

INTELLIGENT DISASTER MANAGEMENT AND GREEN COMPUTING IN THE BIG DATA ERA: POLICIES, PERSPECTIVES AND PROSPECTS

J. Levy
University of Hawaii

B. Pandey
Gynacity Corporation

Intelligent disaster management and green computing constitute rapidly expanding research areas spanning the fields of soft computing, environmental technologies, computer science, engineering and information management. The explosion of Open and Big Data have given rise to new opportunities for understanding and solving formerly intractable environmental and disaster management challenges. The use of Big Data has now been mainstreamed into all recent trends in computing and engineering as well different disciplinary fields such as computational biology, disaster response, healthcare, social networks, finance, transportation and telecommunications. This special issue provides a unique and powerful vehicle for disseminating the latest research dealing with intelligent disaster management and green computing research, development, applications and its intelligence. The rise of Big and Open Data-and the ease with which scientists, communities, thought leaders and decision makers can access it-redefining how governments, civil society and the private sector operate. References to Big and Open Data have grown exponentially over in the past several years, and examples of big data abound, giving rise to a new philosophy of ‘open-source environmental governance and disaster management’, that promotes a linkage between the principles of the disaster science, green computing and open-source and open-content movements.

This set of distinguished eighteen papers strengthens interdisciplinary linkages between the fields of green computing and disaster science investigates current gaps in environmental technologies and and the opening of new research directions in the era of Big and Open Data era. Rather than separating the engineering technologies from its ‘real world’ impact, those contributing to this special issue have demonstrated attention to the issues of societal resilience, environmental governance and disaster risk reduction and that their work informs. Accordingly, this special issue helps

engineering and science academics and practitioners to better understand the complex relationships related to the following key issues: transformative green computing and community resilience; disaster risk reduction and peace-building, human rights, big data and civil society activities; soft computing and social vulnerability; and environmental group decision and negotiation support. In summary, this cross-disciplinary and international collection of papers examines the most challenging societal-technologic dilemmas, with a special emphasis on crafting comprehensive, sustainable and intelligent solutions to effectively transform them with the power of Open and Big Data.

In the first paper Das *et al.* (2019) discuss leading edge technologies for intelligent and effective disaster management systems. In this state of the art survey, current disaster technologies the authors not only identify challenges and opportunities of existing systems but also predict areas for future growth. They note that disasters constitute devastating phenomena that may result in the large scale loss of human life. The paper addresses not only damage to critical infrastructure but also how technologies can address the large scale destruction of critical socio-technical systems as well as how to reduce impacts to the natural and built environment. The authors show that innovative new emergency management technologies can protect human lives and ensure a more disaster resilient future. The authors discuss new technologies for disaster resistant coastal mega-cities including the Internet of Things (IoT), Big Data, as well as advances in Soft Computing and Deep Learning. The authors discuss how the Internet of things (IoT) is comprised of numerous smart devices and communication technologies. The IoT devices interchange critical information through wireless or wired network connections. The strengths and weaknesses of possible solutions for Effective Disaster Management using Multi-Technologies are discussed. Key conclusions are highlighted to promote more efficient and effective disaster management. A comprehensive literature review of current challenges and opportunities in the field are discussed with a focus on computational cybernetics and disaster risk reduction.

In the second paper, Gasim Alandjani (2019) provides a discussion of Blockchain-based medical transaction schemes for organ transplant services. Dr. Alandjani notes

that according to the American Transplant Foundation, over one hundred thousand people in the United States are on the waiting list to receive an organ as of early March, 2019. He quotes poignant statistics dealing with the frequency with which new names are added to the transplant list and highlights the fact that many people each day in the US die due to a lack of organ availability. It is emphasized that according to the US Department of health (DoH) in the US alone, over a thousand new patients are added onto waiting list for organ transplantation in the US. There is a large demand for transplanting not only corneas and kidneys but a wide range of organs and human tissue including intestines, liver, bone marrow and lungs (Decoded Science, 2019). Specific data cited in the paper show that kidneys make up about three-quarters of the global unlawful trade in organs (Whoin, 2019).

