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PREFACE

During the 2019 EAB general assembly it was proposed to compose an annual academic graduation monitoring report, which should provide information about academic theses that are completed in EAB member institutions.

Such report should contain lists of entries of Bachelor-, Master- or PhD-theses and a short summary of each thesis.

EAB is proud to provide now an overview of the research going on in Europe. If you are member of EAB and you can contribute information about your graduated students. In order to facilitate the data collection, a webform, accessible to EAB members, has been added to the EAB website, in which author and contact information can be provided as well as a title, and abstract and an optional link to the report. The webform can be found here: https://eab.org/information/academic_report.html

This report was composed by the European Association for Biometrics (EAB) for its members. If you are not EAB member yet – please join and share the non-profit spirit of EAB. We are grateful for your continuous support of the EAB initiatives through your membership.

MONITOR
PHD-THESES

BERNHARD PROMMEGGER - FINGER VEIN BIOMETRICS - AN ANALYSIS FROM DIFFERENT PERSPECTIVES

Full Title: Finger Vein Biometrics - An Analysis from Different Perspectives
Institution: University of Salzburg
Supervisor: Andreas Uhl
URL: https://www.wavelab.at/member-bprommeg.shtml
Link description: Homepage Bernhard Prommegger
Contact email: bprommeg@cs.sbg.ac.at

Abstract:
In our society, access to many activities or applications is restricted to authorized persons only, or at least it is necessary to keep track of who performed or accessed them. For this it is necessary to know or determine the identity of the persons involved. This can happen in different ways. Classic methods for this are, e.g. a handwritten signature, the presentation of an identification document or the query of passwords and PIN codes. Alternatively, biometric characteristics can also be used for authentication. Biometric systems make it possible to recognize a person based on their behavioural and biological characteristics. The characteristics used for this must be differentiable, reproducible and usable for automated processing. Biometric systems have already found their way into our everyday life and are widely used, e.g. to unlock smartphones or for verifying the identity of a person at borders or at other access systems. The most widespread modalities are probably fingerprint and facial recognition. Other biometric recognition system utilize iris, voice, gait or the vascular pattern inside the human body for authentication. This dissertation deals with the recognition of people based on the structure of the blood vessels inside the human finger, commonly referred to as finger vein biometrics. It is based on the assumption that the structure of the blood vessels within the finger is unique for every person and can thus be used for biometric recognition. Up to now, in finger vein biometrics the palm side (or palmar view) of the finger has been used nearly exclusively. There is little work that also use the opposite side of the finger (dorsal view), but all other perspectives are ignored completely. This is exactly the topic to which this work is tailored. It evaluates whether these additional views show similar or even better recognition rates than the commonly used perspectives or if they at least provide enough information to increase the recognition rates when they are used together with the currently used ones. Since there exists neither appropriate data sets nor suitable capturing devices to acquire different perspectives, such devices needs to get developed and built and data from a sufficient amount of subject needs to be acquired to enable scientific evaluations. Another focus of the work is the evaluation of the effect of longitudinal finger rotation (the finger is subject to rotation around the longitudinal axis of the finger) on the recognition rates and how such a rotation can be compensated or corrected. Finally, four different rotation invariant multi-camera systems are presented.

JASCHA KOLBERG - SECURITY AND PRIVACY FOR BIOMETRIC SYSTEMS

Full Title: Security Enhancement and Privacy Protection for Biometric Systems
Institution: Hochschule Darmstadt
Supervisor: Christoph Busch, Marta Gomez-Barrero
URL: https://christoph-busch.de/files/Kolberg-PhD-Thesis-2021.pdf
Contact email: christoph.busch@h-da.de

Abstract:
Biometric recognition systems are part of our daily life. They enable a user-convenient authentication alternative to passwords or tokens as well as high security identity assessment for law enforcement and border control. However, with a rising usage in general, fraudulent use increases as well. One drawback of biometrics in general is the lack of renewable biometric characteristics. While it is possible to change a password or token, biometric characteristics (e.g. the fingerprint) stays the same throughout a lifespan. Hence, biometric systems are required to ensure privacy protection in order to prevent misuse of sensitive data. In this context, this Thesis evaluates cryptographic solutions that enable storage and real time comparison of biometric data in the encrypted domain. Furthermore, long-term security is achieved by post-quantum secure mechanisms. In addition to those privacy concerns, presentation attacks targeting the capture device are threatening legit operations. Since no information about inner system modules are required to use a presentation attack instrument (PAI) at the capture device, also non-experts could attack the biometric system. Thus, presentation attack detection (PAD) modules are essential to distinguish between bona fide presentations and attack presentations. In this regard, different methods for fingerprint PAD are analysed in this Thesis, including benchmarks on several classifiers based on handcrafted features as well as deep learning techniques. The results show that the PAD performance depends on material properties of the used PAI species in combination with the captured data type. However, fusing multiple approaches enhances the detection rates for both convenient and secure application scenarios.

HAREESH MANDALAPU - ROBUST ALGORITHMS FOR AUDIO-VISUAL BIOMETRIC AUTHENTICATION

Full Title: Robust Algorithms for Audio-Visual Biometric Authentication
Institution: NTNU
Supervisor: Raghavendra Ramachandra and Christoph Busch
URL: https://ntnuopen.ntnu.no/ntnu-xmlui/handle/11250/2834504
Contact email: christoph.busch@ntnu.no

Abstract:
In this thesis, we have focused on improving the generalization of biometrics by working on some of the problems caused by presentation attacks and internal de- pendencies in biometrics. The key challenges in audio-visual biometrics were identified, and research objectives were designed for this thesis. The vulnerab- ilities in audio-visual biometrics are observed with the help of a thorough review of existing recognition and presentation attack detection methods. An exhaustive and comprehensive study along with a comparison and categorization of state- of-the-art methods have resulted in a novel dataset. The dataset includes different attributes, which provide the scope to perform extensive experiments to understand dependencies and vulnerabilities. The thesis proposes a fusion of texture features based iris presentation attack detection algorithm, with results showing superior performance. Further, the cross-dataset experiments led to an empirical evaluation of vulnerabilities in iris biometrics due to presentation attacks.

ALI KHODABAKHSH - AUTOMATED AUTHENTICATION OF AUDIOVISUAL CONTENTS

Full Title: Automated Authentication of Audiovisual Contents: A Biometric Approach
Institution: NTNU
Supervisor: Christoph Busch
URL: https://ntnuopen.ntnu.no/ntnu-xmlui/handle/11250/2757964
Contact email: christoph.busch@ntnu.no

Abstract:
The primary objective of this thesis is to address the audiovisual content authentication problem on the face modality by vulnerability assessment and mitigation of detected vulnerabilities with reliance on biometric and presentation attack detection knowledge. To this end, after producing a taxonomy of existing generation techniques, subjective tests are done to assess the vulnerability of viewers to the most prevalent generation techniques with reliance on data collected from the wild. Following this process, the generation techniques the viewers are most susceptible to were identified. The discovered vulnerabilities are then mitigated individually by the introduction of effective detection techniques that outperform existing solutions. Furthermore, the vulnerability of existing general-purpose detection methods was analyzed and it was discovered that these methods show limited generalization capacity when faced with new generation methods. To mitigate this vulnerability, with reliance on an anomaly extraction approach, a generalizable detection method is introduced and empirically evaluated against the state-of-the- art methods. Additionally, all the datasets that are collected during the course of this thesis work are made publicly available to stimulate further research on this topic.

MONITOR
MASTER-THESES

FLORIAN KRAUSE - HANDWRITTEN SIGNATURE/SIGN VERIFICATION ON MOBILE DEVICES

Full Title: User verification using handwritten signatures/signs for unlocking a FIDO authenticator
Institution: Fraunhofer IGD
Supervisor: Prof. Dr. Arjan Kuijper, Dr. Olaf Henniger
Contact email: olaf.henniger@igd.fraunhofer.de

Abstract:
We live in a time in which everyone creates more and more accounts to participate in the online world. For security reasons each one of those accounts should be secured using its own password, which all need to be memorized. As an alternative it is possible to use biometrics for the authentication. This offers a secure way for most cases, but it does not come without obstacles. Some factors may need special hardware to be useable and some users feel they are giving away too much personal data by using them. So why do we not use an authentication method that is ubiquitous in the analog world? Signatures are getting used every day even for cases with high security requirements and for a digital application any smartphone can be used, since only a touchscreen and an internet connection are needed. For this the high security standard of the FIDO Alliance is used, whose framework is already in use for many different authentication alternatives. This thesis now brings both these elements together to establish signatures as an efficient alternative for passwords.

CHRISTOPH TILMAN STRÜBIG - FACE VERIFICATION IN EMBEDDED SYSTEMS WITH COMPOUND-EYE CAMERA

Full Title: Face verification in embedded systems with compound-eye camera
Institution: Fraunhofer IGD
Supervisor: Prof. Dr. Arjan Kuijper, Dr. Olaf Henniger
Contact email: olaf.henniger@igd.fraunhofer.de

Abstract:
Face verification on resource-constrained systems is currently a field of active research. Modern lightweight neural networks are able to achieve or even exceed human-level performance while requiring considerably fewer parameters than more traditional neural networks. This thesis assesses the feasibility of system-on-card face verification using various pre-trained models combined with a thin compound-eye camera, inspired by the insect's eye. A face verification pipeline from capture to verification decision is developed and evaluated using false match and false non-match rates with regard to the strict resource limitations of smart cards. In an additional step, possible applications and disadvantages of on-card face verification are discussed.

EMANUELE PANCISI - DEEP LEARNING FACE MORPHING DETECTION APPROACH

Full Title: Face Morphing Detection: a Deep Learning Based Approach
Institution: University of Bologna
Supervisor: Matteo Ferrara
URL: https://amslaurea.unibo.it/23154/
Link description: Institutional Theses Repository
Contact email: matteo.ferrara@unibo.it

Abstract:
Face morphing and related morphing attacks have emerged as serious security threat for automatic Face Recognition systems and a challenging research field. Therefore, the availability of effective and reliable morphing attack detectors is strongly needed. The goal of this thesis is to better understand the problem of face morphing and to propose new deep learning-based algorithms for face morphing detection in both single and differential scenarios.

