

# Ibrahim AbuAlhaol

PhD | PEng | SMIEEE

## Summary

**Principal Data Scientist** @ Huawei Technologies and **Adjunct Research Professor** @ Carleton University in Ottawa, Canada. Holds a BSc, an MSc, and a PhD in Electrical and Computer Engineering. Holds an MEng in Technology Innovation Management. A senior member of IEEE and Professional Engineer (PEng) in Ontario, Canada. Interests in machine learning and big-data analytics applications in Cybersecurity and Wireless Communications. Hands-on experience in machine learning modeling, natural language processing, and real-time analytics. Excellent hands-on experience in (i) Python programming (Data analysis and mining with pandas, visualization with matplotlib/seaborn, machine learning with Scikit-learn/Spark-MLlib/TensorFlow, and natural language processing with NLTK/Gensim), (ii) Databases (SQL, MongoDB, and Cassandra), (iii) Real-time analytics (Spark streaming and Kafka), (iv) DevOps (Docker on AWS and Azure).

## Education

- 2014–2015 **MEng in Technology Innovation Management**, Carleton University, Canada, GPA: 11/12.
- 2005–2008 **PhD in Electrical and Computer Engineering**, University of Mississippi, USA, GPA: 4.0/4.0.
- 2002–2004 **MSc in Electrical Engineering**, Jordan University of Science & Technology, Jordan, GPA: 84.4/100.
- 1995–2000 **BSc in Electrical Engineering**, Jordan University of Science & Technology, Jordan, GPA: 84/100.

## Employment

- 2019–Present **Principal Data Scientist**, Huawei Technologies, Ottawa, Canada.  
Project Lead | Team Builder | Neural Networks (DNN,CNN,RNN) | Malware Detection and Classification
- 2017–Present **Adjunct Research Professor**, Carleton University, Ottawa, Canada.  
Graduate Students Supervision | Machine Learning | Big Data Analytics | 5G Wireless Network Personalization
- 2017–2019 **Senior Data Scientist**, Larus Technologies, Ottawa, Canada.  
Business Intelligence Forecasting | LSTM Recurrent Neural Networks | Natural Language Processing | Multi-objective Optimization (MOO) | Real-time Big Data Analytics.
- 2015–2017 **CyberSecurity Research Scientist**, VENUS Cybersecurity Corporation, Ottawa, Canada.  
Collective Intelligence | Machine Learning | Big Data Analytics | BGP Hijacking | DDOS Attacks.
- 2014–2015 **CyberSecurity Researcher**, Carleton University and Xahive.com, Ottawa, Canada.  
Device-to-Device Wireless Security | Internet-based Communications Privacy | RSA Key Exchange | AES Encryption.
- 2009–2014 **Assistant Professor**, Khalifa University of Science & Technology, United Arab Emirates.  
Supervising Graduate Students | Probability and Statistics | Wireless Communications | Modulation and Coding.
- 2008–2009 **Wireless System Engineer**, Broadcom Corporation, San Diego, USA.  
3G/4G System Design | RF Compliance | 3GPP Standards | Bluetooth | WLAN.
- 2008–2008 **System Engineer Intern**, Qualcomm Incorporation, San Diego, USA.  
4G Wireless Network 3GPP Standards | Analysis | Simulation | WiMAX | LTE.
- 2005–2008 **PhD Student/Research Assistant**, University of Mississippi, Oxford, USA.  
Cooperative (UAV) Networks | MIMO/OFDM Systems | Formulation | Optimization | Modeling | Simulation.

## Publications ( <http://bit.ly/ibrahimscholar> )

4 Book chapters | 10 Journals | 5 Patents | 39 Conferences | 389 Google Scholar citations.

## Experience

**May 2019** **Principal Data Scientist**, Huawei Technologies, Ottawa, Canada.

–Present **Objective:** Enhance endpoint security systems and firewall threat detection.

**Challenge:** Leading a team to build ai-enabled cybersecurity solutions.

**Tools/Software:** Big Data mining (PySpark and Kafka), Databases (MongoDB), Data Mining (Python-Pandas and Spark SQL), Data visualization (Python-Seaborn), Natural Language Processing (Python-NLTK and Python-Gensim), DevOps (Docker on Ubuntu).

