

# **COVID-19 Challenge International Virtual Summit**



**29 March 2021  
KES Virtual Conference Centre**

## **Conference Digest**

<http://covidchallenge.kesinternational.org>





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## Welcome

KES International COVID-19 Challenge: A Transition to a more Resilient World - International Virtual Summit

KES Covid-19 Challenge is an international summit focussing on technological, economic, and social developments to combat the effects of global and local disasters as well as the ways in which we can build back better for our communities, industry, and the environment.

We are increasingly aware that disasters occur regularly and come in many forms. In addition, there is a continuing disaster going on around ourselves all the time because of human-influenced climate change. The current pandemic has presented us with a challenge and an opportunity. Governments around the world have injected stimulus funding with the aim of reversing economic decline and there is the opportunity for this funding to contribute to building a more resilient world.

There should be increased investment in low-carbon technologies better able to withstand and mitigate against future problems. There is also a need for thought leadership regarding our rapidly evolving society; for example, the dramatic expansion in home-working and the evolution of smart digital productivity tools enabling this to happen. Cities and rural communities all over the world are in need of the innovative methodologies which allow for holistic resilience and self-sufficiency.

KES International is pleased to respond to the current situation by providing the COVID-19 Challenge International Virtual Summit. This provides an opportunity for researchers, engineers, technologists, economists, and managers and to meet, present their work, and discuss ways to build a more resilient economy and a society better able to resist sporadic and continuing disasters.

## Organisation

### ***Honorary Chairs:***

Prof. Robert J. Howlett, 'Aurel Vlaicu' University of Arad, Romania and Bournemouth University, UK

Prof. Lakhmi C. Jain, University of Technology Sydney, Australia and Liverpool Hope University, UK

Prof. Vincenzo Manca, University of Verona, Italy

### ***Co-Chairs:***

Dr. John Littlewood, Cardiff Metropolitan University, Wales, UK

Prof. Marius M. Balas, Aurel Vlaicu University of Arad, Arad, Romania

### ***Technical Committee:***

Prof. Rajkumar Buyya, University of Melbourne, Australia

Assoc. Prof. Bill Kapralos, Ontario Tech University, Canada

Prof. George Karani, Cardiff Metropolitan University, Wales, UK

Dr. John Littlewood, Cardiff Metropolitan University, Wales, UK

Prof. Lyudmila Mihaylova, University of Sheffield, Sheffield, UK

Prof. Edward Szczerbicki, The University of Newcastle, Australia

## Keynote Talks

### Professor Rajkumar Buyya

University of Melbourne, Australia

### *Neoteric Frontiers in Cloud and Edge Computing*

**Abstract:** Computing is being transformed to a model consisting of services that are delivered in a manner similar to utilities such as water, electricity, gas, and telephony. In such a model, users access services based on their requirements without regard to where the services are hosted or how they are delivered. Cloud computing paradigm has turned this vision of "computing utilities" into a reality. It offers infrastructure, platform, and software as services, which are made available to consumers as subscription-oriented services. Cloud application platforms need to offer (1) APIs and tools for rapid creation of elastic applications and (2) a runtime system for deployment of applications on geographically distributed computing infrastructure in a seamless manner.

The Internet of Things (IoT) paradigm enables seamless integration of cyber-and-physical worlds and opening up opportunities for creating new class of applications for domains such as smart cities and smart healthcare. The emerging Fog/Edge computing paradigm extends Cloud computing model to edge resources for latency sensitive IoT applications with a seamless integration of network-wide resources all the way from edge to the Cloud.

This keynote presentation will cover (a) 21st century vision of computing and identifies various IT paradigms promising to deliver the vision of computing utilities; (b) innovative architecture for creating elastic Clouds integrating edge resources and managed Clouds, (c) Aneka 5G, a Cloud Application Platform, for rapid development of Cloud/Big Data applications and their deployment on private/public Clouds with resource provisioning driven by SLAs, (d) a novel FogBus software framework with Blockchain-based data-integrity management for facilitating end-to-end IoT-Fog/Edge-Cloud integration for execution of sensitive IoT applications, (e) experimental results on deploying Cloud and Big Data/ IoT applications in engineering, and health care (e.g., COVID-19), deep learning/Artificial intelligence (AI), satellite image processing, natural language processing (mining COVID-19 research literature for new insights) and smart cities on elastic Clouds; and (f) directions for delivering our 21st century vision along with pathways for future research in Cloud and Edge/Fog computing.



**Biography:** Dr. Rajkumar Buyya is a Redmond Barry Distinguished Professor and Director of the Cloud Computing and Distributed Systems (CLOUDS) Laboratory at the University of Melbourne, Australia. He is also serving as the founding CEO of Manjrasoft, a spin-off company of

the University, commercializing its innovations in Cloud Computing. He has authored over 850 publications and seven text books including "Mastering Cloud Computing" published by McGraw Hill, China Machine Press, and Morgan Kaufmann for Indian, Chinese and international markets respectively. Dr. Buyya is one of the highly cited authors in computer science and software engineering worldwide (h-index=138, g-index=307, 104,500+ citations). "A Scientometric Analysis of Cloud Computing Literature" by German scientists ranked Dr. Buyya as the World's Top-Cited (#1) Author and the World's Most-Productive (#1) Author in Cloud Computing. Dr. Buyya is recognised as Web of Science "Highly Cited Researcher" for five consecutive years since 2016, IEEE Fellow, Scopus Researcher of the Year 2017 with Excellence in Innovative Research Award by Elsevier, and the "Best of the World", in Computing Systems field, by The Australian 2019 Research Review.

