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ARSENAL

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InOri

Detecting defacement attacks with deep learning

By Nguyen Hoang, Manh Pham & Dong Duong

Nguyen Hoang

I'm a final year student at the Academy of Cryptography Techniques, majoring in information security.

I used to work as a System administrator, DevOps. I specialize in building and developing CDN systems, but gradually fell in love with security tinkering.

Currently, working as a security solutions consultant and a penetration tester.

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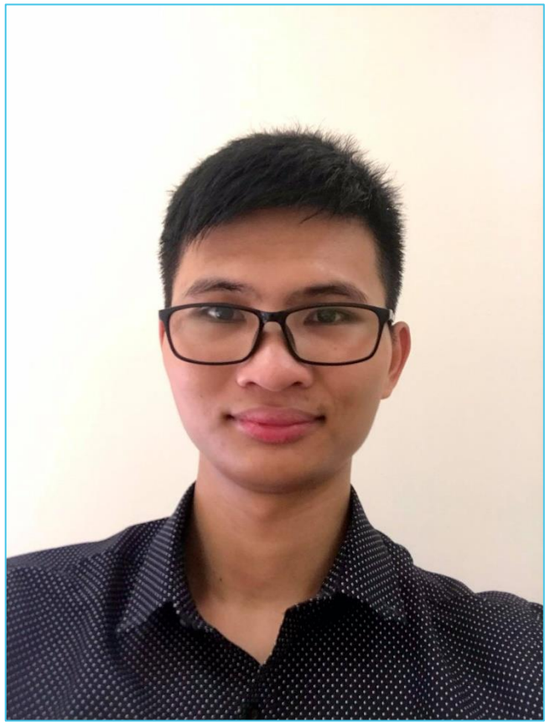

Manh Pham

A security researcher from Vietnam. With over 4 years dedicated in Information security.

Acknowledged by Microsoft, Google, Facebook, Apple, Offensive Security, etc.

Now, I work for NashTech as a Penetration Tester and also join OWASP as a Contributor

Contact: https://linkedin.com/in/manhnho/

Dong Duong

A student from Phan Dinh Phung highschool.

Software developer, Linux system administrator and security researcher.