Alandjani notes that the Internet of Things have brought fundamental and innovative changes to the way society works and lives. He notes that the introduction of machine to machine communication (M2M) can provide services such as setting off alarms, acting as personal assistant for reminders, and keeping track of daily activities etc. The author proposes the use of Blockchain for tracking all transactions without the compromising secrecy of data. This is achieved by keeping its integrity intact for medical-legal requirements and to prevent the risk of fraud. A Blockchain based scheme is proposed to allow auditable medical transactions to prevent organ trafficking and to support the tracking of legitimate organ donors and recipients. This research has contributed to the field of Smart Health services based on Blockchain. It is expected that this research can help to safeguard the rights of medical professionals and patients.

In the third paper, Ali, Aman and Hassan (2019) discuss encryption and decryption approaches for cloud query processing. The authors note that data query services which use cloud technologies are increasing in popularity for challenges that demand scalability and cost-efficient solutions. They also emphasizes the challenges faced by cloud consumers. For example how to best keep confidential data safe and secure? The need to encrypt sensitive data for security and confidentiality purposes is discussed. A wide range of papers are discussed to provide a survey of the field, such as classification approaches for identifying confidential data in order to enhance

the efficiency of query processing over the cloud (Hussein and Sulaiman, 2016). In particular it is shown that properly encrypting data facilitates the protection of private information. The AES and RSA encryption methods are discussed with a particular focus on encryption method performance. Key technologies are highlighted including the use of Microsoft SQL Server as a cloud database simulation system and the use of Visual Studio platform to simulate the local processing of queries. A range of performance evaluation parameters are discussed for encryption and decryption. The architecture of the proposed method contains three key components: the local side; Encryption and Decryption methods (AES and RSA); and the cloud side. The three type of queries discussed are to insert data, retrieve data, and drop data. The authors suggest a combination of multiple encryption methods to improve encryption time and encryption security.

In the fourth paper Mojib, Aman, Khalaf and Hassan (2019) provide simulation analyses for QOS within the context of an Internet of Things (IoT) wireless network. The authors discuss the use of wireless network protocols for connecting smart devices such as 6LoWPAN, RPL, CoAP, MQTT, and AMQP and for transferring messages in an IoT network. The parameters considered for this paper are throughput (Aman *et al.*, 2016), end-to-end delay (Rosilah, 2017) and jitter. They review an analysis of the RPL Routing Standard for Low Power and Lossy Networks (Parasuram, Culler, & Katz, 2016) and a performance evaluation of RPL routing protocol in 6lowpan (Xie *et al.*, 2014). One of the key contributions of this paper involves a comparison of the IPv6 protocol wireless network with the Low Power Wide Area Network (6LoWPAN) and Low Power and Lossy Network Routing (RPL) for IoT communications using the Contiki:cooja simulator. The considered QoS parameters are throughput, end-to-end delay, and jitter. The authors show that the 6LoWPAN demonstrated superior results compared better QoS compared to RPL. It is shown that the link layer of 6LoWPAN and RPL could support the participation of “tiny things”.

In the fifth paper, Haque Nawaz, Husnain Mansoor Ali and Shafiq-ur-Rehman provide an overview of Unmanned Aerial Vehicles (UAV) applications. The authors note how autonomous unnamed aerial vehicle systems are capable of performing important and timely missions. The paper presents the a wide range of UAV

applications in a range of case studies varying from agriculture to military uses. For example, agricultural farming can be improved by using UAVs technology. The authors discuss how UAVs can be used to enhance methodologies of cultivation, to improve soil analysis and the monitoring of crops. The authors also focus on how irrigation system reconnaissance could be carried out by UAVs to improve production yields building on the work of Zhang and Kovacs (2012)2012. For example, the authors discuss the use of UAVs in the crop cycle to create 3-D mappings for soil analyses and to identify bacterial or fungal infections. The innovative use of UAVs also allows for improved irrigation and nitrogen level management (Lu *et al.*, 2017).

