

PREFACE

In the modern era, mobile phones have become universal devices capable of serving various essential purposes, including real time crime scene capture, reporting, and rapid police alerting. This thesis introduces different innovative approaches for detecting suspicious activities using mobile sensor data, with a focus on post-crime detection and criminal tracking through the analysis of sensor data patterns. The research encompasses the development of a robust digital forensic system and investigation techniques that harness the potential of mobile sensor data.

The thesis outlines several unique approaches to pattern recognition and crime investigation. The first approach involves the creation of a modified sub-space K-NN (msK) algorithm, designed to efficiently recognize sensor data patterns indicative of suspicious activities. This msK approach was also compared with traditional Gaussian SVM. To aid this research, an open-source mobile application, the "Evidence Collector (EC) app", was developed to enable the collection of sensor data from various devices such as smartphones, tablets, and wearables. This collected sensor data served as the training set for the msK algorithm, resulting in an exceptional binary training accuracy rate of 99.7 %, compared to standard sub-space KNN which is only 98 %. However, the multiclass accuracy with Gaussian SVM can reach only up to 78 %, on the other hand, for the proposed msK, it could go up to 81 %. While the msK approach demonstrates impressive precision, the need for increased accuracy in solving complex cases led to the proposal of a novel approach.

Initially, we tried using long-short term memory (LSTM) network for feature extraction in combination with DenseNET for classification which was inefficient and direct Densenet was performing better than that. Hence we decided to directly use Densenet called Improved Forensics with Densenet-138 (IFDenseNet-138).

This approach utilizes IFDenseNet-138, a specialized deep neural network algorithm that works for classification of multiclass crime data. IFDensenet-138 achieved an impressive multiclass accuracy of 96.32 % in identifying various incidents within crime scenes. The proposed methodologies offer unique advantages over existing techniques. Although the platform was initially set up with standard Gaussian SVM, the proposed msK approach sets a new standard in binary detection of suspicious activities. Meanwhile, IFDenseNet-138 introduces scalable and adaptable 10-class

classification capabilities. These approaches were validated using recorded crime event videos featuring professional actors, thus sourcing data directly from mobile devices.

This thesis makes significant contributions to the fields of digital forensics, mobile sensor data analysis, and crime scene investigations. The findings aim to assist forensic teams in event reconstruction, suspect identification, and in the gathering of substantial evidence for legal proceedings. The proposed methodologies show potential for practical use by law enforcement agencies involved in crime investigations and suspect identification.