

**Silesian University of Technology**

**Faculty of Automatic Control, Electronics   
and Computer Science**

##### Final Project

##### (choose appropriate)

Implementation of face detection algorithms in video sequences

Author: Wojciech Mazur

Supervisor: PhD Michał Staniszewski

Consultant: PhD Name Surname

Gliwice, January 2019Załącznik Nr 2 do Zarz. Nr 97/08/09

**Oświadczenie**

Wyrażam zgodę/nie wyrażam\* zgody na udostępnienie mojej pracy dyplomowej/rozprawy doktorskiej\*

…………….………., dnia …………………………

……………………………………..……………….……

*(podpis)*

……………………………………………………………

*(poświadczenie wiarygodności podpisu przez Dziekanat)*

*\* właściwe podkreślić*

**Oświadczenie promotora**

Oświadczam, że praca „Implementation of face detection algorithms in video sequences” spełnia wymagania formalne pracy dyplomowej inżynierskiej.

|  |  |
| --- | --- |
| Gliwice, dnia ……………………… | ………………..……………….……  *(podpis)* |

Contents

[1. Introduction 1](#_Toc526891482)

[2. [Problem analysis] 5](#_Toc526891483)

[3. Requirements and tools 9](#_Toc526891484)

[4. External specification 12](#_Toc526891485)

[5. Internal specification 15](#_Toc526891486)

[6. Verification and validation 18](#_Toc526891487)

[7. Conclusions 21](#_Toc526891488)

[Bibliography i](#_Toc526891489)

[List of abbreviations and symbols ii](#_Toc526891490)

[Contents of attached CD-ROM iii](#_Toc526891491)

[List of Figures iv](#_Toc526891492)

[List of Tables v](#_Toc526891493)

# Introduction

This chapter contains following elements:

* introduction into the problem domain,
* settling of the problem in the domain,
* objective of the thesis,
* scope of the thesis,
* short description of chapters,
* clear description of contribution of the thesis’s author – in case of more authors table with enumeration of contribution of authors.

According to Maslow’s Hierarchy of needs, safety is one of our most fundamental needs. Without it, it is hard to think about friends, relationships, accomplishments, or self-fulfillment. Over the last few years it can be observed, that the biological identification is rising in its popularity. There are new ways found to utilize our biological footprints. What we can also notice, is that most of the use cases revolves around security, and for a good reason. Fingerprints are used to unlock locks for decades. Fingerprint scanners have also found a way to consumer electronics. We can’t imagine a world where we can’t secure our smartphone or notebook just with a password. Fingerprint scanners have expended rapidly when it comes to smartphones and made our lives better.

But it’s not the only way we are trying to secure our privacy, including our increasingly valuable resource, which is data. We have developed ways to recognize people by other features like iris, or even from a face in general, using different kinds of sensors. Cameras, infrared light sensors to depth detectors that remember given points on a face. And everything happens within a blink of an eye.

What we want to do apart from protecting our data, is something that we crave to do since beginning of the humanity. We want to protect ourselves. We want to feel safe and comfortable, it is, in fact, required, as stated previously.

One of the main issues arising in recent years, is public safety and detection of dangerous people. We can observe increasing activity of terrorism in a lot of European countries. The awareness of people is also increasing, we are learning that prevention is better that treatment. National safety agencies recognize most of European countries at least on moderate threat of terrorism. A lot of countries are considered even as a high threat for regular travelers. This is something that needs to be addressed as quickly as possible, and we need to work on the technology, that can be effectively applicated for new solutions.

Main goal of this thesis is to implement face detection algorithms, both with the face recognition. This could provide us with useful tools to analyze and examine, for example video footages that are collected every day on thousands of city cameras around the globe. We can use that existing architecture, not only to look for people that have already broke the law, but also to prevent crime. Simple camera system doesn’t provide us with the possibility of detecting the face. We would need to do that manually which is a complicated and tedious work, that not every person is able to do. The main focus is to accomplish filtering dangerous, or at least for some reason crucial for safety people, implementing algorithms that detect and recognize their faces.

# [Problem analysis]

This chapter contains following elements:

* problem analysis,
* state of the art, problem statement,
* literature research (all sources in the thesis have to be referenced [1, 2, 4, 3]),
* description of existing solutions (also scientific ones, if the problem is scientifically researched), algorithms, location of the thesis in the scientific domain.

# Requirements and tools

This chapter contains following elements:

* functional and nonfunctional requirements,
* use cases (UML diagrams),
* description of tools,
* methodology of design and implementation.

.

# External specification

This chapter contains following elements:

* hardware and software requirements,
* installation procedure,
* activation procedure,
* types of users,
* user manual,
* system administration,
* security issues,
* example of usage,
* working scenarios (with screenshots or output files).

The entire document should contain references to the illustrations contained therein (Fig. 4.1).

|  |
| --- |
|  |
| Fig.4.1. *The variation funkstioni* |

# Internal specification

This chapter contains following elements:

* concept of the system,
* system architecture,
* description of data structures (and data bases),
* components, modules, libraries, resume of important classes (if used),
* resume of important algorithms (if used),
* details of implementation of selected parts,
* applied design patterns,
* UML diagrams.

A short code insertion in the text line is possible, e.g. class Main. Longer fragments should be written in *Courier* or *Courier New* font size 10 in frames (Listing 4.1) with a space between the lines of the value 1. All lines of code should be numbered so that they can be referenced in the text of the document.

*Listing 1. Generating random numbers*

|  |  |
| --- | --- |
| 1  2  3  4  5  6  7  8  9  10  11  12  13  14  15  16  17 | **package** polsl.iinf.lab;  **import** java.util.Random;  **public** **class** Main {  **public** **static** **void** main(String[] args) {  Random r = **new** Random();  // drawing a number from the range 1..10  **int** a = r.nextInt(10 + 1);  System.*out*.println(a);  // drawing a number from the range -5..15  System.*out*.println(r.nextInt(21) - 5);  }  } |

# Verification and validation

This chapter contains following elements:

* testing paradigm (eg. V model),
* test cases, testing scope (full / partial),
* detected and fixed bugs,
* results of experiments (optional).

# Conclusions

This chapter contains following elements:

* achieved results with regard to objectives of the thesis and requirements,
* path of further development (eg. functional extension . . . ),
* encountered difficulties and problems.

# Bibliography

|  |  |
| --- | --- |
| [1] | Name Surname, Name Surname. *Webpage title*. http://adres/w/sieci.html [access date: 2018-09-30]. |
| [2] | Name Surname, Name Surname. *Title of a book*. Publisher, Warsaw, 2017. |
| [3] | Name Surname, Name Surname. Title of an article in the journal. *Journal title*, 157(8):1092–1113, 2016. |
| [4] | Name Surname, Name Surname, Name Surname. Title of a conference article. In *Conference title*, pages 5346–5349, 2006.  . |

# List of abbreviations and symbols

|  |  |
| --- | --- |
| *DNA* | deoxyribonucleic acid |
| *MVC* | model–view–controller |
| *N* | cardinality of data set |

# Contents of attached CD-ROM

The thesis is accompanied by a CD-ROM containing:

* thesis (PDF file),
* source code of applications,

# List of Figures

# List of Tables