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Research on methods of detecting defacement attack based on deep learning

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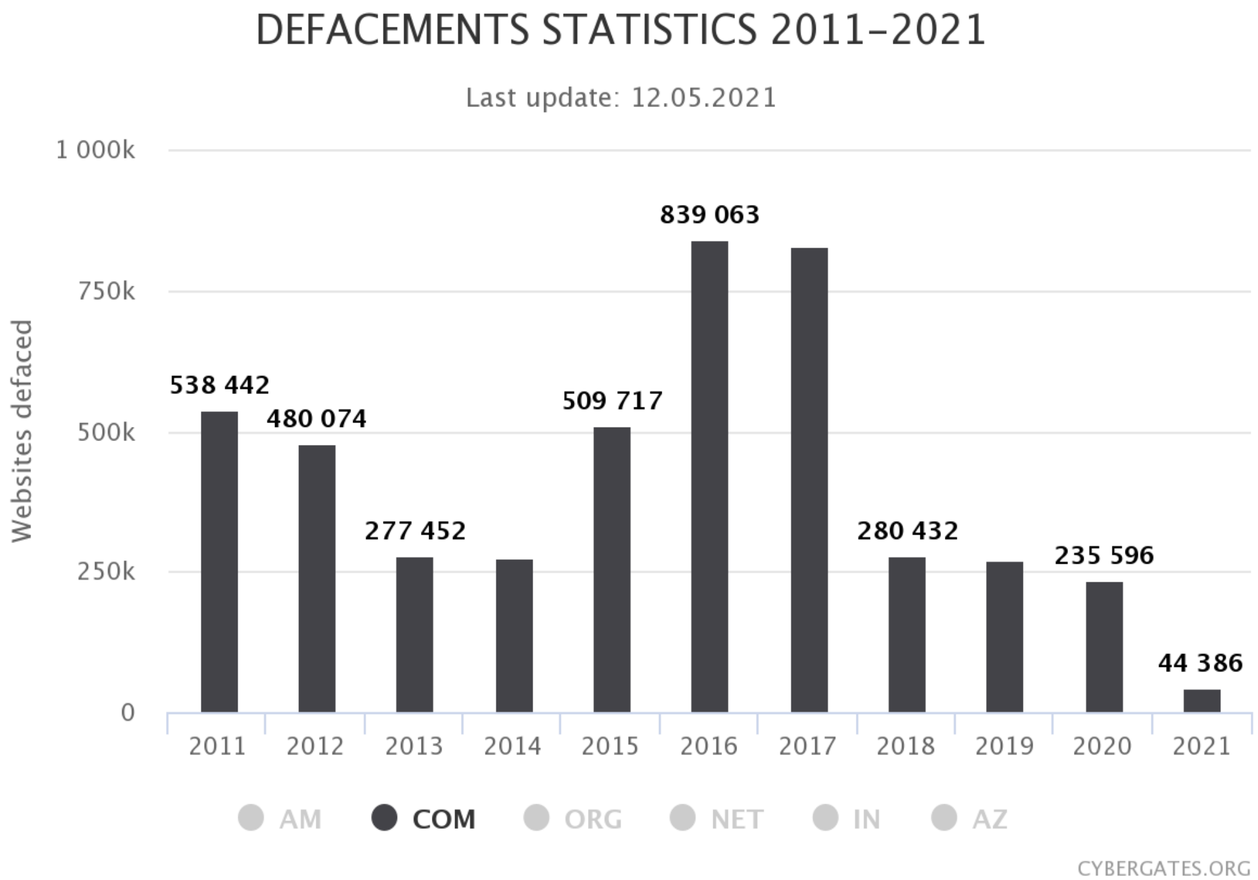
CONTENT

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

MOTIVATION

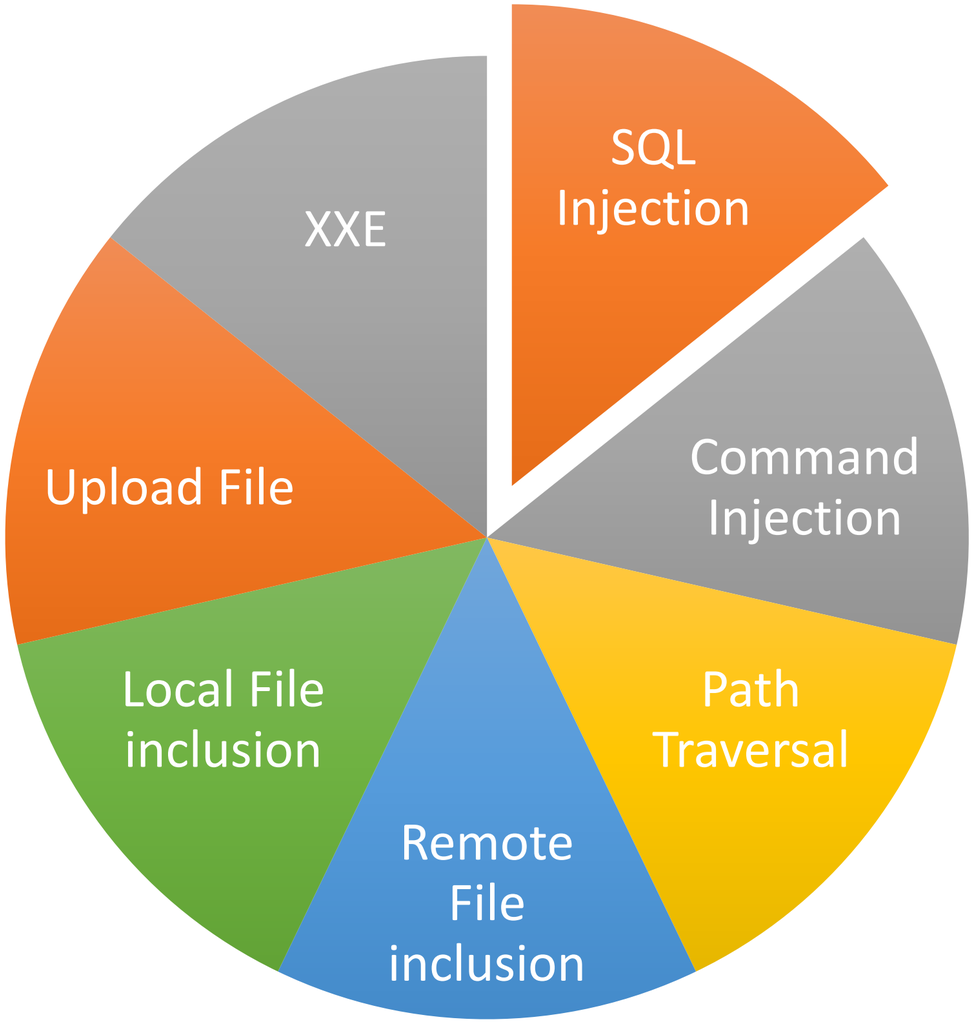
❖ Goals:

