

GHAI TH HAMMOURI

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ABOUT

I am a researcher, an entrepreneur, and a passionate learner. I am dedicated to expanding my knowledge of everything around me and to bridge the various social and scientific worlds I belong to. My field of expertise is information security, machine learning and cryptography. I am interested in new tools and algorithms that are practical enough for real applications. I have a thorough experience in research startups, enterprise software, software development as well as embedded systems. Over the past four years, I have split my time between researching deep links connecting learning theory and cryptography in my private capacity, and developing and deploying new generative-AI applications and algorithms in a consulting capacity.

RESEARCH PROJECTS

My general area of interest is *Information Theory*. My long term area of research is *using low-degree Fourier expansions to learn from cryptographic distributions*.

I am currently working on *exploring adversarial vulnerabilities in Large Language Models (LLM)*, and on *utilizing Retrieval Augmented Generation (RAG) for Security Applications*.

Projects I have worked on in the past include,

- Generative-AI for Security-Vision Applications,
- Automating the Analysis of Legal Contracts using Machine Learning and NLP,
- Machine Learning for Hardware Fingerprinting (CDs, Cameras,...),
- Efficient Search in Encrypted Data (written English),
- Application Specific Homomorphic Encryption,
- Cryptographic Primitives using Physical Variables,
- Theoretically Secure Physically Unclonable Functions (PUFs),
- Secure and Efficient DNA Pattern Matching.

EDUCATION

Worcester Polytechnic Institute (WPI)

June 2004- June 2009

Degree: *Ph.D in Computer Engineering*

Advisor: Professor Berk Sunar

Thesis Title: "Cryptographic Primitives from Physical Variables"

University of Hartford

September 2003- May 2004

Degree: *Masters of Science in Electrical Engineering*

Thesis Title: "A Reconfigurable Implementation of the AES and RSA Algorithms, with Application to Serial Networks"

University of Hartford

September 1999- May 2003

Degree: *Bachelor of Science in Electrical Engineering*

Second Major: Physics, Minor: Math. (Overall GPA: 3.93/4.00)

FUNDING

- NSF Small Business Innovation Research Grant (#1721622), 7/2017-6/2018. “Using Machine Learning and NLP Tools to Expedite the Review and Analysis of Legal Contracts.” **Amount: \$225,000**
- NSF Small Business Innovation Research Grant (#1013651), 7/2010-1/2011. “Fingerprinting Smart-Phones for Strong Authentication.” **Amount: \$150,000**
- NSF Cybertrust (#CNS-0831416), 08/2008-08/2010. “Exploring Physical Functions for Lightweight and Robust Cryptography.” I came up with the idea and co-wrote the application for this grant. The application was submitted under the name of my Ph.D advisor as I was still a graduate student. **Amount: \$149,900.**

PROFESSIONAL EXPERIENCE

Worcester Polytechnic Institute

Affiliate Research Scientist

October 2023 - Present

Worcester, MA

- I collaborate with the CHIPS group at WPI on various research projects. Currently, we are working on exploring adversarial vulnerabilities in LLMs.

Simtix

Partner and Consultant-CEO

September 2020 - Present

Amman, Jordan

- I lead the development of an in-house ANPR engine that utilizes Transformer technology to translate images into verbal information. Currently, Simtix ANPR engine achieves state-of-the-art identification with the ability to expand functionality far beyond other engines. Simtix is currently in negotiations to train and deploy our ANPR engine in collaboration with one of our major customers.
- We entered into a joint-venture agreement to expand Simtix technology to be developed, sold and deployed in the country of Qatar.

Xr.AI, Inc.

Chief Scientific Officer

January 2017 - 2020

Brooklyn, NY

- I co-founded this company and focused on creating a Machine-Learning legal-engine to automate the processing and review of legal documents especially legal contracts.
- I was the PI on a grant awarded by the National Science Foundation to support our research and development efforts.
- We created Amikai, a software product targeting lawyers and offering legal contract analysis features built on our legal-engine technology.

Simtix

CEO

September 2012 - 2016

Amman, Jordan

- I was hired as a last attempt to save a security company that had been losing money for eight years.
- I entered into an agreement with the owners of the company in which myself and partner took over the full ownership of Simtix.
- Within the first year we stabilized the company, delivered pending projects, and re-structured the company to cut costs.
- We identified the company's strength in RFID security and vehicle identification software and immediately focused our efforts on these areas hoping to become a leader in the Middle East market. Within two years, we managed to have the company's RFID solution become the standard for the Ministry of Foreign Affairs (MOFA) in Saudi Arabia.
- In 2014, we signed an exclusivity contract with one of the world's largest license plate vendors for the latest technology in license plate RFID security.

- In 2015, Simtix become one of 5 companies authorized to sell ANPR solutions to the Dubai-Police and today Simtix has about 100 deployments in the city of Dubai.
- In 2016, Simtix became the exclusive developer and vendor for the iGate system; a Saudi Aramco gate automation system which merged ANPR and RFID technology. Today Simtix software and system runs on 40-gates within Saudi Aramco and processes more than 100,000 vehicles every day.
- By the end of 2016, Simtix was stable enough for me to leave and focus my attention on Machine Learning work and research. I retained my partnership in Simtix and left my partner in charge of all operation.

