International Society for Virtual Rehabilitation

ISVR

NEWSLETTER

NUMBER 22 | DECEMBER 2021

Editorial

December 2021 Newsletter 22

Dear reader

Another challenging year is coming to its end. Though frustrating in many ways, the pandemic has also emphasized the significance of remote rehabilitation, frequently including VR. Many have joined in this year's ISVR events, including our conferences (ICVR, ICDVRAT and RehabWeek), webinars and journal clubs which, of course, were mostly held virtual. Let us hope we will be able to meet face to face next year.

In this last issue of 2021, we present the exciting work on VR and BCI done at Denmark's Technical University (DTU) on pages 2 and 3. Among other research, the BCI group at DTU developed "BrainyHome", which includes the development of VR-based smart home and wheelchair control applications. On pages 4 and 5, John Muñoz from the University of Waterloo presents his work on physiological interfaces and wearable sensors to use body signals for intelligent adaptations of digital games.

Dr. Albert A. "Skip" Rizzo has been awarded this year's ISVR Distinguished Service Award, which could not be more deserved. You can find a short bio on page 6, and we will report on his lecture delivered at the ISVR General Assembly in the next issue. We also want to draw your attention to the ISVR General Assembly on 11th January 2022, which will be held online, and you can find all details on page 7.

We also include a call for book chapters on digital health technologies in public health and rehabilitation care in the Covid-19 era; see more details on pages 8 and 9.

We are always looking for interesting contributions to the newsletter. If you would like to share your news, upcoming events or an overview of your research, lab, clinic or company, please contact us at newsletter@isvr.org.

Relaxing holidays and a happy and healthy new year.

Sergi Bermúdez i Badia, ISVR President

IN THIS ISSUE

Scientific Profile
Brain Computer Interface Group
Pages 2 - 3

Technology Profile
Games Institute
Pages 4 - 5

Distinguished Service Award
Dr. Albert A. "Skip" Rizzo
Page 6

ISVR General Assembly
Page 7

CALL FOR BOOK CHAPTERS
Pages 8 - 9

ISVR News
Page 10

UPCOMING EVENTS

REHAB WEEK 2022
July 25-29, 2022
Rotterdam, The Netherlands
https://2022.rehabweek.org/

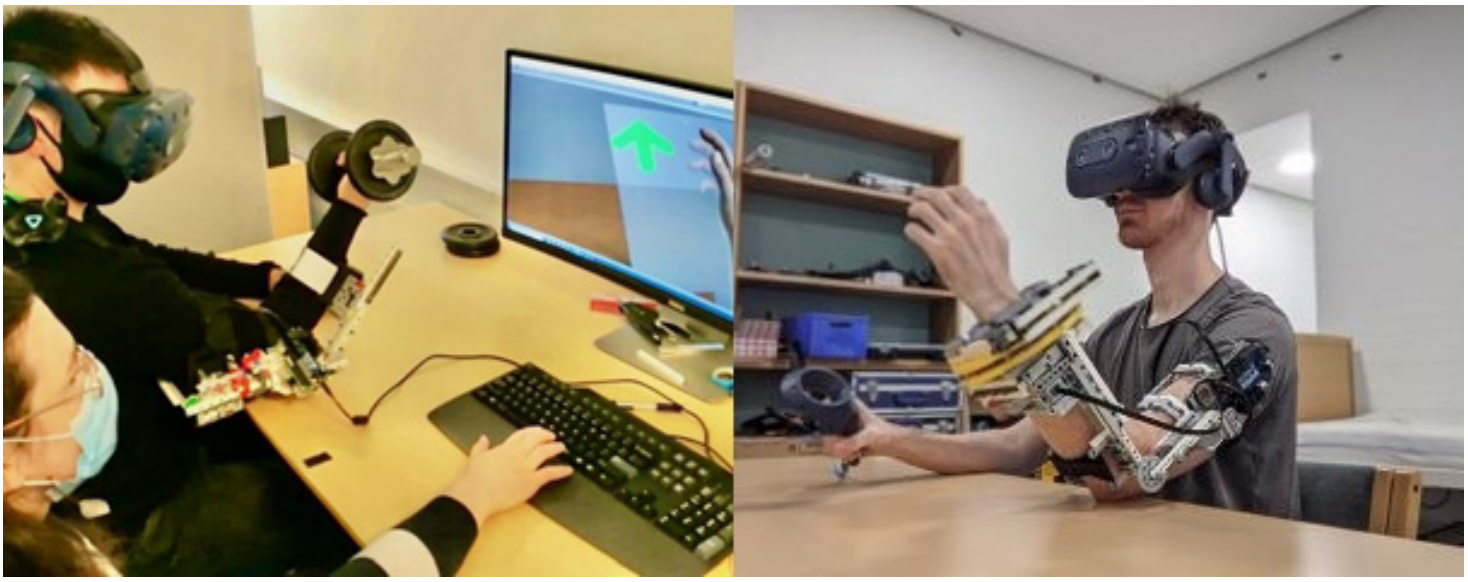
12th World Congress for Neurorehabilitation
December 14-17, 2022
Vienna, Austria
https://www.wfnr-congress.org/