In the sixth paper, Bensalah and El-Kamoun (2019) discuss a novel SDN Network Feature Virtualization (NFV) approach for managing MPLS Infrastructure. The paper addresses the integration of NFV and SDN in different environments such as cloud computing, wide area networks, 5G and telemedicine. The authors note that NFV allows for software components to quickly install, control and manipulate network functions. By integrating cloud and virtualization technologies NFV efficiently creates new network services while optimizing flexibility, scalability and automation. Moreover, NFV technology reduces vendor dependency and allows new features to be rapidly deployed. The authors put forth a novel solution for the virtualization of network services in order to ensure fast network access while ensuring high service quality. Results show that NFV achieves significant improvements in flexibility and cost reduction for next-generation networks. In this paper we have proposed a new architecture for virtualization of MPLS infrastructures by combining SDN and NFV approaches. Results suggest that the proposed architecture successfully manages network services and equipment to meet subscriber QoS requirements in a timely manner. There are a number of reasons for this unparalleled flexibility and cost reduction. A key reason for these remarkable achievements is that a single gateway can instantiate multiple virtual routing tables, each of which is subject to a routing policy that meets users' QoS requirements.

In the seventh paper Aman, Al Junid, Salehudin, Hidayat, Hassan, and Aljunid (2009) propose an Intelligent Ecosystem for Healthcare Service and Management (IEHSM). This tool represents a unique reformulation and extension of previous

approaches in order to achieve a valuable integration of healthcare management systems, health databases as well as disease control and elimination tools. The authors emphasize the optimization of disease prevention through the use of Big Data analytics, cloud computing, machine learning and information centric networking. Based on the Casemix system, the IEHSM framework is capable of aggregating key information about patients and associated procedures based on the type and variety of treatments. In this way the authors put forth a robust and cognitive ecosystem for the management of healthcare services. In this way the authors address several key objectives: to provide a novel and valuable model for the improvement of public health; the intelligent adaptation of disease prevention models; the use of big data analytics and artificial intelligence for healthcare management; and the development of an engaging and sustainable patient and doctor-friendly system.

In the eighth paper, Khan, Channa, Ali, Khan, Qazi, and Mengal discuss the use of three-dimensional (3-D) wildlife modeling to benefit wildlife researchers, students, and experts. The authors use a 3D creation software blender in order to develop live 3D models of different species. This approach is not only user friendly but also provides an attractive way for users to control and retrieve desired information about different species from various ecosystems and regions around the world. 3D processing is an emerging and growing need in the multimedia domain. The first step in their original methodology involves “model creation”. Here, a background image is chosen for the desired 3D model and an image axis is established using the software blender 3D. Next the desired body is created with the help of a “tool cube” in order to resize, scale and extend the shape. The second step in their methodology involves “unwrapping the model” followed by specific modeling steps. In conclusion, the authors successfully develop the 3D recreation of pictures and put forth a new method for deforming and articulating an object from a 2D image to a 3D model. Finally, the original use of the 3D blender software is used to transform the display of 2D to 3D images through the successful alteration of three-dimensional meshes.

Ninth, Shaikh, Hassan, Malik, and Shah (2019) examine the effectiveness of customized financial software. They carry out a thorough review of open source and licensed software applications in accounting, business and finance applications

including Oracle, SPSS, Peachtree, SAAS and Microsoft excel. A major focus of the paper deals with powerful enterprise resource planning (ERP) software such as SAP. For example, SAP ERP incorporates the key business processes and functions of an organization including Operations, Financials (i.e. Management Accounting and Financial Supply Chain Management) and Human Capital Management (Training, Payroll, etc). Operations within SAP ERP include a wide range of fields from Sales & Distribution, Materials Management, Production Planning, and Logistics Execution to Quality Management. The system flow of the novel financial software includes linking details of the account with voucher entries (i.e. the transactions created made by the user). After the process of recording transactions, the software retrieves the transaction details and records the flow of information from sender to receiver. Next the transaction requests approval of transactions by a unit head, with each transactions assigned with a unique identifier followed by the printing of the cheques. With the completion of this process, the cheque book is updated automatically by the software. The proposed software also provides data analysis tools including an income report that shows the variations in the withdrawal of the transactions. On the other hand, the remaining budget is updated to the account sheets.