Software technologies for Grid, Cloud, and Fog computing developed under Dr. Buyya's leadership have gained rapid acceptance and are in use at several academic institutions and commercial enterprises in 50 countries around the world. Dr. Buyya has led the establishment and development of key community activities, including serving as foundation Chair of the IEEE Technical Committee on Scalable Computing and five IEEE/ACM conferences. These contributions and international research leadership of Dr. Buyya are recognized through the award of "2009 IEEE Medal for Excellence in Scalable Computing" from the IEEE Computer Society TCSC. Manjrasoft's Aneka Cloud technology developed under his leadership has received "Frost & Sullivan New Product Innovation Award". He served as founding Editor-in-Chief of the IEEE Transactions on Cloud Computing. He is currently serving as Editor-in-Chief of Software: Practice and Experience, a long standing journal in the field established ~50 years ago. For further information on Dr. Buyya, please visit his cyberhome: [www.buyya.com](http://www.buyya.com).

**Associate Professor Bill Kapralos**

Ontario Tech University, Canada

***The Gamified Educational Network Learning Management System to Facilitate Engaging Cooperative Remote Learning***

**Abstract:** Since the onset of the CODVID-19 pandemic and the resulting shutdowns and work from home orders, medical education has been disrupted, and presents practical and logistical challenges and concerns particularly with respect to laboratory training (and psychomotor skills development in particular) which cannot always be recreated online/remotely. To help overcome these challenges, we are employing the Gamified Educational Network (GEN) Learning Management System (LMS) as a tool to promote psychomotor skills development in a cooperative online learning environment amongst a community comprised of trainees ("peers"), experts, and educators. More specifically, medical trainees can record themselves as they practice a procedure using a physical simulator (e.g., "task trainer"), upload their resulting video to the GEN LMS where a discussion ensues. Through the innovative use of game elements, the GEN LMS engages and motivates students to use and take advantage of the platform, and participate in this discussion/debriefing process ultimately promoting collaborative learning that includes peer-to-peer as well as expert-based feedback. This presentation will begin with an overview of the GEN LMS followed by a description of its use in a variety of medical education applications.



**Biography:** Bill Kapralos is an Associate Professor within the maxSIMhealth Laboratory at Ontario Tech University. He is also the Technical Lead of the Collaborative Human Immersive Interaction Laboratory (CHISIL), Sunnybrook Health Sciences Centre in Toronto. His current research interests include: immersive technologies, serious gaming, multi-modal virtual environments/simulation/reality, the perception of auditory events, and 3D (spatial) sound generation. He was recently awarded a Greek Diaspora Fellowship (sponsored by the Stavros Niarchos Foundation). He is a past recipient of an Australian Government 2018 Endeavour Executive Fellowship to conduct research in Australia, a past recipient of a Natural Sciences and Engineering Research Council of Canada (NSERC) and Japan Society for the Promotion of Science (JSPS) Fellowship, a past recipient of an IBM CAS Faculty Award, and a past co-recipient of a Google Faculty Award.

**Professor George Karani & Dr John R Littlewood**

Cardiff Metropolitan University, UK

***Addressing Challenges and Opportunities through Partnership, to Mitigate against Infection, Pandemics, Climate Change Resulting in Increased Human Resilience and Quality of Life***

**Abstract:** There is epidemiological evidence that human exposure to particulate pollution increases mortality and morbidity from cardiovascular and respiratory disease. Recent studies have demonstrated that long term exposure to particulate air pollution is associated with dementia and type-2 diabetes mellitus. Generally, particle size, shape, density, chemical composition, and mass have been identified as key characteristics for health and environmental studies.

The authors use case studies from projects completed in the UK, Middle East, Africa, and Canada since the mid 1990's on waste management; water recycling; economic and poverty impacts upon diseases, air quality and thermal comfort; community resilience, health and working environment; and inadequate workmanship decreasing physical safety.

The studies have shown that Addressing challenges and opportunities through Partnership to Improve quality of life by collaborating with appropriate stakeholders, API, is a validated approach to develop technologies to inform policy. API is thus an effective way to mitigate against infection, pandemics, climate change and increase human resilience.

**Biographies:**

Prof Karani is Professor of Environmental Health, Centre for Occupational & Environmental Public Health, Cardiff Metropolitan University School of Sport and Health Sciences. Prof Karani leads the Environmental Public Health to Improve Quality of Life Research Group (EPUQOG) research group. The motto of the group is to Address Challenges and

Opportunities through Partnership to improve quality of life by Involvement of all appropriate stakeholders, (API). The research group projects are on Pollution and Health, Poverty Related diseases, Sustainable Development Goals. George's team work with local, regional and international research partners on joint grant applications, publications, postgraduate research supervision, seminars, conferences and innovation activities. We collaborate with Public Health Wales, Cardiff and the Vale & Aneurin University Health Boards, Universities of Nottingham & South Wales, Community groups and Industrial partners. Our current overseas partners based in Cameroon, Ghana, Kenya, Nigeria, Oman, Qatar, Rwanda, United Arab Emirates and Uganda. Prof Karani has been a consultant to the World Bank, World Health

Organization (WHO) and the World Meteorological Organization (WMO). He has been appointed to several government advisory committees. He has served as Lead resource person at various training, workshop and seminar meetings in Africa, Europe, and the Middle East.



Dr. John Littlewood graduated in Building Surveying, holds a Ph.D. in Building Performance Assessment for Operational Energy dwellings, and is a multi-disciplinary Chartered Building Engineer. He is Founder (2009) and been Head of the Sustainable and Resilient Built Environment Research Group (SuRBe) at Cardiff Metropolitan University (UK). John's innovative research has been in collaboration and industry focused since 1996. His specialisms related to improving quality of life for people and wildlife, reducing carbon emissions from energy use and so mitigating climate change include: assessing and testing construction fabric workmanship weaknesses that impact upon fire performance, energy use for heating and thermal comfort so human fuel poverty and physical health - in existing and new dwellings; optimising offsite manufacturing and construction of modern methods of construction systems for nearly to zero operational carbon buildings, using natural and renewable materials; and low impact and organic green infrastructure projects to improve harvest of food and flowers, by protecting and enhancing biodiversity and the natural environment. In addition, John has considerable experience in establishing research centres and collaborations, at local, national, and international levels, and leads on Professional Doctorates in Engineering and Sustainable Built Environment. He has co-authored 150+ peer-reviewed publications, been General Chair of KES International's Sustainability in Energy & Buildings International conference in 2014, and since 2017, and is Co-Editor of Springer's Advances in Sustainability Science and Technology Book series.

