

# 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. Smith et 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)

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- 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

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**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

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**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

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**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

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