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Sherenaz Waleed Al-Haj Baddar

Personal Information

Nationality: Jordanian
Current Employer: King Abdullah II School for Information Technology-Department of Computer Science, The University of Jordan, Amman 11942, Jordan.
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Google Scholar page: https://scholar.google.com/citations?user=tdIm-9oAAAAJ&hl=en

Academic Information:

2005 – 2009 ***Kent State University, USA:*** Department of Computer Science, Ph.D. Computer Science, GPA: 4.0, Dissertation Advisor: Prof. Kenneth E. Batcher).

2001 – 2003 ***The University of Jordan, Jordan:*** Department of Computer Science, M.Sc. Computer Science, GPA: 3.96).

1997 – 2001 ***The University of Jordan, Jordan:*** Department of Computer Science, B.Sc. Computer Science, GPA: 3.86).

Publications:

Journal Papers:

- Saeed, Y.A., Ismail, R.A. & **Al-Haj Baddar, S.W,** "D-SAG: A Distributed Sort-Based Algorithm for Graph Clustering", *Arab J Sci Eng* 46, 8665–8676, 2021.
- Alothman, Zainab, Alkasassbeh, Mouhammd, and **Al-Haj Baddar, Sherenaz**, "An Efficient Approach to Detect IoT Botnet Attacks Using Machine Learning", *in Journal of High Speed Networks*, vol. 26, no. 3, pp. 241-254, 2020.
- **S. Al-Haj Baddar**, A. Merlo and M. Migliardi, "Behavioral-Anomaly Detection in Forensics Analysis," in *IEEE Security & Privacy*, vol. 17, no. 1, pp. 55-62, 2019.
- **S. Al-Haj Baddar**, A. Merlo, M. Migliardi, F. Palmieri, "Saving energy in aggressive intrusion detection through dynamic latency sensitivity recognition", *Computers & Security* 76, p. 311-326, 2018
- **S. Al-Haj Baddar**, Alessio Merlo and Mauro Migliardi: "Generating statistical insights into network behavior using SKETURE", *Journal of High Speed Networks*, 22(1), 65–76, 2016.

- **S. Al-Haj Baddar**, Alessio Merlo, Mauro Migliardi, "Anomaly Detection in Computer Networks: A State-of-the-Art Review", *Journal of Wireless Mobile Networks, Ubiquitous Computing, and Dependable Applications*, Vol. 5, No. 4, pp. 29-64, 2014.
- **S. Al-Haj Baddar**, Basel A. Mahafzah, "Bitonic Sort on a Chained-Cubic Tree Interconnection Network*", Journal of Parallel and Distributed Computing*, Vol. 74, No. 1, pp. 1744-1761, January 2014.
- **S. Al-Haj Baddar** and Kenneth E. Batcher, "An 11-Step Sorting Network For 18 Elements", *Parallel Processing Letters*, Vol. 19, No. 97, pp. 97-103, 2009.

Conference Papers:

- Mauro Migliardi, Alessio Merlo, **S. Al-Haj Baddar**, "Reducing the Impact of Traffic Sanitization on Latency Sensitive Applications", The 11th International Conference on Complex, Intelligent, and Software Intensive Systems (CISIS-2017), Torino, Italy, July 10-12, pp. 1019-1026.
- **S. Al Haj Baddar**, Alessio Merlo, Mauro Migliardi, Francesco Palmieri, "Dynamic Latency Sensitivity Recognition: An Application to Energy Saving", The 12th International Conference Green, Pervasive, and Cloud Computing GPC 2017, Cetara, Italy, May 11-14, pp. 138-151
- R. Alqrainy, **S. Al-Haj Baddar**, "DAS: Distributed analytics system for Arabic search engines", The 7th International Conference on Information and Communication Systems (ICICS), Irbid, 2016, pp. 20-26.
- **S. Al-Haj Baddar,** "Identifying Energy-Deprivation in Wireless Sensor Networks", 2016 30th International Conference on Advanced Information Networking and Applications Workshops (WAINA), Crans-Montana, 2016, pp. 276-279.
- **S. Al-Haj Baddar**, Alessio Merlo, Mauro Migliardi, "SKETURE: A Sketch-based Packet Analysis Tool", Proceedings of the 7th ACM CCS International Workshop on Managing Insider Security Threats, MIST '15, Denver, Colorado, USA, October 12-16, 2015.

Books:

- Mauro Migliardi, Alessio Merlo, **S. Al-Haj Baddar**, "Adaptive Mobile Computing", Edited Book, Elsevier, ISBN: 9780128046036, 2017.
- **S. Al-Haj Baddar**, Kenneth E. Batcher, "Designing Sorting Networks: A New Paradigm", Springer Science + Business Media. New York, USA. ISBN: 978-1461418504, 2011.

Book Chapters:

- **S. Al-Haj Baddar** , "How on Earth Could That Happen? An Analytical Study on Selected Mobile Data Breaches", Adaptive Mobile Computing Advances in Processing Mobile Data Sets, Elsevier, ISBN: 9780128046036, p. 153-183, 2017

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Referee/Reviewer in

- JMLR- Journal of Machine Learning Research
- The 10th International Workshop on Security and High Performance Computing Systems (SHPCS 2015)
- The 11th International Workshop on Security and High Performance Computing Systems (SHPCS 2016)
- The 11th International Workshop on Security and High Performance Computing Systems (SHPCS 2017)
- Arabian Journal of Science and Engineering (AJSE): Scopus, impact factor: 2.807 (2021)
- Journal of High Speed Networks: Scopus, 25th percentile

Employment:

September 2021 – Present:

Associate professor of Computer Science, King Abdullah II School for Information Technology, ***The University of Jordan, Amman – Jordan.***

September 2019- August 2021:

Associate professor of Computer Science, King Hussein School of Computing Sciences, **Princess Sumaya University for Technology, *Amman – Jordan.***

June 2016 – August 2019:

Associate professor of Computer Science, King Abdullah II School for Information Technology, ***The University of Jordan, Amman – Jordan.***

- Assistant Dean for Quality and Development Affairs (September 2016- 2018).

