Cisco – Ariel University
API Security Detection Challenge 2023

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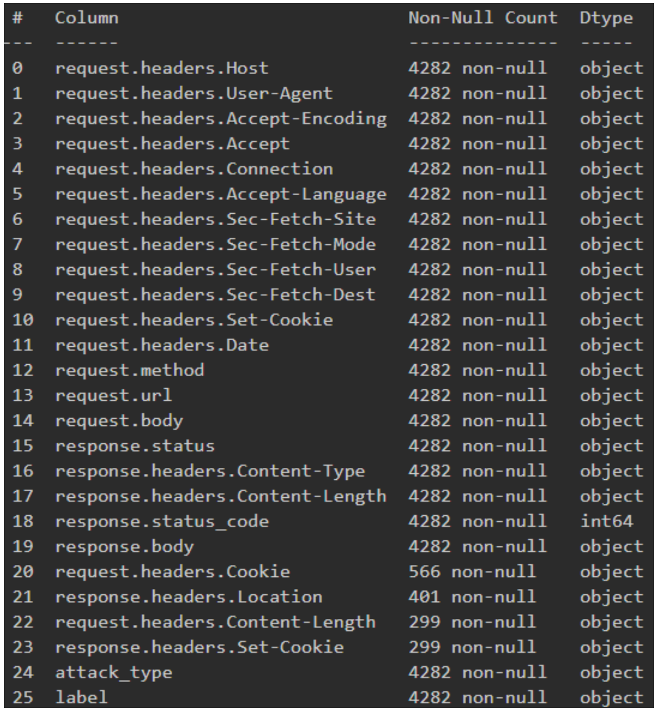
GitHub Link

Original Features

We have 6 datasets, each with the same original features.

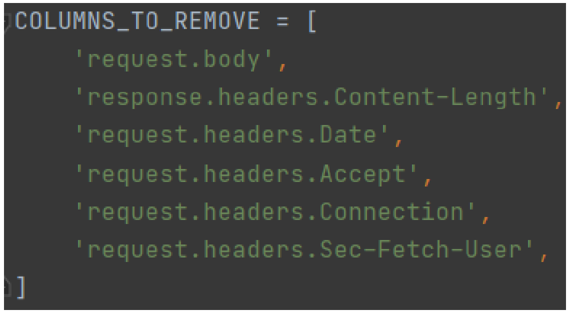


```
#   Column                           Non-Null Count  Dtype
---  ------                           --------------  -----
0   request.headers.Host             4282 non-null   object
1   request.headers.User-Agent       4282 non-null   object
2   request.headers.Accept-Encoding  4282 non-null   object
3   request.headers.Accept           4282 non-null   object
4   request.headers.Connection       4282 non-null   object
5   request.headers.Accept-Language  4282 non-null   object
6   request.headers.Sec-Fetch-Site   4282 non-null   object
7   request.headers.Sec-Fetch-Mode   4282 non-null   object
8   request.headers.Sec-Fetch-User   4282 non-null   object
9   request.headers.Sec-Fetch-Dest   4282 non-null   object
10  request.headers.Set-Cookie       4282 non-null   object
11  request.headers.Date             4282 non-null   object
12  request.method                   4282 non-null   object
13  request.url                      4282 non-null   object
14  request.body                     4282 non-null   object
15  response.status                  4282 non-null   object
16  response.headers.Content-Type    4282 non-null   object
17  response.headers.Content-Length  4282 non-null   object
18  response.status_code             4282 non-null   int64
19  response.body                    4282 non-null   object
20  request.headers.Cookie           566 non-null    object
21  response.headers.Location        401 non-null    object
22  request.headers.Content-Length   299 non-null    object
23  response.headers.Set-Cookie      299 non-null    object
24  attack_type                      4282 non-null   object
25  label                            4282 non-null   object
```

Preprocessing Data

In each dataset, we repeat the same preprocessing for our specific dataset:

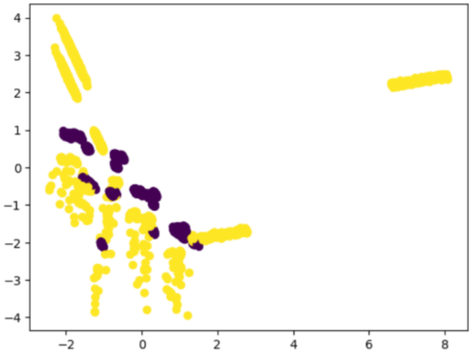
- Replace all Nan values with the string 'Null‘
- Check the correlation of the features
- Remove columns that have:
    - Same values for all rows
    - More then 90% ‘Null’ values
- Create new features from URL

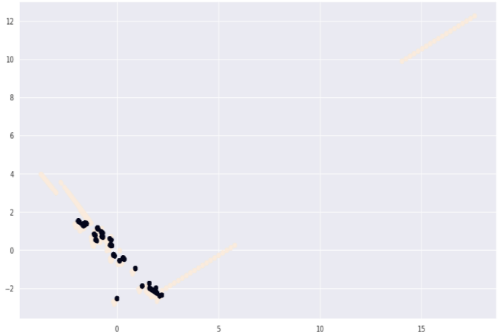


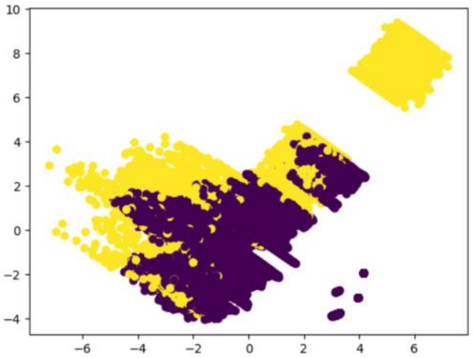
```
COLUMNS_TO_REMOVE = [
    'request.body',
    'response.headers.Content-Length',
    'request.headers.Date',
    'request.headers.Accept',
    'request.headers.Connection',
    'request.headers.Sec-Fetch-User',
]
```