**Responsibilities:** **[1]** Lead (build) a team of data scientists, data engineers, and cybersecurity analysts to develop new capabilities and generate actionable system and network insights through advanced analytics. **[2]** Plan and prioritize project milestones and guide a team to productize and scale high impact prototype analytical models developed to support R&D programs. **[3]** File patents of the inventions after building the proof of concepts. **[4]** Direct collaboration with academic institutes and co-authoring conference/ journal papers and patents. **[5]** Iteratively, review and design test cases of the developed data products. **[6]** Direct the team to any breakthrough in cybersecurity and machine learning research that could enhance our data products.

**JAN 2017** **Adjunct Research Professor**, Carleton University, Ottawa, Canada.

–Present **Objective:** Modeling User satisfaction and zone of tolerance with Machine Learning and big data analytics and proactively direct the scheduler to micro-manage resource allocations in 5G Networks.

**Challenge:** Harness a massive amount of contextual and performance data and model the features that are correlated to the user satisfaction and zone of tolerance in spatial, temporal, and social contexts.

**Tools/Software:** MATLAB, KNIME, Python (Scikit-learn, Pandas, PySpark, and Matplotlib).

**Responsibilities:** **[1]** Co-supervise PhD students to apply machine learning and big data analytics on wireless communication problems. **[2]** Direct the students on designing, developing, and evaluating machine learning models and techniques and apply them to personalize the distribution of resources in 5G networks. **[3]** Direct the effort to synthesize and model user data and tune the models to generate both usage and contextual data. **[4]** Co-author conference and journal papers. **[5]** Direct the work-flow of generating processes, models, and data to provide open-source tools and data that can be utilized by other members in the research community.

**AUG 2018** **Senior Data Scientist**, Larus Technologies, Ottawa, Canada.

–May-2019 **Objective:** Mining big data to develop predictive analytics models and machine learning algorithms to improve both the internal and collaborative processes of the clients.

**Challenge:** Generate Actionable Intelligence for Decision Support System using real-time analytics. Actionable Intelligence includes anomalies, alerts, threats, potential response generation, process refinement and other types of knowledge that improve the efficiency of clients' operations and processes.

**Tools/Software:** MOEA Framework-Java (Multi-objective Optimization), DEAP-Python (Evolutionary Algorithms), Big Data mining (PySpark and Kafka), Databases (Cassandra, PostgreSQL, and MongoDB), Automatic Identification System (AIS) Data Mining (Python-Pandas and Spark SQL), Data visualization (Python-Seaborn), Natural Language Processing (Python-NLTK and Python-Gensim).

**Responsibilities:**

**[1]** Design, optimize, develop, and deliver machine learning-enabled solutions for Decision Support Systems (DSS). **[2]** Develop efficient and automated processes to collect, analyze and provide compiled data to be utilized by Decision Support Systems. **[3]** Build scalable processes to collect, manipulate, present, and analyze big datasets in a production environment.

[4] Work on data acquisition, investigation, visualization, feature engineering, experimentation with machine learning algorithms, and deploying tuned/validated/tested models. [5] Develop functioning prototypes of algorithms and evaluate and compare metrics based on the real-world big datasets. [6] Work on pattern learning, outlier detection, and identification of appropriate analytic and statistical methodology. [7] Develop real-time predictive models with Spark-streaming and Kafka in a production environment. [8] Data-driven vessel service time forecasting using Long Short-Term Memory (LSTM) Recurrent Neural Networks (RNN). [9] Machine learning-enabled retailer promotion planning process. [10] Textual feature extraction with word-to-vector (W2V) embedding and multi-label classification with deep neural network (DNN) models.

**JAN 2017** **Data Scientist**, Larus Technologies, Ottawa, Canada.

–**JUL 2018** **Objective:** Exploit massive amount of sensor data emitted by many maritime actors to improve both internal and collaborative processes for maritime Internet-of-Things related organizations.

**Challenge:** Generate actionable intelligence for Decision Support systems using real-time Big Data analytics. The intelligence includes anomalies, alerts, threats, potential response generation, process refinement and other types of knowledge that improve the efficiency of maritime-related organizations.

**Tools/Software:** Big Data (PySpark), Databases (Cassandra, PostgreSQL, and MongoDB), Automatic Identification System (AIS) Data Mining (Python-Pandas), Data visualization (Python-Seaborn).