**Professor Lyudmila Mihaylova**

University of Sheffield, Sheffield, UK

***Trustworthy Machine Learning Methods for Smart Cities with Increased Resilience***

**Abstract:** A significant number of the world population lives in cities and it is predicted that this number will increase to 70 percent in the next five years. This poses a number of challenges - for mobility, planning, especially linked with the development of autonomous and connected vehicles, safety critical systems, deployment of sensors and quick decision making. In the era of data - volume, velocity, veracity and variety are significant challenges and the data volume is beyond the capacity that a human could process. This talk will present recently developed machine learning methods able to deal with data challenges and at the same time providing trust assessment to the developed approaches. Could we trust the developed methods and how much are they reliable? These methods are part of solutions that can increase the resilience of our cities and can help us to deal with different environments.



**Biography:** Lyudmila Mihaylova, PhD is a Professor of Signal Processing and Control in the Department of Automatic Control and Systems Engineering at the University of Sheffield, Sheffield, United Kingdom. Her research interests are in the areas of autonomous systems with applications to cities, autonomous and assisted living systems. She has expertise in the areas of machine learning, intelligent sensing and sensor data fusion. She won the Tammy Blair best award from the International Conference of Information Fusion 2017, best

paper awards from the IEEE DESSERT'2019, 17th IEEE SPA'2013 Conference and IEEE Sensor Data Fusion Workshop, 2013 and others. Prof. Mihaylova is on the Board of Directors of the International Society of Information Fusion (ISIF) and was the ISIF President in the period 2016-2018. She has given a number of talks and tutorials, a including an invited talk in Harbin (Intelligent Navigation and Advanced Information Technology Workshop'2020), plenary talk in Cairo (JIC Smart Cities'2019), NATO SET-262 AI 2018 (Hungary), Fusion 2017 (Xi'an, China), plenary talks for the IEEE Sensor Data Fusion 2015 (Germany), invited talks at IPAMI Traffic Workshop 2016 (USA) and many others. She was the general vice-chair for the International Conference on Information Fusion 2018 (Cambridge, UK), of the IET Data Fusion & Target Tracking 2014 and 2012 Conferences, publications chair for ICASSP 2019 (Brighton, UK), program chair of Fusion 2020 and others.

**Professor Edward Szczerbicki**

The University of Newcastle, Australia

***Intelligence Augmentation with Decisional DNA and idream.technology***

**Abstract:** The rapidly evolving Cognitive Society of the 21st Century needs increasingly smarter and abler decision-making enhancement to make this evolvement sustainable in the post pandemic age. We address this global challenge by proposing intelligence augmentation with Decisional DNA, which could provide decision-makers with the tools to choose the best outcomes for a Cognitive Society that would promote sustainability, wellbeing, and security to individuals and populations. In nature, deoxyribonucleic acid (DNA) contains the genetic instructions used in the development and functioning of all known living organisms. The idea behind our research is to develop an artificial system, an architecture that would support discovering, adding, storing, improving and sharing information and knowledge among agents and organisations through experience. We propose a novel Knowledge Representation (KR) approach in which experiential knowledge is represented by Set of Experience (SOE), and is carried into the future by Decisional DNA (DDNA). This research has enormous and exciting potential of opening entirely new and so far not conceptually conceived scientific horizons.



**Biography:** Professor E Szczerbicki has had very extensive experience in the area of intelligent systems development over an uninterrupted 40-year period, 30 years of which he spent in the topinformation science research centres in the USA, UK, Australia, and Germany. In this area he contributed to the understanding of information and knowledge management/engineering in complex systems operating in changing environments characterised by

informational uncertainties. He has published over 300 refereed papers which attracted more than 3000 citations over the last 20 years (ISI Web of Science; Scopus). His academic experience includes ongoing positions with Gdansk University of Technology, Gdansk, Poland; Strathclyde University, Glasgow, Scotland; The University of Iowa, Iowa City, USA; University of California, Berkeley, USA; and The University of Newcastle, Newcastle Australia.

## Timetable

Time (BST)	
8:30 - 8:45	Opening Ceremony Prof Robert J Howlett & Dr. John Littlewood
8:45 - 9:15	Keynote Speaker 1 - Main stage Prof Edward Szczerbicki Intelligence Augmentation with Decisional DNA
9:20 - 10:35	Session 1
10:35 - 10:45	Break
10:45 - 11:15	Keynote Speaker 2 - Main stage Dr Rajkumar Buyya Neoteric Frontiers in Cloud and Edge Computing
11:20 - 12:30	Session 2
12:30 - 13:00	Lunch
13:00 - 13:30	Keynote Speaker 3 - Main stage Prof George Karani and Dr John Littlewood Addressing Challenges and Opportunities through Partnership, to Mitigate against Infection, Pandemics, Climate Change Resulting in Increased Human Resilience and Quality of Life
13:35 - 14:35	Session 3
14:35 - 14:45	Break
14:45 - 15:15	Keynote Speaker 4 - Main stage Prof Lyudmila Mihaylova Trustworthy Machine Learning Methods for Smart Cities with Increased Resilience
15:20 - 16:20	Session 4
16:20 - 16:30	Break

**16:30 - 17:00**

Keynote Speaker 5 - Main stage  
Assoc Prof Bill Kapralos  
The Gamified Educational Network Learning Management  
System to Facilitate Engaging Cooperative Remote Learning

