Matlab Based Watermarking Benchmark Environment

Kevin Heylen

Promoters:
Tim Dams
Ann Dooms

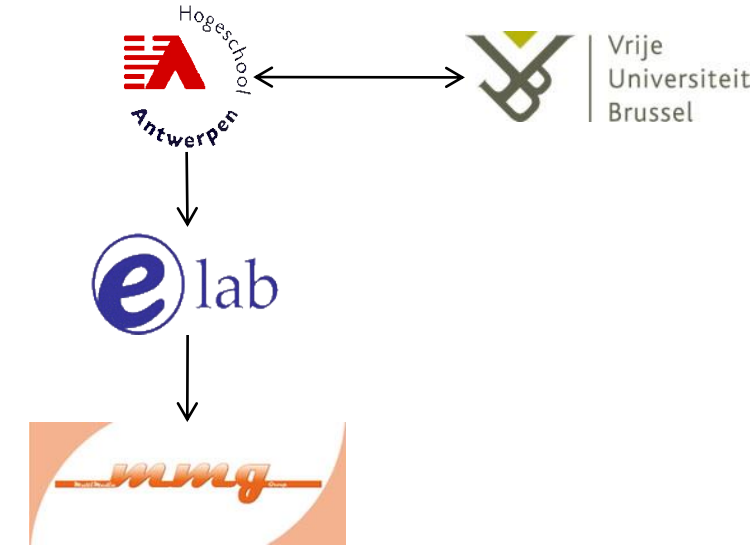
Overview

1. Introduction
2. Watermarking Toolbox: Benchmark
3. Demonstration
4. Future
5. Conclusion

Introduction

- Organisation & History
- Watermarking
- Watermark Benchmarking
- Master's thesis Goal

Introduction: Organisation



Feature-Based Synchronization

Luc Verstrepen
Tom Meesters

Benchmarking

Kevin Heylen

Introduction: History

2006-2007: *A Matlab-Based Tutorial Framework for Digital Watermarking*

Oct 2007: *Definition 2 new masterthesis*
=> Kevin: Benchmark in Matlab…
=> Luc&Tom: Feature-Based Synchronization…

Nov 2007: *Paper BAP submission ECUMICT:* **Accepted**

Jan 2008: *Abstract submission SPIE: A watermarking benchmark and tutorial tool for Matlab:* **Accepted**

Mar 2008: *Presentation ECUMICT: A Matlab-Based Tutorial Framework for Digital Watermarking*

Apr 2008: International Journey: Italy

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- Watermark benchmarking
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Problem…

Private pictures of Paris and Lindsay stolen by Yahoo-hacker

- Load MySpace profile on mobile phone
- Any login is sufficient

Basic watermark scheme

Input Message

Watermark embedder

Watermarked

Key

Cover work

Normal distortions and attacks

Output message

Watermark detector

Watermarked'

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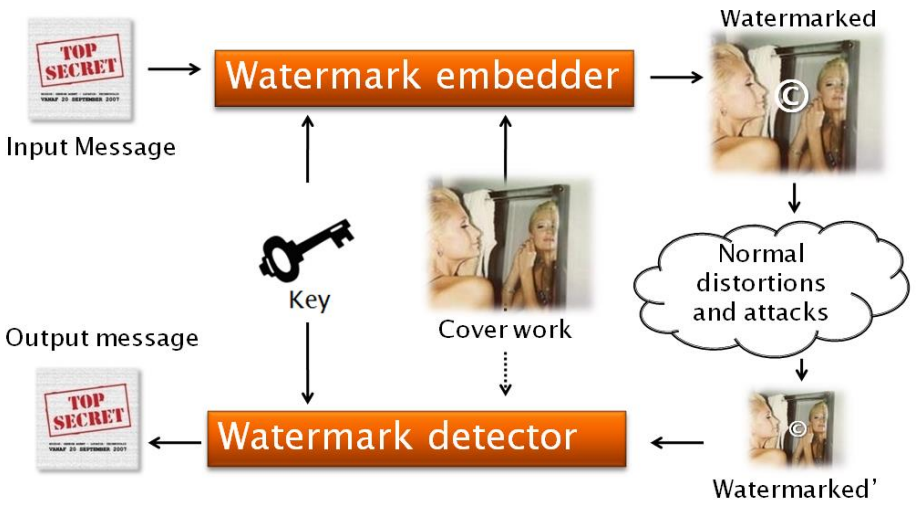
Watermark benchmarking

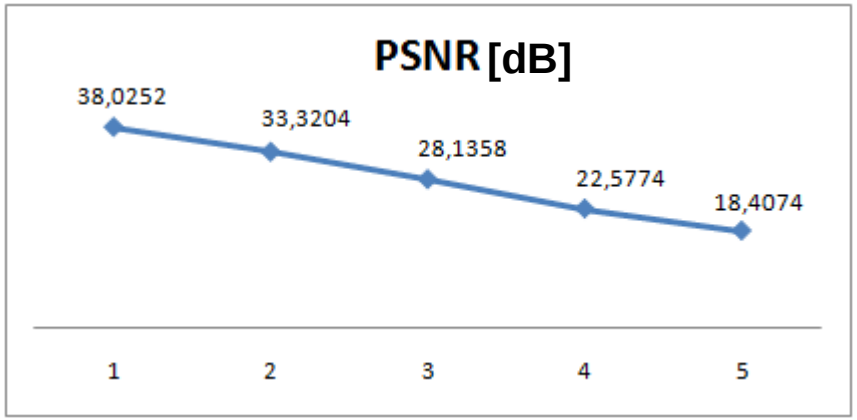
Determines:

