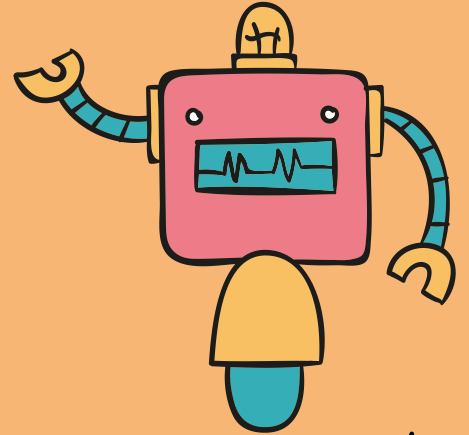
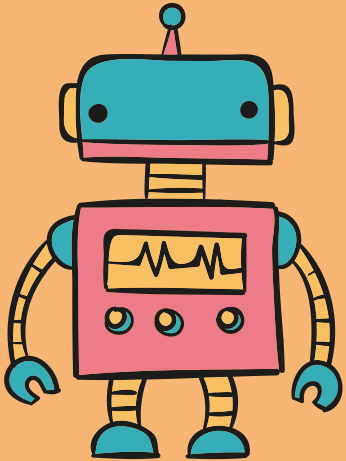


Solving Malware Classification Task using Python

Student: Yana Cherepinina
Matriculation number: 28345





My interests:

data analysis and visualization;
machine learning; cybersecurity-related
data analytics

Topic is important because:

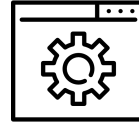
application of machine learning
techniques for malware detection
allows to keep pace with malware
evolution and combat security threats
more effectively compared to other
methods.

Terms



Malware

software that is specifically designed to disrupt, damage, or gain unauthorized access to a computer system

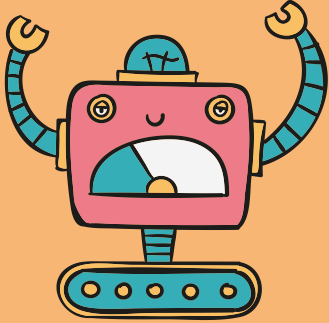


Benign Ware

ordinary software without any malicious activity

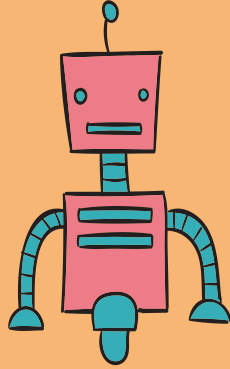
Main Steps

+



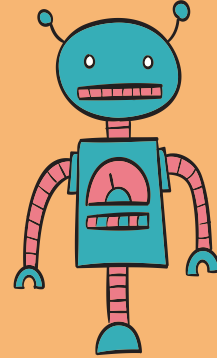
01

Dataset collection



02

Data reduction



03

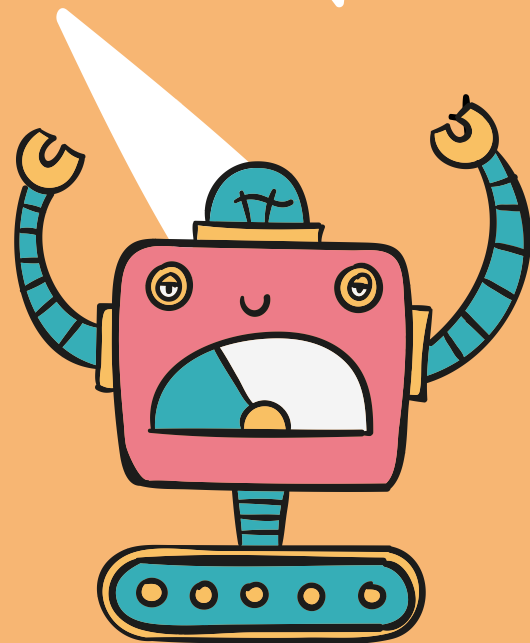
Building a machine learning model

01.

Dataset collection

With data collection, “the sooner the better”, is always the best answer.