CRAGS, Inc. for Cryptographic Consulting

Partner

June 2011 - 2017

Worcester, MA

- Worked with the Turkish National Research Institution to produce various novel techniques for secure pattern matching and for searching within encrypted data.
- Worked with a company (name confidential) and developed a high performance key-search engine for secure embedded systems.

Claveo

Founder and VP of Technology

January 2010 - September 2012

Worcester, MA

- I co-founded this company, lead its research and development teams, and secured government funding through a \$150,000 Small Business Innovation Research grant from the National Science Foundation.
- I invented a new method which uses Machine Learning methods to generate unique hardware fingerprints for smart phones. I also designed several products for file locking and transaction authorization. We filed four utility patents as a result of this work.
- I served in various roles at the start-up ranging from carrying out basic research and software development to writing business plans, proposals and patents to raising funds, managing customer relationships and carrying out sales presentations.

Worcester Polytechnic Institute

Post Doctoral Researcher and Research Assistant

August 2008 - January 2010

Worcester, MA

- I invented a technique for fingerprinting CDs and other forms of optical media. Much of my research focused on using mathematical rigor to show the security of purely experimental constructions.
- I mentored junior graduate students who joined the (CRIS) lab. I acted as their intern adviser and coordinated with the head of the lab. I successfully collaborated and co-authored with most of my senior and junior colleagues in the lab.

Worcester Polytechnic Institute

Teaching Assistant

August 2004 - August 2008

Worcester, MA

- I worked as a lab instructor for the embedded systems and microprocessor courses.
- I was named as the ECE department TA of the year.
- I was chosen to re-design the curriculum for the Microprocessor System Design lab.

University of Hartford

Instructor and Teaching Assistant

January 2001 - May 2004

Hartford, CT

- Starting in my sophomore year as an undergraduate and all throughout my years at the University of Hartford I taught more than 10 physics labs.
- I worked as a TA for the Optics lab and the Digital Signal Processing lab.
- I instructed 2 Algebra and one Pre-Calculus course.
- I was also assigned to solely re-design the curriculum and experiments for the physics I and II labs, and to write a detailed instructor manual.

TEACHING EXPERIENCE

- Microprocessor System Design (Spring 2005 to Fall 2007) *Lab Instructor - WPI*
- Foundations of Embedded Computer Systems (Spring 2005 to Fall 2007) *Lab Instructor - WPI*
- Pre-Calculus (Spring 2004) *Course Instructor - University of Hartford*
- Algebra (Fall 2003, Spring 2004) *Course Instructor - University of Hartford*
- Digital Signal Processing (Fall 2003) *Lab Instructor - University of Hartford*
- Optics (Spring 2002) *Lab Instructor - University of Hartford*
- Calculus Based Physics I and II (2001 to 2004) *Lab Instructor - University of Hartford*

CURRICULUM DEVELOPMENT

- Microprocessor System Design - (WPI - 2008): I designed a new set of lab experiments for this course. This included, choosing a new processor platform, transforming the course goals into detailed lab experiments, and writing a detailed new instructor manual.
- Calculus Based Physics I and II - (University of Hartford - 2002): I designed a new lab curriculum with new experiments for both the Physics I and II courses. I used a new set of tools and sensors that helped interface directly with a computer in order to better reflect the lab concepts. I also authored a detailed instructor manual.

PROFESSIONAL ACTIVITIES

I refereed papers for the following journals and conferences:

- Annual International Conference on the Theory and Applications of Cryptographic Techniques (EUROCRYPT),
- Journal of Cryptology,
- IEEE Transactions on Information Forensics & Security,
- Workshop on Cryptographic Hardware and Embedded Systems (CHES),
- RSA (Cryptographic Track),
- Design, Automation, and Test in Europe (DATE).

RECOGNITION AND AWARDS

- Featured in the Worcester Telegram and Gazette for using smart phones to simplify security (2010).
- Awarded "ECE Teaching Assistant of the Year" at WPI (2005).
- President of the engineering honors society (TBP) chapter at the University of Hartford (2002-2003).
- Awarded the Regents award for the senior graduating with the highest GPA in the college of Engineering (2003).
- Chosen as one of Mass-High-Tech's Whiz kids of the year (2003).
- Awarded the Belle Ribicoff Scholarship given to one graduating senior based on academic excellence and leadership roles (2002).
- Awarded the physics memorial award and the physical book award for a physics student displaying academic excellence (2002).

- Awarded a full scholarship covering tuition and board for my BSc and MSc degrees from the University of Hartford (1999-2004).
- Admitted to the Jubilee School which annually chooses 80 students with the highest IQ in Jordan (1996-1999).