Recently acknowledged by Microsoft

Contact: https://cu64.github.io/

Agenda

1. Motivation
2. Building model Machine Learning
3. Alert system development
4. Experiment and evaluation

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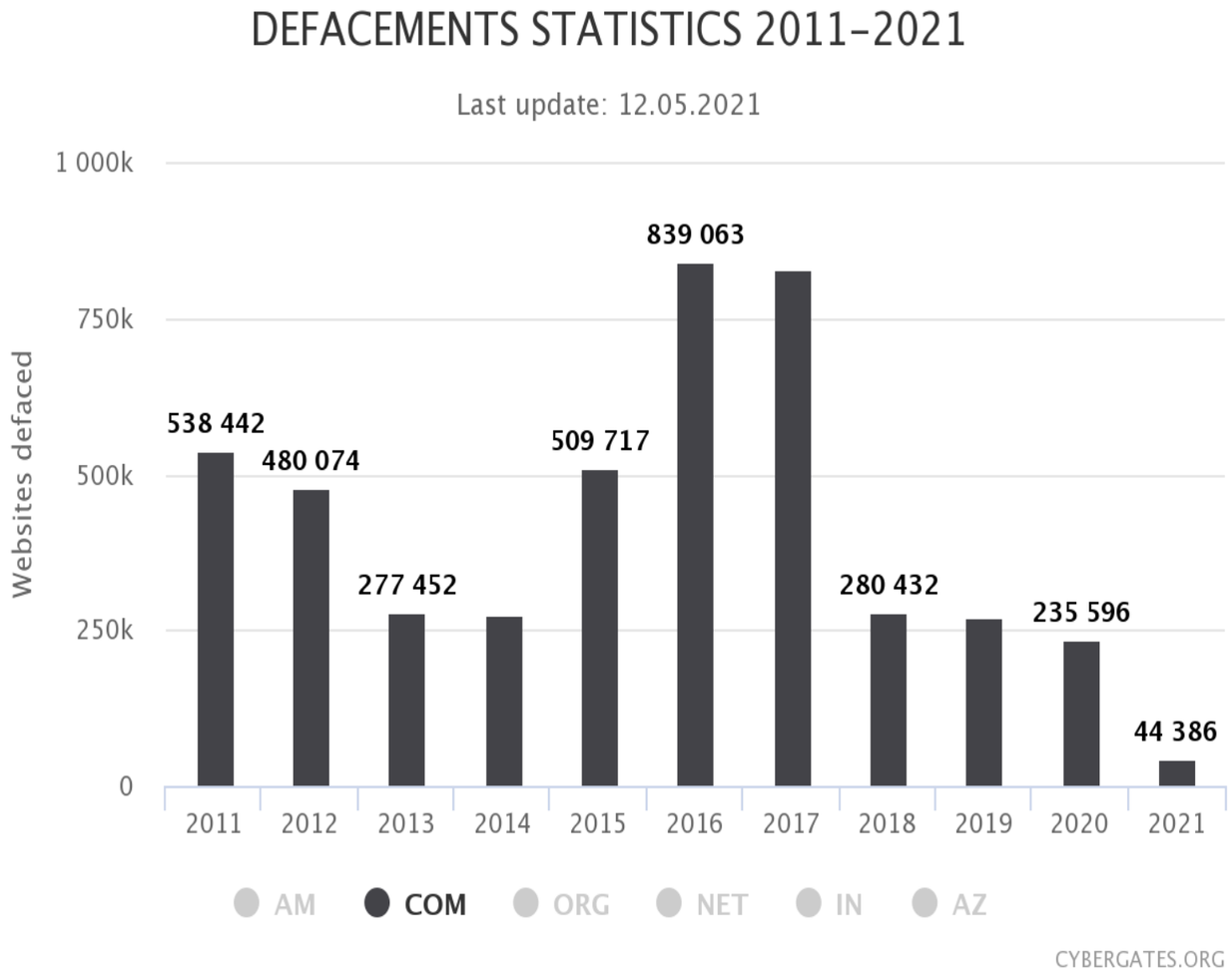
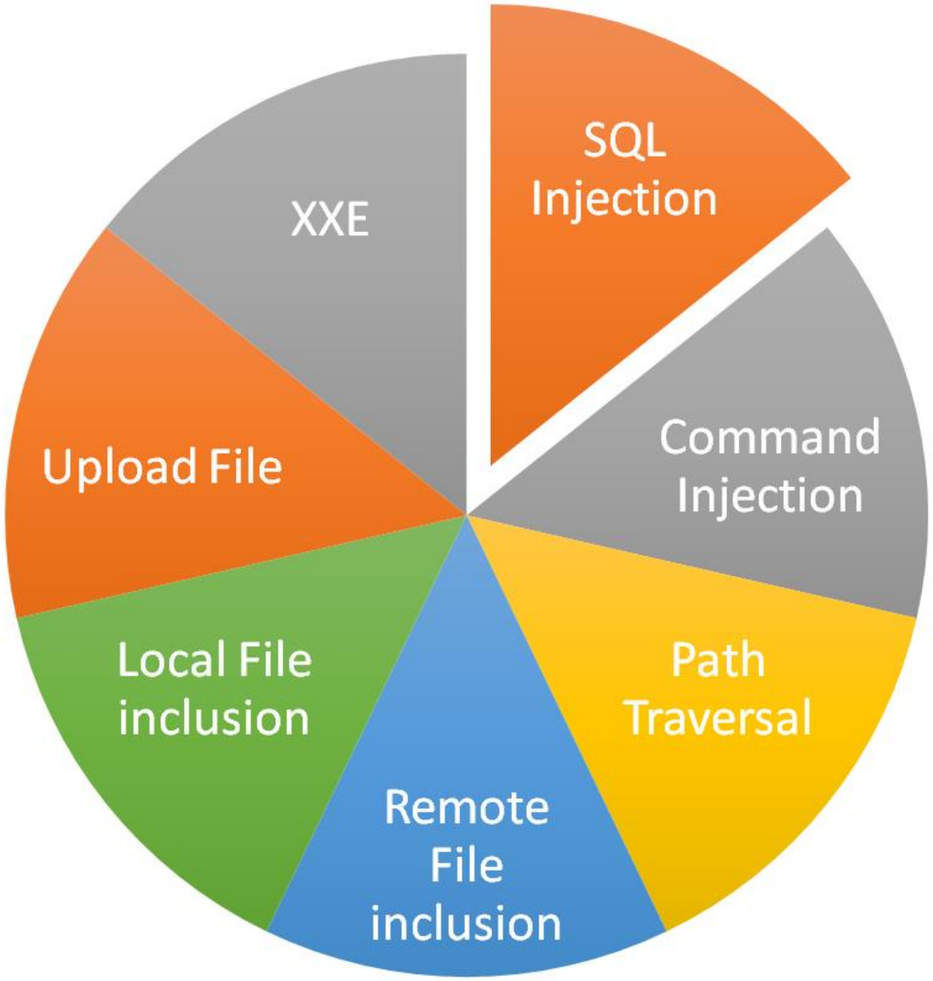
Motivation