KOEN RIKKERINK - FINGER VEIN SCANNER.

Full Title: Enabling Perspective Multiplication for Multi-Perspective Enrollment with University of Twente Finger Vein Scanner.
Institution: Universiteit Twente
Supervisor: Luuk Spreeuwers
URL: https://essay.utwente.nl/86247/
Link description: Enabling Perspective Multiplication for Multi-Perspective Enrollment with University of Twente Finger Vein Scanner.
Contact email: l.j.spreeuwers@utwente.nl

Abstract:
This research will focus on improving the current Finger Vein Scanner by enhancing Image quality and implementing Perspective Multiplication for Multi-Perspective Enrollment. In addition a new protocol is established: Full PM-MPE. This protocol will compare all images with their corresponding pseudo-perspectives to PM-MPE.

JAKUB SVOBODA - APPLICATION FOR RECOGNITION OF PEOPLE BY FACE

Full Title: Application for Recognition of People by Face
Institution: Brno University of Technology
Supervisor: Tomas Goldmann
URL: https://www.fit.vut.cz/study/thesis/22804/
Contact email: igoldmann@fit.vutbr.cz

Abstract:
Person identification has in the recent years gained notoriety as one of the most powerful ways of extracting information from image data. This thesis is focused on the task of human identification from facial photographs. To solve this task, we employ algorithms based on neural networks, which produce more robust results than traditional algorithms. In this thesis, we studied the common approaches for solving this problem and based on the gathered knowledge we created an architecture of a neural network trained to tackle the task of human identification and verification based on facial photographs. We have then further improved the model architecture and the training process by performing various experiments and observing the results. The final model has reached an accuracy comparable to other state–of–the–art models. Furthermore, we created a desktop application to demonstrate the results visually and to enable easier manipulation with the identity database. The knowledge gathered in this thesis can be used for improvements of current identification models or models modified for solving similar tasks.

PONTUS HEDMAN - THE EFFECT OF BEAUTIFICATION FILTERS ON IMAGE RECOGNITION: ARE FILTERED SOCIAL MEDIA IMAGES VIABLE OPEN SOURCE INTELLIGENCE?

Full Title: The Effect of Beautification Filters on Image Recognition: Are filtered social media images viable Open Source Intelligence?
Institution: Halmstad University, Sweden
Supervisor: Josef Bigun, Kevin Hernandez Diaz, Fernando Alonso-Fernandez
URL: http://urn.kb.se/resolve?urn=urn:nbn:se:hh:diva-44799
Contact email: feralo@hh.se

Abstract:
In light of the emergence of social media, and its abundance of facial imagery, facial recognition finds itself useful from an Open Source Intelligence standpoint. Images uploaded on social media are likely to be filtered, which can destroy or modify biometric features. This study looks at the recognition effort of identifying individuals based on their facial image after filters have been applied to the image. The social media image filters studied occlude parts of the nose and eyes, with a particular interest in filters occluding the eye region. Our proposed method uses a Residual Neural Network Model to extract features from images, with recognition of individuals based on distance measures, based on the extracted features. Classification of individuals is also further done by the use of a Linear Support Vector Machine and XGBoost classifier. In attempts to increase the recognition performance for images completely occluded in the eye region, we present a method to reconstruct this information by using a variation of a U-Net, and from the classification perspective, we also train the classifier on filtered images to increase the performance of recognition. Our experimental results showed good recognition of individuals when filters were not occluding important landmarks, especially around the eye region. Our proposed solution shows an ability to mitigate the occlusion done by filters through either reconstruction or training on manipulated images, in some cases, with an increase in the classifier's accuracy of approximately 17% points with only reconstruction, 16% points when the classifier trained on filtered data, and 24% points when both were used at the same time. When training on filtered images, we observe an average increase in performance, across all datasets, of 9.7% points.

ROBERT MYSZA - THERMAL IMAGING SYSTEM FOR MEASURING BODY TEMPERATURE

Full Title: Thermal Imaging System for Measuring Body Temperature
Institution: Brno University of Technology
Supervisor: Tomas Goldmann
URL: https://www.fit.vut.cz/study/thesis/24048/
Contact email: igoldmann@fit.vutbr.cz

Abstract:
The COVID-19 pandemic brought increased need for measuring human temperature. This thesis deals with solution of using low-cost thermal camera module FLIR Lepton 3.5 for measuring human forehead temperature and examines the real usability of this in terms of an accuracy. In the beginning, I describe various methods of measuring temperature and factors, which can influence the measurement. Subsequently, I examine various factors influencing human body and surface temperature. As of result of thesis is full design and implementation of thermal image system for temperature measurement, which I tested in different environmental conditions and compared its the precision against medical contactless infrared thermometer.

SARA CONCAS - DEEPFAKE DETECTION USING QUALITY MEASURES

Full Title: Deepfake detection using quality measures
Institution: University of Cagliari
Supervisor: Gian Luca Marcialis, Giulia Orrù
URL: https://drive.google.com/file/d/1K7cg3J527S4TAuPnFEJPVF7nucd4qykl/view
Contact email: marcialis@unica.it

Abstract:
The term “DeepFake”, usually refers to a video where the face of a person has been replaced with another one or its expression has been changed following that of a source face, typically using deep learning-based techniques. There are several positive applications of deepfakes, such as video dubbing of foreign movies, virtually trying on clothes while shopping, reanimation of historical figures for educational purposes. The malicious applications, however, overcome the positive ones: the most alarming are the creation of fake news, hoaxes, financial fraud and unethical use such as the transposition of celebrity faces into porn videos. The name “deepfakes” itself was originated by a Reddit user who, in 2017, used deep learning to swap faces of celebrities into pornographic videos and posted them online. The distribution of deepfakes is becoming particularly alarming among kids and teenagers, harmless victims of online harassments, revenge porn and acts of intimidation. Very often, the minor is ashamed of revealing the abuse, risking to suffer serious damages to his/her psyche. There exist several types of deepfakes: face swap (when the entire face of a person is replaced with that of another person), reenactment (when the expression, mouth, gaze, pose or body of the target identity is driven by that of a source), editing (when one or more attributes of the target person are added, altered, or removed), synthesis (the fake is created using human face and body synthesis techniques). The quality of deepfakes is increasing exponentially, so much that very often is impossible to notice the difference between a fake and a real video. Some deepfakes, however, present artifacts; we hypothesize that there exists a correlation between the presence of manipulations and visible or non-visible artifacts. The goal of this thesis is to propose a new deepfake detection method that exploits the presence of those visual artifacts on manipulated video sequences using three types of quality measures: BRISQUE (that quantifies the “naturalness” of an image), Fast Fourier Transform (evaluating the number of high frequencies) and the Laplacian operator (determining the level of sharpness of the image). These three quality measures are computed on the mouth and eyes regions over 300 frames for each video (about 10 seconds) and the obtained feature matrix is used to train a Convolutional Neural Network and perform classification. The experiments have been carried out on the FaceForensics++ dataset, using two experimental protocols: an intra-dataset protocol (where the system is trained and tested on the same typologies of attack) and a cross-dataset protocol (where the system is tested on never-seen-before typologies of attack).

MARTINA GRZYBOWSKA - HUMAN MO-CAP SYSTEM BASED ON INERTIAL MEASUREMENT UNITS

Full Title: Human Mo-cap System Based on Inertial Measurement Units
Institution: Brno University of Technology
Supervisor: Martin Drahansky
URL: https://www.fit.vut.cz/study/thesis/20602/
Contact email: drahan@fit.vutbr.cz

Abstract:
The aim of this thesis is to design, construct and implement a custom inertial motion capture system. Though multiple techniques have been studied, the primary focus is placed on inertial motion capture itself – its merits and demerits, key properties and components necessary for construction of an inertial-based system. The preliminary information gathering is followed by the design, implementation and evaluation phases, which deal with presenting the process of developing and testing the solution. The main contribution of the system implementation is the construction of hardware motion capture devices, i.e. small, lightweight, battery-powered wearable bands, which are completely wireless – both in terms of communication with the outside world as well as in their Qi-compliant charging capabilities.

DANIEL BAPTISTA - MULTI-ADVERSARIAL DOMAIN GENERALIZATION TO IMPROVE FACE RECOGNITION RELIABILITY

Full Title: Multi-adversarial Domain Generalization to Improve Face Recognition Reliability
Institution: Instituto Superior Tecnico - Universidade de Lisboa, Portugal
Supervisor: Paulo Lobato Correia
URL: https://www.it.pt/Supervisions/Supervision/16706
Contact email: paulo.lobato.correia@tecnico.ulisboa.pt

Abstract:
Facial recognition is one of the most popular technologies nowadays, constituting the first security barrier for devices like smartphones and tablets. This, in turn, makes facial recognition systems vulnerable to attacks with one of the most notorious being face presentation attacks. Face presentation attacks are an emerging threat and therefore have become more complex and unpredictable, through the years. The challenge of detecting face presentation attacks has led to the appearance of solutions based on liveness detection, facial appearance, contextual information, and more recently, solutions based on deep learning techniques. Within the deep learning field, one topic that has been explored to recognize such attacks is the domain generalization topic. This work focuses on a solution that incorporates this topic. The adopted approach improves on an existing solution, taken as baseline, that trains a model with face presentation attacks seen in different conditions, to be able to generalize to other acquisition conditions. The present work proposes a source domain reorganization to enhance the generalized feature space, together with a modified triplet loss function that is more suitable for the proposed domain reorganization. The experiments were conducted on four public datasets. The solution proposed includes domain reorganization and a more suitable triplet loss function, achieving on-pair performance when tested with REPLAY-ATTACK dataset and outperforming the baseline architecture in the CASIA and MSU datasets. Future work includes complementing the proposed solution with a liveness detection algorithm, and a solution for addressing previously unseen attacks.

