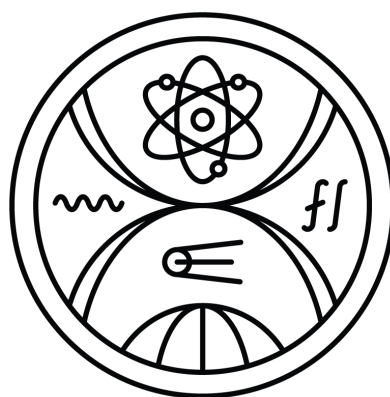


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INFORMATICS



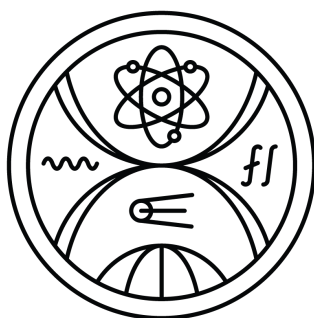
**PERSON IDENTIFICATION
WITH PARTIALLY OCCLUDED FACE**

Diploma Thesis

2022

Bc. Anna Camara

COMENIUS UNIVERSITY BRATISLAVA
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PERSON IDENTIFICATION
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Diploma Thesis

Study programme: mAIN/k - Applied Computer Science (Conversion Programme)
Field of Study: Computer Science
Department: FMFI.KAI Department of Applied Informatics
Supervisor: RNDr. Zuzana Černeková, PhD.

Bratislava, 2022

Bc. Anna Camara



Comenius University in Bratislava
Faculty of Mathematics, Physics and Informatics

THESIS ASSIGNMENT

Name and Surname: Bc. Anna Camara
Study programme: Applied Computer Science (Conversion Programme) (Single degree study, master II. deg., full time form)
Field of Study: Computer Science
Type of Thesis: Diploma Thesis
Language of Thesis: English
Secondary language: Slovak

Title: Person identification with partially occluded face

Annotation: The goal of the thesis is to identify a person in case when face is partially occluded for example with sunglasses or face mask. Study the topic of person identification based on the face. Analyze the performance of the existing solutions published in the literature. Propose a new method based on a neural network, which can find and identify a person. Create a dataset for training and testing purposes. Evaluate the proposed method and draw the conclusions.

Supervisor: RNDr. Zuzana Černeková, PhD.
Department: FMFI.KAI - Department of Applied Informatics
Head of department: prof. Ing. Igor Farkaš, Dr.

Assigned: 24.09.2018

Approved: 03.10.2018

prof. RNDr. Roman Ďurikovič, PhD.
Guarantor of Study Programme

Student

Supervisor

Čestne prehlasujem, že túto diplomovú prácu som vypracovala samostatne len s použitím uvedenej literatúry a za pomoci konzultácií s môjou školiteľkou.

Bratislava, 2023

.....

Bc. Anna Camara

Podakovanie

Touto cestou by som sa chcel v prvom rade poďakovať môjmu školiteľovi za jeho cenné rady a usmernenia, ktoré mi veľmi pomohli pri riešení tejto diplomovej práce. Takisto sa chcem poďakovať mojím kolegom za rady ohľadom implementácie a v poslednom rade chcem tiež poďakovať

Abstract

Key words: facial identification, facial recognition,

Abstrakt

Kľúčové slová: tvárová identifikácia, rozpozanie tvárií.

Chapter 1

Introduction

More and more, facial identification is becoming part of our lives. We are hearing terms like facial identification, facial recognition, verification, biometric and others. First let's clarify what these terms mean and what is the difference between them.

The International Organization for Standardization (ISO) [6] provides following definitions:

Biometric Characteristic is a biological and behavioural characteristic of an individual from which distinguishing, repeatable biometric features can be extracted for the purpose of biometric recognition.

Biometric Recognition/Biometrics is an automated recognition of individuals (referring to only humans) based on their biological and behavioural characteristics. Biometric recognition encompasses *biometric verification* and *biometric identification*.

Biometric identification is a process of searching against a biometric enrolment database to find and return the biometric reference identifier(s) attributable to a single individual.

Biometric verification is a process of confirming a biometric claim through comparison.

In simpler words, when we speak of biometrics or biometric recognition we mean biological and behavioral measurements that can be used to identify individuals. This is a broad term for both verification and identification. In verification we are comparing (1:1) one input against one control point. Basically we are asking *"Is this the same person as saved in our control point?"* or *"Are you who you say you are?"*. In identification we are comparing (1:N) one input against a whole database. We are asking *"Who, from our database, is this?"* or *"Who are you?"*.

This of course includes more than recognition based on ones face. In current age we are able to identify a person from many sources some of which are fingerprints, voice, scan of retina and face.

Now when we have these definitions it is simple to clarify what is facial recognition. **Facial recognition** is biometric recognition based on persons face. This theses will focus on facial identification, specifically on facial identification with partially occluded face by face mask.

1.1 Goals

The goal of this thesis is to improve facial identification techniques to be able to identify masked faces. In this process I would like to focus on two groups of questions:

1. Face identification with facial mask:
 - What different techniques are currently used for facial identifica-

tion?

- How well do facial identification models/software perform on masked faces?
- Are these systems able to identify a person that is wearing a mask even when there are no masked people in the database? If they are not, how can we achieve it?

2. Racial bias:

- How do current systems perform on people of different colors? I would like to do separate evaluation on different groups.
- How to reduce this bias?

TO DO : WHY IS ANSWERING THESE QUESTIONS IMPORTANT...

- How do current systems perform on people of different colors -> Toto je hlavne dolezite preto ze mame viac socialneho bias voci people of color(ZDROJ) a tym padom su castejsie odsudeny na sudoch. prepojit s tym ako sa momentalne pouzva identifikacia tvarii.

+ ukazat ze sa tomu nevenuje dostatok studii, ze tieto otazky neboli dostatočne zodpovedane

maybe add short intro on how facial recognition works. Like in here [9]

TO DO: Dodat organizaciu prace. aka co sa kde nachadza.

Chapter 2

Current facial recognition techniques

For us humans it is most natural to identify one another by recognizing the face of an individual (if we have sight). Therefore, even though it may be less precise compared to other biological triads, like fingerprints, it is our first choice. Thus the idea of face recognition has existed for a very long time. First, we could recognize people only from their physical presence, then paintings and other visualizations came along and later on with the invention of photography we started creating “databases” of identities. Not only for personal use, these collections have been used in forensic examinations, as referential databases, to find the identity of an individual [1]. A photography comparison as evidence in order to verify a person’s identity was used in an English court as early as 1871 [8]. Needless to say, back then the comparison was done manually by humans. This was even before forensic techniques for this kind of face recognition were yet to be born. Since then technology completely changed the way we view facial recognition and widened the possibilities of its usage.

2.1 Usage of face recognition

Nowadays many smartphones , notebooks just from the top of my mind I can name: unlocking a phone/computer, bank access/id verification, airport security?, location of missing people

Verification applications

2.2 Current face identification models and softwares

"In early times, research interests were mainly focused on face recognition under controlled conditions where simple classical approaches provided excellent performance. Today, the focus of research is on unconstrained conditions in which deep learning technology has gained more popularity as it offers strong robustness against the numerous variations that can alter the recognition process. In addition, many academics struggle to find robust and reliable data sets for testing and to evaluate their proposed method: finding an appropriate data set is an important challenge especially in 3D facial recognition and facial expression recognition." [1]

2.3 Performance of current models on masked data

on general database that systems use

on racially separated data

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List of Figures