June 2009 – June 2016:

Assistant professor of Computer Science, King Abdullah II School for Information Technology, ***The University of Jordan, Amman – Jordan.***

- Assistant dean for Laboratory Affairs (September 2011- August 2013).
- Assistant Dean for Computer and Quality Affairs, DAR, September 2012
- Assistant Dean for Community Outreach, DAR, September 2011
- Computer Center Director (August 2013 - September 2014)
- Director of Website Contents (October 2015 – September 2016)

Invited Talks / Conferences Talks:

- Sherenaz Al-Haj Baddar, **" Dynamic Latency Sensitivity Recognition: an Application to Energy Saving"**, GPC2017: The 12th International Conference

on Green, Pervasive and Cloud Computing, Cetara, Amalfi Coast, Italy, May 11-14, 2017.

- Sherenaz Al-Haj Baddar, **"SKETURE: A Sketch-based Packet Analysis Tool"**, the 7th ACM CCS International Workshop on Managing Insider Security Threats, MIST '15, Denver, Colorado, USA, October 12-16, 2015.

Memberships:

- ***IEEE*** www.ieee.org since 2013.

Projects:

- **Behavioral Anomaly Detection for networks security:**
  The question I am trying to answer here is how to understand then model the behavior of nodes in a network based on traces they leave behind, such that we get to tell when a node's behavior deviates from normal. Until now, neither commercial nor academic approaches managed to adequately address behavioral anomaly detection. And while several tools for signature-based anomaly detection met wider success, they fail at recognizing unseen anomalies. To explore this problem, I needed first to collect nodes behavior footprints, i.e. packet traces, and to do so without jeopardizing users' privacy I developed a tool called SKETURE. Then, I designed a clustering algorithm called QUIST to help me profile nodes behaviors. Finally, I put together the tools I developed to design and implement a behavioral-oriented forensic tool. Next, each of these tools is briefly described.

  - **Packet Analysis using SKETURE:**
    In this project, I used a combination of C and Java to create SKETURE; a privacy-preserving lightweight packet analysis tool. SKETURE listens to traffic that reaches a given Network Interface Card (NIC) and strips some information from the respective IPV4 packets' headers. I could not simply use Wireshark or the like, because that would breach users' privacy. The extracted information was used to build statistical summaries of nodes sending and receiving behavior. One-way encoding was used to obfuscate sender and receiver IP addresses and additional information on packets' size, counts, and arrival/departure times were aggregated. SKETURE processed 167K packets/second and managed to summarize a month-long dump of packet traces from a campus network comprising 11.5G packets in less than 24 hours using an Intel Core i5 processor and no more than 4GB of memory.
  - **Packet Analysis using F-SKETURE:**
    F-SKETURE is a flow-based version of SKETURE that performs the statistical aggregation on flows rather than single nodes.
  - **Clustering Using QUIST:**
    QUIST stands for Quick Clustering, it is a divisive algorithm I designed to cluster multivariate values quickly. Its core idea is simple, when input is sorted,

similar values get together, and all you have to do is cut the data at the right places.

- **CATTURE:**

This is a network forensics tool that utilizes the summaries generated by SKETURE and QUIST in order to profile nodes in a network and model their behavior. CATTURE aims at identifying **compromised** nodes that deviate from their promised behavior without prior knowledge on what constitutes a normal/abnormal behavior. CATTURE is written in Java and was used to identify statistical anomalies in the summaries SKETURE generated from a campus network. Combined with human network administrators' expertise, CATTURE becomes an effective behavioral anomaly detection tool.

- **A practical *n*lg *n* sorting network:**

Nine years ago in my PhD studies, I discovered two sorting networks that beat the lower bound obtainable by bitonic/odd-even merge sorting for both 18 and 22 inputs. I used a tool called Sortnet developed by my advisor, Prof. Ken E. Batcher, to help discover these networks. My ultimate goal has always been to design practical, theoretically-optimal, sorting networks; as theoretically-optimal ASK networks are impractical.

Research Interests:

- Behavioral Anomaly detection in computer networks.
- Sorting Networks
- Parallel and distributed processing.

Skills:

- Technical: Java | C/C++ | Shell Scripting (Linux/Windows) | MPI using C | nesC | Assembly | Prolog | Matlab | Fortran | COBOL | Pascal | Basic Android Programming | Basic Python | Basic Node.js
- Tools: WireShark | Latex | Overleaf | R | basic Octave
- Interpersonal: Strong communication (verbal, non-verbal, and listening) skills | Effective team member | Strong sense of responsibility | Solid problem solving and decision making skills | Very good at negotiation and conflict resolution.

Spoken Languages: Arabic, English, Basic Italian

Scholarships and Awards:

- ***Erasmus Mundus - HERMES postdoctoral Scholarship, University of Genoa, Italy, September 2014- May 2015***

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References:

- Dr. Mauro Migliardi, DEI, University of Padova, Italy.
- Dr. Francesco Palmieri, University of Salerno, Salerno, Italy.
- Prof. Kenneth E. Batcher, Emeritus Professor, Department of Computer Science, Kent State University, USA.
- Prof. Johnnie Baker, Department of Computer Science, Kent State University, USA.
- Prof. Hassan Peyravi, Department of Computer Science, Kent State University, USA.