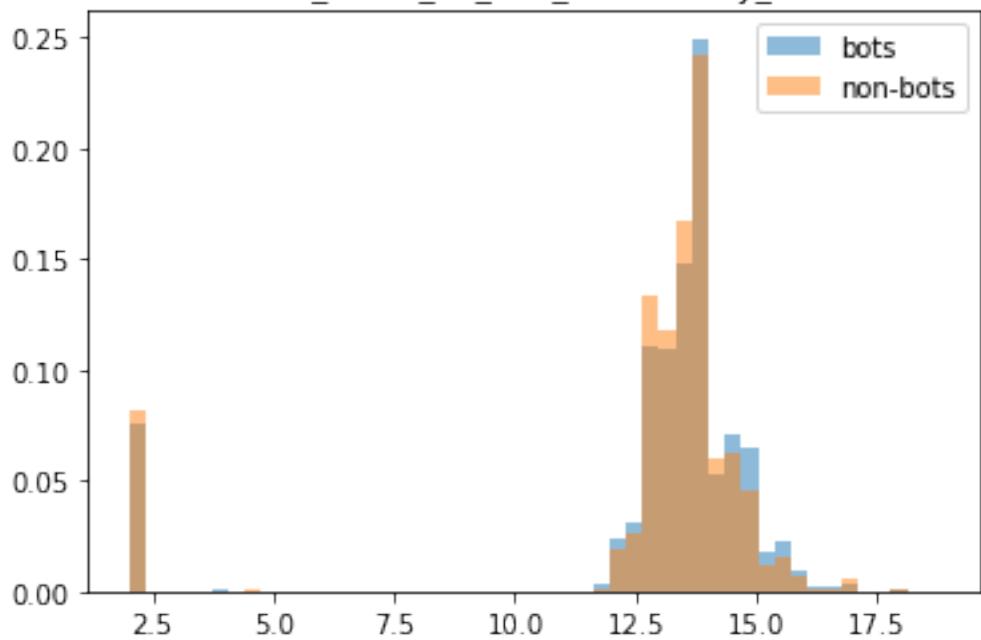
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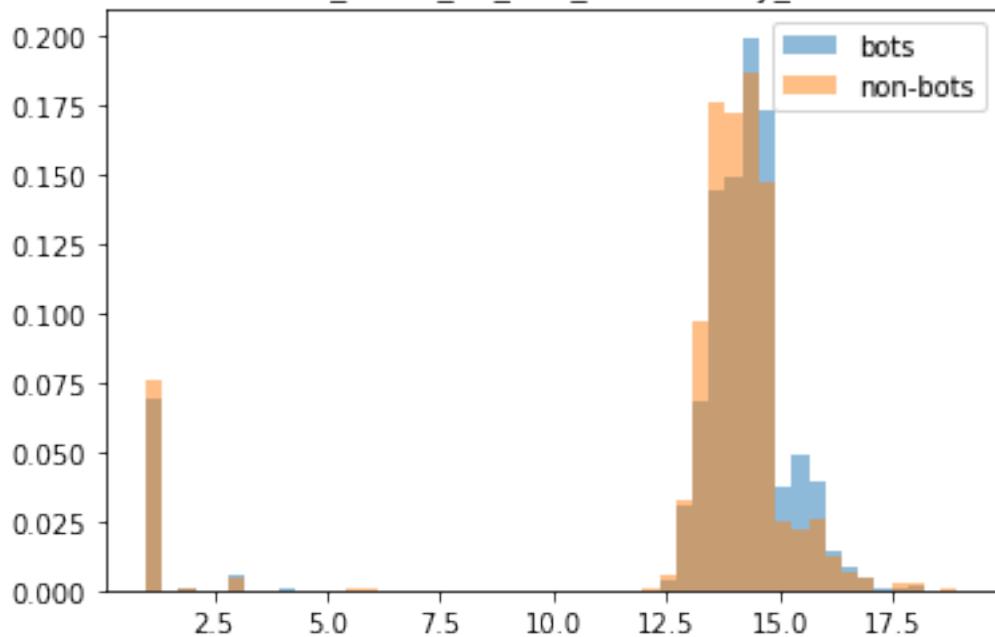
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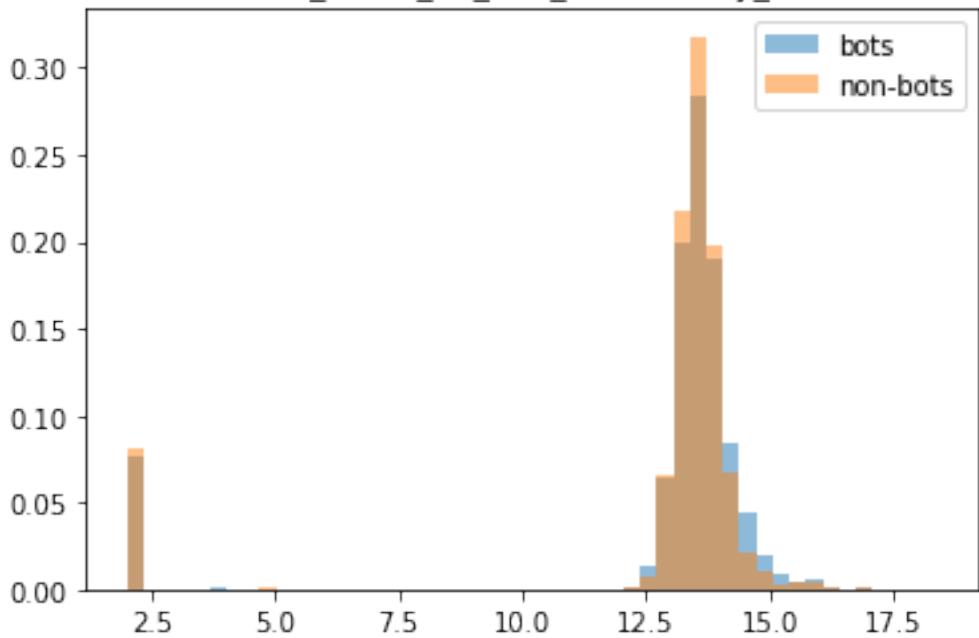
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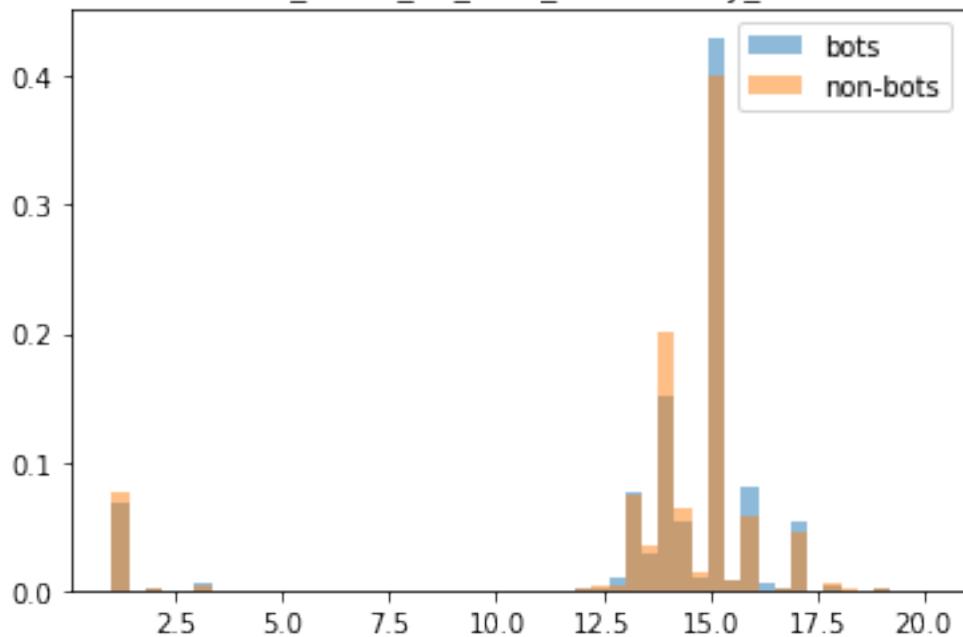
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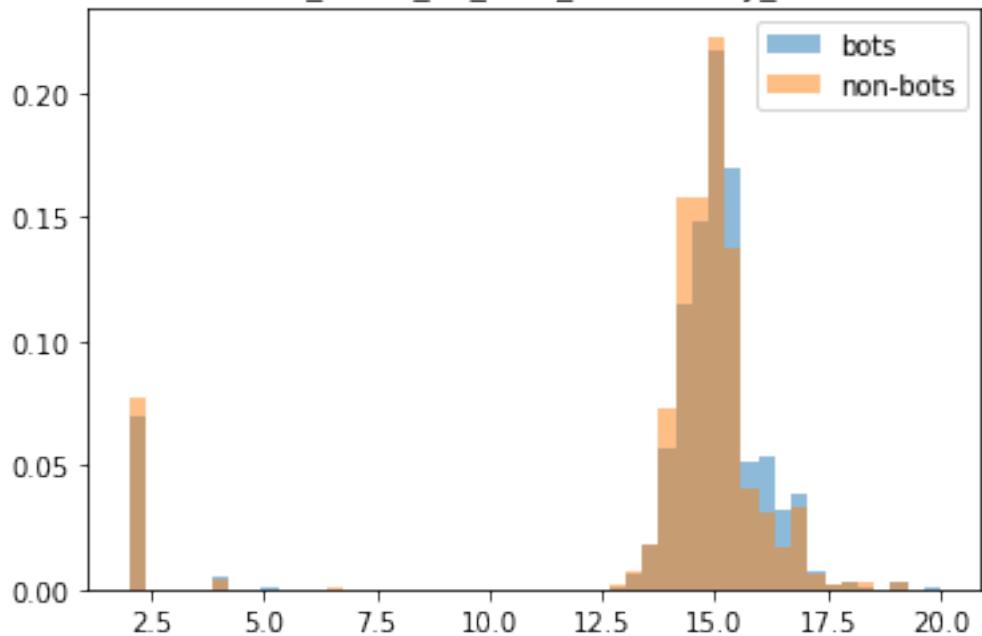
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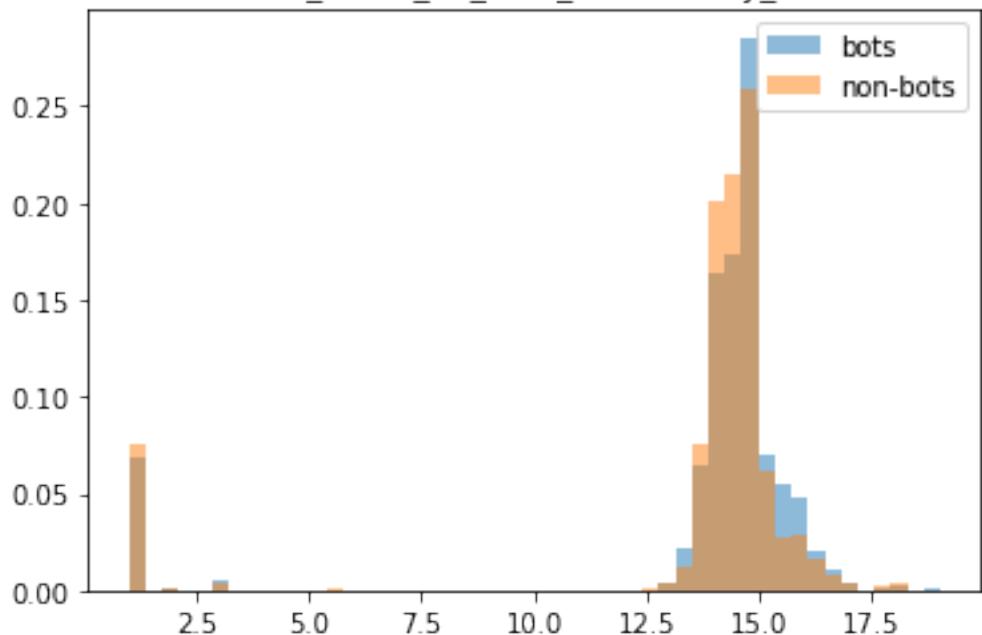
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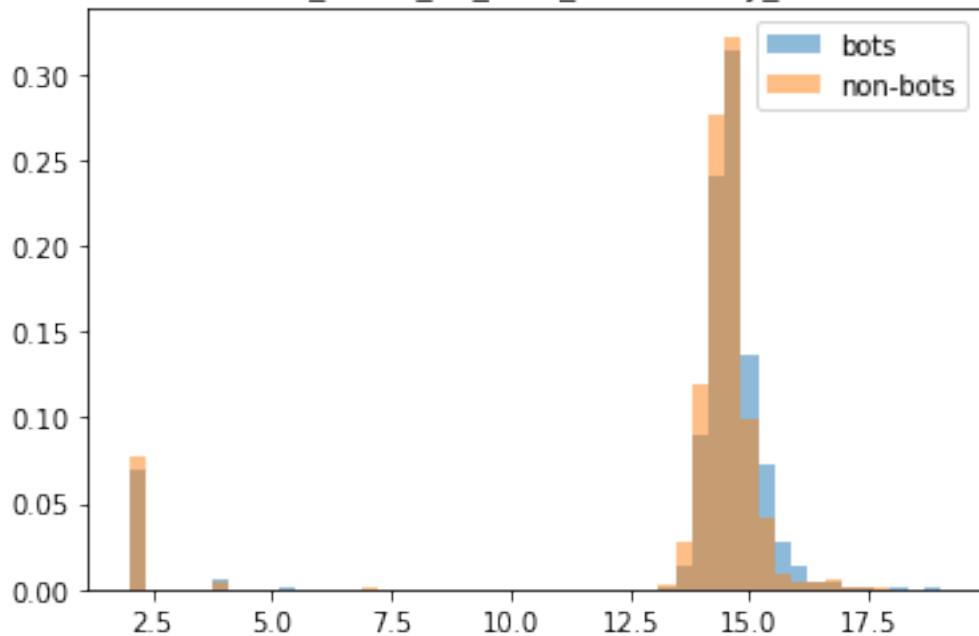
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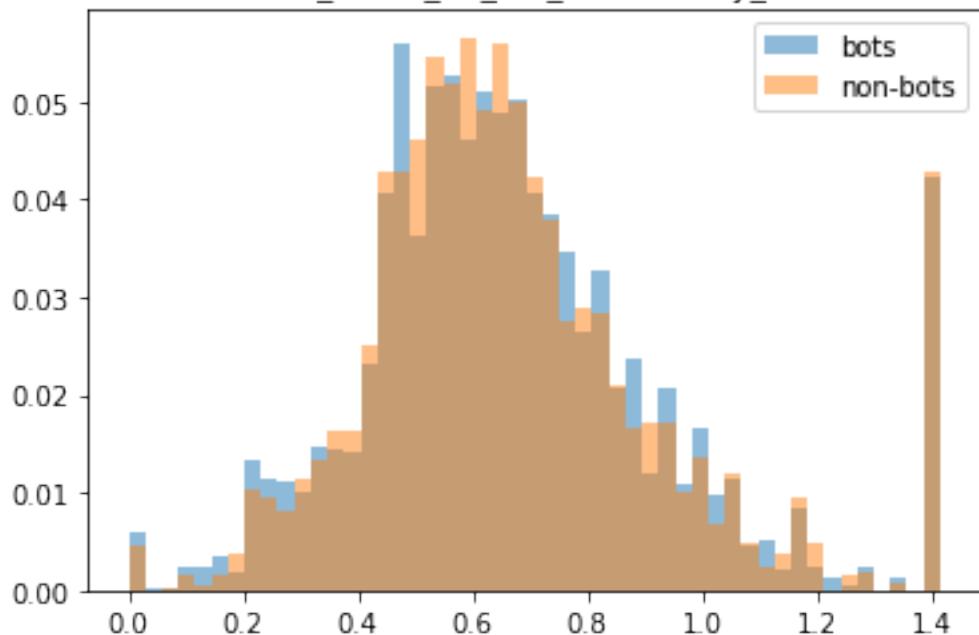
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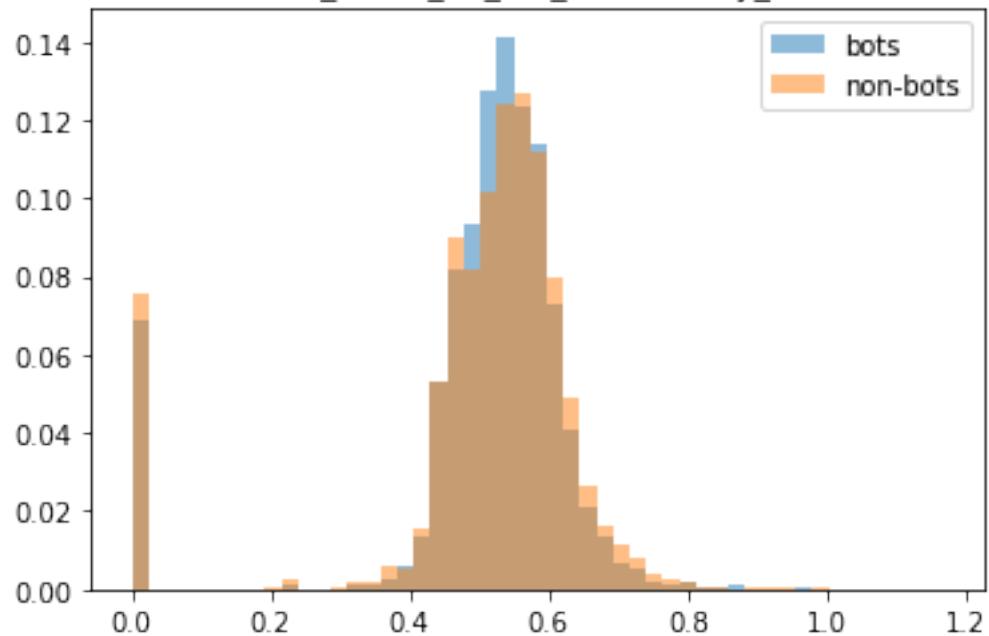
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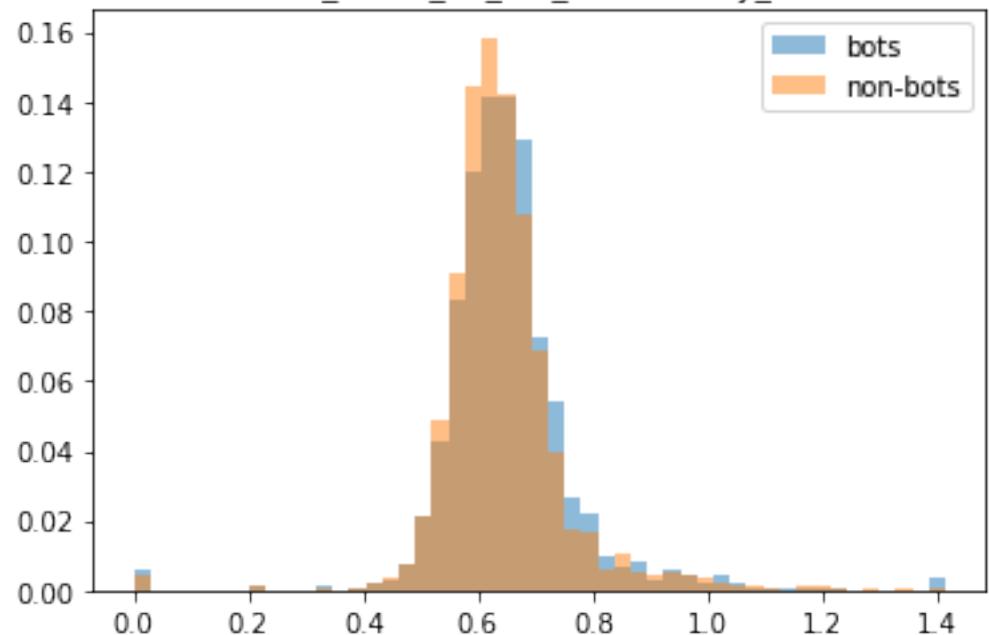
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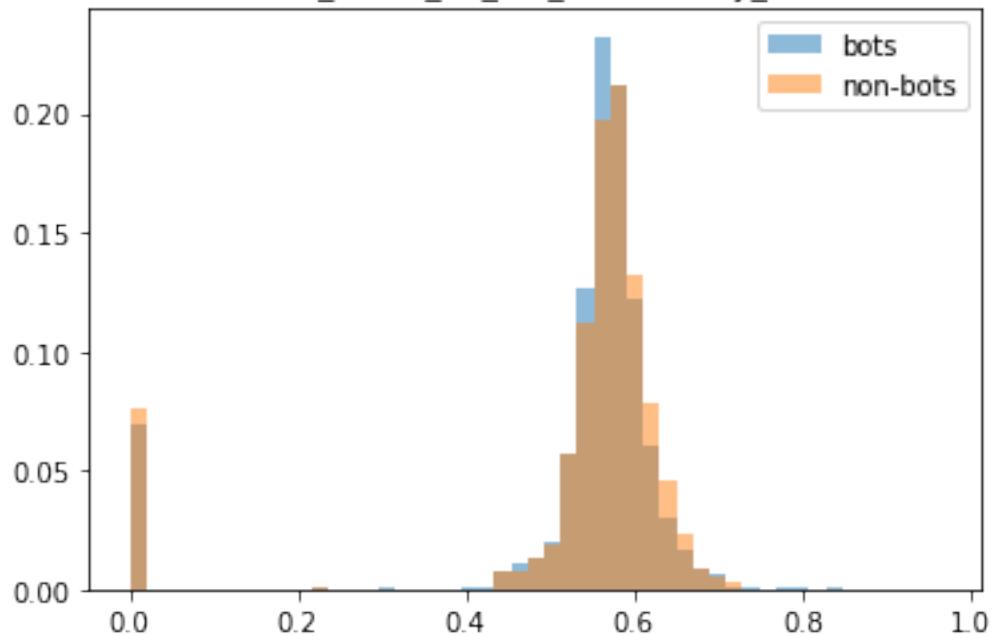
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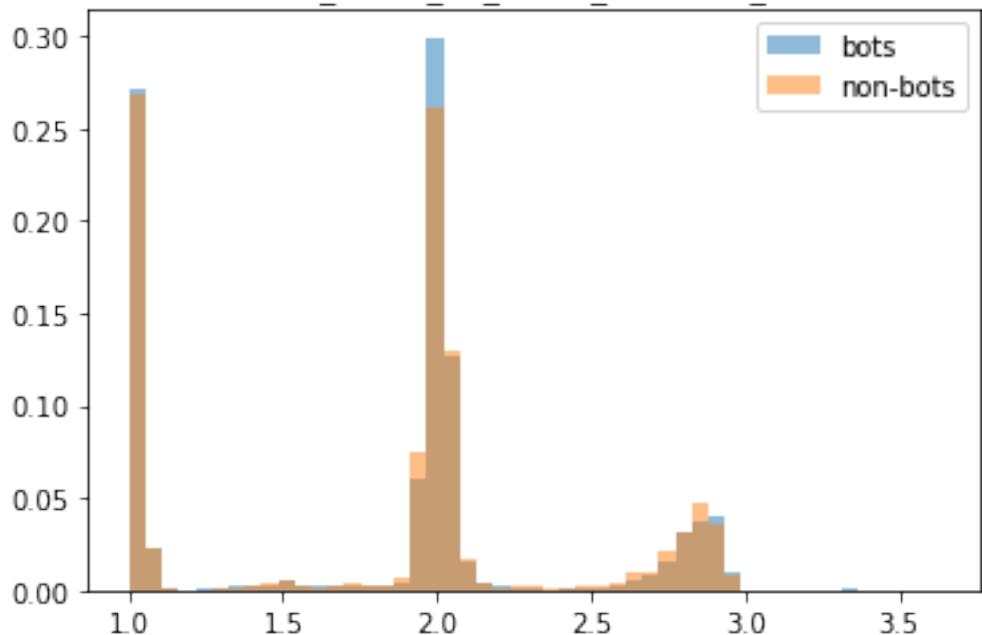
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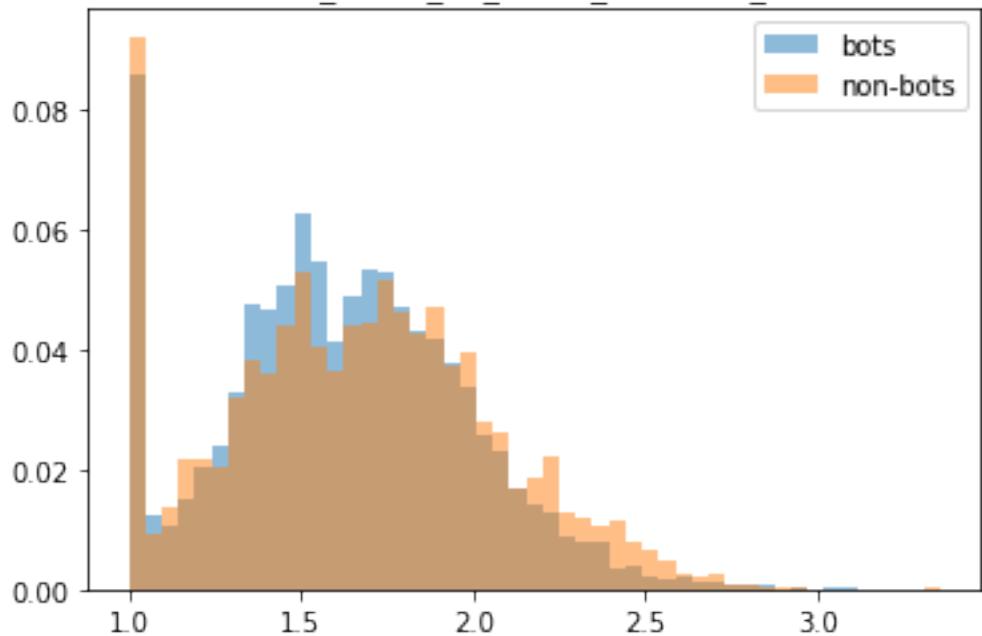
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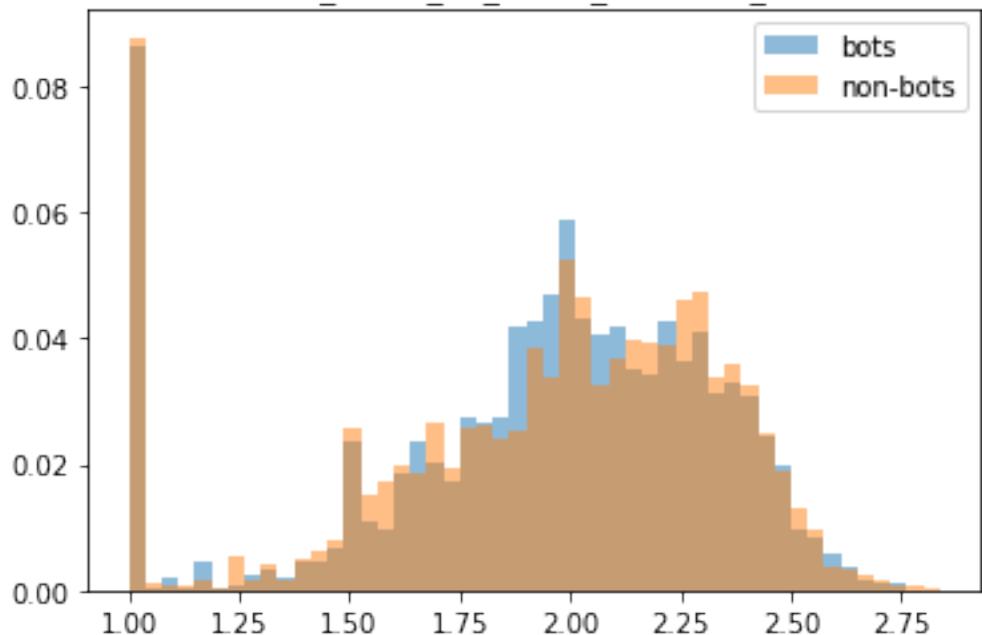
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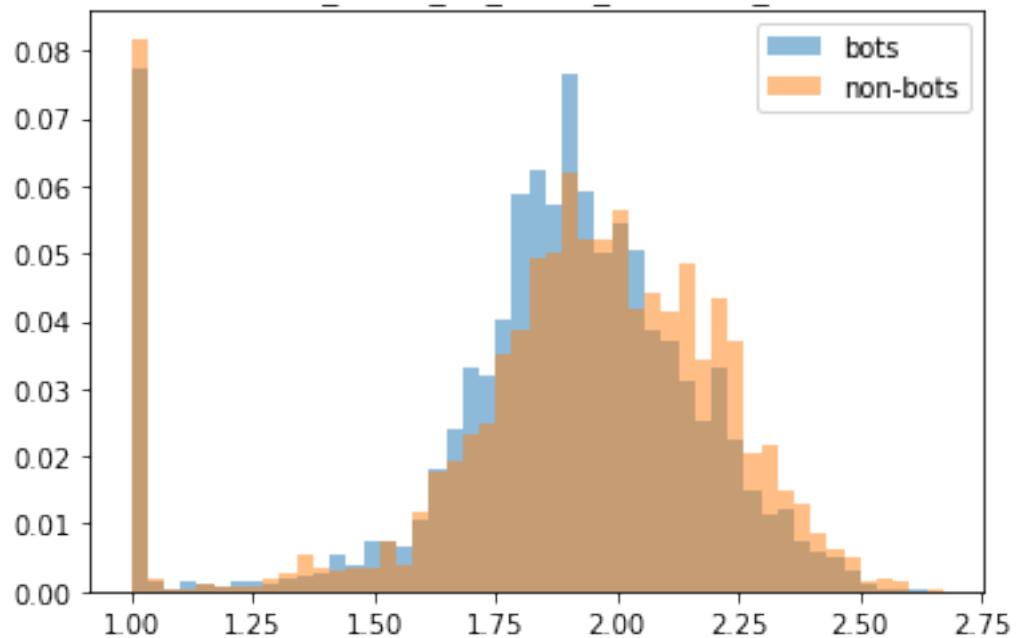
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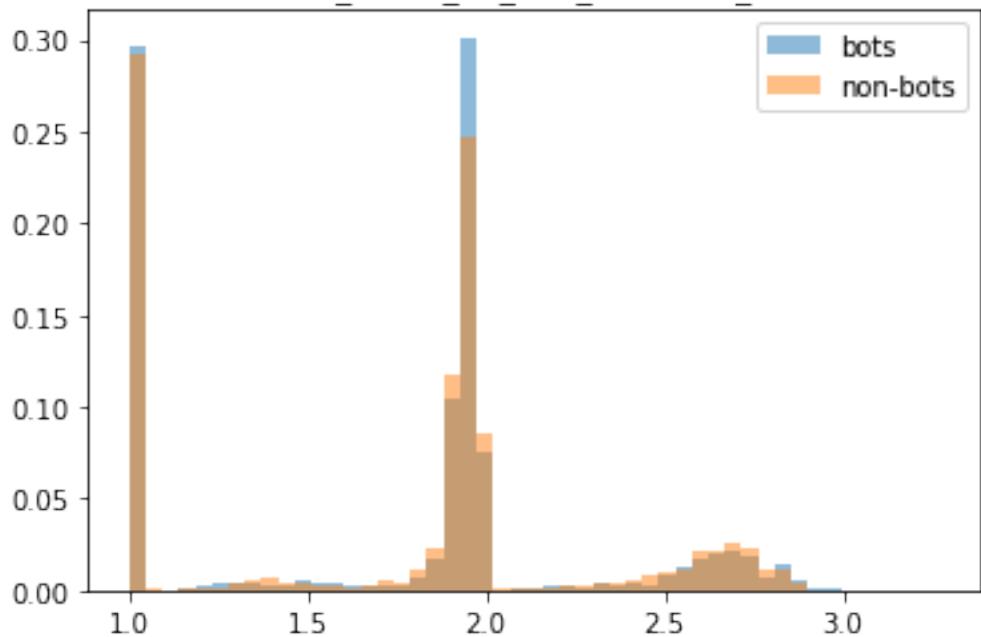
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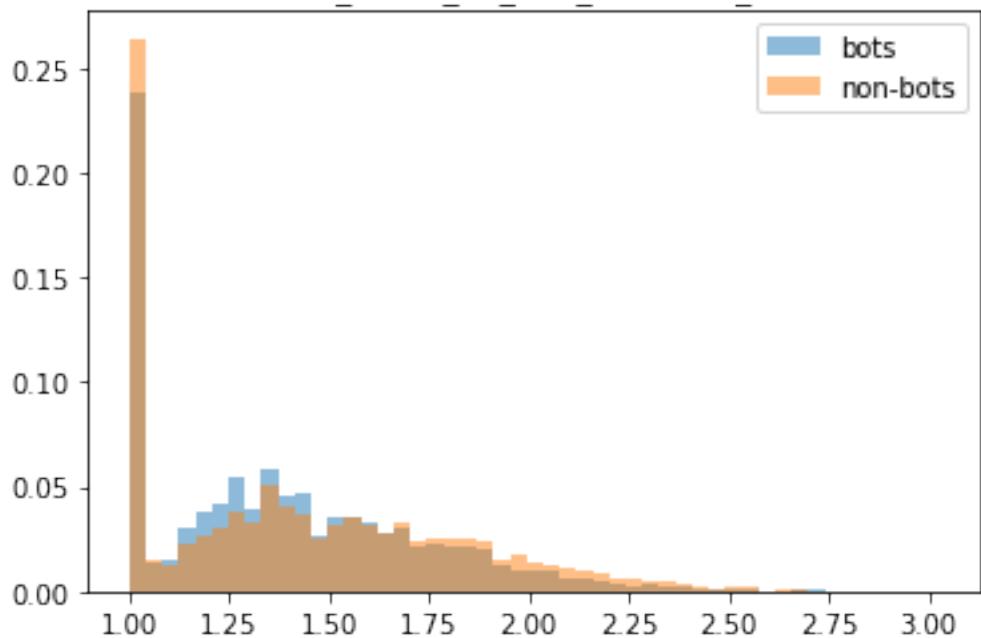
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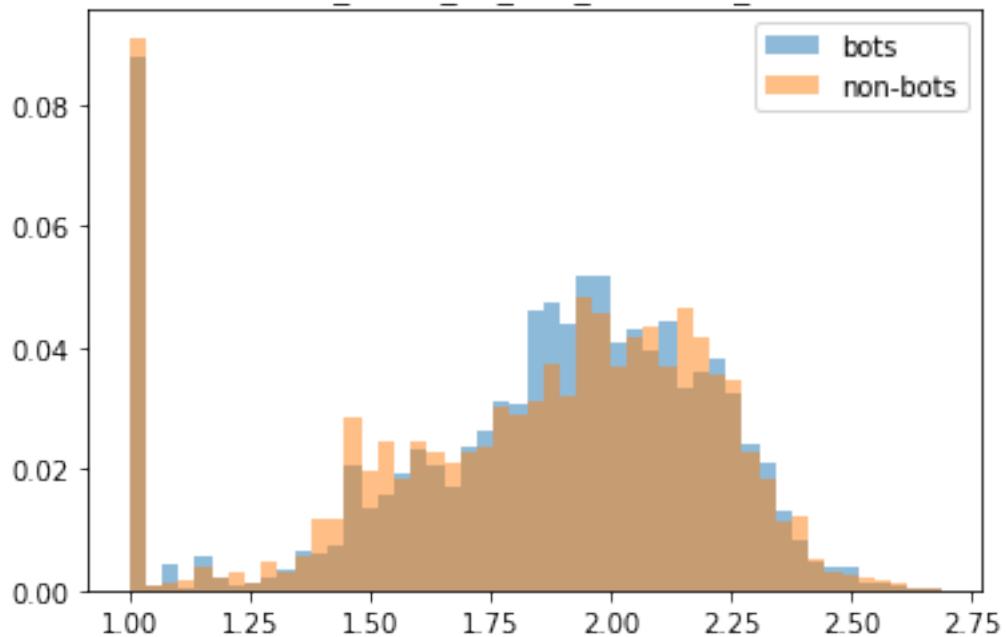
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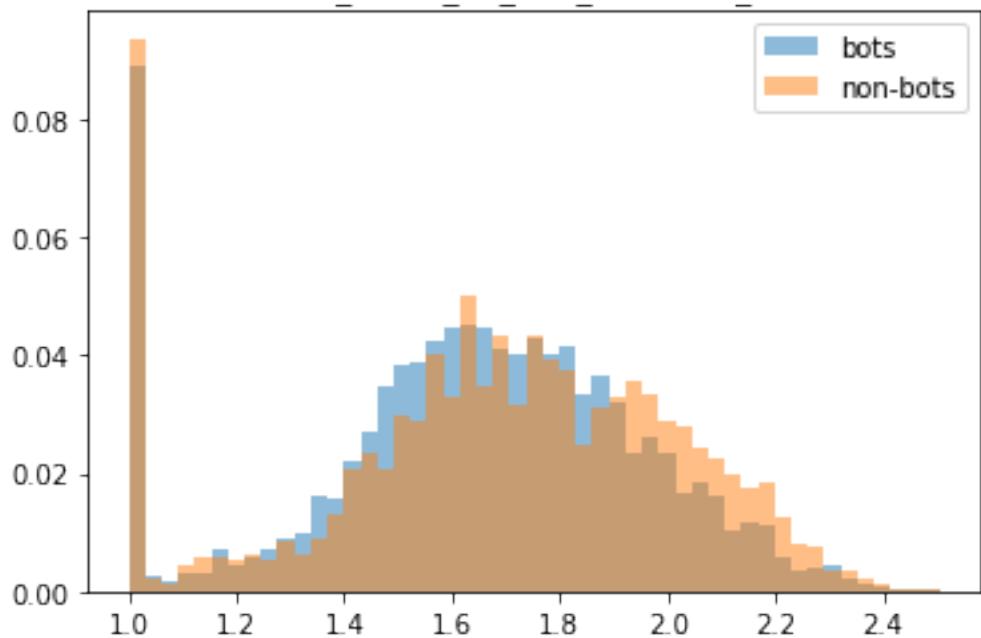
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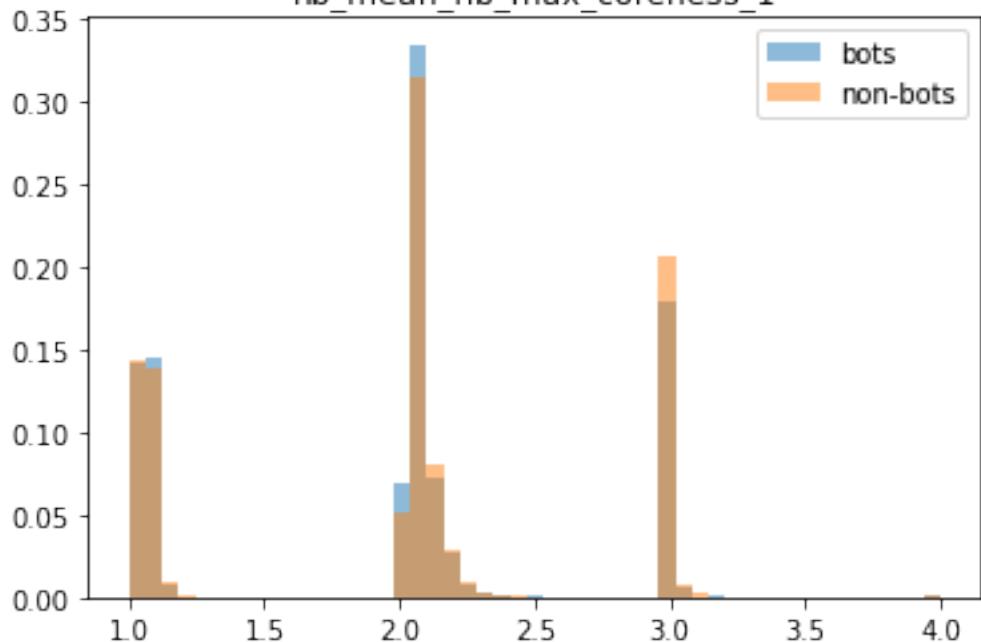
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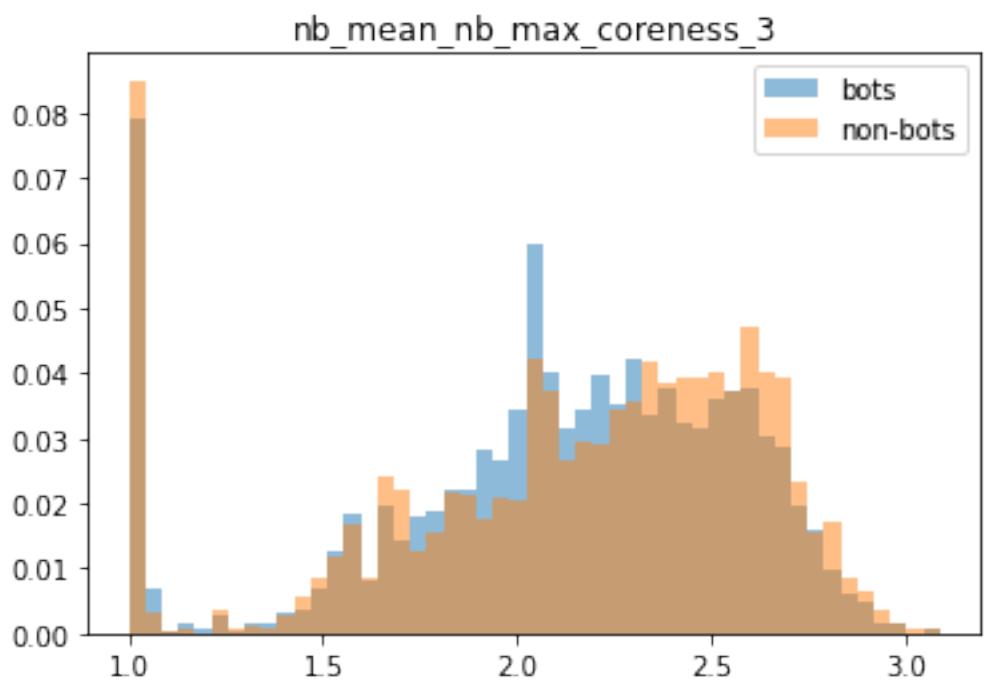
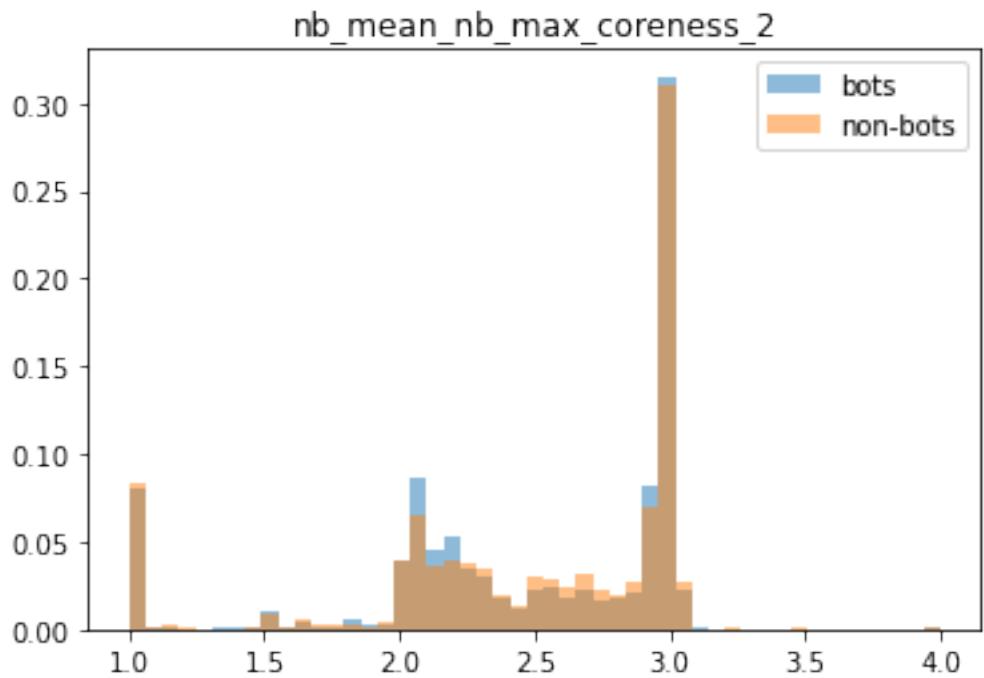


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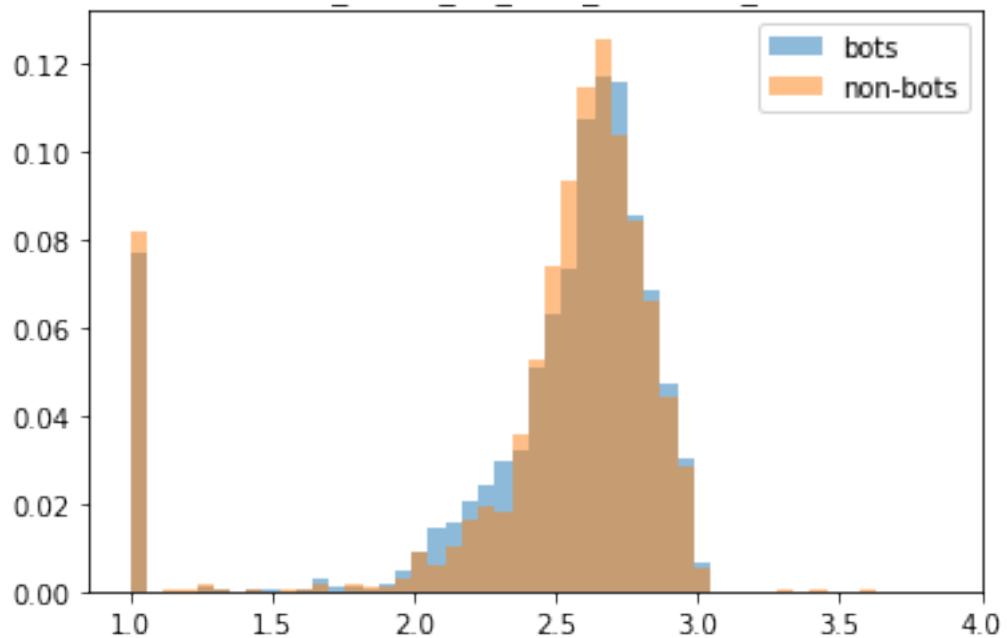


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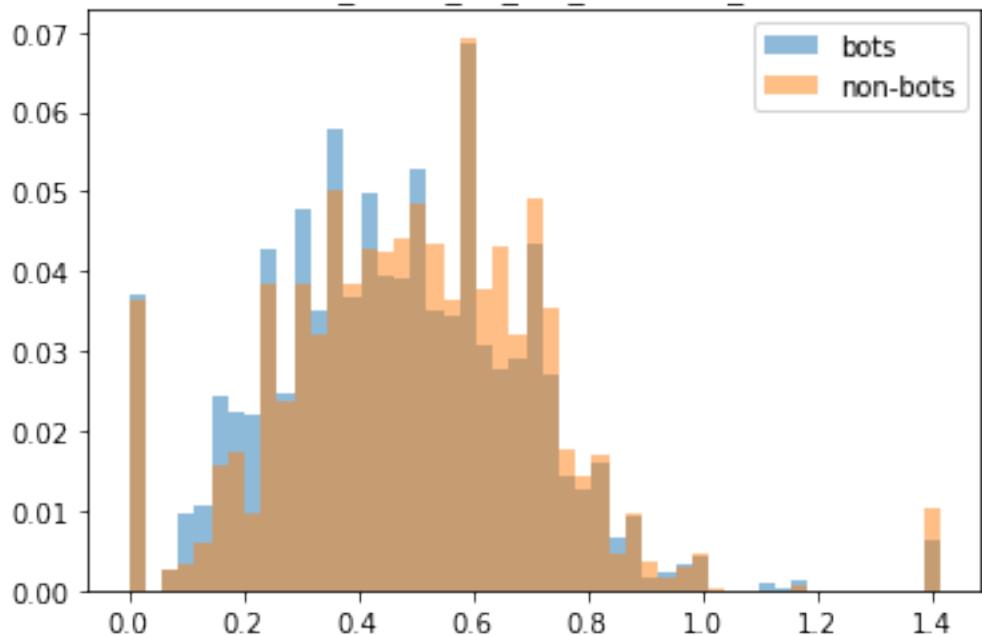




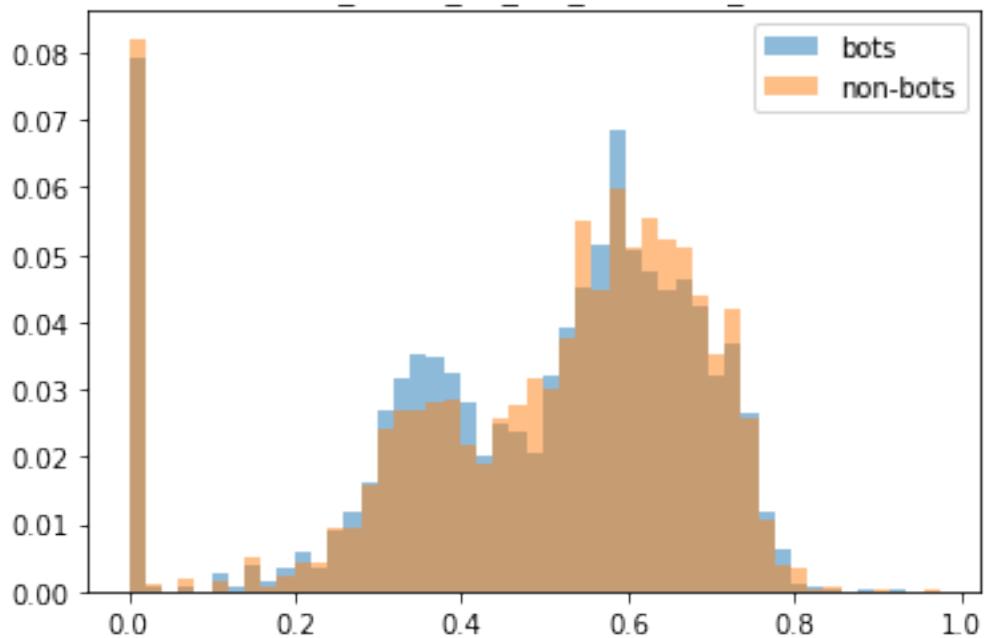
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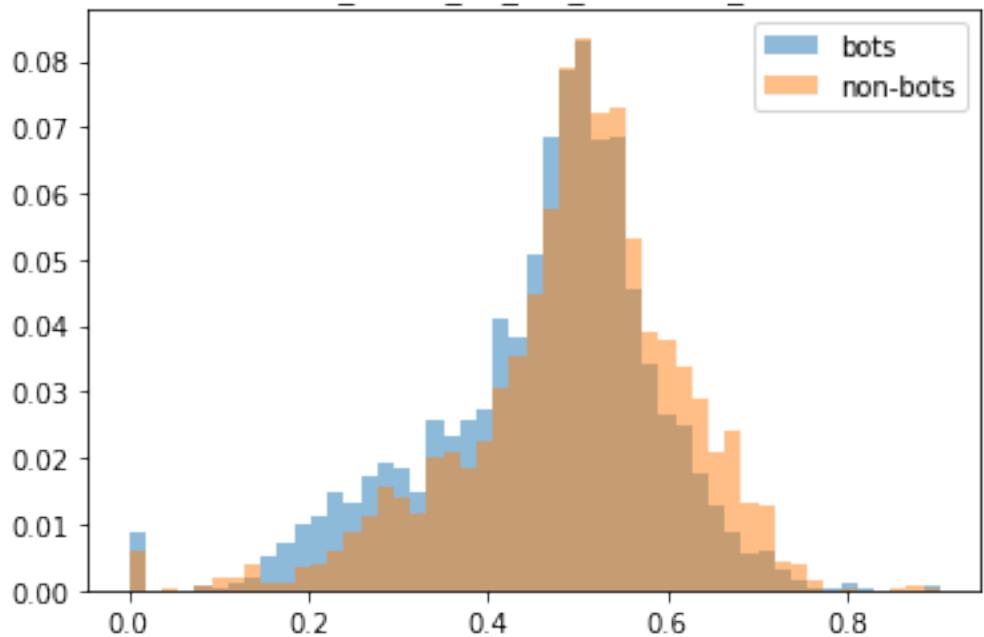
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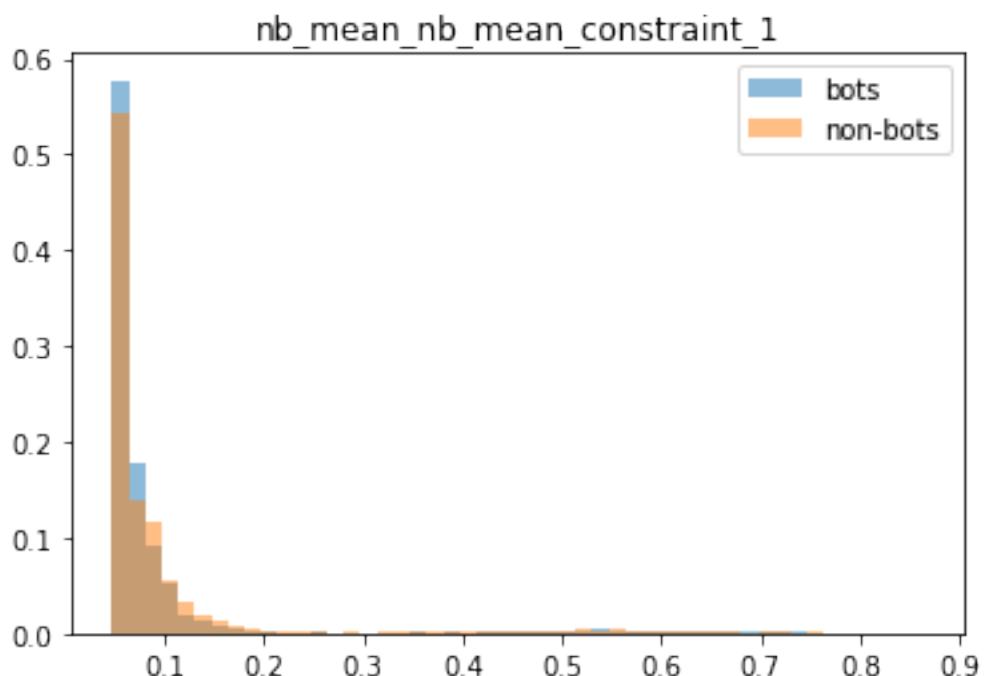
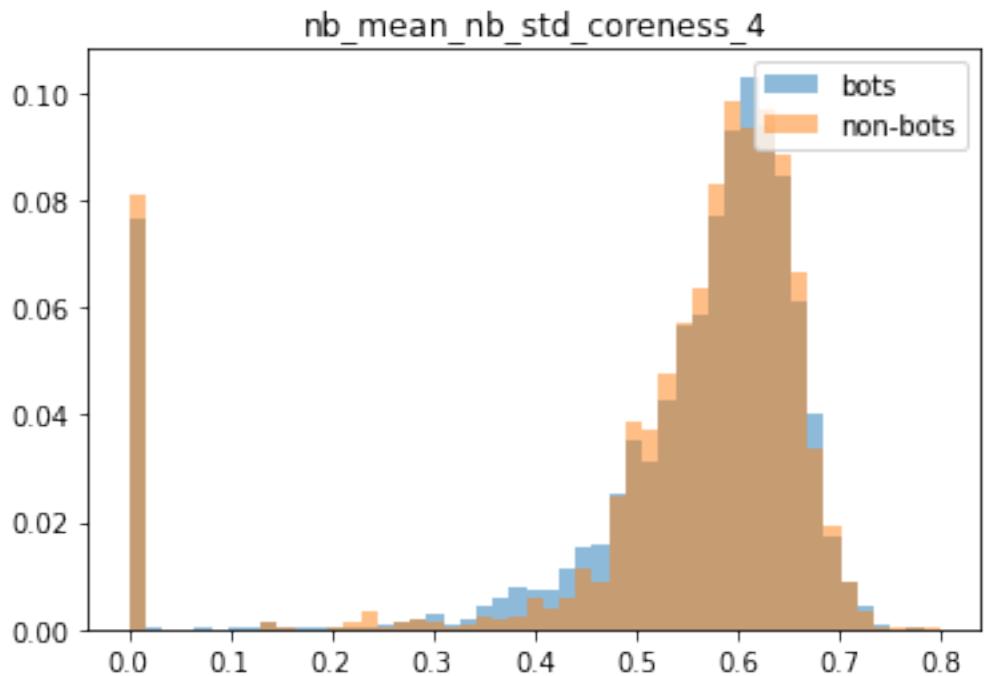


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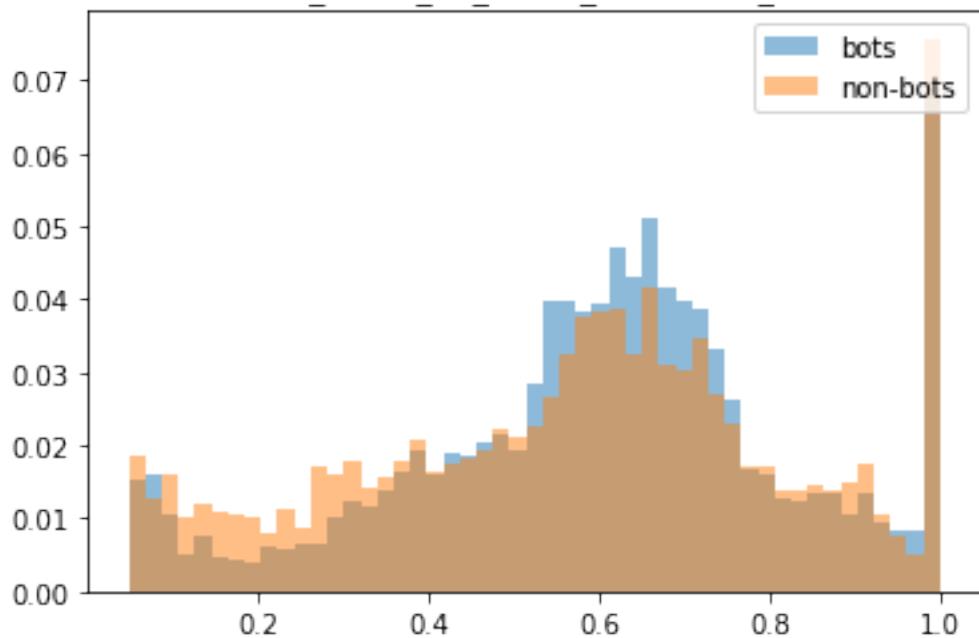


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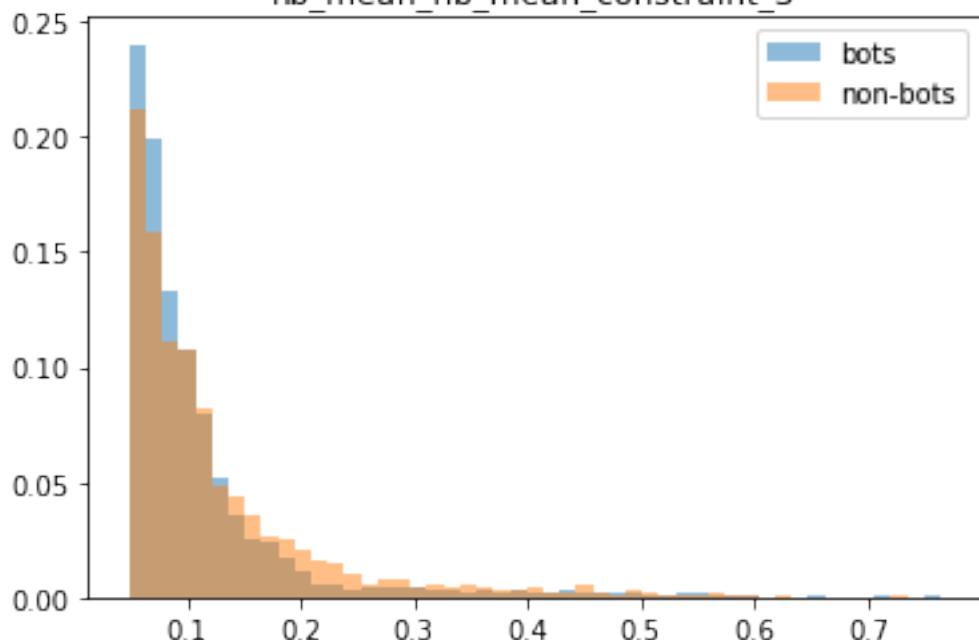




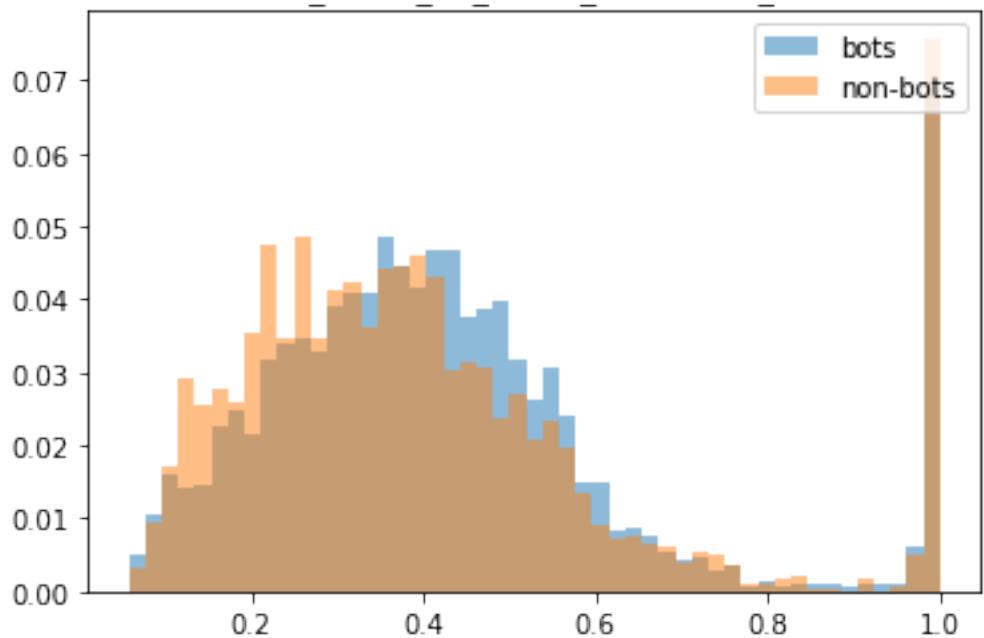
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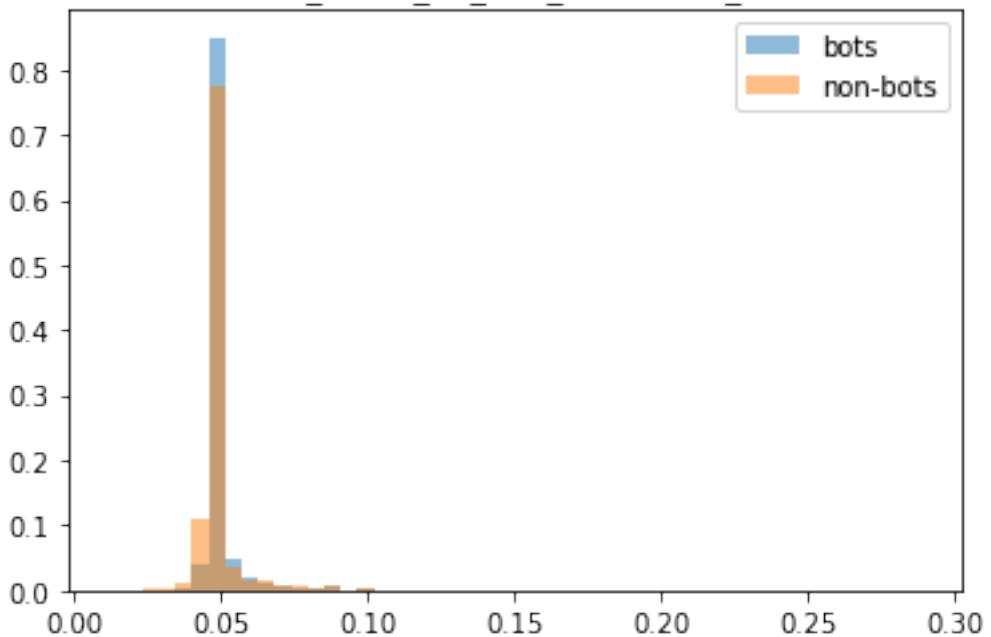
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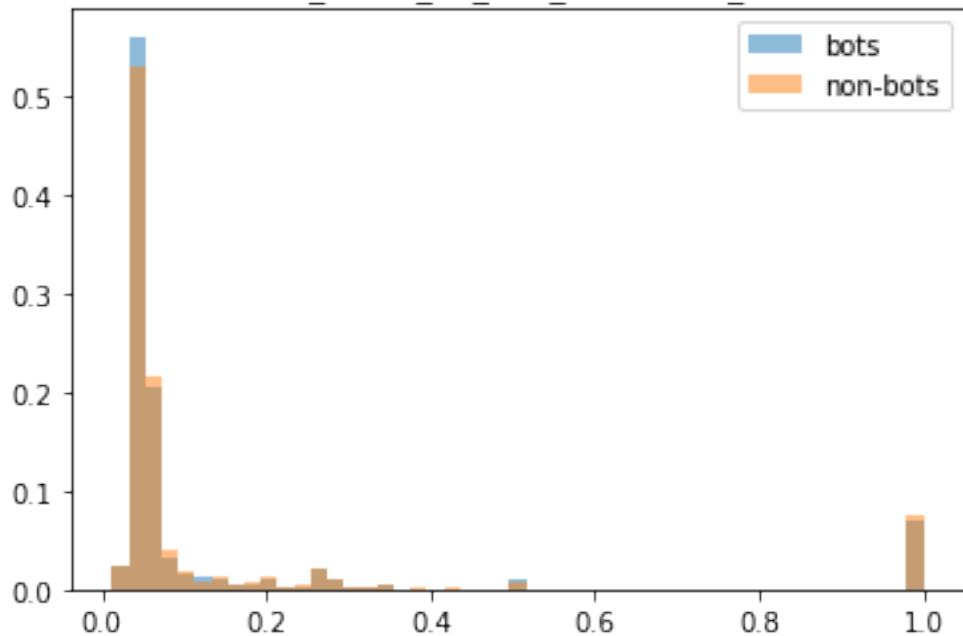
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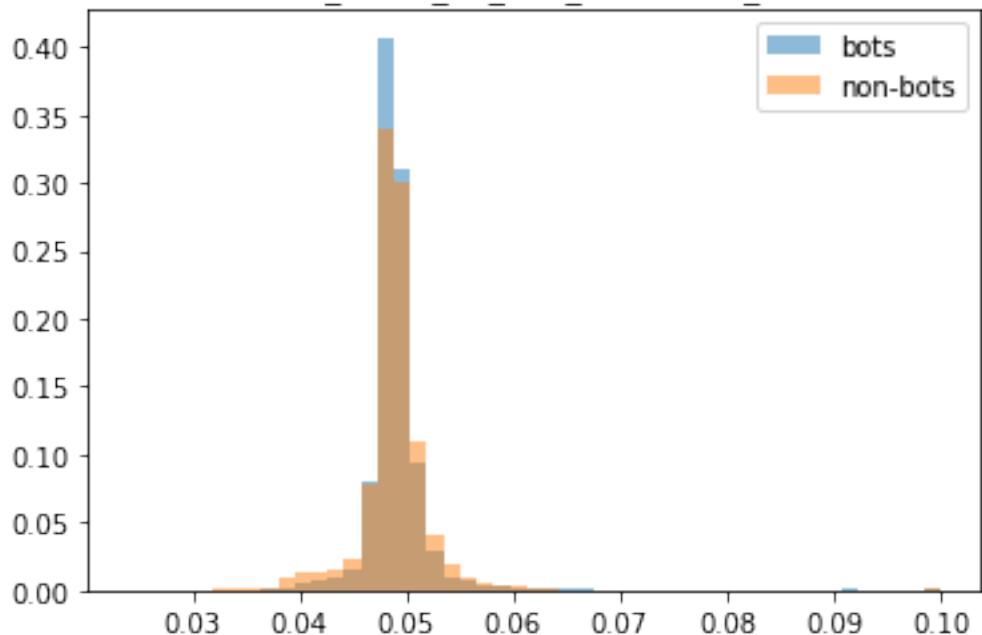
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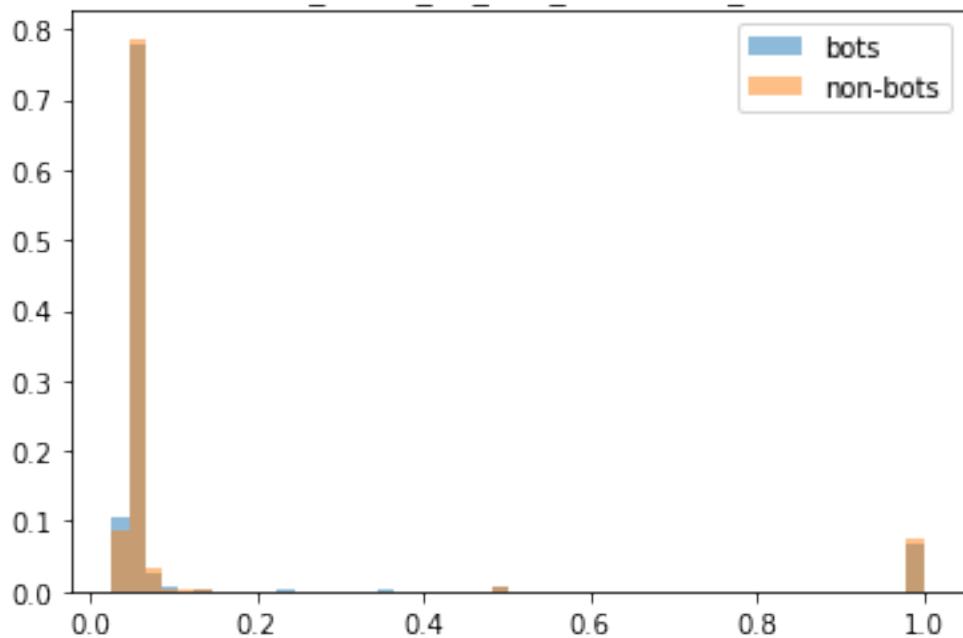
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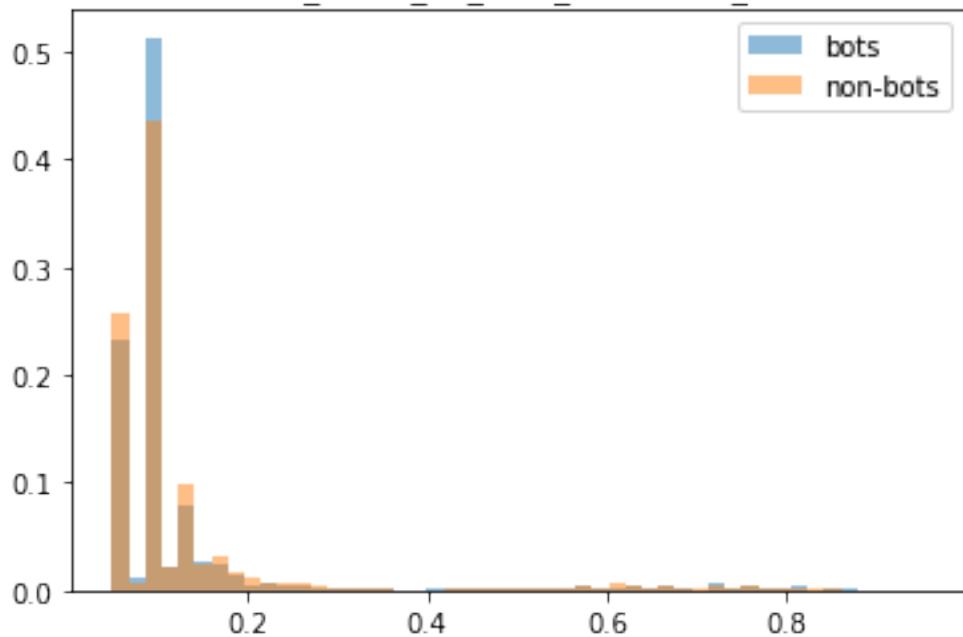
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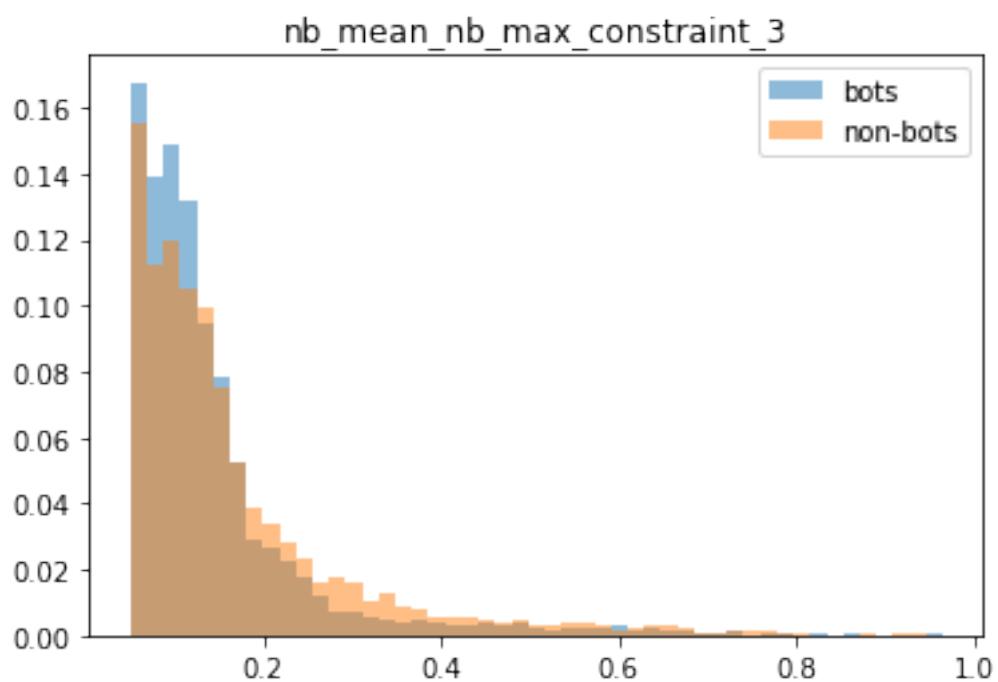
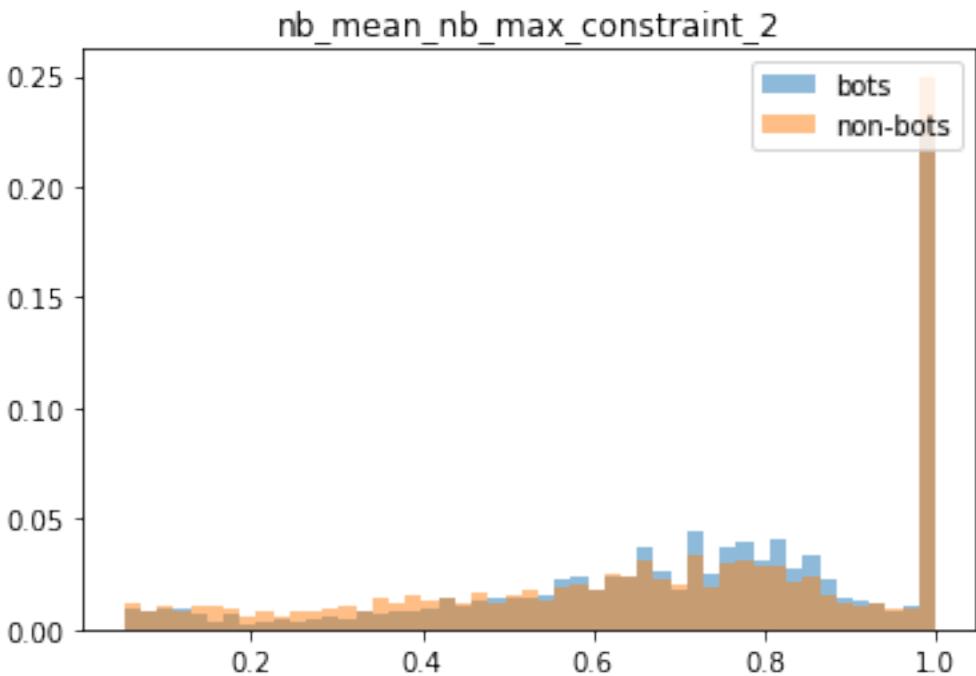


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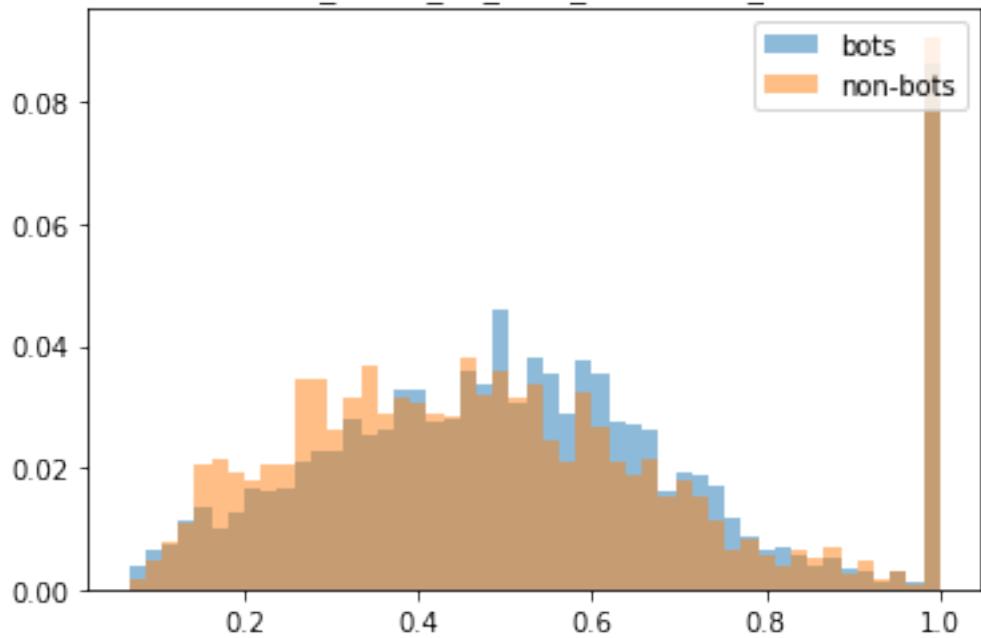


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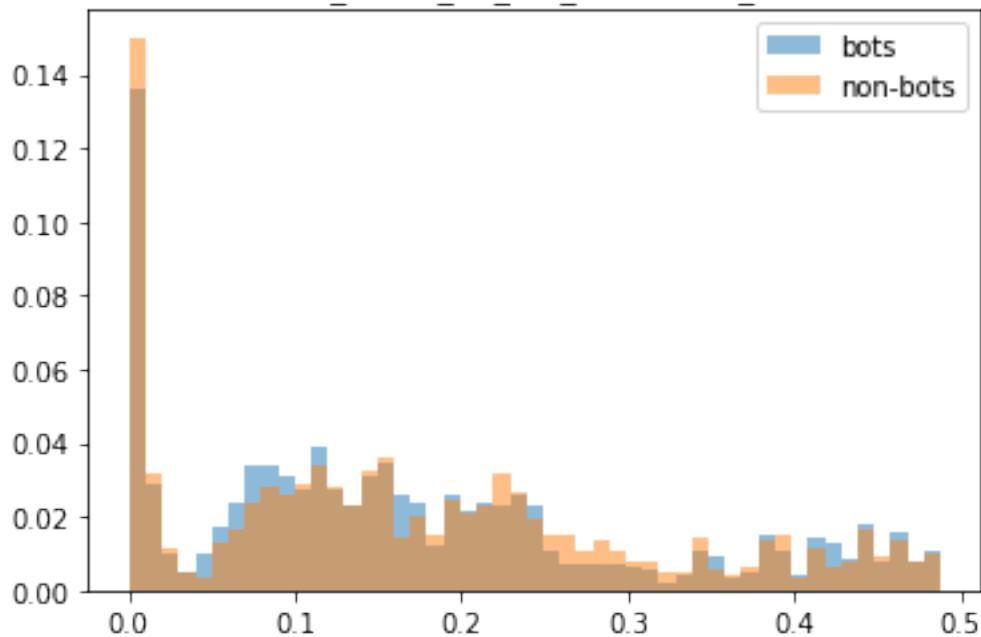




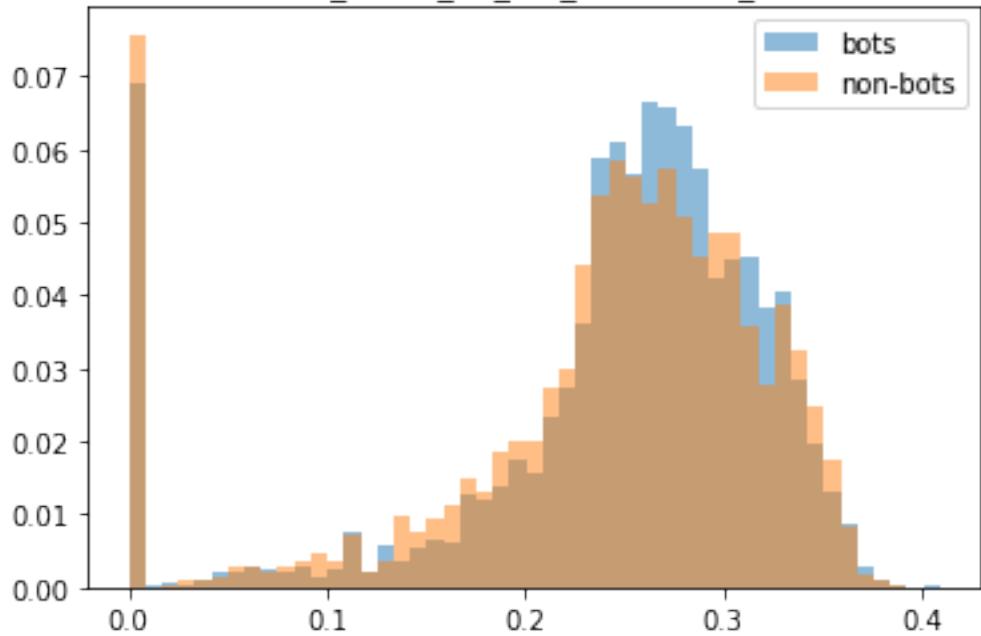
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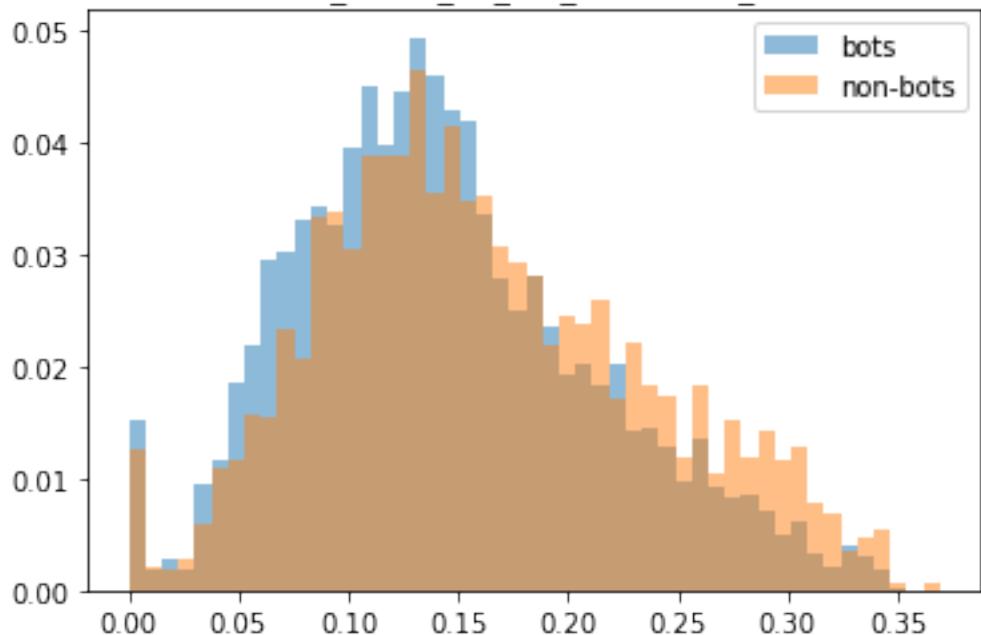
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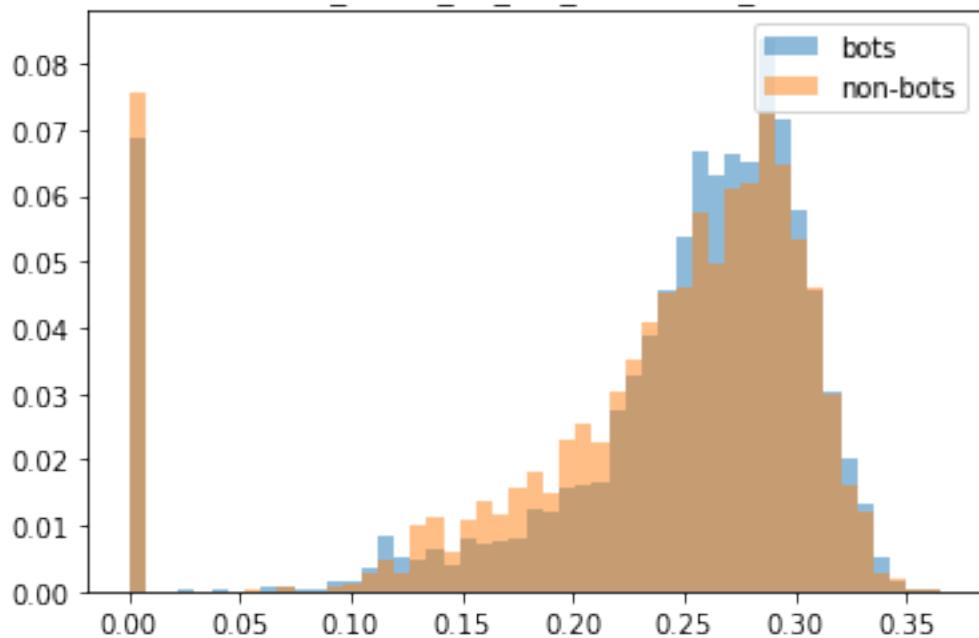
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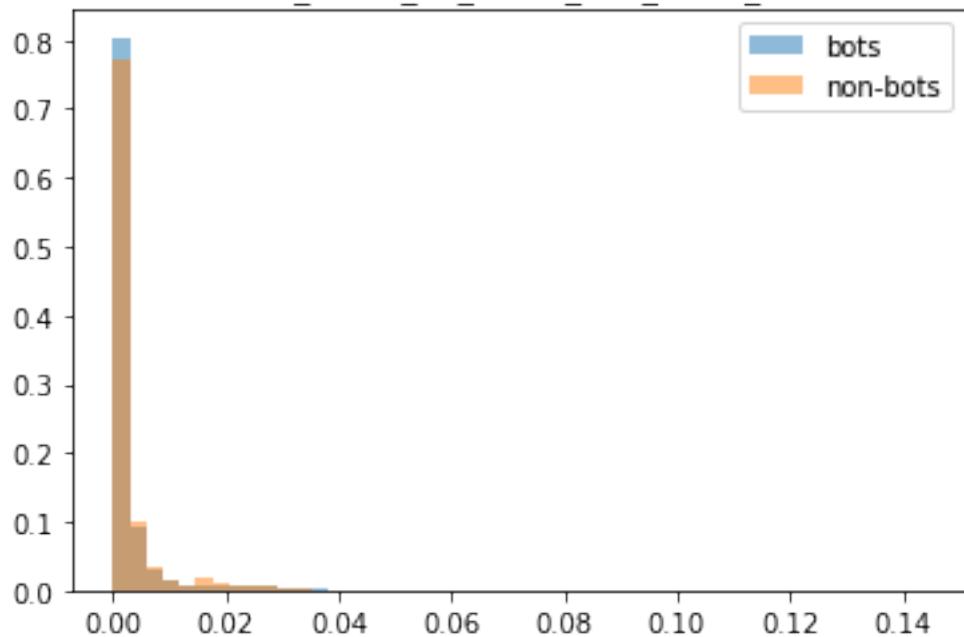
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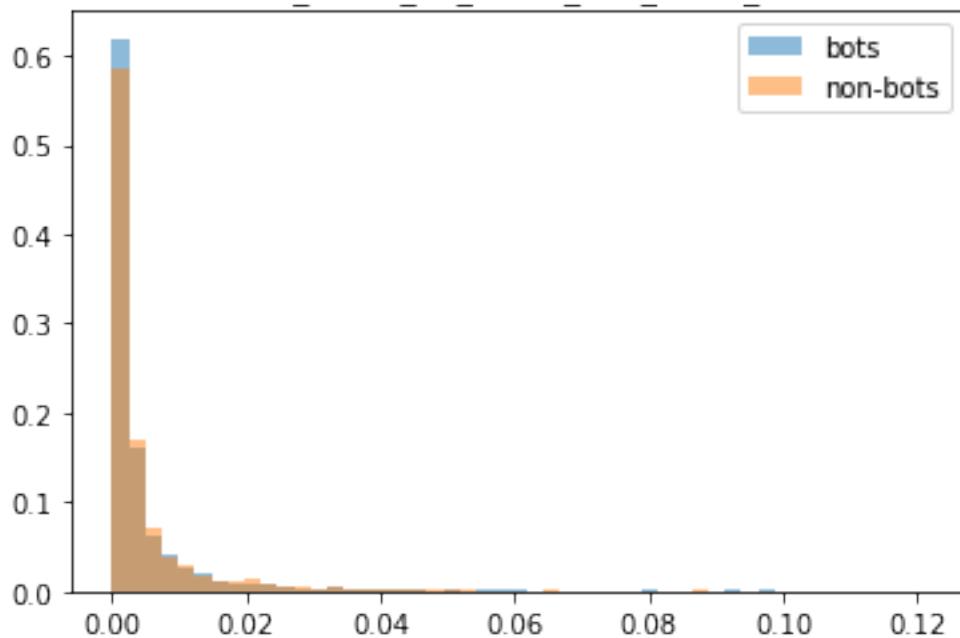
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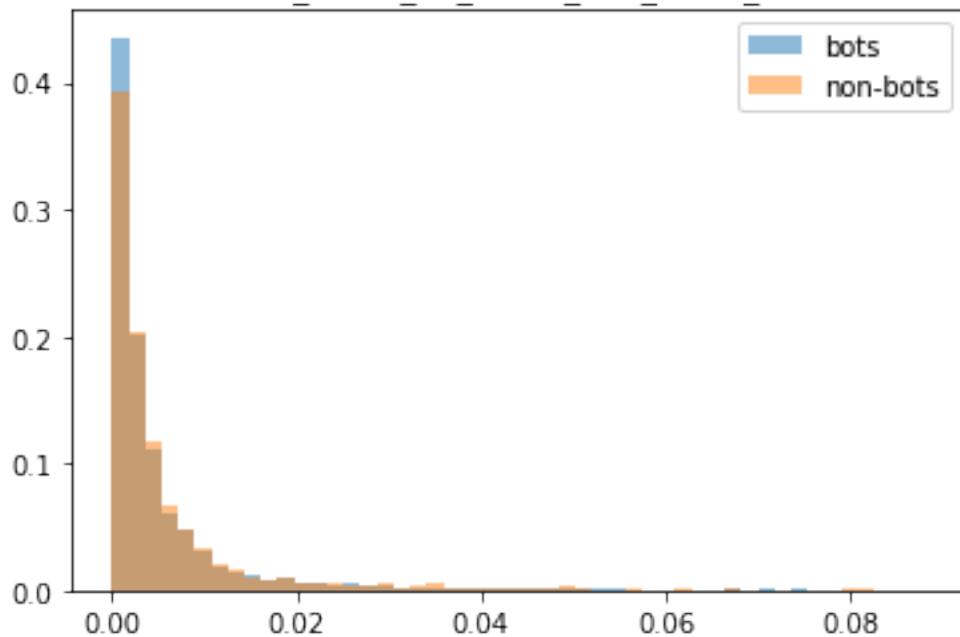
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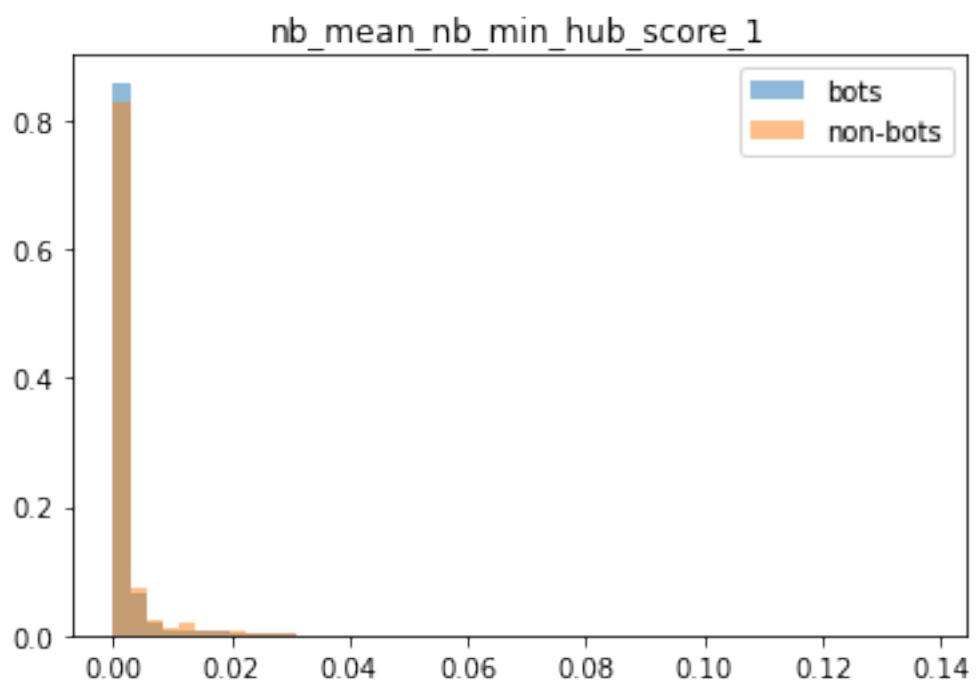
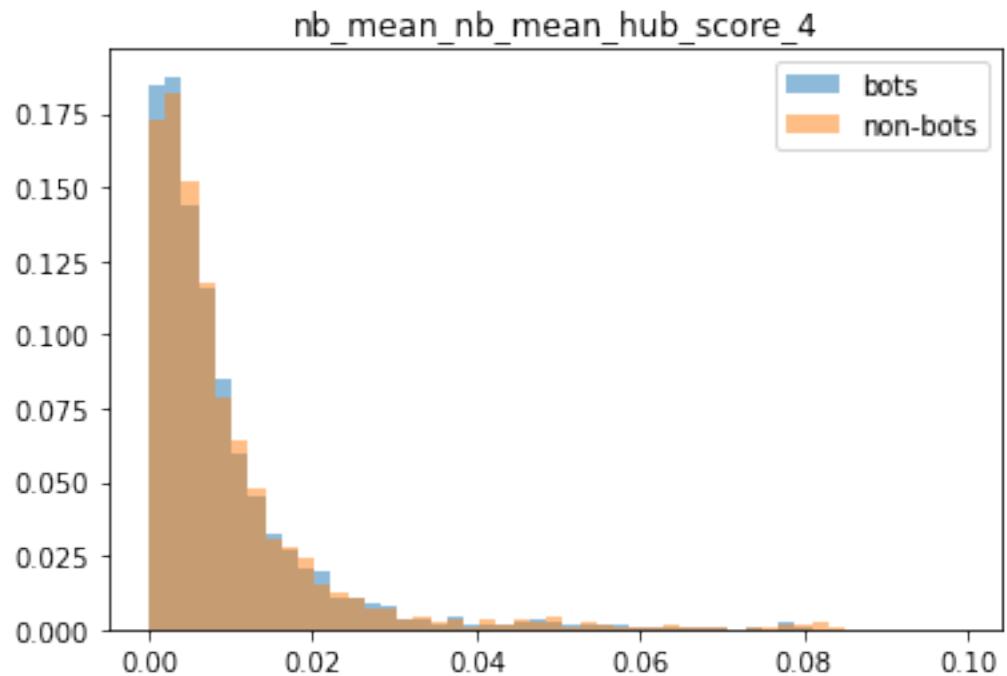


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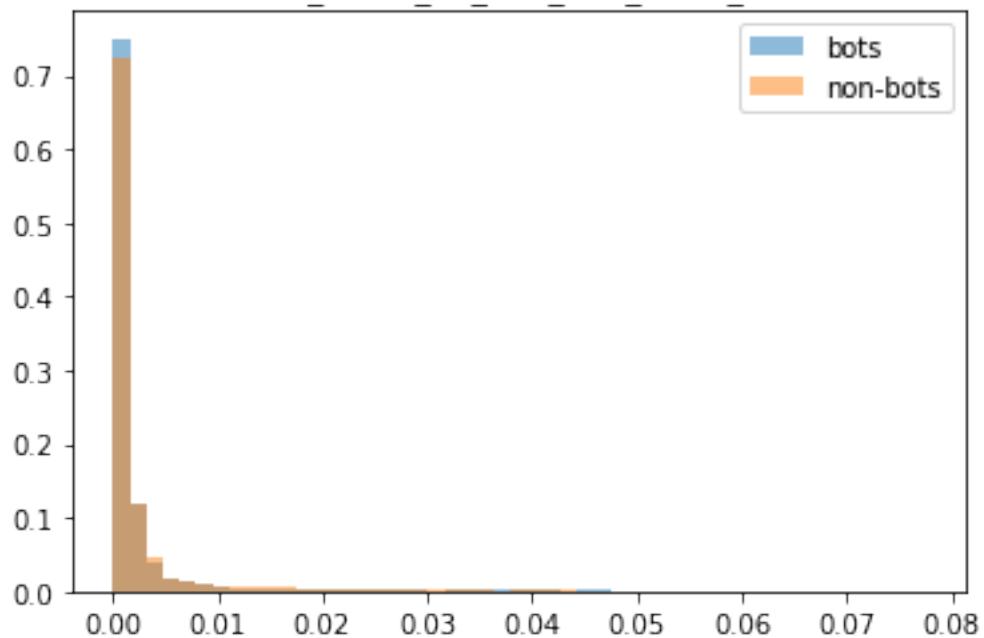


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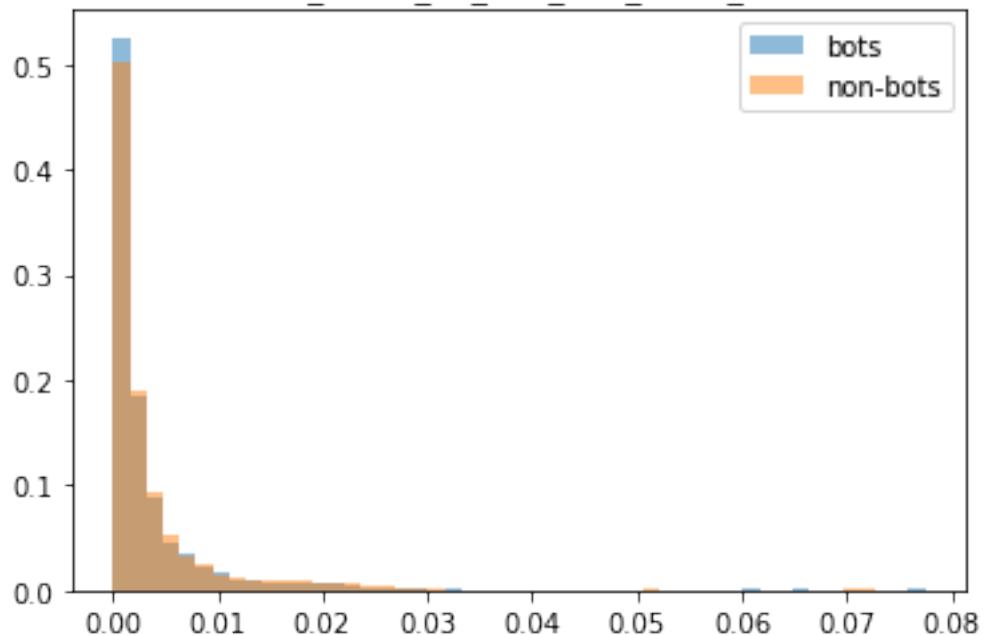


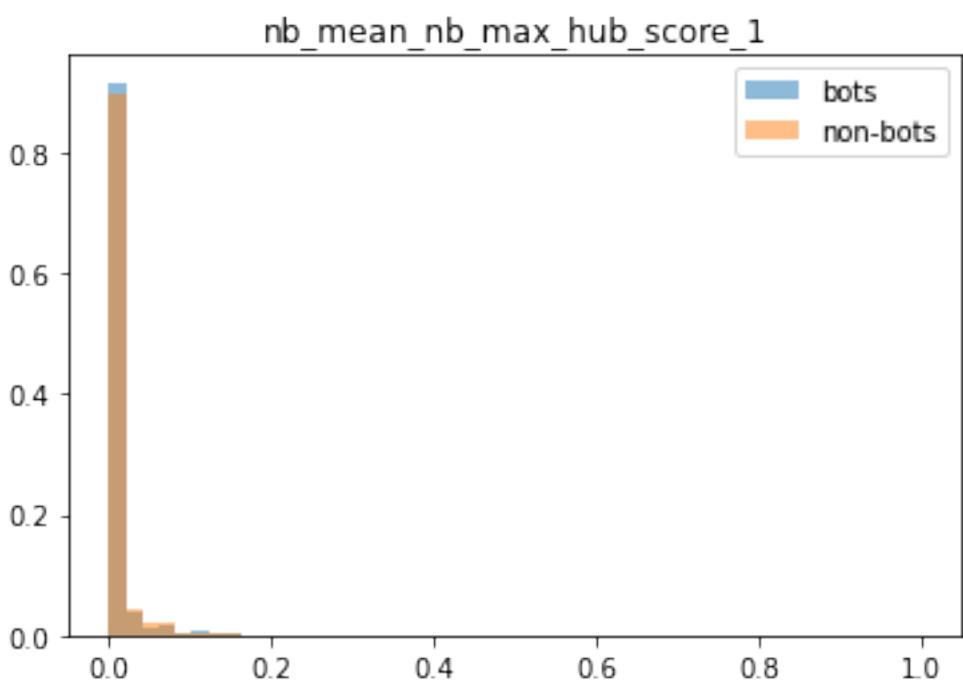
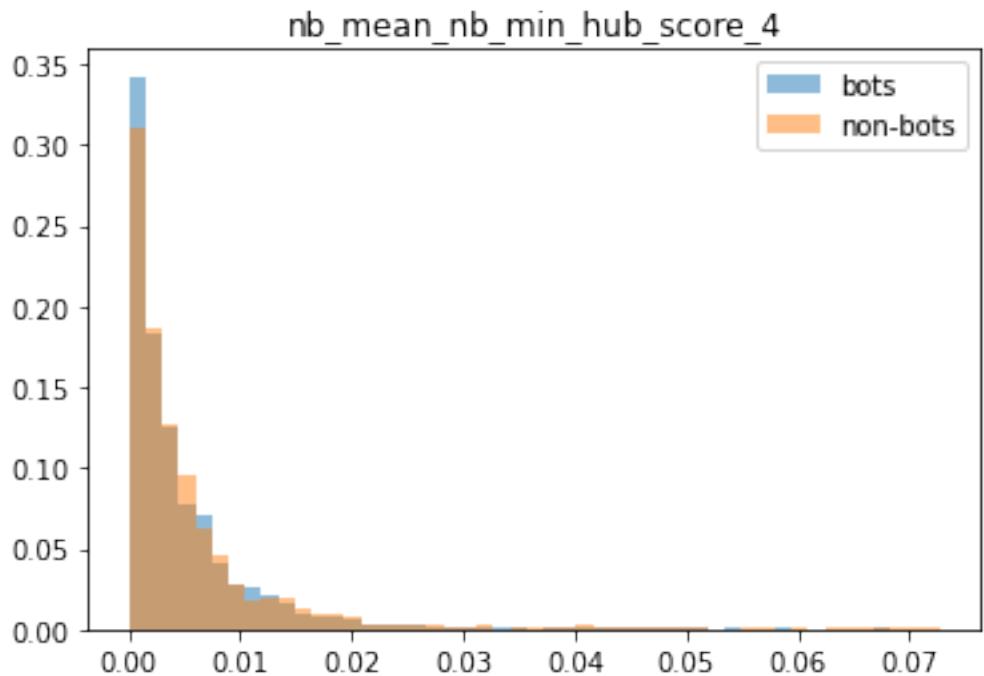


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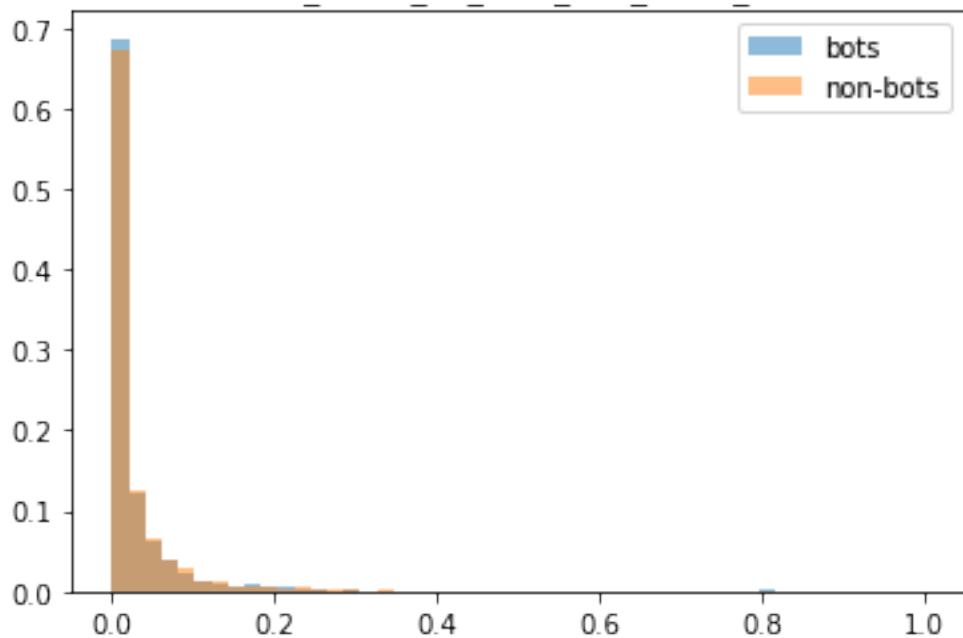


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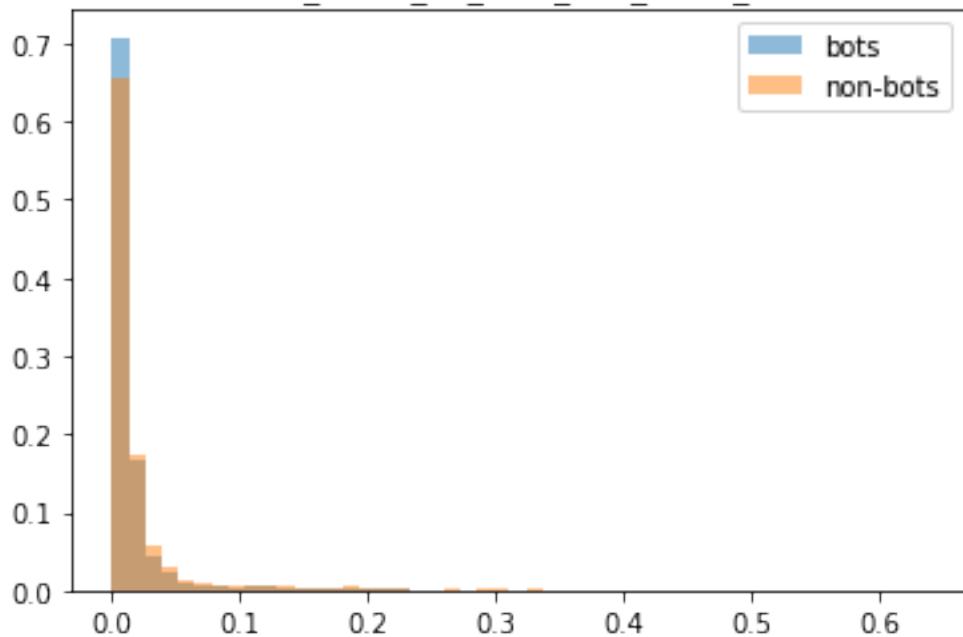


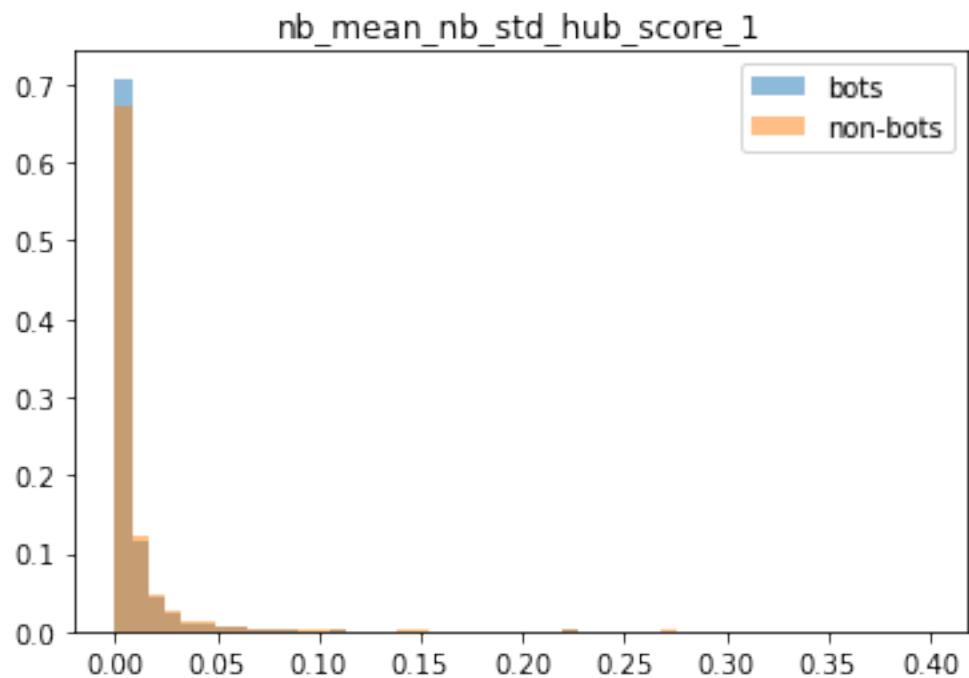
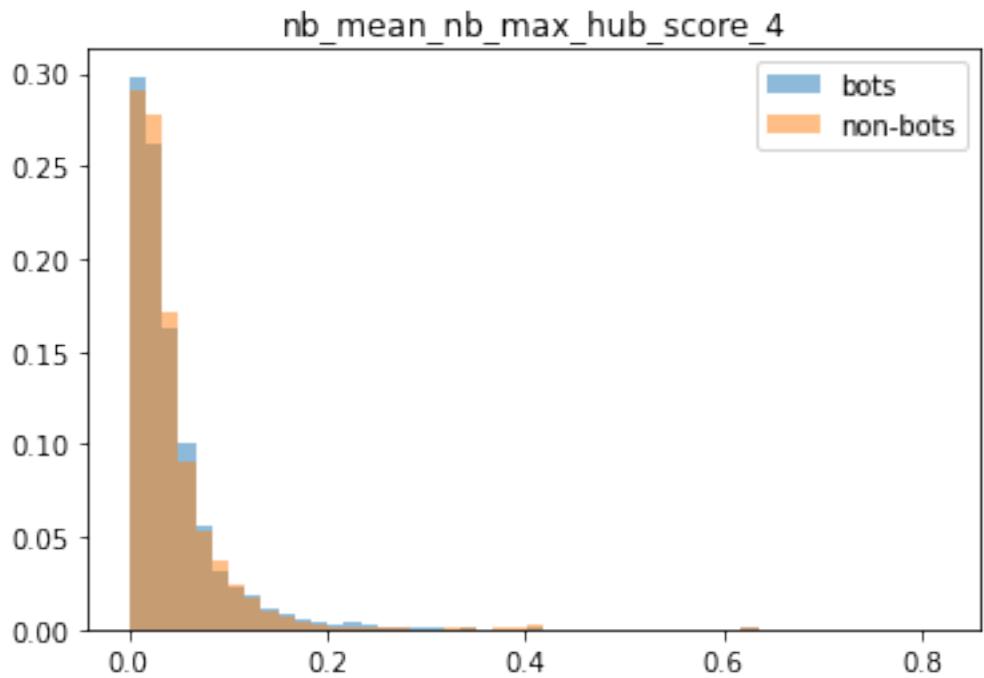


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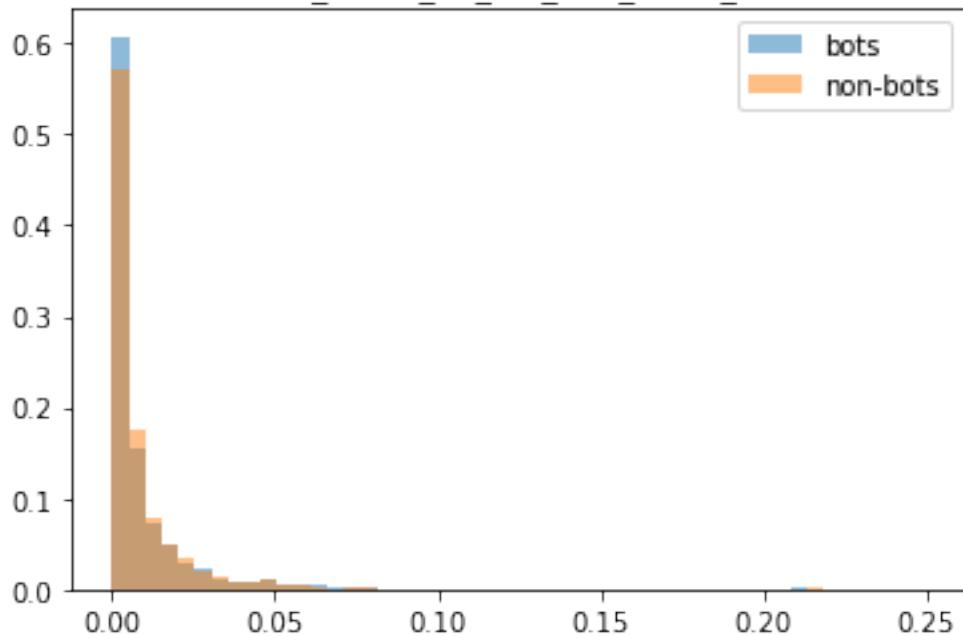


nb_mean_nb_max_hub_score_3

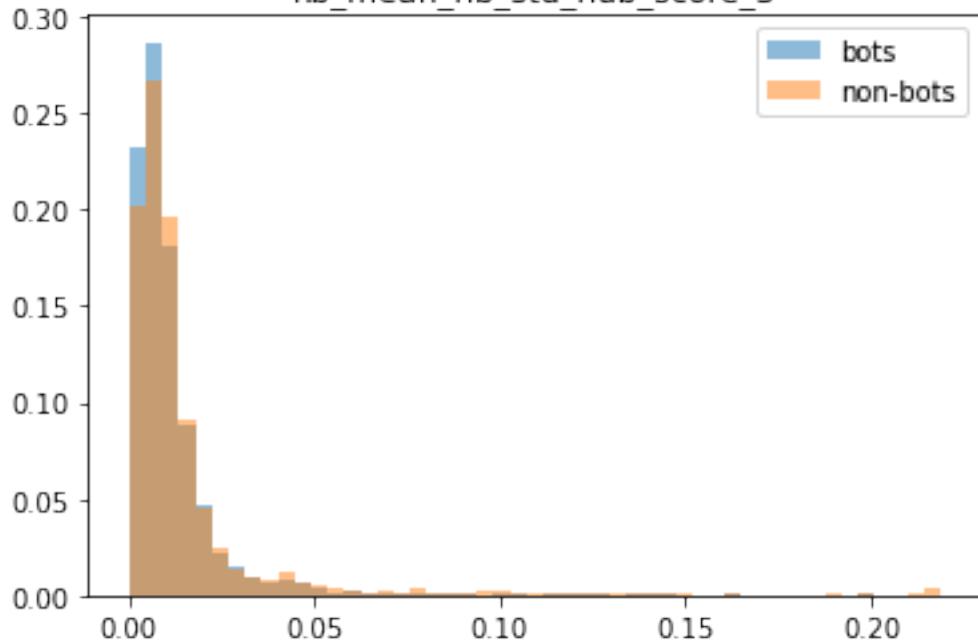




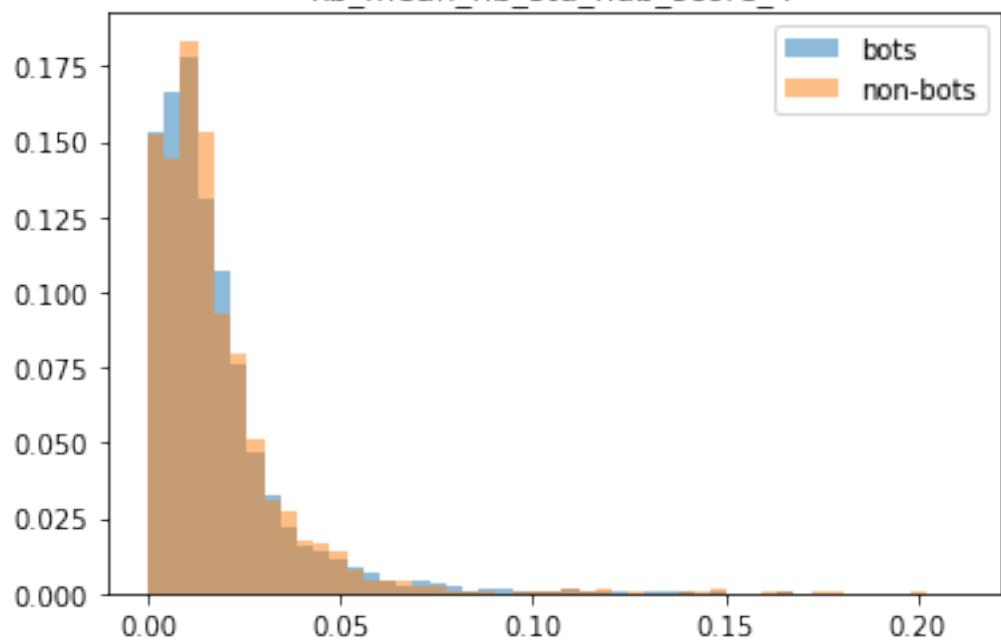
nb_mean_nb_std_hub_score_2



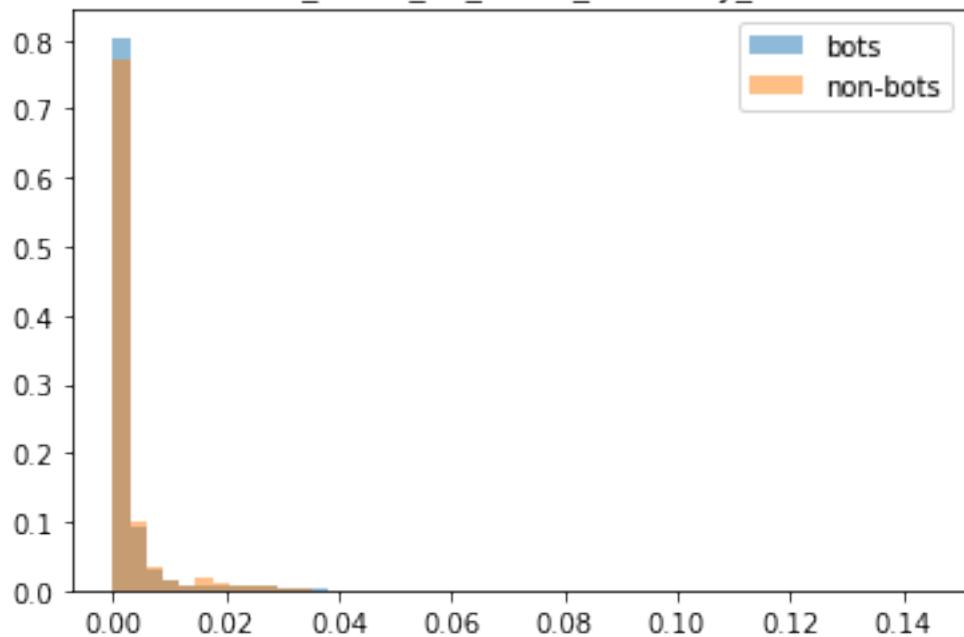
nb_mean_nb_std_hub_score_3



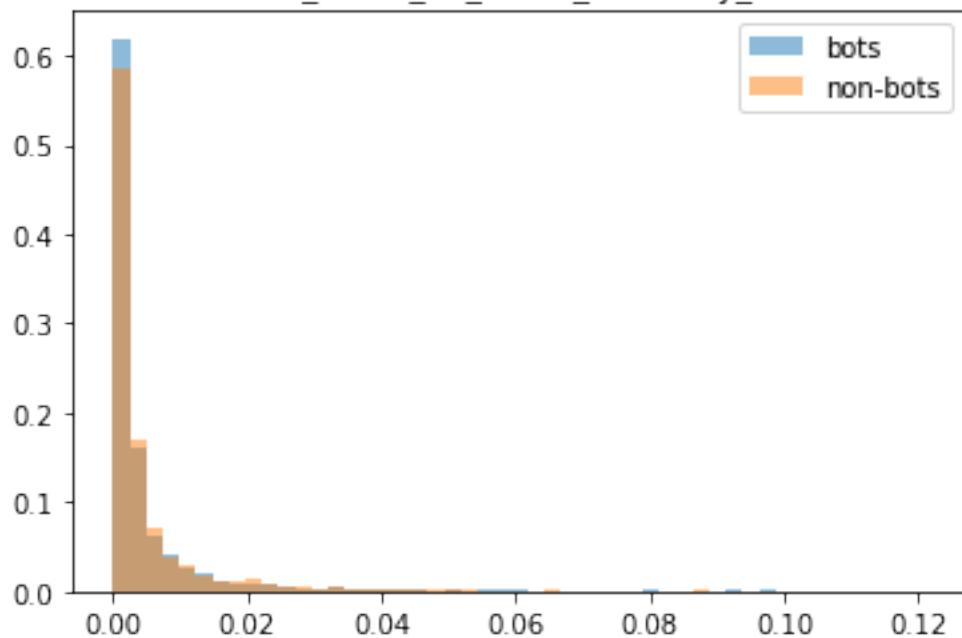
nb_mean_nb_std_hub_score_4



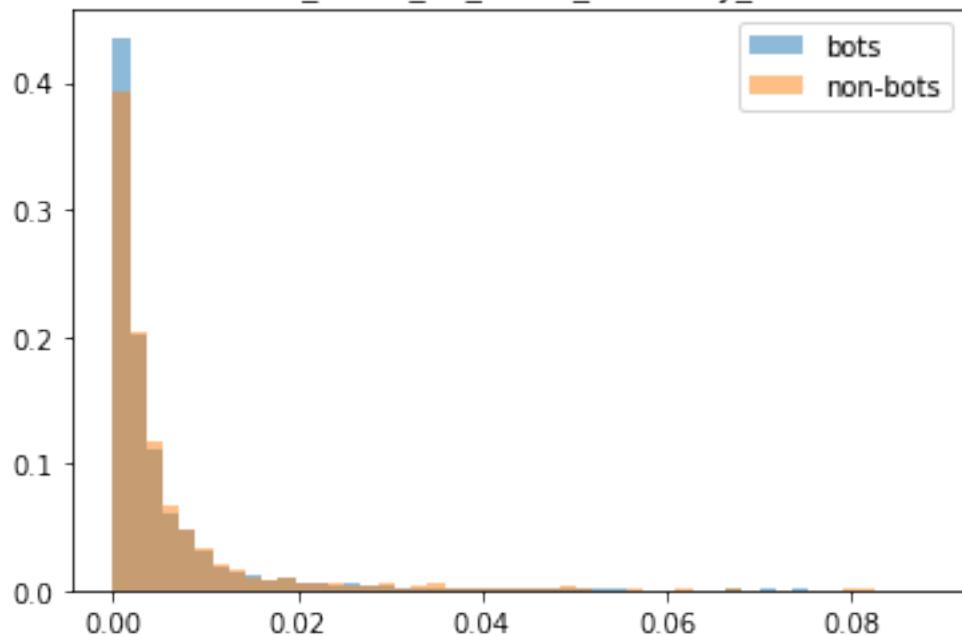
nb_mean_nb_mean_authority_1



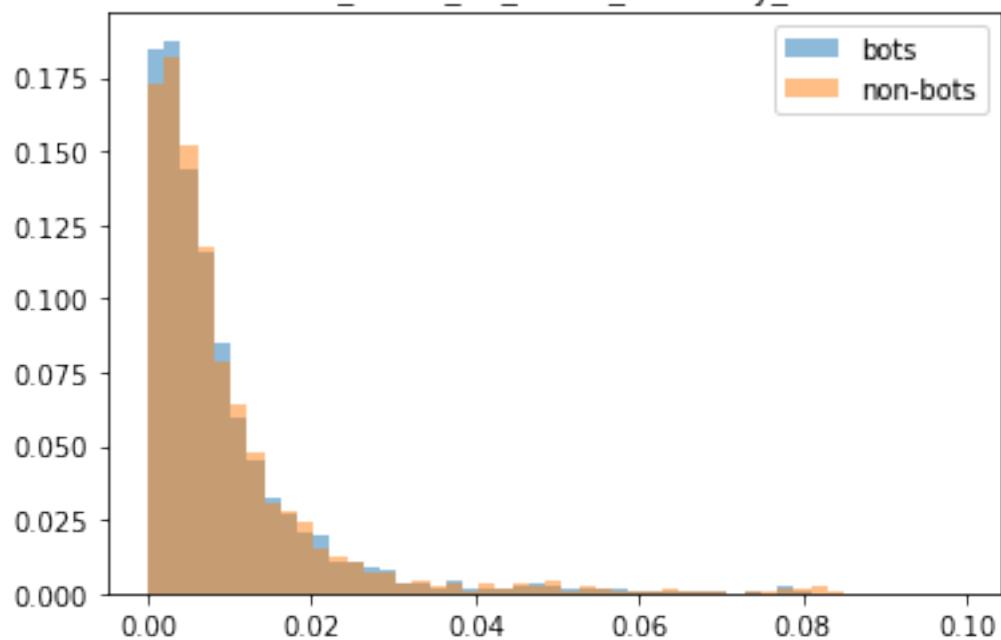
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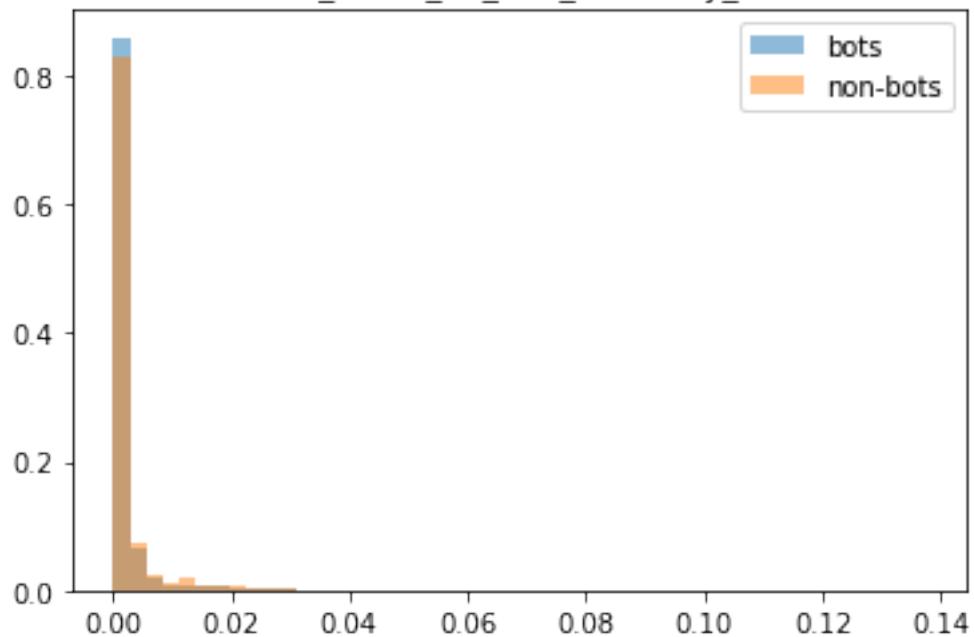
nb_mean_nb_mean_authority_3



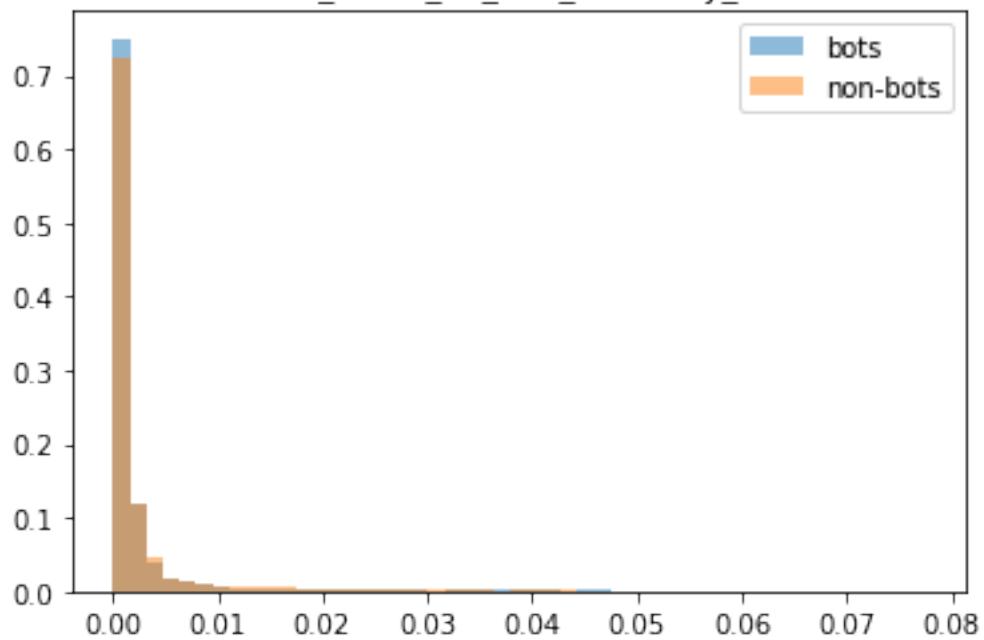
nb_mean_nb_mean_authority_4



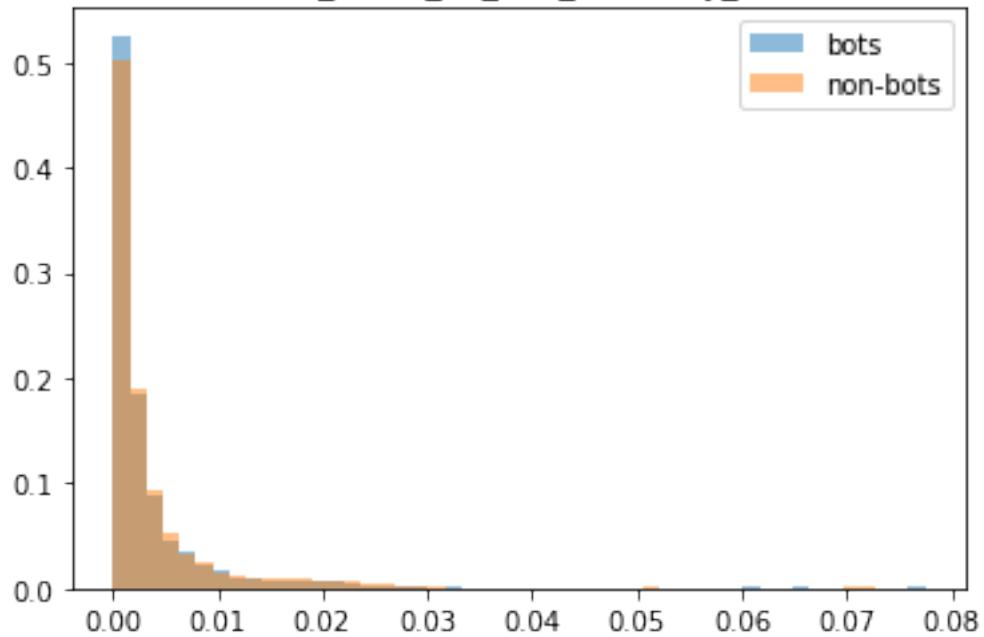
nb_mean_nb_min_authority_1



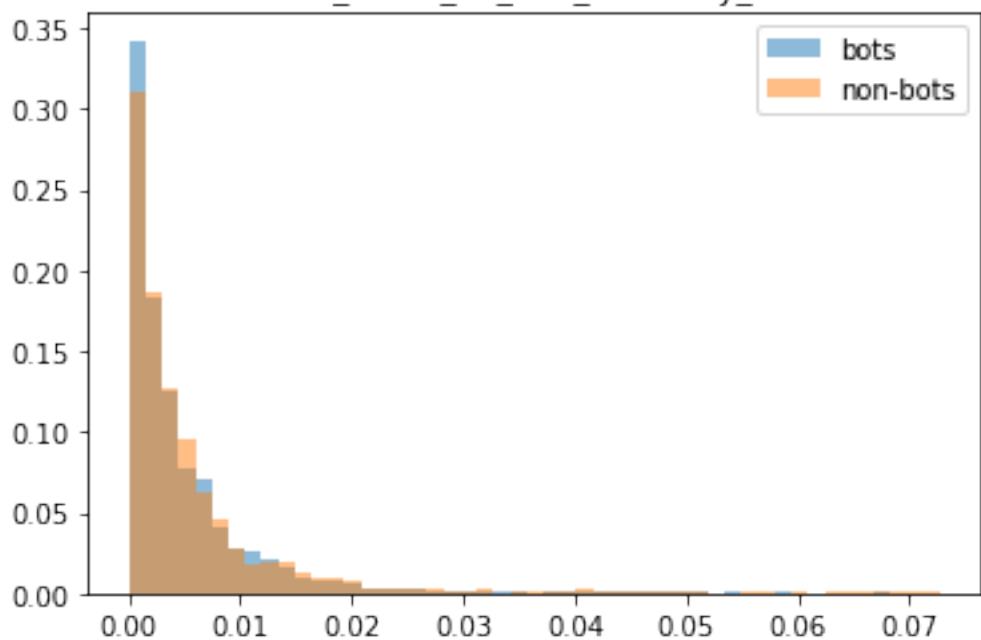
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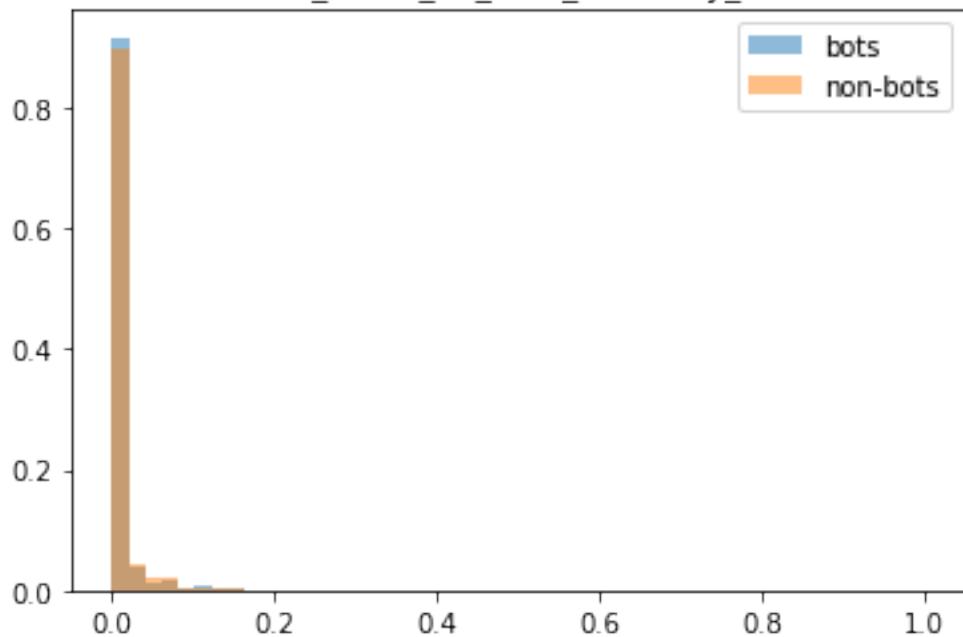
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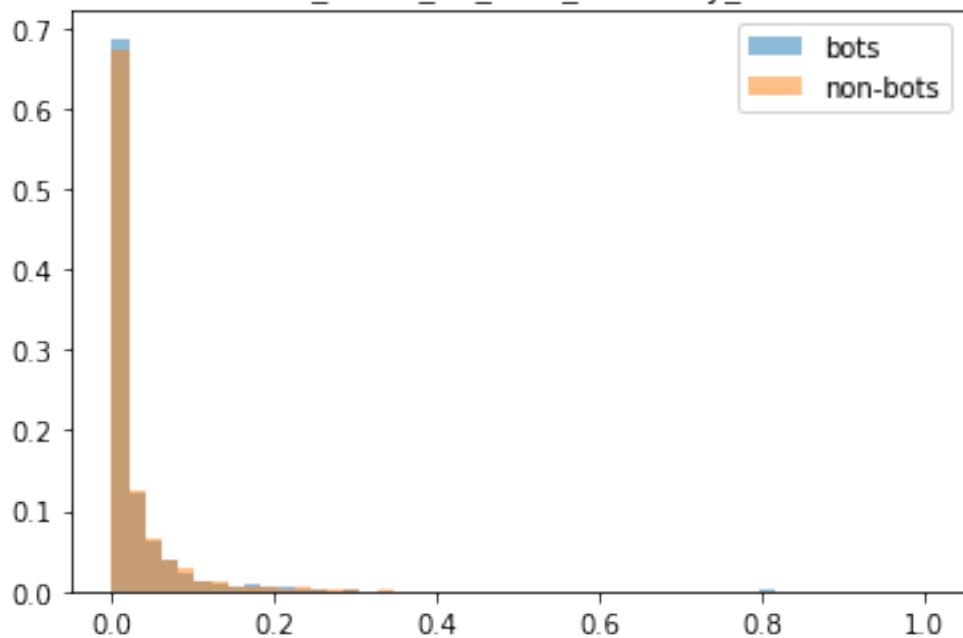
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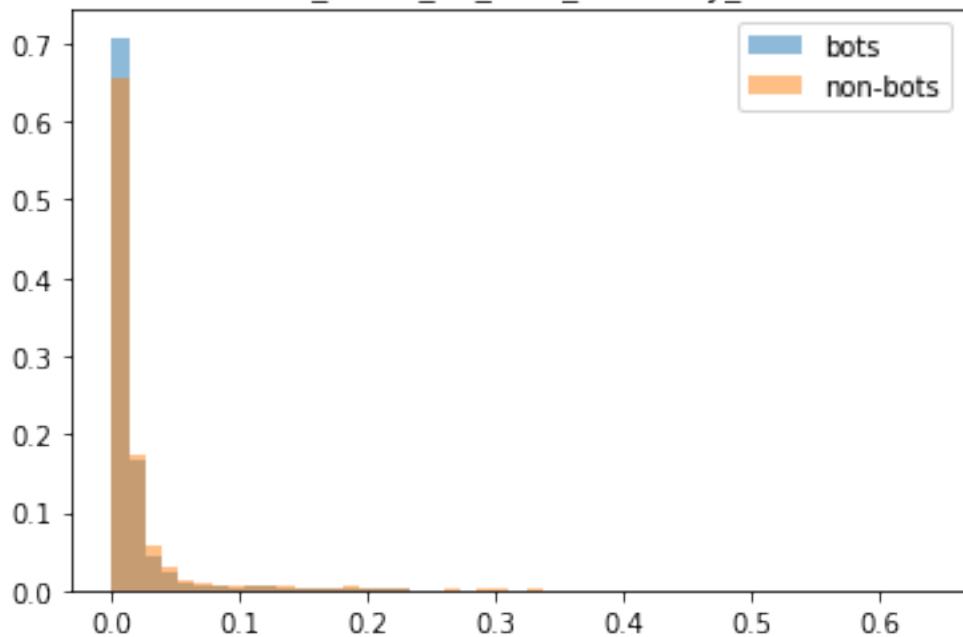
nb_mean_nb_max_authority_1



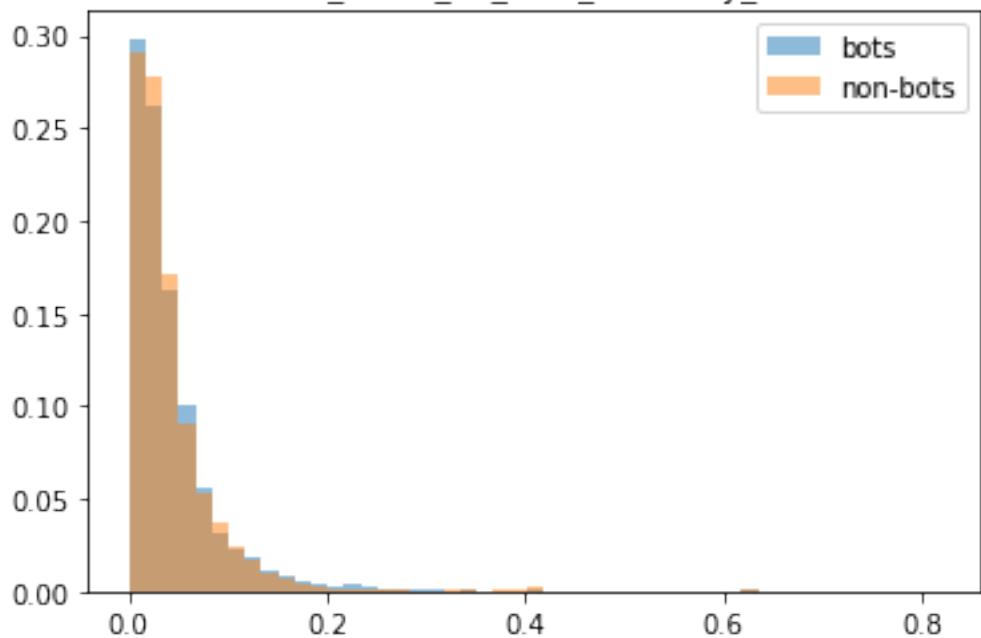
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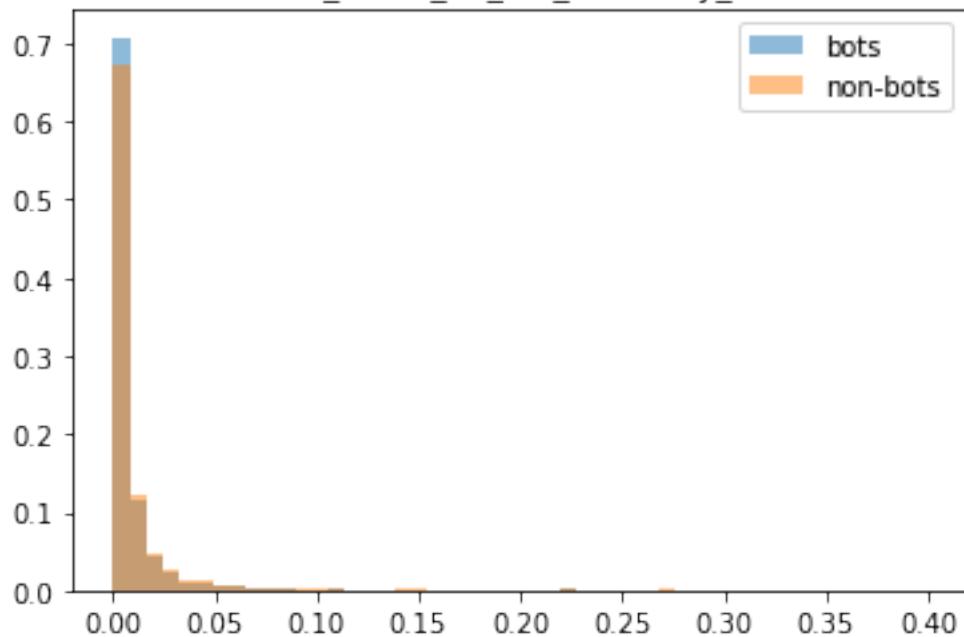
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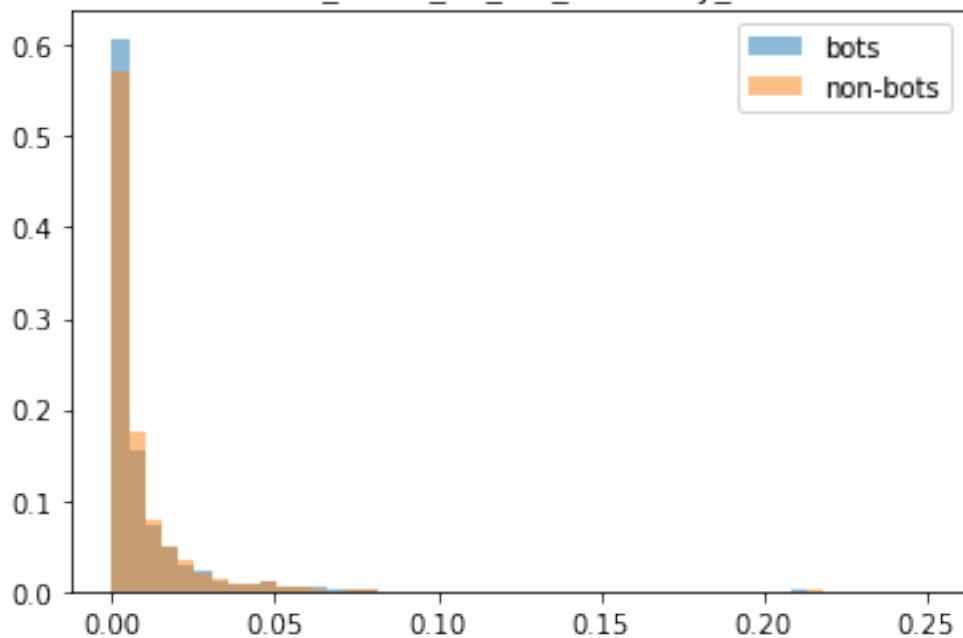
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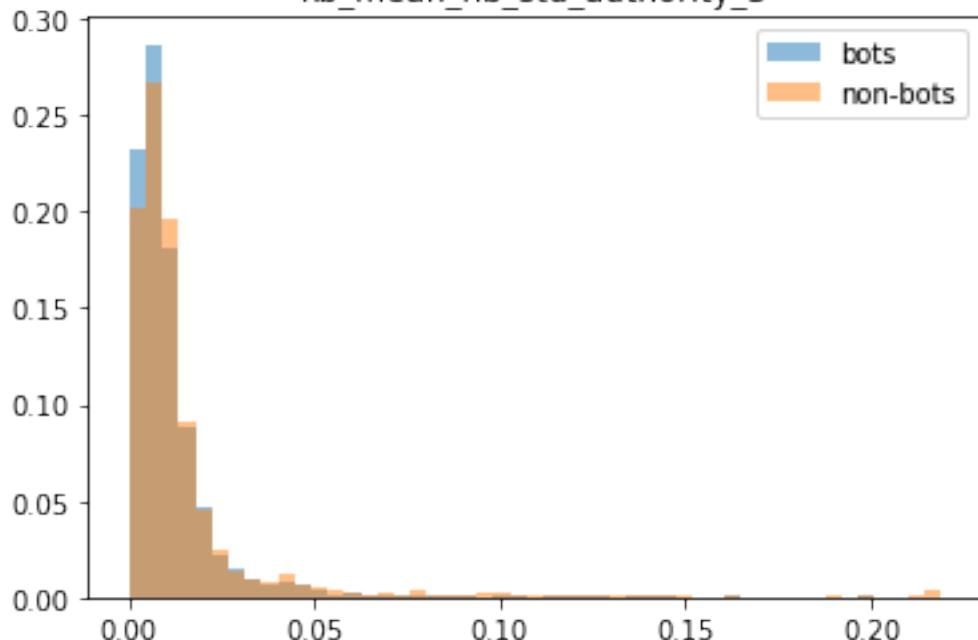
nb_mean_nb_std_authority_1



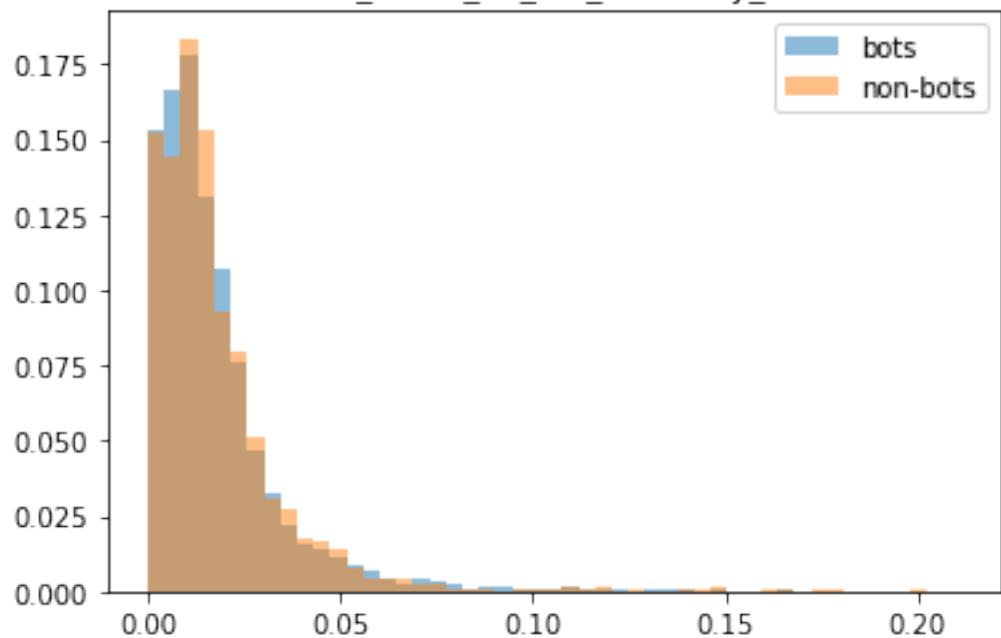
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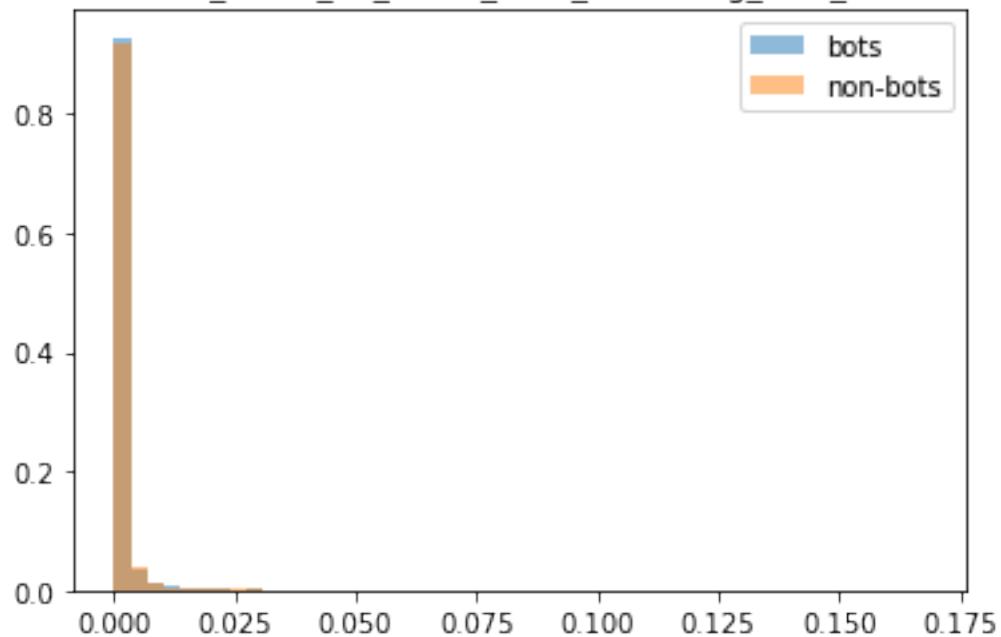
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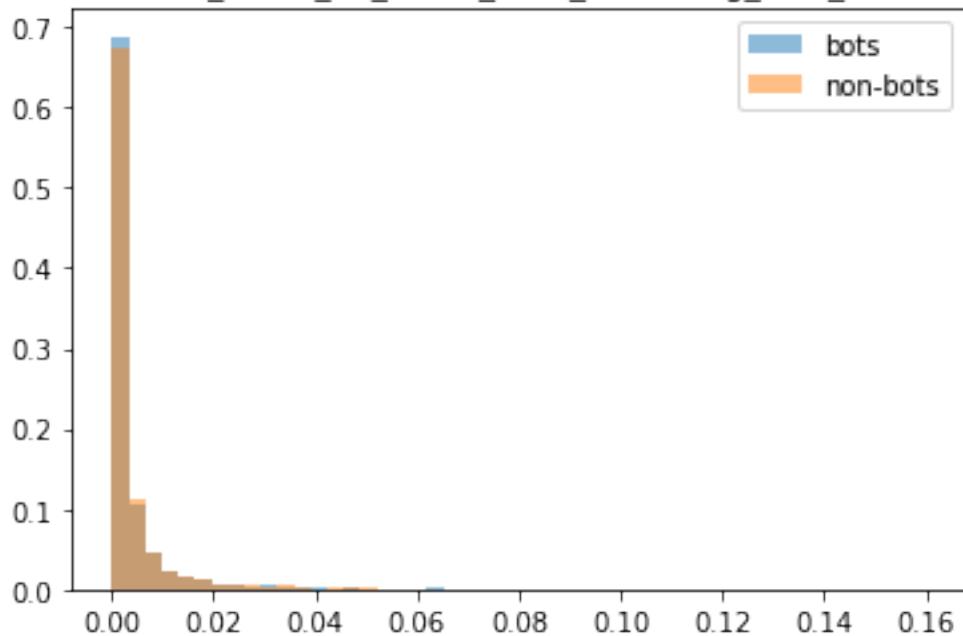
nb_mean_nb_std_authority_4



