

Belkhouja, Taha

School of Electrical Engineering and Computer Science
Washington State University
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RESEARCH INTERESTS

My general research interests are in the area of robust and trustworthy machine learning. My current research focuses on developing efficient algorithms and theory to improve reliability and safety of deep learning algorithms for diverse problem settings and data domains. My current work includes:

- Robust deep learning for the time-series domain with diverse applications including mobile health, smart grid, and human activity monitoring.
- Trustworthy machine learning for sequential data with a focus on out-of-distribution detection.
- Uncertainty quantification for reliable machine-learning using conformal prediction.

EDUCATION

Washington State University, Pullman, WA 2019 – Current
Doctor of Philosophy in Computer Science - GPA 3.96
Advisor: Prof. Jana Doppa
• Thesis: *Novel Directions for Reliable and Safe Machine Learning: Algorithms and Theory*

University of Idaho, Moscow, ID 2017 – 2019
Master of Science in Electrical Engineering - GPA: 4.0
Advisor: Prof. Sameh Sorour
• Thesis Title: *Efficient Security Schemes for Wireless Implantable Medical Devices*

University of Padova, Padova, Italy 2015 – 2016
Exchange Program in Information Technology Engineering Program
• Focus Area: *Optical Communication*.

Higher School of Communications of Tunis (SUPCOM), Ariana, Tunisia 2013 – 2016
Engineering degree in Telecommunication - *Graduated with Excellence*
• Thesis Title: *Experimental Characterization of Distributed Fiber Optic Pressure Sensors*

Preparatory School For Engineering Studies of Tunis (IPEIT), Tunis, Tunisia 2011 – 2013
University first cycle studies
• Major: Mathematics-Physics

PROFESSIONAL APPOINTMENTS

Research Intern June 2022 – Aug 2022
Computer Science Lab - SRI International, USA
• Trustworthy machine learning with a focus on sequential data: Out-of-distribution detection for sequential traffic data with multiple driving agents using deep learning and neuro-symbolic regularization.

Research Assistant May 2021 – Current
EECS Department - Washington State University, USA,
• Novel Directions for Reliable and Safe Machine Learning: Algorithms and Theory.

- Teaching Assistant** Aug 2019 – May 2021
EECS Department - Washington State University, USA
- CptS 315 - Introduction to Data Mining (Spring-2020, Spring-2021)
 - CptS 570 - Machine Learning (Fall-2020)
 - CptS 223 - Advanced Data Structures in C++ (Fall-2020)
 - CptS 451 - Introduction to Database Systems (Spring-2020)
 - CptS 440/540 - Artificial Intelligence (Fall-2019)
- Summer Research Appointment** May 2019 – Aug 2019
EECS Department - Washington State University, USA
- Investigation of security vulnerabilities in machine learning algorithms
- Teaching Assistant** Jan 2017 – May 2019
ECE Department - University of Idaho, USA
- ECE 241 - Digital Logic Circuit Lab
 - ECE 311 - Microelectronics I Lab
- Research Assistant** Jan 2017 – May 2019
ECE Department - University of Idaho, USA
- Light-weight security schemes for wireless Implantable Medical Devices
- Graduation Project Internship** Mar 2016 – Aug 2016
University of Padova, Padova, Italy
- Design and experimental characterization of distributed fiber optic pressure sensors based on a novel structure
- Research Intern** Jun 2015 – Aug 2015
GresCom Research Lab, Tunis, Tunisia
- Study and analysis of end-to-end performances of Free Space Optical transmission systems
- Software Engineering Intern** Oct 2014 – Apr 2015
DisruptCK, Tunisia
- Design and implementation of a desktop application for detecting, identifying and recognition of humans in video streams

AWARDS AND HONORS

- Voiland College of Engineering, Outstanding Teaching Assistant from the School of EECS 2021
- Best Graduate Student Teaching Assistant in Computer Science 2021
- Mahmoud M. Dillsi Family Graduate Fellowship 2020
- Alfred Suksdorf Fellowship 2019
- Third Prize in UIIdaho 3-Minute Thesis Competition 2019
- Best Graduate Research Presentation Award, ECE Spring Colloquium 2018
- Distinctive Entrepreneurial Project Prize for Sustainable Development 2014
- Top 5% in the National Qualification Exam for Engineering Schools Entrance 2013

PUBLICATIONS

PAPERS UNDER REVIEW

1. D. Hussein*, T. Belkhouja*, G. Bhat, and J. Doppa. **Energy-Efficient Missing Data Recovery in Wearable Devices: A Novel Search-based Approach**. 60th IEEE/ACM Design Automation Conference (DAC), 2023. (* denotes equal contribution)
2. S. Ghosh, Y. Shi, T. Belkhouja, Y. Yan, J. Doppa, and B. Jones **Probabilistically Robust Conformal Prediction**. 26th International Conference on Artificial Intelligence and Statistics (AISTATS), 2023.
3. T. Belkhouja, Y. Yan, and J. Doppa. **Detecting Out-of-Distribution Time-Series data using Deep Generative Models**. ACM Transactions on Intelligent Systems and Technology (TIST), 2022.