- Goals:
  - Cause political conflict
  - For fun
  - Warn the system administrator



Attack Techniques Observed

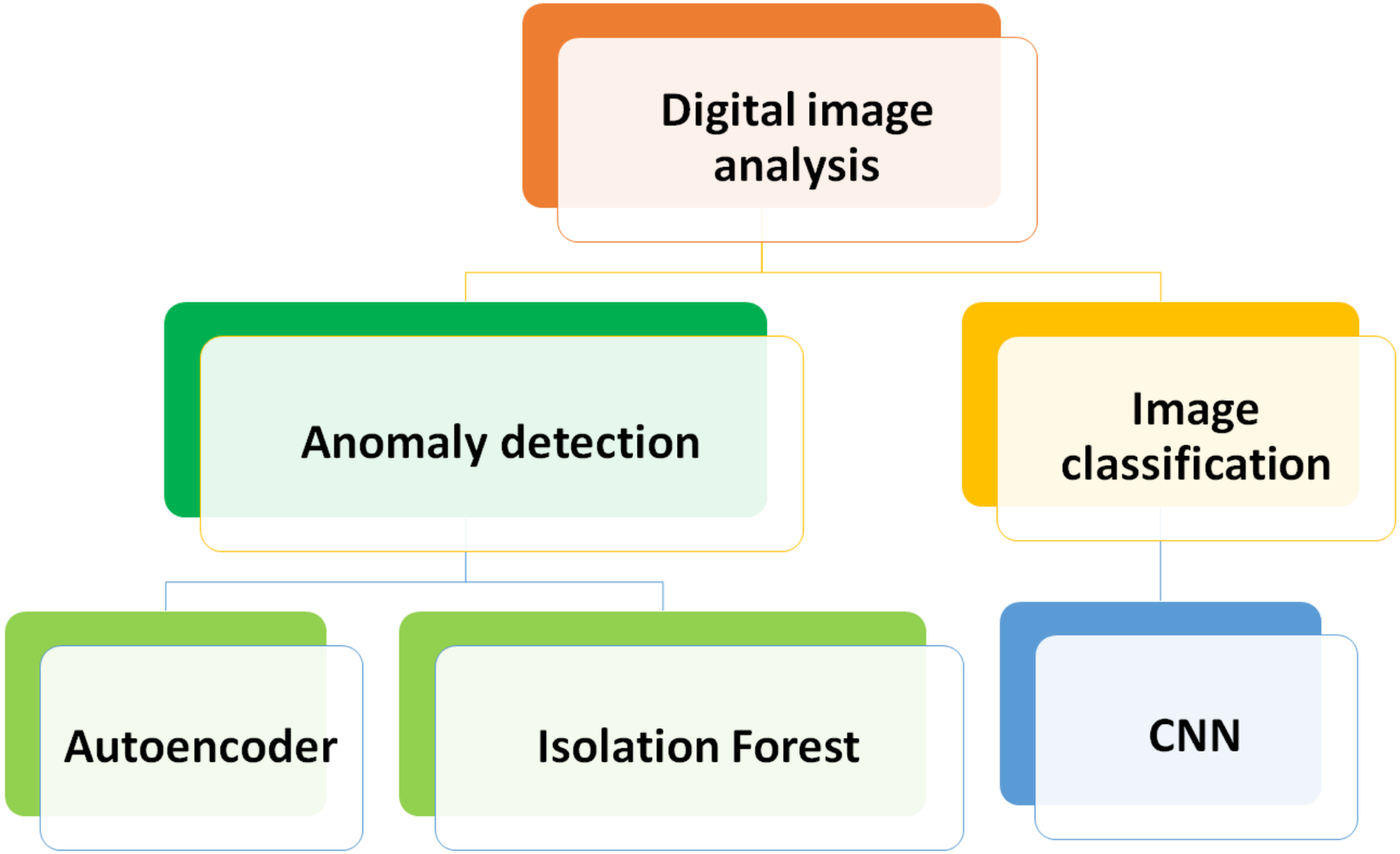


Critical web vulnerabilities

Detection Techniques

Hash	• Comparing hashes
Signature	• Determine attacker's signature • Determine web page's signature
Compare differences	• Compare changes in source code • Compare DOM Tree
Machine Learning	• Anomaly detection • Image classification

Approach


Digital image analysis
Anomaly detection
Image classification
Autoencoder
Isolation Forest
CNN