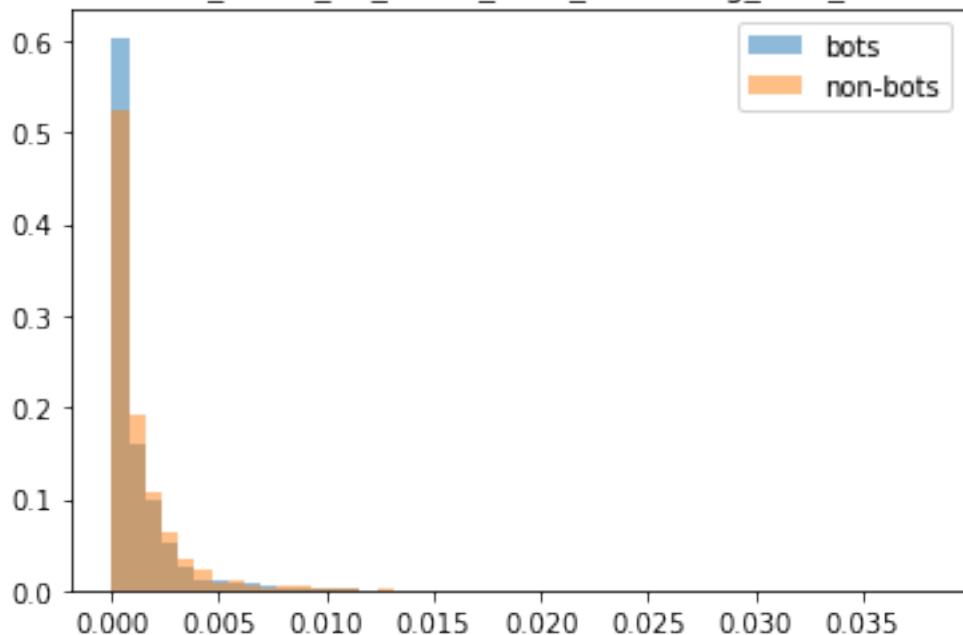
nb_mean_nb_mean_local_clustering_coef_1



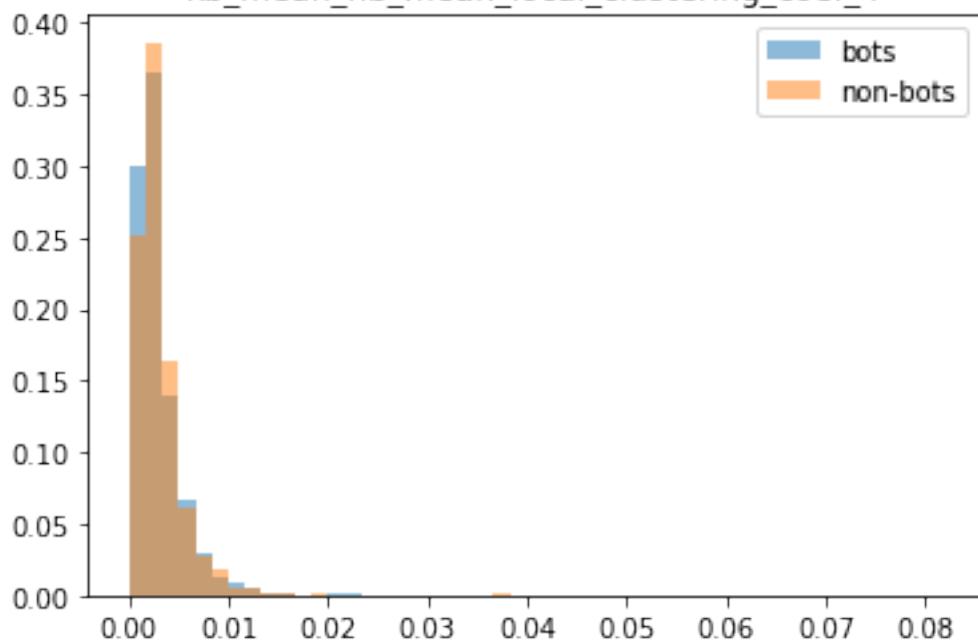
nb_mean_nb_mean_local_clustering_coef_2



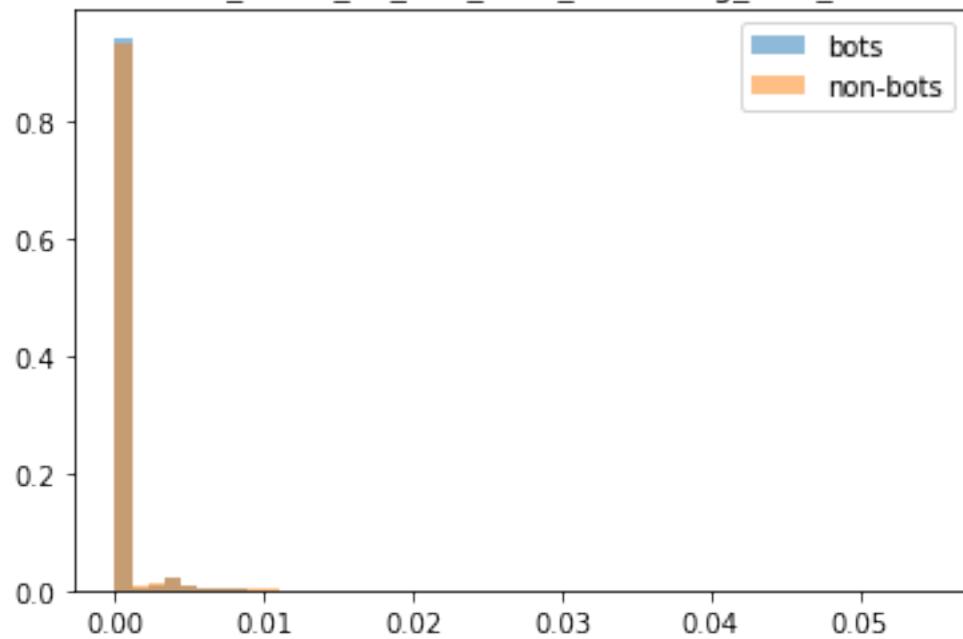
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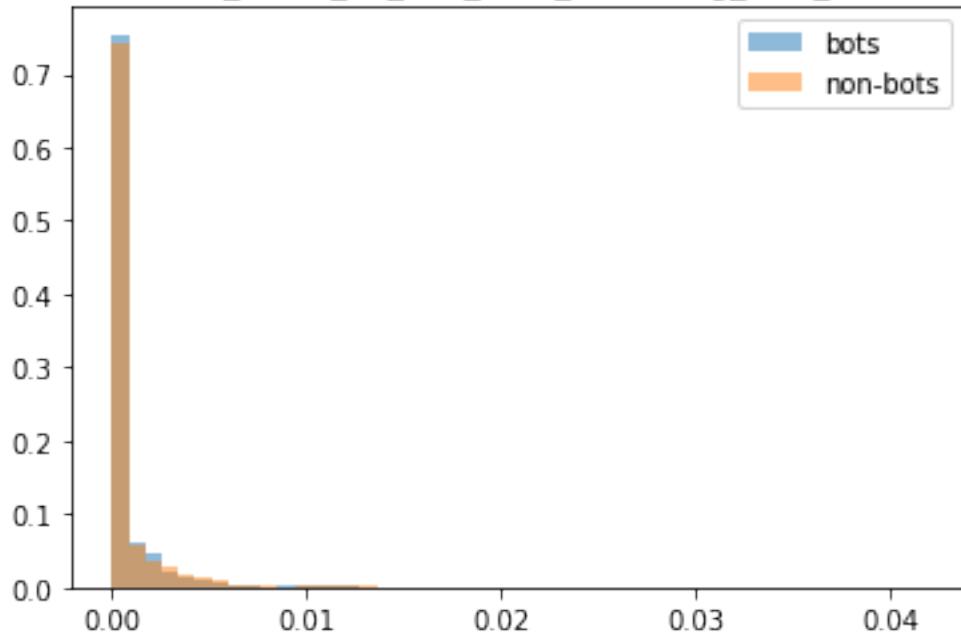
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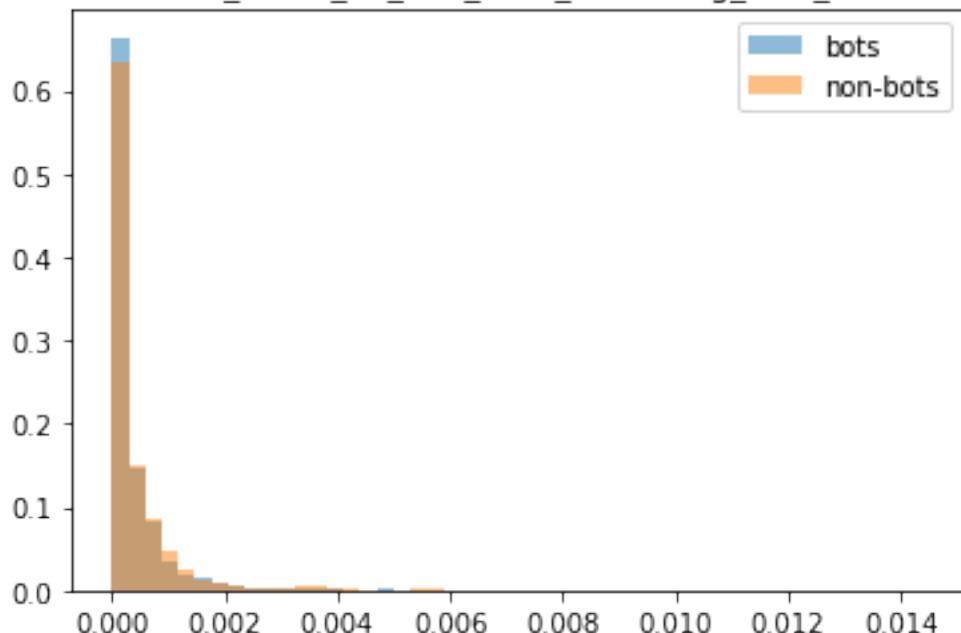
nb_mean_nb_min_local_clustering_coef_1



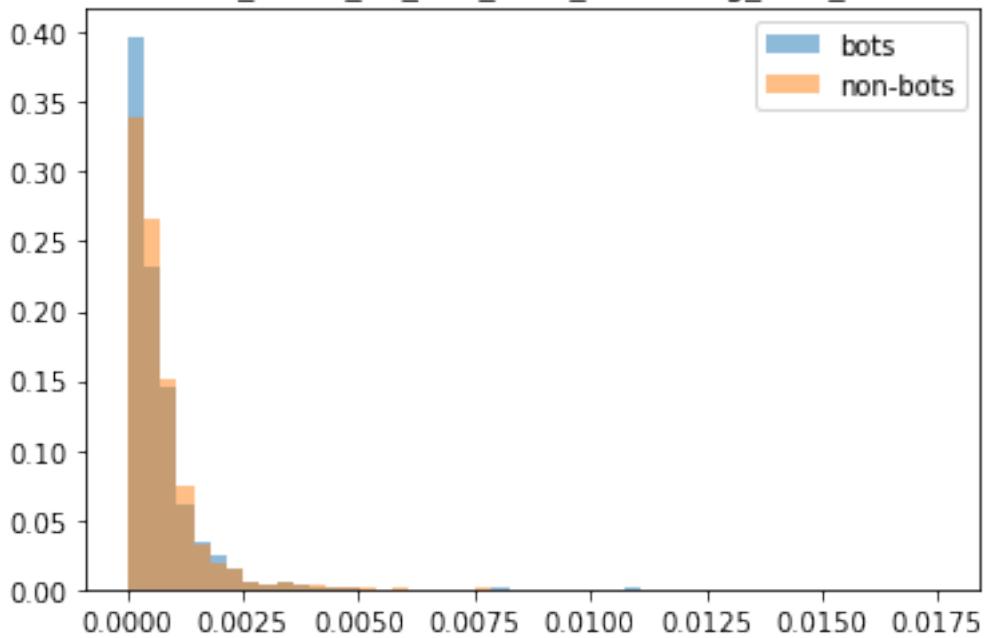
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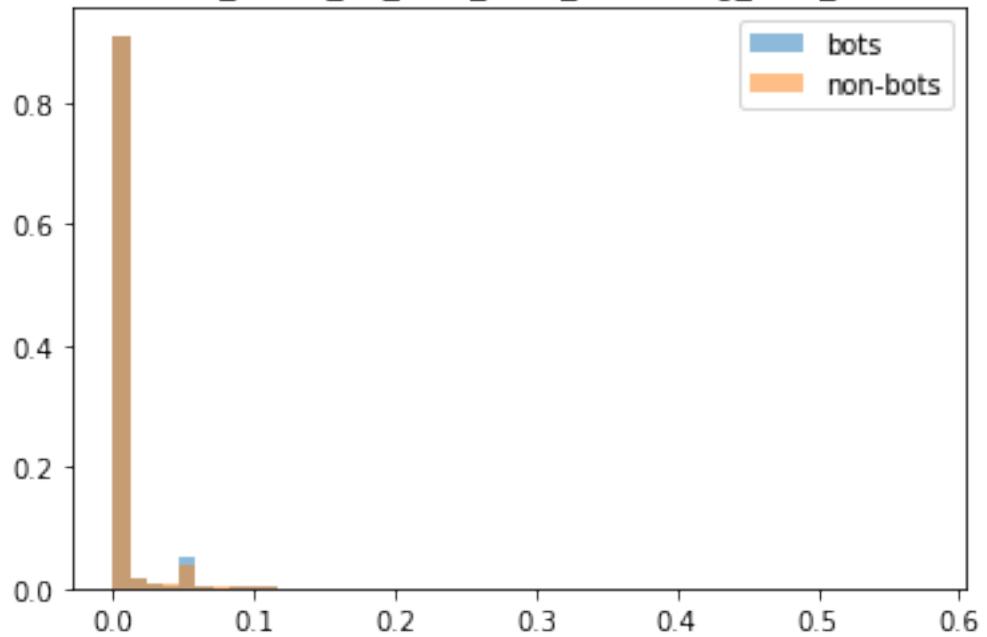
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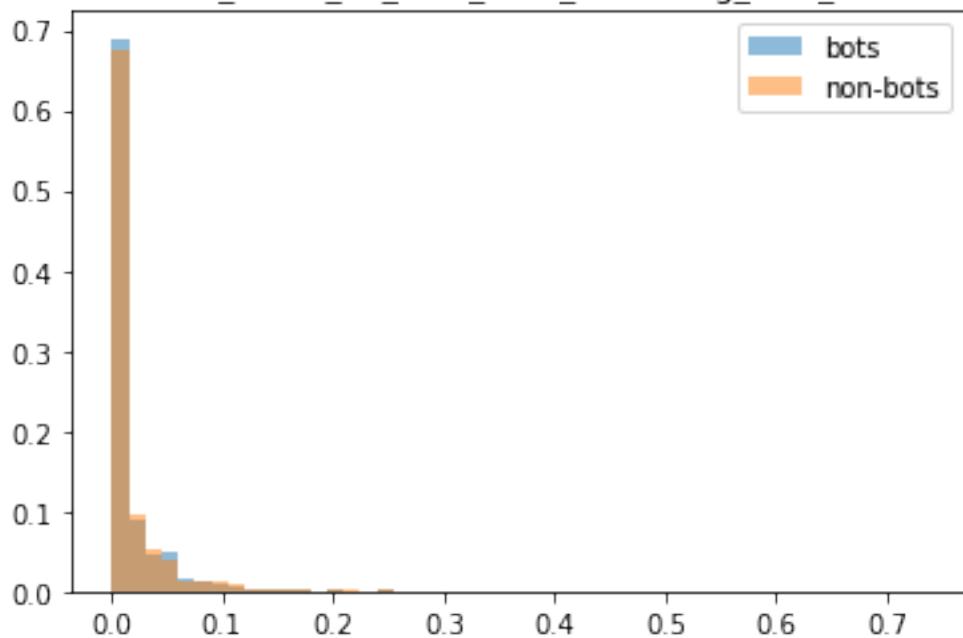
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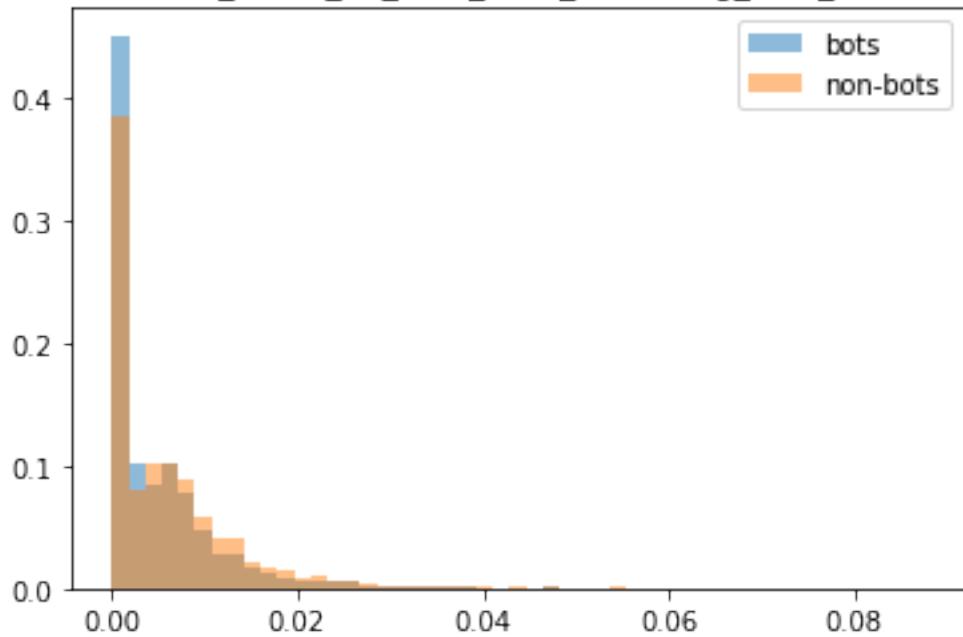
nb_mean_nb_max_local_clustering_coef_1



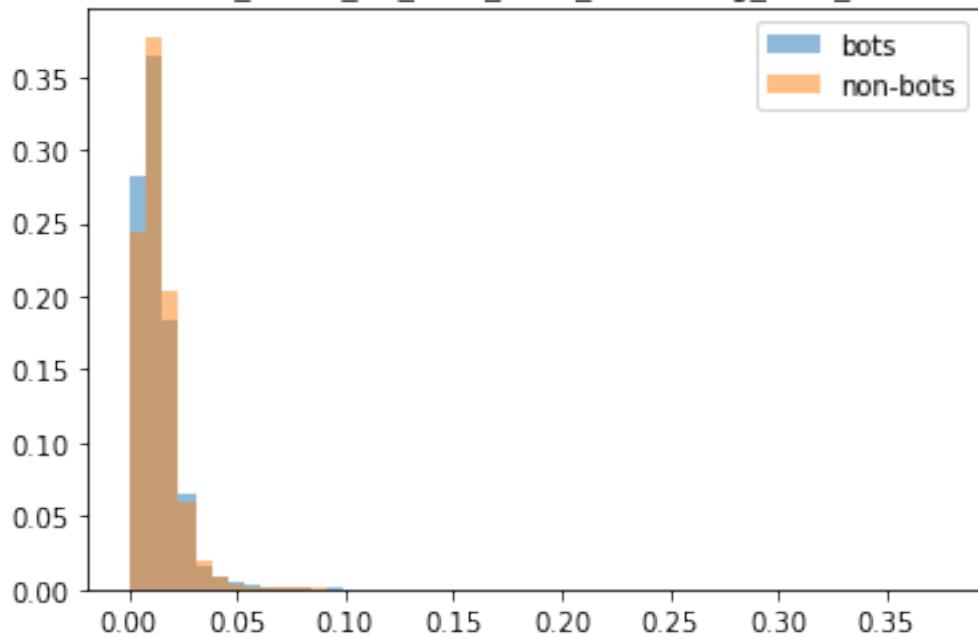
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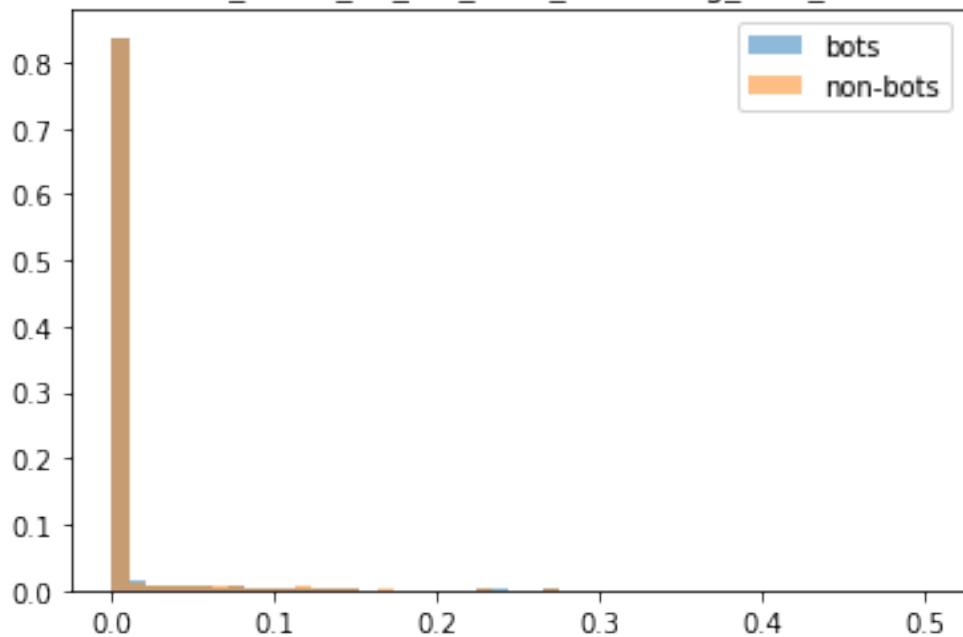
nb_mean_nb_max_local_clustering_coef_3



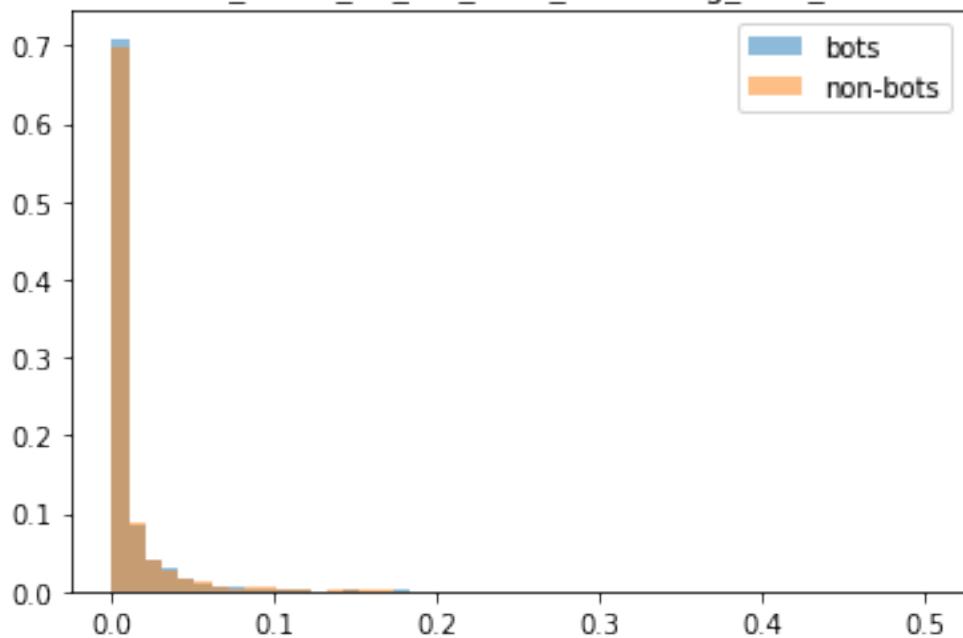
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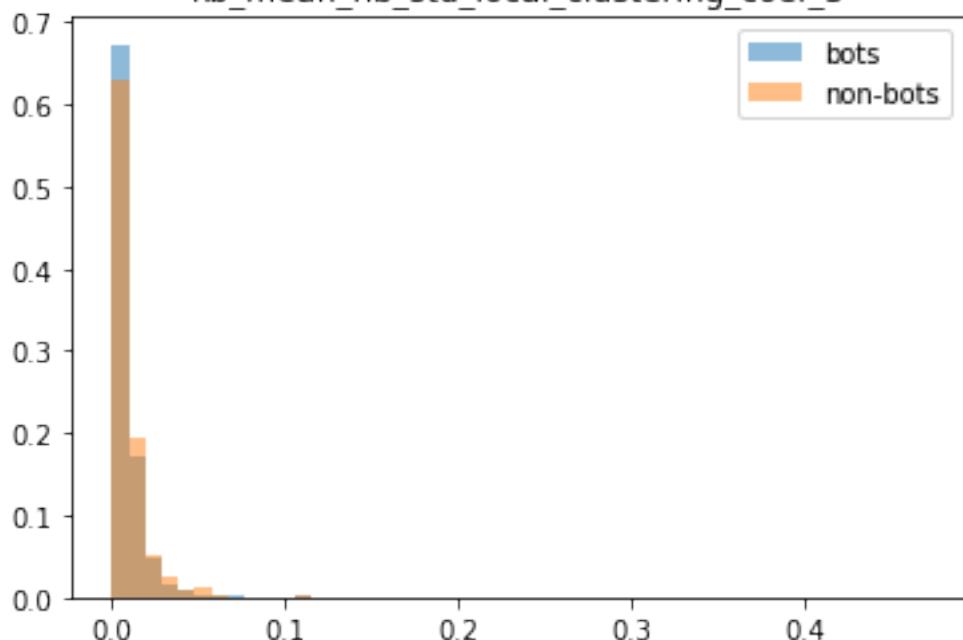
nb_mean_nb_std_local_clustering_coef_1

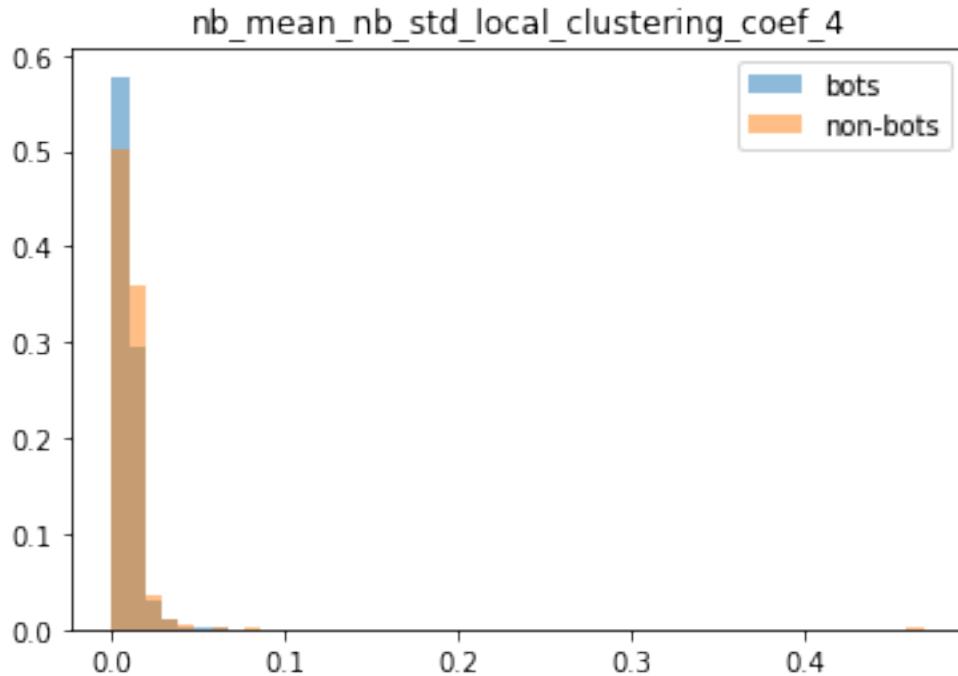


nb_mean_nb_std_local_clustering_coef_2



nb_mean_nb_std_local_clustering_coef_3





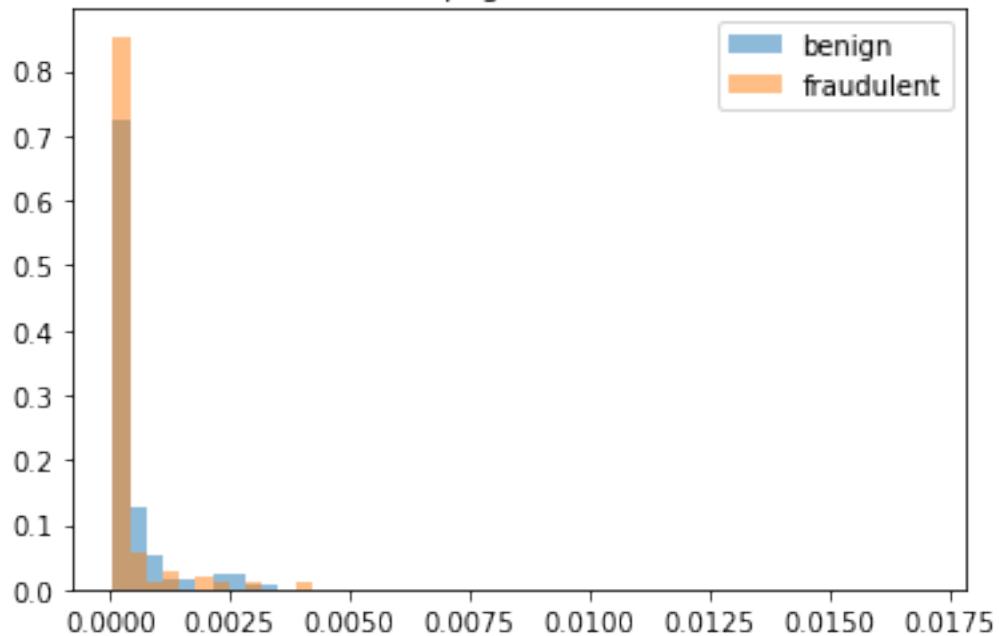
0.2 Bitcoin Alpha

```
[ ]: bitcoin_alpha_gf = pd.read_csv("bitcoin_alpha_gf.csv")
for col in bitcoin_alpha_gf.columns[1:-1]:
    x = bitcoin_alpha_gf.loc[bitcoin_alpha_gf["label"] == 1, col]
    y = bitcoin_alpha_gf.loc[bitcoin_alpha_gf["label"] == 0, col]

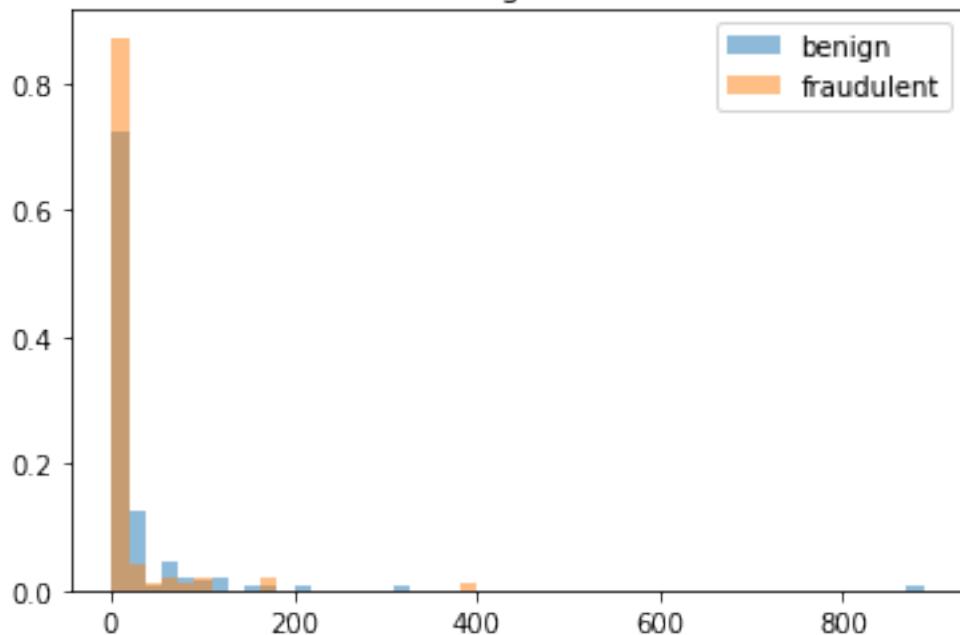
    bins = np.linspace(min(bitcoin_alpha_gf[col]), max(bitcoin_alpha_gf[col]), 50)

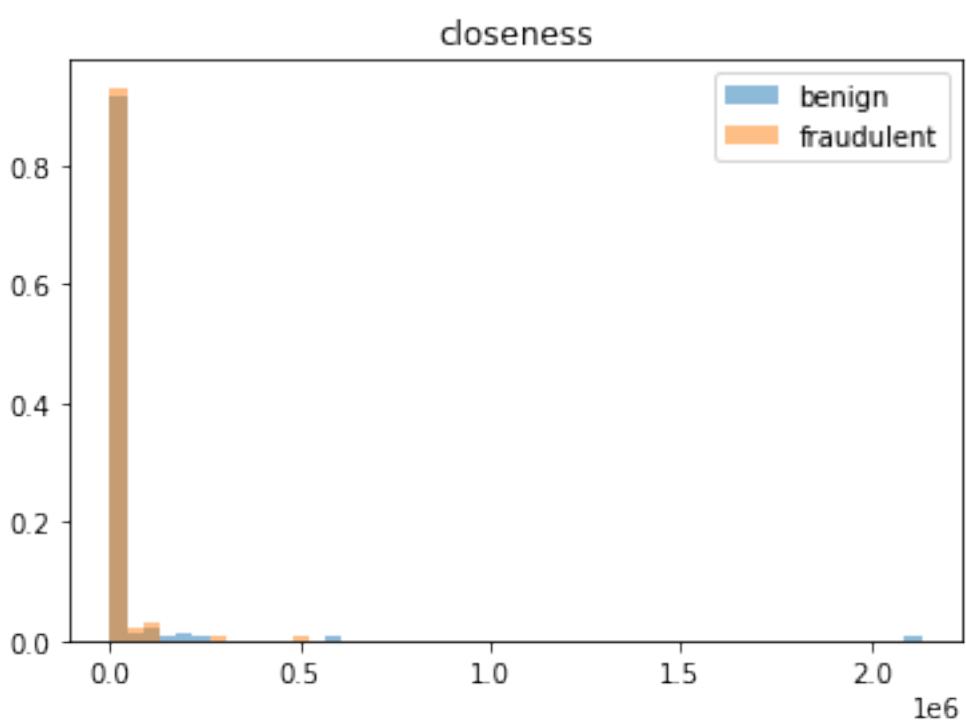
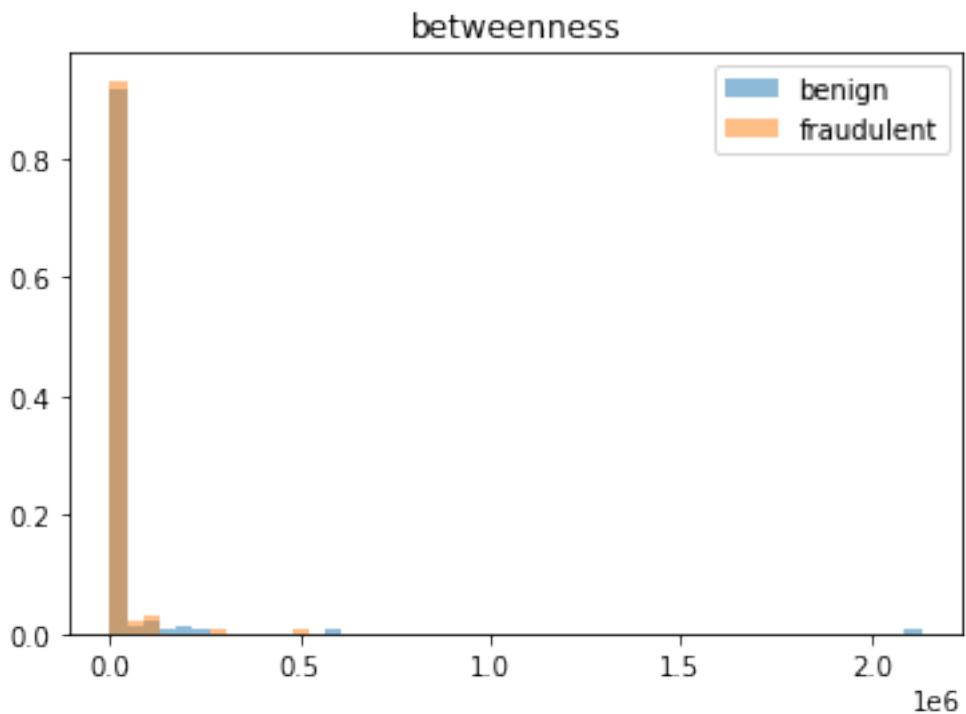
    plt.hist(round(x, 5), bins, alpha=0.5, label='benign', weights=np.ones(len(x))/len(x))
    plt.hist(y, bins, alpha=0.5, label='fraudulent', weights=np.ones(len(y))/len(y))
    plt.legend(loc='upper right')
    plt.title(col)
    #plt.savefig(f'./charts/{col}.pdf')
    plt.show()
```

pagerank

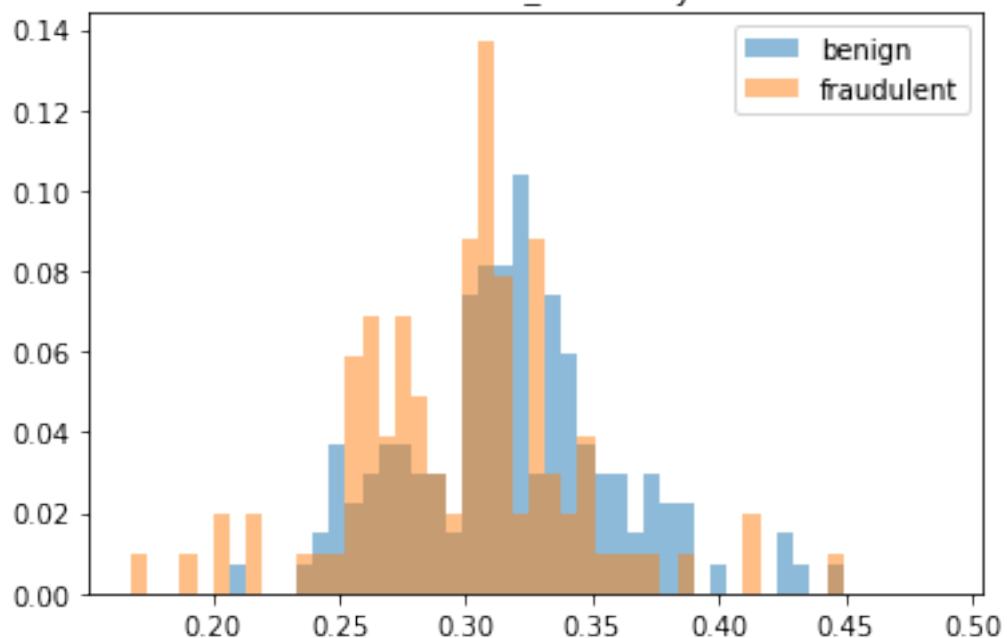


degree

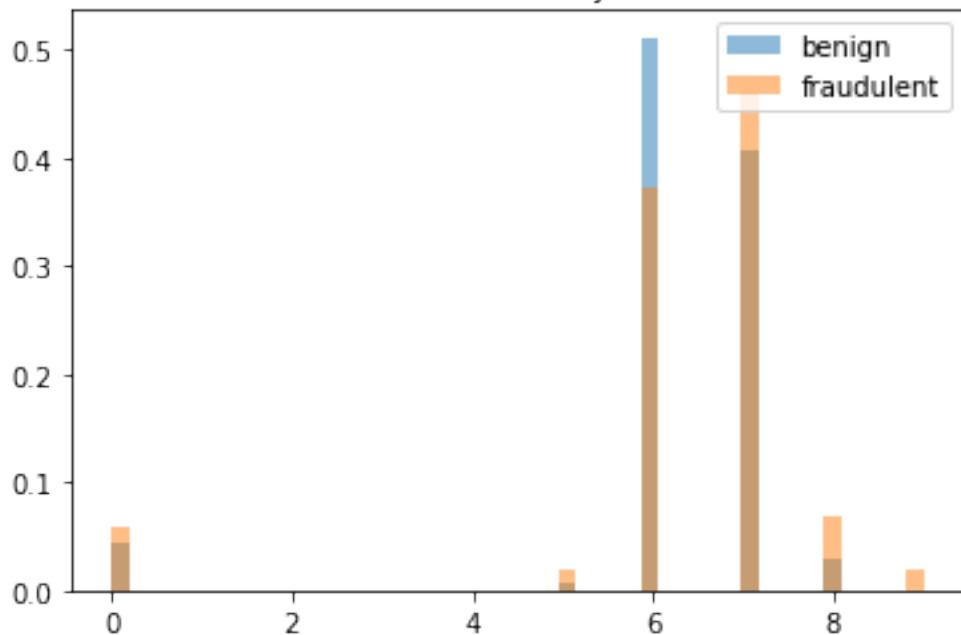




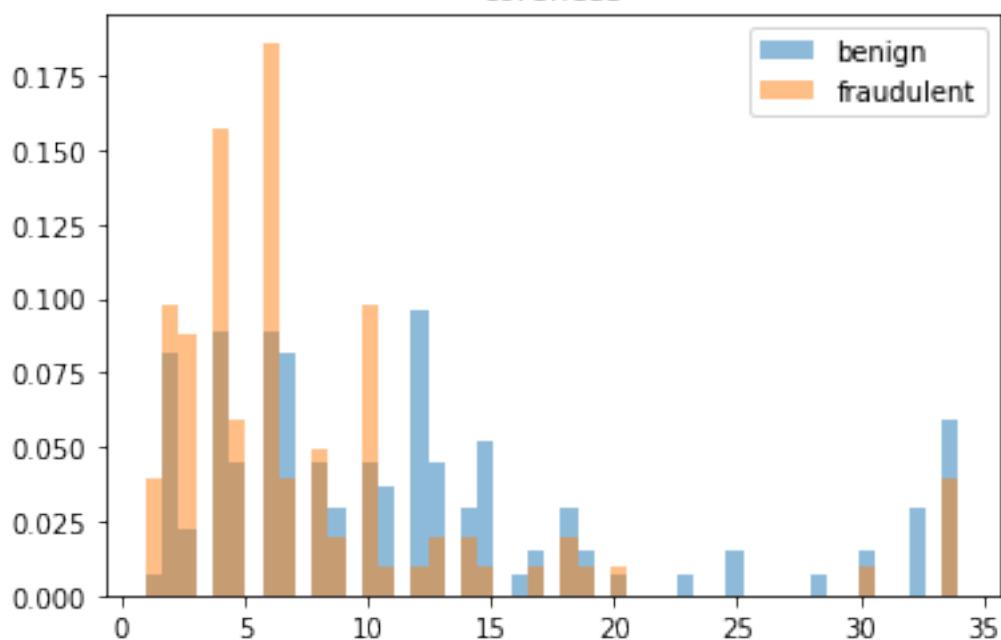
harmonic_centrality



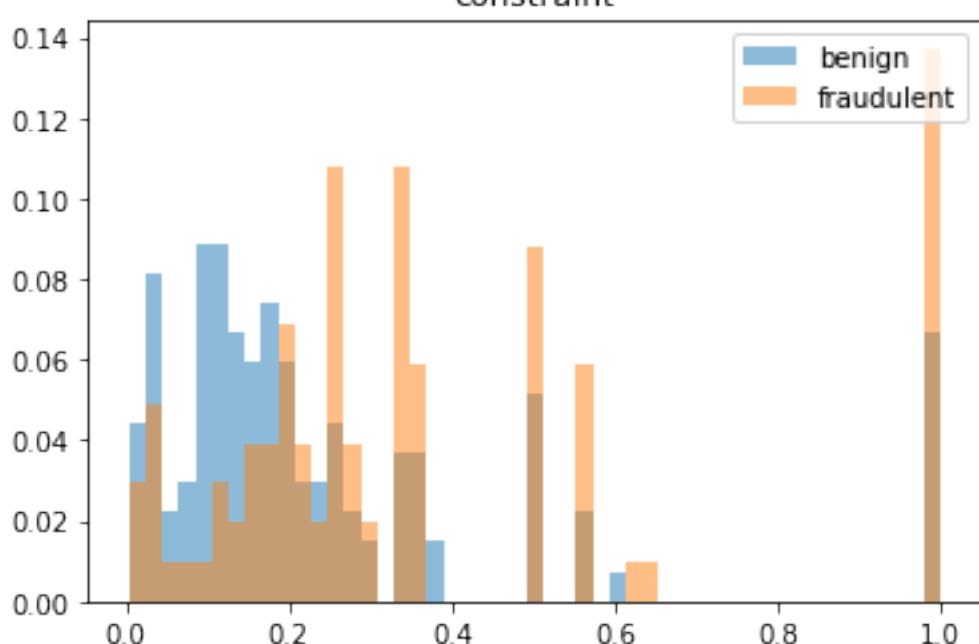
eccentricity



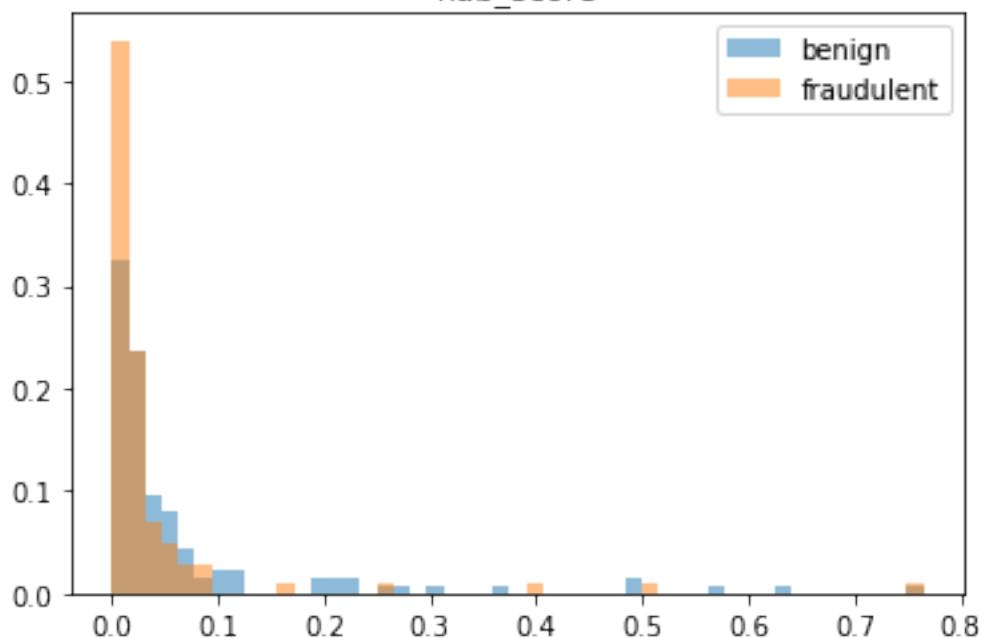
coreness



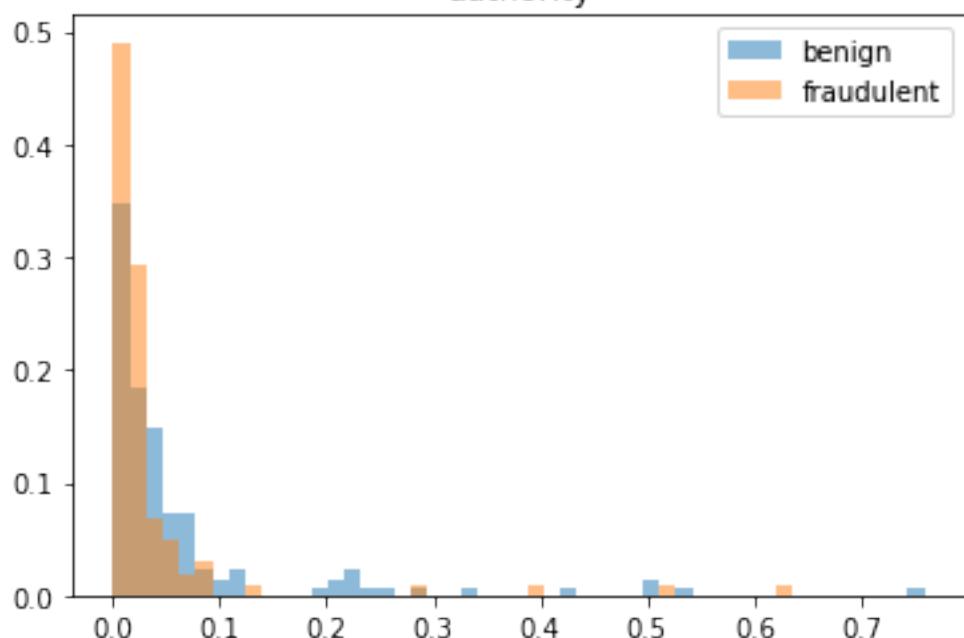
constraint



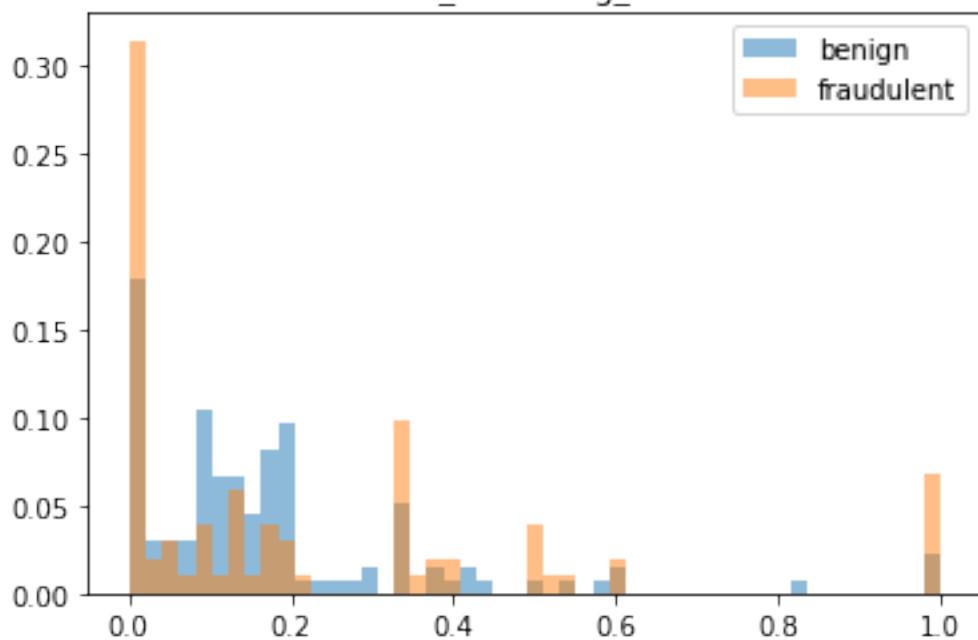
hub_score



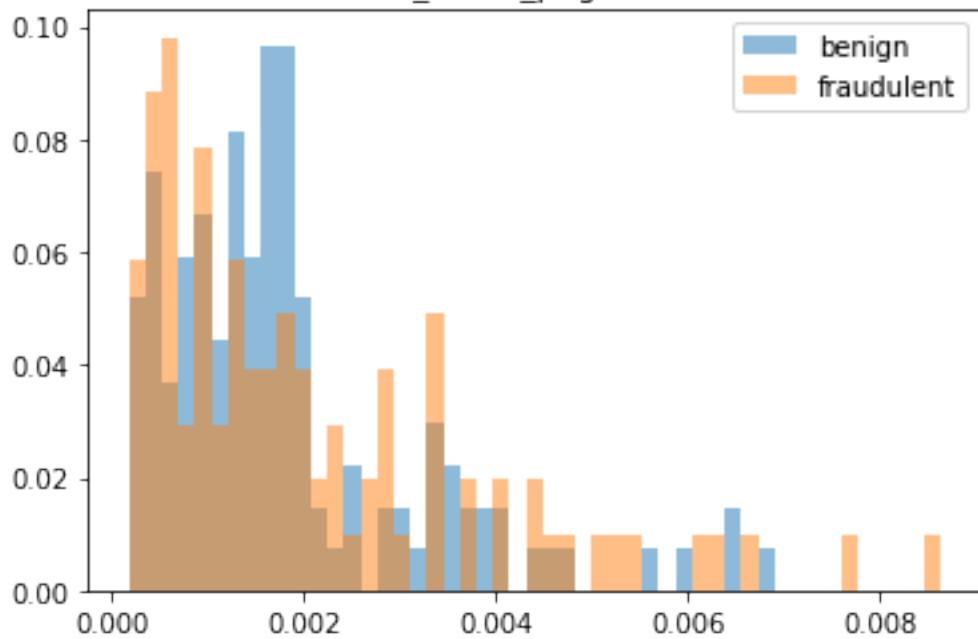
authority

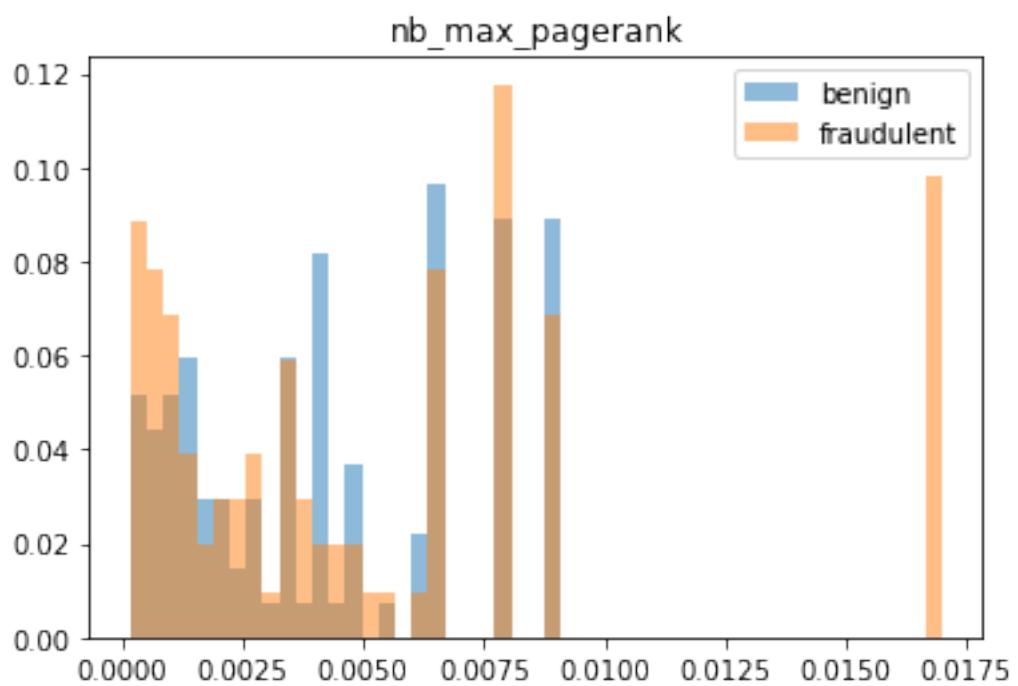
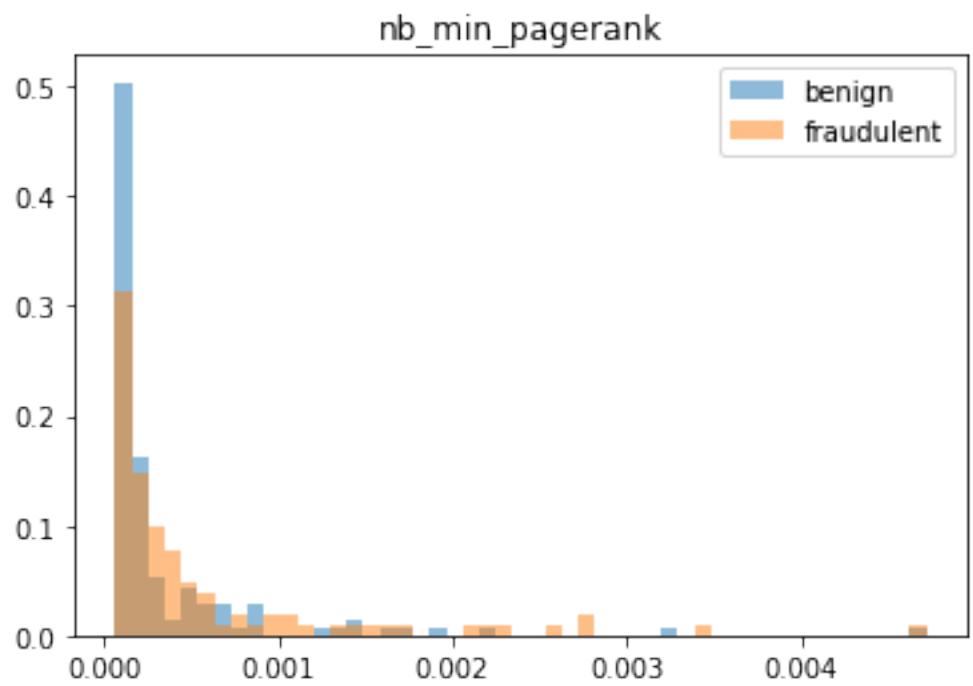


local_clustering_coef

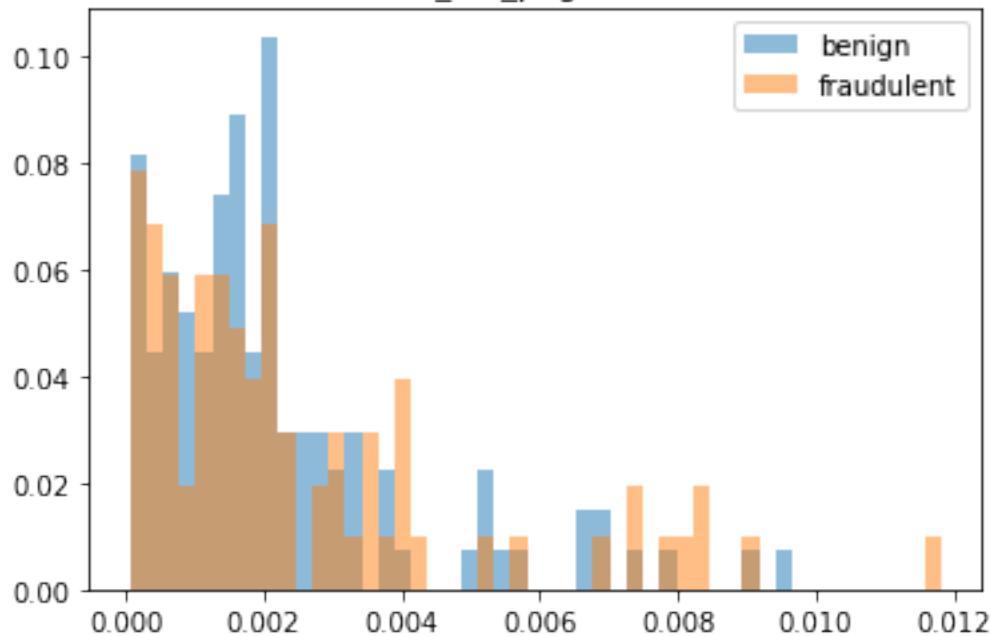


nb_mean_pagerank

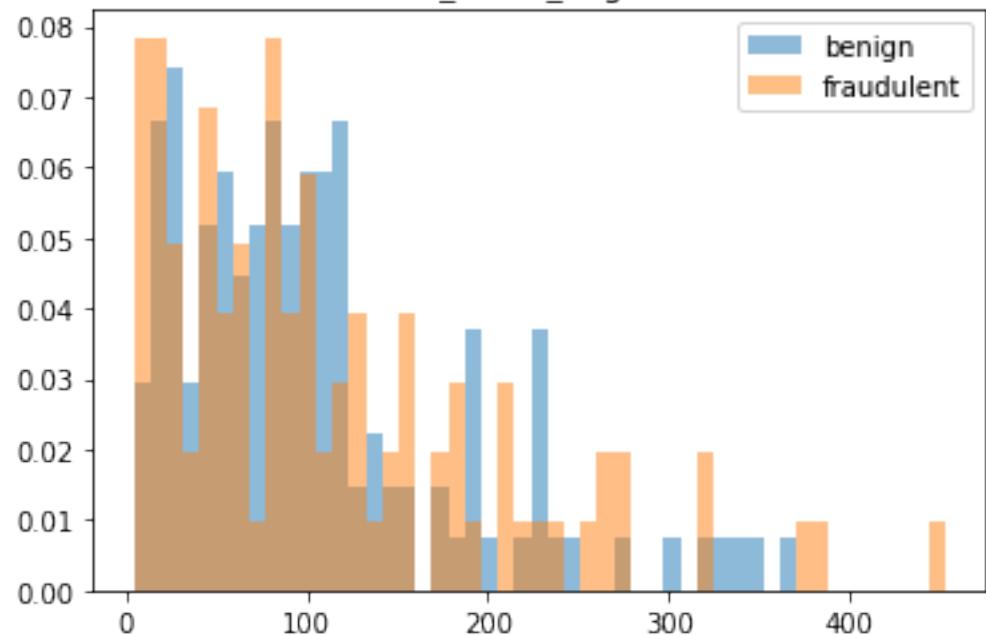




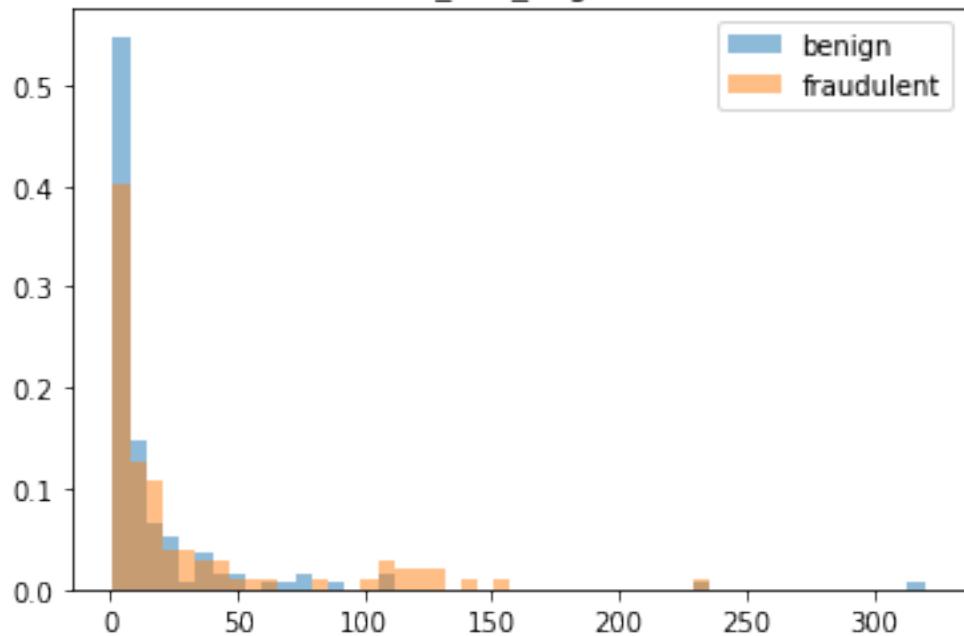
nb_std_pagerank



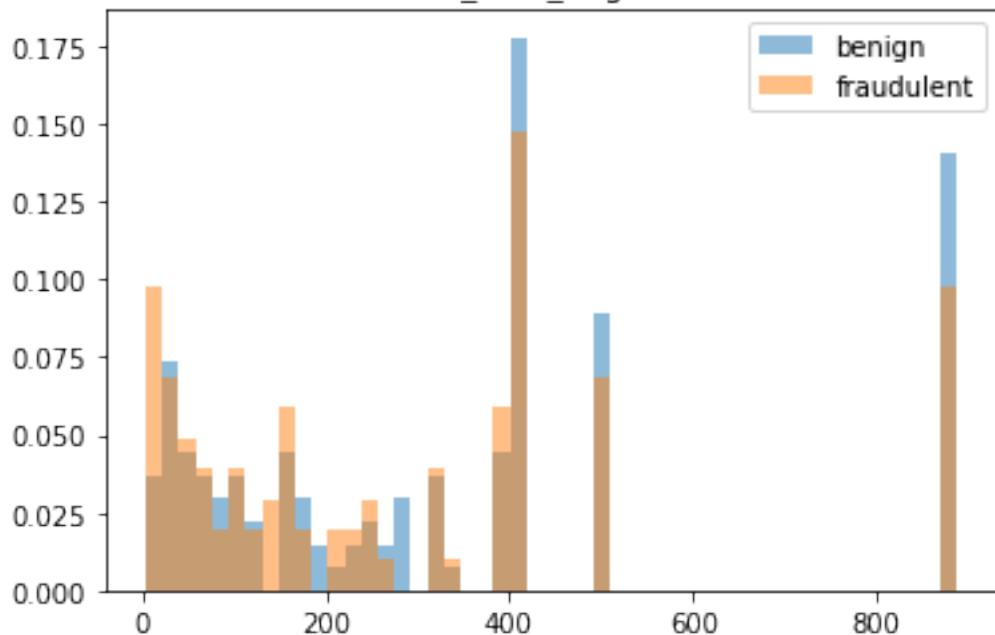
nb_mean_degree



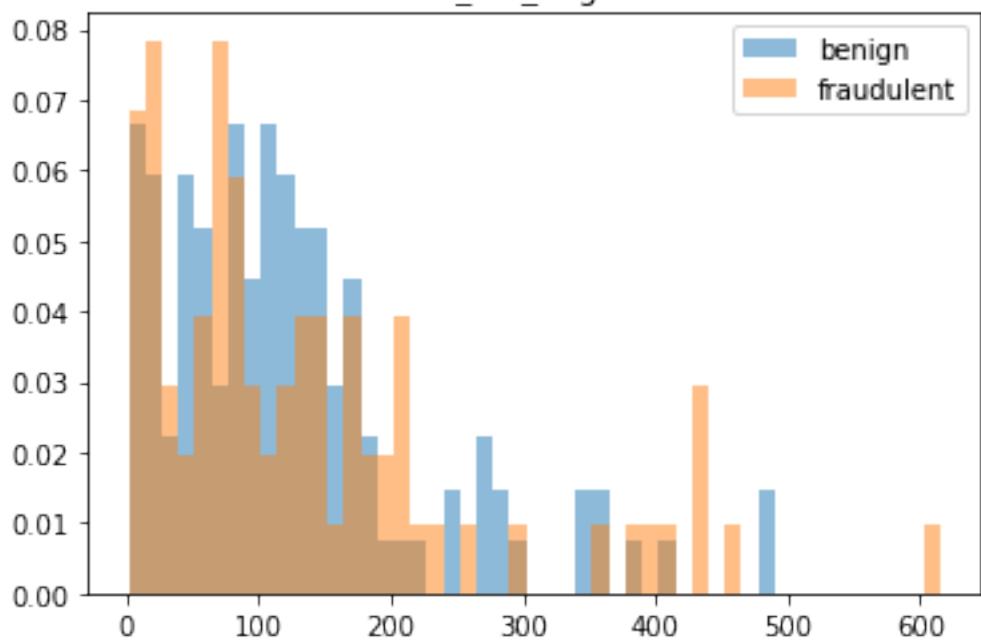
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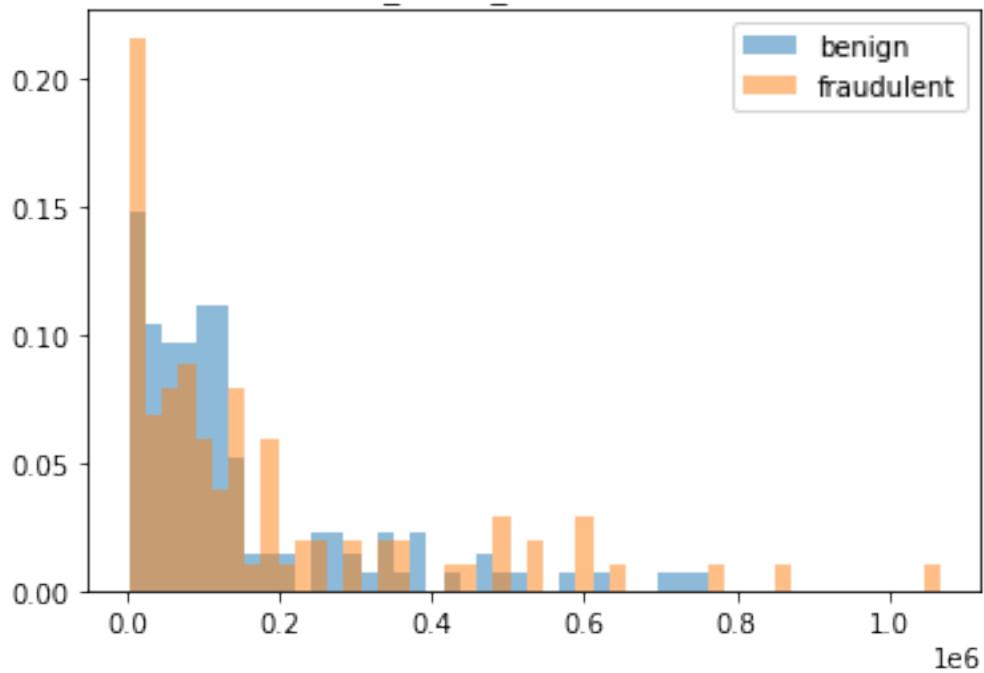
nb_max_degree

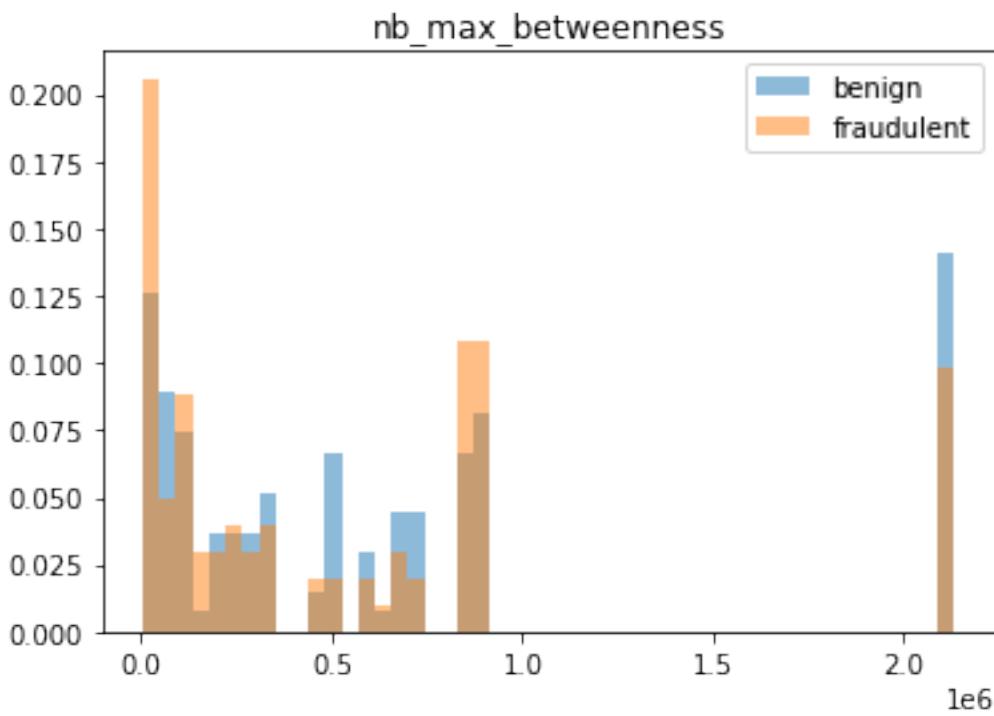
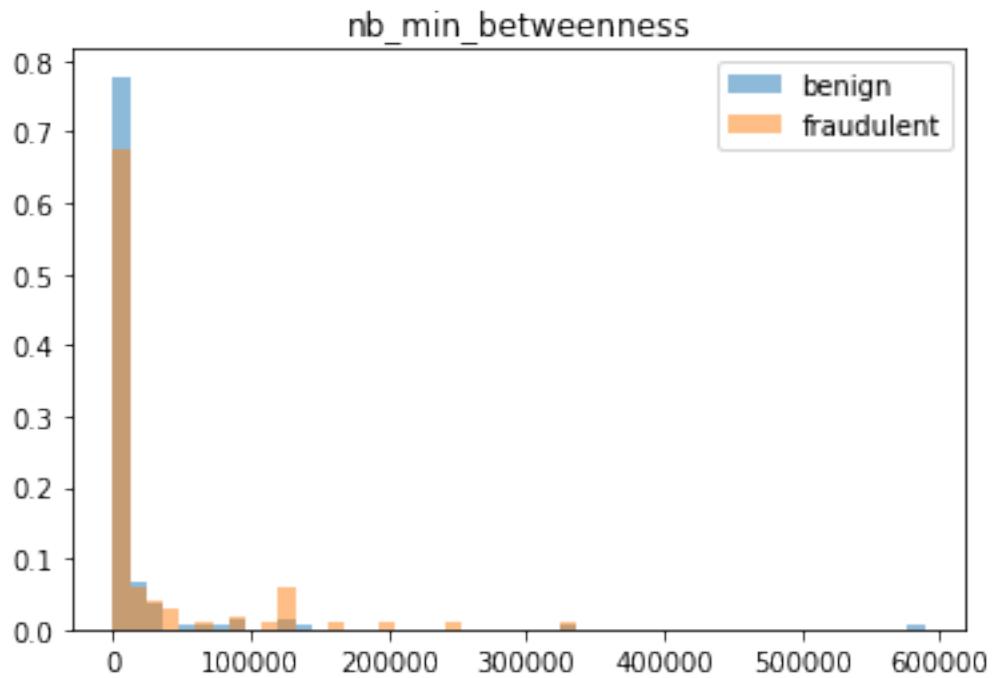


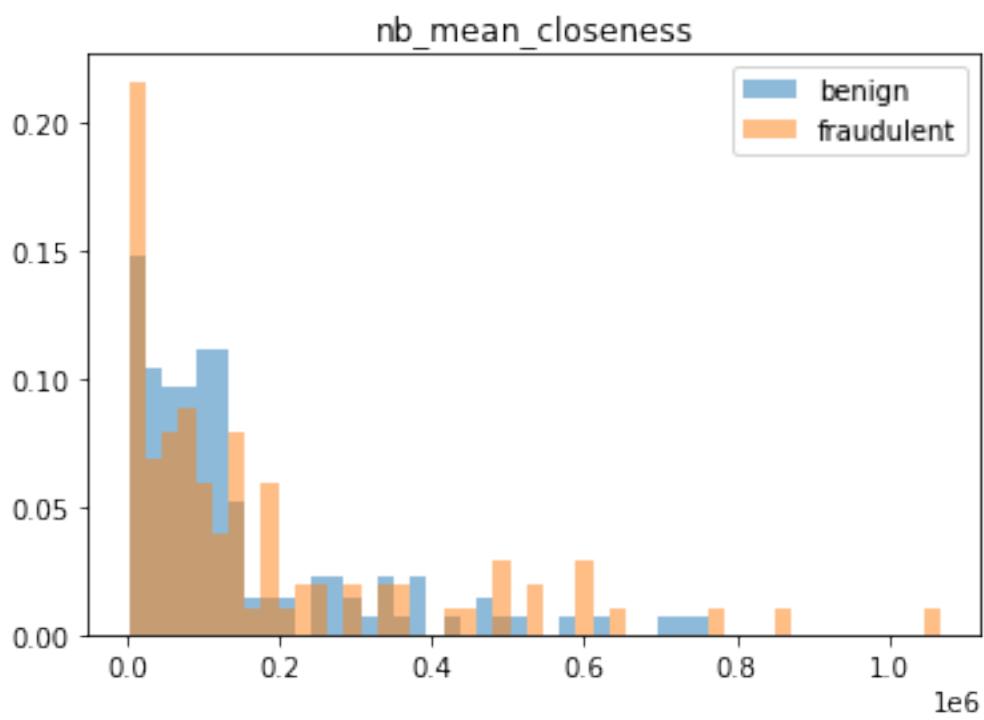
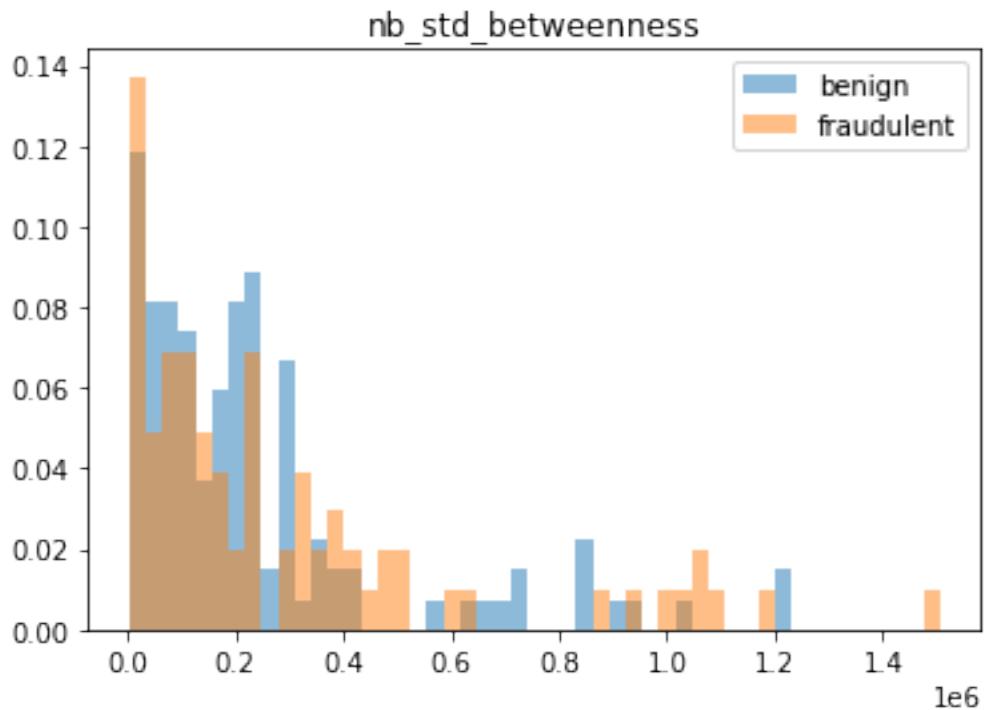
nb_std_degree

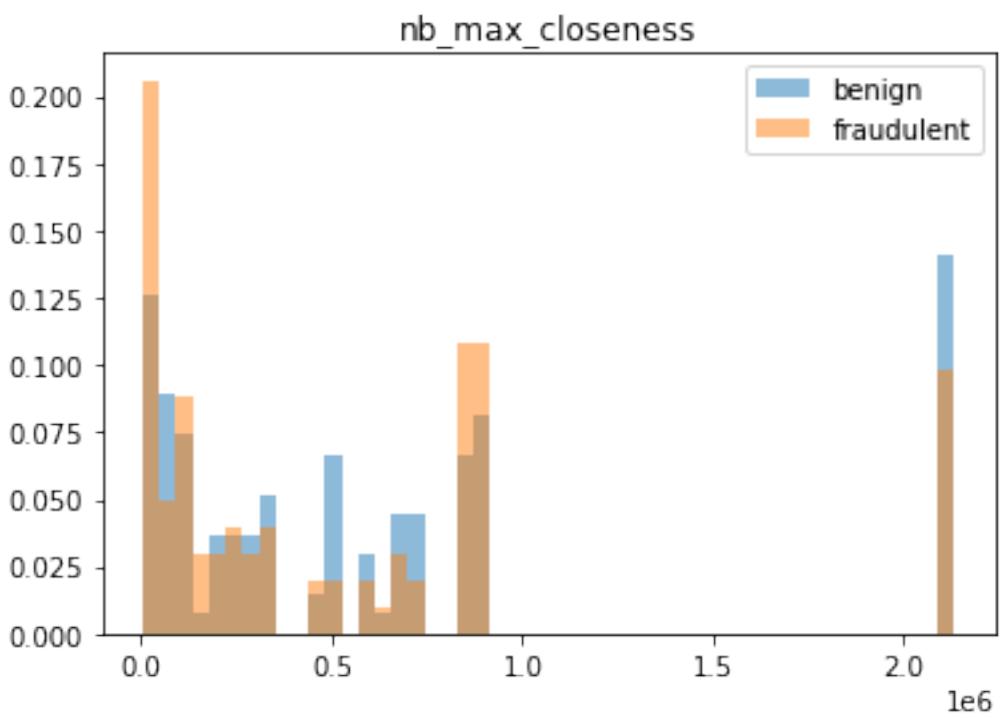
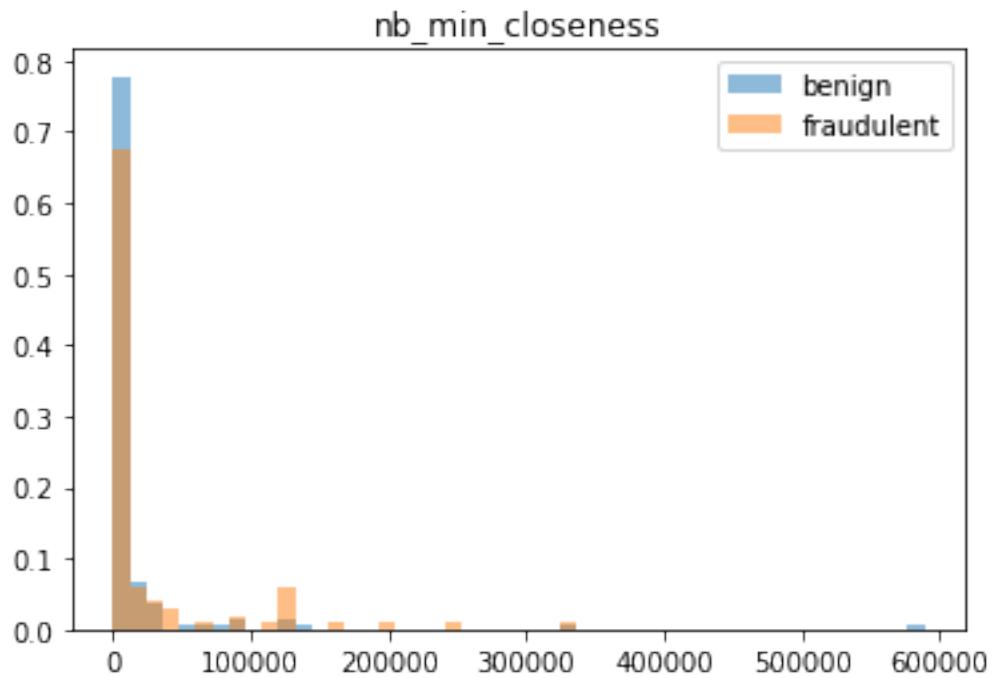


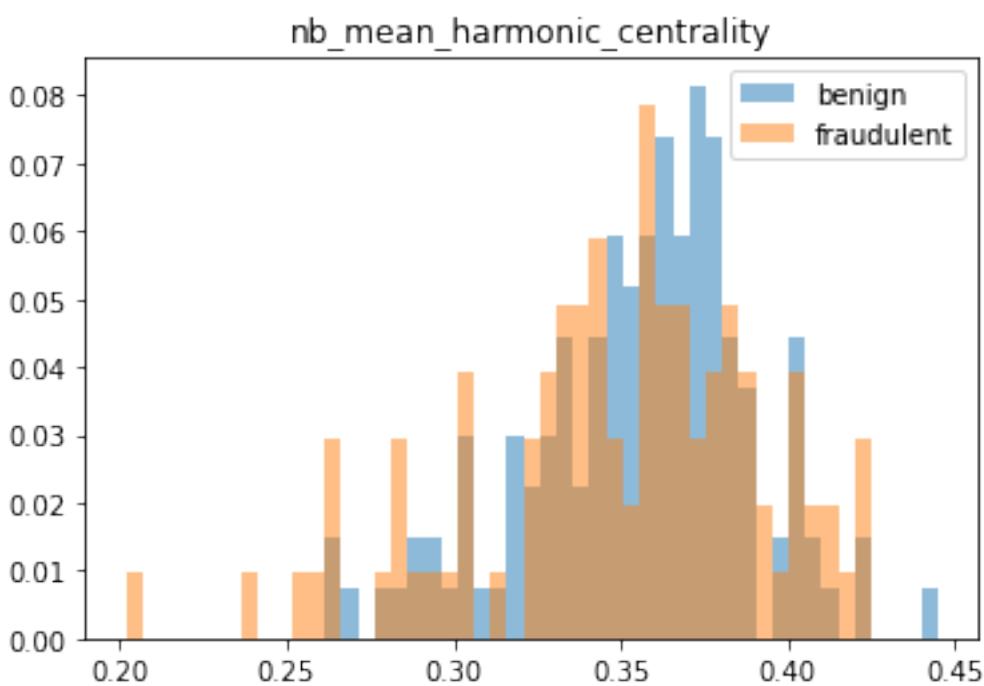
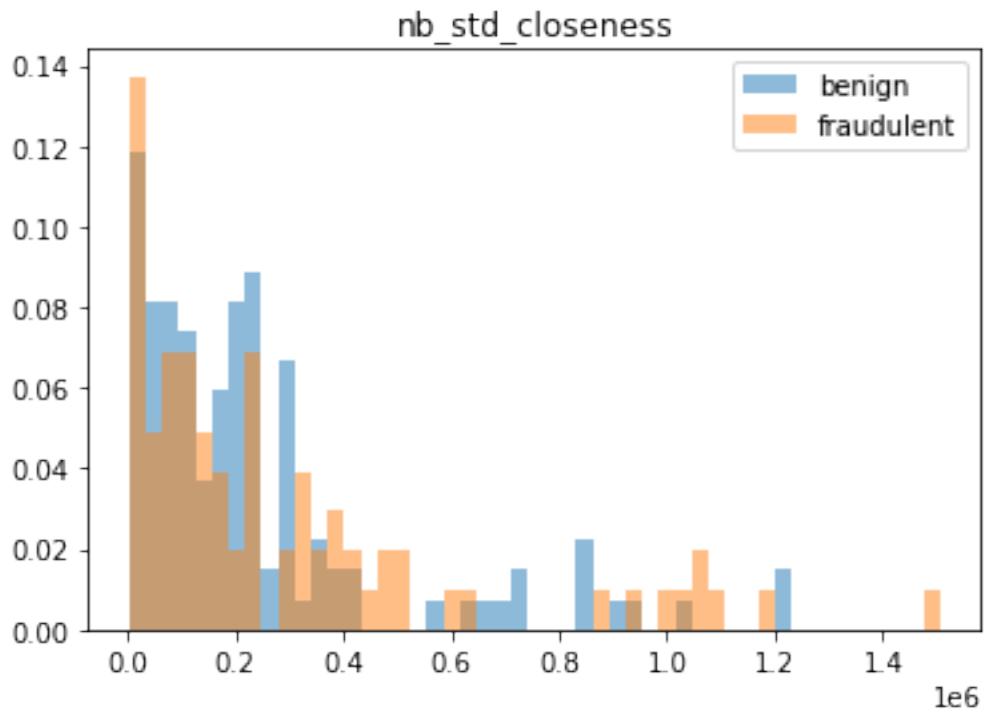
nb_mean_betweenness



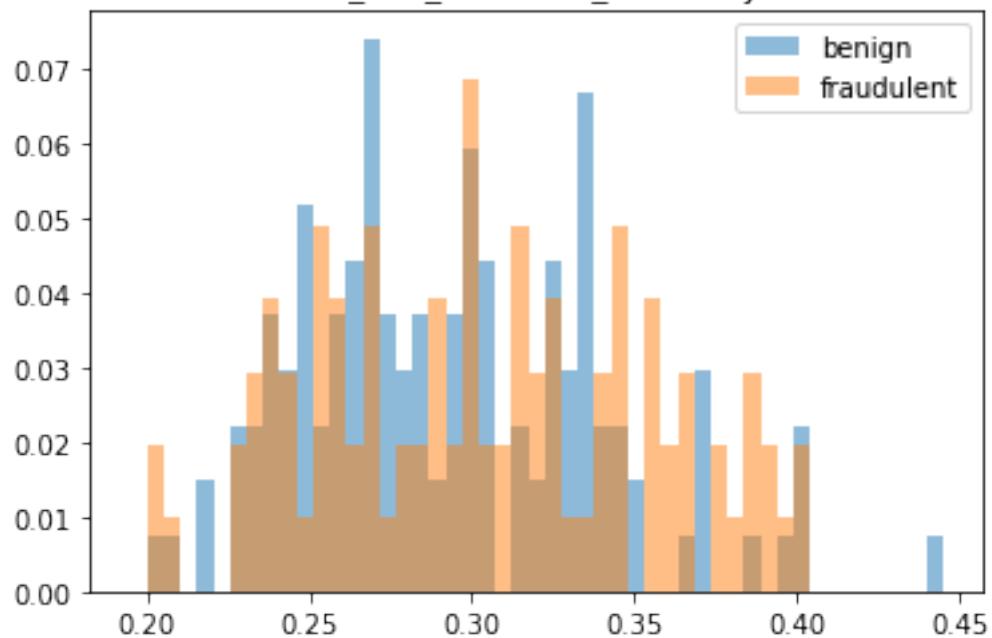




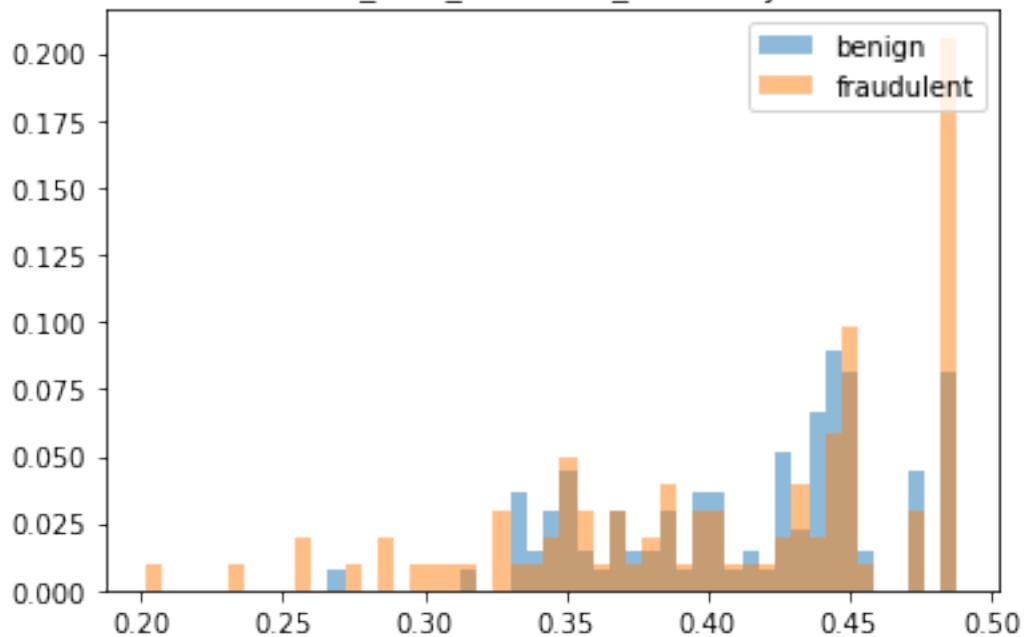




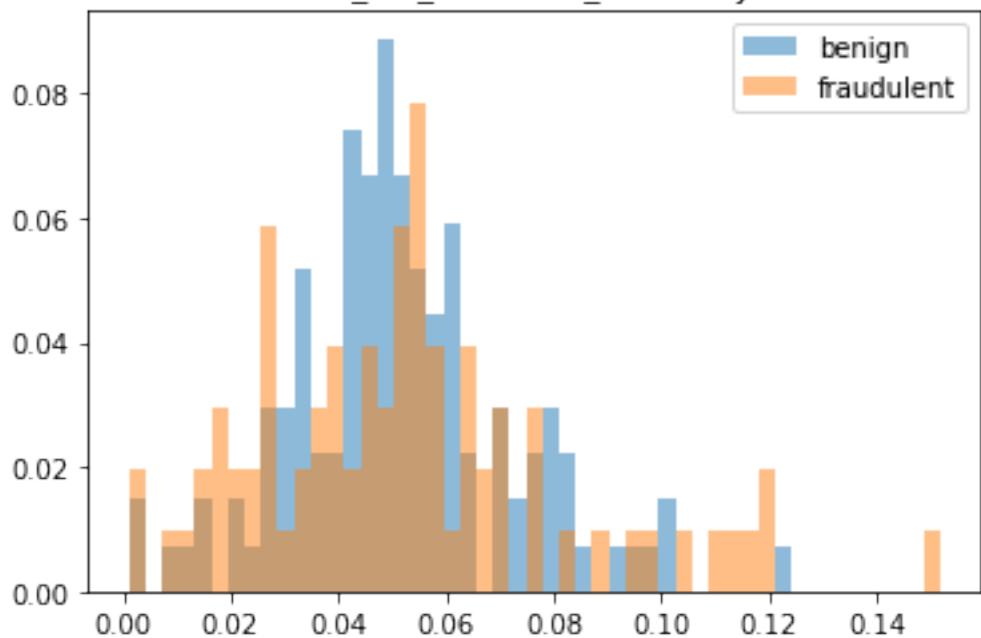
nb_min_harmonic_centrality



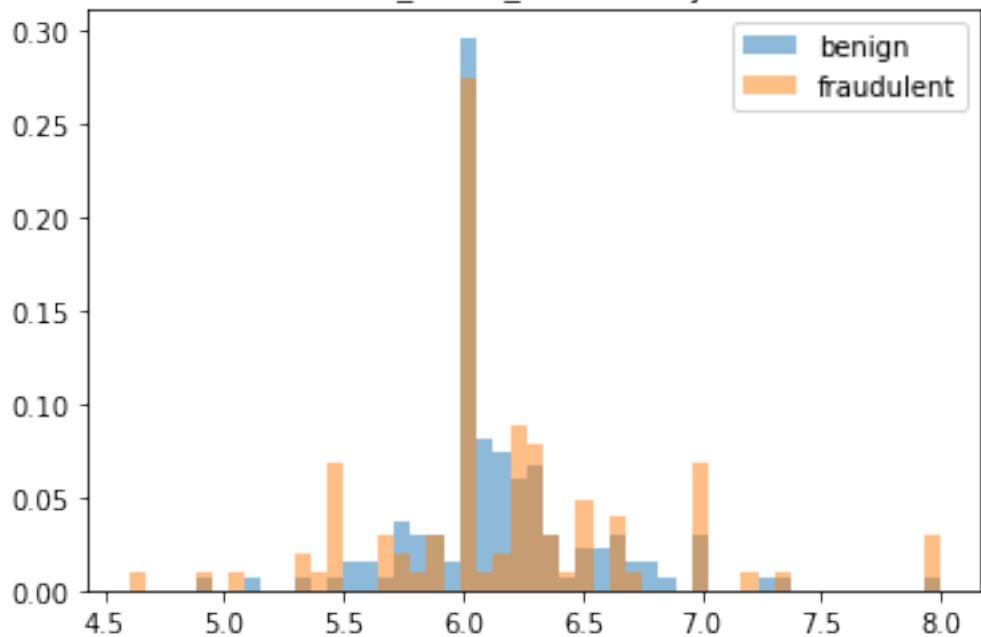
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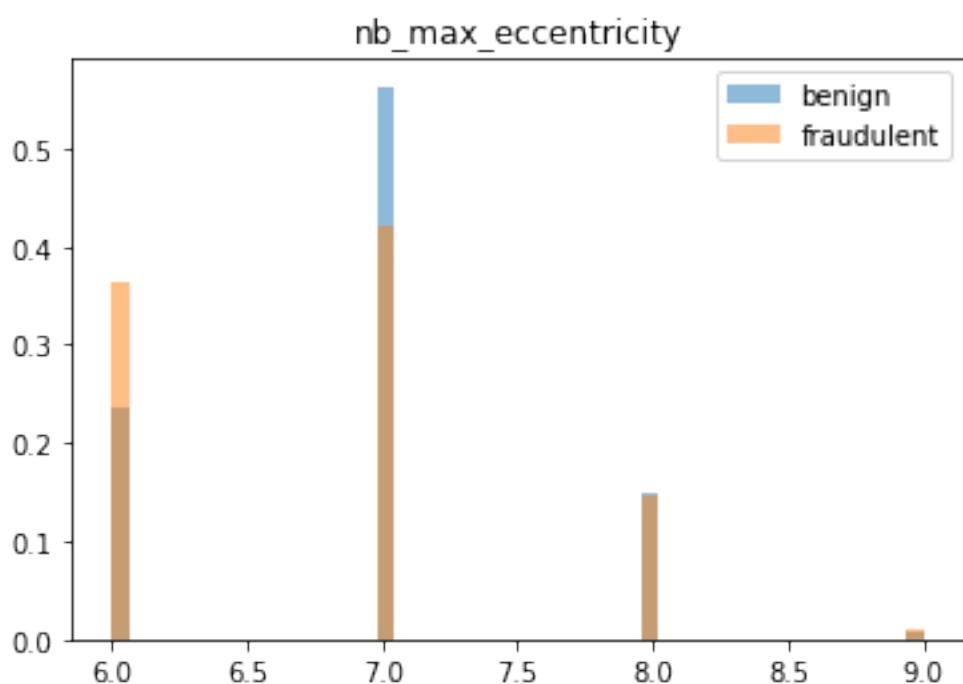
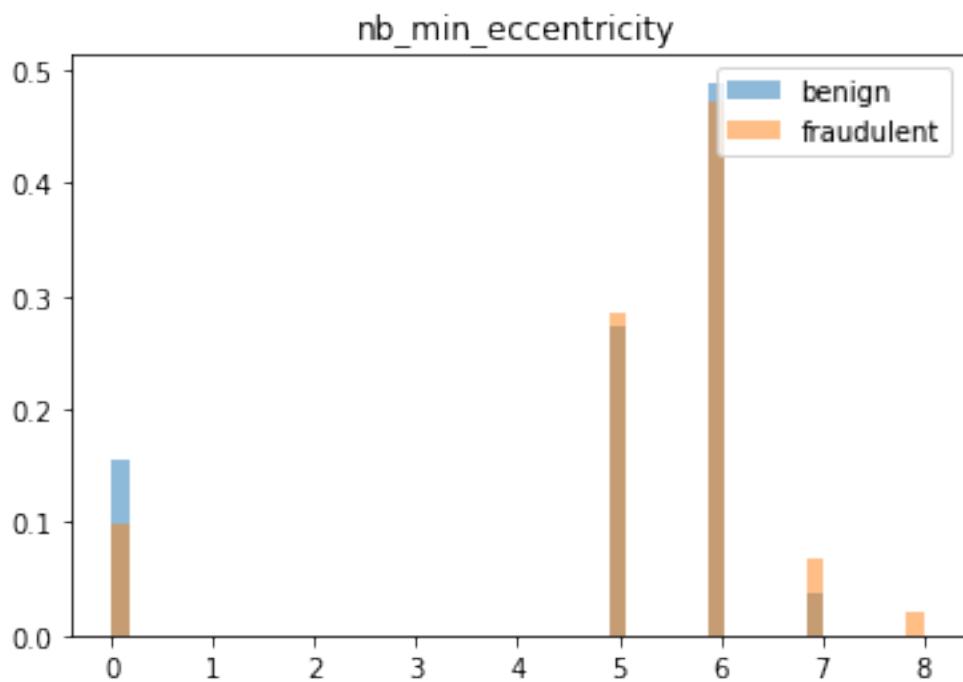


nb_std_harmonic_centrality

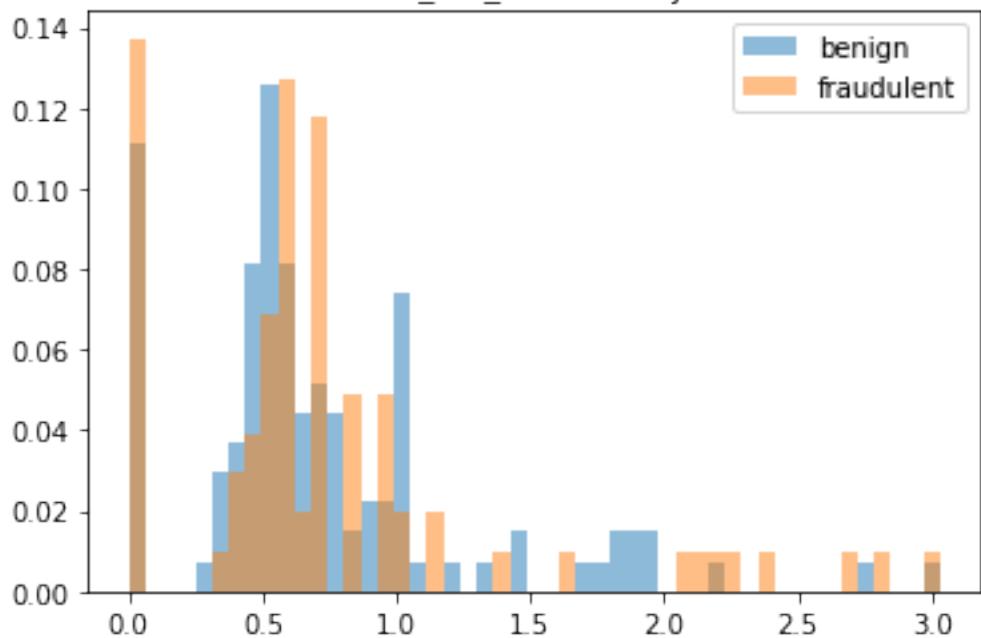


nb_mean_eccentricity

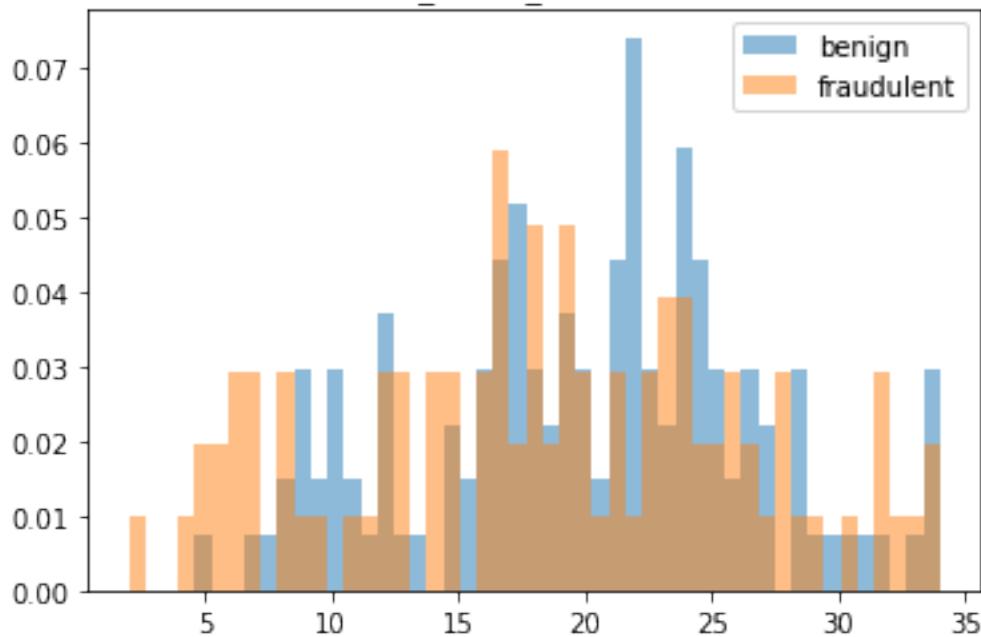


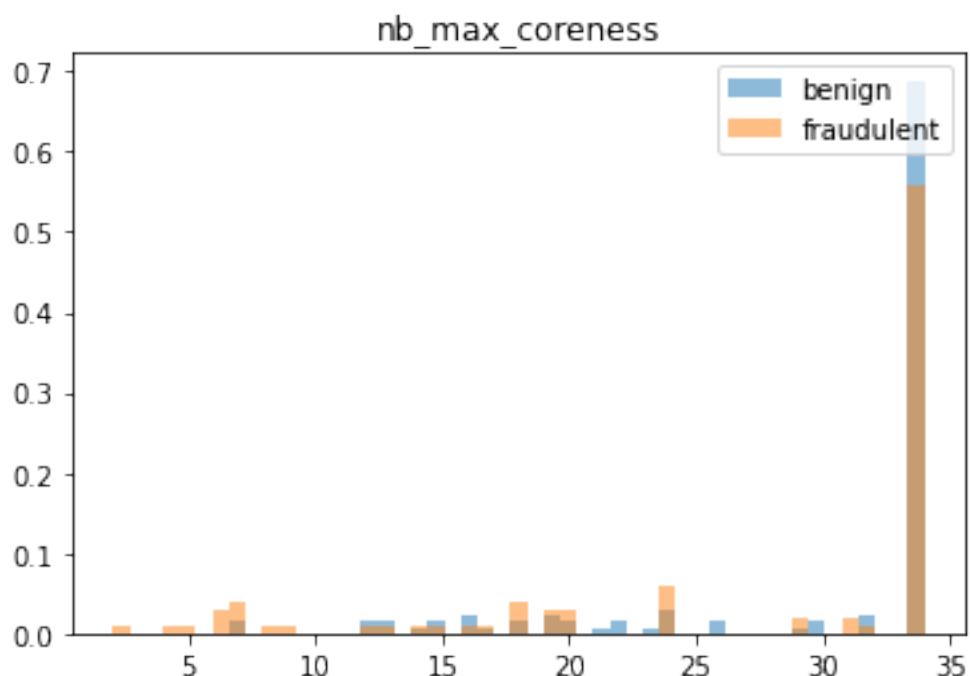
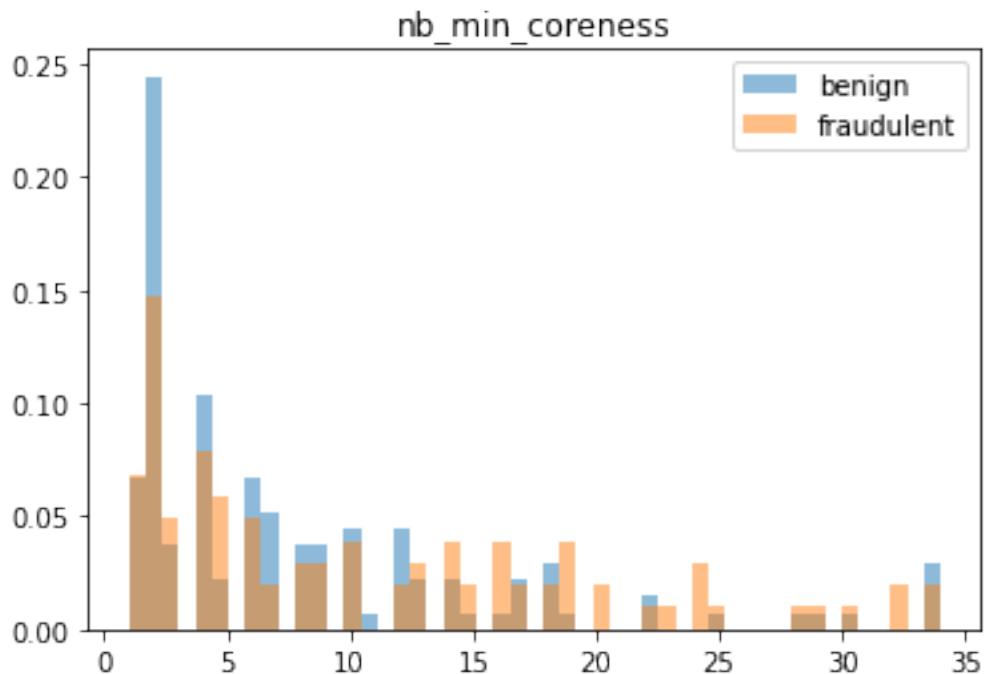


nb_std_eccentricity

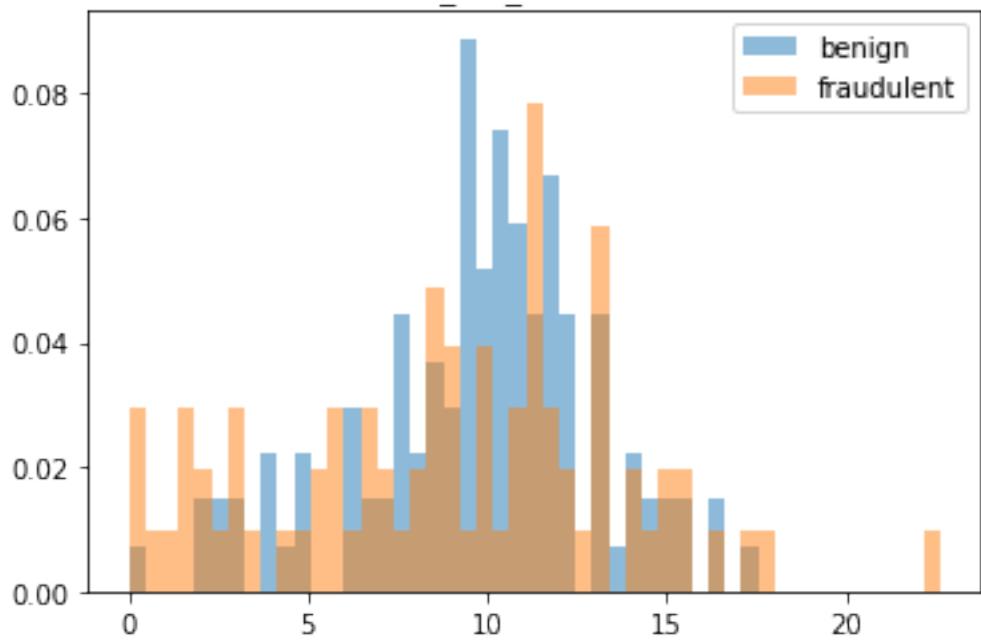


nb_mean_coreness

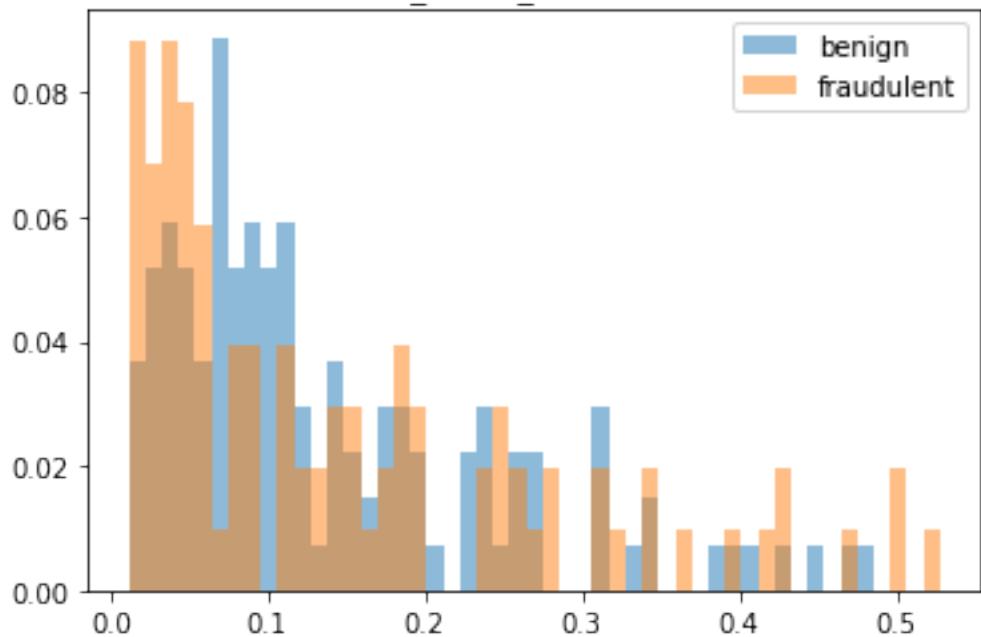


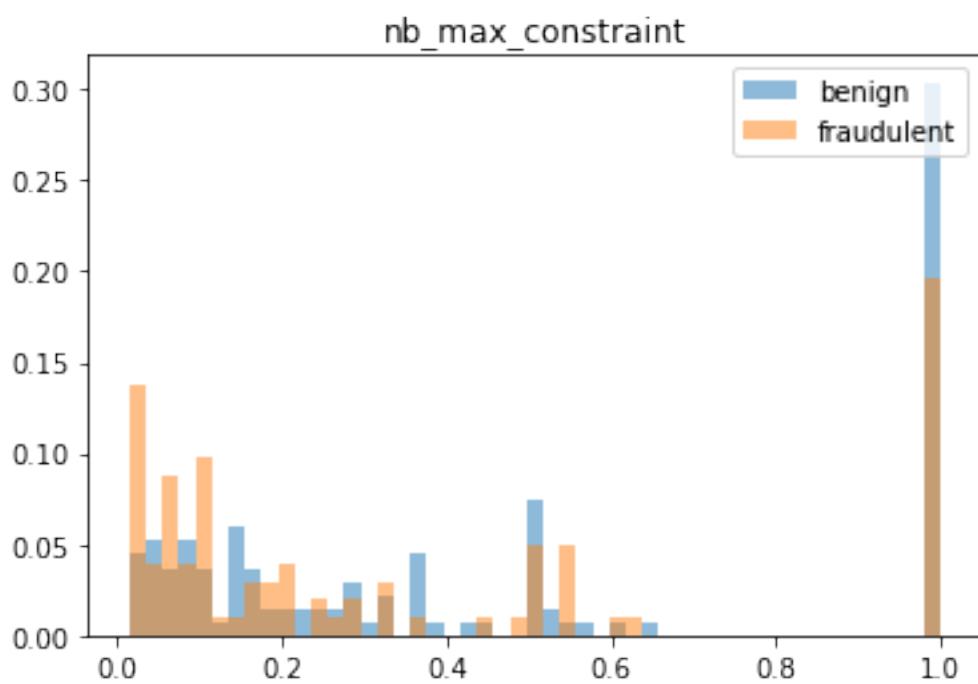
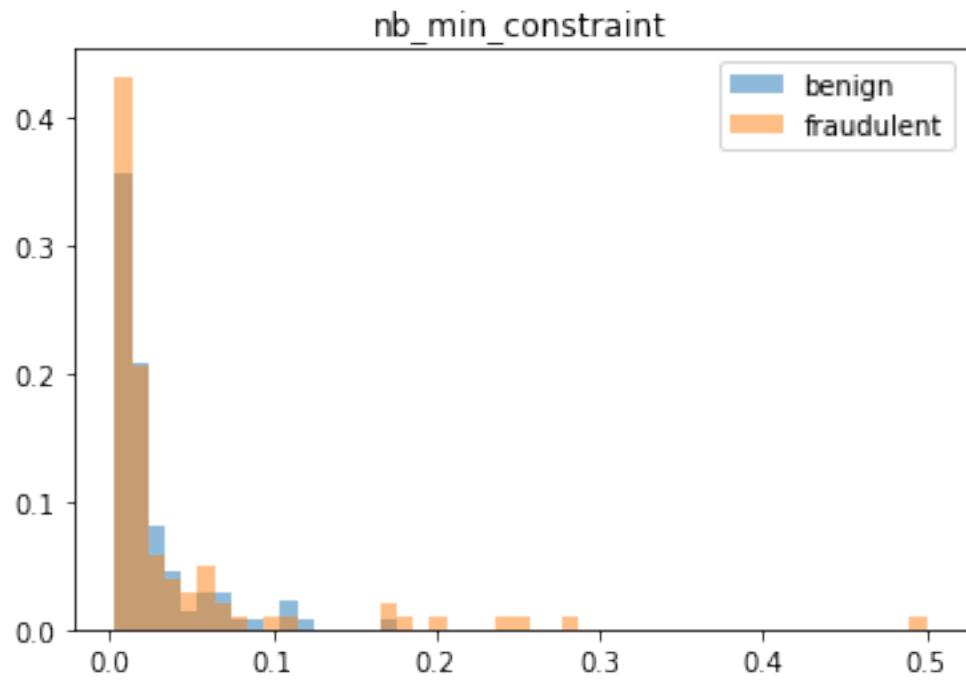


nb_std_coreness

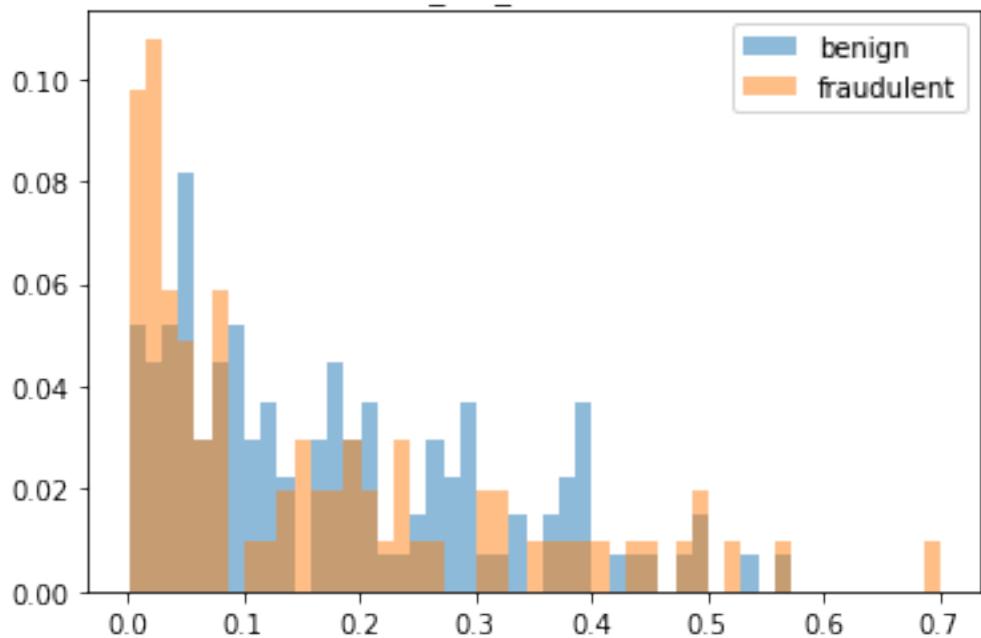


nb_mean_constraint

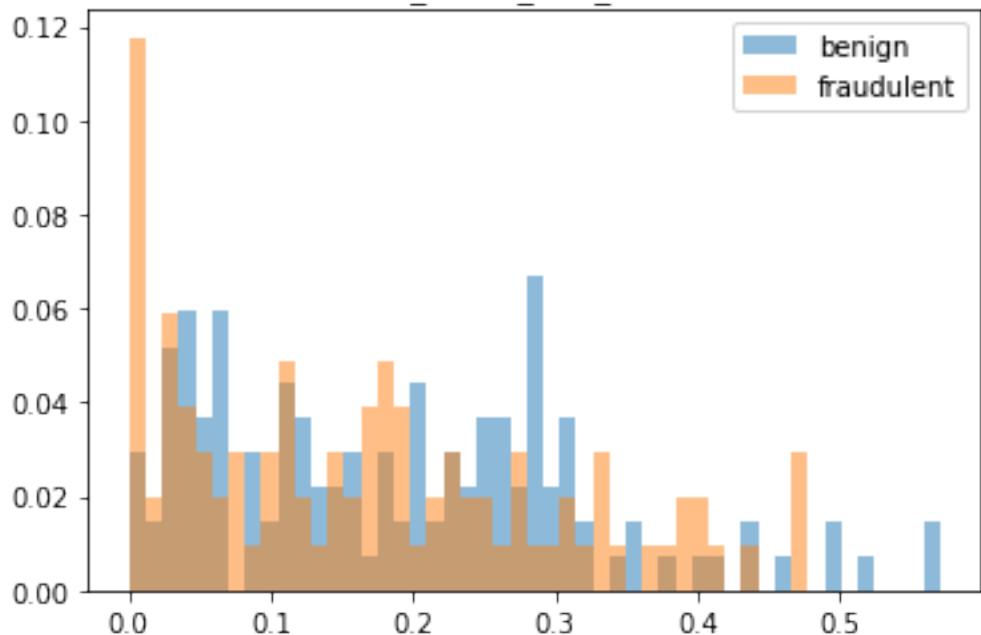


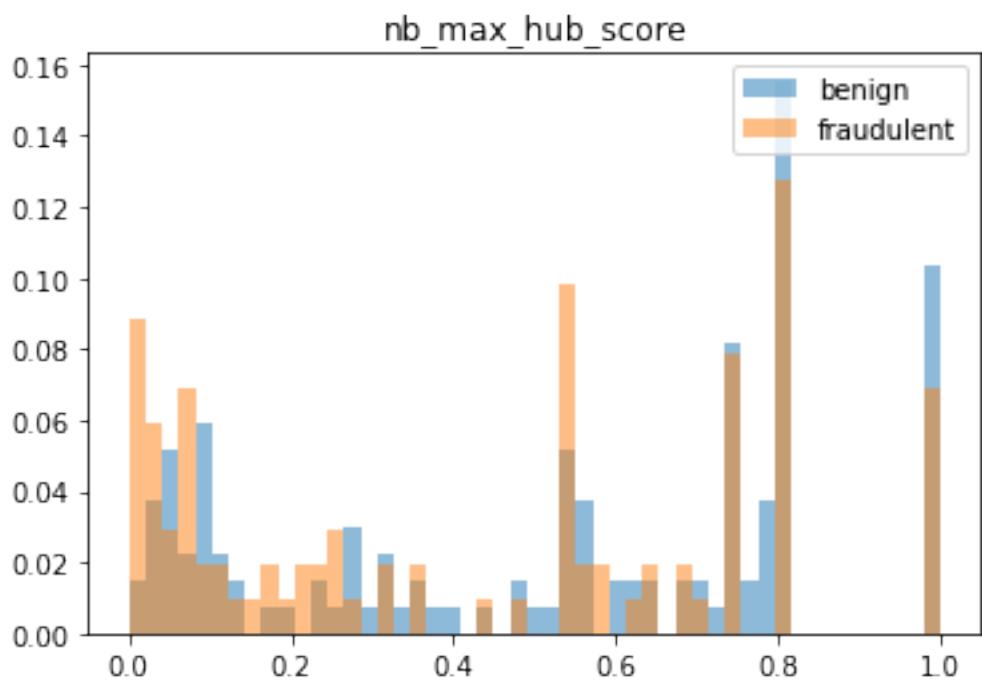
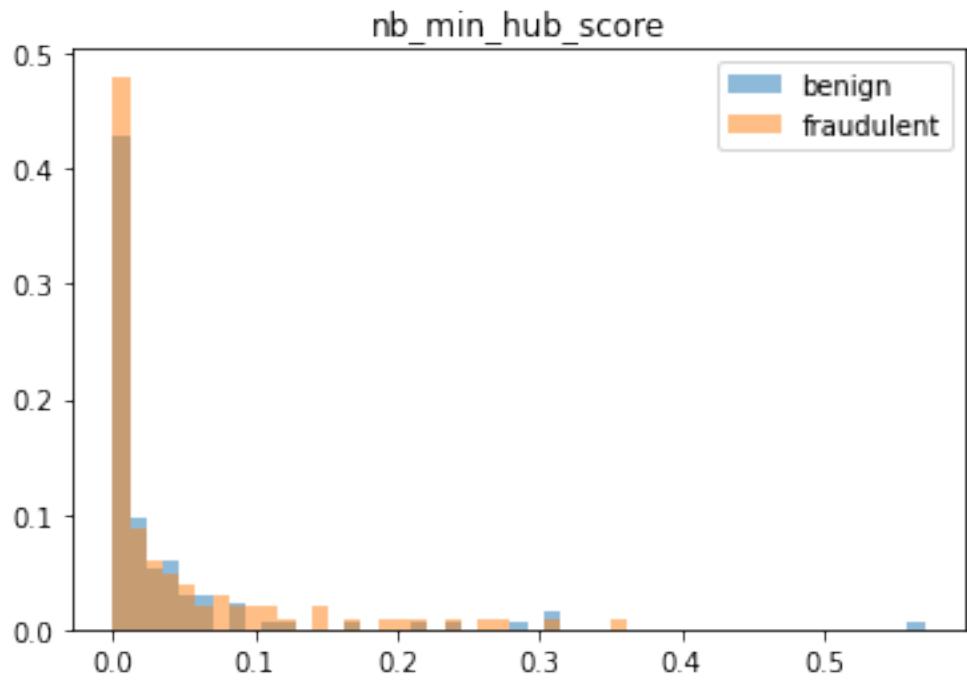


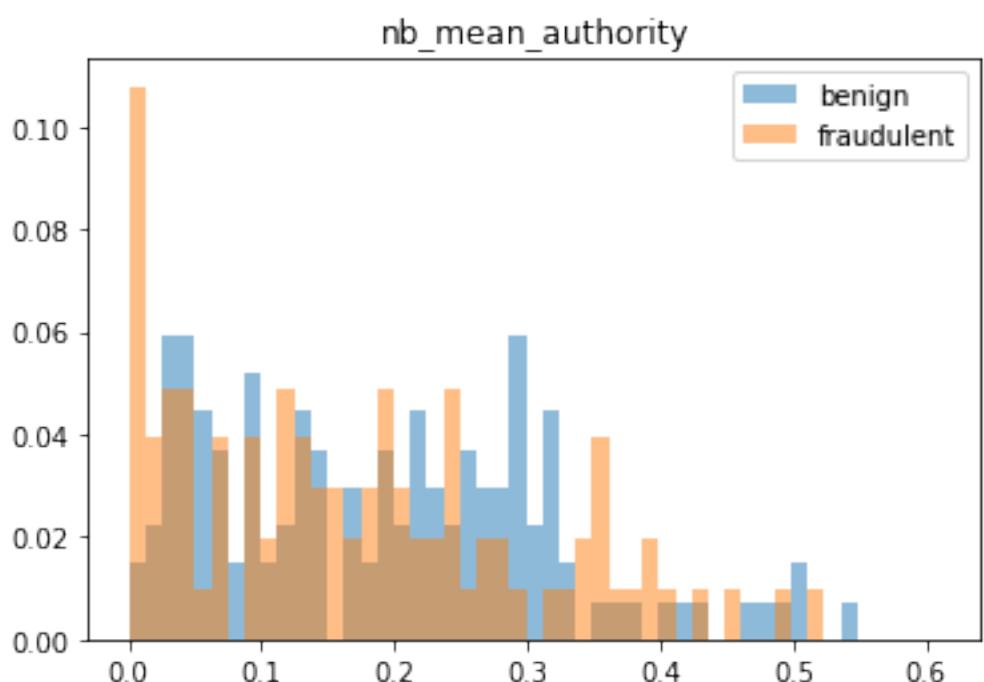
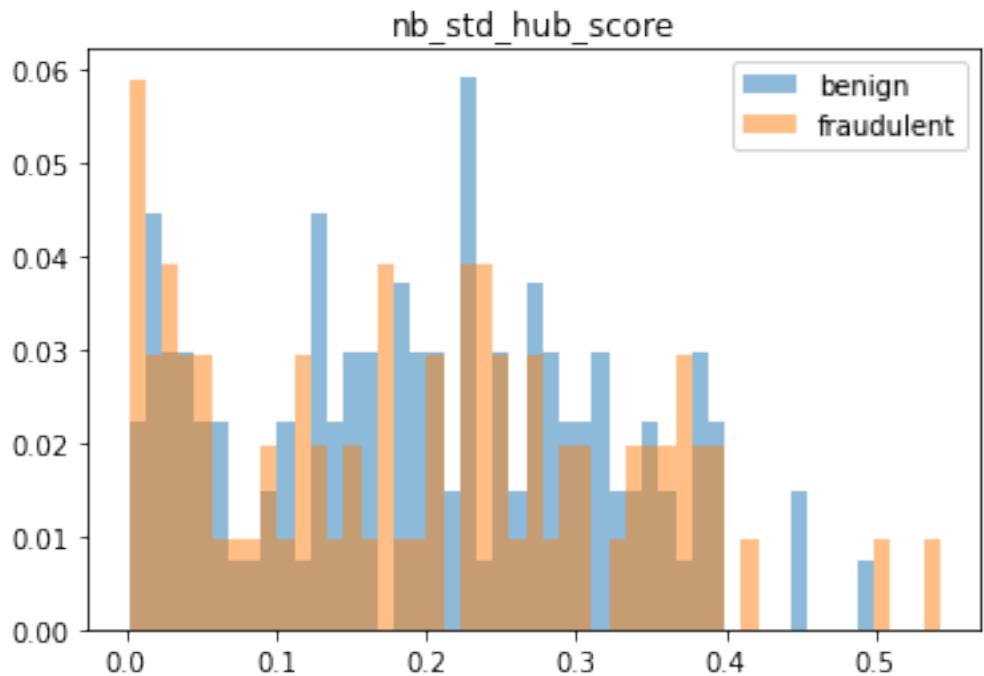
nb_std_constraint

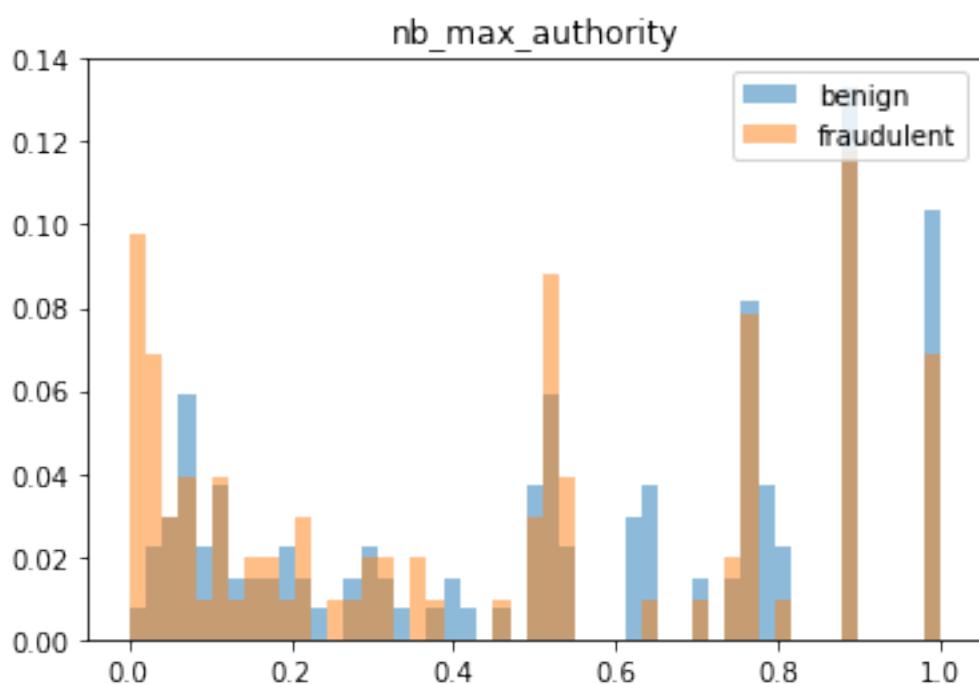
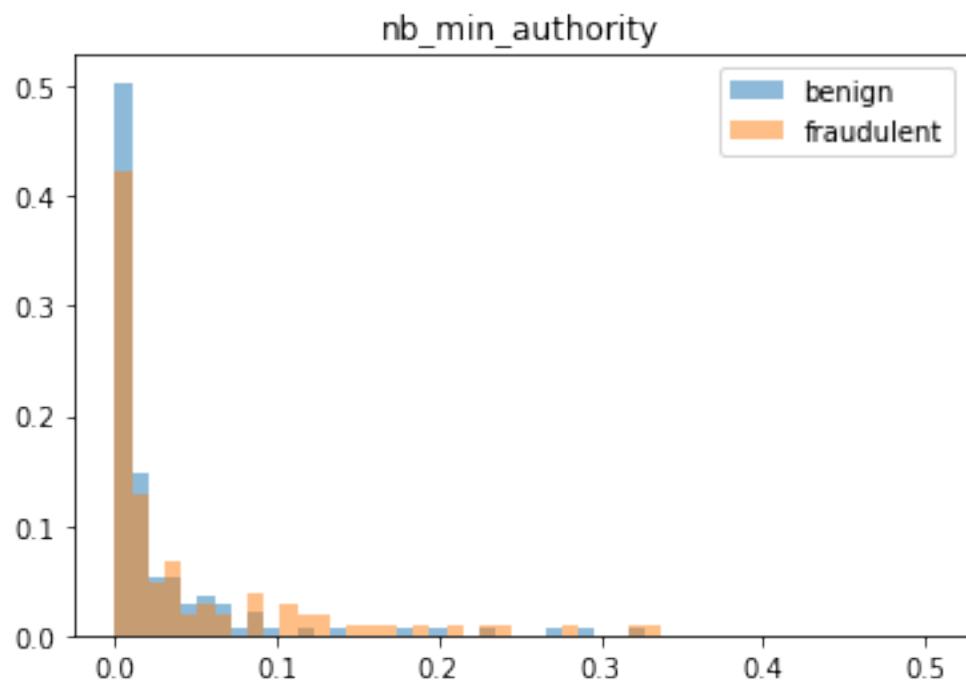


