

CONTENT

INTRODUCTION	5
1 CURRENT STATE IN THE RESEARCH AREA	6
1.1 Biometric System	6
1.2 Modern Methods in Hand-based Biometric Systems.....	6
1.3 Methods in Biometric Systems Using Infrared Radiation	7
1.4 Unresolved Challenges of Hand-based Biometric Systems.....	8
2 AIM OF THE DISSERTATION AND RESEARCH METHODOLOGY	10
2.1 Aim of the Dissertation	10
2.2 Research Methodology	10
3 METHODS SUITABLE FOR ACHIEVING THE AIM OF THE DISSERTATION	11
3.1 Methods Suitable for Image Processing and Feature Extraction	11
3.2 Methods Suitable for Classification	12
4 HAND IMAGES DATASET	13
4.1 Biometric Hand-scanner.....	13
4.2 Thermal Camera and Its Settings	14
4.3 Creating a Dataset	15
5 DESIGNED MULTI-BIOMETRIC SYSTEM	16
5.1 Sensor-level Fusion	16
5.2 Image Processing.....	17
5.3 Convolutional Neural Network as a Feature Extraction	17
5.4 Tuning of Convolutional Neural Networks for Classification	18
6 RESEARCH RESULTS	19
6.1 Performance of Biometric Identification in Terms of Accuracy	20
6.2 Performance of Biometric Identification in Terms of Computational Complexity	23
6.3 Comparison of the Proposed Multi-biometric and Uni-biometric System	25
6.4 Error Analysis	26
7 RESEARCH PERSPECTIVES	27
8 DISSERTATION BENEFITS	28
8.1 Scientific Benefits	28
8.2 Application and Economic Benefits.....	28
CONCLUSION	30
REFERENCES	31
PUBLICATIONS OF THE STUDENT	35