



Vishaka Basnayake

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Padukka (Sri Lanka)

ABOUT ME

Vishaka Basnayake earned her Ph.D. in Computer Science from the Universite Bourgogne Franche Comte (UBFC), France, in June 2023. Prior to that, she completed her M.Sc. in Wireless Communications Engineering at the University of Oulu, Finland, in 2019, and her B.Sc. in Electrical and Electronic Engineering at the University of Peradeniya, Sri Lanka, in 2017. Her research interests encompass a range of topics, including Short range D2D Communication in Cellular Wireless networks, Asynchronous Non orthogonal Multiple Access, Optimization, Localization, Network Protocol Design, and Federated Learning.

EDUCATION AND TRAINING

PhD - Thesis Title: Reliable 5G Emergency Wireless Communication Service

Universite Bourgogne Franche Comte(UBFC) [24/10/2019 – 02/06/2023]

City: Montbéliard | Country: France | Website: <https://theses.fr/2023UBFCD013>

MSc - Thesis Title: Federated Learning For Enhanced Sensor Reliability Of Automated Wireless Networks

University of Oulu, Finland [01/01/2018 – 31/07/2019]

City: Oulu | Country: Finland | Website: <https://oulurepo.oulu.fi/handle/10024/14165>

BSc in Electrical and Electronic Engineering

University of Peradeniya, Sri Lanka [06/01/2014 – 17/10/2017]

City: Peradeniya | Country: Sri Lanka

CURRENT EMPLOYMENT

[01/03/2024 – Current]

Postdoctoral Researcher | University of Oulu

- Conduct research related to vehicular software solutions, and to conduct research on vehicular sensing systems.

WORK EXPERIENCE

University engineering lecturer

Sri Lanka Technological Campus [10/09/2019 – Current]

City: Padukka | Country: Sri Lanka

- Program Lead in MSc in Electronics and Communications Engineering
- Teaching and Research (Internet of Things, Communication Theory, Electromagnetism, Satellite Communications, Antenna and Microwave Communications, Microwave Engineering)
- Research (Network Protocol Design, D2D Localization Techniques, Asynchronous Non Orthogonal Multiple Access, Federated Learning, Edge Computing)

Research associate in university

Universite Bourgogne Franche Comte, France [07/01/2020 – 02/06/2023]

City: Montbéliard | Country: France

- Network Protocol Design for D2D based Multi-Hop Emergency Communications
- Localization of Multiple Devices using D2D Data Analysis
- Unsupervised Learning for Device Cluster Detection
- Optimization in Asynchronous Multiple Access Schemes

Research assistant in university

University of Oulu, Finland [01/09/2018 – 31/12/2018]

City: Oulu | Country: Finland

- Optimization for Edge Computing
- Federated Learning for Sensor Measurement Reliability for Wireless Networks
- Convex Optimization for Wireless Networks

Master Thesis Student (Full Time)

University of Oulu, Finland [01/09/2018 – 31/07/2019]

City: Oulu | Country: Finland

- Following courses on Communication Signal Processing, Wireless Communications, Deep learning, etc.
- Completing Thesis on Federated Learning for Sensor Measurement Reliability for Wireless Networks.

Teaching assistant

University of Peradeniya [17/10/2017 – 31/08/2018]

City: Peradeniya | Country: Sri Lanka

- Managing the University Learning Management Tool
- Lab demonstrations

LANGUAGE SKILLS

Mother tongue(s): Sinhala

Other language(s):

English

LISTENING C1 READING C1 WRITING C1

SPOKEN PRODUCTION C1 SPOKEN INTERACTION C1

Levels: A1 and A2: Basic user; B1 and B2: Independent user; C1 and C2: Proficient user

DIGITAL SKILLS

JAVA C++ Python / Matlab/Simulink / Scikit-learn & TensorFlow - Basic / Python (Spyder/Jupyter Notebook IDE)
/ Basic knowledge of OOP / SQL (online course with certificate) / Matplotlib (Creating Interactive Visualization)
/ Hands on experience with Vscode ,Pycharm / Google tools (Colab, Drive, Sheet, Slides, etc) / Circuit Design:
LTspice, Proteus / Ansys HFSS (Base) / Text processing (Word, LaTeX)