nb_mean_hub_score

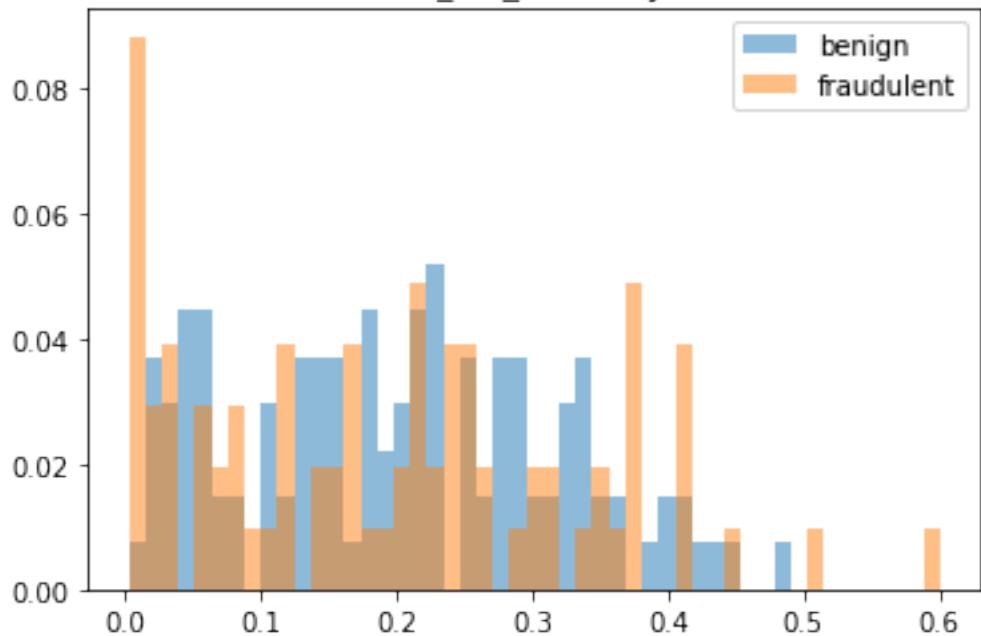




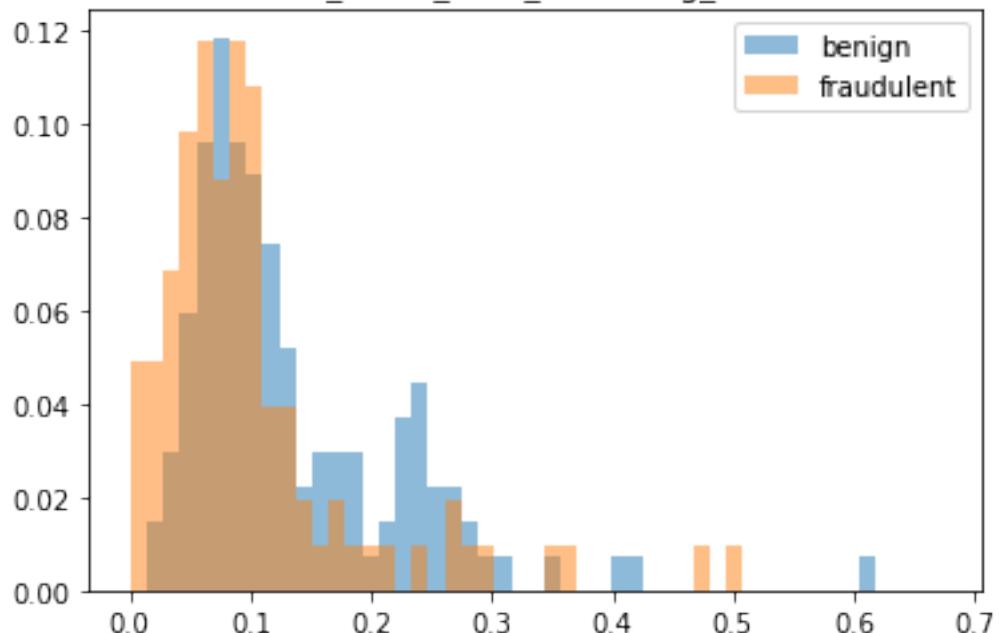




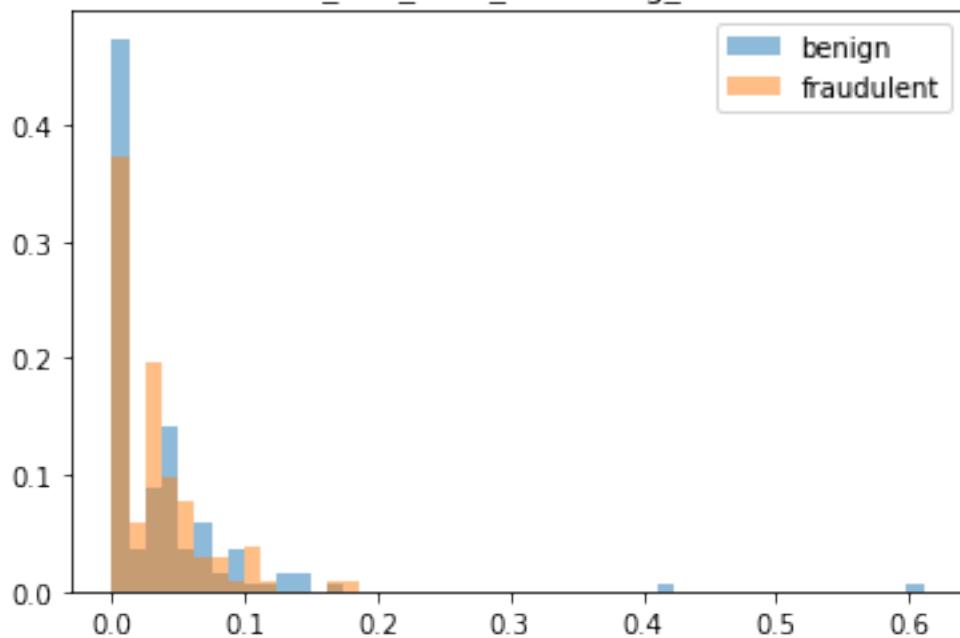
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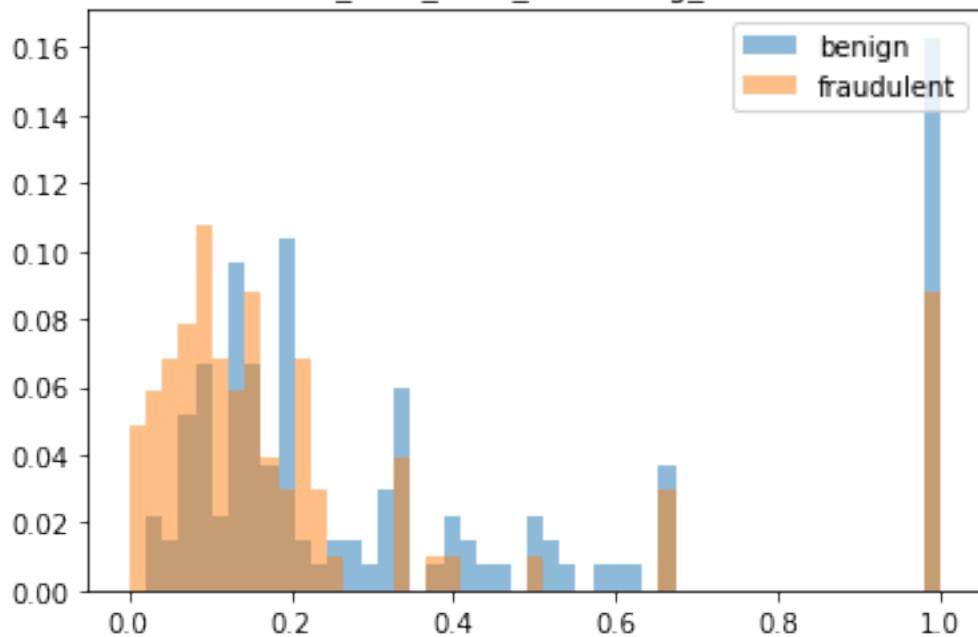
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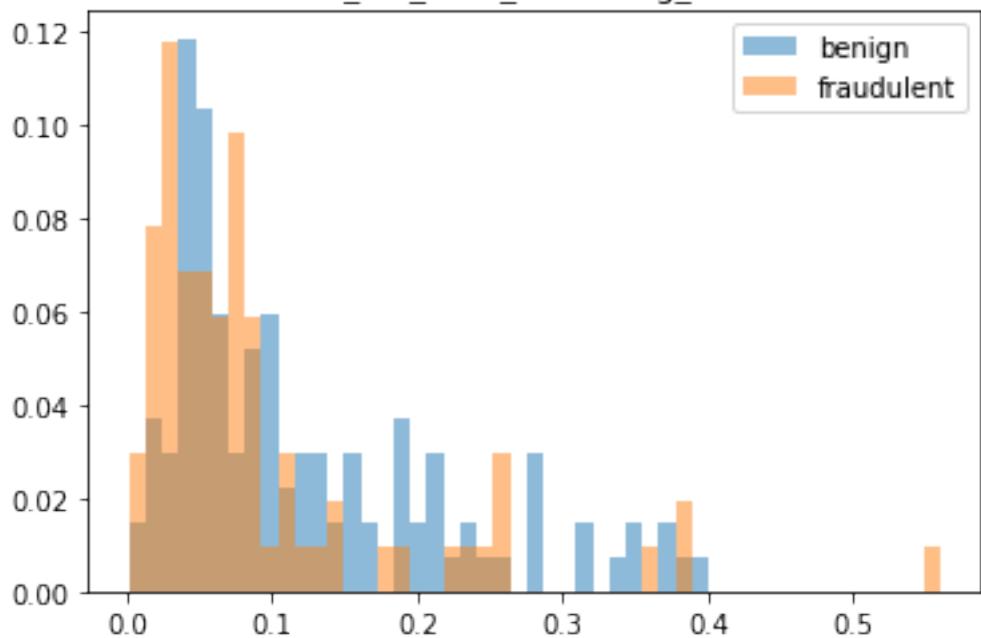
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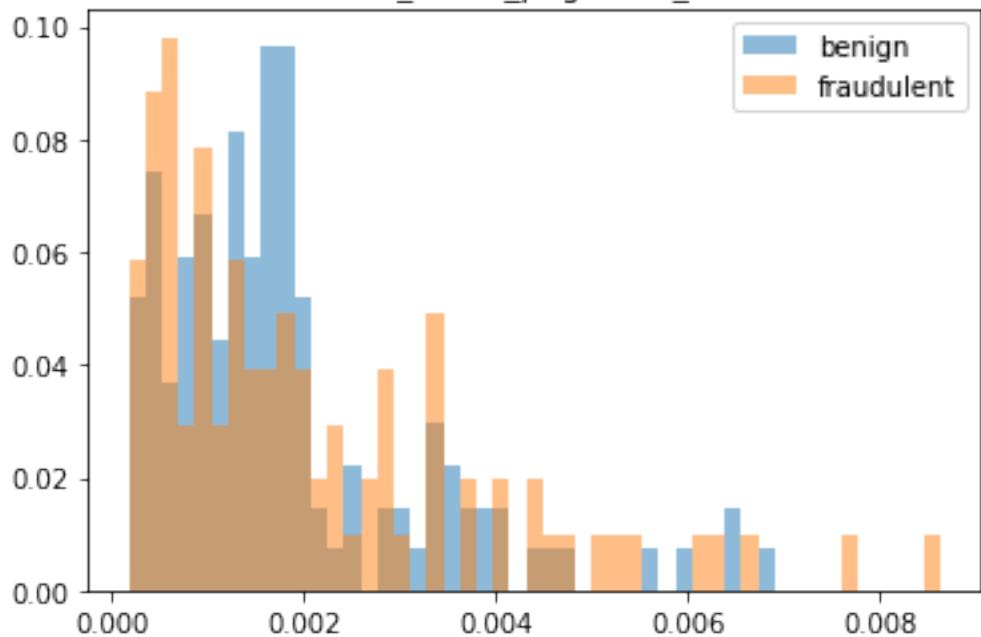
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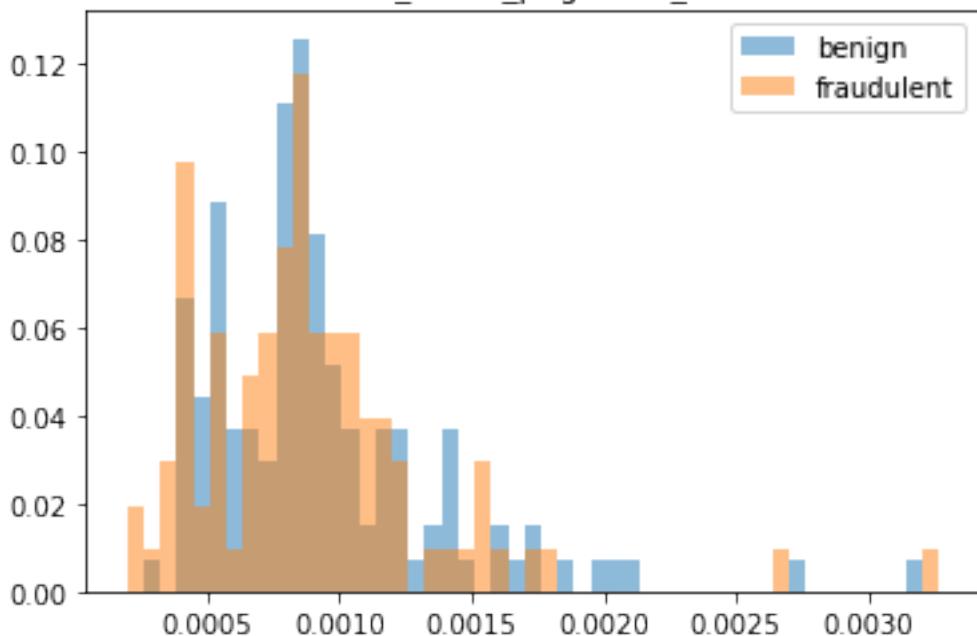
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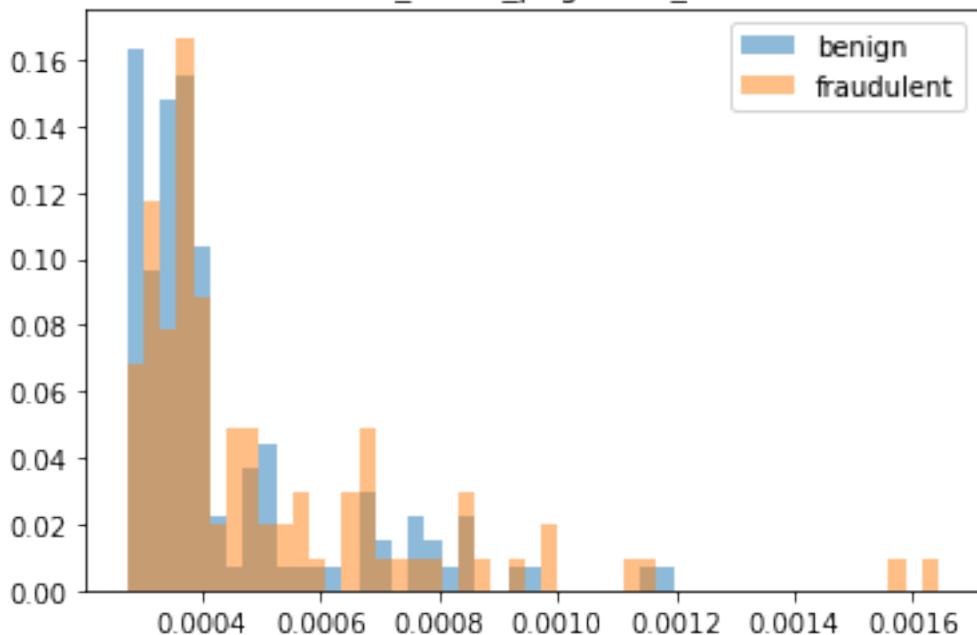
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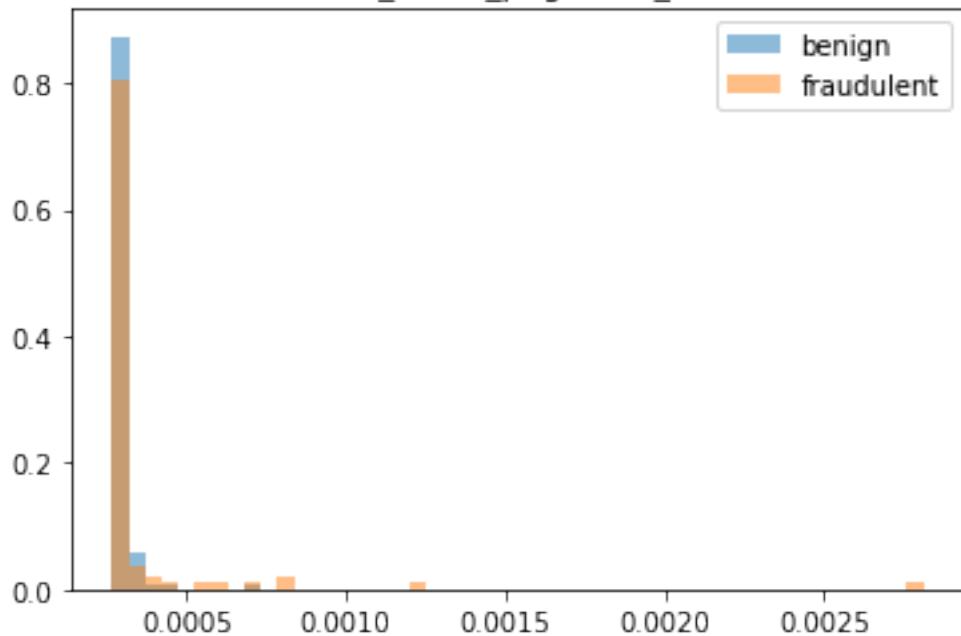
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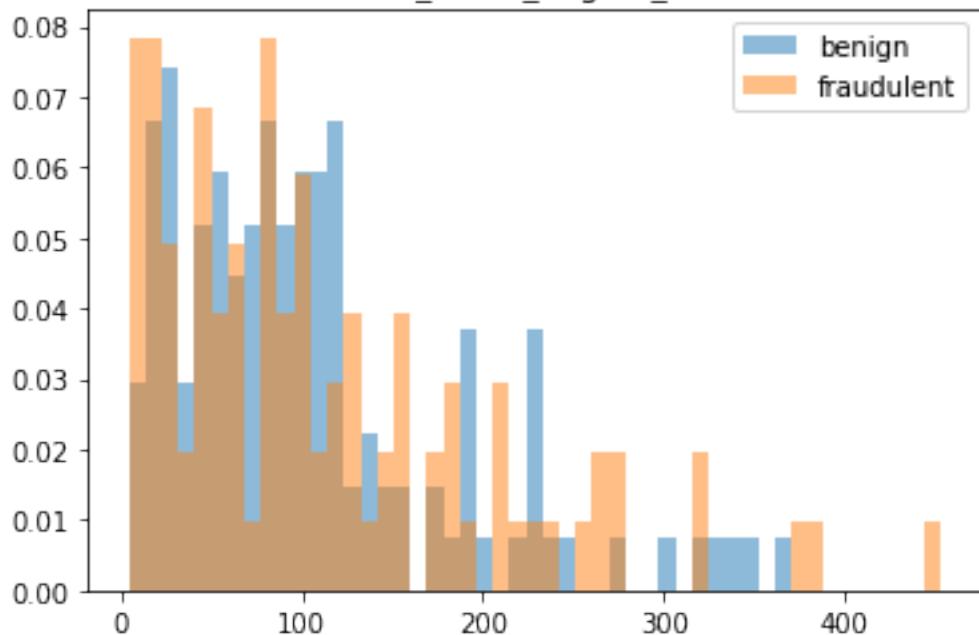
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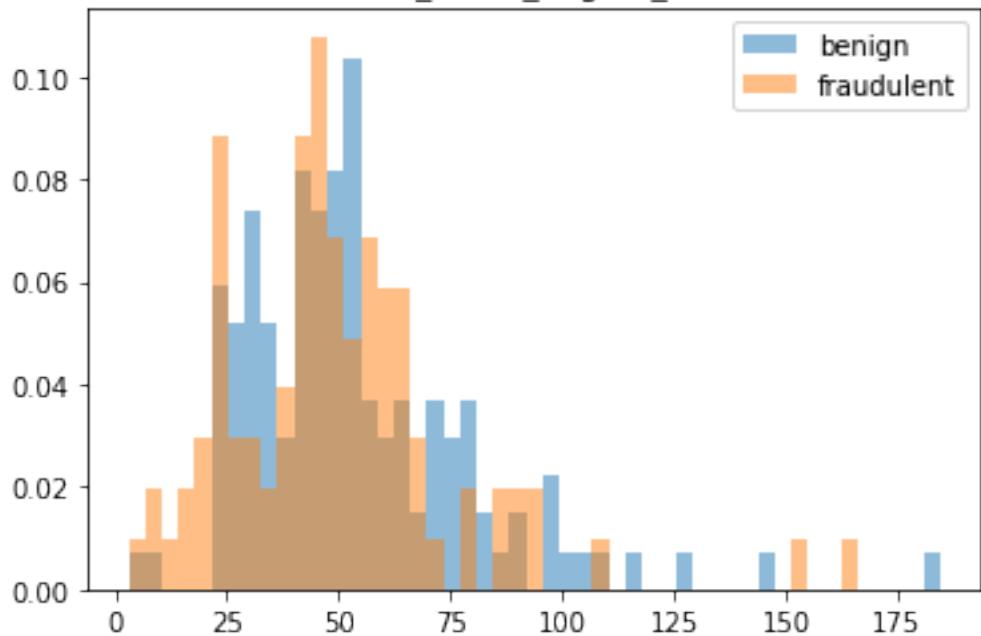
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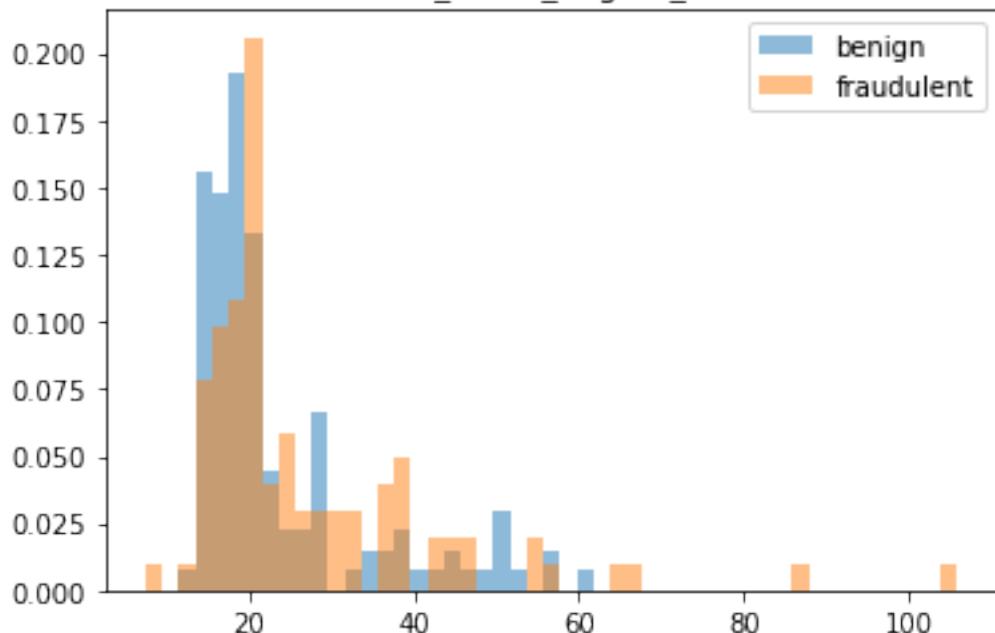
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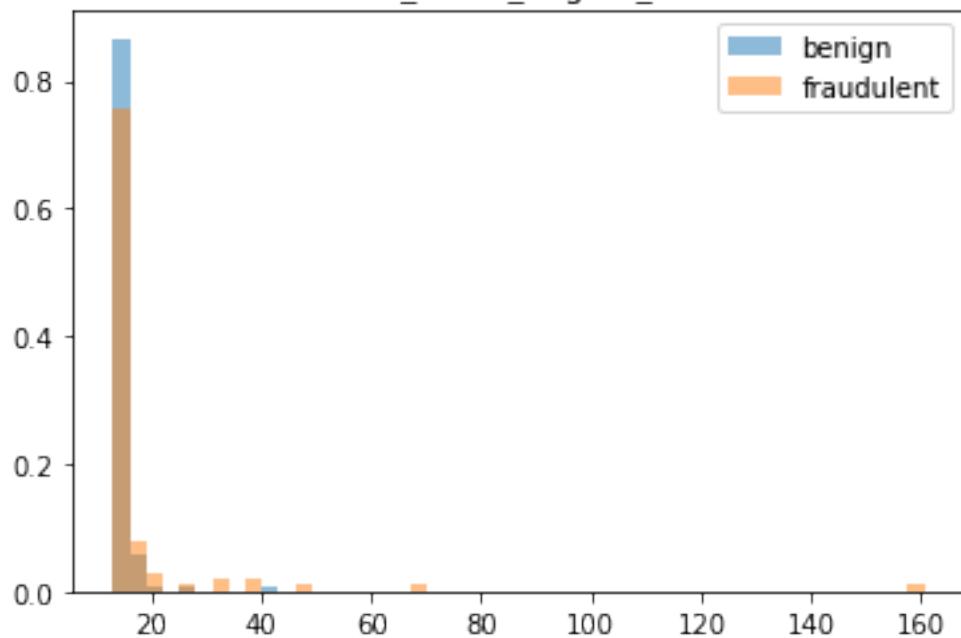
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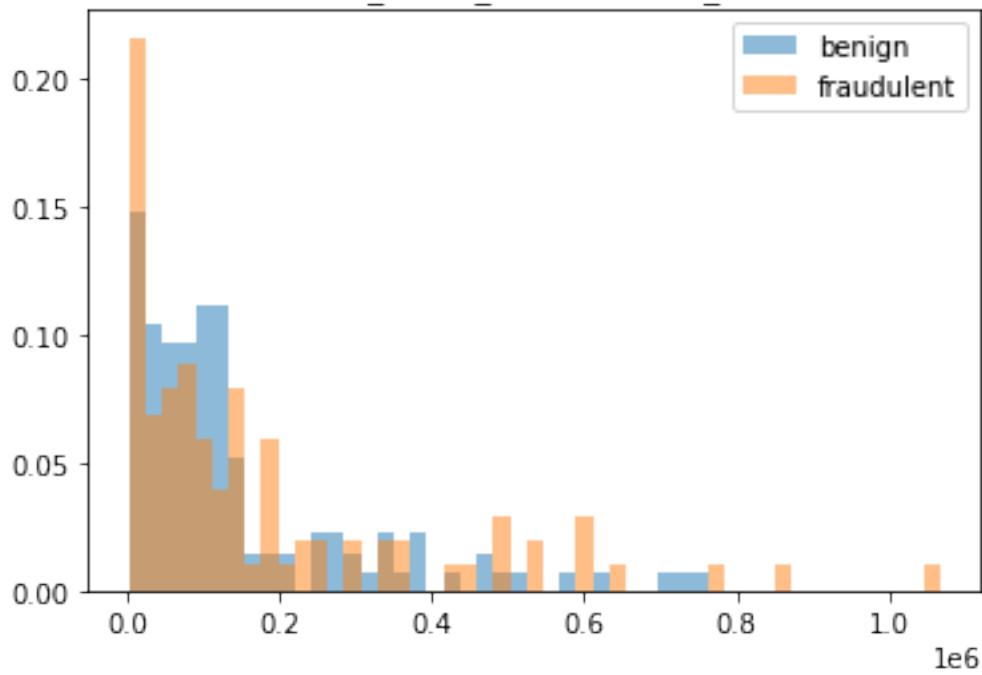
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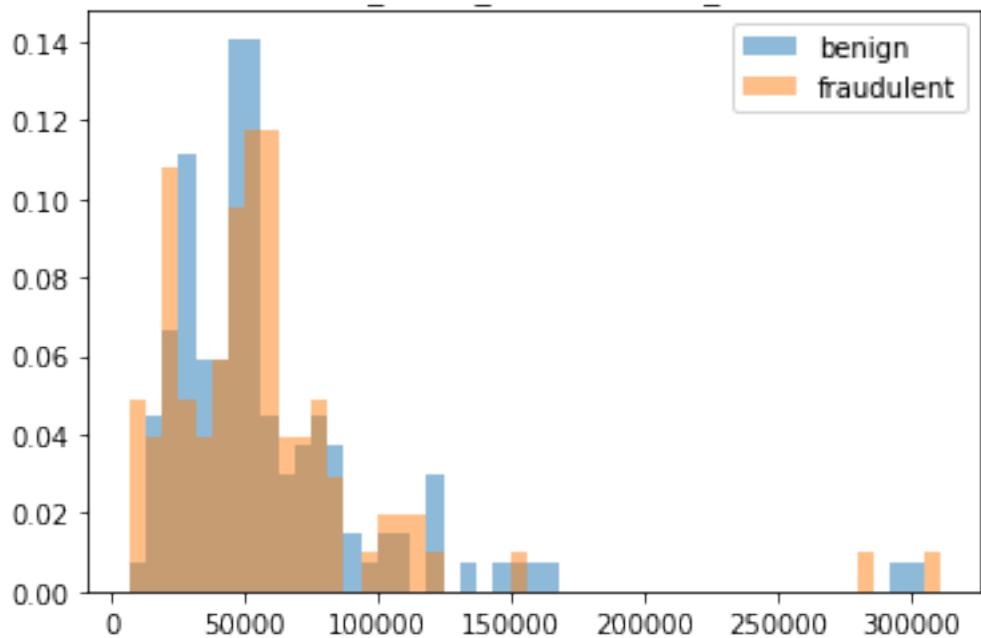
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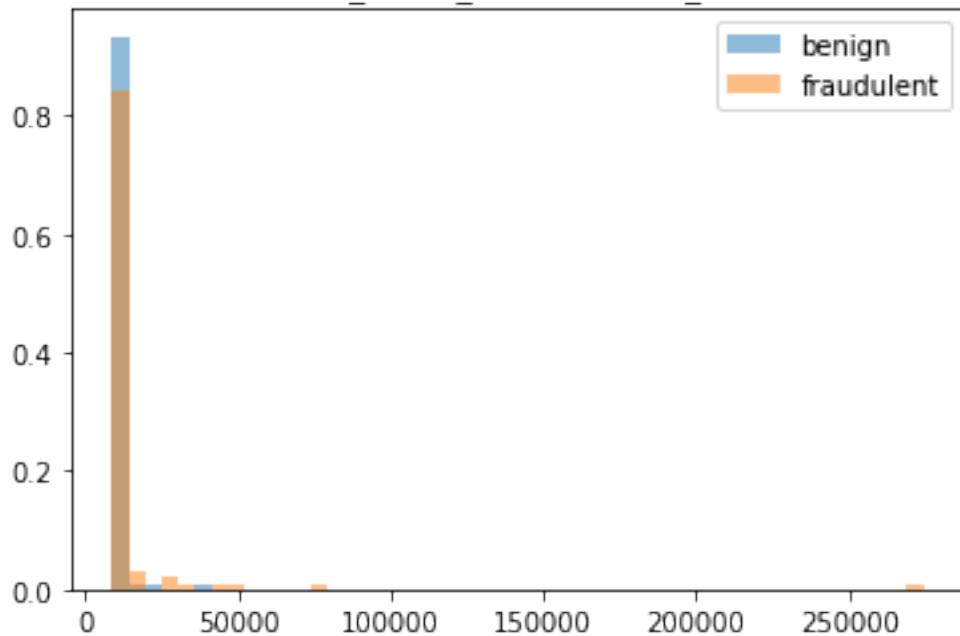
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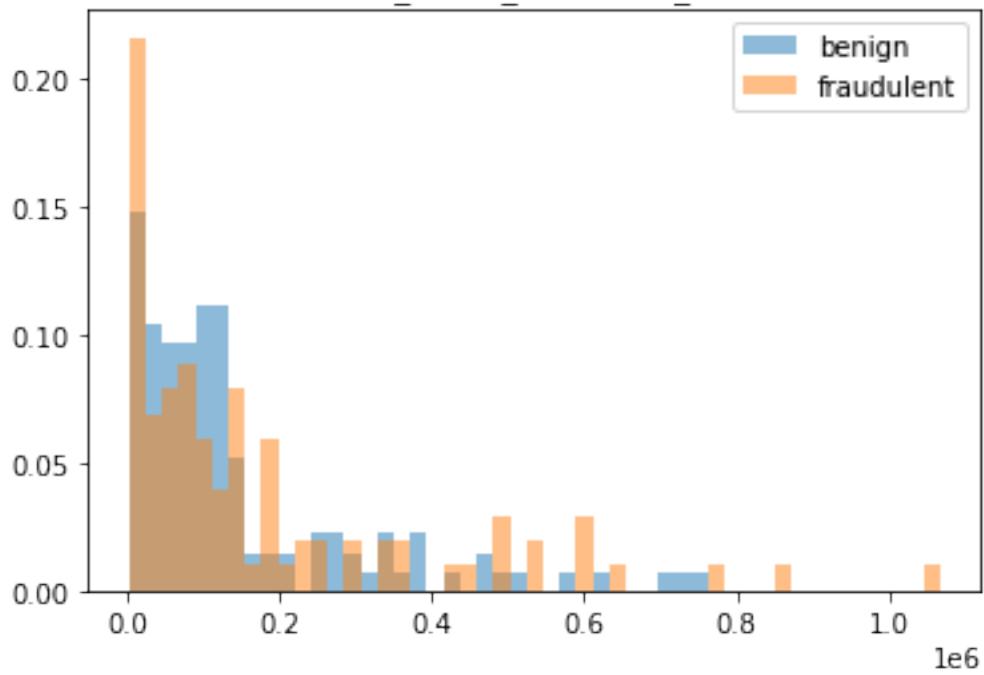
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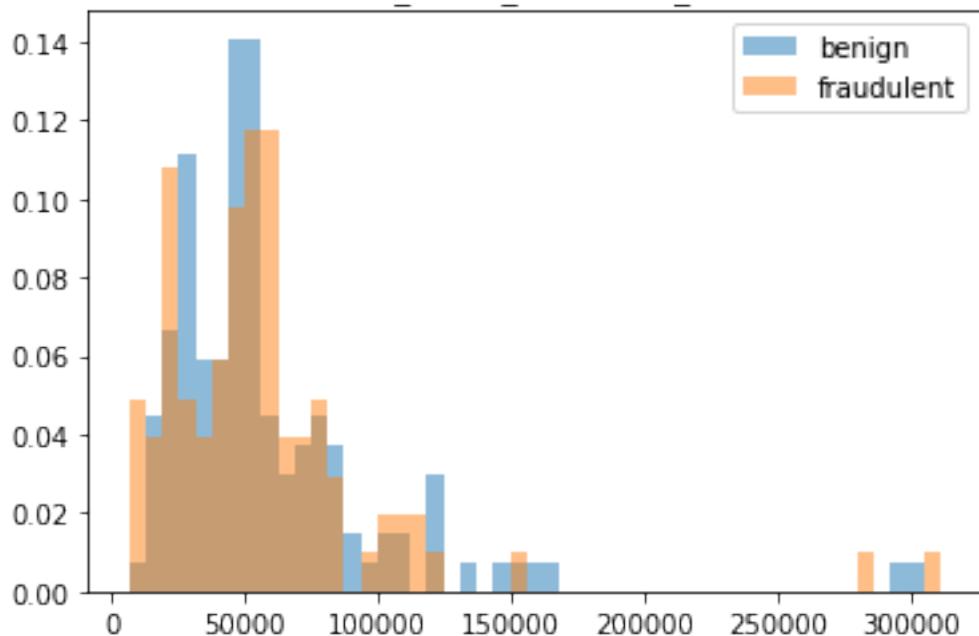
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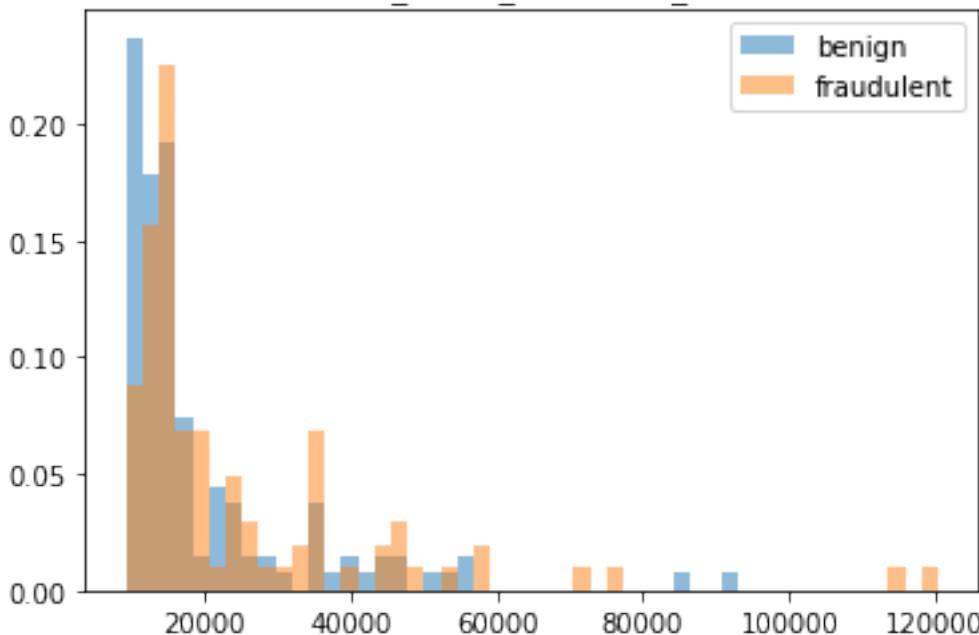
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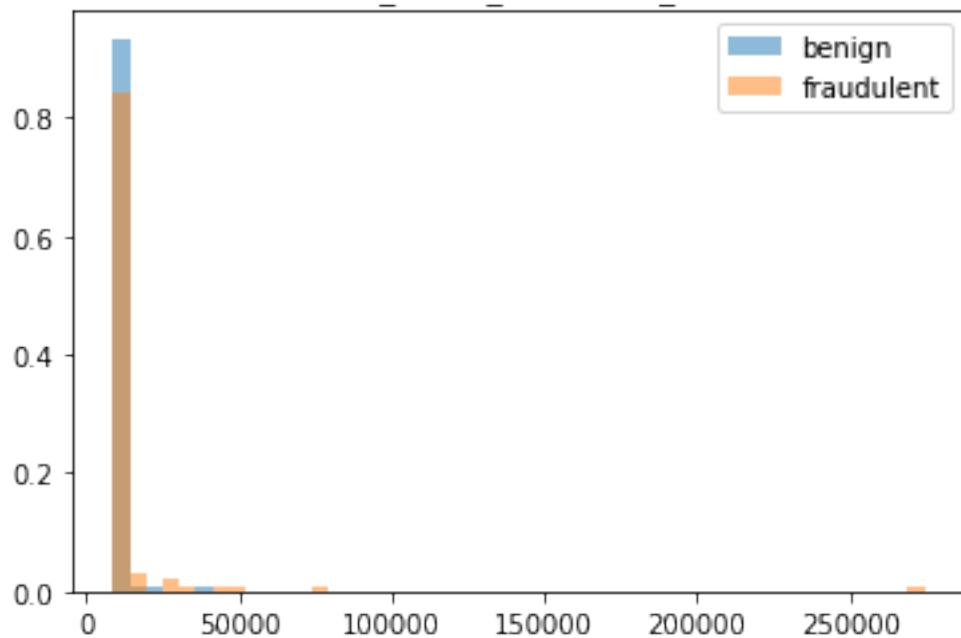
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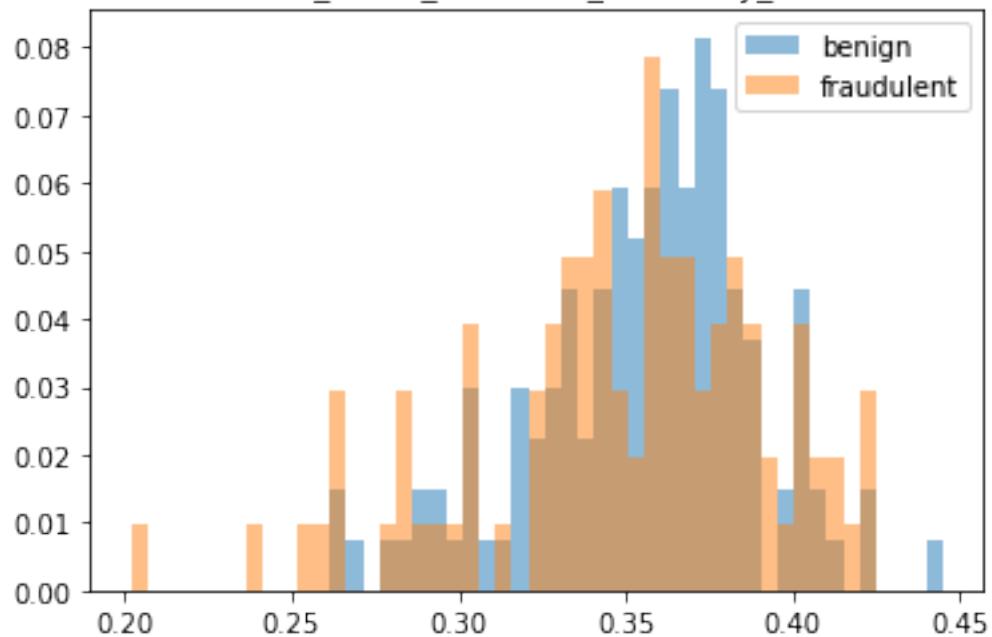
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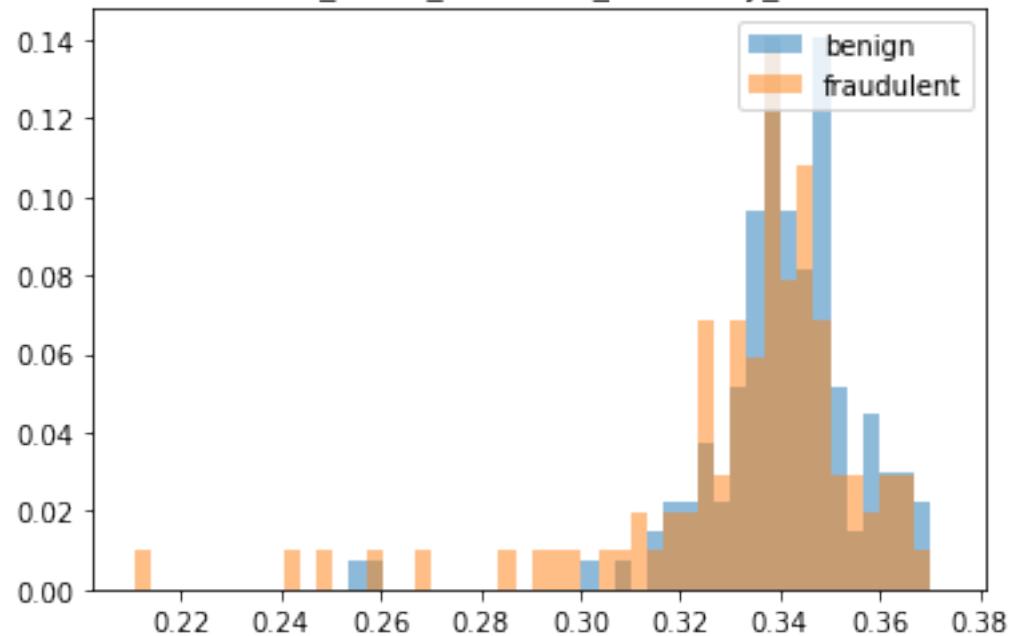
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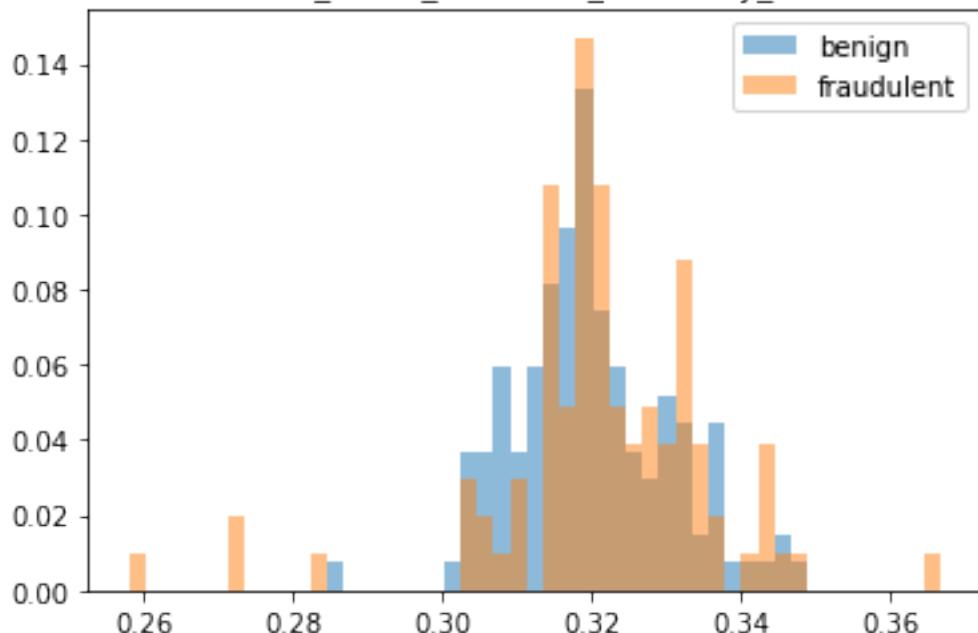
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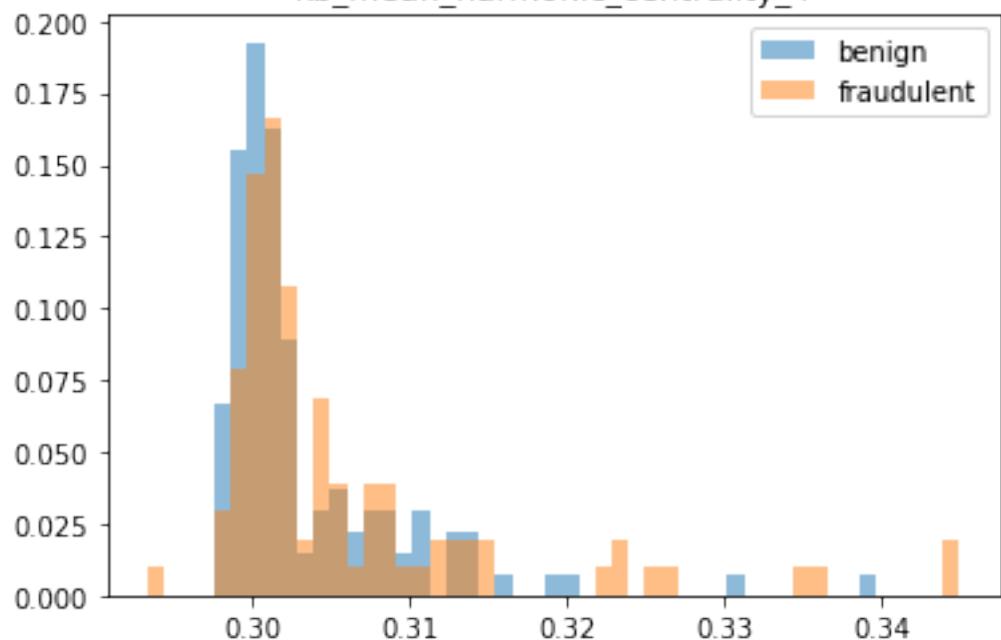
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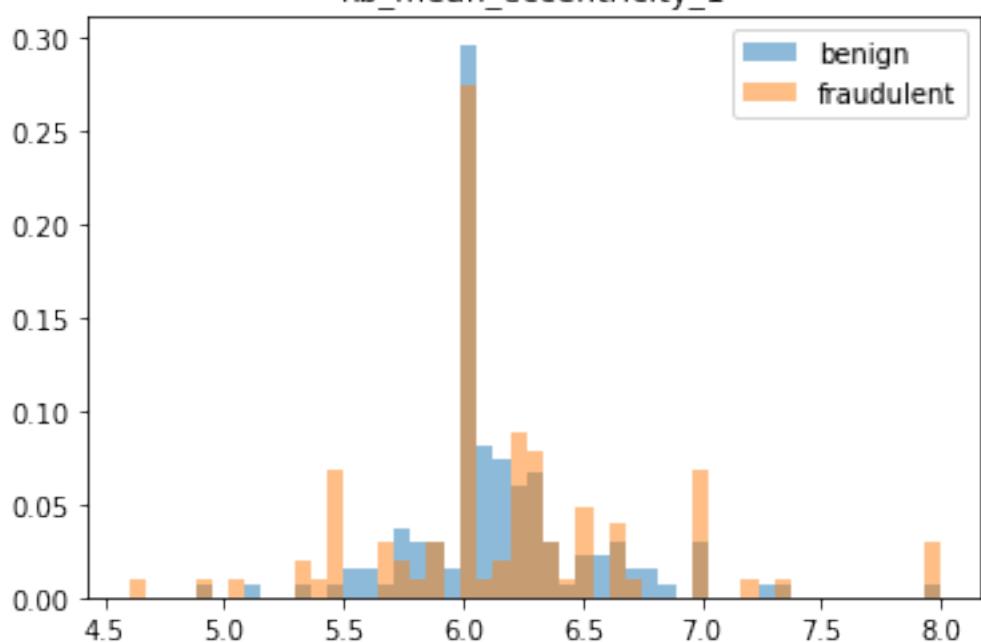
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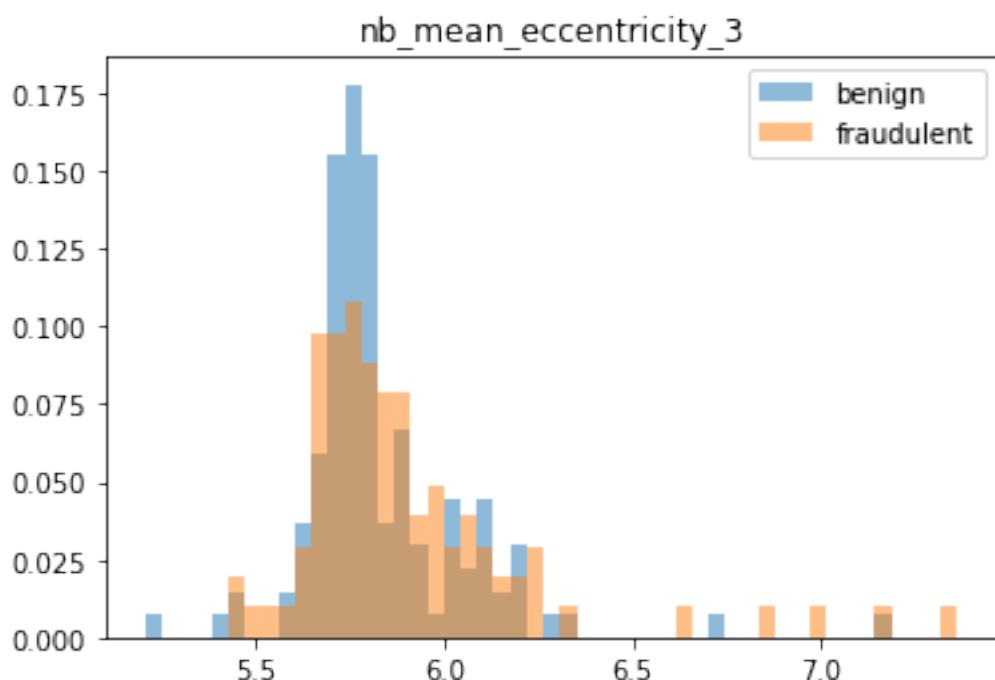
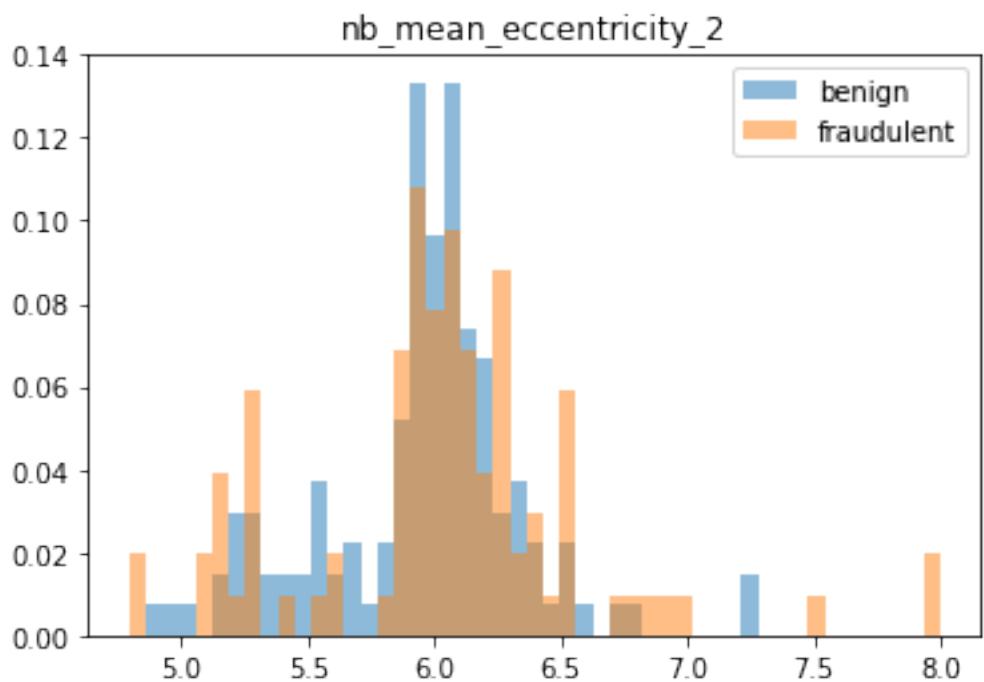


nb_mean_harmonic_centrality_4

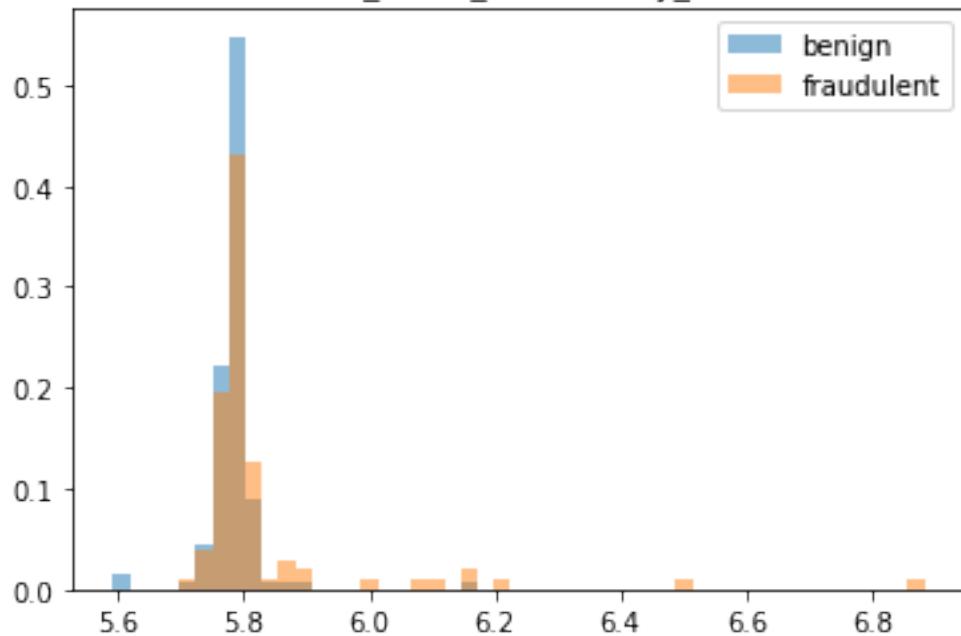


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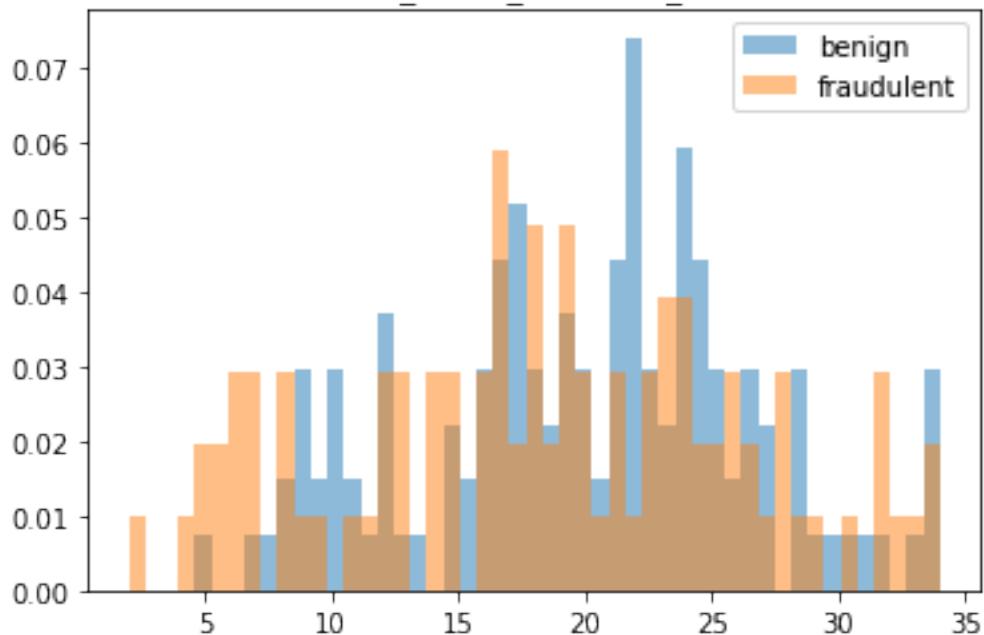




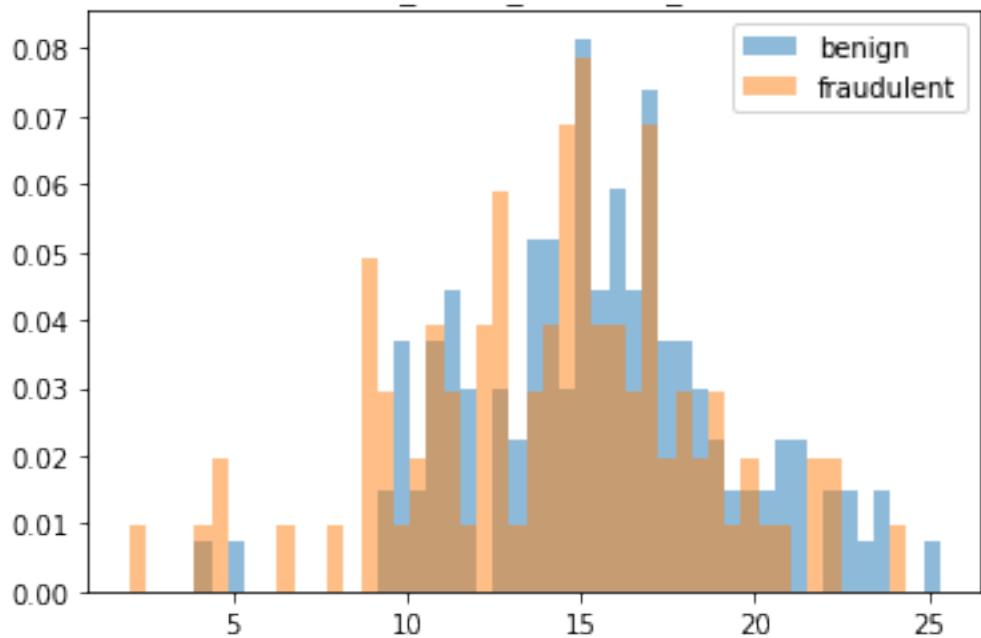
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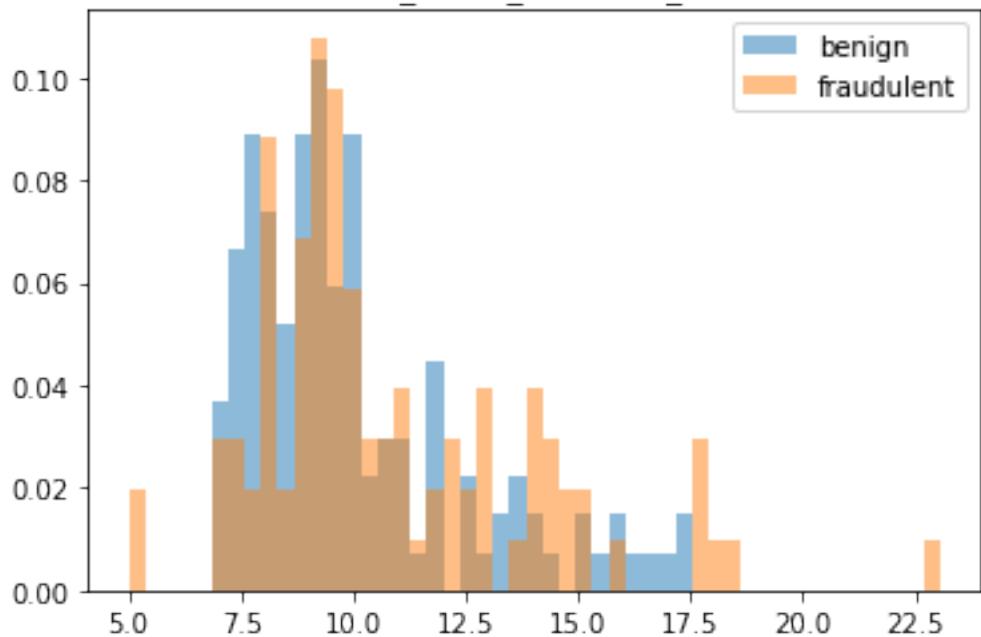
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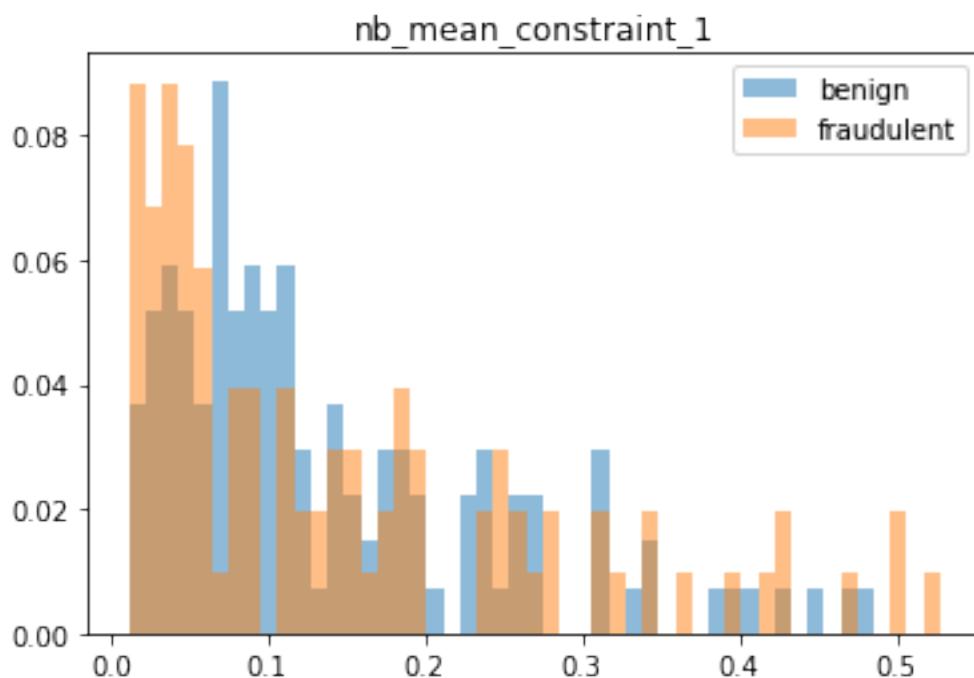
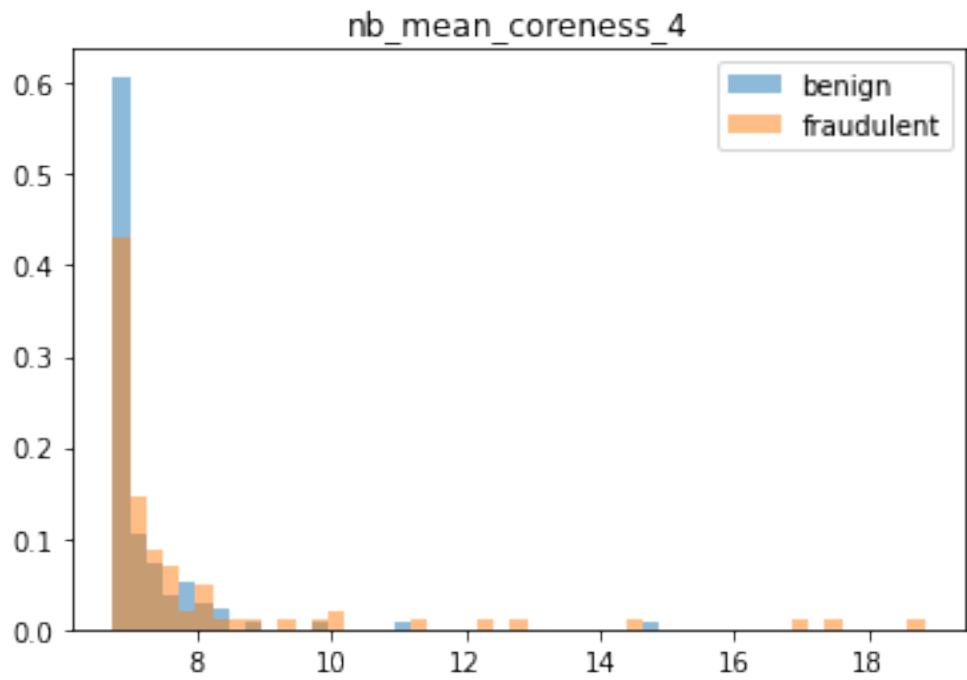


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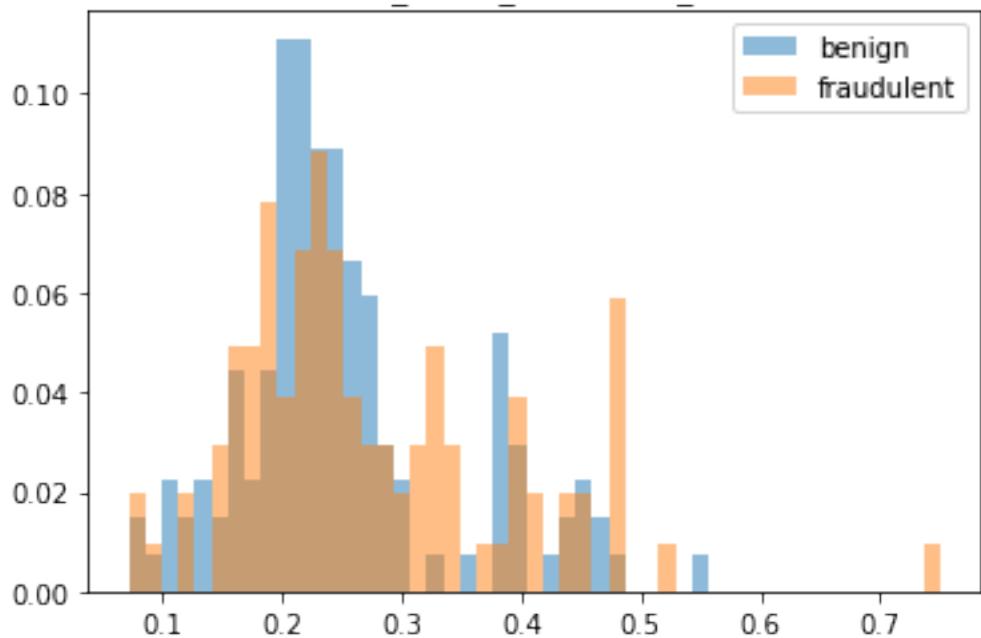


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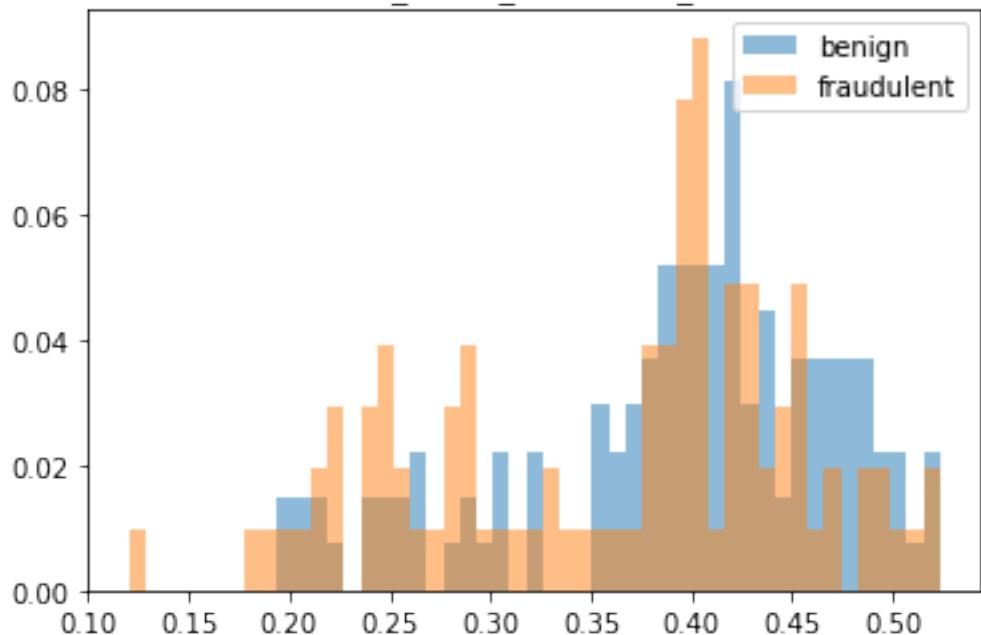




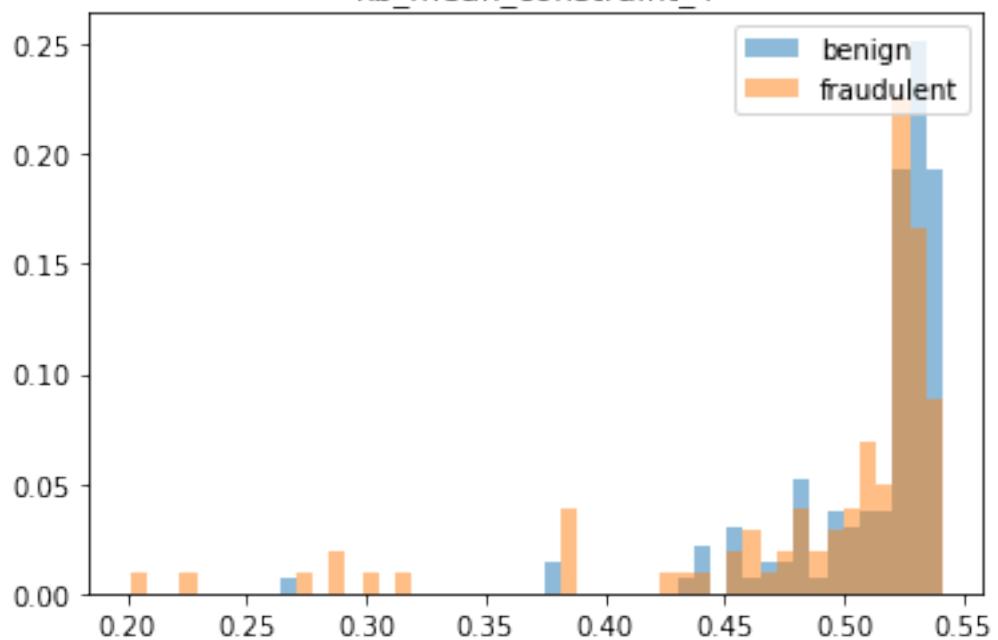
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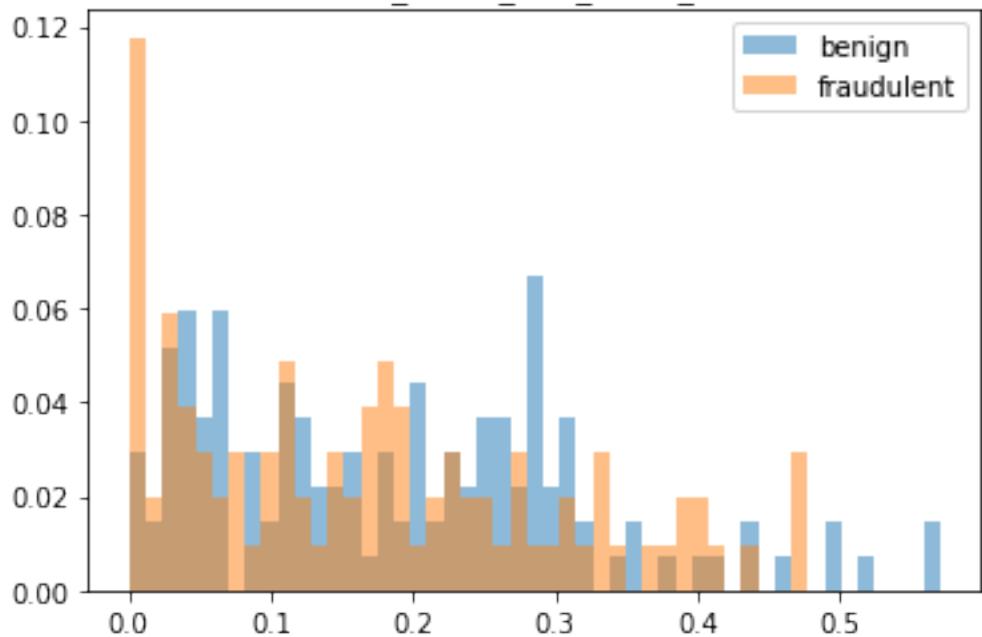
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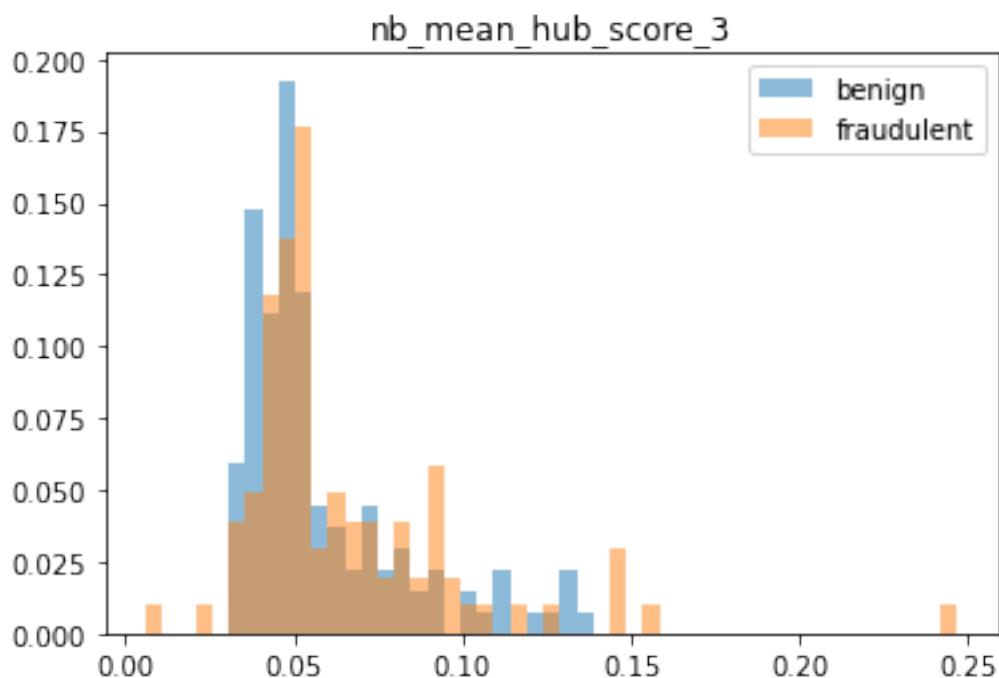
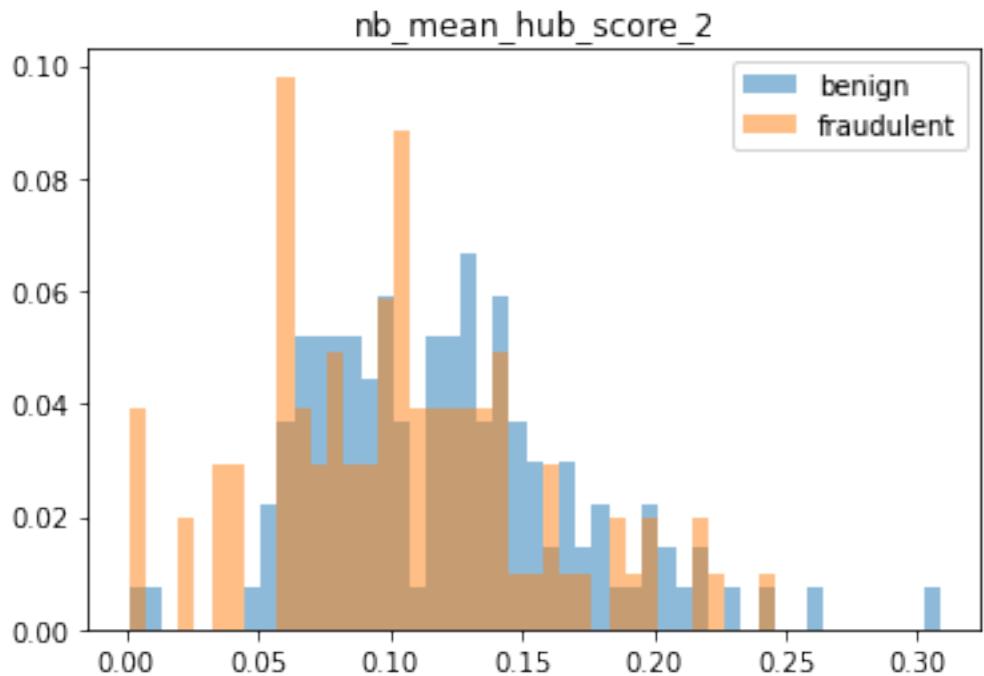


nb_mean_constraint_4

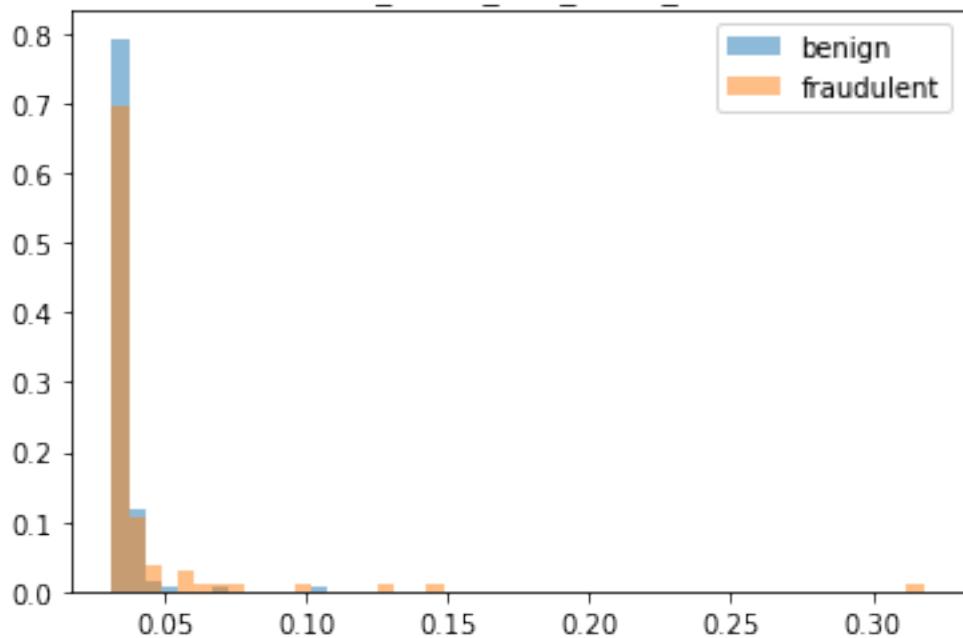


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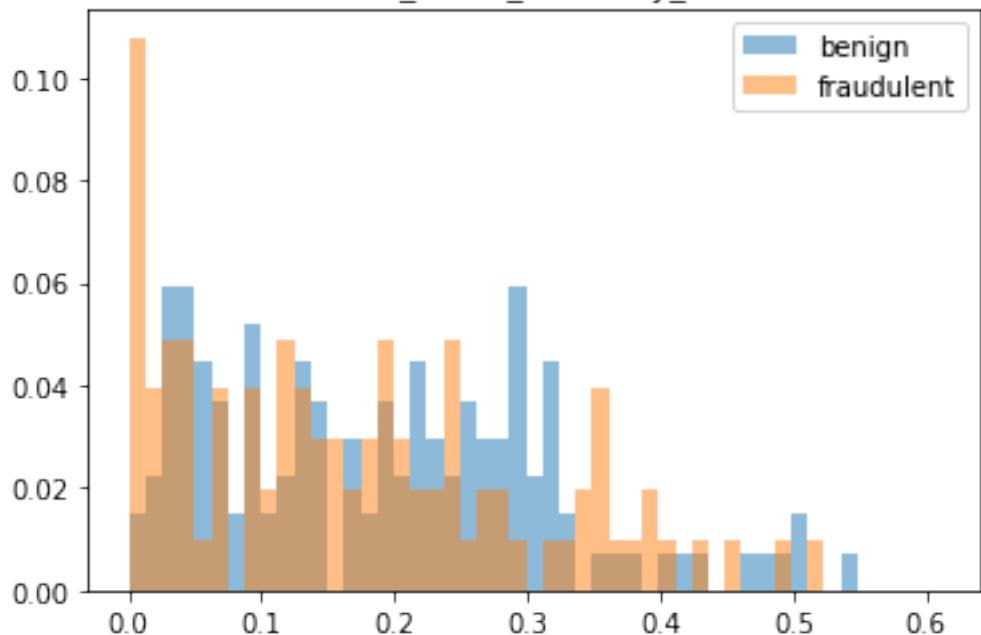




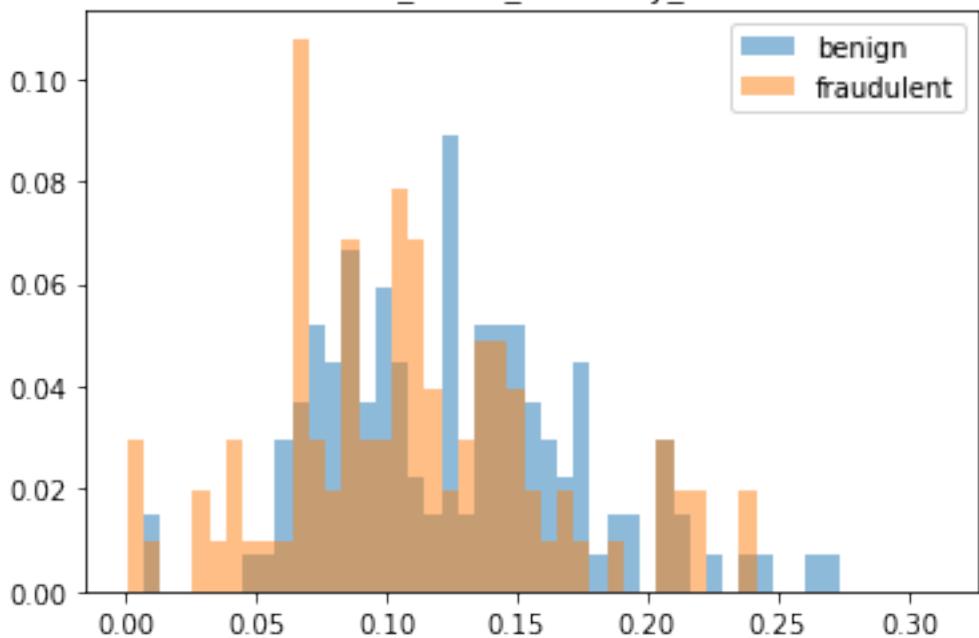
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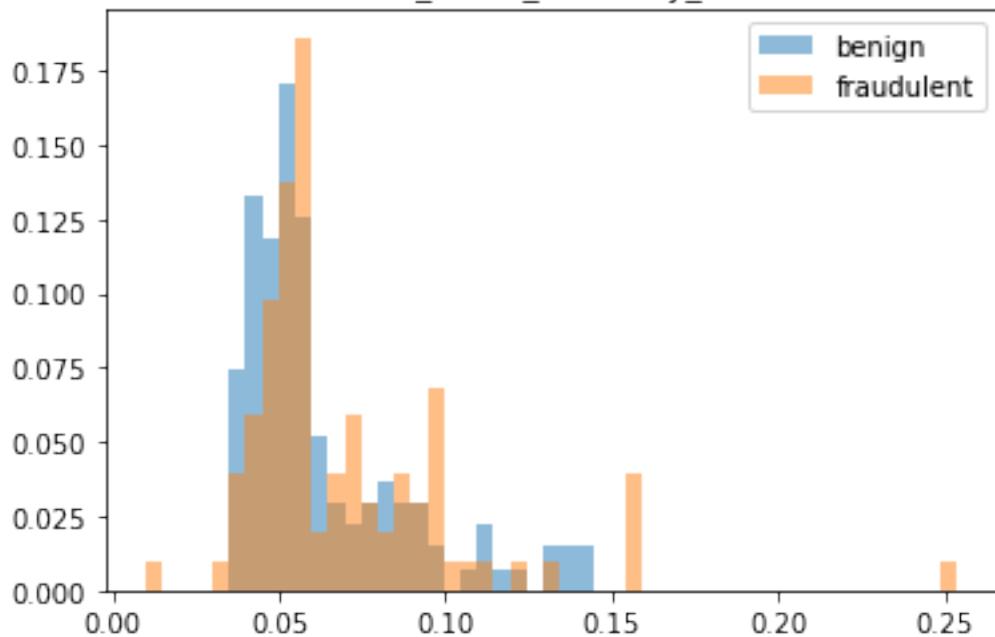
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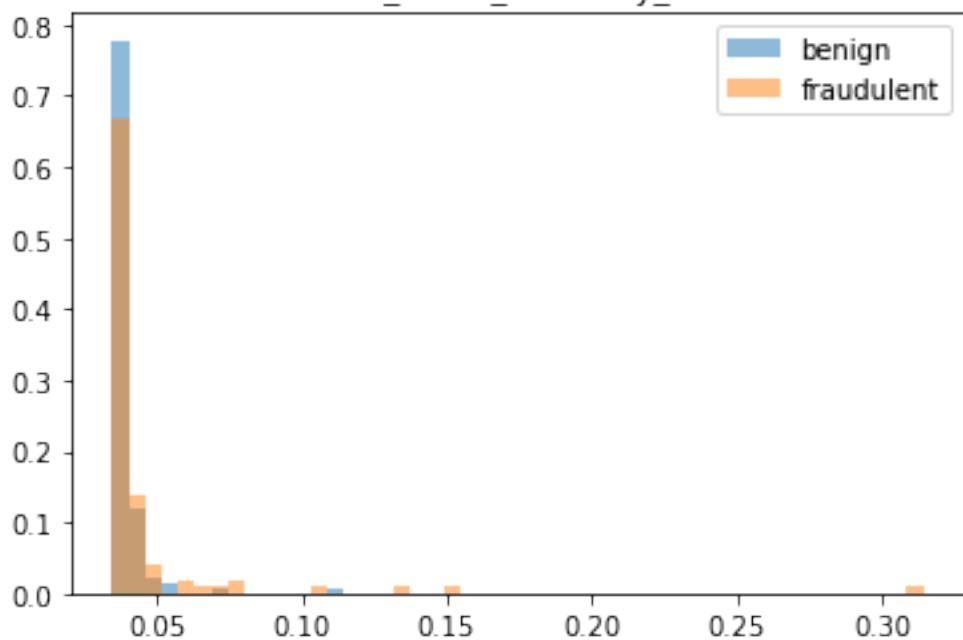
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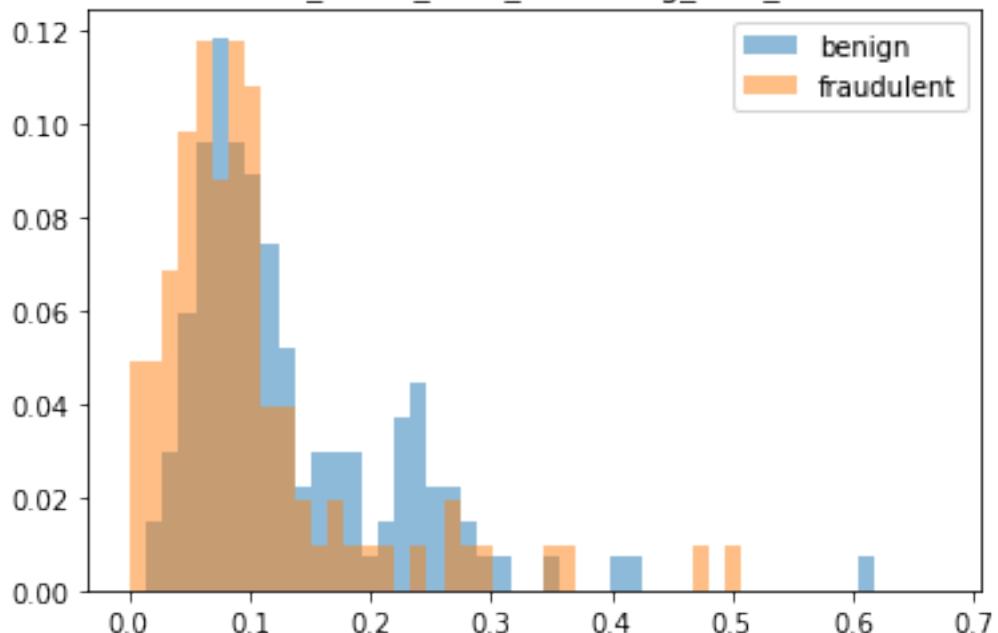
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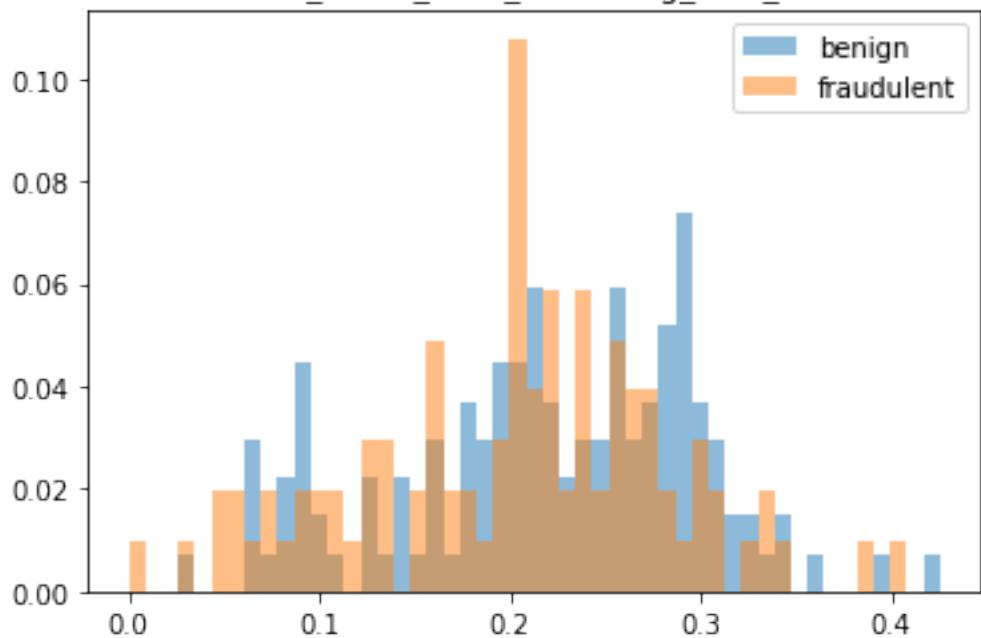
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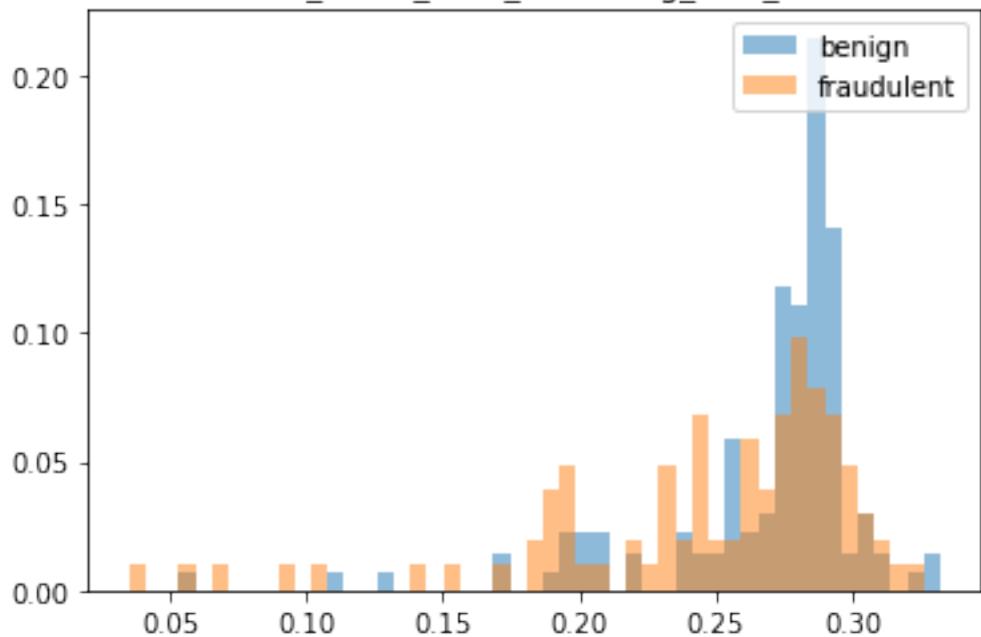
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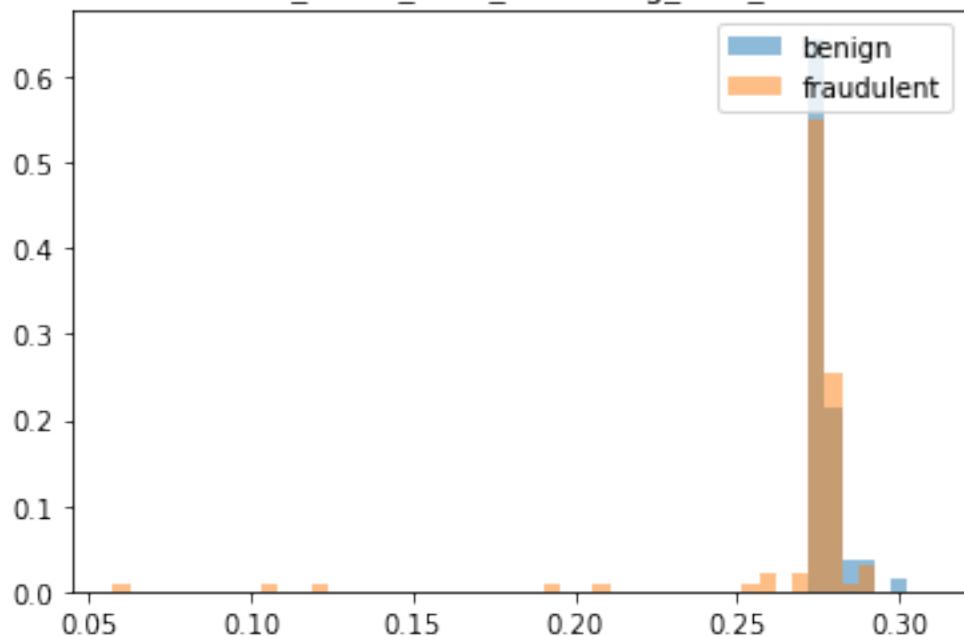
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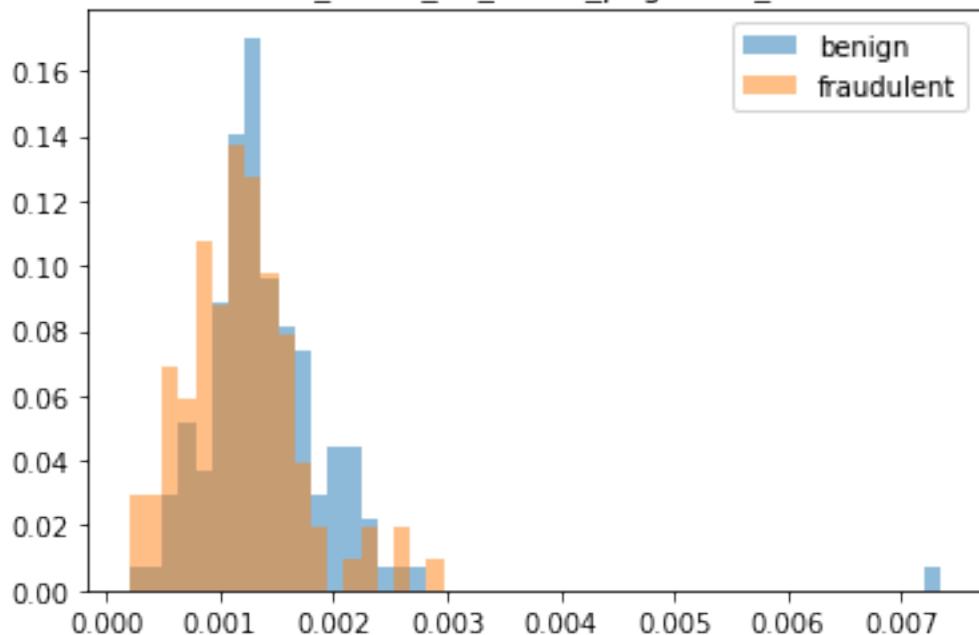
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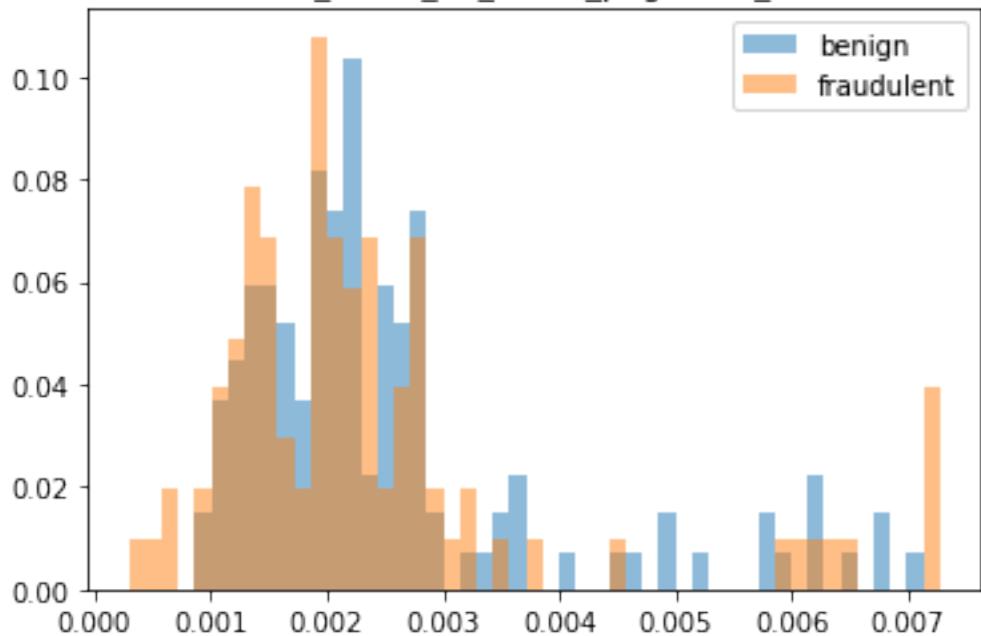
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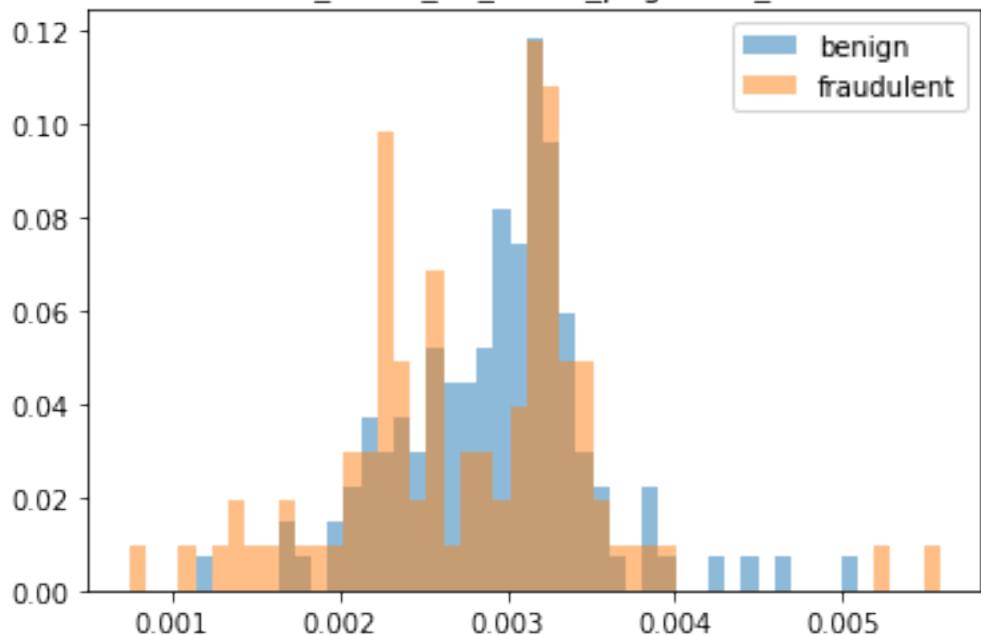
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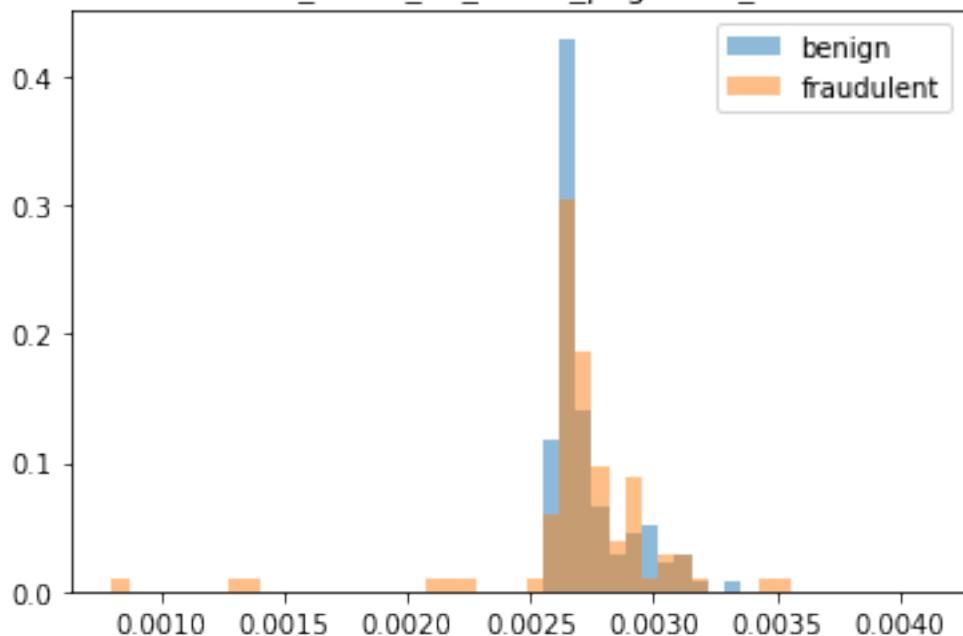
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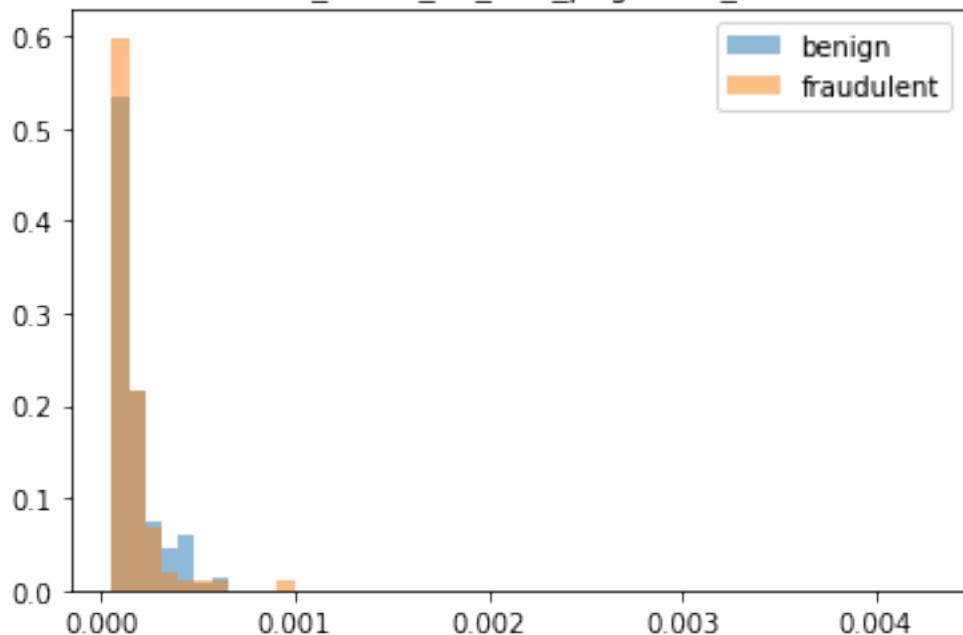
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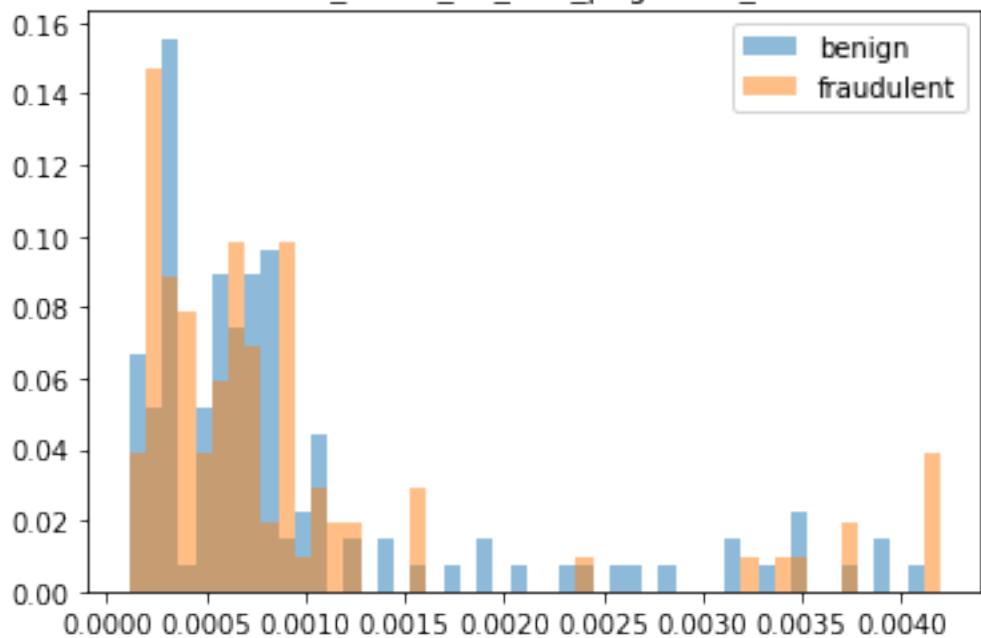
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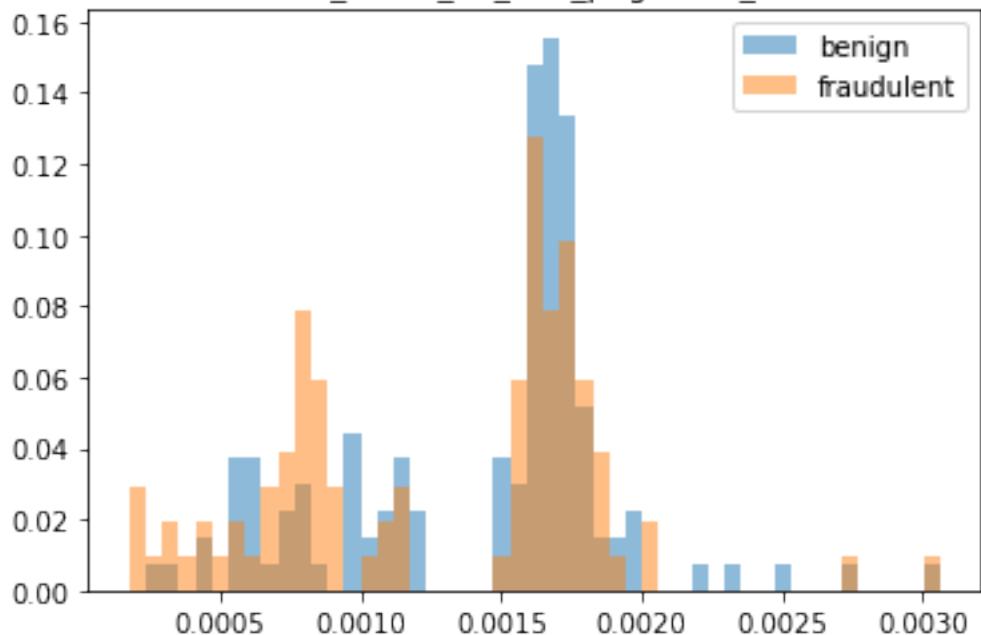
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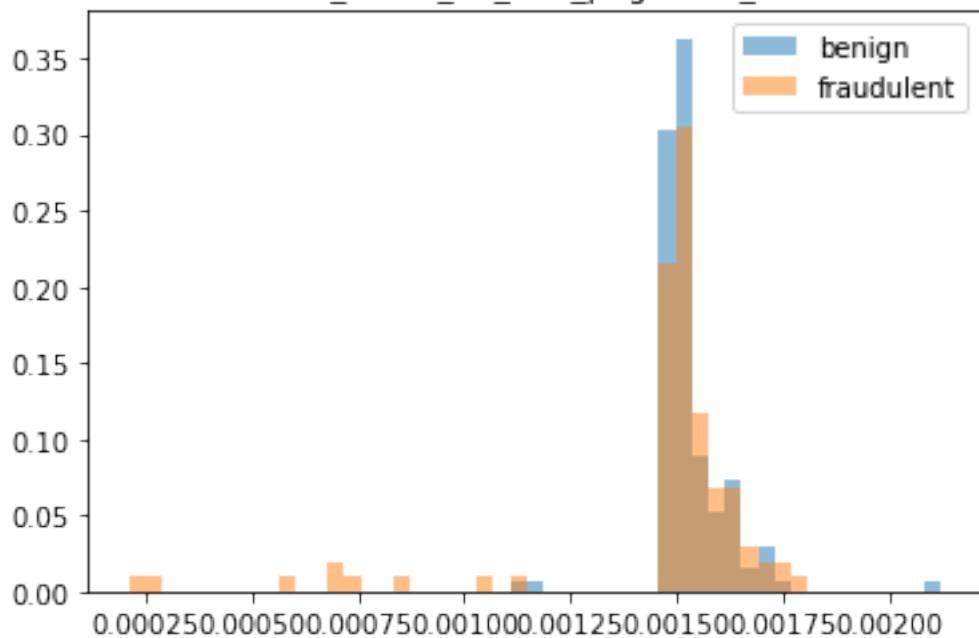
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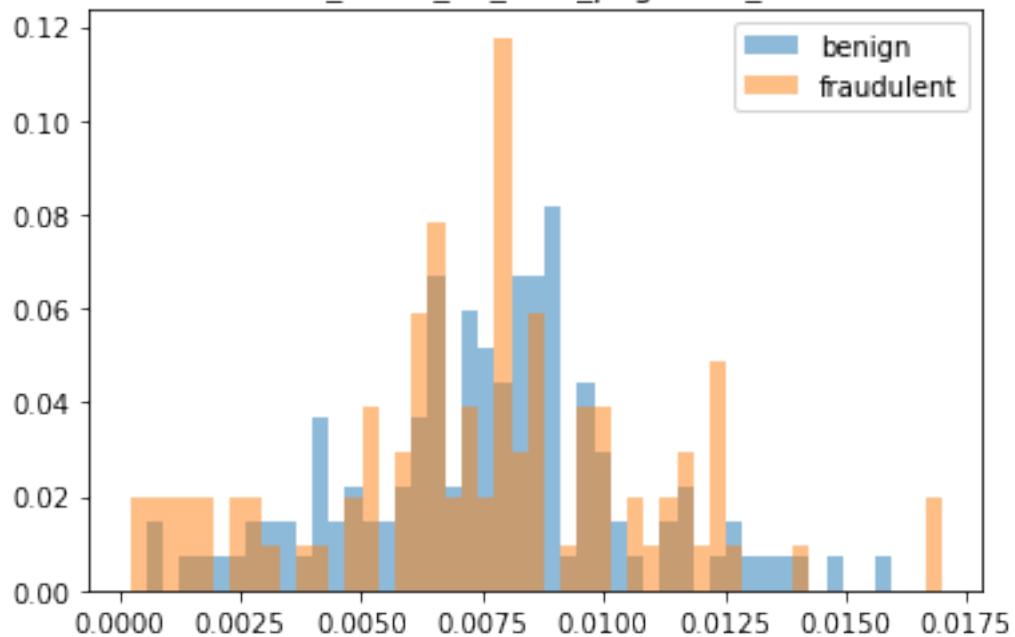
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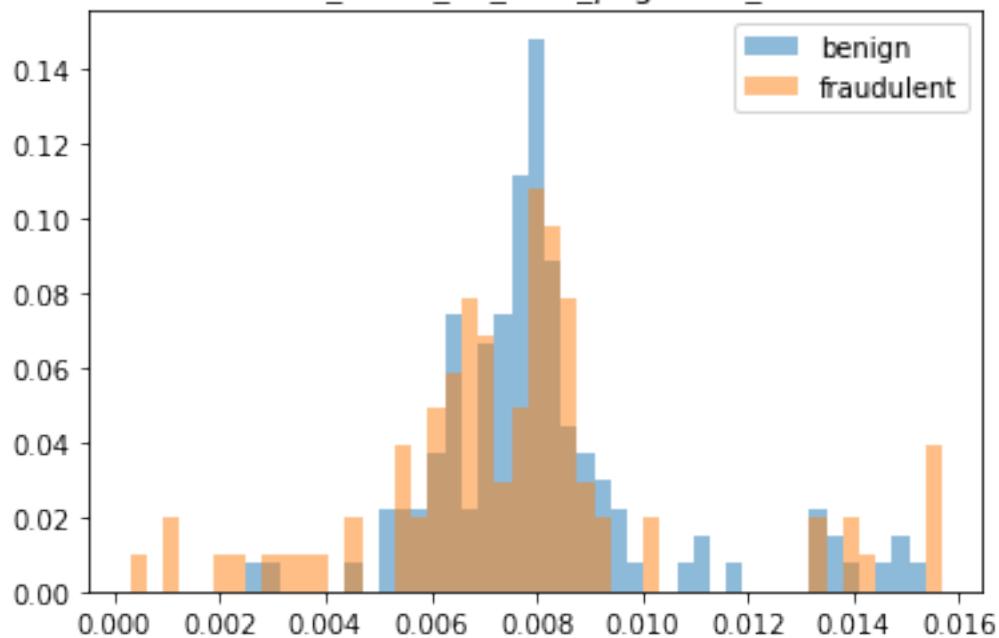
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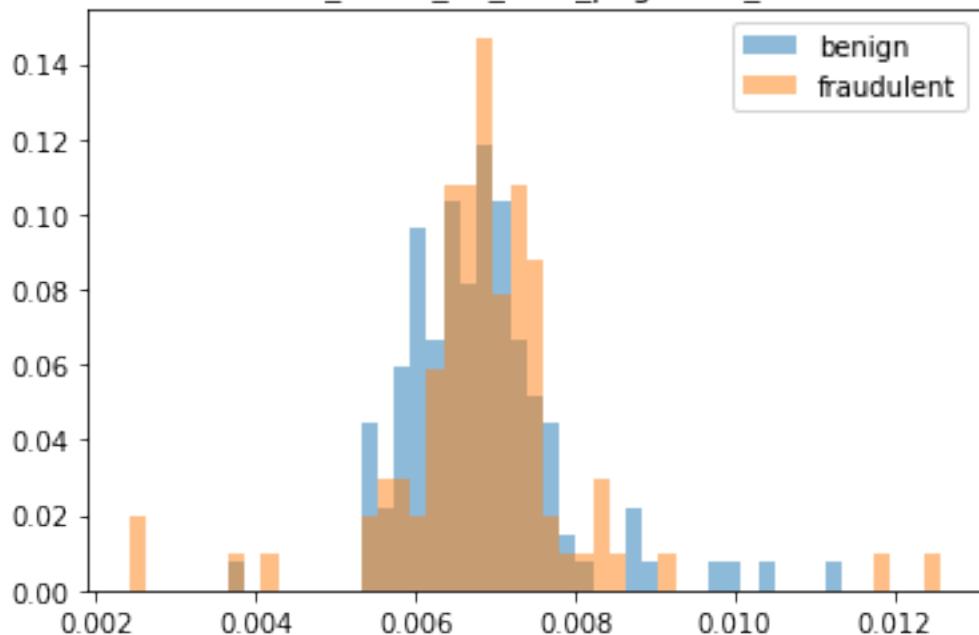
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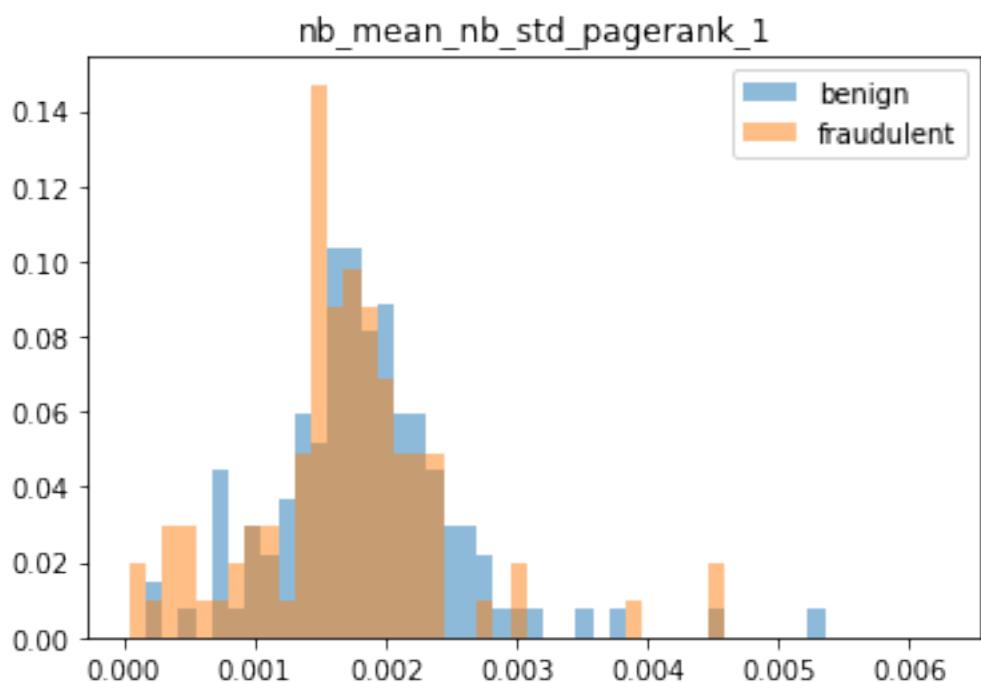
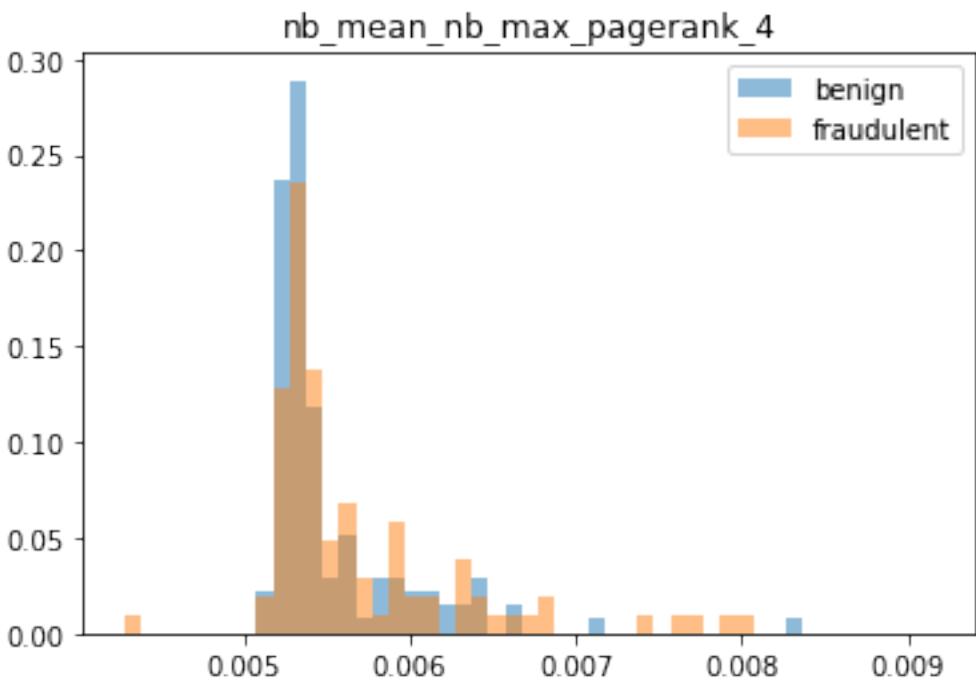


nb_mean_nb_max_pagerank_2

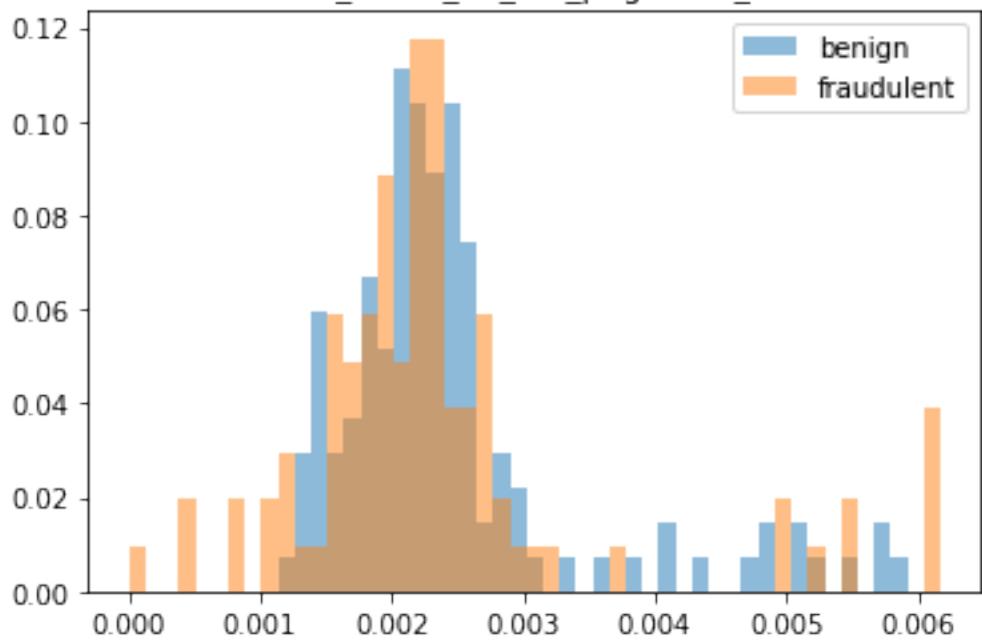


nb_mean_nb_max_pagerank_3

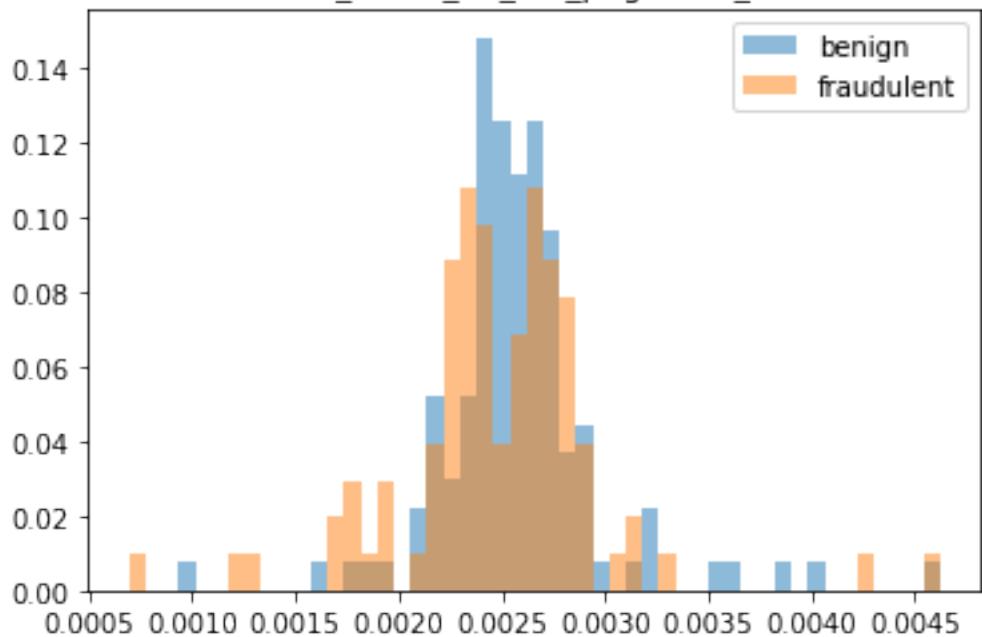




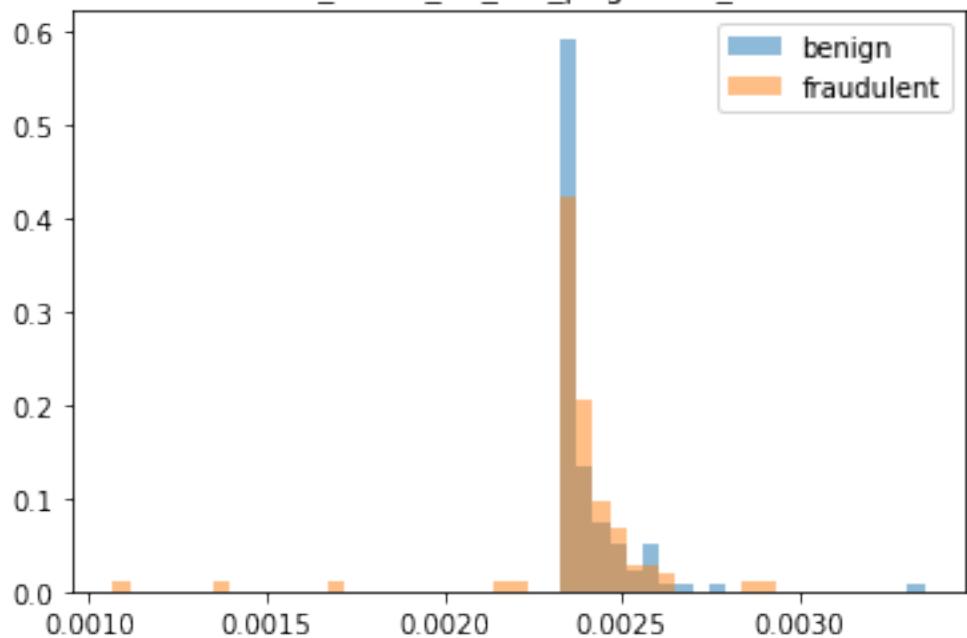
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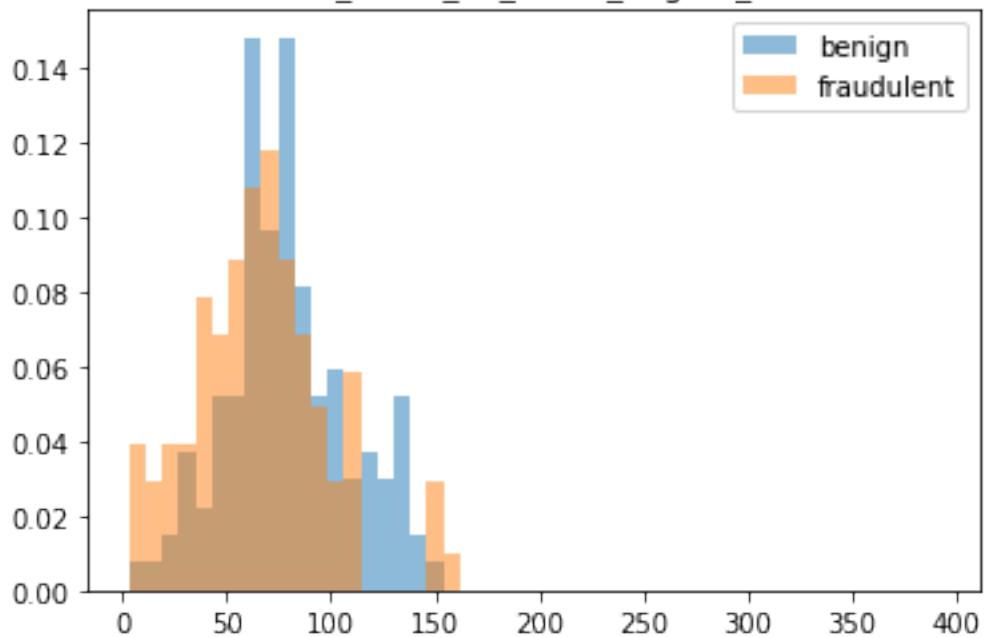
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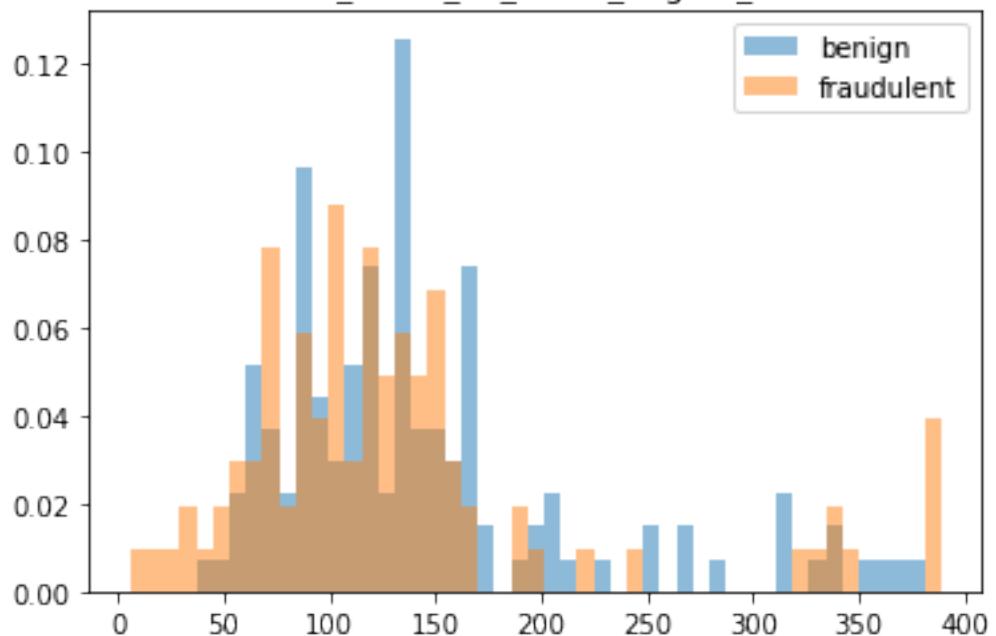
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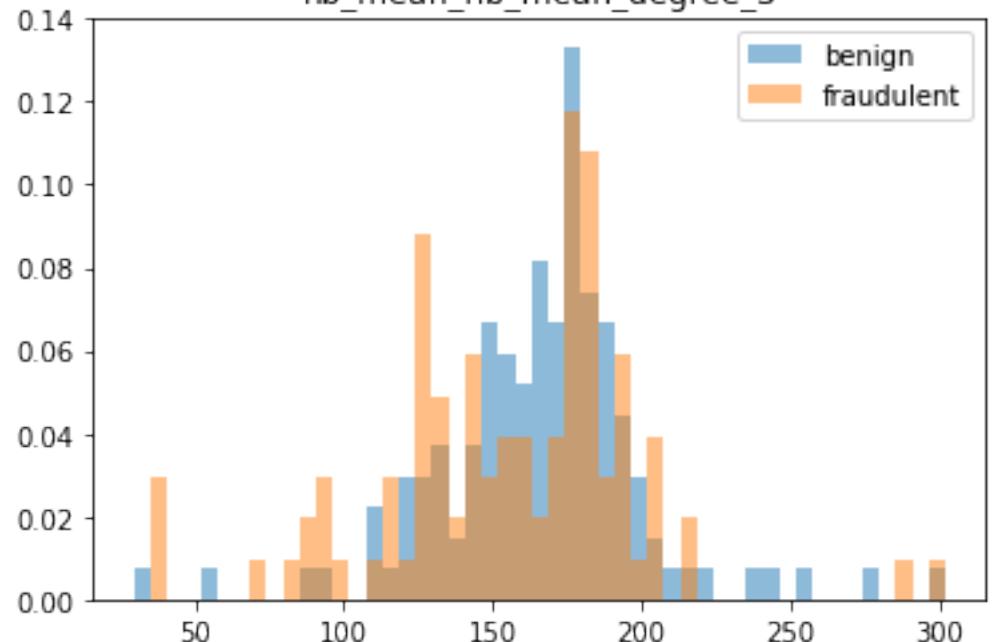
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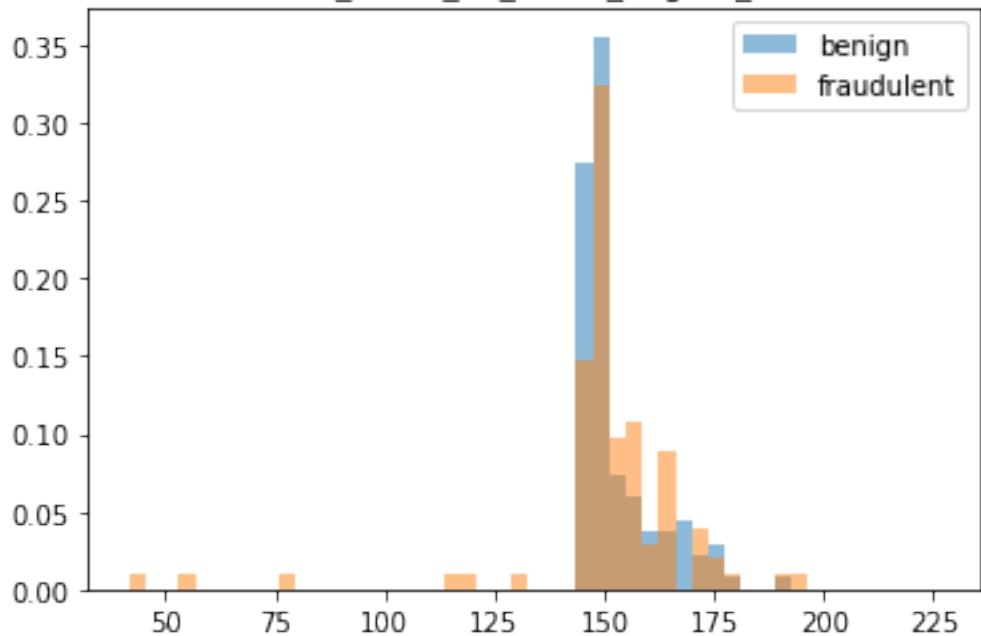
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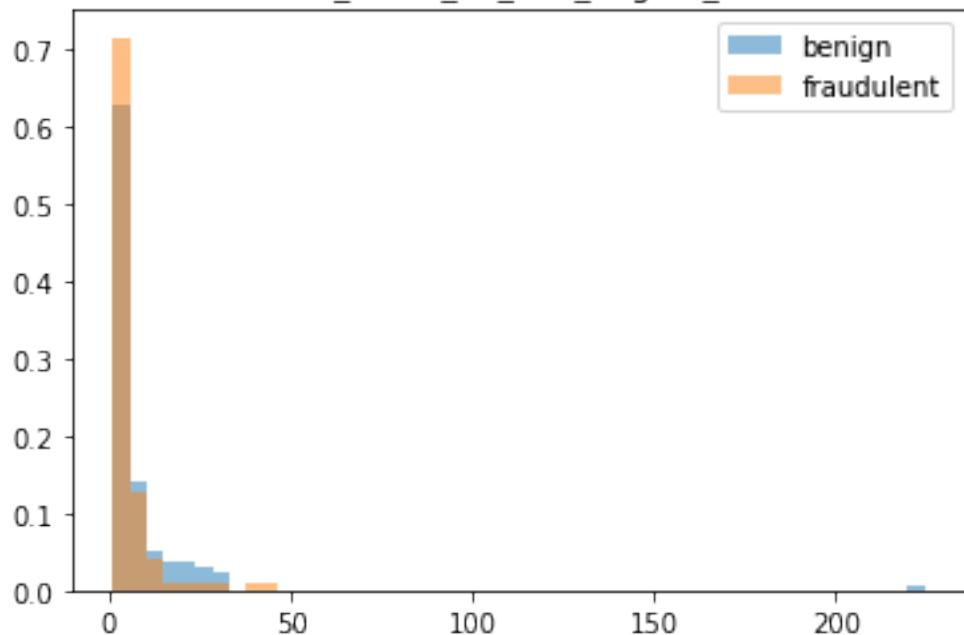
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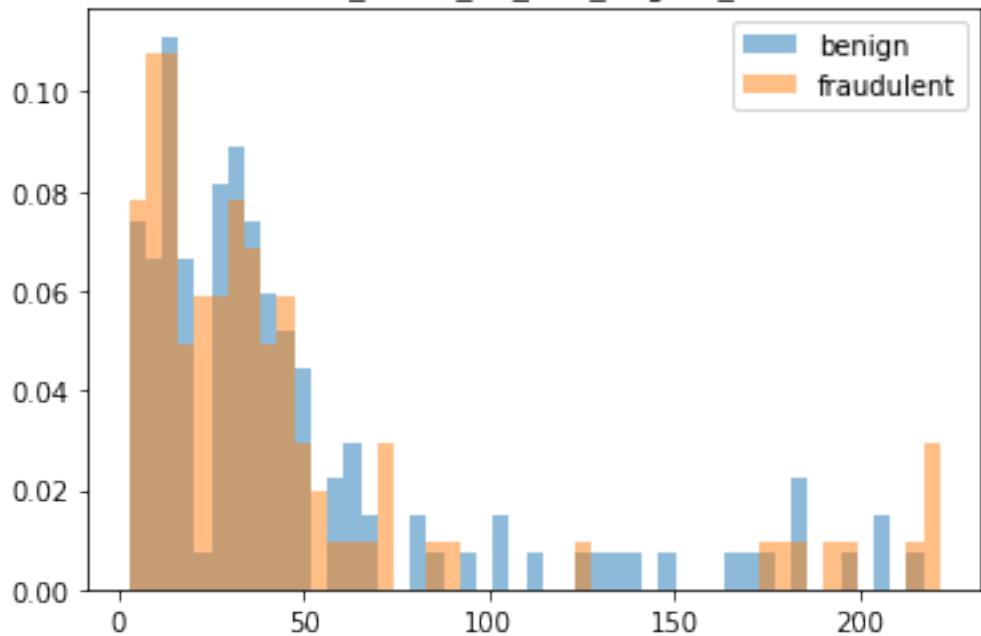
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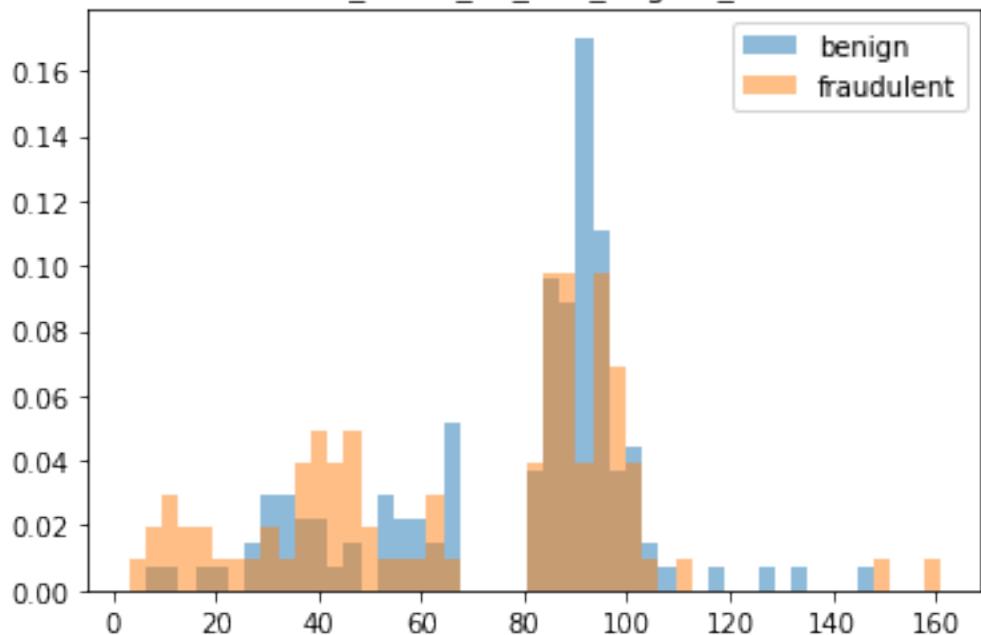
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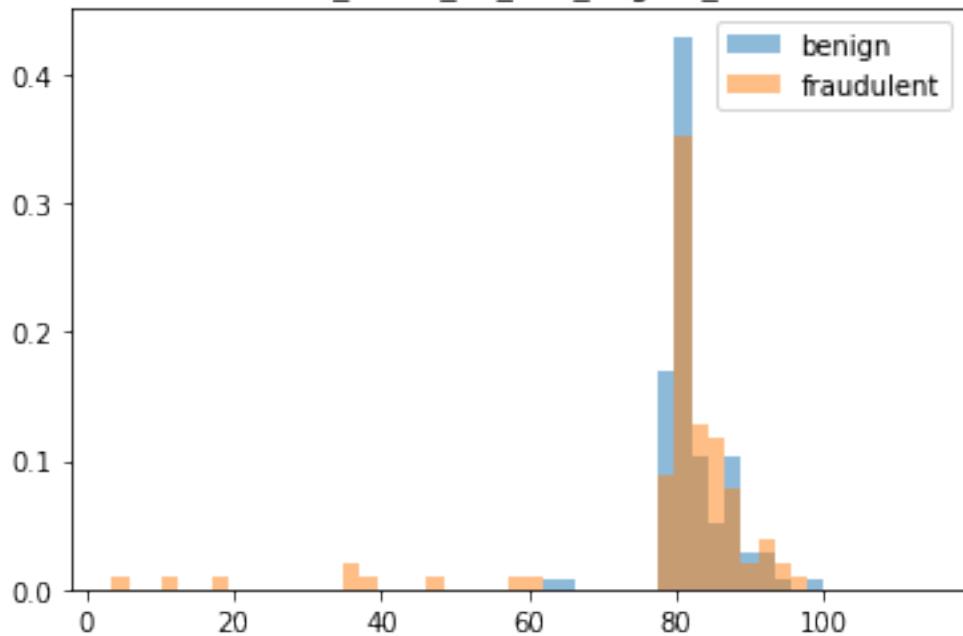
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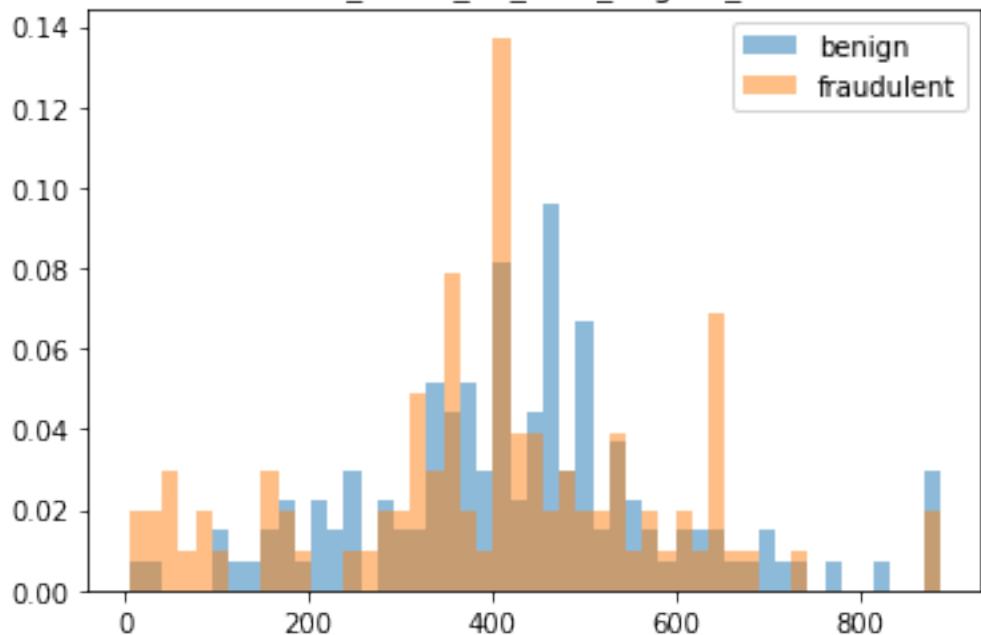
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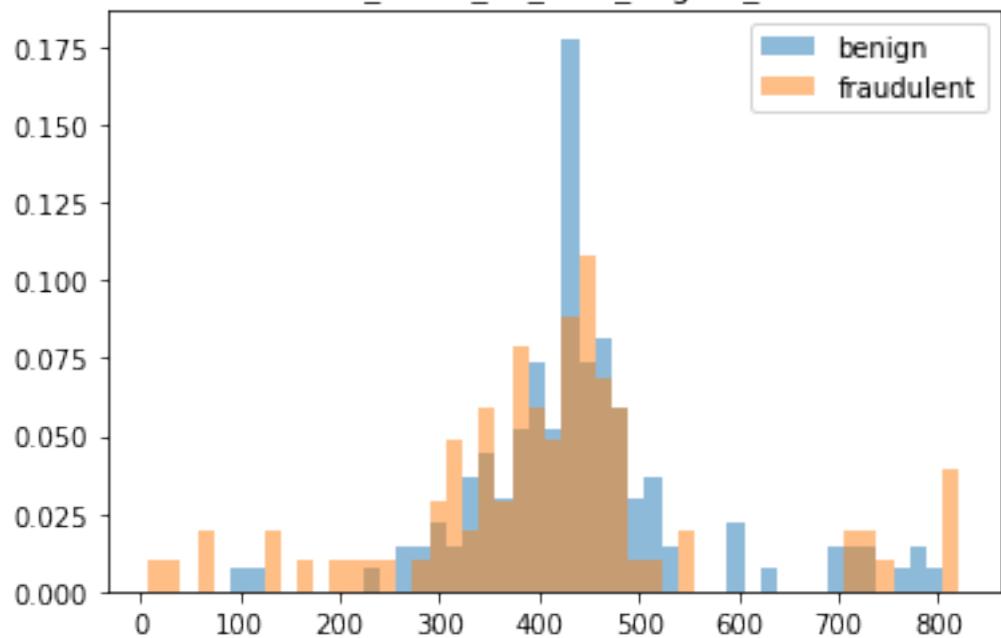
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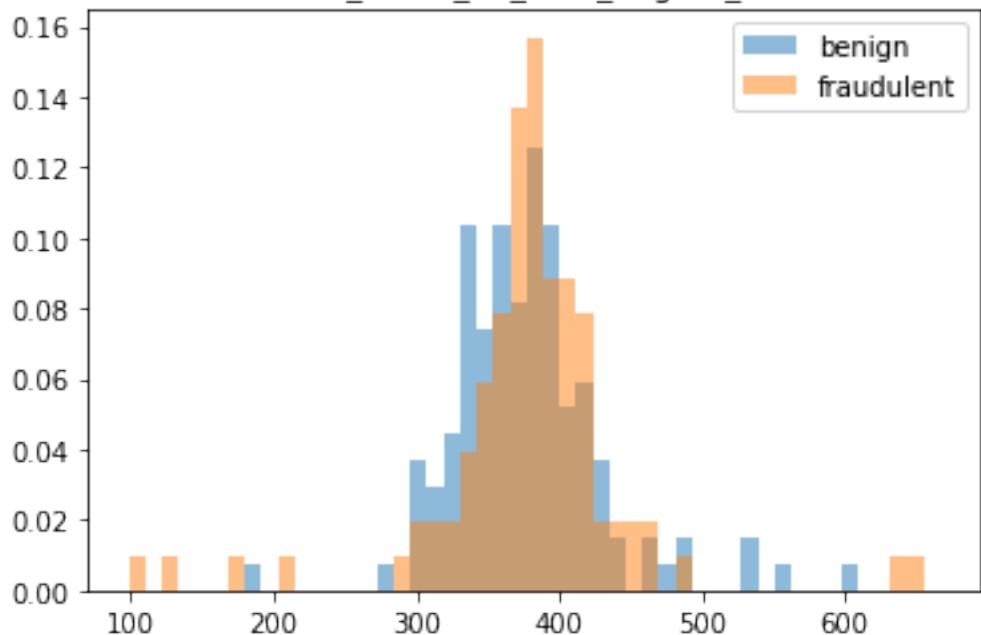
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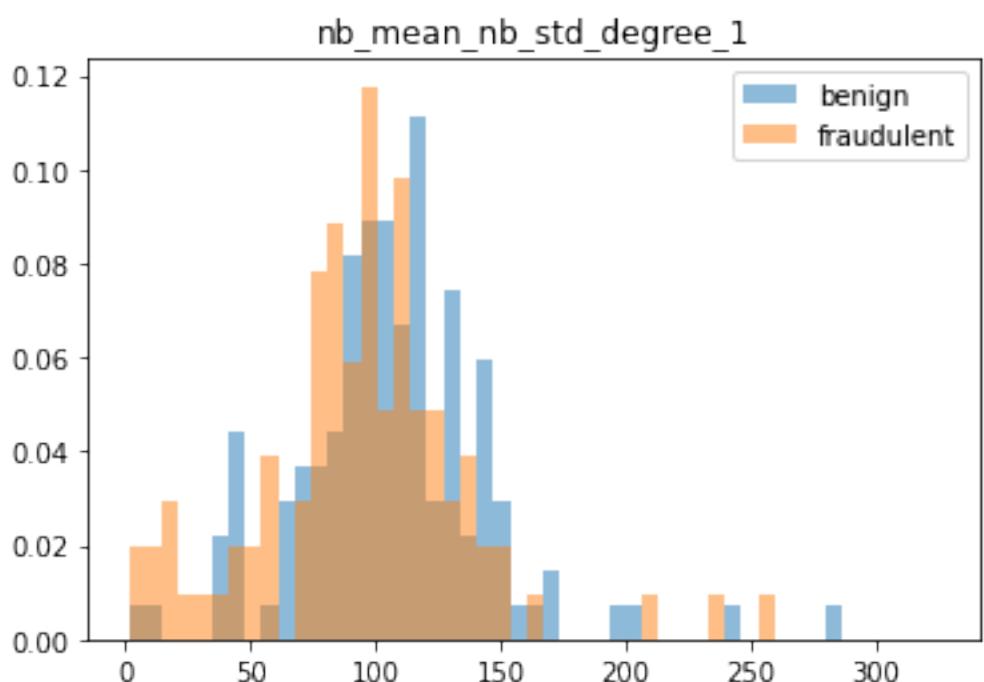
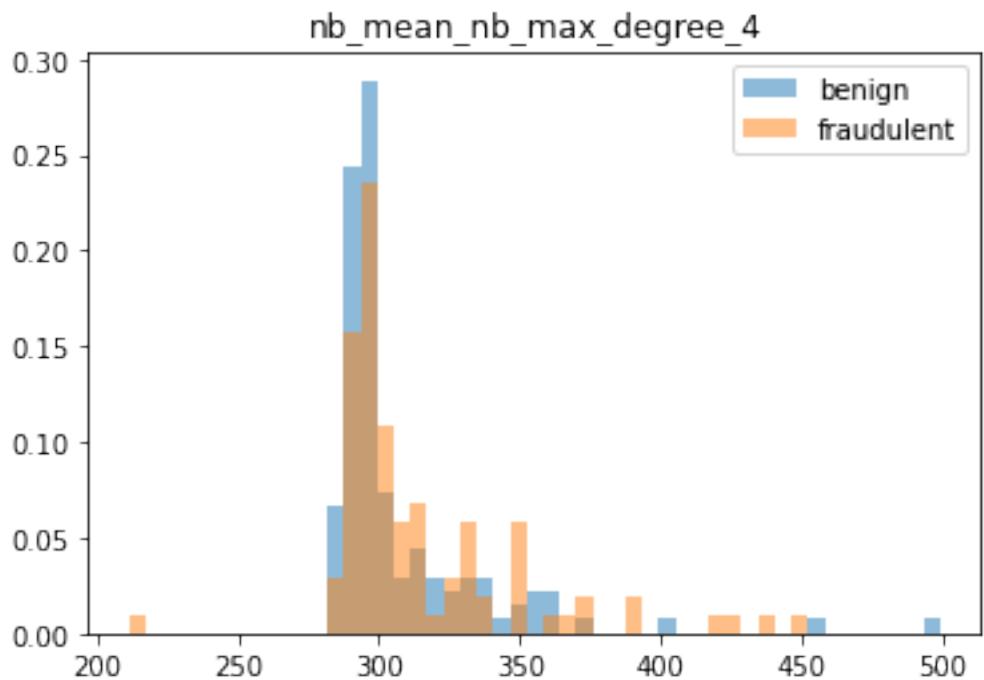


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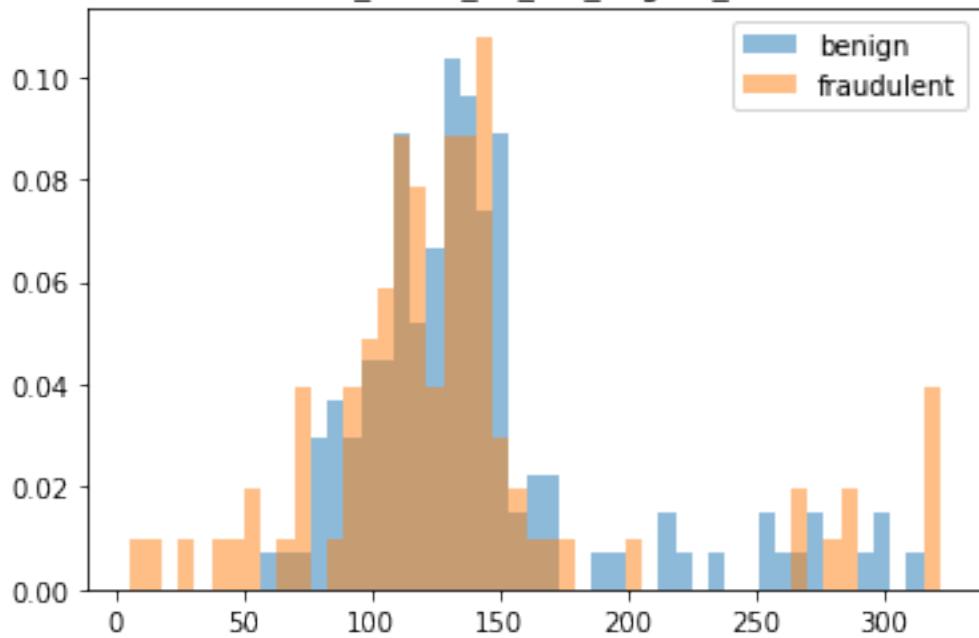


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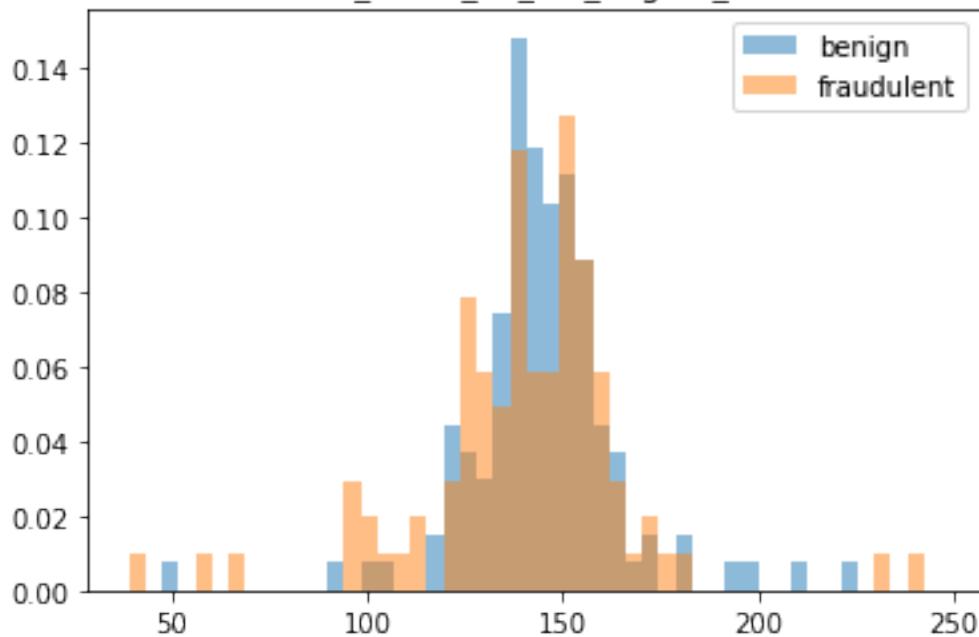




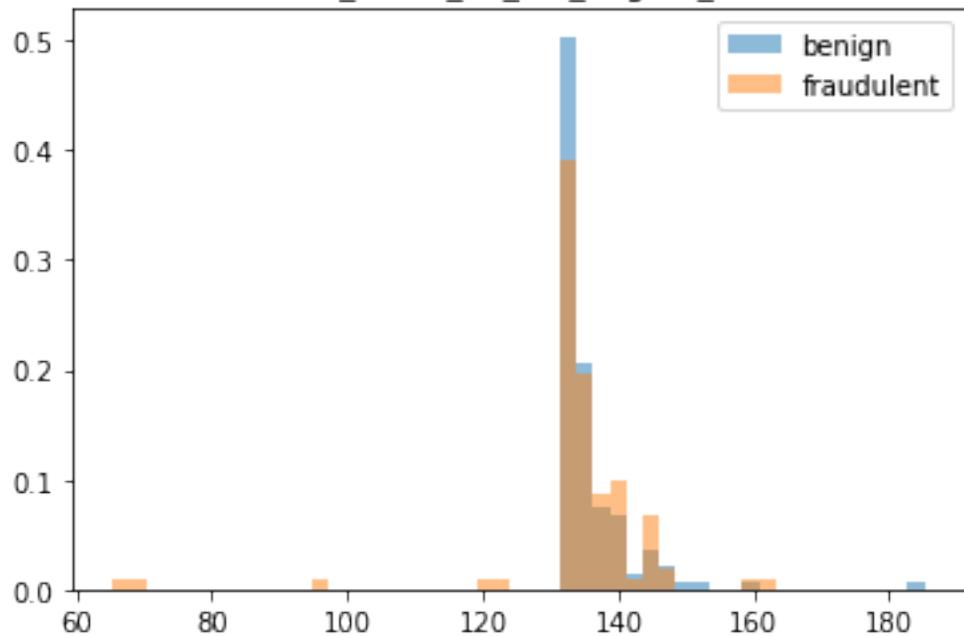
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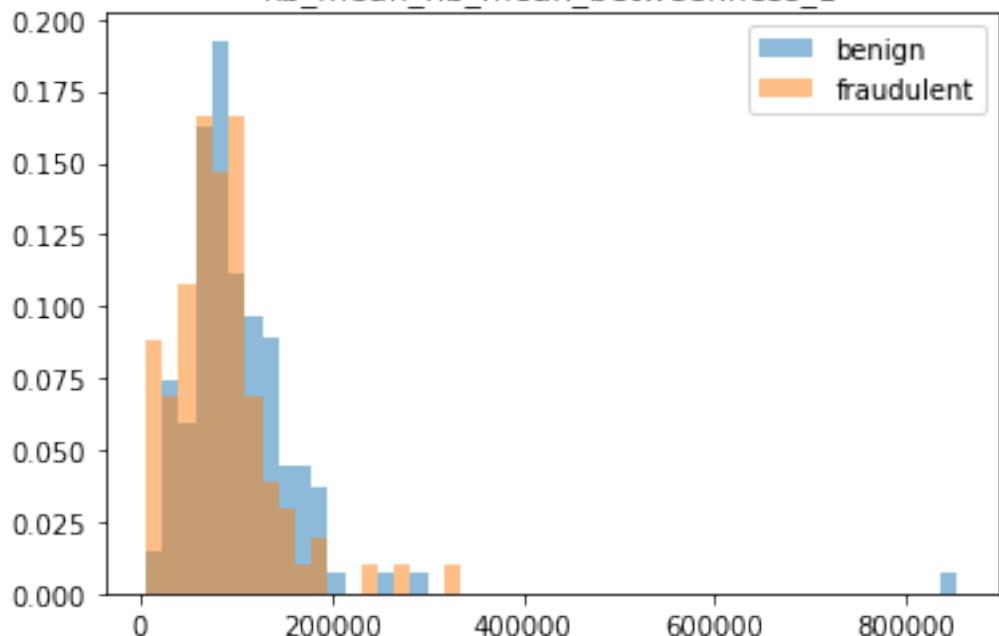
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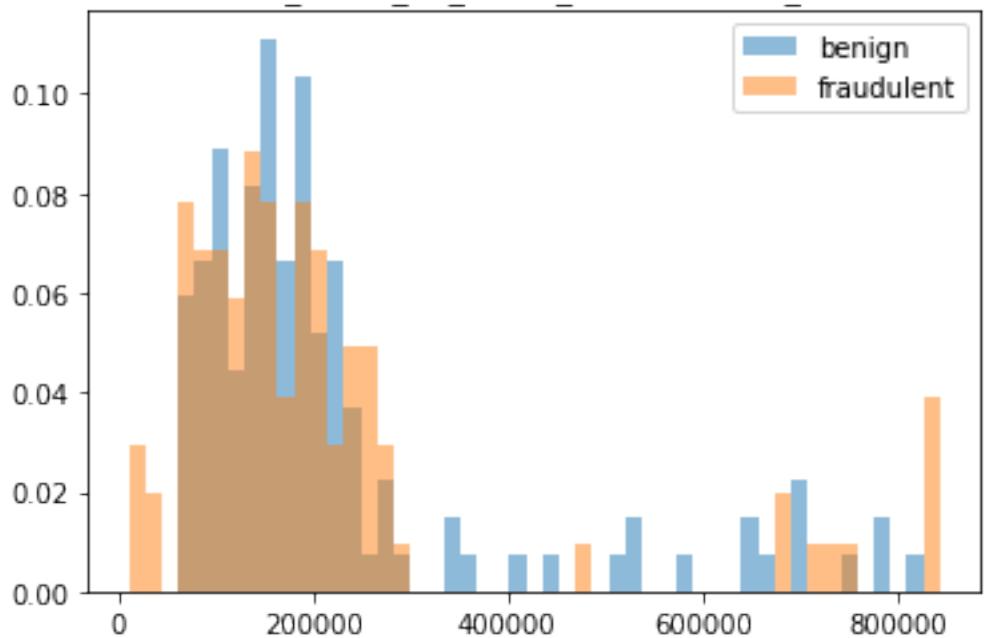
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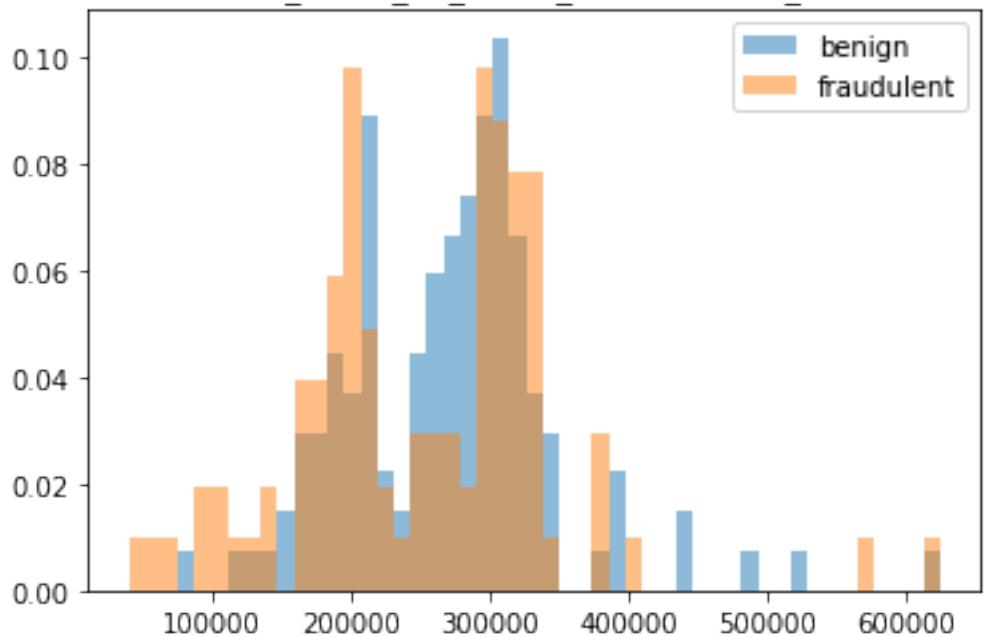
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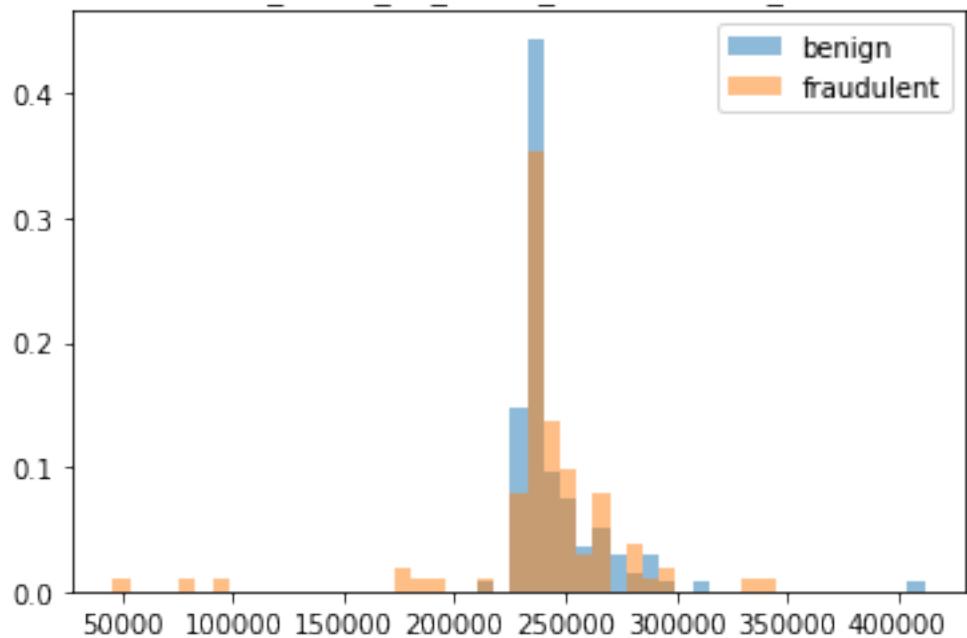
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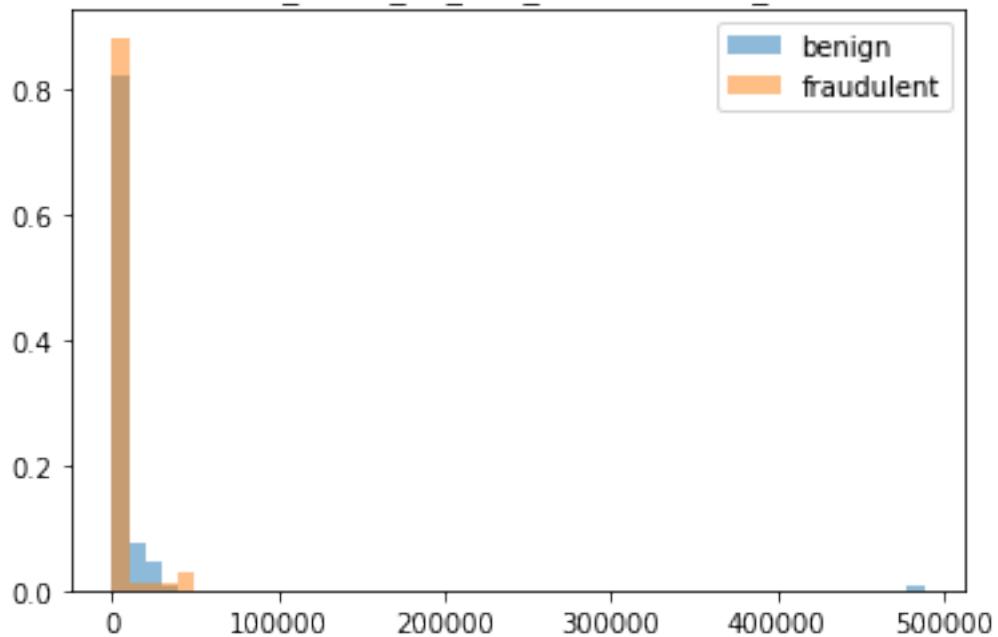
nb_mean_nb_mean_betweenness_3



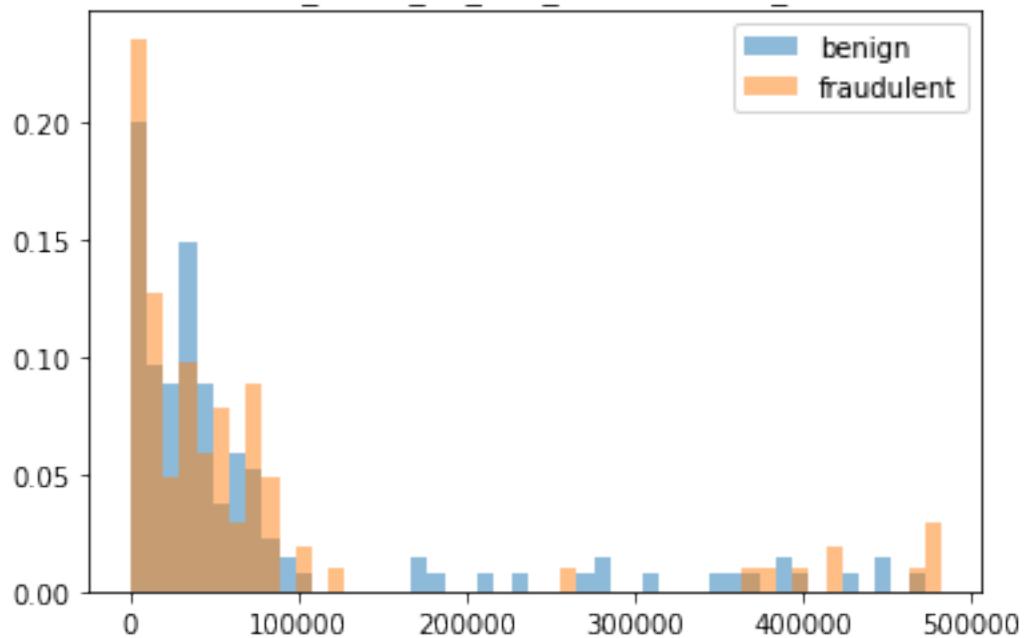
nb_mean_nb_mean_betweenness_4



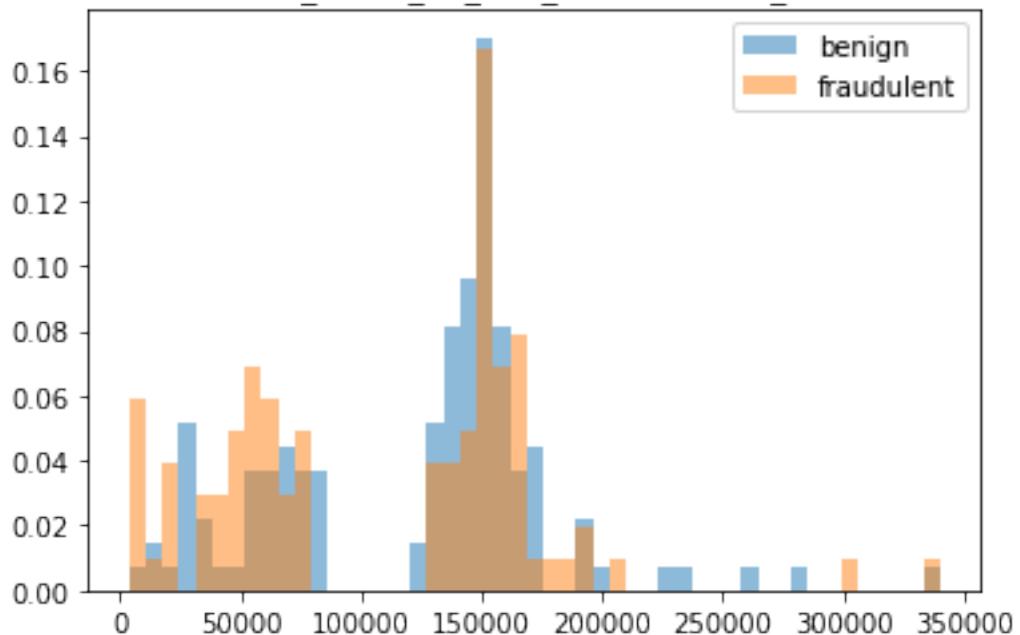
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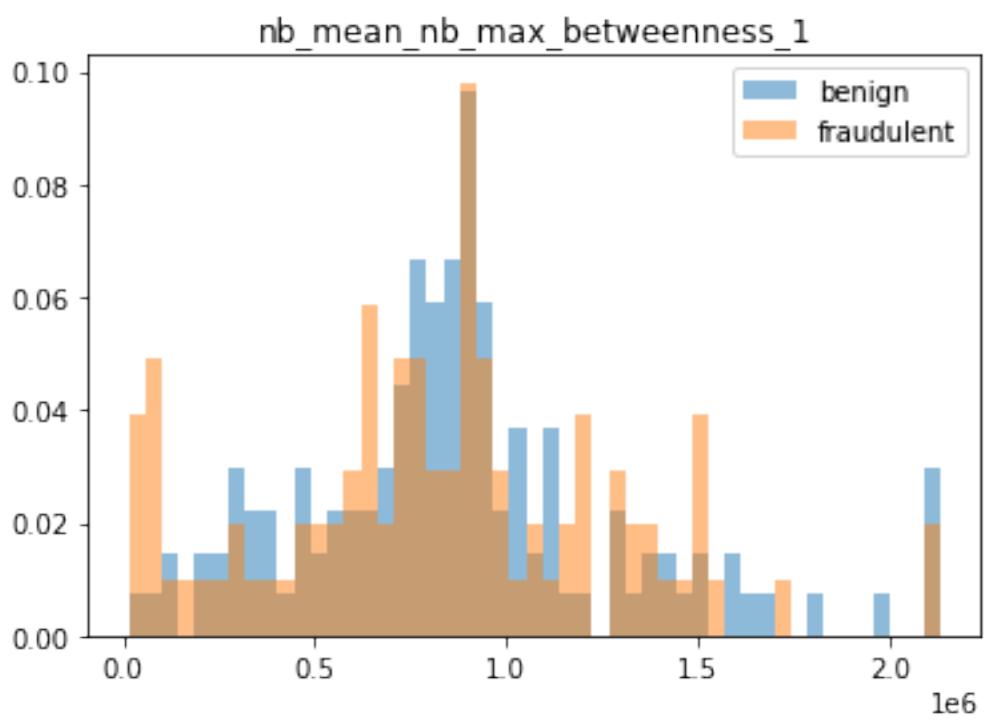
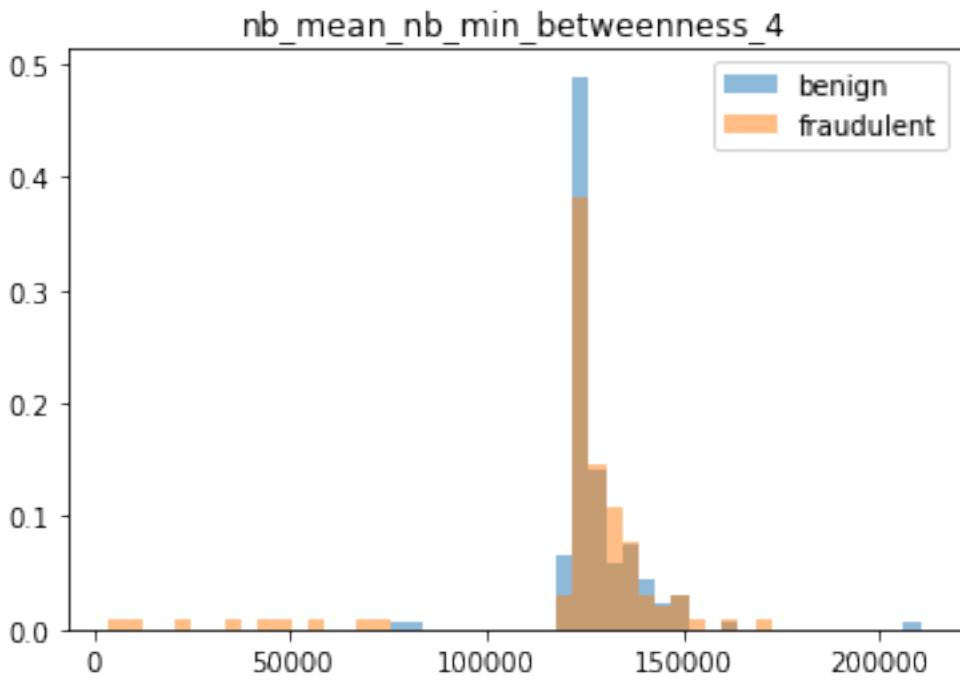


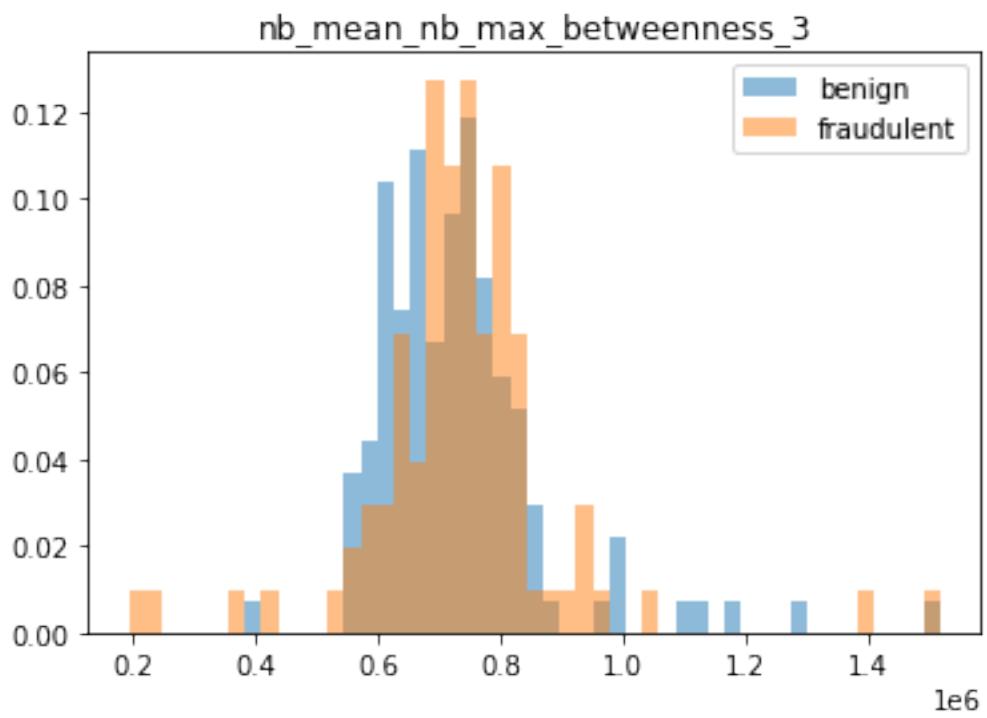
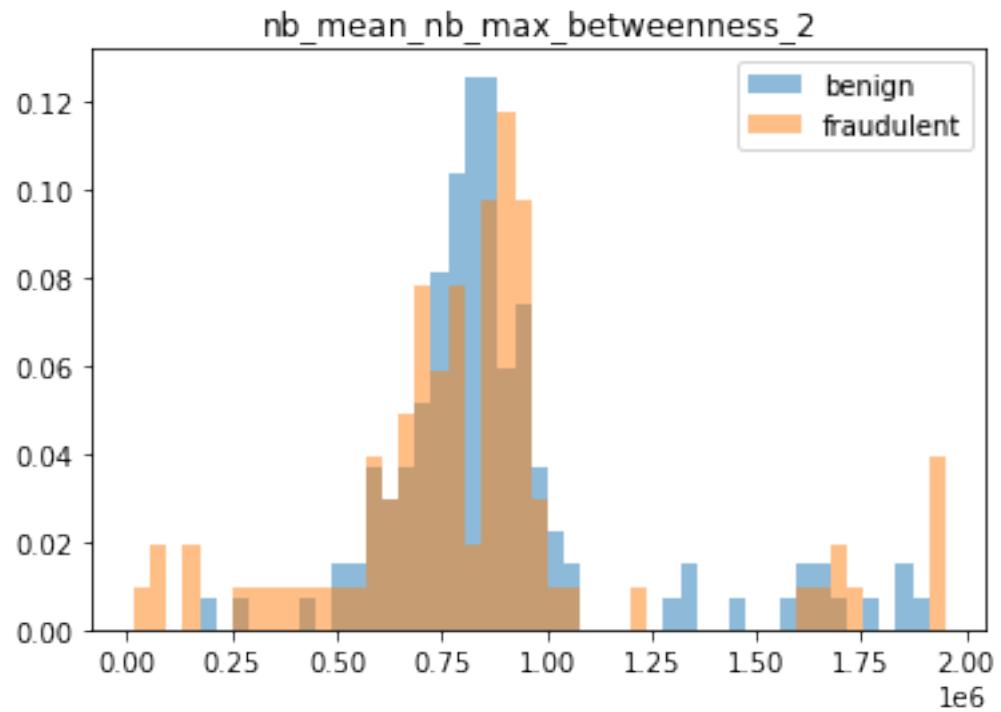
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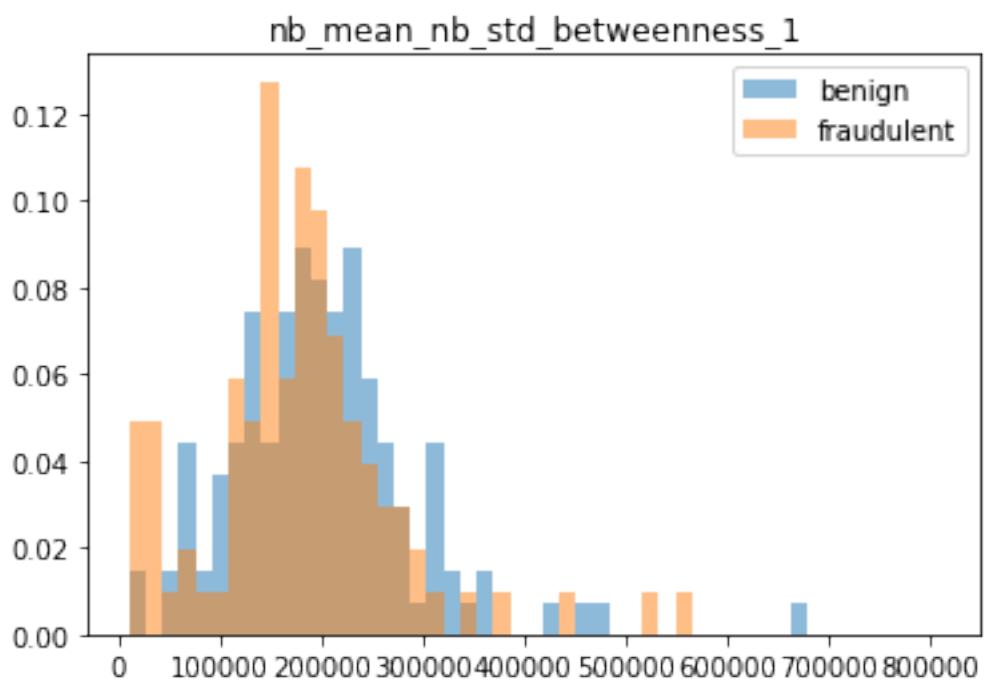
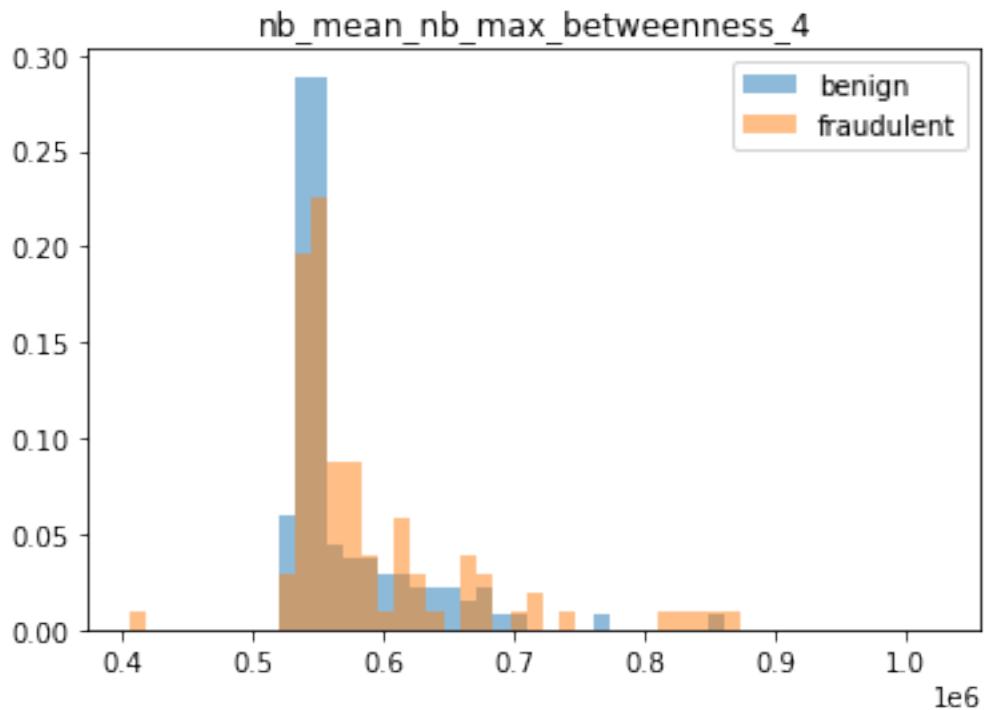