Editors:
Iris Brunner
Gerard Fluet
Teresa Paulino
newsletter@isvr.org

SCIENTIFIC PROFILE

Brain Computer Interface Group

Muhammad Ahmed Khan
Technical University of Denmark
https://www.healthtech.dtu.dk/brain-computer-interface
mahkh@dtu.dk



Experimental setups for VR based research activities

Brain-Computer Interface (BCI) group is one of the leading research groups at the Digital Health division of the Department of Health Technology, Technical University of Denmark (DTU). This research group is led by Prof. Sadasivan Puthusserypady who is specialized in developing artificial intelligence (AI) based algorithms for biomedical applications. BCI group's research focuses on developing user-friendly neurorehabilitation and assistive systems for disabled and elderly people to help them lead independent lives. Moreover, the group is also working in interfacing such systems with the virtual reality (VR) and augmented reality (AR) technologies. The use of VR can play an important role in neurorehabilitation because the current rehabilitation approaches lack to exploit the patients' motivation, which is an important factor. Thus, after a while, many patients lose their interest and are too passive in clinical settings. Hence, the combination of BCIs with VR provides a virtual environment with entertaining, thrilling, and stimulating tasks. It keeps the patients more focused and motivated to do the rehab exercises with the added benefit of engaging more neural circuits, which helps in restoring motor functions in a more effective way. The VR/AR associated research is performed in close collaboration with the GazeIt lab of DTU, headed by Prof. John Paulin Hansen. His lab conducts research in the field of gaze and BCI-interaction with VR, robotics and assistive technologies.

Among different VR research projects, the GazeIt lab is involved in the EU Horizon 2020 project "Rehyb" (rehyb.eu) with the responsibility to build next-generation AR interfaces for exoskeletons supporting stroke patients during rehabilitation. The particular responsibility of DTU within this project is to develop and test a human-robot interface that stroke survivors find easy and motivating to use, while at the same time providing the information needed for therapists to monitor the rehabilitation. GazeIt do this by exploring interfacing of external third-party technologies such as, but not limited to, head-mounted displays and wearables with exoskeleton, controller unit, and the digital twin.

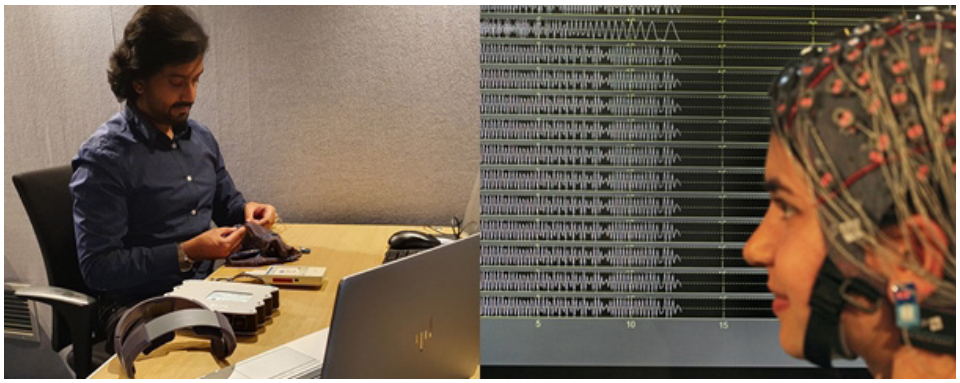
Currently, the BCI group is working on a project entitled, "BrainyHome" that includes the development of VR based smart home and wheelchair control applications, powered by BCI system. In recent years, smart home applications have become popular to improve the life quality of people, especially for those with motor disabilities. While the smart home applications are controlled with interaction tools such as mobile phone, voice control etc., these may not be appropriate for people with severe health issues that impacts their motor functions, for instance amyotrophic lateral sclerosis (ALS), cerebral palsy (CP), stroke, locked-in-syndrome (LIS), etc. In this research, the BCI group has already developed a smart home and wheelchair control application in a VR environment, which is controlled solely by the steady state visual evoked potential (SSVEP) based BCI system. It offers high accuracy along with a relatively low-cost, easy to setup, and wireless communication protocol.