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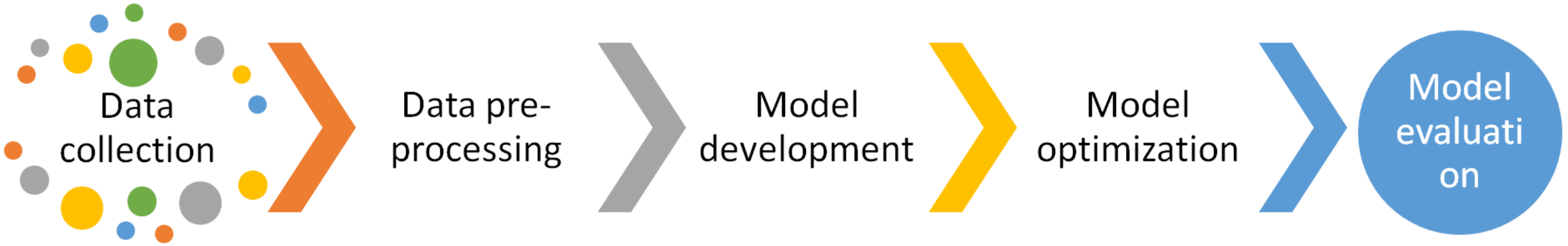
Approach


Data collection
Data pre-processing
Model development
Model optimization
Model evaluation