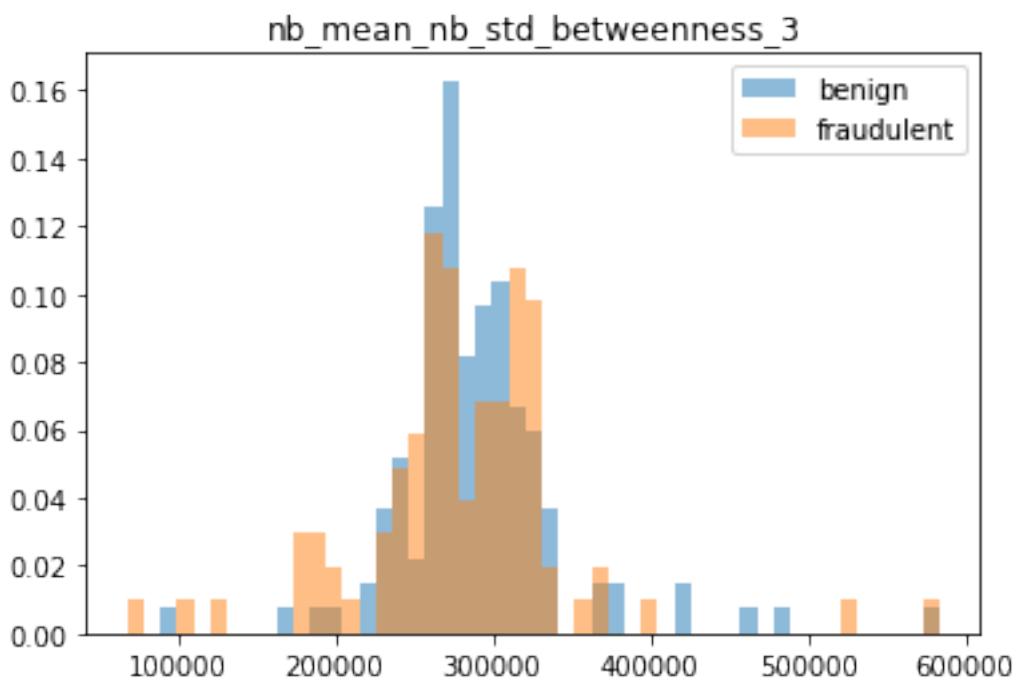
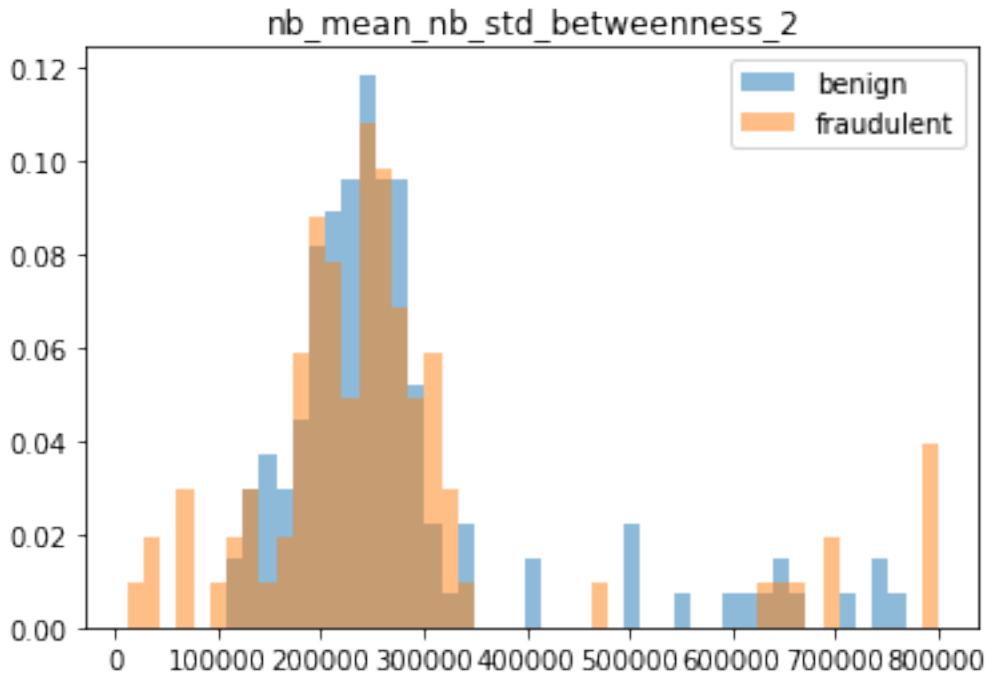
nb_mean_nb_min_betweenness_3

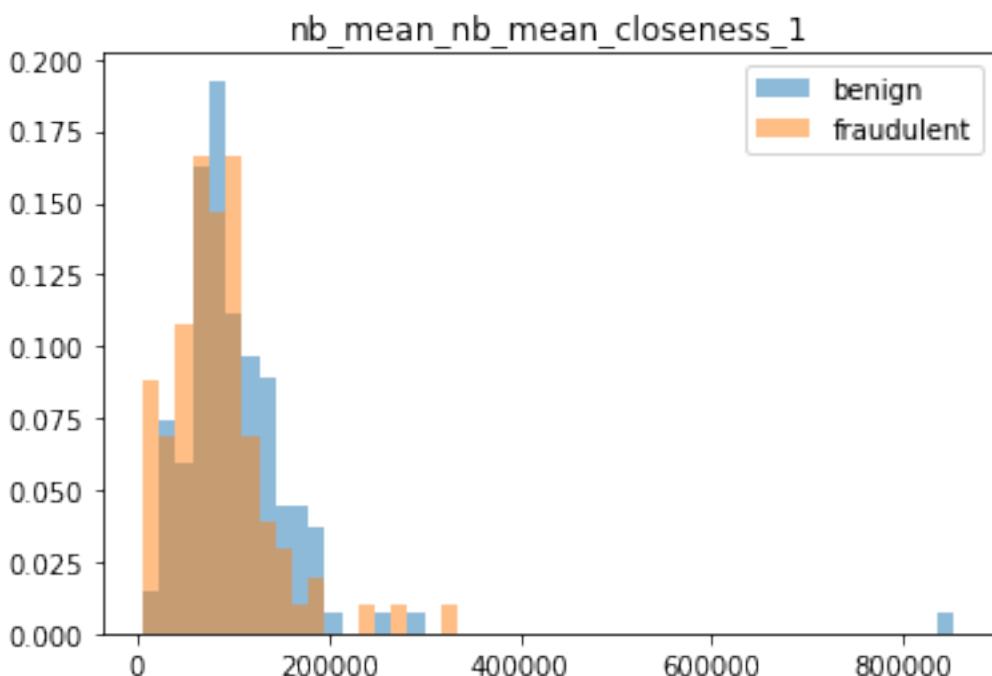
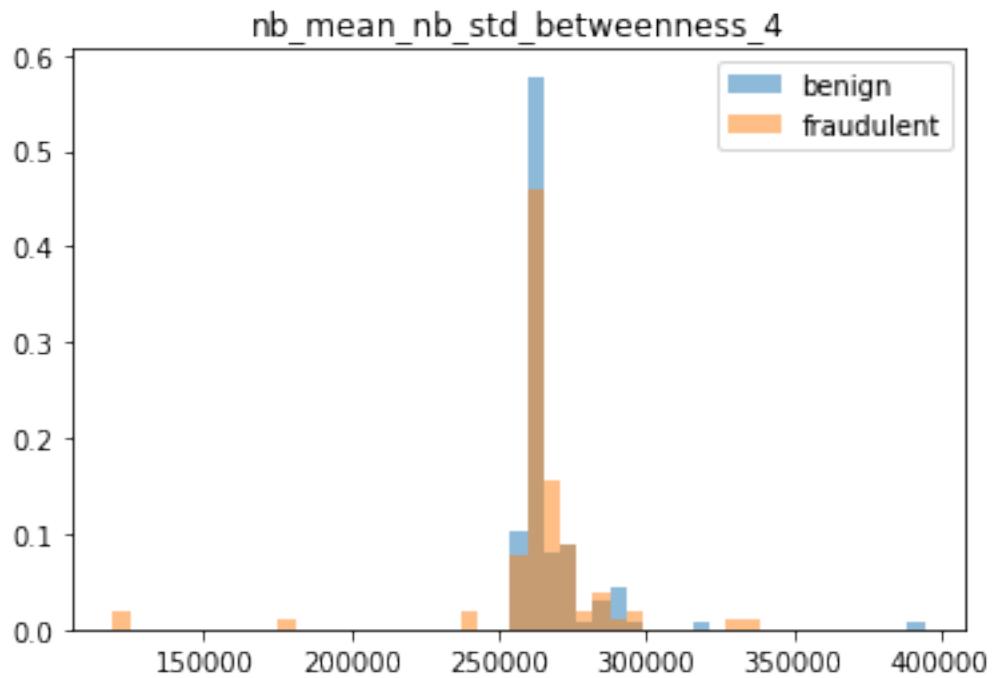




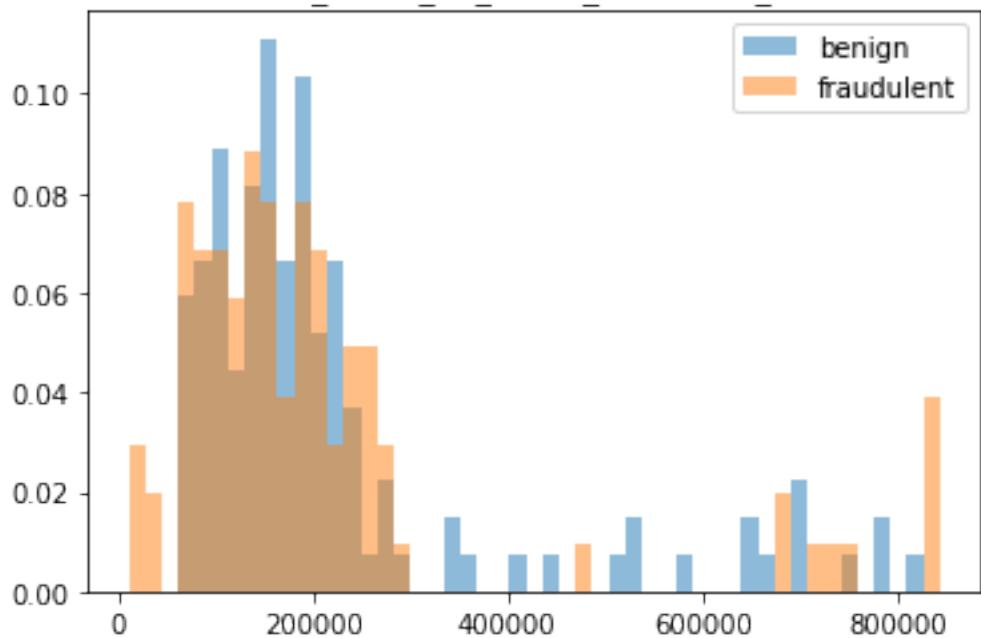




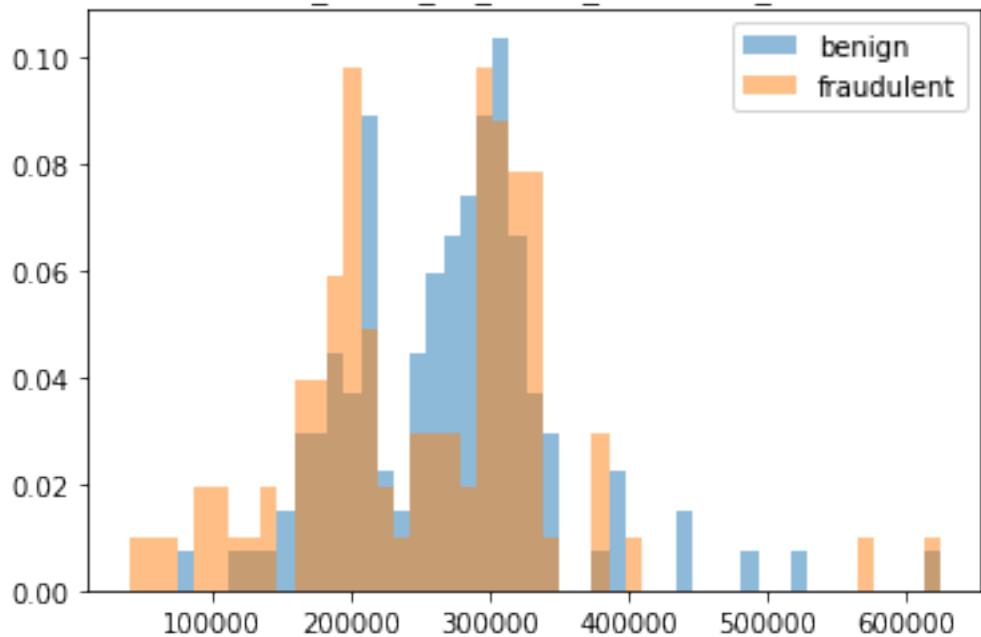


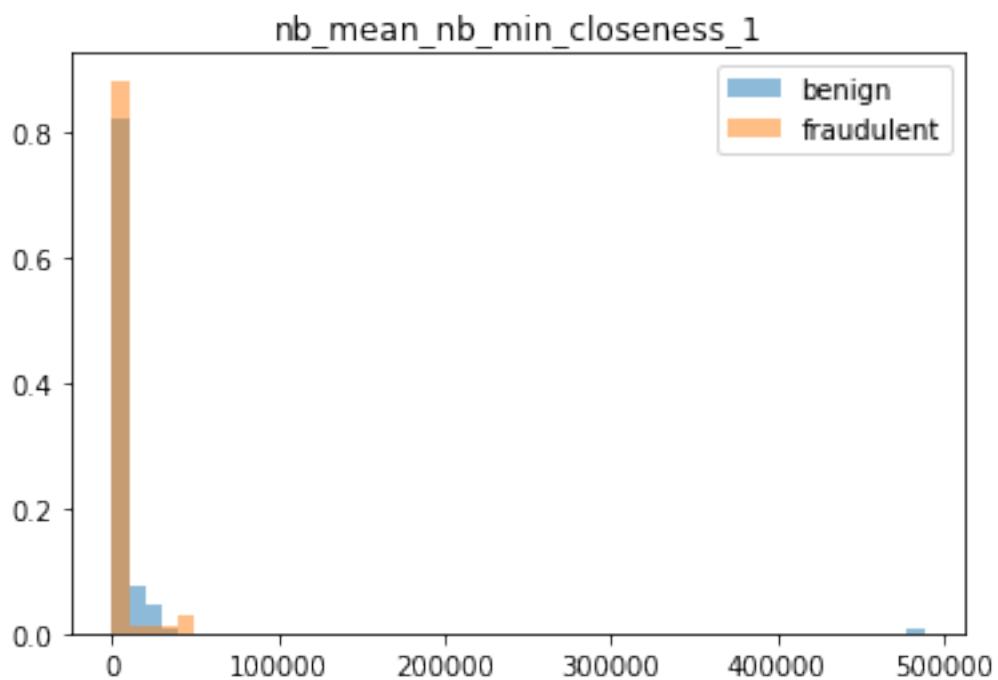
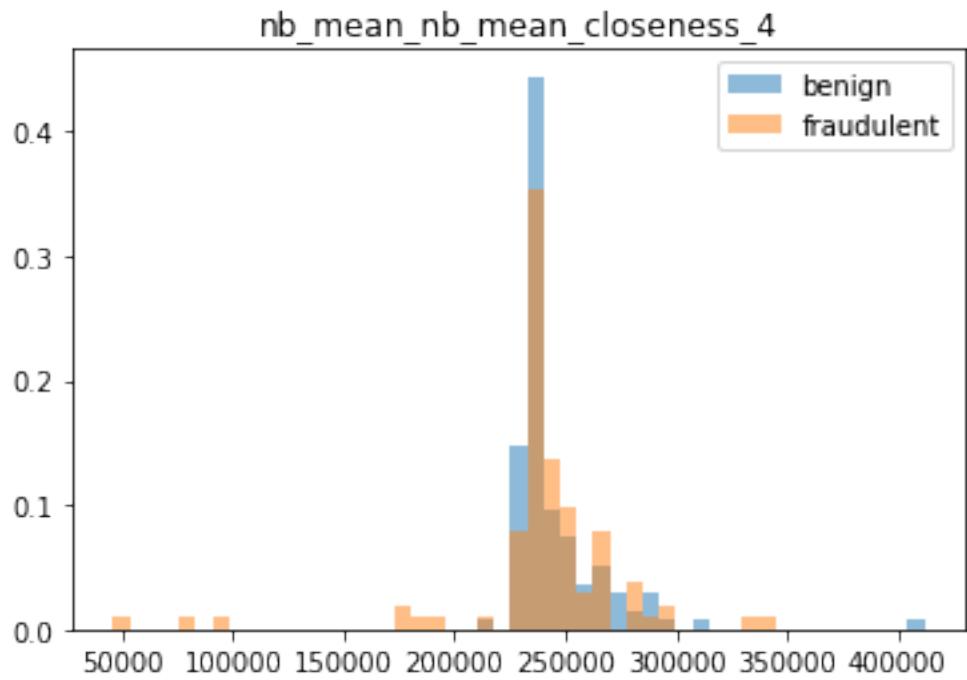


nb_mean_nb_mean_closeness_2

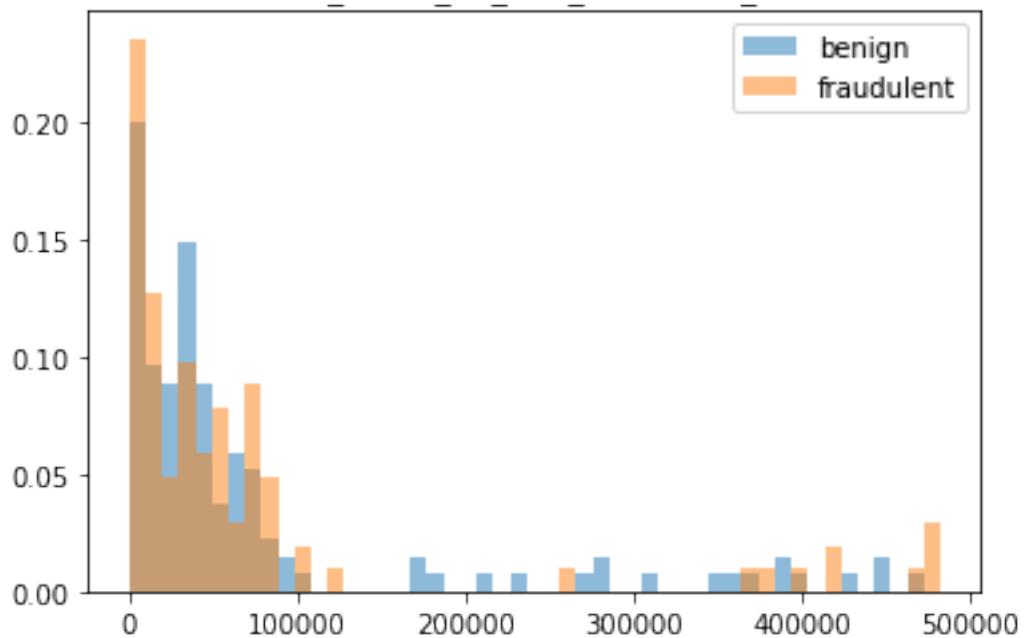


nb_mean_nb_mean_closeness_3

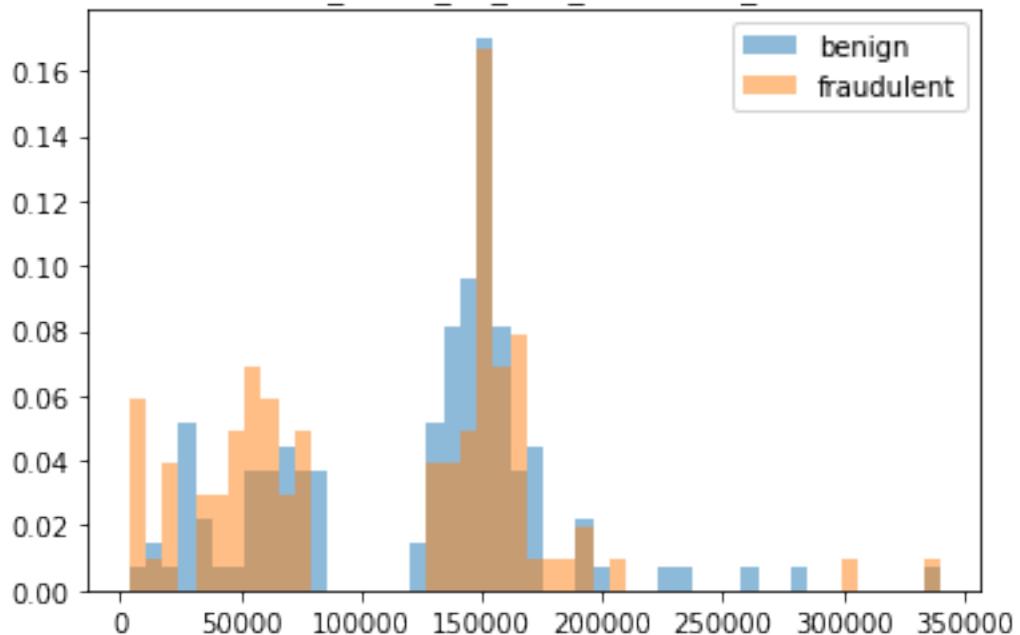


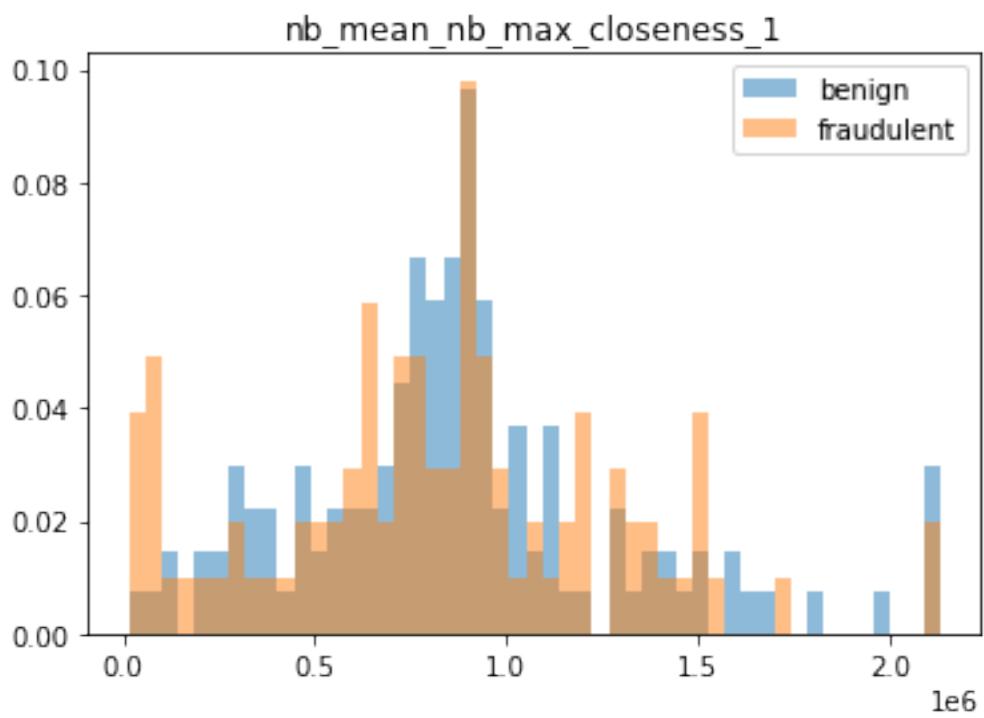
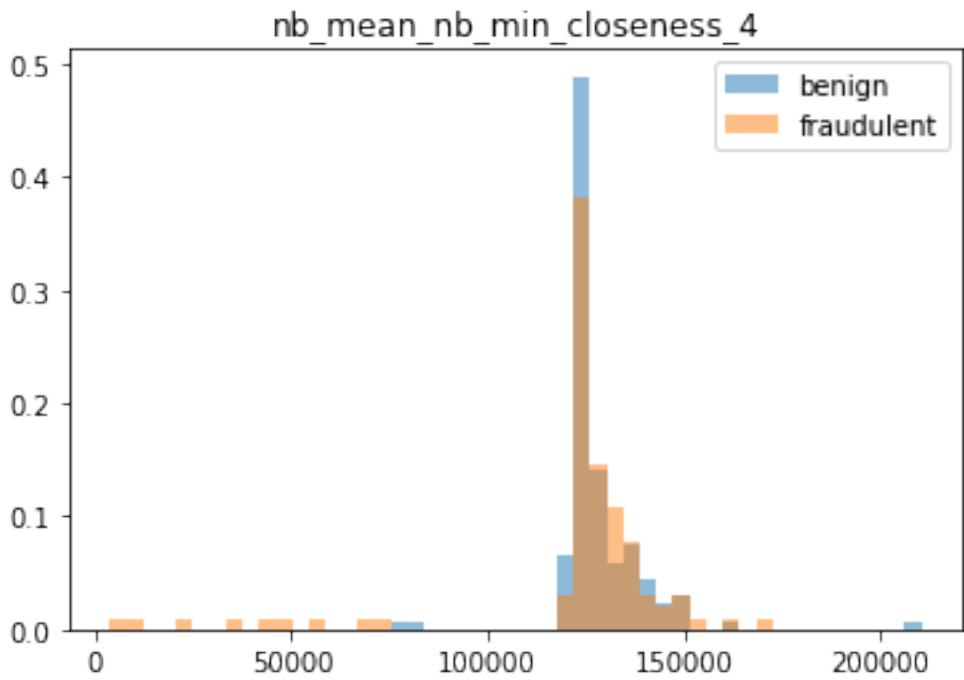


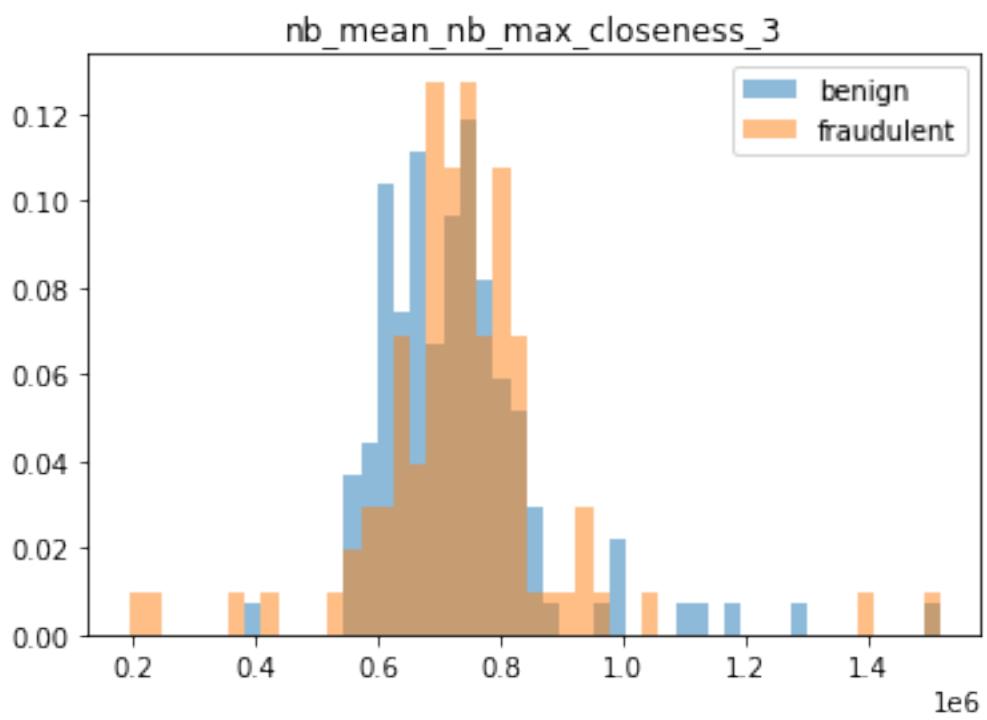
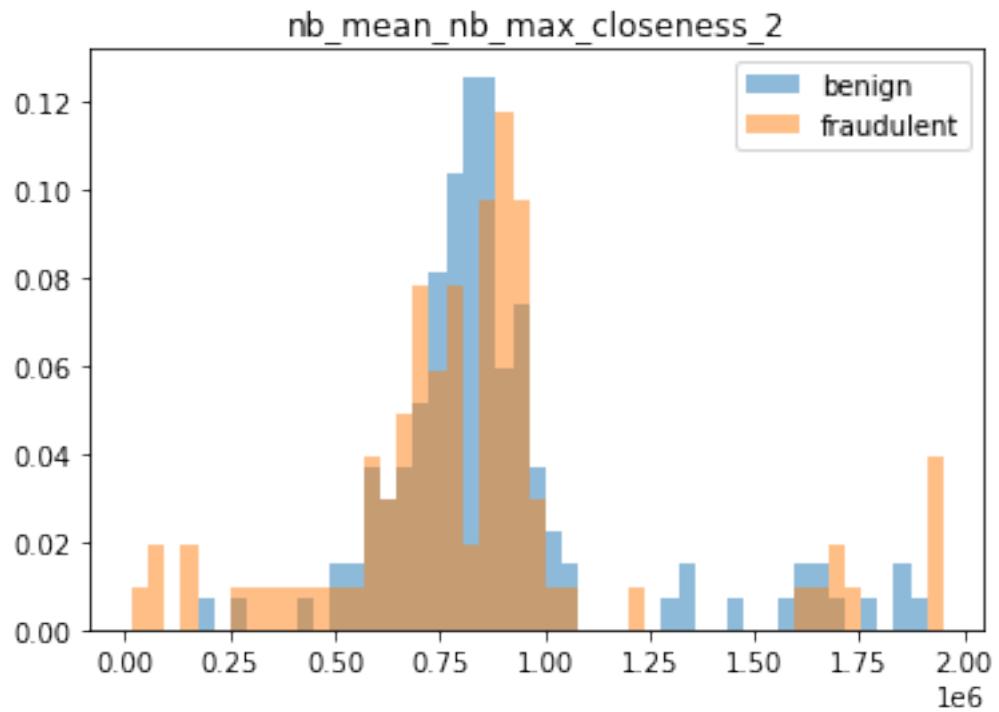
nb_mean_nb_min_closeness_2

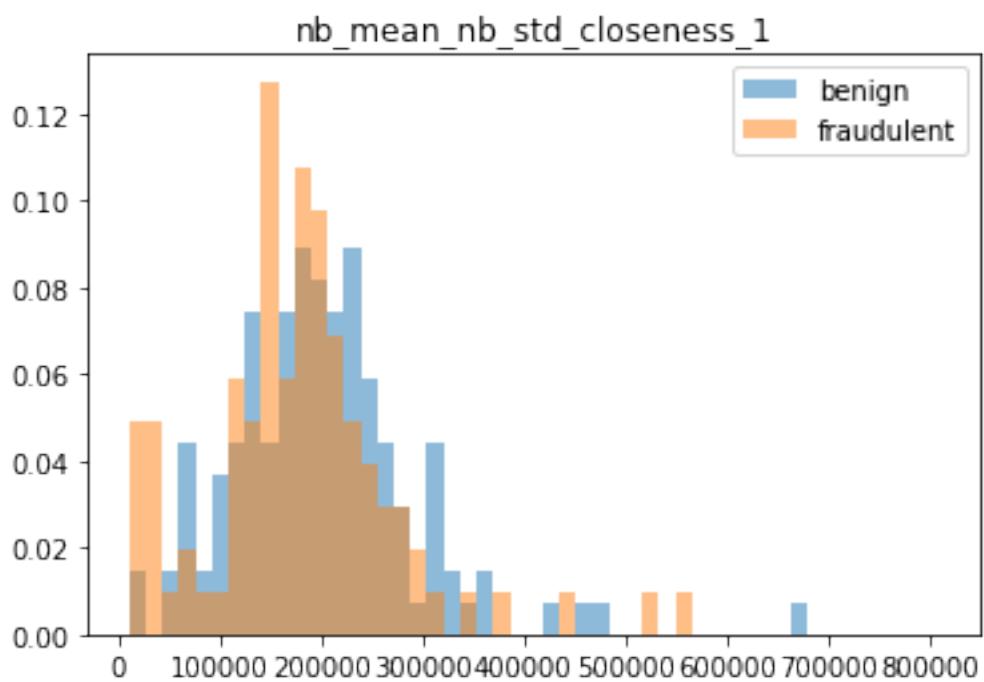
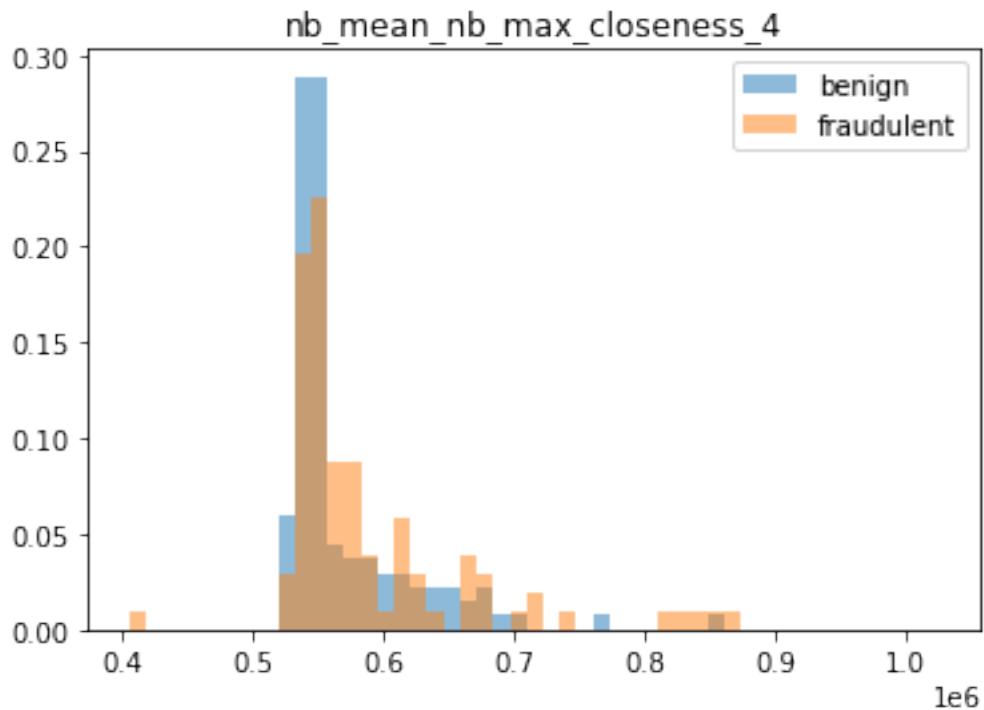


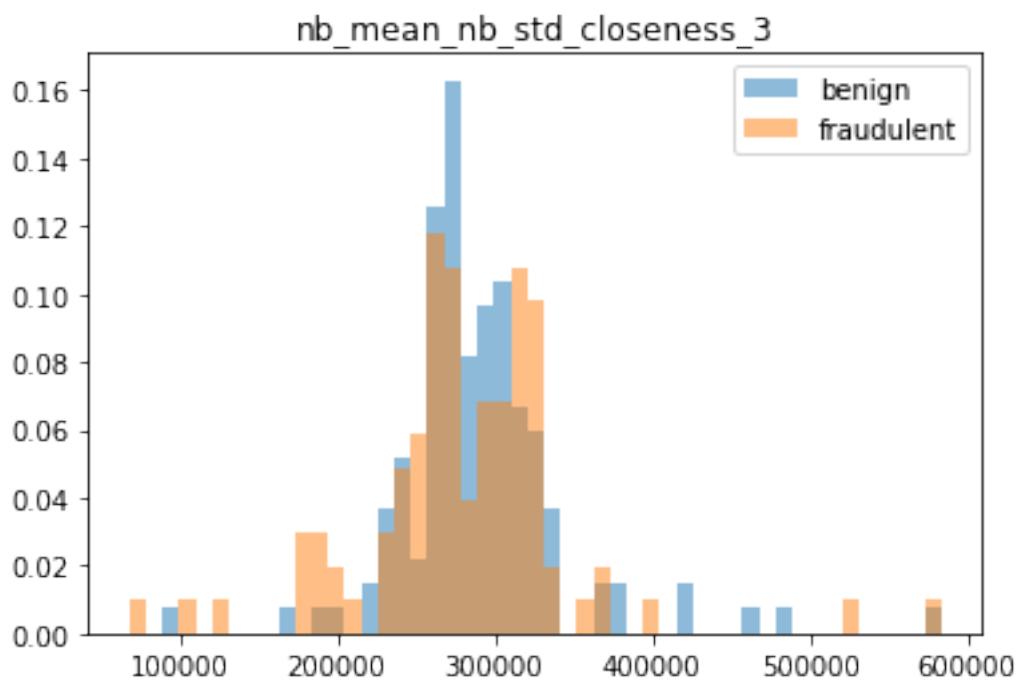
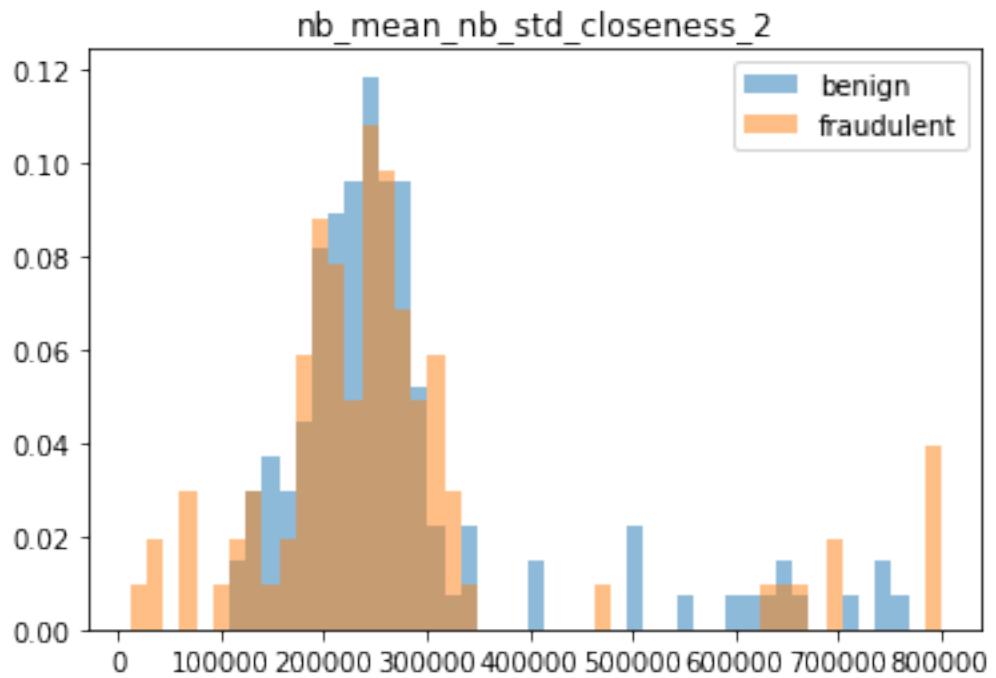
nb_mean_nb_min_closeness_3

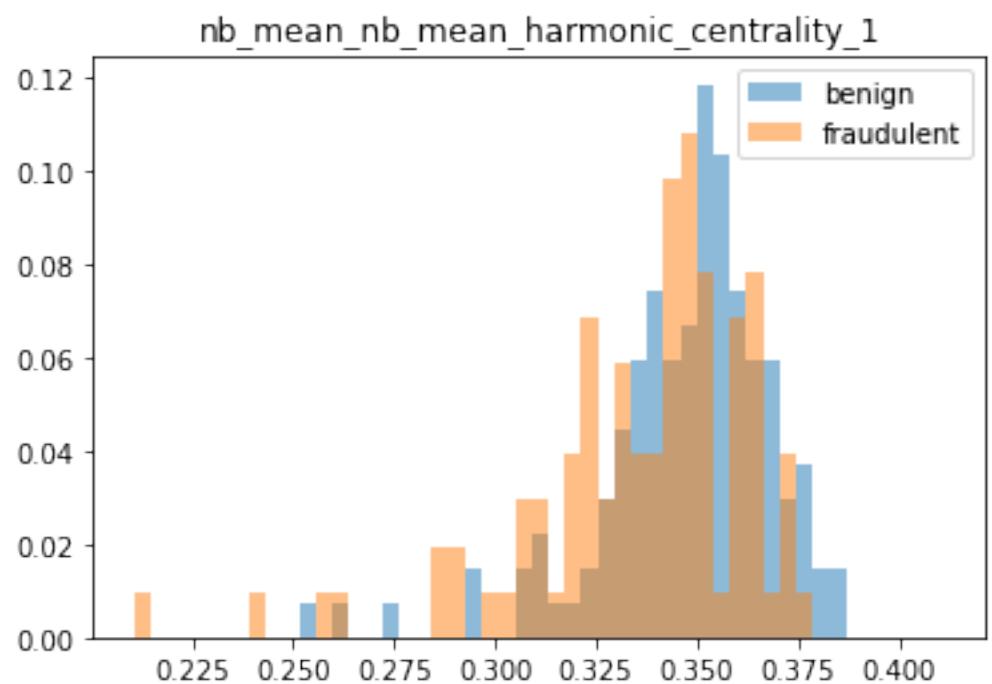
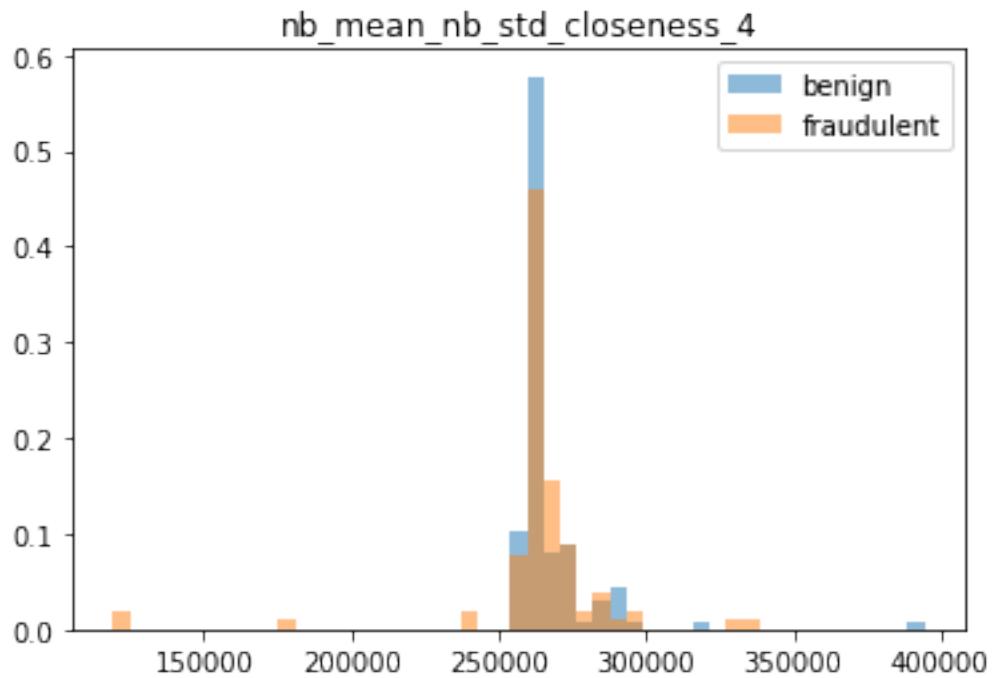




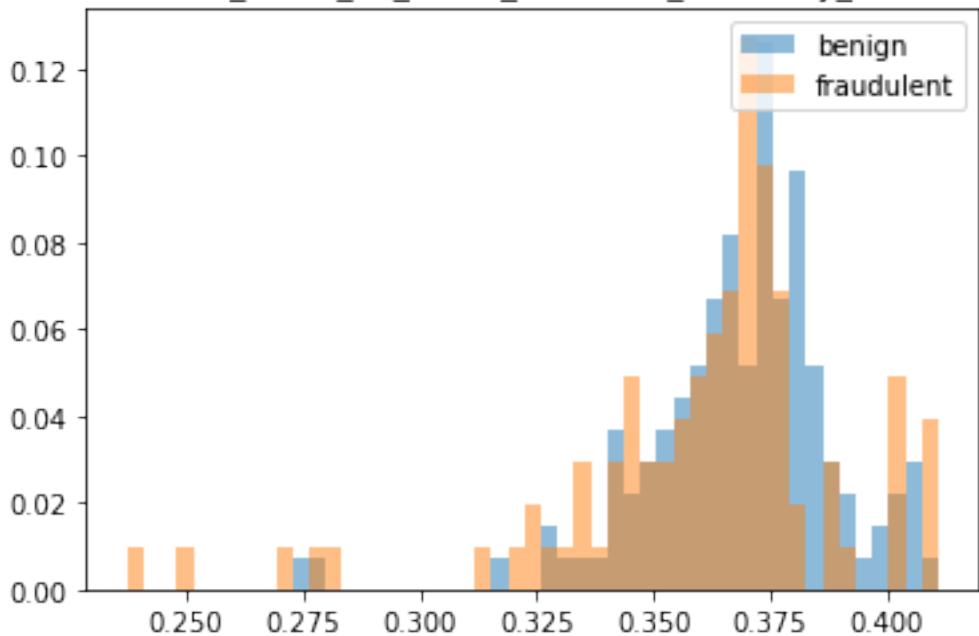




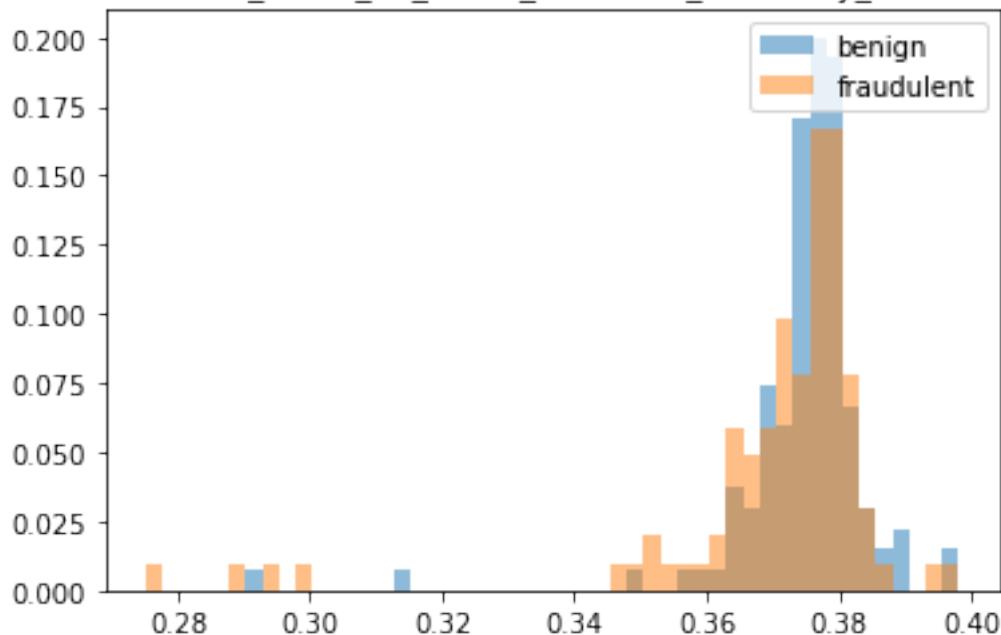




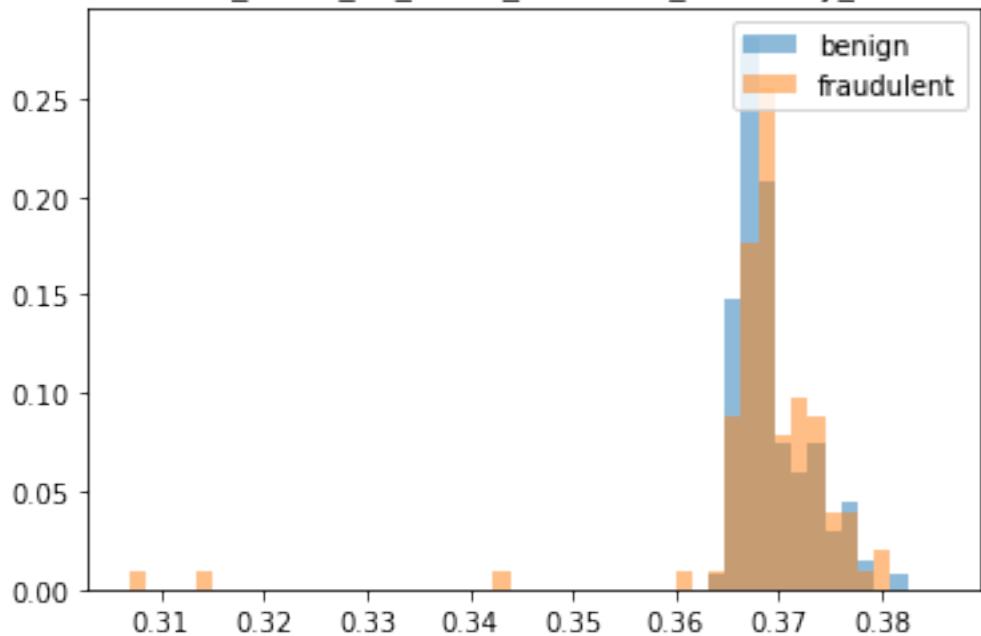
nb_mean_nb_mean_harmonic_centrality_2



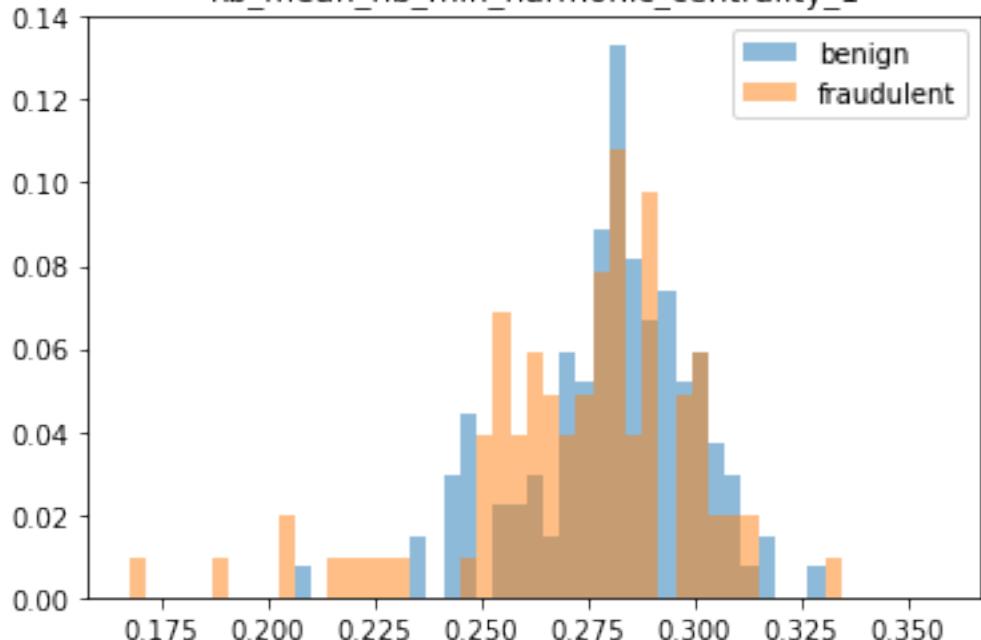
nb_mean_nb_mean_harmonic_centrality_3



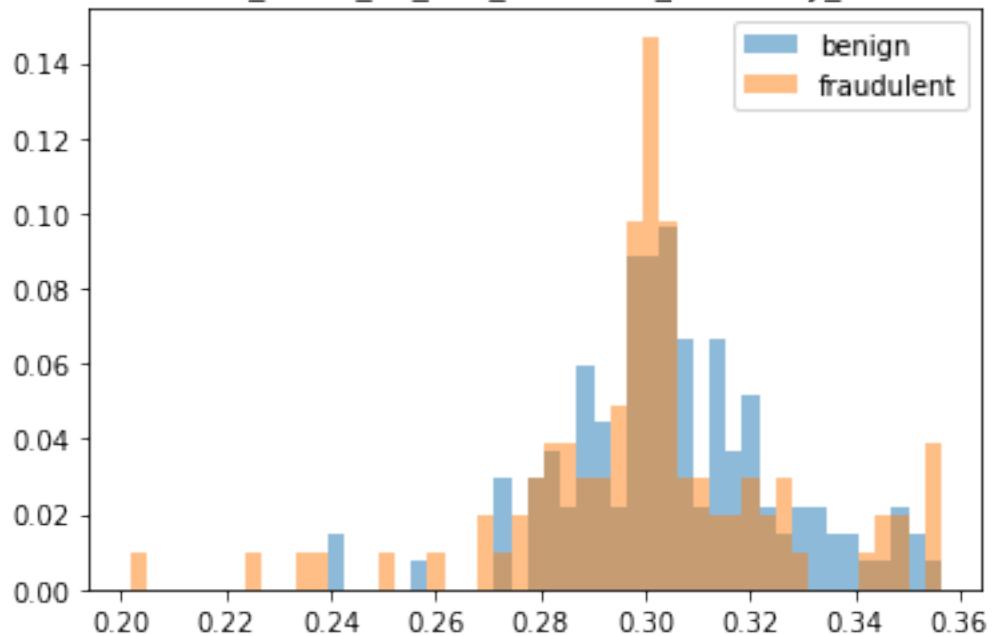
nb_mean_nb_mean_harmonic_centrality_4



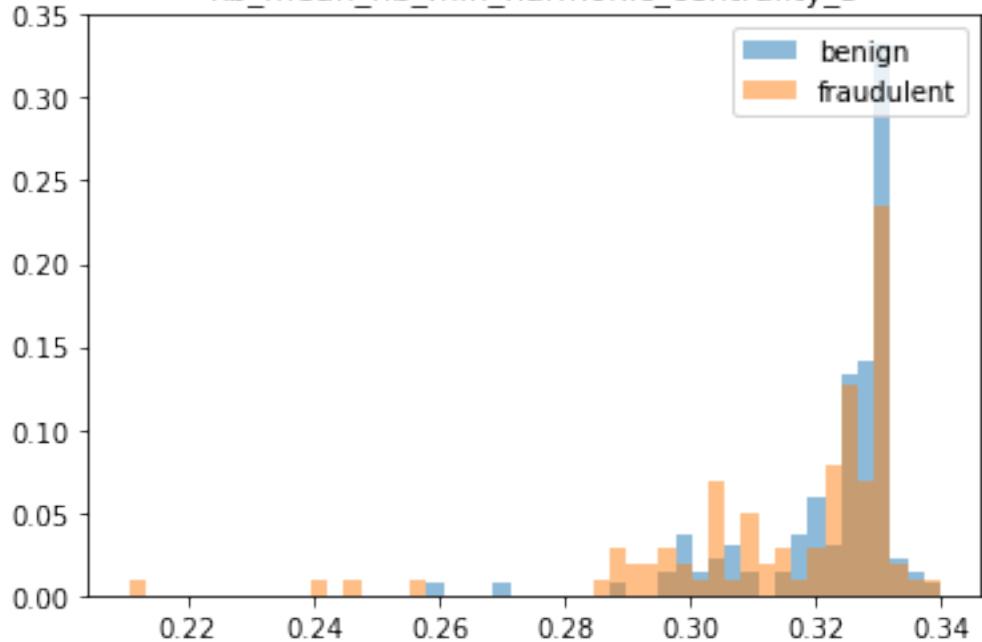
nb_mean_nb_min_harmonic_centrality_1



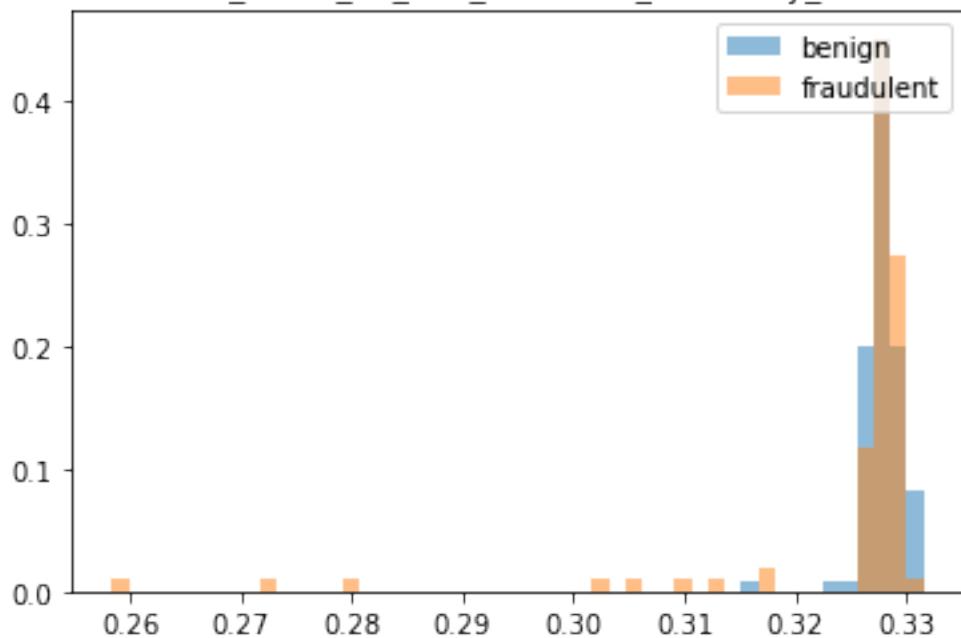
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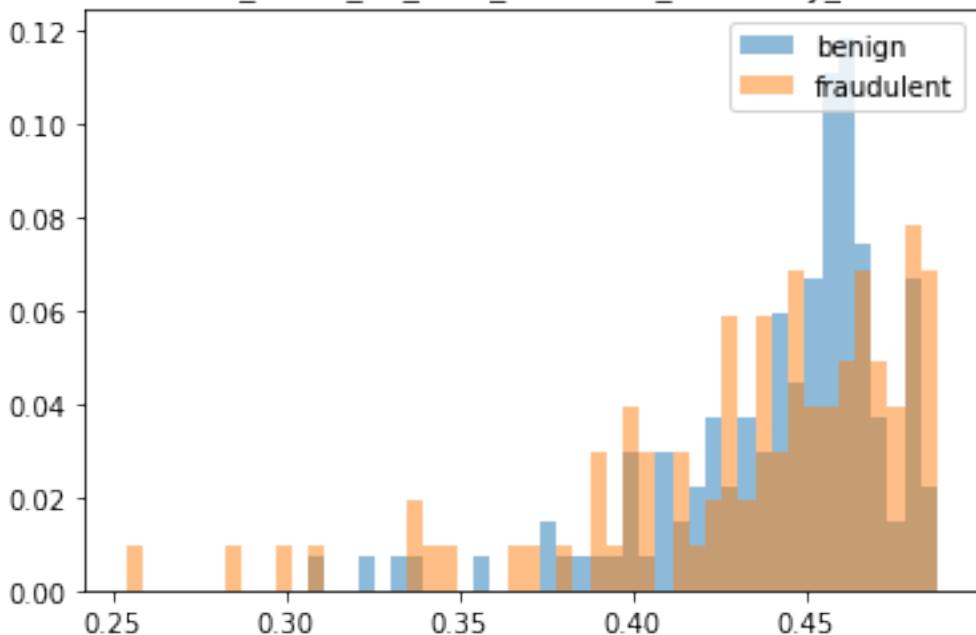
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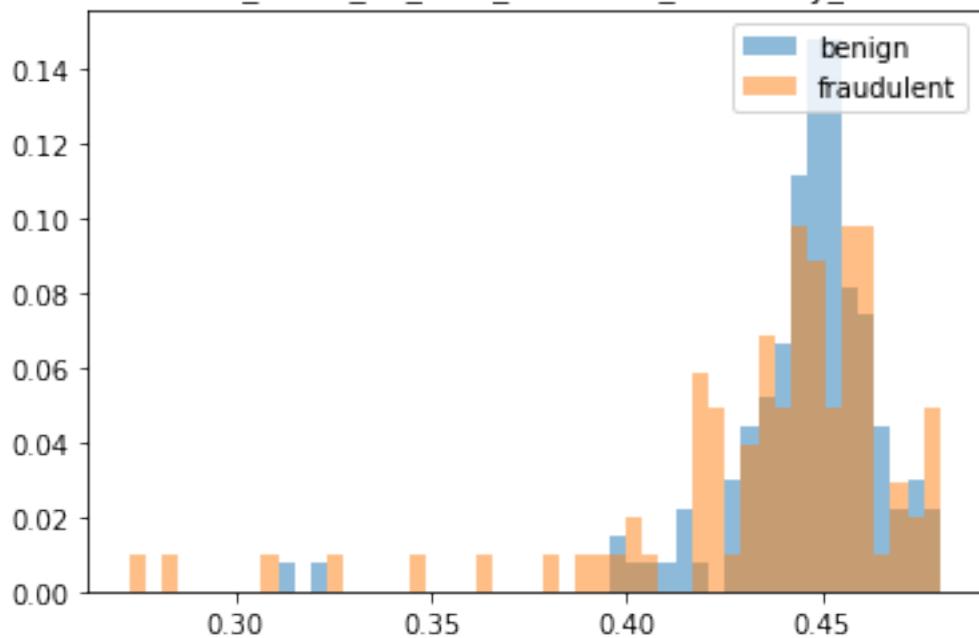
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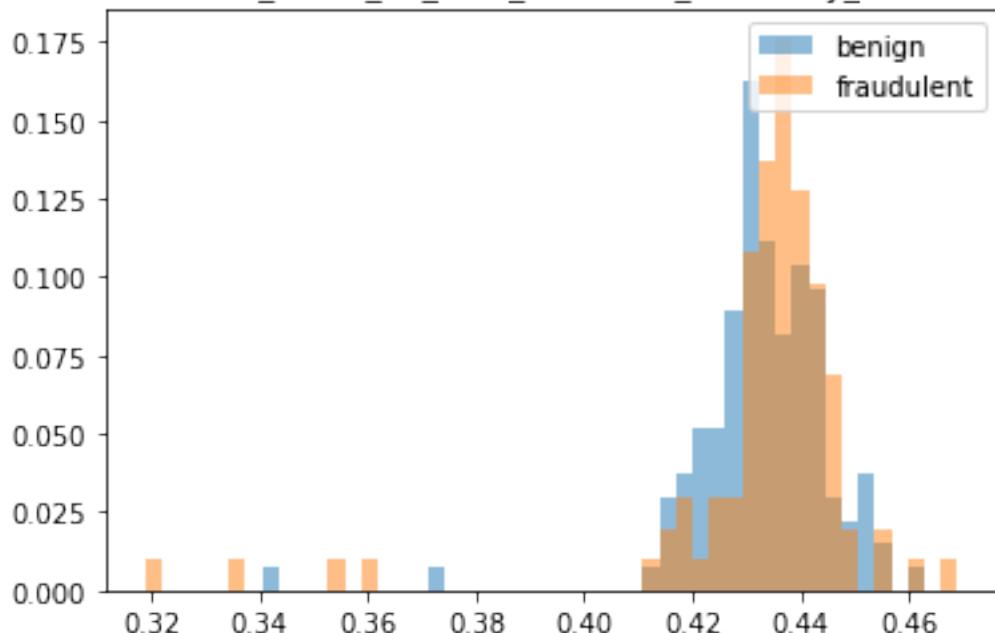
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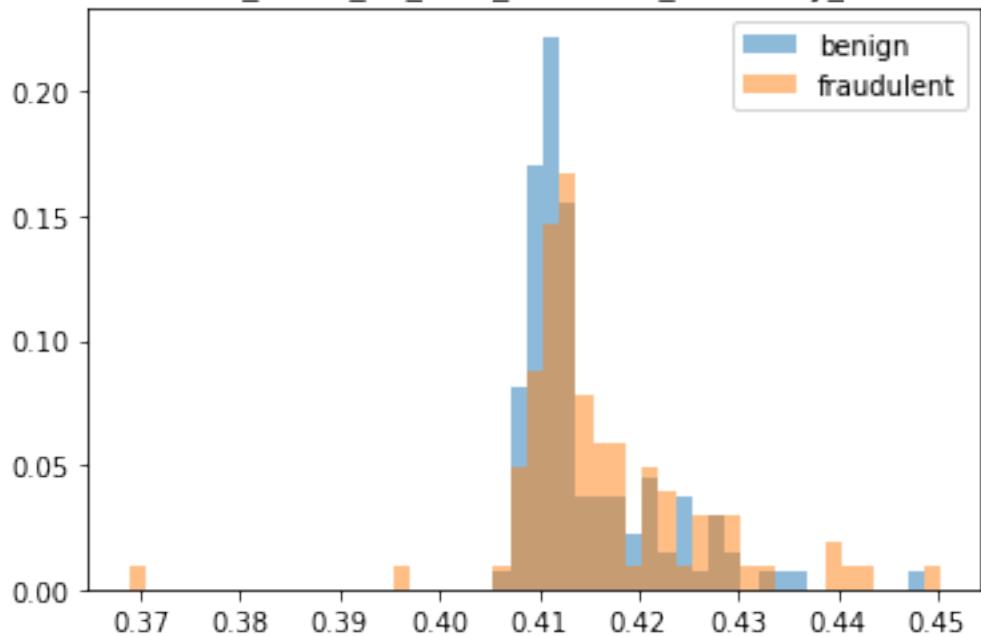
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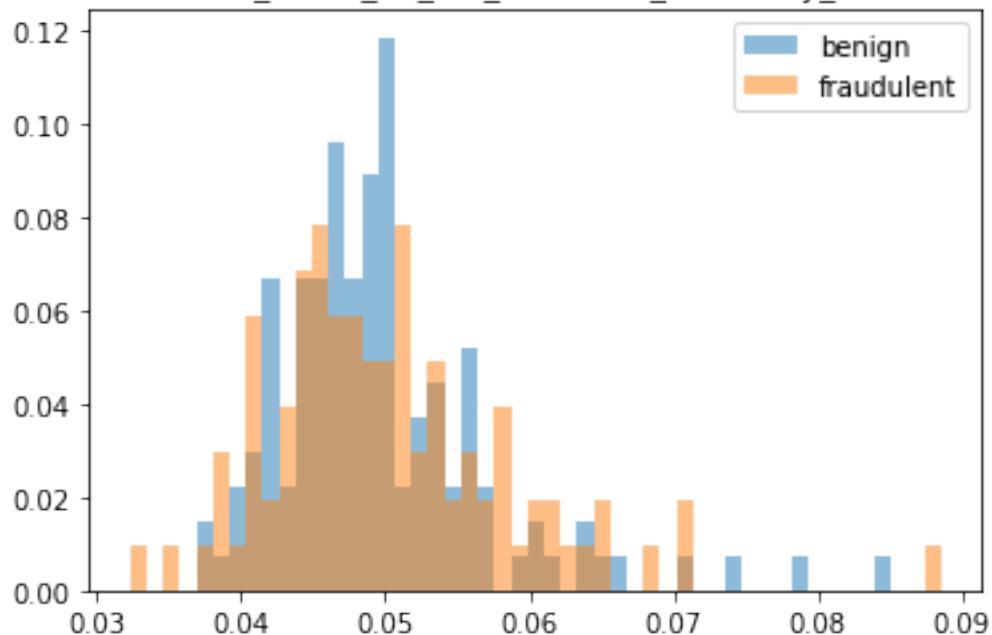
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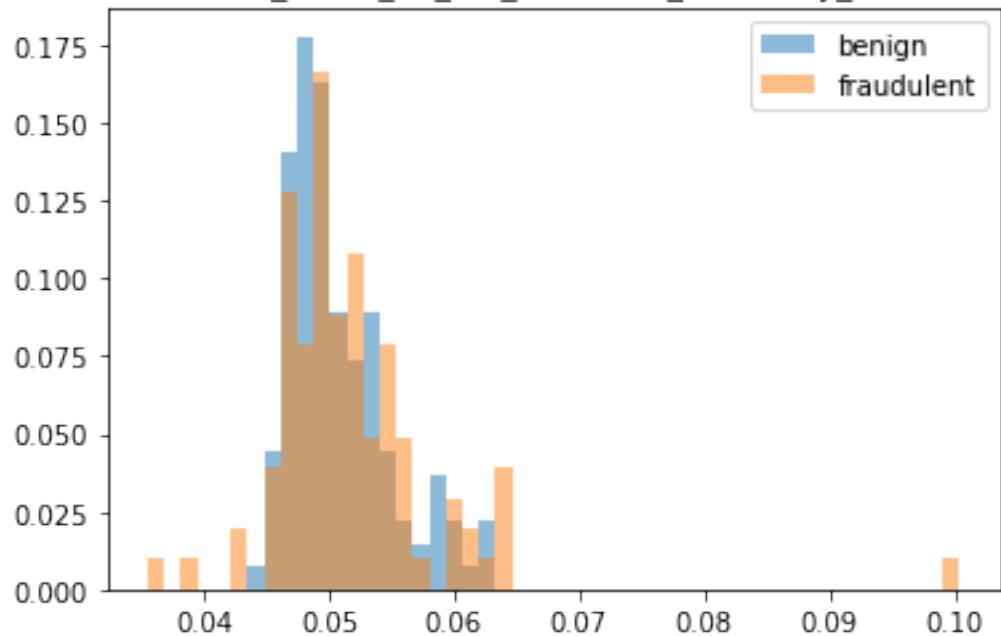
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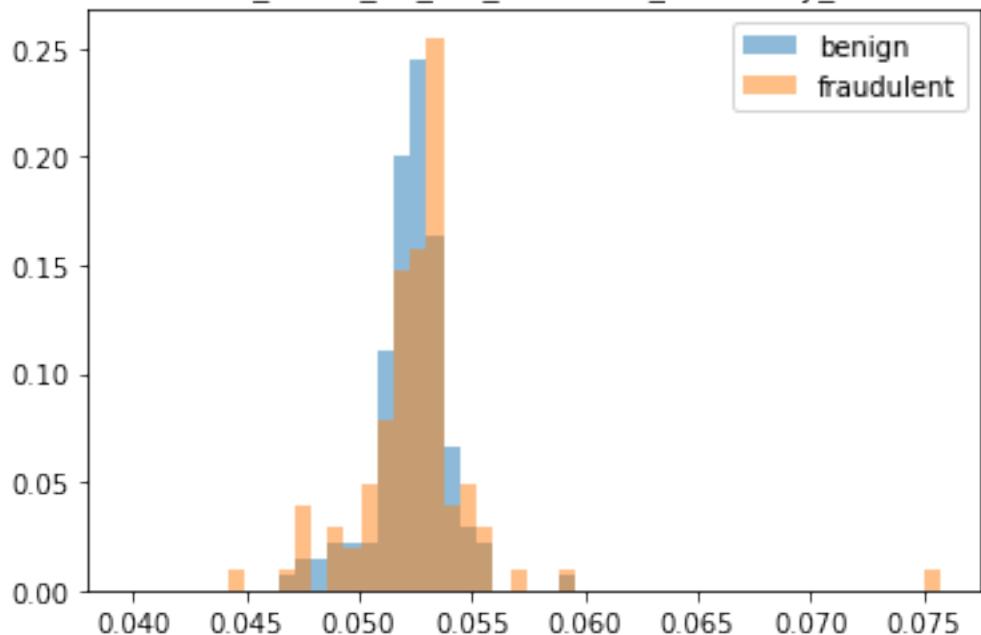
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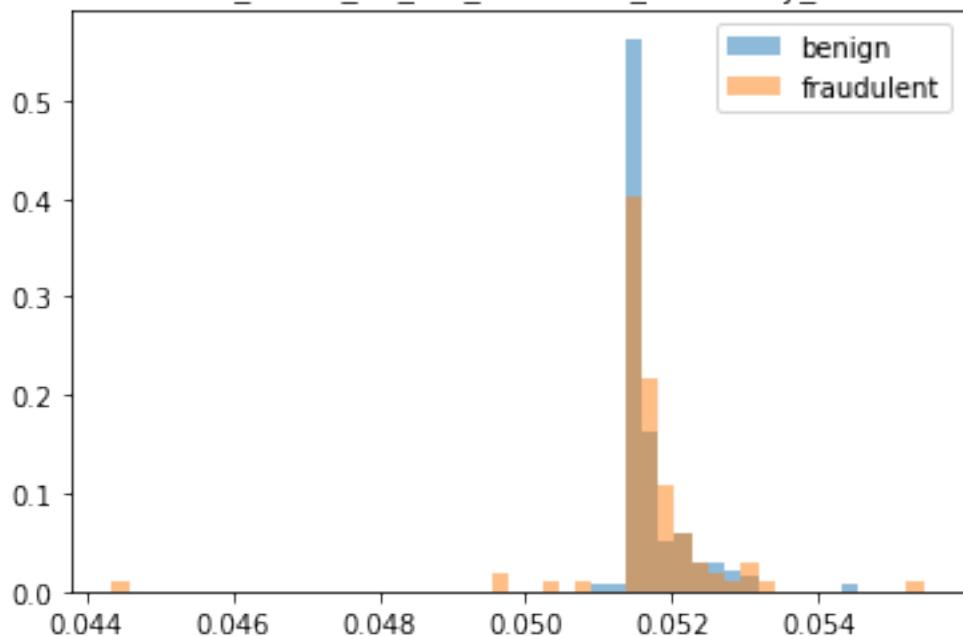
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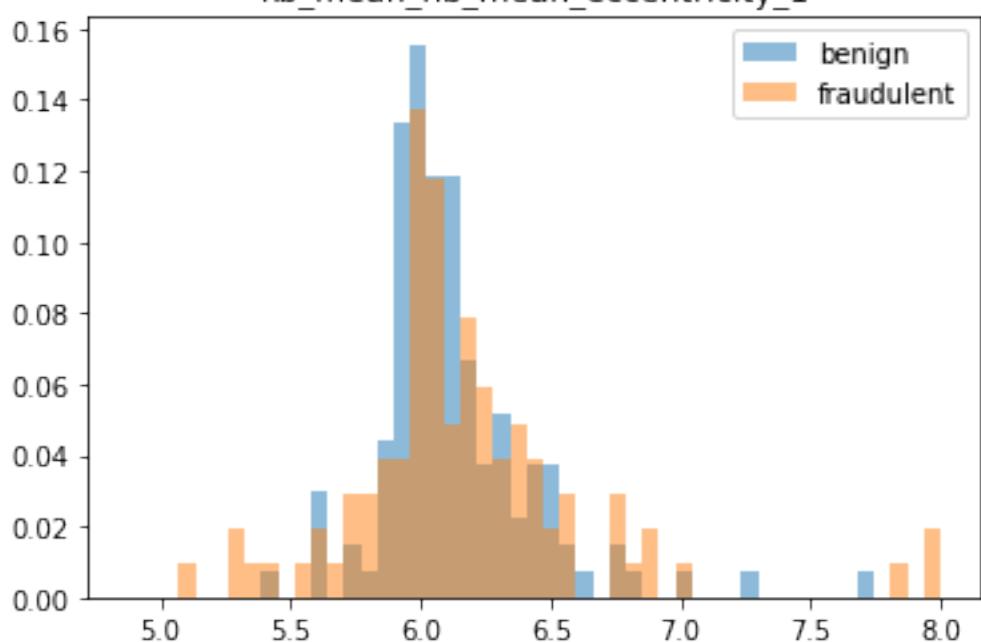
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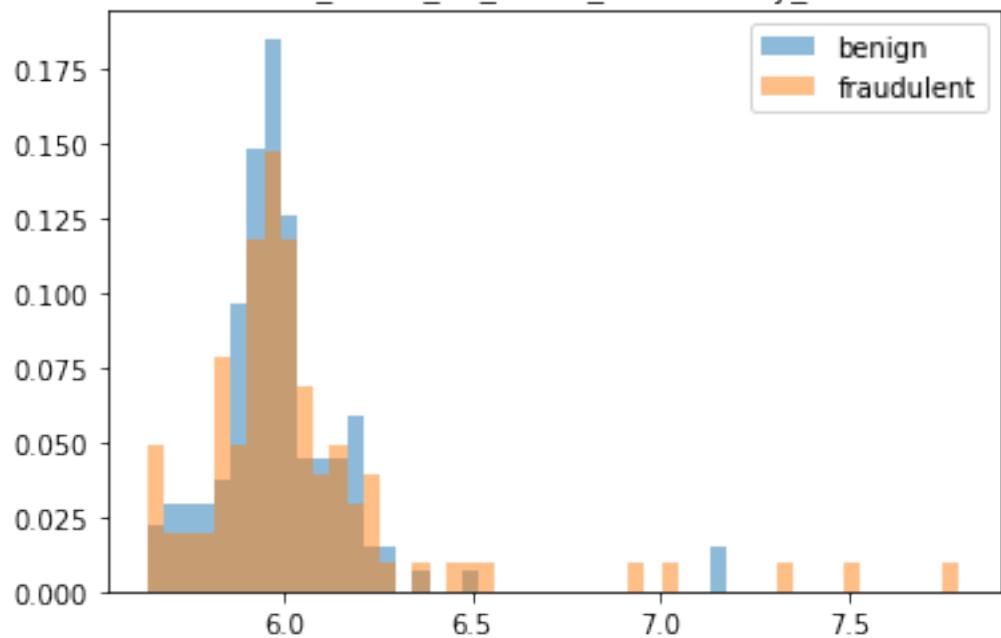
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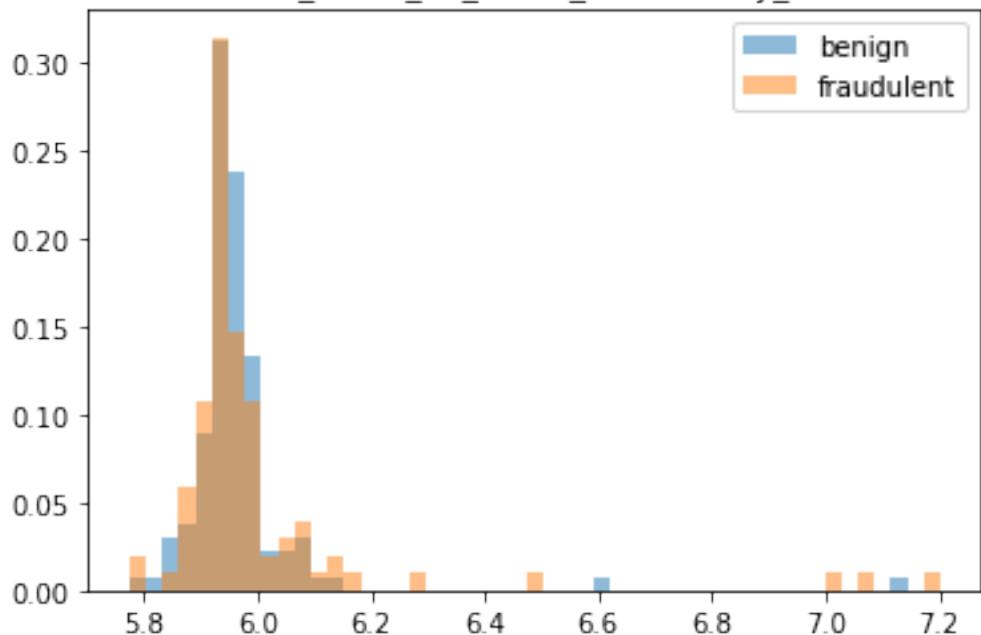
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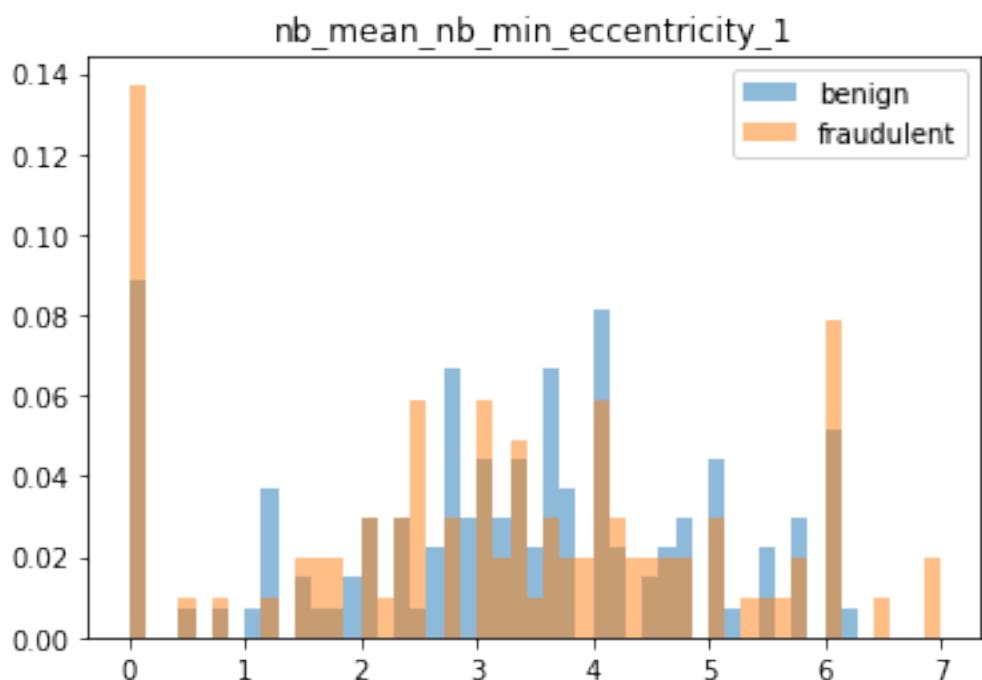
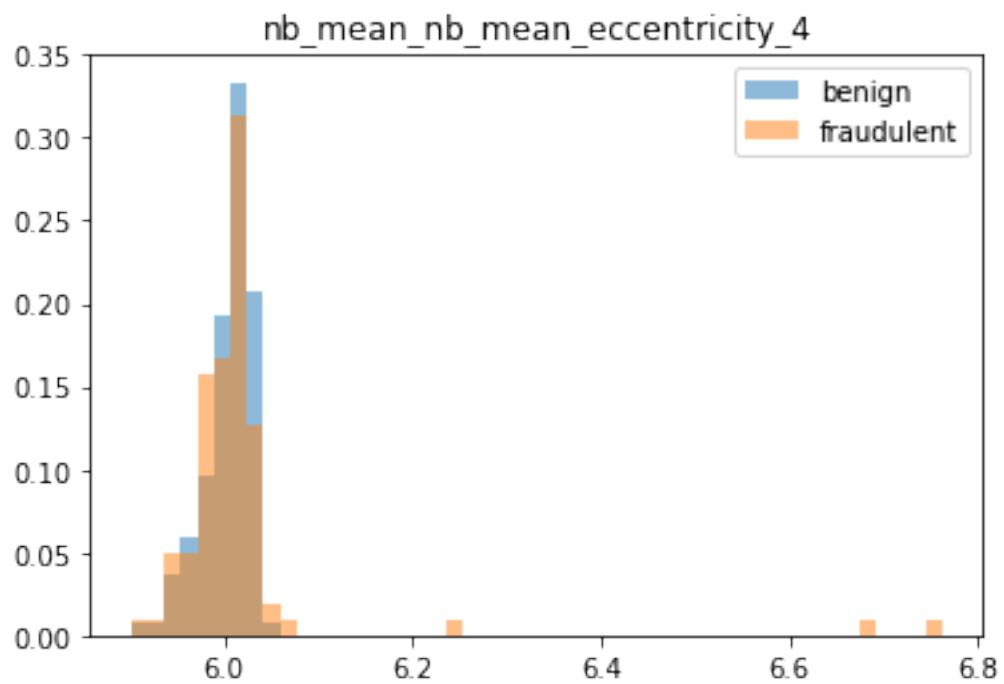


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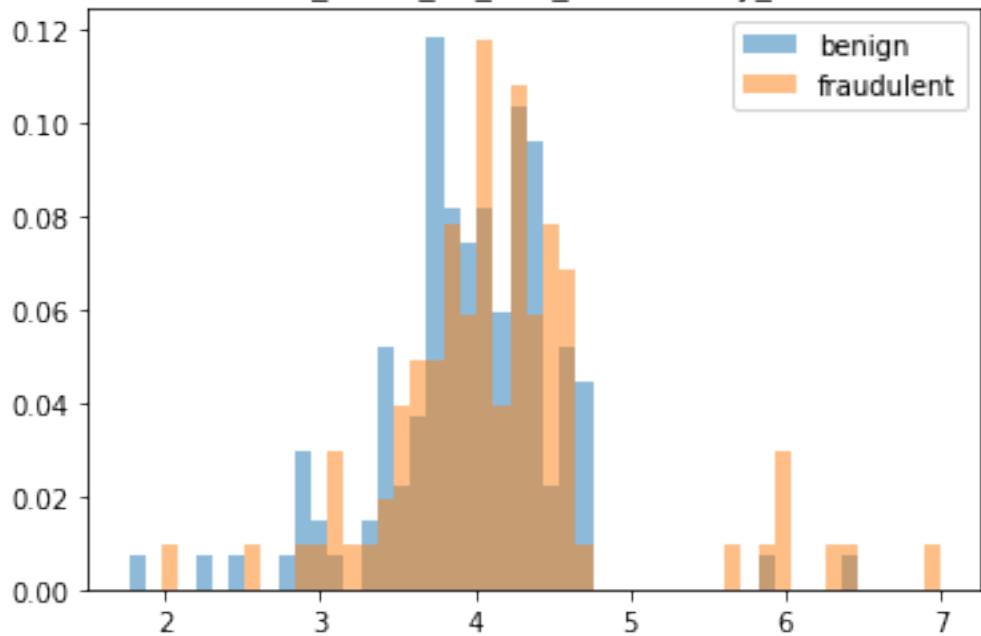


nb_mean_nb_mean_eccentricity_3

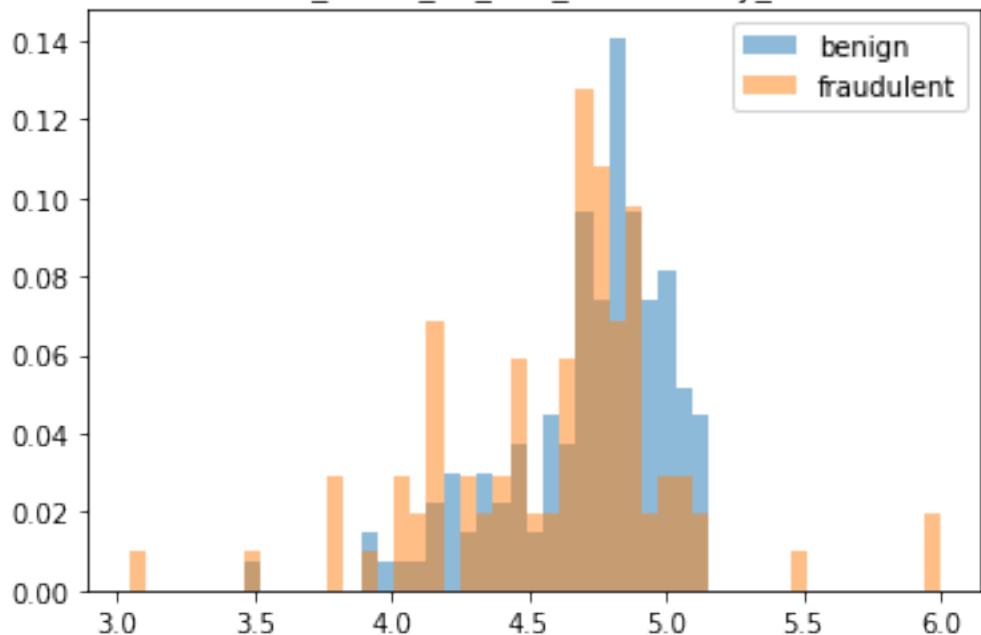




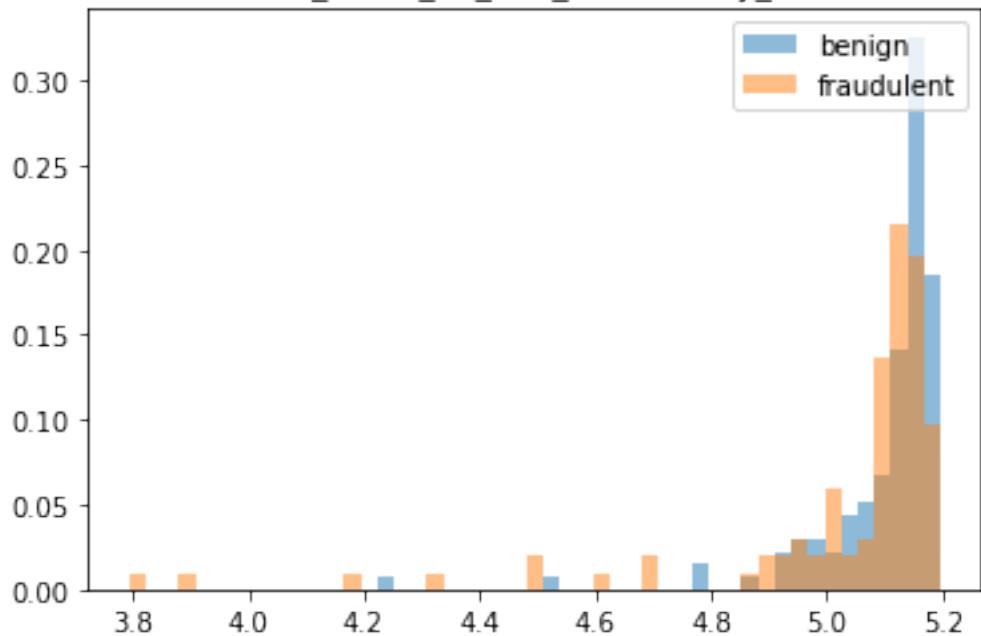
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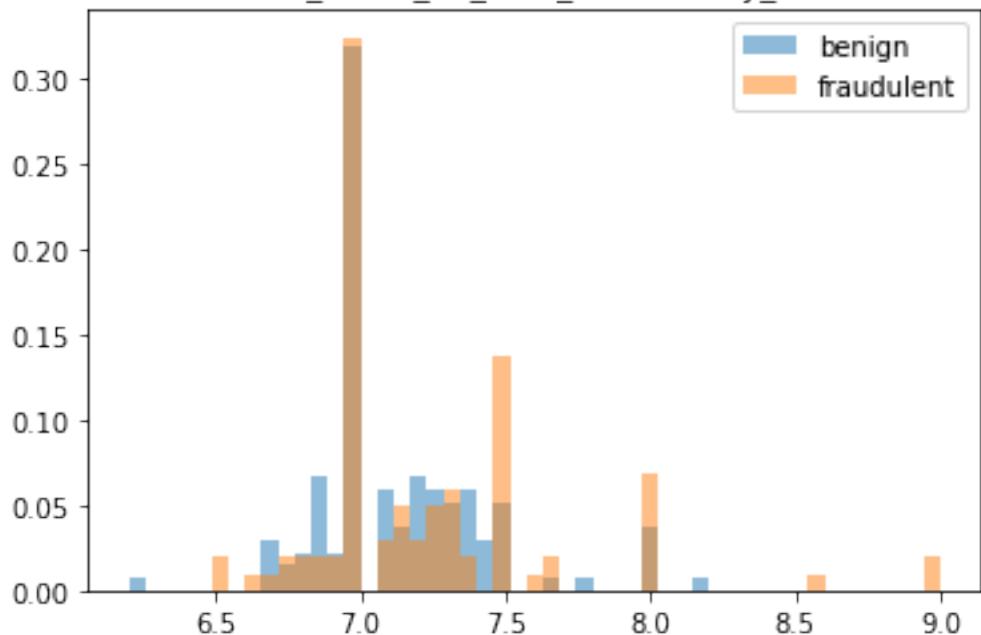
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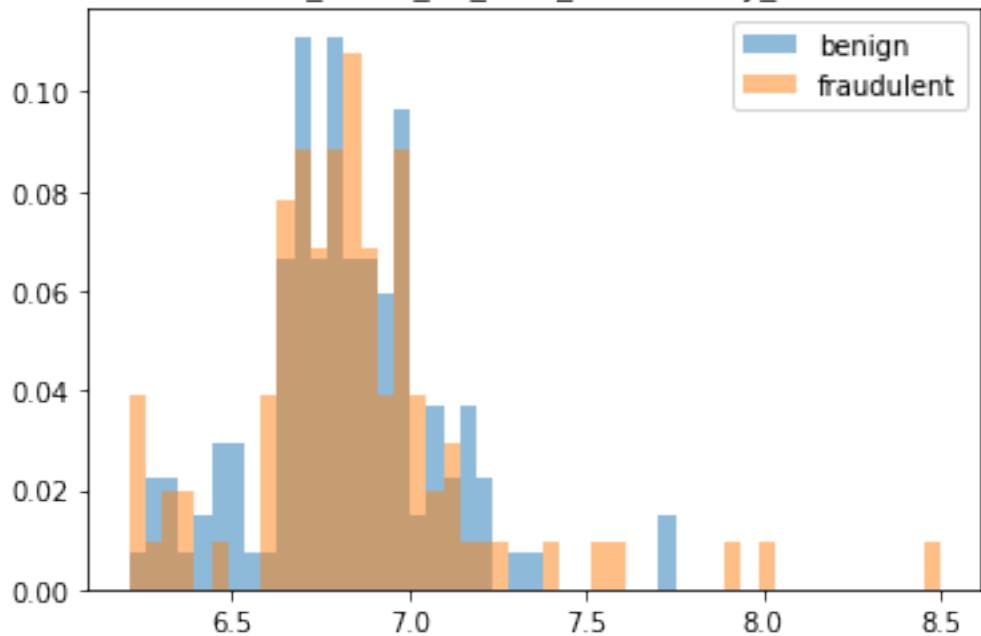
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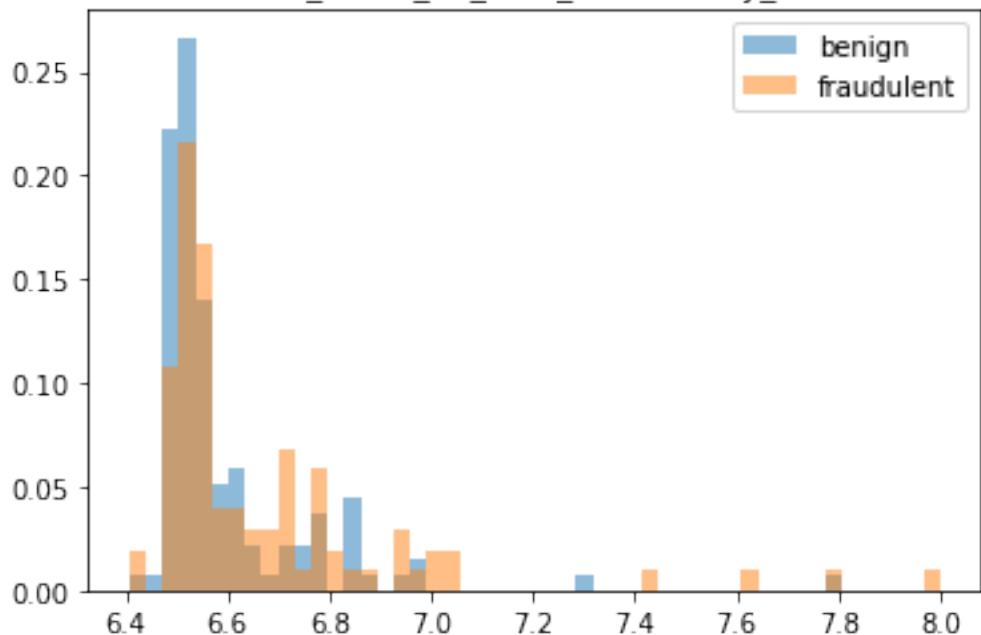
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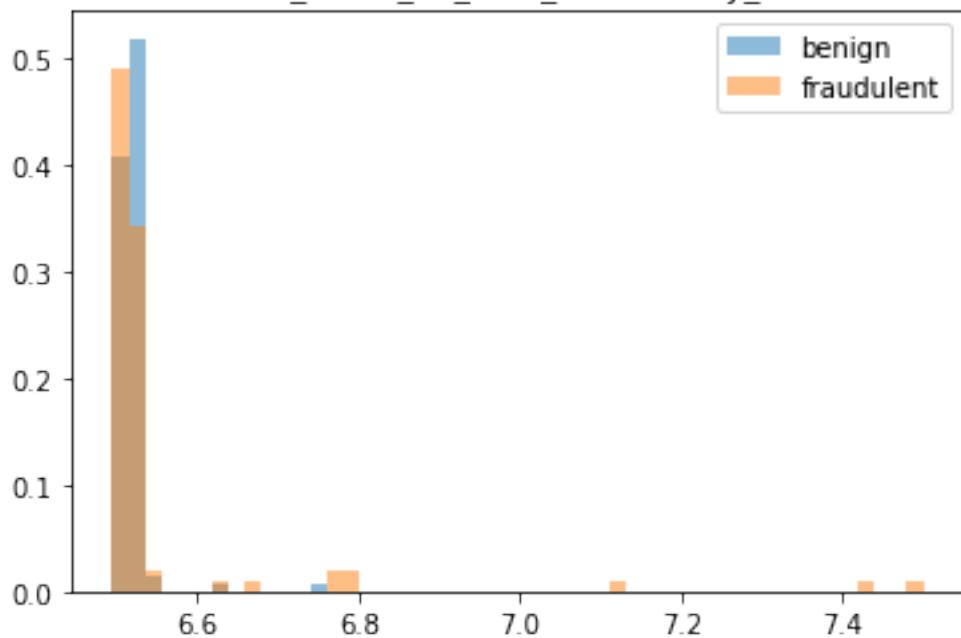
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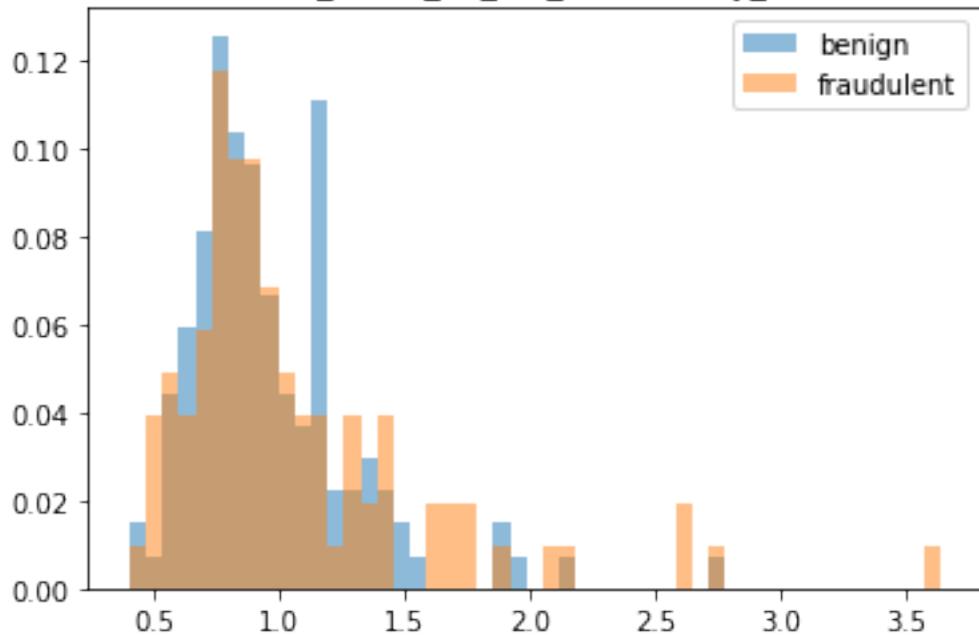
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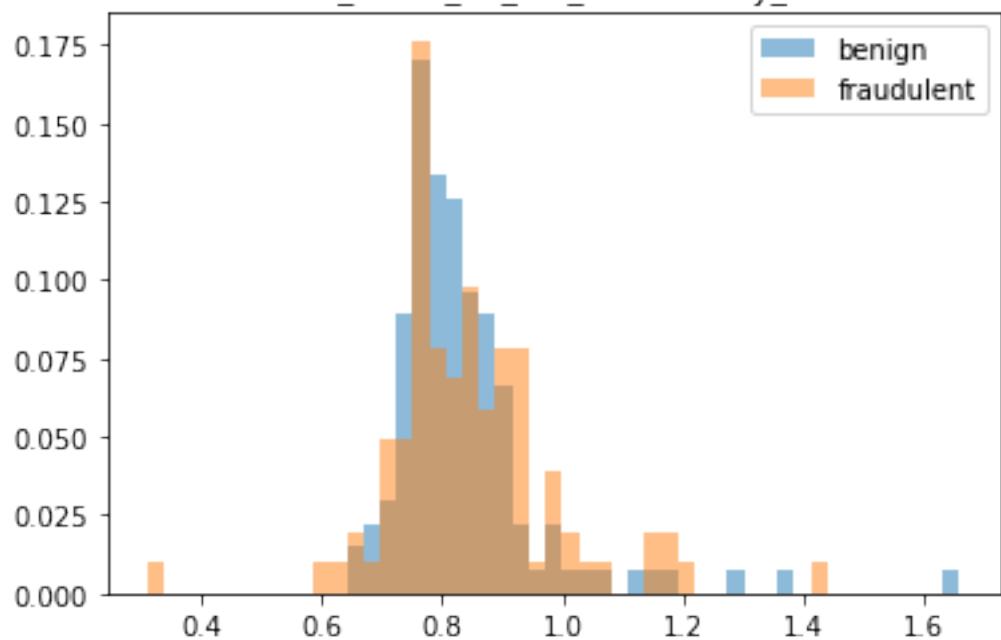
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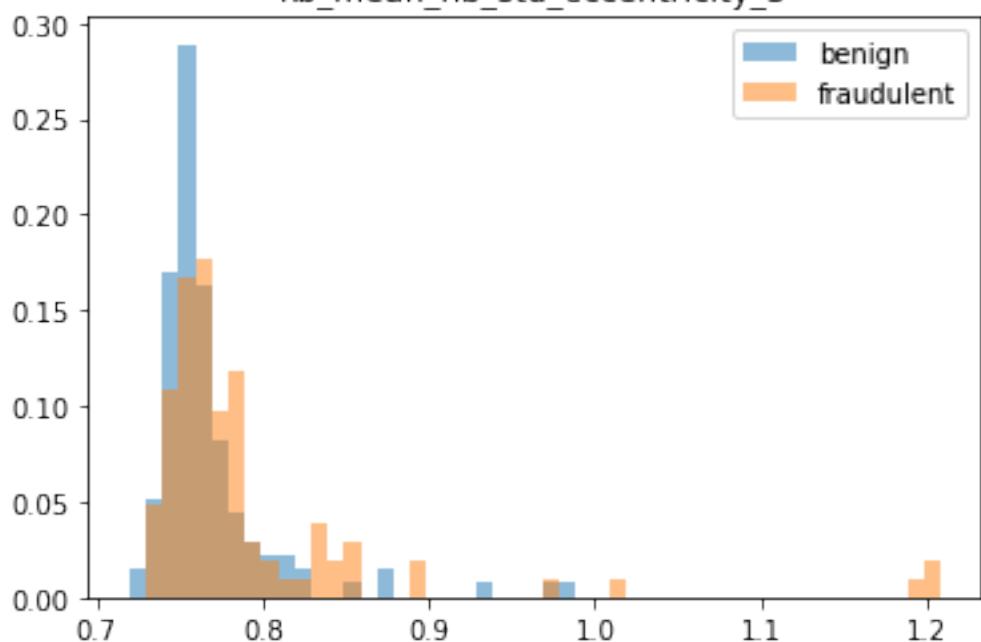
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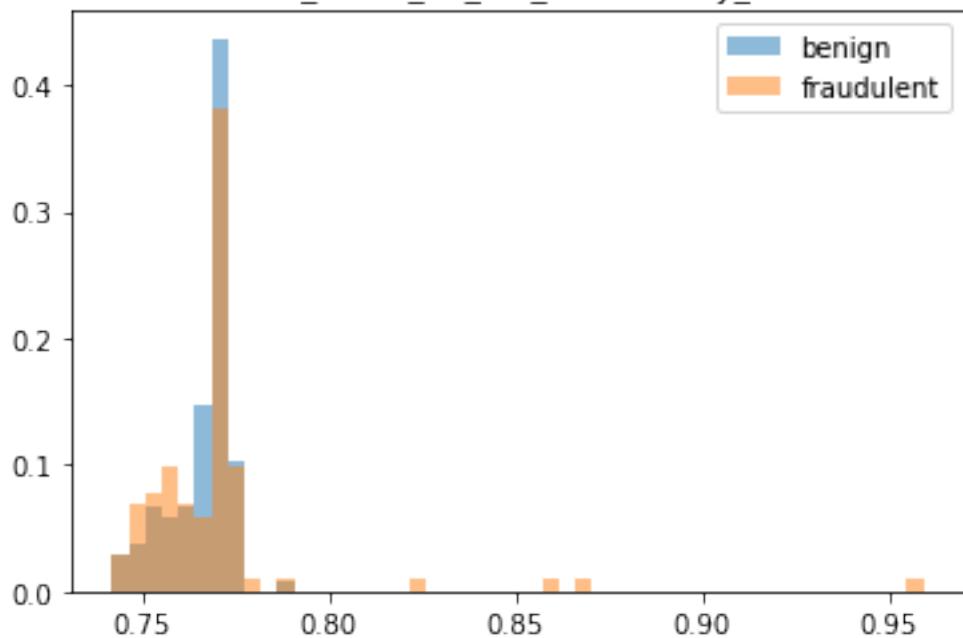
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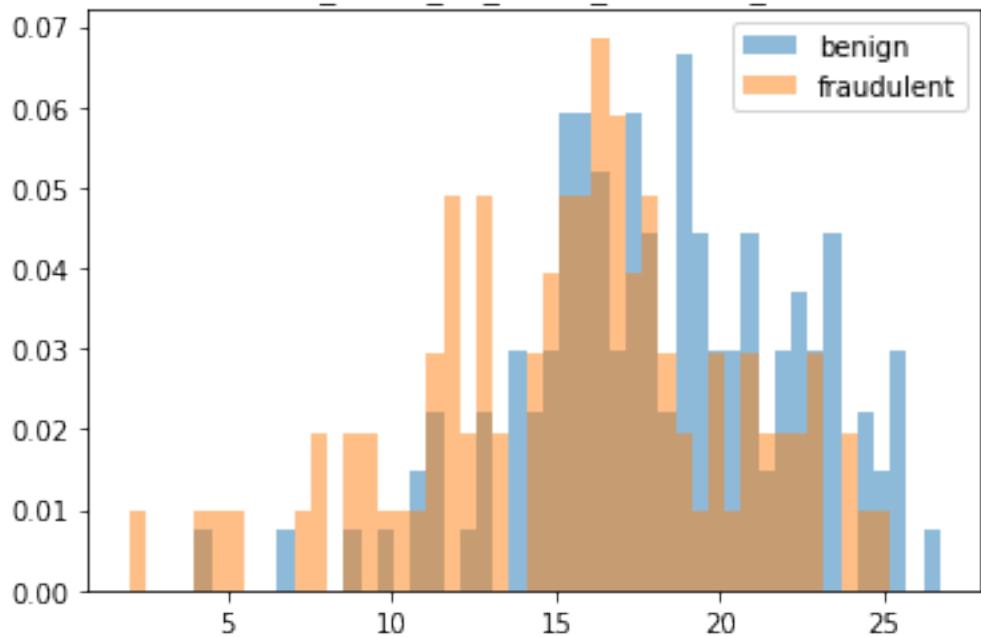
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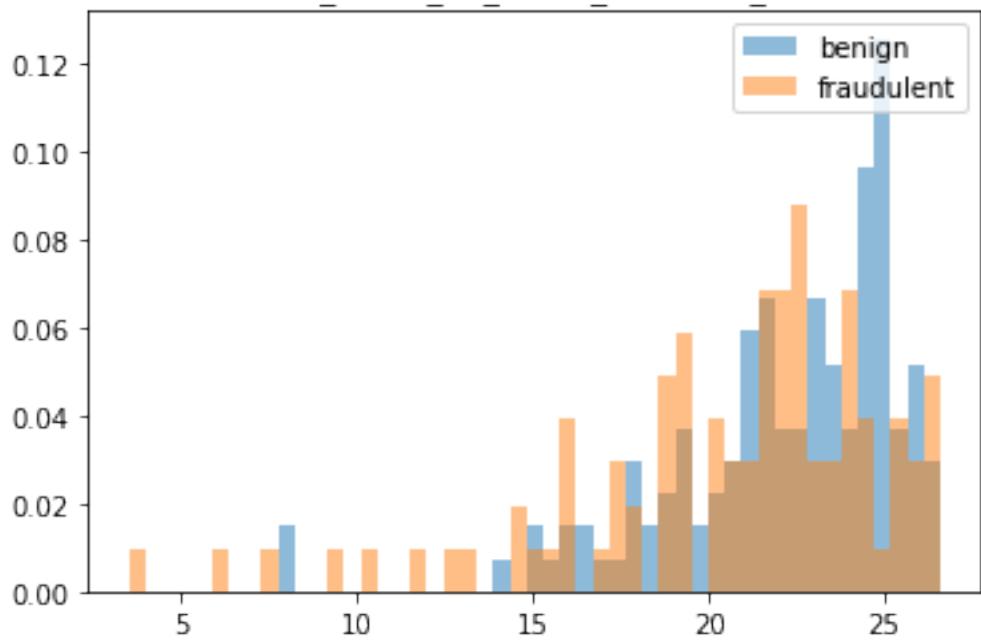
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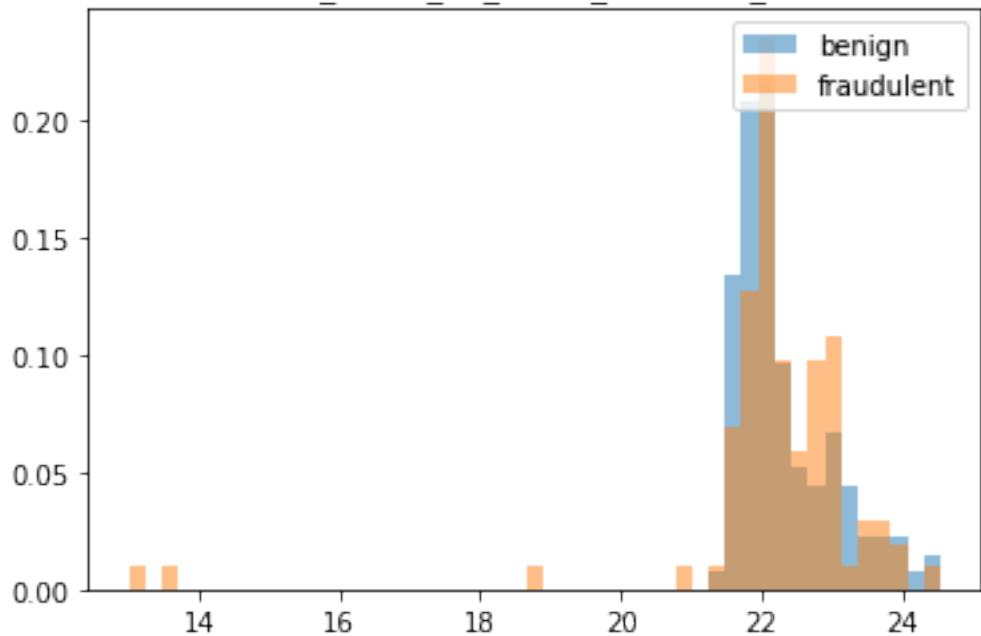
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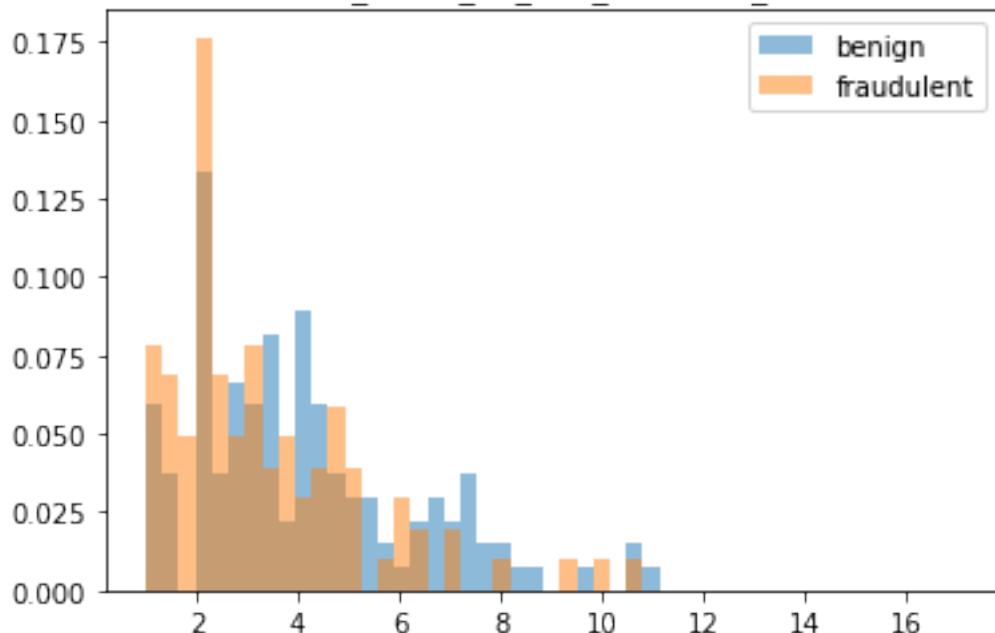
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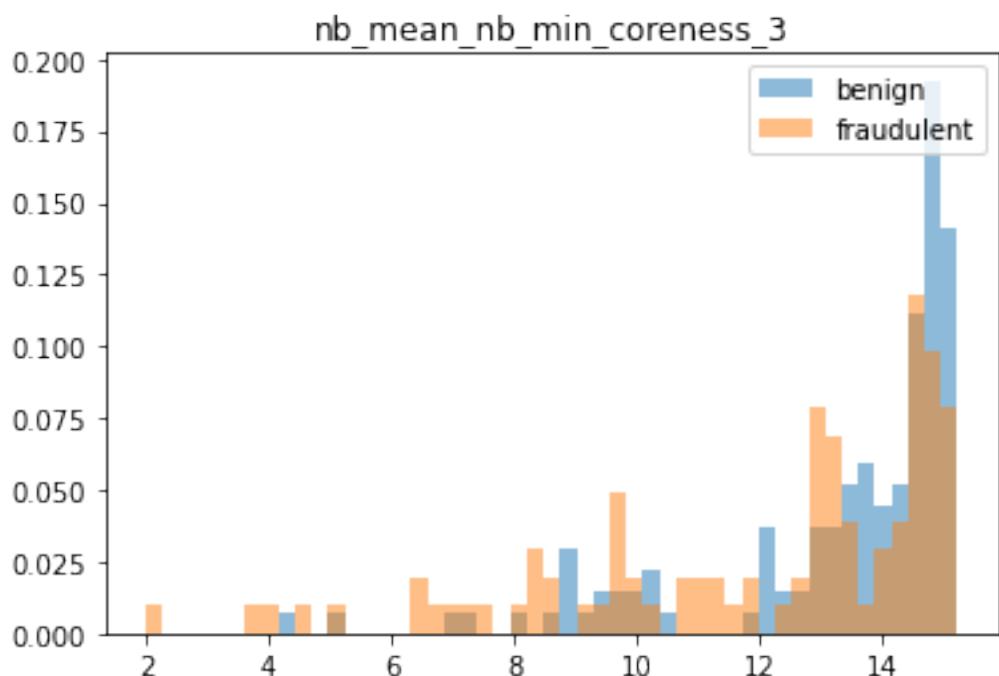
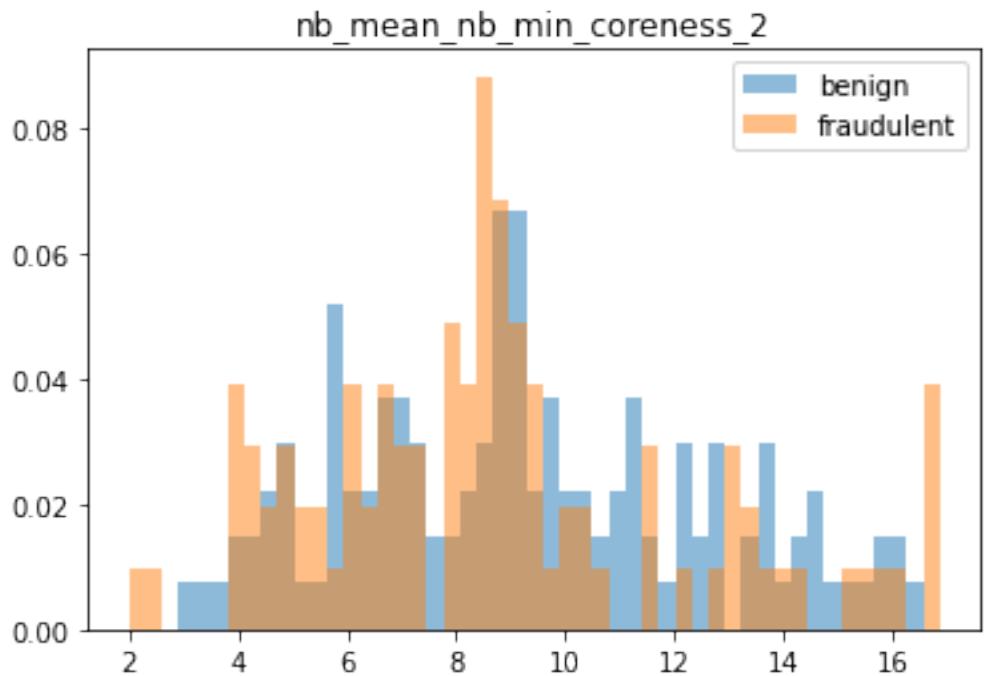


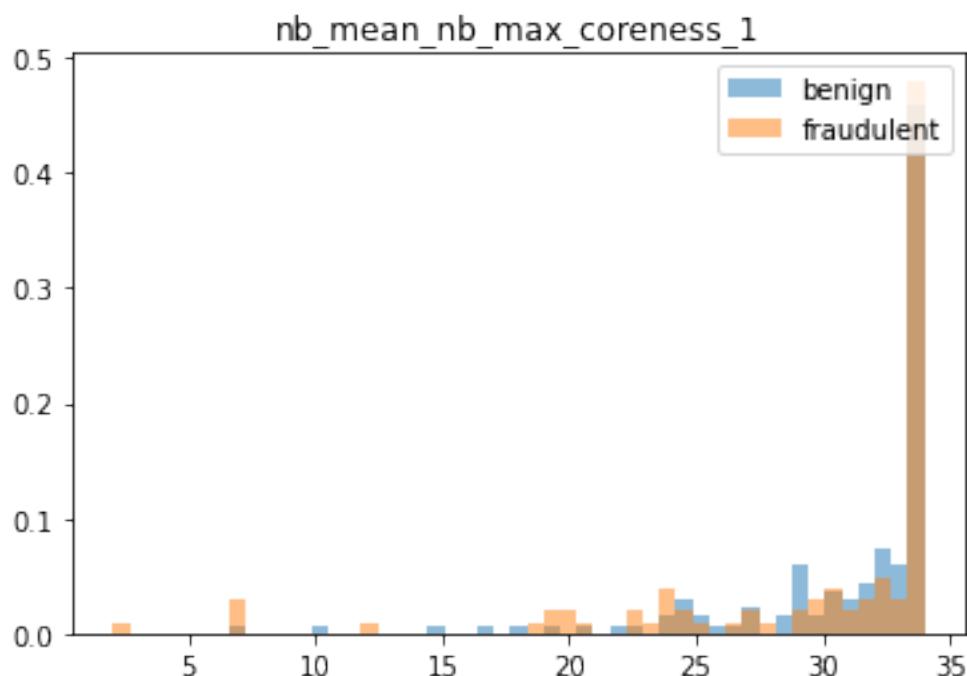
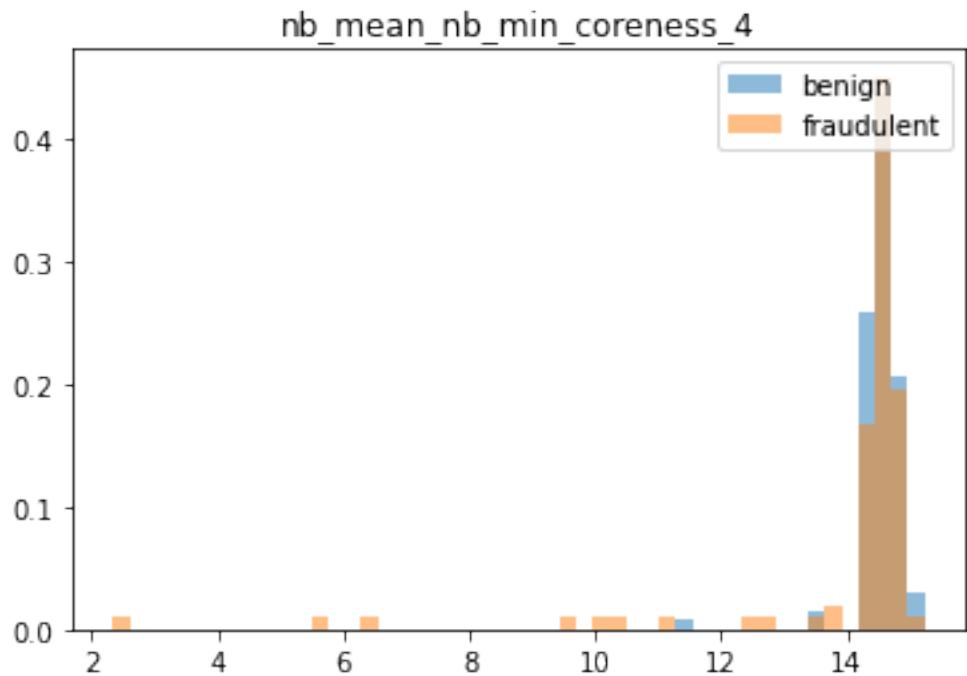
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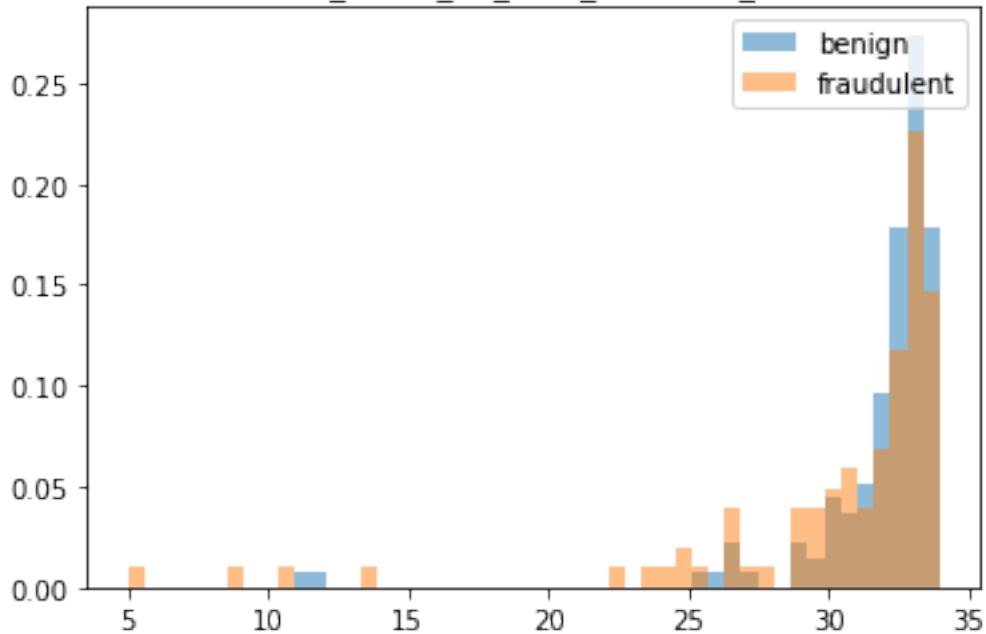
nb_mean_nb_min_coreness_1



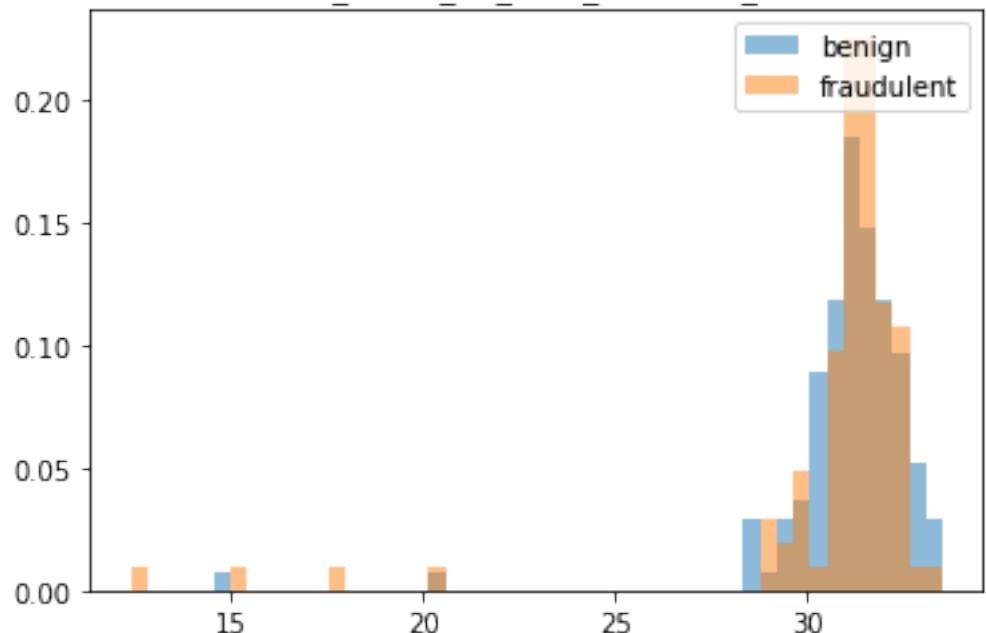




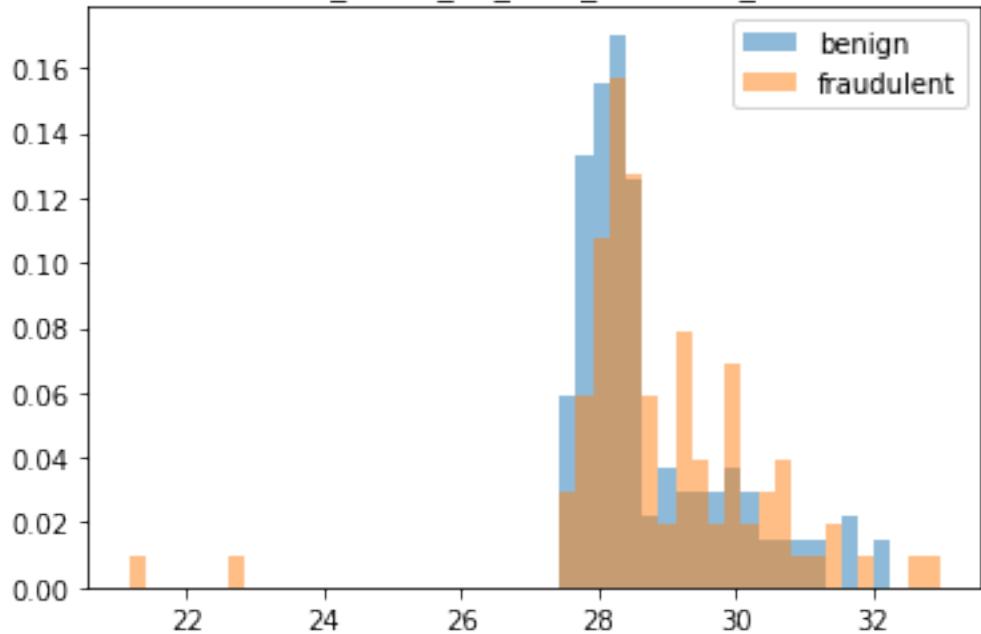
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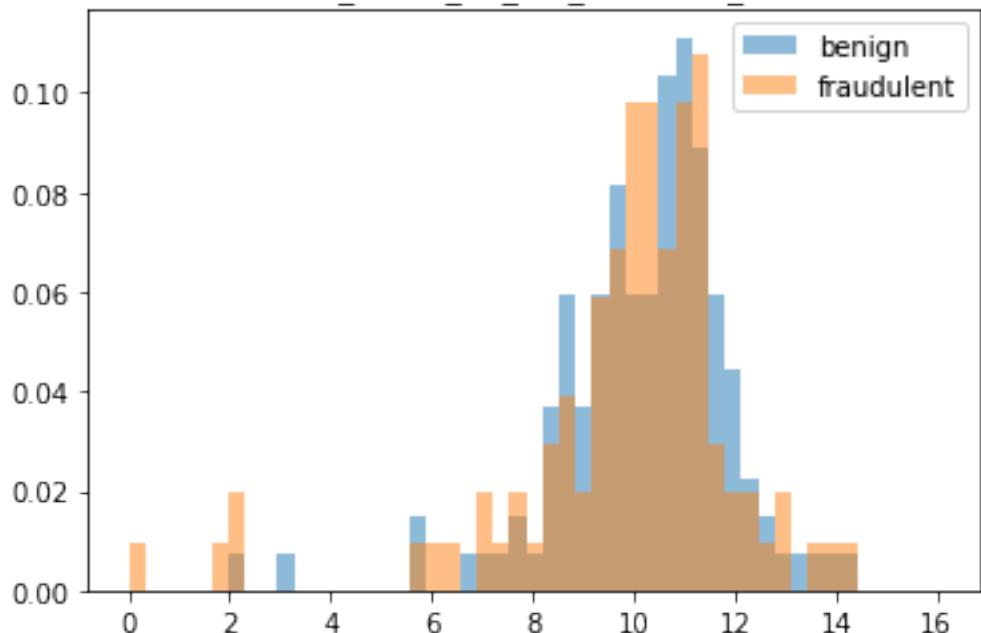
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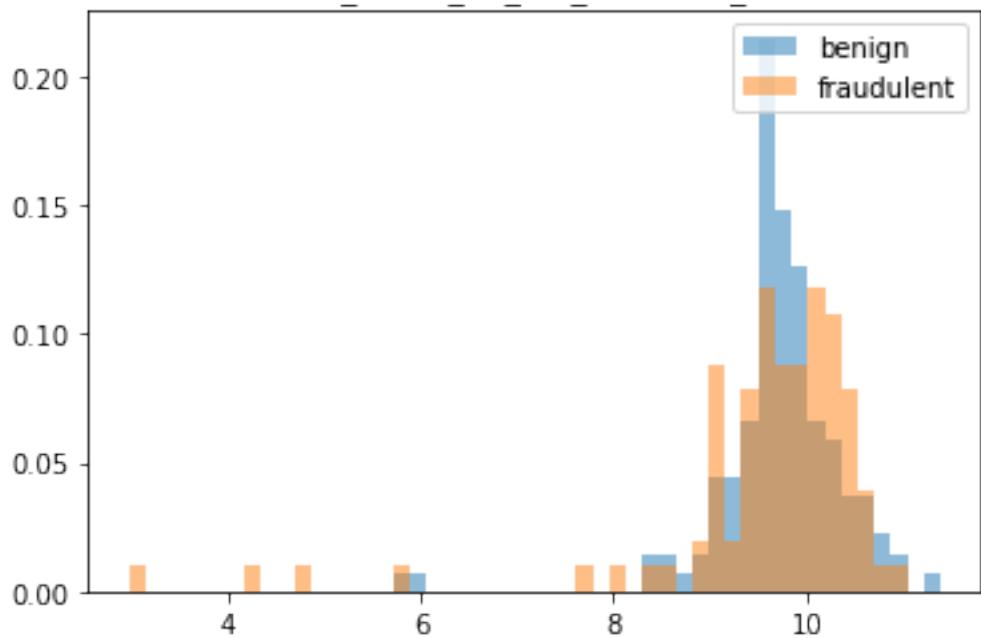
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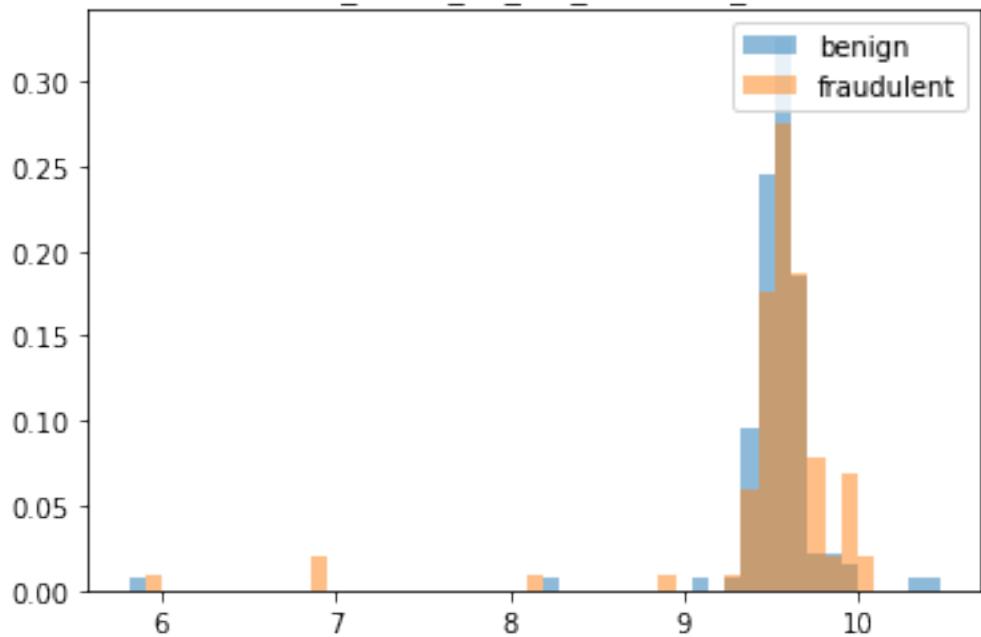
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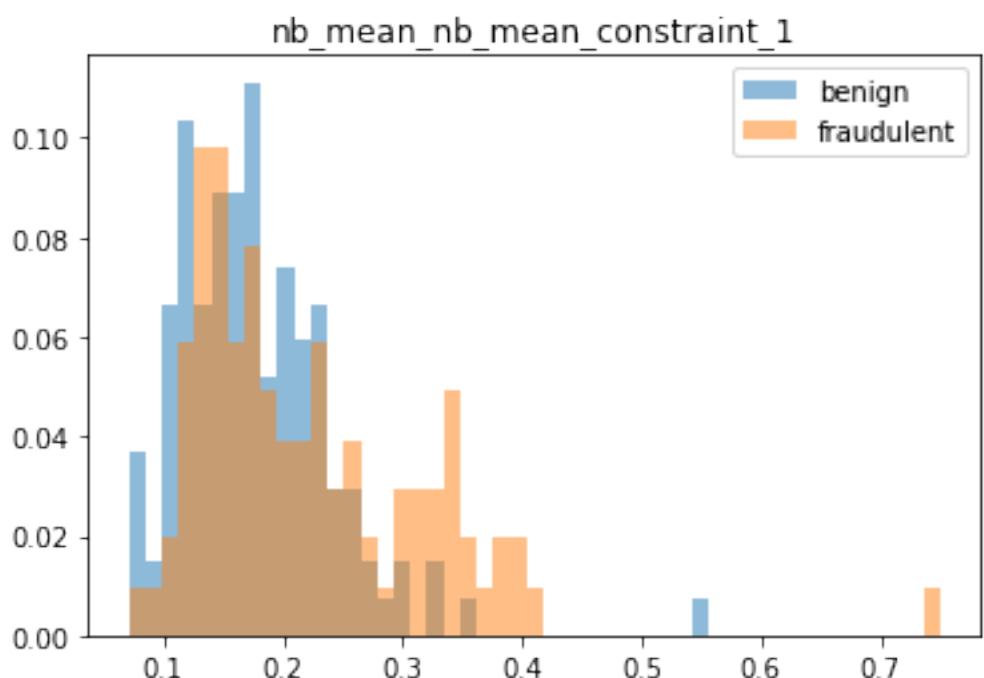
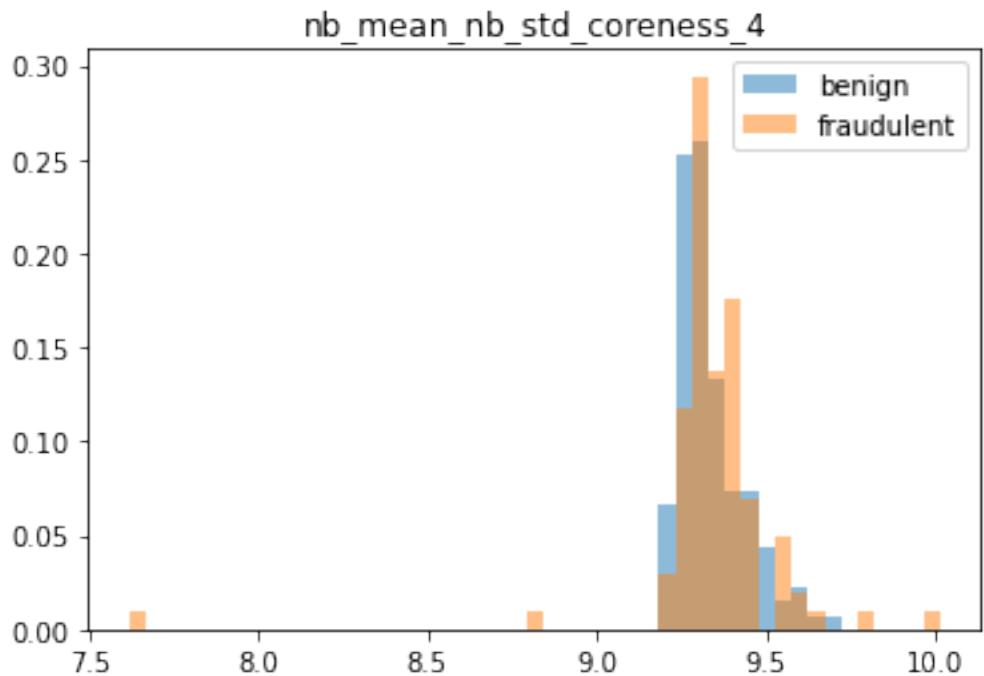


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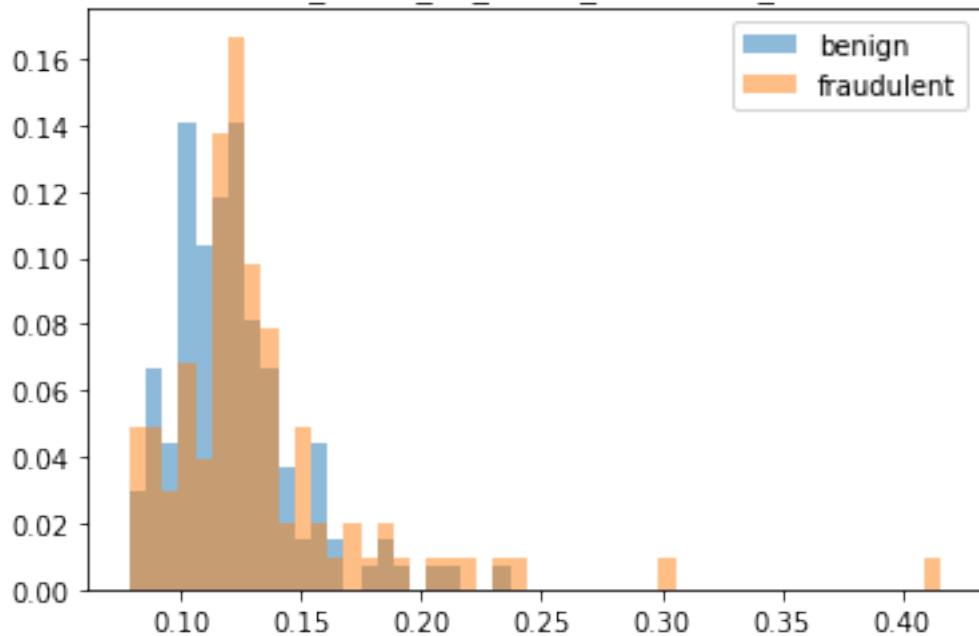


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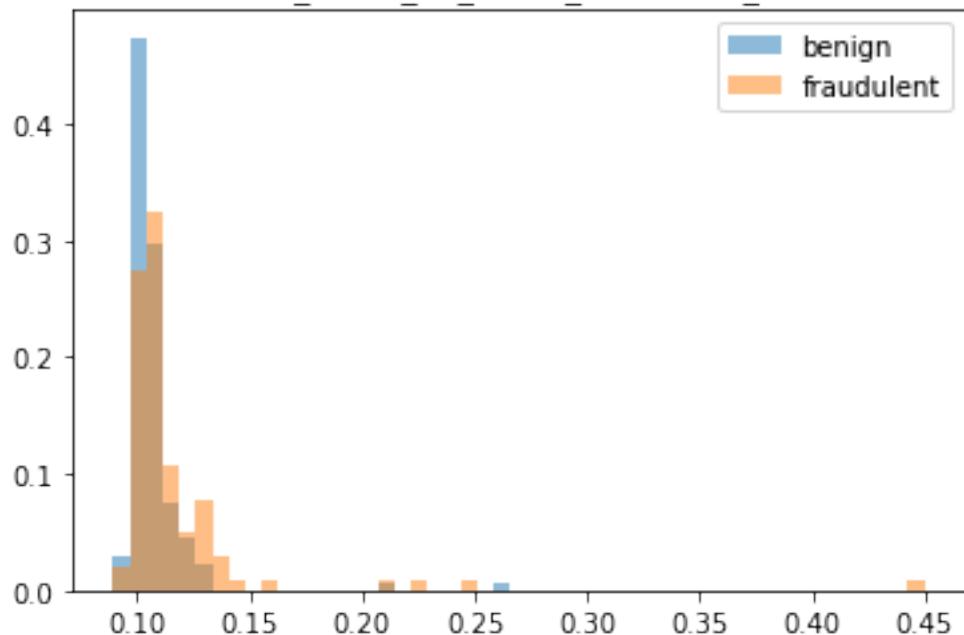




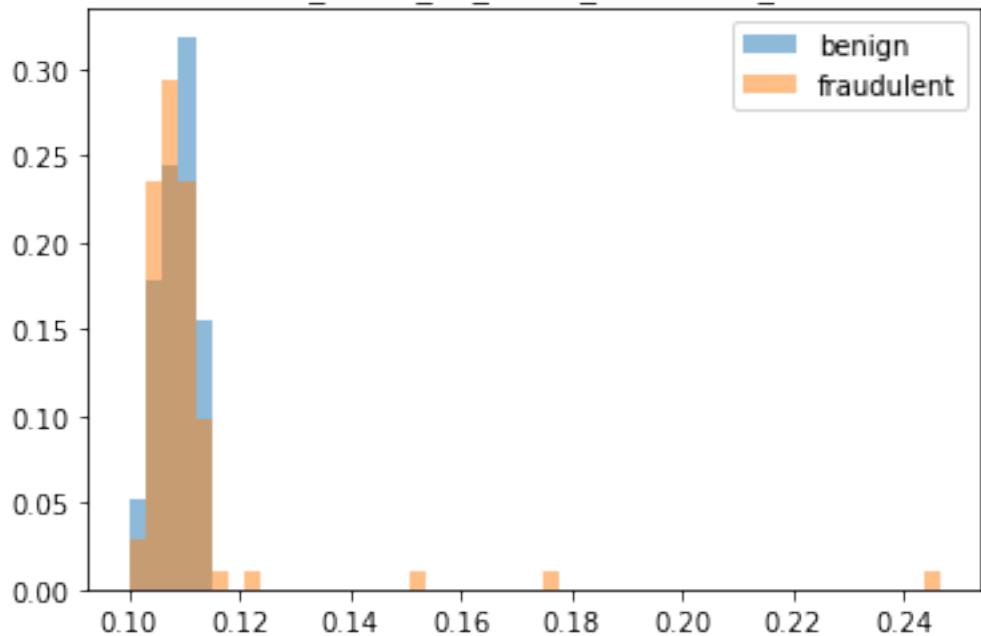
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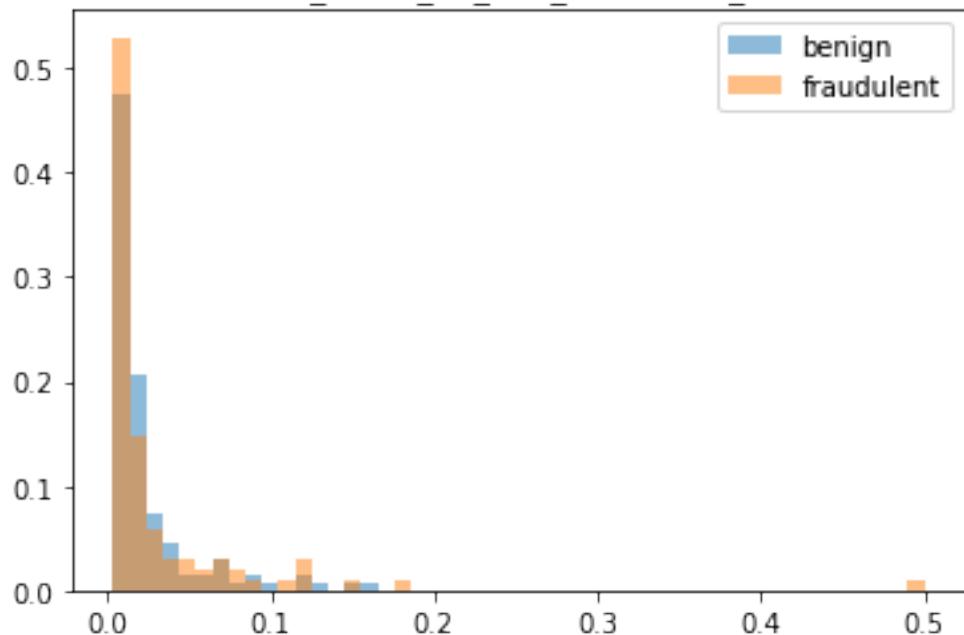
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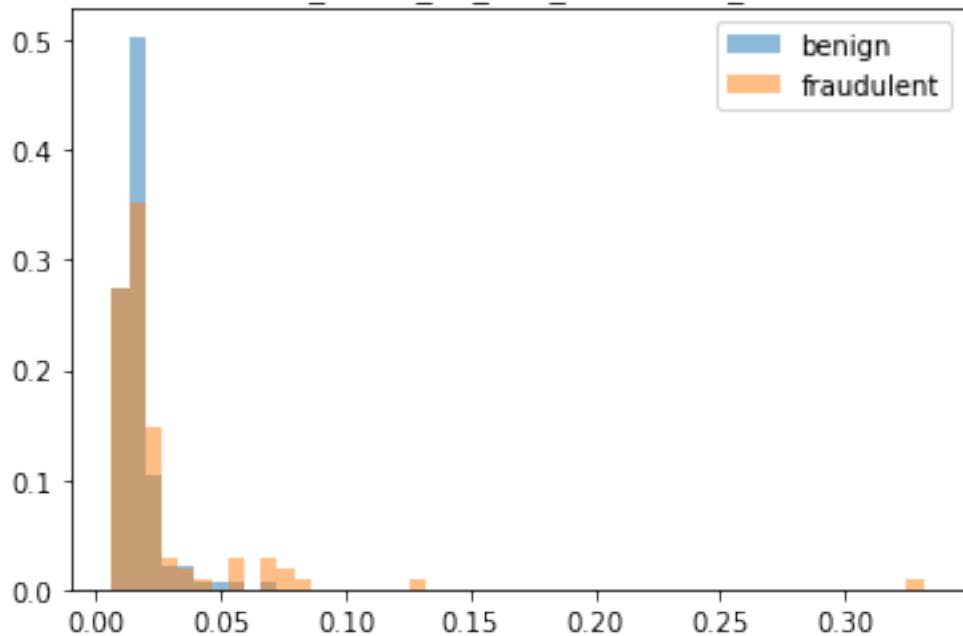
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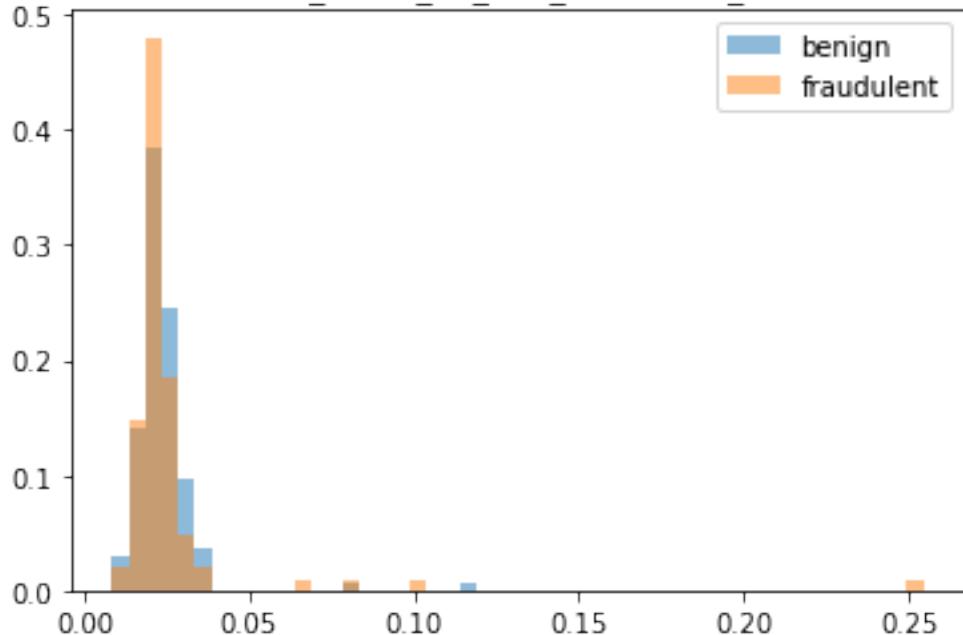
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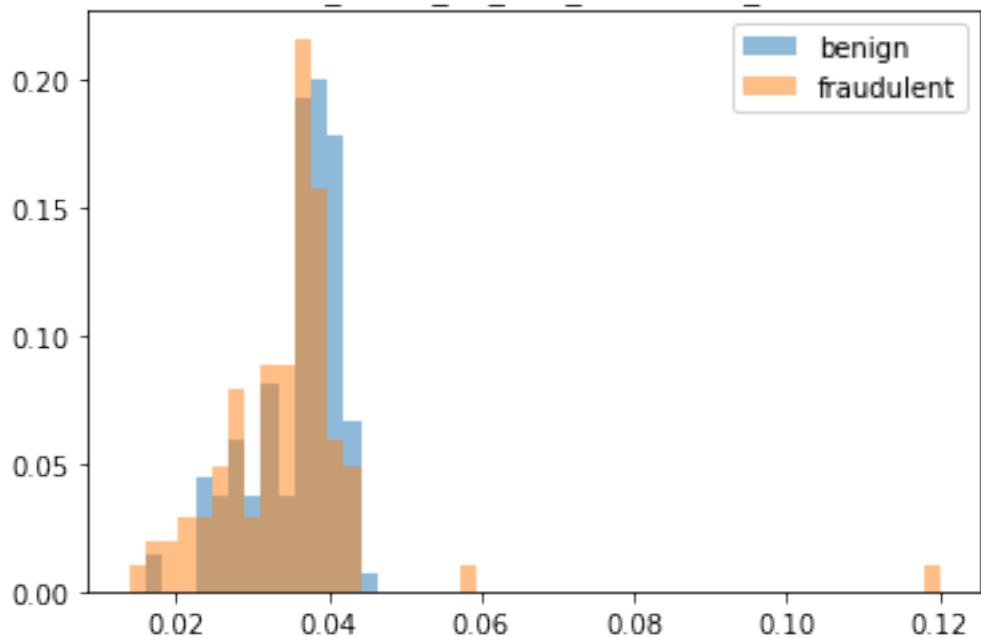
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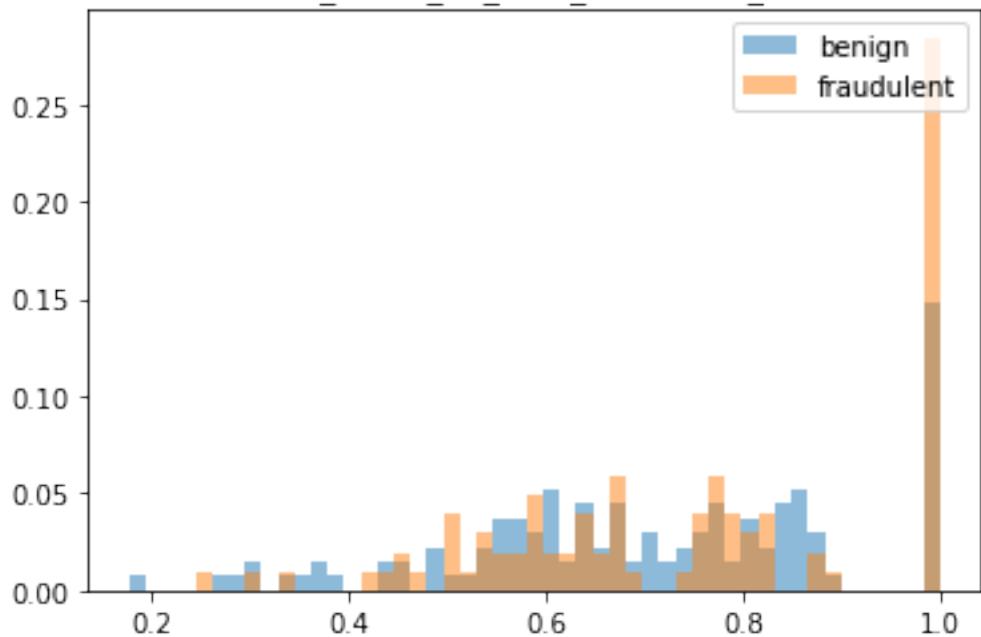
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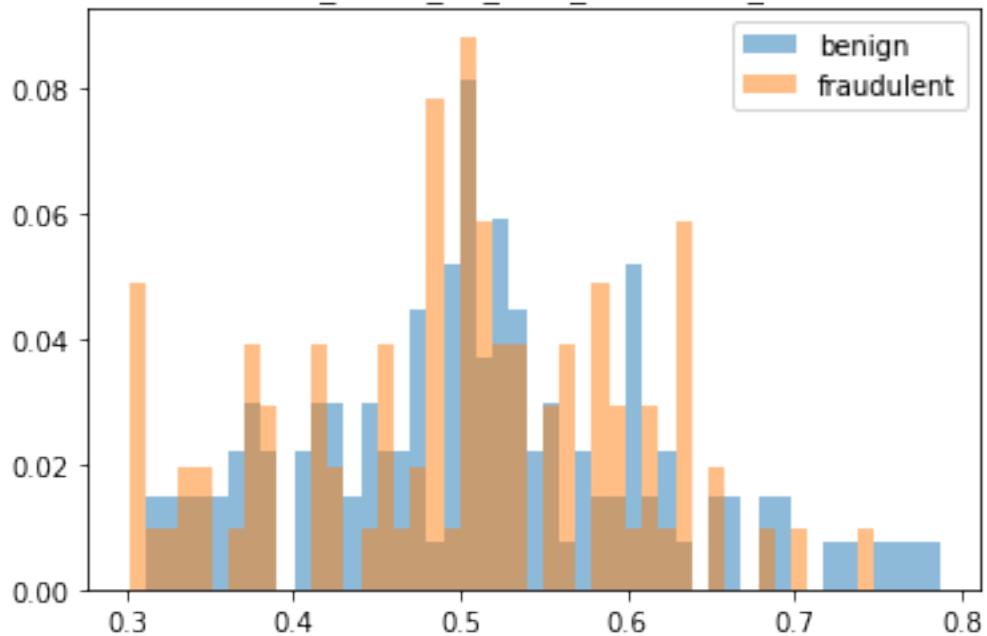
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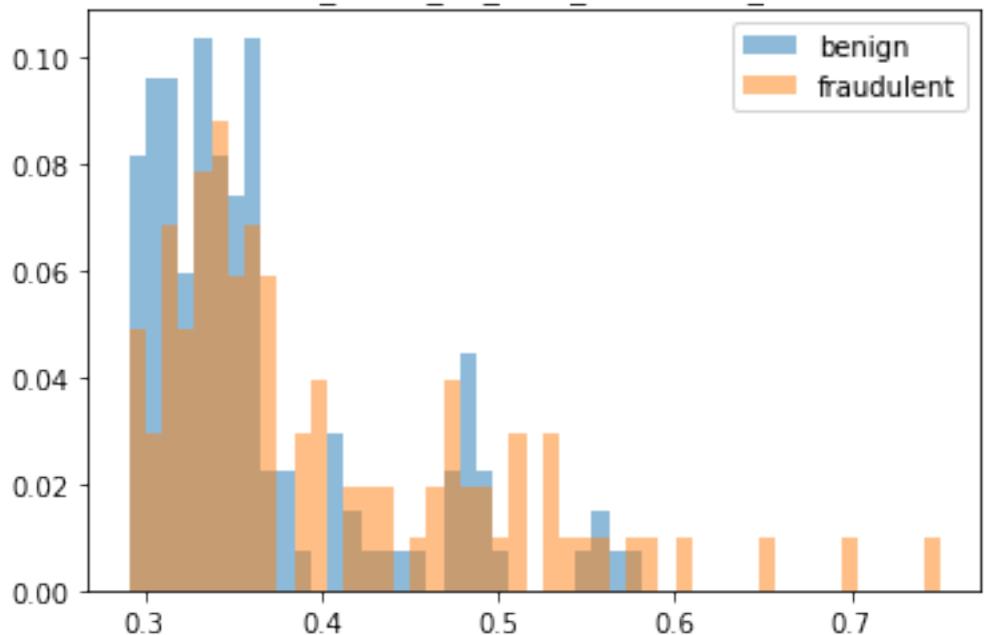
nb_mean_nb_max_constraint_1

