Sarah Hyunsuk Nam, Ph.D.

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PROFESSIONAL EXPERIENCE

SPRI (SOFTWARE POLICY & RESEARCH INSTITUTE) , KOREA | REMOTE, CHANDLER, AZ **February 2019 – Present**
Senior AI Researcher

- Conducted research on future technology prediction and data analysis using artificial intelligence techniques.
  - ✔ Presented and led research on the outlook for the top 10 challenges in the software industry for the upcoming year.
    - Implemented data collection, processing, and modeling for unstructured data, including daily news, social media, and academic papers, using the Latent Dirichlet Allocation (LDA) algorithm on Google Colab with Python.
    - Provided data visualization using Intertopic Distance Maps and derived the top 30 relevant terms to predict topic trends.
    - Conducted a survey of 1,000 software industry experts using LDA outputs, analyzed the results, and presented findings at the Software Industry Prospect Conference in 2022 and 2023.
    - Identified the top 10 major issues in the software industry for 2023, including advancements in foundation models, the spread of the industrial metaverse, and the expansion of platform-type Software-as-a-Service (SaaS) in the public sector.
  - ✔ Analyzed the technical expertise of patent agents for global immersive technology companies.
    - Analyzed the patent holdings of global companies, examining 19,579 patents to classify visual, auditory, and tactile immersive technologies, including virtual reality, augmented reality, and extended reality, using specialized tools.
    - Evaluated both quantitative technology levels (number of patents held and holding rate) and qualitative technology levels (technological impact measured by Cites Per Patent (CPP) and market dominance measured by Patent Family Size (PFS)).
    - Identified the top 30 global companies based on patent technical levels, considering both quantitative and qualitative technology metrics.
  - ✔ Compared and analyzed the utilization rate of AI in the public sector using national statistical data and zero-shot classification with fine-tuned BERT language models.
    - Presented and published an analysis of artificial intelligence in the domestic public sector based on big data at the Korea Society of IT Services conference.
    - Implemented data collection using web crawlers like Scrapy, performed data cleaning, and applied machine learning with zero-shot labeling using the BERT language model in Python.
    - Achieved results 10 times faster and significantly reduced costs.
  - ✔ Conducted research on the use of artificial intelligence in the private sector.
    - Conducted research and analyzed the current status 4,922 domestic AI companies
    - Developed a domestic AI ecosystem map, visualized AI company relationships, analyzed network centrality, and assessed AI investment status.

- Conducted research on the maintenance and establishment of national statistics related to software technology under the Ministry of Science and ICT.
  - ✔ Software convergence status survey in the ICT industry (2020–2023, 3 years).
  - ✔ Established the artificial intelligence statistics system (1 year).
- Conducted research on the analysis of software policies and trends.
  - ✔ Project leader for government funded projects under the Ministry of Science and ICT.
    - Analyzed the Metaverse market and trends in 2023 (1 year)
    - Conducted research and analysis of trends in digital content markets abroad in 2020/2024 (2 years)
    - Conducted research on artificial intelligence usage in the public sector (1 year)
    - Analyzed the prospects of the top 10 software industry issues in 2022/2023 (2 years)
- Member of the National Advisory Committee on AI and Immersive Technologies.

M2APPL, Seoul, Korea **May 2018 – November 2018**

Principal Engineer

- Integrated a Security Information and Event Management (SIEM) system, visualized monitoring log data, and analyzed data.
  - ✔ Integrated and tested open-source Host-based Intrusion Detection Systems (HIDS) such as OSSEC for enhanced security monitoring on both Linux and Windows.
  - ✔ Integrated Splunk Enterprise and the Elastic/ELK stack to enable data visualization and analysis.
  - ✔ Analyzed large volumes of data by inspecting logs and working with JSON and SQL query languages.
- Project leader of research and development for SIEM system projects funded by the Ministry of SMEs and Startups.

University of Arizona, Tucson, Az, Usa **August 2012 – May 2017**

Research Assistant

- Worked on various system modeling and design projects for multi-objective optimization in distributed embedded systems.
  - ✔ Conducted research on security-driven optimization methodology using various mixed cryptographic security models.
  - ✔ Implemented a Genetic Algorithm for design space exploration methodology using task chromosomes, security chromosomes, and DVFS chromosomes to evaluate four different architectures with various applications.
  - ✔ Used the Parameterized Synchronous Dataflow (PSDF) model to specify system tasks, parameterized data sizes, and tokens transmitted between tasks.
  - ✔ Demonstrated that using mixed cryptographic implementations yields increased security compared to using a single cryptographic algorithm, with improvements of up to 45%.
- Worked on latency, power, and security optimization in distributed reconfigurable embedded systems to balance hardware, security, and power trade-offs.
  - ✔ Evaluated a video-based object detection and tracking application, along with several synthetic benchmarks, and utilized multi-objective genetic optimization algorithms.

