IOT Security Gateway

Intrusion Detection In IOT Nets

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Systems Lab

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How detection is done?

Methods and Models

Results

References

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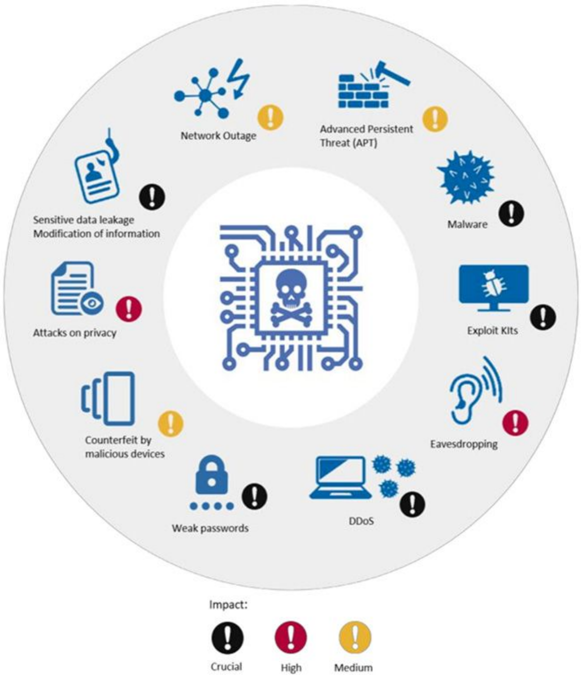
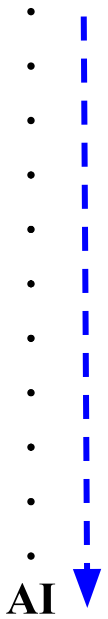
How detection is done?

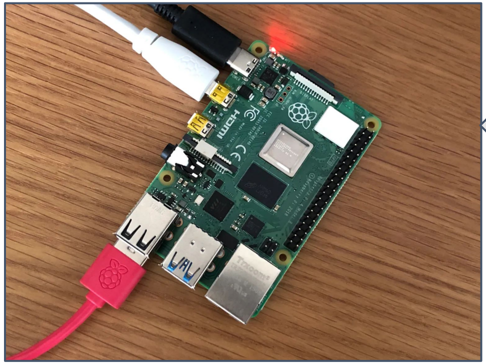


[1]

- Heuristic Analysis
- Signature-Based Detection



Real and Infected IOT Devices



[6]

[6]

3 Real IOT Devices : [4]

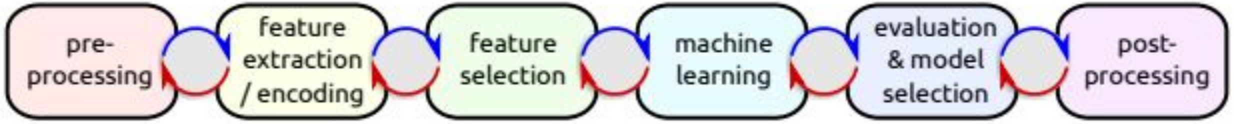
- Philips HUE smart LED lamp
- Amazon Echo home intelligent personal assistant
- Somfy smart doorlock

[4]

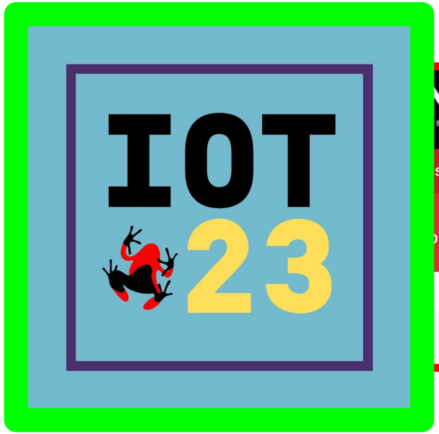
[4]

[4]

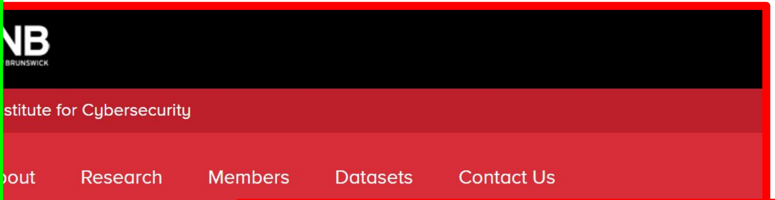
ML design cycle



Dataset Selection



[4]