**Responsibilities:** [1] Prepare literature reviews on supply chain management and optimization and identify maritime-related problems (pain points) to be solved (optimized) by real-time Big Data analytics.

[2] Design, develop, and evaluate data mining processes to extract global speed statistics and outliers for all sea vessel categories at a specific period of interest (POI) and time of interest (TOI). [3] Harness publicly available maritime ports meta-data and establish efficient automated processes to collect, analyze and provide compiled data to be utilized by other DS systems optimizers. [4] Mining port congestion indicators from big AIS data. [5] Co-authoring publications in the area of meta-heuristics multi-objective optimization enabled by big data analytics and machine learning.

**OCT 2015** **CyberSecurity Research Scientist**, VENUS Cybersecurity Corporation, Ottawa, Canada.

– **DEC 2016** **Objective:** Data mining and exploratory analysis of live and historical Border Gateway Protocol (BGP) data to enable Cybersecurity operational monitoring, post-event analysis, and real-time anomaly detection.

**Challenge:** Real-time mining with unsupervised machine learning capabilities to tune supervised machine learning predictors. This includes feature engineering, cleaning, averaging, filtering, and time-series aggregation.

**Tools/Software:** KNIME, MATLAB, Python (Skit-learn, Pandas, and PySpark), Databases (MongoDB), Real-time streaming platform (Apache Kafka), Javascript visualization (D3, Crossfilter, DC).

**Responsibilities:** [1] Prepare a prior art review on Exploratory Data Analysis (EDA), Border Gateway Protocol (BGP) anomaly detection, and real-time analytics frameworks and software architecture. [2]

Design, prototype, and evaluate BGP anomaly indicators and build machine learning models (supervised and unsupervised) to predict BGP IP prefix hijacking and Distributed Denial of Service (DDOS) attacks.

[3] Build a visual interactive dashboard on the data being ingested from a BGP stream. This includes displaying recent alerts and providing interactive visualizations of the context of a given alert using timelines, histograms, and moving averages of several types of indicators that are being monitored.

[4] Collaborate with the team to integrate the prototype as a real-time analytics engine that ingests BGP real-time stream, and push it to Apache Kafka, and store the processed indicators in a MongoDB Database and utilize Apache Spark MLLIB to predict the anomalies. The generated intelligence is pushed to a web-based dashboard that enables the analyst to drill down and explore the incident. [5] Documentation and publish original research in peer-reviewed conferences and journals. [6] Testing and validating the developed processes in large-scale and real-life BGP IP prefix hijacking and DDOS incidents.

**FEB 2014** **CyberSecurity Researcher**, Carleton University and Xahive.com, Ottawa, Canada.

- **SEP 2015** **Objective:** Investigate the security and privacy differentiation in end-to-end encryption services.  
**Challenge:** Improve the value proposition through usability in end-to-end encryption services.  
**Tools/Software:** MATLAB and open-source Javascript libraries (AES-JS: AES-256 encryption/decryption, JSENCRYPT: RSA key-exchange).  
**Responsibilities:** [1] Prepare a prior art review on solutions that achieves communication security and privacy. [2] Identify the limitations of the currently used communication encryption/decryption standards. [3] Conduct a prior art review to identify communication security standards to overcome the identified limitations. [4] Propose a multi-layer-based approach to enable an agile defensive response for a system under attack by shifting Device-to-Device (D2D) communication to a new combination of encryption implementation, routing protocol, and media access technique and frequency band. [5] Provide guidance on the chosen standards and how to customize/improve them. [6] Conduct MATLAB system-level simulations to prove the feasibility of chosen algorithms/standards. [7] The applicable algorithms/standards are recommended to the development team for integration and testing.