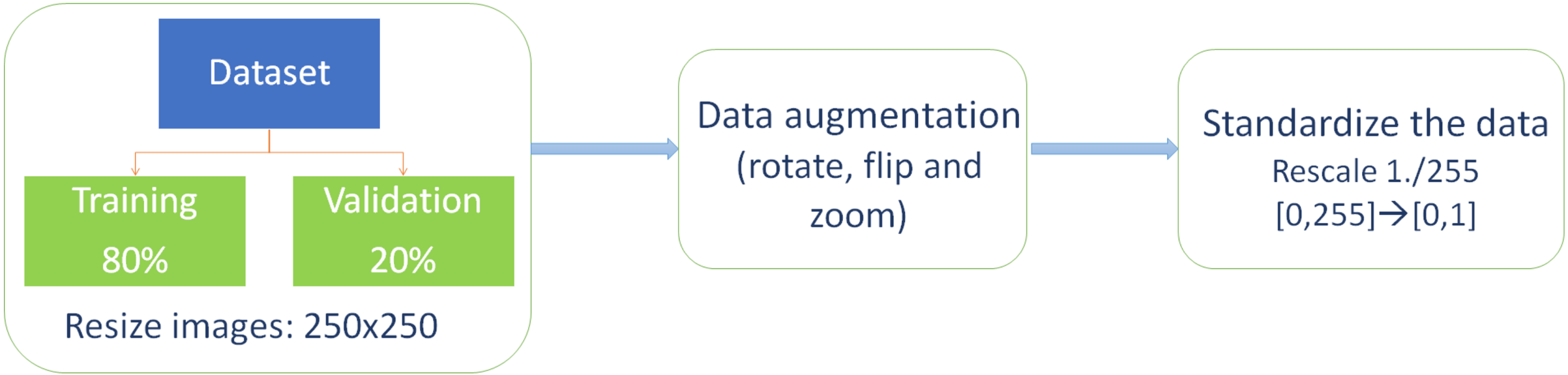
Training data collection

- Normal website data
  - moz.com/top500
  - github.com/GSA/govt-urls

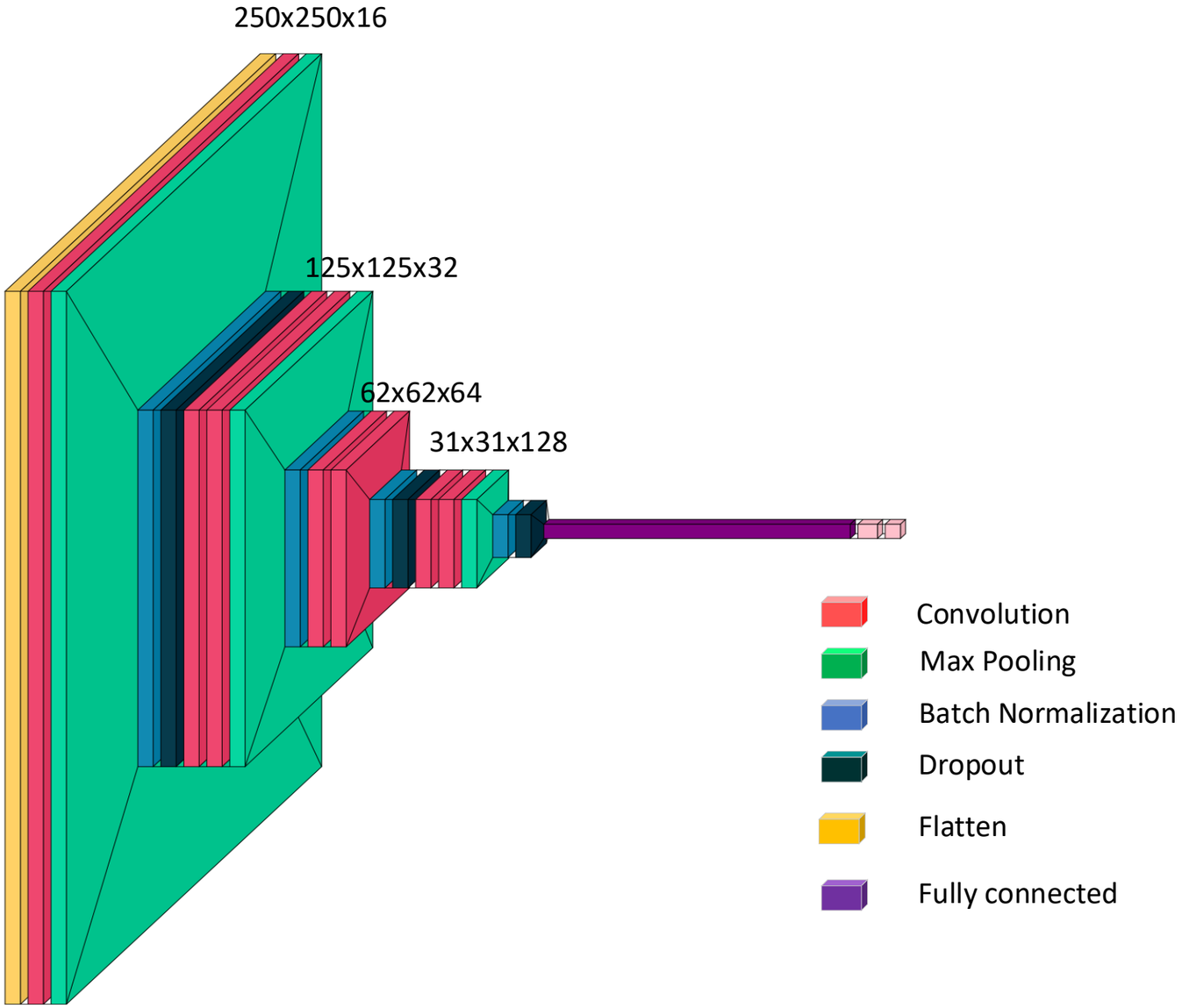
- Defaced website data
  - mirror-h.org
  - zone.kurd-h.org
  - www.zone-h.org
  - www.xatrix.org/defac.php

