



ERCIM "ALAIN BENSOUSSAN"  
FELLOWSHIP PROGRAMME



## Scientific Report

First name / Family name

Ogerta ELEZAJ

Nationality

Albanian

Name of the *Host Organisation*

Norwegian University of Science and  
Technology (NTNU)

First Name / family name  
of the *Scientific Coordinator*  
Period of the fellowship

Sule Yildirim Yayilgan

01/05/2019 to 30/04/2020

### I – SCIENTIFIC ACTIVITY DURING YOUR FELLOWSHIP

I have followed a research plan that, along with the suggestions of my scientific supervisor, would fit to the research programme prepared since the beginning of this fellowship. I started with a depth scientific literature review conducted based on key journals and conferences in the area information science, computer science, and law. I conducted this review mainly in the first months of this fellowship, in order to capture needs of different Legal Enforcement Agencies (LEAs) and their practices and to understand their expertise in using OSNs as digital crime evidences. Then, I started to create a conceptual framework called CISMO as a semantic tool suitable for gathering digital evidence from Online Social Networks helping LEAs to develop new investigative systems to counter the threat of different crimes. In the second part of the research, we focused on developing a knowledge-based graph and using the field of artificial intelligence, and machine learning knowledge extraction. Different machine learning algorithms are tuned and applied to the data represented in the graph, to predict and extract knowledge for the crime domain. After developing a stable version of the framework, we evaluated it with big data sets available from hacker forums. The ongoing work around the framework has been successful enough to help me and my colleagues to publish several papers, accepted in international scientific events, with more papers pending review in the following months.

### *Research findings*

- OSNs generate a huge massive volume of unstructured data making difficult for the LEAs to 'patrol the facts' and to gather intelligence in order to provide it to the legal domain.
- There is no semantic solution, among those found in literature, that allows to exhaustively describe all the aspects of crime investigation targeting data integration, information sharing, collection and preservation of digital evidences by using biometric features, and query answering.
- The developed CISMO framework is a hybrid ontology linked to a graph database, which provides LEAs with the possibility to process unstructured data and identify hidden patterns and relationships in the interconnected data of OSNs with the focus on crime investigation and prevention. The main components of the proposed framework are a hybrid ontology for collecting and integrating the unstructured social media content and a graph database used as a storage back-end to store the semantic data and perform efficient querying and storage.

### *Reviews of articles to conferences and journals:*

- Two Reviews for the ICICT 2020: The 3rd International Conference on Information and Computer Technologies, Silicon Valley, San Jose, United States.
- Review for the IEEE Access
- Review for SECITC 2019

### *Supervision of two master students in NTNU.*

## **II – PUBLICATION(S) DURING YOUR FELLOWSHIP**

1. **Elezaj, Ogerta;** Yildirim Yayilgan, Sule; Ahmed, Javed; Kalemi, Edlira; Brichfeldt, Brumle; Haubold, Claudia (2020). *Crime Intelligence from Social Media Using CISMO*. “Fifth International Congress on Information and Communication Technology, London, UK, 20-21 February 2020
2. **Elezaj, Ogerta;** Yildirim Yayilgan, Sule; Kalemi, Edlira; Wendelberg, Linda; Abomhara, Mohamed Ali Saleh; Ahmed, Javed. (2019) *Towards Designing a Knowledge Graph-Based Framework for Investigating and Preventing Crime on Online Social Networks*. Communications in Computer and Information Science. vol. 1111.
3. **Elezaj, Ogerta;** Yildirim Yayilgan, Sule; Abomhara, Mohamed Ali Saleh; Yeng, Prosper; Ahmed, Javed. (2019) *Data-driven Intrusion Detection System for Small and Medium Enterprises*. IEEE International Workshop on Computer Aided Modeling and Design of Communication Links and Networks, CAMAD. vol. 2019-September.
4. Golrang, Anahita; Golrang, Alale; Yildirim Yayilgan, Sule; **Elezaj, Ogerta.** (2020) *A Novel hybrid IDS based on modified NSGAI-ANN and Random Forest*. Electronics.
5. Ahmed, Javed; Yildirim Yayilgan, Sule; Nowostawski, Mariusz; Abomhara, Mohamed Ali Saleh; Ramachandra, Raghavendra; **Elezaj, Ogerta.** (2020) *Towards*

*Blockchain-based GDPR-compliant Online Social Networks: Challenges, Opportunities and Way Forward*. Advances in Intelligent Systems and Computing. vol. 1129.