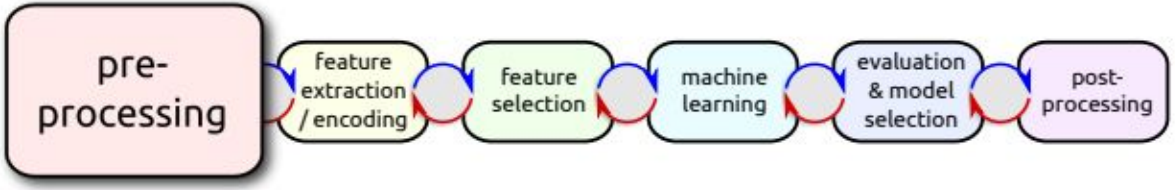
[2]

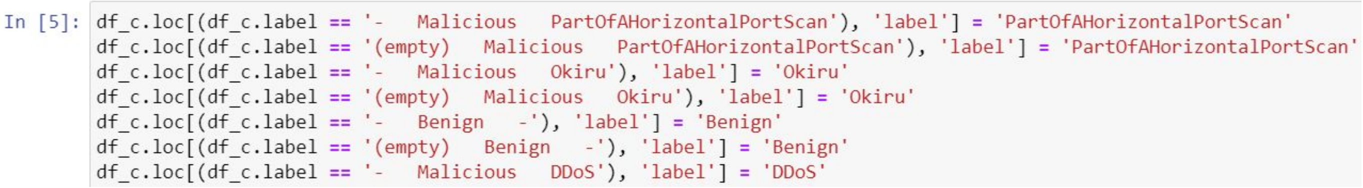
IoT Traffic Generation Patterns Dataset

Traffic Generation Patterns of 10000 IoT devices (incl. Attributes of Devices)

[3]

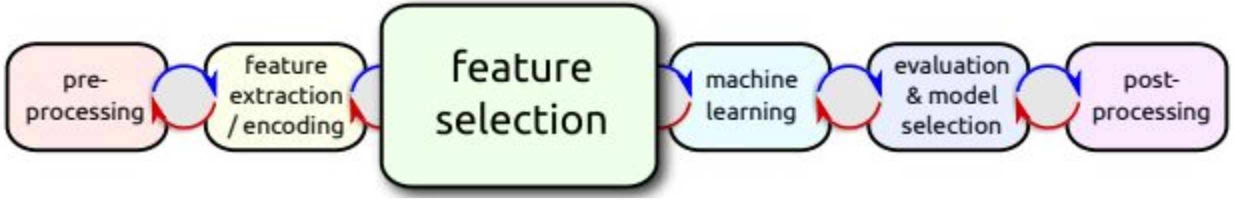
Pre-processing

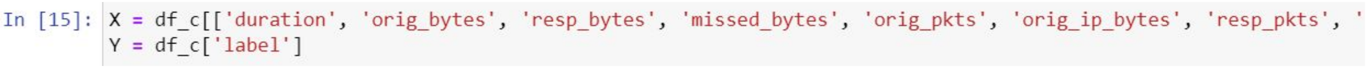




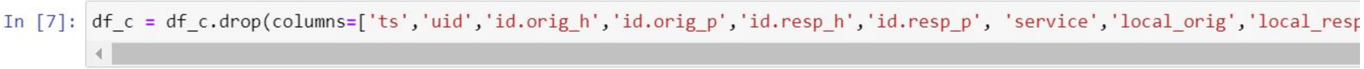
```
In [5]: df_c.loc[(df_c.label == '-   Malicious   PartOfAHorizontalPortScan'), 'label'] = 'PartOfAHorizontalPortScan'
        df_c.loc[(df_c.label == '(empty)   Malicious   PartOfAHorizontalPortScan'), 'label'] = 'PartOfAHorizontalPortScan'
        df_c.loc[(df_c.label == '-   Malicious   Okiru'), 'label'] = 'Okiru'
        df_c.loc[(df_c.label == '(empty)   Malicious   Okiru'), 'label'] = 'Okiru'
        df_c.loc[(df_c.label == '-   Benign   -'), 'label'] = 'Benign'
        df_c.loc[(df_c.label == '(empty)   Benign   -'), 'label'] = 'Benign'
        df_c.loc[(df_c.label == '-   Malicious   DDoS'), 'label'] = 'DDoS'
```