NAHUEL MANTEROLA - STEREOSCOPY FOR 3D FACE RECONSTRUCTION.

Full Title: Evaluating the feasibility and effectiveness of multi-perspective stereoscopy for 3D face reconstruction.
Institution: Universiteit Twente
Supervisor: Luuk Spreeuwers
URL: https://essay.utwente.nl/88167/
Link description: Evaluating the feasibility and effectiveness of multi-perspective stereoscopy for 3D face reconstruction.
Contact email: l.j.spreeuwers@utwente.nl

Abstract:
This paper presents research on the feasibility and effectiveness of multi-perspective stereoscopy. A method is introduced to reconstruct a 3D face from a set of images taken by a camera array on a 2D plane. A physical setup is presented to dynamically emulate this array, along with a digital rendering setup. Quantitative measurements are shown on the performance of the physical setup, and the results of the digital setup are qualitatively compared. The influence of the camera baseline, subject surface angle and the number of cameras on the reconstruction quality is determined. Conclusions are drawn, but only for the current setup and methods.

ADAM SUBA - SYNTHETIC FINGERPRINT GENERATION FROM BIOMETRIC TEMPLATE

Full Title: Synthetic Fingerprint Generation from Biometric Template
Institution: Brno University of Technology
Supervisor: Ondrej Kanich
URL: https://www.fit.vut.cz/study/thesis/23943/
Contact email: kanich@fit.vutbr.cz

Abstract:
The goal of this master thesis is to design and implement an approach for synthetic fingerprint generation from a biometric template. The thesis bases the solution on an existing fingerprint generator called SyFDaS developed at the Brno University of Technology, Faculty of Information Technology. Individual components of the generator had to be modified and automized to suit better the task of generating from a template. The end product enables the user to create a fingerprint without any intervention just by importing a template. The evaluation in this thesis presents results obtained by comparing the synthetic and original fingerprints using the VeriFinger algorithm. Entirely automatically created fingerprints achieved mixed results; however, manual adjustments of the parameters brought substantial improvements. Up to 72% of synthetic fingerprints reached the match by the VeriFinger. The results of the evaluation helped to identify weak points of the current solution. Based on these, the thesis proposes further steps to improve the success rate of automatic generation and the quality of other components.

HANS VAN DER HEIDE - SYNTHESIS AND CLASSIFICATION OF GHOST FINGERPRINTS.

Full Title: Synthesis and classification of ghost fingerprints.
Institution: University of Twente
Supervisor: Luuk Spreeuwers
URL: https://essay.utwente.nl/88010/
Link description: Synthesis and classification of ghost fingerprints.
Contact email: l.j.spreeuwers@utwente.nl

Abstract:
The Dutch police force possesses a dataset of fingerprints of which some contain a ghost: a second overlapping print caused by a calibration error. It is desirable to assess automatically whether a ghost is present, how severe it is, and in what region it is present. This presents an analysis of the dataset identifying key characteristics, a synthesizer capable of generating realistic looking samples and three classification method. The first method uses stacked hough transforms to find parallel curved lines. The second algorithm is a CNN capable of finding the region in which the ghost is present. The final algorithm is designed to find the severity of the ghost.

ZOFIA VRABLOVA - ADVANCED GENERATION OF SPOOF ARTEFACTS INTO SYNTHETIC FINGERPRINTS

Full Title: Advanced Generation of Spoof Artefacts into Synthetic Fingerprints
Institution: Brno University of Technology
Supervisor: Ondrej Kanich
URL: https://www.fit.vut.cz/study/thesis/23942/
Contact email: kanich@fit.vutbr.cz

Abstract:
The goal of this thesis is to extend the application for spoof effects generation into synthetic fingerprints with the possibility of generation of two new spoof effects together with annotations of generated damages. Spoof effects chosen for this thesis are areas with lower clarity and defects in spoof material. Those effects were analyzed, methods to generate those effects were designed and then implemented. According to testing, generation of two new added spoof effects led to reduction in quality of fingerprint images, as well as the value of the similarity score determined during identification. In comparison with the original solution, the quality of the fingerprints decreased more in the extended solution, the similarity score in the generation of separate spoof effect decreased overall approximately equally.

RASMUS VAN DER GRIFT - DEVELOPMENT OF FINGER VEIN PHANTOMS

Full Title: Development of finger vein phantoms with realistic finger vein patterns.
Institution: Universiteit Twente
Supervisor: Luuk Spreeuwers
URL: https://essay.utwente.nl/88556/
Link description: Development of finger vein phantoms with realistic finger vein patterns.
Contact email: l.j.spreeuwers@utwente.nl

Abstract:
This report will cover a method to make phantom fingers with realistic finger veins. Just like real blood vessels, these veins can be detected under NIR light. These phantom fingers can help future extraction methods and finger vein scanners with their performance as the position of the veins is known unlike their real counterparts. It turns out that this method can also be used for spoofing as the performance of Miura max curvature together with ICP drops down if phantom fingers are introduced which represent a real finger.

CRISTIAN BOTEZATU - IMPACT OF SELFIE FILTERS ON FACE RECOGNITION

Full Title: Impact of Selfie Filters on Face Recognition
Institution: Technical University of Denmark (DTU)
Supervisor: M. Ibsen (h_da), C. Rathgeb (h_da), C. Busch (h_da), C. D. Jensen (DTU)
Contact email: cristian.botezatu@ntnu.no

Abstract:
Each individual has distinctive physiological and behavioural characteristics, making it possible for biometric systems to use this information for recognition purposes. Among other biometric systems, face recognition is widely accepted, convenient and accurate, seeing significant performance enhancement since the appearance of deep learning. Despite the nearly perfect recognition performance of state-of-the-art face recognition systems, there is still concern with regards to their reliability when being exposed to occluded faces. Inline with the aforementioned information, the goal of the thesis is to assess the effect of selfie filters on face recognition systems, and to provide an algorithm for reconstructing occluded facial parts with the aim of improving face recognition performance. To be able to engage in such an investigation, an appropriate dataset of facial images is required. To this end, popular mobile applications are used to create selfie filtered images. The created datasets of selfie filtered facial images, are used to evaluate the impact of selfie filters on face recognition systems, by comparing the performance of state-of-the-art face recognition systems on unaltered and corresponding selfie filtered facial images. The results show that selfie filters affect both the tested commercial and open-source systems, especially on facial images where the eye or nose region is occluded. Furthermore, selfie filters of high facial coverage have shown to be the most challenging, significantly declining face detection, face quality assessment and face recognition performance.

SANJEET VARDAM - 3D FACE RECOGNITION SYSTEMS OF MORPHING ATTACKS.

Full Title: Vulnerability of 3D Face Recognition Systems of Morphing Attacks.
Institution: Universiteit Twente
Supervisor: Luuk Spreeuwers
URL: https://essay.utwente.nl/88470/
Link description: Vulnerability of 3D Face Recognition Systems of Morphing Attacks.
Contact email: l.j.spreeuwers@utwente.nl

Abstract:
Face morphing has proved to be threat to 2D face recognition systems. But it is still quite untested against a 3D face recognition system. This thesis looks into methods of face morphing in 3D. Then uses this face morphs to attack 3D face recognition systems. The objective is to understand the vulnerability of 3D face recognition systems against 3D face morphing.

VERONIKA SVORADOVA - ADVANCED GENERATION OF DAMAGE EFFECTS INTO SYNTHETIC FINGERPRINTS

Full Title: Advanced Generation of Damage Effects into Synthetic Fingerprints
Institution: Brno University of Technology
Supervisor: Ondrej Kanich
URL: https://www.fit.vut.cz/study/thesis/24014/
Contact email: kanich@fit.vutbr.cz

Abstract:
The main goal of this thesis was to design and implement a application that would be able to generate fingerprint damage into a synthetic fingerprint. The application can create fingerprint images damaged by pressure, moisture and skin disease dyshidrosis with different intensity of damage. The application also allows annotation of the generated damage and its export. Selected damages were analyzed before the design was created. A database of fingerprints from five users was created to analyze the damage caused by pressure and moisture. The generated images and the achieved results are tested with VeriFinger and FiQiVi. For testing, 19 sets with fingerprints of different intensity and different type of damage were created. Experiments showed that the quality of the fingerprint decreased the most during the generation of moisture with the highest intensity of damage, where the quality decreased by 61.8 %. This thesis can be used for further research in the field of biometric fingerprint processing.

JONAS OLAFSSON - EFFICIENT HE FOR FACE IDENTIFICATION

Full Title: Efficient Facial Identification using Homomorphically Encrypted Templates
Institution: DTU
Supervisor: Christoph Busch, Jascha Kolberg
Contact email: jascha.kolberg@h-da.de

Abstract:
Biometric recognition systems are part of our daily lives. They provide a fast and convenient method of authentication as an alternative to the classical knowledge- or token based approaches. As general technological use increases, attacks tend to do as well, and unlike passwords, a person's biometric characteristics cannot be revoked or changed if a system is compromised. Hence, biometric systems are required to ensure privacy, but many classical approaches would make comparisons hard to impossible as biometric data is inherently noisy. One approach towards protection is to use Homomorphic Encryption (HE), where it is possible to perform computations on encrypted data, e.g. an encrypted biometric comparison. While this solves the privacy issue, it introduces a new one: encrypted operations are relatively slow. Another challenge is the trap-door problem behind these HE schemes, where many schemes today build on the Ring-Learning With Errors (R-LWE) problem. HE with R-LWE is relatively new, so not many standards exist, and this may compromise the security of the schemes if bad parameters are chosen. It may be tempting to choose such bad parameters, as it causes a trivial speed-up of the homomorphic operations. Instead, to perform an efficient authentication, different methods exist called workload reductions methods, which aim at reducing the number of computational operations necessary to perform the same task. The workload reduction method in this thesis attempts to find a more compact format of biometric templates by using dimensionality reduction. It is found that biometric templates contain abundant information and can be heavily compressed with minor loss in biometric identification performance. A method to efficiently encrypt the templates is developed, leading to a quadratic workload reduction as a function of smaller template size in an identification scenario, while preserving the security parameters.