**OCT 2009** **Assistant Professor**, Khalifa University of Science & Technology, United Arab Emirates.

- **JAN 2014** **Objective:** Teach and research wireless communications.  
**Challenge:** Teach, supervise graduate students, and attract research funds.  
**Tools/Software:** MATLAB and Latex.  
**Responsibilities:** [1] Teaching: Introduction to Professional Engineering (ENGR 110), Probability and Statistics (MATH 215), Wireless Communications (CMME 400), Communication Networks (CMME 320), Modulation and Coding Techniques (CMME 404), Digital Communications I (CMME 302), Communication Engineering Project Laboratory (CMME 395) and Digital Communication Laboratory (CMME 300). [2] Advise students on academic matters and career decisions. [3] Supervised the following undergraduate projects: Mobile Bluetooth-Based Parking System, Multi-Sources Patient Localization System for Emergency Response, Wireless Control of Self-Sustained Solar Power Generation System, Evaluation of Spectrum Sensing Techniques in Cognitive Radio Networks, Solar Thermal Power Generation System, Performance Evaluation of MIMO-OFDM System over Fading Channels, Simulation of Interference Mitigation for OFDM Multi-hop LTE Networks, Single Carrier Frequency Division Multiple Access Air Interface for LTE, Wireless Device to Alert Drivers to Keep a Safe Distance, Downlink Power Control Techniques in CDMA Systems, Universal Mobile Telecommunications System (UMTS) Physical Layer, Orthogonal Frequency Division Multiplexing (OFDM) Synchronization Techniques. [4] Electrical and Computer Engineering (ECE) Committee Member: Responsible for establishing a Master of Science in Electrical and Computer Engineering (M.Sc. in ECE) program. [5] Resources Committee Member: Assessed current and future material requirements for the academic programs and propose new equipment and resources. [6] External Relations Committee Member: Identified best practices for interaction with all-important external constituencies and defined means that facilitated strong relationships with the University.

- SEP 2008 Wireless System Engineer**, Broadcom Corporation, San Diego, USA.
- **OCT 2009 Responsibilities:** **[1]** Perform system-level test plan, execution, troubleshooting, optimization and problem resolution on 2G/3G mobile devices. **[2]** Work with a multi-discipline team to test and commercialize UMTS (Single SIM/Dual SIM) solutions. **[3]** Actively involved in producing requirements for tools and system simulators and work closely with development teams and test equipment vendors to come up with the appropriate test setups and associated automation. **[4]** Ensure close interaction with the modem stack, multi-media, RF, drivers, 3GPP standard representatives, and System Design Engineers to ensure proper test coverage of the features.
- MAY 2008 System Engineer Intern**, Qualcomm Incorporation, San Diego, USA.
- AUG 2008 Responsibilities:** **[1]** Analyze and simulate fourth-generation (4G) wireless network core components. **[2]** Characterize and improve the performance of RF/RX front in WiMax and LTE wireless systems. **[3]** Identify RF/RX front functionality for which minimum standard system performance requirements should exist (Digital filtering (down-sampling & jammer rejection), DC offset removal (inner loop and outer loop), automatic gain control (AGC), digitally controlled variable gain amplifier (DVGA), and IQ-imbalance.) **[4]** Generate and consolidated performance requirements data and conducted analysis and evaluation of critical performance metrics for 4G using MATLAB and C++. **[5]** Compare system-level performance findings with other wireless standards (i.e., GSM, WCDMA, Bluetooth, WLAN).

## MOOC Courses

- 2019 Structuring Machine Learning Projects | Andrew Ng | [www.coursera.org/specializations/deep-learning](http://www.coursera.org/specializations/deep-learning)
- 2019 Convolutional Neural Networks | Andrew Ng | [www.coursera.org/specializations/deep-learning](http://www.coursera.org/specializations/deep-learning)
- 2019 Sequence Models | Andrew Ng | [www.coursera.org/specializations/deep-learning](http://www.coursera.org/specializations/deep-learning)
- 2018 Neural Networks and Deep Learning | Andrew Ng | [www.coursera.org/specializations/deep-learning](http://www.coursera.org/specializations/deep-learning)
- 2018 Improving Deep Neural Networks | Andrew Ng | [www.coursera.org/specializations/deep-learning](http://www.coursera.org/specializations/deep-learning)
- 2017 Docker for DevOps : From development to production | Nick Janetakis | [www.udemy.com](http://www.udemy.com)
- 2017 Taming Big Data with Apache Spark and Python - Hands On! | Frank Kane | [www.udemy.com](http://www.udemy.com)
- 2017 Deep Learning for Natural Language Processing (NLP) | Jon Krohn| [www.learning.oreilly.com](http://www.learning.oreilly.com)
- 2016 Learning Python for Data Analysis and Visualization | Jose Portilla | [www.udemy.com](http://www.udemy.com)
- 2016 Machine Learning, Data Science and Deep Learning with Python | Frank Kane | [www.udemy.com](http://www.udemy.com)