6. Catak, Ferhat Özgür; Aydin, Ismail; **Elezaj, Ogerta**; Yildirim Yayilgan, Sule. (2020) *Practical Implementation of Privacy Preserving Clustering Methods Using a Partially Homomorphic Encryption Algorithm*. Electronics. vol. 9 (2).
7. Abomhara, Mohamed Ali Saleh; Yildirim Yayilgan, Sule; Nymoen, Anne Hilde Ruen; Shalaginova, Marina; Székely, Zoltán; **Elezaj, Ogerta**. (2019) How to do it right: A framework for biometrics supported border control. Communications in Computer and Information Science. vol. 1111.
8. Ahmed, Javed; Yildirim Yayilgan, Sule; Nowostawski, Mariusz; Ramachandra, Raghavendra; **Elezaj, Ogerta**; Abomhara, Mohamed Ali Saleh. *GDPR Compliant Consent Driven Data Protection in Online Social Networks: A Blockchain Based Approach*. The 3rd International Conference on Information and Computer Technologies. March 9-12, 2020 - Silicon Valley, San Jose, United States

Pending papers:

1. **Elezaj, Ogerta**; Yildirim Yayilgan, Sule. (2020) *Criminal Community Detection and Mining in Social Media Forensics*.
2. **Elezaj, Ogerta**; Yildirim Yayilgan, Sule; Abomhara, Mohamed Ali Saleh; Yeng, Prosper; Ahmed, Javed. (2020) *Data-Driven Machine Learning Approach for IDS: A Comparison Study*.
3. Lee, Yen-Ting; Pengying, Thitinun; Yildirim Yayilgan, Sule; **Elezaj, Ogerta** (2020). *Data-Driven Machine Learning Approach for Human Action Recognition Using Skeleton and Optical Flow*.
4. Mulliqi, Nita; Yildirim Yayilgan, Sule; Mohammed, Ahmed; Ahmedi, Lule; Wang, Hao; **Elezaj, Ogerta**; Hovde, Øistein. (2020) *Data-Driven Machine Learning Approach for Human Action Recognition Using Skeleton and Optical Flow*. In 27th IEEE International Conference on Image Processing (ICIP 2020) (**Submitted, under review**)
5. Golrang, Anahita; Yildirim Yayilgan, Sule; **Elezaj, Ogerta**. (2020). *A Novel multi-objective feature selection framework in Android malware detection systems*.
6. Catak, Ferhat Ozgur ; Yazı, Ahmet; **Elezaj, Ogerta**; Ahmed, Javed. (2020). *Deep learning based sequential model for malware analysis using Windows exe API calls*. (**Submitted, under review**).
7. Wendelberg, Linda; Elezaj, Ogerta; Volden, Volden. (2020) Use of Artificial Intelligence to Detect Promising Indicators of Death Anxiety - an Experimental Ontological Perspective. In Cognitive Psychology (**Submitted, under review**).

### III – ATTENDED SEMINARS, WORKHOPS, CONFERENCES

#### Conferences

1. ICICT: Fifth International Congress on Information and Communication Technology, London, UK, 20-21 February 2020.
2. 8th International Conference on e-Democracy, Greece, December 12-13, 2019.
3. CAMAD: IEEE International Workshop on Computer Aided Modelling and Design of Communication Links and Networks, Cyprus, September 2019.

### **Organization**

1. ECODIS and InterSecure Workshop, 4 February 2020, Gjøvik, Norway.
2. INTAP: Third International Conference on Intelligent Technologies and Applications (INTAP'20) will be held on 28-30 September 2020, Gjøvik, Norway

### **Project meetings**

1. Kick-off meeting “The development and implementation of a PhD Program in ICT for the Kosovo Education System”, Kosovo, 25-26 November 2020.

### **Seminars**

1. Presentation of the research in the CCIS seminar, 24 January 2020, Gjøvik, Norway. (<https://kotuku.hig.no/publish/1579867441-7f0cce301c90/camera.mp4> )

### **Workshops**

3. CISaR Workshop, 30-31 January 2020, Gjøvik, Norway.

## **IV – RESEARCH EXCHANGE PROGRAMME (REP)**

SBA Research – (Vienna, Austria), 13-17 January 2020.

During my visit at SBA Research, I met professor Andreas Rauber and Tomasz Miksa and we discussed research cooperation possibilities. I presented them my work and my research interests related to semantic web and knowledge graphs in detecting and preventing crimes happening on OSNs, and we found common ground for joint research in the future. The visit was very fruitful, and we agreed to keep in contact for possible publications together and applications to future project calls.