VASILIOS SKEPETZIS - THE EFFECT OF BEAUTIFICATION FILTERS ON IMAGE RECOGNITION: "ARE FILTERED SOCIAL MEDIA IMAGES VIABLE OPEN SOURCE INTELLIGENCE?"

Full Title: The Effect of Beautification Filters on Image Recognition: "Are filtered social media images viable Open Source Intelligence?"
Institution: Halmstad University, Sweden
Supervisor: Josef Bigun, Kevin Hernandez Diaz, Fernando Alonso-Fernandez
URL: http://urn.kb.se/resolve?urn=urn:nbn:se:hh:diva-44799
Contact email: feralo@hh.se

Abstract:
In light of the emergence of social media, and its abundance of facial imagery, facial recognition finds itself useful from an Open Source Intelligence standpoint. Images uploaded on social media are likely to be filtered, which can destroy or modify biometric features. This study looks at the recognition effort of identifying individuals based on their facial image after filters have been applied to the image. The social media image filters studied occlude parts of the nose and eyes, with a particular interest in filters occluding the eye region. Our proposed method uses a Residual Neural Network Model to extract features from images, with recognition of individuals based on distance measures, based on the extracted features. Classification of individuals is also further done by the use of a Linear Support Vector Machine and XGBoost classifier. In attempts to increase the recognition performance for images completely occluded in the eye region, we present a method to reconstruct this information by using a variation of a U-Net, and from the classification perspective, we also train the classifier on filtered images to increase the performance of recognition. Our experimental results showed good recognition of individuals when filters were not occluding important landmarks, especially around the eye region. Our proposed solution shows an ability to mitigate the occlusion done by filters through either reconstruction or training on manipulated images, in some cases, with an increase in the classifier's accuracy of approximately 17% points with only reconstruction, 16% points when the classifier trained on filtered data, and 24% points when both were used at the same time. When training on filtered images, we observe an average increase in performance, across all datasets, of 9.7% points.

JAKUB LUKAC - TRACKING PEOPLE IN VIDEO CAPTURED FROM A DRONE

Full Title: Tracking People in Video Captured from a Drone
Institution: Brno University of Technology
Supervisor: Tomas Goldmann
URL: https://www.fit.vut.cz/study/thesis/23952/
Contact email: igoldmann@fit.vutbr.cz

Abstract:
This thesis deals with the problem of determining the location of a person through their distance from camera approximation. The location is derived from video which is captured using a drone. The goal here is to propose and test existing solutions, and state-of-theart algorithms for each encountered subproblem of the tracking. This means overcoming challenges such as object detection, re-identification of persons in time, estimating object distance from camera and processing data from various sensors. Then, I am using the methods to design the final solution which can operate in nearly real-time. Implementation is based on the use of Intel NCS accelerator unit with the cooperation of small computer Raspberry Pi. Therefore, the setup may be easily mounted directly to a drone. The resulting application can generate tracking metadata for detected individuals in the recording. Afterwards, the positions are visualised as paths for better end-user presentation.

ROMANO FERLA - EXPLORING THE GANFORMER FOR FACE GENERATION : INVESTIGATING THE SEGMENTATION AND SMILE AUGMENTATION POTENTIAL.

Full Title: Exploring the GANformer for Face Generation : investigating the segmentation and smile augmentation potential.
Institution: Universiteit Twente
Supervisor: Luuk Spreeuwers
URL: https://essay.utwente.nl/90496/
Link description: Exploring the GANformer for Face Generation : investigating the segmentation and smile augmentation potential.
Contact email: l.j.spreeuwers@utwente.nl

Abstract:
Advancing the research in face applications is limited by proprietary databases and increasing data protection regulations, synthetically generated databases may provide a solution. In this work the GANformer, a hybrid generative image model, is explored for this application. While only trained for unconditioned face generation like many other models, this works shows the potential of two use cases. First, the unique implementation of the attention is examined for the application of segmentation. Results indicate segmenting behaviour is present, though post-processing is needed before its implementation in synthetic databases. Second, real labeled faces are reconstructed in latent space to find latent directions describing disentangled attributes. This concept is brought in practice by augmenting neutral to smiling faces, but could be applied on other expressions and attributes as well. In both the segmentation and the smile augmentation the results indicate that the GANformer is able to be used for multiple applications in synthetic database generation. This work can be use as basis as it opens up two directions for further research.

DIMITRIOS BOUSIAS - GAIT RECOGNITION FROM MONOCULAR VIDEO BASED ON HUMAN POSE ESTIMATION

Full Title: Towards view-invariant Gait Recognition from monocular video based on Human Pose Estimation
Institution: Universiteit Twente
Supervisor: Luuk Spreeuwers
URL: https://essay.utwente.nl/86202/
Link description: Towards view-invariant Gait Recognition from monocular video based on Human Pose Estimation
Contact email: l.j.spreeuwers@utwente.nl

Abstract:
Gait recognition is the biometric method that can differentiate and identify individuals by the way they walk. Gait as a biometric feature has some interesting characteristics as it can be collected at distance while it can be very hard to fake. Previous gait recognition works that rely on human silhouette representation, are often dependent on robust contouring or background extraction methods. Additionally they can be very limited regarding the viewing angle or require specific conditions to be met. Inspired by recent progress in the field of human pose estimation and skeleton based gait recognition methods, we propose a framework for extracting markerless motion capture data from monocular video and identifying individuals based on extracted features. The generalizing power of off-the-shelf pose estimators towards in the wild videos is tested. The approach is aiming towards a view-angle and clothing invariant solution. A gait dataset is acquired to validate the uniqueness and permanence of various gait features. We report results of verification and identification experiments which are compared to respective ones attained with a commercial depth sensor. Correct identification rates of 79% up to 88% in the overall experiment are achieved using different combinations of features and template matching methods. Possible shortcomings of the method related to view-angle dependent bias or the filtering of identity information are discussed.

THOMAS VAN ZONNEVELD THOMAS VAN ZONNEVELD - 3D FINGER VEIN PATTERNS : ACQUISITION, RECONSTRUCTION AND RECOGNITION.

Full Title: 3D finger vein patterns : acquisition, reconstruction and recognition.
Institution: Universiteit Twente
Supervisor: Luuk Spreeuwers
URL: https://essay.utwente.nl/88484/
Link description: 3D finger vein patterns : acquisition, reconstruction and recognition.
Contact email: l.j.spreeuwers@utwente.nl

Abstract:
Fingerprint and facial recognition systems are widely used for recognition and identification purposes. However, a drawback of these methods is that they are relatively easy to spoof, since the biometric features are acquired from surface of the human body. A partial solution to this problem is the use of vein patterns from inside the fingers. Typically, used vascular systems are 2D systems and the rotations that occur during the acquisition phase may potentially not be acounted for, resulting in a lower accuracy of these systems. Previous research has attempted to identify and address these issues by developing 3D vein pattern recognition systems, but the quantity of papers written on this topic is severely limited and mostly these works are not well documented. To fill this research gap, this works develops a new finger vein scanner that allows 3D vein patterns to be constructed by combining multiple highly detailed 2D vein images. These images are used to construct 3D reconstructions and to perform recognition experiments. The results indicate that 2D systems can perfectly handle rotations in artificial fingers and achieve 99% accuracy for 2D while 98% accuracy is achieved for 3D. For real fingers 2D outperforms 3D with 95% accuracy for 2D compared to 91% for 3D, and the EER rates are 0.045 and 0.089 for 2D and 3D respectively.

MICHAEL LINORTNER - MINUTIAE-BASED FINGER VEIN RECOGNITION USING STANDARD FINGERPRINT RECOGNITION TOOLS

Full Title: Minutiae-based Finger Vein Recognition Using Standard Fingerprint Recognition Tools
Institution: University of Salzburg
Supervisor: Andreas Uhl
URL: https://www.wavelab.at/member-mlinortner.shtml
Link description: Homepage Michael Linortner
Contact email: mlinortner@cs.sbg.ac.at

Abstract:
Biometrics has become a well established technology for authentication with a wide range of use. Therefore, security and privacy are of great interest when using biometric systems. Regarding these topics certain issues are addressed by biometric smartcards. The user's biometric information is only stored on a card and even the comparison process may be executed on card, which is then called a match-on-card (MoC) system. This technology further enhances security and has been applied successfully in several areas of biometrics, for example in fingerprint recognition utilizing minutiae points. However, in finger vein recognition such a system is not available yet. Utilizing minutiae points from vein images in combination with classical minutiae-based fingerprint comparison software offers a great opportunity to integrate vein recognition on MoC systems. In this work two publicly available and two commercial fingerprint comparison tools are used to evaluate the recognition performance of vein minutiae, represented in a standardized data format. Experiments are conducted on six data sets from three publicly available databases. The results strongly indicate that minutiae-based comparison technology developed for fingerprint recognition can be applied to finger vein recognition and is able to compete with and even outperform classical correlation-based methods currently utilized in this field. Hence, this work paves the way for vein recognition on MoC systems.

PATRICK VINE - TRAINING FACIAL RECOGNITION

Full Title: Training Facial Recognition with Synthetic Faces
Institution: Universiteit Twente
Supervisor: Luuk Spreeuwers
URL: https://essay.utwente.nl/88198/
Link description: Training Facial Recognition with Synthetic Faces
Contact email: l.j.spreeuwers@utwente.nl

Abstract:
The effective generation of synthetic faces may be useful for improving facial recognition training datasets. This work explores methods for generating synthetic faces and trained a generative network to synthesize front facing facial images of existing identities with different attributes as well as of completely new identities. The identities of the synthetic faces were evaluated using 3 pretrained facial recognition systems. Facial recognition networks were trained to compare the performance of training with the synthetic faces and real faces. The ability to use the synthetic faces for data augmentation was also evaluated. It was found that the mean equal error rate (EER) increased from 2.21% when using the real facial images to 5.27% when training with completely synthetic faces of new identities. When using the synthetic faces for data augmentation, the new identities could improve the mean EER. However, this improvement is not guaranteed with some training datasets leading to higher mean EER after training with more synthetic faces. There is clearly still a difference between the synthetic faces generated and real faces. Understanding what is still missing in the synthesized faces would be valuable research to more effectively enable training facial recognition with only synthetic faces.