**17:05 - 18:40**

Session 5

## Presentation Schedule

### Session 1

9:20 - 10:35

PROSE Paper No	Paper Title / Author
<b>cvc21-003</b>	Equipping European higher education teachers for successful e-learning with home remote work during COVID-19 Dr. Luis Fernández-sanz
<b>cvc21-009</b>	Practice of Fully Online Project Based Learning of Software Development under the COVID-19 Pandemic Professor Atsuo Hazeyama
<b>cvc21-013</b>	Integration of Indoor Air Quality concerns in educational community through collaborative framework of Campus Bizia Lab of the University of the Basque Country Dr. Inigo Rodriguez-Vidal
<b>cvc21-021</b>	Opportunities and Barriers of Digitization in the COVID-19 Crisis for SMEs Dr. Ralf-christian Haerting
<b>cvc21-008</b>	Education after COVID-19 Dr. Manuel Mazzara
<b>cvc21-029</b>	Forecasting the COVID-19 spread using nonlinear autoregressive neural network and ARIMA-based hybrid models: a case study for Iran, Mexico, and Italy Dr. Mostafa Naemi

**Session 2**

11:20 - 12:30

<b>PROSE Paper No</b>	<b>Paper Title / Author</b>
<b>cvc21-012</b>	A health-energy nexus perspective for Virtual Power Plants: power systems resiliency and pandemic uncertainty challenges Dr. Sambeet Mishra
<b>cvc21-006</b>	Sustainable nutritional behavior in the era of climate changes Mrs. Simona Gavrilas
<b>cvc21-005</b>	The transformation of global supply chain in the context of business ecosystem: Case study on the VentilatorChallengeUK in response to Covid-19 pandemic Dr. Zheng Liu
<b>cvc21-022</b>	A Tale of Two Zones : Pandemic ERT Evaluation Mr. Enamul Haque
<b>cvc21-026</b>	Sustainable mobility strategies during and after the pandemic emergency B. Sc. Domenico Suraci

**Session 3**

13:35 - 14:35

PROSE Paper No	Paper Title / Author
<b>cvc21-014</b>	A flexible clinical decision support system for COVID-19 Student Yu He
<b>cvc21-010</b>	The Development of a Smart and Sustainable Full-Spectrum LED Lighting Technology to Prevent and Treat Covid-19 Infections, for Society's Resilience and Quality of Life Mr. Uthayakaren Thurairajah
<b>cvc21-018</b>	New Triazine Base Antimicrobial Agents Phd Valentina Beghetto
<b>cvc21-017</b>	Performance Analysis of Deep Learning Models for COVID-19 Diagnosis based on Chest X-ray Images: A Comparative Study Mr Shah Siddiqui

**Session 4**

15:20 - 16:20

<b>PROSE Paper No</b>	<b>Paper Title / Author</b>
<b>cvc21-002</b>	Fuzzy Cognitive Maps Applied in Determining the Contagion Risk Level of SARS-COV-2 Based on Validated Knowledge in the Scientific Community Phd Márcio Mendonça
<b>cvc21-015</b>	An overview of methods for control and estimation of capacity in COVID19 pandemic from point cloud and imagery data Dr Jesús Balado-frías
<b>cvc21-019</b>	Intelligent multi-sensor system for remote detection of COVID-19 Assistant Professor Ghita Zaz
<b>cvc21-027</b>	Frequency Analysis of Phrases Using Geotagged Tweets for COVID-19 Dr. Ayahiko Niimi

**Session 5**

17:05 - 18:40

<b>PROSE Paper No</b>	<b>Paper Title / Author</b>
<b>cvc21-004</b>	Three models of the analysis of the pandemic: a quarantine measures aggregation and a life-cycle model, a short-term COVID-19 incidence prediction in countries, and a quarantine measures efficiency assessment by Data Envelopment Analysis Professor Fuad Aleskerov
<b>cvc21-020</b>	Geostatistical patterns models for COVID19 spatial point data Assoc. Prof. Stelios Zimeras
<b>cvc21-007</b>	Strategic Facilities Management: Anticipating and Preparing for Future Change Dr Jeremy Gibberd
<b>cvc21-023</b>	A Housing Association Led Carbon Sequestration Strategy for a Post Covid19 Resilient and Globally Responsible Wales Ms Kirsten Stevens-wood
<b>cvc21-028</b>	Modelling and evaluating the impact of social restrictions on the spread of COVID-19 using Machine Learning Dr. Mostafa Naemi
<b>cvc21-029</b>	Forecasting the COVID-19 spread using nonlinear autoregressive neural network and ARIMA-based hybrid models: a case study for Iran, Mexico, and Italy Mr. Amin Naemi
<b>cvc21-024</b>	Towards an Enclosed Environment Monitoring System to Count the Number of Students in Classrooms for COVID19 Prevention Dr Bogart Yail Marquez

## Summaries of Talks

### *Session 1*

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#### **Equipping European higher education teachers for successful e-learning with home remote work during COVID-19**

Dr. Luis Fernández-sanz

COVID-19 consequences in the shape of restrictions and lockdowns caused a sudden need of transition from traditional higher education (HE) teaching scenario to e-learning with teachers working remotely from home. A combined study based on literature review and a specific survey to HE teachers in Europe has collected consistent results to suggest which should be the contents for equipping teachers for the new teaching paradigm.

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#### **Practice of Fully Online Project Based Learning of Software Development under the COVID-19 Pandemic**

Professor Atsuo Hazeyama

The COVID-19 pandemic affected nearly every living area. Institutions of higher education were similarly affected, and the sudden need for keeping physical distance made on-campus lectures impossible. Many institutions of higher education started to offer distance learning. This paper reports on the practice of Project Based Learning (PBL) for software development at Tokyo Gakugei University during the COVID-19 pandemic. We devised ways to solve problems in the remote learning process, such as preparing an environment for communication in group activities, methods of working outside the lecture, and support for individual reflection.