PUBLICATIONS

[2023]

Continuous and Responsive D2D Victim Localization for Post-Disaster Emergencies Published in: [IEEE Transactions on Mobile Computing](#) (Early Access)

Page(s): 1 - 16

Date of Publication: 28 November 2023

One of the most challenging tasks in a disaster scenario is the detection and localization of victims with high accuracy and minimum delay, especially in out-of-coverage areas. In the event of a disaster that disrupts the cellular network infrastructure, emergency calls can be relayed to the core network via multi-hop D2D communications. In this paper, a localization system is proposed that uses radio measurements obtained through such D2D multi-hop assisted emergency calls to localize in-coverage and out-of-coverage devices. To address the uncertainty and gradual reception of data in real-time in this scenario, a dynamic constraint satisfaction-based Multi Victim Localization Algorithm (MVLA) is proposed. This algorithm locates multi-hop devices in a progressive propagation manner to provide fast and accurate updates on victim locations. Additionally, three modes of MVLA, namely MVLA_recent, MVLA_seq, and MVLA_all are proposed. Simulation results demonstrate that MVLA_all has a lower localization error compared to MVLA_recent and MVLA_seq. Moreover, MVLA_all, is compared with an existing particle filtering-based localization algorithm called RSSI Monte-Carlo Boxed Localization (RSSI-MCL) under an increasing number of emergency user devices and functional gNodeBs. Results show that MVLA_all significantly outperforms the RSSI-MCL method in terms of localization accuracy and computational delay.

Vishaka Basnayake; Hakim Mabed; Philippe Canalda; Dushantha Nalin K. Jayakody

Link: <https://doi.org/10.1109/TMC.2023.3336353>

[2023]

Post-Disaster Victim Localization via D2D Communications Published in: [2023 IEEE 34th Annual International Symposium on Personal, Indoor and Mobile Radio Communications \(PIMRC\)](#)

Date of Conference: 05-08 September 2023

Date Added to IEEE Xplore: 31 October 2023

[2023]

[M-Ary QAM Asynchronous-NOMA D2D Network With Cyclic Triangular-SIC Decoding Scheme](#) Published in: [IEEE Access](#) (Volume: 11)

Page(s): 1-15

Date of Publication: 16 January 2023

Electronic ISSN: 2169-3536

The complexity of successive interference cancellation at the receiver's end is a challenging issue in conventional non-orthogonal multiple access assisted massive wireless networks. The computational complexity of decoding increases exponentially with the number of users. Further, under realistic channel conditions, a synchronous non-orthogonal multiple access scheme is impractical in the uplink device-to-device communications. In this paper, an asynchronous non-orthogonal multiple access-based cyclic triangular successive interference cancellation scheme is proposed for a massive device-to-device network. The proposed scheme reduces the decoding complexity, energy consumption, and bit error rate of a superimposed signal received in an outband device-to-device network. More specifically, the scheme follows three consecutive stages; optimization, decoding, and re-transmission. In the optimization stage, a dual Lagrangian objective function is defined to maximize the number of data symbols decoded at the receiver by determining an optimal interference cancellation triangle, under the co-channel interference and data rate constraints. In the decoding stage, the data in the optimal interference cancellation triangle is decoded using a conventional triangular successive interference cancellation technique. Next, the remaining users' data are decoded in sequential iterations of the proposed scheme, using the retransmissions from such users. Utilizing the successive interference cancellation characteristics, the performance of the proposed device-to-device network is defined in terms of energy efficiency, bit error rate, computational complexity, and decoding delay metrics. Moreover, the performance of the proposed decoding scheme is compared with the conventional triangular successive interference cancellation decoding scheme to demonstrate the superiority of the proposed scheme.