SCIENTIFIC PROFILE

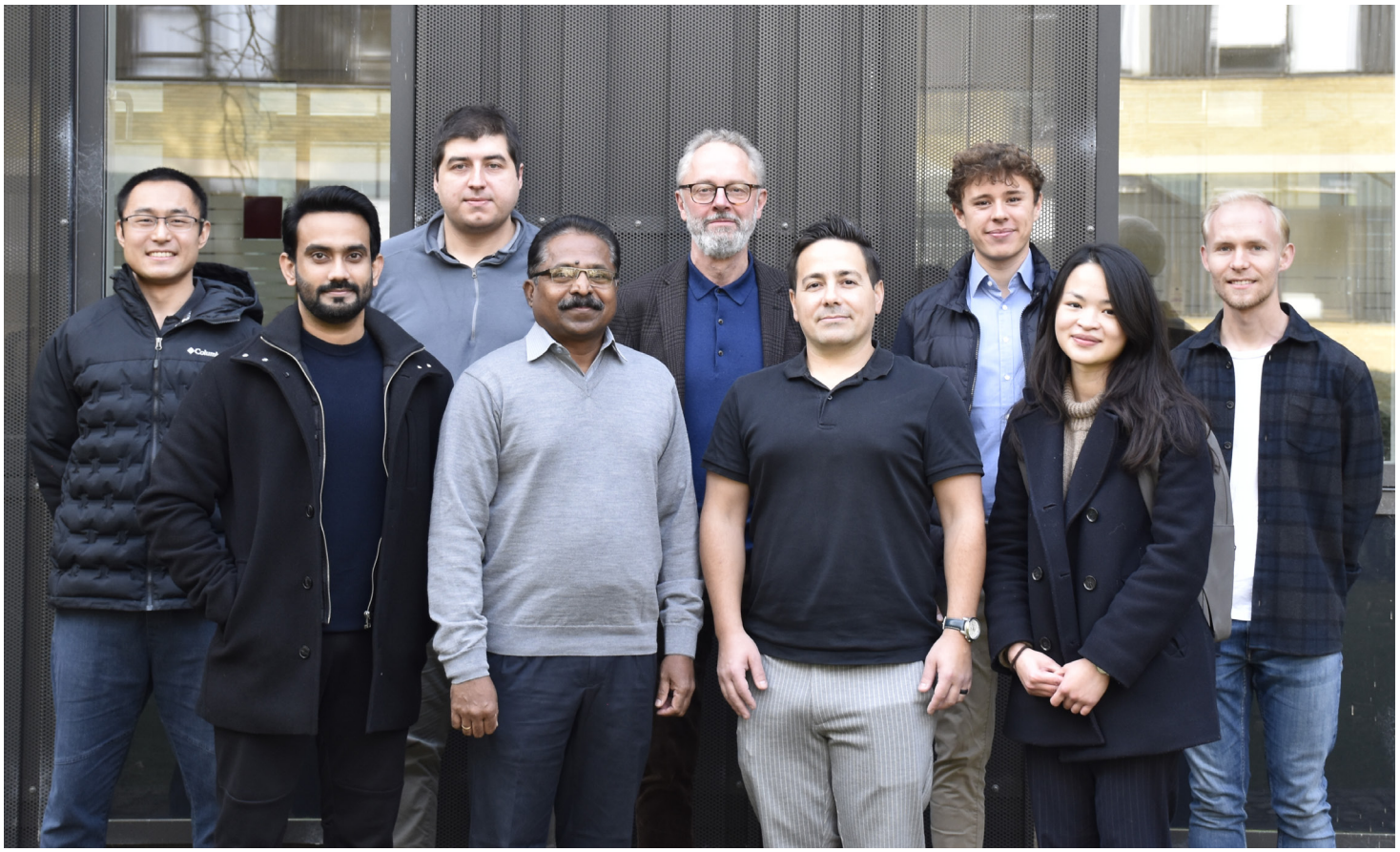
(continued from page 2)