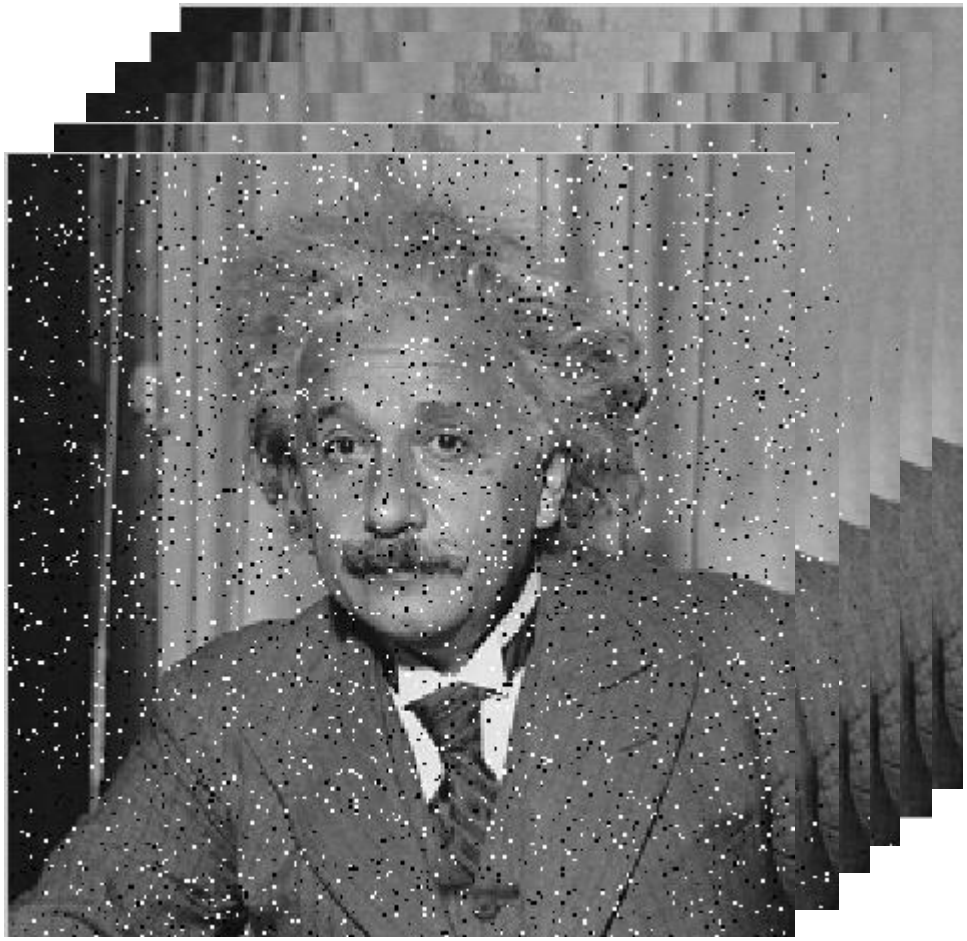
1. The visual impact of the algorithm and attacks on the cover work.
2. The results of distortions and attacks on the robustness.
3. Large image dataset
   (1million images search)



Watermark benchmarking

- Visual Impact…?





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Why this Master's thesis?

- Existing benchmarking programs
  - Stirmark
  - Checkmark
  - Certimark
  - Web-based evaluations
- Programs old!
- Web-based: privacy, development?
- Final step in development
- **Goal: Integrate benchmarking and development efficiently!!**

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Watermark Toolbox: Benchmarking

- Specifications
- Architecture
- Design philosophy

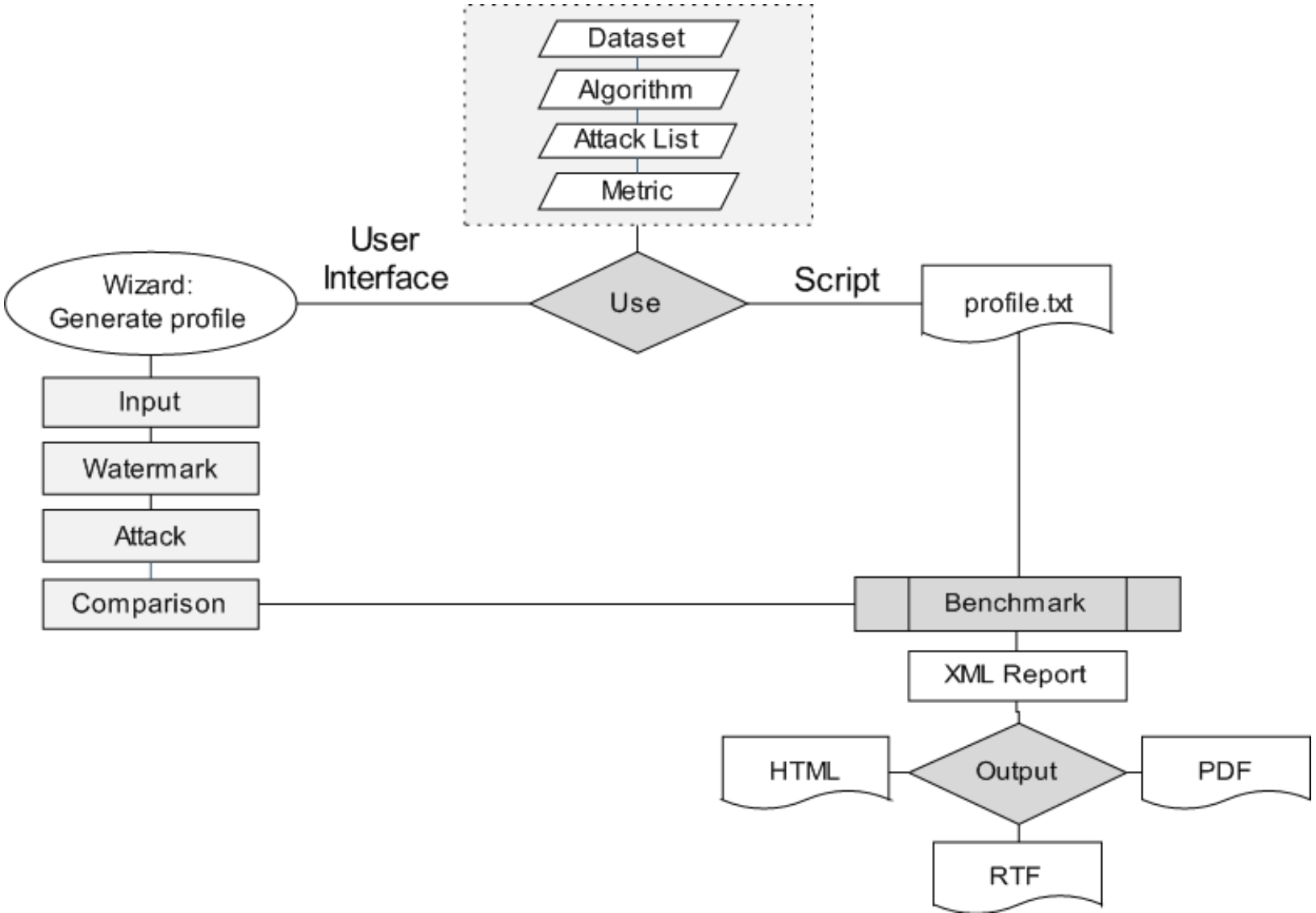
Masterthesis: Specifications

- Easy to implement
  - Watermark algorithms
  - Attacks
  - Metrics
- Compliant with Certimark guidelines
- Automatic report generation
- Proof of Concept