## **Integration of Indoor Air Quality concerns in educational community through collaborative framework of Campus Bizia Lab of the University of the Basque Country**

Dr. Inigo Rodriguez-Vidal

Nowadays Indoor Air Quality (IAQ) of occupied spaces has become a major concern for many stakeholders due current health situation caused by the COVID-19 pandemic. This problem is even more pressing in educational context due several reasons such as the high density of occupation, reduced distance between students, coexistence of multiple mechanical and natural systems to cope with indoor environmental needs or the training and awareness of users on the use of the building. All these reasons and the impossibility of offering a single criterion of action generates the need to take clear, effective and useful measures for users. In this sense, this research aims to analyze the behavior of the IAQ of educational spaces belonging to centers on the Gipuzkoa Campus of the University of the Basque Country (UPV/EHU). The study analyzes different types of spaces with different characteristics in order to analyze the behavior of each one of them. To do this, based on a monitoring campaign, the research analyzes CO2 as a clear indicator of pollution level that will define ventilation needs. Results have shown the clear effect that the visualization of the data has on the users. So it can be concluded that the information based decision making achieved through the employment of monitoring panels could provide an effective and easy-to-use solution to achieve IAQ goals. The research is also framed within the Campus Bizia Lab program where the collaborative process between academic staff, service and administrative staff and students in order to respond to sustainability challenges within the University itself.

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## **Opportunities and Barriers of Digitization in the COVID-19 Crisis for SMEs**

Dr. Ralf-christian Haerting

For some years now, digitization has played a decisive role in the activities of all companies. Small and medium-sized enterprises are also striving to further digitize processes and are even developing business models based on digital opportunities. Due to the Covid-19 pandemic and the associated "social distancing", many companies were forced to push ahead with these activities, for example in the form of home office options for their employees. A qualitative study from spring/summer 2020 with the same title already examined the opportunities and barriers of digitization in the Covid-19 crisis for SMEs. This paper is based on a quantitative survey that tests the hypotheses put forward. Experts from various economic sectors who hold a managerial position were interviewed, as well as IT experts and professors with practical activities.

## Education after COVID-19

Dr. Manuel Mazzara

The year 2020 has brought life-changing events for many, and affected numerous professional sectors. Education has been one of those fields heavily impacted and institutions have almost worldwide switched to forms of online education, which has become a common practice. With a 4th industrial revolution happening in front of our eyes, some elements of the existing education system are showing themselves as outdated. However, despite the realization that online teaching is here to stay, frontal classes are a millennia-old practice that cannot be fully replaced without neglecting the very human nature. Instead, old and new can coexist, and humanity and machines can cooperate for societal development. In this paper, we present past, present and future of education, what we have learnt by the experience of teaching online, and how we see, and are getting ready for future developments of the field.

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## Forecasting the COVID-19 spread using nonlinear autoregressive neural network and ARIMA-based hybrid models: a case study for Iran, Mexico, and Italy

Dr. Mostafa Naemi

This paper analyses single and next waves COVID-19 outbreaks using two different hybrid models, which combine the machine learning and statistical methods with Richards growth models [2], to simulate and forecast the spread of the infection. For this purpose, the historical cumulative number of confirmed cases for three countries, including Iran, Italy and Mexico is used. The analysis of the Richards models shows that its single-stage form can model the cumulative number of infections in countries with a single wave of outbreak (Italy and Mexico) accurately while its performance deteriorates for countries with next outbreaks (Iran), which clarifies the requirement of multi-stage Richards models. The results of multi-stage Richards models reveal that the prevention of the next waves could reduce the outbreak size in Iran by approximately 400,000 cases, and the pandemic could be controlled almost 7 months earlier. Although the cumulative size of outbreak is estimated accurately using multi-stage Richards models, the results show that these models cannot forecast the daily number of cases, which are important for health systems? planning. Therefore, two hybrid models, including Autoregressive Integrated Moving Average (ARIMA)-Richards and Nonlinear Autoregressive neural network (NAR)-Richards, are proposed. The accuracy of these models in forecasting the number of daily cases for 14 days ahead is calculated using the test data set, which indicates that forecast error ranges from 8 to 25%. The comparison between these hybrid models also shows that the machine learning-based models have superior performance compared with statistical-based ones and on average, are 20% more accurate. Finally, the total number of deaths is

estimated using the historical Case Fatality Rate (CFR), which shows Mexico will have the highest total number of deaths with more than 112,000 people, and Italy and Iran with approximately 34,000 and 28,000 are in the next positions. Our results can be beneficial in similar situations in the future because all pandemic obey growth models. So our proposed model can be used to forecast and avoid the spreading of such diseases in future.

## **Session 2**

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### **A health-energy nexus perspective for Virtual Power Plants: power systems resiliency and pandemic uncertainty challenges**

Dr. Sambheet Mishra

The objective of this paper is to introduce and discuss a novel “health-energy nexus under pandemic uncertainty” concept, that arises as a consequence of the current pandemic that we are experiencing world-wide. Traditionally, the concept of “health-energy nexus” in literature has been utilized merely to investigate the energy consumption within the healthcare system. While other studies proposed a health-energy nexus concept to investigate the effect of climate change on the overall state of health of the population and accounting for the health impacts from electricity generation to justify the decarbonization needs. The key contribution of this paper is to propose a novel health-energy nexus perspective, that widens the scope: in light of the pandemic implications on the power and energy systems, we discuss how the global health conditions are tightly connected with the energy consumption needs and how the two areas closely interact with each other. Opportunities and challenges that lie behind the interaction between health and energy will be outlined, and ways to address the changes in the power systems resiliency due to pandemic conditions will be discussed. Virtual Power Plants will be presented, as a way to address the pandemic challenges and improve the systems? resiliency. Moreover, the value of interdisciplinary education and research, together with the novel interdisciplinary domain of Energy Informatics, will be proposed as key pathways to overcome the challenges posed by the novel health-energy nexus under pandemic uncertainty.