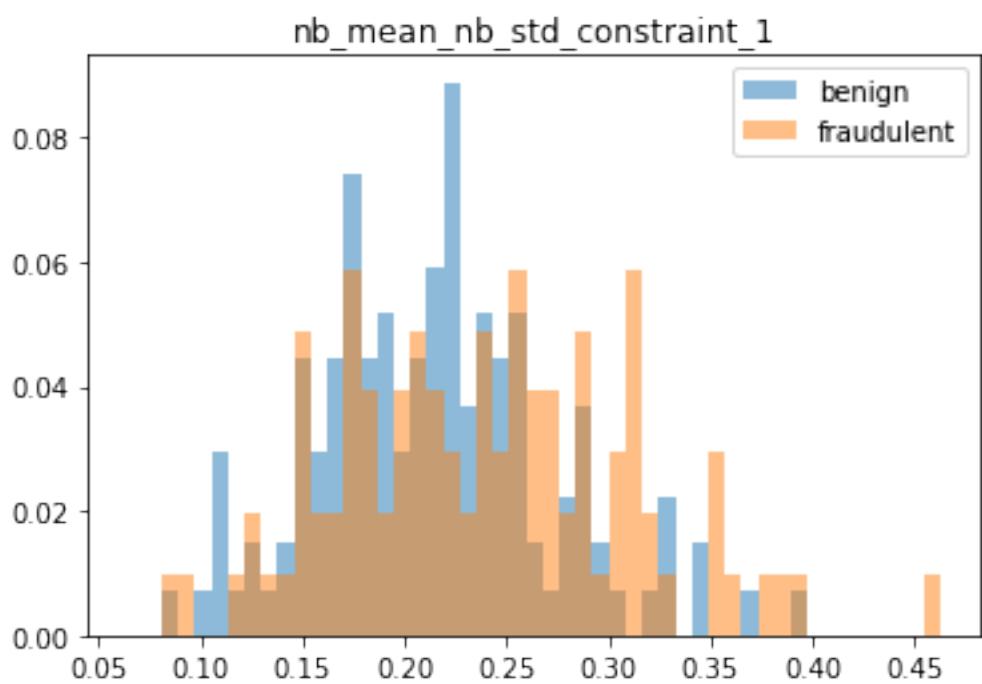
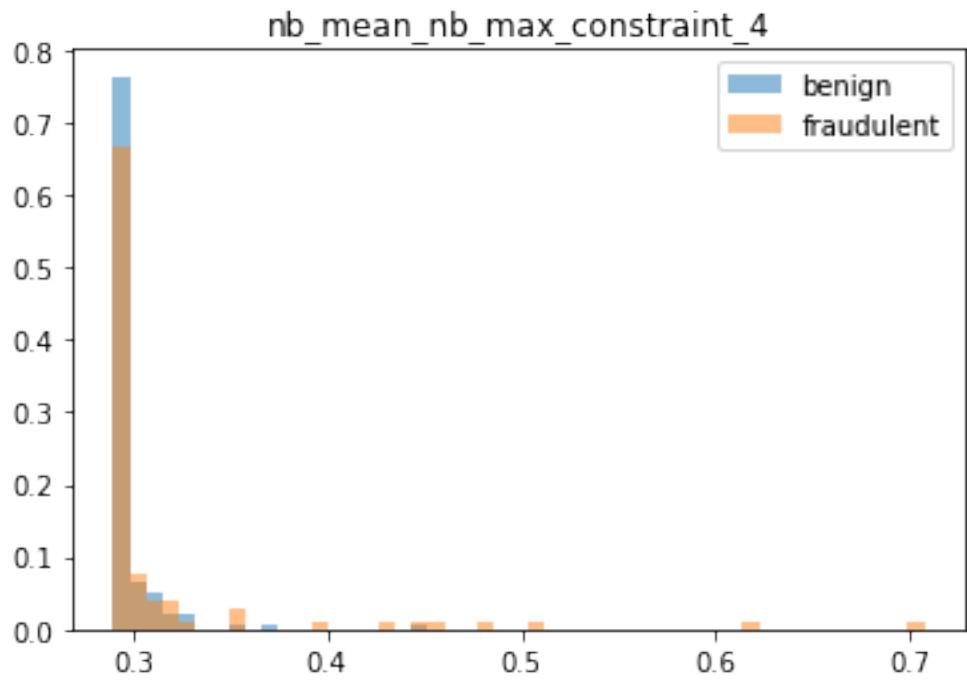


nb_mean_nb_max_constraint_2

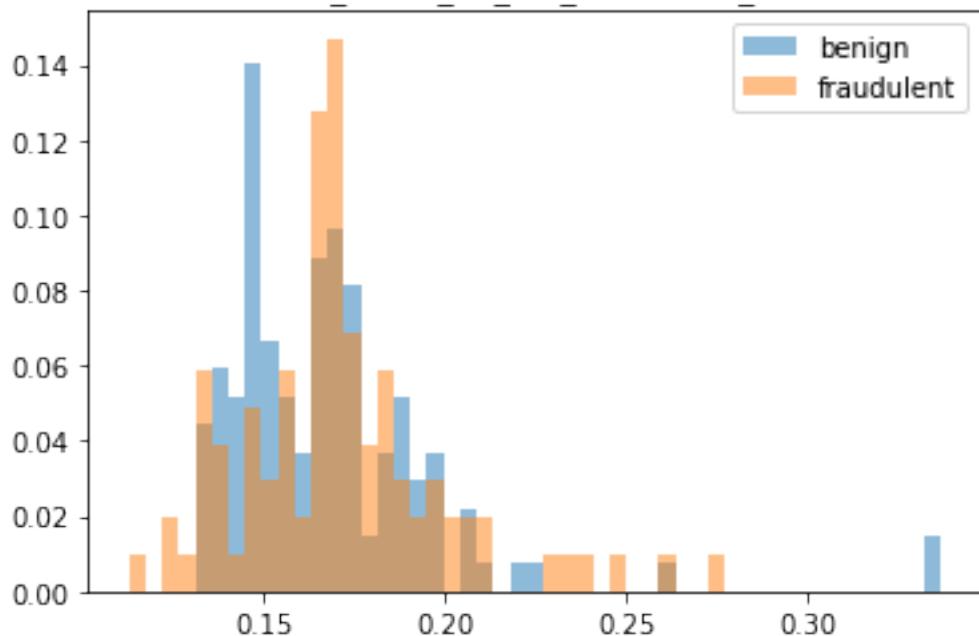


nb_mean_nb_max_constraint_3

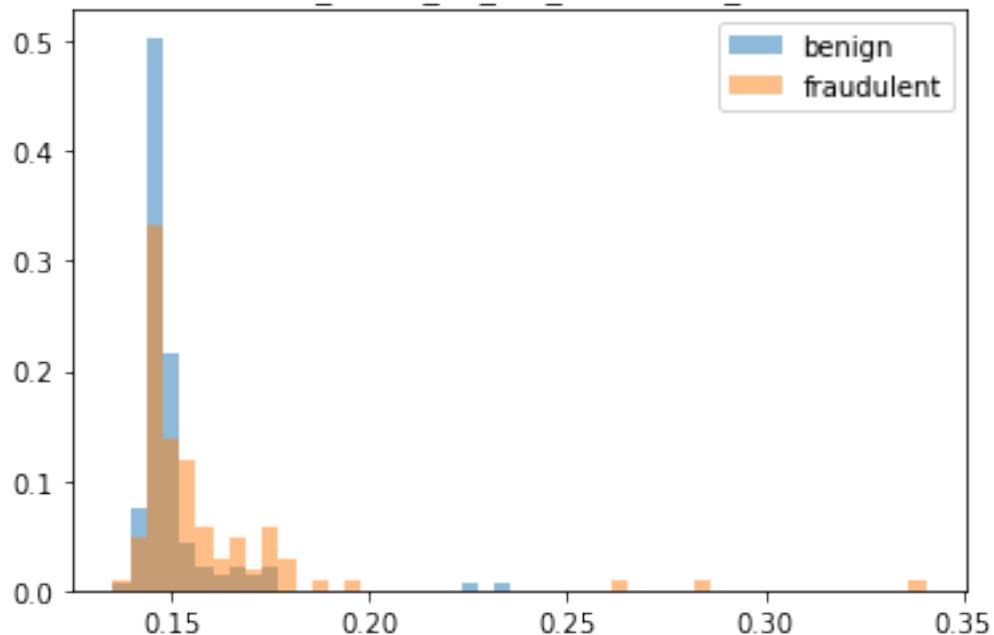


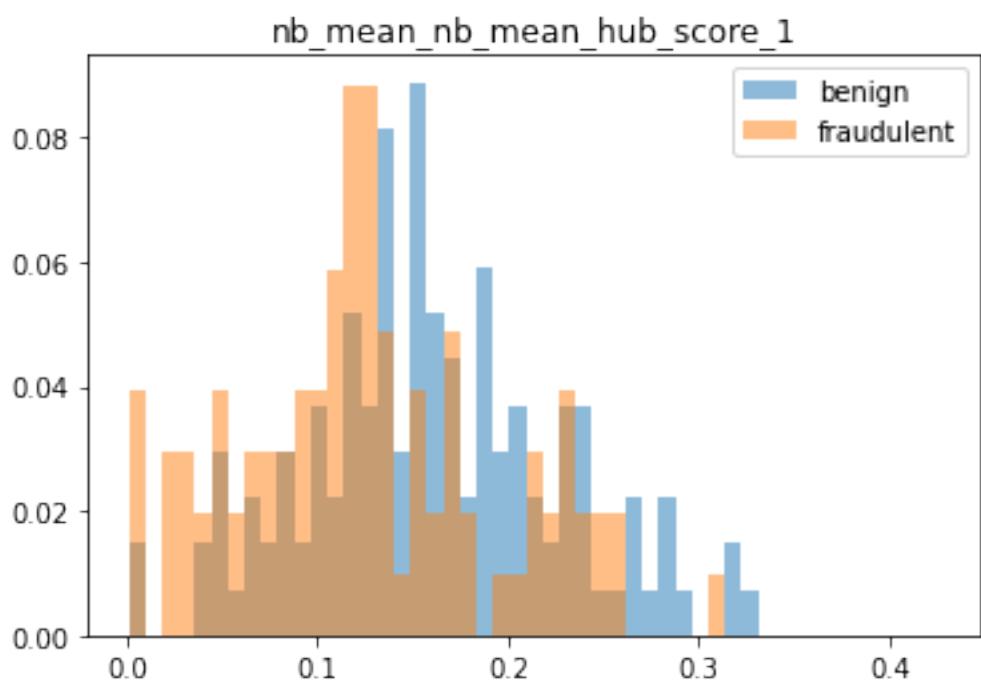
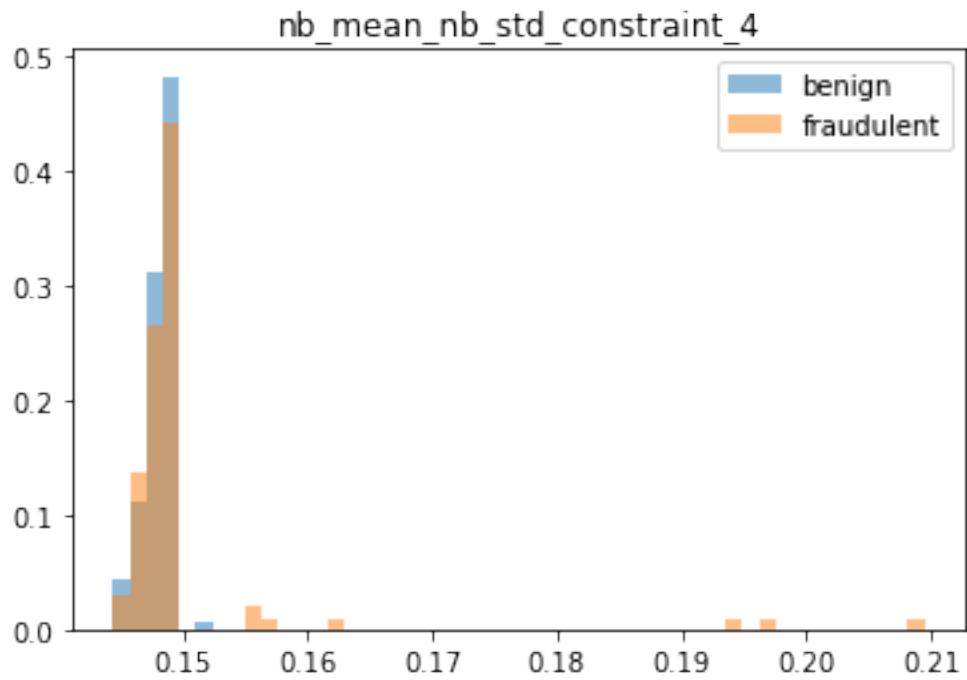


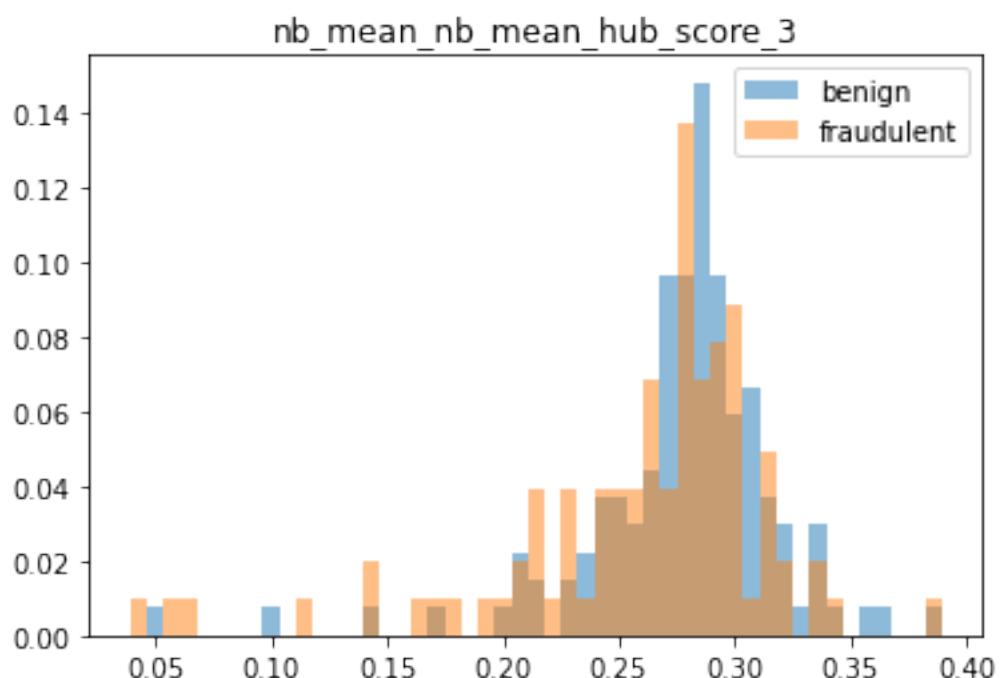
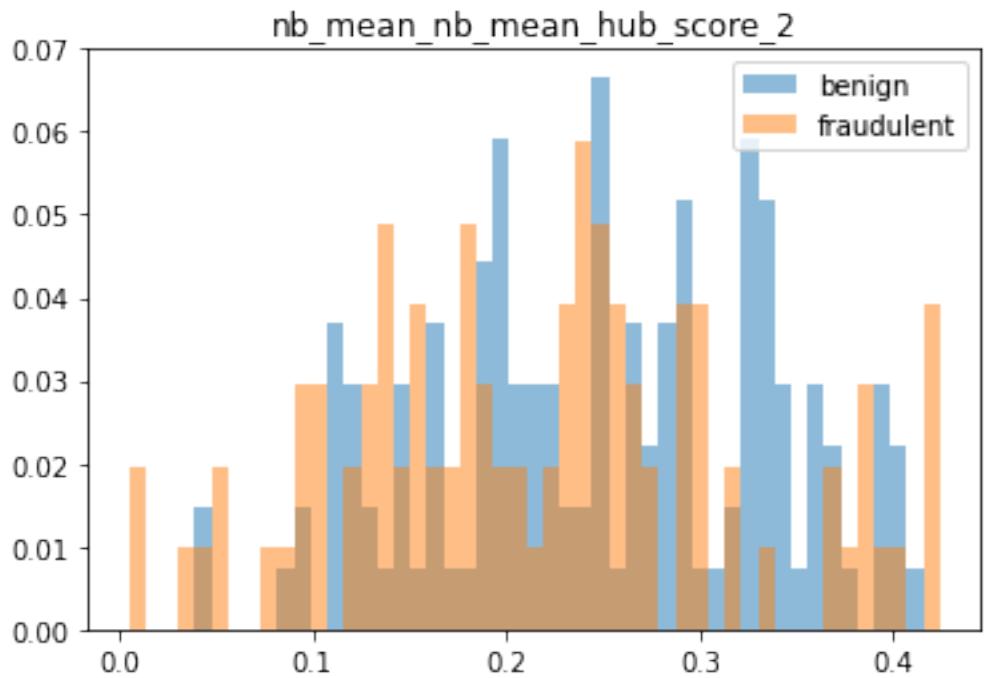
nb_mean_nb_std_constraint_2



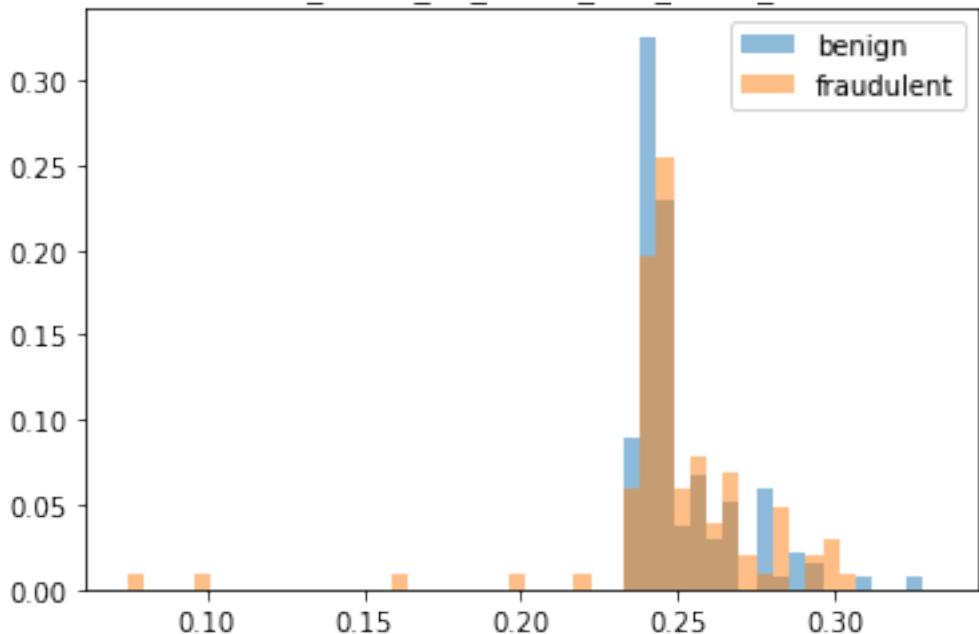
nb_mean_nb_std_constraint_3



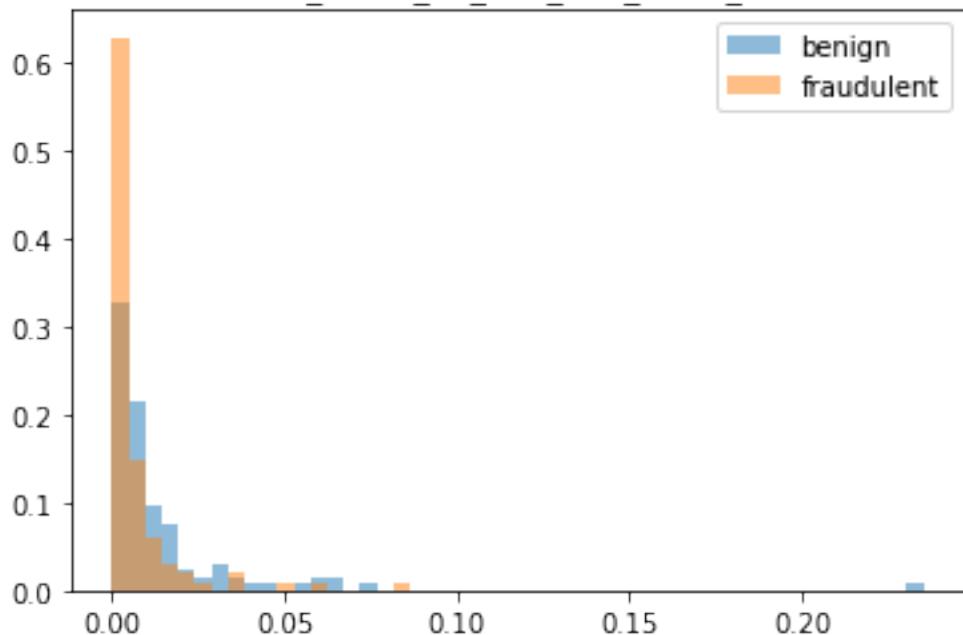




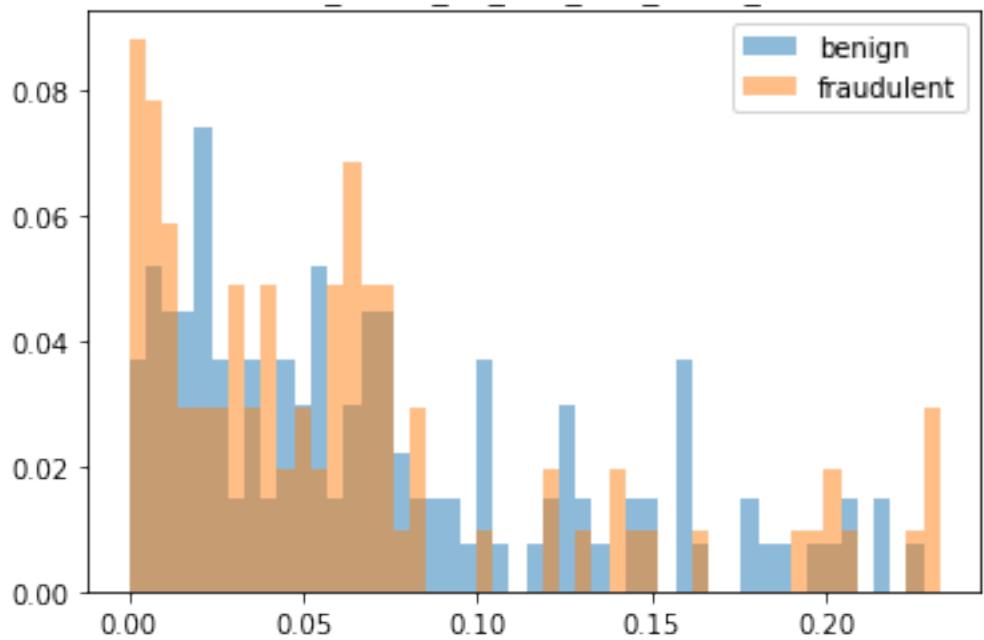
nb_mean_nb_mean_hub_score_4



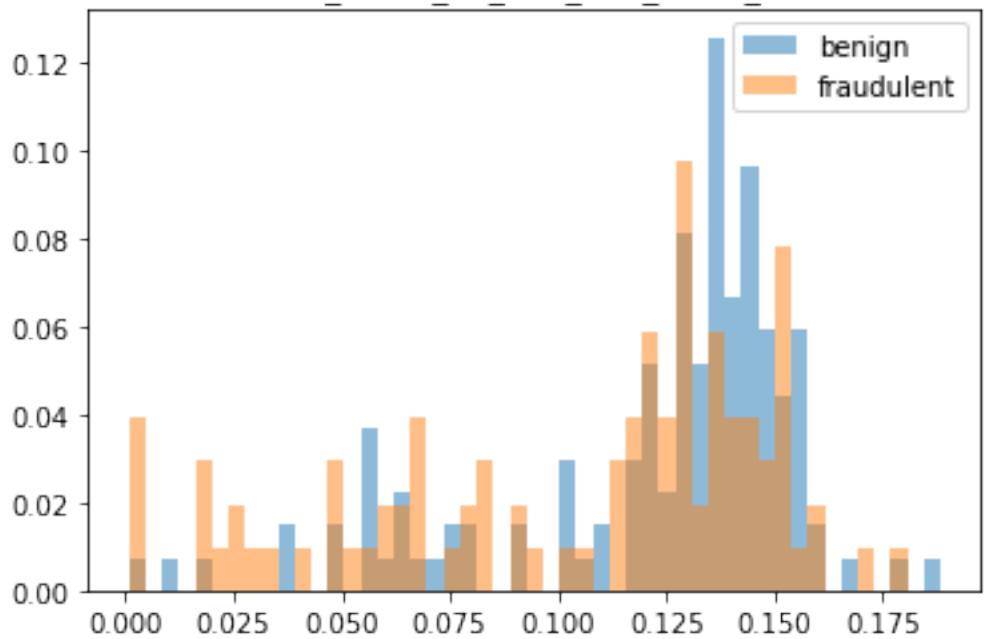
nb_mean_nb_min_hub_score_1



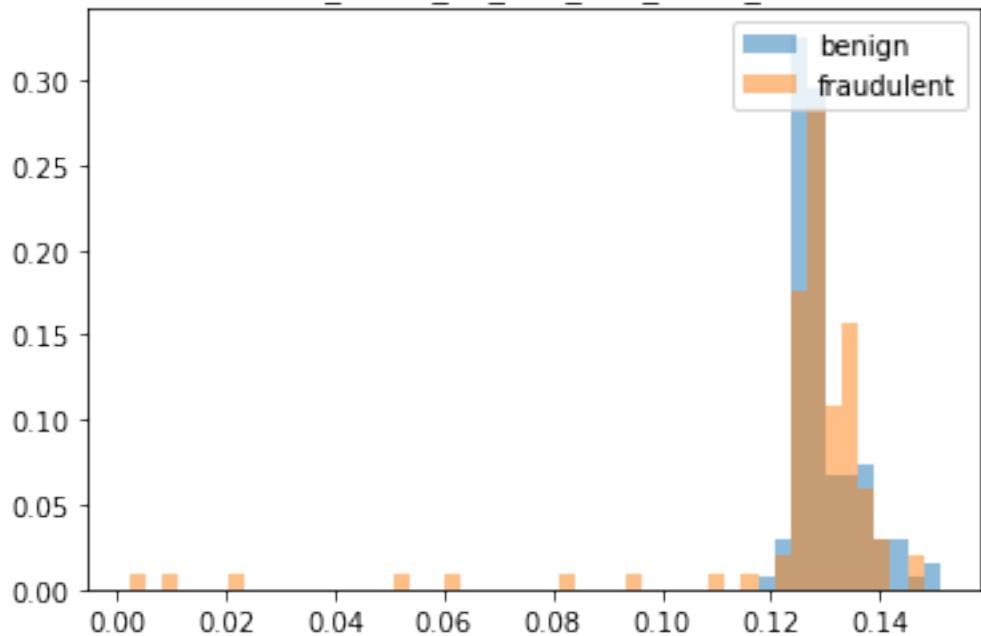
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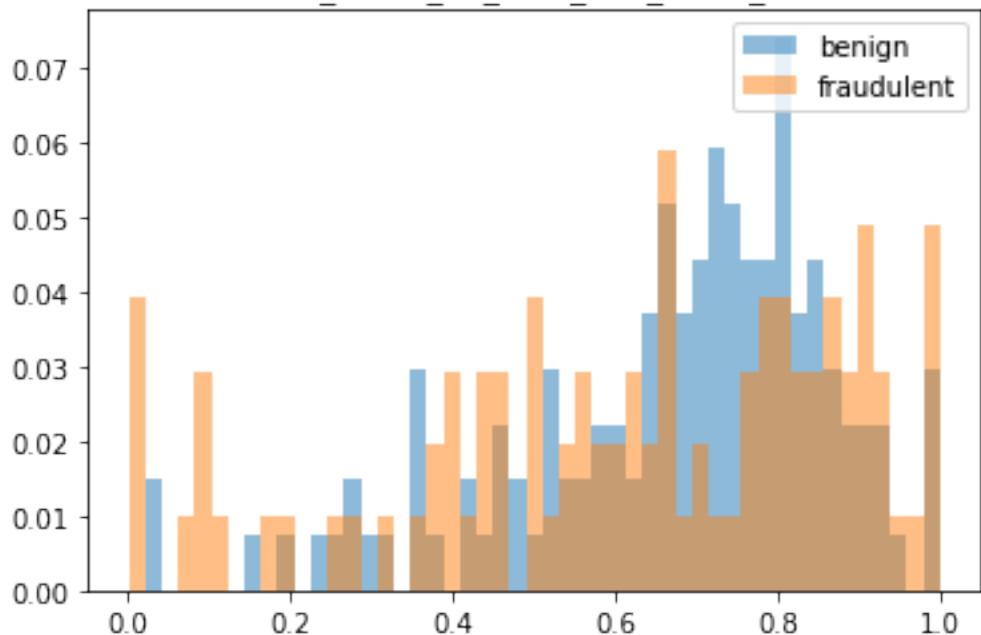
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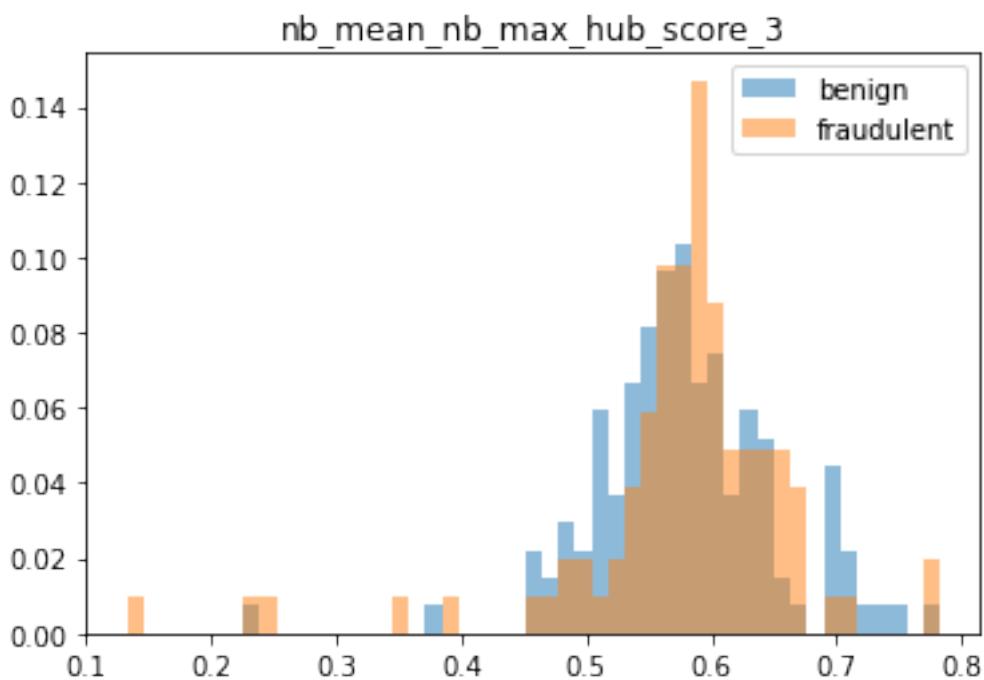
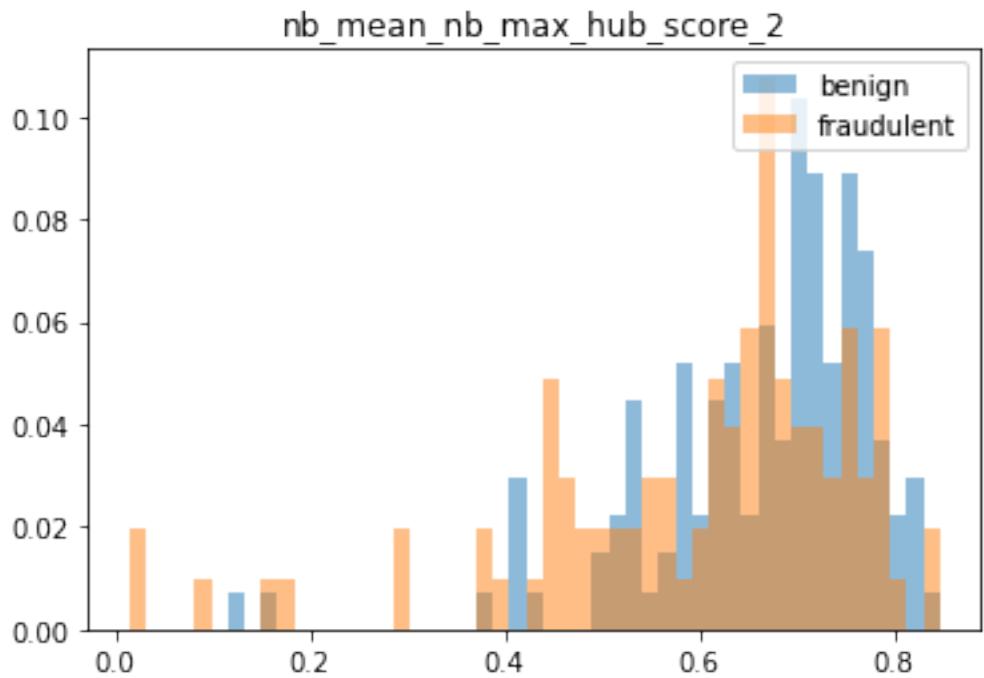


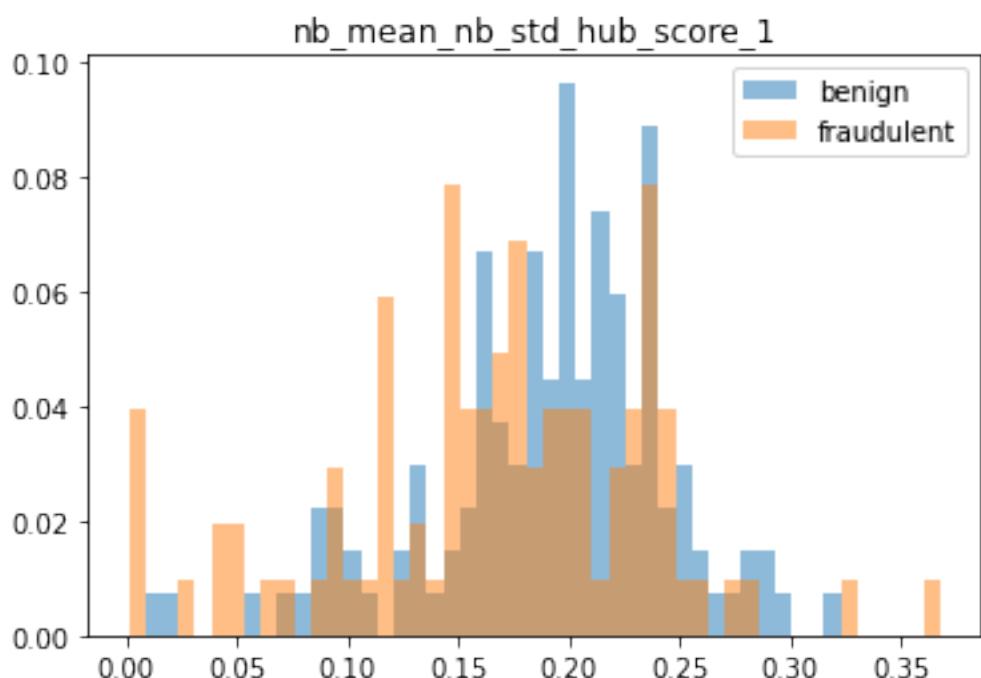
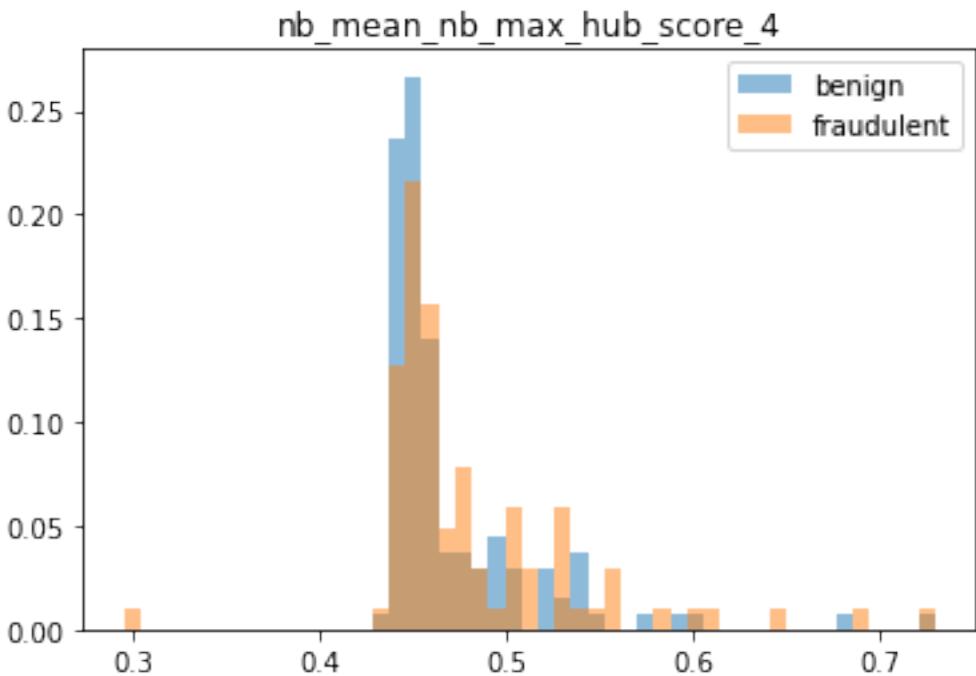
nb_mean_nb_min_hub_score_4

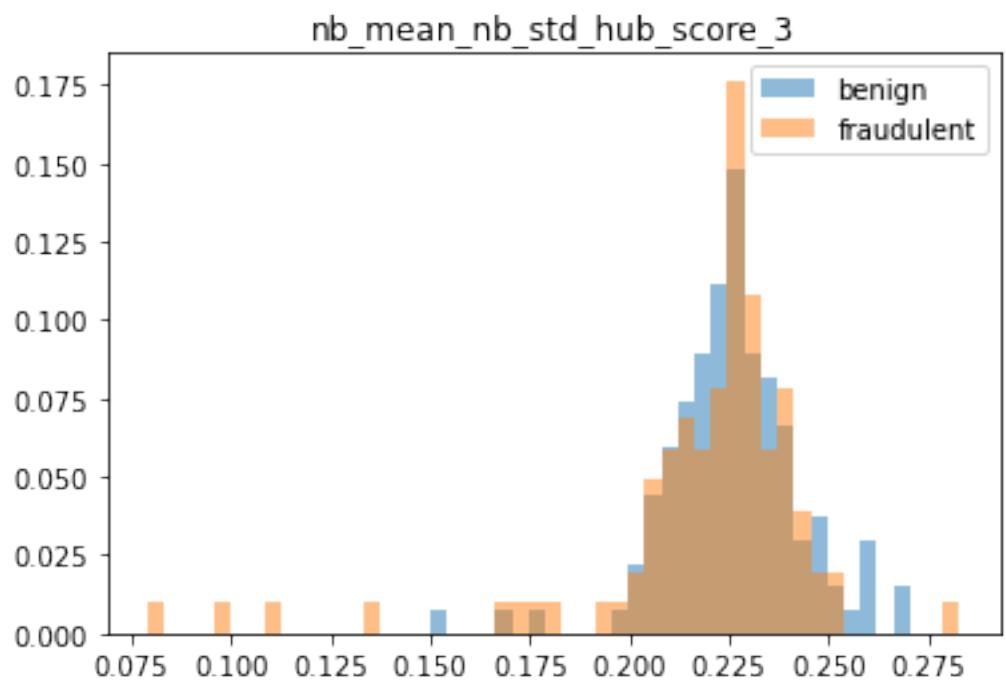
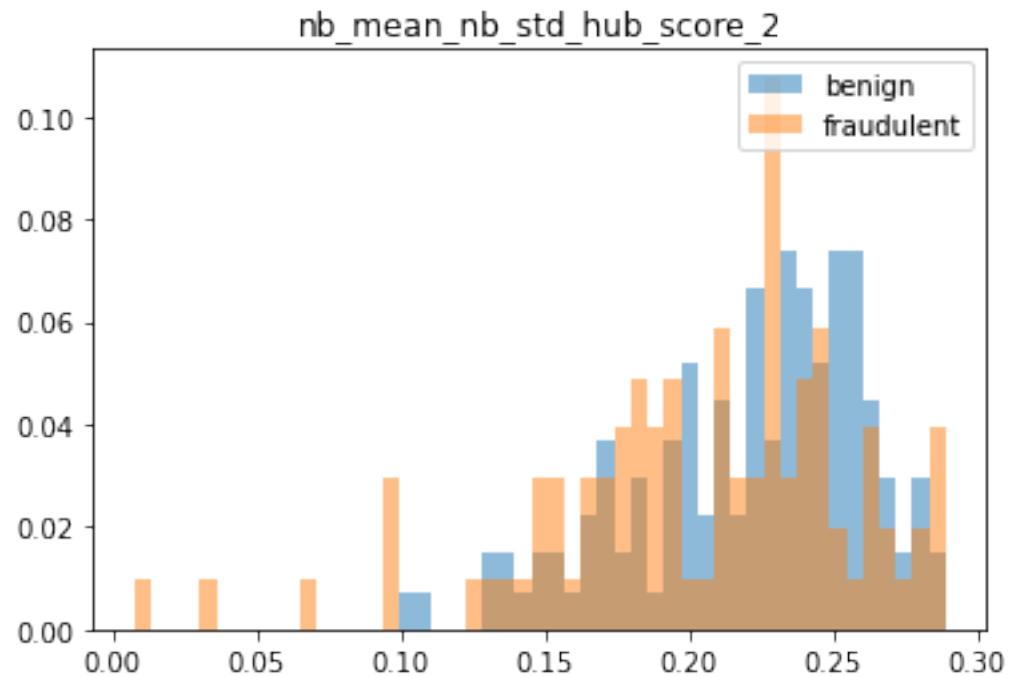


nb_mean_nb_max_hub_score_1

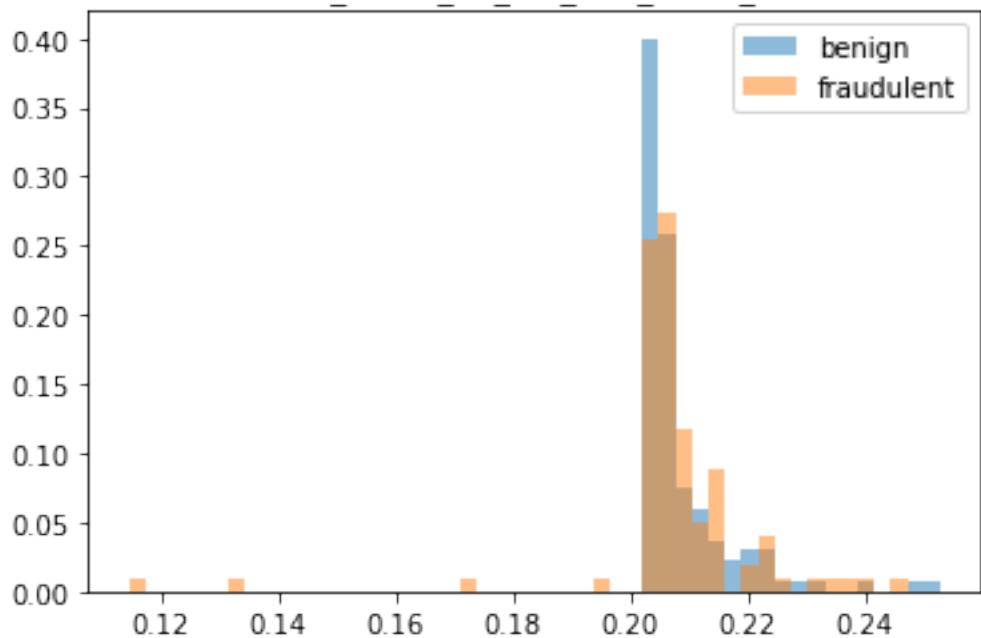




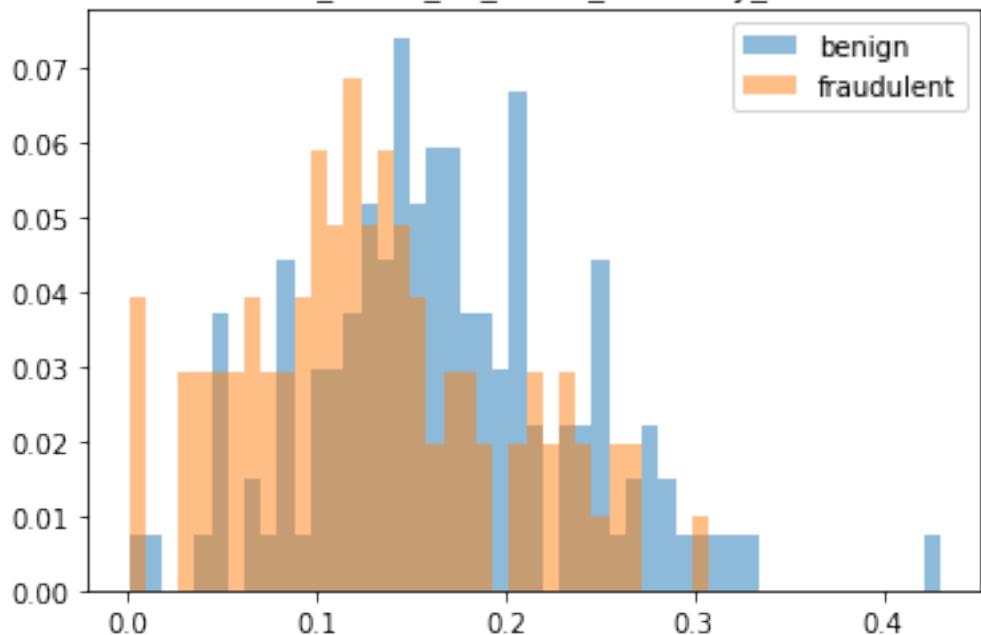




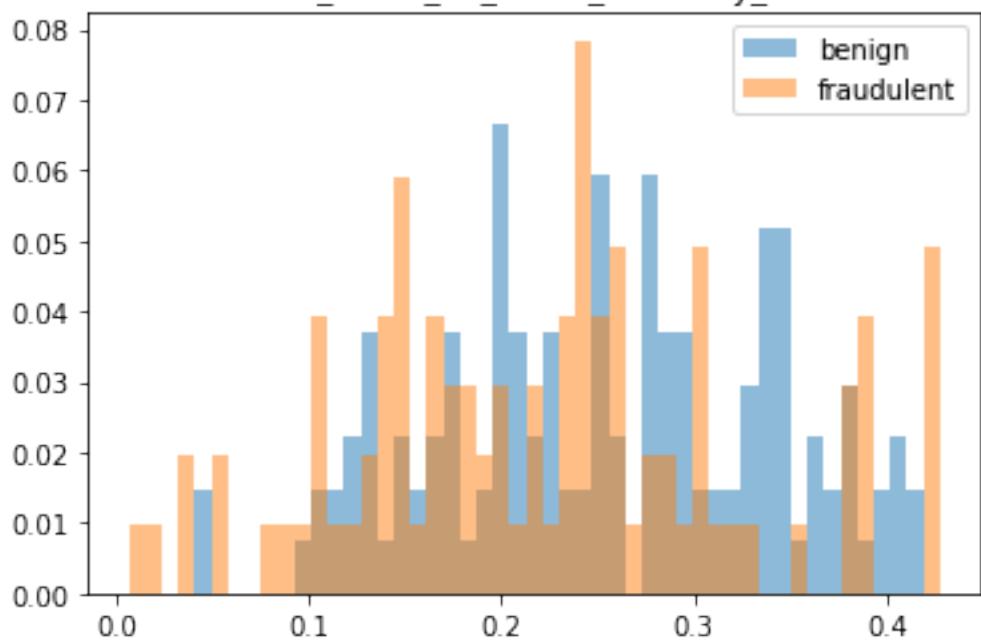
nb_mean_nb_std_hub_score_4



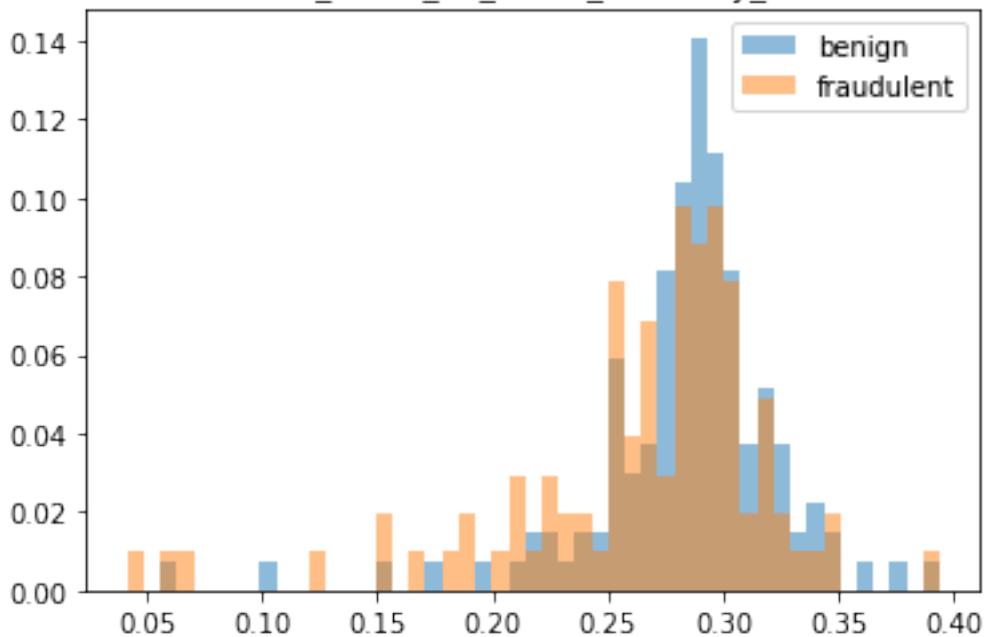
nb_mean_nb_mean_authority_1



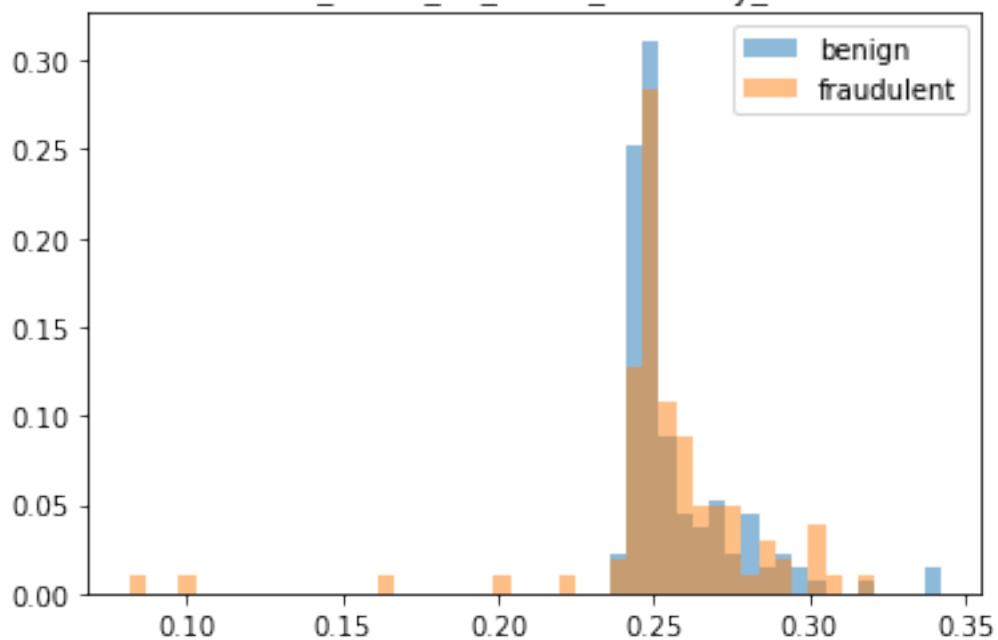
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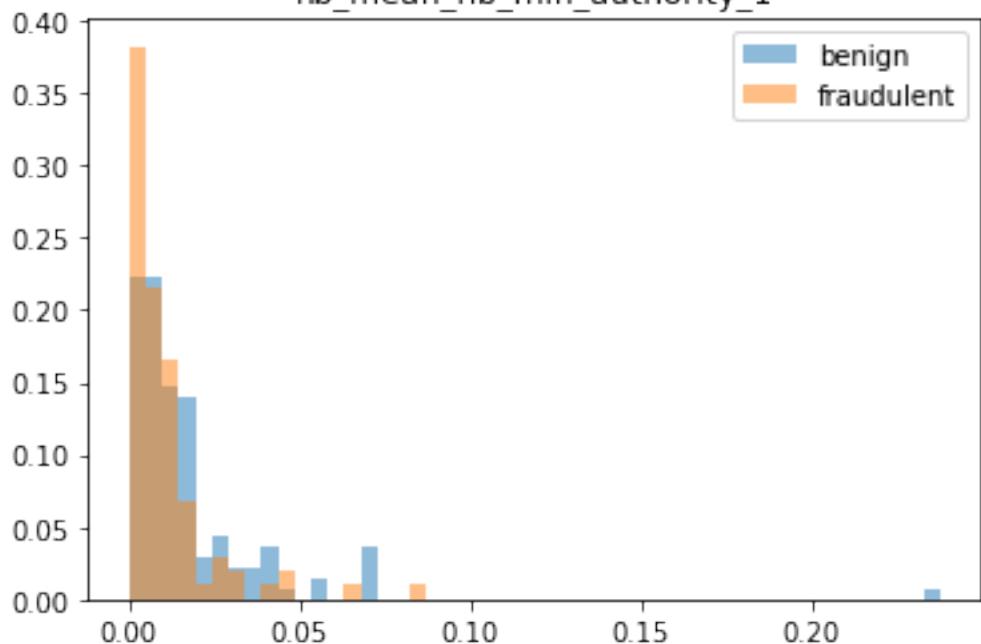
nb_mean_nb_mean_authority_3



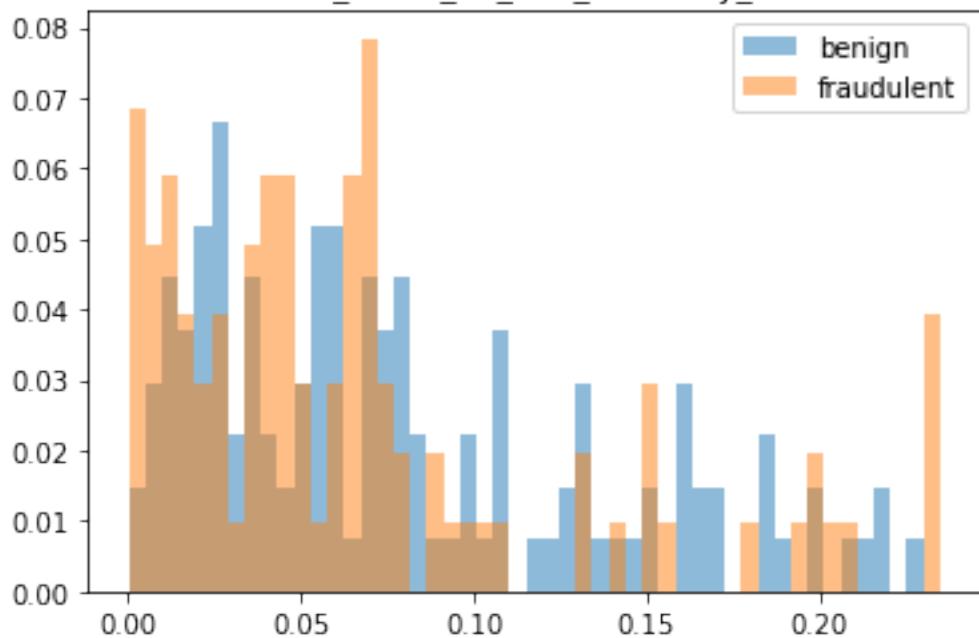
nb_mean_nb_mean_authority_4



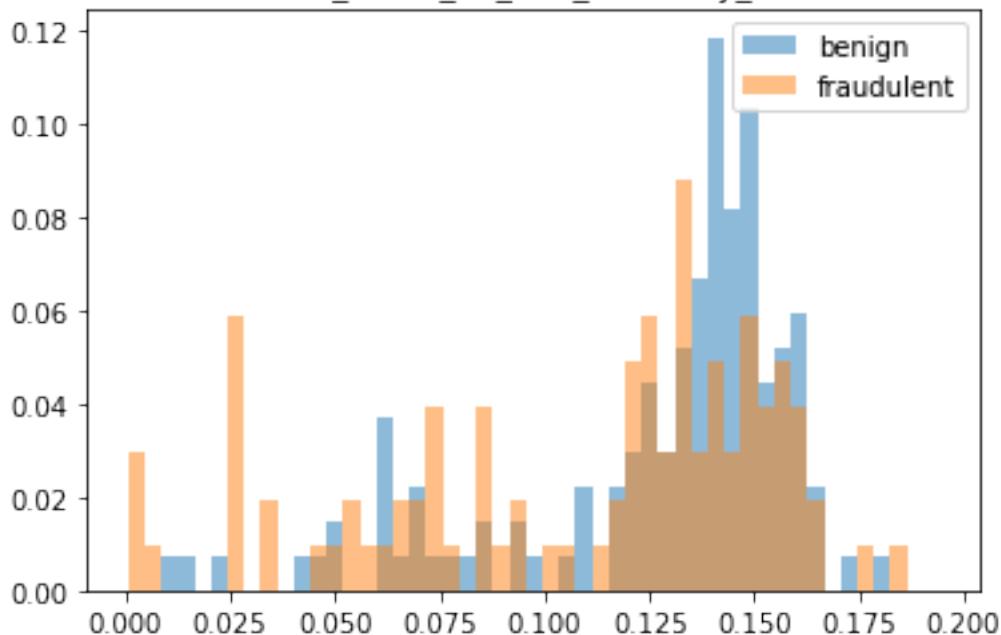
nb_mean_nb_min_authority_1

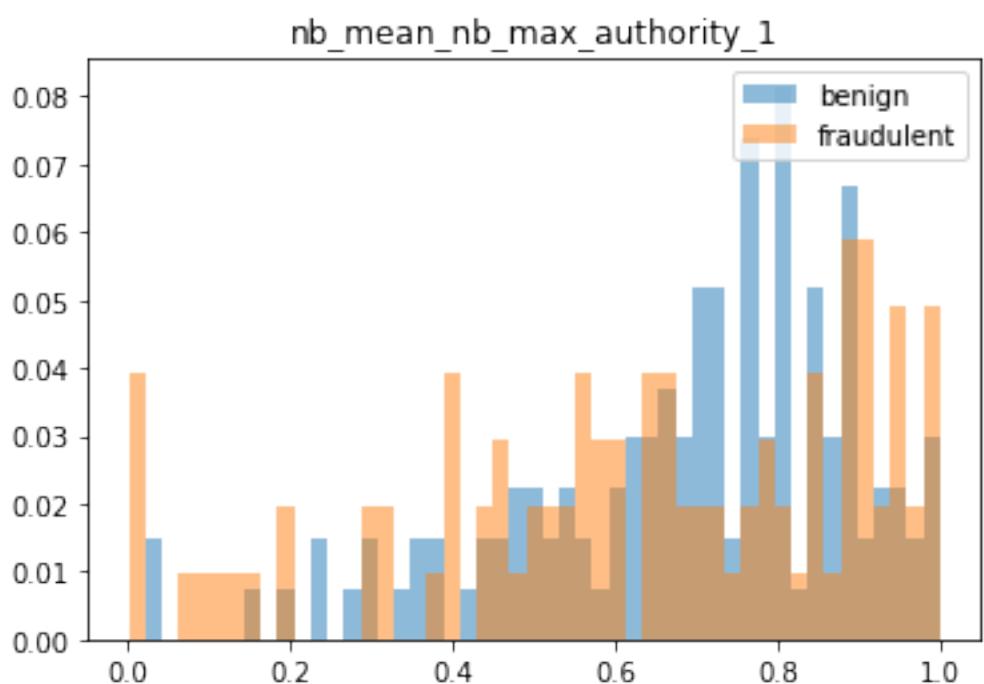
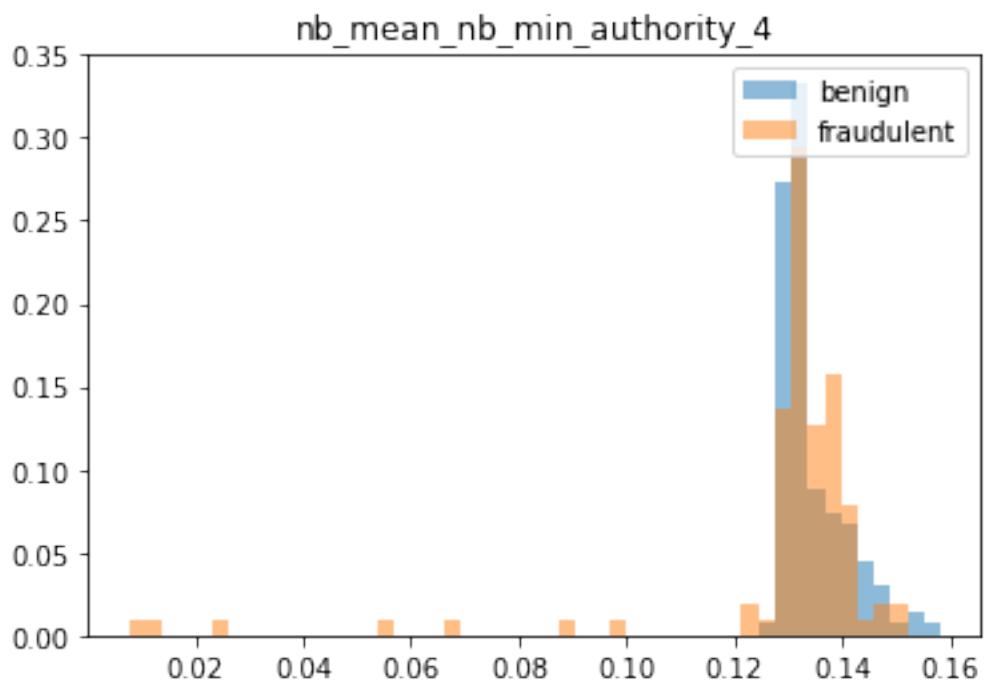


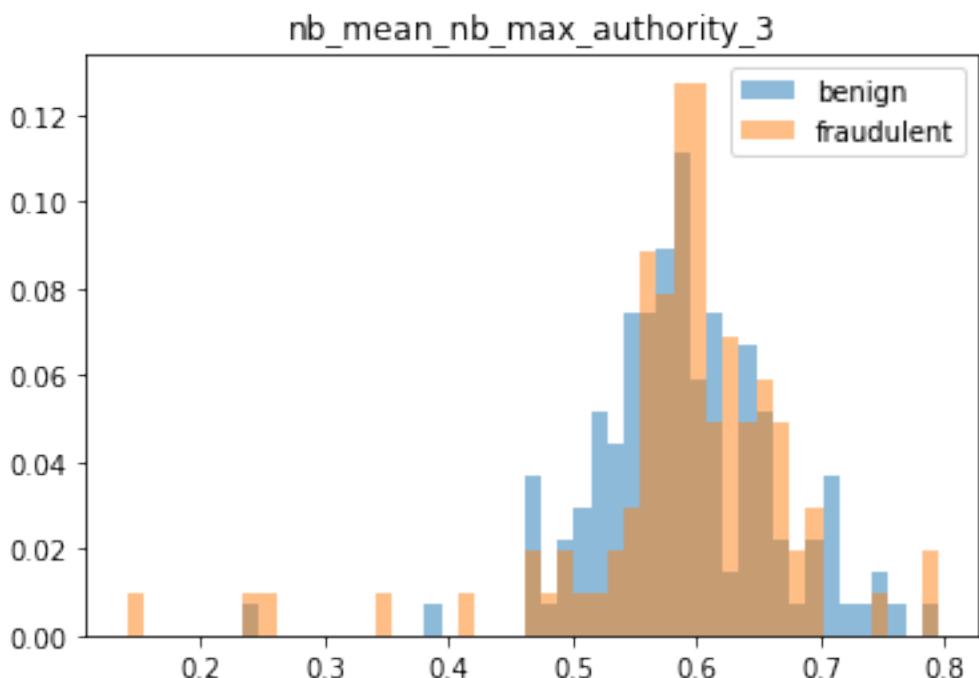
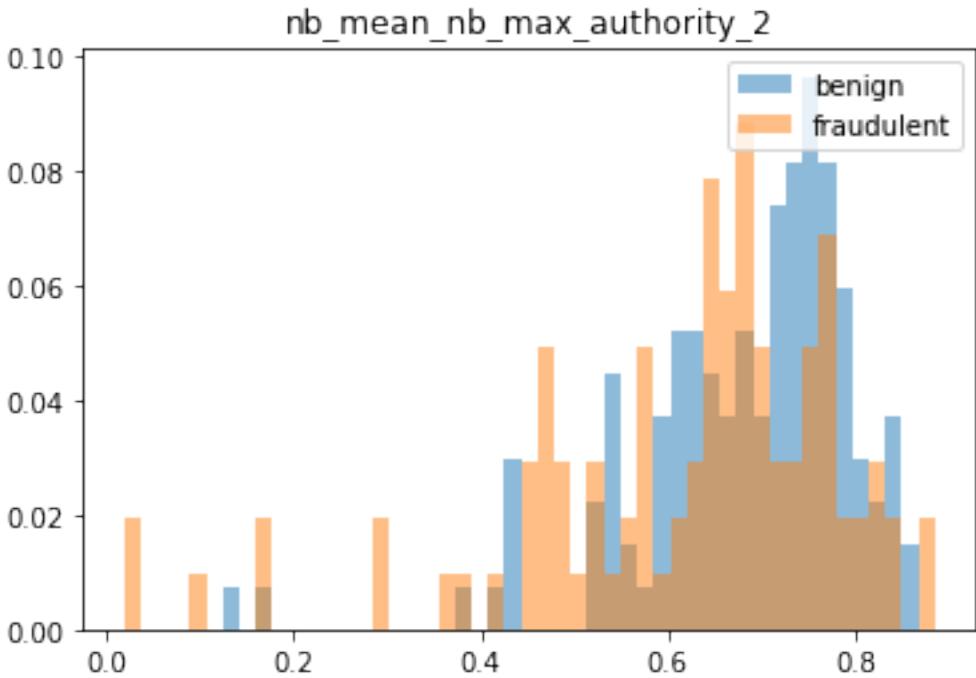
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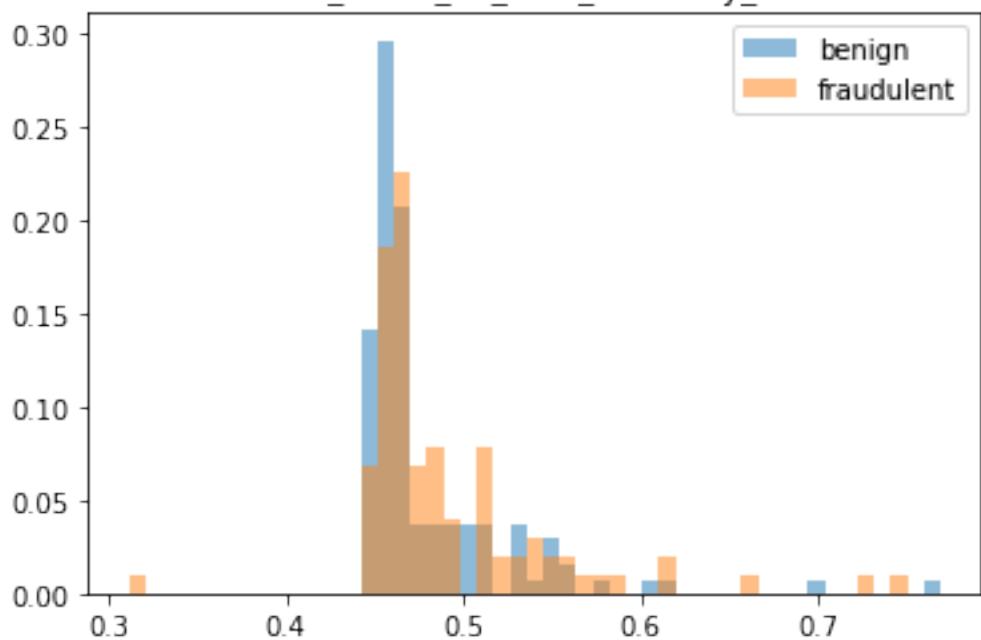
nb_mean_nb_min_authority_3



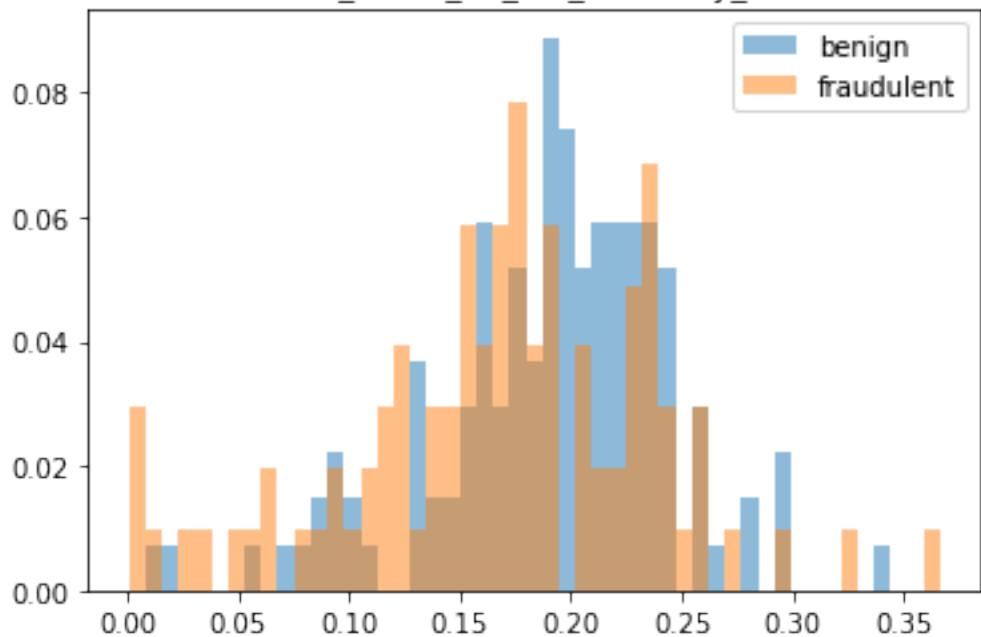




nb_mean_nb_max_authority_4



nb_mean_nb_std_authority_1

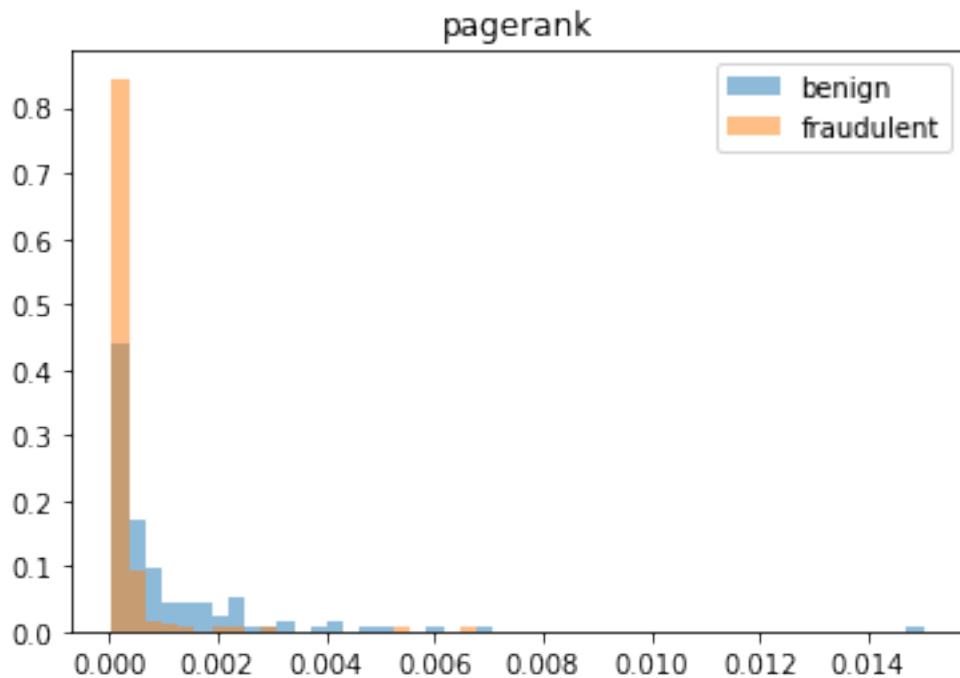


0.3 Bitcoin OTC

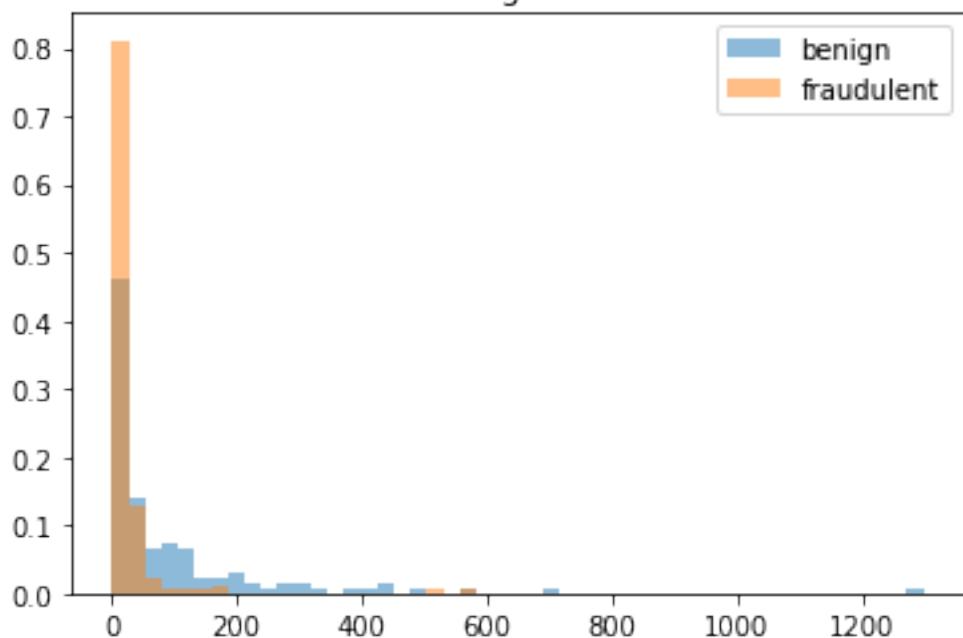
```
[39]: bitcoin_otc_gf = pd.read_csv("bitcoin_otc_gf.csv")
for col in bitcoin_otc_gf.columns[1:-1]:
    x = bitcoin_otc_gf.loc[bitcoin_otc_gf["label"] == 1, col]
    y = bitcoin_otc_gf.loc[bitcoin_otc_gf["label"] == 0, col]

    bins = np.linspace(min(bitcoin_otc_gf[col]), max(bitcoin_otc_gf[col]), 50)

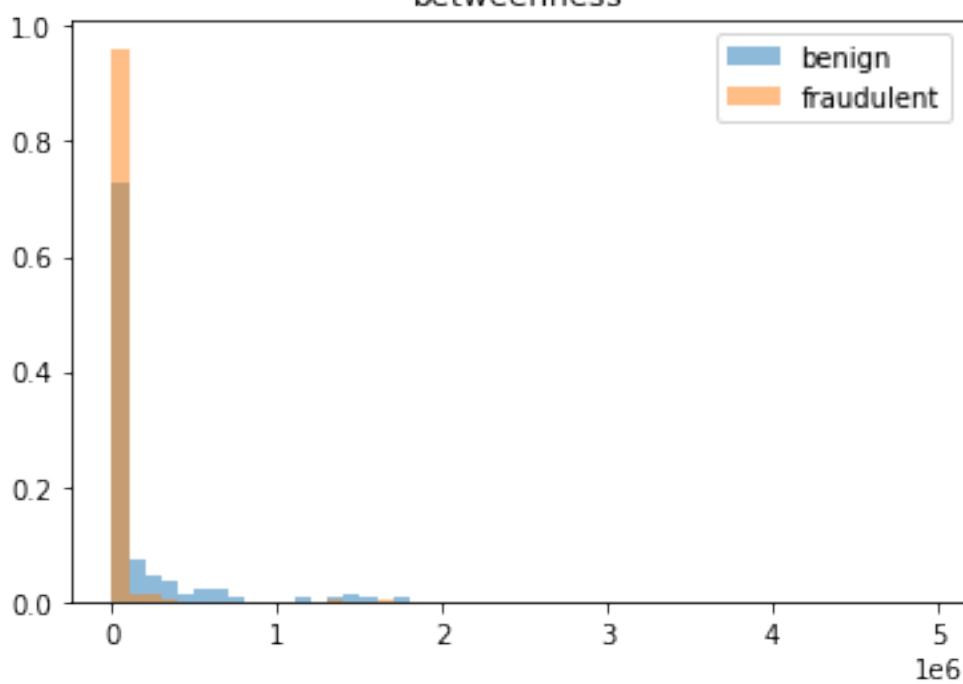
    plt.hist(round(x, 5), bins, alpha=0.5, label='benign', weights=np.
    ↪ones(len(x))/len(x))
    plt.hist(y, bins, alpha=0.5, label='fraudulent', weights=np.ones(len(y))/
    ↪len(y))
    plt.legend(loc='upper right')
    plt.title(col)
    #plt.savefig(f'./charts/{col}.pdf')
    plt.show()
```

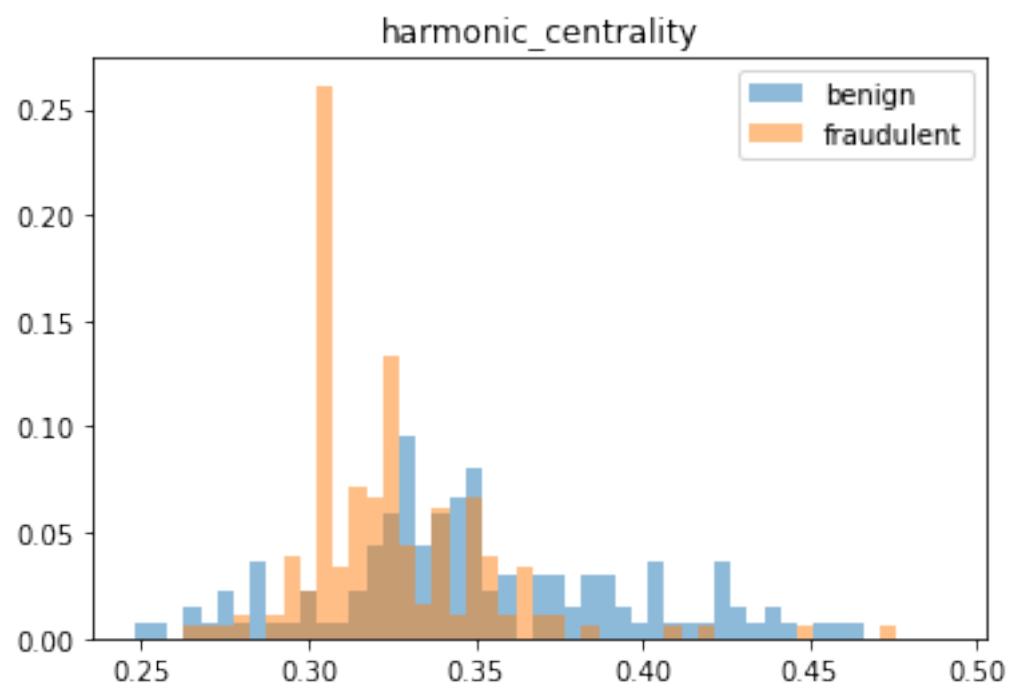
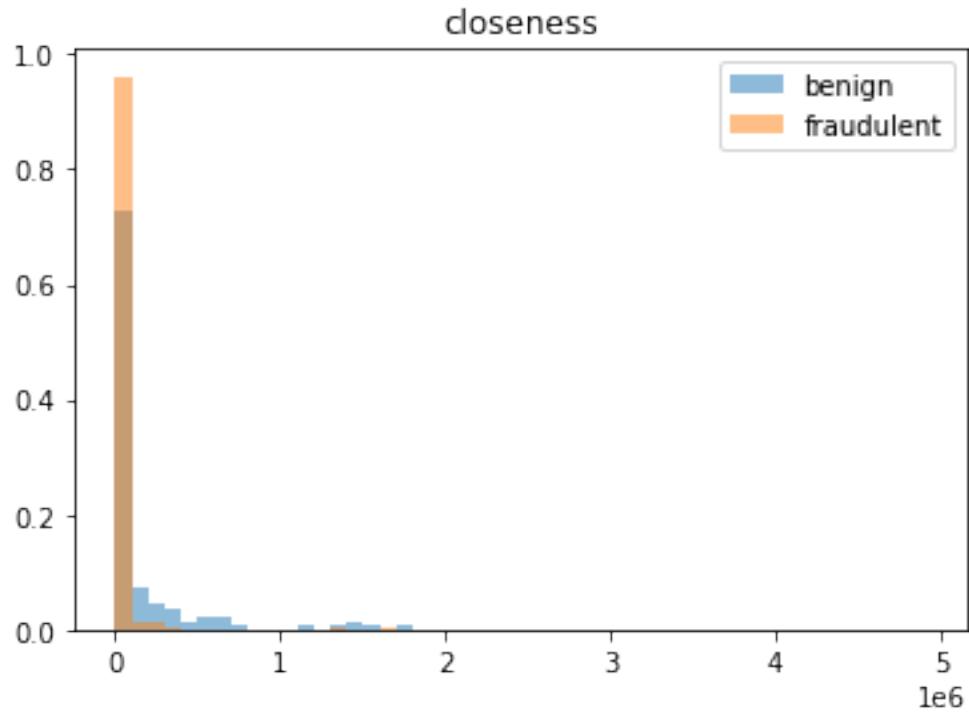


degree

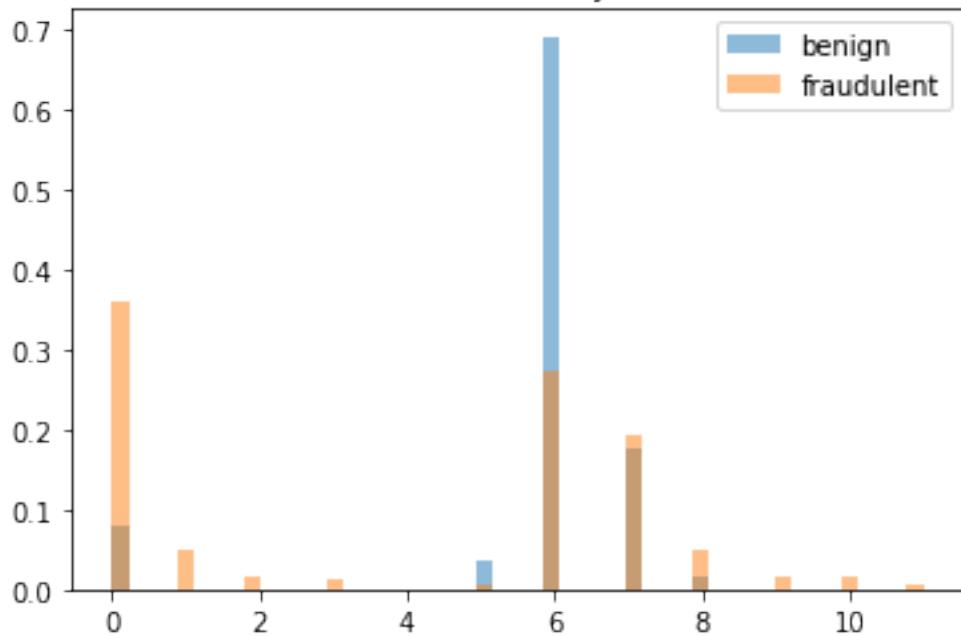


betweenness

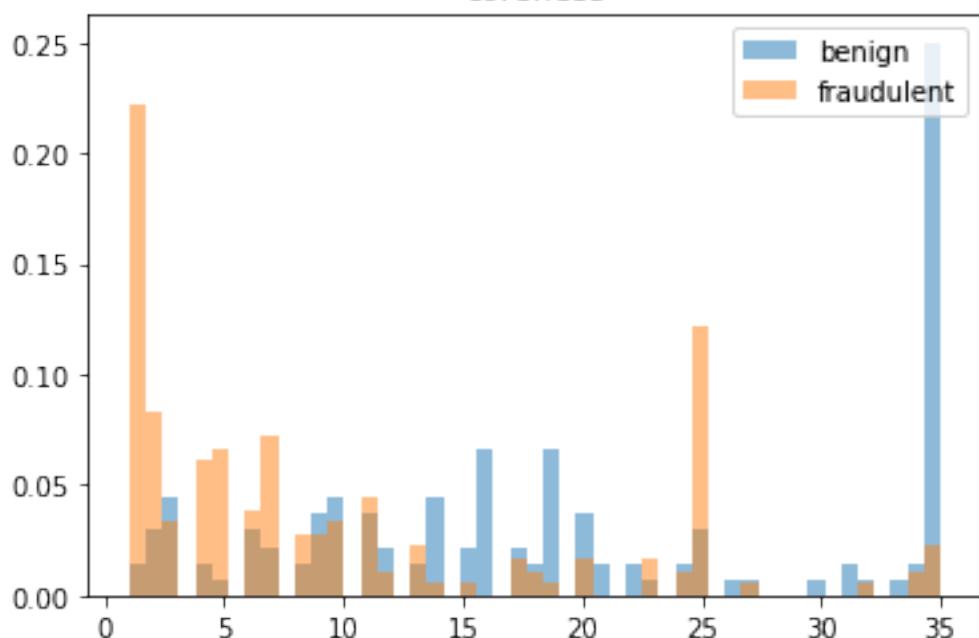




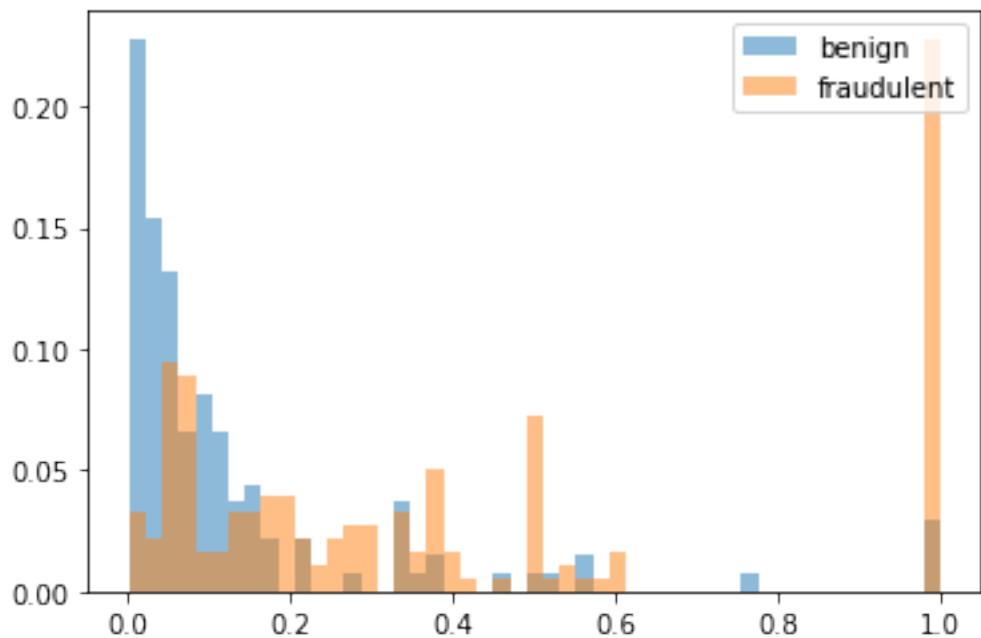
eccentricity



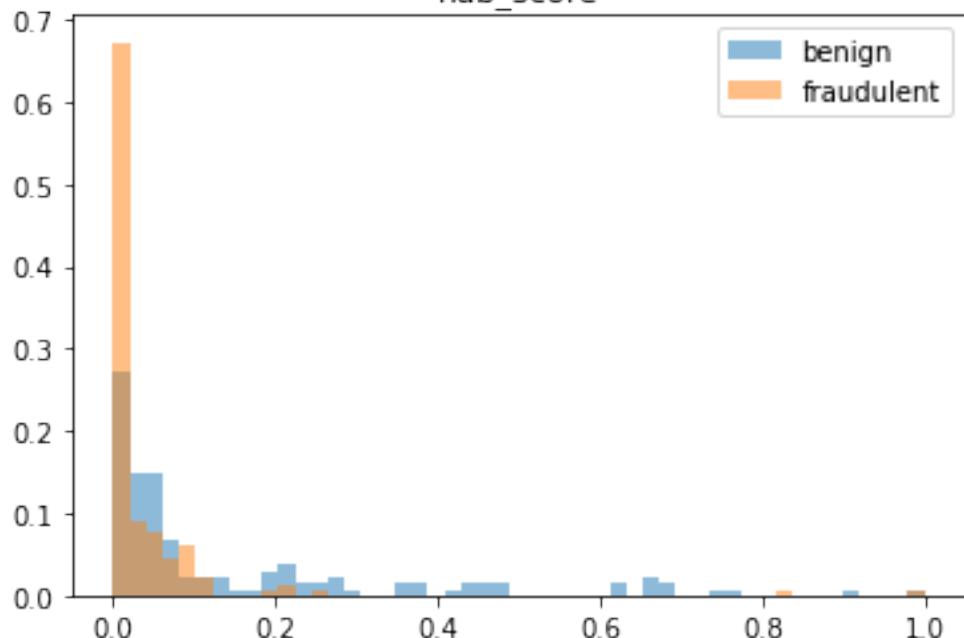
coreness

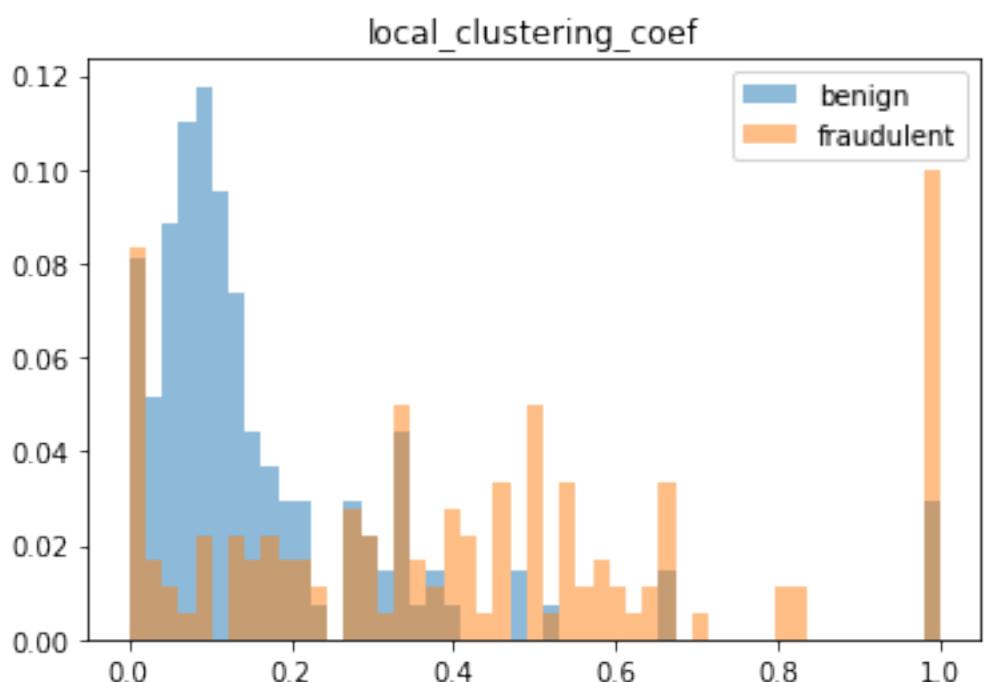
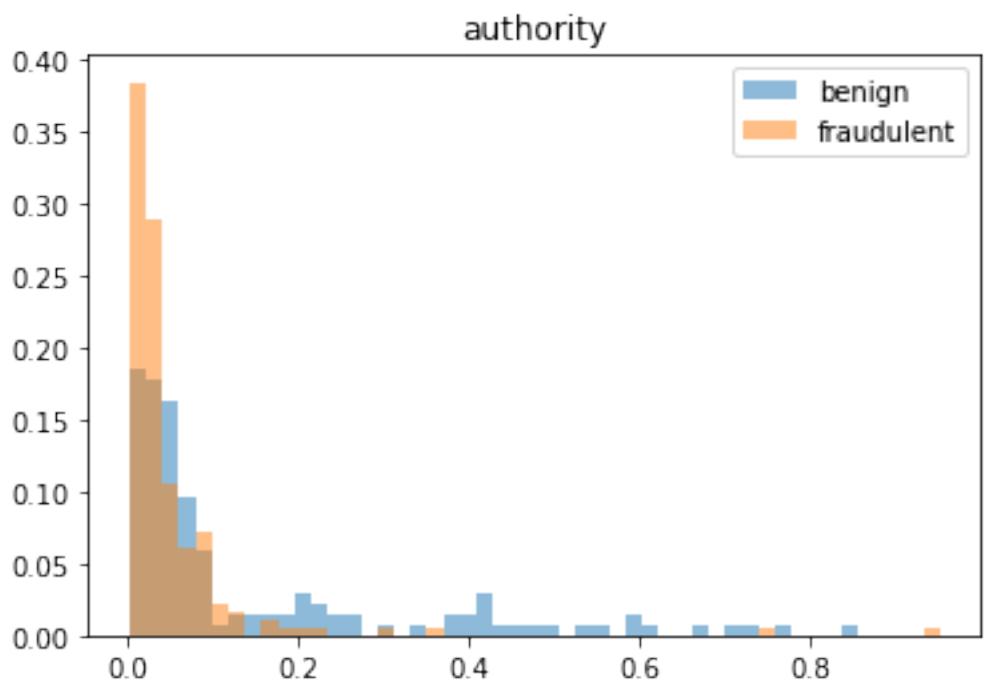


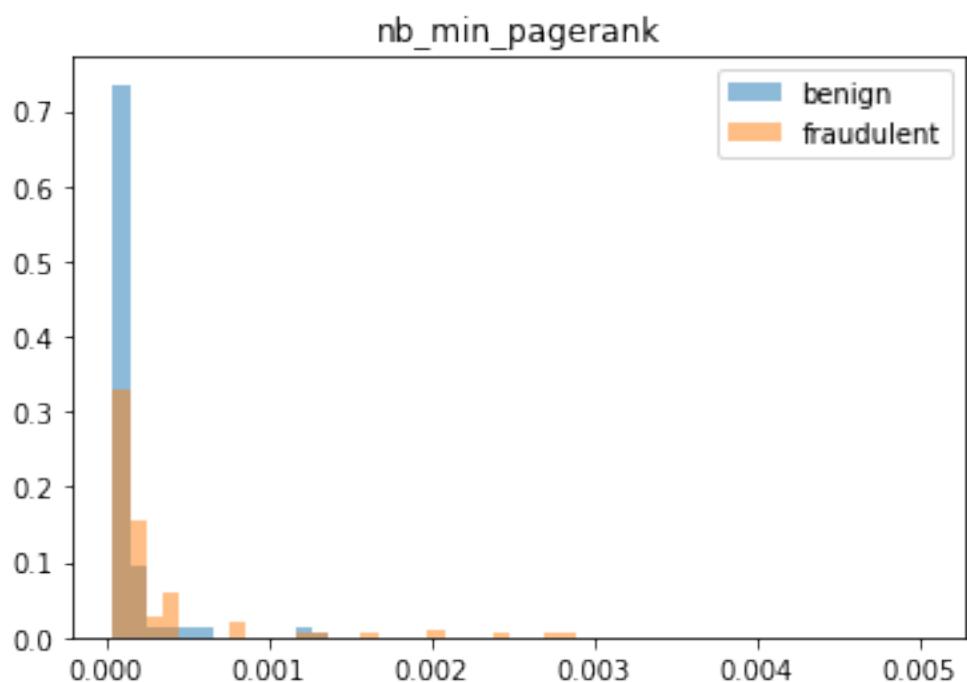
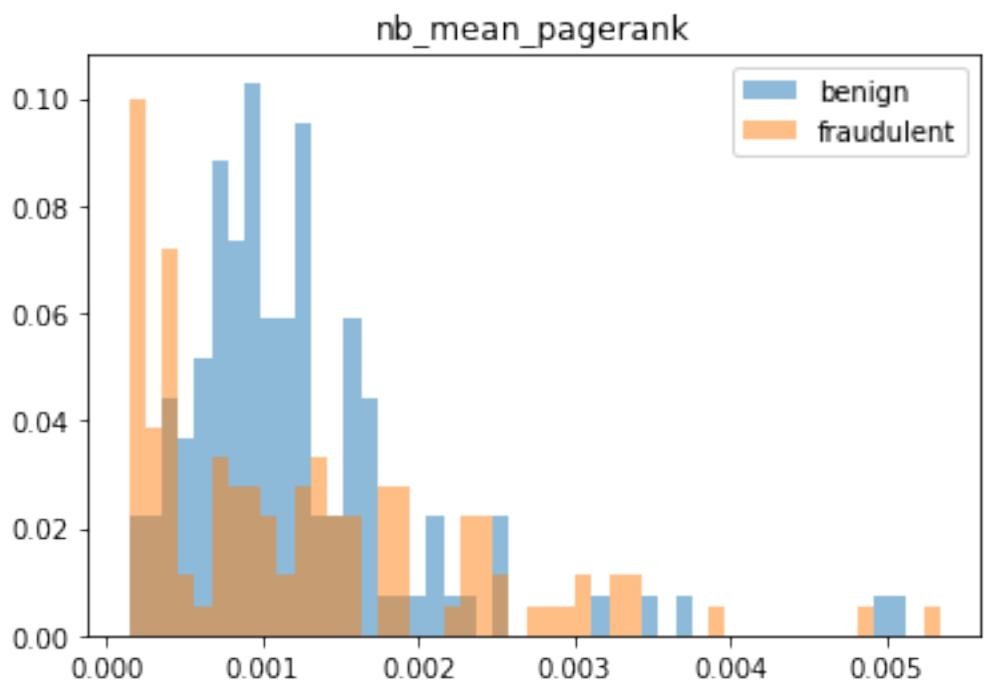
constraint

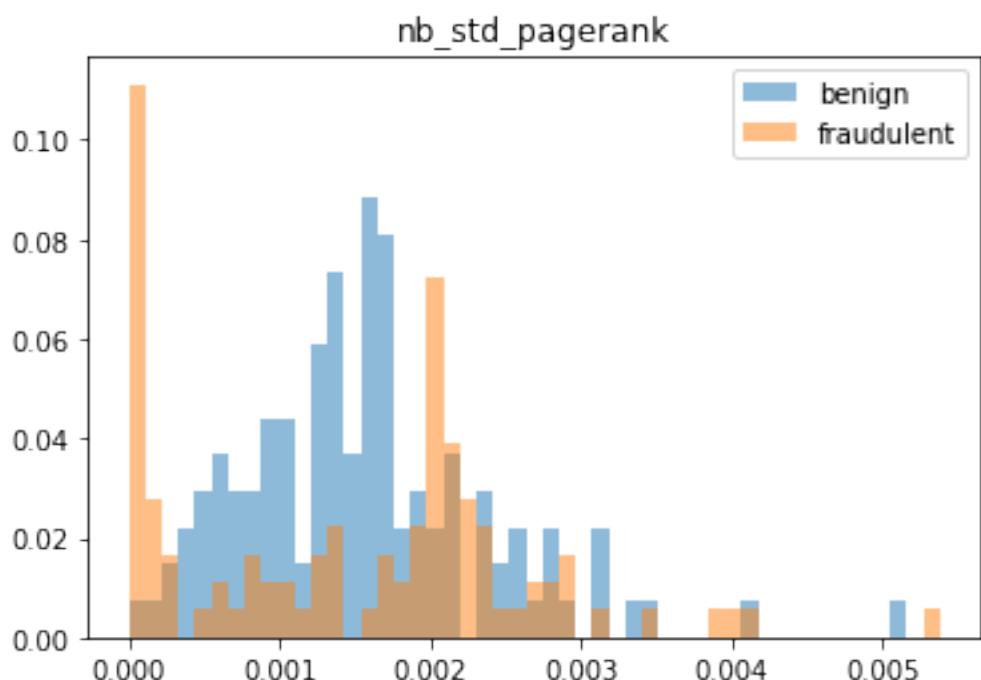
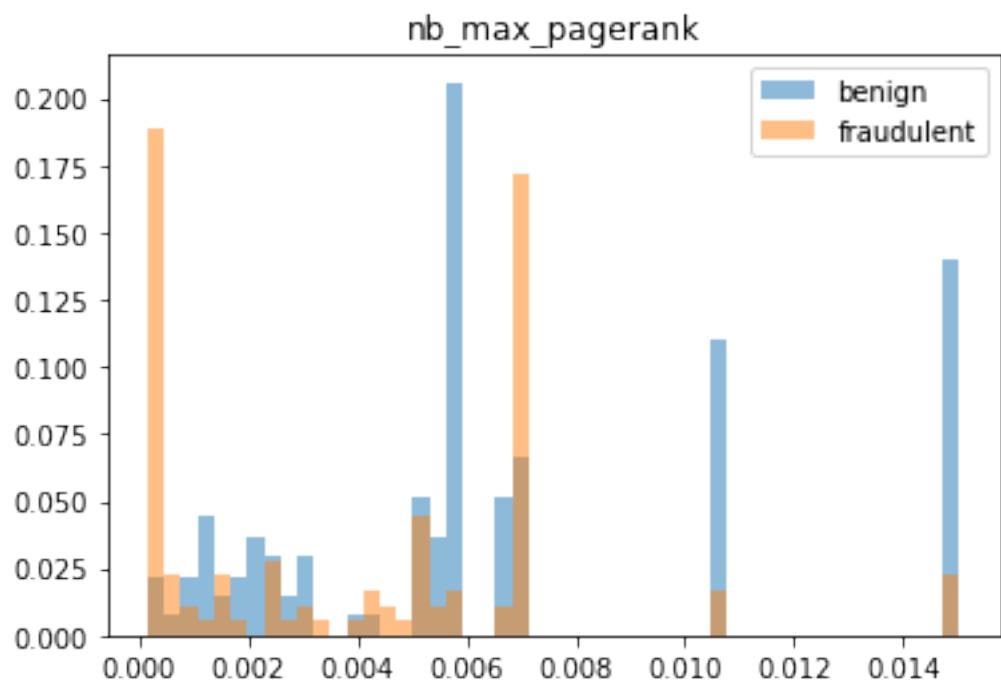


hub_score

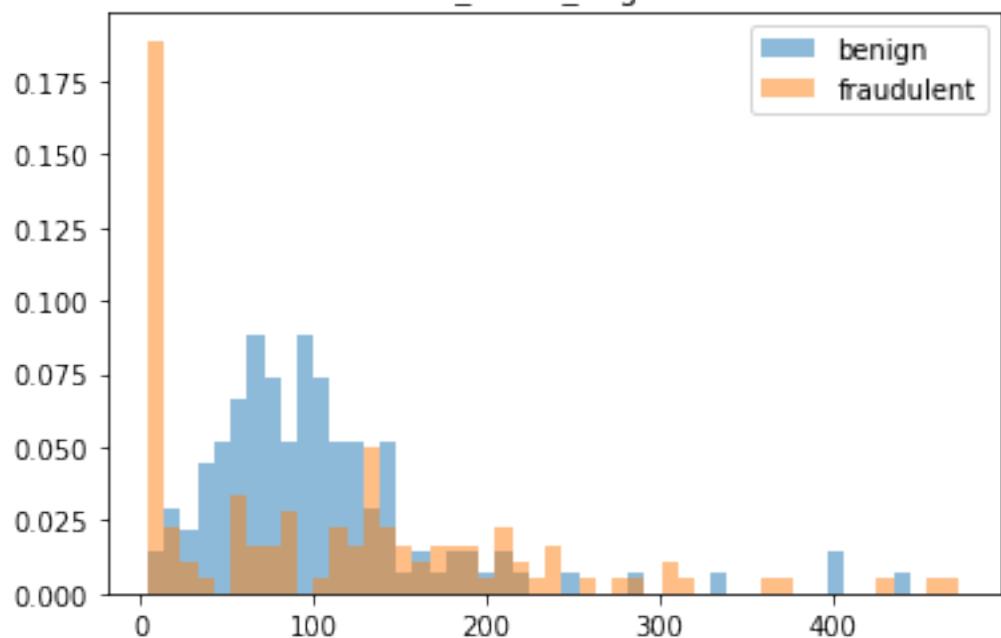




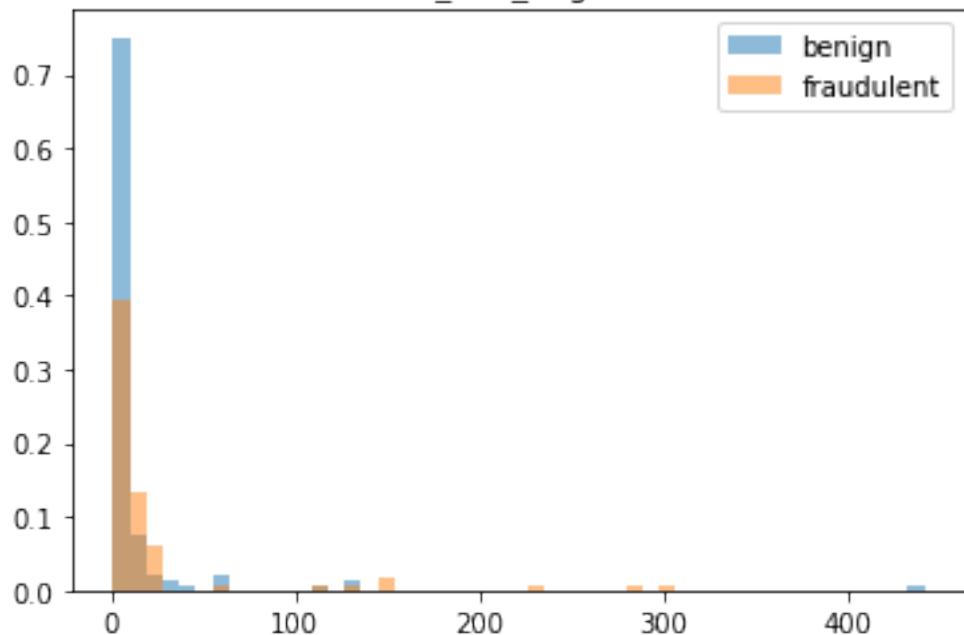




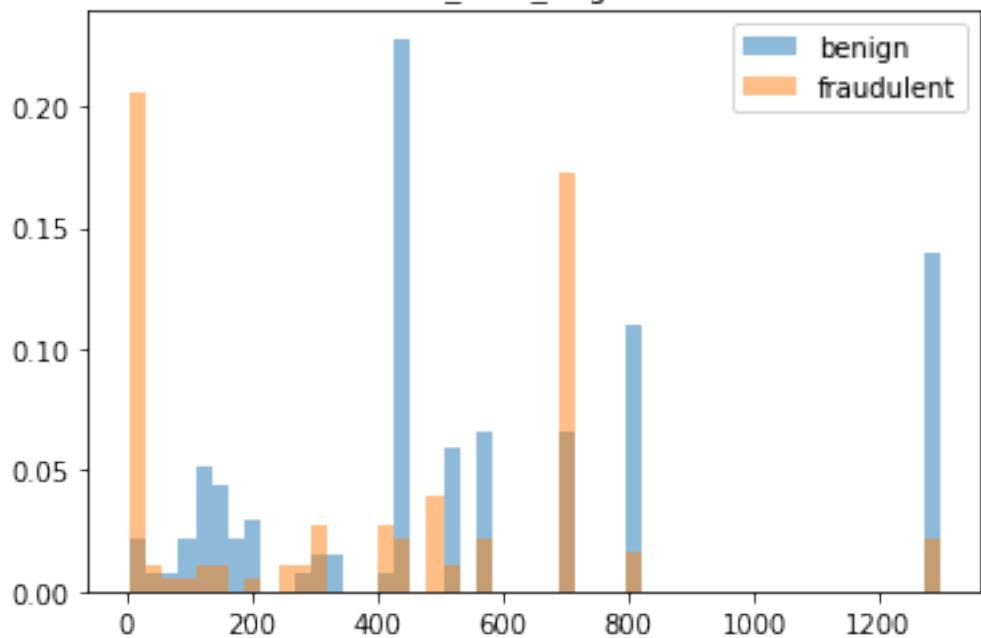
nb_mean_degree



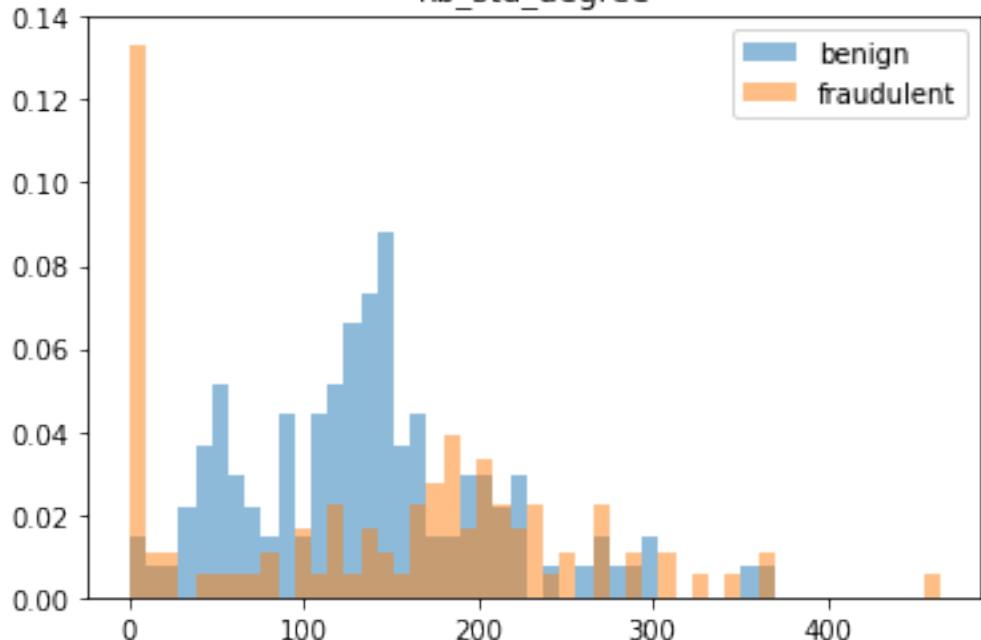
nb_min_degree

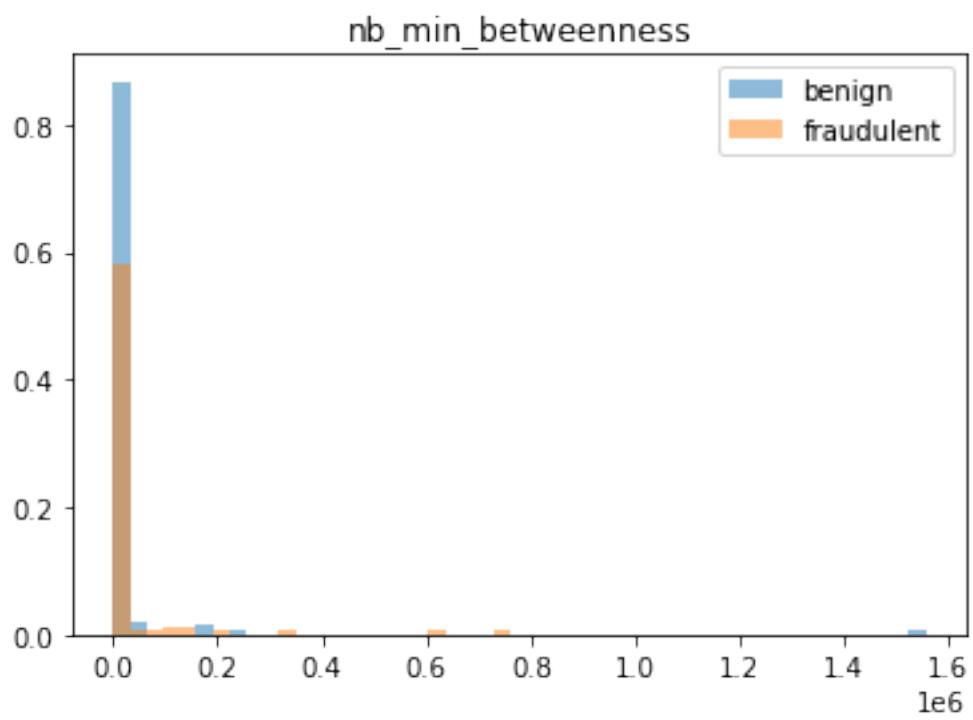
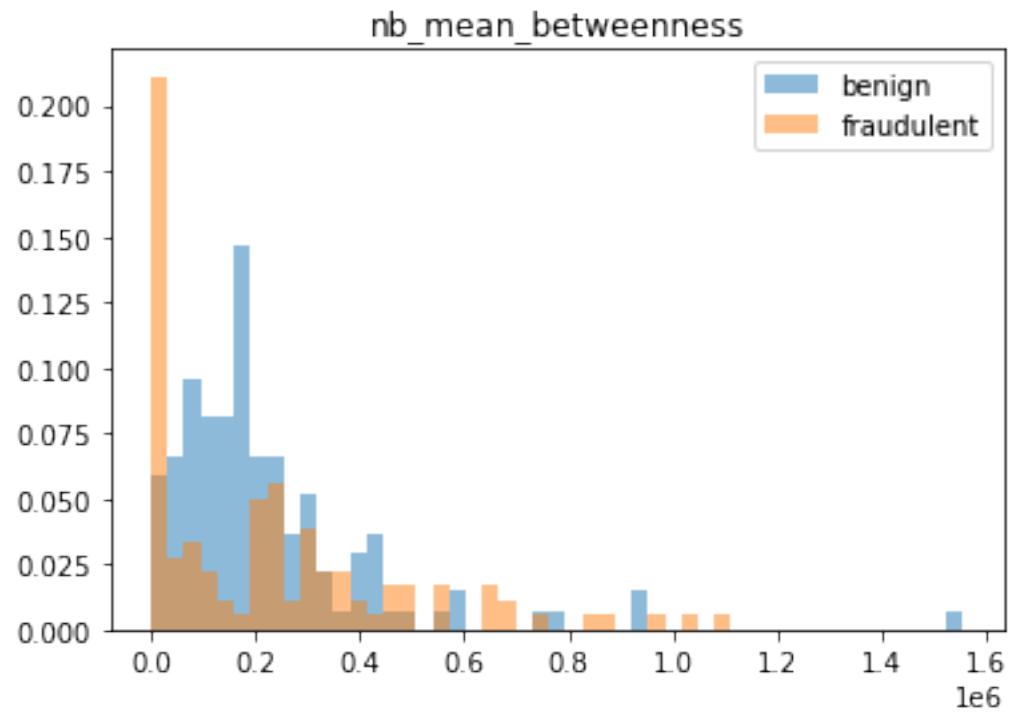


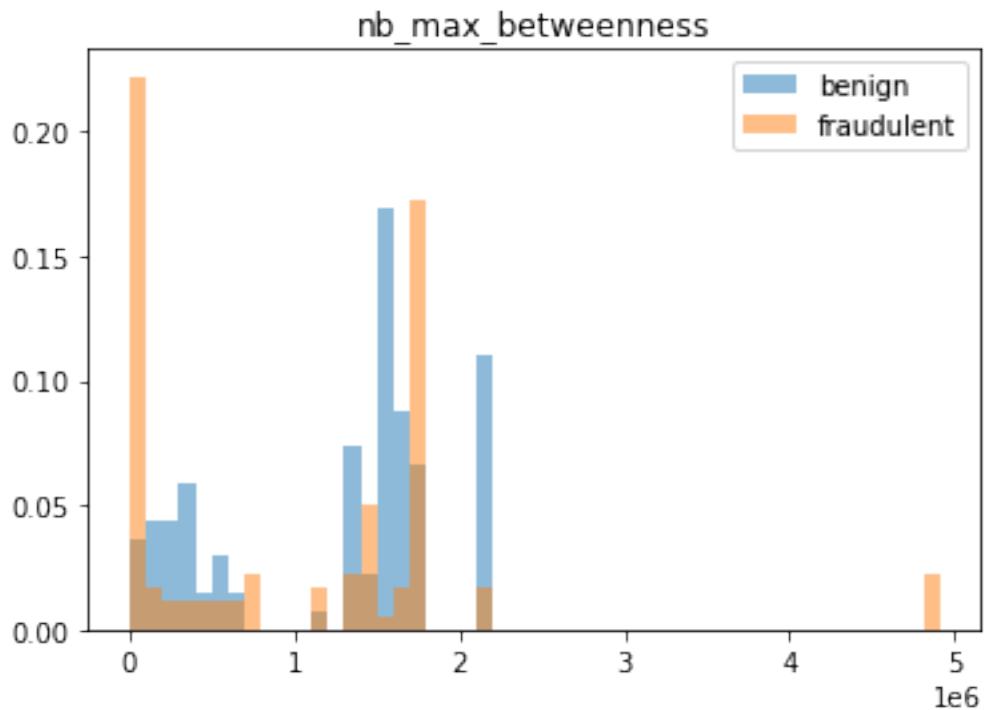
nb_max_degree

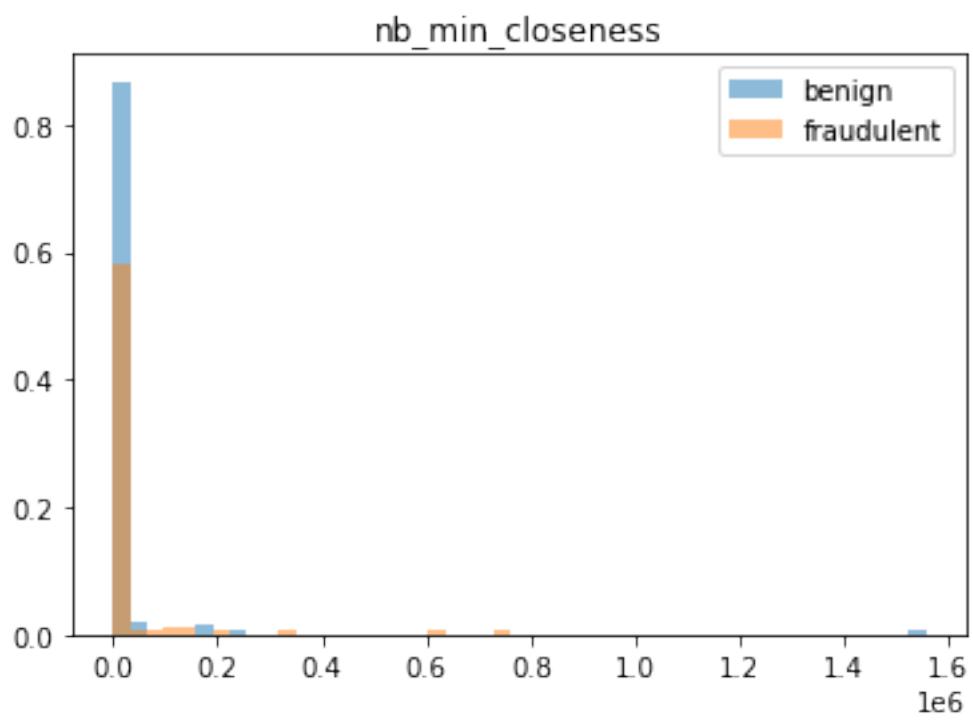
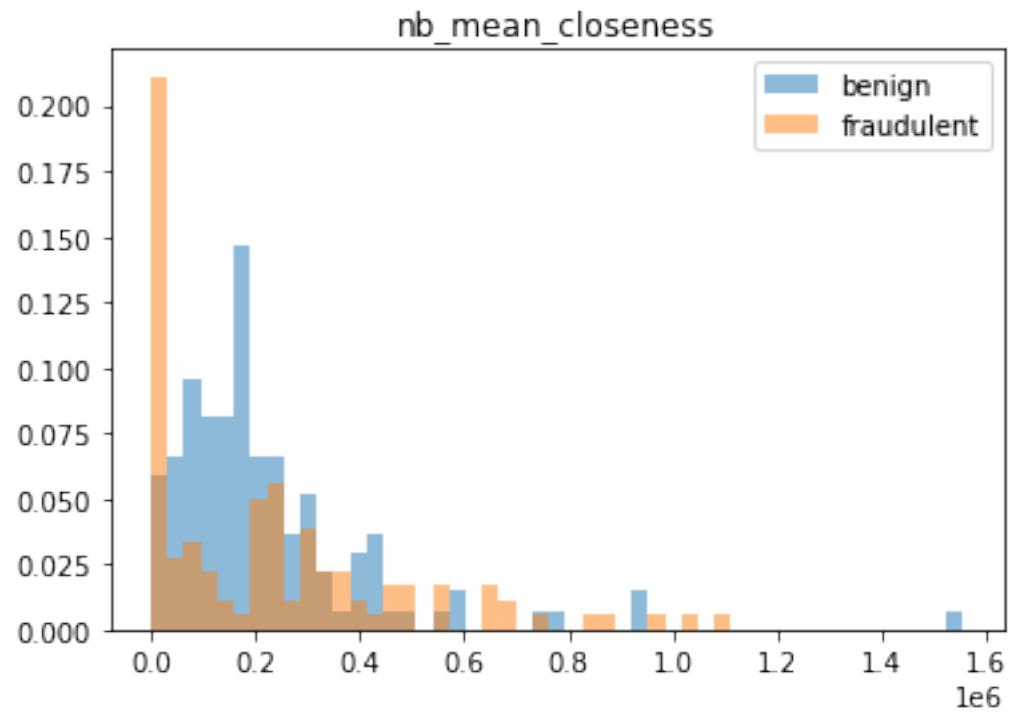


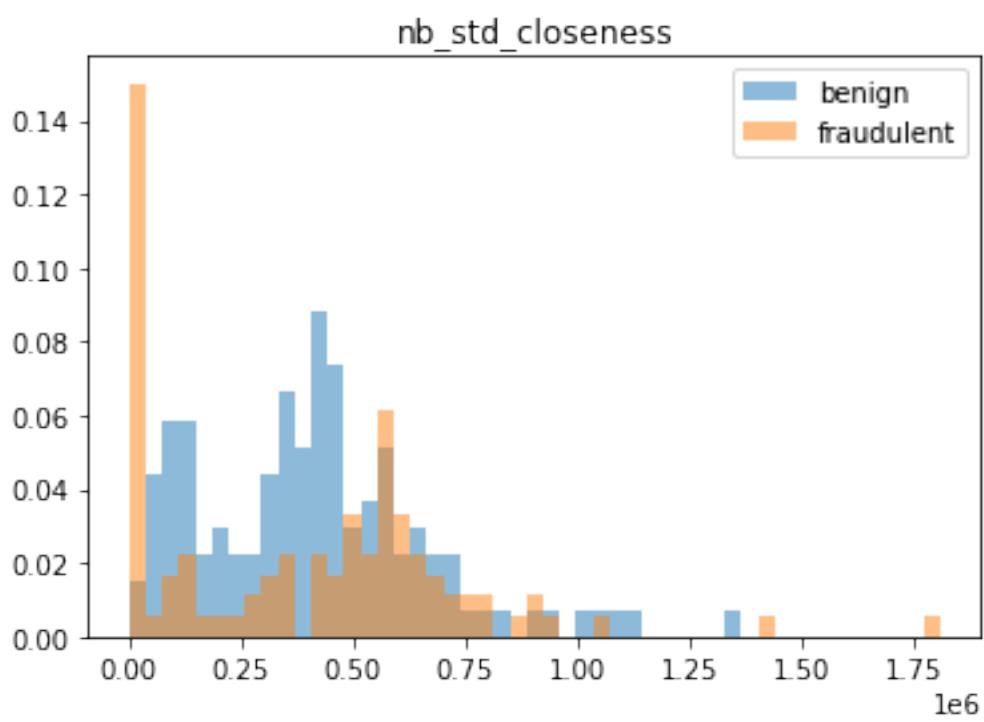
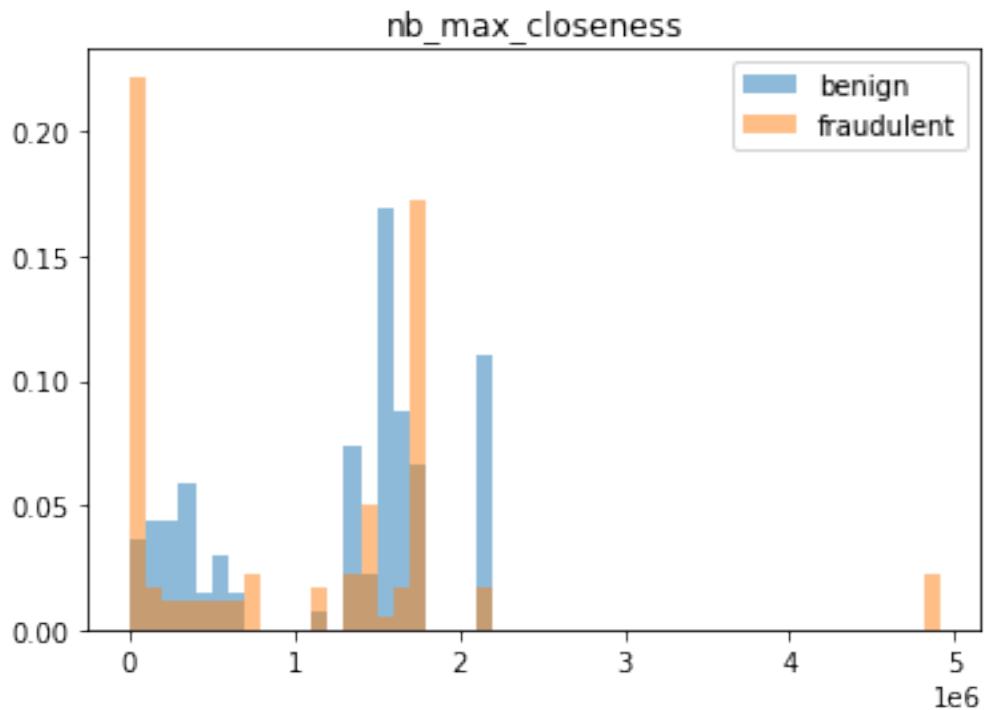
nb_std_degree



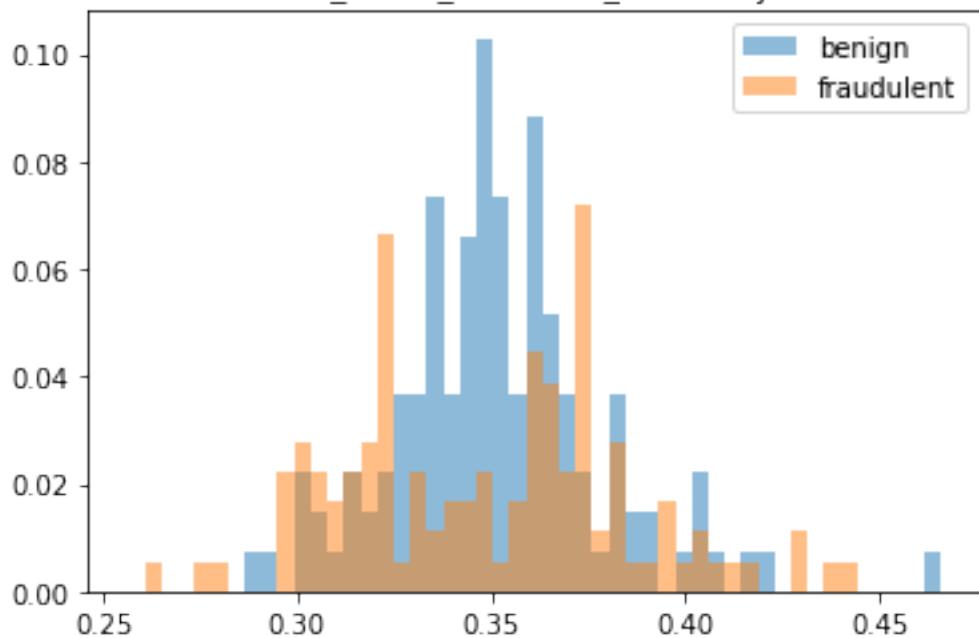




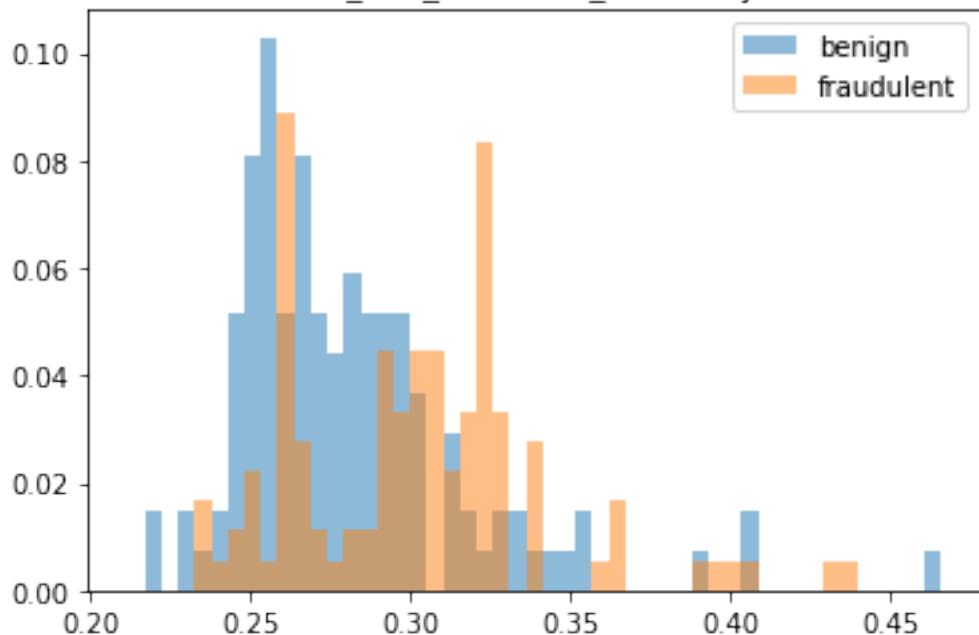




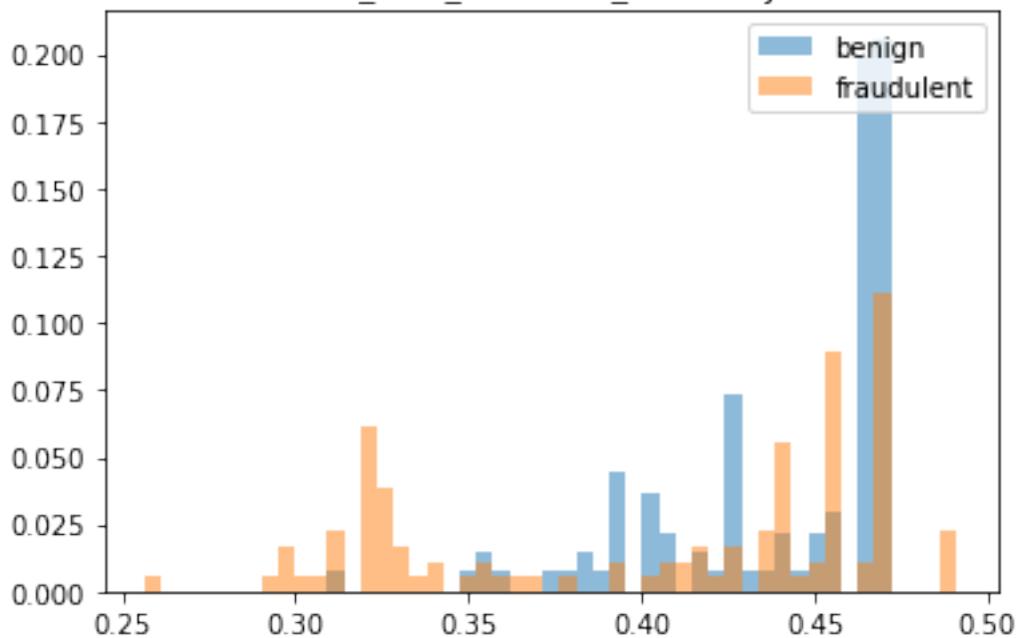
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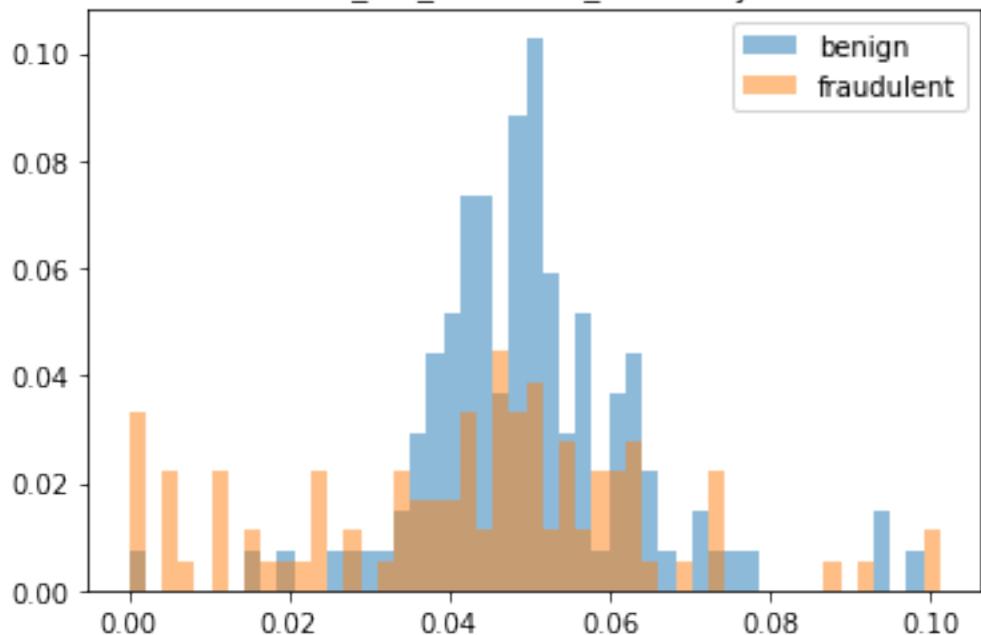
nb_min_harmonic_centrality



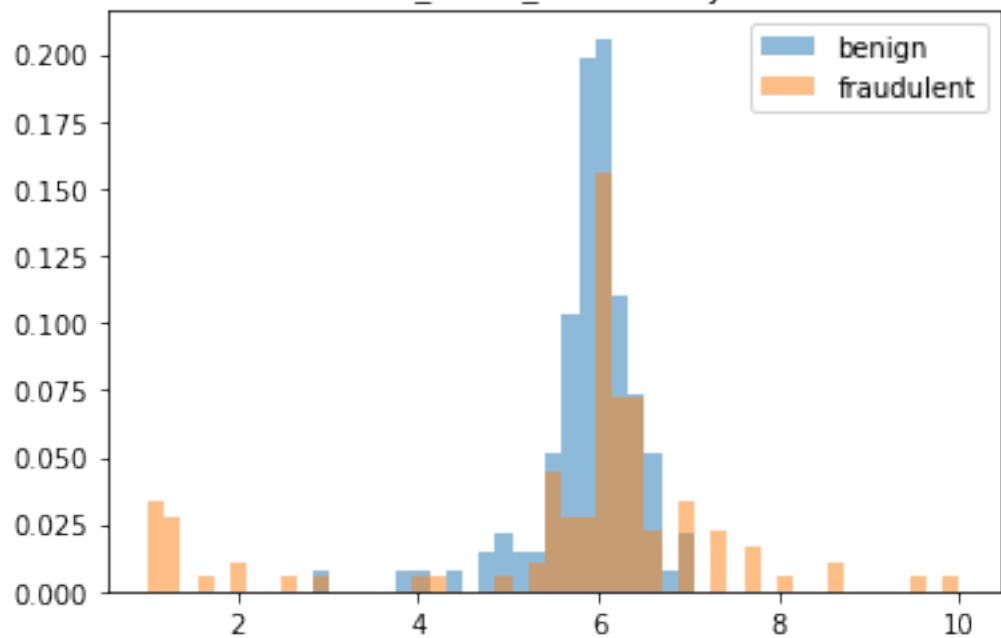
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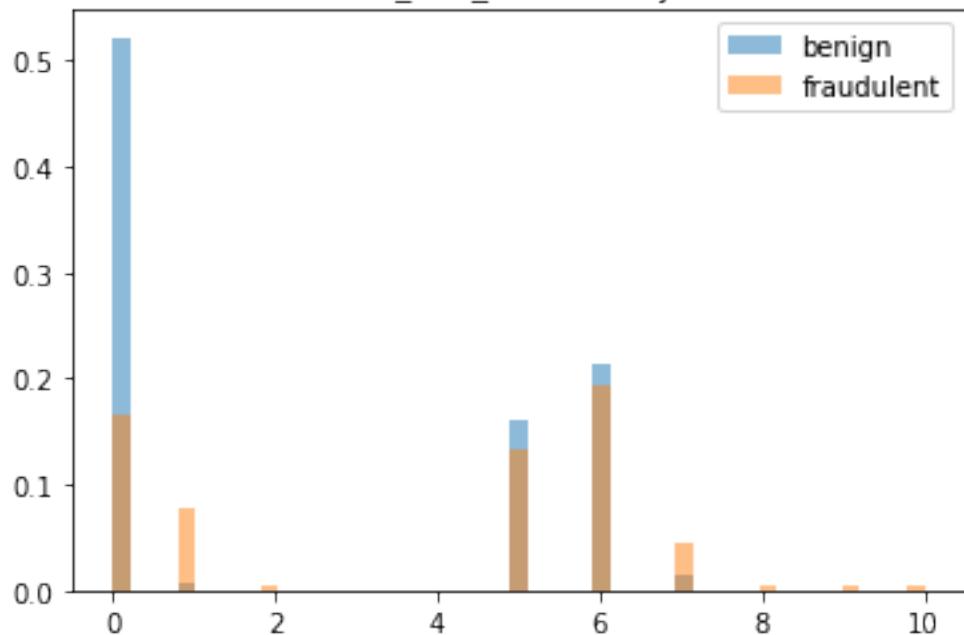
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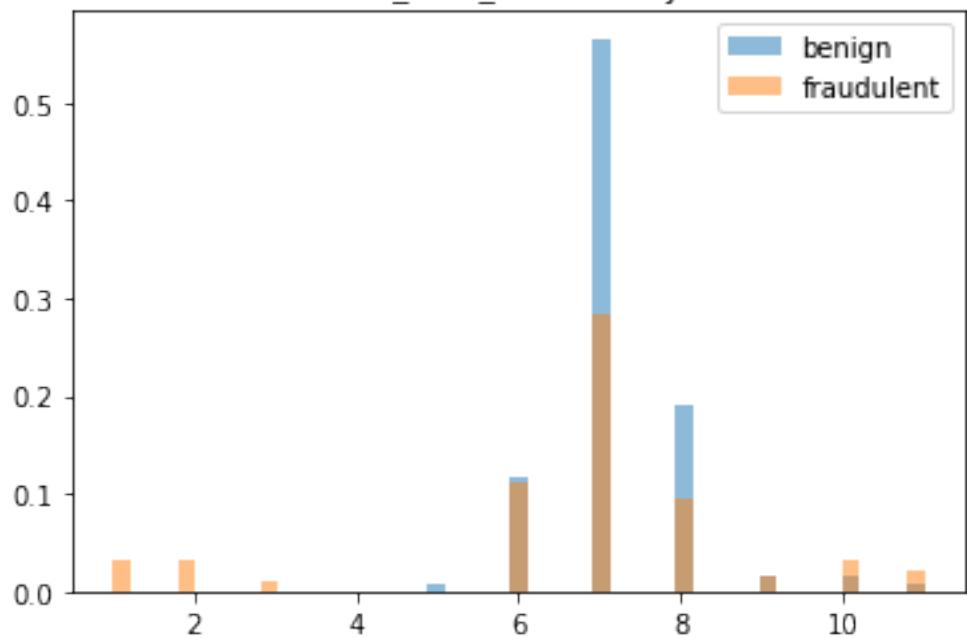
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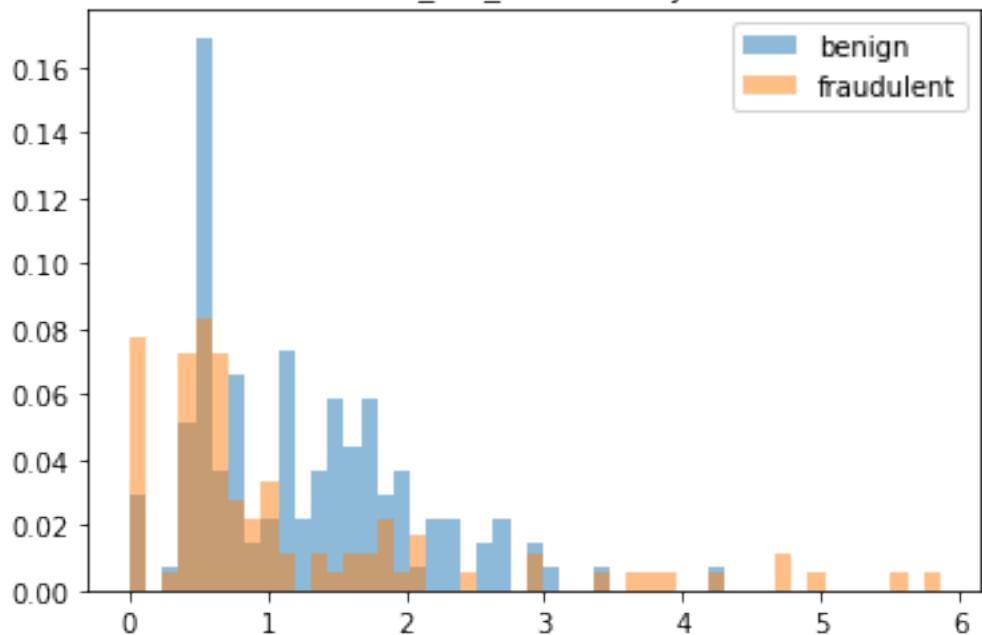
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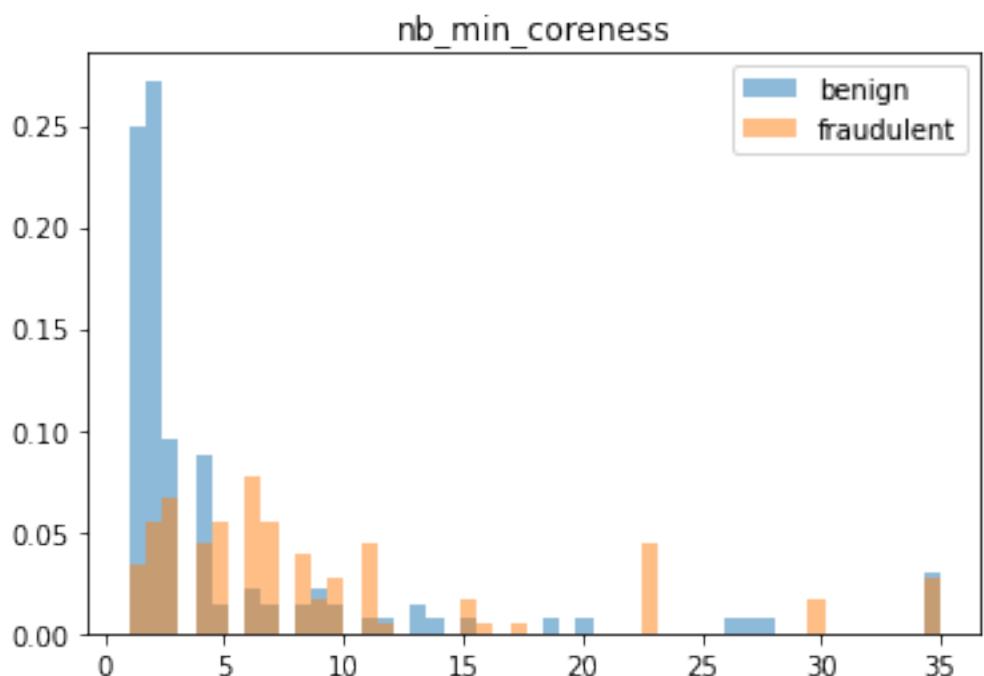
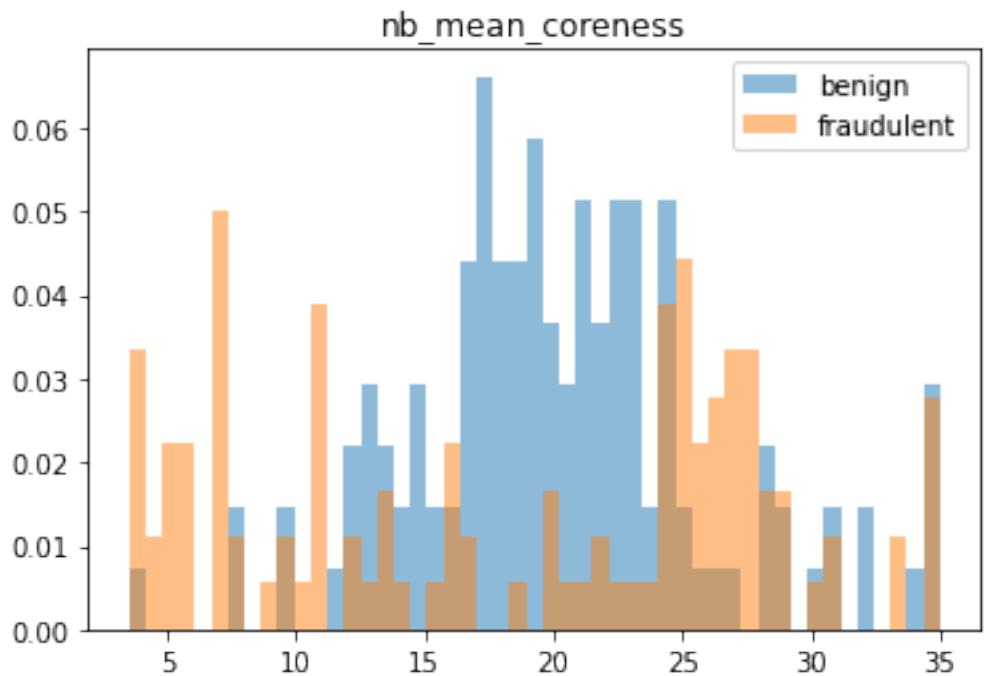


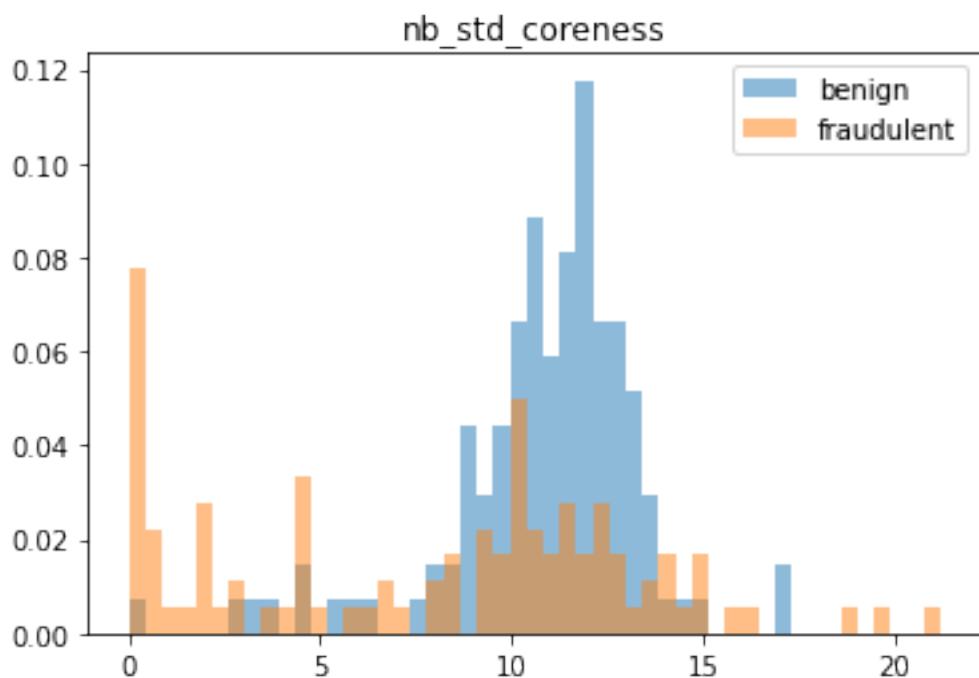
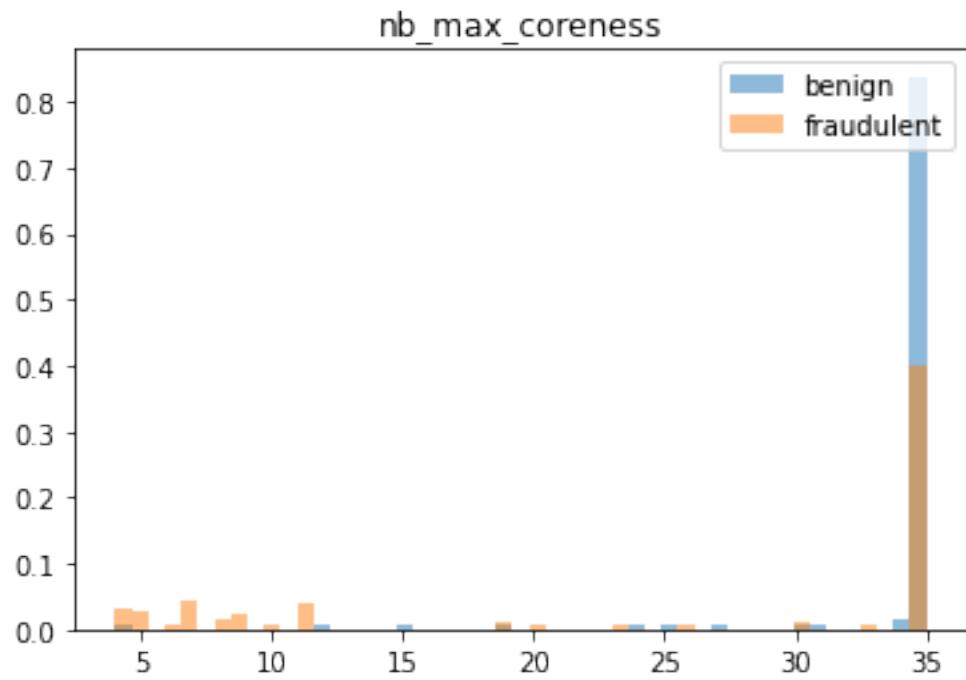
nb_max_eccentricity