The system has been tested on healthy subjects and the preliminary results show that all the subjects completed the device interaction and wheelchair navigation tasks with ≈ 100% and > 90% command accuracy, respectively. These results clearly indicate that in the future, the developed system could be used for real-time interfacing with assistive devices and smart home appliances.

Furthermore, recently, Dr. Muhammad Ahmed Khan, a postdoctoral fellow from BCI group has been awarded a 4-year research grant from the Novo Nordisk Foundation for a project entitled, "SmartRehab". This will allow Muhammad to perform three years of his research activities as a Visiting Researcher at the Stanford Bio-X Institute. In SmartRehab, a pilot study for developing a novel stroke rehabilitation system will be performed that will merge the 'BCI-VR technology' with 'Home-Based Stroke Rehabilitation' for the first time. The developed system will be completely wireless, portable, user-friendly, and easy to use at home and will be supported by a motor imagery EEG-based BCI system, VR, and electrical stimulation approaches. SmartRehab is highly interdisciplinary in nature and will be executed in collaboration with DTU, Stanford Bio-X Institute, and Aarhus University. It will be carried out under the primary mentorship of Prof. Kimford Jay Meador, Prof. Maarten G Lansberg and Prof. Ada Poon of Stanford University, USA. Moreover, Prof. Sadasivan Puthusserypady from DTU and associate professor Iris Brunner from Aarhus University will be the co-mentors throughout the project. The project will have a significant societal impact as it provides a novel solution for health challenges associated with neural disability. Also, it is in line with the EU strategy for the sustainable development goals of "Good Health and Well-Being", and thus contributes to the EU's scientific excellence.



Experimental setups for VR based research activities



BCI Research Group of Technical University of Denmark

TECHNOLOGY PROFILE

Games Institute

John Edison Muñoz
University of Waterloo
johnhci.com
john.munoz.hci@gmail.com

How did it start, how long has it been around?

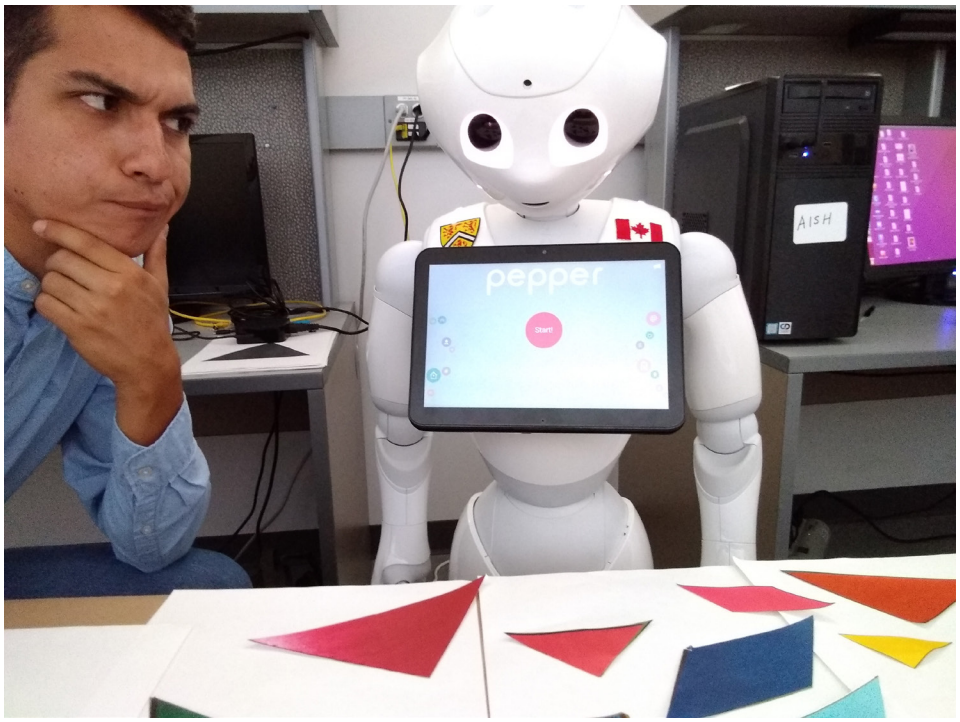
I started developing physiologically interactive systems when I was doing a master degree in Colombia, interacting with clinicians, exercise professionals and people with motor disabilities (especially older adults and children). To date, I have co-designed a dozen interactive games, virtual reality simulations and specialized software tools that facilitate the integration of body signals for intelligent adaptation in games and interactive systems such as social robots.