## **Sustainable nutritional behavior in the era of climate changes**

Mrs. Simona Gavrilas

The nineteenth century could be considered the starting point in the scientific analysis of climate change monitoring. During that period of time appear many theories regarding the negative influence of greenhouse gas emissions and human activity on various environmental aspects. Technological development has brought advantages also in this field. With the help of mathematical modeling of data, multiple connections between the probable causes and the effects of various factors on the environment can be made. In general, the climate is influenced by a number of factors, including geographical position, air movement, and characteristic topography. The changes at this level are also recognized by the European Commission, which includes among the most probable causes the greenhouse gases: CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, fluorinated gases. These result from intensive activities as burning fossil gases and fuels, deforestation, animal husbandry, use of nitrogen fertilizers, production of fluorine-based gases. Effects of climate changes are usually divided in two directions, based on their direct and immediate impact: increase of minimum and maximum temperature level, and the number of extreme phenomena, higher sea and ocean level and temperatura, decrease of glaciers dimensions. All these have a negative impact on humans health and behaviour and on environment. Climate modifications results can be observed at global level. This situation is an important point for all national governments, so they created a mechanism (Intergovernmental Panel on Climate Change-IPCC) which supports, based on scientific reports, possible pathways for limitation or remouve of all assumptive hazards.

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## **The transformation of global supply chain in the context of business ecosystem: Case study on the VentilatorChallengeUK in response to Covid-19 pandemic**

Dr. Zheng Liu

This paper aims to explore the transformation of a new supply chain in the context of business ecosystem, to deal with product and process volatility, uncertainty, complexity, and ambiguity, resulted from the Covid-19 pandemic. Through the in-depth case study of a ventilator manufacturing project, led by the VentilatorChallengeUK consortium, we have identified the five stages of forming and configuring the supply chain from fragmented resources alongside the business ecosystem coevolution. The interaction mechanism highlights the role of intermediary and social network. Our paper contributes to the business ecosystem and supply chain bodies of knowledge by providing valuable insight and enriching the understanding into the transformation stages of the business ecosystem and its building blocks to form a new supply chain.

**A Tale of Two Zones : Pandemic ERT Evaluation**

Mr. Enamul Haque

'STUDENT PAPER' During the COVID-19 pandemic many educational institutes went from in-person to all virtual classes. Here we evaluated and compared developing countries zone and developed countries zone in terms of their ERT programs from well-known CIPP model perspective. We conducted qualitative and quantitative research to find the gaps and improvement opportunities for both the zones.

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**Sustainable mobility strategies during and after the pandemic emergency**

B. Sc. Domenico Suraci

STUDENT PAPER Analysis regarding changes in urban mobility due to the coronavirus and strategies to be prepared for the future challenges of cities, including new possible pandemics.

### **Session 3**

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#### **A flexible clinical decision support system for COVID-19**

Student Yu He

1. We propose to model clinical knowledge as external files to achieve decoupling between program and knowledge. 2. We have designed a knowledge editing environment that can graphically represent clinical knowledge and allow clinical experts to update that knowledge through simple manipulation of the graphics. 3. This flexible approach can better respond to the persistence and evolution of COVID-19 and can also be applied to other health emergencies.

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#### **The Development of a Smart and Sustainable Full-Spectrum LED Lighting Technology to Prevent and Treat Covid-19 Infections, for Society's Resilience and Quality of Life**

Mr. Uthayakaren Thurairajah

STUDENT PAPER This paper discusses a smart and sustainable full-spectrum lighting technology that could prevent and treat Covid-19 infections and enhance the global society's resilience and quality of life (QoL). The scope of this work is to develop a full-spectrum lighting system using light-emitting diode (LED) technology to provide the daylight effect for people in buildings and any season, to improve Vitamin D and Serotonin production during the day.

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#### **New Triazine Base Antimicrobial Agents**

Phd Valentina Beghetto

In this work we describe the synthesis of new chloro-triazines derived antimicrobial quaternary ammonium salts (TQAS). Several TQAS were synthesized and their antimicrobial activity tested. The efficacy of TQAS was tested against Gram-positive and Gram-negative bacterial strains, such as *Staphylococcus aureus* and *Escherichia coli*. TQAS that showed the best performance in terms of antimicrobial activity are currently under study for the synthesis of various block copolymers and the preparation of polymeric TQAS.

## **Performance Analysis of Deep Learning Models for COVID-19 Diagnosis based on Chest X-ray Images: A Comparative Study**

Mr Shah Siddiqui

The rise of COVID-19 has caused immeasurable problems to public health globally. The world has faced an acute shortage of the gold-standard testing kit known as RT-PCR (Reverse Transcription Polymerase Chain Reaction). Furthermore, in some countries, COVID-19 prevention measures were delayed due to this kit's shortage. Although the covid vaccination programs are being rolled out worldwide, the infection rates are still high, and we need an alternative testing solution to RT-PCR. Due to the superiority of deep learning in image processing, it is characterised as the most effective COVID-19 diagnosis based on X-Ray and CT images. An automated, faster, and reliable COVID-19 diagnosis method algorithm with better performance can reduce the use of expensive RT-PCR kits globally. Therefore, there is increasing interest in deep learning models based on X-ray and CT chest images in many publications in the last several months. However, the existing deep learning methods are trained and tested on a relatively small dataset, which may degrade the performance of deep learning methods for new sets of images. Our priority for this research is to build a large dataset by combining various published COVID-19 chest X-ray images. We have investigated the available models' performance based on our new dataset, and finally, we have built an effective deep learning model to diagnose COVID-19 from X-ray images.