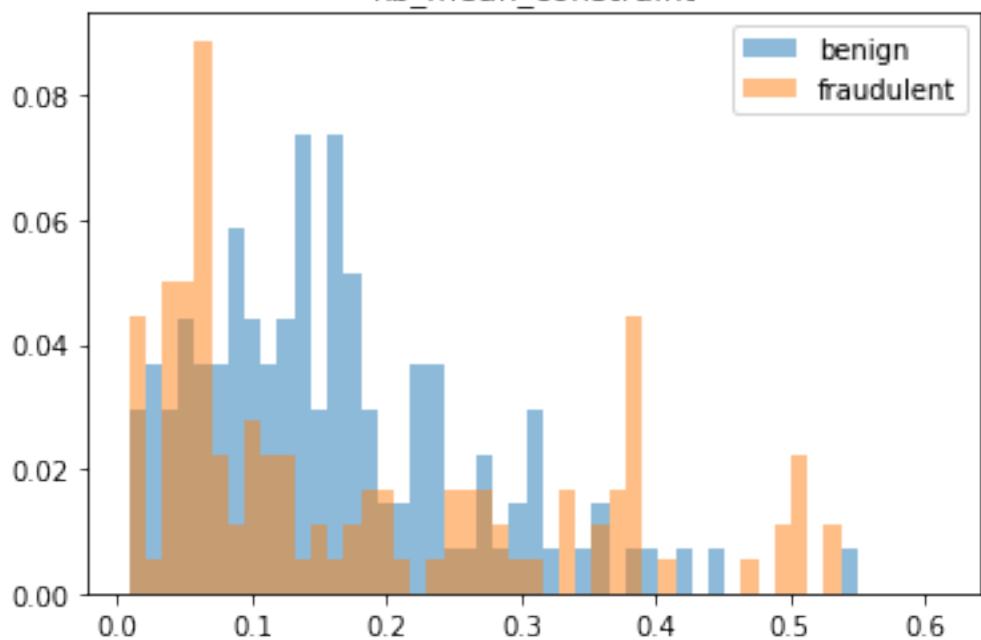
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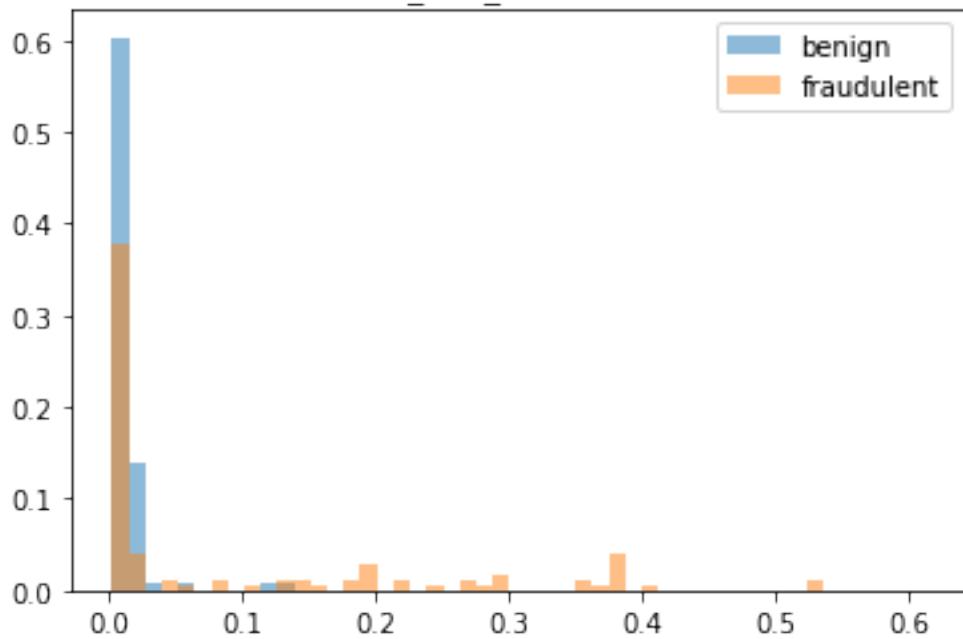


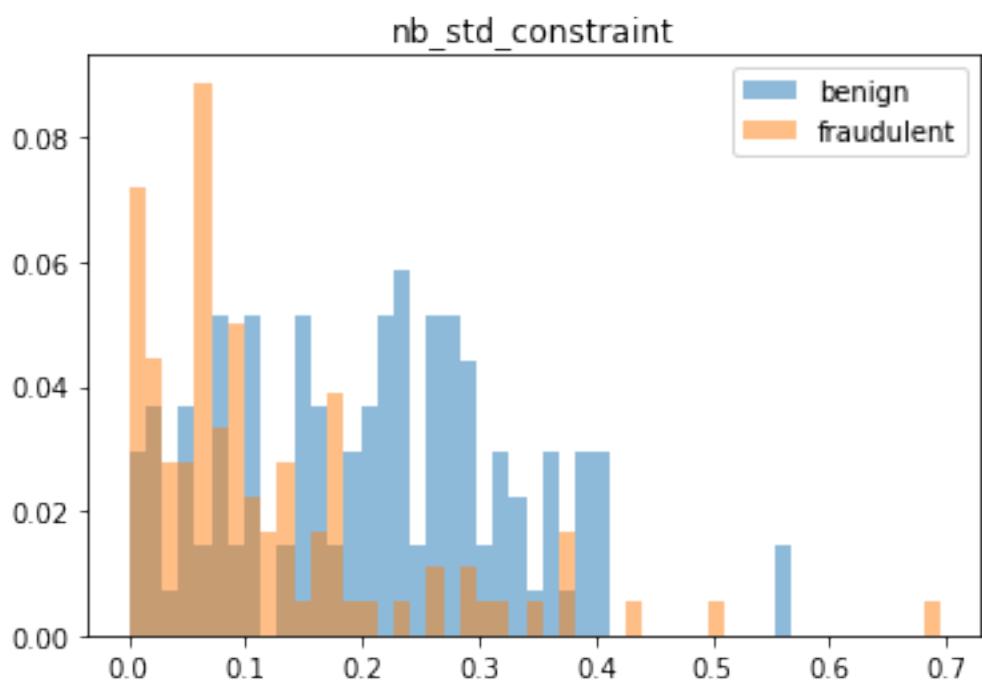
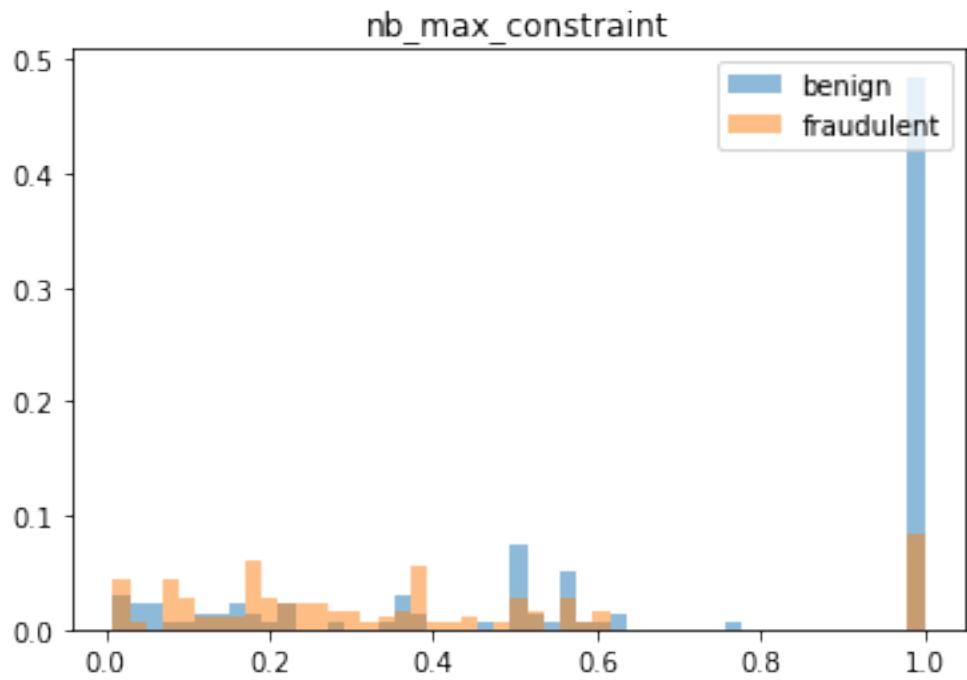


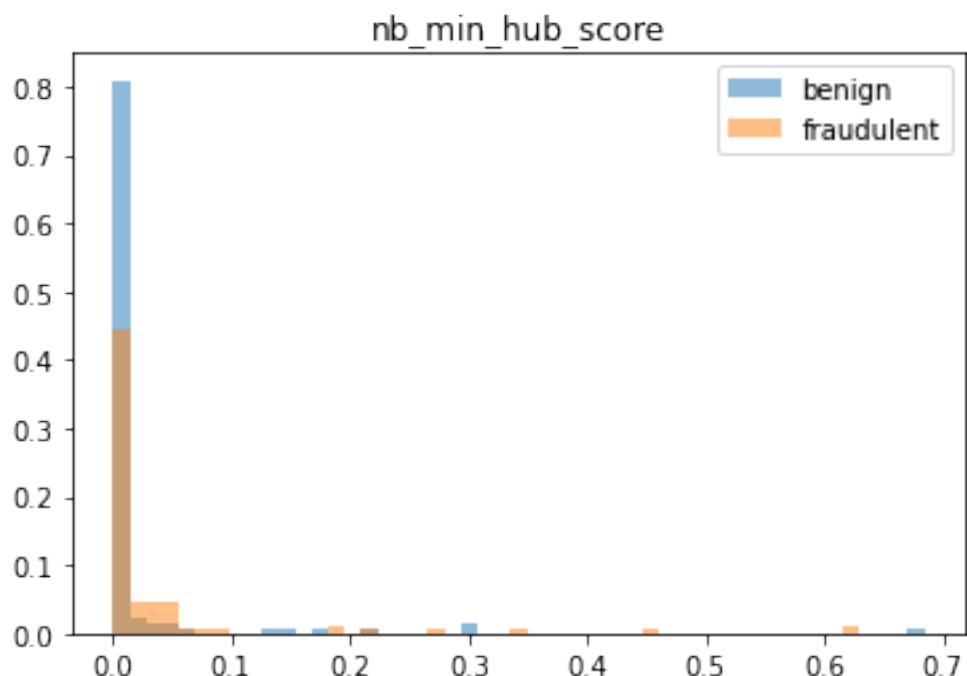
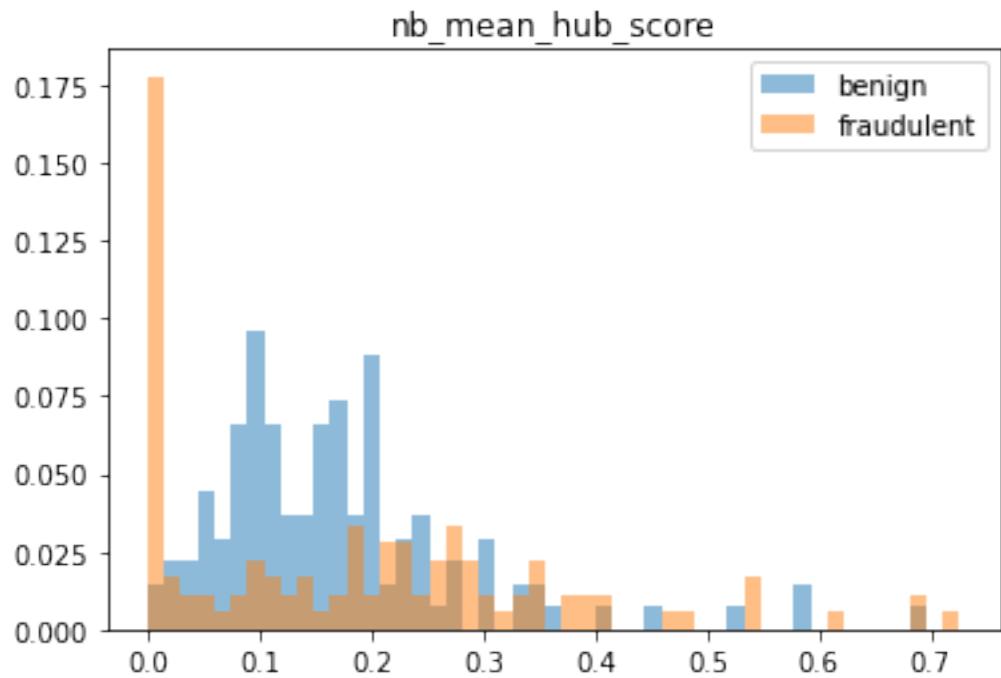
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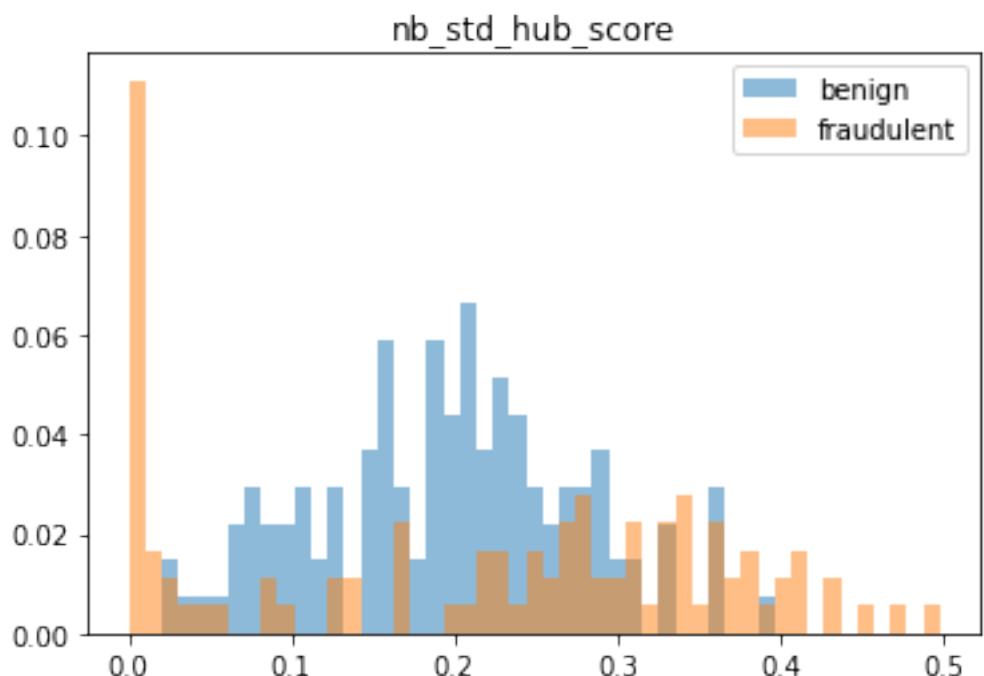
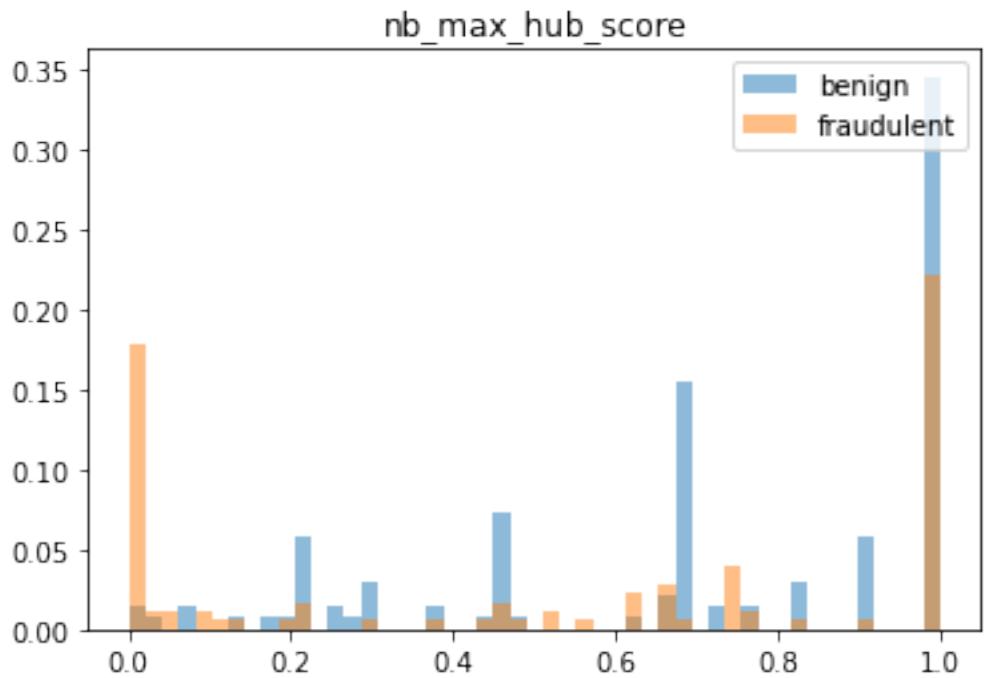


nb_min_constraint

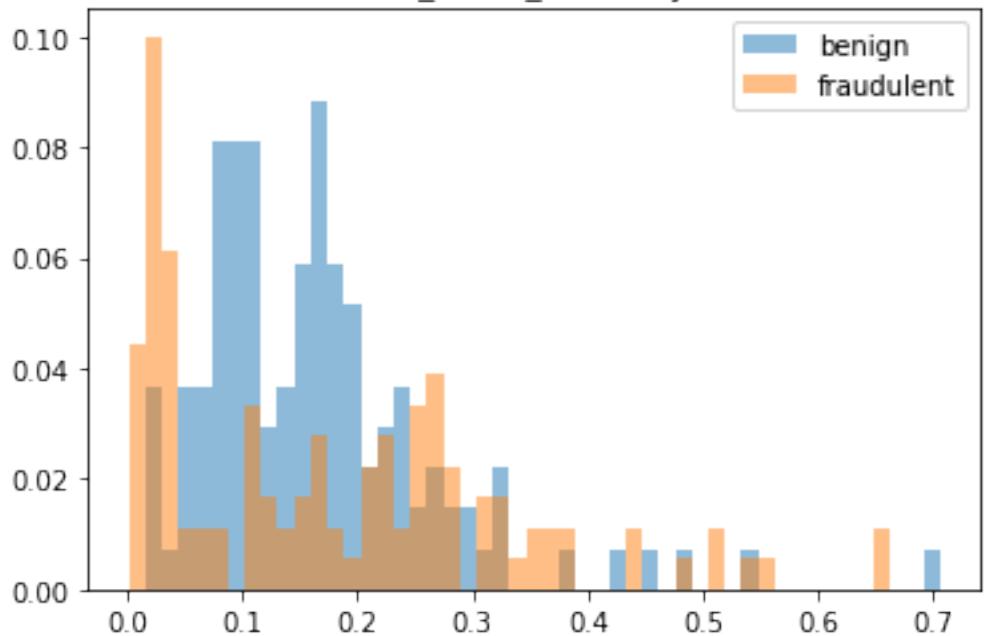




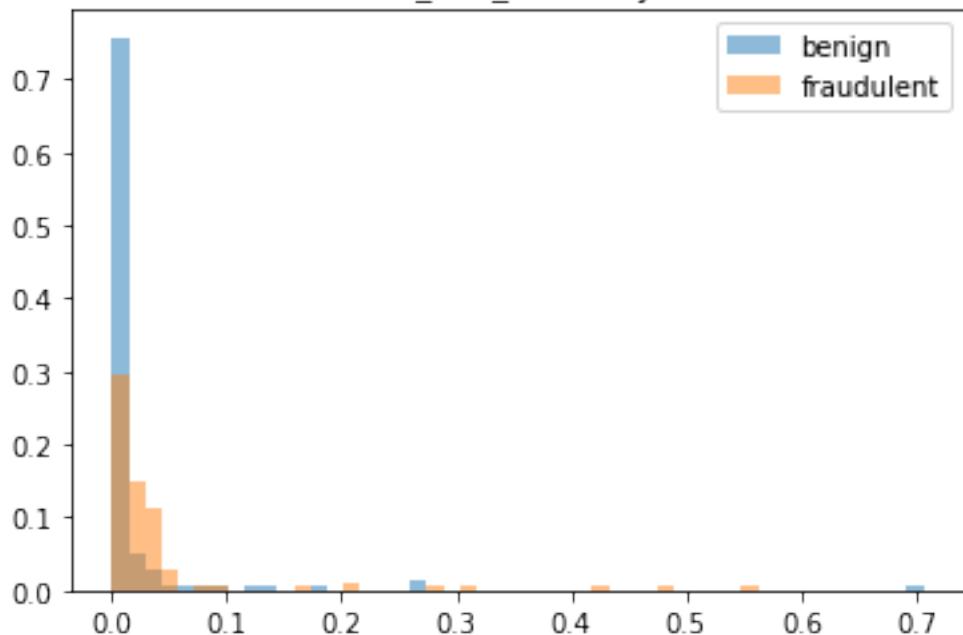


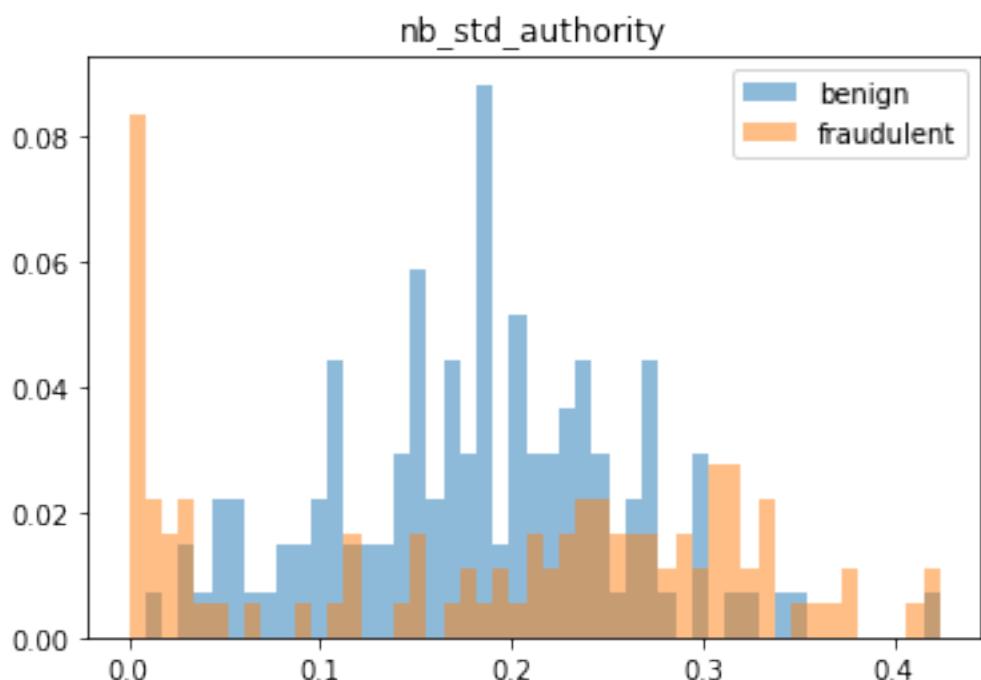
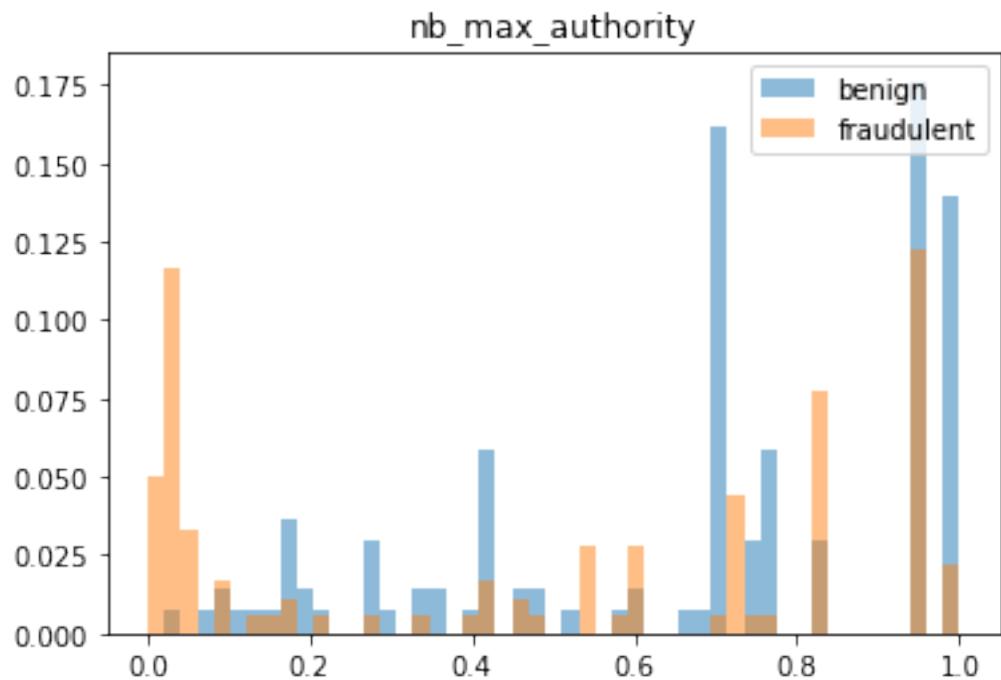


nb_mean_authority

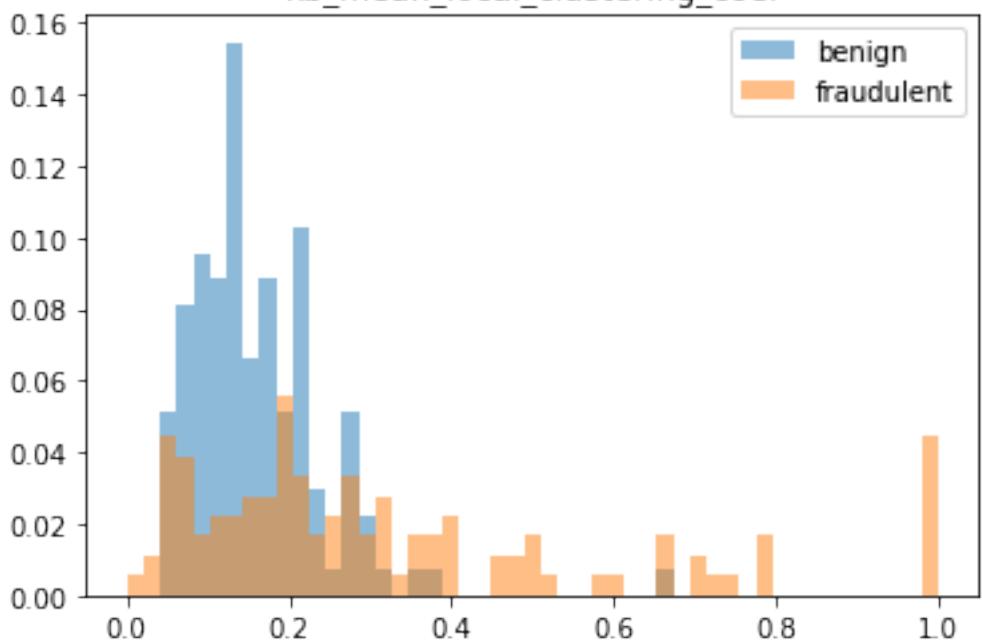


nb_min_authority

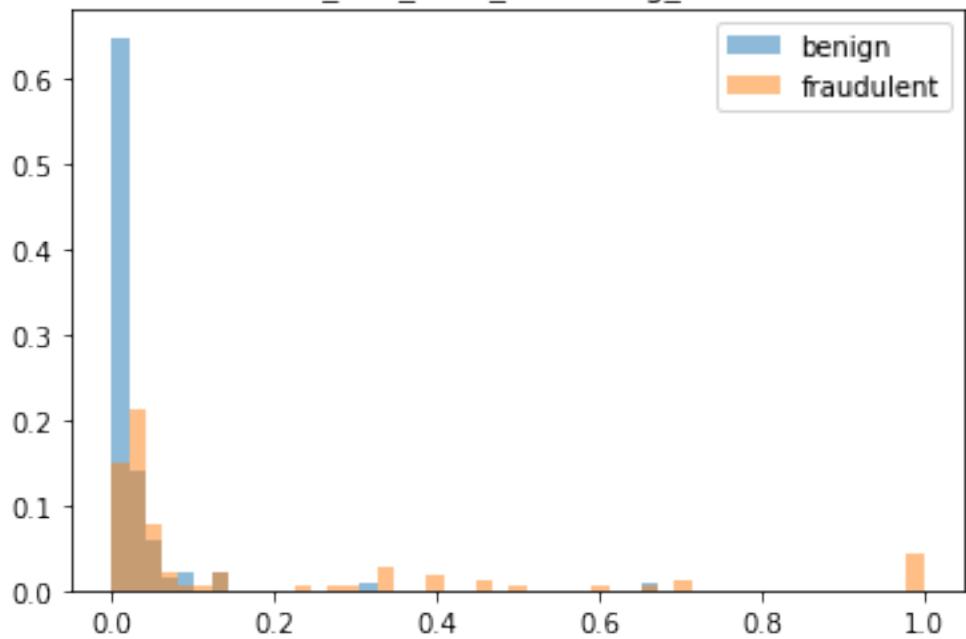


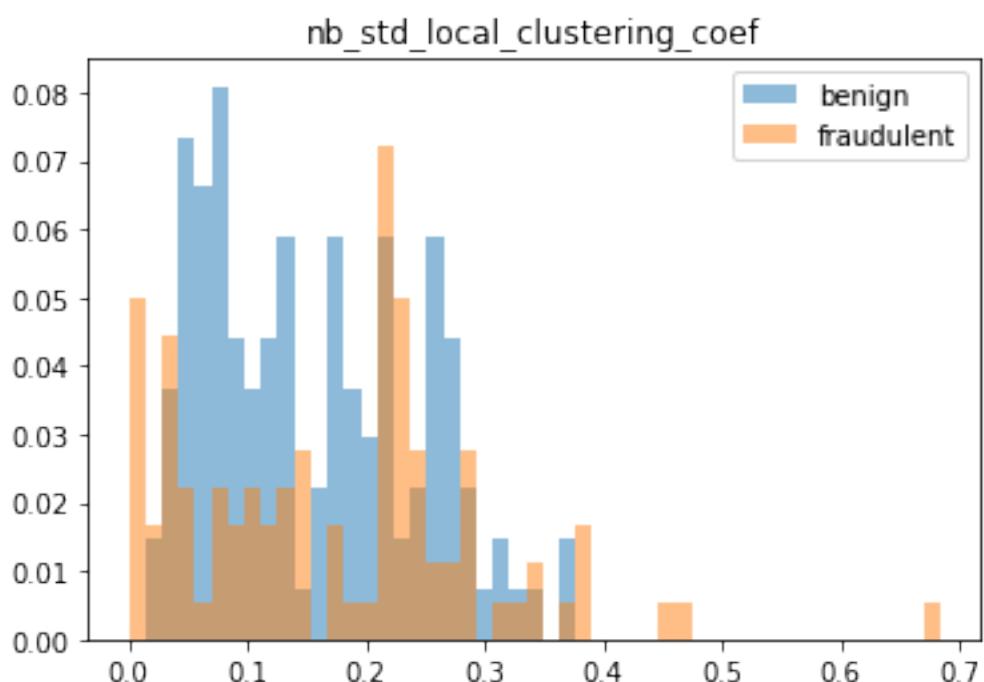
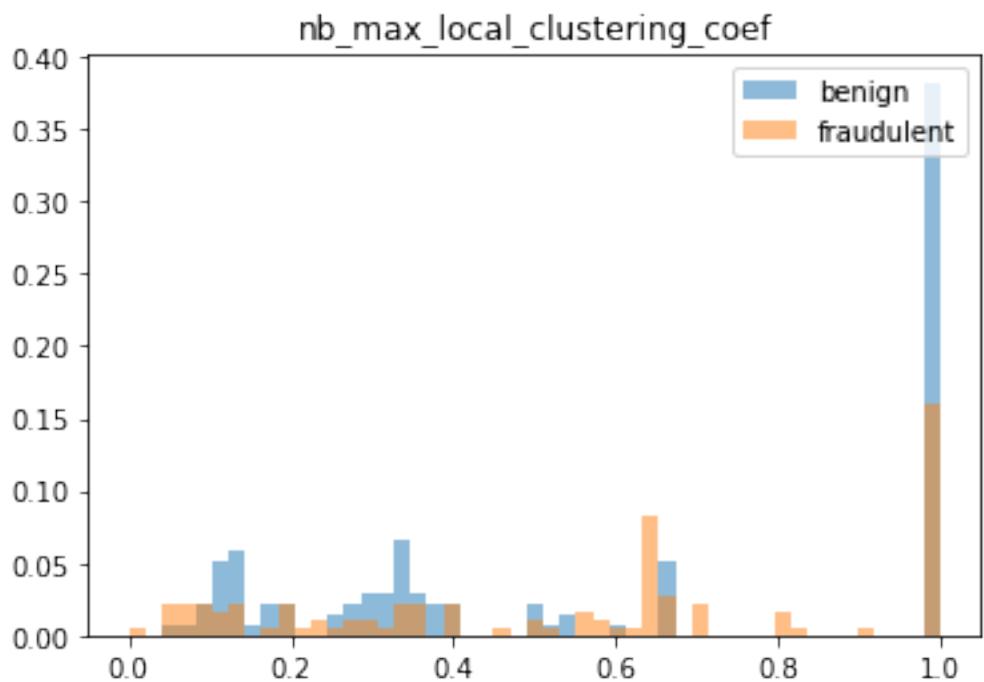


nb_mean_local_clustering_coef

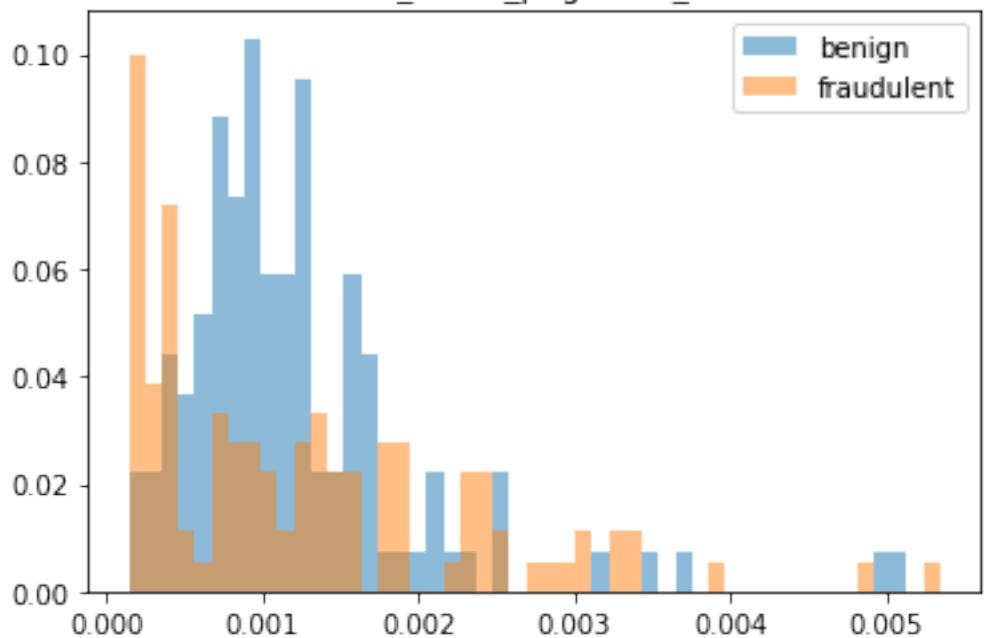


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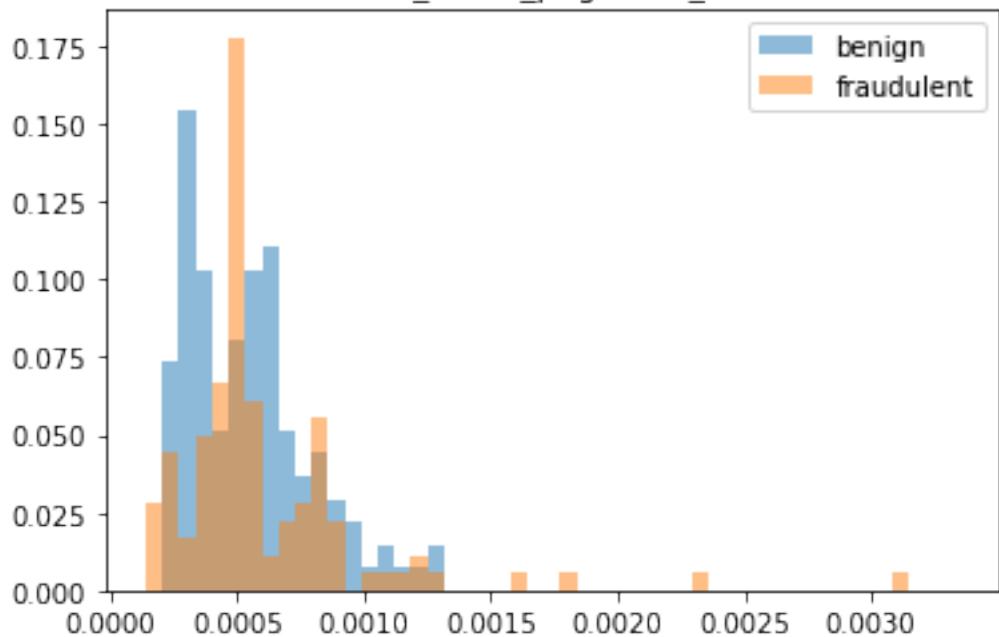




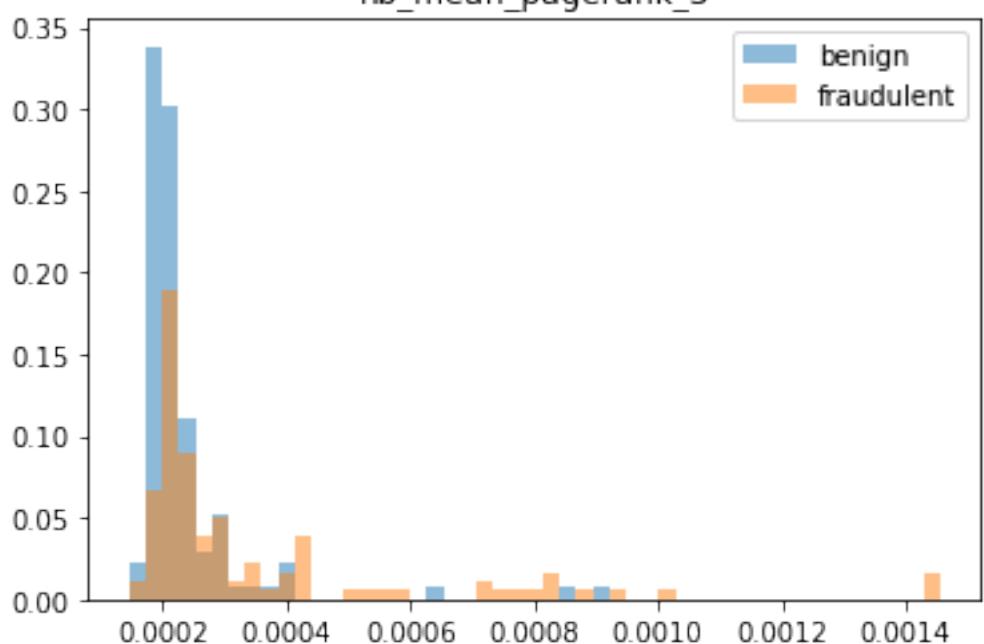
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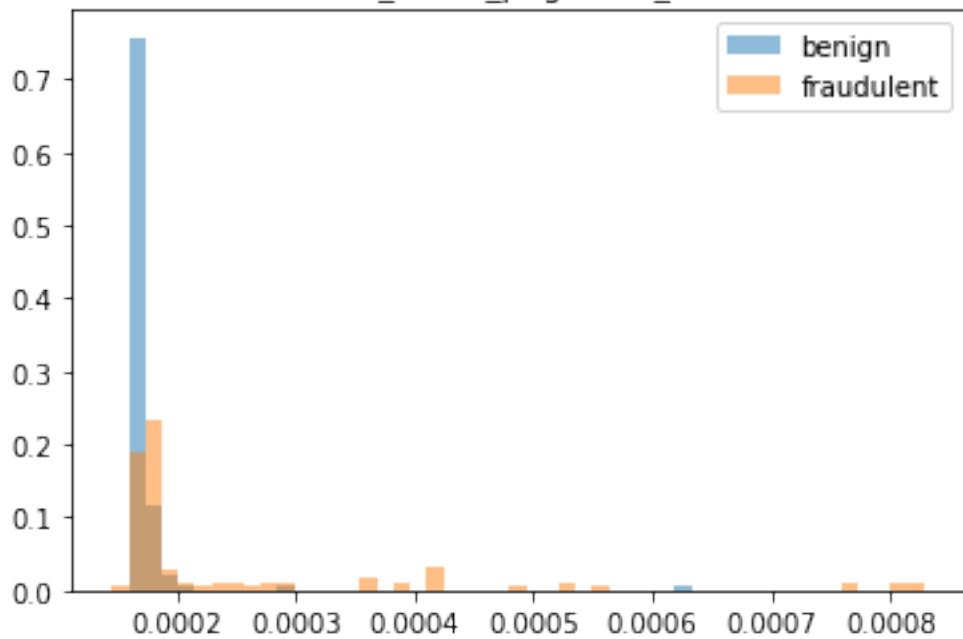
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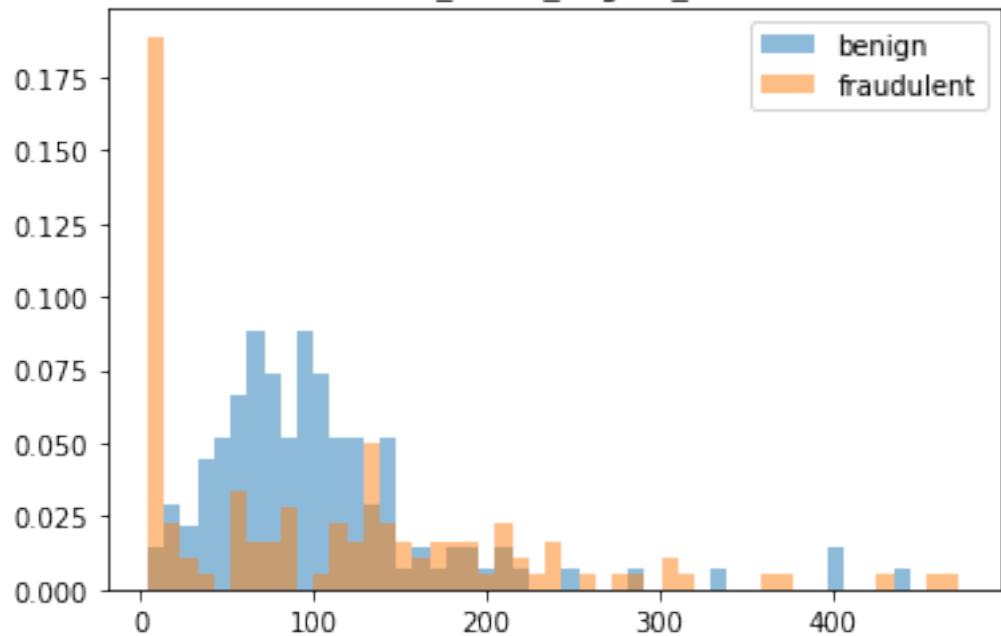
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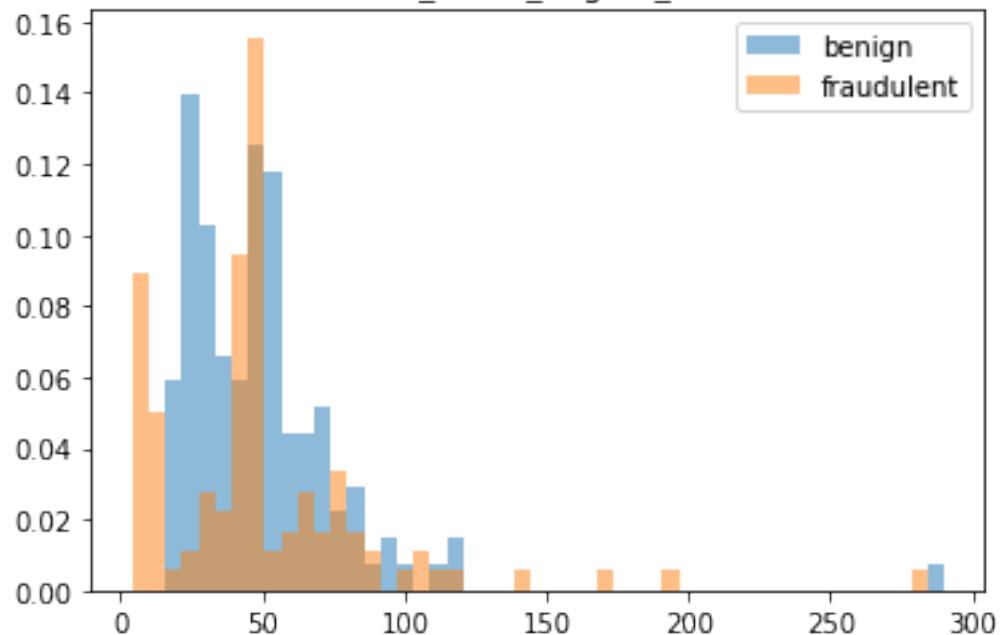
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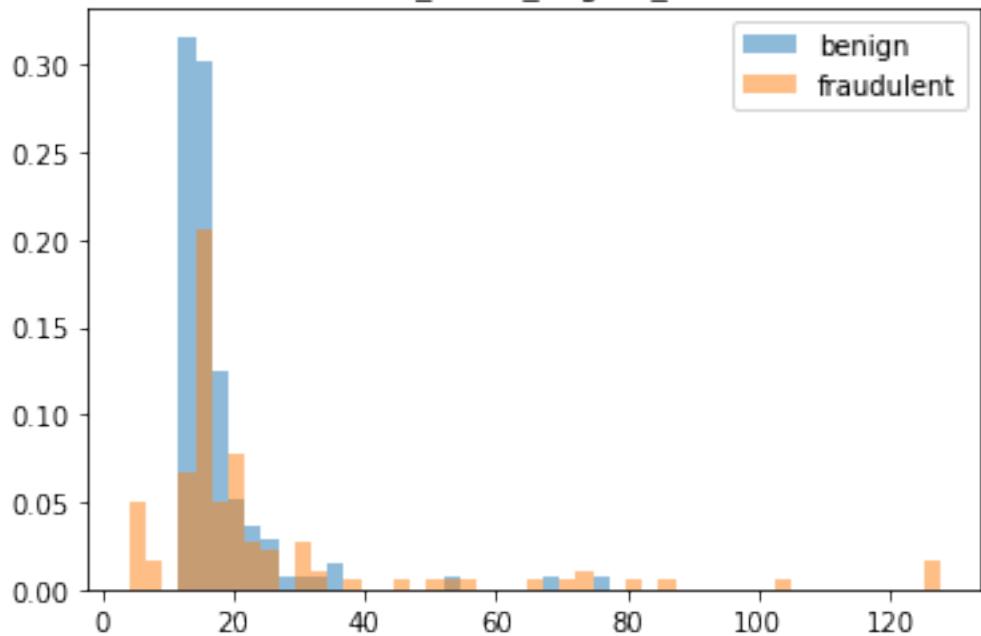
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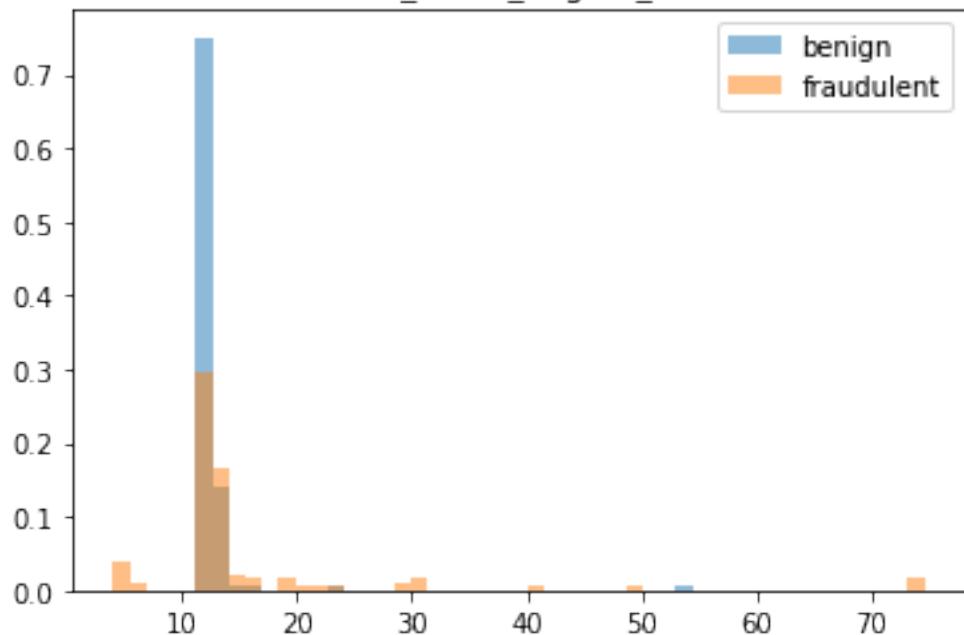
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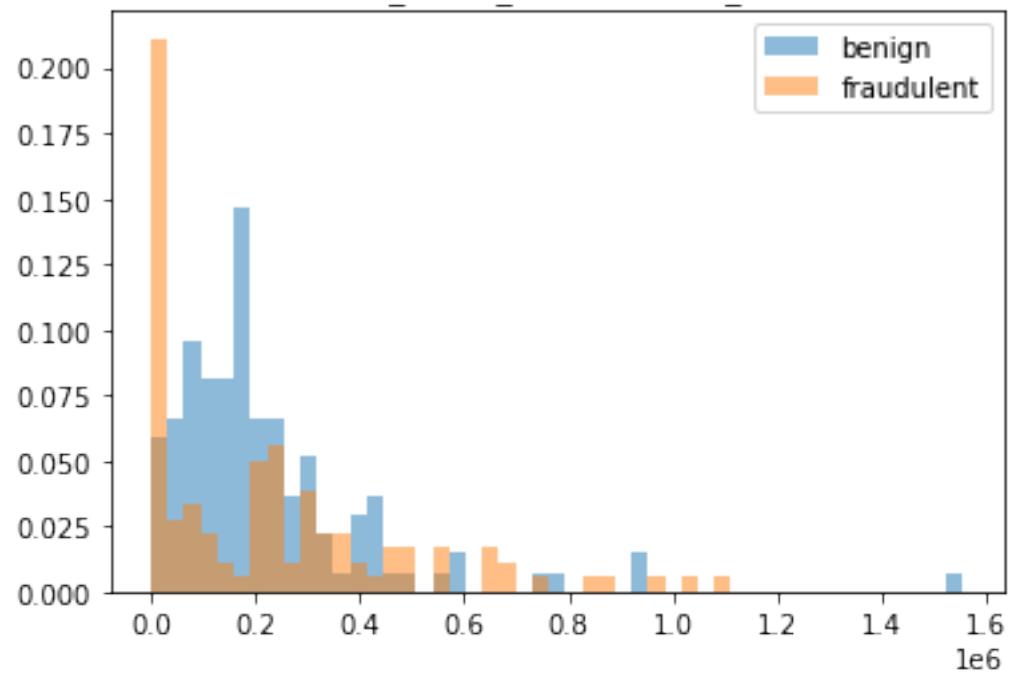
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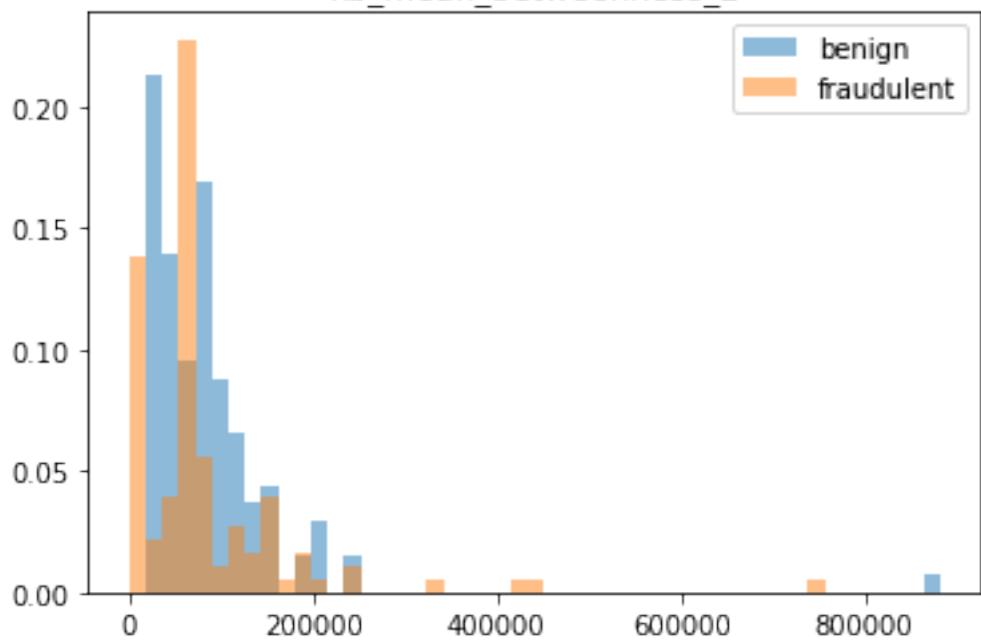
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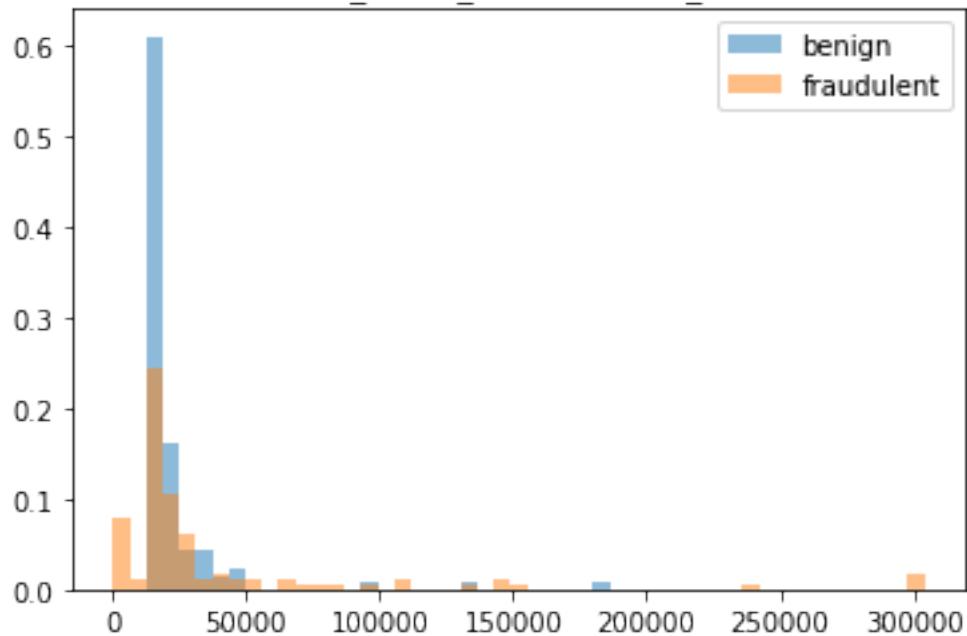
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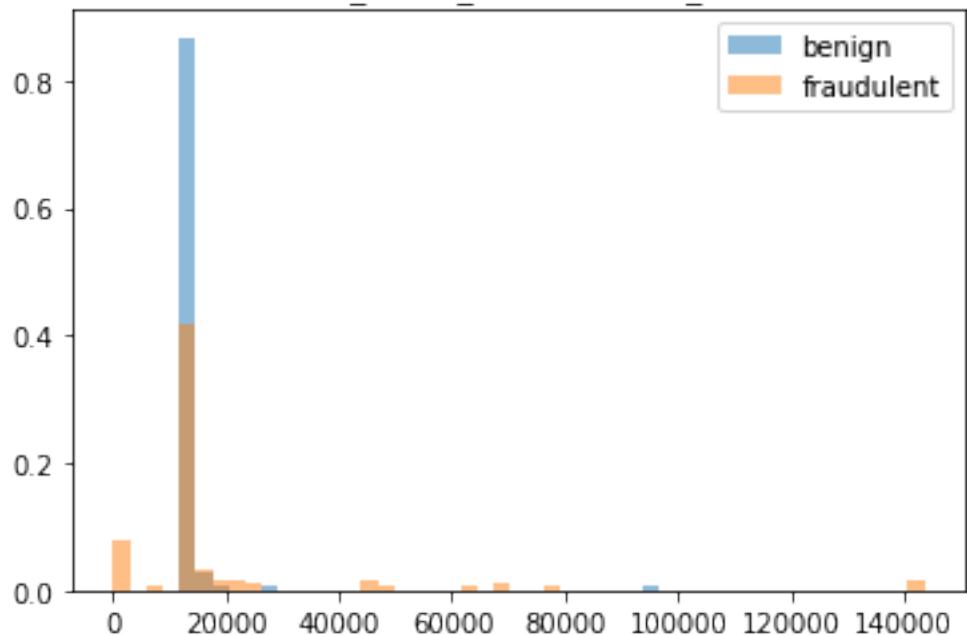
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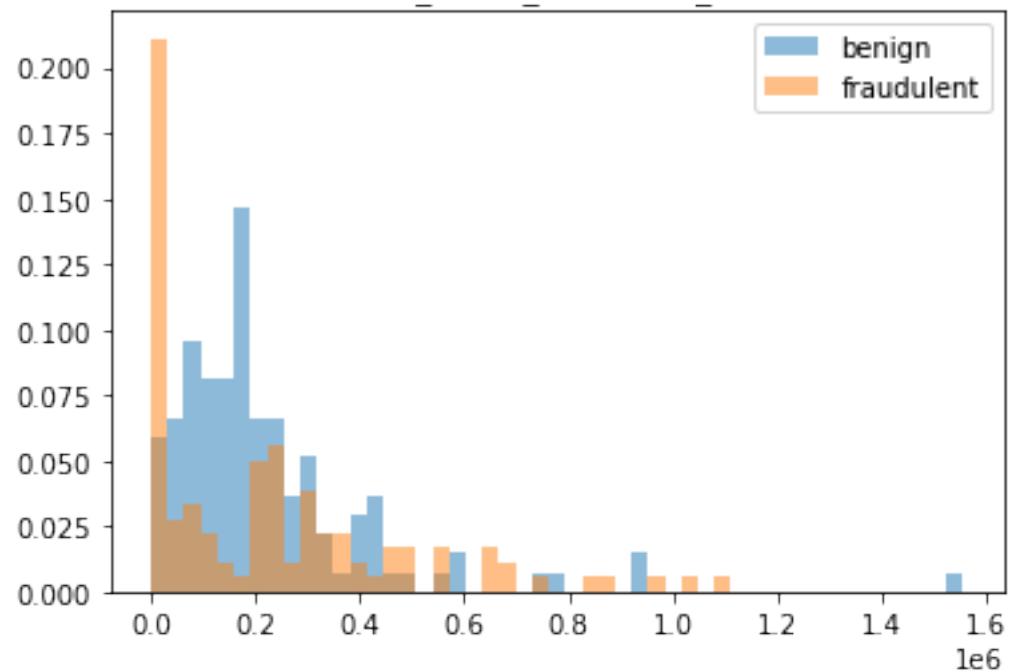
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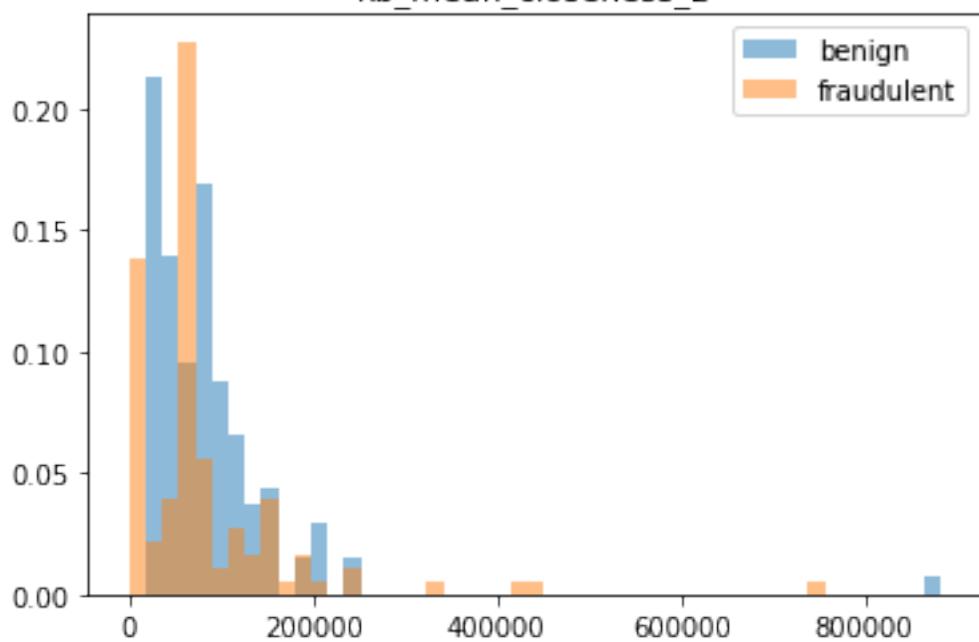
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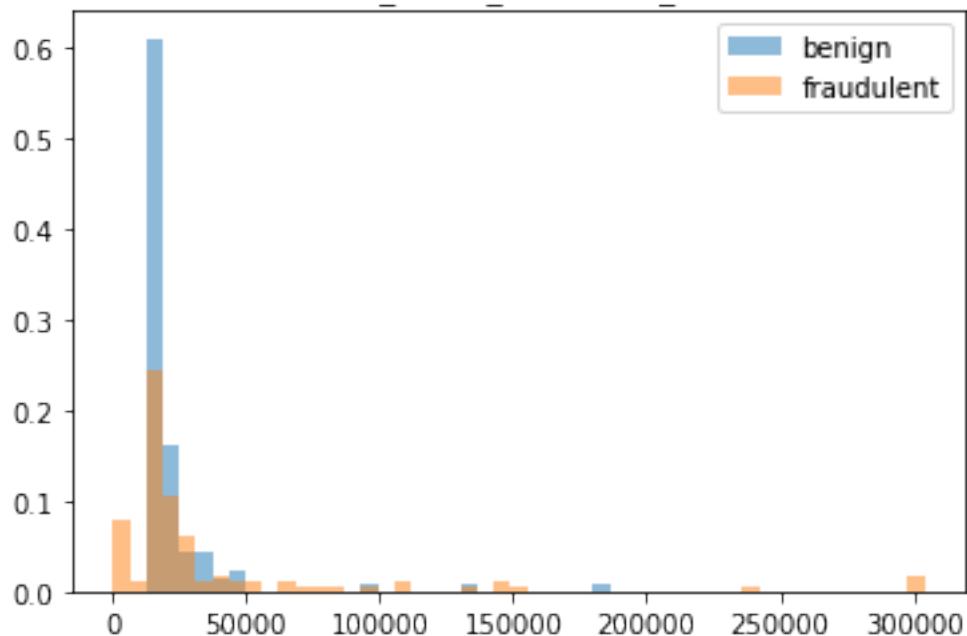
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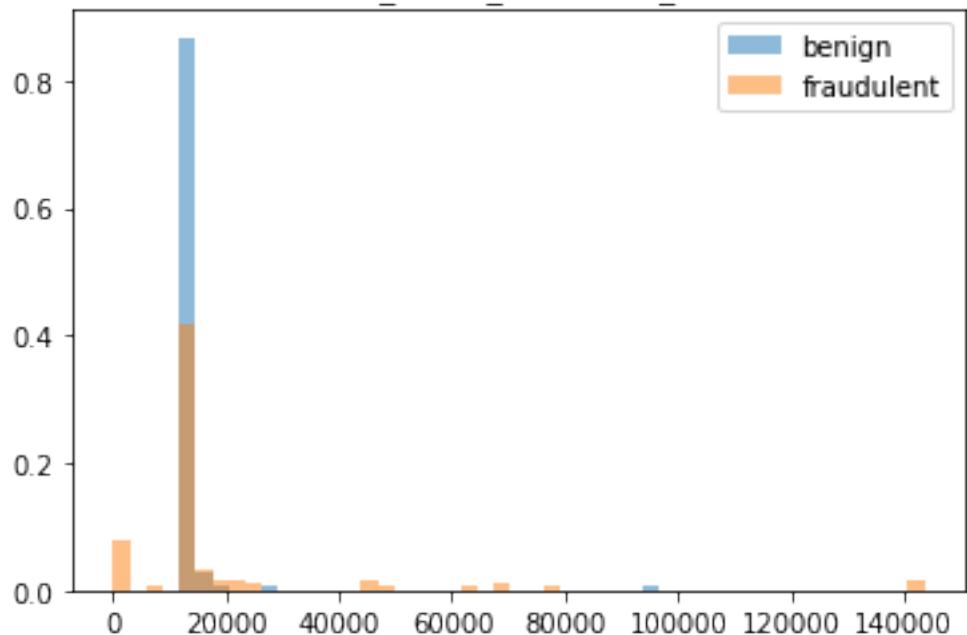
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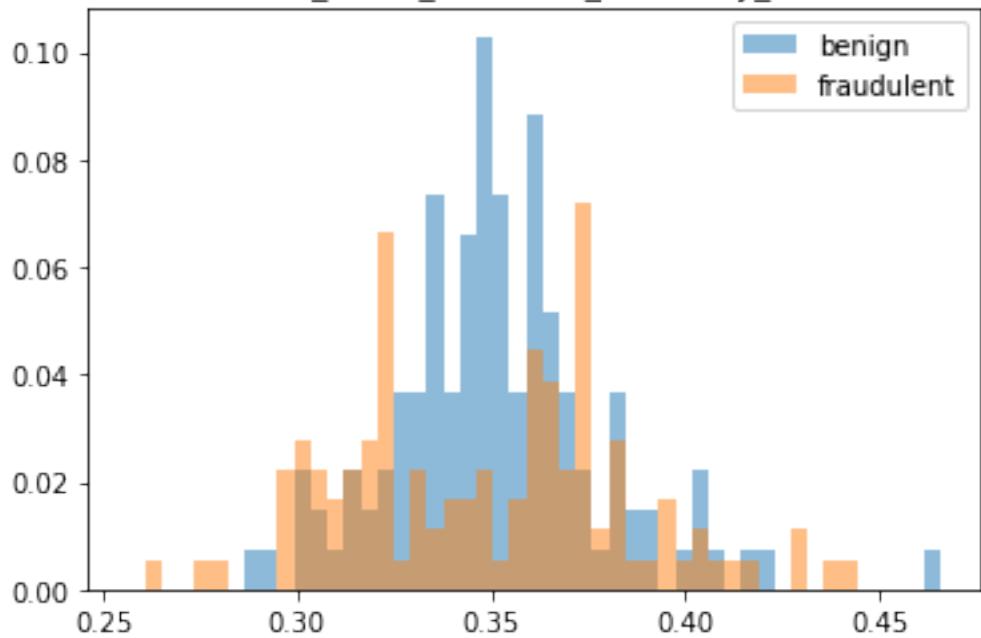
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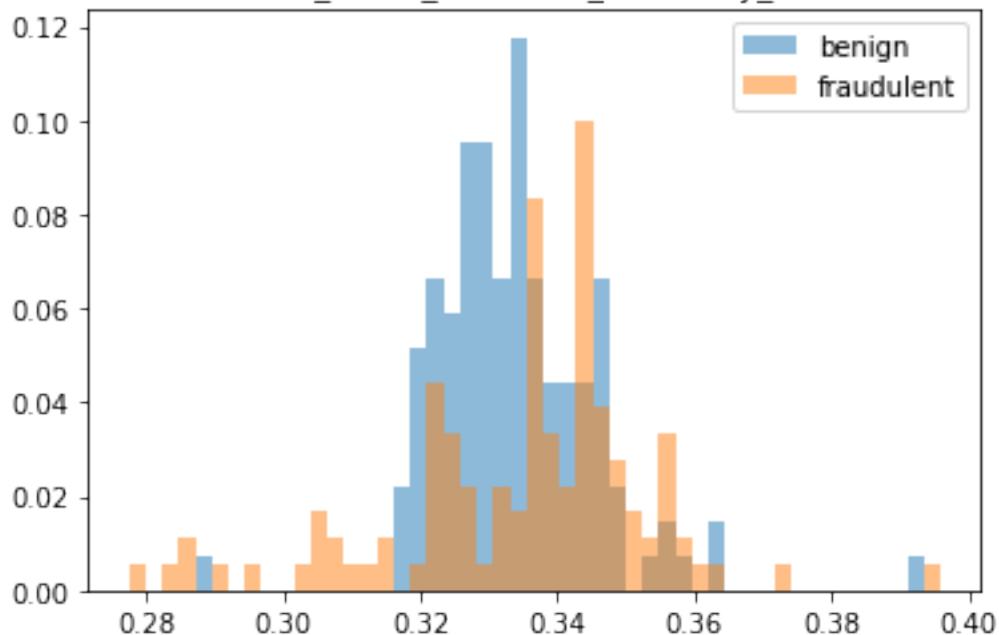
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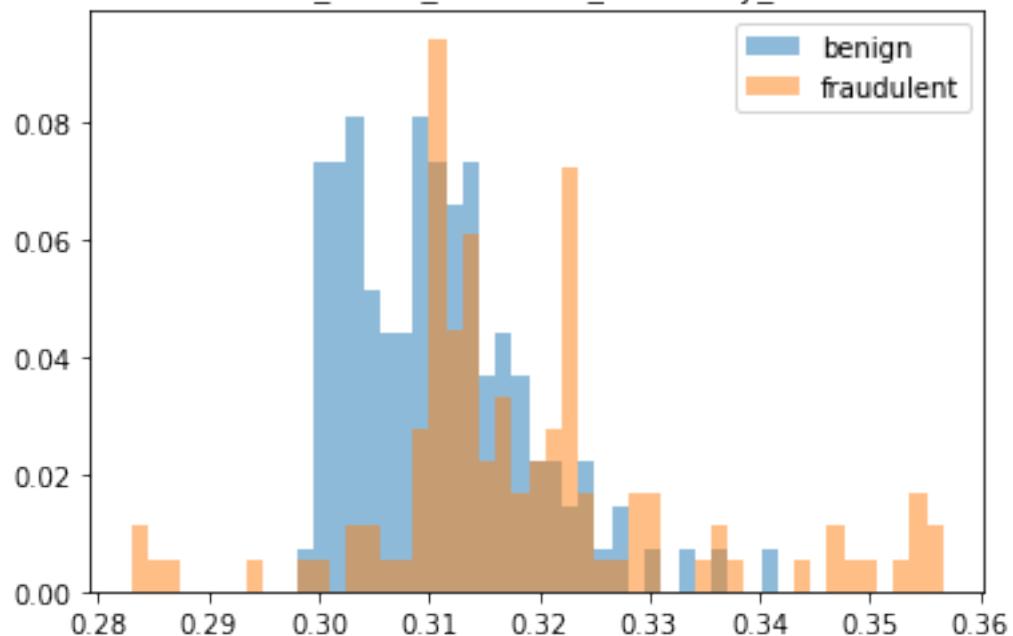
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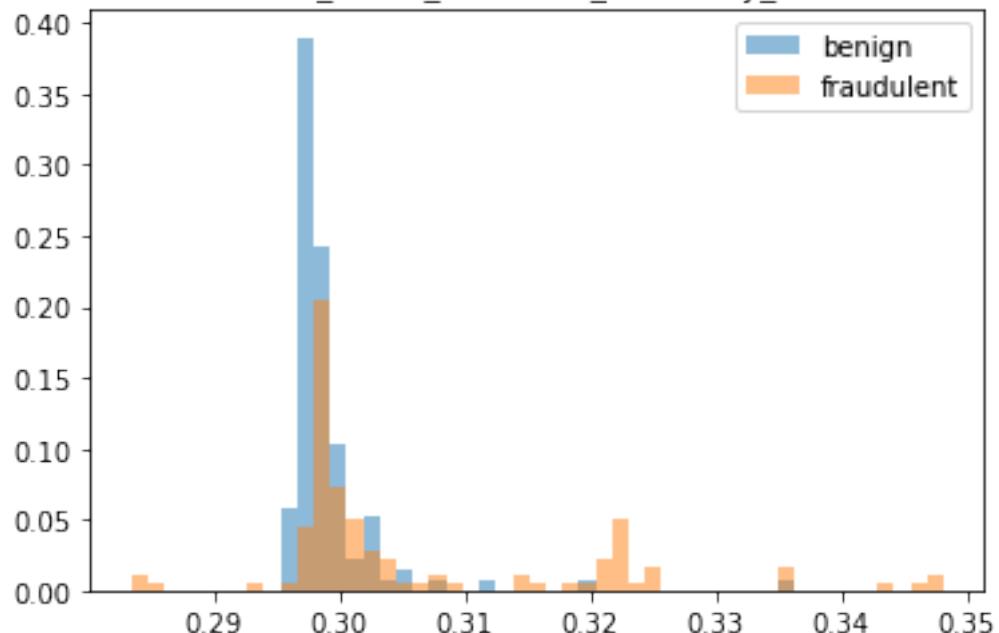
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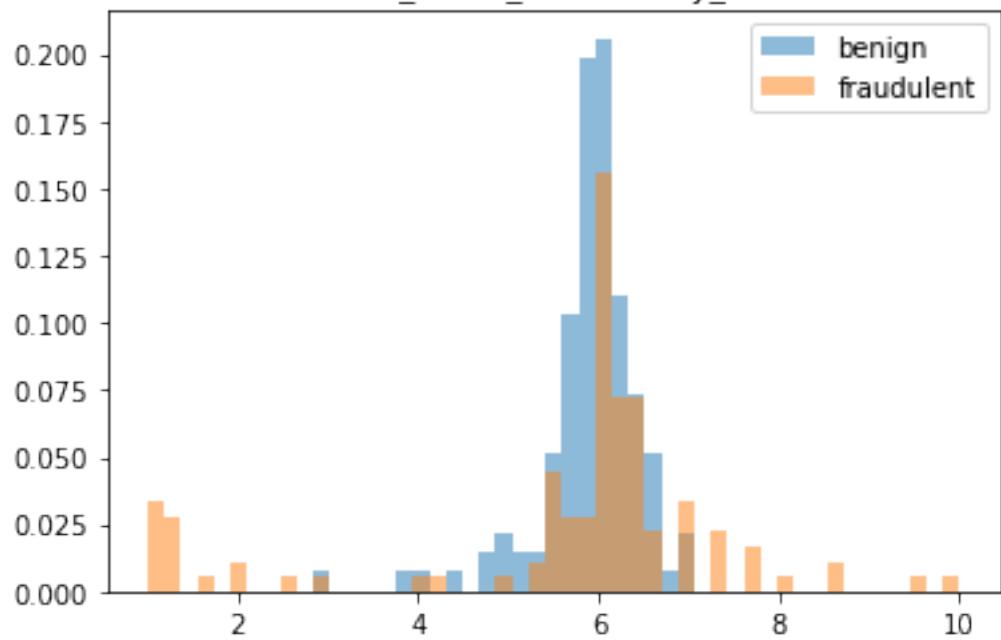
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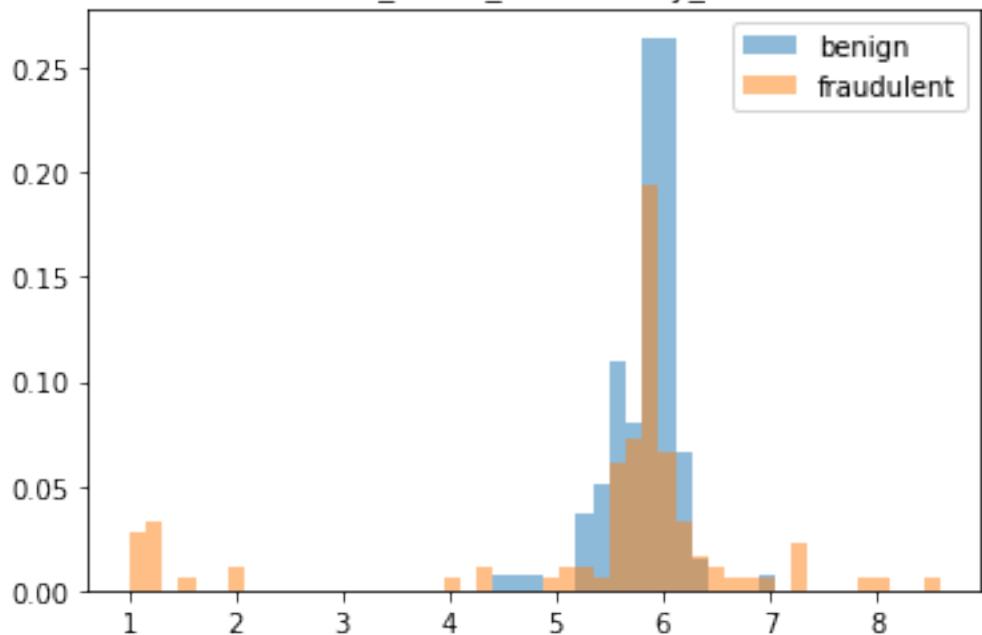
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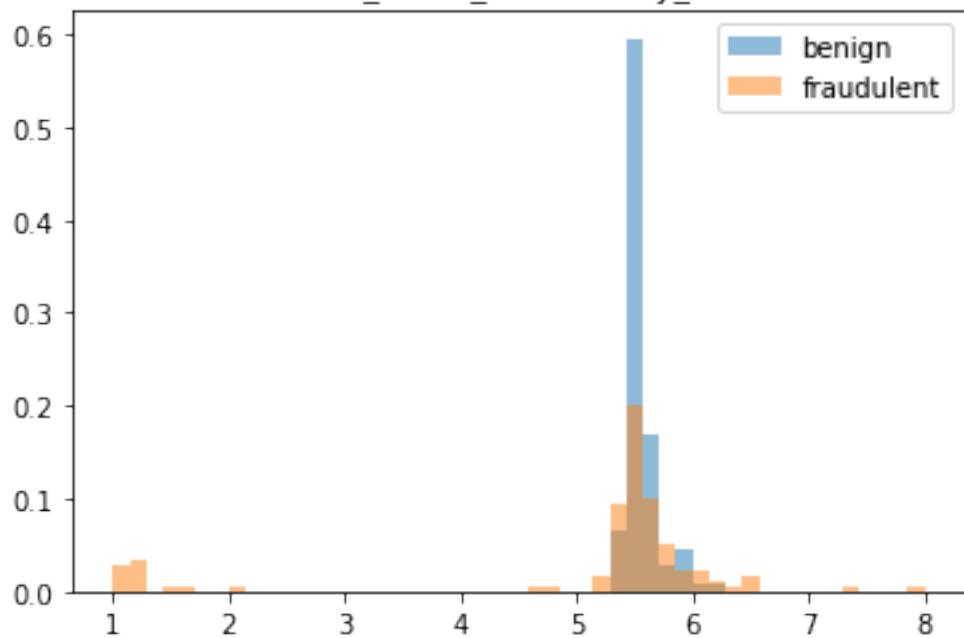
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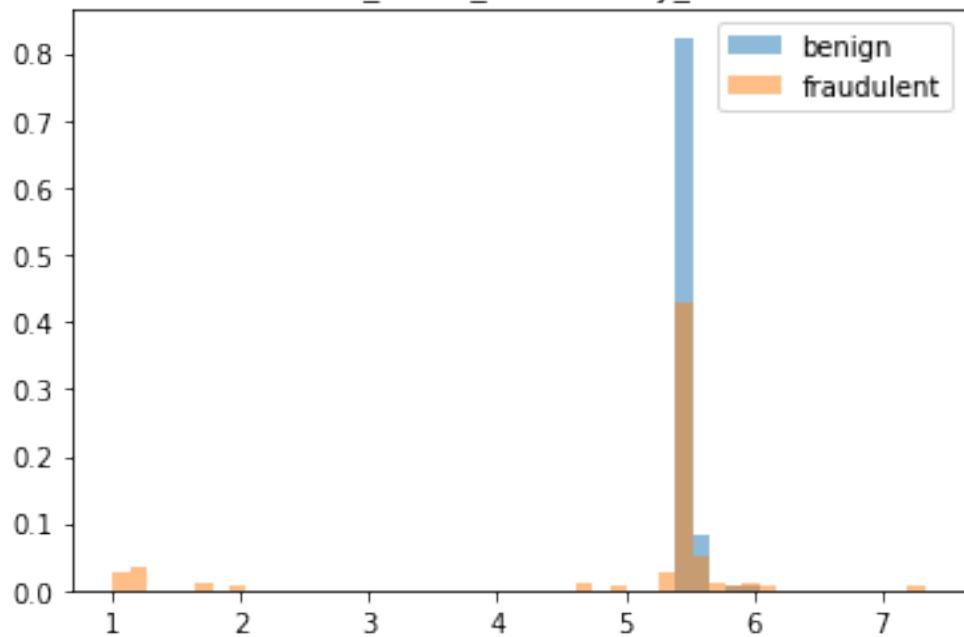
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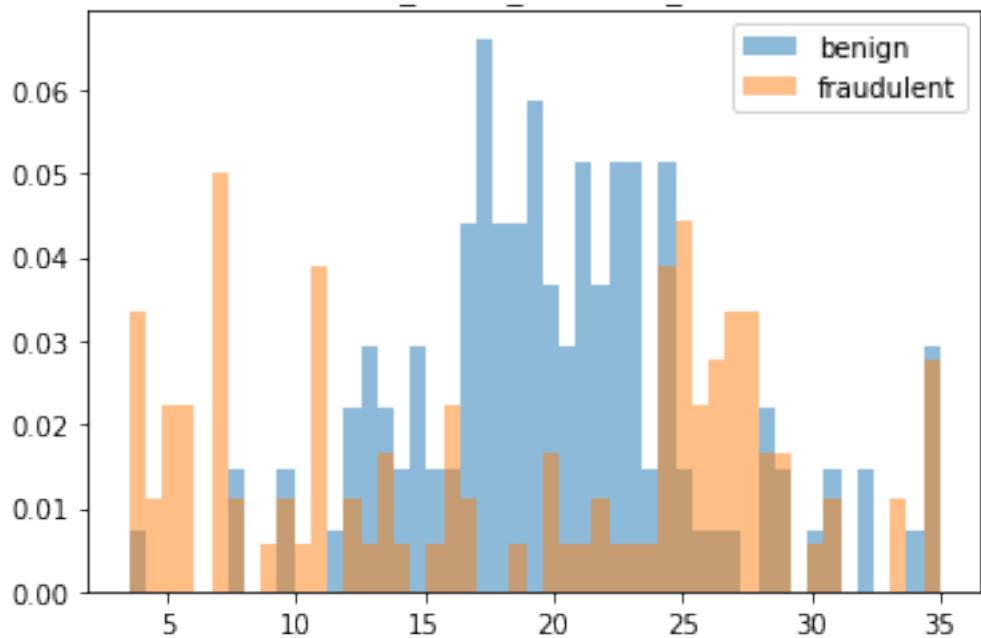
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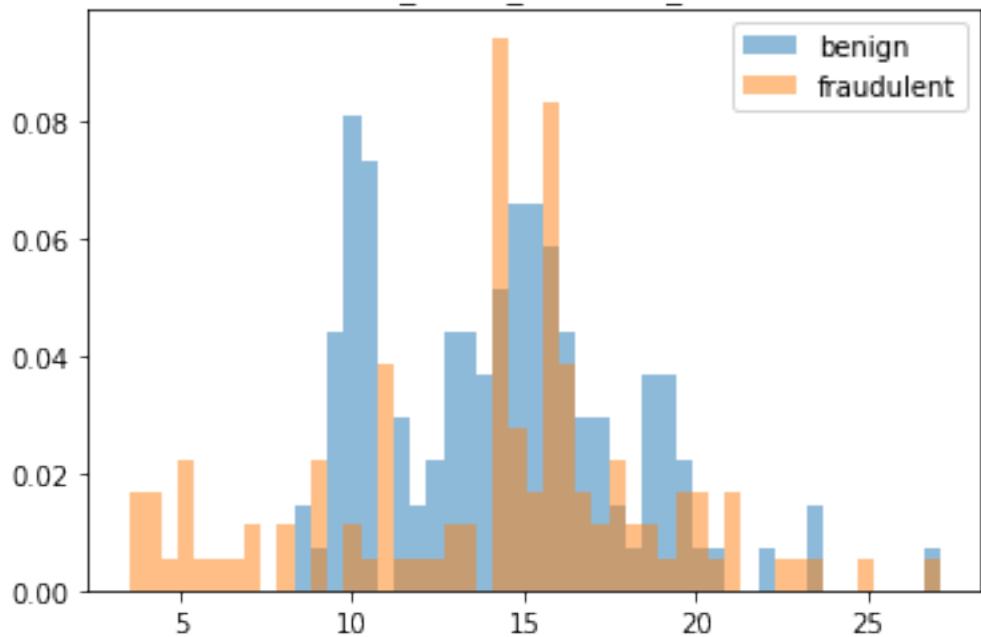
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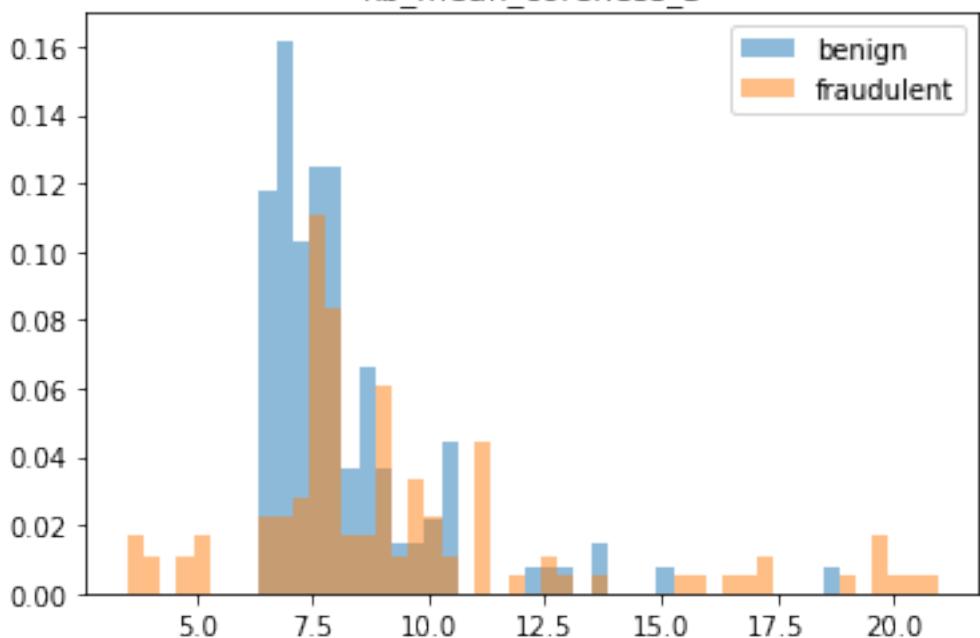
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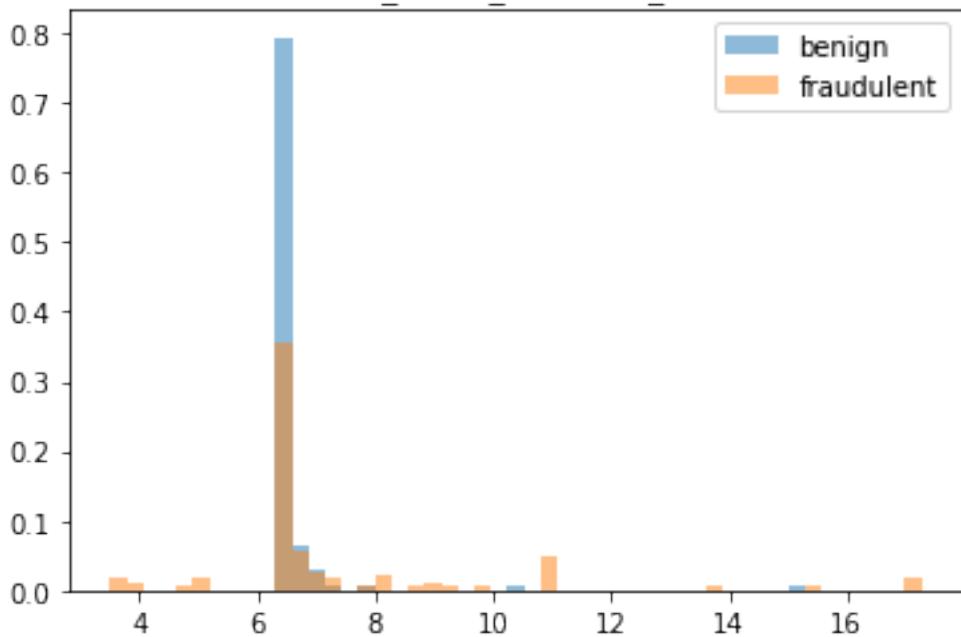
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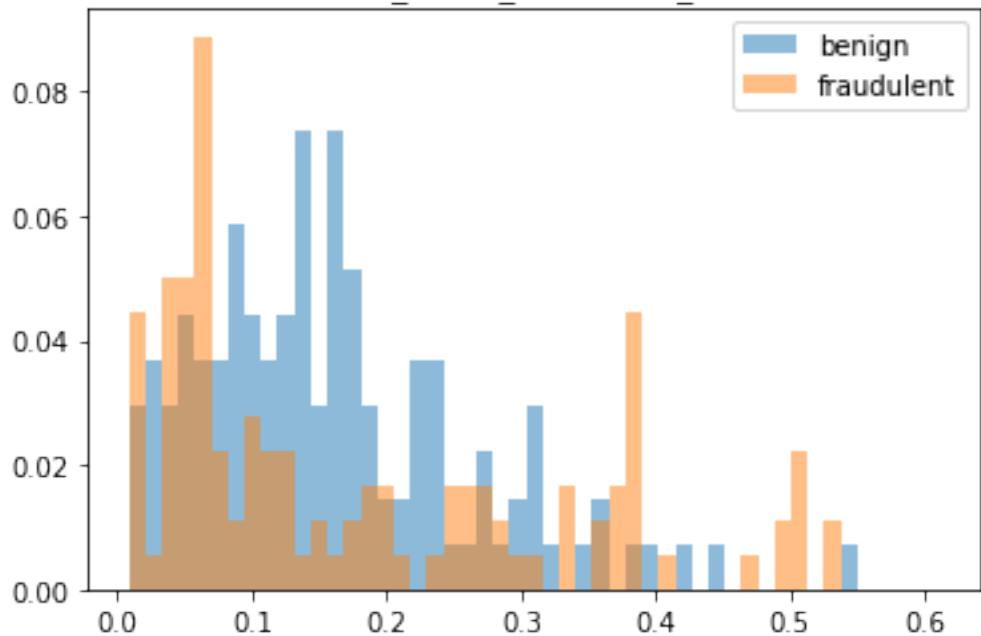
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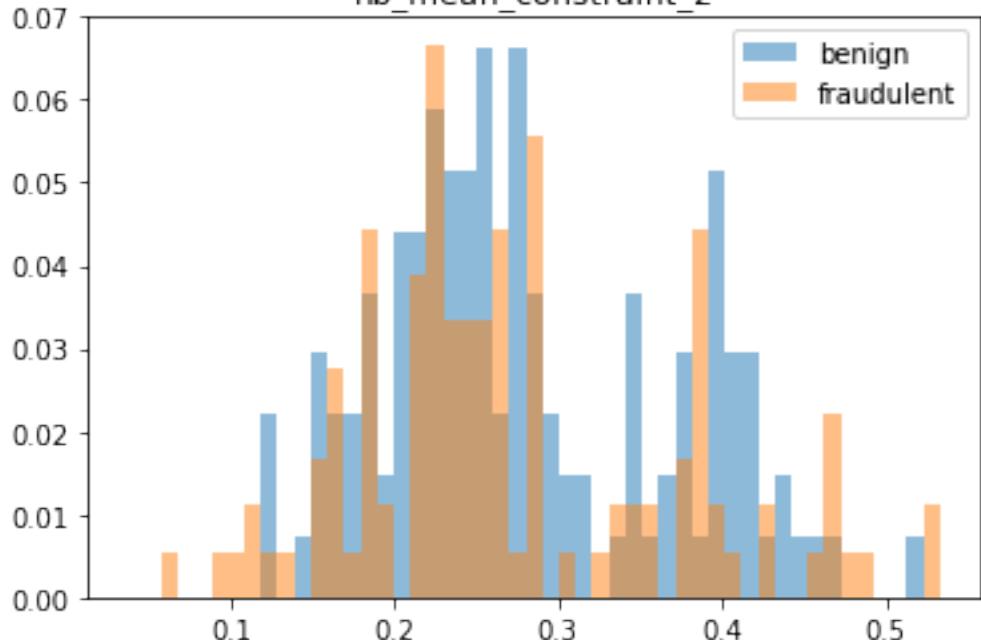
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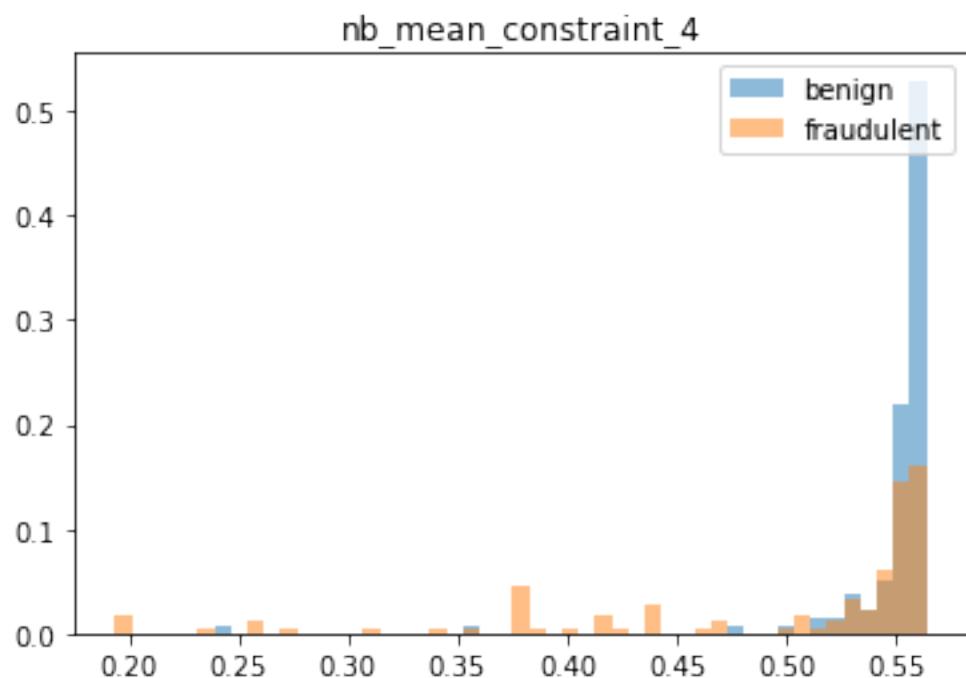
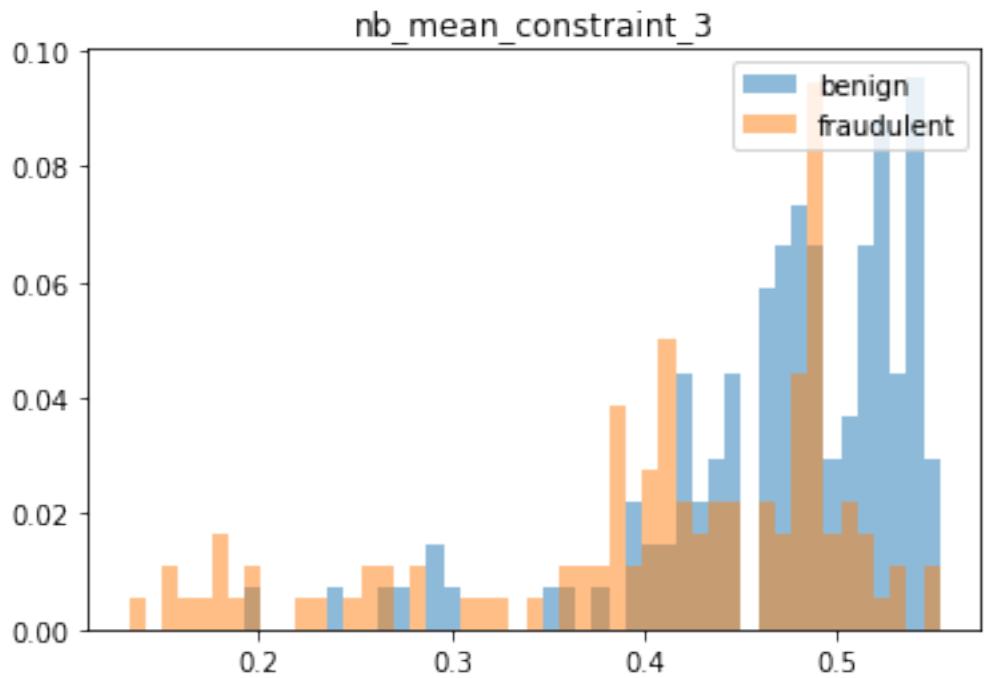


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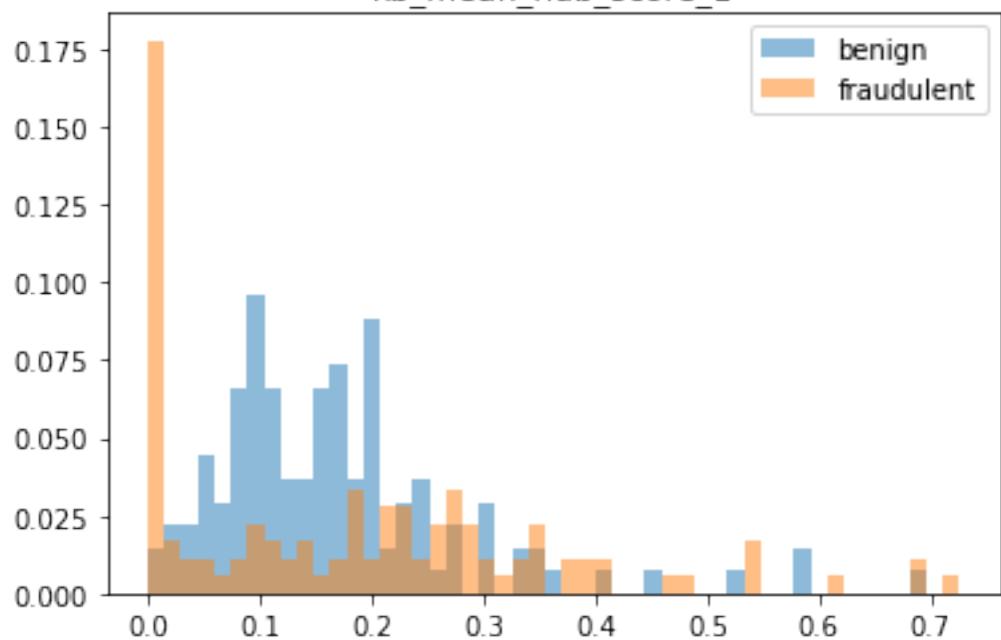


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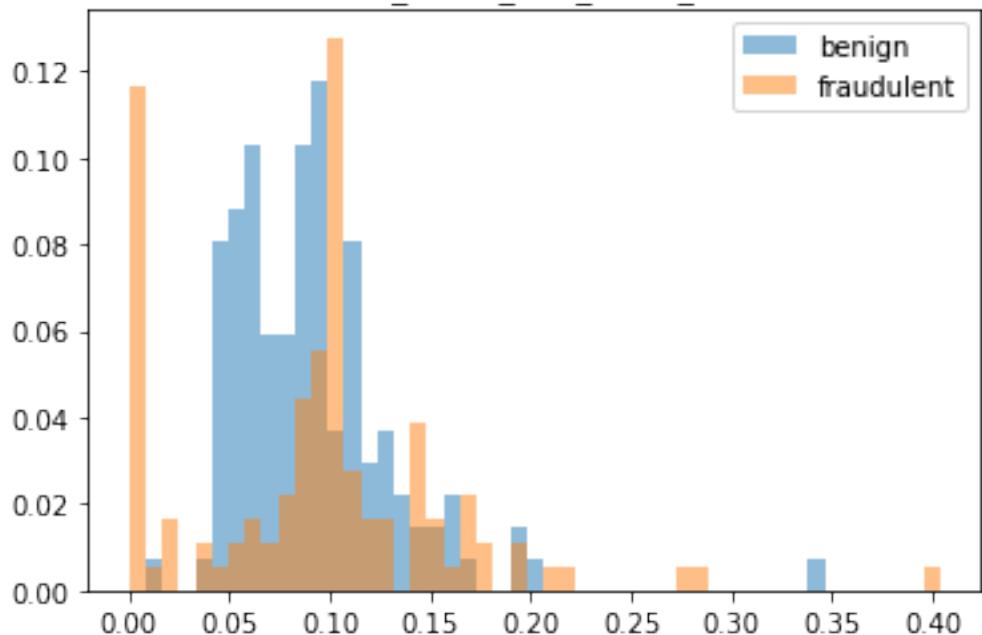


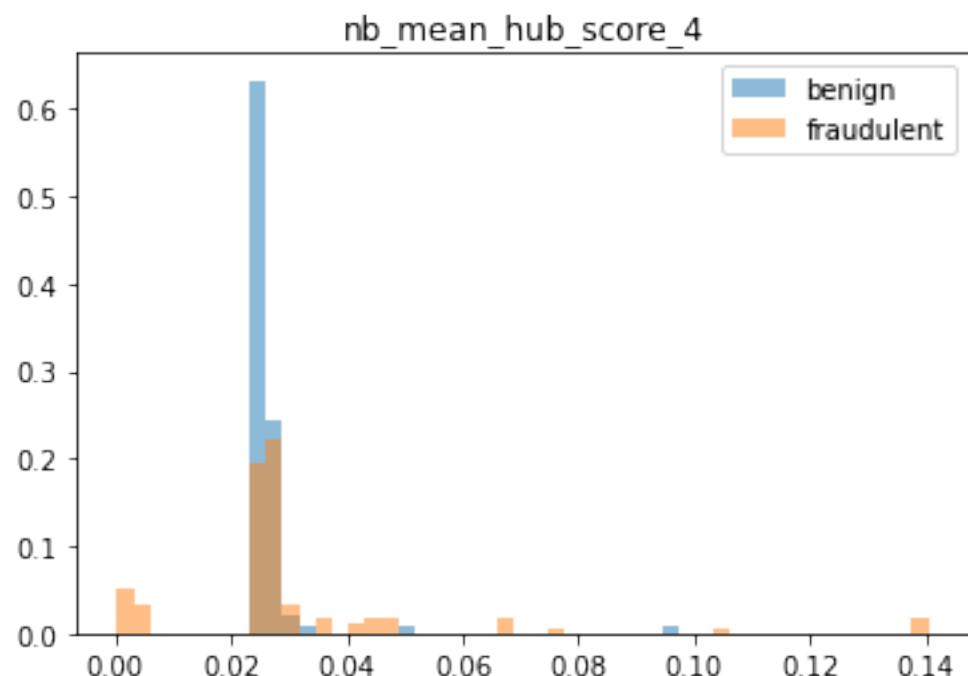
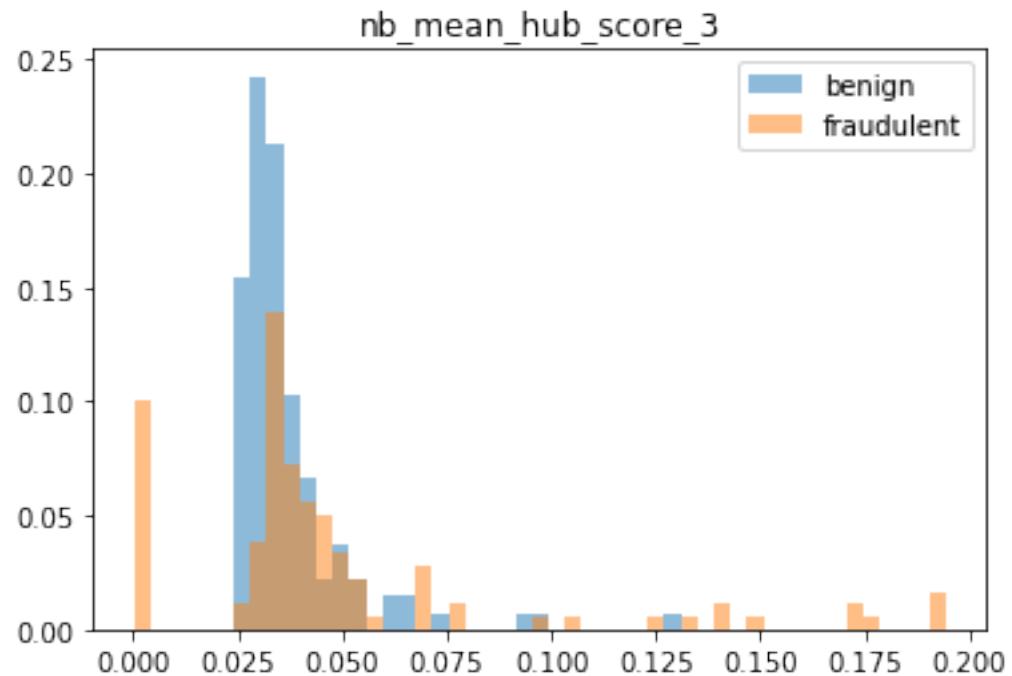


nb_mean_hub_score_1

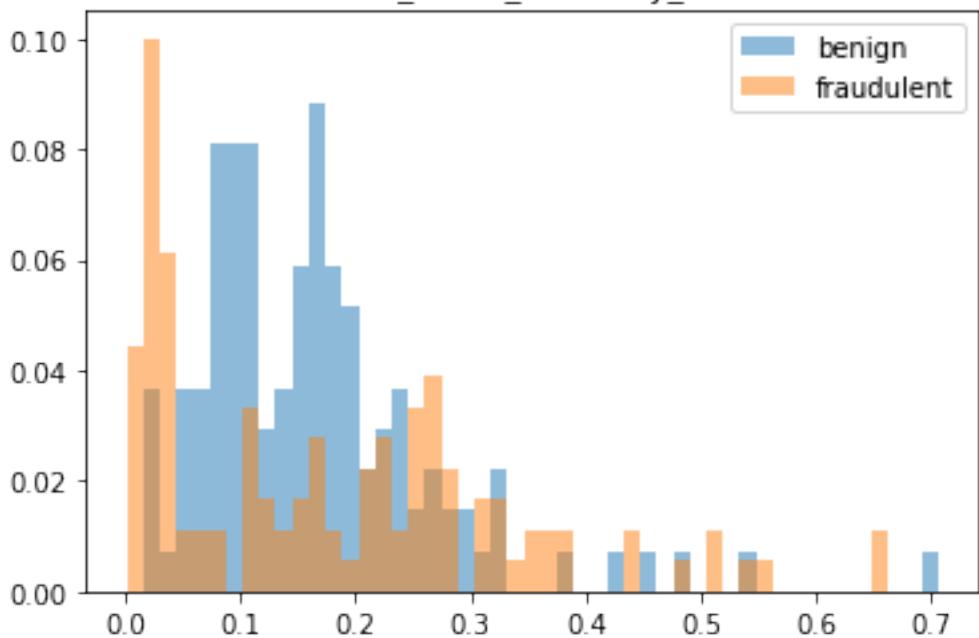


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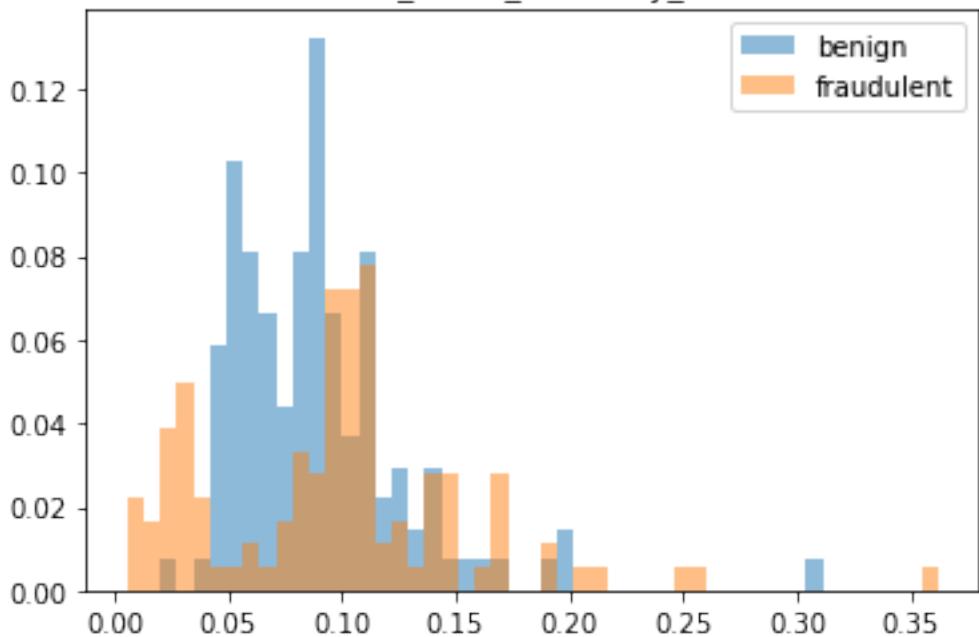




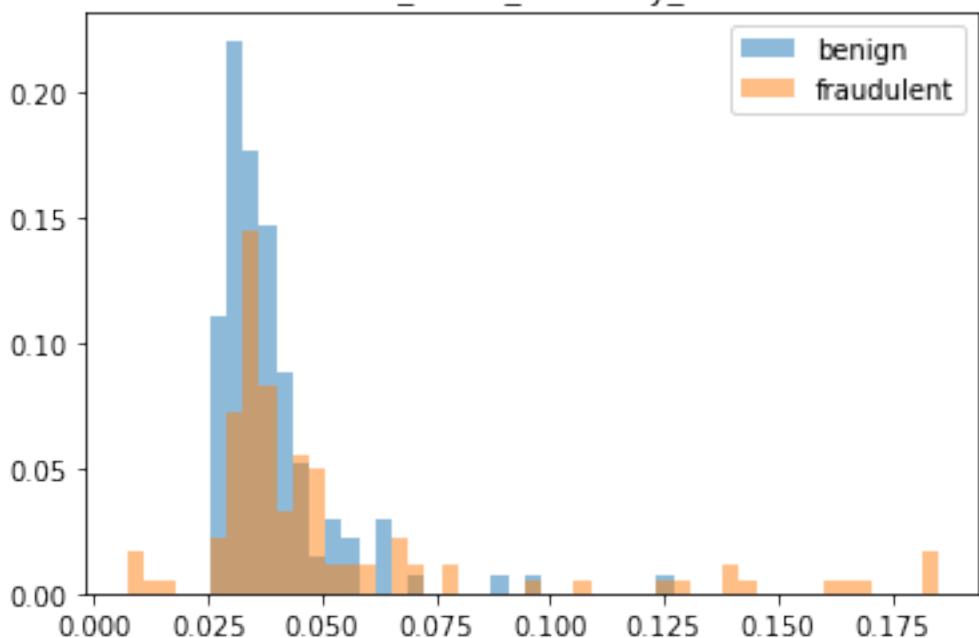
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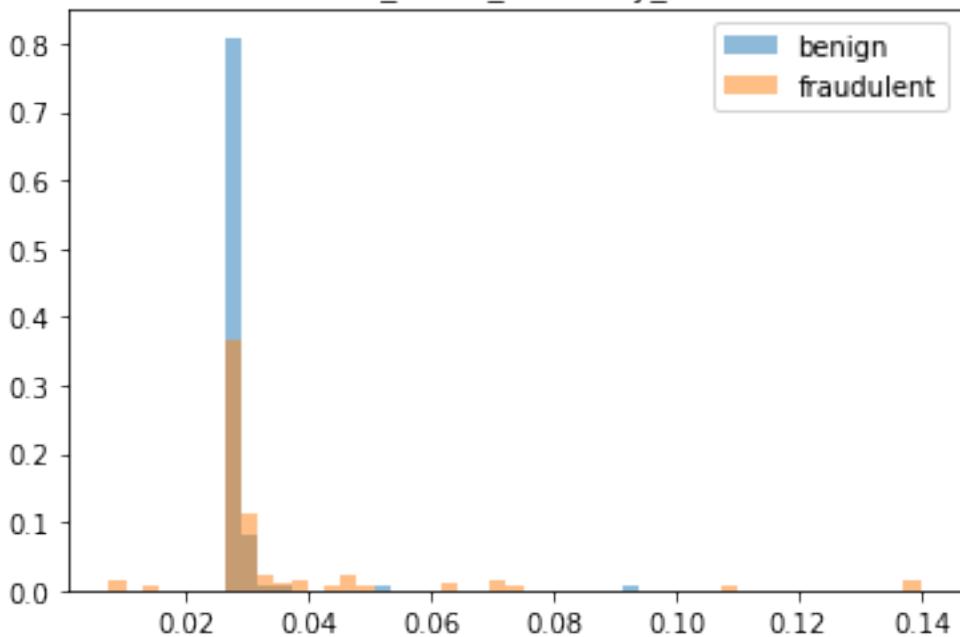
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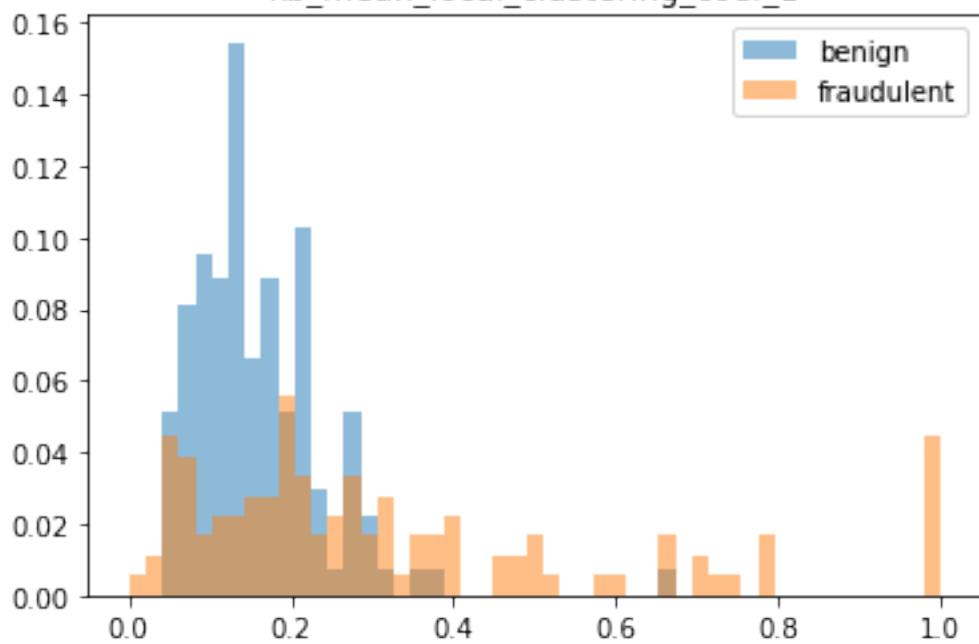
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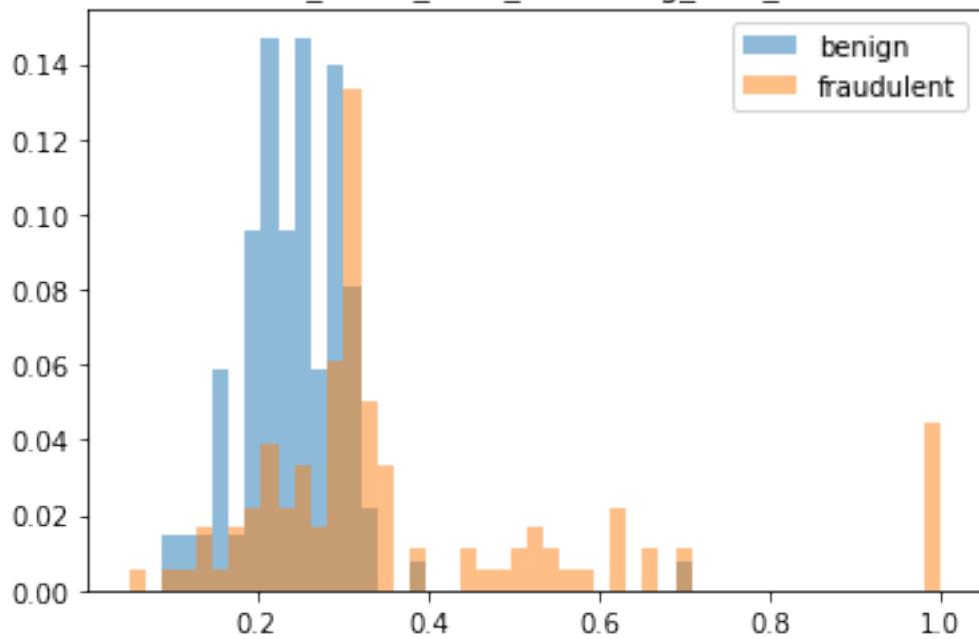
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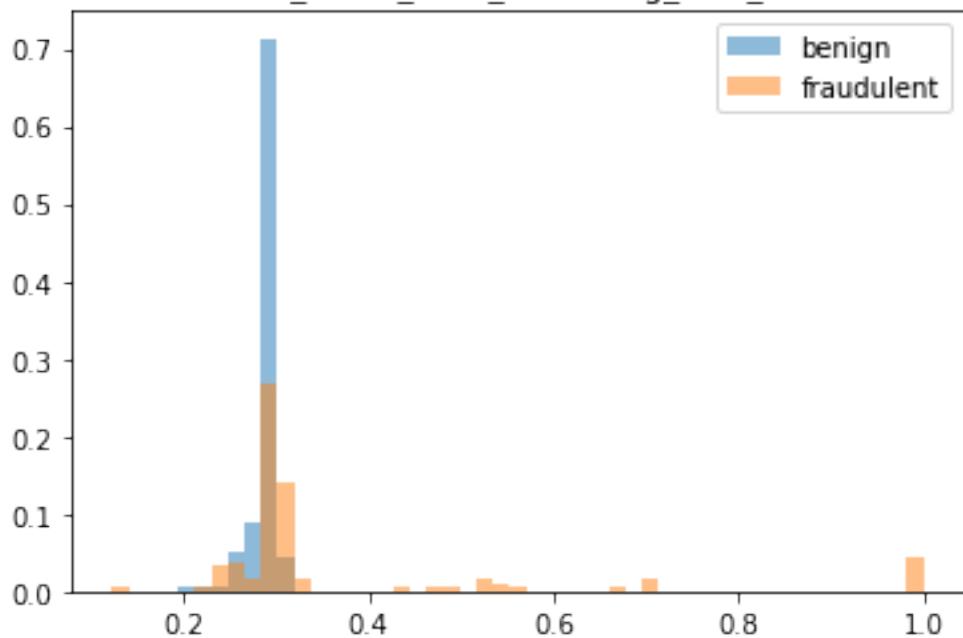
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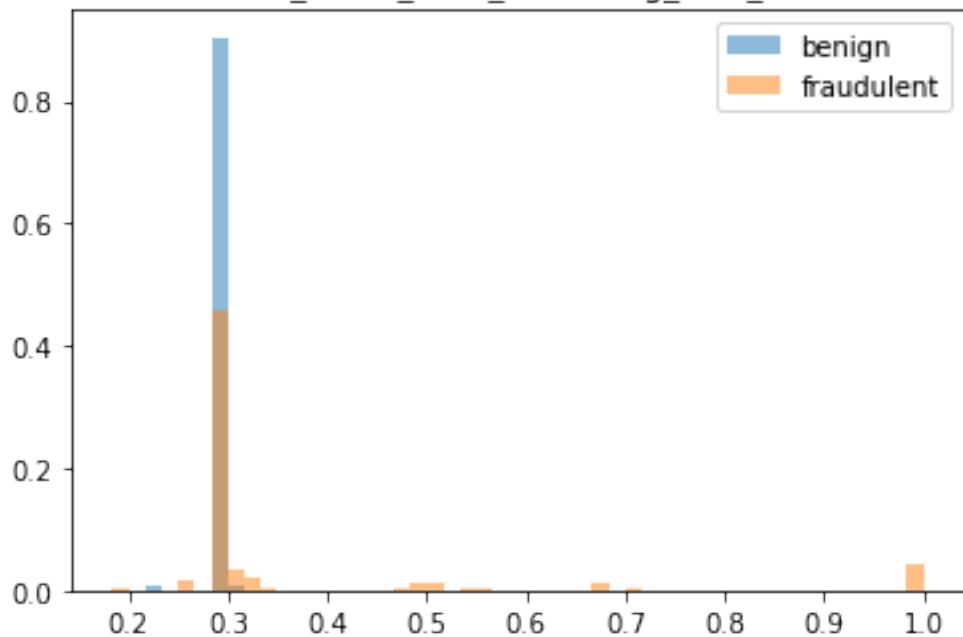
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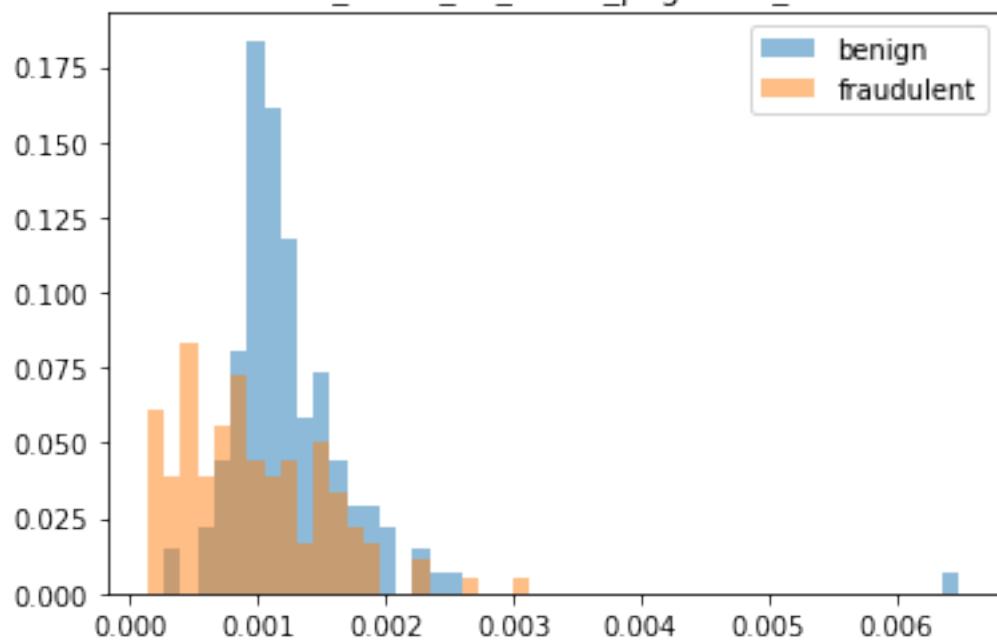
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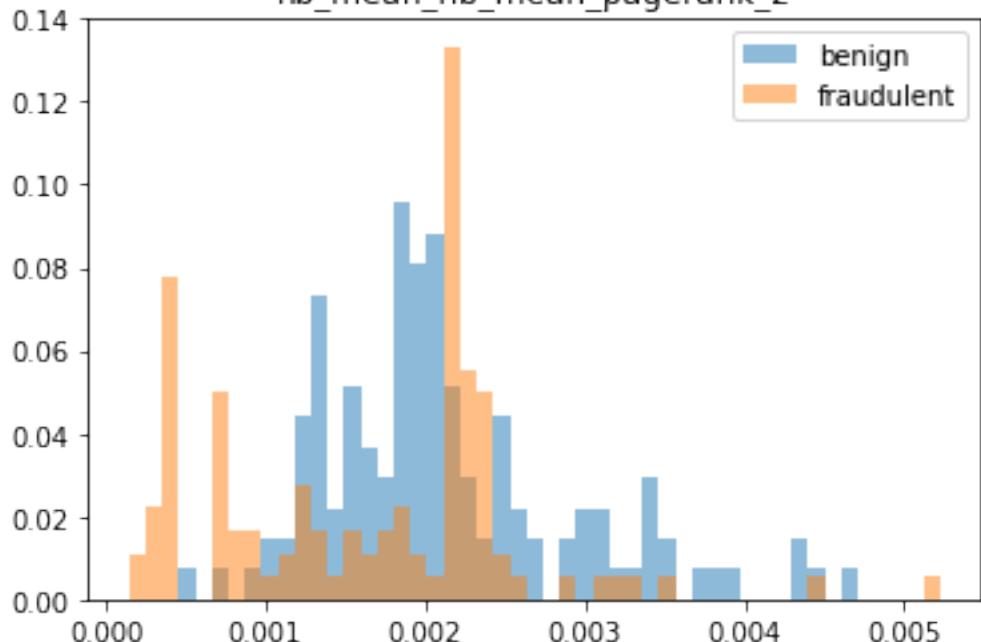
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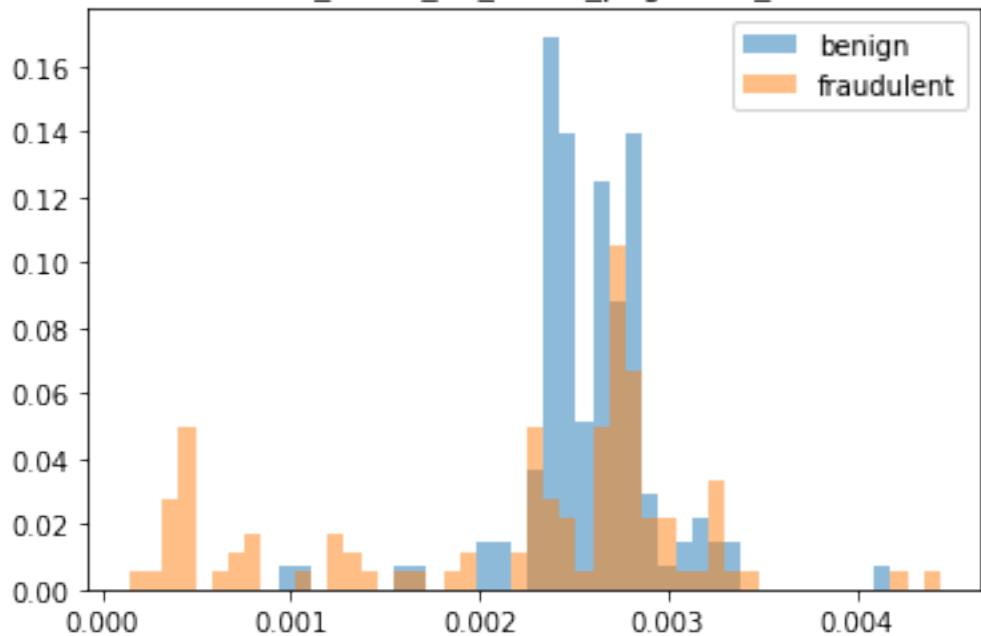
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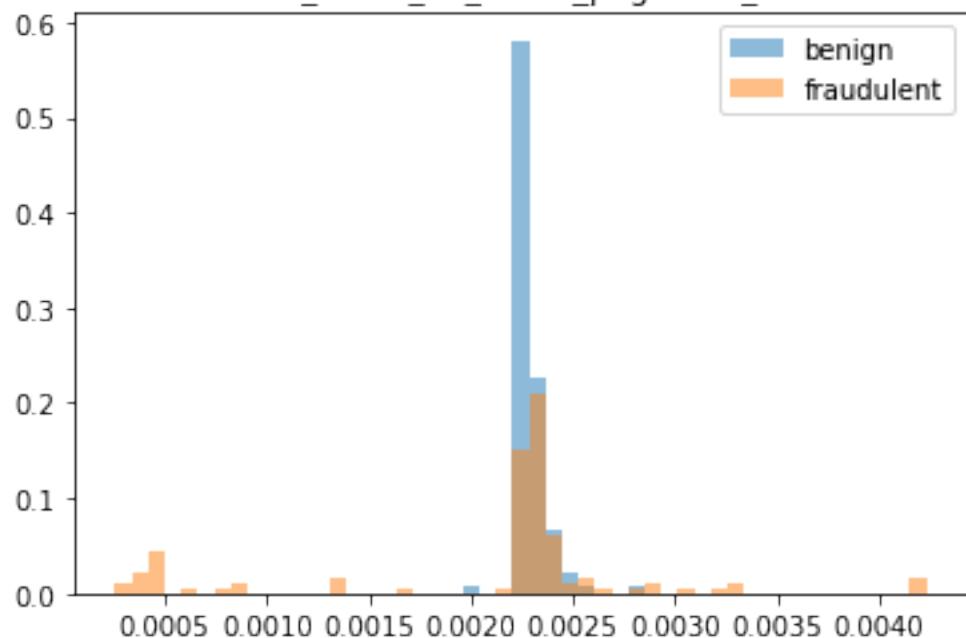
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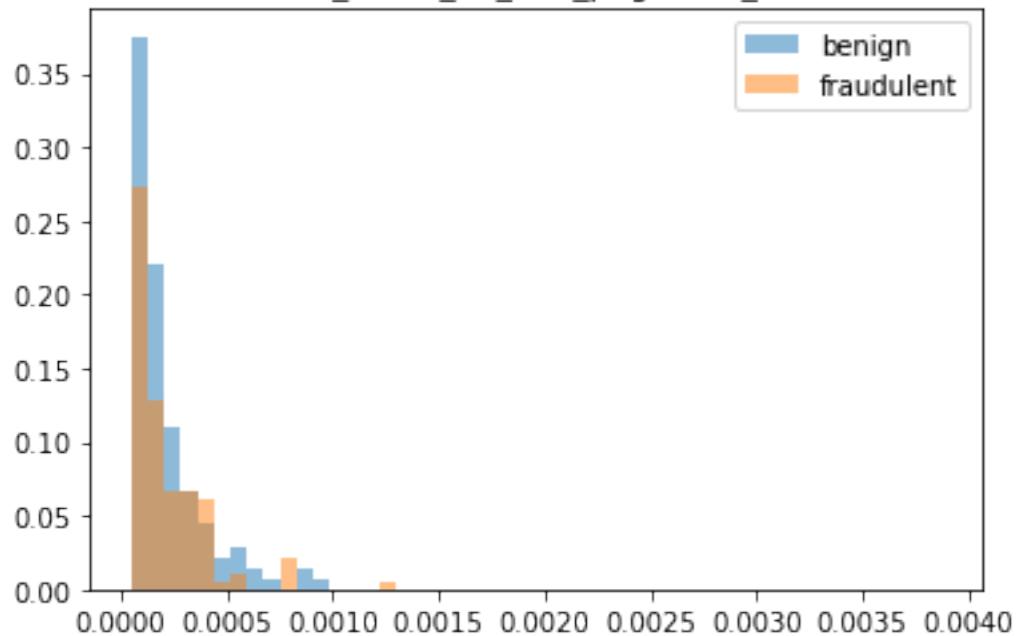
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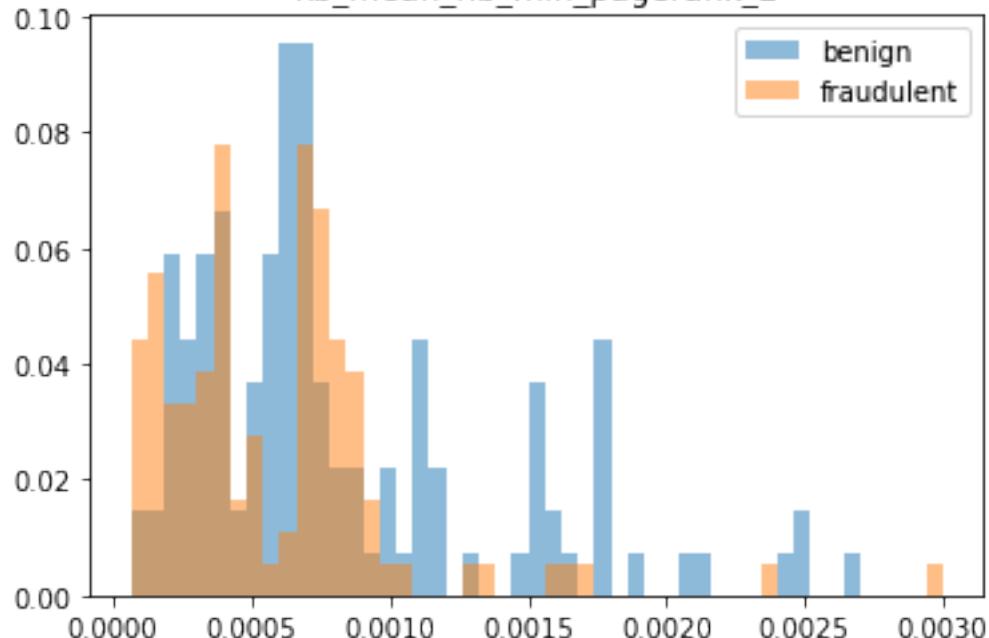
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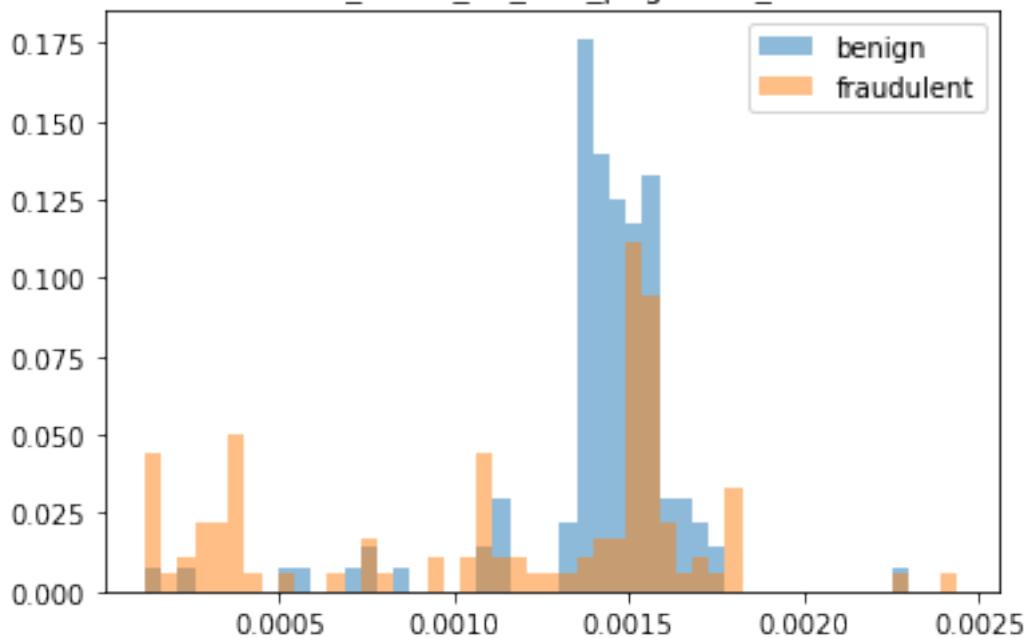
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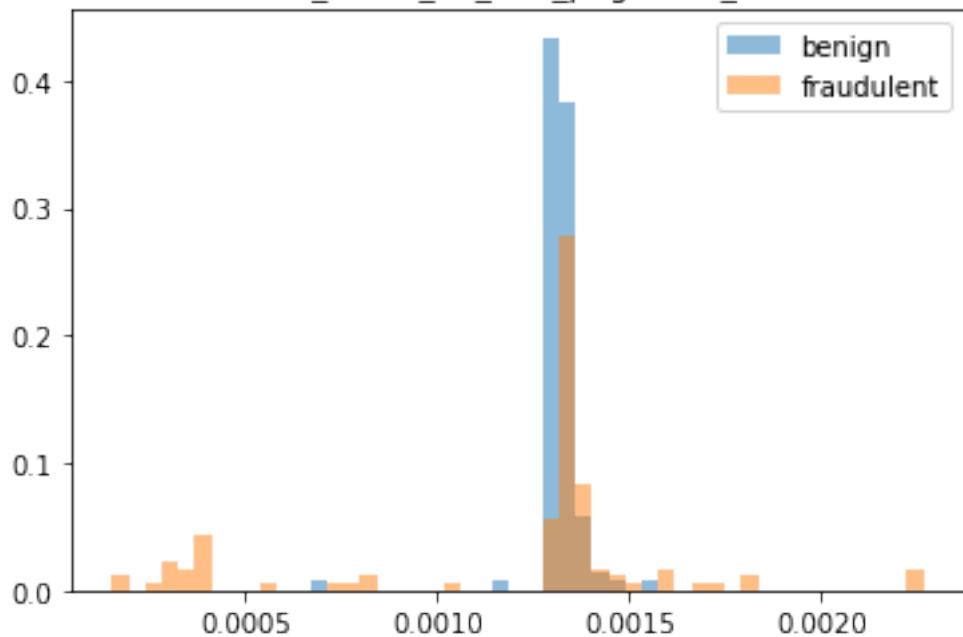
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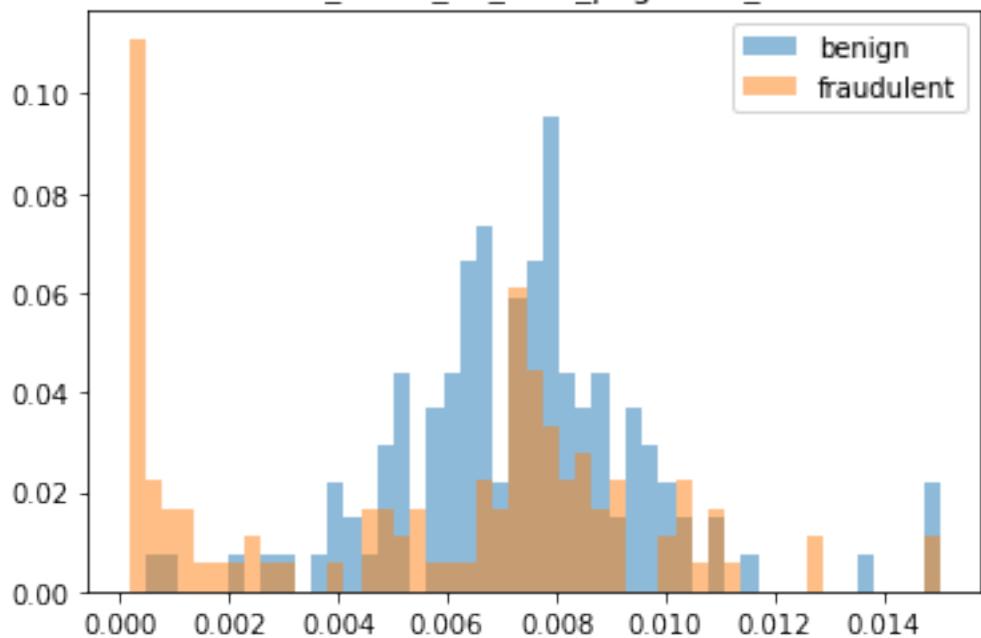
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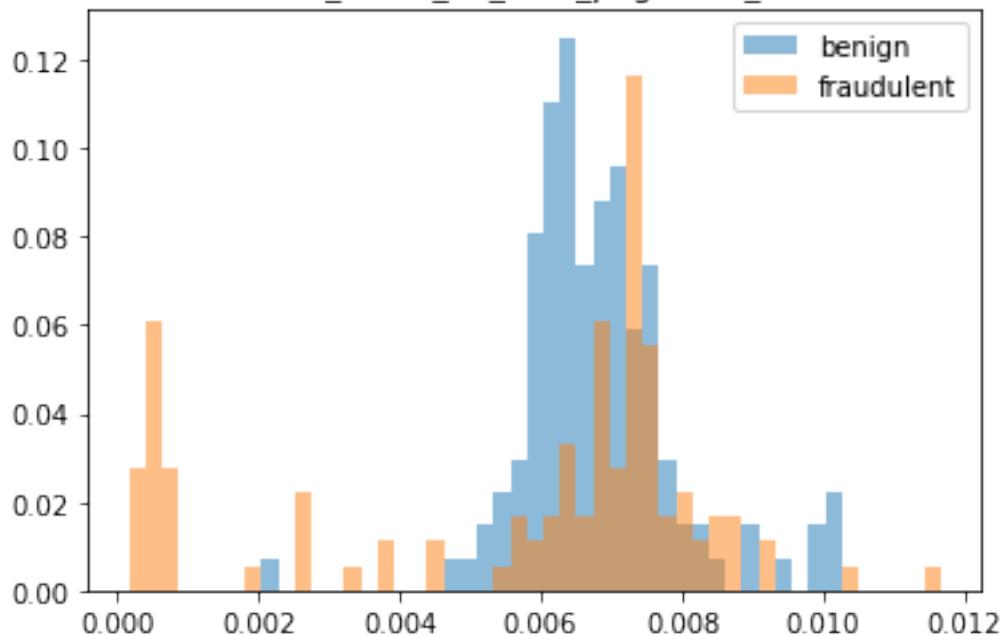
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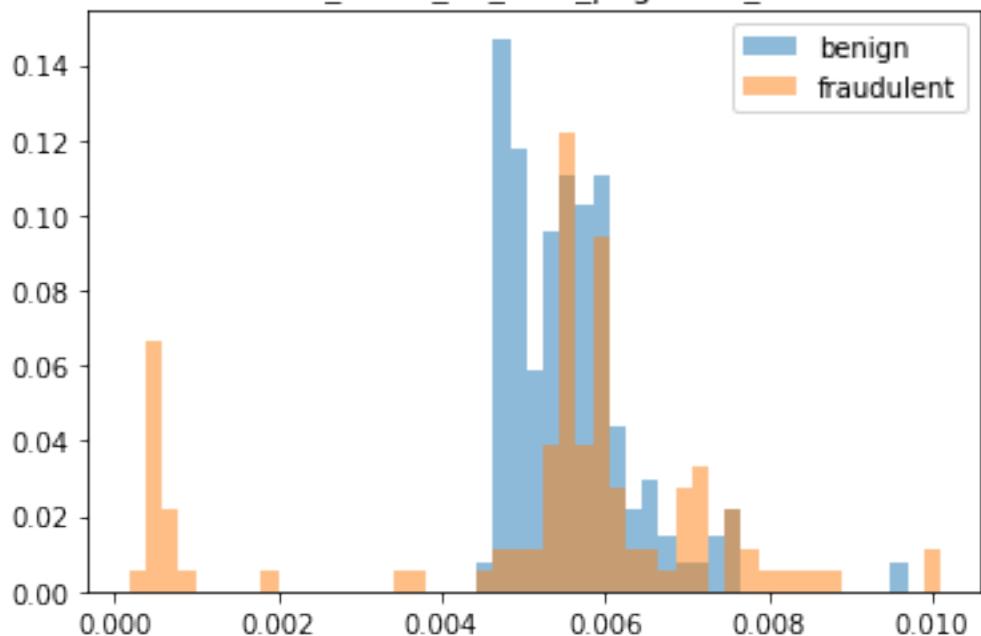
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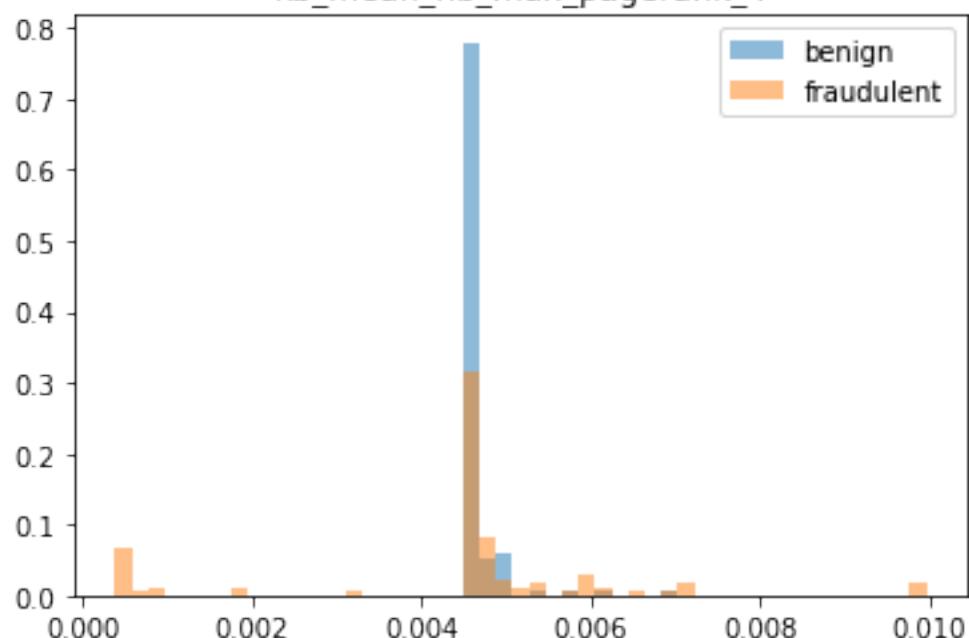
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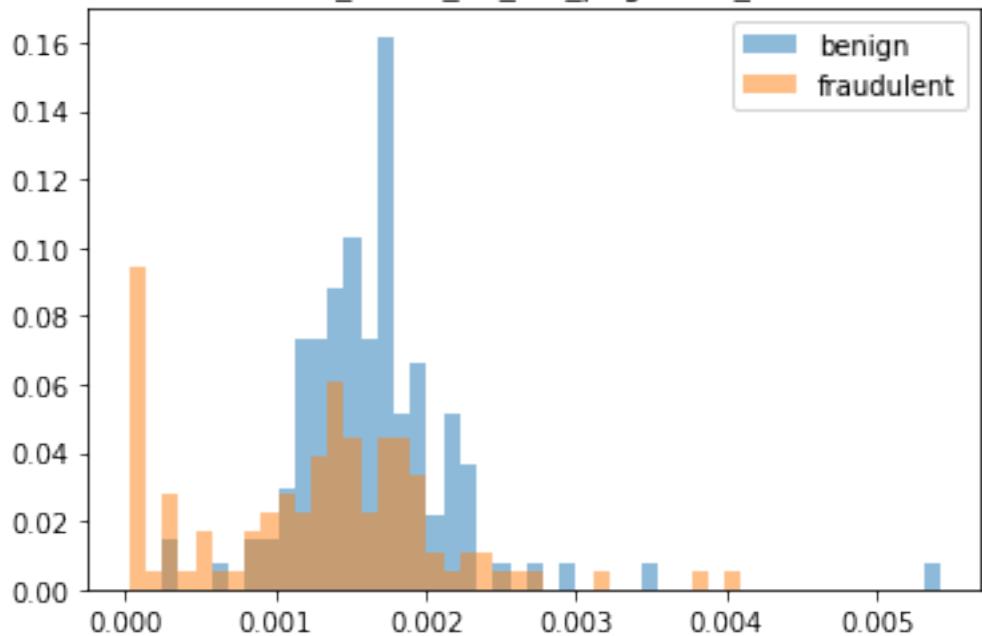
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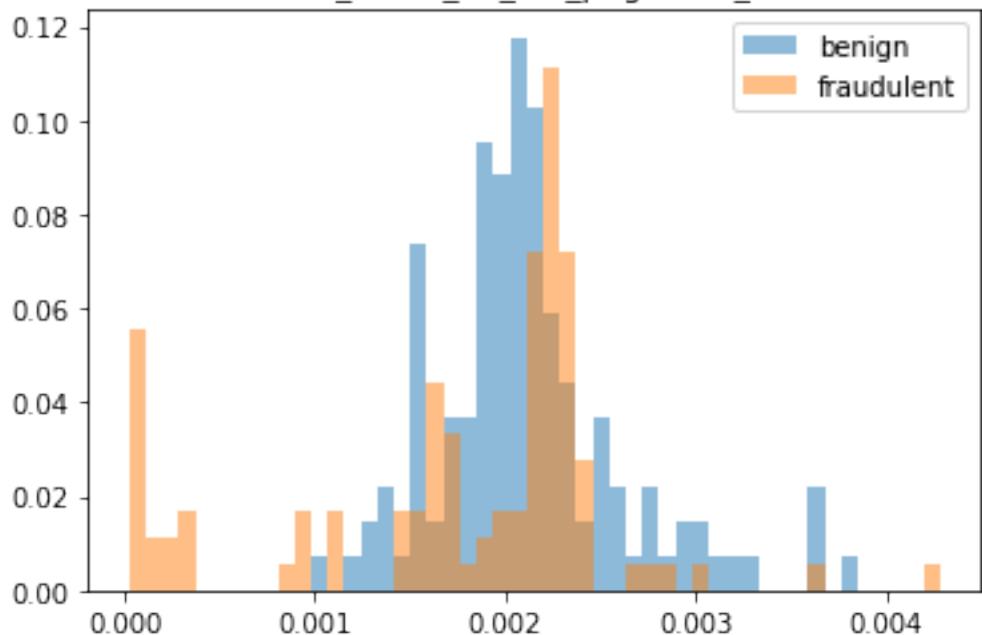
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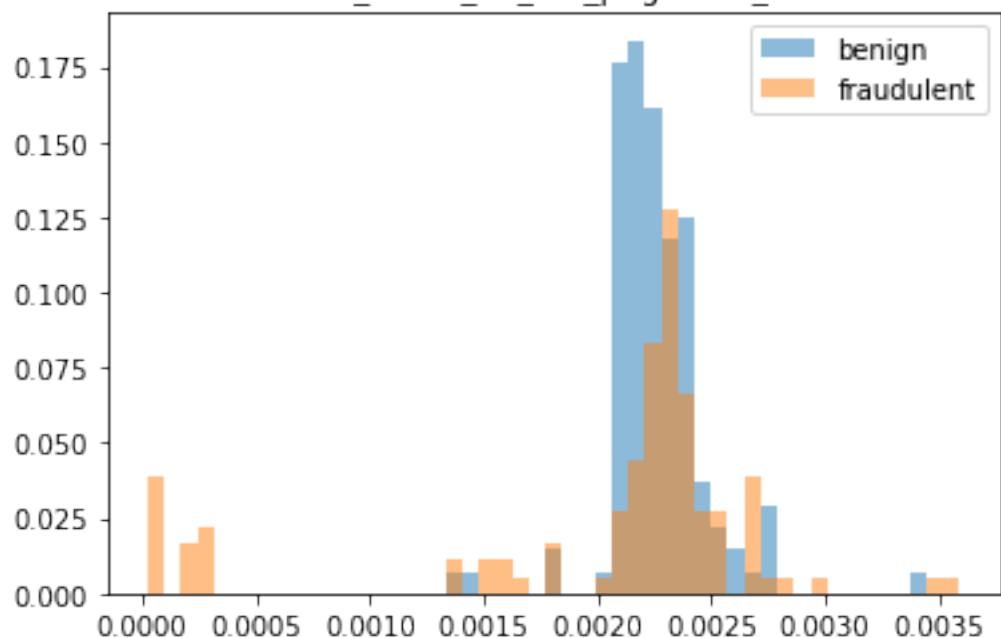
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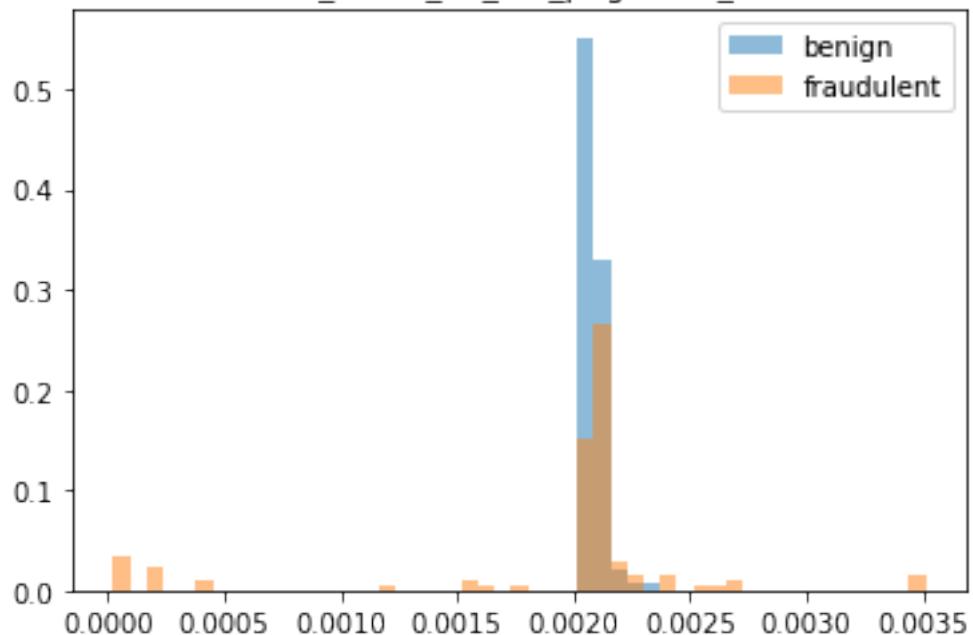
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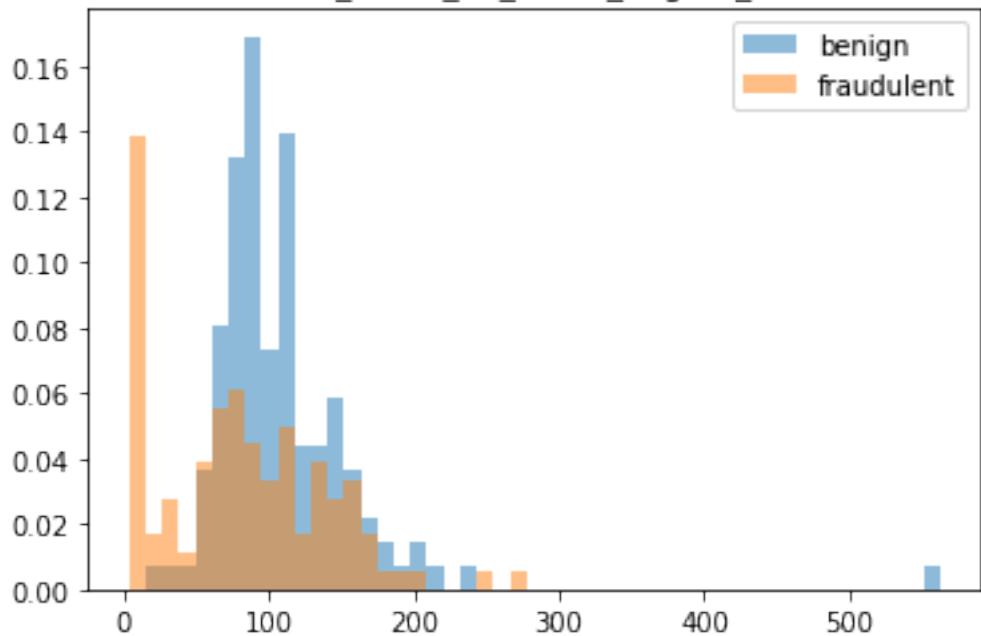
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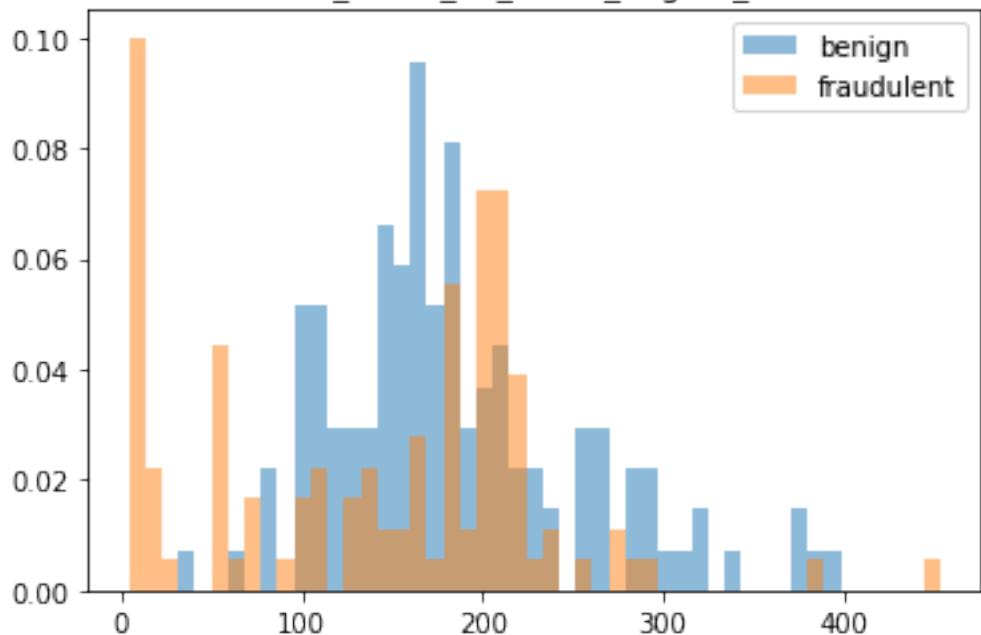
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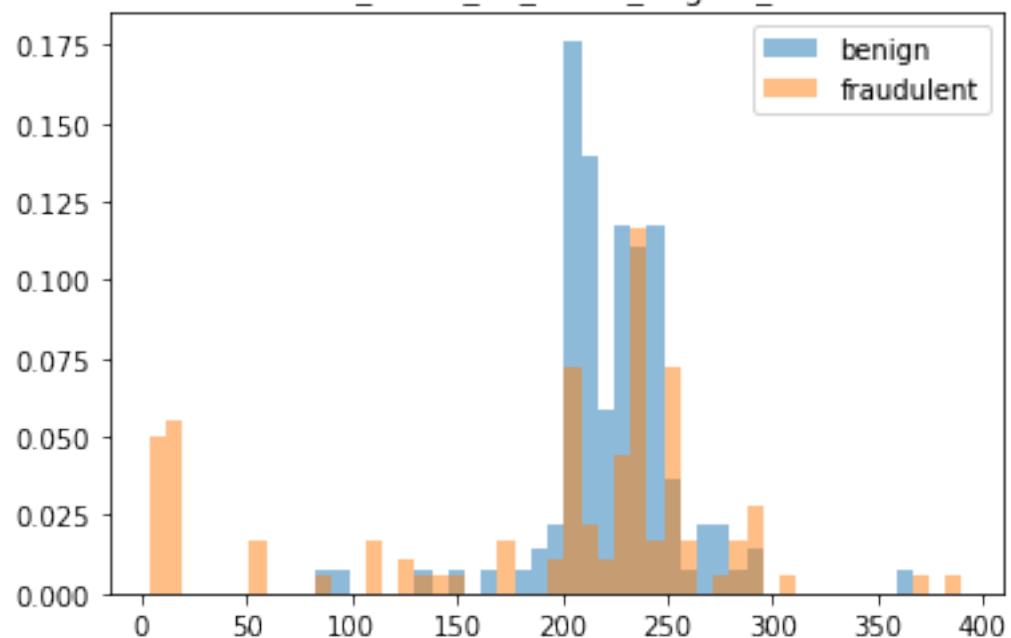
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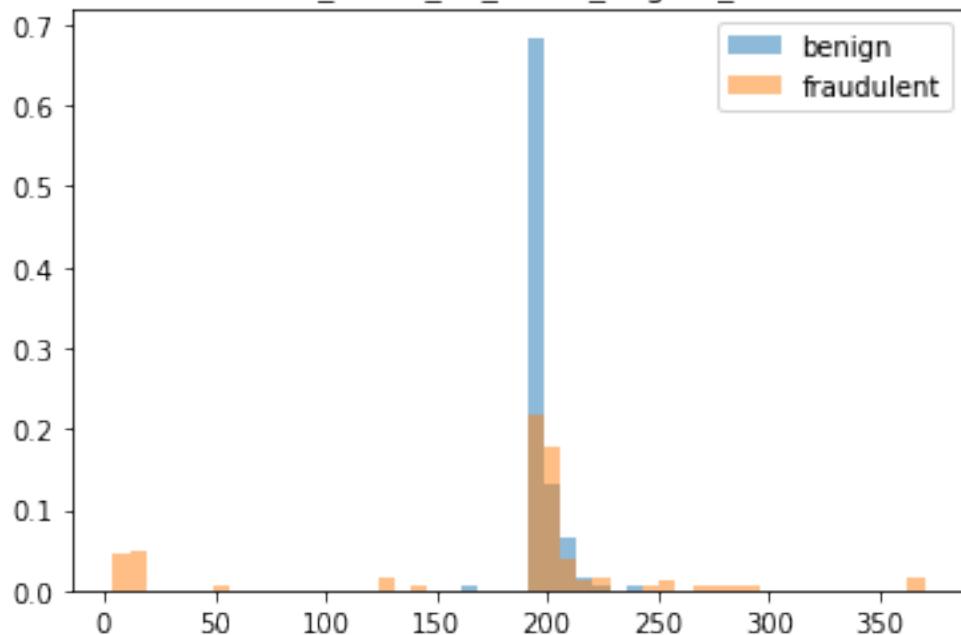
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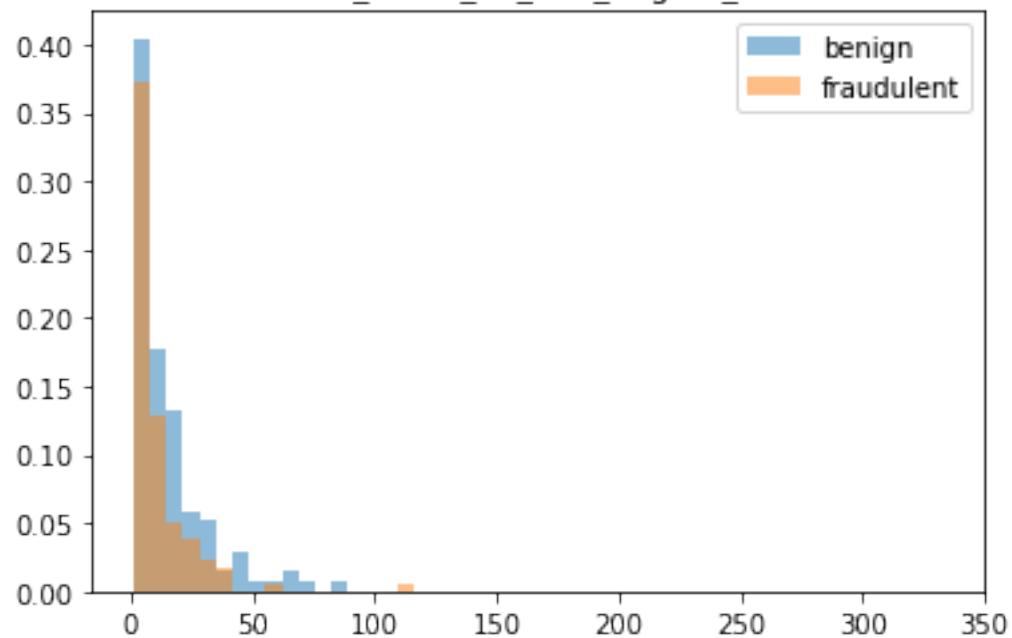
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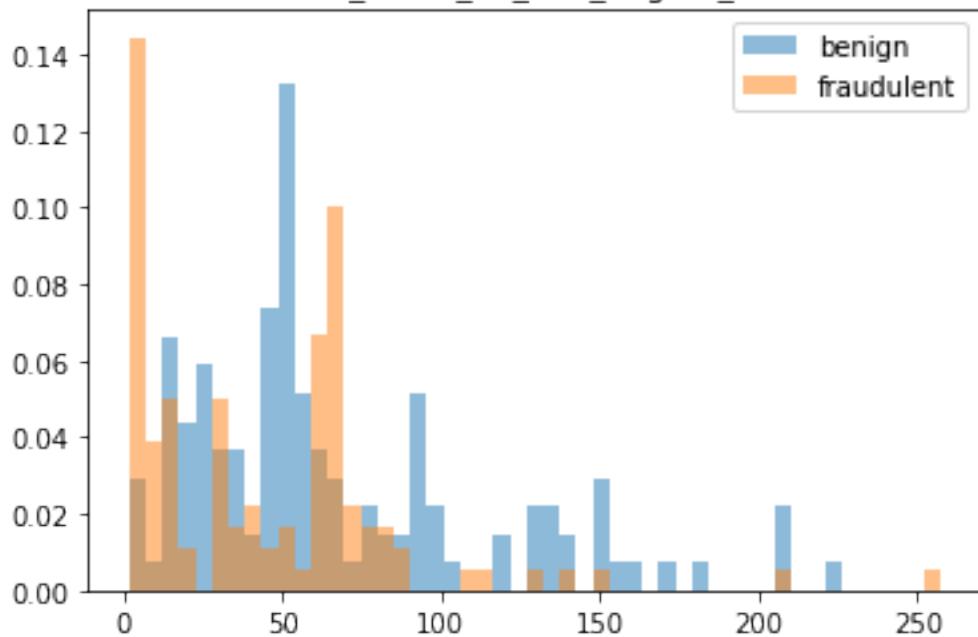
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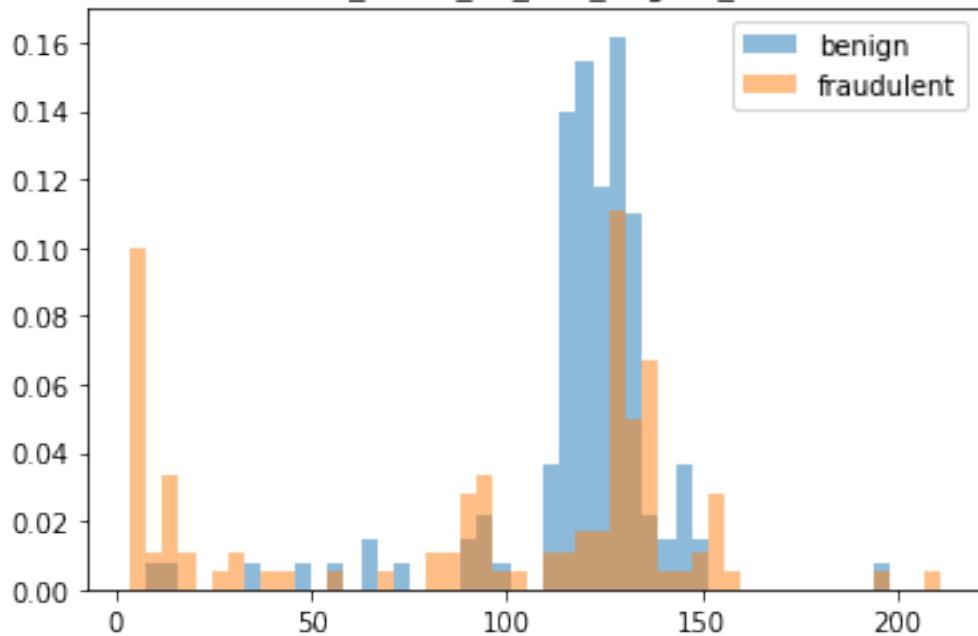
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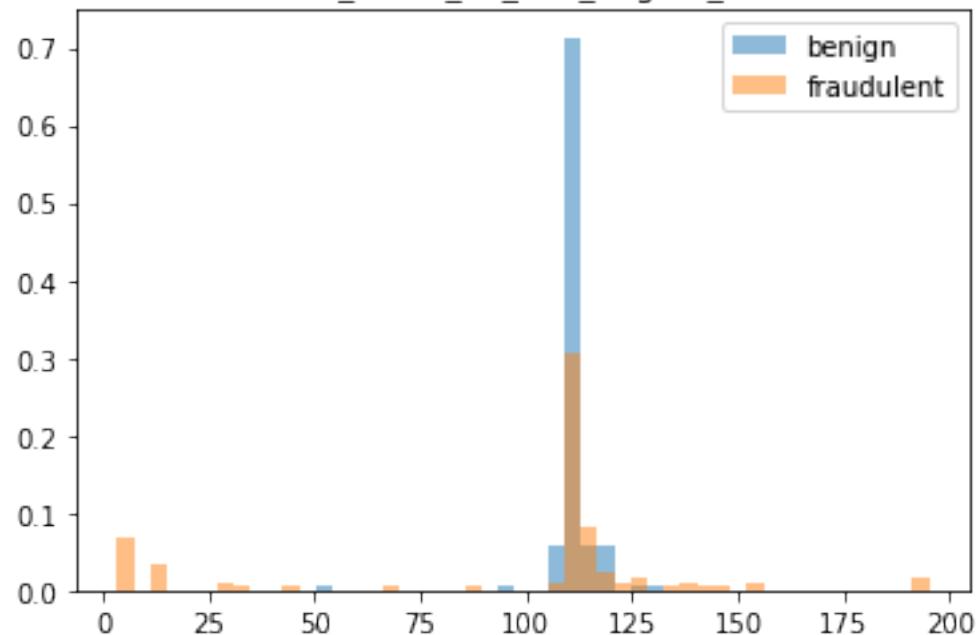
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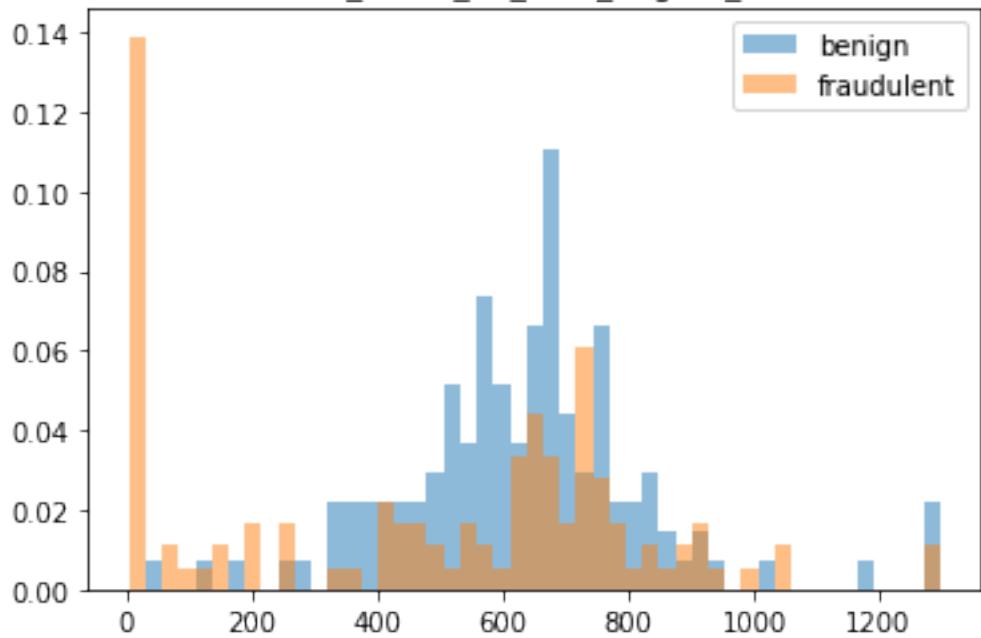
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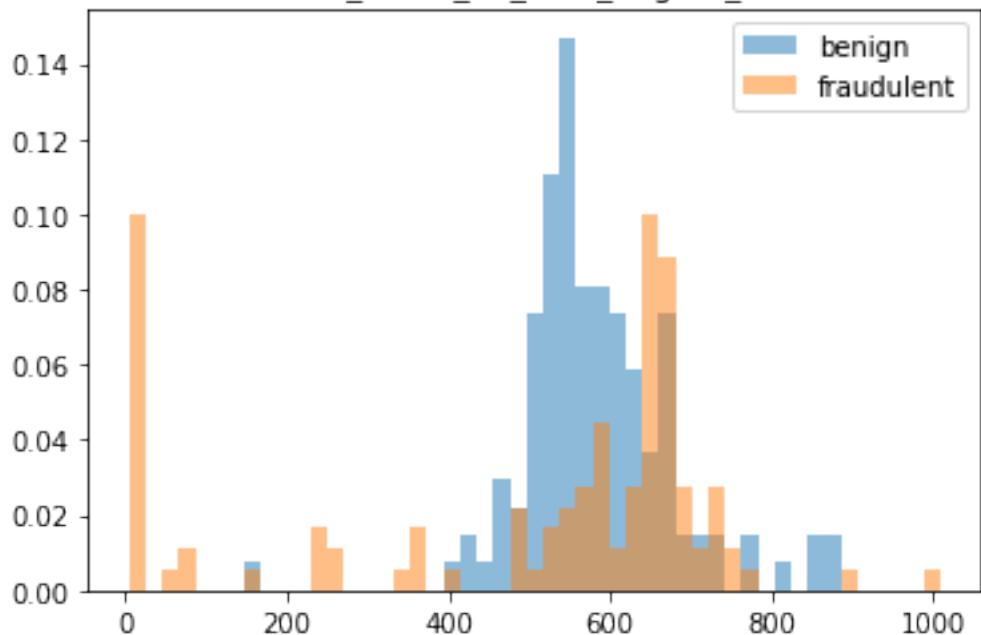
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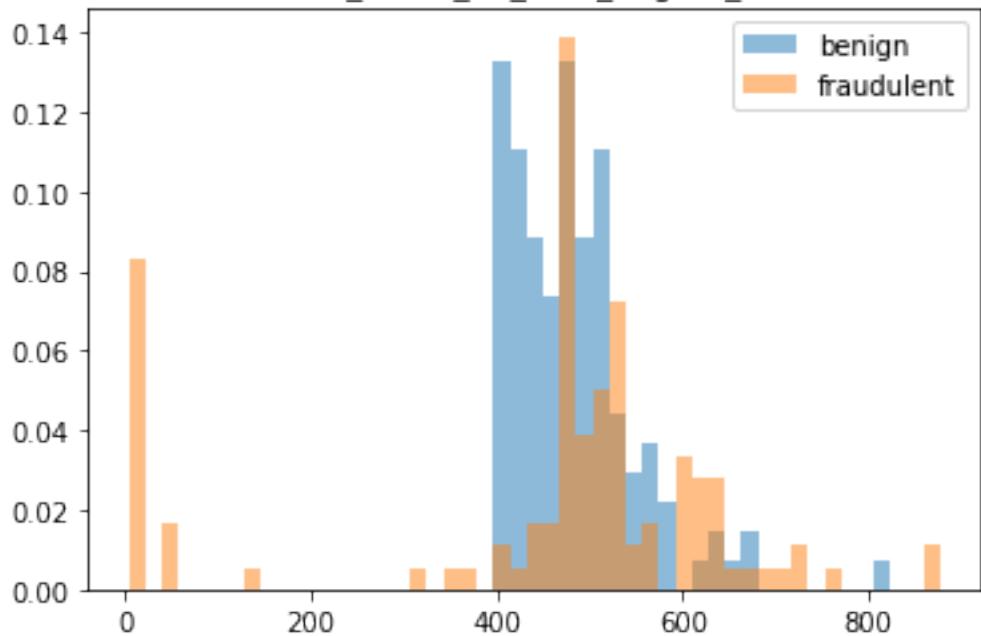
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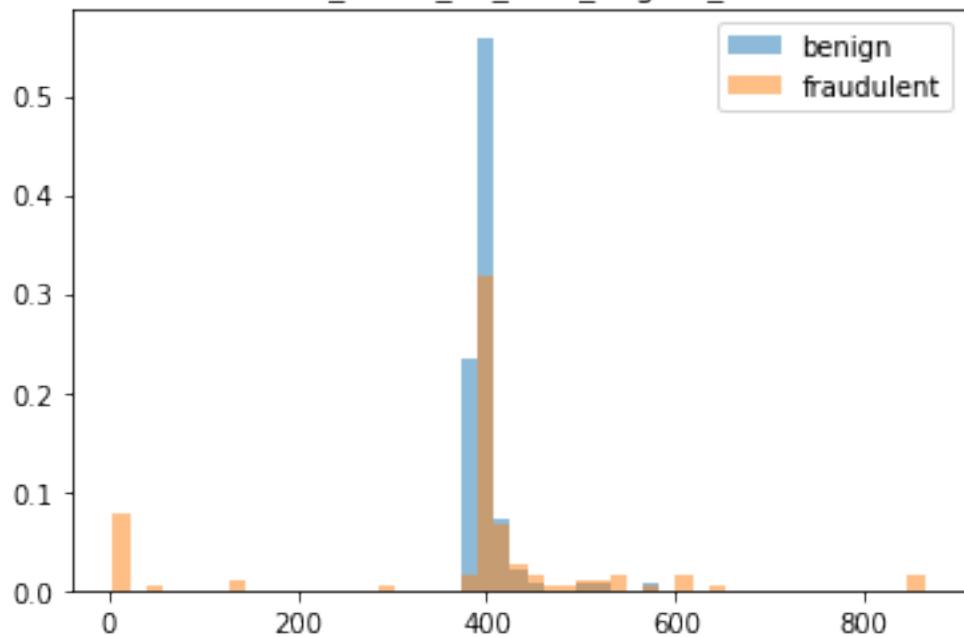
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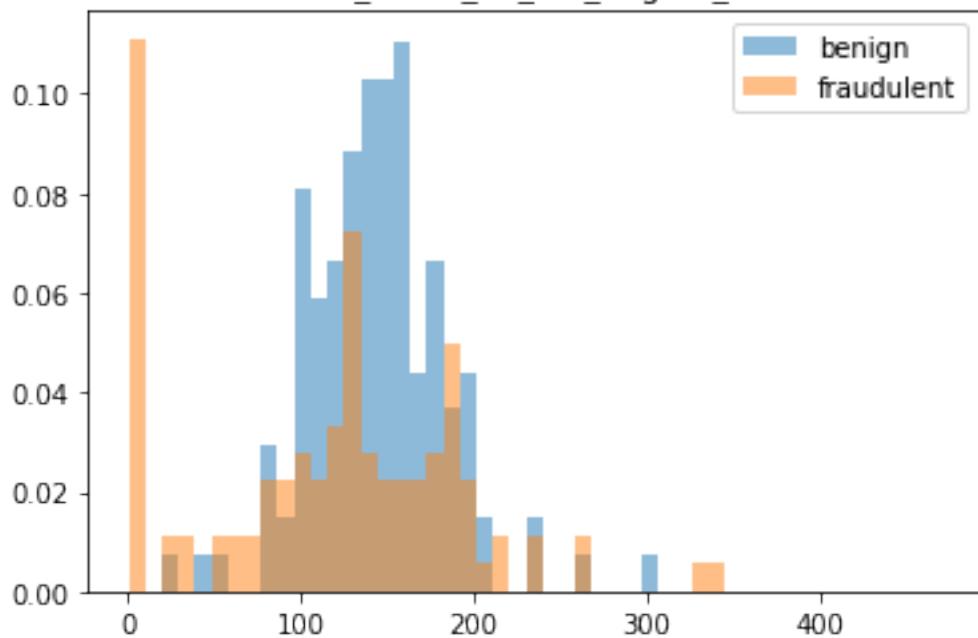
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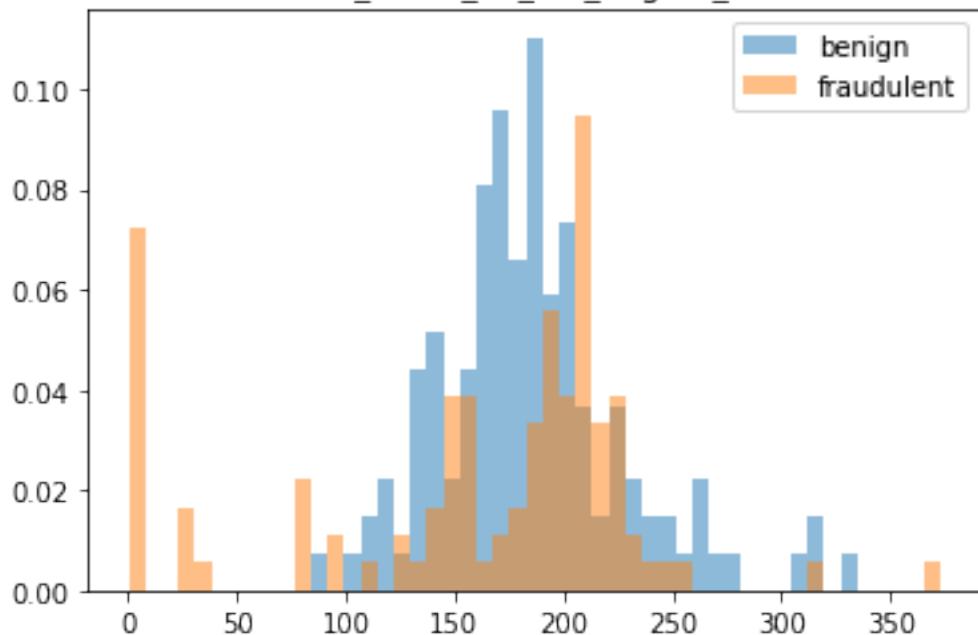
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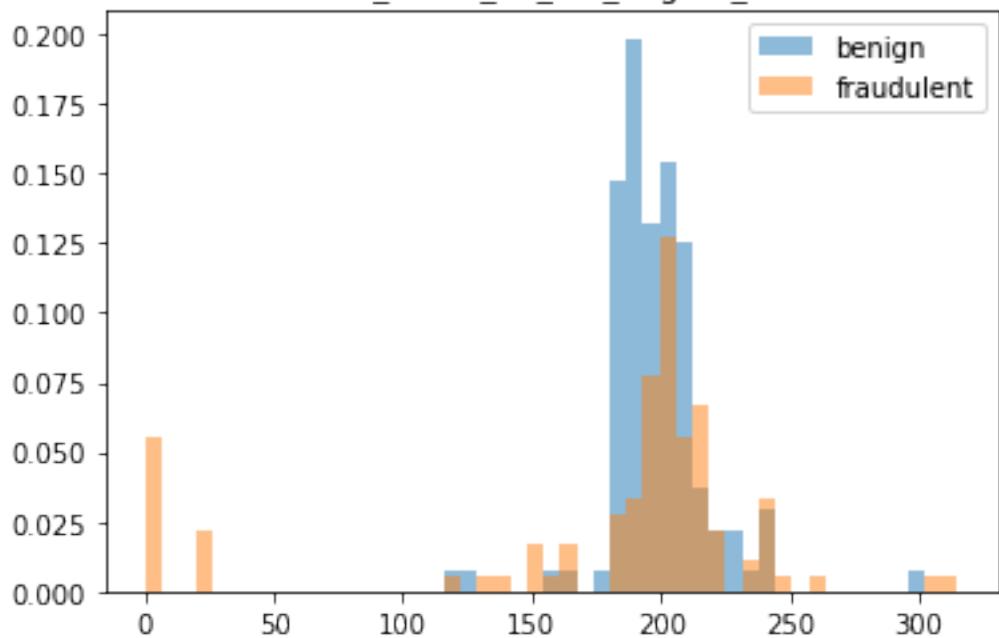
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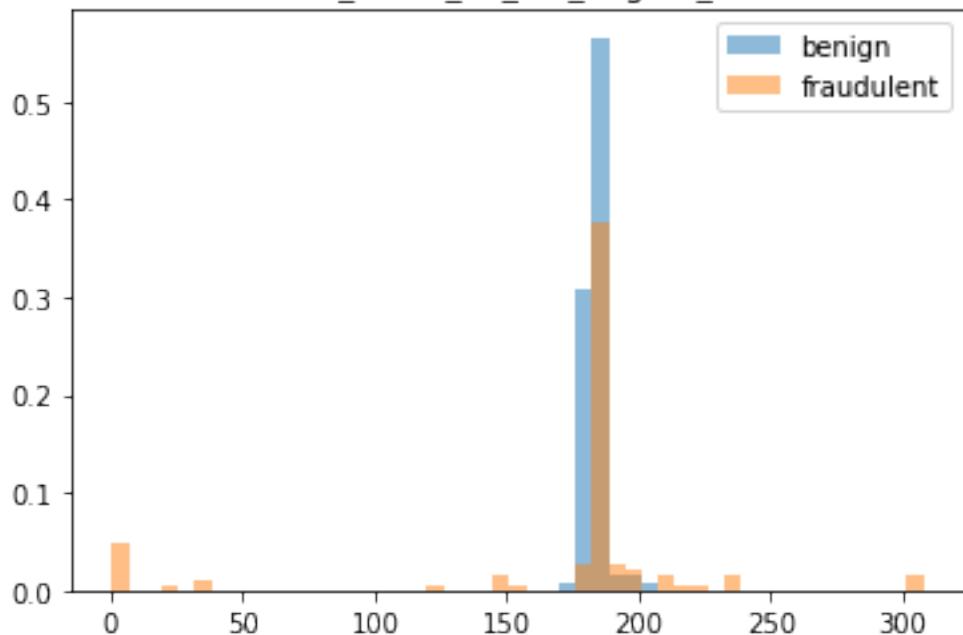
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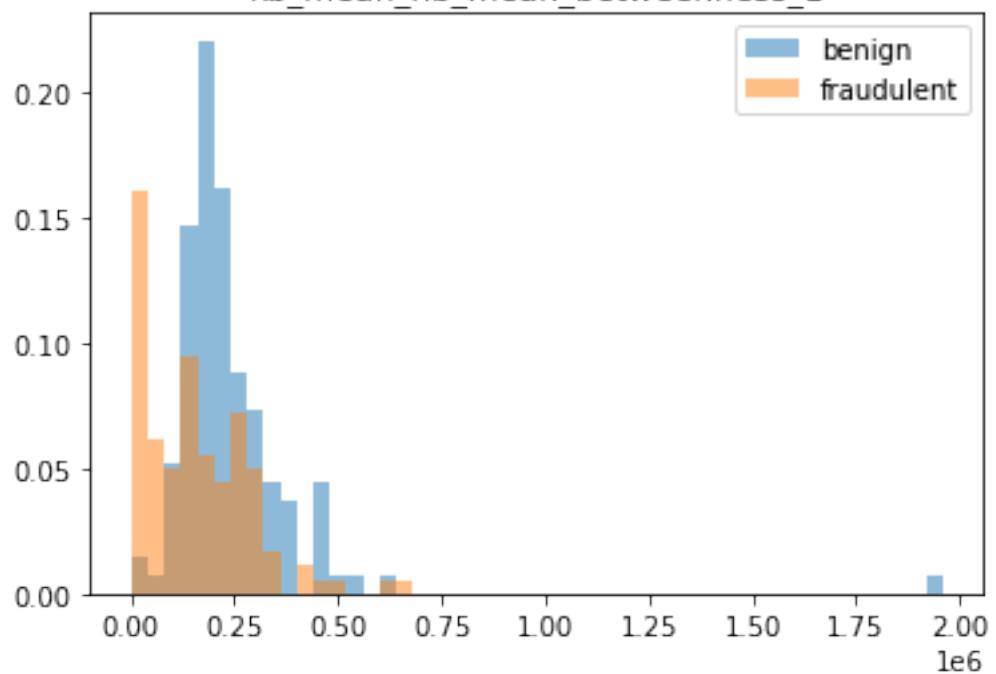
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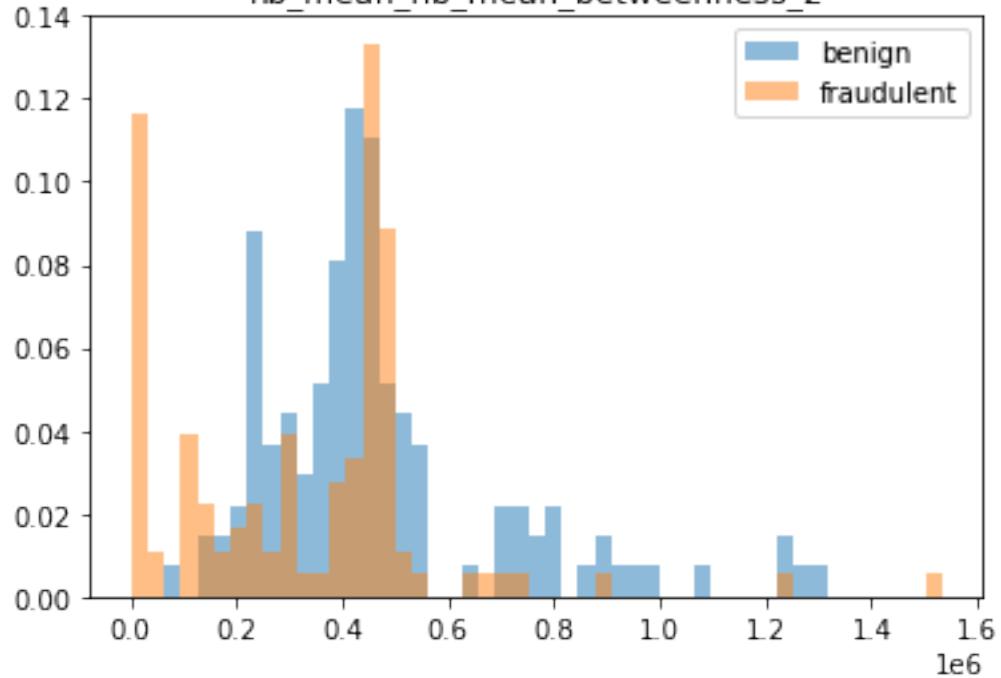
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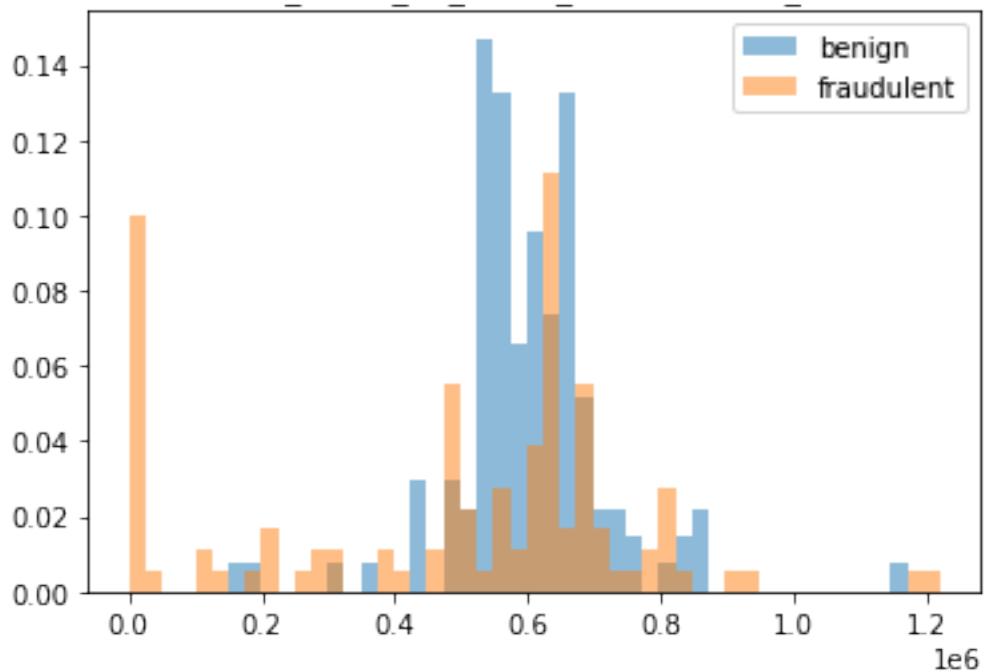
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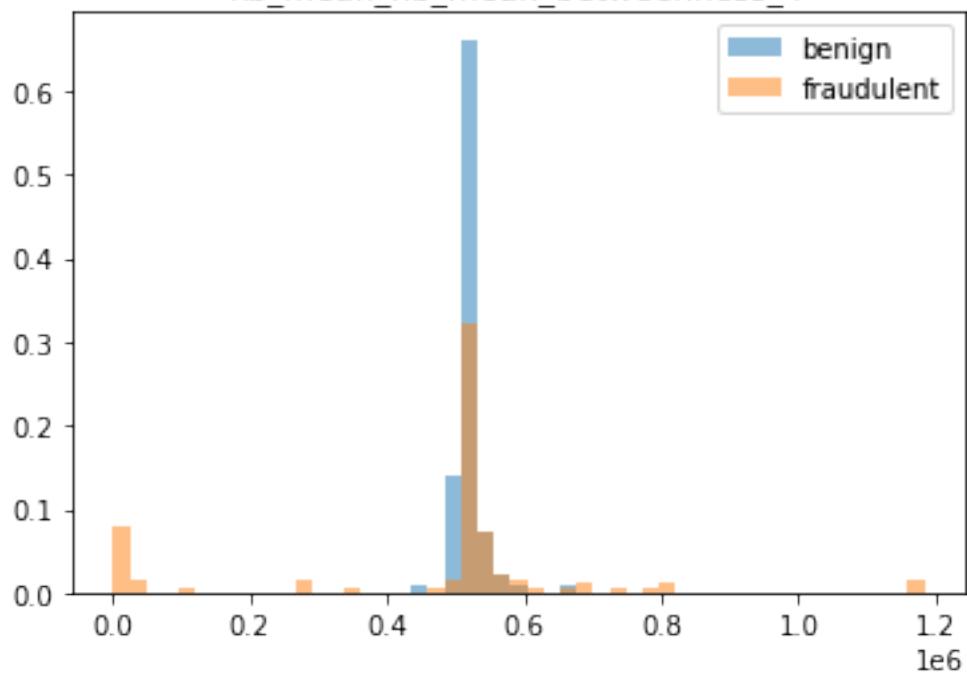
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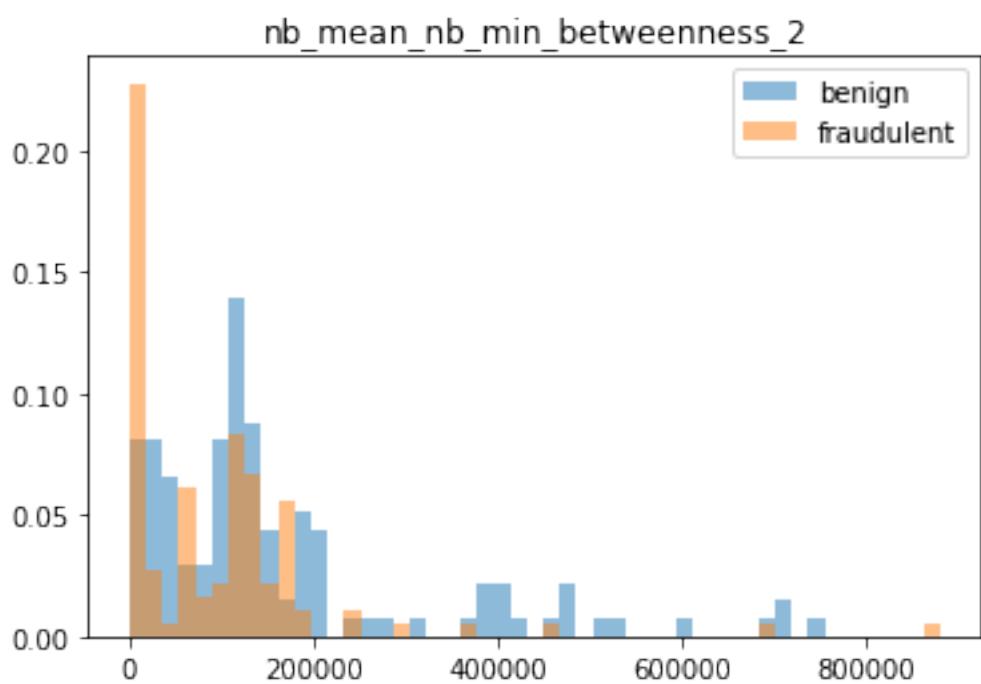
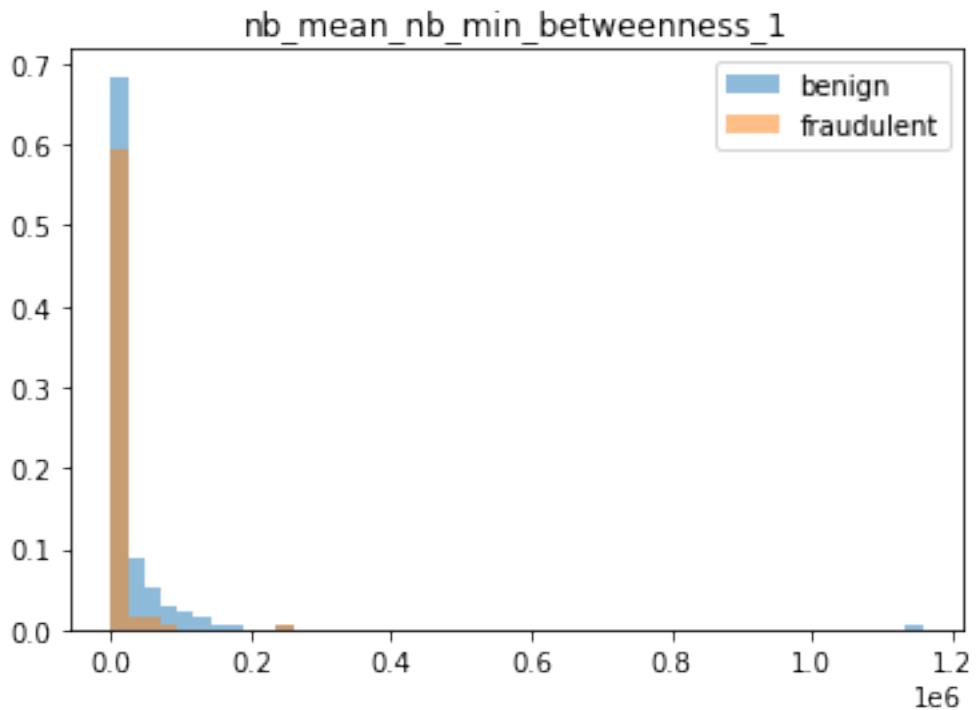