—Marissa Mayer



Problem

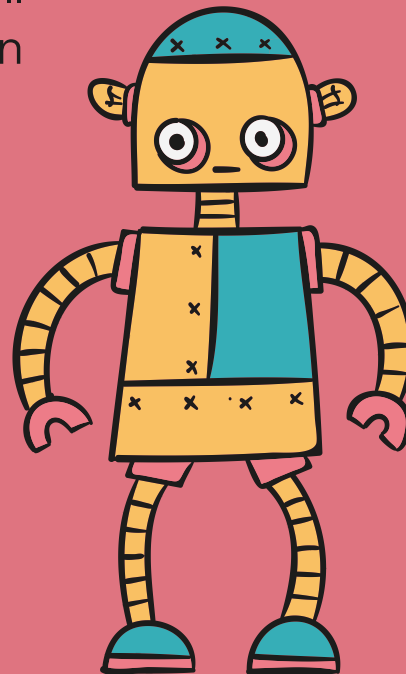
Create a dataset with features that will help the system distinguish between good and bad files:



find files representing malicious and benign activity



extract features from these files and tabulate them



+

Solution



Found:



3077 binary malicious files



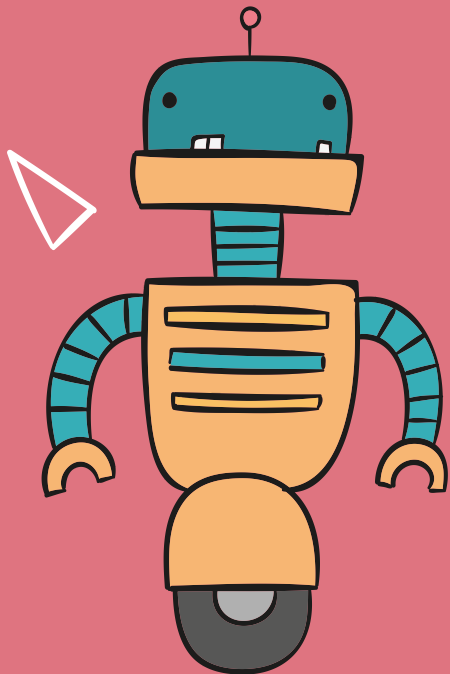
collected from "VX Heavens Virus Collection"



1952 binary benign files



collected on local PC



+



.exe .dll .sys

+

Solution



Extracted:

100 features from binary portable executable files (.exe, .dll, .sys, etc.) using "pefile" python module



pefile

.CSV

IMAGE_DIRECTORY_ENTRY_DEBUG:Size	IMAGE_DIRECTORY_ENTRY_LOAD_CONFIG:Size	IMAGE_DIRECTORY_ENTRY_IAT:Size	...	Target
0	0	880	...	Malware
28	148	1168	...	Benign
0	0	348	...	Malware
0	0	2392	...	Benign
0	0	1632	...	Benign
28	64	600	...	Malware
56	64	852	...	Malware
112	64	528	...	Benign
56	64	468	...	Benign

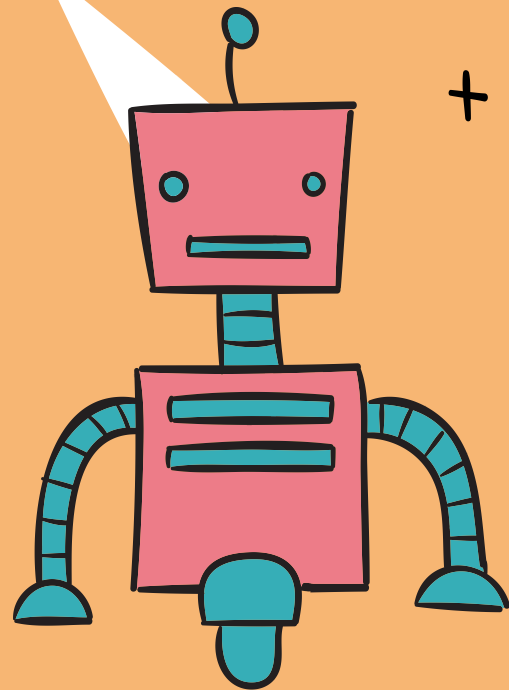
+

02.

Dataset reduction

Redundancy is expensive but
indispensable.