JOURNAL PAPERS

1. T. Belkhouja, Y. Yan, and J. Doppa. **Dynamic Time Warping based Adversarial Framework for Time-Series Data**. IEEE Transactions on Pattern Analysis and Machine Intelligence (TPAMI), 2022.
2. T. Belkhouja and J. Doppa. **Adversarial Framework with Certified Robustness for Time-Series Data via Statistical Features**. Journal of Artificial Intelligence Research (JAIR), 2022.
3. T. Belkhouja, J. Doppa. **Analyzing Deep Learning for Time-Series Data through Adversarial Lens in Mobile and IoT Applications**. IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems (TCAD), 2020.
4. T. Belkhouja, X. Du, A. Mohamed, A.K. Al-Ali, M. Guizani. **Biometric-based Authentication Scheme for Implantable Medical Devices during Emergency Situations**. Future Generation Computer Systems - Elsevier, 2019.
5. T. Belkhouja, X. Du, A. Mohamed, A.K. Al-Ali, M. Guizani. **Symmetric Encryption Relying on Chaotic Henon System for Secure Hardware-Friendly Wireless Communication of Implantable Medical Systems**. Journal of Sensor and Actuator Networks, 2018.

CONFERENCE PAPERS

1. S. Ghosh*, T. Belkhouja*, Y. Yan, and J. Doppa. **Improving Uncertainty Quantification of Deep Classifiers via Neighborhood Conformal Prediction: Novel Algorithm and Theoretical Analysis**. 37th AAAI Conference on Artificial Intelligence, 2023. (* denotes equal contribution)
2. T. Belkhouja, Y. Yan, and J. Doppa. **Training Robust Deep Models for Time-Series Domain: Novel Algorithms and Theoretical Analysis**. 36th AAAI Conference on Artificial Intelligence, 2022.
3. D. Hussein*, T. Belkhouja*, G. Bhat, and J. Doppa. **Reliable Machine Learning for Wearable Activity Monitoring: Novel Algorithms and Theoretical Guarantees**. International Conference on Computer-Aided Design (ICCAD), 2022. (* denotes equal contribution)
4. T. Belkhouja, S. Sorour, M. Hefaida. **Role-based Hierarchical Medical Data Encryption for Implantable Medical Devices**. IEEE Global Communications Conference (GlobeCom), 2019.
5. T. Belkhouja, X. Du, A. Mohamed, A.K. Al-Ali, M. Guizani. **Light-Weight Solution to Defend Implantable Medical Devices Against Man-In-The-Middle Attack**. IEEE Global Communications Conference (GlobeCom), 2018.
6. T. Belkhouja, X. Du, A. Mohamed, A.K. Al-Ali, M. Guizani. **Salt Generation for Hashing Schemes based on ECG readings for Emergency Access to Implantable Medical Devices**. International Symposium on Networks, Computers and Communications (ISNCC), 2018.
7. T. Belkhouja, X. Du, A. Mohamed, A.K. Al-Ali, M. Guizani. **Light-weight encryption of wireless communication for implantable medical devices using henon chaotic system**. Wireless Networks and Mobile Communications International Conference (WINCOM), 2017.
8. T. Belkhouja, X. Du, A. Mohamed, A.K. Al-Ali, M. Guizani. **New Plain-Text Authentication Secure Scheme for Implantable Medical Devices with Remote Control**. IEEE Global Communications Conference (GlobeCom), 2017.

PROFESSIONAL AND OUTREACH ACTIVITIES

PROGRAM COMMITTEE

- International Conference on Artificial Intelligence and Statistics (AISTATS), 2023
- AAAI Conference on Artificial Intelligence - Safe and Robust AI Track, 2023

MENTORSHIP

- Have mentored Tyler Cleveland, an undergraduate student pursuing a Computer Science degree at WSU during Summer and Fall 2020. Tyler aims to pursue graduate school in the field of Machine Learning in the future (currently working at Microsoft).
- Mentoring two junior PhD students Chibuike Ugwu and Azza Fadhel (Fall 2022 to present).

ORGANIZATIONS

- **TEDxUIIdaho:** Team member, Volunteer coordinator and Speaker curator, Moscow, ID. 2019
- **TEDxSupCom:** Team leader, Webmaster and Community builder, Tunisia. 2014
- **IT Innovation organization (NetLinks):** Technical manager, Tunisia. 2015-2016

TECHNICAL/PROFESSIONAL EVENTS

- Volunteer for AAAI Conference on Artificial Intelligence 2020
- Volunteer for Conference on Neural Information Processing Systems (NeurIPS) 2019
- TEDxSupCom second edition 2015
- IONS Tunisia: First North African International OSA (The Optical Society) Network of Students conference 2015
- OpenUp: Cultural event supporting diversity and underrepresented students minorities 2015
- LUPA: Lighting Up Africa Tunisia, Optics and Photonics conference 2015
- National Engineering School Forum: Higher School of Communications of Tunis representative 2014
- ACM ICPC: Tunisian Collegiate Programming Contest 2013

LANGUAGES

- Arabic: Native
- French: Bilingual
- English: Professional
- German: Basic