- Cause political conflict
- To show off
- Warn the system administrator



The amount of websites under the .com domain that faced defacement attacks from 2011 to 2021

SOME ATTACK TECHNIQUES



Some critical web vulnerabilities

DETECTION TECHNIQUES

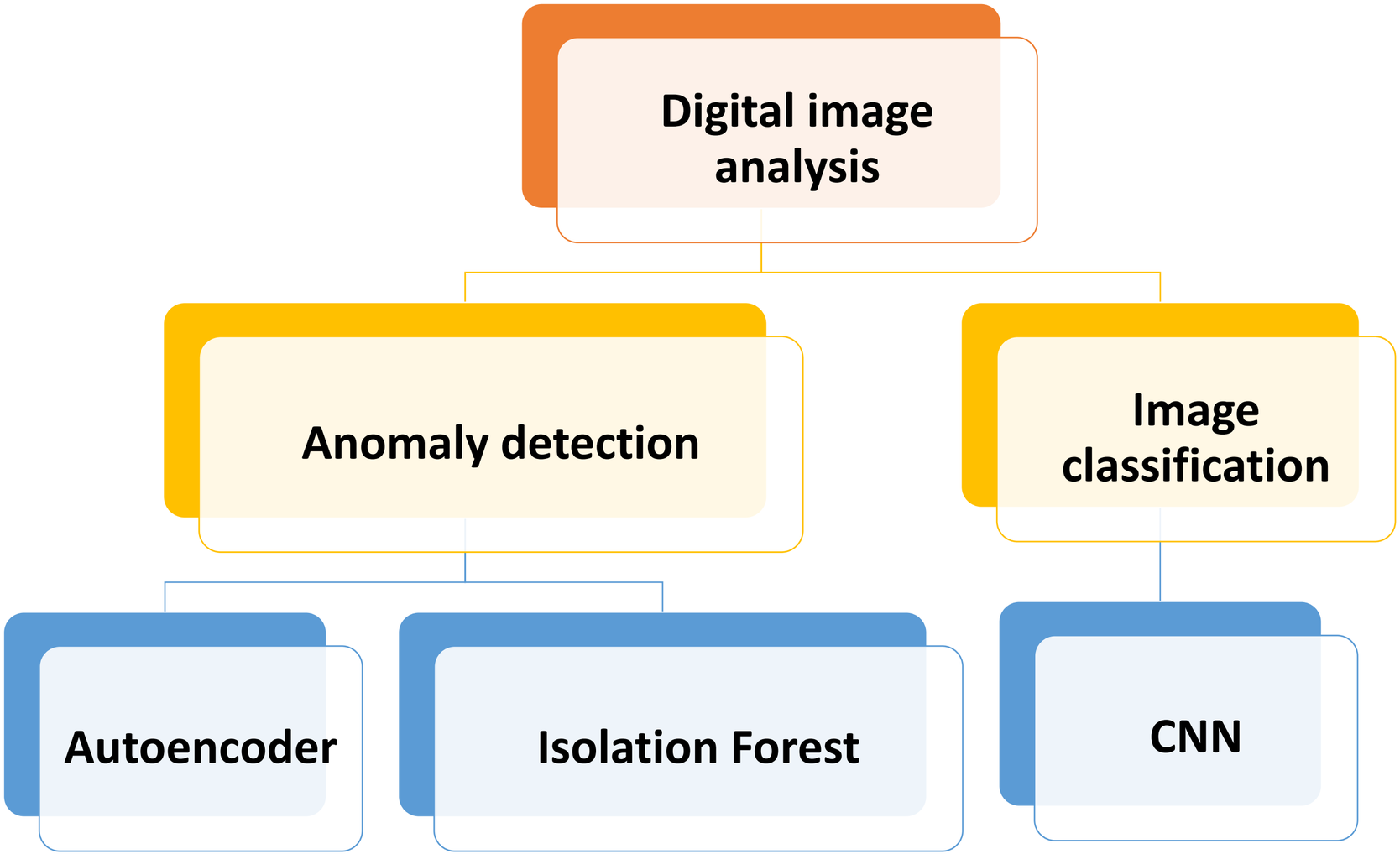
Hash	• Comparing hashes
Signature	• Determine attacker’s signature • Determine web page’s signature
Compare differences	• Compare changes in source code • Compare DOM Tree
Machine Learning	• Anomaly detection • Image classification

INTRODUCTION

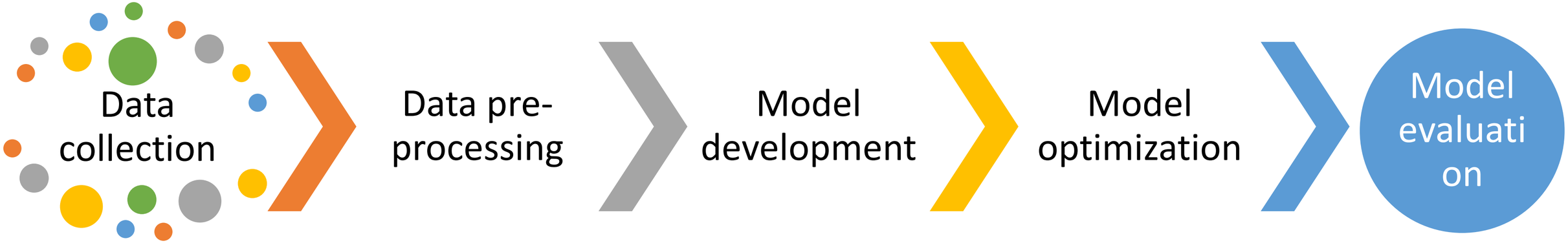
"RESEARCH ON METHODS OF DETECTING DEFACEMENT ATTACKS BASED ON DEEP LEARNING"

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

APPROACH


Digital image analysis
Anomaly detection
Image classification
Autoencoder
Isolation Forest
CNN