—Jane Jacobs

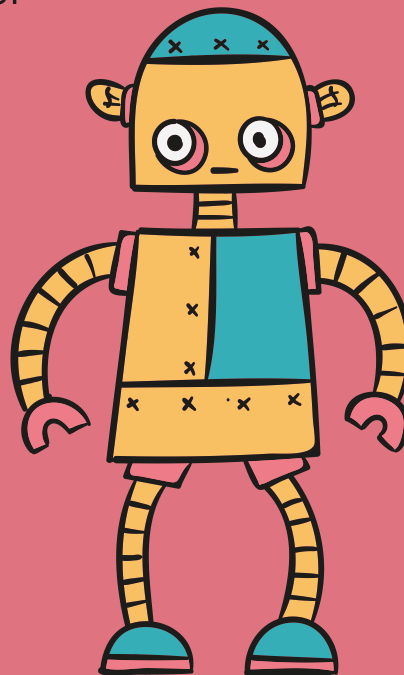


Problem

Select features that yield the most accurate results:

apply data reduction algorithms

obtain dataset with reduced dimensionality



+

Solution



Applied:



Feature importance technique based on Gini importance metric



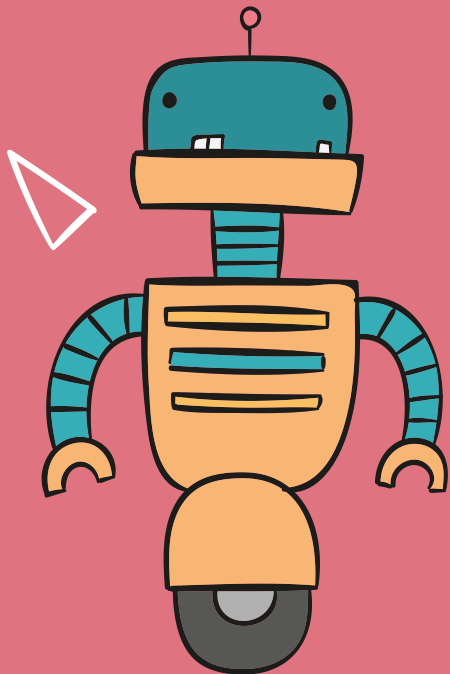
for input features with low correlation



Principal component analysis (PCA)



for input features with high correlation



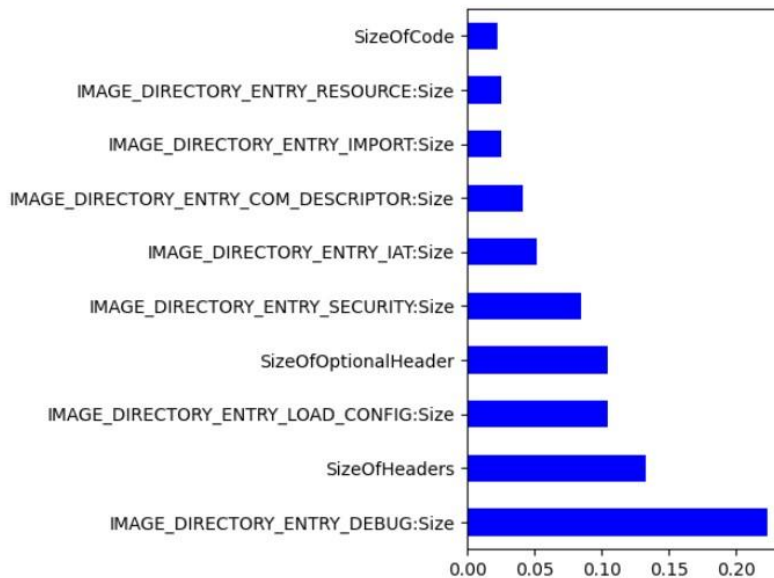
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Solution

Obtained:

10 features with the highest scores; the higher, the more important the feature



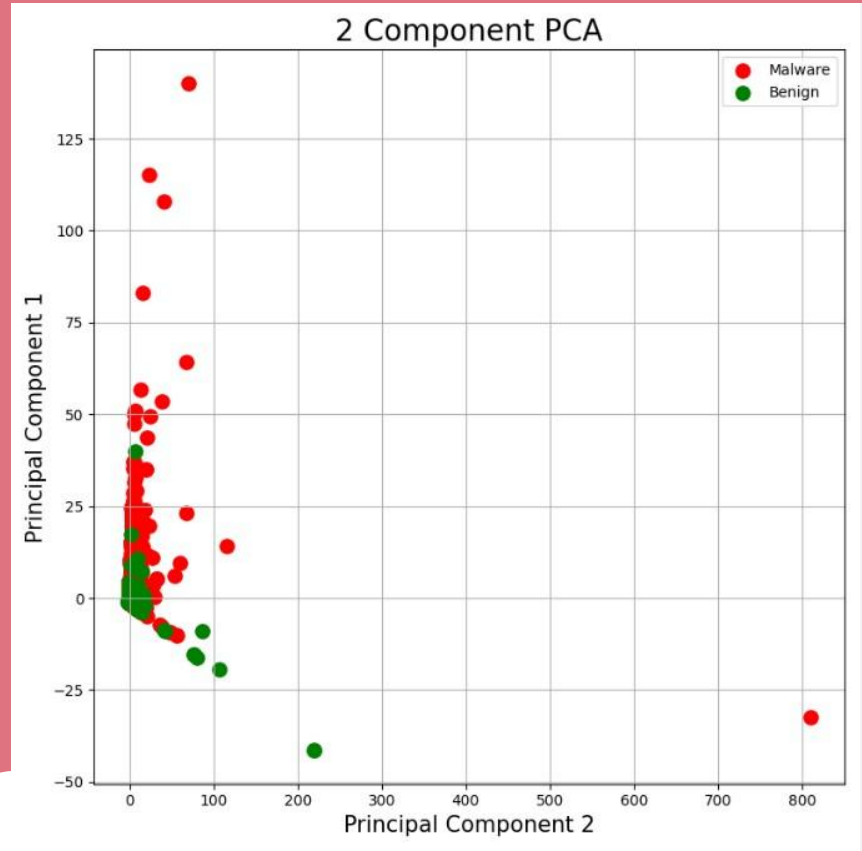
Solution

Obtained:

reduced the dimensionality
of the data from **8** to **2**

Principal component 1 -
78.77% of the variance

Principal component 2 -
13.03% of the variance

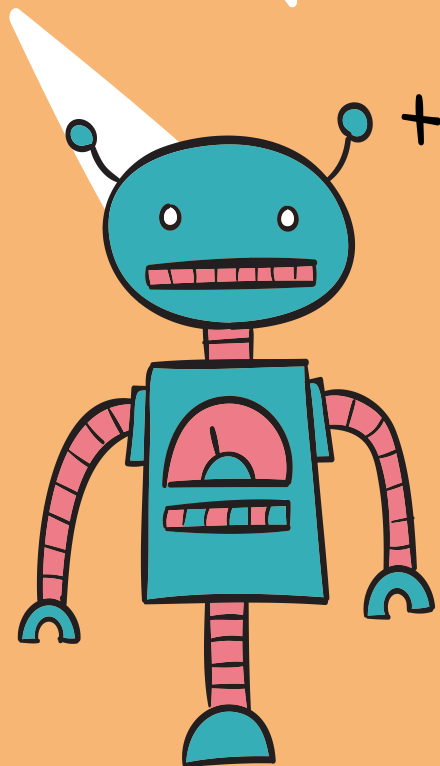


03.

Building a machine learning model

What we want is a machine that can learn from experience.

—Alan Turing

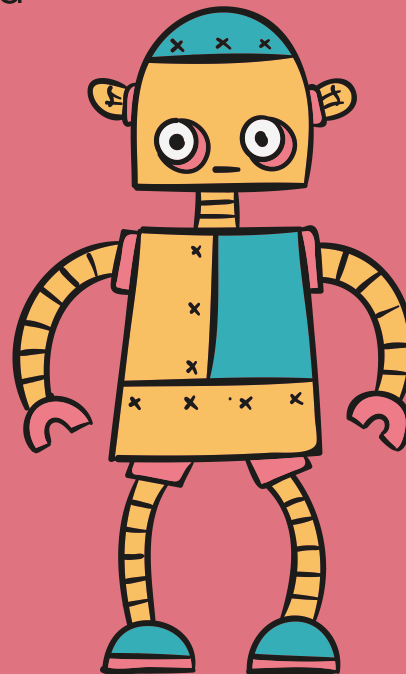


Problem

Determine which file is malicious and which is benign:

split the data into training and validation sets

apply a machine learning algorithm



Solution

The data was split into:

5 equal folds

Each fold was used for both training and validation.