Feature selection



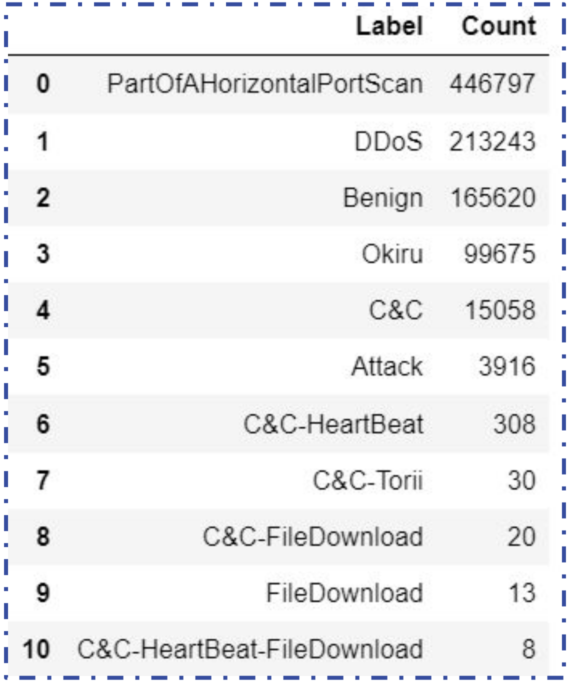


```
In [15]: X = df_c[['duration', 'orig_bytes', 'resp_bytes', 'missed_bytes', 'orig_pkts', 'orig_ip_bytes', 'resp_pkts', '
         Y = df_c['label']
```



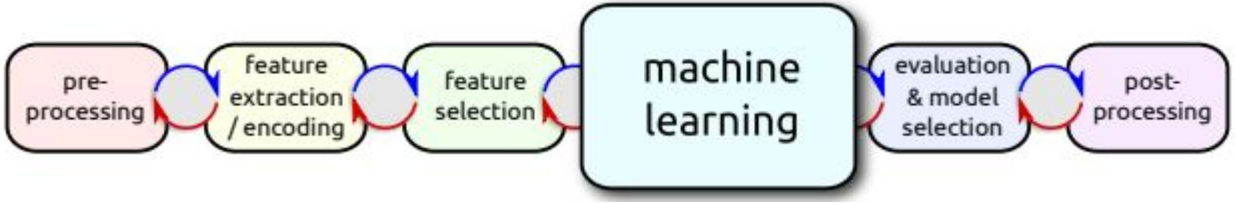
```
In [7]: df_c = df_c.drop(columns=['ts','uid','id.orig_h','id.orig_p','id.resp_h','id.resp_p', 'service','local_orig','local_resp
```