## Software & Tools

- OS** Unix, mac-os, Windows.
- Programming** Python, Java, C++, MATLAB.
- Databases** MySQL, PostgreSQL, MongoDB, Cassandra.
- Optimization** Java (MOEA-Framework), Python (DEAP).
- Visualization** Python (Matplotlib, Seaborn, Bokeh, Folium), JavaScript (D3.js, DC.js, Crossfilter.js).
- Data Mining** Python-Pandas, Python-Orange, MATLAB, KNIME.
  - ML** Python (Scikit-learn, TensorFlow, PySaprk-MLLIB).
  - NLP** Python (NLTK, spaCy, Gensim).
  - BI** Power BI, Python-Superset.
- Cloud** Google Cloud Platform (GCP).
- Big Data** Apache Spark.
- DevOps** Docker.
- Cloud** AWS and Azure
- Real-time** Kafka and spark-streaming.

## Machine Learning | Data Mining | Big Data Analytics

- J 2020** R. Alkurd, **I. Abualhaol**, and H. Yanikomeroglu, "Data-Driven Evolutionary Multi-objective Optimization of Personalized Wireless Networks Resources," submitted to the IEEE Open Access, June 2020.
- C 2020** R. Alkurd, **I. Abualhaol**, and H. Yanikomeroglu, "Deep neural network to predict user satisfaction in personalized wireless networks," submitted to the 2020 IEEE Global Communications Conference (GLOBECOM), Taipei, Taiwan, 7-11 December, 2020.
- C 2020** R. Alkurd, **I. Abualhaol**, and H. Yanikomeroglu, "User Persona in Personalized Wireless Networks: A Big Data-Driven Prediction Framework," accepted for publication in IEEE VTC2020-Fall, Victoria, British Columbia, Canada, 4 – 7 October, 2020.
- J 2019** R. Alkurd, **I. Abualhaol**, and H. Yanikomeroglu, "Big Data-Driven AI-based Framework to Enable Personalization in Wireless Networks," in IEEE Communications Magazine 58, no. 3 (2020): pp. 18-24.
- P 2019** R. Alkurd, **I. Abualhaol**, and H. Yanikomeroglu, "Enabling wireless network personalization using Zone of Tolerance modeling and predictive analytics", W.O. Pat. Ser. No. PCT/CA2019/051197, filed on AUG 29, 2019.
- C 2019** R. Alkurd, **I. Abualhaol**, and H. Yanikomeroglu, "A Synthetic Dataset Modeling for Data-Driven AI-Based Personalized Wireless Networks," in Proc. 2019 IEEE International Conference on Communications Workshops (ICC Workshops), Shanghai, China, May 2019.
- C 2019** R. Alkurd, **I. Abualhaol**, and H. Yanikomeroglu, "Dataset modeling for data-driven AI-based personalized wireless networks," in Proc. 2019 IEEE International Conference on Communications (ICC), Shanghai, China, May 2019.
- C 2018** **I. Abualhaol**, R. Falcon, R. Abielmona, and E. Petriu, "Data-Driven Vessel Service Time Forecasting using Long Short-Term Memory Recurrent Neural Networks," in IEEE International Conference on Big Data, Seattle, United States, 10-13 DEC, 2018.
- C 2018** **I. Abualhaol**, R. Falcon, R. Abielmona, and E. Petriu, "Mining port congestion indicators from big AIS data," in IEEE World Congress on Computational Intelligence (IEEE WCCI), Rio de Janeiro, Brazil, 8-13 July., pp. 3743–3750, 2018.
- C 2017** I. Al Ridhawi, N. Mostafa, Y. Kotb, M. Aloqaily, and **I. Abualhaol**, "Data Caching and Selection in 5G Networks Using F2F Communication," in 2017 IEEE International Symposium on Personal, Indoor and Mobile Radio Communications (PIMRC 2017), Montreal, QC, Canada.