PATENTS

1. Ghaith Hammouri, Berk Sunar, Cetin Koc, Kahraman Akdemir, *Computing-System Identifier Using Software Extraction and Manufacturing Variability*. Patent number US/8694687, July 16, 2010. **(Granted)**
2. Ghaith Hammouri, Berk Sunar, Cetin Koc, *Mobile Phone Aided Operations System and Method*. Patent number US/8842827, July 16, 2010. **(Granted)**
3. Matt Hubert, Cody Walker, Carl Minden, Ghaith Hammouri, *Systems and Methods for Authorizing Transactions Via a Digital Device*. Patent number US/10013692, July 3, 2018. **(Granted)**
4. Berk Sunar, Ghaith Hammouri, Aykutlu Dana, *Method and Apparatus for Fingerprinting and Copy Protecting Optical Recording Media*. Patent application number US 12/831,518, July 07, 2010.

PUBLISHED PAPERS

1. Ghaith Hammouri, Berk Sunar, *Generating Unique Identifiers for Smartphones Using Software*. Electronics Letters, vol.50, no.13, pp.938-939, (June 2014).
2. Yarkin Doroz, Berk Sunar, and Ghaith Hammouri, *Bandwidth Efficient PIR from NTRU*. Workshop on Applied Homomorphic Cryptography and Encrypted Computing - WAHC 2014. Springer, (2014).
3. Chenguang Yang, Ghaith Hammouri, Berk Sunar, *Voice Passwords Revisited*, In: International Conference on Security and Cryptography (Secrypt 2012).
4. (Book Chapter) Ghaith Hammouri, Aykutlu Dana, Berk Sunar, *License Distribution Protocols from Optical Media Fingerprints*, In Towards Hardware-Intrinsic Security, David Basin, Ueli Maurer, Ahmad-Reza and Sadeghi and David Naccache (eds.), Springer, (2010).
5. Kahraman Akdemir, Ghaith Hammouri, Berk Sunar, *Non-linear Error Detection for Finite State Machines*. In: Youm, H. Y., Yung, M., (eds.) Proceedings of the 10th International Workshop on Information Security Applications (WISA 2009), LNCS, vol. 5932, pp. 226-238, Springer-Verlag, Heidelberg, Germany, (2009).
6. Ghaith Hammouri, Aykutlu Dana, Berk Sunar, *CDs Have Fingerprints Too*. In: Clavier, C., Gaj, K., (eds.) Proceedings of the 11th Workshop on Cryptographic Hardware and Embedded Systems (CHES 2009), LNCS, vol. 5747, pp. 348-362, Springer-Verlag, Heidelberg, Germany, (2009).
7. Ghaith Hammouri, Kahraman Akdemir, Berk Sunar, *Novel PUF-Based Error Detection Methods in Finite State Machines*. In: Lee, P.J., Cheon, J.H., (eds.) Proceedings of the 11th International Conference on Information Security and Cryptology (ICISC 2008), LNCS, vol. 5461, pp. 235-252, Springer-Verlag, Heidelberg, Germany (2008).
8. Yin Hu, Ghaith Hammouri, Berk Sunar, *A Fast Real-time Memory Authentication Protocol*. In: Xu, S., Nita-Rotaru, C., Seifert, J.P., (eds.) Proceedings of the 3rd ACM Workshop on Scalable Trusted Computing (STC 2008), pp. 31-40, ACM, New York, NY, USA (2008).
9. Ghaith Hammouri, Erdinc Ozturk, Berk Birand, Berk Sunar, *Unclonable Lightweight Authentication Scheme*. In: Chen, L., Ryan, M.D., Wang, G., (eds.) Proceedings of the 10th International

Conference on Information and Communications Security (ICICS 2008), LNCS, vol. 5308, pp. 33-48, Springer-Verlag, Heidelberg, Germany (2008).

10. Ghaith Hammouri, Erdinc Ozturk, Berk Sunar, *A Tamper-Proof and Lightweight Authentication Scheme*. Pervasive and Mobile Computing, 4(6), pp. 807-818, (2008).
11. Ghaith Hammouri, Berk Sunar, *PUF-HB: A Tamper-Resilient HB Based Authentication Protocol*. In: Bellovin, S.M., Gennaro, R., Keromytis, A.D., Yung, M., (eds.) Proceedings of the 6th International Conference on Applied Cryptography and Network Security (ACNS 2008), LNCS, vol. 5037, pp. 346-365, Springer-Verlag, Heidelberg, Germany (2008).
12. Erdinc Ozturk, Ghaith Hammouri, Berk Sunar, *Physical Unclonable Function with Tristate Buffers*. In: Proceedings of the International Symposium on Circuits and Systems (ISCAS 2008), 18-21 May 2008, Seattle, Washington, USA, pp. 3194-3197, IEEE, Washington, DC, USA (2008).
13. Erdinc Ozturk, Ghaith Hammouri, Berk Sunar, *Towards Robust Low Cost Authentication for Pervasive Devices*. In: Proceedings of the Sixth Annual IEEE International Conference (PerCom 2008), 17- 21March 2008, Hong Kong, pp. 170-178, IEEE Computer Society, Los Alamitos, CA, USA (2008).