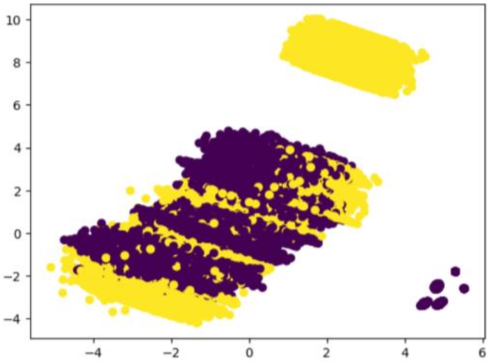
PCA in 2D

Compressing the data into two components allows us to analyze its distribution.



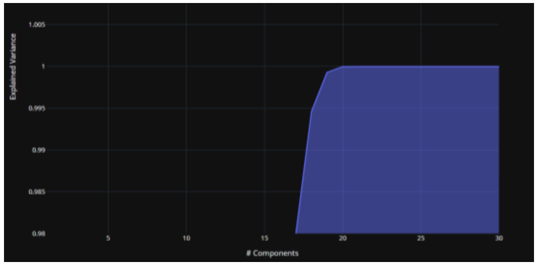


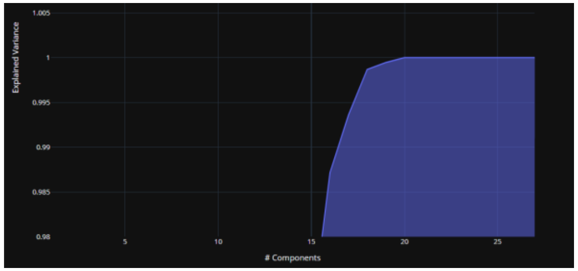


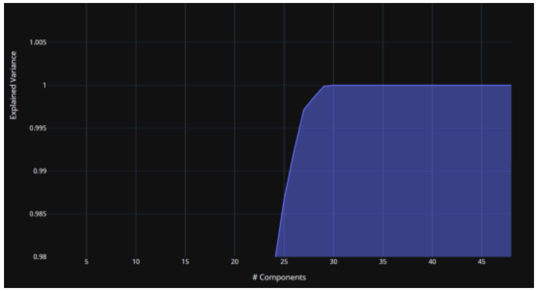


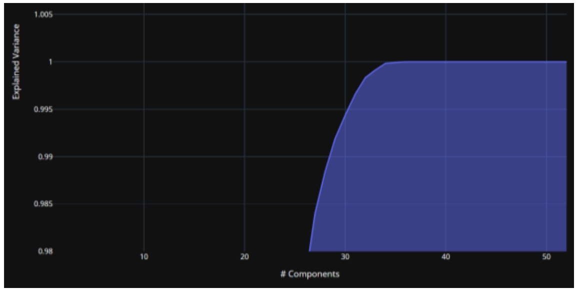
PCA - Ratio

Using this ratio, we can find out how much information we lose compared to how many features we have.









Important Feature

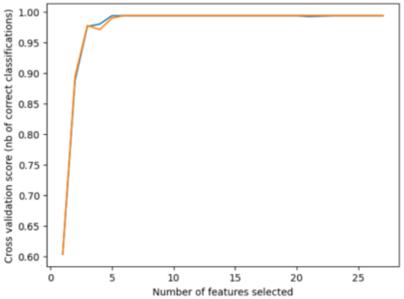
Then, we Identify the importance of features using the following models:

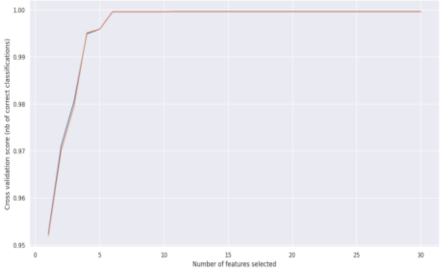
- Random Forest
- Ada Boost
- Gradient Boosting
- Linear SVM
- Decision Tree
- Extra Tree

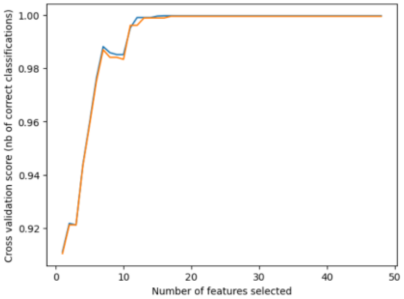
Feature Selection

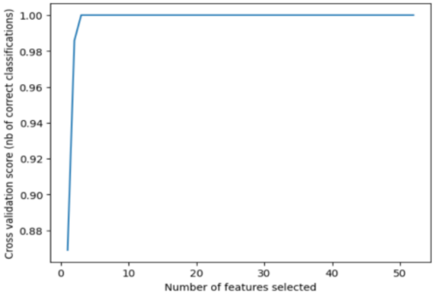
Using RFECV we found the optimal number of features.

Now, a grid search object finds the best hyperparameters for the model.









Random Forest Classifier

The RandomForestClassifier is an ensemble learning algorithm that uses multiple decision trees to predict the future.

Except for Task_4_Attach, which was 97% accurate, our model was 100% accurate across all datasets.

We then repeat our preprocessing steps for the test data, just as we did for the training data.

The END

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