- ✔ Evaluated execution latency models for software, hardware, and communication latency, and estimated power models for software, hardware, communication, and security power.

- Led research on machine learning algorithms for vehicle recognition, contributing to advancements in automated systems.
  - ✔ Implemented vehicle recognition by training car images using a Support Vector Machine (SVM) in OpenCV and conducted evaluations.
- Led research on FPGA Reconfigurable Computing.
  - ✔ Worked on various theories of Reconfigurable Computing, such as Xilinx CLBs, Altera FPGA blocks, design flow, symmetrical architecture approach, placement algorithms, etc.
  - ✔ Wrote a paper on "Optimization of Power Reduction in FPGA Interconnect by Charge Recycling."

Teaching Assistant
- Assisted faculty in teaching ECE-274 Digital Logic and ECE-304 Design of Electronics, delivering lectures and guiding students on digital circuits such as ALUs and op-amps, using the Spartan FPGA board.

SAMSUNG ELECTRONICS CO., LTD., GYEONGGI-DO, KOREA **April 2001 – July 2007**
Senior Engineer, Mobile Modem R&D Group, System LSI Division
- Developed GSM/GPRS/EDGE modem systems in collaboration with TTPCom (now Motorola, UK) and Skyworks Solutions (USA).
  - ✔ Developed an equalizer algorithm for 8-PSK in GSM/GPRS/EDGE systems.
  - ✔ Optimized demodulation code, including the Viterbi equalizer and convolutional channel codec, using StarCore DSP, and corrected throughput errors in a prototype modem by adjusting the equalizer.
  - ✔ Optimized the MIPS-based modem receiver and ported demodulation using Assembly and C programming employing dual-MAC CEVA-Teak DSP processor.
  - ✔ Analyzed and modified modems in the product of SGOLD2 Modem by Infineon Germany, and studied Single Antenna Interference Cancellation (SAIC) within GSM/GPRS/EDGE/UMTS systems
  - ✔ Researched the physical layer in 3GPP
- Led the development and certification of high-performance transceiver algorithms for GSM900 and DCS1800 modems.
  - ✔ Performed algorithm analysis, software development, porting, debugging, integration, and field testing.
  - ✔ Debugged and tested in the FTA (Full Type Approval) institution, achieving 100% certification for the GSM900 and DCS1800 bands
  - ✔ Achieved significant performance improvements while ensuring compliance with industry standards.
- Designed modem receivers in VHDL for W-CDMA systems.

- ✔ Designed a time tracker of the rake receiver in VHDL for W-CDMA systems.
- ✔ Developed demodulation including a rake receiver, interpolation, and combiner within W-CDMA.
- ✔ Conducted research on QPSK modulation, physical channels of W-CDMA, timing methods, Space-Time Transmit Diversity (STTD) decoder, and Compressed Mode.
- ✔ Reviewed 3 GPP specifications related to W-CDMA, particularly the physical layer.

HYUNDAI ELECTRONICS(NOW, SK HYNIX), SEOUL, KOREA **March 2000 – April 2001**

HW Engineer,

- Designed MPEG-4 encoder/decoders using VHDL following the formal standard ISO/IEC 14496.
  - ✔ Designed an MPEG -4 decoder using VHDL in ModelSim provided by Mentor Graphics
  - ✔ Performed pre-simulated and post-simulated for ASIC implementation of MPEG-4 encoder/decoder
  - ✔ Conducted placement and routing simulations and verifications for MPEG-4 encoder/decoder designs.
- Designed a Direct Digital Frequency Synthesizer (DDFS) using 15,000 logic gates with Altera® FPGA and ASIC.
  - ✔ Designed a CMOS chip for direct digital frequency synthesizer using Coordinate Rotate Digital Computer (CORDIC) algorithm.
  - ✔ Optimized CORDIC design using schematic and VHDL for ASIC
  - ✔ Designed a 64-bit Reduced Instruction Set Computer (RISC) with 32-bit integer arithmetic operations, including addition, subtraction, multiplication, and division.