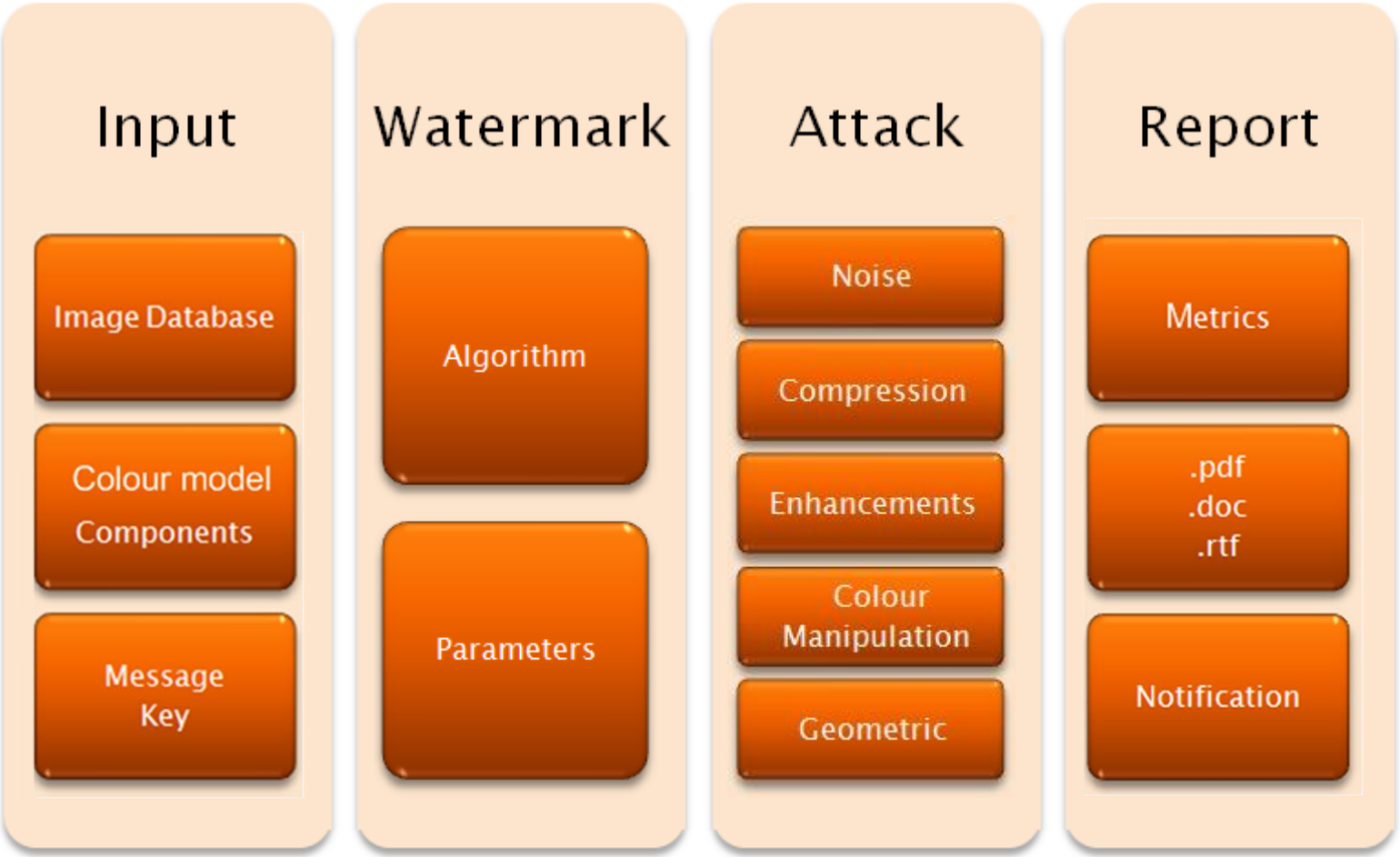
Watermark Toolbox: Benchmarking

- Specifications
- Architecture
- Design philosophy

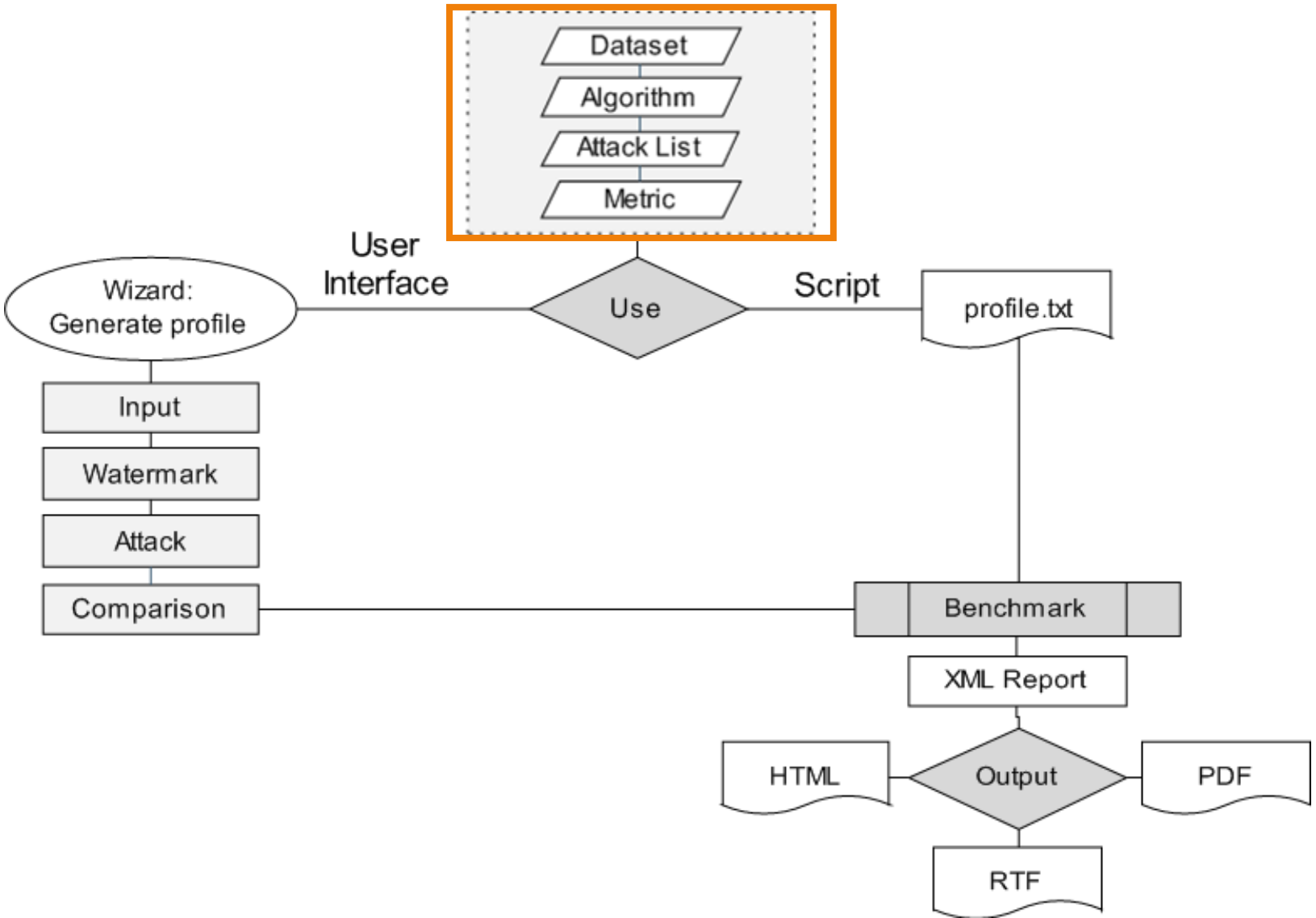
Architecture: General



Four major building sections

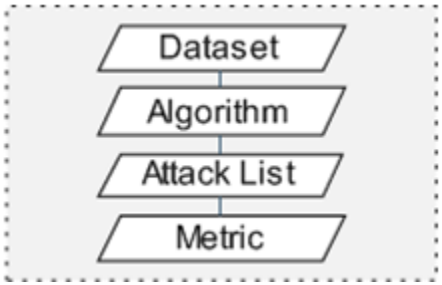