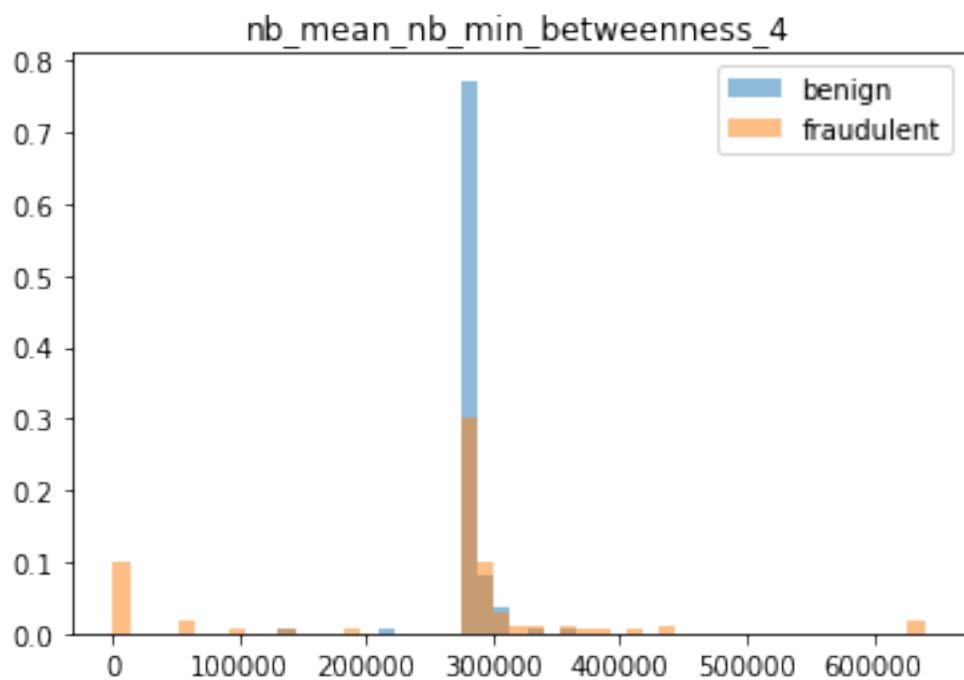
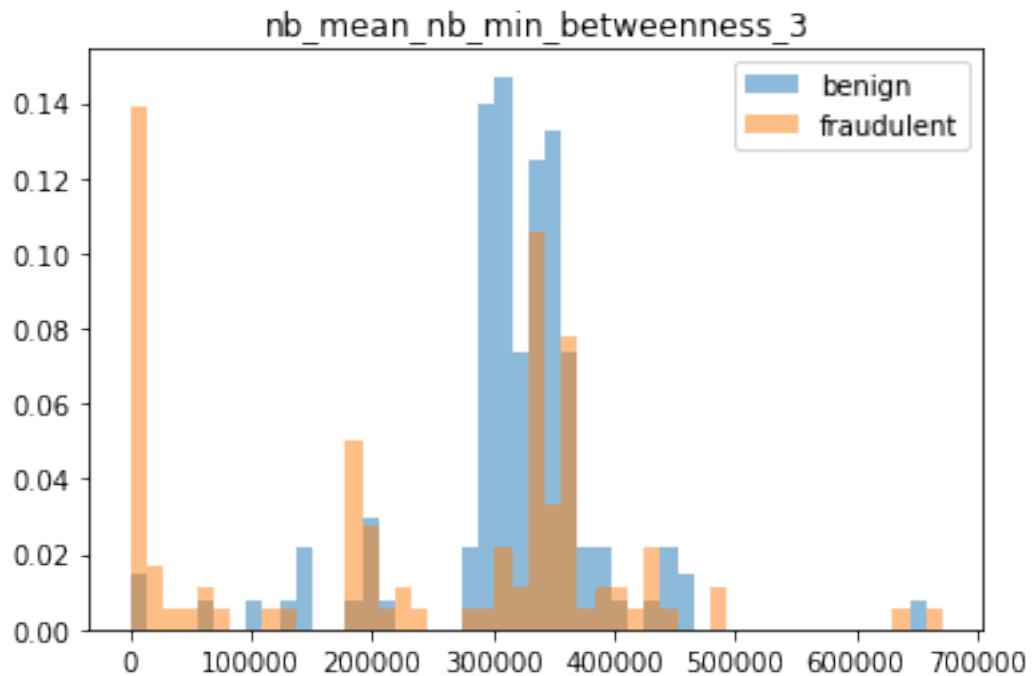
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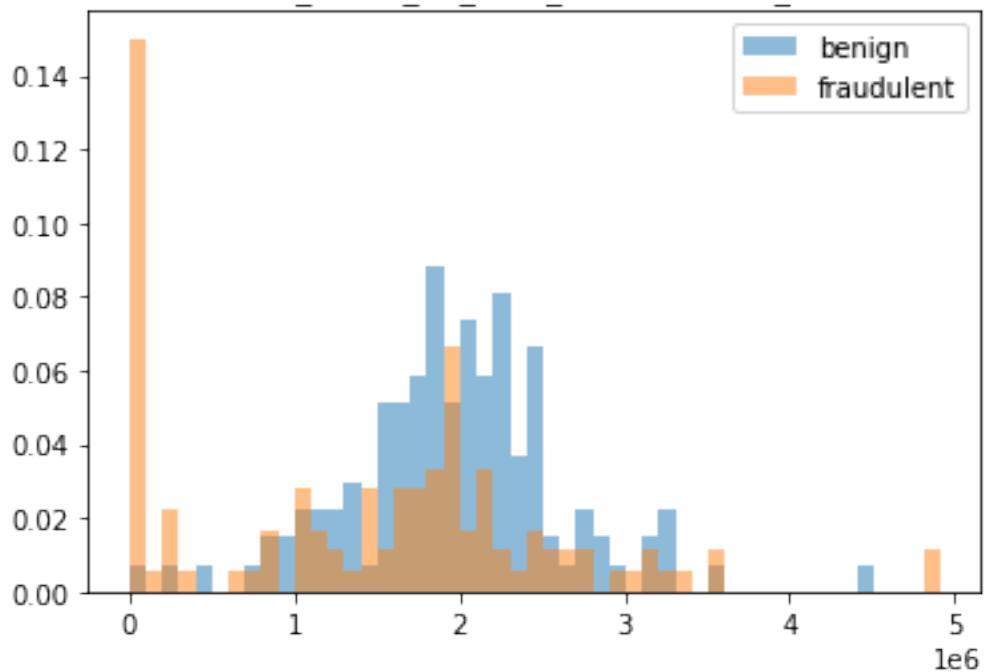
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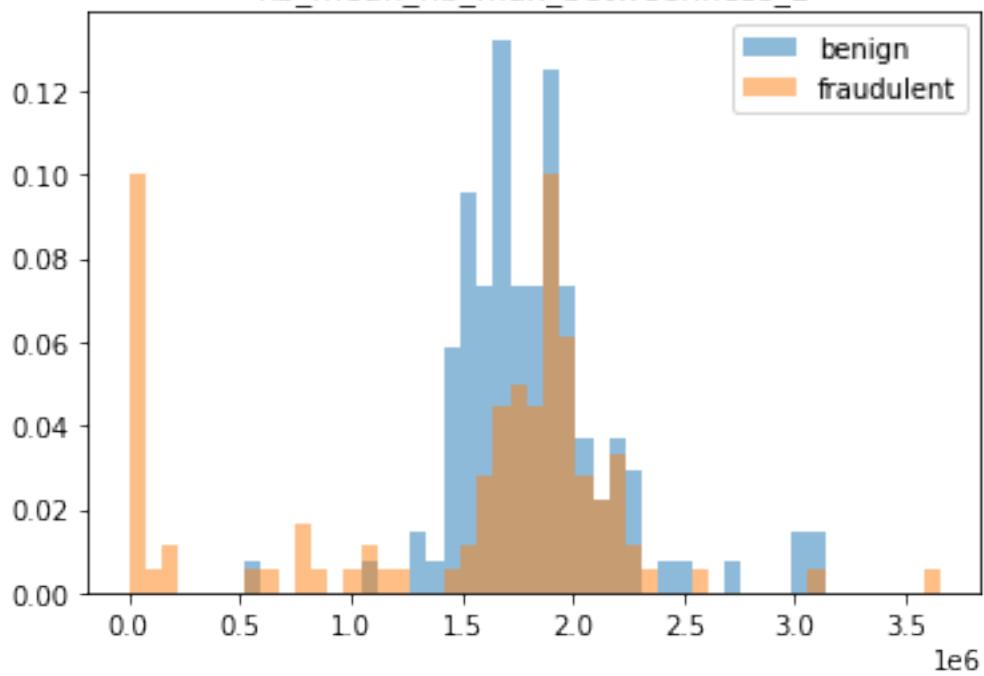




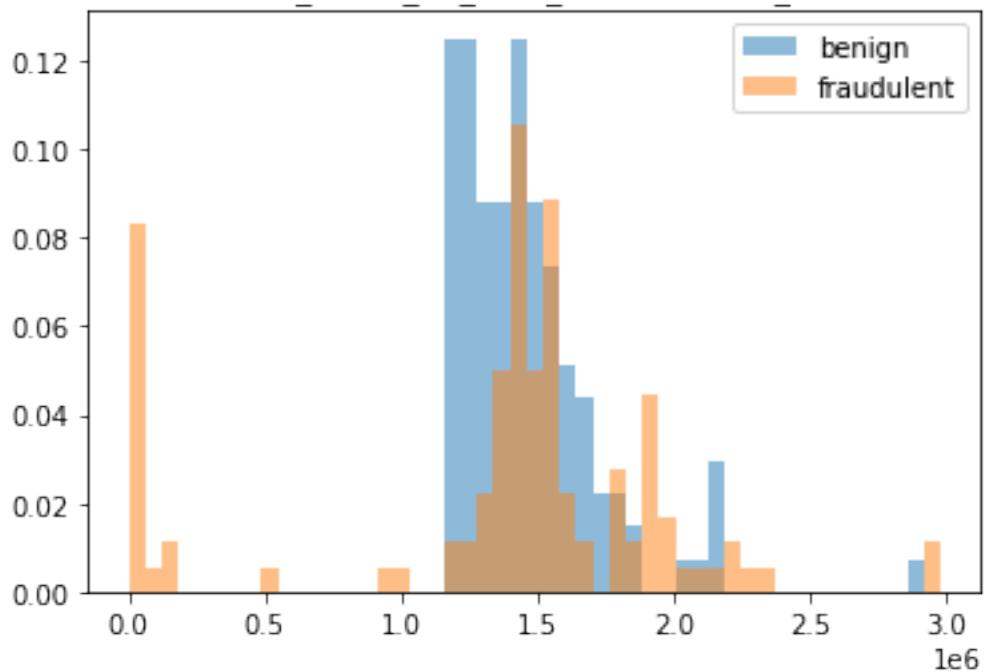
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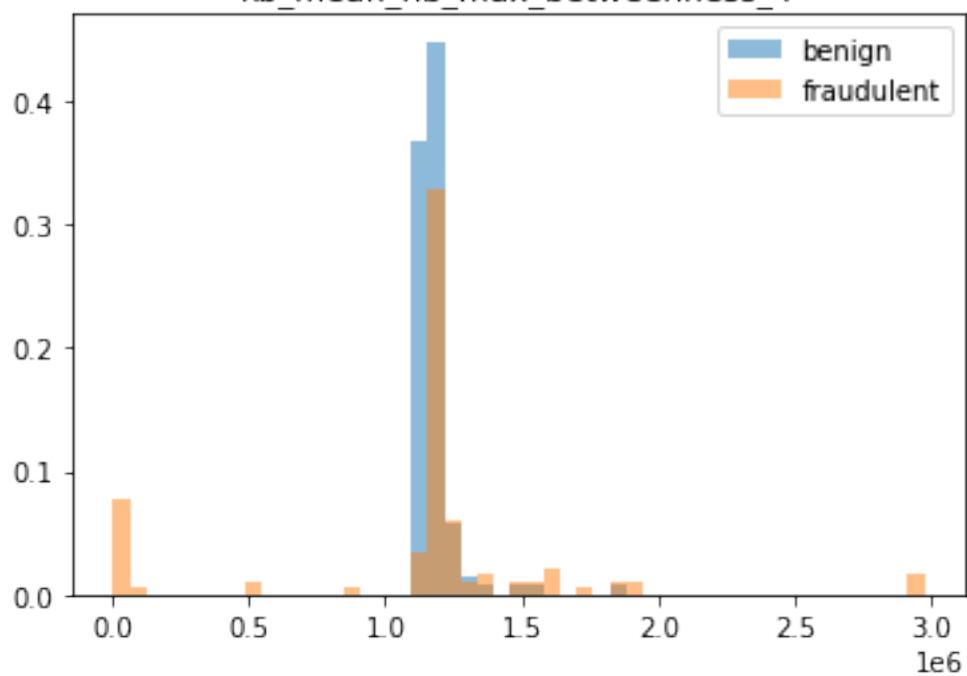
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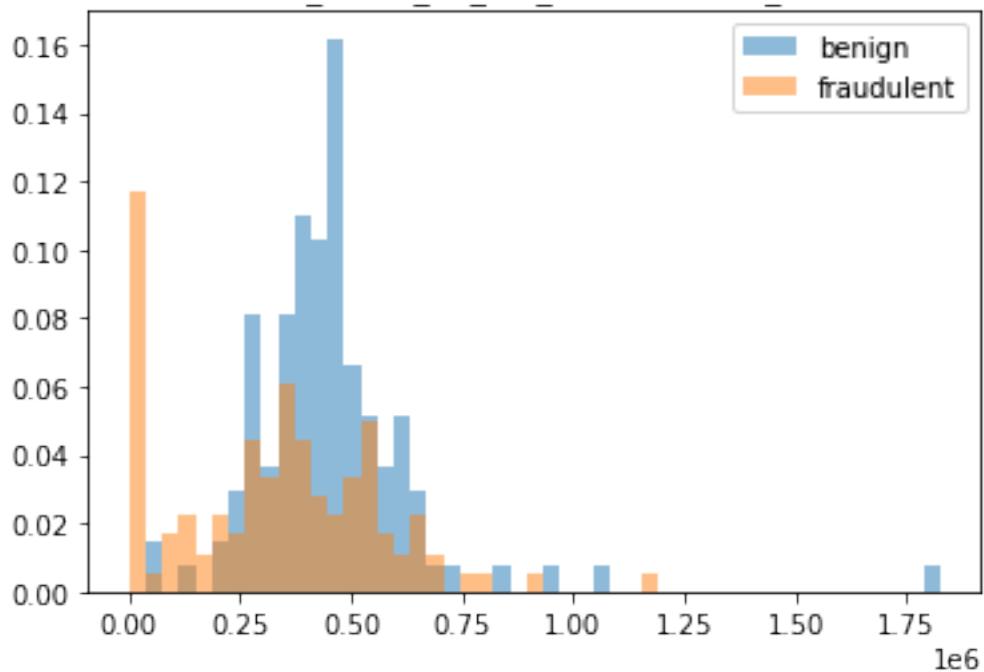
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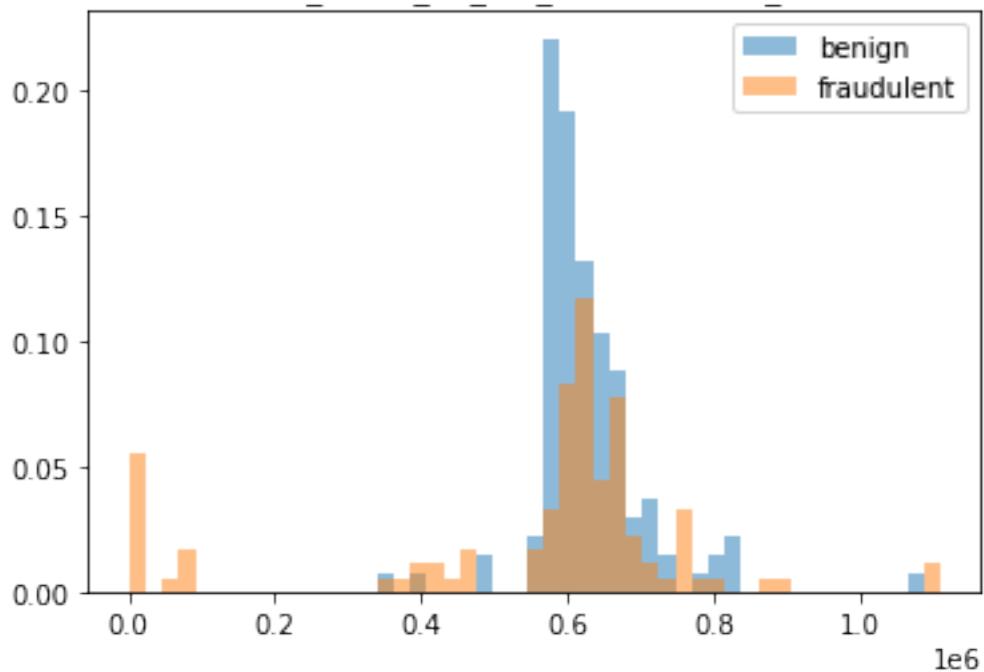
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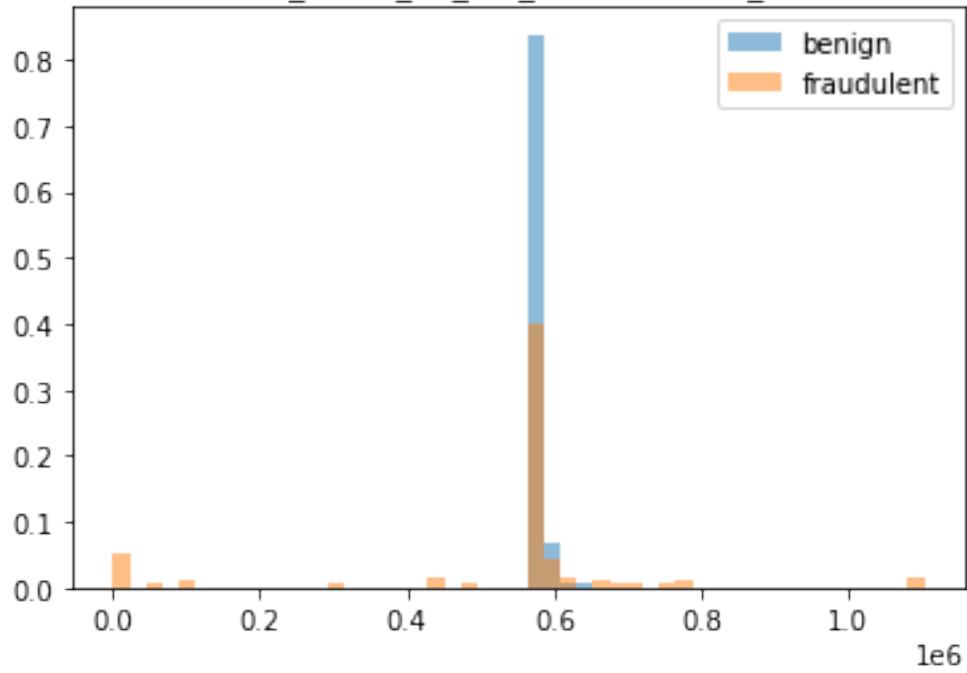
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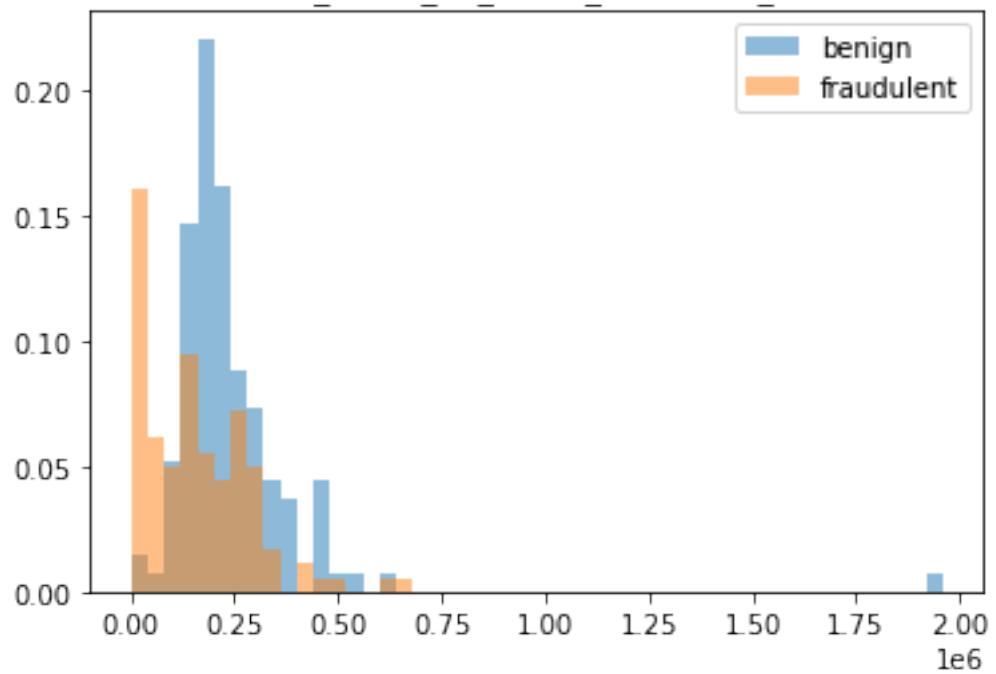
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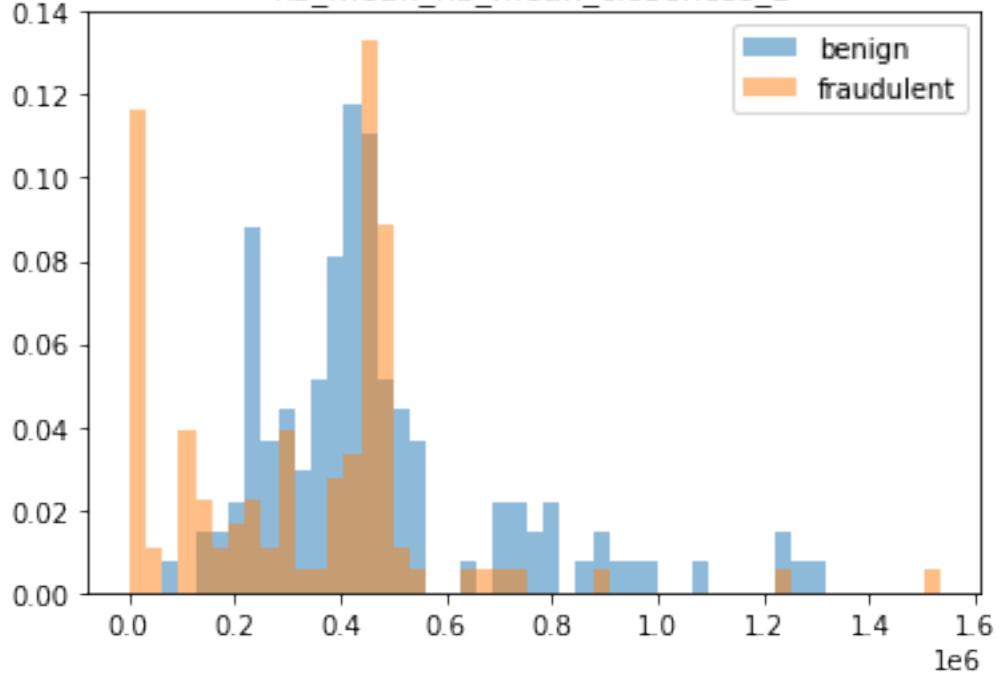
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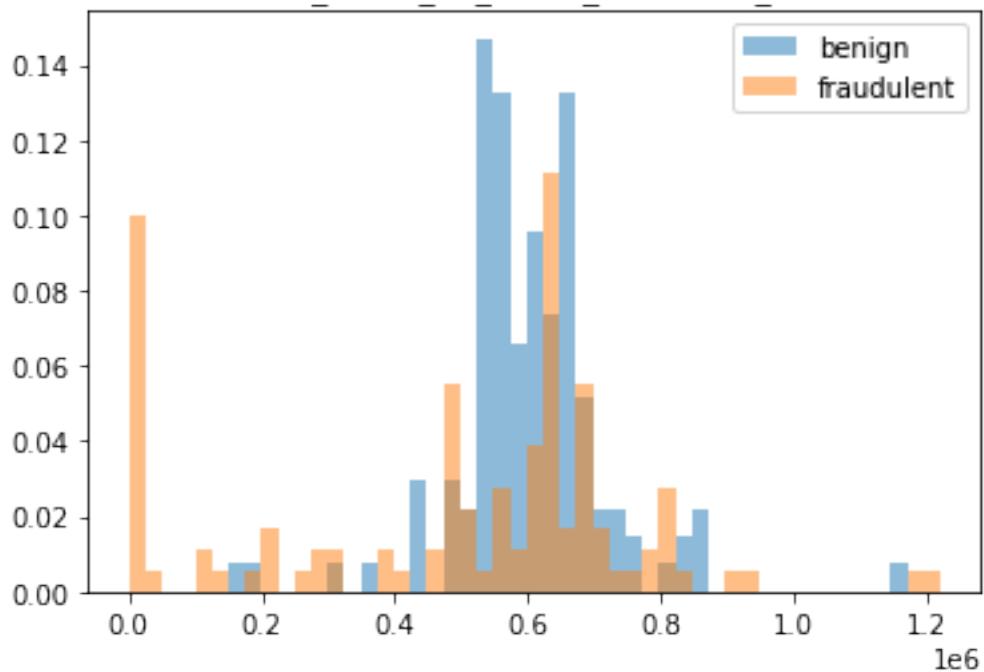
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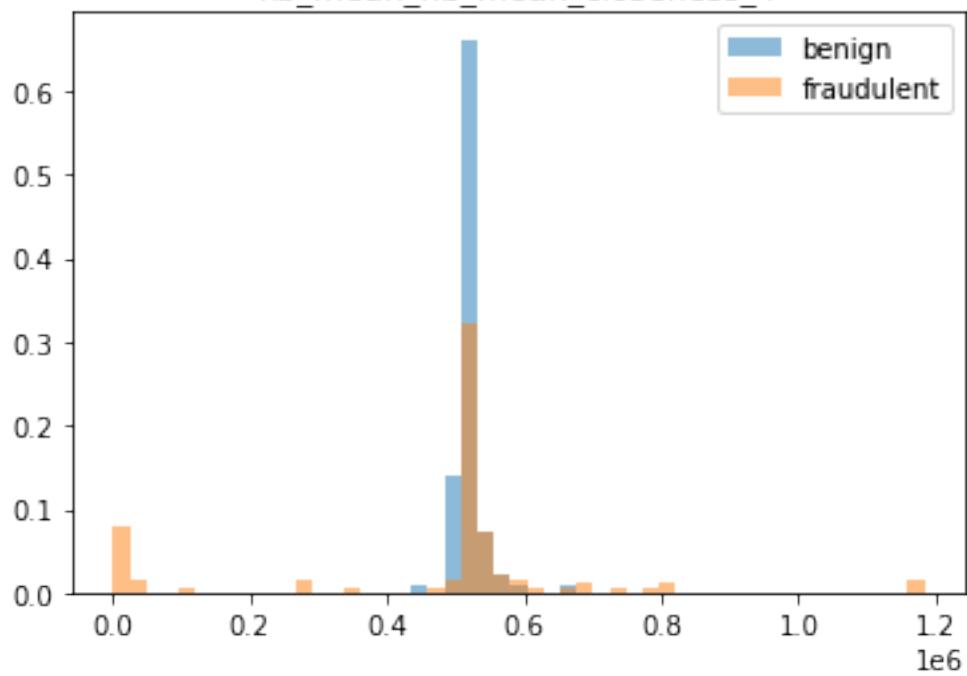
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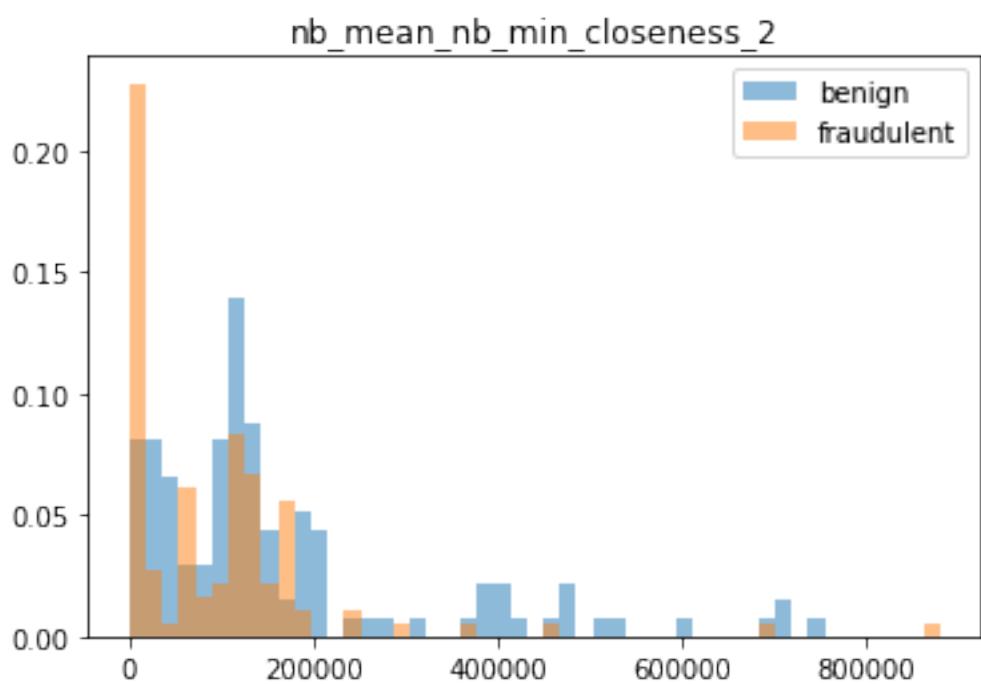
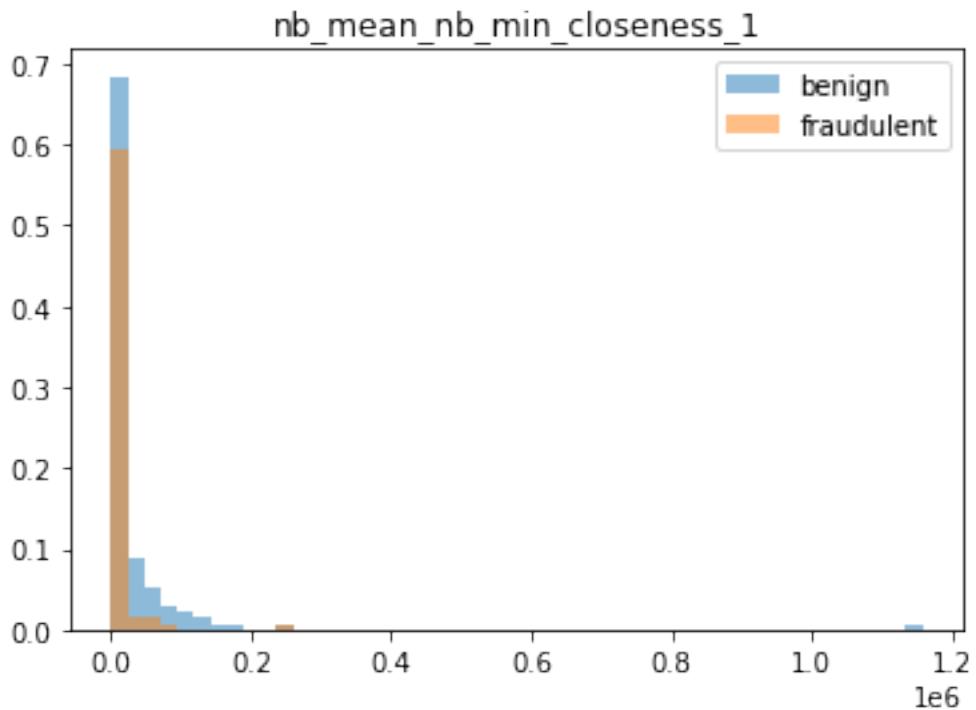


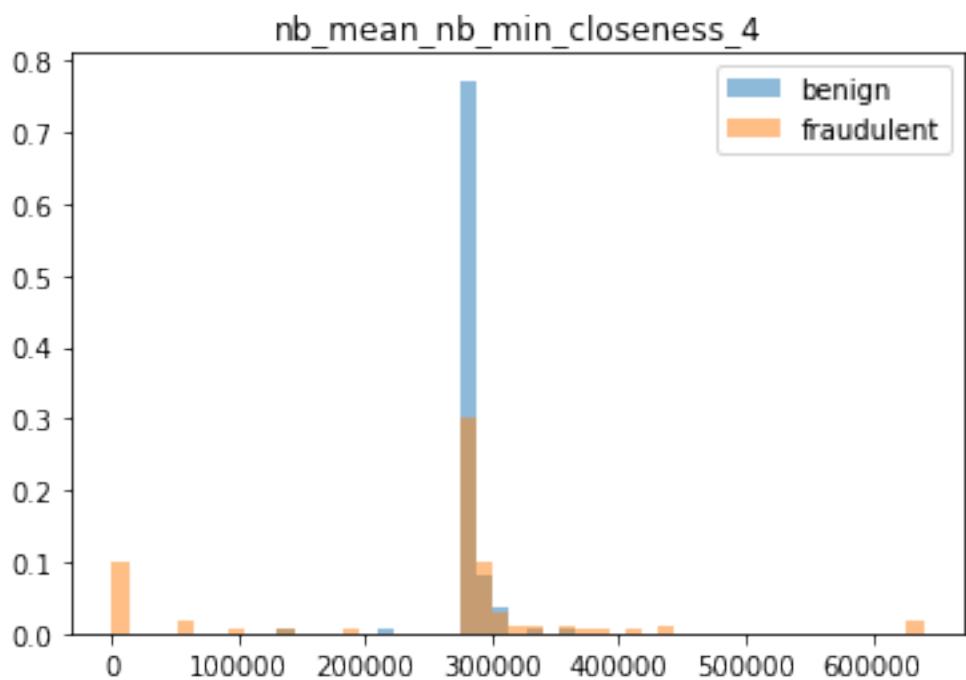
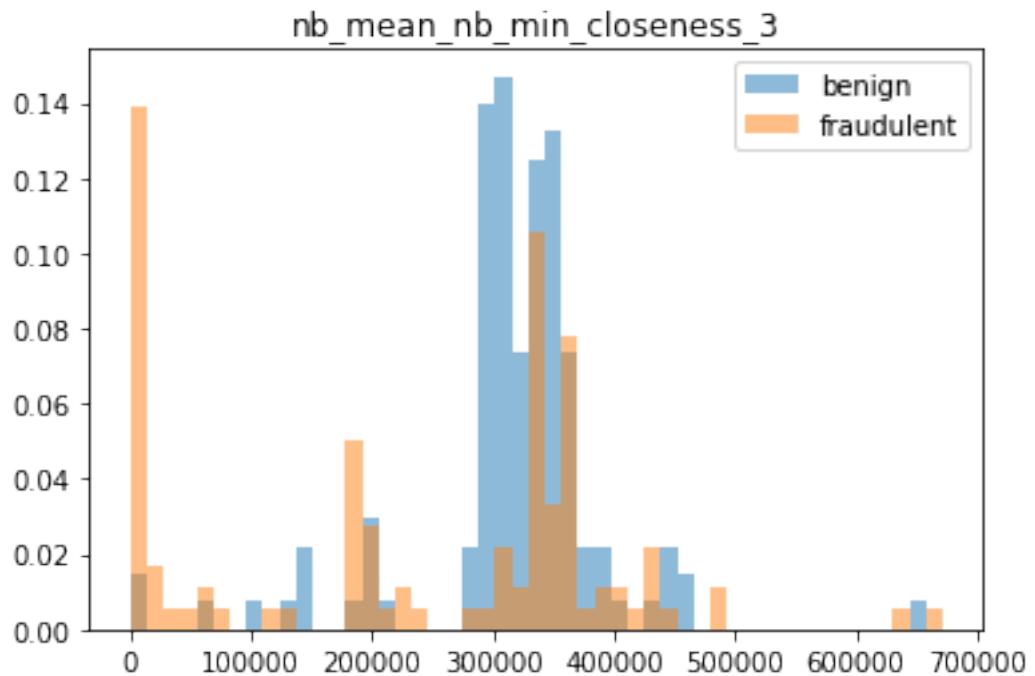
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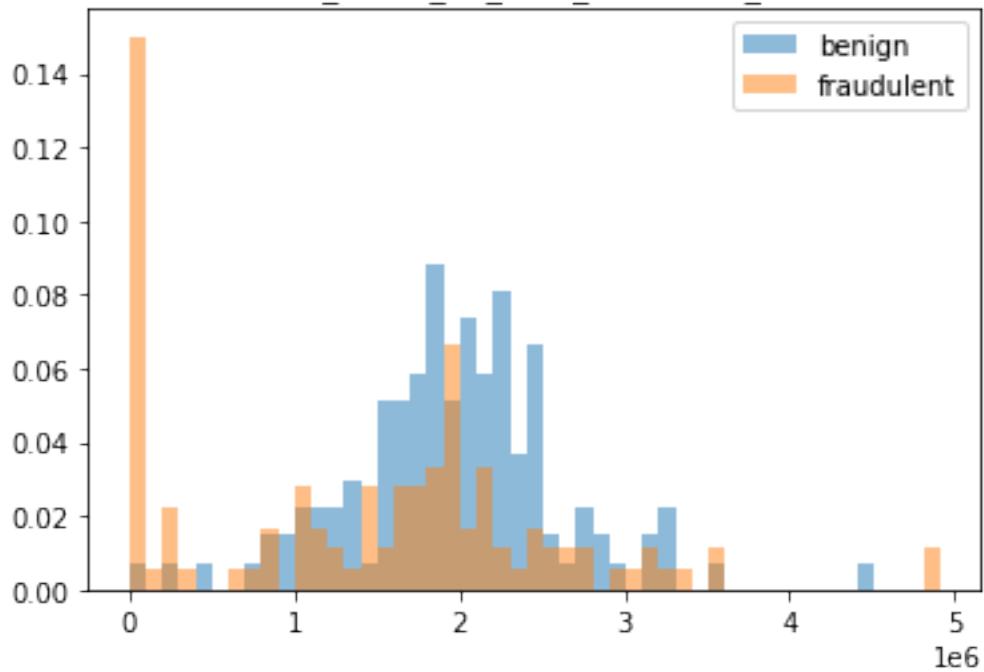
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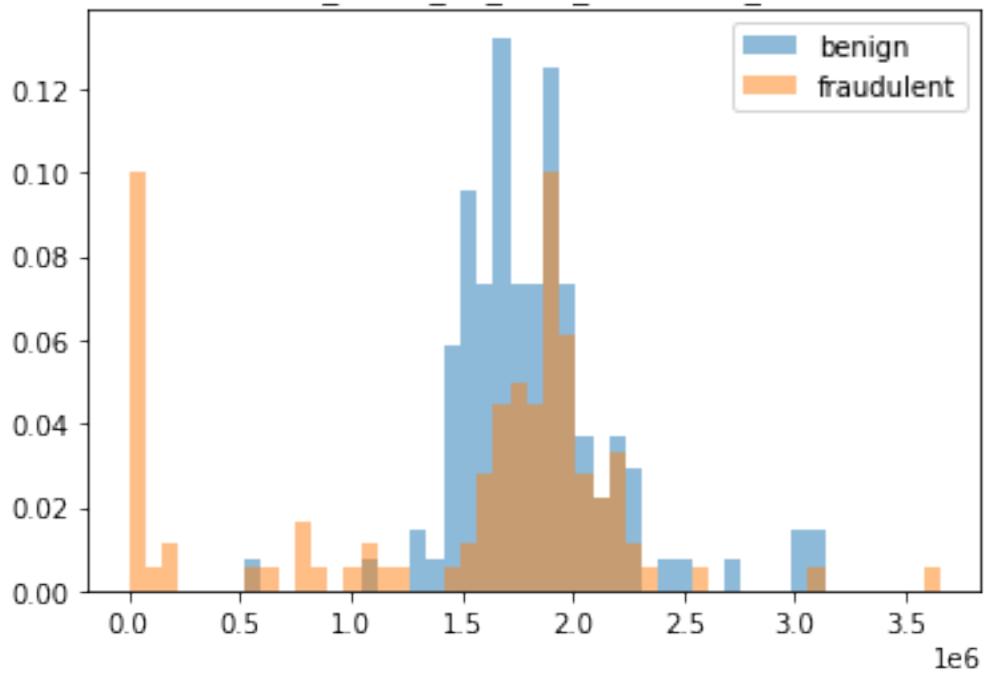


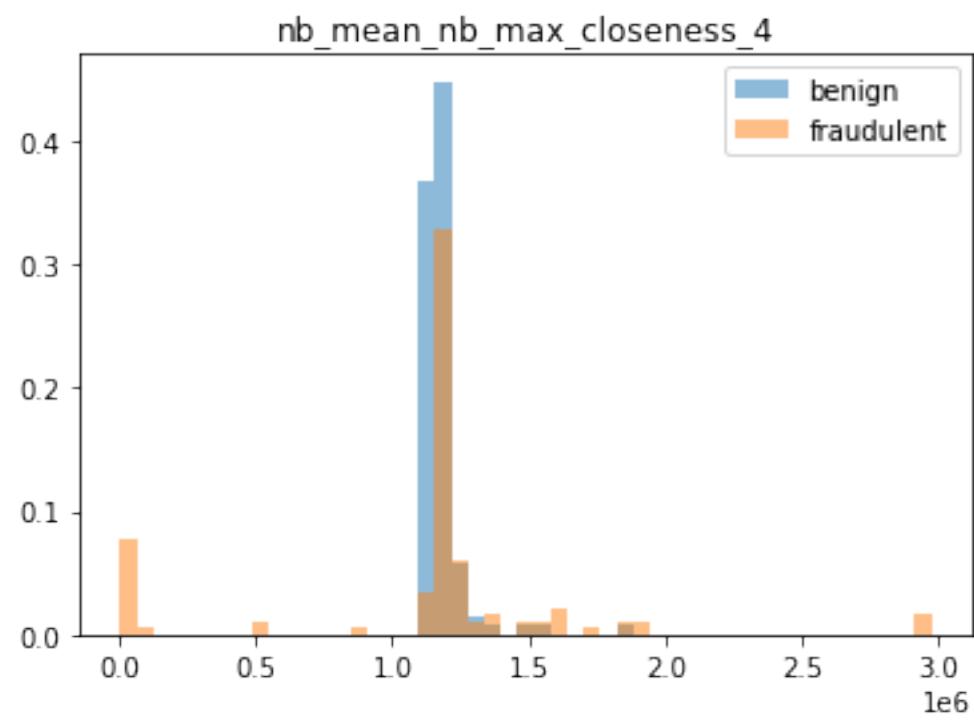
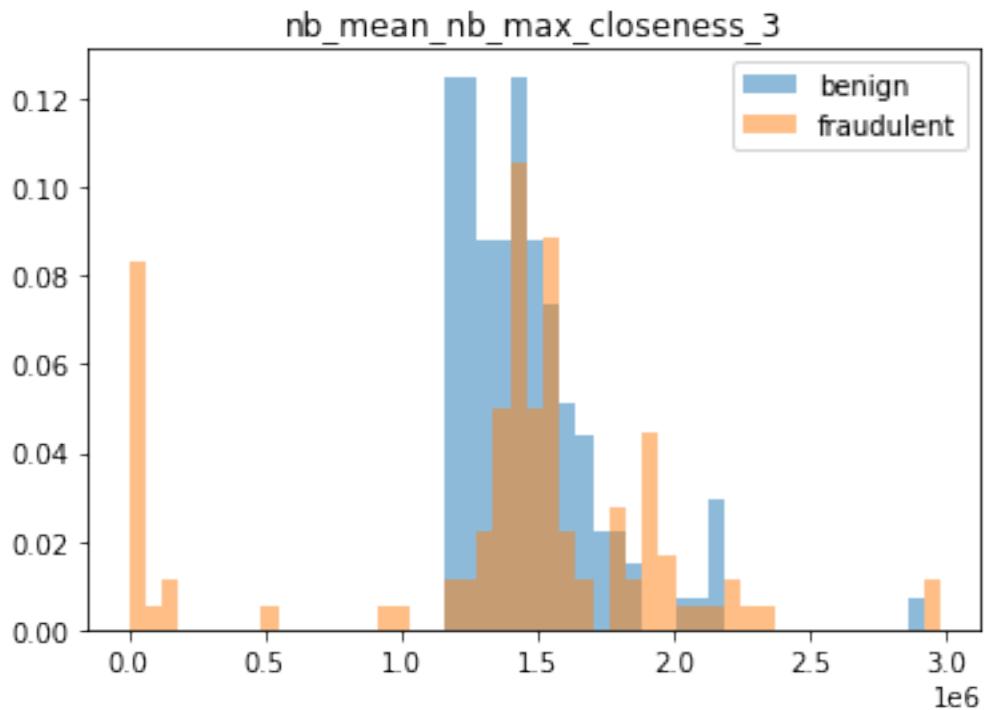


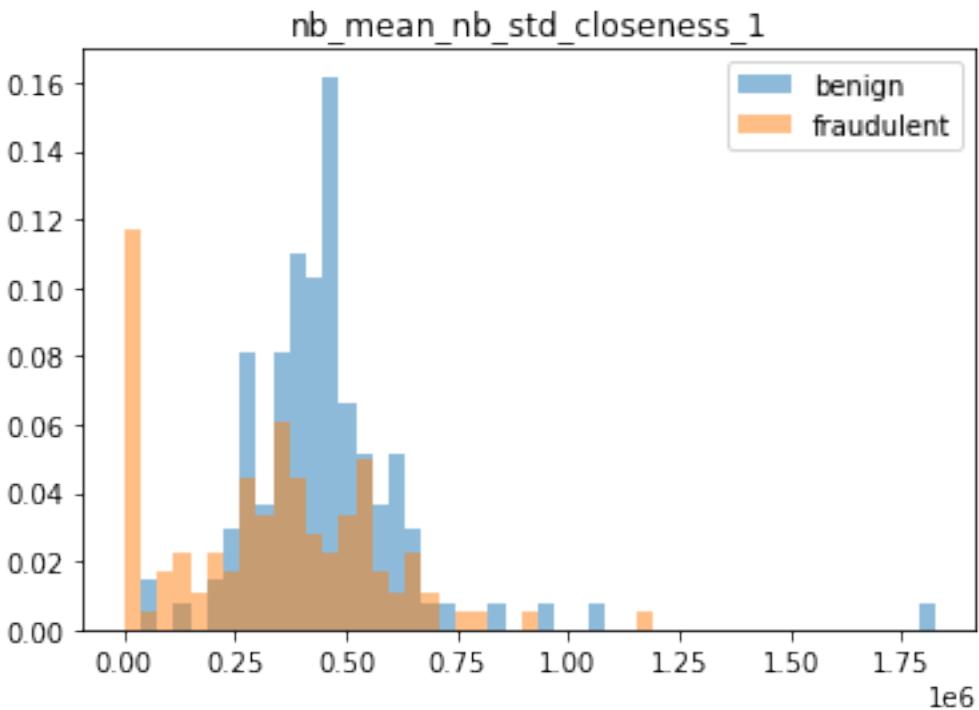
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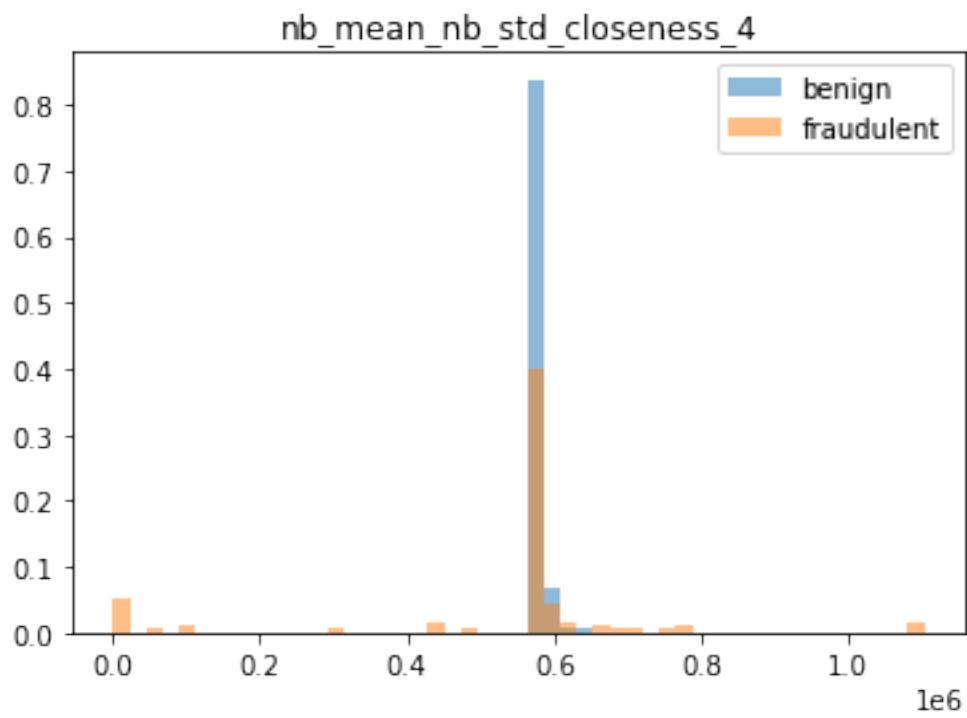
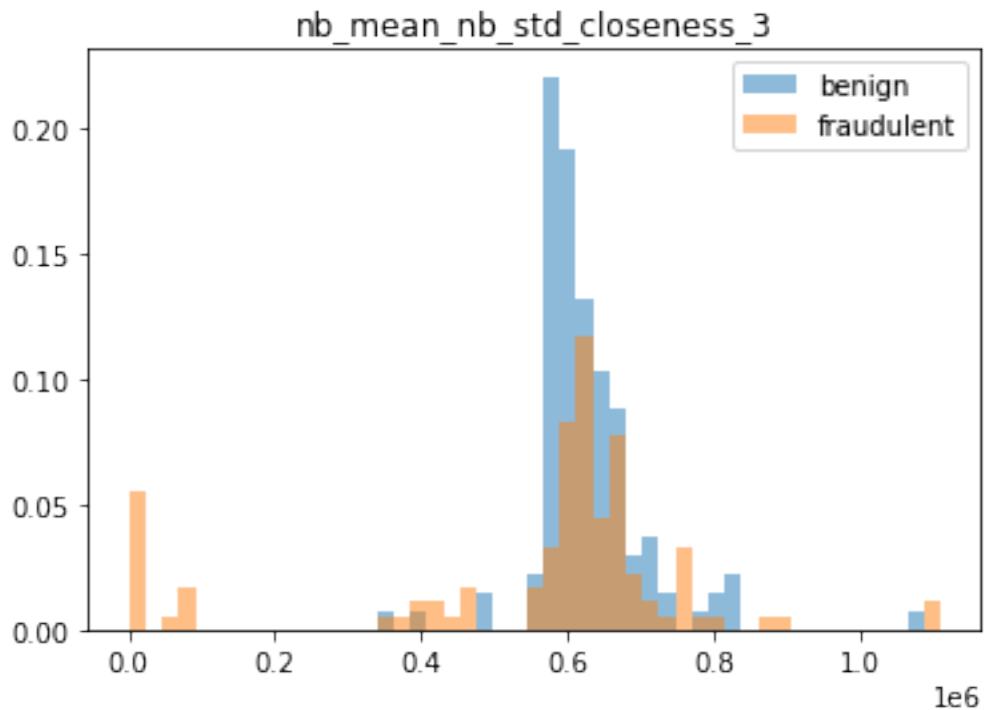


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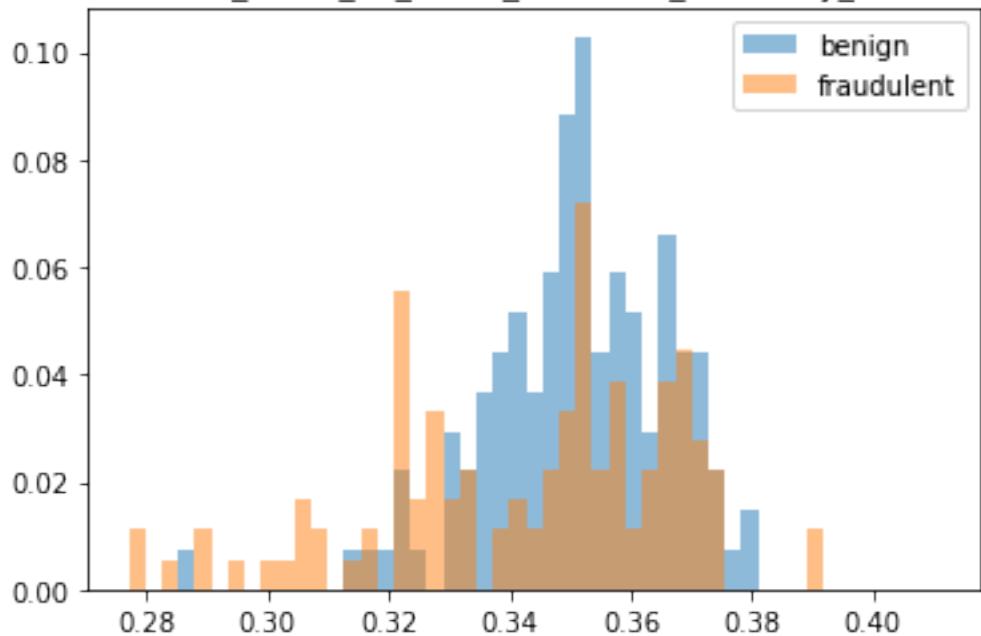




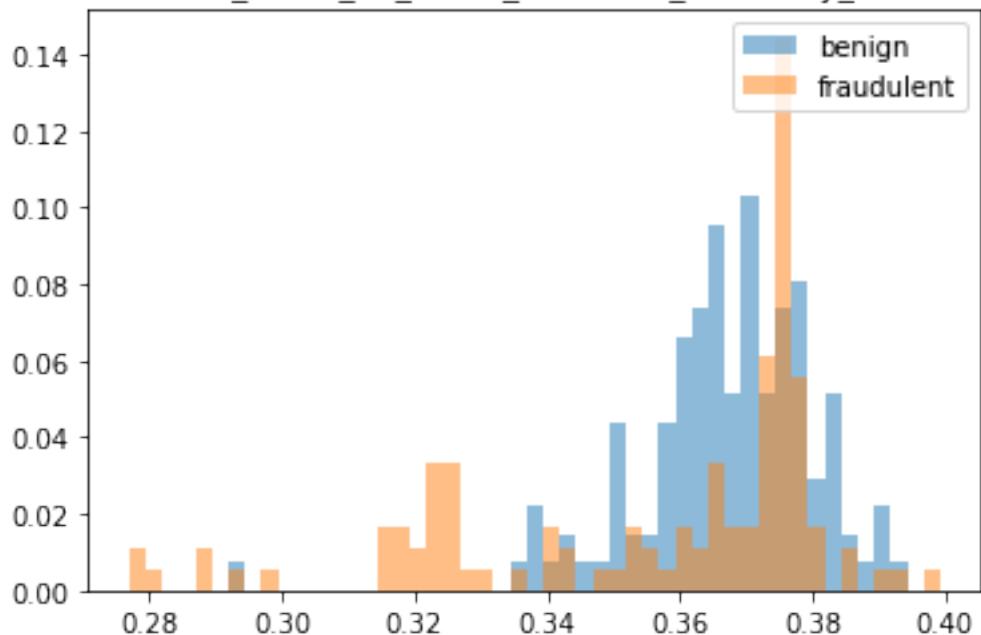




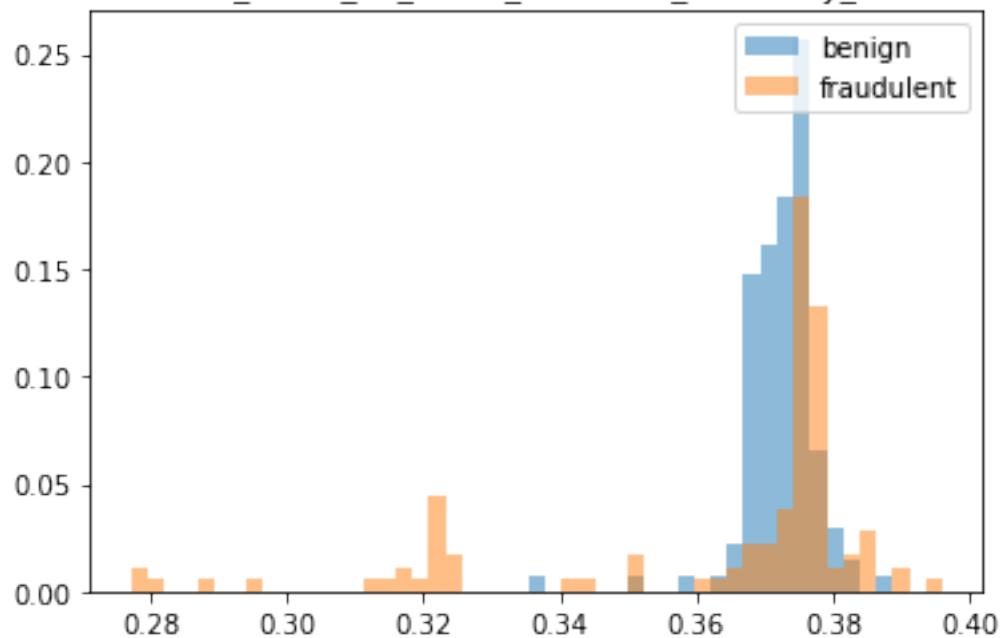
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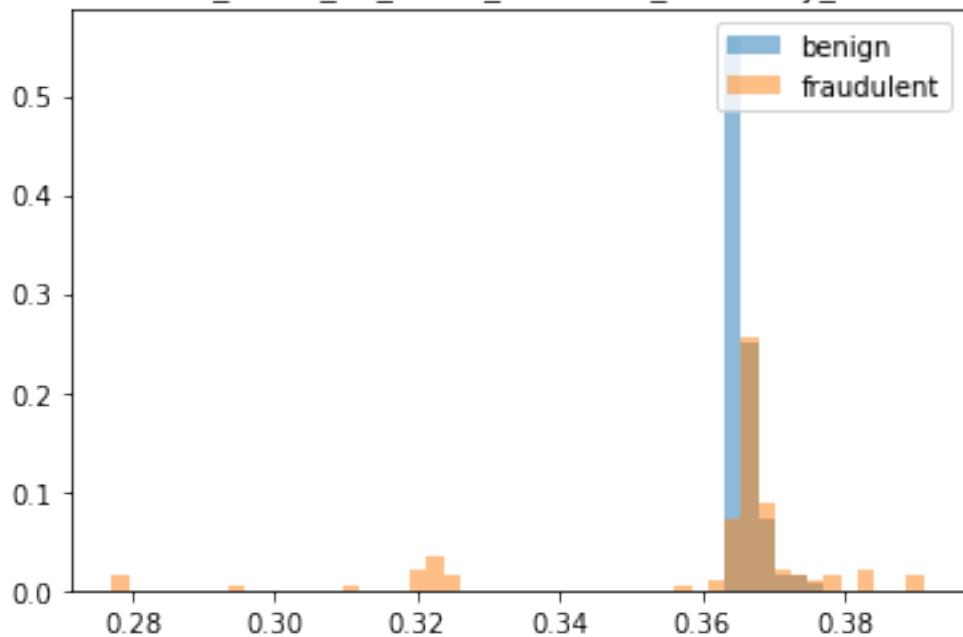
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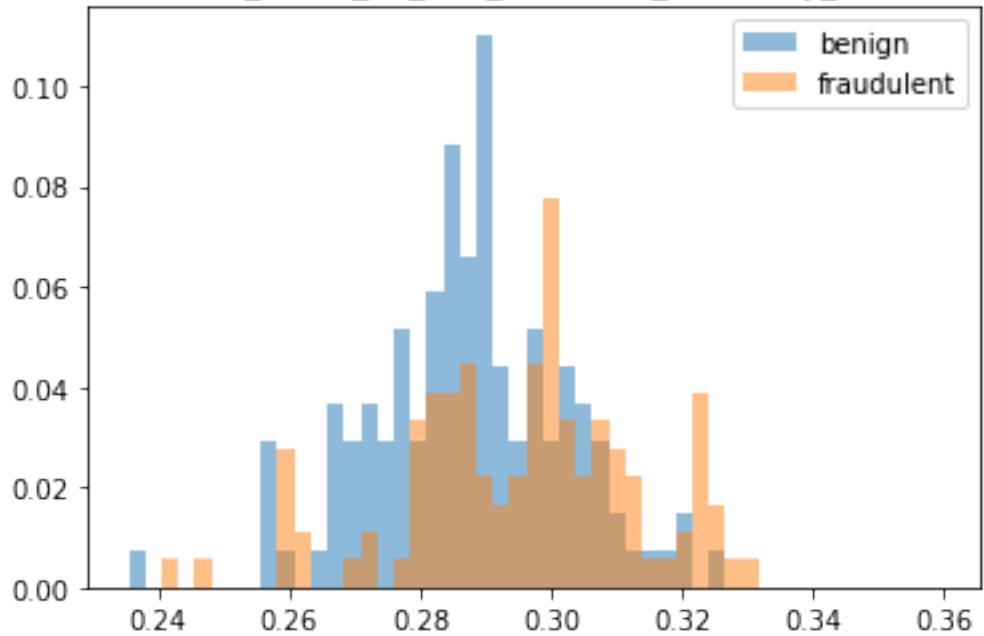
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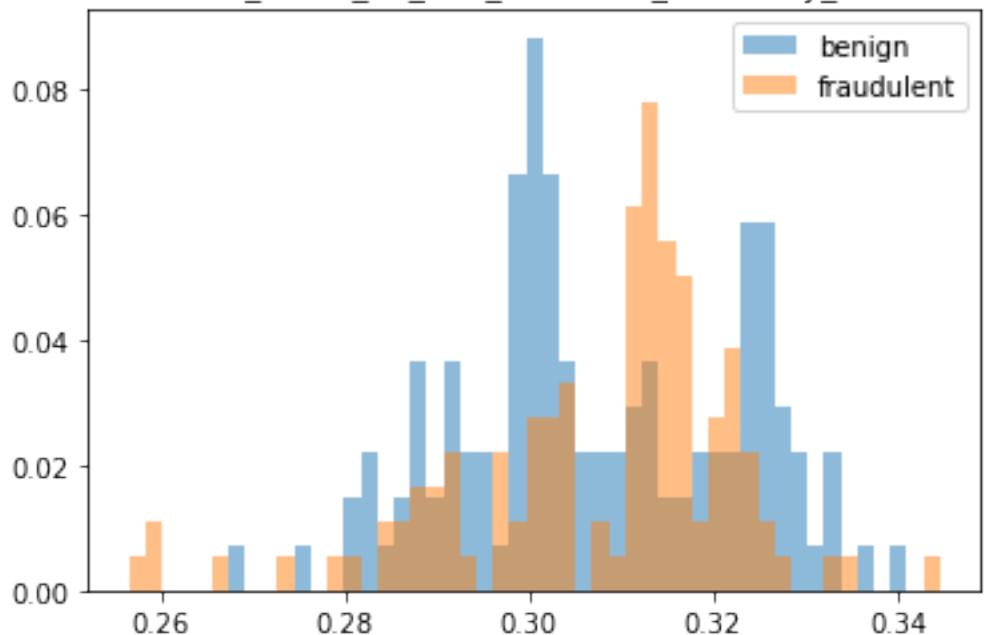
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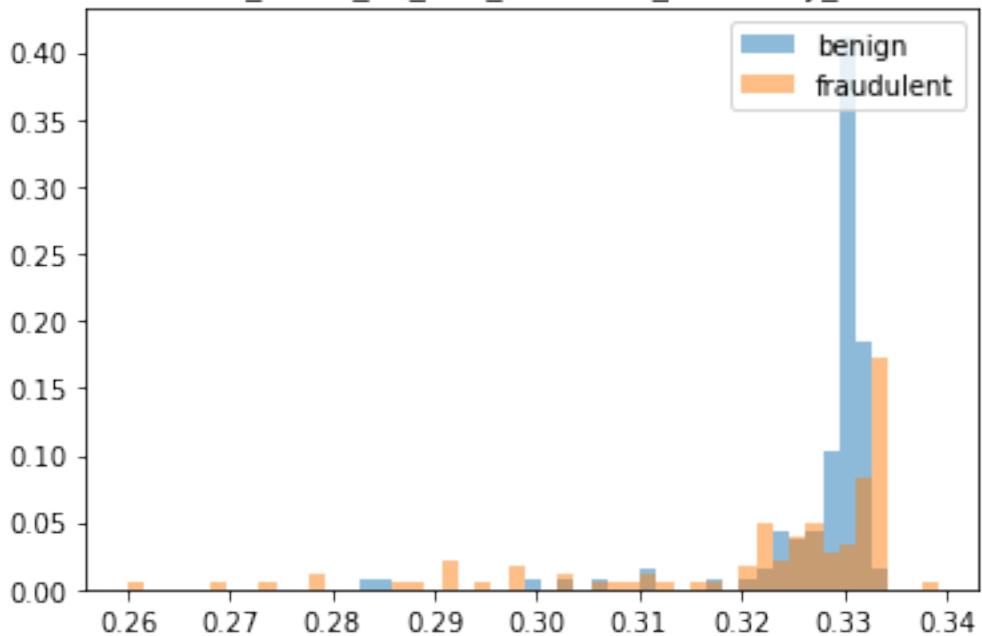
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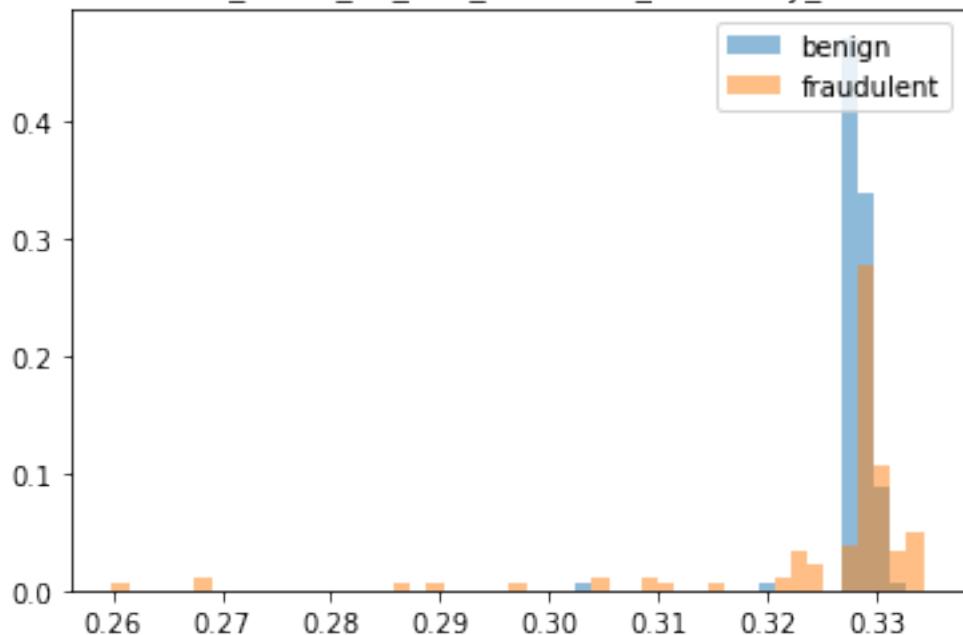
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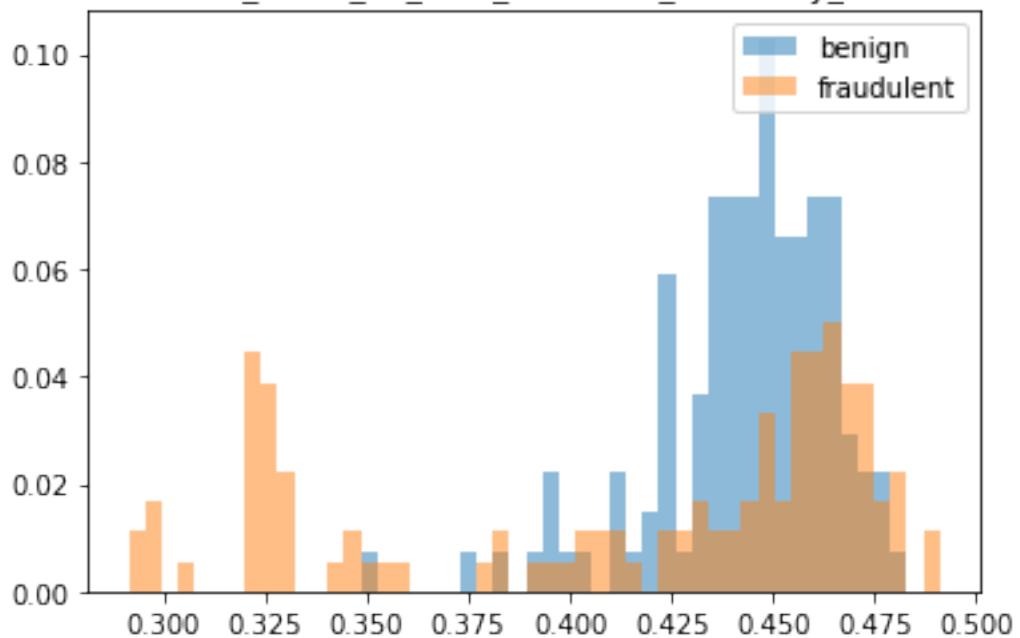
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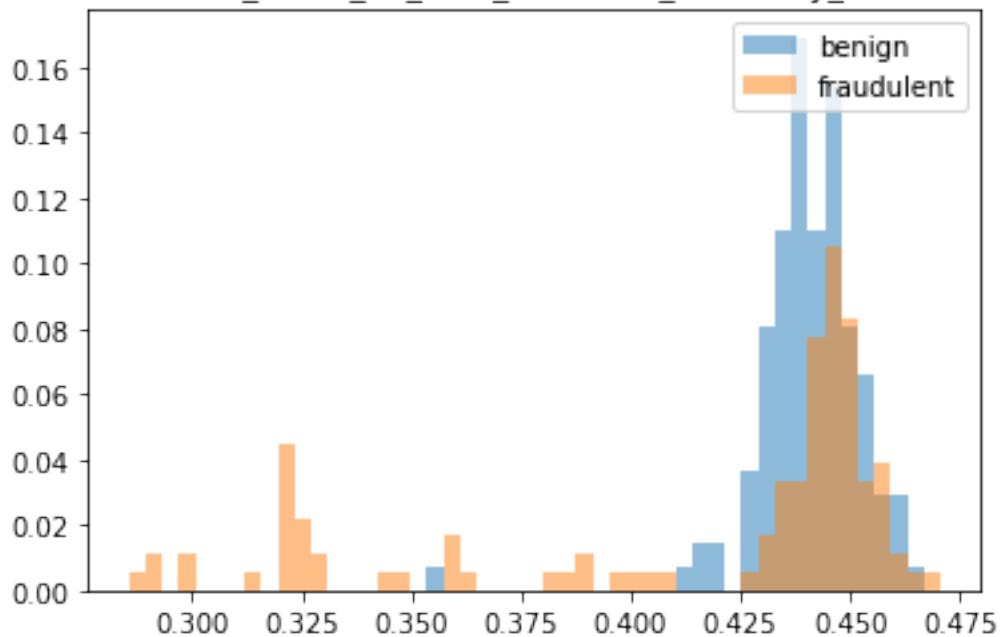
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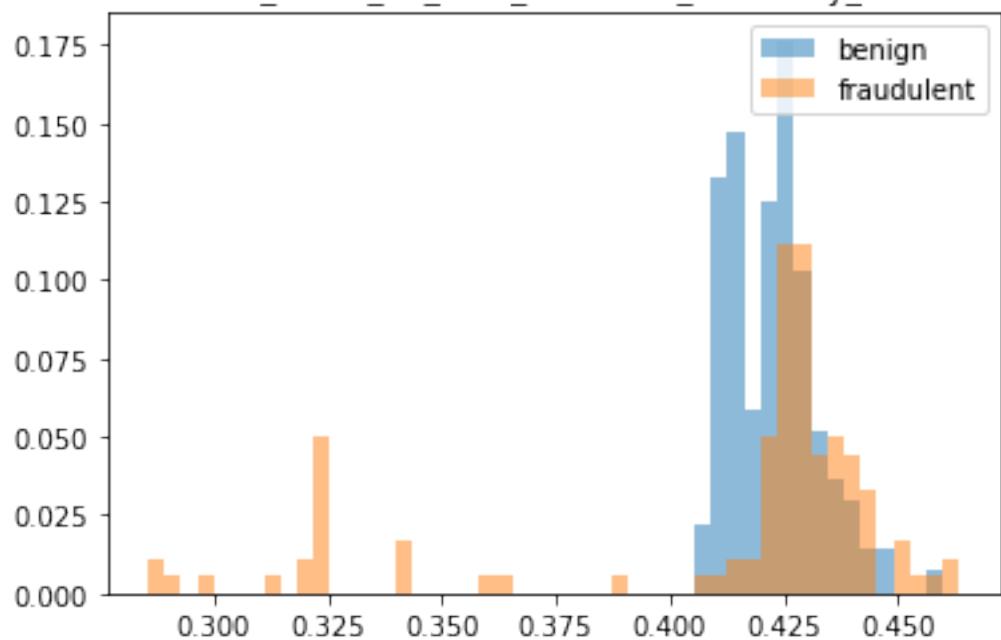
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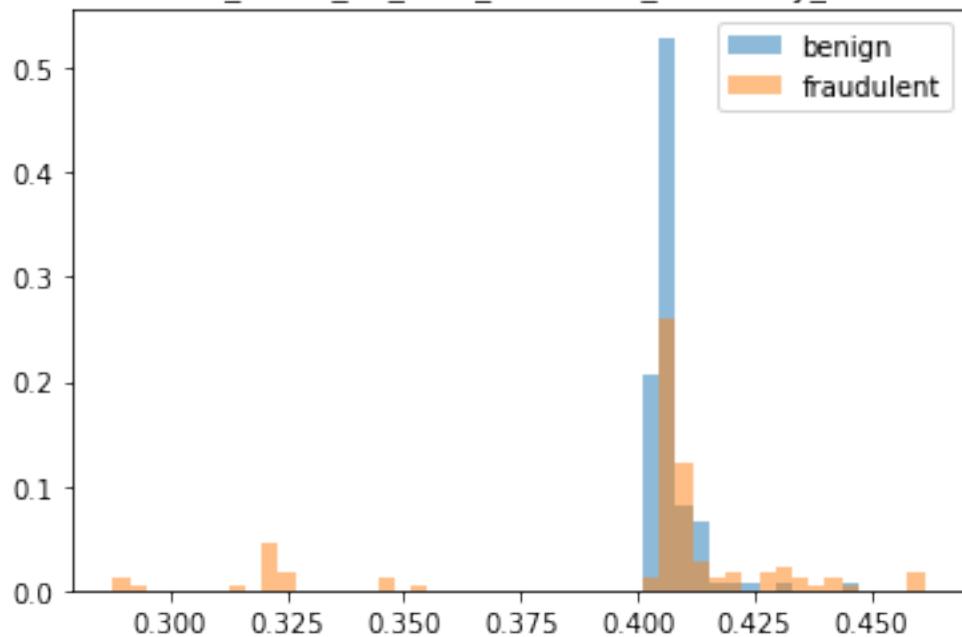
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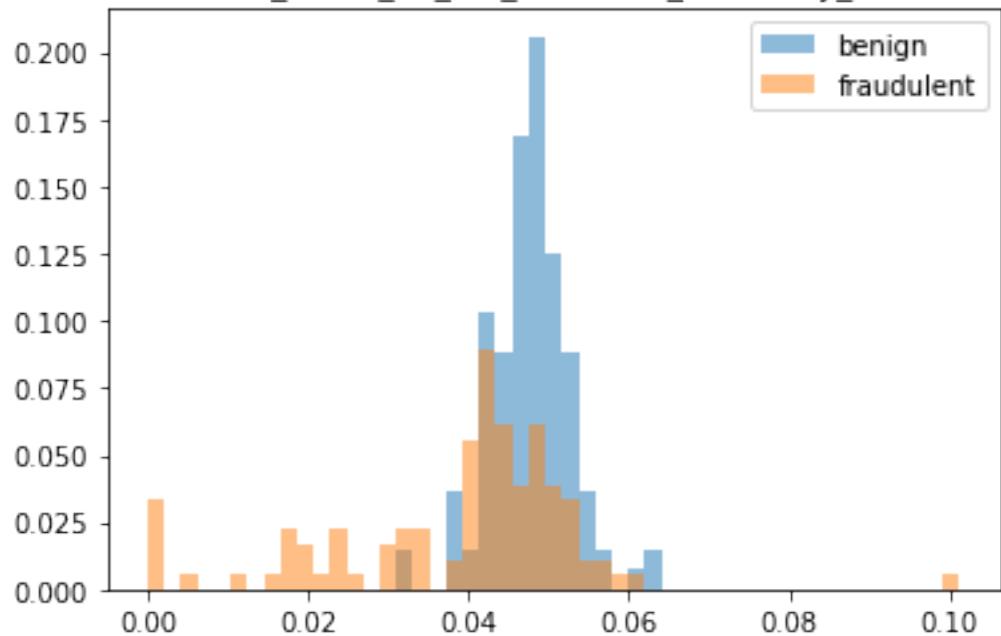
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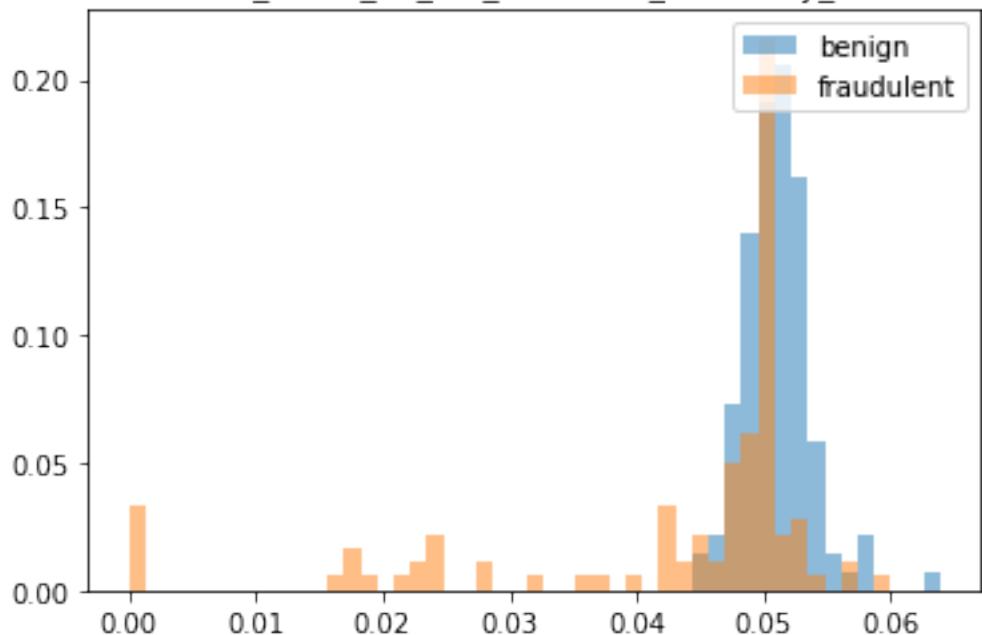
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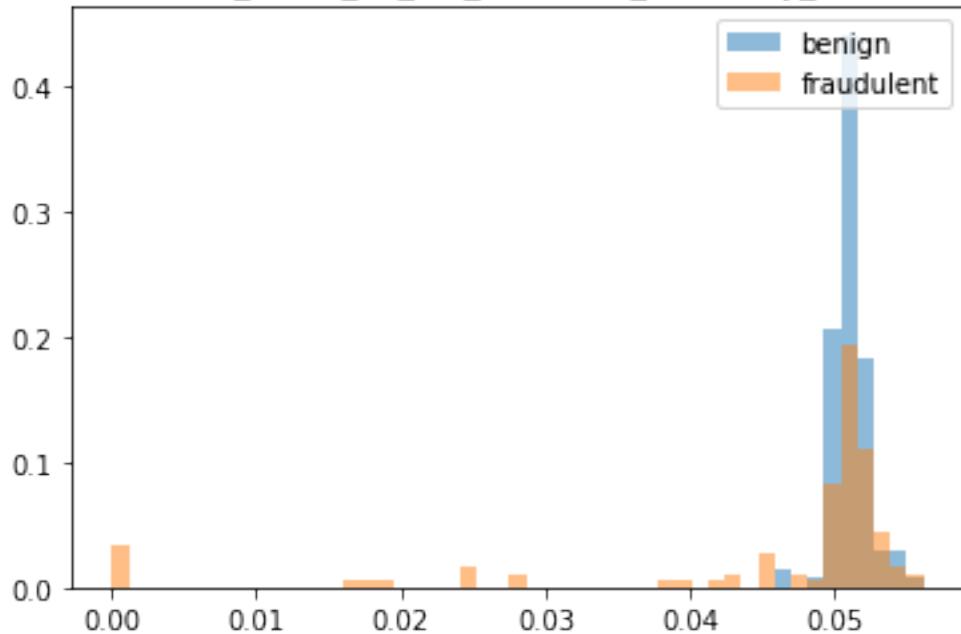
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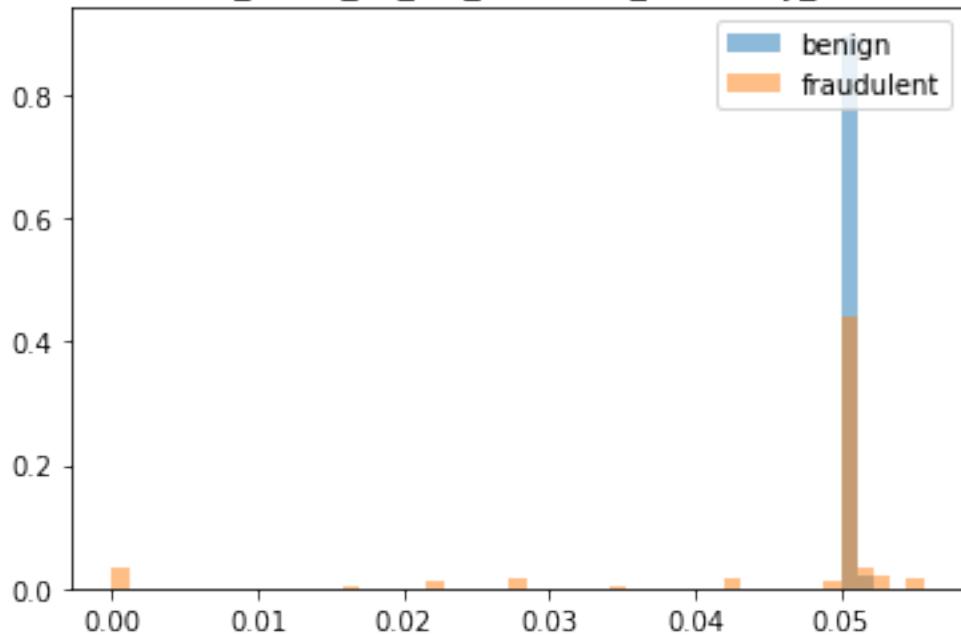
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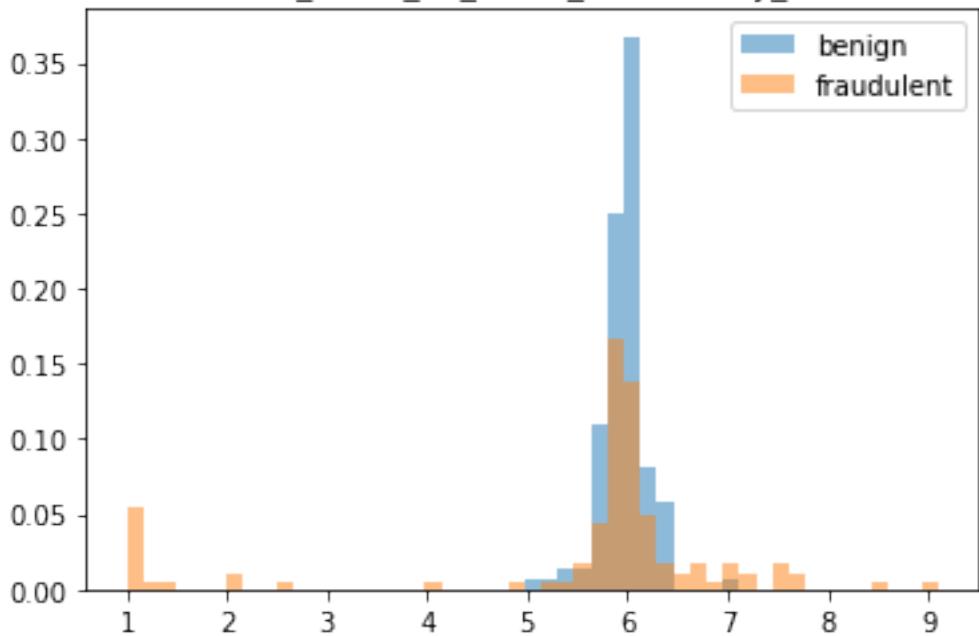
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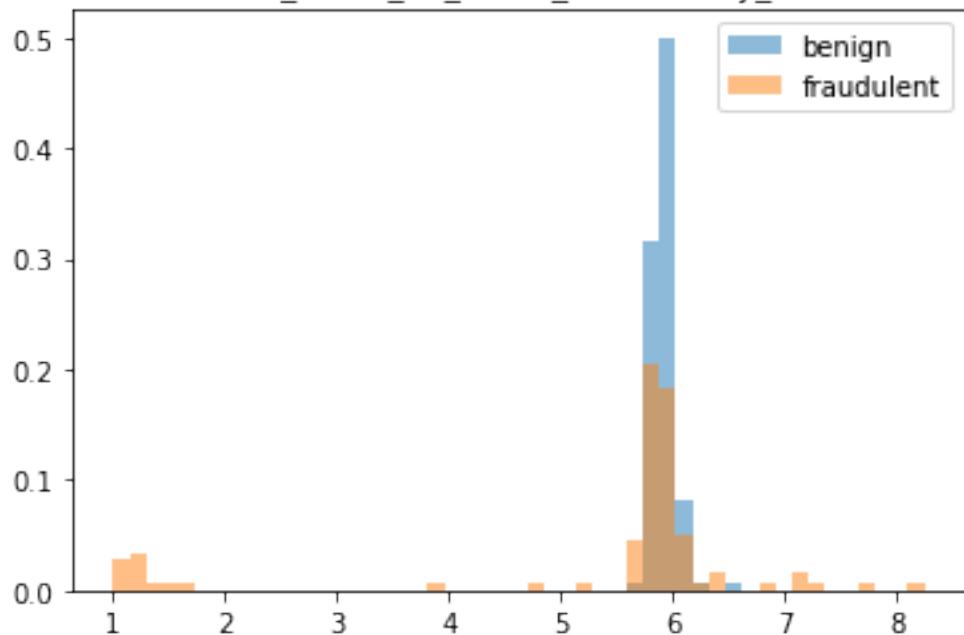
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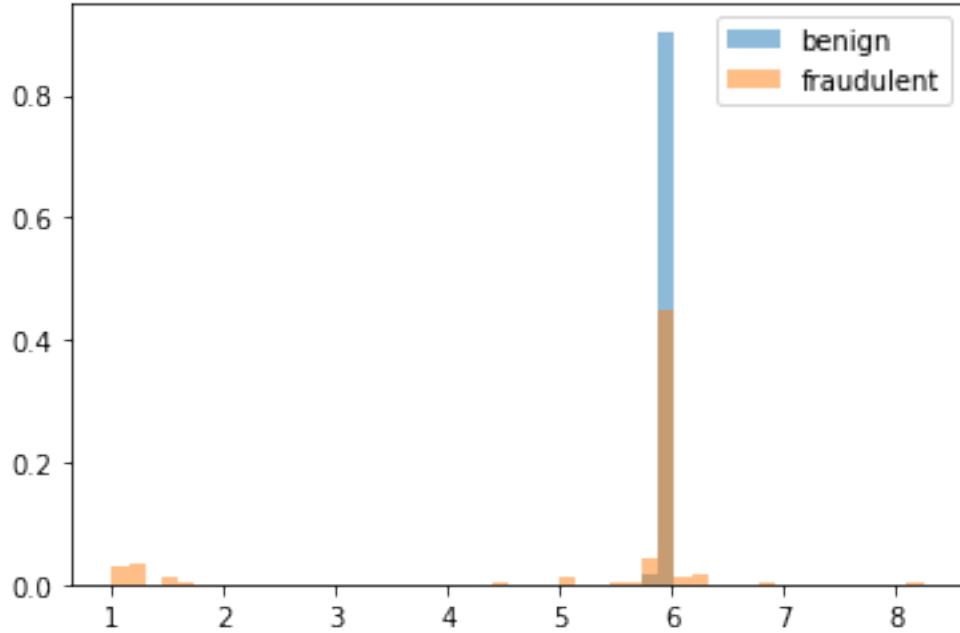
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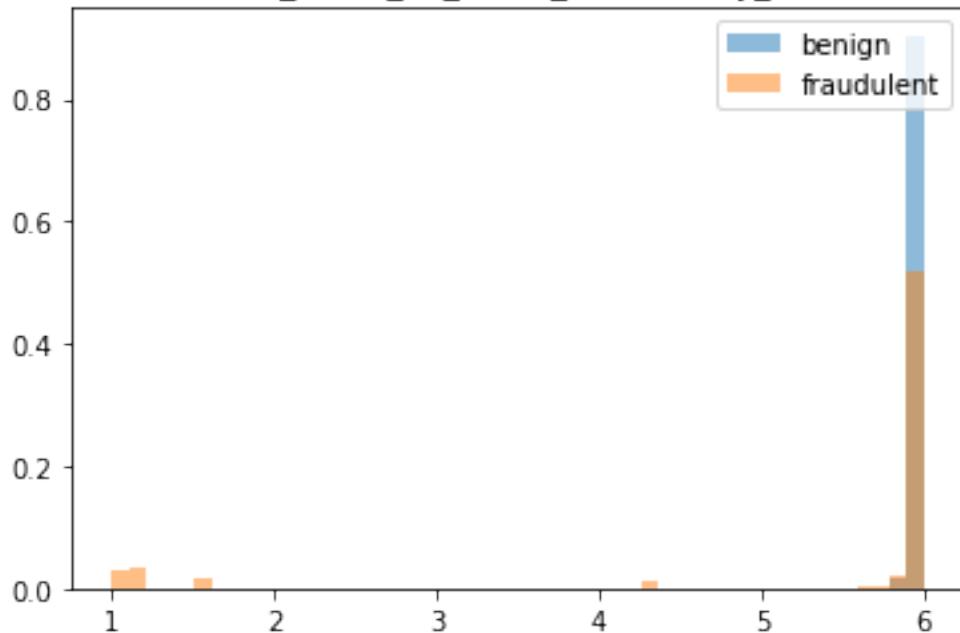
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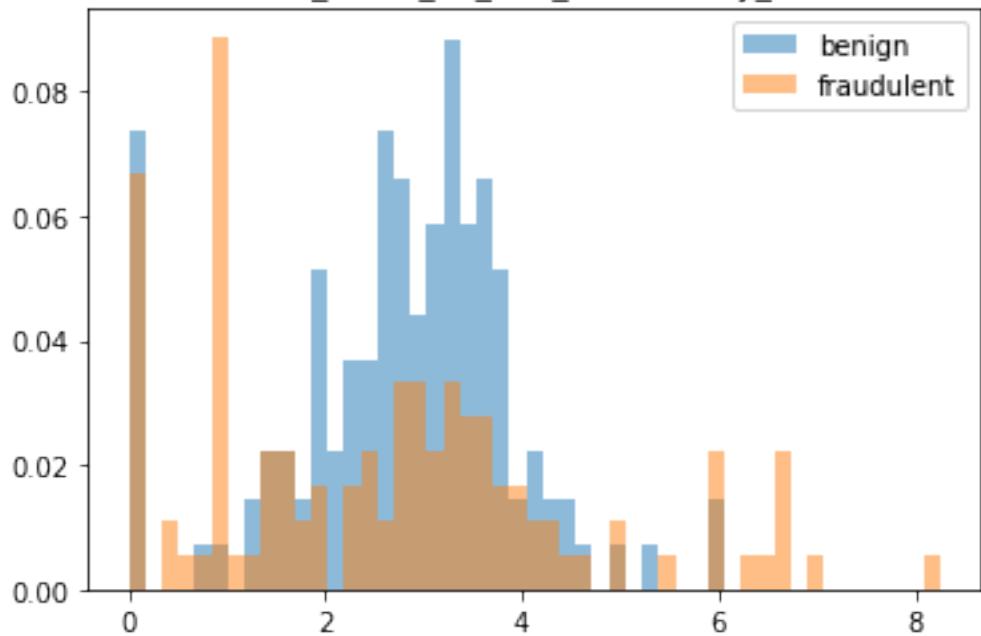
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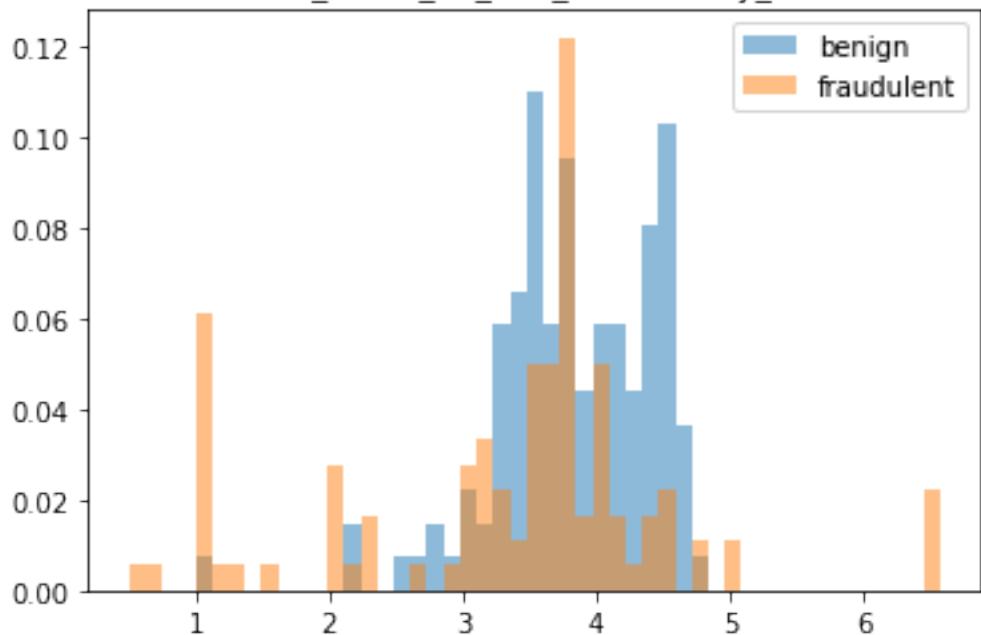
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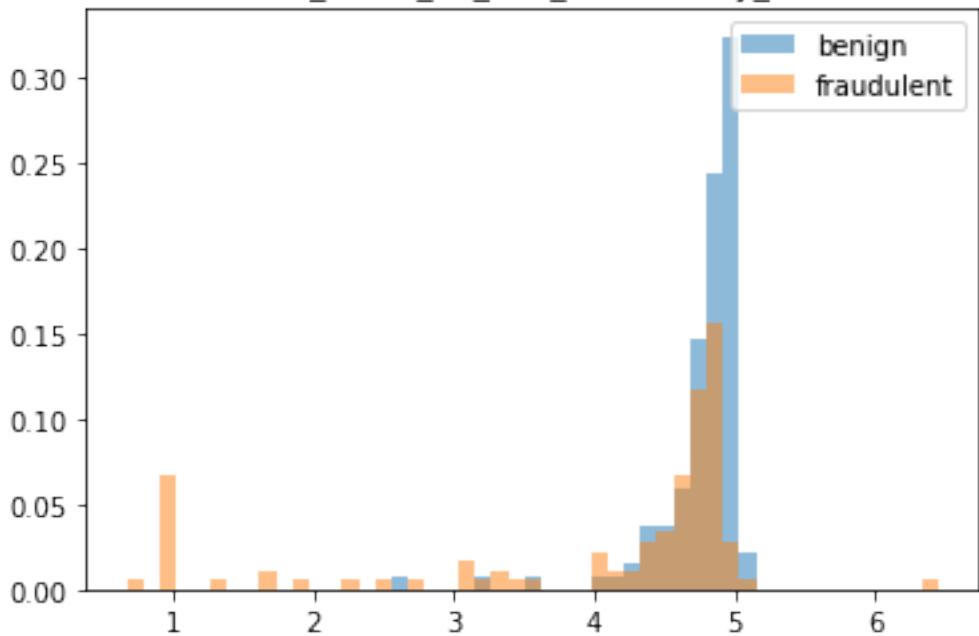
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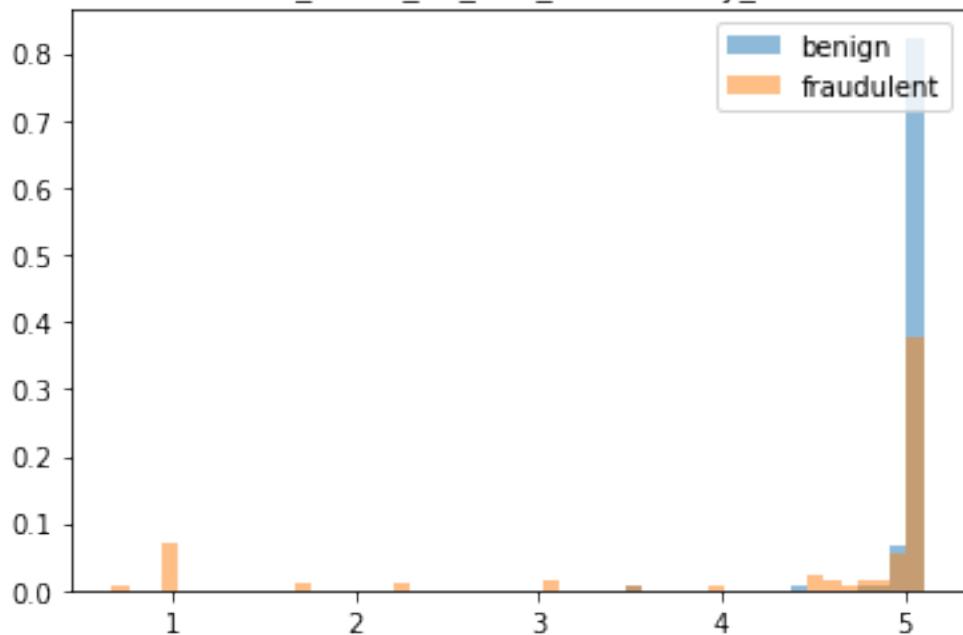
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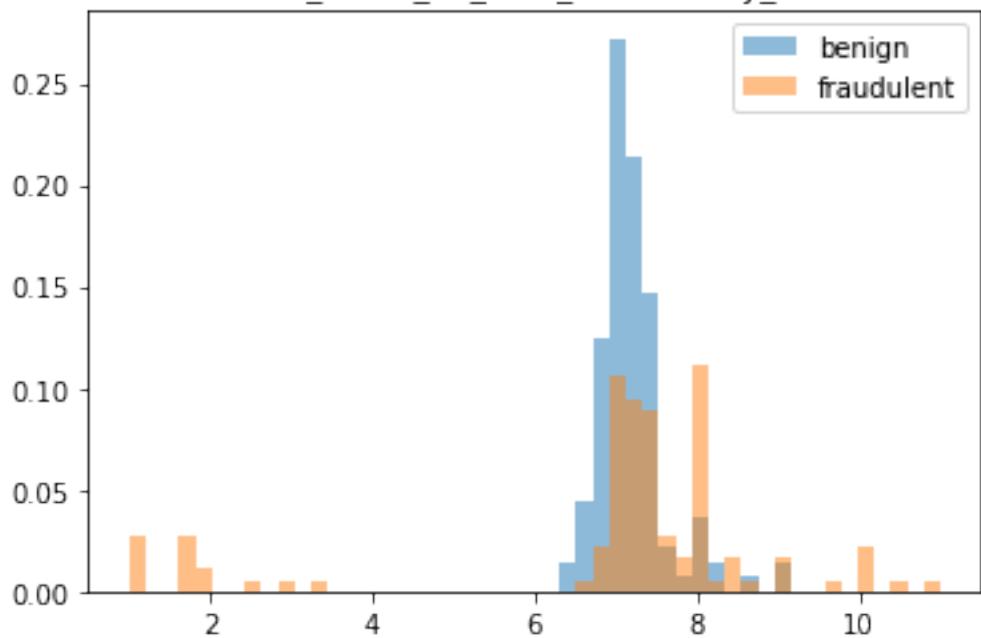
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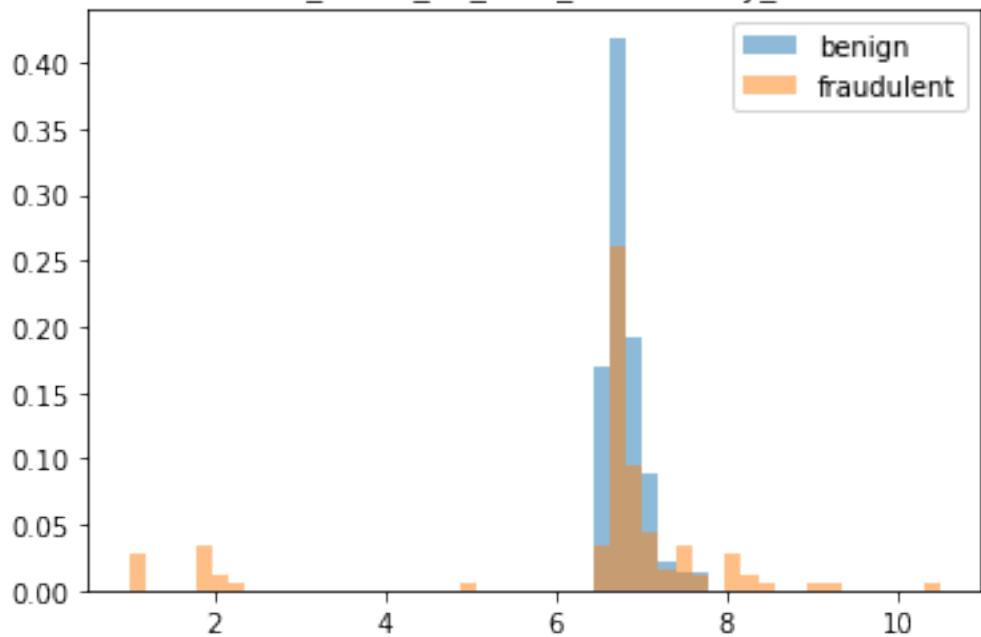
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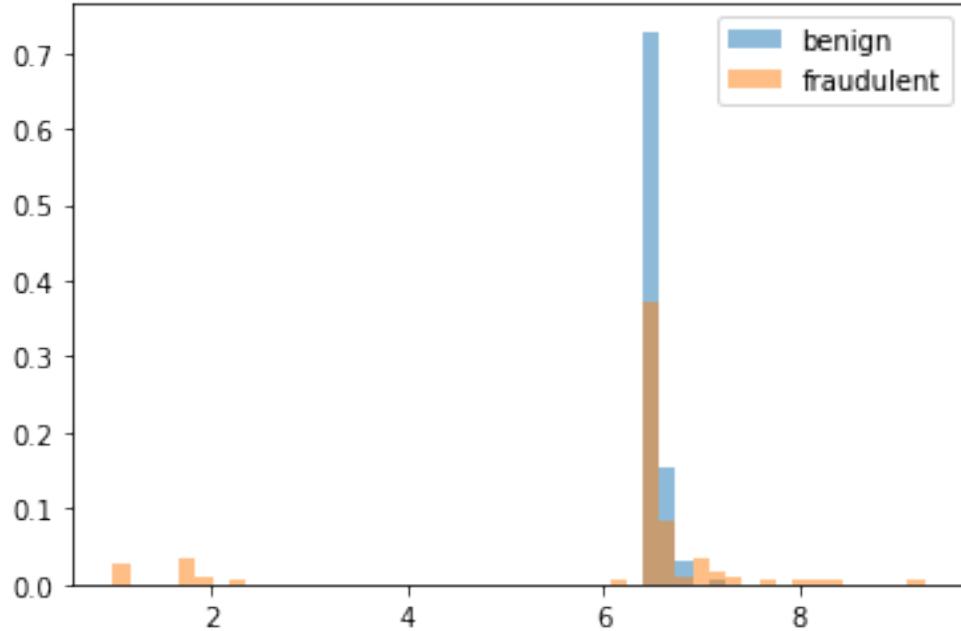
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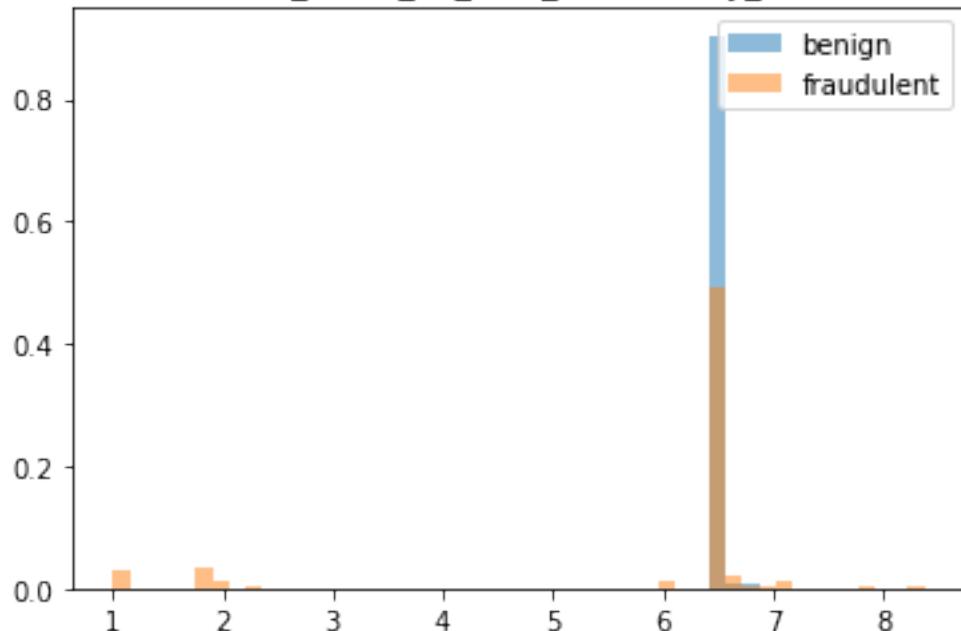
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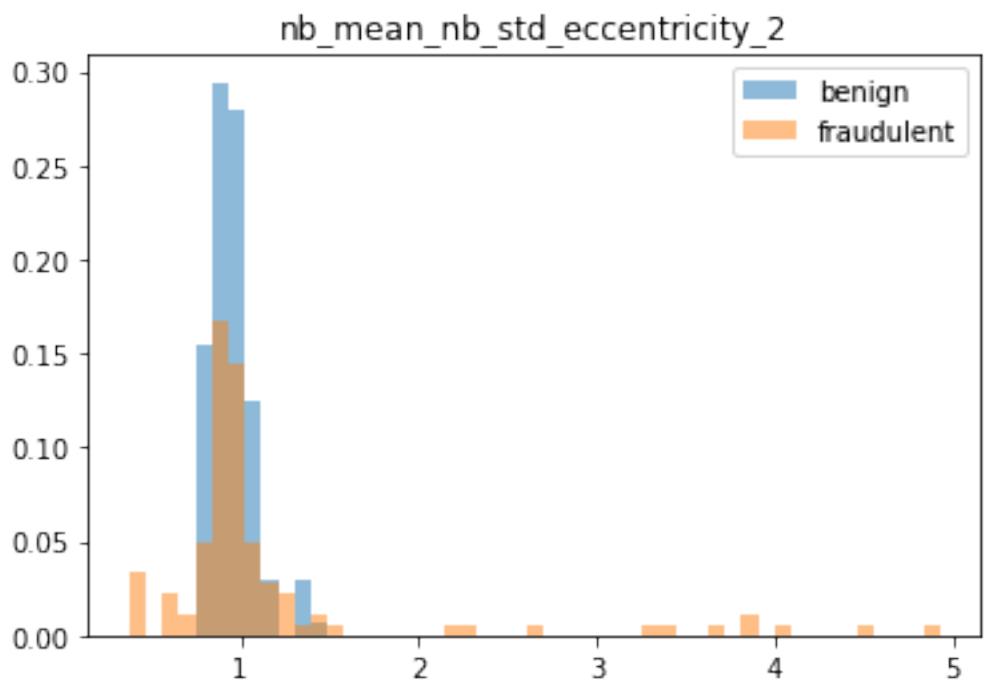
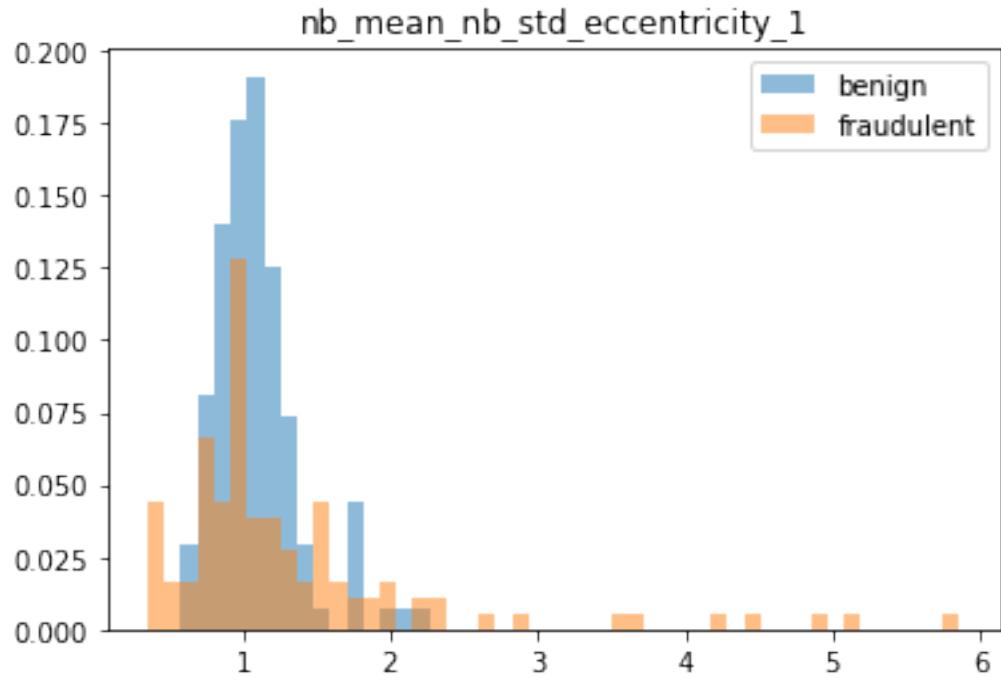


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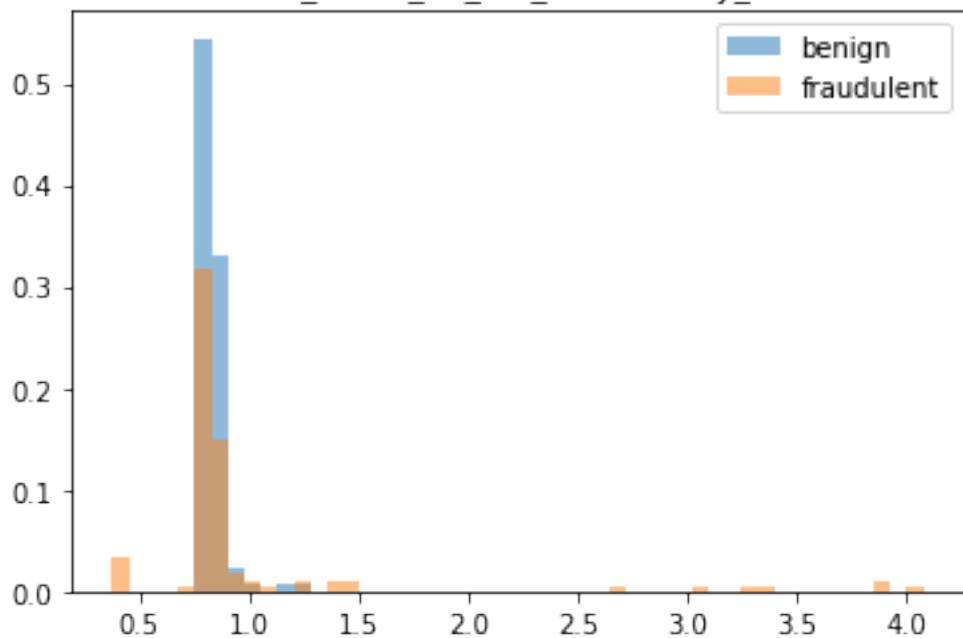


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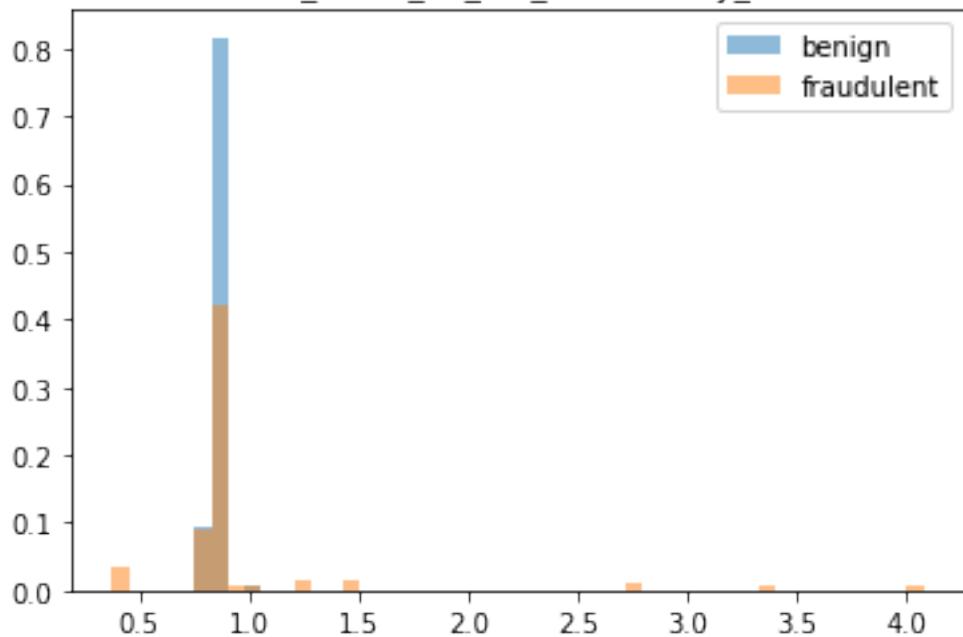