ANDRÉ DÖRSCH - MASTER-FACES ATTACKS ON FACE RECOGNITION BASED ON MORPHING

Full Title: Master-Faces Attacks on Face Recognition based on Morphing
Institution: Hochschule Darmstadt
Supervisor: Christoph Busch and Chistian Rathgeb
Contact email: christian.rathgeb@h-da.de

Abstract:
A Master Face describes a, in most cases, semi-synthetic face image that achieves a significantly higher chance of false matches when attacking random face galleries. The methodology for creating a master face can vary. In this work we investigated if it is possible to generate such a facial image by current morphing techniques. Subsequently, we generated averaged faces within demographic morphing trees to analyze whether these averaged faces increase the probability of success on a false match in a face recognition system attack and whether there are any concrete differences for specific demographic groups. Two state-of-the-art face recognition systems were evaluated by attacking the demographic face galleries using the averaged faces. For the generation of these faces and the classification of the deposited face galleries, subsets of publicly available face databases were created and classified. To analyze the identification systems, only the rank-1 comparison score was evaluated in the experiments for each averaged face. For the majority of experiments, the tendency of increased false matches decreases as the attacking faces become more average. Only the Asian demographic groups showed a strong deviation from these trends, scoring significantly higher on average than the other groups even for averaged faces from deeper morphing trees.

GUILHERME ATANÁSIO - DEEPFAKES: BOOSTING PRIVACY AND AESTHETICS THROUGH FACE OBFUSCATION

Full Title: DeepFakes: Boosting Privacy and Aesthetics through Face Obfuscation
Institution: Instituto Superior Tecnico - Universidade de Lisboa, Portugal
Supervisor: Paulo Lobato Correia, Fernando Pereira
URL: https://www.it.pt/Supervisions/Supervision/16947
Contact email: paulo.lobato.correia@tecnico.ulisboa.pt

Abstract:
With thousands of pictures taken every single day in public places, the privacy of individuals is at constant risk. This Thesis proposes a face obfuscation system that aims at protecting the privacy of specific individuals in pictures while at the same time minimizing the visual impact of these manipulations on the aesthetical quality and realism of the resulting images. The proposed system obfuscates the faces of the selected individuals automatically by swapping them with synthetic, non-existing faces generated using deepfake generation algorithms. This system is specifically designed to produce aesthetically pleasant and realistic obfuscated images when working with non-occluded frontal faces. The proposed Face Obfuscation solution includes three main stages. First, given an input image, the human faces are detected, and a user selects the target faces to be obfuscated to protect their privacy. Next, for each target face, a deepfake face from a dataset that was created beforehand is selected, notably the face that should produce the most realistic and aesthetically pleasant output after performing the face swapping. Finally, the selected deepfake is swapped with the target face with the goal of transparently blending it into the background to produce a realistic result. Since the face selection method offers several configurations and there are two blending techniques, a subjective quality assessment survey has been performed to evaluate the multiple system configurations. It has been concluded that the proposed Face obfuscation solution can be used in real application scenarios with acceptable performance when the faces to obfuscate have specific characteristics or the aesthetical quality of the result is not the main concern.

PIA BAUSPIESS - PRIVACY-PRESERVING PRESELECTION FOR IDENTIFICATIONS

Full Title: Privacy-Preserving Preselection for Workload Reduction in Protected Biometric Identification Systems
Institution: Hochschule Darmstadt
Supervisor: Christoph Busch, Jascha Kolberg
Contact email: jascha.kolberg@h-da.de

Abstract:
Biometric authentication has gained increasing popularity due to its usability and versatility, from smartphone access to border control. However, biometric data are sensitive data deserving adequate protection. Adding to that, the efficiency of biometric systems, in particular efficient and accurate biometric identification, is one of the most challenging open problems in biometric authentication. As a solution to a combination of both challenges, this Thesis proposes an efficient privacy-preserving reduction of the computational workload of biometric identification systems. More precisely, a preselection on the protected biometric database is facilitated by applying public-key encryption with keyword search (PEKS) to biometric identification. For long-term protection of the biometric data, post-quantum secure PEKS and fully homomorphic encryption are applied. Throughout the system, the unprotected recognition performance is preserved. In an evaluation on two public face databases, the computational workload of an identification search is reduced down to 8.4% compared to an exhaustive search, achieving identification on 1062 subjects in 210 milliseconds. Based on these results, an identification search on 1 million subjects can be estimated at under 3 minutes using off-the-shelf hardware.

PETER SKOV BORNERUP - FISHER VECTOR ENCODING OF DEEP FEATURES FOR FACE PRESENTATION ATTACK DETECTION

Full Title: Fisher Vector Encoding of Deep features for Face Presentation Attack Detection
Institution: Technical University of Denmark
Supervisor: Prof. Dr. Christoph Busch, Dr. Christian Damsgaard Jensen, MSc. Lazaro Janier Gonzalez-Soler
Contact email: lazaro-janier.gonzalez-soler@h-da.de

Abstract:
Rapid development in the field of face recognition and computer science has made the deployment of biometrics viable on increasingly greater scale. Several threats to these systems are emerging, and Deep Learning based security systems have proven vulnerable to attack presentations, which are easily carried out by non-authorized subjects. Face Presentation Attack Detection (PAD) is essential for securing biometric security systems and existing techniques have reported high detection rates when evaluated on known Presentation Attack Instruments (PAI). When presented for more challenging scenarios, existing techniques have proven to not generalise well when unknown PAI species are presented and/or changes in the capture process is introduced. In this work, the feasibility of employing Fisher Vectors (FV) in combination with deep features extracted from multiple pre-trained networks is investigated. Three different methods of incorporating deep features are proposed. Extensive testing has been carried out, initially with focus on model optimisations, and a general performance degradation was observed. For evaluation on known PAIs, an average D-EER of 4.40% is reported. For cross-database testing, D-EERs of 22.5% and 22.82% are reported for a single test, and an average D-EER of 36.85% is reported for the full cross-database testing. The proposed methods showed no improvement in generalisation capabilities overall and it is shown that networks tailored for face recognition is less suitable than networks trained for object recognition.

SEBASTIAN BUNDA - SUB-BYTE QUANTIZATION OF MOBILEFACENET USING QKERAS.

Full Title: Limited Resource Optimization for Face Recognition Neural Networks: Sub-byte quantization of MobileFaceNet using QKeras.
Institution: Universiteit Twente
Supervisor: Luuk Spreeuwers
URL: https://essay.utwente.nl/90930/
Link description: Limited Resource Optimization for Face Recognition Neural Networks: Sub-byte quantization of MobileFaceNet using QKeras.
Contact email: l.j.spreeuwers@utwente.nl

Abstract:
Face recognition is one of the most populair biometric identification systems and as such is widely used. With the growing need for digital personal data security, it is crucial to seek solutions to work on personal devices. To stimulate these developments, the computational and memory footprint of these face recognition systems should be reduced to fit on edge devices. Based on the populair MobileNetV2, MobileFaceNet is a very efficient face recognition neural network with 99.15% accuracy on the LFW dataset with a model size of only 4MB using a 32-bit representation. This work presents a method to reduce the bit length of MobileFaceNet in the form of QMobileFaceNet using sub-byte quantization. This is achieved by first identifying the most strategic use of the QKeras library enabling sub-byte dynamic fixed-point quantization. This work shows that 8-bit and 4-bit versions of QMobileFaceNet can be obtained with 98.68% and 98.63% accuracy on the LFW dataset which reduces footprint to 25% and 12.5% of the original weight respectively. Both show an accuracy loss similar to the performance described by other quantization methods applied on MobileNetV2. Using mixed-precision, an accuracy of 98.17% can be achieved whilst requiring only 10% of the original weight footprint.

PEDRO ALBUQUERQUE - CAN THE WAY YOU WALK REFLECT YOUR HEALTH?

Full Title: Can the way you walk reflect your health?
Institution: Instituto Superior Tecnico - Universidade de Lisboa, Portugal
Supervisor: Paulo Lobato Correia
URL: https://fenix.tecnico.ulisboa.pt/downloadFile/1689244997261877/Thesis_81392.pdf
Link description: MSc Thesis
Contact email: paulo.lobato.correia@tecnico.ulisboa.pt

Abstract:
Gait analysis, i.e. the study of human motion, can provide useful information for the diagnosis, monitoring and recovery of gait related pathologies. As an alternative to the current standard practice that relies on subjective assessment, the state-of-the-art vision based approaches for automatic gait pathology detection and classification use deep learning. The development and testing of such solutions requires the availability of suitable pathological gait datasets. However, mainly due to privacy and ethical concerns associated with sharing data from real patients, few gait pathology datasets are publicly available. Furthermore, in those available, volunteers simulate gait affected by specific pathologies, considering at most 10 subjects. To address this, the developed work presents a new pathological gait dataset, GAIT-IT. Captured from 21 subjects simulating 4 gait pathologies and normal gait, GAIT-IT is significantly larger than publicly available gait pathology datasets. With video sequences recorded in a professional studio, nearly perfect binary silhouettes were extracted, allowing the improved training of machine learning algorithms.
A novel deep learning approach for pathological gait classification is proposed, combining the spatial and temporal feature extraction abilities of convolutional and recurrent neural networks, respectively. The proposed CNN-LSTM framework processes gait cycles as a collection of silhouette frames, allowing the system to learn temporal patterns among the spatial features extracted at individual time steps. Trained with gait sequences from GAIT-IT, the proposed system is able to outperform state-of-the-art solutions, achieve a greater generalization capability on cross-dataset tests and support a significant reduction in network complexity without compromising the overall performance.