Architecture: General



Architecture : Requirements

- **Dataset**
  - .tif images



- **Syntax**
  - Algorithm

$$I_W = Algorithm_{Watermark}(I_C, Key, Payload, x, ..., y)$$

$$Payload = Algorithm_{Detect}(I_W, Key, x, \ldots, y)$$

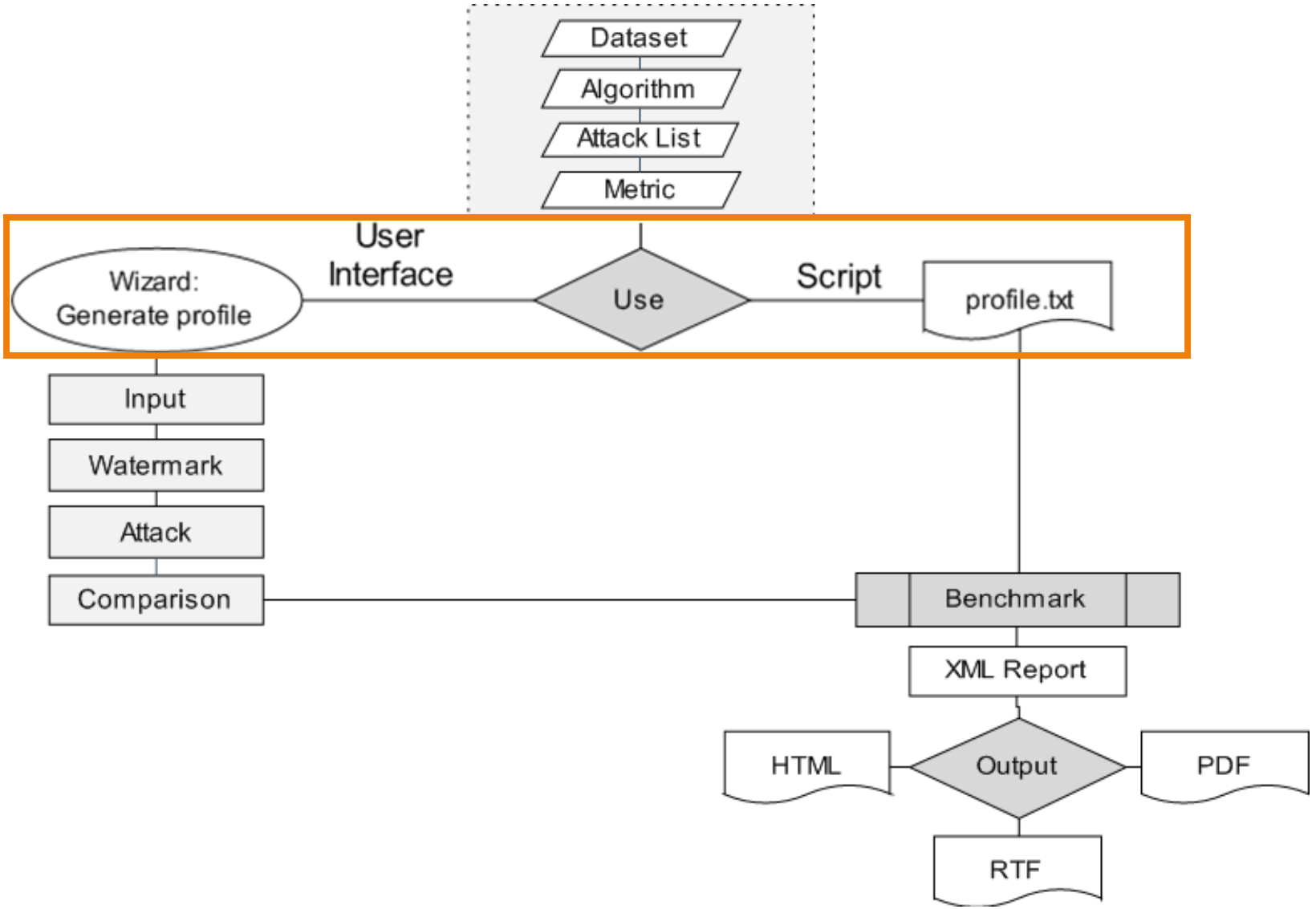