Who are the members?

I conduct research involving end-users, primarily older adults with/ without cognitive impairments, exercise professionals (e.g., physio, occupational, recreational therapists), kinesiologists, neuroscientists, engineers, game developers and artists. The multidisciplinary approach of my research allows me to create usable and scalable interactive systems that can be used outside research laboratories.

What research interests do you have?

My research focuses on the development of assistive interactive systems that use body signals as a way to create intelligent adaptation. I design games that use physiological interfaces and wearable sensors, virtual reality headsets, floor projections, motion trackers and social robots, aiming to assist users to promote positive wellbeing. From game design frameworks to open-source development tools to speed up the prototyping of physiologically adaptive systems, my research interests apply methodologies from serious game design to human-robot interaction.



Games robot Pepper

What problem does your system solve?

The creation of more personalized, adaptive and usable games for health capable of effectively producing measurable benefits in players. During my research, I have been able to create tools that streamline the integration of body signals such as heart rate and EEG into interactive applications as games and simulations aiming to provide adaptive assistive systems. The use of body signals as a way to better understand players and as an adaptive mechanism to create more personalized solutions is challenging and requires the synchronization of multiple technologies. I have co-designed and evaluated games and simulations that can be used along with measures of body reactions in real time to improve the responsiveness and effectiveness of games used for exercise promotion, physical therapy and skills training.

What makes it unique?

Researchers and companies in the field of games for health often use physiological signals to study player's behaviors but its use to create physiologically adaptive systems is scarce. I design tools, methodologies, models and taxonomies that allow a meaningful integration of body signals into interactive applications such as digital games, simulations and human-robot interaction scenarios. The creation of physiologically adaptive systems is unique since it combines elements from psychophysiology and human-computer interaction to create systems that connect users with their inner responses, thus facilitating the training of self-regulation skills.

(continued from page 4)

How is it better than other existing systems?

Using body signals as input in adaptive systems has the potential to boost the effectiveness of games for therapeutic or training purposes. When combined with other input modalities (e.g., contextual, perceived experience), physiological interfaces are highly effective in allowing a quantification of the therapeutic/training effects of using an assistive interactive system. Whereas other researchers have developed physiologically adaptive applications, my research is focused on the creation of infrastructure (e.g., software frameworks, design methodologies) and the evaluation of illustrative examples for studying its use in neuromotor rehabilitation, training and exercise promotion. This facilitates the prototyping and further adoption of physiologically adaptive systems in applications of virtual and augmented reality and human-robot interaction.

Tell us about the development process.

When thinking on designing adaptive games capable of collecting body signals and creating personalized experiences, understanding the physiological phenomena is definitively the first step. Body signals such as EEG and cardiovascular signals can be always complex to understand considering how they behave differently depending on the context and users. Therefore, user modeling (e.g., profiling, psychological, physiological) is always a fundamental part of the design and development process of the adaptive systems I have created. When possible, I like partnering with companies and indie developers to create usable and accessible applications that can be used outside research laboratories (top right image). Indeed, I have developed methodologies and design frameworks that aim to facilitate the collaboration between healthcare institutions, content developers and scientific researchers (see Collaboration Model diagram).

Virtual reality applications

What level of readiness is the technology now?