APPROACH


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

INPUT 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

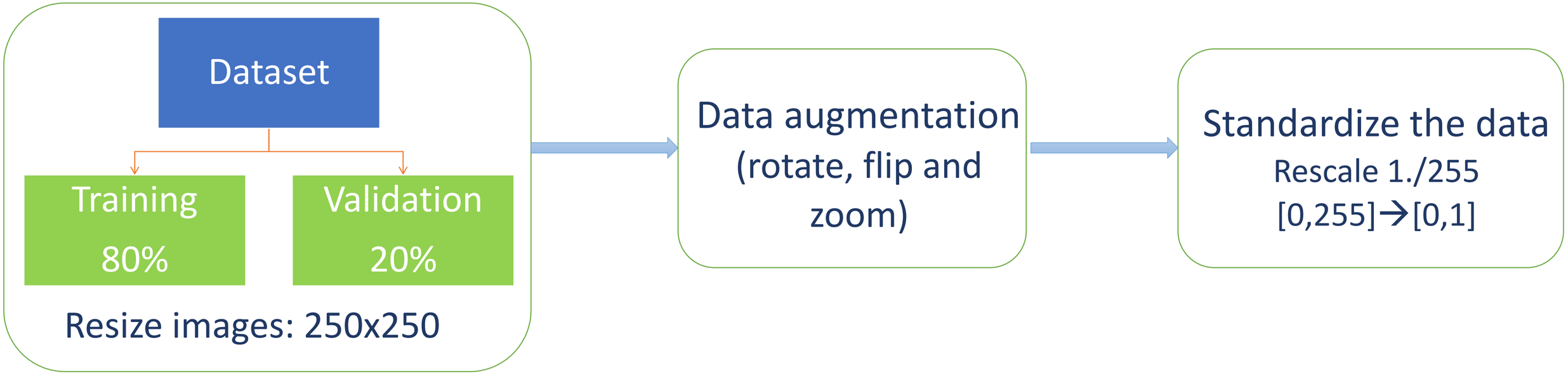
Screenshot: Python-selenium & Chromium

```
def screenshot(url):
    options = webdriver.ChromeOptions()
    options.headless = True
    options.add_argument("--start-maximized")
    options.add_argument('--disable-dev-shm-usage')
    options.add_argument('--disable-setuid-sandbox')
    options.add_argument('--no-sandbox')
    driver = webdriver.Chrome(options=options)
    try:
        driver.get(url)
        print("Screenshoting..." + url)
        time.sleep(5)
        driver.get_screenshot_as_file("defaced_images/web_screenshot.png")
        driver.quit()
    except:
        print(url + "was died")
        pass
print("resizing...")
image = Image.open('gov_images/web_screenshot.png')
new_image = image.resize((250, 250))
name = hashlib.md5(url.encode())
new_image.save('gov_images/' + name.hexdigest() +'.png')
```