  - Attack List

$$I_A = Algorithm_{Attack}(I_W, Setting)$$

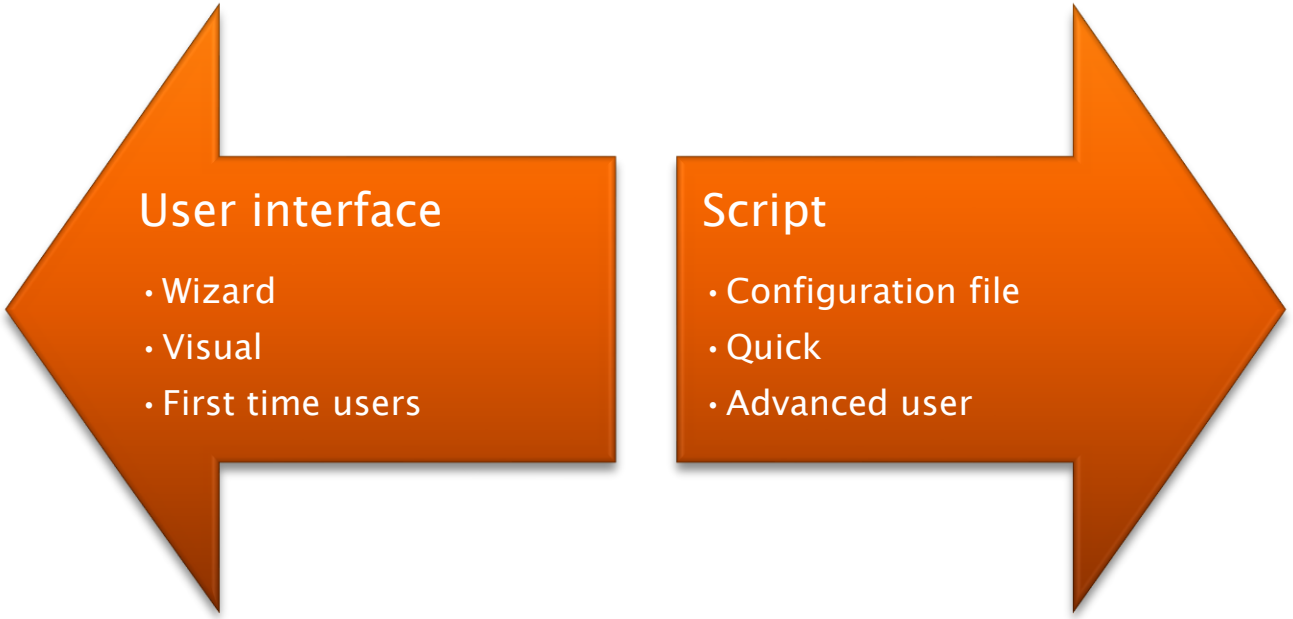
  - Metric

$$Metric = Algorithm_{Metric}(I_1, I_2)$$

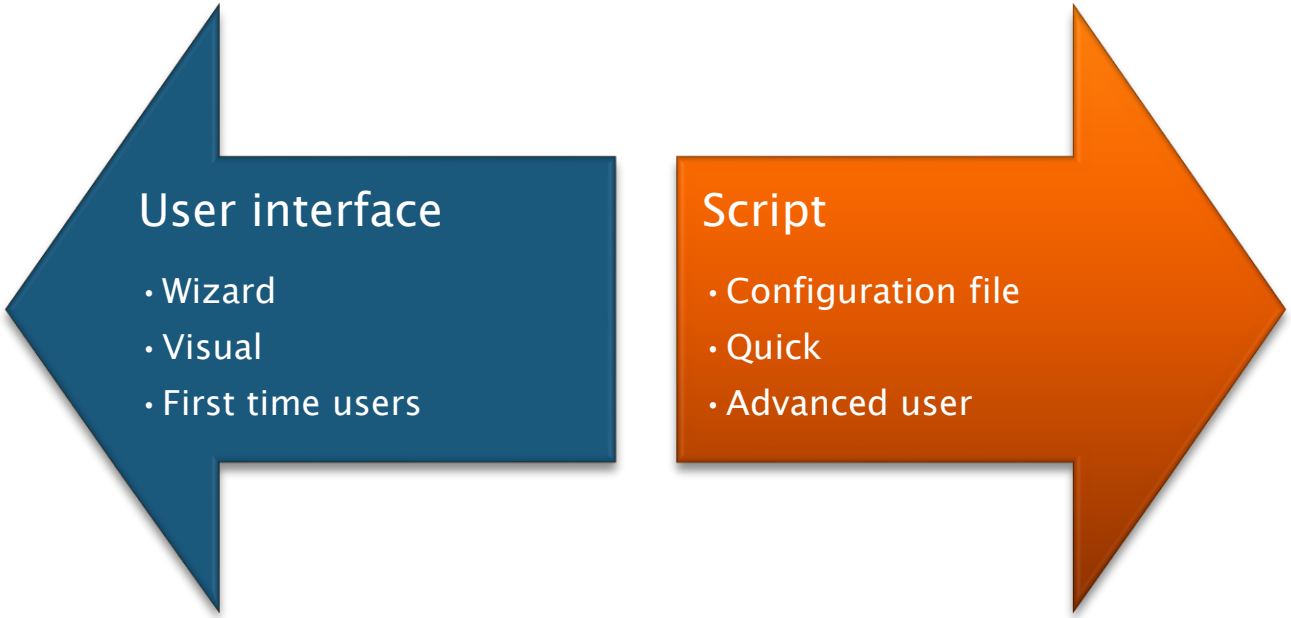
Architecture: General



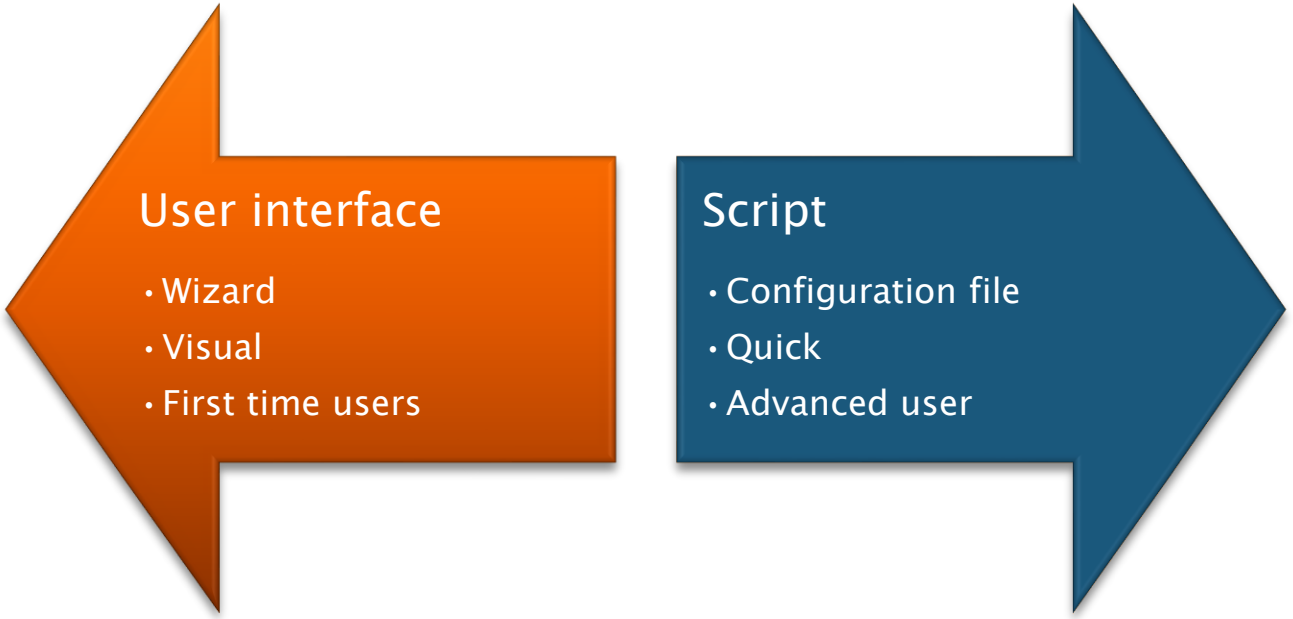