ADAM BAK - SIMULATION OF SKIN DISEASES EFFECT USING GAN

Full Title: Simulation of Skin Diseases Effect Using GAN
Institution: Brno University of Technology
Supervisor: Ondrej Kanich
URL: https://www.fit.vut.cz/study/thesis/24097/
Contact email: kanich@fit.vutbr.cz

Abstract:
The aim of this master's thesis is to generate a dataset of synthetic fingerprint images that display symptoms of skin disease. The thesis deals with damage caused by skin disease in the fingerprint images and synthetic fingerprint generation. The diseased fingerprints are generated using a model based on Wasserstein GAN with gradient penalty. A unique diseased fingerprint database created at FIT BUT was used for training of the GAN model. The model was trained on three types of skin disease: atopic eczema, psoriasis vulgaris and dyshidrotic eczema. The generator network of the trained WGAN-GP model was used to generate datasets of synthetic fingerprint images. The synthetic images were compared with real fingerprint images using the NFIQ and FiQiVi quality assessment tools and by comparing minutiae location and minutiae orientation distributions in the fingerprint images.

TEJAS CHANDRA MOHAN - BLIND IMAGE QUALITY ASSESSMENT OF SMARTPHONE-CAPTURED IMAGES

Full Title: Blind Image Quality Assessment of Smartphone-captured Images in the Wild.
Institution: Universiteit Twente
Supervisor: Luuk Spreeuwers
URL: https://essay.utwente.nl/89267/
Link description: Blind Image Quality Assessment of Smartphone-captured Images in the Wild.
Contact email: l.j.spreeuwers@utwente.nl

Abstract:
Real-world images captured using an imaging device suffers from distortion while capturing, processing, or storage. These distortions in images affect their visual quality, rendering them unusable for further processing. This thesis concentrates on images captured by a smartphone from behind a car's windshield. The objective is to classify these images into good quality and bad quality employing deep learning models focusing on Image Quality Assessment. This paper provides an overview of recent developments in Blind Image Quality Assessment (BIQA) using deep learning and the available standard datasets. Specifically, three recent BIQA models are selected to evaluate these images and quantify them as good and bad based on their image quality. Further research is conducted on an ensemble of these BIQA models for the same task. Later, a classification approach is explored consisting of three transfer learning models to classify the images as good quality and bad quality. An ensemble comprising of these models is built. The test results show that the ensemble combination comprising of two BIQA models delivers the highest accuracy towards rightly classifying images as good quality and bad quality

MARJAN STOIMCEV - CONTACTLESS PALMPRINT RECOGNITION

Full Title: Learning to combine local and global image information for contactless palmprint recognition
Institution: University of Ljubljana
Supervisor: Vitomir Štruc
URL: https://repozitorij.uni-lj.si/IzpisGradiva.php?id=124454
Link description: Link to thesis PDF
Contact email: vitomir.struc@fe.uni-lj.si

Abstract:
Among various biometric technologies, the field of palmprint recognition has attracted great attention in biometrics because of its effectiveness. In the past couple of years there has been a leap from the traditional palmprint recognition methodologies which use handcrafted features, to a deep learning based approaches, especially the convolutional neural network (CNN) models which are able to automatically learn the feature representations from the data. However, the information that is preserved by them is very limited to the most discriminative part of the input, which can be problematic when the data is acquired in unconstrained setting as in case for contactless palmprint images. Also, encoding the palmprint structure in a holistic manner cannot address the issues known to be problematic for contactless palmprint recognition, such as the presence of elastic deformations. In this thesis we address the problem of elastic deformations by presenting a new approach to contactless palmprint recognition that is based on a specially devised CNN model. The model is designed as a two-path architecture, where one path processes the input in a holistic manner, while the second input extracts the local information from sampled image patches from the input image. In this way the local processing path addresses the issues related to elastic deformations thereby compensating the information from the global processing path. At the final stage the most relevant local information is selected by a max-pooling operation across channel dimension, and combined with the global one by a simple concatenation. The model is trained with a combined learning objective which uses the standard cross-entropy and the center loss. By using this design, the discriminative power of the learned features is enhanced while exhibiting high level of robustness to elastic deformations and ensures state-of-the-art performance. The approach was tested on two publicly available contactless palmprint databases, namely, IITD and CASIA database and show that it outperforms several classical palmprint recognition methods, and report comparable results against the state-of-the-art palmprint recognition methods from the literature.

MONITOR
BACHELOR-THESES

BARBORA NEMCEKOVA - RETINAL BLOOD VESSEL SEGMENTATION

Full Title: Retinal Blood Vessel Segmentation
Institution: Brno University of Technology
Supervisor: Andrii Kavetskyi
URL: https://www.fit.vut.cz/study/thesis/23976/
Contact email: ikavetskyi@fit.vutbr.cz

Abstract:
The retina is an important part of the human eye. Incident light is processed here and moreover, it plays an essential role in diagnosing various diseases. Its early diagnostics can prevent serious consequences, such as blindness. The most common retinal diseases include diabetic retinopathy, as a consequence of diabetes, and age-related macular degeneration. Automatic retinal vessels segmentation facilitates and speeds up the work of an ophthalmologist. This work focuses on retinal blood vessels segmentation and its further classification into thin and thick vessels. The proposed algorithm is based on morphological operations, k-means clustering, and Frangi's algorithm. Evaluation of the proposed method was performed on two publicly available datasets - Drive and HRF. The results obtained represent 69,89 % for sensitivity, 91,55 % for specificity, and 88,63 % for accuracy. Division of the vessels shows, that on average 21,50 % vessels pixels belong to thick vessels and the rest 78,50 % belong to thin vessels.

LADISLAV ONDRIS - DEPTH-BASED DETERMINATION OF A 3D HAND POSITION

Full Title: Depth-Based Determination of a 3D Hand Position
Institution: Brno University of Technology
Supervisor: Martin Drahansky
URL: https://www.fit.vut.cz/study/thesis/23384/
Contact email: drahan@fit.vutbr.cz

Abstract:
This work aims to offer a real-time, depth-based gesture recognition system using a hand's skeletal information. The Tiny YOLOv3 neural network detects the hand in the depth image. The detected hand is rid of the background and used by the JGR-P2O neural network, which estimates the hand's skeleton represented by 21 key points. Furthermore, a novel technique for gesture recognition from hand key points that compares the input skeleton with user-defined gestures has been proposed. A dataset consisting of four thousand images was captured to evaluate the system.

SIMONE BOESSO - SMARTPHONE ACCELEROMETER TO RECOGNIZE CONVENTIOLAN GESTURES USED AS PASSPHRASES

Full Title: Accelerometro del cellulare per riconoscere gesti convenzionali usati come passphrase - Smartphone accelerometer to recognize conventiolan gestures used as passphrases
Institution: Sapienza University of Rome
Supervisor: Maria De Marsico
Contact email: demarsico@di.uniroma1.it

Abstract:
The internship is divided into two parts: the first part is about creating the smartphone application MemGes that allows the acquisition of gestures by users. The second part focuses on creating tests to assess the validity of two algorithms used for the evaluation of the degree of similarity between two gestures. The algorithms we are going to test are: the DTW and an algorithm based on fuzzy function.

FRANCESCO SARTO - GAIT RECOGNITION

Full Title: Gait recognition
Institution: Sapienza University of Rome
Supervisor: Maria De Marsico
Contact email: demarsico@di.uniroma1.it

Abstract:
The aim of this work was to compare the gait recognition performance obtained on accelerometer signals either using DTW, on the whole or segmented signals, versus a machine learning approach. For the realization of the experiments, five recognition algorithms were implemented that exploit different matching strategies. The first works with complete walks, the second uses segmented walks while the last three use machine learning techniques. Eclipse was mainly used as a development environment and Java as a programming language, although Python and some of its libraries were used for machine learning to implement a particular procedure.

ROK PAVLOVIČ - CROWD-COUNTING WITH MACHINE LEARNING

Full Title: Crowd-counting with machine learning methods
Institution: University of Ljubljana, Slovenia
Supervisor: Vitomir Štruc
URL: https://repozitorij.uni-lj.si/IzpisGradiva.php?id=133173
Link description: The PDF is available for the thesis - in Slovene
Contact email: vitomir.struc@fe.uni-lj.si

Abstract:
Crowd counting is an important research topic in the field of computer vision. It is still difficult to accurately count larger crowds of people at festivals, concerts, protests and choirs, where people are crowded together. In the past years, crowd counting has advanced greatly with the help of deep neural networks. Deep learning methods are the most modern approach to crowd counting and estimating human density. Many such approaches were presented in the literature and the estimates generated are typically influenced by many factors, such as weather conditions, scene type, perspective and image resolution. In the thesis, we are interested in how two crowd counting methods work. We select CSRNet in MCNN for our analysis. CSRNet (Congested Scene Recognition Network) is a method designed to count people in large crowds, which works on the principle of dilated convolutions. The second method MCNN (Multi-column Convolutional Neural Network) uses three column convolutional neural networks to better recognize the different sizes of people in the image data. Both methods were evaluated on both parts of the ShanghaiTech dataset and on the UCF-CC-50 dataset. The experiments were performed on all three collections, separating the data into additional sets so that we could analyze the influence of the angle of view and the type of light. Our analysis shows that, on average, the CSRNet method performs better. In the analysis of the angle of view, we come to the conclusion that the models have better results at a lower angle of view. With regard to the type of light factor, we can conclude that the models have good recognition of people both in natural light and in artificially created light.

DAVIDE SANTORO - PERFORMANCE DIFFERENCE IN BIOMETRCI RECOGNITION BETWEEN MALE AND FEMALE FACESENCE

Full Title: Differenze di performance nel riconoscimento biometrico tra volti maschili e femminili - Performance difference in biometrci recognition between male and female faces
Institution: Sapienza University of Rome
Supervisor: Maria De Marsico
Contact email: demarsico@di.uniroma1.it

Abstract:
The object of this internship is the study of performance differences, as well as frequencies of errors, which emerge from the biometric recognition of male faces e feminine. The report is organized into 4 main parts, specifically: an introduction to biometric systems, a presentation of the dataset used for testing, an explanation of how the algorithms are used for performance evaluation, and a description of the tests performed.