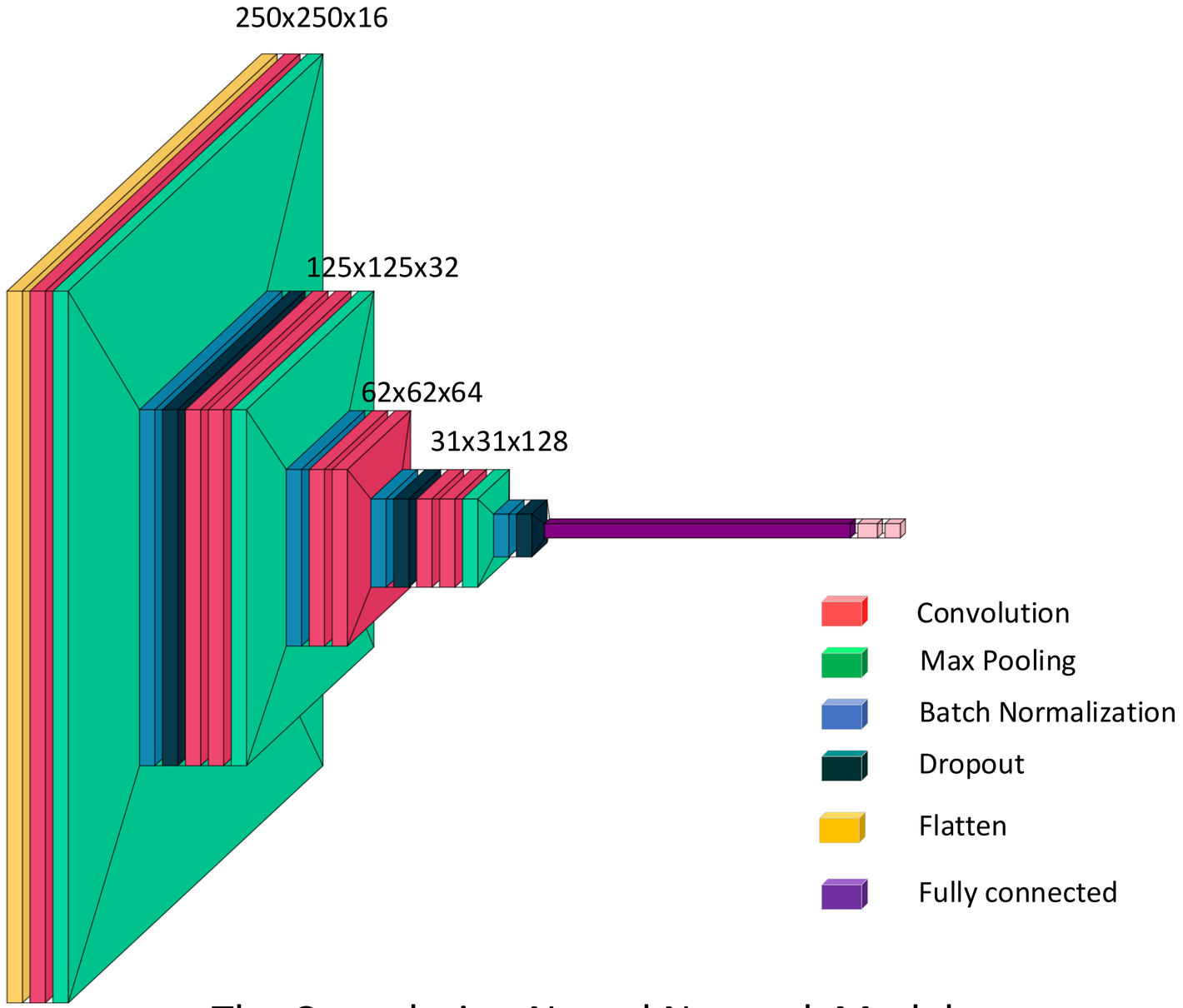
DATA PRE-PROCESSING

❖ Dataset

- Clean: 6,796 pics
- Deface: 4,917 pics



BUILDING MODEL



The Convolution Neural Network 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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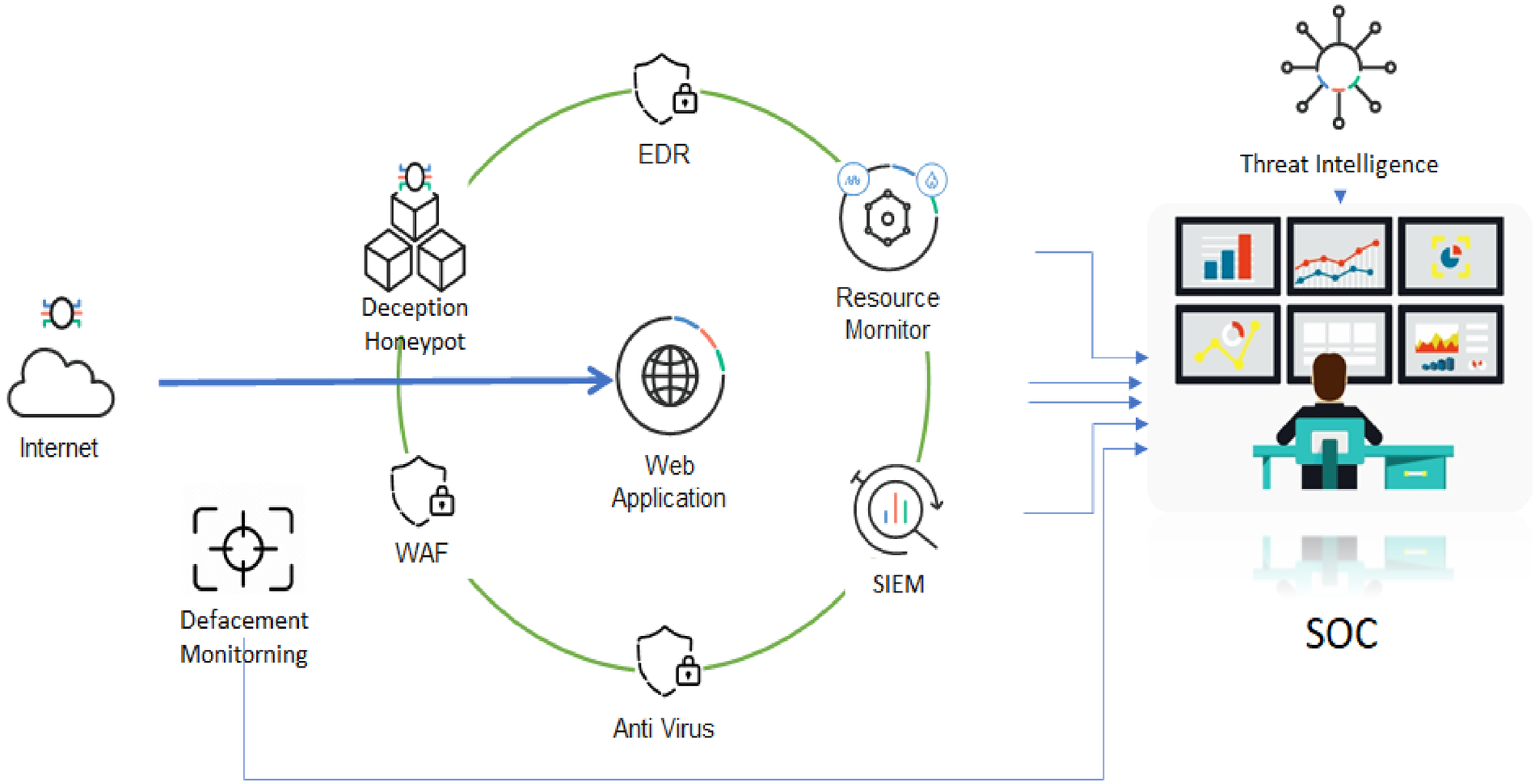
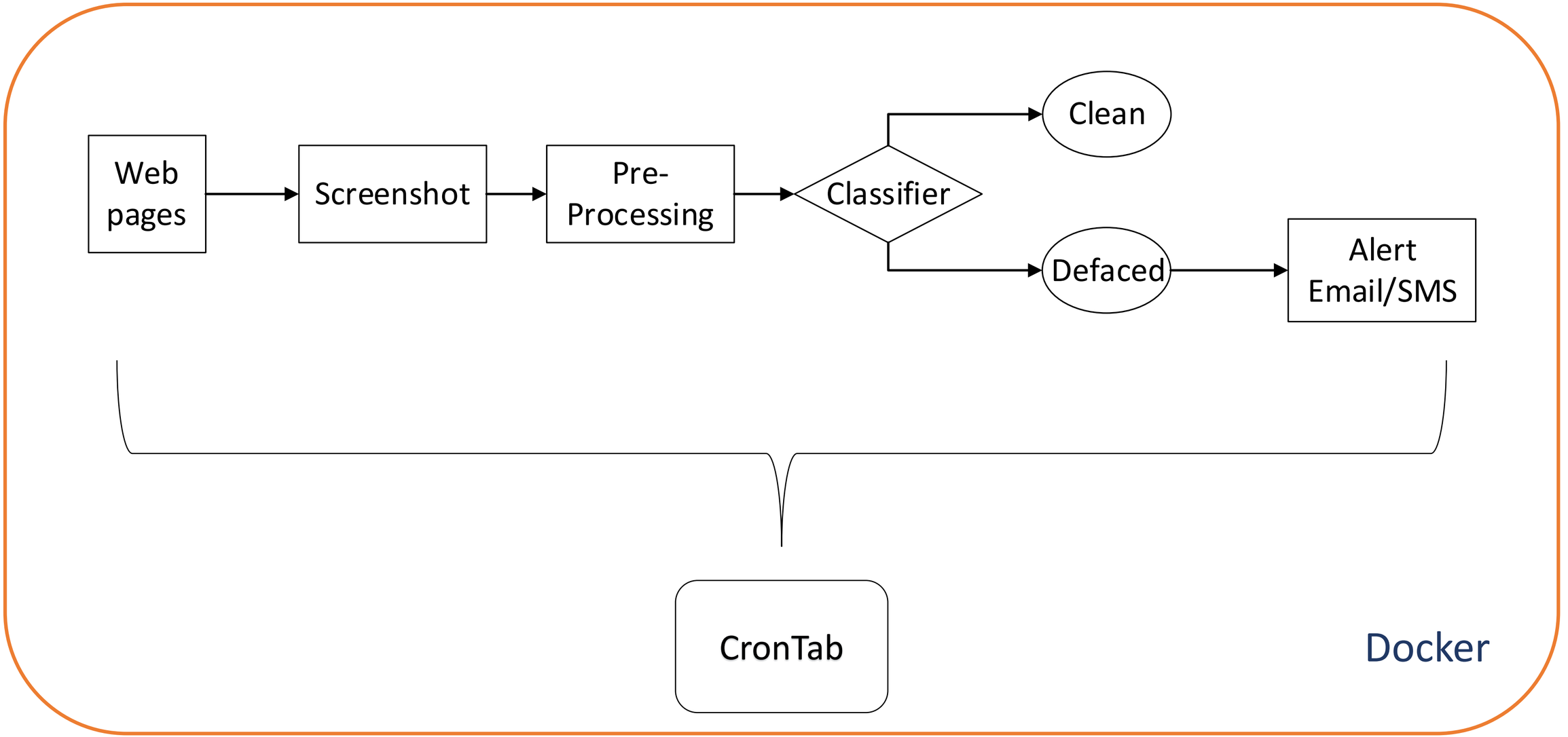
MOTIVATION