The tenth paper involves the design and tuning of digital power line carriers to improve network line parameters with a particular focus on (high voltage) transmission lines. This paper, authored by Khowaja, Halepoto, and Memon (2019) involves the designed, configuration, and simulation of a Digital Power Line Carrier (DPLC) over a 3-phase 500kV/220kV high voltage transmission line. The authors employ the Micom software and configure the DPLC for fast and efficient data transmission. In particular data transmission involved distances that exceeded 700 km. Key objectives included the need to reduce noise by using different enhanced digital techniques and advanced indoor/outdoor equipment. As a case study the existing network of the National Transmission and Dispatching Center was used Pakistan. Two two remote stations between 500kV Jamshoro and NKI Karachi were employed for in situ line condition measurements with respect to attenuation and noise. Line spectrum results show that in the Rx (116 KHz to 124 KHz) band high noise levels exist (-3.951dB and analog line gain of 10.45 dB.) To ameliorate this noise level, the DPLC was

reconfigured and after synchronising both DPLCs of 500kV Jamshoro and NKI Karachi, there was a significant improvement in line parameters including noise, attenuation and BER. When DPLC was used for data transmission the system was 99.6% error free when running for half an hour.

The eleventh paper, authored by Memon, Nizamani, Memon, Memon and Soomro (2019) discuss achieving a high input power factor for a DCM Buck Power Factor Correction (PFC) converter. Such converters are commonly employed for a broad range of AC/DC applications. However, the authors note that there is a significant downside: traditional Discontinuous Conduction Mode (DCM) Buck Power PFC operates on a constant duty-cycle control (CDCC) scheme. As a result its input power factor (PF) is low. To deal with this challenge, the authors propose a variable-duty-cycle control (VDCC) method. Another approach is also employed: the fitting duty-cycle method was shown to improve circuit implementation easier. As a result, the PF was improved to approximately unity. Finally, rigorous simulation results were employed to verify and validate the analysis and technique. In summary, a high power factor was achieved through the use of a variable duty-cycle control scheme and the implementation of a proposed circuit. Simulation results are presented for the verification of the analysis.

Twelfth, Memon, Memon, Memon, and Hashmani (2019) examine a high efficiency critical conduction Mode Buck-Buck/Boost converter. A novel approach is put forth to overcome the low efficiency of the buck converter when the on-time is constant, which results in higher conduction and switching losses (due to increased levels of the rms and peak values of the inductor current. The proposed methodology focuses on improving efficiency through a powerful Variable On-Time Control (VOTC) strategy to create a buck-buck/boost topology with numerous advantages. The new system has not only a simpler structure but also reduces losses and has lower component costs. A saber simulator is employed for validity testing. The simulation results confirm that the the new approach offers a promising tool for increasing the efficiency of the buck converter.

In the thirteenth paper in this special issue Memon, Memon and Memon (2019) examine a traffic surveillance problem. The authors explore how to improve surveillance for the purposes of motor vehicle taxation with specific reference to excise taxation in the Sindh government. The Sindh excise taxation department collects revenue from vehicles operating under the purview of the government of Sindh. Currently a tiring and cumbersome manual system is used to check payments of individual vehicles. It is proposed to develop an online automatic portal that addresses the key issues of tax defaulters. Accordingly, the authors address the optimal solution for detecting defaulters using a new technology known as Automatic Vehicle Number Plate Recognition (AVNPR). This tool uses face recognition and image processing to meet key goals. For example, license number plate numbers and characters are automatically read by image processing algorithms. The proposed system has great promise for increasing the payment of vehicle taxes by delinquent motorists.

In the fourteenth paper, Levy and Pandey (2019) explore how to best combine the ethics and science of Disaster Management. They note that the scientific discourse about disasters has historically focused predominantly upon the characteristics of the physical hazards themselves and the costs of mitigation actions to reduce the risks of these physical threats. While this physical science approach involves important geologists, hydrologists and other experts, the importance of community resilience and social vulnerabilities has become increasingly recognized in the social sciences. This research uses statistical tools including binary logistic regression to analyze ethical considerations in flood disaster management issues with a focus on Asia's more devastating floods. The authors conclude that it is important that values and ethical considerations are made explicit during the disaster planning process so that they are consistent with the ethical judgments that underlie the emergency management decision process. In summary the authors note that during the disaster planning phase, there will be innumerable technical and political issues, each with its own ethical components. What humans and assets do we protect, and to what level of safety? How do we set disaster budgets and priorities? The way these questions are answered reflects the ethical perspectives and moral analysis strategies of planning groups. In this paper the role of both ethical and scientific decisions in flood management challenges are comprehensively considered.