Architecture: Use



Architecture: Use



Architecture: Use

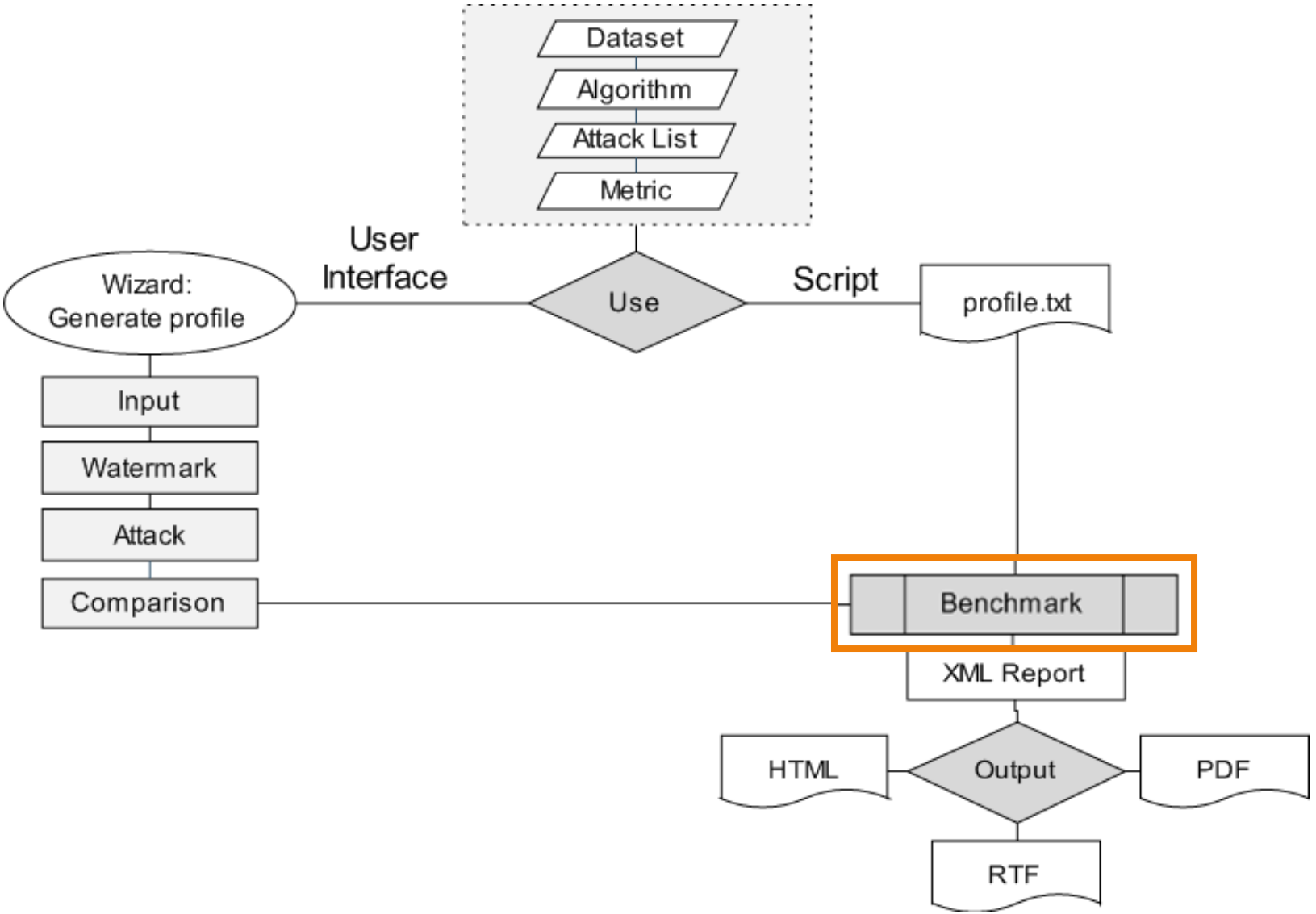


Script: Configuration file

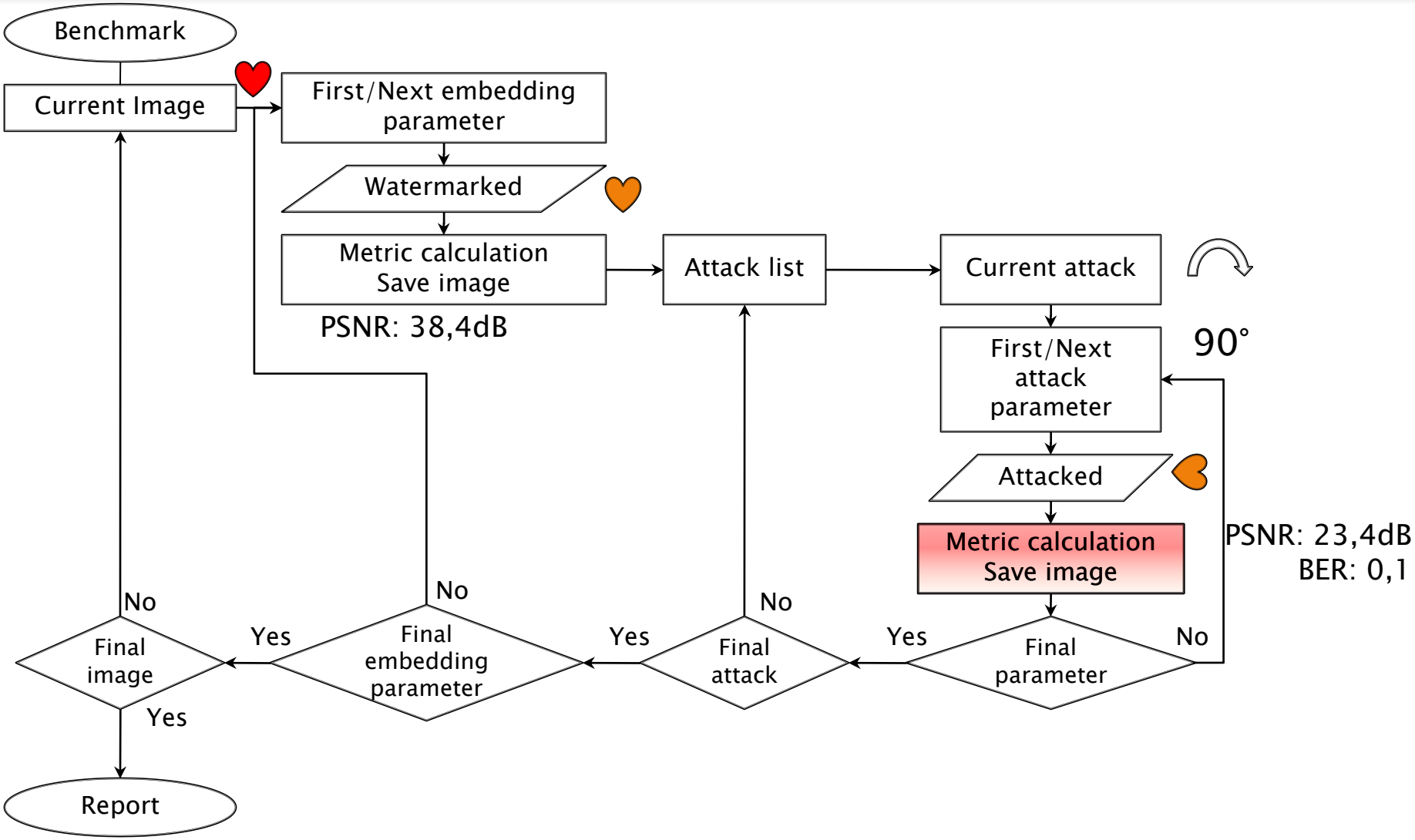
- .txt config file
- Identical results of wizard procedure
- Matlab syntax: large structure
- Illustration

```
struct(...
...
'Specifications_of_the_input_parameters','',...
...
        'path_dataset','Input Images\Dataset1',...
        'name_embedding_component','Red Layer',...
        'message','01010011',...
        'key_size', 64,...
...
```