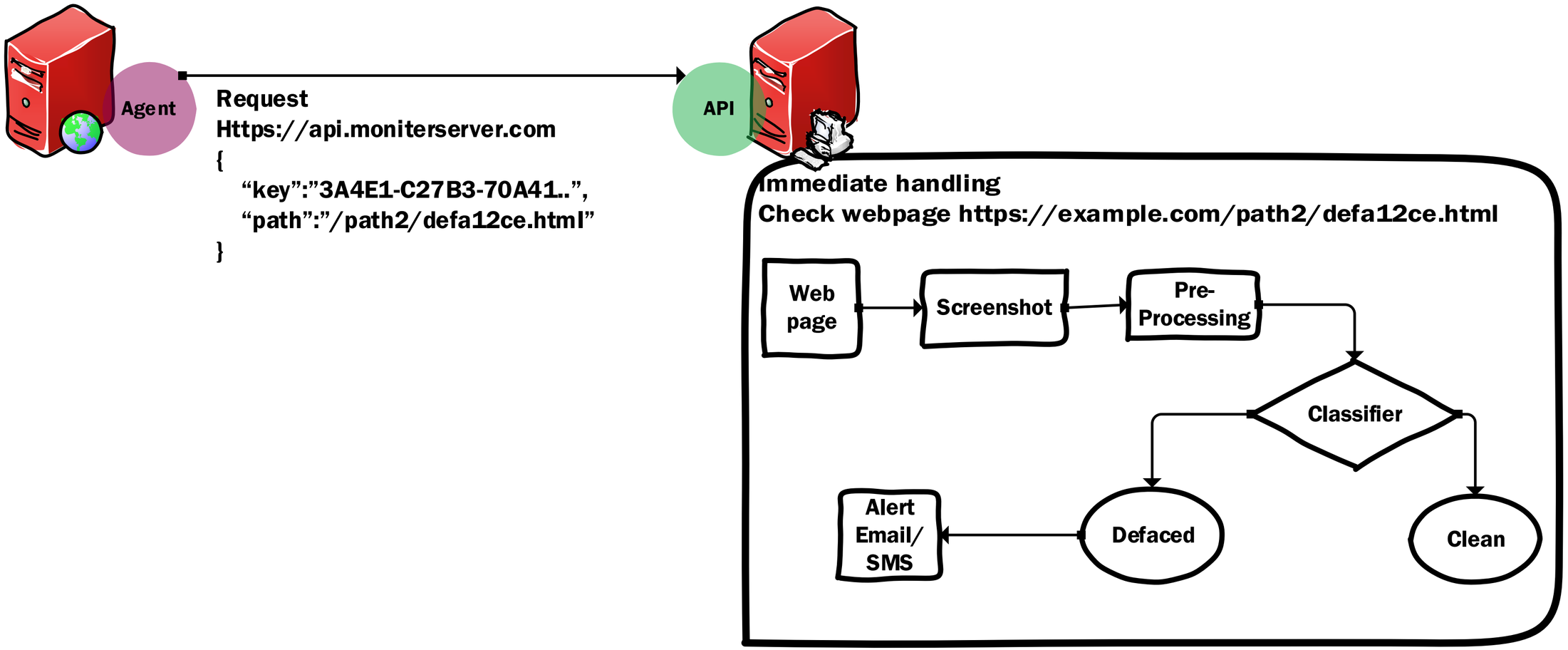
Some security solutions for a web application

ALERT SYSTEM DEVELOPMENT



Detection and warning diagram

AGENT DEPLOYMENT



Event handling flow

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

INSTALLATION

Cloning the repository

```
git clone https://github.com/J4FSec/In0ri.git
cd In0ri
```

Configuring email credentials to send notifications and agent keys from

```
Edit the file FlaskApp/sendEmail.py
EMAIL_ADDRESS = "foo@gmail.com"
EMAIL_PASSWORD = "$uper$ecurePa$$word"
```