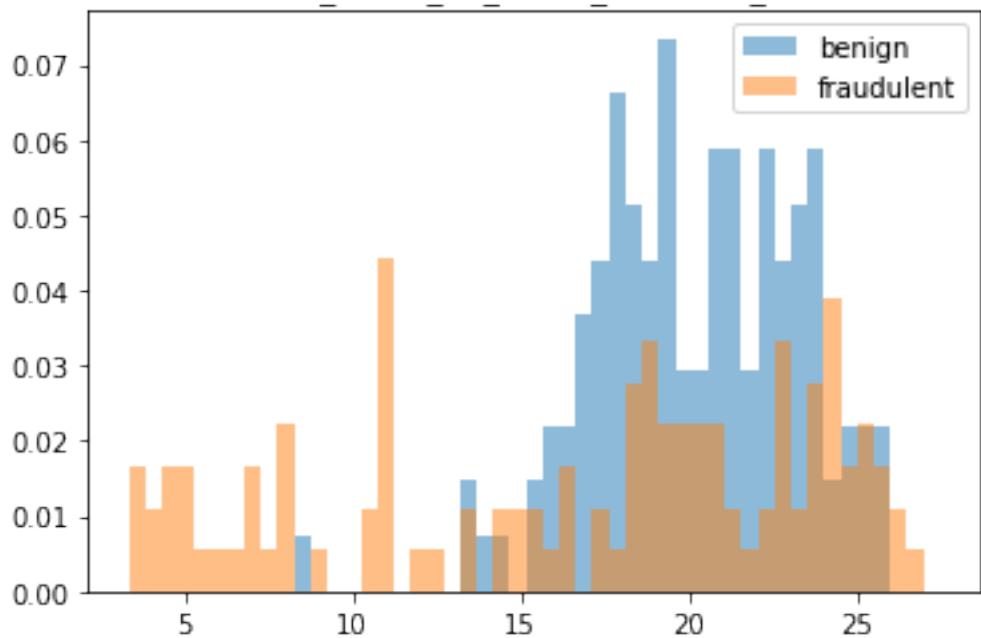
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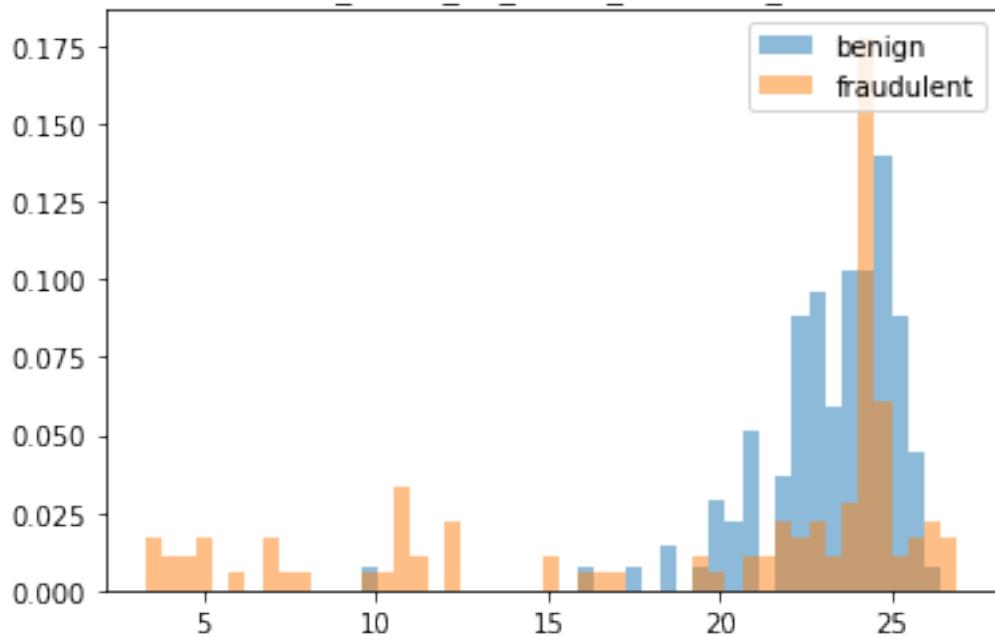
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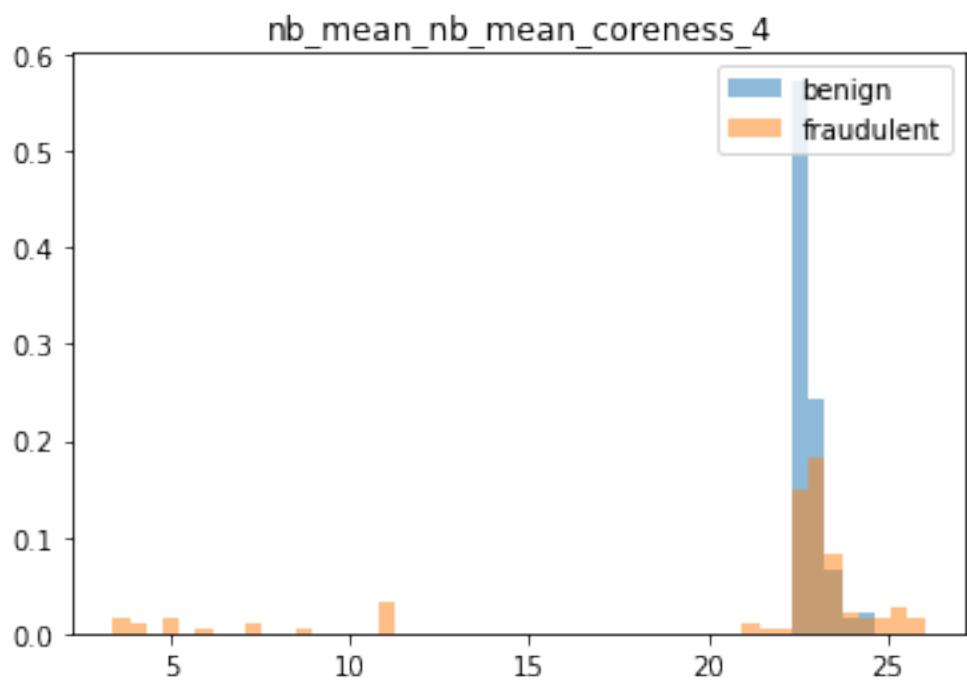
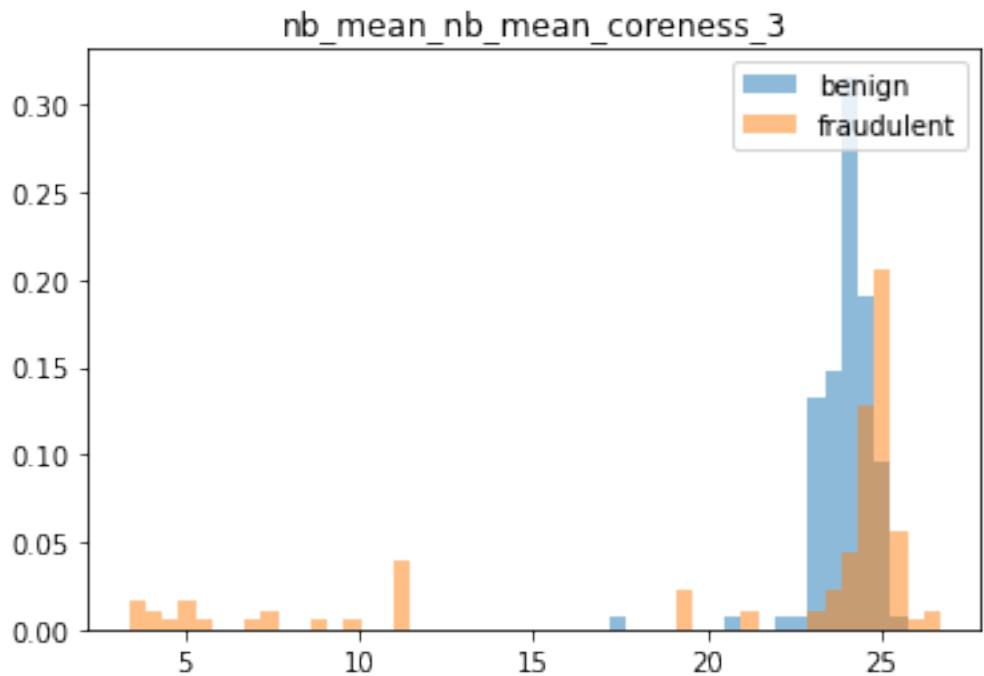


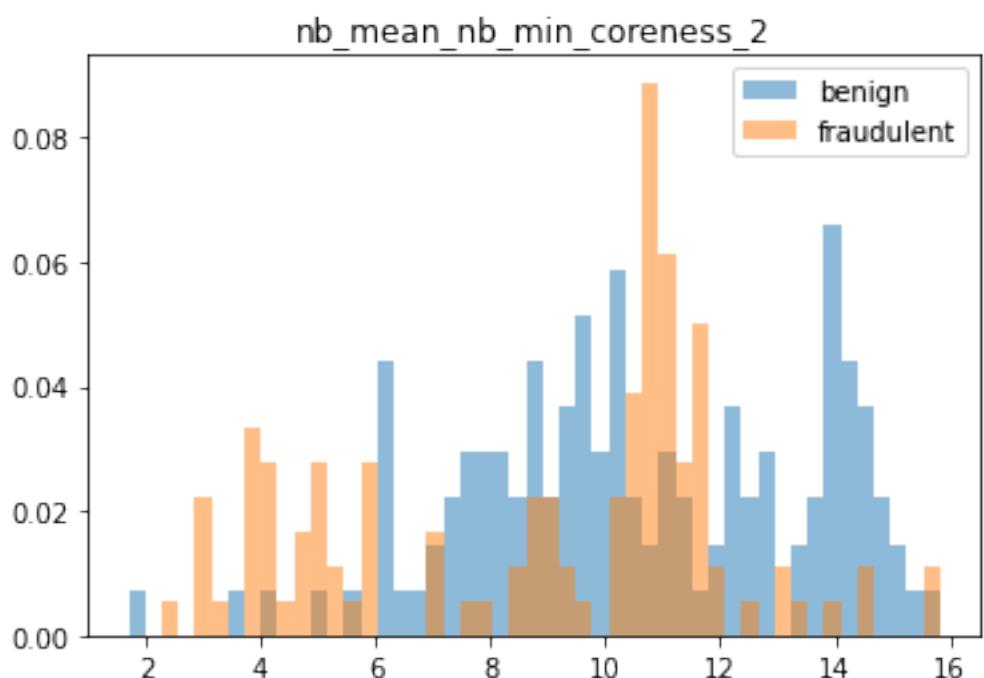
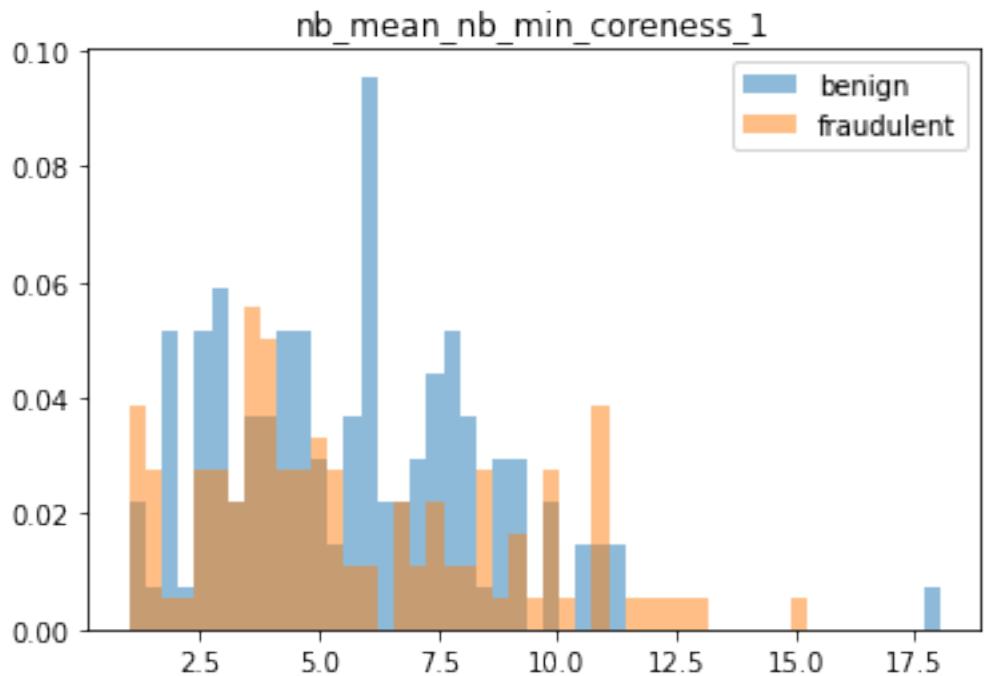
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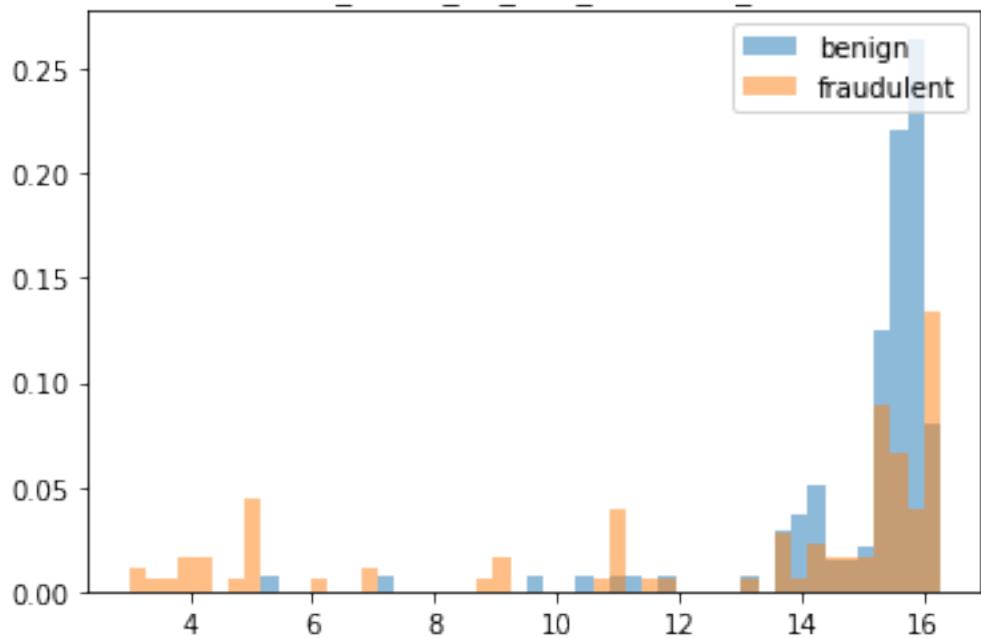
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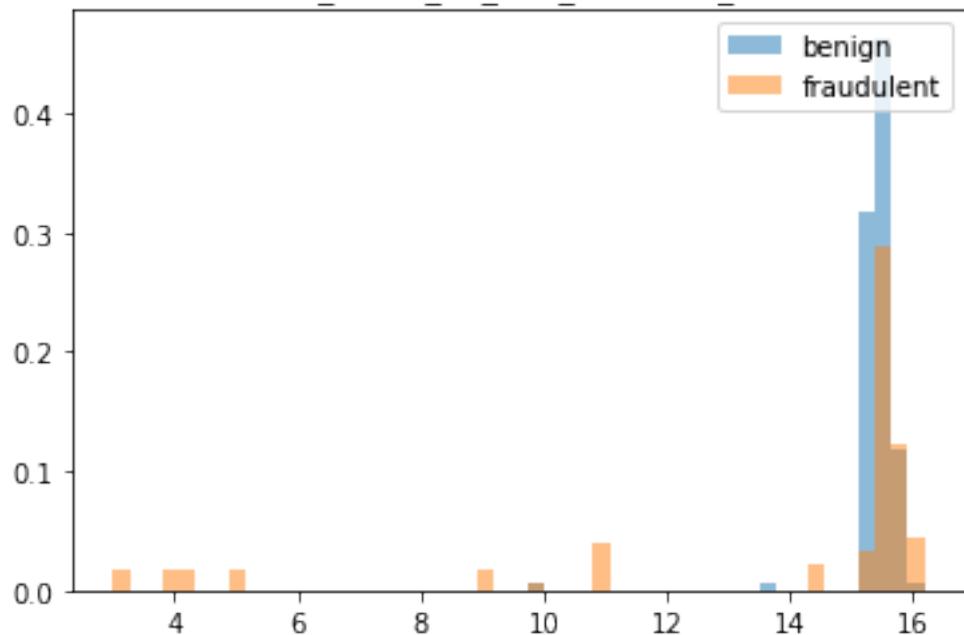


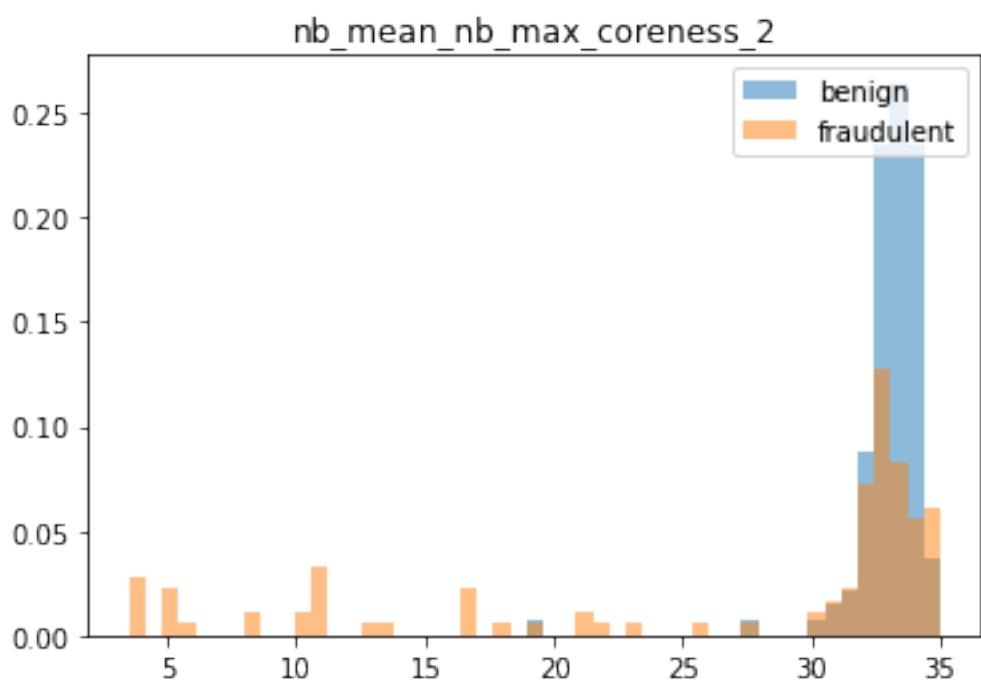
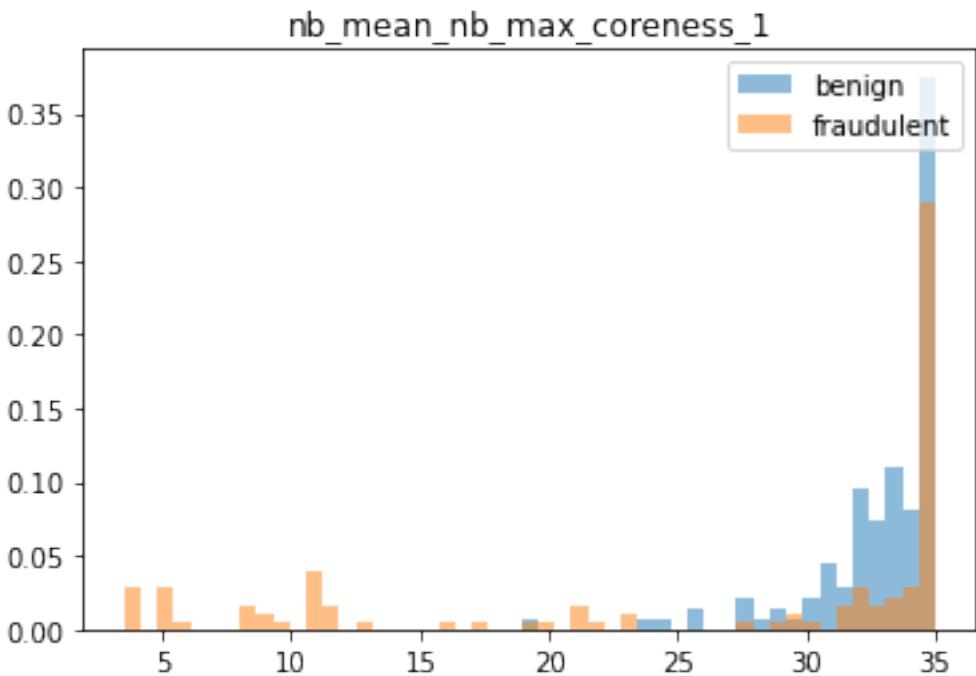


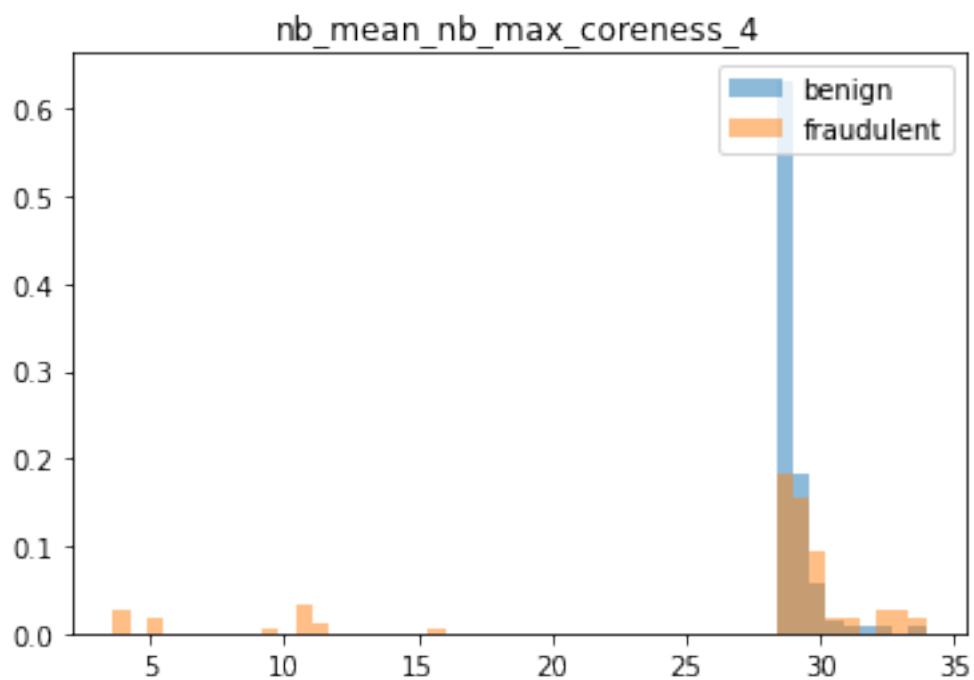
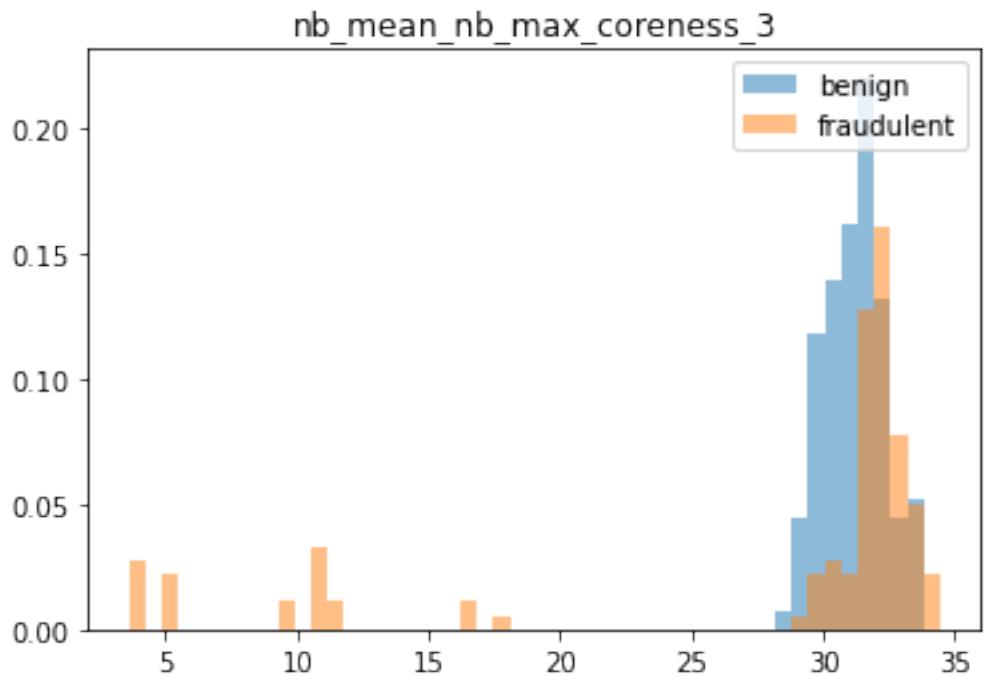
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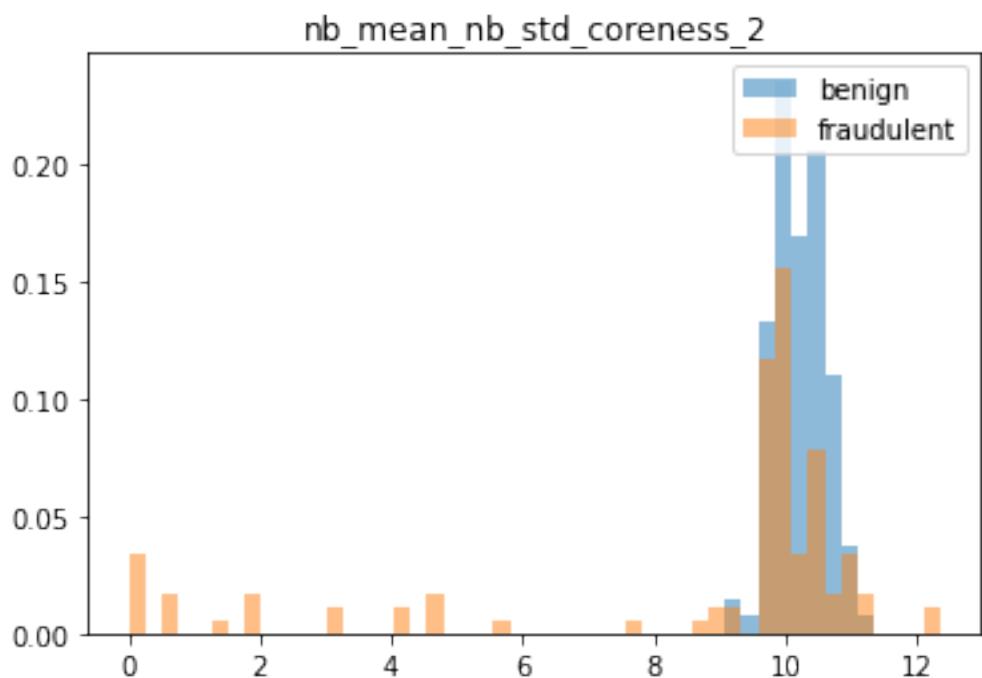
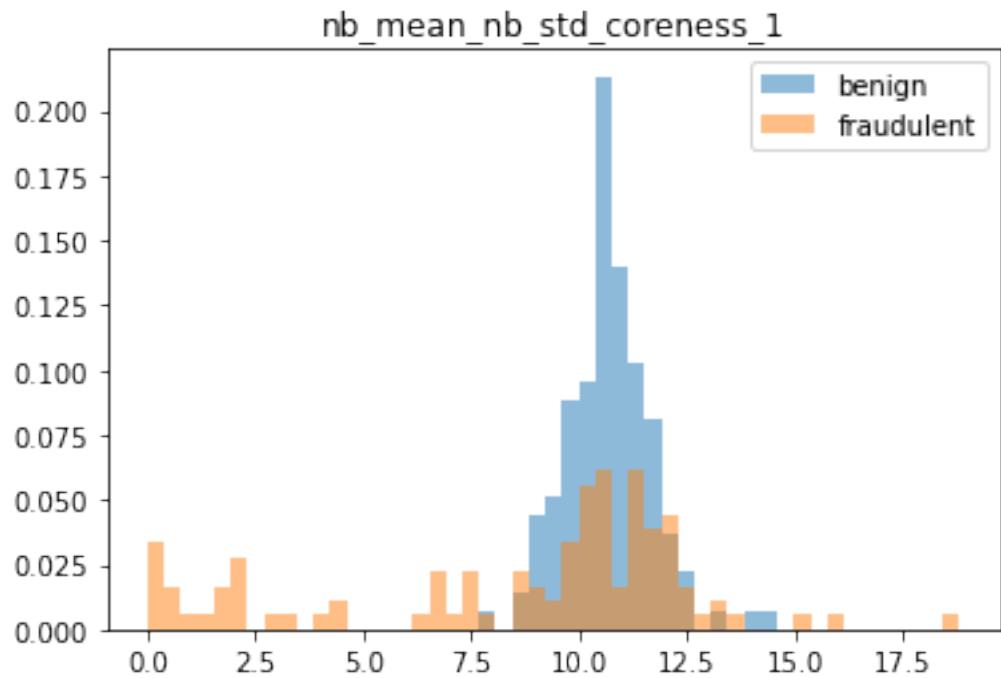


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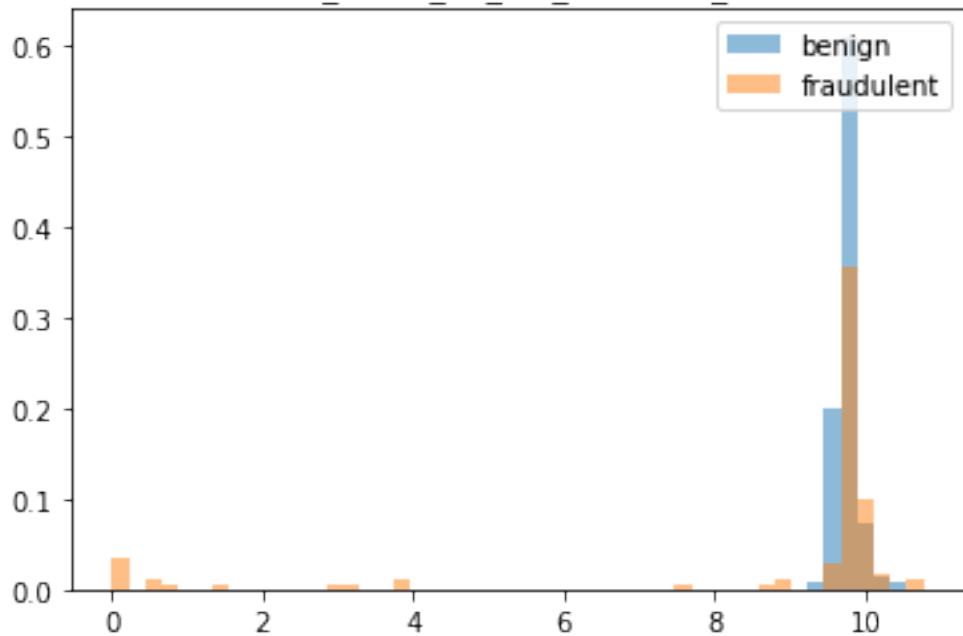




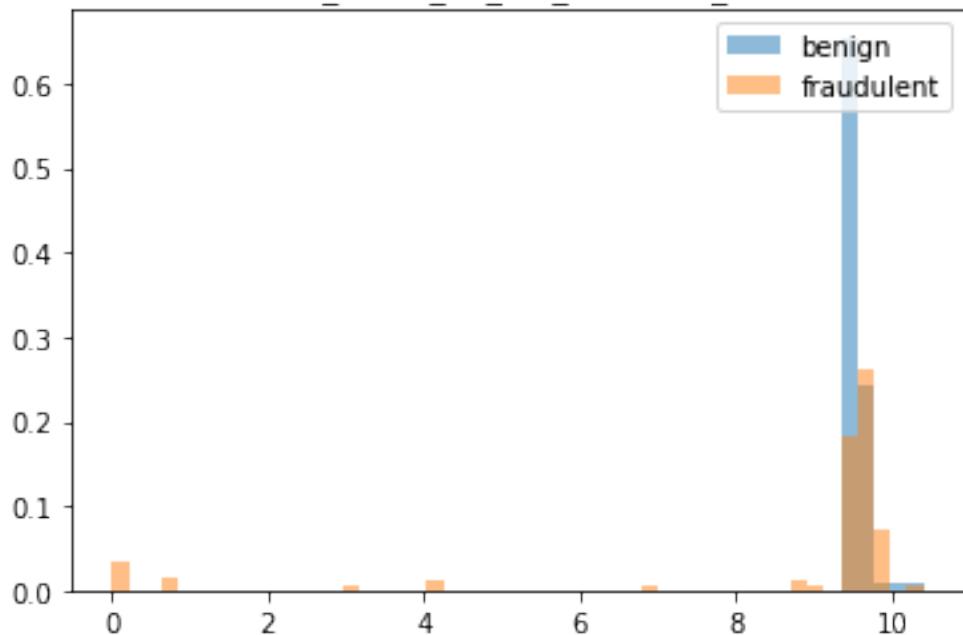




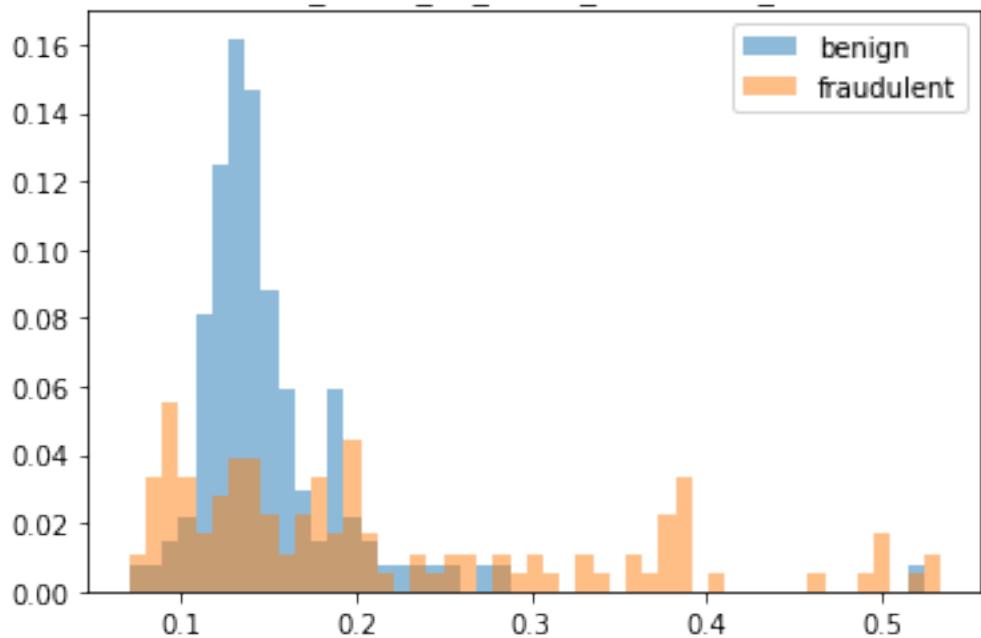
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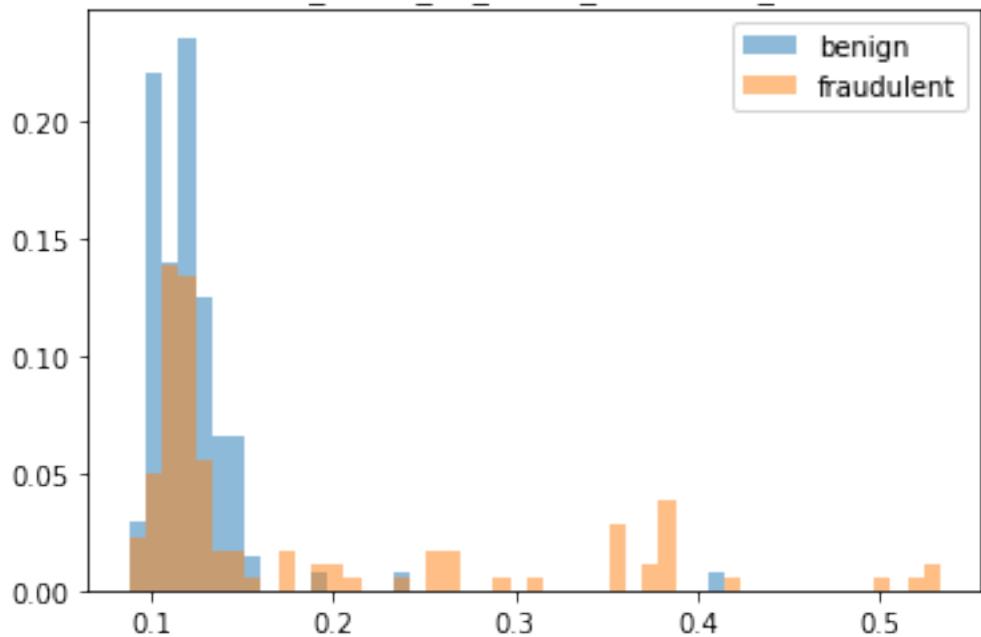
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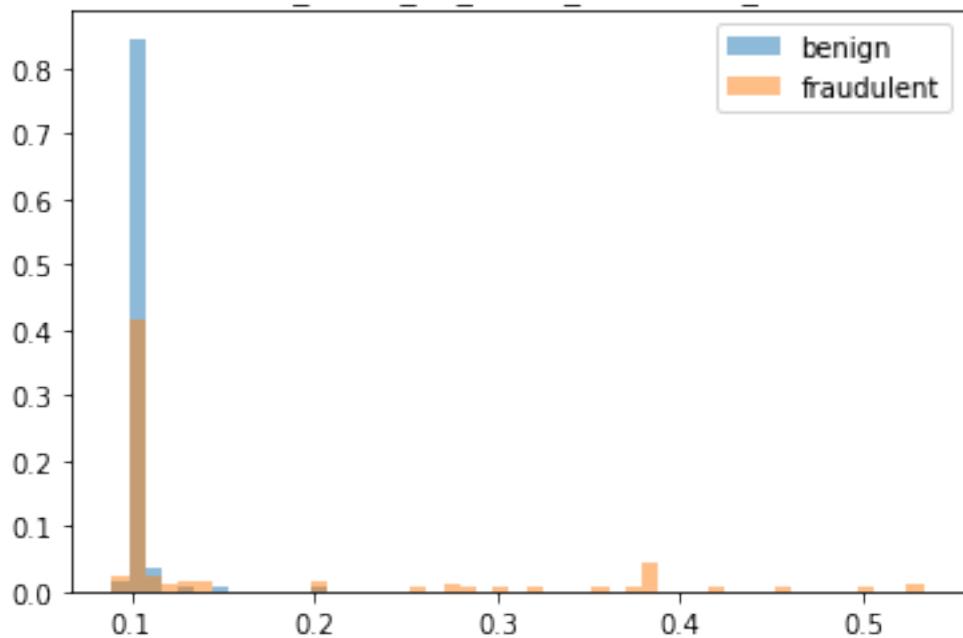
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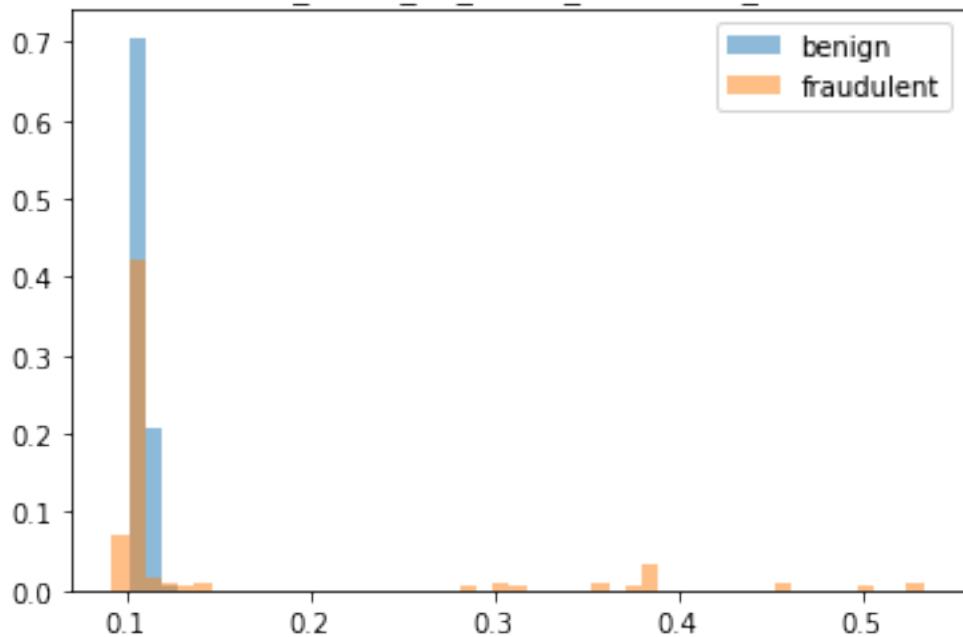
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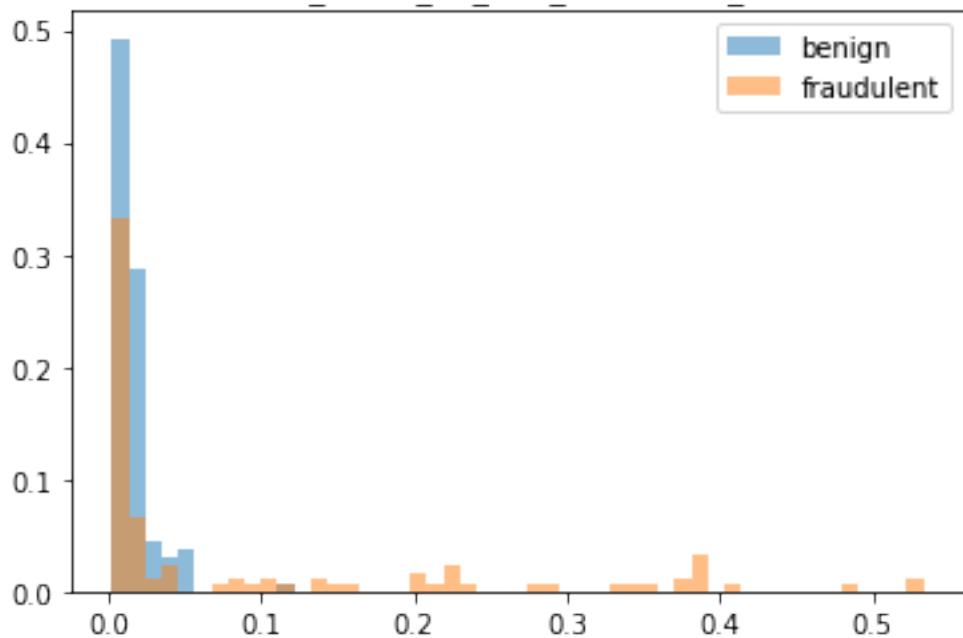
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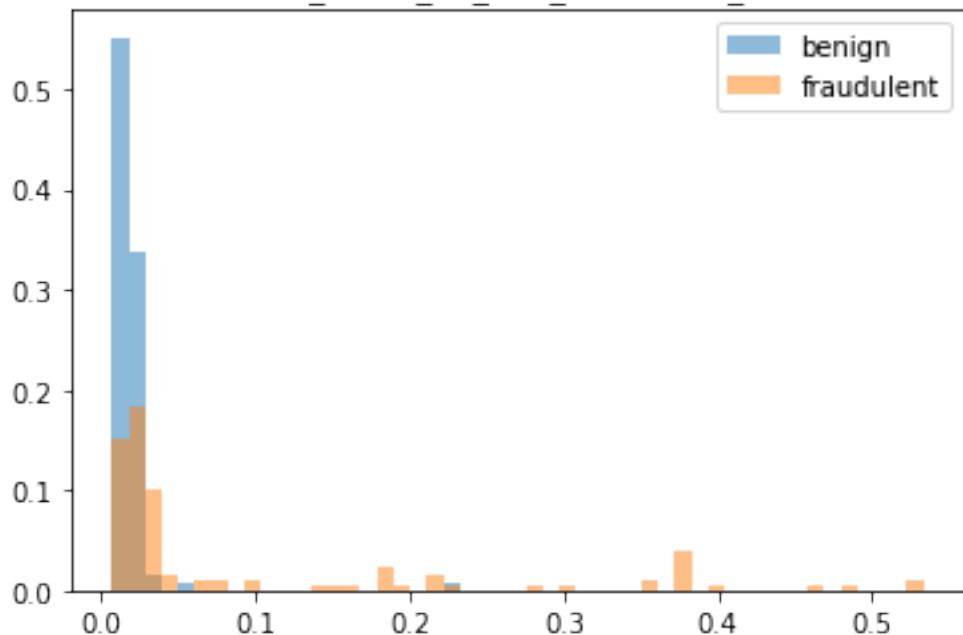
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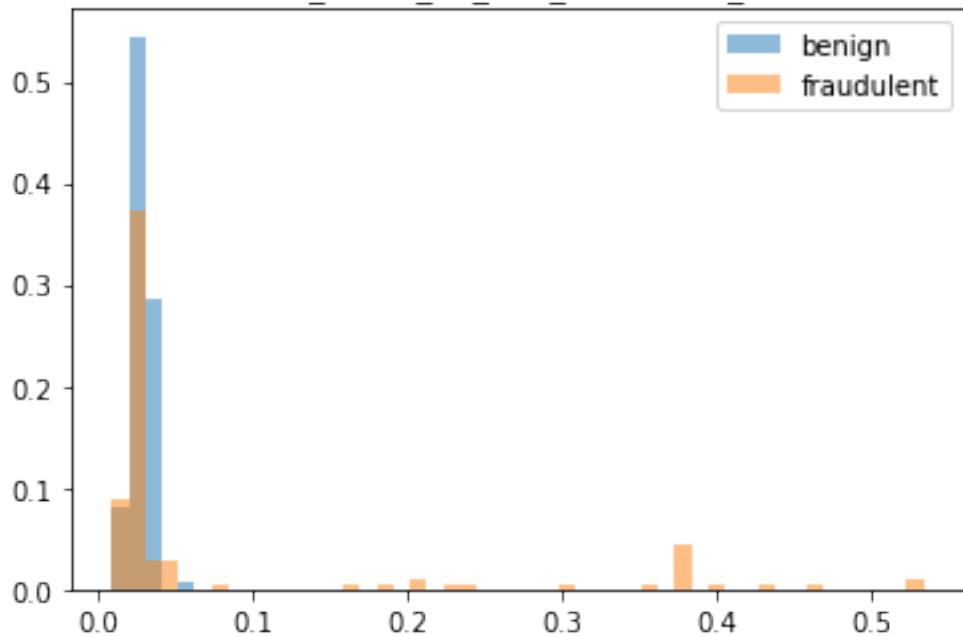
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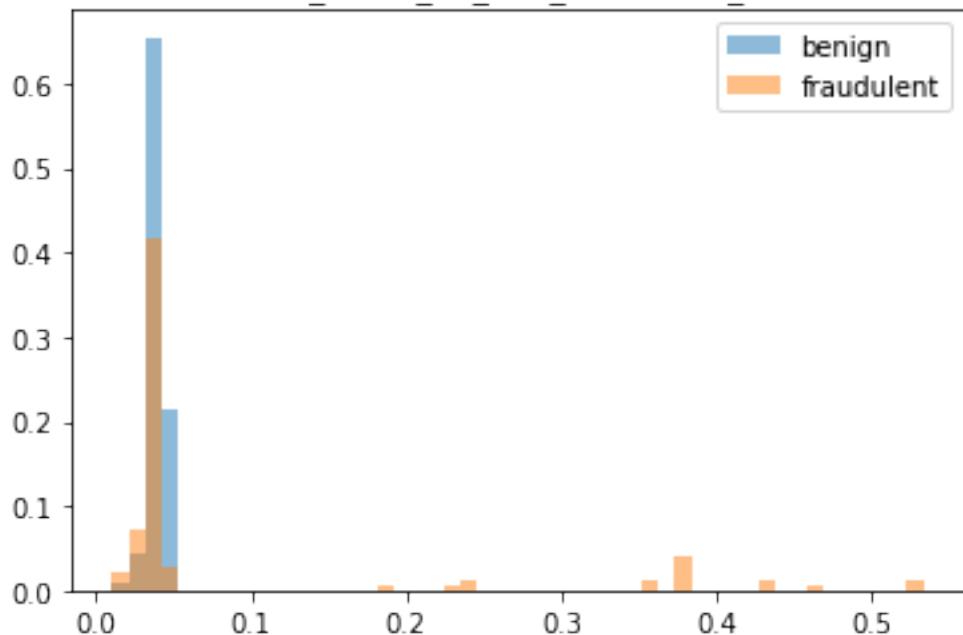
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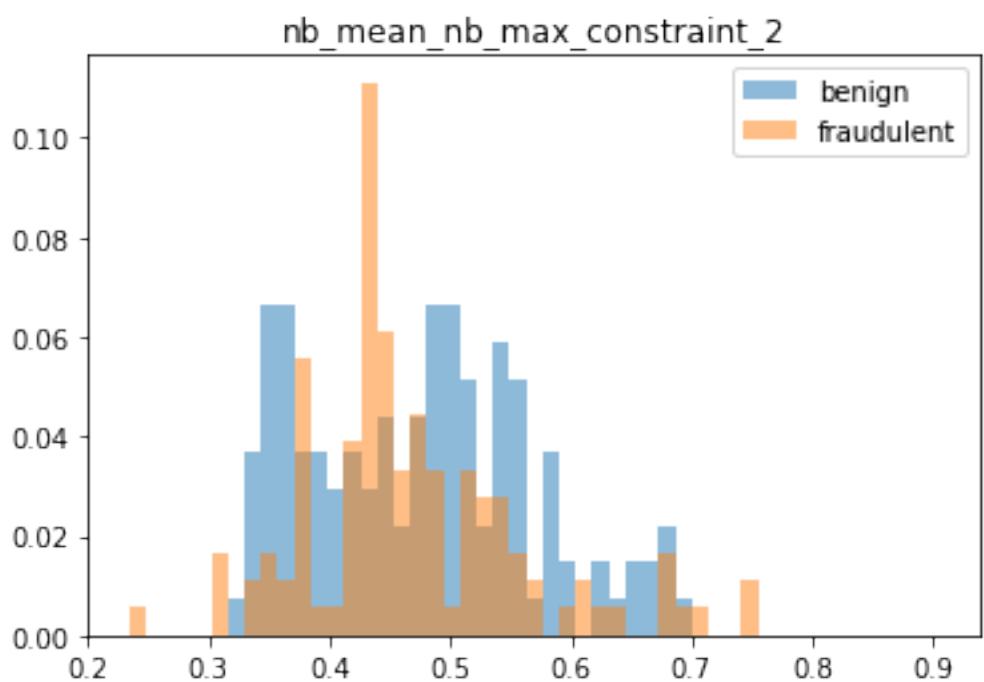
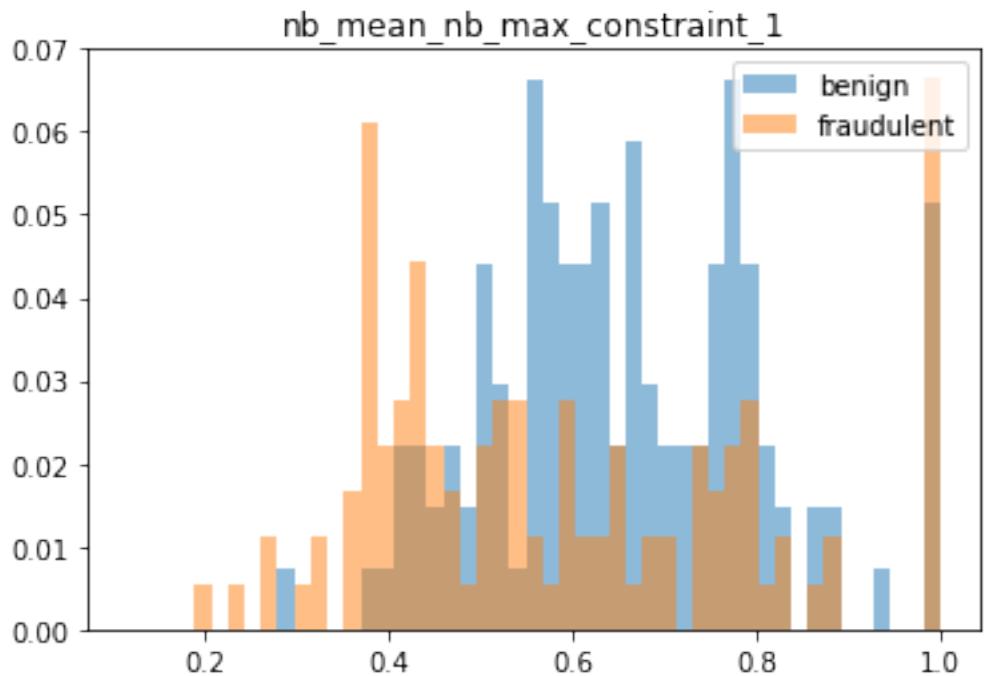


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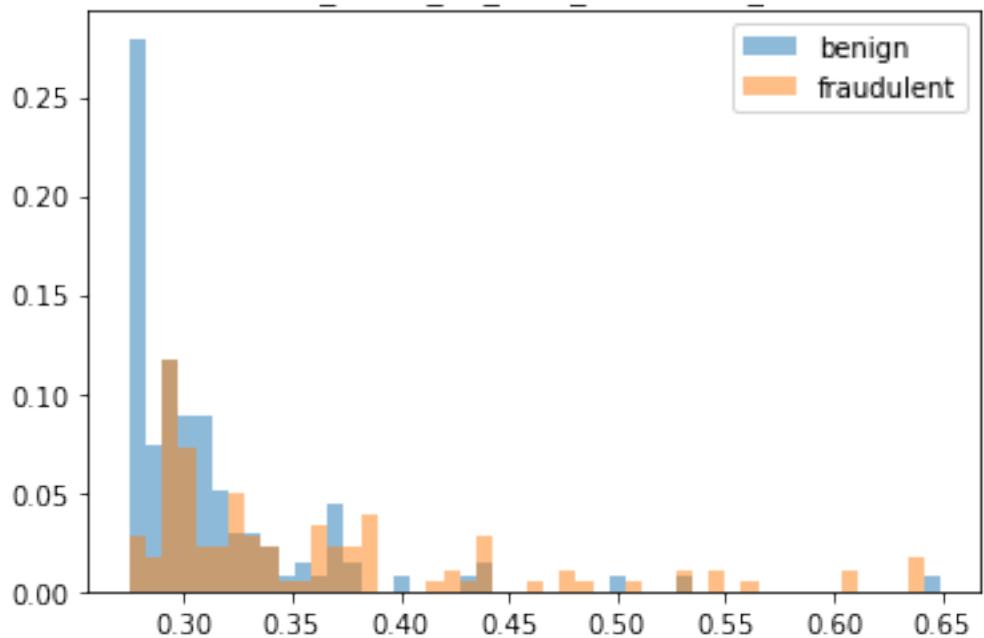


nb_mean_nb_min_constraint_4

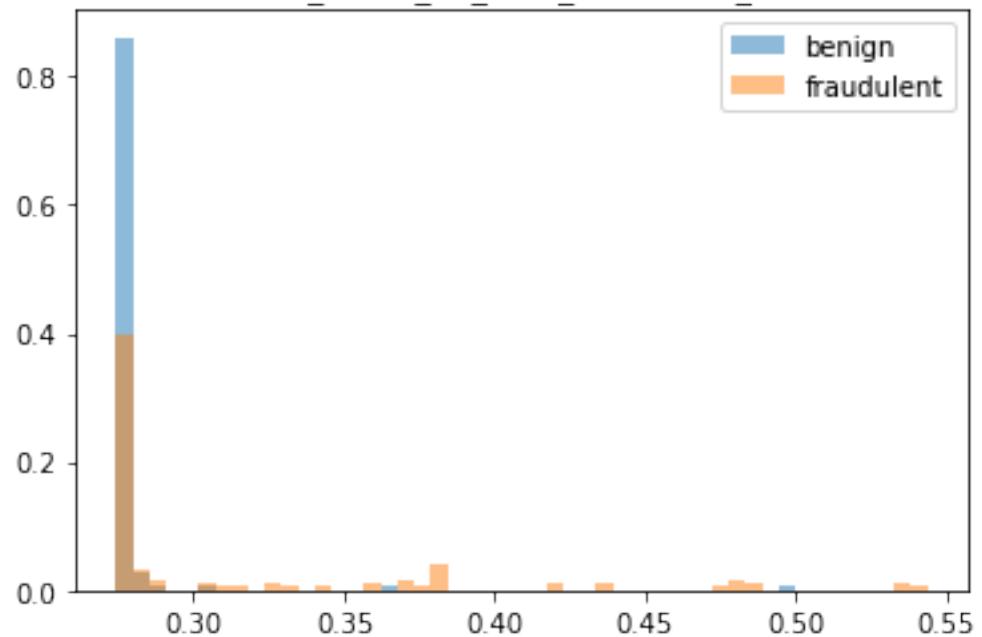




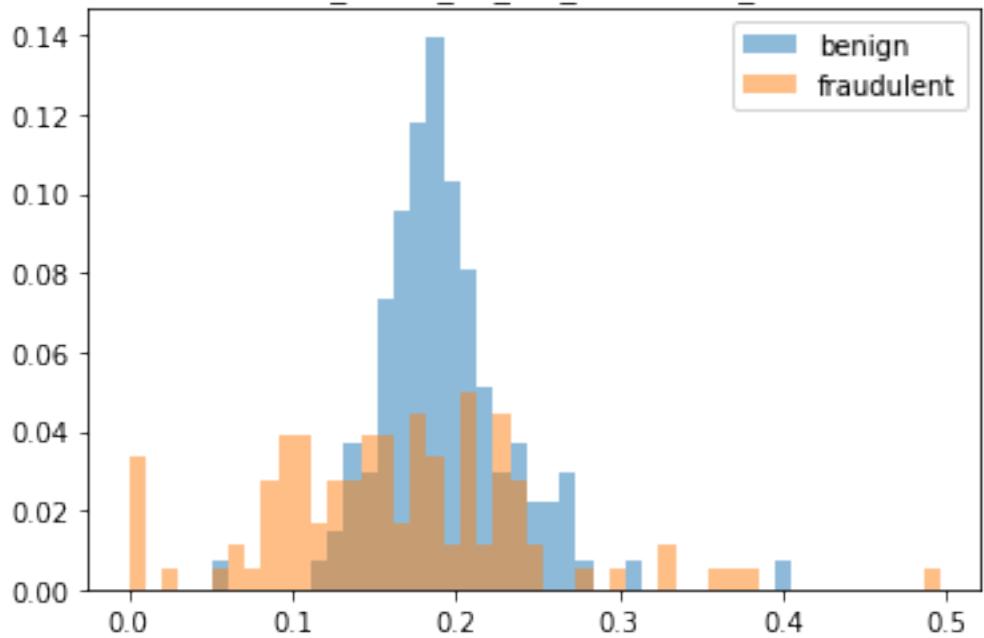
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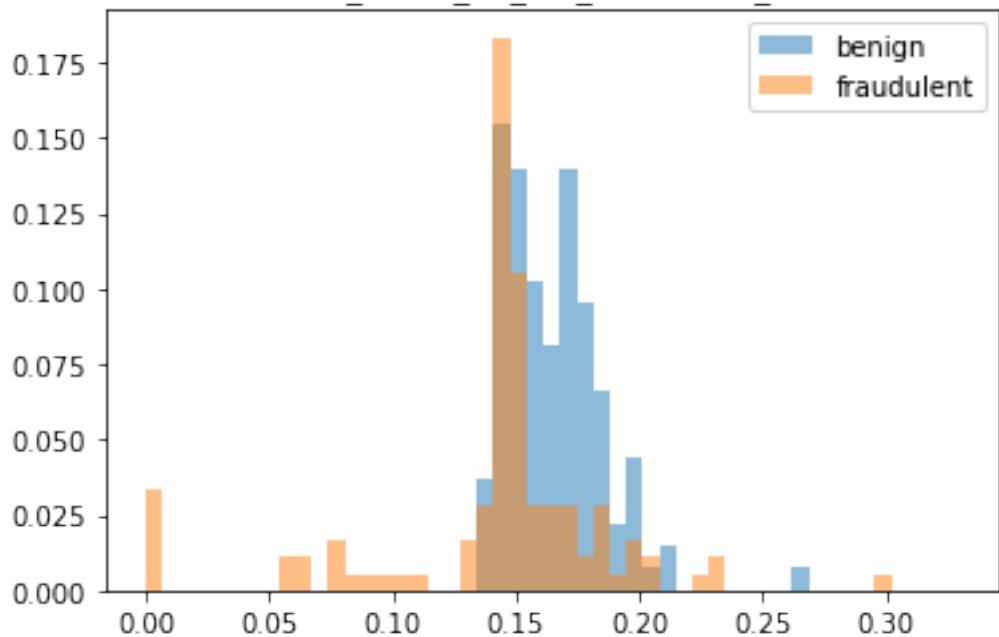
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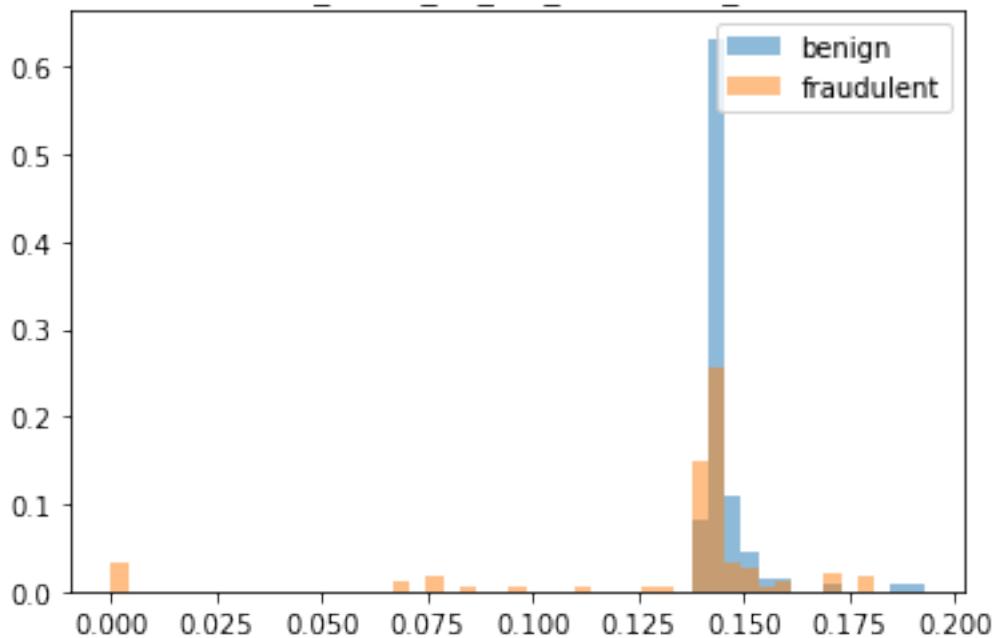
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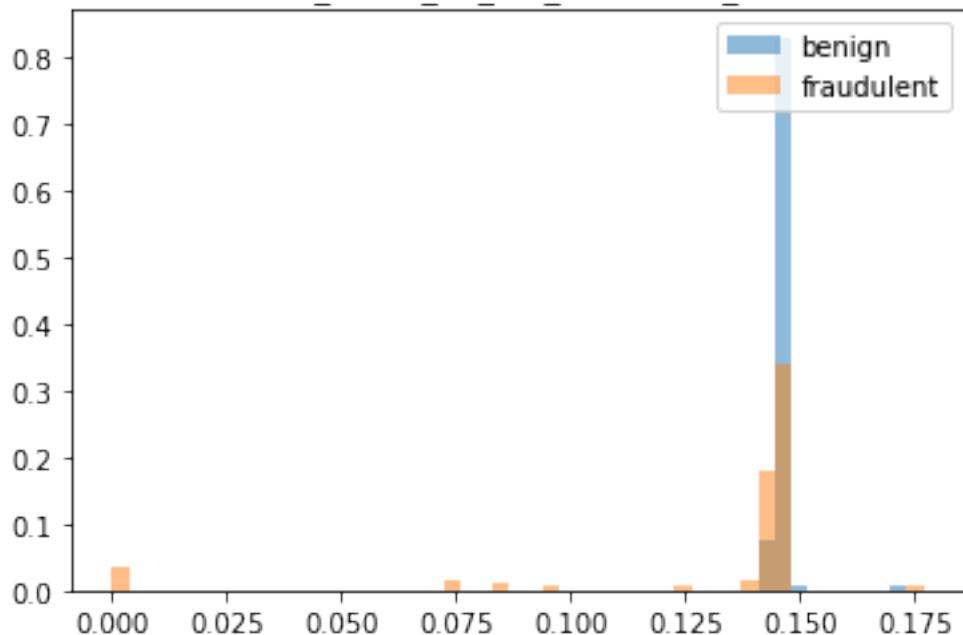
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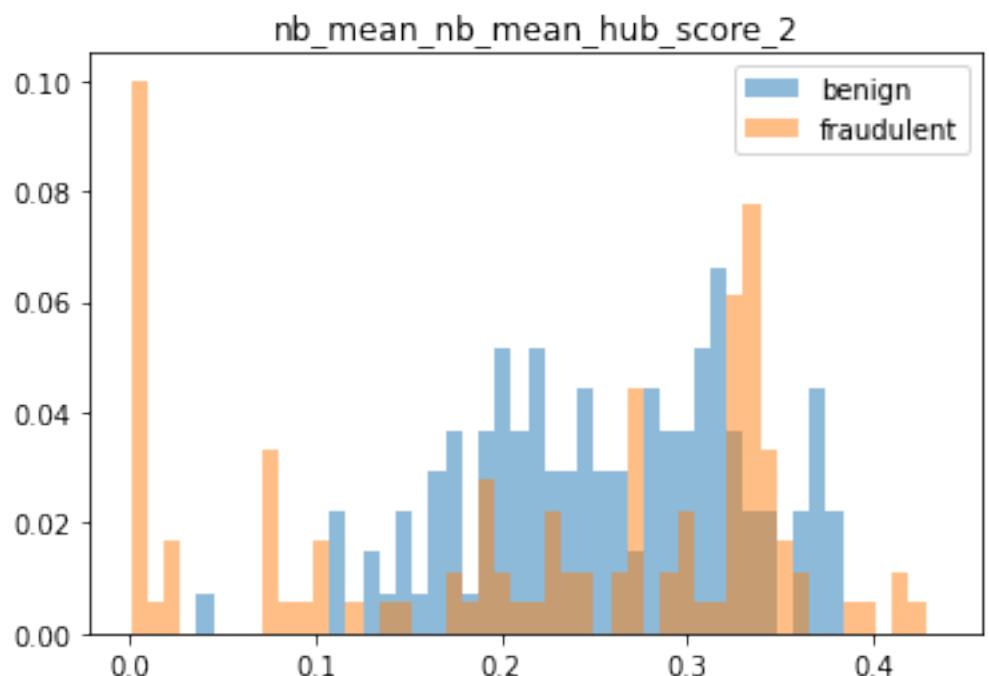
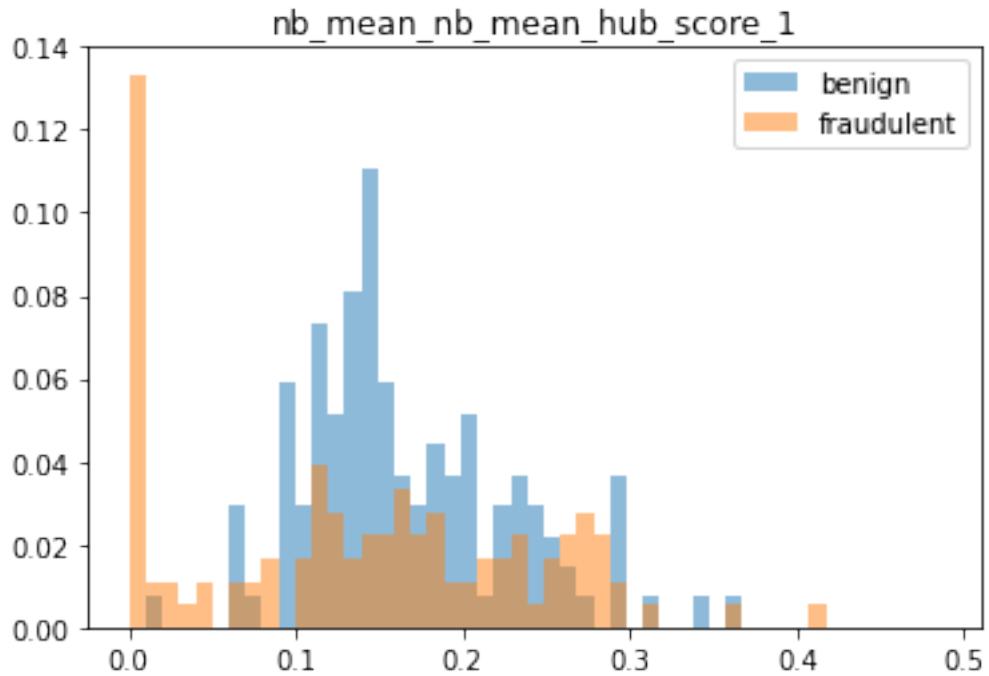


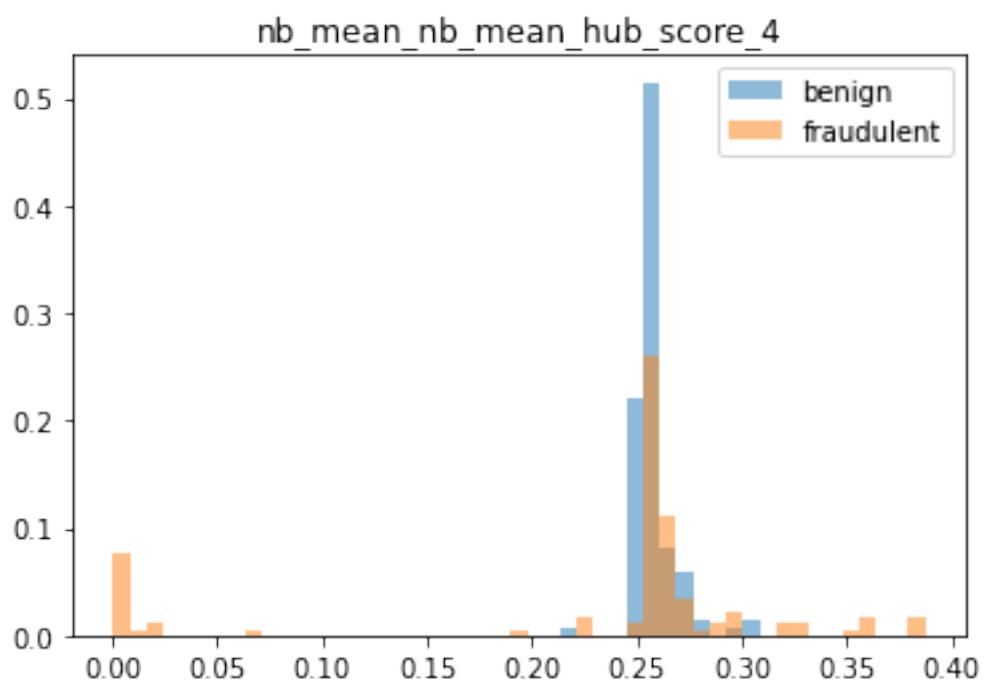
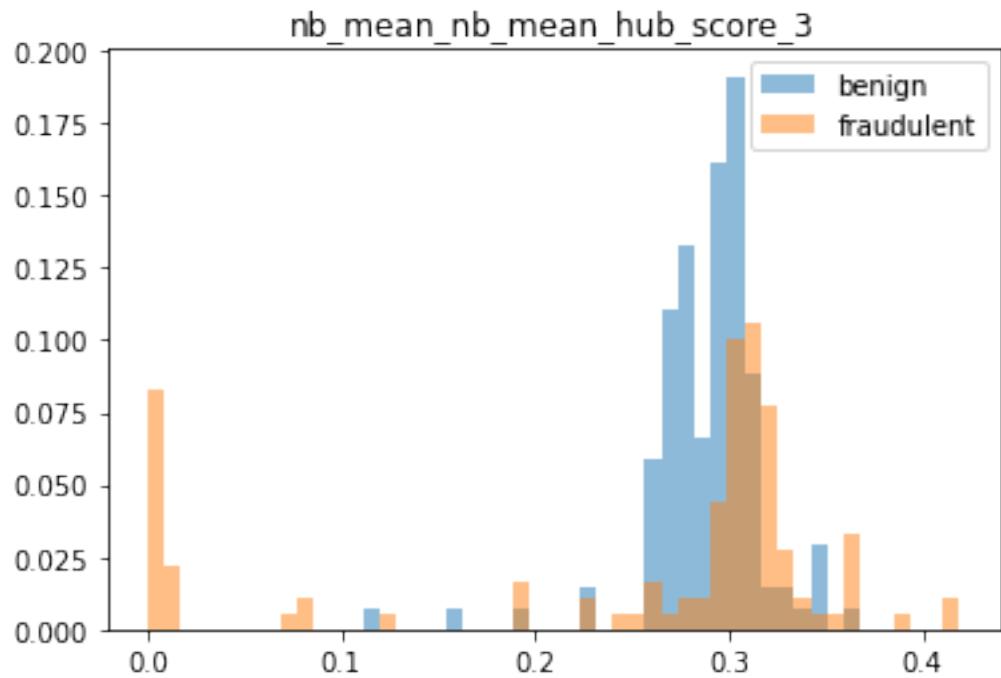
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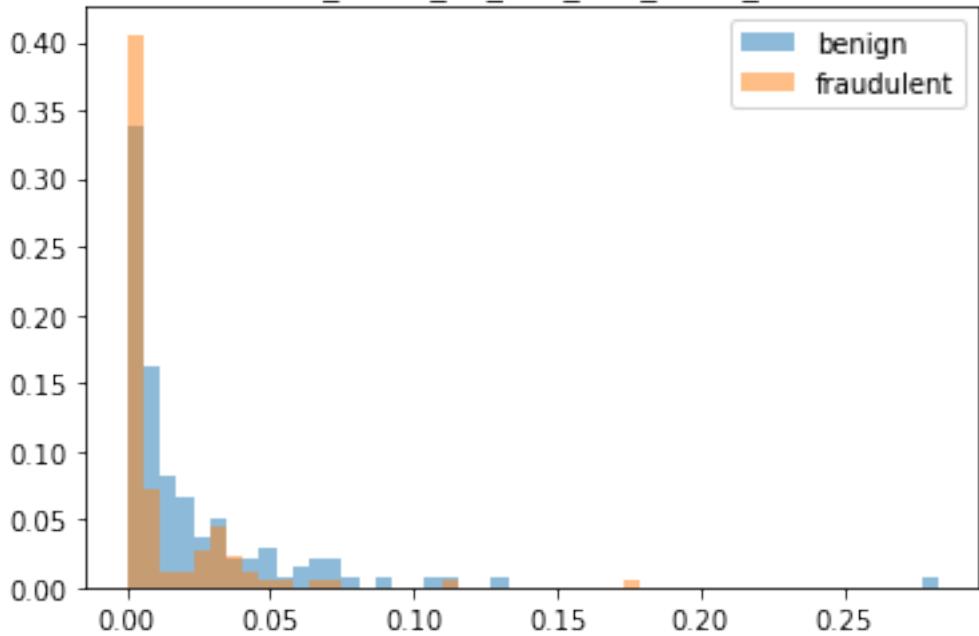
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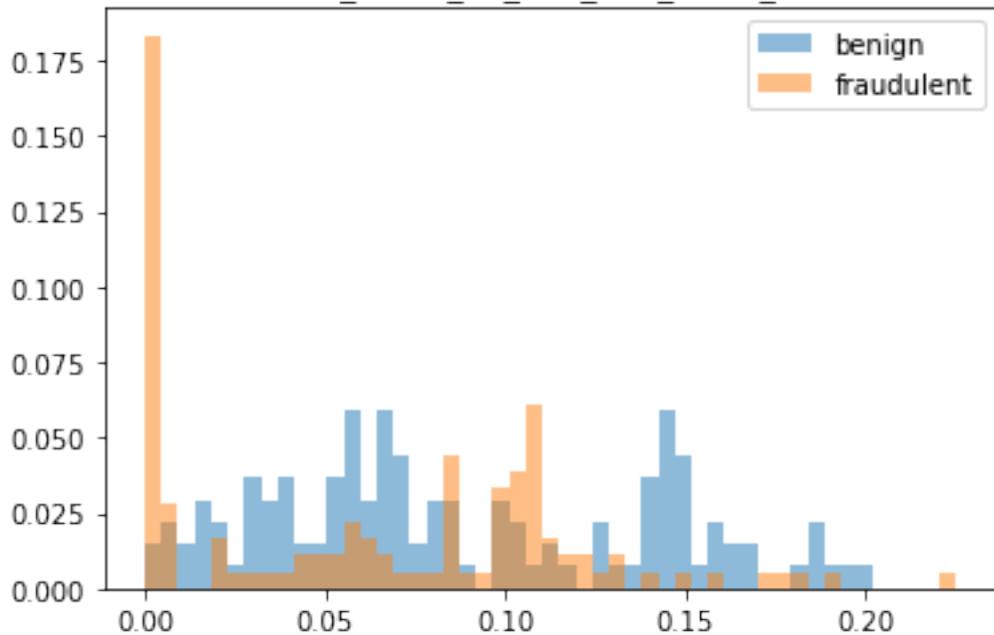




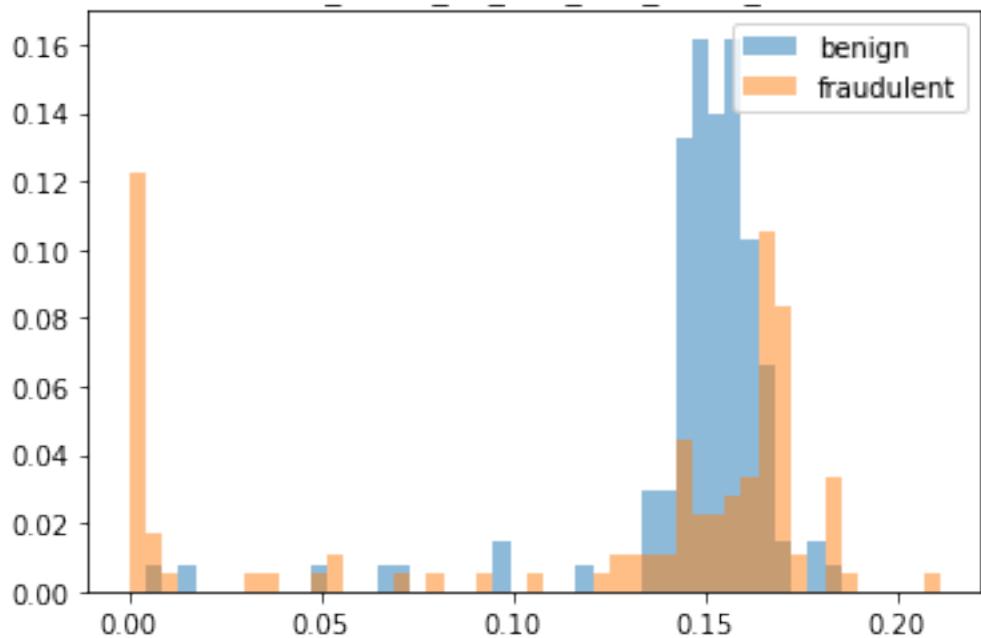
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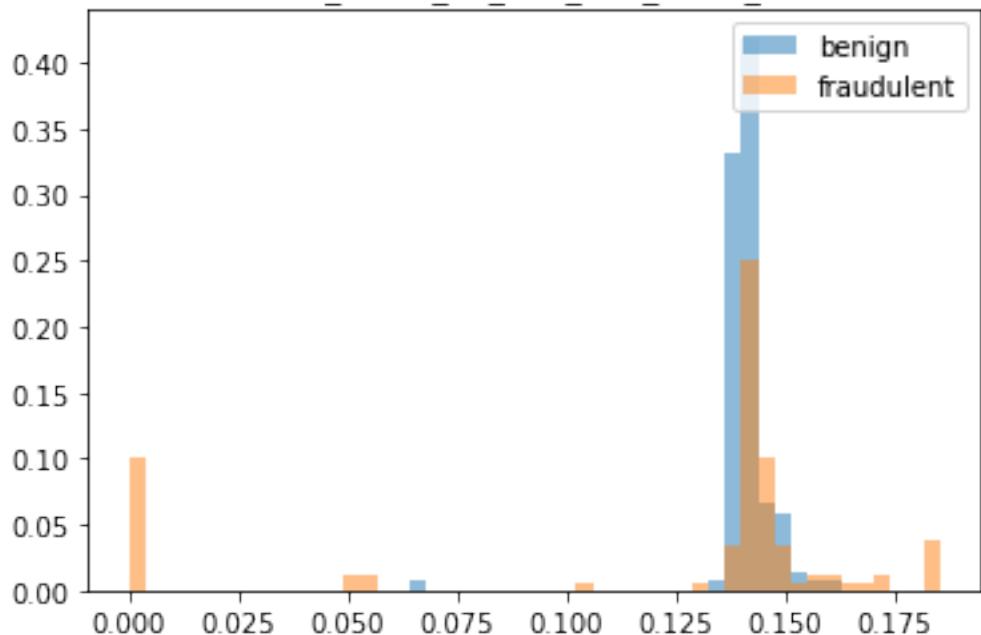
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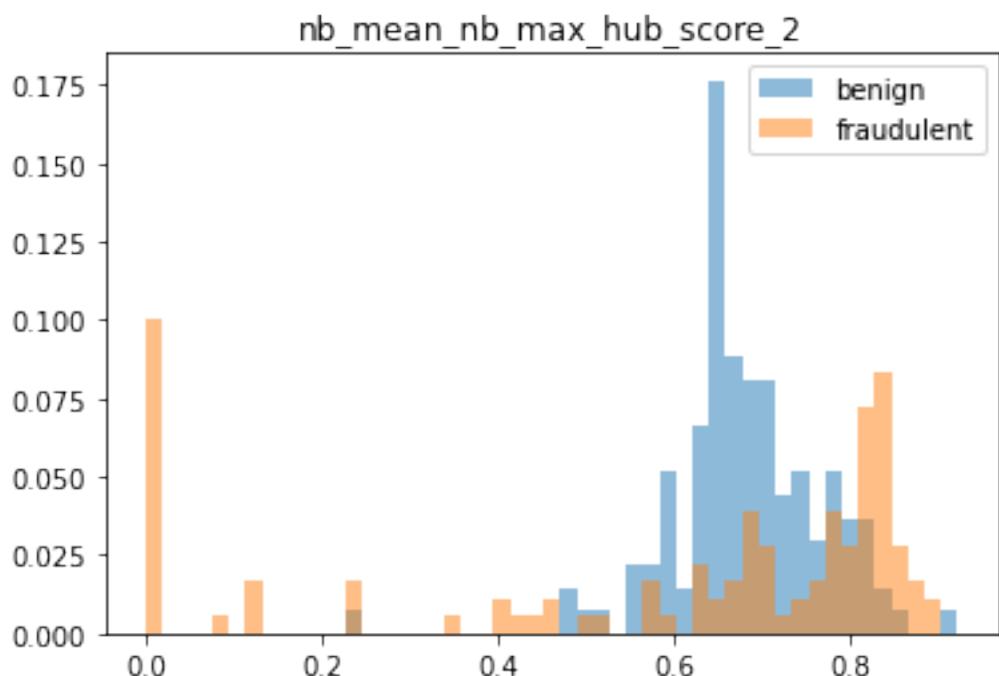
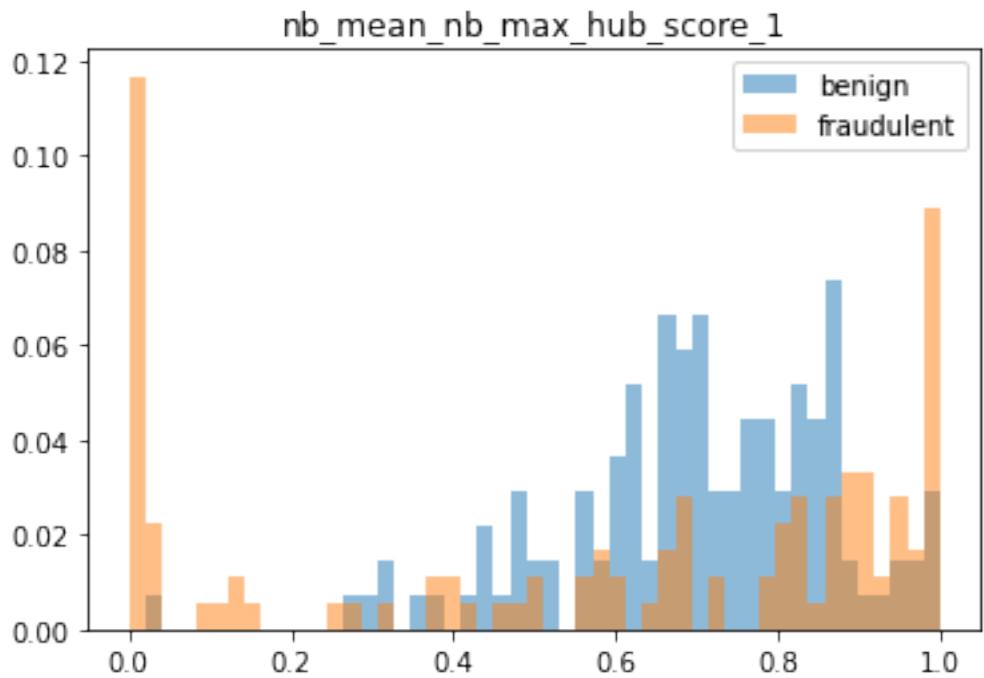


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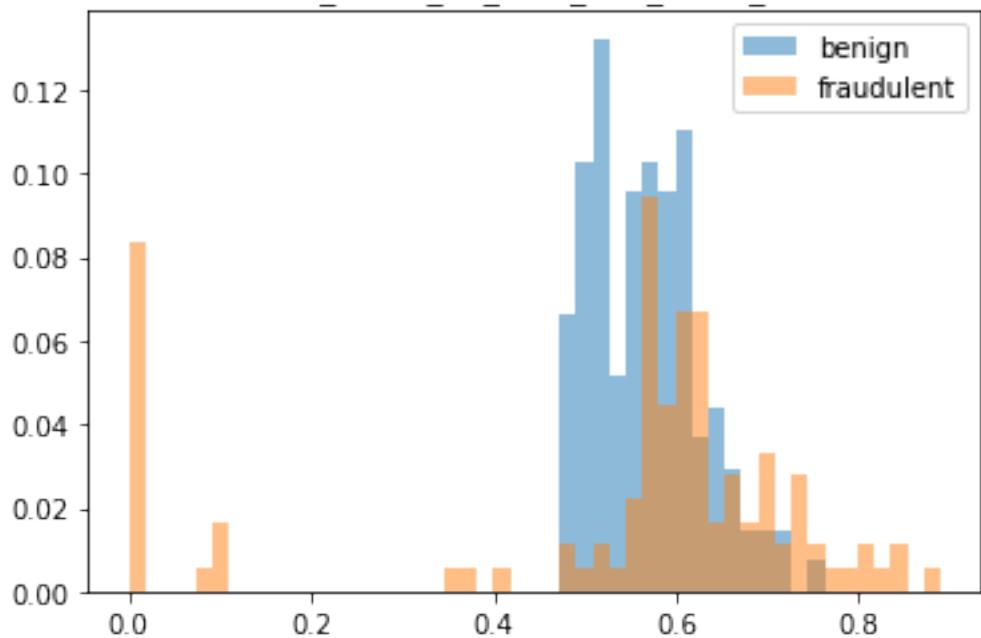


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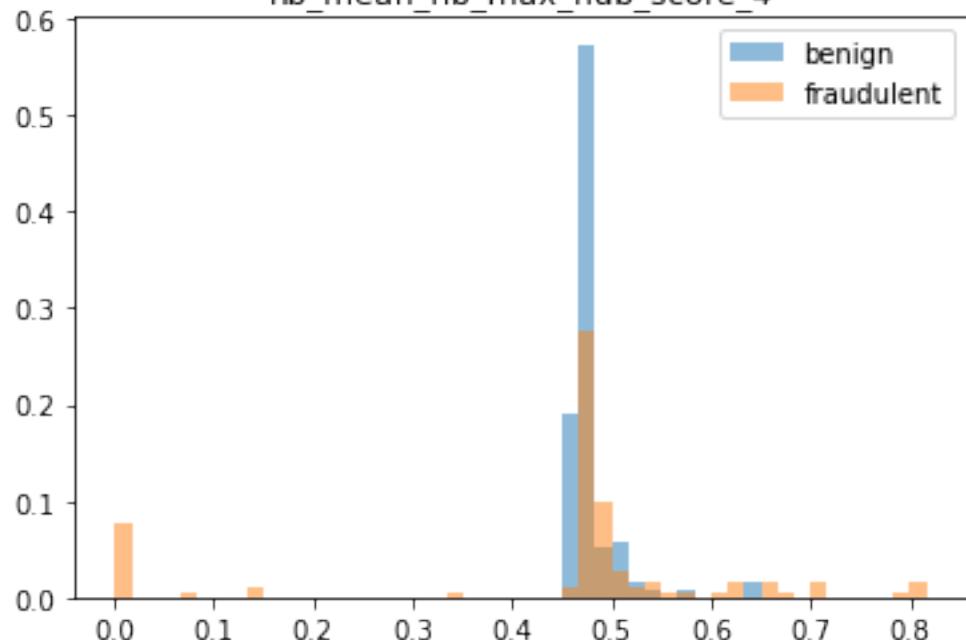




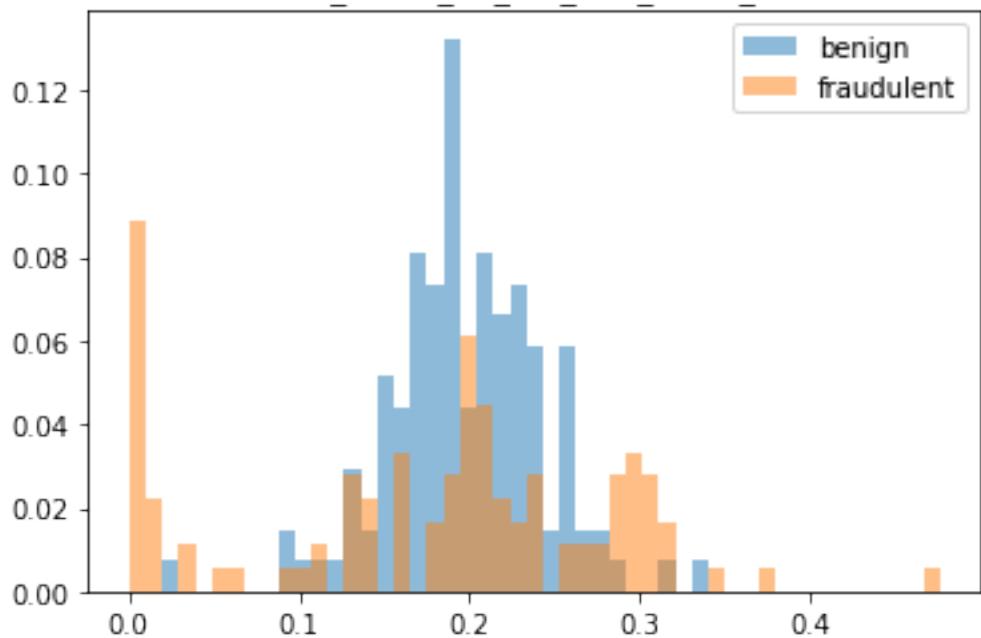
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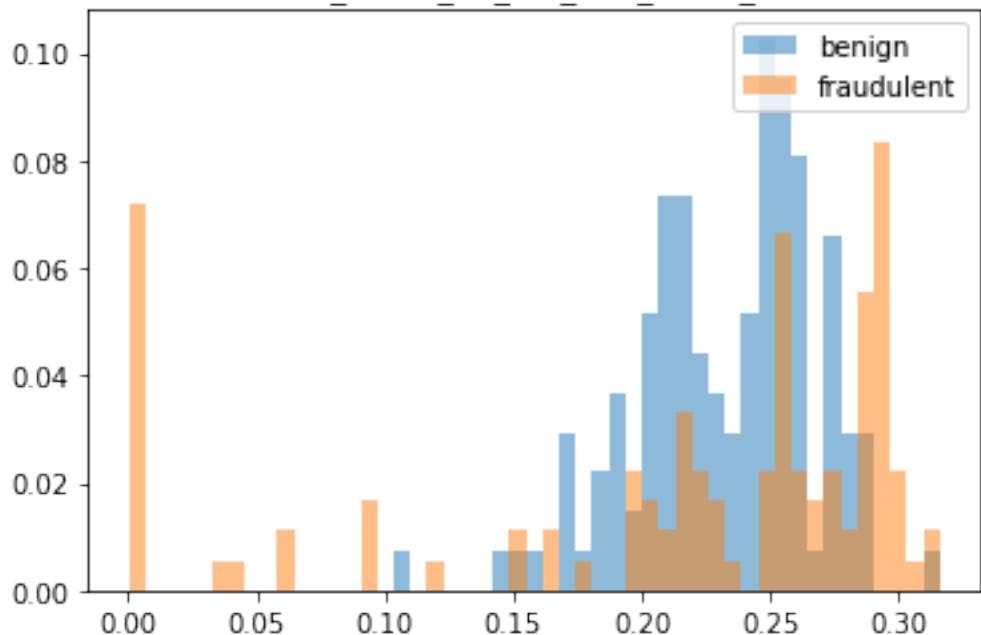
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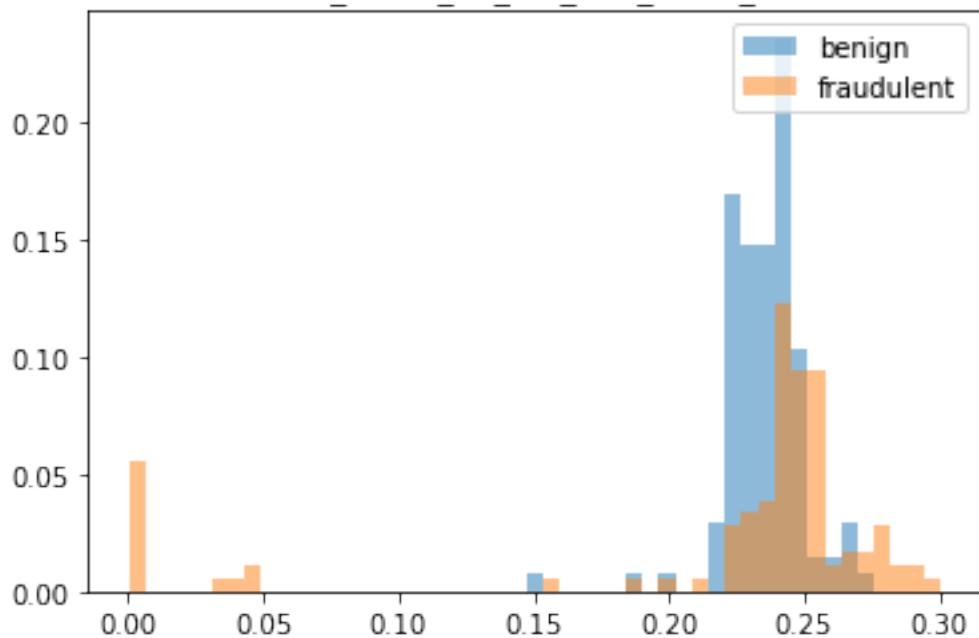
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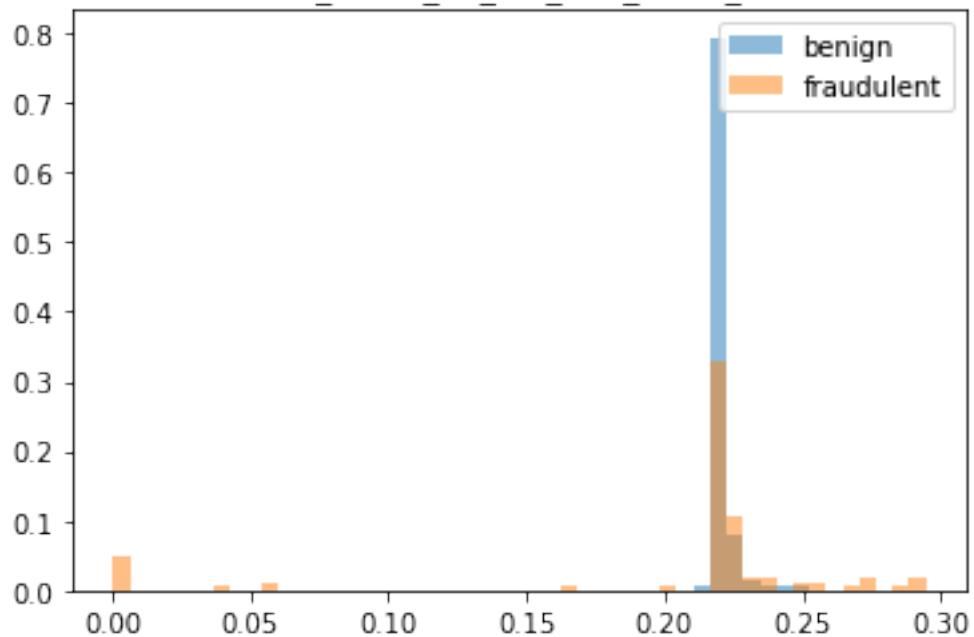
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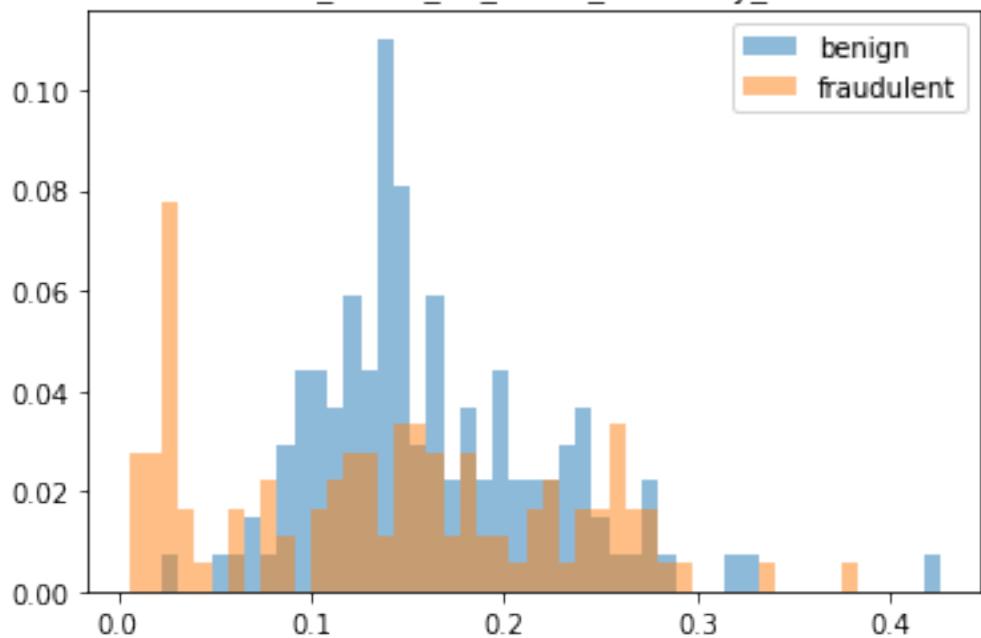
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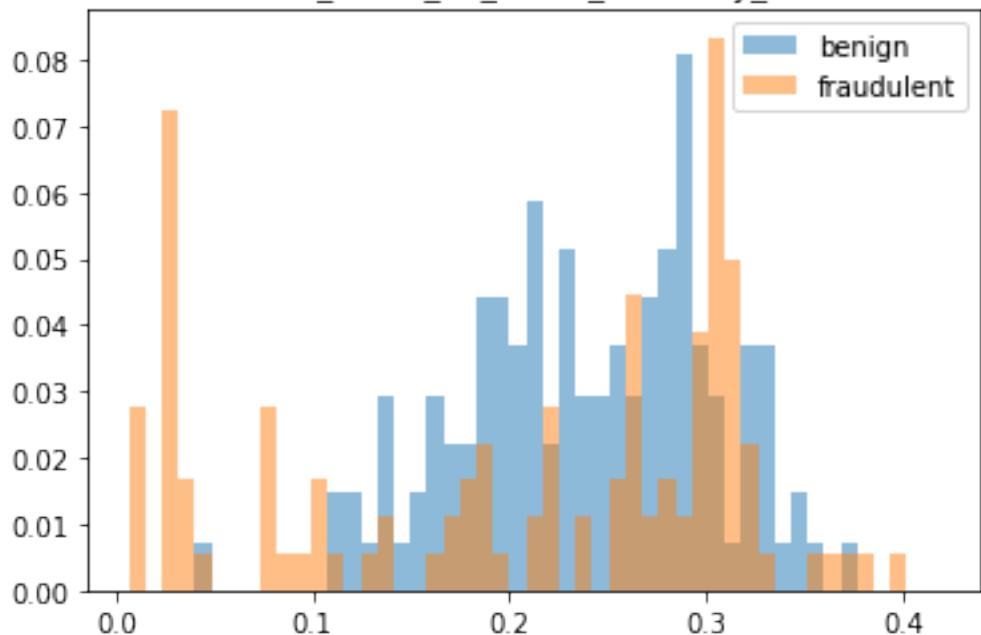
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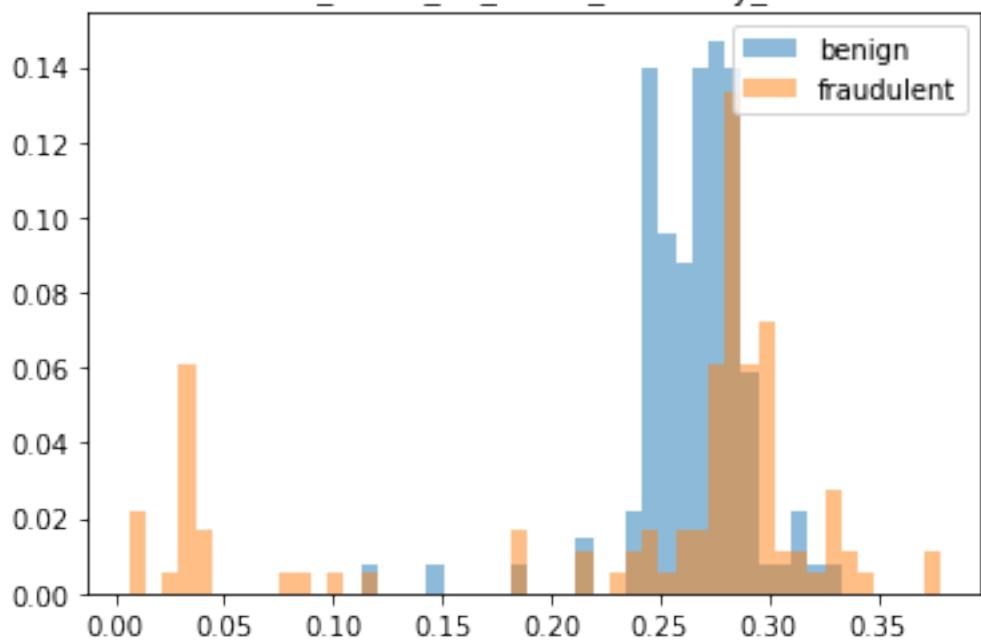
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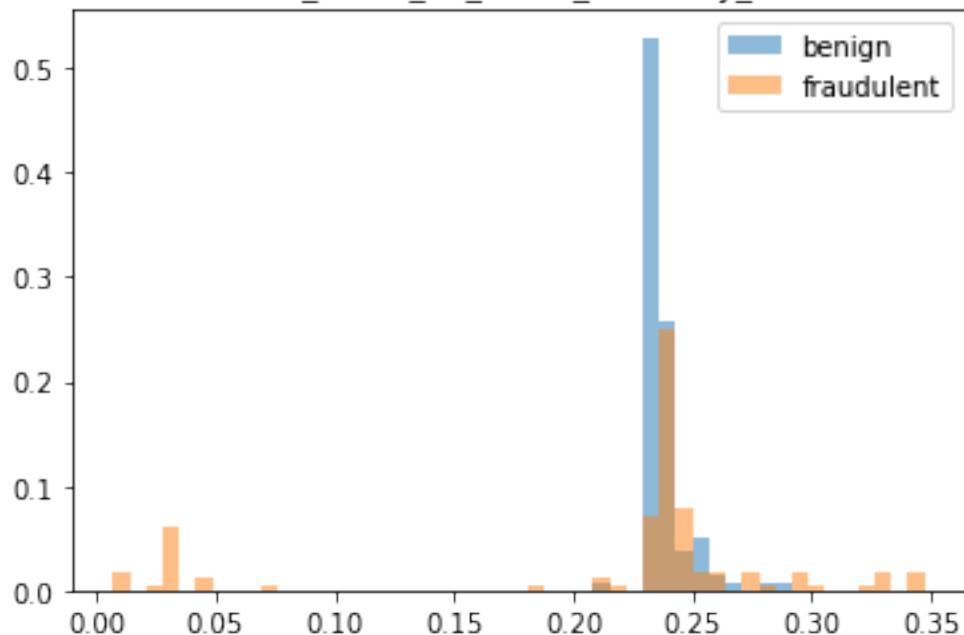
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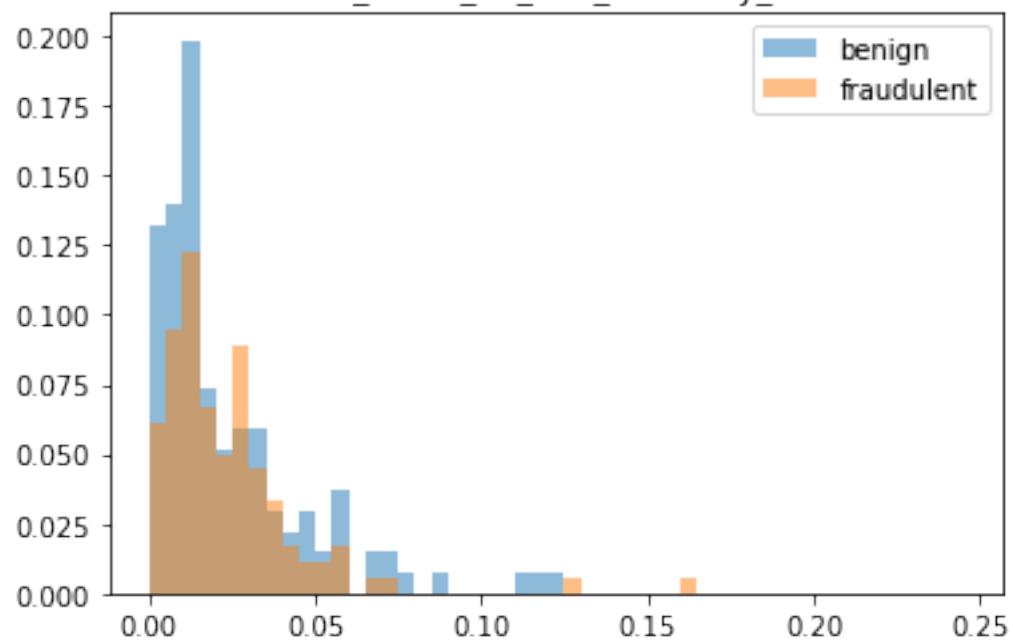
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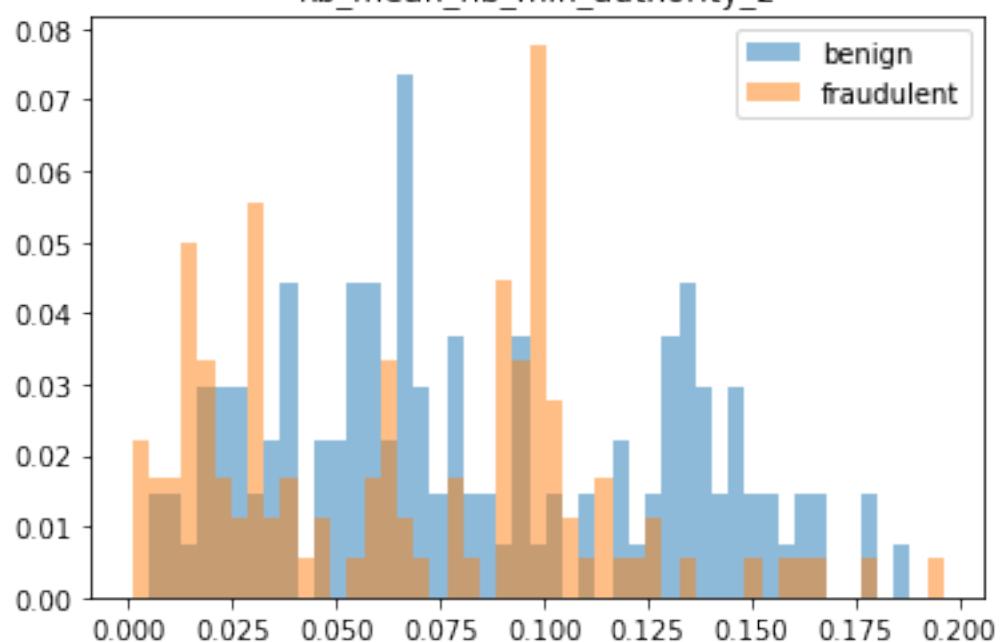
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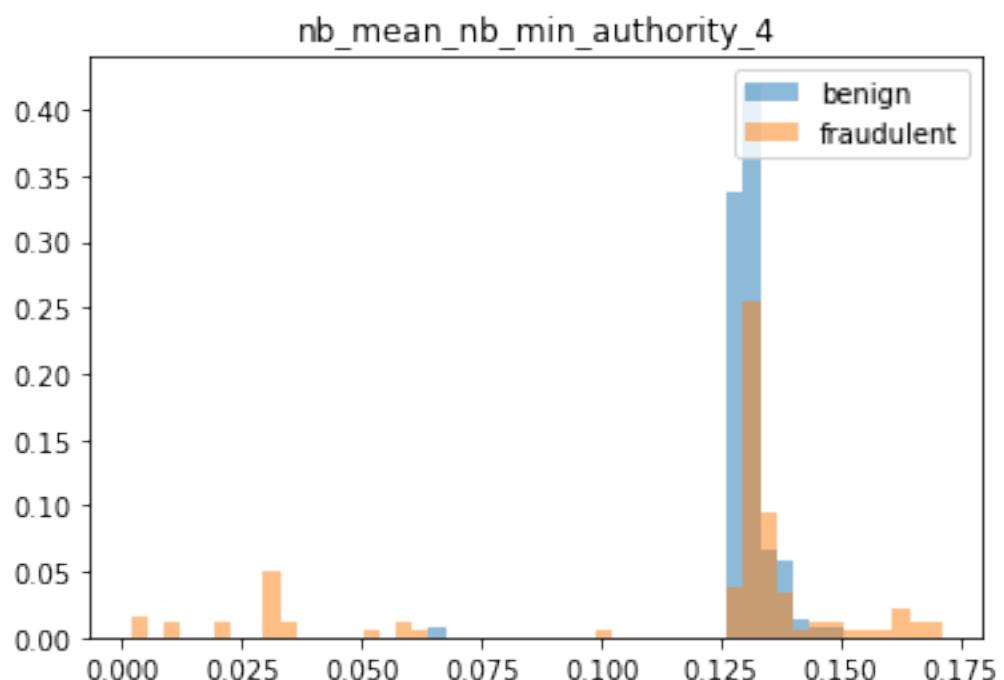
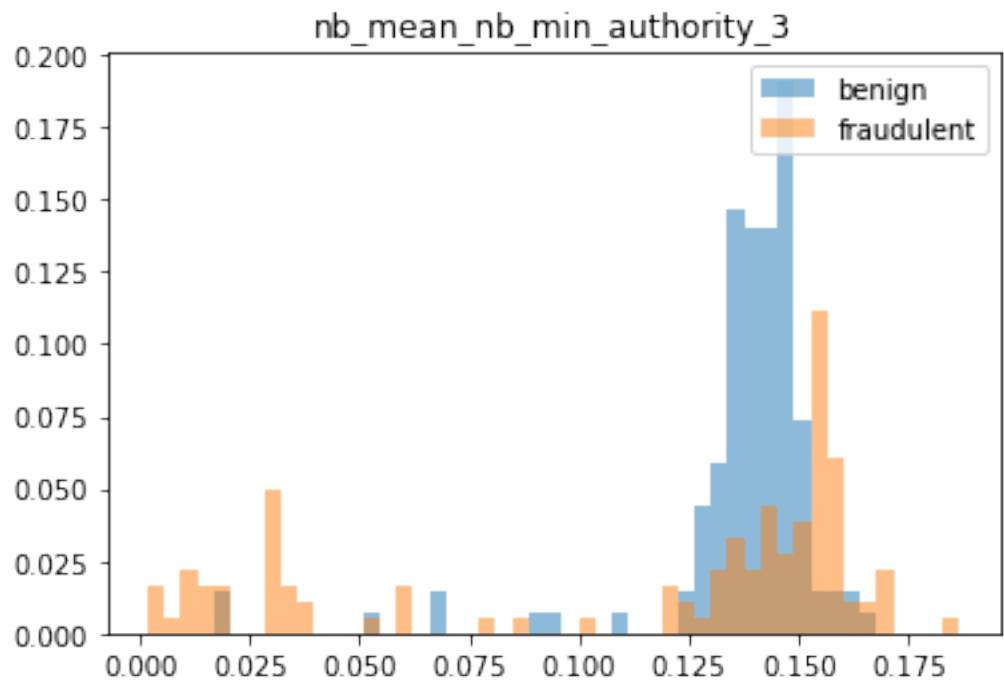


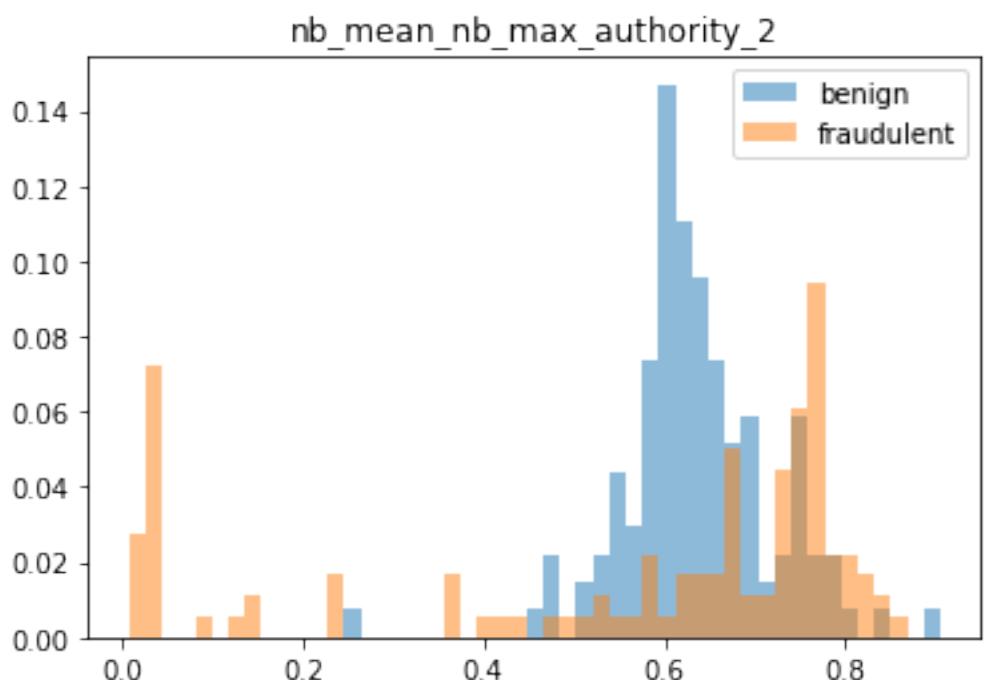
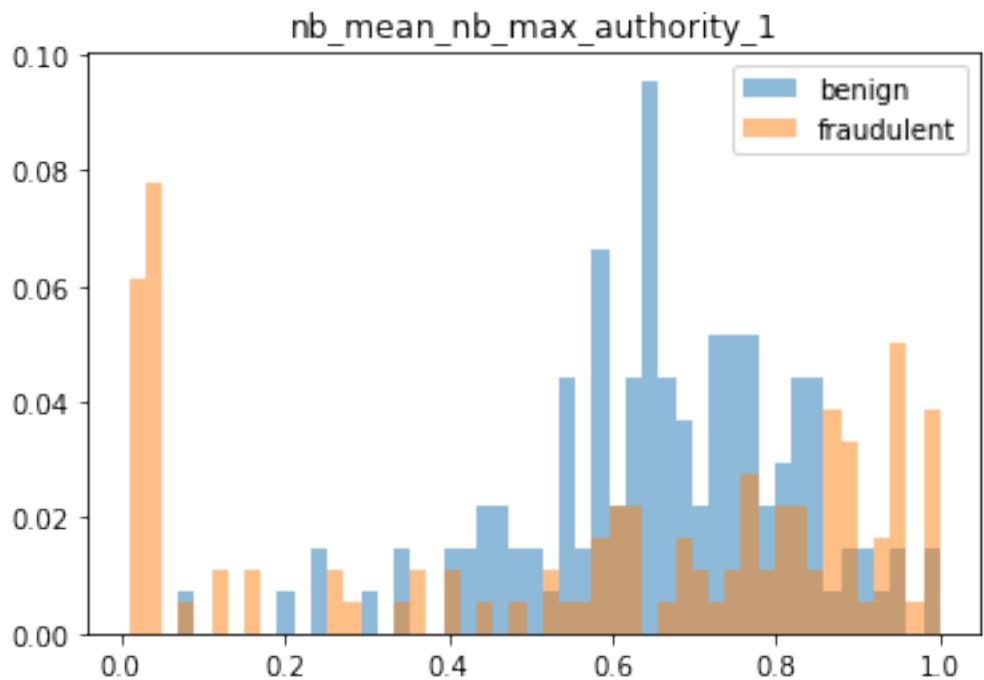
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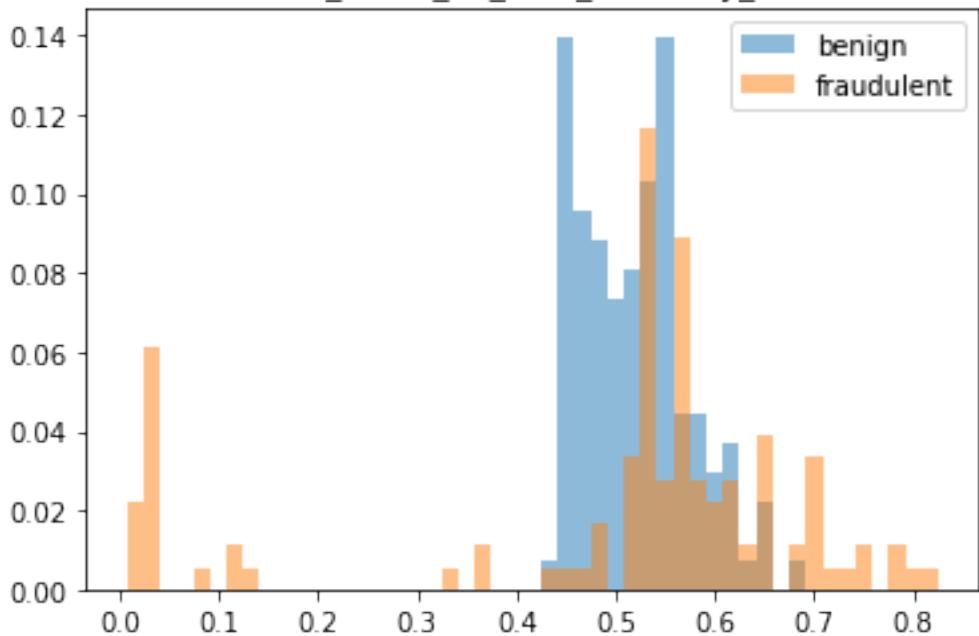
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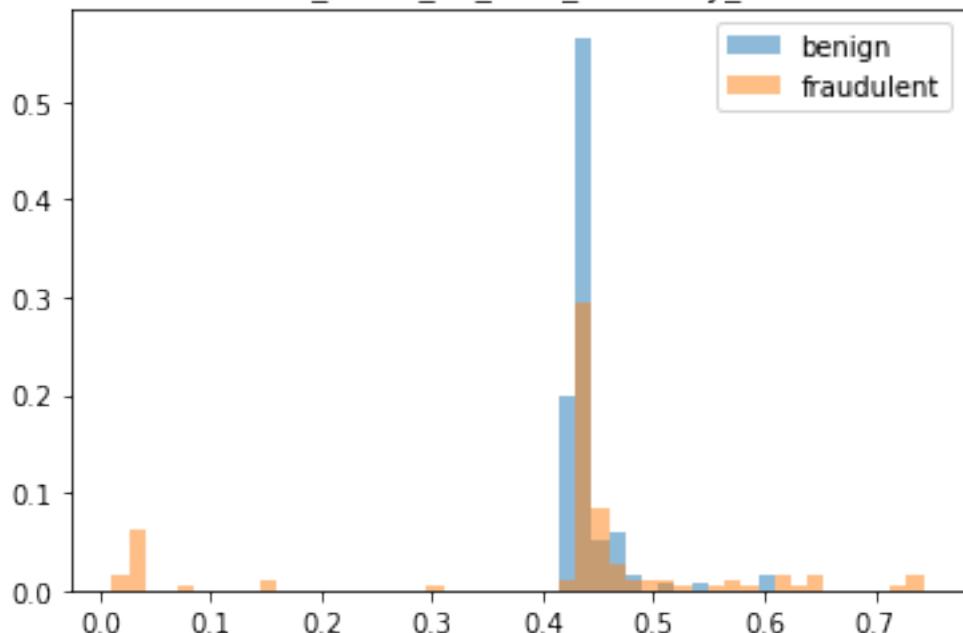




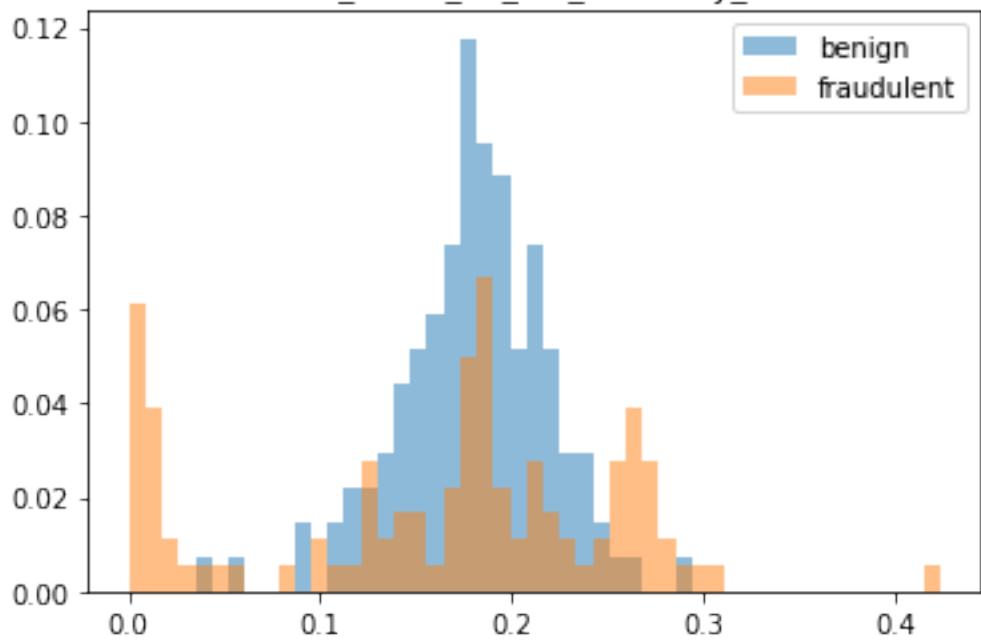
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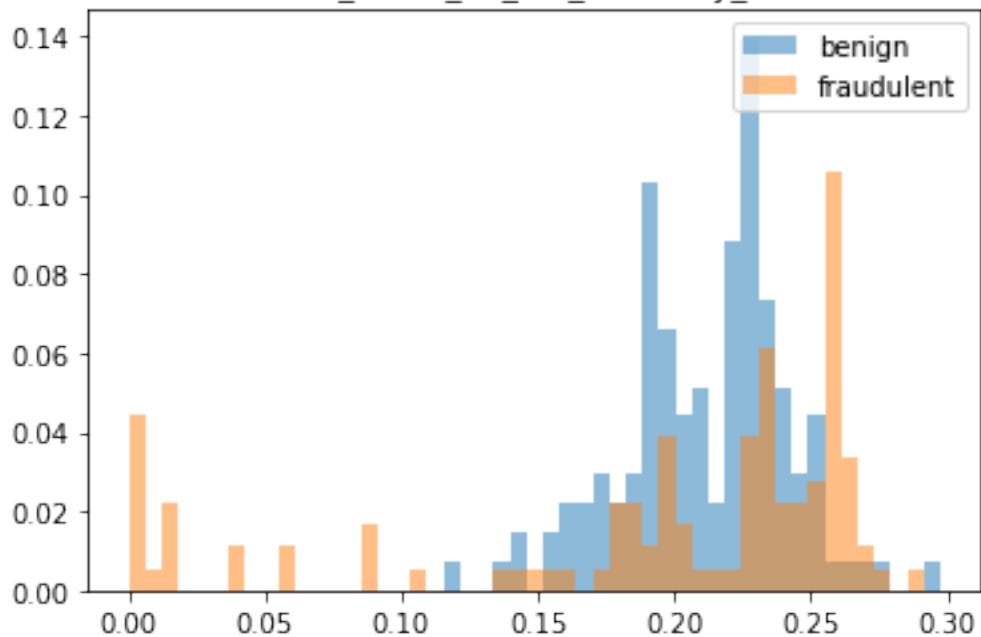
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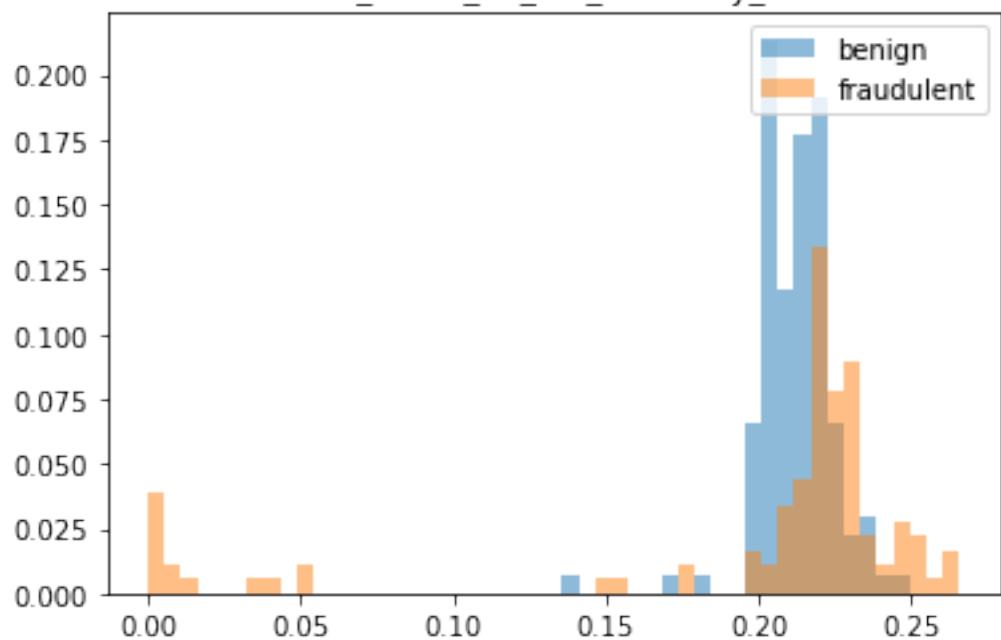
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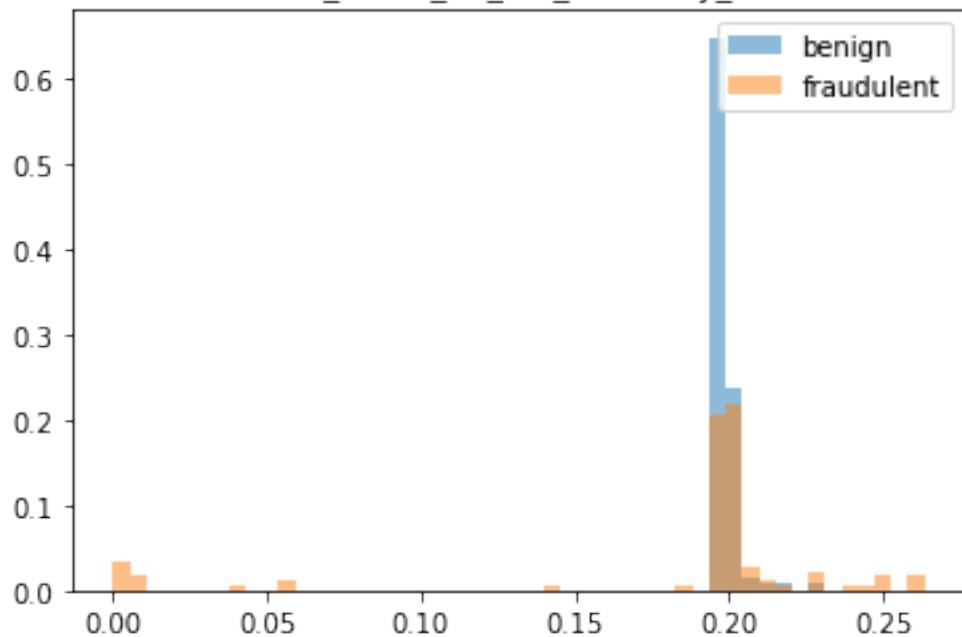
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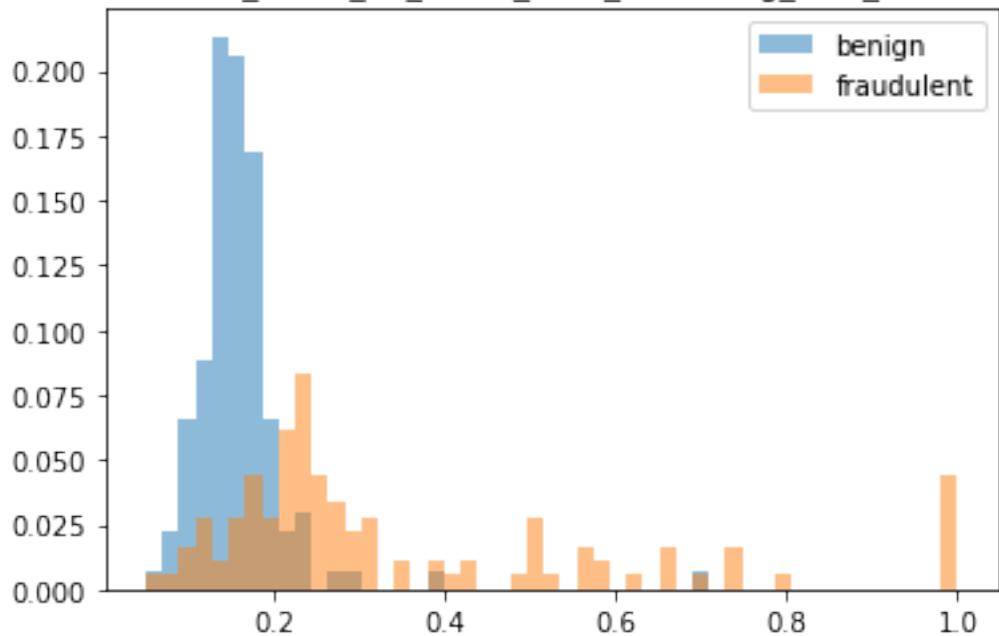
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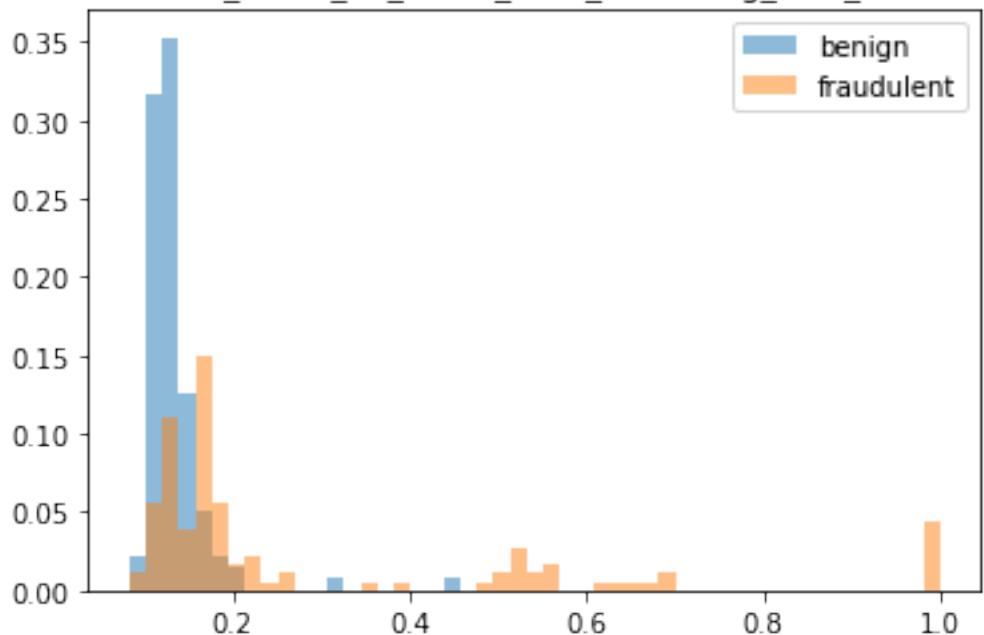
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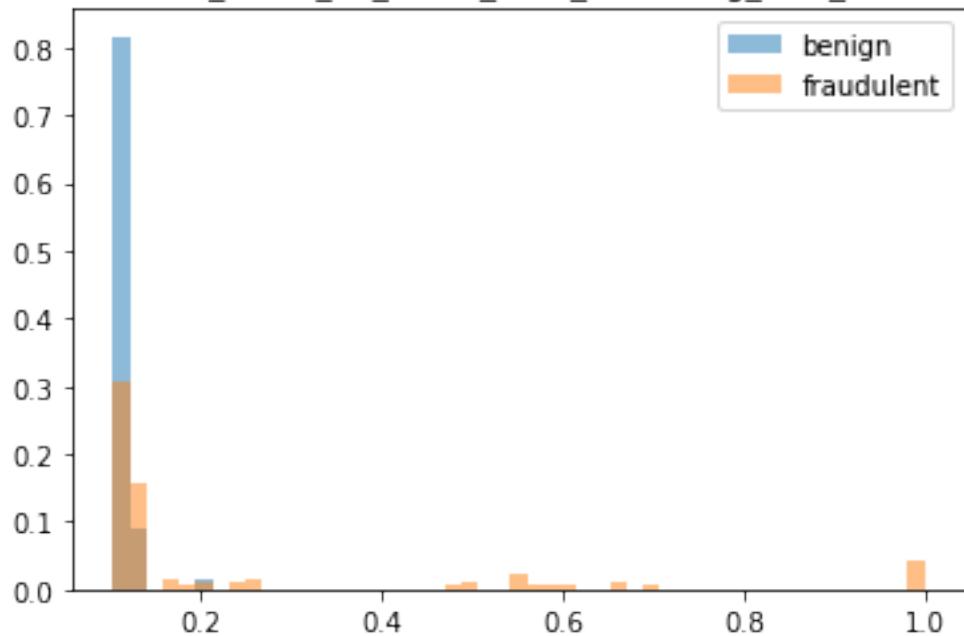
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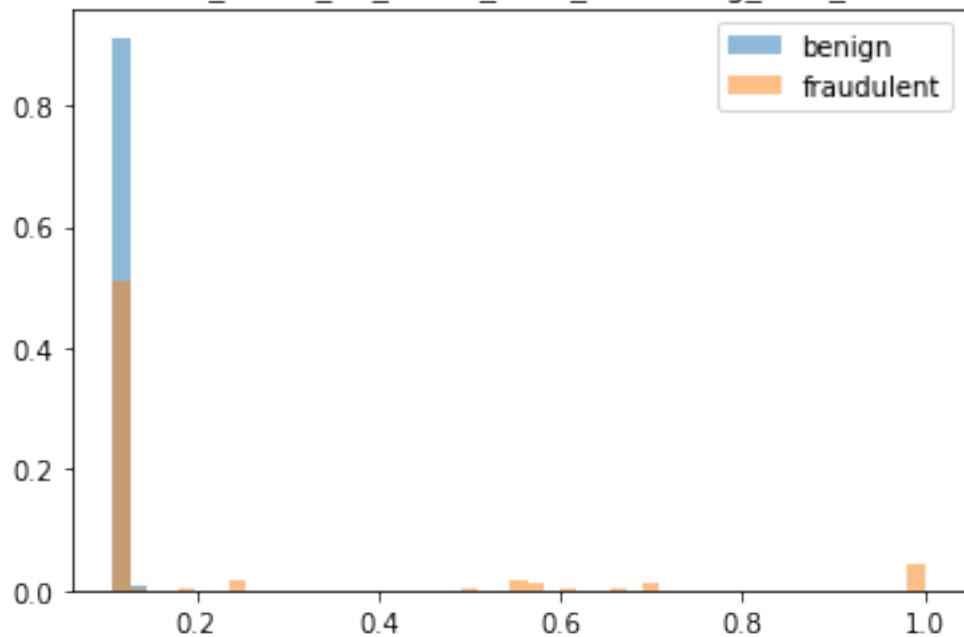
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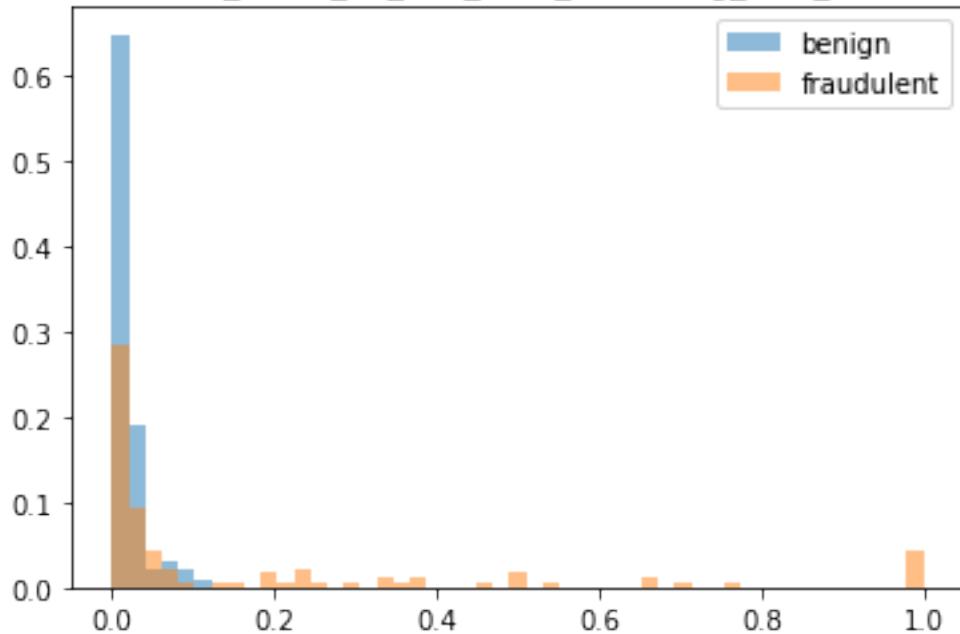
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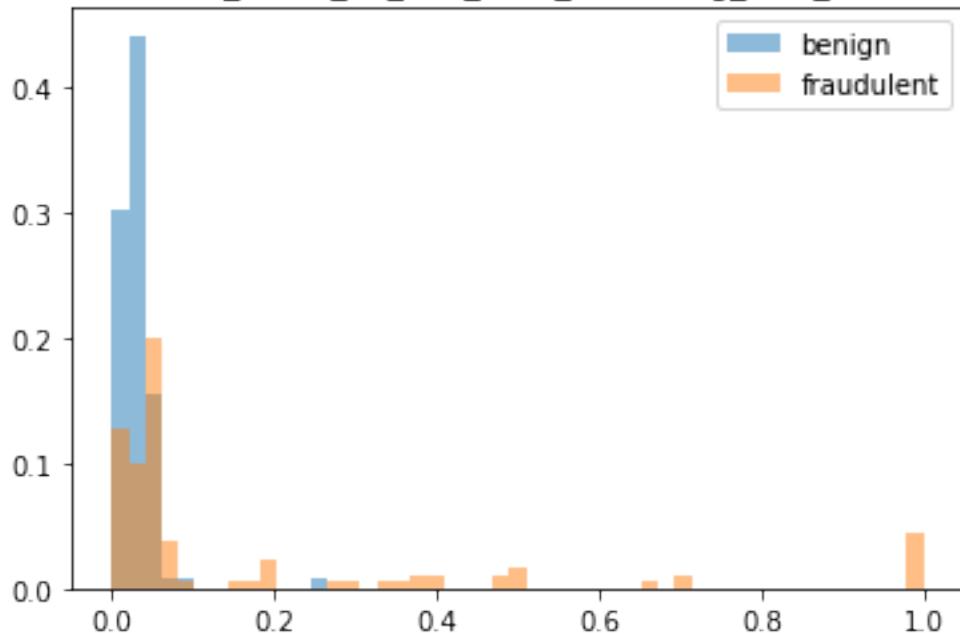
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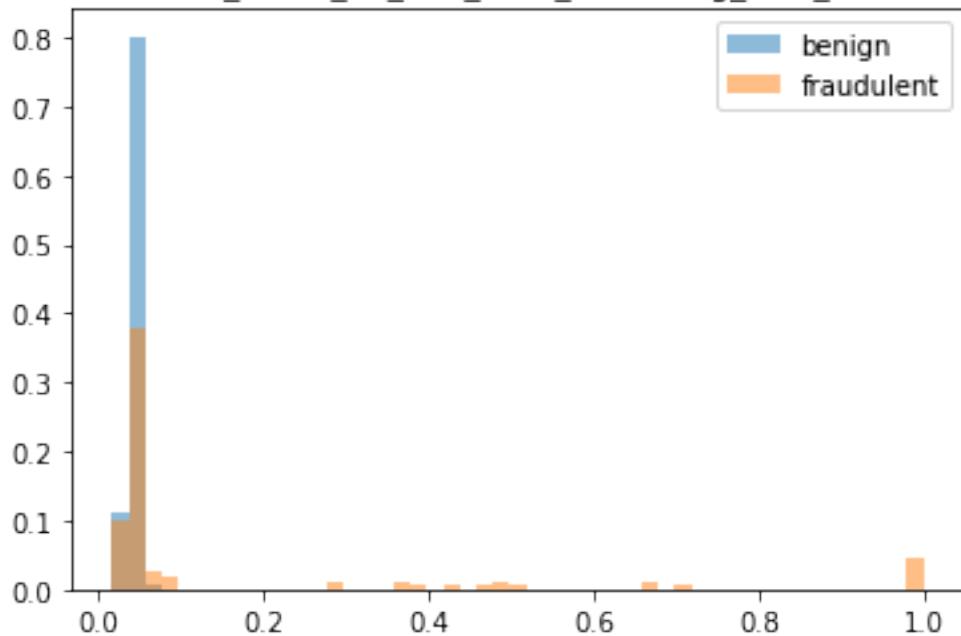
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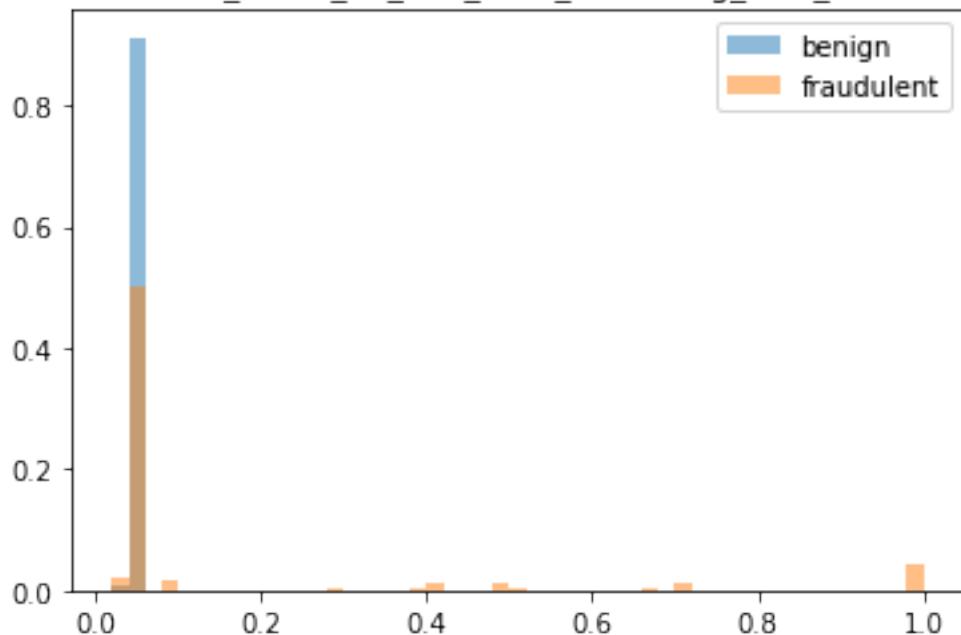
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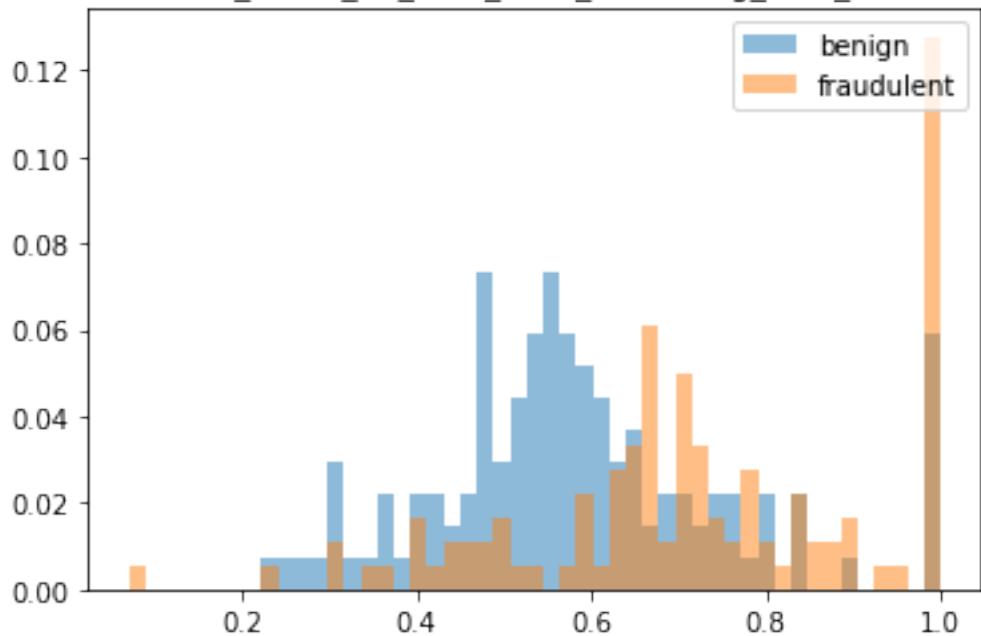
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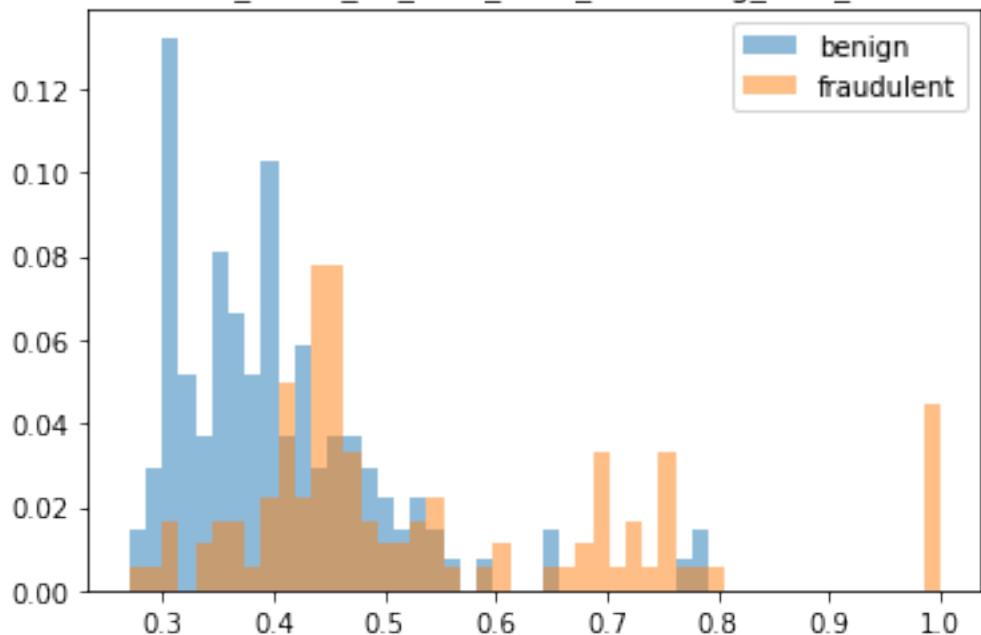
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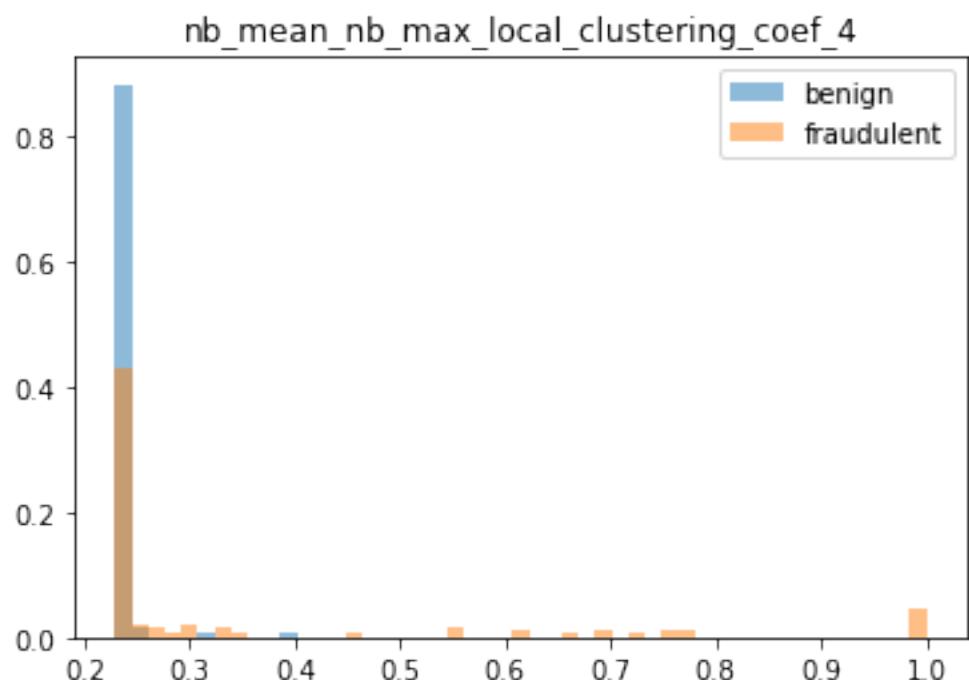
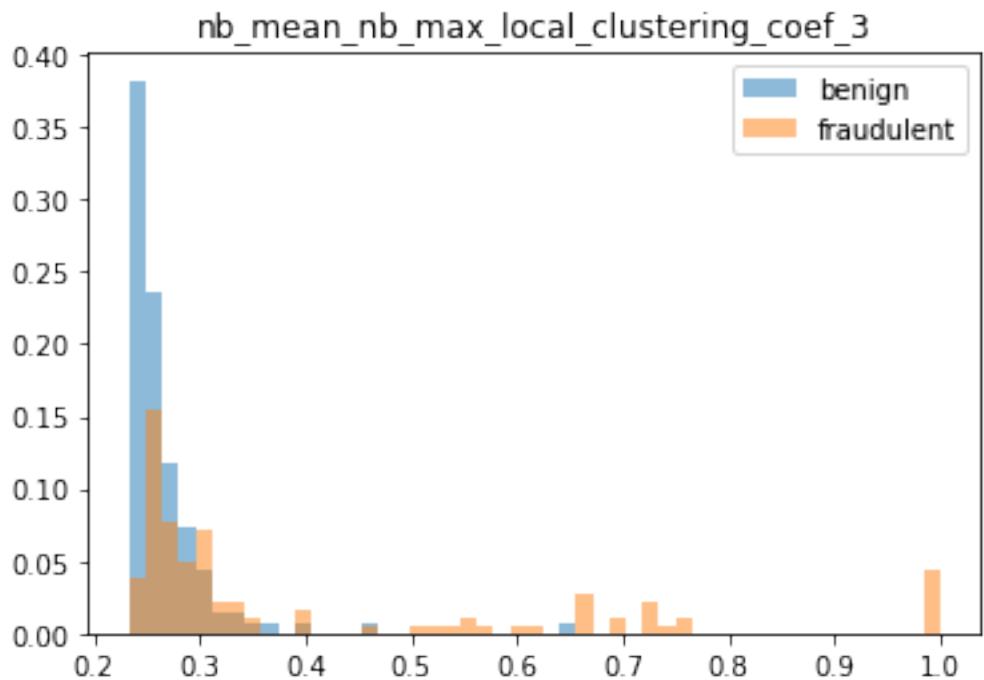


nb_mean_nb_max_local_clustering_coef_1

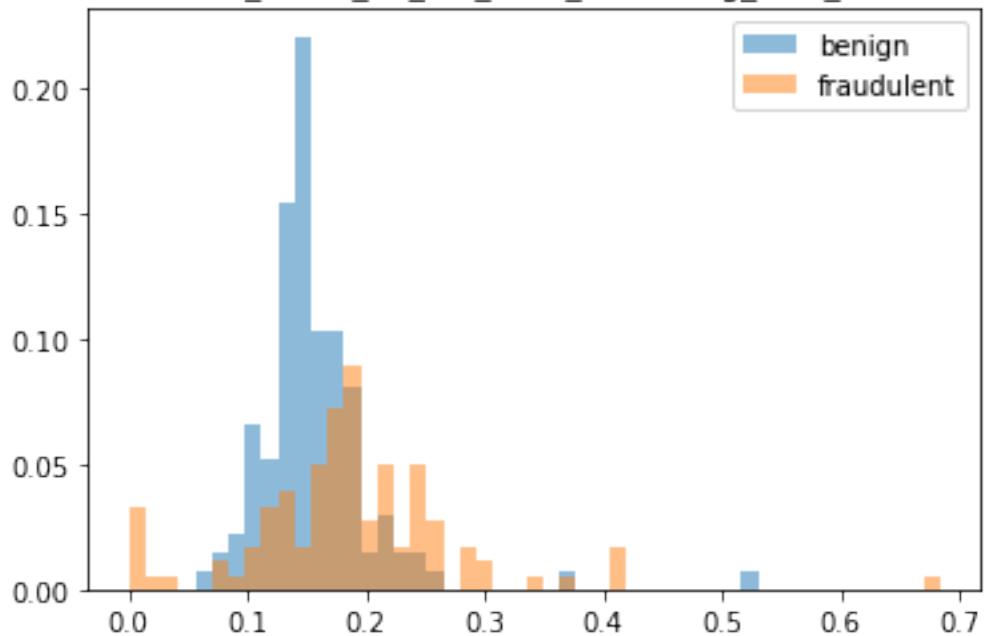


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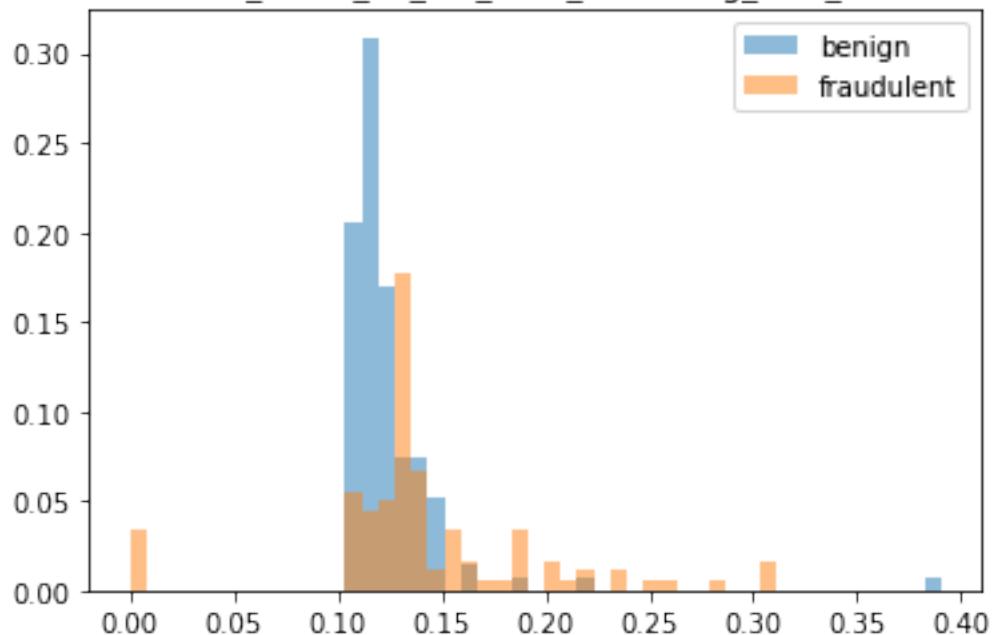




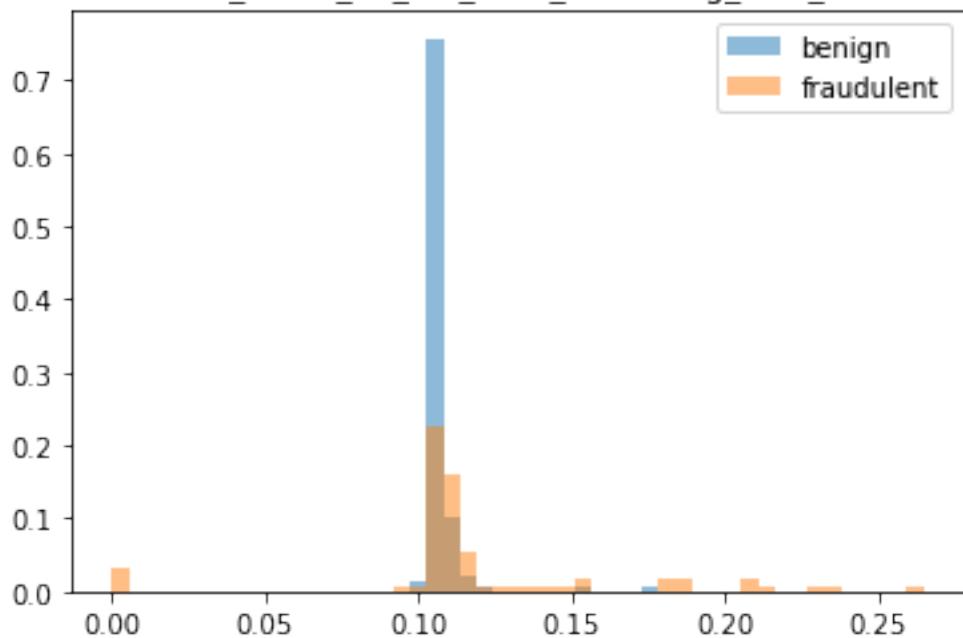
nb_mean_nb_std_local_clustering_coef_1



nb_mean_nb_std_local_clustering_coef_2



nb_mean_nb_std_local_clustering_coef_3



nb_mean_nb_std_local_clustering_coef_4