Body sensors that allow unobtrusive collection of physiological signals are becoming cheaper, more robust and more integrated with gaming technologies (such as VR headsets, game controllers). Communication protocols are becoming standardized across platforms and hardware (e.g., LSL), allowing a streamlined integration of physiological sensing into game engines such as Unity or Unreal. The creation of interactive experiences that use physiological signals to interpret human states in real-time is an ongoing work, where companies and research laboratories are still investigating on the best signals to use, the computational methodologies that best fit their solutions and comprehensive and sustainable business models to make profit of. The next generation of interactive systems (e.g., games, simulators, robots) will include technologies capable of collecting, analyzing and transforming body signals into usable inputs to create physiologically intelligent applications.

Stakeholder Group	Long-term Care Home	VR Industry Partner	Research Team
Interest	End-User Representation	Market-ready Product	Evidence & Innovation
Investment	Therapist Time, Resources	Hardware, Dev Time	Project Managing, Students Thesis
Key People	Therapists, PLWD/MCI	Business, Developer	Kinesiologists, Game Designers, Engineers
Benefits	Tailored Solution, Discount	Commercialization, R&D	Focus on Research, Accessibility

Collaboration Model

2021 ISVR DISTINGUISHED SERVICE AWARD

Dr. Albert A. "Skip" Rizzo, University of Southern California Institute for Creative Technologies since 1995 and the Director of Medical Virtual Reality (MedVR) since 2004

Dr. Rizzo has been a "titan" in the field of applications of virtual reality to rehabilitation, indeed, a key pioneer in the definition of this field since his early work in the mid-1990s. Since those early days, he has consistently carried out research on the design, development and evaluation of VR systems targeting the areas of clinical assessment, treatment and rehabilitation. This work spans the domains of psychological, cognitive and motor functioning in both healthy and clinical populations. He has mentored numerous graduate students and post-doctoral fellows, traveled extensively to deliver keynote addresses at major professional events and visited laboratories in many countries to meet with less experienced researchers. Skip's publication and grant record are outstanding, and he continues to play a major role in defining and refining the ways in which virtual reality can be optimally applied to a wide range of clinical and basic science topics.

ISVR GENERAL ASSEMBLY

Join us at the next general assembly of International Society for Virtual Rehabilitation, which will be followed by the presentation of the recipients of the of ISVR 2021 Early Career and Distinguished Service Awards, Dr. Marika Demers (Virtual rehabilitation for neurological population) and Dr. Skip Rizzo (Clinical VR: What a Long, Strange Trip it's Been!).

Registration is required : https://bit.ly/3oHt28X

Tuesday, January 11, 2022

7:00-9:00 AM West coast USA, 10:00 AM-12:00 PM East coast USA, 3:00-5:00 PM UK/Portugal, 5:00-7:00 PM Israel

Schedule

ISVR Annual General Meeting (30 min)
Sergi Bermúdez i Badia, President, ISVR

Virtual rehabilitation for neurological populations: importance of multidisciplinary collaborations (45 min)
Dr. Marika Demers, Post-doctoral research fellow
University of Southern California, USA
Recipient of the ISVR 2021 Early Career Award

Clinical VR: What a Long, Strange Trip it's Been! (45 min)
Dr. Albert A. "Skip" Rizzo
Director, Medical Virtual Reality - Institute for Creative Technologies
University of Southern California, USA
Recipient of the ISVR 2021 Distinguished Service Award

CALL FOR BOOK CHAPTERS

DIGITAL HEALTH TECHNOLOGIES IN PUBLIC HEALTH AND REHABILITATION CARE
Covid-19 Era

CALL FOR BOOK CHAPTERS IN HANDBOOK BY ELSEVIER

Dear Colleagues and Researchers,

In this 21st century, the world has changed rapidly with the development and application of new digital technologies. Especially in the COVID-19 Era, digital technology has had a dramatic impact on health care industries and people's lives. The digital technology is ranging from the use of Mobile/Smart phone to Computers, wearable and non-wearable technologies, sensors, 3D printers/ technologies, robotics, Artificial Intelligence (AI), Internet/sensors technologies, Websites and apps, Virtual and Augmented realities, and Computer games.