LORENZO SANTINICCHIA - COMPARISON OF DIFFERENT SEGMENTATION ALGORITHMS ON THE IRIS RECOGNITION PERFORMANCE

Full Title: Confronto dell'effetto di diversi algoritmi di segmentazione dell'iride sul successivo riconoscimento - Comparison of different segmentation algorithms on the iris recognition performance
Institution: Sapienza University of Rome
Supervisor: Maria De Marsico
Contact email: demarsico@di.uniroma1.it

Abstract:
This thesis work aims to analyze and compare the performance of three different segmentation algorithms in order to establish if and how the use of a better segmentation algorithm can produce better results in recognition. First of all, an introduction to biometric systems is provided. Below, the phases that make up the iris recognition process are described, and the segmentation and coding phases are explored, with a more detailed account reserved for the segmentation algorithms and coding operators used. Finally, we move on to the presentation of the experiments carried out and the consequent results obtained.

RICCARDO TOCCHINI - GAIT RECOGNITION BY FEATURE EXTRACTION FROM ACCELEROMETER SIGNALS AND MACHINE LEARNING

Full Title: Riconoscimento del gait tramite estrazione di caratteristiche da segnali acquisiti con accelerometri e machine learning - Gait recognition by feature extraction from accelerometer signals and machine learning
Institution: Sapienza University of Rome
Supervisor: Maria De Marsico
Contact email: demarsico@di.uniroma1.it

Abstract:
Two previous theses tackled a feature-based approach to the recognition of the gait through signals produced by inertial sensors. The aim was to use machine learning techniques after the extraction and selection of representative features from the accelerometer signals. These are then used for recognition in place of the original signals. The final goal is to reduce the computational complexity, and therefore the times, of recognition procedures while improving their accuracy, favoring their future use on mobile devices. The goal of this internship was to continue studying this approach in particular by experimenting with its effectiveness on a different set of data which has also allowed us to study the influence of factors on recognition such as the age of the subjects and the slope conditions of the ground. The results obtained were then compared with those present in the literature.

ALEX ONOFRI - RECOGNITION WITH A MASK VIA PERIOCULAR ZONE

Full Title: Riconoscimento con mascherina tramite zona perioculare - Recognition with a mask via periocular zone
Institution: Sapienza University of Rome
Supervisor: Maria De Marsico
Contact email: demarsico@di.uniroma1.it

Abstract:
This thesis work analyzes the efficiency of using the periocular area in the recognition of individuals wearing masks. Background on biometrics and systems is initially provided. Subsequently, the theme of periocular recognition is explored, by defining the area of interest, the benefits and the different stages of the recognition process. As the main part of the work, the developed biometric system is presented, highlighting the techniques and operators used. This system has been implemented through the programming language "Python" and making use of libraries "OpenCV" and "SciPy". Finally, the results obtained from the tested system are shown using the "Face Mask Lite" dataset.

ADAM KRAVACEK - DETECT THE USE OF RETOUCH FILTERS IN A FACE IMAGE

Full Title: Detect the Use of Retouch Filters in a Face Image
Institution: Brno University of Technology
Supervisor: Tomas Goldmann
URL: https://www.fit.vut.cz/study/thesis/23951/
Contact email: igoldmann@fit.vutbr.cz

Abstract:
These days, altering images via filters is one of the easiest ways of enhancing its properties. Social networks like Instagram or Snapchat, focused primarily on image sharing, offer their users the option to apply filters on their images, which alter their colours to make them look better. If someone was to extract images from these platforms, many of these images would have a filter applied. This thesis explains the principles of these filters and focuses on detection of filters on facial images. Several approaches to detecting filters are being experimented with. Detection by analysis of histograms and detection by convolutional neural network achieve the best results and so are implemented in a program with a simple user interface. They achieved a success rate of 94,44% (histogram) and 99,10% (CNN). This thesis also investigates the impact of filters on facial recognition, where the impact varies depending on the filter used. Some filters have a significant impact on the rate of successful identifications, whereas others have little impact.In general, however, it can be said that the changes introduced by the application of filters are not negligible.

TEREZIA SOCHOVA - ANALYSIS OF FINGERPRINT SPOOFS CREATED FROM MOLD DONE BY BURNING TECHNIQUE

Full Title: Analysis of Fingerprint Spoofs Created from Mold Done by Burning Technique
Institution: Brno University of Technology
Supervisor: Ondrej Kanich
URL: https://www.fit.vut.cz/study/thesis/23973/
Contact email: kanich@fit.vutbr.cz

Abstract:
This work is devoted to the production and analysis of fingerprint spoofs created from mold using a burning technique. The aim of this work is to create fingerprints spoofs from different materials and then to design and to implement an algorithm that compares spoofs with model fingerprints. Spoofs are made using beech wood molds. In order to create the fingerprints, plasteline, silicone and liquid latex are used. The analysis of the differences between fingerprint spoofs and their real fingerprints is based on the minutiae extraction and on their subsequent processing. The results of analysis are represented by three monitored metrics: number and type of minutiae, number of paired minutiae and average distance difference between fingerprint spoof minutiae and real fingerprint minutiae. The created program is tested using a database of produced fingerprint spoofs. The results of the program are compared with the results of the VeriFinger application. Both programs agreed that spoofs made by silicone are the ones of the highest quality.

ROBERT NICHOLS - HUMAN PERFORMANCE IN DETECTING DIGITAL FACE IMAGE MANIPULATIONS

Full Title: Psychophysical Evaluation of Human Performance in Detecting Digital Face Image Manipulations
Institution: Hochschule Darmstadt
Supervisor: Christoph Busch and Pawel Drozdowski
Contact email: christoph.busch@h-da.de

Abstract:
In recent years, increasing deployment of face recognition technology in security-critical settings, such as border control or law enforcement, has led to considerable interest in the vulnerability of face recognition systems to spoofing attacks utilizing legitimate documents based on digitally manipulated face images. As automated attack detection remains a computationally demanding task with operational limitations regarding unconstrained environments, conventional processes with officers performing identity verification remain indispensable, in part attributable to the remarkably low impact of difficult viewing conditions. These circumstances merit a closer look at human capabilities in detecting manipulated face images, as previous work in this field is sparse and often concentrated on distinct scenarios and characteristics. This thesis presents a flexible web-based framework and application providing functionality to design and conduct remote visual discrimination experiments on the basis of principles adopted from the field of psychophysics and subsequently discusses an exploratory trial sequence with the aim of examining human proficiency in detecting different types of digitally manipulated face images, specifically face swap, morphing and retouching. In addition to analyzing limitations and presenting overall performance measures suggestive of independence from domain-specific experience, a possible metric of detectability is considered by means of estimating a psychometric function from acquired experimental data.

CHRISTIAN MANFURO - IRIS SEGMENTATION BY DEEP NETWORKS

Full Title: Segmentazione dell'iride tramite Deep Network - Iris segmentation by deep networks
Institution: Sapienza University of Rome
Supervisor: Maria De Marsico
Contact email: demarsico@di.uniroma1.it

Abstract:
This thesis work focuses on analyzing and implementing a type of convolutional neural network architecture to calculate segmentation masks of images of the irises. The first part introduces the concepts of biometrics and biometric systems. Next, we explain the Neural Networks and the most used tools within them, such as the activation functions, the types of learning, and the types of problems they try to solve. The core of the thesis work is focused on the implementation of the U-Net architecture, a particular type of convolutional network designed for image segmentation. The underlying operations of this network are explained, such as convolution, pooling, optimization algorithms, and data augmentation techniques. Finally, some results obtained through different iterations of the designed U-Net are presented.

FILIP MACAK - PEDESTRIAN DETECTION AND RECOGNITION IN A MULTI-CAMERA SYSTEM

Full Title: Pedestrian Detection and Recognition in a Multi-Camera System
Institution: Brno University of Technology
Supervisor: Tomas Goldmann
URL: https://www.fit.vut.cz/study/thesis/24151/
Contact email: igoldmann@fit.vutbr.cz

Abstract:
The main purpose of this bachelor's thesis is to create an application for person detection and recognition from scenes captured in a multi-camera system. The output of the application is a video on which the detected persons are highlighted and each person is assigned an identification number through which it can be recognized across the input scenes. Several solutions to the problem of person detection and recognition were examined and the text of this work serves as an overview of these problems. The application is built on PyTorch and Torchreid libraries. A detector with a Faster-RCNN network is used for detection and recognition is based on the OSNet network. The application also includes a simple user interface to facilitate work with the application. The application serves as a demonstration of the state-of-the-art for person detection and recognition.

PETR CESKA - EXTRACTION OF DETAILED INFORMATION FROM FINGERPRINT

Full Title: Extraction of Detailed Information from Fingerprint
Institution: Brno University of Technology
Supervisor: Ondrej Kanich
URL: https://www.fit.vut.cz/study/thesis/24033/
Contact email: kanich@fit.vutbr.cz

Abstract:
This bachelor's thesis deals with the extraction of detailed information from a fingerprint, especially width, direction and density of papillary lines. The main goal is to design and implementat an application that extracts these information from the fingerprint, which it graphically displays, statistically processes and provides them for further processing. Testing was performed using two synthetic databases, one real database and several separate fingerprints. The extracted information is compared with the gender of the fingerprint owner and it is evaluated whether it correlates together. Information showed some correlation, but due to the insufficiently large database, general conclusions cannot be made.

RICHARD SOLTIS - DETECTION AND QUALITY IMPROVEMENT OF FACE OBJECTS IN LOW-QUALITY SOURCE IMAGES

Full Title: Detection and Quality Improvement of Face Objects in Low-Quality Source Images
Institution: Brno University of Technology
Supervisor: Martin Drahansky
URL: https://www.fit.vut.cz/study/thesis/23385/
Contact email: drahan@fit.vutbr.cz

Abstract:
The aim of this thesis was to construct an algorithm for the detection of human face from poor quality source images and subsequently improving the image of human face. The result of the work is an application with a graphical interface which detects human face objects from the input images and then improves these inherited faces from the point of quality and size. When creating the application, current techniques and algorithms such as neuron networks were used. They formed the basis for detection and image improvement, $S3FD$ detection and last but not least the GAN network to improve the image. Part of the thesis is testing the individual parts of the application in predefined scenarios as well as testing a comprehensive run application.