Architecture: General



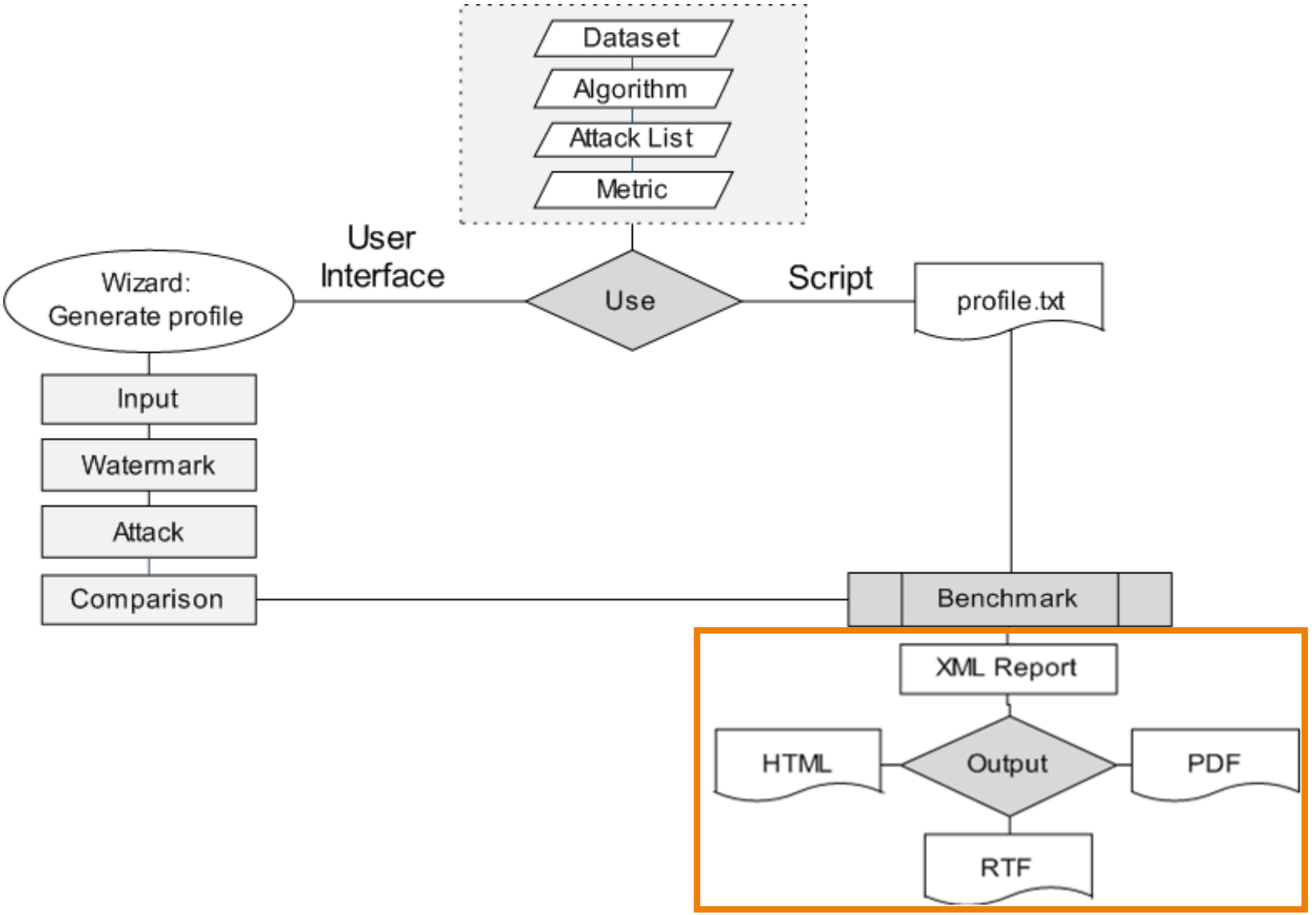
Architecture: Benchmark



Geometric attacks & Metrics

- Unable to compare unequal dimensions
- Solution: Resize
  - Default: 'OFF'
  - Adjustable resize
  - Only used for comparison
- Default 2 metrics
- Multiple algorithms exist
- Use complementary metrics
  - PSNR (general metric)
  - SSIM (HVS model)

Architecture: General



Architecture: Report

- HTML
  - Uploading results to FTP-server
- RTF
  - Compatibility
  - Tables copy/paste spreadsheet programs
- PDF
  - Universal
- Notification/Report attached

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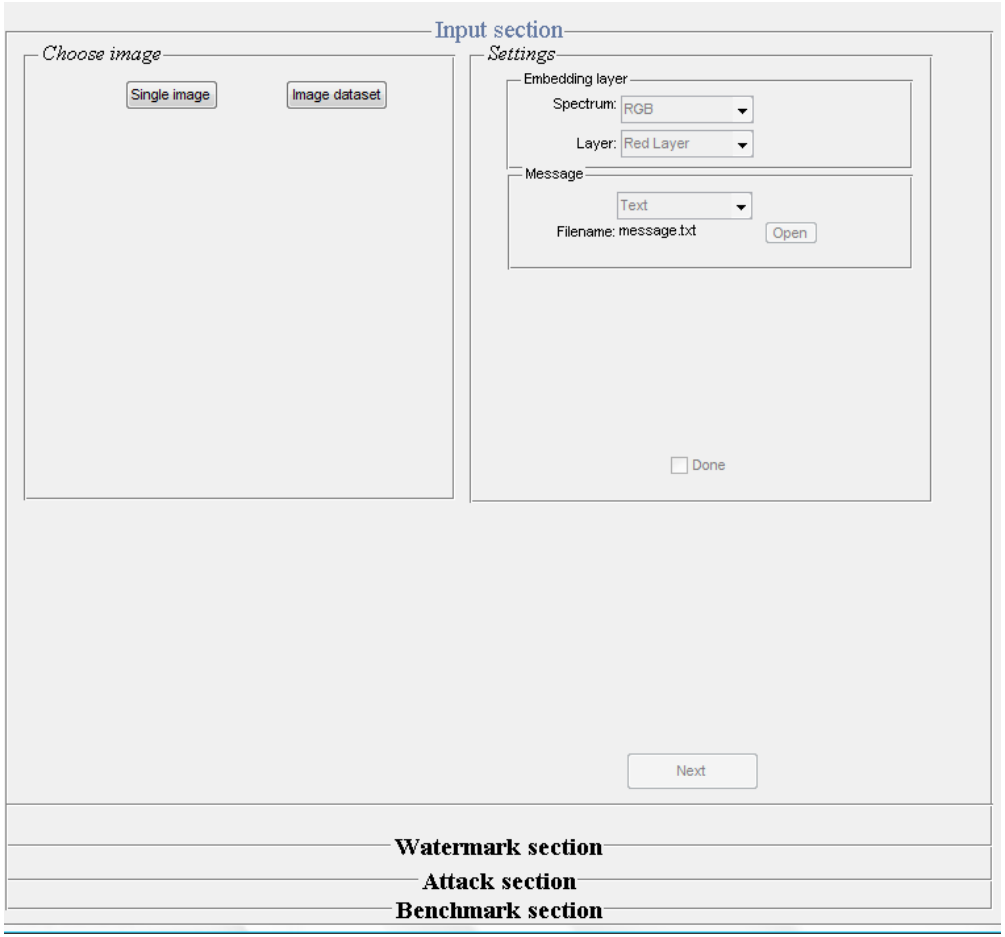
Demonstration



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Future work

- Expansion of the attack algorithms
- Automatic support for distributed computing
- Expansion:
  - Video benchmarking
  - Simulink
- ...

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Masterthesis: Conclusion

- Open adjustable toolbox
- Compliant with standards
- Advanced report generator
- Successful proof of concept: much potential

Questions

Questions ?
Thanks for your attention.

Project and source code soon available on e-lab website
www.e-lab.be

"It is mathematics that offers the exact natural sciences, a certain measure of security which, without mathematics, they could not attain "

A. Einstein

Hogeschool Antwerpen