V. Basnayake, D. N. K. Jayakody, H. Mabed, A. Kumar, T. D. P. Perera, IEEE Access (Q1)

[2022]

[Adaptive Emergency Call Service for Disaster Management](#) Reliable and efficient transmission of emergency calls during a massive network failure is both an indispensable and challenging task. In this paper, we propose a novel fully 3GPP and 5G compatible emergency call protocol named 5G Standalone Service (5G-SOS). A 5G-SOS-enabled emergency service provides potential out-of-coverage victims' devices with a way to contact the 4G/5G core network through D2D multi-hop relaying protocol. The objective of 5G-SOS is to maintain this connection even when a large fraction of the network infrastructure is destroyed. 5G-SOS is a fully distributed protocol designed to generate zero additional control traffic and to adapt its parameters based on the local emergency call congestion. Therefore, devices behave as an ad-hoc network with the common purpose to ensure the best chances for emergency call transfer within a reasonable delay. A densely populated Traverse city of Michigan, USA, with a 15,000 population, is used to evaluate 5G-SOS under extreme emergency scenarios. The performance of 5G-SOS is shown to be significant when compared with existing protocols, namely, M-HELP and FINDER, in terms of transmission success rate, end-to-end latency, network traffic control, and energy management. 5G-SOS provides satisfactory performance (success rate of 50%) even when the number of simultaneous emergency calls is very high (5000 calls over 10 min). On average, 5G-SOS performs 24.9% better than M-HELP and 73.9% than FINDER in terms of success rate. Additionally, 5G-SOS reduces the average end-end latency of the emergency calls transfer by 20.8% compared to M-HELP and 61.7% compared to FINDER.

[2021]

Enhanced Convex Hull based Clustering for High Population Density Avoidance under D2D Enabled Network

Global pandemics such as Covid-19 have led to massive loss of human lives and strict lockdown measures worldwide. To return to a certain level of normalcy, community awareness on avoiding high population density areas is significantly important for infection prevention and control. With the availability of new telecommunication technologies, it is possible to provide highly informative population clustering data back to people using wireless aerial agents (WAAs) placed in a local area. Hence, a service architecture that allows users to access the localization of population clusters is proposed. Further, a convex hull-based clustering method, enhanced population clustering (E-PC), is proposed. This method refined the result of conventional clustering methods such as K-means and Gaussian mixture model (GMM). Moreover, the potential in E-PC to achieve the same or higher results compared to the original K-means and GMM, while consuming lesser data points, is demonstrated. On average, E-PC improved the cluster detection performance in both K-means and GMM by 18.93% under different environments such as remote, rural, suburban, and urban in terms of silhouette score. Further, E-PC allows a 15% data reduction which results in decreasing the computational cost and energy consumption of the WAAs.

Vishaka Basnayake; Hakim Mabel; Philippe Canalda; Dushantha Nalin K. Jayakody

[2020]

M-HELP - Multi-Hop Emergency Call Protocol in 5G Wireless mobile networks are widely used during large catastrophes such as earthquakes and floods where robust networking systems are indispensable to protect human lives. The objective of this paper is to present a self-adaptive emergency call protocol that allows keeping potential victims connected to the core network through the available functional stations, called gNBs in 5G, when a fraction of gNBs in a network area are fully destructed with no access to other gNBs or the core network due to the disaster. Nowadays, the density of mobile devices and progress in outband device to device (D2D) communication provide the framework for the extension of both mobile and network coverage. We propose a novel, 3GPP compatible and completely distributed protocol called M-HELP for emergency call service for 4G/5G enabled mobile networks. We assess M-HELP efficiency under various scenarios representing different degrees of network destruction and different emergency call conditions. The tests demonstrate the significant performance of M-HELP in terms of transmission success rate, energy management, latency and control traffic load.

Vishaka Basnayake; Hakim Mabel; Dushantha Nalin K. Jayakody; Philippe Canalda

[2020]

A New Green Prospective of Non-orthogonal Multiple Access (NOMA) for 5G Energy efficiency is a major concern in the emerging mobile cellular wireless networks since massive connectivity is to be expected with high energy requirements from the network operators. Non-orthogonal multiple access (NOMA) being the frontier multiple access scheme for 5G, there exists numerous research attempts on enhancing the energy efficiency of NOMA enabled wireless networks while maintaining its outstanding performance metrics such as high throughput, data rates and capacity maximized optimally. The concept of green NOMA is introduced in a generalized manner to identify the energy efficient NOMA schemes. These schemes will result in an optimal scenario in which the energy generated for communication is managed sustainably. Hence, the effect on the environment, economy, living beings, etc is minimized. The recent research developments are classified for a better understanding of areas which are lacking attention and needs further improvement. Also, the performance comparison of energy efficient, NOMA schemes against conventional NOMA is presented. Finally, challenges and emerging research trends, for energy efficient NOMA are discussed.