Configure Telegram notification

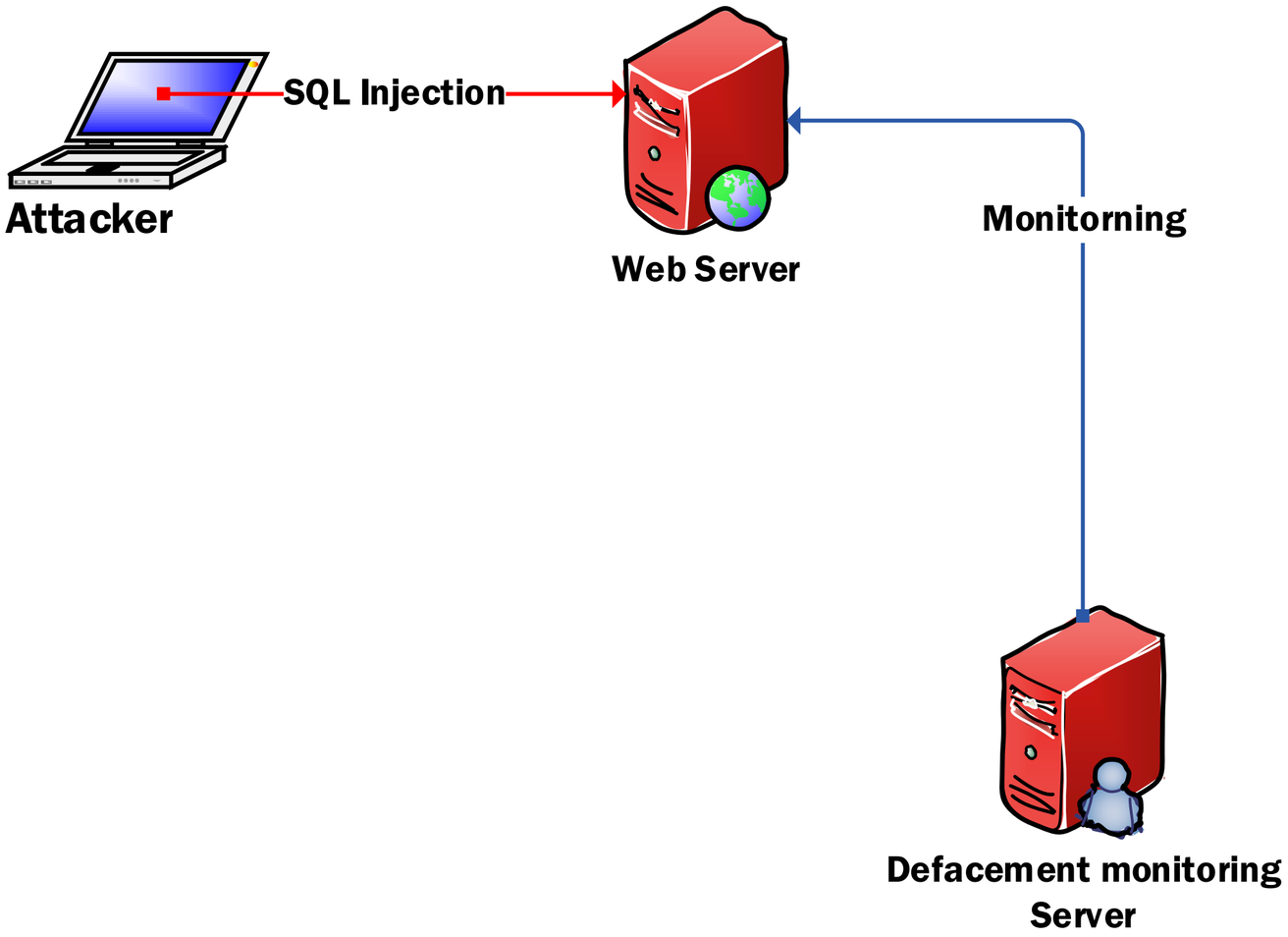
```
Edit the file chatbot.py
CHAT_ID= 'foo' // Channel ID to send notifications to
TOKEN = 'bar' // Bot token retrieved from @BotFather
```