In the fifteenth paper, Khokhar et.al. (2019) discuss the occupational hazards of construction companies. The principal objective of their research is to investigate occupational health and safety (OH&S) training to be delivered effectively to the workers of the construction companies. It has also been investigated that how the construction workers been trained during OH&S training.

In the sixteen paper, Alauddin, Yee, and Teck (2019) propose a new way of promoting airline business with the help of both social network and mobile applications. In the proposed method, authors are using BigQuery to process huge volume of online customers' data. The proposed method is to understand the airline ecommerce online visitors effectively by analysing the event data stream collected from various digital properties.

In the seventeenth paper, Kalhoro, Waleed, Shahid, Ahmed, Lashari and Ara (2019) investigate the future of Renewable energy production in Pakistan. They observed the solar irradiation trend and the fluctuation for the hourly, daily, monthly and yearly durations. The Solar irradiation is available in the form of energy only need to explore it. They are using the python software for the solar irradiation trend observation for the Karachi.

In the eighteenth paper, Alla, Hassan and Chen (2019) discuss ongoing trends among the most Higher Education Institutions (HEI) to achieve a Green ICT Campus as part of its responsibility for building a sustainable environment. Efficient energy distribution is one of the key factors to achieve the maximum benefits of producing clean and green energy. Authors focuses on studying the current practices in energy usage in MHEI and proposing various techniques to reduce the consumption of energy usage to achieve Green ICT Campus through the Smart Grid including suggesting for alternate energy production.

REFERENCES

- Alandjani, G.** (2019). Blockchain-based medical transaction schemes for organ transplant services. *3C Tecnología. Glosas de innovación aplicadas a la pyme. Special Issue, November 2019*, 41-63. doi: <http://dx.doi.org/10.17993/3ctecno.2019.specialissue3.41-63>
- Ali, Z., Aman, A.H.B.M., & Hassan, R.** (2019). Cloud Query Processing Analysis: Encryption and Decryption. *3C Tecnología. Glosas de innovación aplicadas a la pyme. Special Issue, November 2019*, 65-75. doi: <http://dx.doi.org/10.17993/3ctecno.2019.specialissue3.65-75>
- Aman, A.H.M, Al Junid, S.A.M., Salehudin, H. Hidayat, A. Rosilah, H., & Aljunid, S.M.** (2019). Ecosytem for Healthcare Services and Management System. *3C Tecnología. Glosas de innovación aplicadas a la pyme. Special Issue, November 2019*, 121-131. doi: <http://dx.doi.org/10.17993/3ctecno.2019.specialissue3.121-131>
- Aman, A.H.M., Hashim, A.H.A, Abdullah, A., Ramli, H.A.M, & Islam, S.** (2016). Parametric comparison of multicast support for network mobility management: A qualitative analysis. *International Journal of Multimedia and Ubiquitous Engineering*, 11(9), 203-210.
- Bensalah, F., & El Kamoun, N.** (2019). Towards a new SDN NFV approach for the management of MPLS Infrastructures. *3C Tecnología. Glosas de innovación aplicadas a la pyme. Special Issue, November 2019*, 107-119. doi: <http://dx.doi.org/10.17993/3ctecno.2019.specialissue3.107-119>
- Das, B., Butto, A., Bano, A., Pandey, B., Levy, J., & Ahmed Al-Abiary, Y.A.M.** (2019). Technologies for Effective Disaster Management Systems: A State of the Art Survey of Current Challenges and Opportunities. *3C Tecnología. Glosas de innovación aplicadas a la pyme. Special Issue, November 2019*, 29-39. doi: <http://dx.doi.org/10.17993/3ctecno.2019.specialissue3.29-39>
- Decoded Science.** (2019, March 7). Retrieved from: <https://www.decodedscience.org/organ-harvesting-human-trafficking-black-market/56966>