## Session 4

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### **Fuzzy Cognitive Maps Applied in Determining the Contagion Risk Level of SARS-COV-2 Based on Validated Knowledge in the Scientific Community**

Phd Márcio Mendonça

Specifically, this work aims to develop an intelligent application to help assess the risk of contagion of individuals from COVID-19, also raising awareness of the risk of various activities; due to the current pandemic causing psychological problems, sequelae, in some cases, irreparable damage and, mainly, leading people around the planet to death. The risk levels of activities are inspired by a validated behavior table presented by the Texas Medical Association. An extension of a Fuzzy Cognitive Maps infers the risk levels of SARS-CoV-2 from information on human behavior in everyday life, which quantifies the level of risk of infection, and presents a normalized risk value. Some preliminary results will be presented with their due analysis. And, finally, the work ends with conclusions based on the results obtained and addresses future works.

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### **An overview of methods for control and estimation of capacity in COVID19 pandemic from point cloud and imagery data**

Dr Jesús Balado-frías

One measure that most governments have taken to contain, or at least to reduce the spread of COVID19 is to limit the capacity of all places [1]. The underlying idea is to limit the number of people gathered in the same place, as well as to maintain safety distances. The places targeted by this measure are both indoors (supermarkets, shops, cinemas, theatres, transport, stations, etc.) and outdoors (beaches, parks, public squares, etc.). Although obtaining the capacity is a relatively simple calculation, depending on the complexity of the environment, measuring the built environment can be a tedious task. In addition to the capacity calculation, a capacity control must be added, maintaining a safety distance between people, and controlling the incoming and outgoing flows.

Point clouds and images are data types used to study the as-built environment but with great differences, both in the way they are processed and in possible applications. The different advantages of each one could be complementary in situations such as the current pandemic. This paper discusses the advantages of each type of data for being useful to applications for estimating and controlling the capacity of people.

## **Intelligent multi-sensor system for remote detection of COVID-19**

Assistant Professor Ghita Zaz

The worldwide spread of COVID-19 pandemic creates an urgent need for research and development of fast and efficient solutions for detection patient of COVID-19 without any physical contact. Currently, the available and reliable techniques for screening COVID-19 require a treatment from a few hours to a few days and the number of screening devices is limited due to their high-cost. In this paper, we propose an intelligent, reliable and low-cost system that can remotely detect the main symptoms of COVID-19 disease: fever, cough and breathing difficulties. This system applies the principle of multi-sensor data fusion to provide a robust, accurate and complete description of these symptoms.

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## **Frequency Analysis of Phrases Using Geotagged Tweets for COVID-19**

Dr. Ayahiko Niimi

In this study, English tweets containing words related to COVID-19 were classified by country and region, and ranked high when sorted by the actual number of infected people in the United States and when sorted by the number of infected people per 100,000 people. The purpose of this study is to compare characteristic words that occur frequently by performing analysis in different regions and to investigate whether there are any differences.

## Session 5

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### **Three models of the analysis of the pandemic: a quarantine measures aggregation and a life-cycle model, a short-term COVID-19 incidence prediction in countries, and a quarantine measures efficiency assessment by Data Envelopment Analysis**

Professor Fuad Aleskerov

Based on the Oxford COVID-19 Government Response Tracker's (OxCGRT) data we construct the aggregation of the quarantine measures. We construct the life-cycle model of the pandemic for the countries. Next, we provide the model for predicting the number of cases of morbidity in the short term in the context of a preliminary assessment of countries based on three indicators: expert assessments of the law-abiding population, the level of education and restrictive measures taken in the country. The description and composition of the groups obtained are given. An assessment of the accuracy of the forecast results is presented. Then we provide a systematic way to measure and compare government responses to COVID-19 across countries by evaluation of quarantine measures efficiency using Data Envelopment Analysis methods.

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### **Geostatistical patterns models for COVID19 spatial point data**

Assoc. Prof. Stelios Zimeras

Geostatistics provides the practitioner with a methodology to quantify spatial uncertainty. Statistics come into play because probability distributions are the meaningful way to represent the range of possible values of a parameter of interest. In addition, a statistical model is well suited to the apparent randomness of spatial variations.. It must be noted that there is considerable variety of statistical methods that have been applied in the analysis of spatial variation in data, summarized by [1]. These include dispersal analysis, spectral analysis, wavelet analysis, kriging and spatial Monte Carlo simulations and many geostatistics methods. Kriging was developed for estimating thresholds of continuous variables. It has been used for interpolation and simulation of categorical variables and for spatial uncertainty analysis. Auto-correlation of the spatial variables was represented by indicator auto- variogram models.

## **Strategic Facilities Management: Anticipating and Preparing for Future Change**

Dr Jeremy Gibberd

The COVID-19 pandemic has highlighted how ill-prepared the building industry and facilities management sector has been to anticipate and respond to, change. In the near future, further major disruptions related to pandemics, climate change, new business models and emerging technologies such as artificial intelligence, are anticipated. It is necessary therefore to prepare for this change in the way we plan and manage buildings. This paper investigates the nature of anticipated future change and its implications for buildings. It proposes a structured approach for preparing and responding to change in a pro-active structured way. This approach is called Strategic Facilities Management (SFM) and the paper describes the objectives and elements of the approach. Through a case study of a medium-sized office building within a science park in Pretoria, South Africa, it shows how SFM can be applied. It outlines some of the scenarios and options that are generated by this approach to respond to the COVID-19 pandemic and other potential future changes. The case study, methodology and options generated are critically evaluated to ascertain the value of the approach. The study finds that SFM is a valuable methodology for ensuring that buildings are managed more pro-active for future change and makes recommendations for future research in this area.

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## **A Housing Association Led Carbon Sequestration Strategy for a Post Covid19 Resilient and Globally Responsible Wales**

Ms Kirsten Stevens-wood

This paper looks to explore how a community-based housing association based in Wales, has sought to respond to the challenges of climate change and the Covid-19 pandemic in 2021, by planning land acquisition for carbon capture and sequestration, and community based environmentally responsive social enterprises.