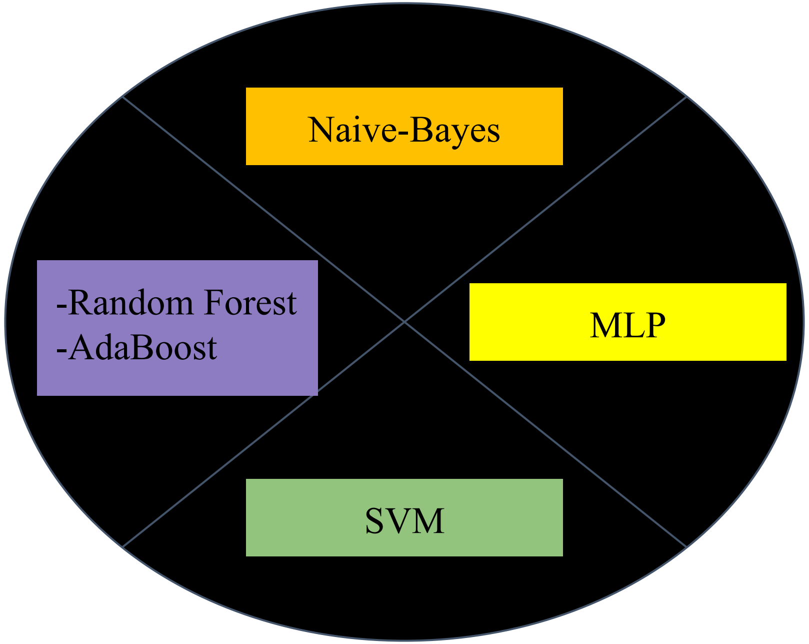
Label overview



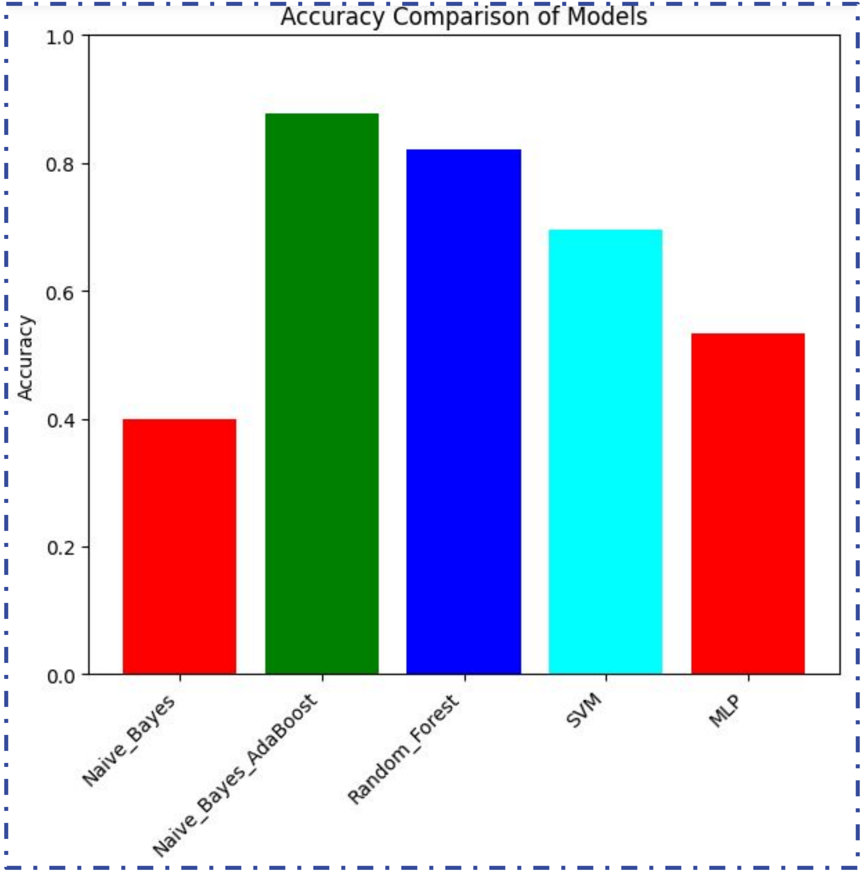
	Label	Count
0	PartOfAHorizontalPortScan	446797
1	DDoS	213243
2	Benign	165620
3	Okiru	99675
4	C&C	15058
5	Attack	3916
6	C&C-HeartBeat	308
7	C&C-Torii	30
8	C&C-FileDownload	20
9	FileDownload	13
10	C&C-HeartBeat-FileDownload	8

Models


pre-processing
feature extraction / encoding
feature selection
machine learning
evaluation & model selection
post-processing


