Krishna Chandra Roy

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EDUCATION

Ph.D. in Electrical Engineering (Concentration**:** Computer Engineering, CGPA: 3.95/4) Expected May. 2022
The University of Texas at San Antonio, Texas

M.S. in Electrical Engineering (Concentration**:** Computer Engineering, CGPA: 3.97/4) Dec. 2021
The University of Texas at San Antonio, Texas

B.Sc. in Electronics and Communication Engineering (CGPA: 3.75/4) Sep. 2014
Khulna University of Engineering and Technology, Khulna, Bangladesh

RESEARCH EXPERIENCE

Graduate Research Assistant, IoT Security Lab Jan. 2019 – Present
The University of Texas at San Antonio, United States
Supervisor: Guenevere Chen, Ph.D.

Cyber Physical System

- Conducted driving tests in simulation-based Testbed using OpenDS for 50 college-age drivers (IRB approved) under 20 driving tasks and 12 cyber-attack scenarios.
- Collected physical and behavioral data of the vehicle (e.g., position, steering angle, reaction time etc.).
- Proposed Cyber, Physical and Human factor-based framework, ExHPD for driving behavior modeling to detect vehicle cyber-attack using Random Forest and LSTM Autoencoder model. **(Published in IEEE Internet of Things Journal)**

Enterprise Network

- Developed testbed of bare-metal servers for host log (benign/malware) data collection with FOG-project, WLS, Windows ETW and ELK stack.
- Collected audit and application log (Windows/Linux) dataset under benign scenario for 90-days and 35-users (IRB approved) in a large enterprise network in collaboration with Sandia National Lab (SNL).
- Collected malware dataset in controlled environment (Cuckoo sandbox) for more than 150 malware samples (e.g., Adware, Ransomware, Backdoor/Trojan etc.).
- Indexed collected data (2TB) in Elastic server using Logstash, analyzed and visualized using Kibana for preprocessing (anonymization for privacy) in Python.
- Designed and implemented DeepRan an attention-based bi-LSTM and CRF model for ransomware early detection and classification with more than 98% accuracy (**Published in Springer Journal**)
- Proposed LogGNN a Graph Neural Network (GNN) based graph embedding algorithm for representation learning of heterogeneous Provenance graph constructed from host log and behavioral data.
- Developed Cyber-Psychology (Delay Discounting, Risk-Taking) mapping framework for early detection of Insider Threat.
- Currently working on GNN-LSTM based unsupervised malware detection model using provenance graph constructed from collected malware logs for threat hunting in enterprise network.

Graduate Research Assistant Jan. 2018 – Dec. 2018
The University of Texas at San Antonio, United States

- Designed differential privacy mechanism for publishing optimized building energy consumption data.
- Analyzed k-anonymity, Local differential privacy (LDP), Exponential and Laplace mechanism for differential privacy mechanism and.
- Analyzed differential privacy mechanisms for social graphs using Facebook data from SNAP

SELECTED PUBLICATIONS

- **Roy, K. C.**, & Chen, Q. "DeepRan: Attention-based BiLSTM and CRF for Ransomware Early Detection and Classification." *Information Systems Frontiers*, pp.1-17, Jun 2021.
- Q. Chen, P. Romanowich, J. Castillo, **K. C. Roy**, "ExHPD: Exploiting Human, Physical and Driving Behaviors to Detect Vehicle Cyber Attacks" IEEE Internet of Things journal, 2021.
- E. Acquesta, G. Chen, S. S. Adams, R. D. Bryant, J. J. Haas, N. T. Johnson, P. Romanowich, **K. C. Roy**, M. Shakamuri, M. Smithet al. "Detailed statistical models of host-based data for detection of malicious activity." Sandia National Lab. (SNL-NM), Albuquerque, NM, 2019.

SELECTED PUBLICATIONS (CONT'D)

- S Rana, MS Islam, M Faisal, **K. C. Roy**, R Islam, SF Kaijage. "Single-mode porous fiber for low-loss polarization maintaining terahertz transmission." *Optical Engineering*, pp.55(7), 2016.
- **Roy, K.C**., Shuvo, M.M.H., Hossain, M.F. "Interfacing an MCU based remote controller system with a PC." *In 1st National Conference on Electrical and Communication Engineering and Renewable Energy*, 2014.
- Shuvo, M.M.H., **Roy, K.C**., Robin, M.R.H. "Development of a portable GSM SMS-based patient monitoring system for healthcare applications." *Global Journal of Computer Science and Technology*, Sep 2014.

TEACHING EXPERIENCE

Graduate Teaching Assistant Jan. 2018 – May. 2019 & May. 2021 – Aug. 2021
Department of Electrical and Computer Engineering, The University of Texas at San Antonio

- Taught 5 classes of undergraduate students for 4 semesters.
- Courses taught: Introduction to electrical and Computer engineering (EE1322), Applied Engineering Analysis (EE2323), Analysis and Design of Control System (EE3413).
- Designed and conducted lecture reviews and recitations for classes of around 150 students in 4 sections for each semester.
- Graded exams, homework's and provided office ours for problem solving.
- Designed and conducted Lab experiments with MATLAB, NI myDAQ, LabVIEW and basic electrical hardware instruments (Project work).
- Mentored and evaluated class project groups for final projects design in each of the classes.

Lecturer, Department of Electrical and Electronic Engineering Sep. 2015 – Dec. 2017
Bangladesh University, Dhaka, Bangladesh

- Taught 10 classes of undergraduate students for 5 semesters.
- Courses taught- Computer Programming Language (C, C++), Digital Signal Processing, Microprocessor and System Design, Engineering Electromagnetics
- Graded exams, homework's and provided office ours for problem solving.
- Designed and conducted Lab experiments with 8085/8086 Microprocessor training kit.
- Supervised two undergraduate research (undergraduate thesis) group of 3 students concentrated on MATLAB ultrasound image analysis using Field II simulation tool.