Data pre-processing

- Dataset
  - Clean: 7,277 pics
  - Deface: 4,954 pics

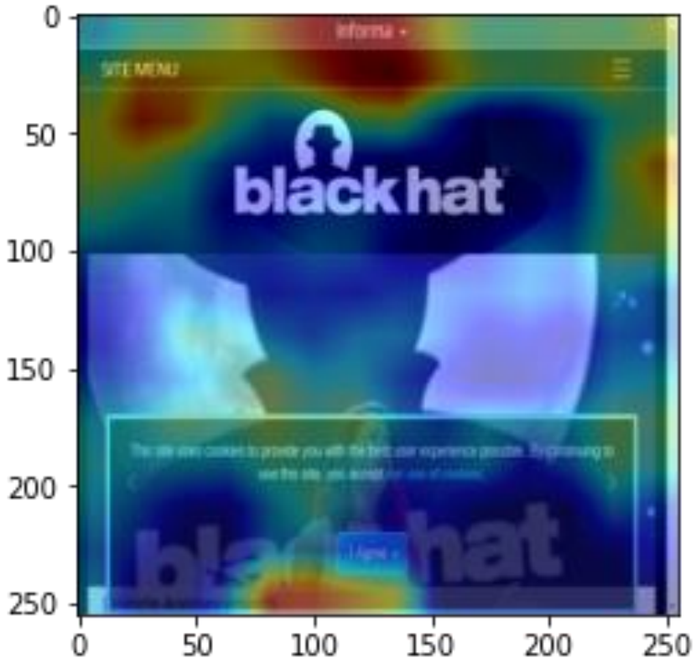


Building detection model

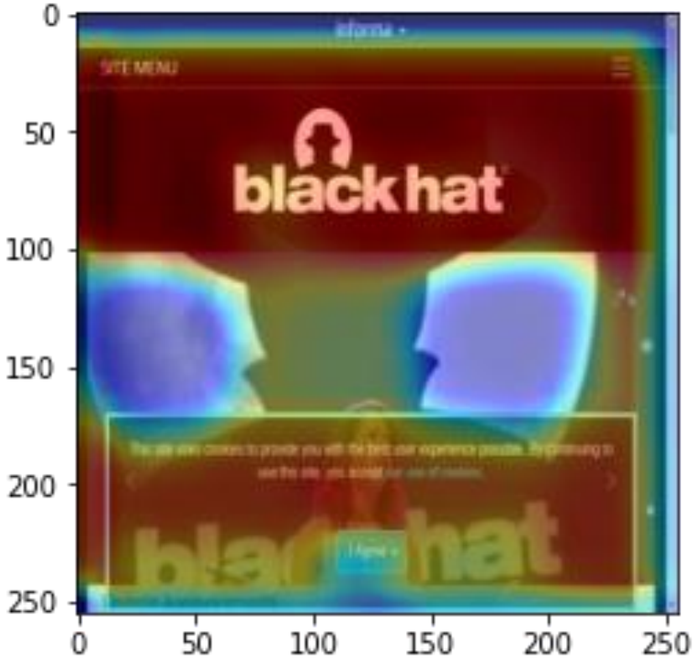


Model of the Convolutional Neural Network

Building detection model



VGG 16



My Model

Model optimization

- Reduce overfitting
  - Add Dropout layers
  - Data augmentation
  - Add Batch Normalization layers

Model Evaluation

❖ Evaluation criteria:

Accuracy