The COVID-19 pandemic has not only damaged to the people lives, but it has also given alarm to health care industries, especially public health and rehabilitation discipline and their practice. Since the outbreak, government and public health departments around the world have made significant changes in the regulation of health care services. Especially, WHO and various ministry of health - government organizations advised to take more precautionary measures for certain people who are at higher risk for COVID-19 infection, such as older adults, people with diabetes, heart disease, hypertension (high blood pressure), lung disease, cancer, chronic kidney disease. Furthermore, to reduce the spread of COVID-19 infections, various healthcare experts guided to limit the contact between person with COVID-19 infections and therapists, therefore, outpatient appointments and rehabilitation centers have been closed or limited during this pandemic- lockdown period. Some public or private hospitals have been allowed to operate the face-to-face rehabilitation services for those infected or suspected with COVID-19. In contrast, rehabilitation service was considered as a non-essential service for acute, subacute, and long-term phases of face- to-face rehabilitation care for patients with COVID-19 in some developing countries.

All these COVID-19 pandemic lockdown and social distancing related restrictions made huge impact on the world of "Public Health and Rehabilitation Services". The people with requirement of rehabilitation treatments, including people with Stroke, Parkinson's diseases, older adults with physical and cognitive impairments, Children with Autism and ADHD, and individuals with physical and mental health disorders, have suffered by physically, and socially and mentally due to unavailability of rehabilitation services during this COVID-19 pandemic. Although using digital technologies in the health care industries are not uncommon, this COVID-19 Era has developed an extreme necessity transition of, "face-to-face rehabilitation intervention services into "Digital Technologies based Public Health and Rehabilitation Services", for patients with or without COVID-19 to the entire world. To implement the effective, "Digital Technologies based Public Health and Rehabilitation Services", the involvement of researchers from the field of public health and rehabilitation health care system is very essential, and this team consists of various professionals, including Doctors, Nurses, Physical therapists, Occupational therapists, Speech therapists, Psychologists, Biomedical Engineers, and other Public health officers. Therefore, in this book, we would like to focus on the potential applications of advanced digital technologies (Mobile/Smart phone, Computers, Wearable and non-wearable technologies, Sensors, 3D printers/technologies, robotics, Artificial Intelligence (AI), Internet/sensors technologies, Websites and Apps, Virtual and Augmented realities, and Computer games) to promote advanced, innovative, feasible, effective "Digital Technologies based Public Health and Rehabilitation intervention". We invite the Co-researchers, Doctors, Nurses, Physical therapists, Occupational therapists, Speech therapists, Psychologists, Biomedical Engineers, and other Public health officers to submit their novel research and theoretical approaches work on the applications of Digital technology on Public Health and Rehabilitation Intervention, under related to any one of topics:

- COVID-19 and Digital health
- Public health interventions and disaster risk reduction using mobile technologies
- Telemedicine and Telehealth
- Application of Digital technologies for older adults
- Digi-tech for any medical conditions
- Wearable and non-wearable technologies for rehabilitation and public health care
- Sensor / Internet / sensors technologies / applications and intervention in rehabilitation and public health care
- Application of Robotics in Public health areas
- Application of Robotics in Robotics and Rehabilitation Thermal imaging in rehabilitation care
- Thermal imaging in public health
- 3D printers/technologies, Websites and apps, and Computer games approaches in the application in the rehabilitation
- eHealth/mobile heath
- Artificial Intelligence (AI) and public health
- Artificial Intelligence (AI) and Rehabilitation care
- Virtual and Augmented realities on Rehabilitation intervention
- Digital Health at home – Ambient assisted living solutions
- Digitally supported rehabilitation and public health care models
- Health Information Systems
- Case studies of the application of Digital health to rehabilitation care and public health Application of digital technology and mental health care
- Barriers in the application of Digital technologies
- Case studies /Digital public health and rehabilitation

CALL FOR BOOK CHAPTERS

(continued from page 8)

It would be great if you can confirm your Chapter Title by November 25, 2021, or as early as possible. As per the timeline, we would like to receive a short description/abstract (max 500-750 words) of your interested/proposed chapter by December 10, 2021. This abstract will help us to give you quick feedback to start to write your full chapter (5000 words) and submit it to us by January 30, 2022.