Starting In0ri

```
docker-compose up -d
```

SCENARIO 1

Scenario content



Scenario 1 diagram

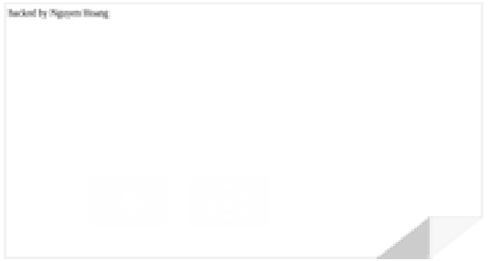
SCENARIO 1

Result

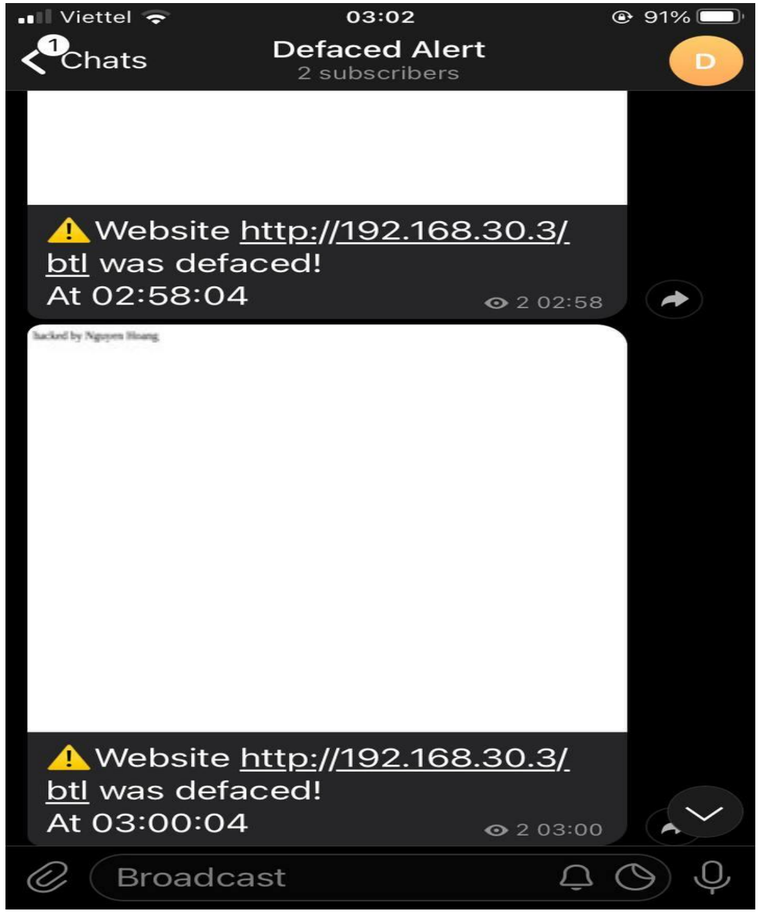
Website Defacement Hộp thư đến ×

htnguyenbg@gmail.com
tới tôi

You website was defaced!
URL: http://192.168.30.3/btl



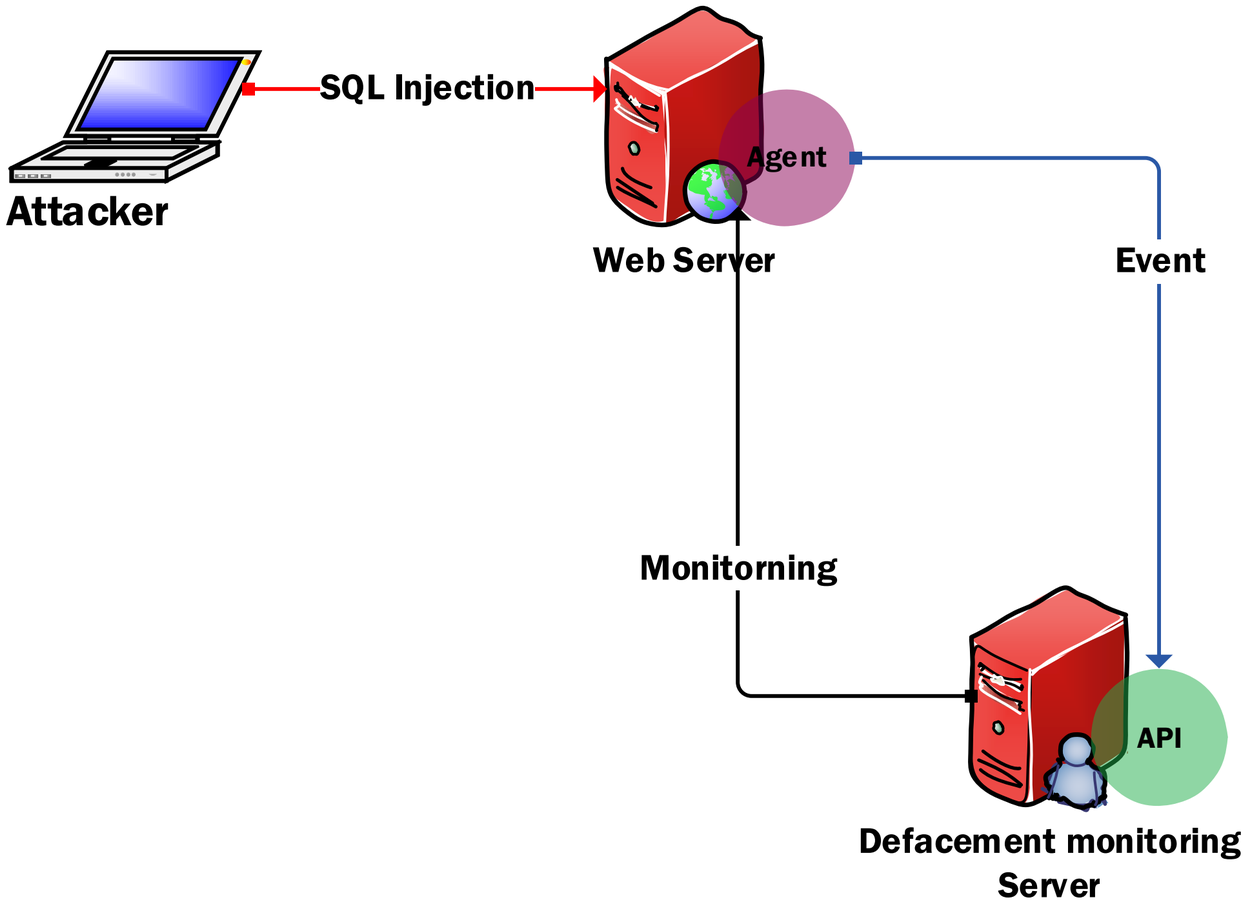
Email Alert



Telegram Alert

SCENARIO 2

Scenario content

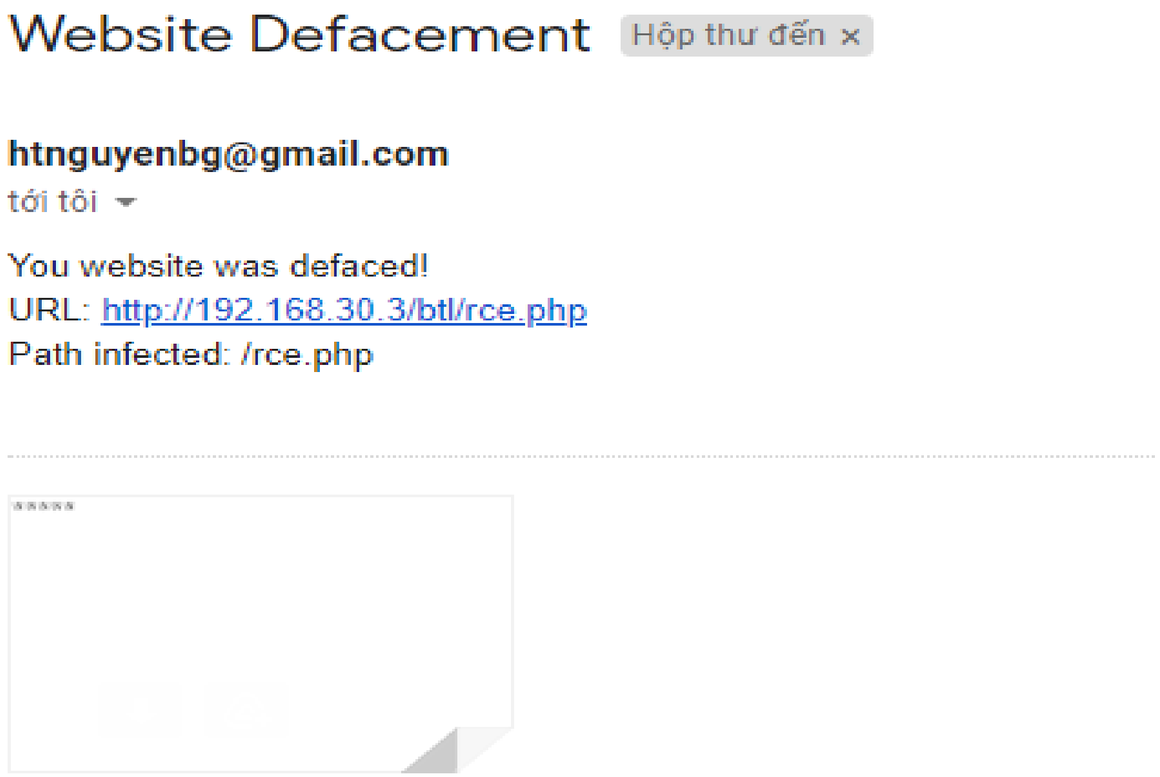


Scenario 2 diagram

SCENARIO 2

Result 1

- The system detected that an suspicious file has been created on the server and send out a warning