$$Accuracy = \frac{TP+TN}{TP+TN+FP+FN} = 98.01$$

False positive rate

$$FPR = \frac{FP}{FP + TN} = 3.73$$

Positive predictive value

$$PPV = \frac{TP}{TP + FP} = 94.00$$

True positive rate

$$TPR = \frac{TP}{TP + FN} = 98.12$$

False negative rate

$$FNR = \frac{FN}{FN + TP} = 1 - TPR = 1.88$$

F1 Score

$$F1 = 2 \times \frac{PPV \times TPR}{PPV + TPR} = 96.02$$

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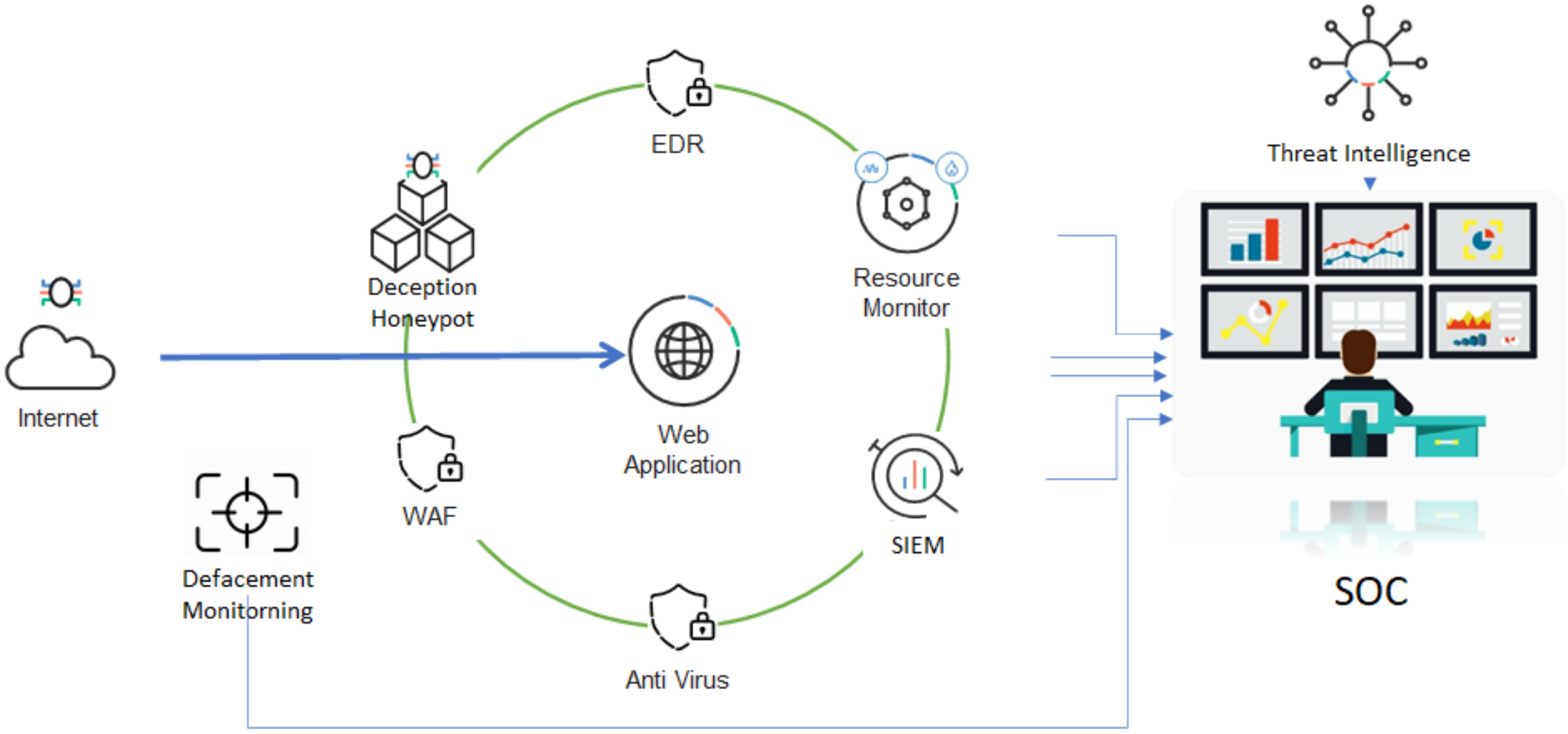
Alert system development