Publishing date: April/May 2022

Thanks for your valuable interest and contribution to this Digital Technology Book on Public health and Rehabilitation.
Please do not hesitate to contact me for further information at: bala21ot@yahoo.co.in; bala- sankar.ganesan@polyu.edu.hk

About the Editors

Prof. Raymond Tong

Professor Tong is a Founding Chairman and Professor in the Department of Biomedical Engineering, The Chinese University of Hong Kong. He received his PhD in Bioengineering from the University of Strathclyde, Glasgow, UK. Over the years, he has made great strides in developing a wide range of rehabilitation devices. His innovative work on the "Hand of Hope" rehabilitation robot system was the first Hong Kong invention to have received the grand prize in the 40-year history of the International Exhibition of Inventions of Geneva (2012), making Hong Kong internationally visible in this emerging area in healthcare technology. The Kinelabs project awarded Dr. Tong the highest honour of winner in the e-Health category in the Asia Pacific ICT Awards (APICTA) from Brunei in 2012. He was also the recipient of the Grand Award of the innovation awards from the Hong Kong Institute of Engineers in 2008 and the Ten Outstanding Young Persons in Hong Kong in 2013. He is presently the Chairman of the Asia Regulatory Professional Association (ARPA)-Hong Kong Academy. He is a senior Member of the Engineering in Medicine and Biology Society of the IEEE and Member of the Hong Kong Institute of Engineers (HKIE).

Dr. Balasankar Ganesan

Dr. Balasankar Ganesan received his Dual PhD degree from the University of Technology Sydney, Australia and The Hong Kong Polytechnic University, Hong Kong. He is also registered Occupational Therapist in Hong Kong and India. He has been recognized with various prestigious scholarships from Australia, such as UTS President's Scholarship (UTSP) Australia, UTS Top Up Scholarship, UTS International Research Scholarship, and PhD Post Thesis Publication Scholarship award. He has also developed an innovative assessment method for clubfoot (3DAMC) by using 3D technology. In addition, he is a member of International Society for Virtual Rehabilitation and International Society of Global Health.

Prof. Kenneth Fong

Prof. Kenneth N. K. Fong is Professor in the Department of Rehabilitation Sciences, The Hong Kong Polytechnic University, Hong Kong. His background training is in occupational therapy. He
is now the Editor-in-Chief of the Hong Kong Journal of Occupational Therapy (HKJOT) (indexed in SCI with 2019 Impact Factor: 0.480 and 5-year impact factor: 0.803), and honorary advisors of several organizations for people with chronic diseases and disabilities in Hong Kong.
He received the Department Outstanding Teaching Award in 2011, the Department Outstanding Team-Teaching Award in 2018, and the Faculty Team Teaching Award of the Faculty of Health and Social Sciences in 2010 and 2019 respectively. Currently, he is supervising 4 PhD students and 4 DHSc students, and co-supervising 4 PhD students. His undergraduate students received overseas awards in design of assistive technology products every year in the Student Innovation World Challenge, i-CREATe held in different countries in Asia.

ISVR Society News

The website at http://www.isvr.org acts as a portal for information about the society. We are keen to to enhance the community aspects of the site as well as to to make it the first port of call for people wanting to know what is going on in the field of virtual rehabilitation and its associated technologies and disciplines. Please do visit the site and let us know details of any upcoming events or conferences or news items you would like us to feature on the site. We intend to add further features in the coming year including member profiles; a directory of journals who publish virtual rehabilitation related work; and a list of Masters and PhD level theses completed or currently being undertaken in the field. As well as sending us details of events and news for display, we would welcome suggestions from members about what else they would like to see on the site, or ideas for how we can further develop the virtual rehabilitation community through it.

Please mail webdec@isvr.org with any information/ideas using ISVR INFO in the subject header.

Membership information

Membership of ISVR is open to all qualified individual persons, organizations, or other entities interested in the field of virtual rehabilitation and/or tele-rehabilitation. Membership (regular, student or clinician) entitles the member to receive reduced registrations at ISVR sponsored conferences and affiliated meetings (see webpages for more details). There is also an active ISVR facebook page, which is another source of useful information, currently with 1197 members.

Call for Contributed Articles

- If you are a technology expert in virtual rehabilitation or you have experience in the clinical use of virtual rehabilitation technologies, and would like to be featured in an upcoming ISVR newsletter issue
- If you would like to submit a contributed article relevant to the ISVR community
- If you have any news, summaries of recent conferences or events, announcements, upcoming events or publications

We are looking forward to your contribution! Please contact us at newsletter@isvr.org.

Join our mailing list: http://isvr.org/join-our-mailing-list/