## Cyber Security

- P 2020** **I. Abualhaol**, "Size-agnostic representation of portable executable (PE) files using convolutional auto-encoder (AE) deep neural network," internally submitted on April 1st, 2020.
- P 2020** R. Giagone and **I. Abualhaol**, "Sections header information with deep neural network (DNN) parallel model architecture to predict malwares," internally submitted on April 1st, 2020.
- P 2020** Y. Zhou, **I. Abualhaol**, and R. Giagone, "String-based feature representation with deep neural network (DNN) to predict malicious portable executable (PE) files," internally submitted on April 1st, 2020.
- P 2020** **I. Abualhaol**, R. Giagone, and Y. Zhou, "Multi variate ensemble deep neural network (DNN) based model to detect malicious portable executable (PE) files," internally submitted on April 1st, 2020.
- B 2017** M. Gad and **I. Abualhaol**, "Securing Smart Cities Systems and Services: A Risk-Based Analytics-Driven Approach," in Transportation and Power Grid in Smart Cities: Communication Networks and Services, John Wiley, UK.

- J 2017** A. Shah, **I. Abualhaol**, M. Gad, and M. Weiss, "Combining Exploratory Analysis and Automated Analysis for Anomaly Detection in Real-Time Data Streams", *Technology Innovation Management Review*, 7(4): 25-31, 2017.
- C 2016** **I. Abualhaol** and S. Muegge "Securing D2D Wireless Links by Continuous Authenticity with Legitimacy Patterns," 49th Hawaii International Conference on System Sciences (HICSS), pp. 5763-5771, Jan 2016.
- C 2016** M. Weiss,**I. Abualhaol**, and M. Amin, "A Leader-Driven Open Collaboration Platform for Exploring New Domains," OpenSym conference, Berlin, Germany, August 17-19, 2016.
- J 2016** A. Shah, S. Selman, and **I. Abualhaol**, "License Compliance in Open Source Cybersecurity Projects," *Technology Innovation Management Review*, 6(2): 28-35, 2016.
- B 2014** C. Han, S. Muhaidat, **I. Abualhaol**, M. Dianati, and R. Tafazolli, "Intrusion Detection in Vehicular Ad-Hoc Networks on Lower Layers," *Security, Privacy, Trust, and Resource Management in Mobile and Wireless Communications*, pp. 148–173, IGI Global, PA, USA, 2014.
- B 2013** Y. Abu Haeyeh, **I. Abualhaol**, Y. Iraqi, and S. Muhaidat, "Intrusion Detection in Vehicular Ad-Hoc Networks: A Physical Layer Approach," *Communication Systems: New Research*, pp. 133–152, Nova publishers, 2013.

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## Modeling | Optimization

- C 2020** F. Cheraghchib, **I. Abualhaol** R. Falcon, R. Abielmona, B. Raahemi, and E. Petriu, "Distributed Multi-Objective Cooperative Coevolution Algorithm for Big-Data-Enabled Vessel Schedule Recovery Problem," accepted for publication in *IEEE Conference on Cognitive and Computational Aspects of Situation Management (CogSIMA)*, University of Victoria, British Columbia, Canada, May 4-7, 2020.
- J 2018** F. Cheraghchib, **I. Abualhaol** R. Falcon, R. Abielmona, B. Raahemi, and E. Petriu, "Modeling the Speed-based Vessel Schedule Recovery Problem using Evolutionary Multiobjective Optimization", *Information Sciences* 448 (2018): 53-74.
- C 2017** F. Cheraghchib, **I. Abualhaol**, R. Falcon, R. Abielmona, B. Raahemi, and E. Petriu, "Big-Data-Enabled Modelling and Optimization of Granular Speed-based Vessel Schedule Recovery Problem", in *2017 IEEE International Conference on Big Data*, Boston, MA, USA, Dec 11-14, 2017.
- C 2016** Rawan Alkurd, **I. Abualhaol**, Raed Shubair, and Muriel Medard, " Optimum HDAF Relay-Assisted Combining Scheme with Relay Decision Information," *IEEE 84th Vehicular Technology Conference*, Montréal, Canada, September 18-21, 2016.
- C 2015** R. Alkurd, R. Shubair, and **I. Abualhaol**, "Optimum Decode-and-Forward Relay-Assisted Combining Scheme with Relay Decision Information," *IEEE International Conference on Communications (ICC)*, pp. 2331–2337, June 2015.
- C 2015** R. Alkurd, R. Shubair, and **I. Abualhaol**, "Modeling Conditional Error Probability for Hybrid Decode-Amplify-Forward Cooperative System," *IEEE Wireless Communications and Networking Conference (WCNC)*, 7-12, March 2015.
- J 2011** **I. Abualhaol** and M. Matalgah "Unified Analysis of Optimized Relay-based Wireless Systems," *Journal of Selected Areas in Telecommunications (JSAT)*, July Edition, 2011.
- J 2009** **I. Abualhaol** and M. Matalgah, "Throughput Optimization of Cooperative Teleoperated UGV Network," *International Journal of Mobile Computing and Multimedia Communications (IJMCMC)*, pp. 32–46, 2009.
- C 2006** **I. Abualhaol** and M. Matalgah "Throughput Optimization of Cooperative UAVs Using Adaptive Channel Assignment," *IEEE Wireless Communications and Networking Conference (WCNC)*, vol. 4, pp. 2279–2284, 3 -6 April, 2006.