SOFIA FAZIO - FINGERPRINT RECOGNITION FROM FINGERPHOTOS

Full Title: Riconoscimento di impronte digitali acquisite da foto (fingerphoto) - Fingerprint recognition from fingerphotos

Institution: Sapienza University of Rome
Supervisor: Maria De Marsico
Contact email: demarsico@di.uniroma1.it

Abstract:
Touchless fingerprint recognition is a rapidly growing field of research. With this type of acquisition, many problems of touch-based systems are avoided, for example, the presence of latent fingerprints or distortions caused by the pressure of the fingers on the sensor surface. However, touchless fingerprint recognition systems reveal new challenges. In particular, reliable detection and focusing of a presented finger, as well as appropriate pre-processing of the scanned image of the finger, are the most crucial tasks. Several research groups are also currently investigating further issues, such as interoperability between touchless and touch-based fingerprints. So far, many works have been proposed to put contactless fingerprint recognition into practice. Published approaches range from self-identification scenarios with basic devices, such as smartphones, to high-performance on-the-go implementations that pave the way for new fingerprint recognition application scenarios. This work summarizes the state of the art in the field of touchless 2D fingerprint recognition at each stage of the recognition process. Then it proposes a basic recognition scheme. In addition, technical considerations and trade-offs of the methods presented are discussed along with open questions and challenges.

THANH PHONG CAO - FIDO2 AUTHENTICATION

Full Title: Integration of FIDO2 authentication into websites
Institution: Hochschule Darmstadt
Supervisor: Prof. Dr. Christoph Busch, Dr. Olaf Henniger
Contact email: olaf.henniger@igd.fraunhofer.de

Abstract:
User authentication is ubiquitos in our personal and work-related lives. Most authentication schemes utilize passwords. However, studies have shown that four out of five passwords either get lost, are forgotten over time by the users or get hacked due to the usage of weak passwords. While most forgotten passphrases can be reset, resetting passwords too often may lead to wrongfully recalling the newly set passwords. Furthermore, due to the increasing amount of online services, people tend to reuse previously used passwords or only introduce small variations to the same passwords, which increases the risk of those credentials being vulnerable to cyberattacks. Recently, new authentication methods have emerged that try to solve the aforementioned issues. One of the proposed solutions is the FIDO2 Authentication published by the FIDO Alliance. It enables a passwordless or two-factor authentication for online services. In this thesis it was analyzed how a FIDO2 Authentication could be integrated into websites and which requirements need to be fulfilled on the user and provider side. For this purpose, a demonstrator consisting of a web application and a server-backend was built, which incorperates a FIDO2 authentication scheme. In the experimental evaluation, the FIDO2 Authentication has shown an improvement upon classic authentication methods with regards to usability and security. However, compatibility for older devices remains an open issue, which may negatively affect the applicability of such an authentication scheme.

SAMUEL GAJDOS - GENERATOR OF THE SPATIAL STRUCTURE OF THE CARDIOVASCULAR SYSTEM OF THE HUMAN HAND FINGER

Full Title: Generator of the Spatial Structure of the Cardiovascular System of the Human Hand Finger
Institution: Brno University of Technology
Supervisor: Martin Drahansky
URL: https://www.fit.vut.cz/study/thesis/22613/
Contact email: drahan@fit.vutbr.cz

Abstract:
The work contains theoretical knowledge in the field of scanning the veins of the human finger as a biometric feature. In addition to the study of biometrics, the thesis also includes resources from the field of medicine, where it mainly studies the anatomy and distribution of organs in the human finger. Subsequently, the algorithm that was selected to generate the spatial structure of the cardiovascular system of the human finger is discussed. This is a Space Colonization algorithm that was not created for this purpose. However, with small modifications to the basic algorithm, this procedure proved to be relatively efficient and suitable for the given task. The work also describes the used programming environment Processing and its libraries, which were used in the implementation of the spatial model generator.

MICHAL KOVAL - FACE DETECTION IN POOR QUALITY VIDEOS

Full Title: Face Detection in Poor Quality Videos
Institution: Brno University of Technology
Supervisor: Tomas Goldmann
URL: https://www.fit.vut.cz/study/thesis/22953/
Contact email: igoldmann@fit.vutbr.cz

Abstract:
This bachelor thesis deals with face detection in low quality videos, while mainly focusing on occluded faces. It describes elementary priciples of machine learning algorithms and their methods, which are often used in the field of computer vision. Out of them are more closely described convolutional neural networks and their state of the art models focused on face detection. Out of those, convolutional neural networks and state of the art models for face detection are more closely described. For the practical part face detection models inspired by state of the art model RetinaFace were implemented and trained. The best performing model achieves 85.5% average precision on WIDER Face HARD testing dataset and 90.9% on dataset focused on occluded faces. Part of this thesis is also a program with graphical user interfaces which provides tools to use developed models on videos and pictures.

PIETRO BRUNO - GAIT RECOGNITION BY THE CONVERSION OF ACCELEROMETER SIGNALS INTO IMAGES

Full Title: Gait recognition sulla conversione dei segnali prodotti da accelerometro in immagini - Gait recognition by the conversion of accelerometer signals into images
Institution: Sapienza University of Rome
Supervisor: Maria De Marsico
Contact email: demarsico@di.uniroma1.it

Abstract:
The following document is based on the internship that was carried out in the field of biometric security, specifically on the recognition of the person based on their own gait, also known as gait recognition. It was decided to work on a new type of approach that aims to exploit the walking data of the subjects analyzed, obtained through an accelerometer, and to produce characteristic images. The focus of this project is precisely the work done on the analysis and processing of these images, which were used as a tool for recognition and validation of the subjects taken. The idea is to obtain images starting from the accelerations provided, and then use these images to generate characteristic patterns for each subject in the database, patterns that will be essential later to carry out the recognition of the subjects themselves and of the walks that will be used as a probe (or probes). To measure the performance of the chosen approach, it was decided to use graphs generated from the results produced by the program created, which is responsible for controlling the number of false successes and false rejections.

CHRISTIAN HERWEH - DEMOGRAPHIC FACTORS IN ANONYMISATION OF FACIAL IMAGES

Full Title: Demographic Factors in Anonymisation of Facial Images
Institution: Hochschule Darmstadt
Supervisor: Christoph Busch and Pawel Drozdowski
Contact email: christoph.busch@h-da.de

Abstract:
Facial recognition has improved significantly in recent years. This opens up completely new possibilities and applications, but also carries the risk of misuse. People should therefore be able to protect their faces from unauthorised analysis and thus preserve their privacy. One suitable way to address this problem would be facial anonymisation. Facial anonymisation methods should provide reliable protection for all people, regardless of demographic factors such as sex, skin tone, or age. It has been found that such demographic factors can indeed influence the outcome of automated decision-making systems or biometric systems. Therefore, it is investigated whether facial anonymisation methods are also affected by such demographic differentials. For this purpose, several face anonymisation methods were examined for demographic differences in this thesis. In addition, the quality of the anonymised images and the strength of the protection provided were also considered. For this purpose, we used popular face image datasets and stateof-the-art face recognition systems. The experiments have shown that the anonymisation methods are indeed affected by such demographic differentials.

LORENZO DEL SIGNORE - GAIT RECOGNITION VIA FEATURE VECTORS

Full Title: Riconoscimento della camminata mediante vettori di features - Gait recognition via feature vectors
Institution: Sapienza University of Rome
Supervisor: Maria De Marsico
Contact email: demarsico@di.uniroma1.it

Abstract:
The objective of this work is to carry out an analysis on the walk of a certain set of individuals (dataset) through identification and verification and the use of vectors of features (templates) in order to verify the performance of theimplemented walking recognition system. In particular, a dataset composed of 153 subjects (ZJU-Gaitacc) recorded by a Chinese research group using Wii sensors was used as a reference. For each of these subjects 12 walks were recorded, divided into two sessions separated over time. Each of these walks is represented by a CSV file that contains the three values measured by the accelerometer on the three Cartesian axes (X, Y, Z) as time t changes. As foreseen in the Machine Learning tasks, in order to make predictions on the data, the creation of the mathematical model is based on the decomposition of the dataset into two subsets of data: the training set and the testing set. The training set is used to create a model that can predict results while the testing set is used to evaluate the performance of the trained model.

PAVEL BEDNAR - ALGORITHMIC SOLUTION FOR DETERMINING THE AGE OF A PERSON BASED ON 2D PHOTOGRAPHY USING ARTIFICIAL INTELLIGENCE

Full Title: Algorithmic Solution for Determining the Age of a Person Based on 2D Photography Using Artificial Intelligence
Institution: Brno University of Technology
Supervisor: Martin Drahansky
URL: https://www.fit.vut.cz/study/thesis/22612/
Contact email: drahan@fit.vutbr.cz

Abstract:
Automated person's age estimation from a facial image is one of the challenges in the field of artificial intelligence and machine learning. Age estimation is often a non-trivial complexity for a person, unlike other biological characteristics such as determining gender or race. Information about an individual's age is very important for certain situations. For example, when committing an offense or crime, the amount of the sentence is co-determined by age. This information can also be used in the analysis of customers of a commercial entity and the subsequent adjustment of the offer. The aim of this work is to be able to extract his age from a photograph of a human face. The algorithm consists of two modules. If the first module says that the person is under 14 years old, the image will go to the second module. Furthermore, another version of the algorithm is proposed with an added module focused on selected facial features. In all modules transformations are performed on the image and their results are averaged. Finally, the algorithm is evaluated on standard datasets for age estimation and compared with state-of-the-art methods in this area.