Some security solutions for a web application

Alert system development

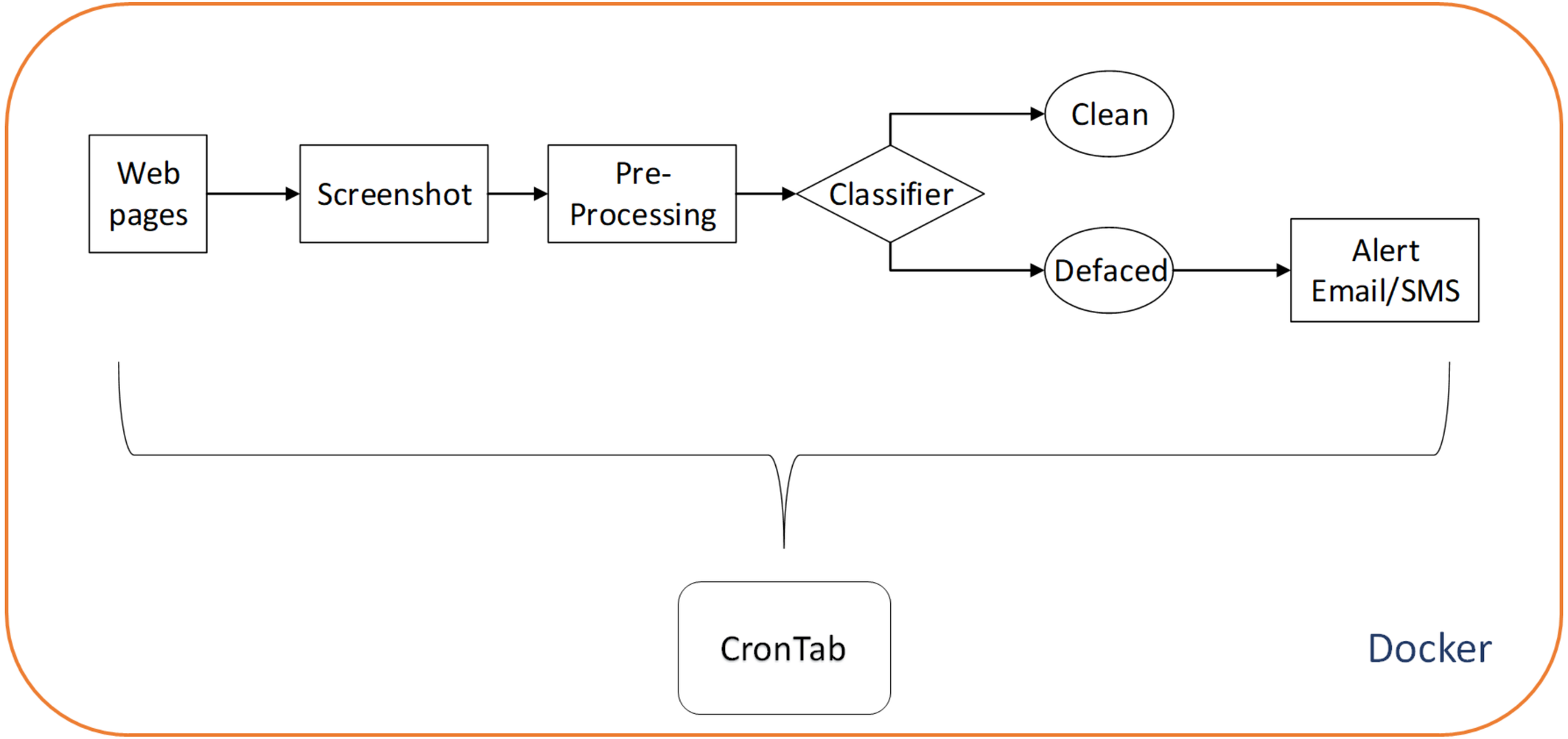
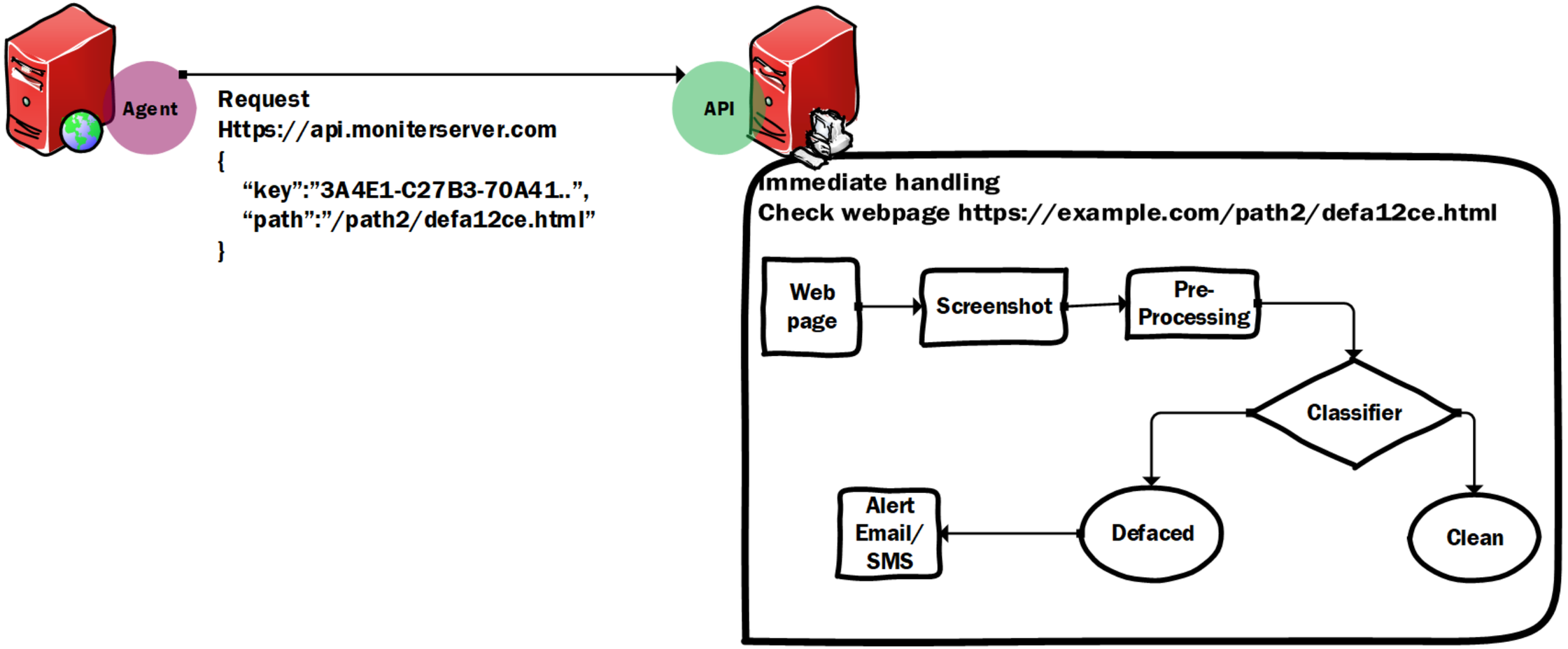


Diagram of the detection and warning system

URLs reported on Zone-h

	R		[redacted].th/wh.html	Linux
	R		[redacted]on.go.th/silence.html	Linux
	R		[redacted]en-yvelines.fr...	Linux
	R		[redacted]rpl.txt	Linux
	R		[redacted]d/haha.html	Linux
	R		[redacted].id	Linux
	R		[redacted]al/kurd.txt	MacOSX
M			[redacted]/qq.html	Win 2012
M	R		[redacted].org/qq.html	Win 2012

Agent deployment



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