Naive-Bayes
-Random Forest
-AdaBoost
MLP
SVM

Accuracy and confusion matrix



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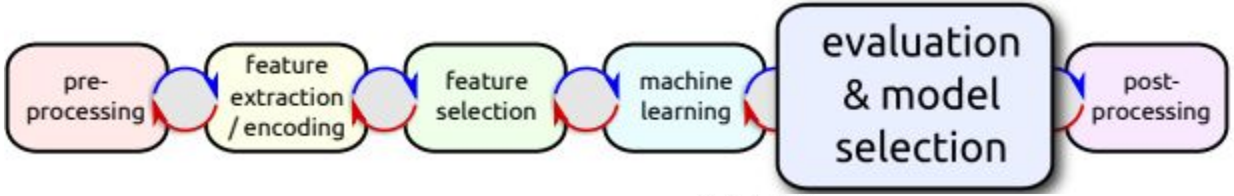
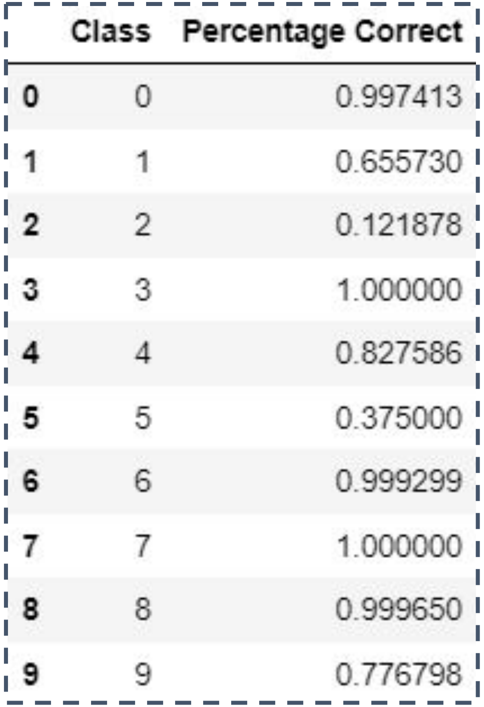
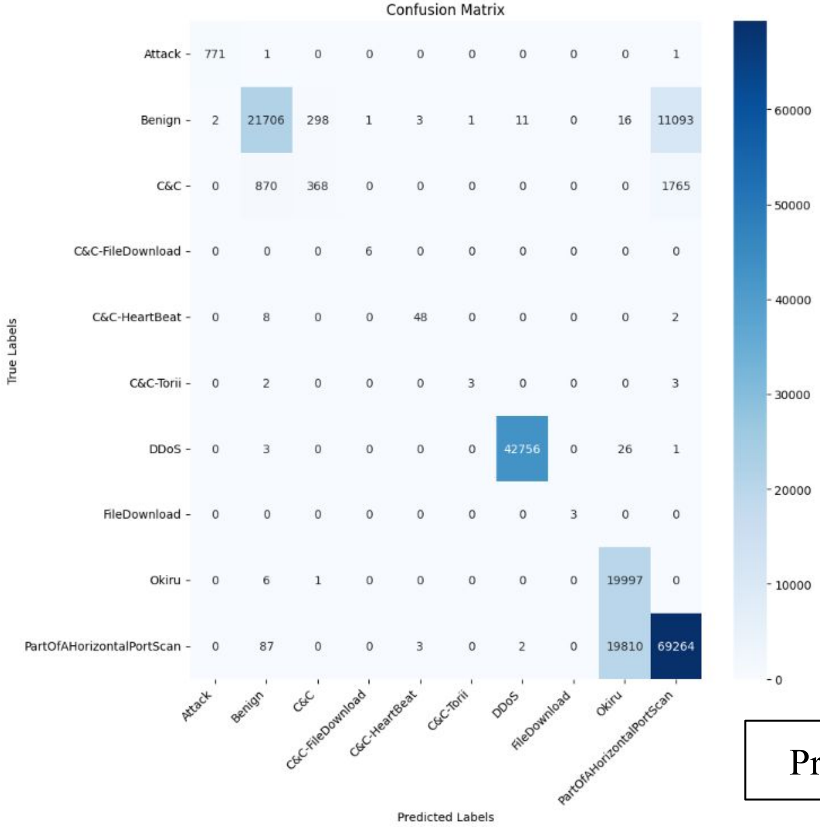




	Class	Percentage Correct
0	0	0.997413
1	1	0.655730
2	2	0.121878
3	3	1.000000
4	4	0.827586
5	5	0.375000
6	6	0.999299
7	7	1.000000
8	8	0.999650
9	9	0.776798

Random-Forest



Confusion Matrix

	Attack	Benign	C&C	C&C-FileDownload	C&C-HeartBeat	C&C-Torii	DDoS	FileDownload	Okiru	PartOfAHorizontalPortScan
Attack	771	1	0	0	0	0	0	0	0	1
Benign	2	21706	298	1	3	1	11	0	16	11093
C&C	0	870	368	0	0	0	0	0	0	1765
C&C-FileDownload	0	0	0	6	0	0	0	0	0	0
C&C-HeartBeat	0	8	0	0	48	0	0	0	0	2
C&C-Torii	0	2	0	0	0	3	0	0	0	3
DDoS	0	3	0	0	0	0	42756	0	26	1
FileDownload	0	0	0	0	0	0	0	3	0	0
Okiru	0	6	1	0	0	0	0	0	19997	0
PartOfAHorizontalPortScan	0	87	0	0	3	0	2	0	19810	69264

Prof. Dr. Josif Grabocka

References

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Questions

Thank YOU

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