PROJECTS ACCOMPLISHED

Graduate Course Projects Jan. 2018 – Present
The University of Texas at San Antonio, United States

- **CSVM: Cybersecurity Solution for Vehicles in Military (MadHack)**
  - Proposed Blockchain framework to ensure data security, sustainment & recovery
  - Designed AI-based IDS using Guided-GAN adversarial model for detecting cyber-attack (Conquest) during mission.
- **Smart and Secured Parking System (IoT Security)**
  - Developed RFID-based parking system for real time tracking of empty spots to **reduce searching time** in busy hour.
  - Used light weight MQTT Protocol in Raspberry Pi and low-cost RFID Tags for implementation.
  - Performed security analysis using packet sniffing tool Wireshark and found wildcard vulnerability in MQTT code.
- **TRN for Video Summarizing (Deep Learning)**
  - Implemented multiscale temporal relational network (TRN) in PyTorch for video event detection and summarizing.
- **Cache Performance Simulator in Python (Computer Architecture)**
  - Designed and implemented Cache Performance Simulator using Python and calculated Hit and Miss rate.
- **Cloud Solution for Medical Emergency (Cloud Computing)**
  - Proposed and implemented a cloud solution for handling medical emergency visits in rural areas.
  - Developed an Android app and interfaced with OpenStack through collective communication system**.**

Undergraduate Course Projects Mar. 2010 – Sep. 2014
Khulna University of Engineering and Technology, Bangladesh

- Designed and implemented microcontroller-based PC remote controller system with RC5 protocol.
- Designed and implemented Line follower robot with mash solving ability.
- Developed FPGA based 64-bit magnitude comparator with BIST facility.

PROFESSIONAL EXPERIENCE

System Executive, Media and Panel Research Dec. 2014 – Aug. 2015
KANTAR, Dhaka, Bangladesh

- Collected TV viewing data in weekly and analyzed using MediaExpress4.
- Generated TRP reports for numerous TV channels for two countries Bangladesh and India.

REVIEWER

Personal and Ubiquitous Computing Journal, Springer Nature 2020

WORKSHOPS ATTENDED

Uncertainty Quantification Summer School Aug. 2019

Organized by University of Southern California (USC) and Sandia National Laboratory (SNL)

- Participated in a 3 Day workshop on current research in the area of Uncertainty Quantification with fundamental mathematical concepts related to computational and algorithmic issues.
- Topics discussed: Variational Inference, Probabilistic Machine Learning, Design of Experiments of Low Rank Tensors, and Gaussian Processes.

Full Custom Very Large-Scale Integrated Circuit Design Apr. 2016

Organized by HEQEP under UGC, Implemented by Department of EEE, BUET, Bangladesh

- Hands-on training on designing integrated circuits using professional Cadence tool.
- Designed CMOS Inverter Layout in Cadence.

WORKSHOPS ARRANGED

Brainstorming with Host Data Sep. 2019

Organized by IoT Security Lab (UTSA) and Sandia National Laboratory (SNL)

- Arranged 3 day long brainstorming workshop for exploratory host data analysis.
- Planned and prepared computing setup and arranged food for all the workshop attendees.

Microcontroller programming Mar. 2014

Organized by MECE, Electronics and Embedded System Design Club at KUET, Bangladesh

- Arranged day long workshop on microcontroller programming for undergraduate students.
- Conducted presentation on "Atmega32 microcontroller programming with C" followed by hardware demonstration of I/O interfacing.

SKILLS AND EXPERTISE

Analytics	AI algorithms (ML/DL), Graph Neural Network
Programming Languages	Python, C, C++, MATLAB, CUDA
Software & Tools	ELK stack (Elasticsearch, Logstash, Kibana), WLS, WireShark, TensorFlow, PyTorch, Keras, Weka
Web & Cloud	Google Colaboratory, Azure Notebooks, IBM Watson Studio
Platforms	Windows, Linux/Unix

AWARDS AND ACHIEVEMENTS

- College of Engineering Doctoral Scholarship from The University of Texas at San Antonio, 2021
- Selected as finalists in Mad Hack: Fury Code 2021, organized by NSIN, Department of Defense (DOD)
- Ranked in top 20 (out of 330) in CONQUER THE HILL: Adventure Edition, Cyberforce competition by U.S Department of Energy (DOE), 2021
- Received Financial Award from Sandia National Lab for participating UQ Summer School University of Southern California, Los Angeles, 2019
- Ph.D. Summer Research and Development Scholarship from the ECE department at UTSA, 2018
- Bangladesh-Sweden Trust Fund travel grant for students traveling abroad for higher studies, 2018
- Received ECE Financial Award (FA), UTSA, Jan 2018 – Present
- Received KUET Excellence Scholarship, Bangladesh, 2013
- Awarded Championship on Specified Problem Implementation (Blood Pressure Monitoring Device) in Inter University Tech Fiesta'12, KUET, Bangladesh, 2012

EXTRACURRICULAR ACTIVITIES

- Served as Treasurer, Bangladesh Student Association (BSA) at UTSA, Texas Jan. 2019 – Dec. 2019
- Governing Body Member of MECE, Electronics and Embedded System Design Club at KUET Jan. 2014
- Member at DREAM -Voluntary Blood Donation Club of KUET, Bangladesh Apr. 2010 – Sep. 2014
- Patrol Leader of Scouts, Dinajpur, Bangladesh Jan. 2009 – Dec. 2010
- Member of Institution of Engineers, Bangladesh (IEB)