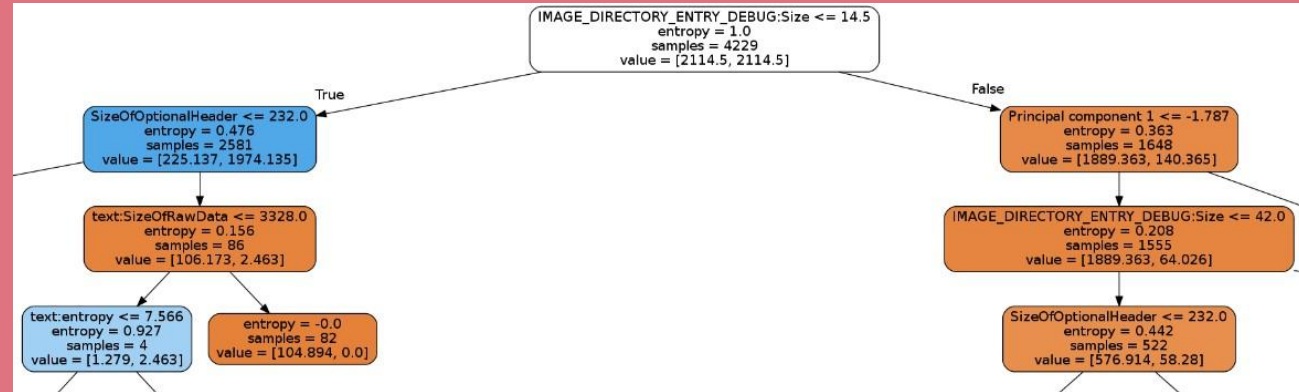
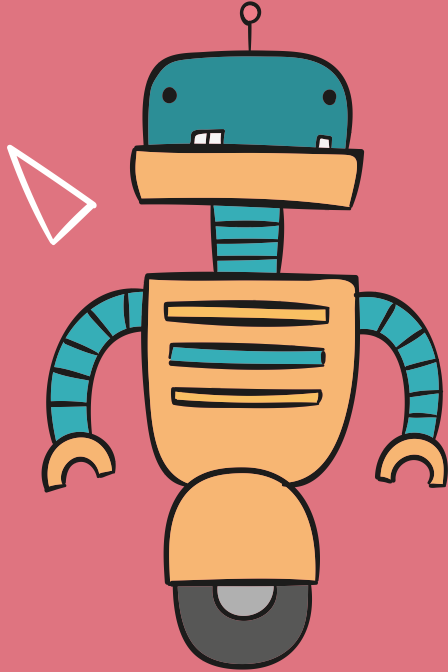
Solution

Applied:

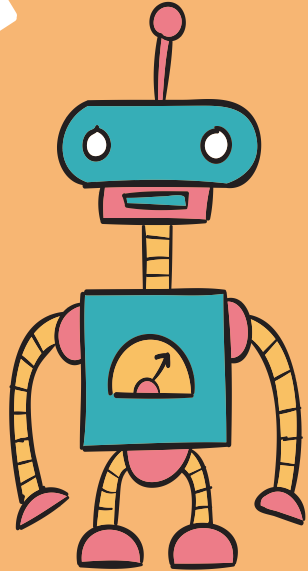
Decision Trees Classifier algorithm.

Built Decision Tree.

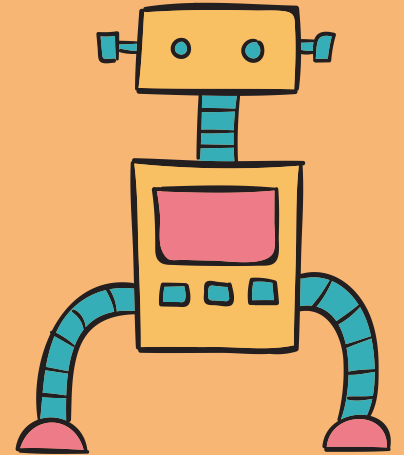
Classification rate (accuracy score): **0.9371**



Libraries & frameworks used



Pandas
Numpy
Pefile
Scikit-learn
Matplotlib
Math



Resources

M. Zubair Shafiq et al. (2009) PE-Miner: Mining Structural Information to Detect Malicious Executables in Realtime. In: Engin Kirda, Somesh Jha, Davide Balzarotti, eds. Recent Advances in Intrusion Detection, 12th International Symposium, Saint-Malo: Springer, pp. 121-141.

California State University (2021) Malware, Trojan, and Spyware. [online], available from: <https://www.csuchico.edu/isec/stories/malware-trojans-spyware.shtml#:~:text=Malware%3A%20Malware%20is%20short%20for,access%20to%20a%20computer%20system.> [accessed 13 June 2021]

Presentation template

CREDITS: This presentation template was created by [Slidesgo](#), including icons by [Flaticon](#), infographics & images by [Freepik](#)

Thanks!

Does anyone have any questions?
chereyana3@gmail.com

Source code



<https://github.com/YanaCh/MalwareAnalysis>