Basnayake, V.; Jayakody, D.N.K.; Sharma, V.; Sharma, N.; Muthuchidambaranathan, P.; Mabel, H

[2022]

Optimization of Secure Emergency Call Services in Asynchronous-NOMA D2D Network This paper investigates the issue of improving secrecy capacity of device-to-device (D2D) communications in disaster

scenarios under the presence of jammers in close proximity. Furthermore, an asynchronous-non orthogonal multiple access (A-NOMA) assisted transmission scheme is considered due to the resource limitations and the asynchrony in signal receptions in out-of-coverage D2D scenarios. A binary optimization problem is proposed to select the optimal data which enhances the sum secrecy capacity of the transmissions. The results show that the proposed optimized scheme outperforms the conventional secrecy capacity.

Vishaka Basnayake, Ambrish Kumar, Dushantha Nalin K Jayakody

[2019]

Federated Learning For Enhanced Sensor Reliability Of Automated Wireless Networks Autonomous mobile robots working in-proximity humans and objects is becoming frequent and thus, avoiding collisions becomes important to increase the safety of the working environment. This thesis develops a mechanism to improve the reliability of sensor measurements in a mobile robot network taking into the account of inter-robot communication and costs of faulty sensor replacements. In this view, first, we develop a sensor fault prediction method utilizing sensor characteristics. Then, network-wide cost capturing sensor replacements and wireless communication is minimized subject to a sensor measurement reliability constraint. Tools from convex optimization are used to develop an algorithm that yields the optimal sensor selection and wireless information communication policy for aforementioned problem. Under the absence of prior knowledge on sensor characteristics, we utilize observations of sensor failures to estimate their characteristics in a distributed manner using federated learning. Finally, extensive simulations are carried out to highlight the performance of the proposed mechanism compared to several state-of-the-art methods.

Vishaka Basnayake, Sumudu Samarakoon, Mehdi Bennis, Lilantha Samaranayake

HONOURS AND AWARDS

[30/09/2022] Sri Lanka Technological Campus

2nd Place in Best Paper Award | SLTC International Research Conference (IRC) 2022 at Sri Lanka Technological Campus, Sri Lanka Achieved the **First Runner-Up** in the Paper Presentation at the **International Research Conference 2022**, organized by SLTC Research University in Sri Lanka for the Paper Titled "Optimization of Secure Emergency Call Services in Asynchronous NOMA D2D Networks". Also, this paper was the **Best Paper under the Telecommunication Engineering** Track.

MANAGEMENT AND LEADERSHIP SKILLS

Lead in MSc in Electronics and Communications Engineering Managing the MSc Programme in Electronics and Communications Engineering under the Faculty of Postgraduate Studies and Research at Sri Lanka Technological Campus, Sri Lanka.

Link: <https://www.youtube.com/watch?v=zw8hl-HMFfA>

Lead in Editorial Committee | SLTC International Research Conference 2023 Responsible for curating top-tier research papers, ensuring academic excellence and fostering rigorous scholarly discourse.

Link: <https://irc2023.slct.ac.lk/conference-committee/>

CERTIFICATIONS

[17/10/2023]

SQL for Data Science

Issed By: Coursera

Authorized By: University of California, Davis, USA

Credential ID: EUUFZ445D95T

Link: <https://coursera.org/verify/EUUFZ445D95T>

[08/09/2019]

Wireless Communications for Everybody

Issued By: Coursera

Authorized By: Yonsei University, Korea

Credential ID: EQPJ7TW2HZGD

Link: <https://coursera.org/verify/EQPJ7TW2HZGD>

[09/01/2019]

How Google Does Machine Learning

Issued By: Coursera

Authorized By: Google Cloud

Credential ID: VYEJ2VAEWHAK

Link: <https://www.coursera.org/verify/VYEJ2VAEWHAK>

[11/02/2019]

Programming for Everybody (Getting Started with Python)

Issued By: Coursera

Authorized By: University of Michigan, USA

Credential ID: TKUXA3QGY4XC

Link: <https://coursera.org/verify/TKUXA3QGY4XC>

REFERENCES

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