## Statistical and Performance Analysis

- C 2014** R. Alkurd, **I. Abualhaol**, and S. Muhaidat, "Error Rate Performance Analysis of Cooperative SCR in VANETs over Generalized Fading Channels," IEEE Wireless Communications and Networking Conference (WCNC), pp. 3184–3189, 6-9 April, 2014.
- C 2013** R. Alkurd, R. Shubair, **I. Abualhaol**, "Error rate performance analysis of cooperative MRC receivers over generalized fading channels," IEEE 20th International Conference on Electronics, Circuits, and Systems (ICECS), pp. 201–204, 8-11 Dec, 2013.
- C 2013** E. Salahat and **I. Abualhaol**, "General BER analysis over Nakagami-m fading channels," in 6th Wireless and Mobile Networking Conference (WMNC), pp. 1–4, 23-25 April, 2013.
- J 2011** **I. Abualhaol** and M. Matalgah "Performance analysis of cooperative multi-carrier relay-based UAV networks over generalized fading channels," International Journal of Communication Systems (IJCS), Jan, 2011.
- C 2011** **I. Abualhaol**, "Symbol Error Rate Analysis of Relay-based Wireless Systems", IEEE 22nd International Symposium on Personal Indoor and Mobile Radio Communications, pp. 1894–898, 11-14 Sep, 2011.
- C 2011** **I. Abualhaol** and M. Bawa'aneh "Capacity analysis of cooperative relay-based communication system," IEEE GCC Conference and Exhibition, pp. 21–24, 19-22 Feb, 2011.
- C 2007** **I. Abualhaol** and M. Matalgah "End-to-End Performance Analysis of Cooperative Relay-Based Wireless System Over Generalized Gaussian-Finite-Mixture Fading Channels," IEE 50th IEEE Global Communications Conference (GLOBECOM), pp. 3942–3947, 26-30 Nov 2007.
- C 2007** **I. Abualhaol** and M. Matalgah "Capacity Analysis of MIMO System Over Identically Independent Distributed Weibull Fading Channels," IEEE International Conference on Communications (ICC), pp. 5003-5008, 24-28 June 2007.
- C 2006** **I. Abualhaol** and M. Matalgah "Outage Probability Analysis in a Cooperative UAVs Network Over Nakagami-m Fading Channels," IEEE 64th Semiannual Vehicular Technology Conference (VTC), pp. 1–4, 25-28 Sep 2006.

## Wireless and Cooperative Communications

- C 2014** R. Alkurd, R. Shubair, and **I. Abualhaol**, "Survey on device-to-device communications: challenges and design issues," 12th IEEE International New Circuits and Systems Conference (NEWCAS), pp. 361–364, 22-25 June 2014.
- C 2013** S. Al Maeeni, S. Muhaidat, and **I. Abualhaol**, "Non-coherent detection for cooperative OFDM-based system over time-varying fading channels," 20th IEEE International Conference on Electronics, Circuits, and Systems (ICECS), pp. 197–200, 8-11 Dec 2013.
- C 2013** R. Alkurd, **I. Abualhaol**, and S. Muhaidat, "An efficient approximation of  $Q(\sqrt{x})$  function and general BER performance analysis," IEEE 7th GCC Conference and Exhibition, pp. 367–371, 17-20 Nov 2013.
- C 2013** E. Salahat and **I. Abualhaol**, "Generalized average BER expression for SC and MRC receiver over Nakagami-m fading channels," IEEE 24th International Symposium on Personal Indoor and Mobile Radio Communications (PIMRC), pp. 3360–3365, 8-11 Sep 2013.
- C 2013** H. Eghbali, **I. Abualhaol**, S. Muhaidat, and Y. Iraqi, "Random-based Fair Allocation Algorithm with Fuzzy Comprehensive Evaluation for Single Carrier Multi-Relay Cooperative Networks," 19th European Wireless Conference (EW), pp. 1–5, 16-18 April 2013.
- J 2012** M. Ahmed, S. Jimaa, and **I. Abualhaol**, "Performance Enhancements of MIMO-OFDM system using Various Adaptive Receiver Structures," International Journal of Computer and Information Technology (IJCIT), pp. 99–106, vol. 1, 2012.