EDUCATION

- Ph.D. in Electrical and Computer Engineering, University of Arizona, Tucson, AZ, May 2017
  - ✔ Dissertation: Security-driven Design Optimization of Mixed Cryptographic Implementations in Distributed, Reconfigurable, and Heterogeneous Embedded Systems.
- M.S. in Information and Communication Engineering, Chungbuk National University, South Korea, February 1999
- BS in Computer and Communication Engineering, Chungbuk National University, South Korea, February 1997

AUTHORIZATION TO WORK

- Permanent Resident of the USA
- Authorized to Work in the USA without sponsorship

TECHNICAL SKILLS

- Software Languages: C/C++, Python, Java, Star Core/Teak DSP, MATLAB, JavaScript
- Hardware Development Languages: VHDL, Verilog, SystemC, Assembly

- Tools: Agilent 8960, Racal Instruments 6113, Model Sim, Deepnote, Google Colab Cloud

PUBLICATIONS

- **H. Nam**, J. Jang, J. M. Kim, "A Study on the Analysis of Artificial Intelligence in the Domestic Public Sector based on Big Data", *Korea Society of IT Services*, May 2023.
- **H. Nam**, R. Lysecky, "Security-Aware Multi-Objective Optimization of Distributed Reconfigurable Embedded Systems", Journal of Parallel and Distributed Computing, Volume 133, pp. 377-390, November 2019. ***SCI***
- **H. Nam**, R. Lysecky, "Mixed Cryptography Constrained Optimization for Heterogeneous, Multicore, and Distributed Embedded Systems"*, Computers,* Volume 7, No. 2, 22 pages, April 2018. ***SCI***
- **H. Nam**, R. Lysecky, "Latency, Power, and Security Optimization in Distributed Reconfigurable Embedded Systems", *Reconfigurable Architecture Workshop (RAW),* pp.124-131, May 2016.
- H. Kwon, J. Kim, J. Rim, D. Kim, W. Suk, J. Kim, S. Hwang, **H. Nam**, K. Kim, Y. Kim, and S. Chung, "Development Platform Implementation and Verification for UMTS UE MODEM", *15th Annual IEEE International ASIC/SOC Conference,* September 2002.
- **H. Nam**, D. Kim, and Y. You, "A Design of a Direct Digital Frequency Synthesizer with an Array Type CORDIC Pipeline", *Journal of the Institute of Electronics Engineers of Korea*, May 1999.
- **H. Nam,** Y. You, "A CORDIC-based Direct Digital Frequency Synthesizer Design", *ASIC Design Workshop of the Institute of Electronics Engineers of Korea*, 303-304, November. 1998.

TECHNICAL REPORTS

- **H. Nam**, N. Kwak, "Analysis of Metaverse Policy Trends in Major Countries", IS-166, 12.19.2023.
- **H. Nam**, M. An, "Research of Artificial Intelligence Usage in Public Sector", RE-156, Feb. 2023.
- **H. Nam**, "Prospects of Top 10 SW industry issues in 2023", RE-154, 09.22. 2023.
- **H. Nam**, et al., "Analysis and Implications on the Use of the Artificial Intelligence by the Public Sector in the Domestic and Foreign Countries", IS-157, 03.21. 2023.
- **H. Nam**, L. Jeon, "Prospects of Top 10 SW industry issues in 2023", IS-155, 12.22. 2022.
- J. Kim, **H. Nam**, "Outlook for the Top 10 Issues in the SW Industry in 2022", RE-128, 05.25. 2022.
- D. Lee, **H. Nam**, M. Choi, "A Study on the Establishment of the Artificial Intelligence Statistics System", RE-125, 05.25. 2022.
- **H. Nam**, "The Use and Status of XR Space in Architecture and Real Estate during the Non-face-to-face era", IS-105, 10.07. 2021.
- **H. Nam**, "Analysis of the Technical Level of Patent Agent for Global XR Companies", IS-120, 07.28. 2021.

- **H. Nam**, “In-depth Research and Analysis of Trends in Digital Content Markets Abroad in 2020”, RE-107, 04.13. 2021.
- **H. Nam**, “Technology Trends of Digital Holography Companies in the Medical Care and Automotive Industries”, 04.28. 2020.
- S. Lee, **H. Nam**, H. Kim, “Policies for Immersive Industry Development”, RE-091, 04.21. 2020.
- S. Lee, **H. Nam**, H. Kim, “Emergence of Immersive Economy and Spillover Effect”, 10.08. 2019.

PATENTS

- **H. Nam** and S. Kim, Blind Detection method and apparatus, and communication receiver, Korean Patent 10-0611507-0000 issued August 04, 2006, United States Patent US 20060176981 issued August 10, 2006, European Patent EP 1694015B1 issued September 01, 2008.
- **H. Nam**, Y. You, and D. Kim, Design of DDFS using CORDIC, Korean Patent 10-0295099-0000 issued April 24, 2001.
- D. Kim and **H. Nam**, A direct digital frequency synthesizer, Korean Patent 10-2000-0031136 issued June 05, 2001.