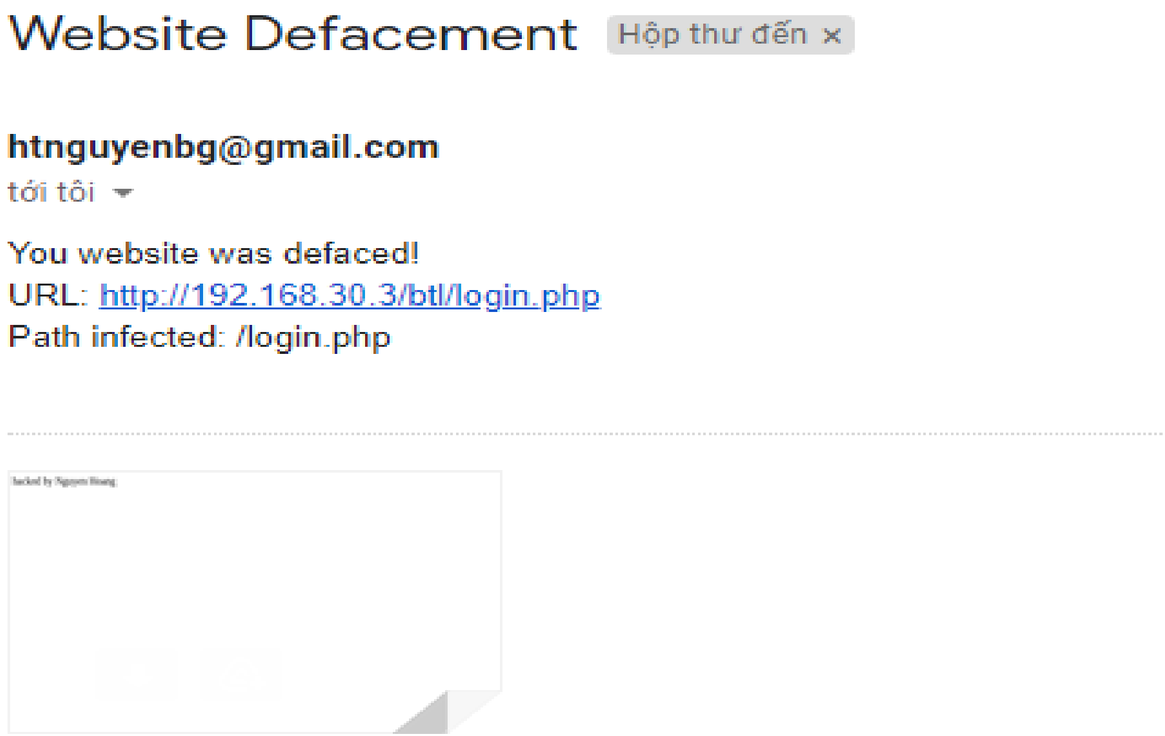


Email Alert

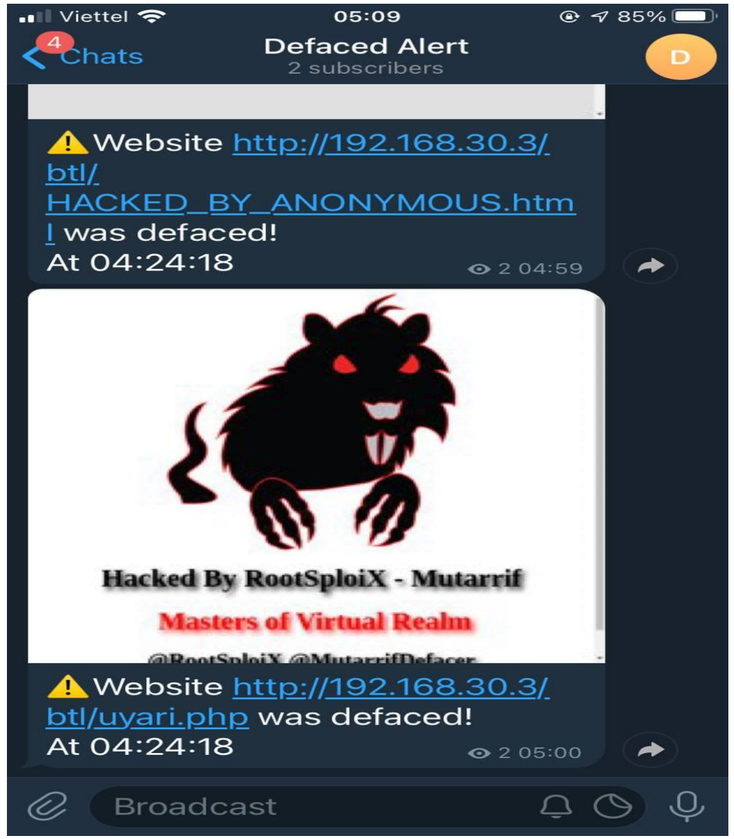
SCENARIO 2

Result 2

- Detect any file without registering them previously



Email Alert



Telegram Alert

SCENARIO 2

Result 3

- The system does not alert when legitimate changes are made.

```
hoang@ubuntu:~/Agent$ python3 checkfloder.py
hey nguyen, /var/www/html/btl/rce.php has been modified
^Choang@ubuntu:~/Agent$ python3 checkfloder.py
hey nguyen, /var/www/html/btl/login.php has been modified
hey nguyen, /var/www/html/btl/login.php has been modified
```

```
hoang@ubuntu: /var/www/html/btl
hoang@ubuntu:/var/www/html/btl$ cp
admin/          css/            index.php.bka   login.php.bka   public/
autoload/       fogotpass.php   libraries/      logout.php      rce.php
changepass.php  index.php       login.php       PHPMailer/      register.php
hoang@ubuntu:/var/www/html/btl$ cp login.php.bka login.php
hoang@ubuntu:/var/www/html/btl$
```

Backup to the original file

```
Website was defaced!
127.0.0.1 - - [18/Jun/2021 04:30:42] "POST /checkdeface HTTP/1.0" 200 -
Screenshoting...http://192.168.30.3/btl/login.php
resizing...
Website was defaced!
127.0.0.1 - - [18/Jun/2021 04:46:18] "POST /checkdeface HTTP/1.0" 200 -
Screenshoting...http://192.168.30.3/btl/login.php
resizing...
Every thing oke!
```

The server receives the event and run a check

QnA