- C 2012** M.A Ahmed, S.A Jimaa, and **I. Abualhaol**, "Enhanced channel estimation technique in MIMO-OFDM system," IEEE 8th International Conference on Wireless and Mobile Computing, Networking and Communications (WiMob), pp. 545–549, 8-10 Oct 2012.
- C 2012** M. Ahmed, S. Jimaa, and **I. Abualhaol**, "BER Enhancement of MIMO-OFDM Using an Optimized NLMS Receiver," 6th Asia Modeling Symposium (AMS), pp. 211–214, 29-31 May 2012.
- C 2012** H. Eghbali, **I. Abualhaol**, S. Muhaidat, and Y. Iraqi, "Cluster-Based Fair Allocation Algorithm for Multi-Relay Single Carrier Distributed Networks," IEEE 75th Vehicular Technology Conference (VTC Spring), pp. 1–5, 6-9 May 2012.
- C 2012** H. Eghbali, S. Muhaidat, and **I. Abualhaol**, "Enhanced ZP-OFDM receiver in multi-relay cooperative networks," 25th IEEE Canadian Conference on Electrical & Computer Engineering (CCECE), pp. 1–6, 29 April-2 May 2012.
- C 2012** Y. Iraqi, **I. Abualhaol**, and S. Muhaidat, "Lifetime Evaluation of Cooperative OFDM WSNs," IEEE Wireless Communications and Networking Conference (WCNC), pp. 2054–2058, 1-4 April 2012.
- C 2011** H. Eghbali, S. Muhaidat, and **I. Abualhaol**, "Distributed single-carrier frequency-domain equalization for multi-relay cooperative networks over frequency-selective Rician channels," 45th Asilomar Conference on Signals, Systems and Computers (ASILOMAR), pp. 1115–1120, 6-9 Nov 2011.
- J 2011** H. Eghbali, **I. Abualhaol**, and S. Muhaidat, "Enhanced Iterative-based ZP-OFDM Receiver in Multi-Relay Cooperative Networks," Journal of Selected Areas in Telecommunications (JSAT), September Edition, 2011.
- B 2010** **I. Abualhaol** and M. Matalgah "Resource Allocation for a Cooperative Broadband MIMO-OFDM System," Cooperative Communications for Improved Wireless Network Transmission: Frameworks for Virtual Antenna Array Applications, pp. 382–398, IGI Global, PA, USA, 2010.
- C 2010** **I. Abualhaol** and M. Matalgah "Performance analysis of multi-carrier relay-based UAV network over fading channels", IEEE GLOBECOM Workshops, pp.1811–1815, 6-10 Dec 2010.
- C 2010** **I. Abualhaol** and Y. Iraqi, "Random-based fair allocation in Multi-Relay cooperative OFDM system," IEEE 6th International Conference on Wireless and Mobile Computing, Networking and Communications (WiMob), pp. 596–599, 11-13 Oct 2010.
- C 2010** **I. Abualhaol**, M. Matalgah, and A. Abu-Abed "Enhanced cooperative coding for relay-based MIMO-OFDM systems," IEEE 21st International Symposium on Personal Indoor and Mobile Radio Communications (PIMRC), pp. 2299–2303, 26-30 Sep 2010.
- C 2008** **I. Abualhaol** and M. Matalgah "Subchannel-Division Adaptive Resource Allocation Technique for Cooperative Relay-Based MIMO-OFDM Wireless Systems," IEEE Wireless Communications and Networking Conference (WCNC), pp. 1002–1007, March 31- April 3, 2008.
- C 2008** **I. Abualhaol** and M. Matalgah "Capacity Analysis of MIMO System Over Nakagami- $m$  Fading Channels Using Finite Mixture with Expectation-Maximization Algorithm," IEEE International Conference on Computer Systems and Applications (AICCSA), pp. 309–316, March 31- April 4, 2008.