- Hussein, A., & Sulaiman, R.** (2016). A Classification Method for Identifying Confidential Data to Enhance Efficiency of Query Processing over Cloud. *Journal of Theoretical and Applied Information Technology*, 93(2), 412-420.
- Khan, S., Channa, S., Ali, S.A., Khan, M.H., Qazi, A.H., & Mengal, K.** (2019). 3D Modeling for Wildlife Encyclopedia Using Blender. *3C Tecnología. Glosas de innovación aplicadas a la pyme. Special Issue, November 2019*, 133-147. doi: <http://dx.doi.org/10.17993/3ctecno.2019.specialissue3.133-147>
- Khowaja, M.H., Halepoto, I.A., & Memon, S.** (2019). Design and tuning of a digital power line carrier to improve network line parameters at high voltage transmission lines. *3C Tecnología. Glosas de innovación aplicadas a la pyme. Special Issue, November 2019*, 167-183. doi: <http://dx.doi.org/10.17993/3ctecno.2019.specialissue3.167-183>
- Levy, J., & Pandey, B.** (2019) Combining the Ethics and Science of Disaster Management: Key Issues, Policy Considerations and Best Practices. *3C Tecnología. Glosas de innovación aplicadas a la pyme. Special Issue, November 2019*, 233-251. doi: <http://dx.doi.org/10.17993/3ctecno.2019.specialissue3.233-251>
- Liu, P., Chen, A.Y., Huang, Y.N., Han, J.Y., Lai, J.S., Kang, S.-C., ... Tsai, M.H.** (2014). A review of rotorcraft Unmanned Aerial Vehicle (UAV) developments and applications in civil engineering. *Smart Structures and Systems*, 13(6), 1065-1094. <https://doi.org/10.12989/SSS.2014.13.6.1065>
- Memon, A.A., Memon, A.R., & Memon, A.H.** (2019). Conducting traffic surveillance for motor vehicle taxation. *3C Tecnología. Glosas de innovación aplicadas a la pyme. Special Issue, November 2019*, 221-231. doi: <http://dx.doi.org/10.17993/3ctecno.2019.specialissue3.221-231>
- Memon, A.H., Nizamani, M. O., Memon, A.A., Memon, Z.A., & Soomro, A.M.** (2019). Achieving high input power factor for DCM Buck PFC converter by variable duty-cycle control. *3C Tecnología. Glosas de innovación aplicadas a la pyme. Special Issue, November 2019*, 185-199. doi: <http://dx.doi.org/10.17993/3ctecno.2019.specialissue3.185-199>

- Memon, A.H., Mansoor, A. M., Memon, Z.A., & Hashmani, A.A.** (2019). Critical Conduction Mode Buck-Buck/Boost Converter with High Efficiency. *3C Tecnología. Glosas de innovación aplicadas a la pyme. Special Issue, November 2019*, 201-219. doi: <http://dx.doi.org/10.17993/3ctecno.2019.specialissue3.201-219>
- Mojib, G., Aman, A.H.M., Khalaf, M., & Hassan, R.** (2019). Simluation analysis for QoS in Internet of Things wireless network. *3C Tecnología. Glosas de innovación aplicadas a la pyme. Special Issue, November 2019*, 77-83. doi: <http://dx.doi.org/10.17993/3ctecno.2019.specialissue3.77-83>
- Nawaz, H., Ali, H.N., & Rehham-ur-Shafiq, A.** (2019). Applications of unmanned aerial vehicles: a review. *3C Tecnología. Glosas de innovación aplicadas a la pyme. Special Issue, November 2019*, 85-105. doi: <http://dx.doi.org/10.17993/3ctecno.2019.specialissue3.85-105>
- Parasuram, A., Culler, D., & Katz, R.** (2016). An Analysis of the RPL Routing Standard for Low Power and Lossy Networks. Technical Report No. UCB/EECS-2016-106 98.
- Rosilah, H., & Rana, J.** (2017). End-to-end (e2e) Quality of Service (QoS) for IPv6 Video Streaming. *19th International Conference on Advanced Communication Technology (ICACT)*, 1-4, South Korea.
- Who.in. (2019, March 09). Retrieved from: <https://www.who.int/bulletin/volumes/85/12/06-039370/en/>
- Xie, H., Zhang, G., Su, D., Wang, P., & Zeng, F.** (2014). Performance evaluation of RPL routing protocol in 6lowpan. Proceedings of the *IEEE International Conference on Software Engineering and Service Sciences, ICSESS*, 625-628. doi: <https://doi.org/10.1109/ICSESS.2014.6933646>
- Zhang, C., & Kovacs, J.M.** (2012). The application of small unmanned aerial systems for precision agriculture: A review. *Precision Agriculture*, 13(6), 693-712. doi: <https://doi.org/10.1007/s11119-012-9274-5>