## **Modelling and evaluating the impact of social restrictions on the spread of COVID-19 using Machine Learning**

Dr. Mostafa Naemi

The rapid spread of COVID-19 has influenced various aspects of human life significantly. Authorities introduced different levels of social restrictions to manage the spread of this virus and minimize its impact on economy, health care systems, human well-being etc. This paper therefore analyses and models the impact of these restrictions on the infection spread using Machine Learning techniques. For this aim, various machine learning algorithms including deep neural networks and ensemble learning (random forest and gradient boosting) will be applied. The results of this study enable us to simulate the COVID-19 spread under different conditions and scenarios of authorities' decisions on imposing social restrictions. It also provides an insight on the importance of timely decisions by government and health authorities and quantifies their effect on virus spread, which can be very useful for managing and control of future pandemics. For this purpose, Oxford dataset has been used which contains number of confirmed cases and death per day for all countries along with information about various restrictions imposed by authorities. This information includes restrictions on schools, workplaces, public events, gatherings, public transports, internal traveling and international traveling.

## Forecasting the COVID-19 spread using nonlinear autoregressive neural network and ARIMA-based hybrid models: a case study for Iran, Mexico, and Italy

Mr. Amin Naemi

This paper analyses single and next waves COVID-19 outbreaks using two different hybrid models, which combine the machine learning and statistical methods with Richards growth models [2], to simulate and forecast the spread of the infection. For this purpose, the historical cumulative number of confirmed cases for three countries, including Iran, Italy and Mexico is used. The analysis of the Richards models shows that its single-stage form can model the cumulative number of infections in countries with a single wave of outbreak (Italy and Mexico) accurately while its performance deteriorates for countries with next outbreaks (Iran), which clarifies the requirement of multi-stage Richards models. The results of multi-stage Richards models reveal that the prevention of the next waves could reduce the outbreak size in Iran by approximately 400,000 cases, and the pandemic could be controlled almost 7 months earlier. Although the cumulative size of outbreak is estimated accurately using multi-stage Richards models, the results show that these models cannot forecast the daily number of cases, which are important for health systems? planning. Therefore, two hybrid models, including Autoregressive Integrated Moving Average (ARIMA)-Richards and Nonlinear Autoregressive neural network (NAR)-Richards, are proposed. The accuracy of these models in forecasting the number of daily cases for 14 days ahead is calculated using the test data set, which indicates that forecast error ranges from 8 to 25%. The comparison between these hybrid models also shows that the machine learning-based models have superior performance compared with statistical-based ones and on average, are 20% more accurate. Finally, the total number of deaths is estimated using the historical Case Fatality Rate (CFR), which shows Mexico will have the highest total number of deaths with more than 112,000 people, and Italy and Iran with approximately 34,000 and 28,000 are in the next positions. Our results can be beneficial in similar situations in the future because all pandemic obey growth models. So our proposed model can be used to forecast and avoid the spreading of such diseases in future.

## **Towards an Enclosed Environment Monitoring System to Count the Number of Students in Classrooms for COVID19 Prevention**

Dr Bogart Yail Marquez

COVID19 is profoundly affecting lives around the globe. The coronavirus pandemic affects all people no matter their age, gender, culture, or socioeconomic status. The COVID-19 incubation period range from 1 to 14 days. It means that if a person stays well 14 days after exposure, they may not have been infected [2]. For that reason, almost all the authorities in the world decided to start a quarantine, which means voluntary confinement. In Mexico, the government detected the first case of COVID 19 on February 29th. From that day to date, the Mexican government's official website reports more than 100,000 cases and 11,000 deaths. However, from June, several regions will end the quarantine and return to what the government calls new normality.

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*Some of the countries - Australia, Chile, Croatia, England, Germany, Japan, Ireland, Italy, Poland, Portugal, New Zealand, United States, Vietnam, Wales*

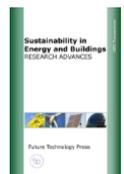
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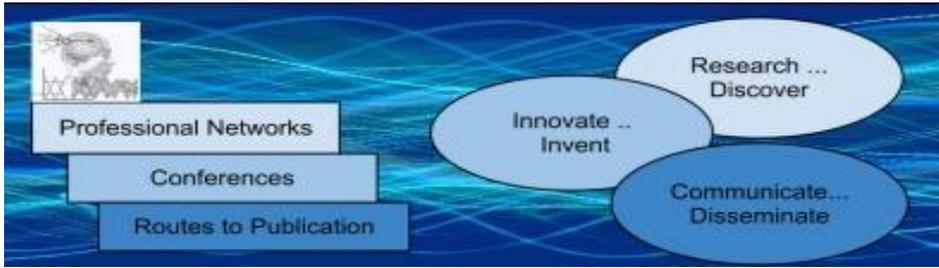
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# KES International – 2021 Conferences

## Celebrating 25 Years of KES

Due to the COVID-19 pandemic, all conferences this year will be planned as hybrid events. Participants will be able to attend either in person or online via our unique virtual platform.

### SDF-21: 14-16 June 2021



Smart Digital Futures 2021 brings you six of our most popular conferences on various aspects of intelligent systems (Innovation in Medicine & Healthcare, Intelligent Decision Technologies, Human Centered Intelligent Systems, Agent & Multi-agent Systems, Smart Education & E-Learning and Smart Transport Systems) in the stunning city of **Rome**. It will feature a unique and exciting social programme.

### KES-2021: 8-10 September 2021

We are delighted to announce that this is the 25th International Conference on Knowledge Based and Intelligent information and Engineering Systems! Celebrate with us in **Szczecin, Poland** at the **Radisson Blu Hotel** and on social events throughout this incredible and historic city.



### SST-21: 15-17 September 2021



Sea and is Croatia's second largest city.

Smart Sustainable Technologies 2021 is KES's dual themed conference incorporating: Sustainability in Energy and Buildings (SEB-21) & Sustainable Design and Manufacturing (SDM-21) It will be held at the beautiful **Hotel President**, which sits in the centre of the lively city of **Split, Croatia**. Split lies on the eastern shore of the Adriatic

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