NextGen HighTech Solutions to Improve the QoL in Cerebral Stroke Consequences

Roumiana Yossifova Ilieva[1] and Vladimir Damyanov[2]

[1]Department of Economics, Industrial Engineering and Management, Faculty of Management, Technical University of Sofia Sofia, Bulgaria, rilieva@tu-sofia.bg

[2]Vice Managing Director of DCC 8, Sofia, Bulgaria, dam_v@abv.bg

***Abstract*—The paper discusses the nature of the next generation technologies and the potential of AI and ML in cerebral stroke diagnostics. A schematic workflow of supervised machine learning is illustrated. The implementation of new technologies in cerebral stroke problems treatment and rehabilitation for engaging and stimulating brain are analyzed. Innovative stroke recovery devices, video games assistance, bio-robotics support, video conferencing with doctors, etc. are also discussed.**

Keywords—AI, ML, NextGen, HighTech, QoL, Cerebral Stroke

I. Introduction

Cerebral stroke is a genuine medical issue in every single industrialized nation. This is the third driving reason for death and leaves many enduring patients with physical and mental inabilities, which is an extraordinary social and financial weight for the society. According to the World Health Organization (WHO), stroke is characterized as a harm to mind work and the existence of central neurological side effects enduring over 24 hours because of vascular etiology [1].

Quality of life (QoL) after a stroke can be significantly improved by contemporary achievements in technological intelligence. The goal of the paper is to evaluate and systemize the opportunities provided by contemporary next generation technologies which could rapidly diagnose and ease the consequences of cerebral stroke. It is based on an overview and state-of-the-art analysis of modern intelligent innovations [21] and their opportunities for application to enhance the quality of life patients suffering from cerebral stroke.

II. Indispensable Need FOR NextGen HighTech Solutions to Improve the QoL in Cerebral Stroke Consequences

The development of technology is continually changing the restoration game. There is growing agreement on the significance of QoL of patients with cerebral stroke. Evaluating personal satisfaction is helpful for better understanding of patients' reaction to their sickness and the impact of remedial procedures just as is controlling the adequacy of therapeutic consideration. The information obtained from the assessment of QoL can be utilized to lead monetary examination and assignment of money related assets [23]. The improvement of innovation is continually changing the recovery pleasure [21]. From video talks with specialists to automated gloves and intelligent computer games, stroke recuperation and restoration apparatuses have made some astonishing evolution in the previous decade. This new stroke recuperation innovation is helping joint neuroplasticity and learning. All this has a key role in recovery from a stroke.

This new stroke innovation gives patients more reiterations, practice time and force in comparison with past development trainings. In addition, this new technology also is progressively intuitive, eye catching and truly spurs the patient. These innovations are helping saddle the cerebrum's capacity to fix itself in manners that have not been seen previously.

III. The Nature of the Next Generation Technologies

Next generation technologies are cutting-edge technologies that bring new innovative solutions in each aspect of our lives especially healthcare which will be reviewed in this report. Examples of such technologies are Artificial Intelligence, Machine Learning, Blockchain, Smart Cities, Internet of Things, Cloud Technology, etc. All of these technologies are here to improve our lives. They are supposed to extend traditional solutions by improving the life quality of patients with cerebral stroke.

IV. Potential of AI and ML in Cerebral stroke Diagnostics

Artificial intelligence (AI) or Computerized reasoning, a bionic framework expecting to copy human knowledge, is acquiring increasing awareness and is being consolidated into numerous fields, including medical treatment. Stroke treatment is one such sector of use of AI, for improving the exactness of determination and the nature of patient consideration [5].

For stroke supervision and manipulation, sufficient investigation of stroke imaging is vital [19]. As of late, AI strategies have been applied to interpret the information from stroke imaging and have shown some encouraging outcomes. Sooner rather than later, such AI systems may play a crucial role in deciding on helpful techniques and anticipating the visualization for stroke patients in an individualized way. In this segment we offer a glance at the utilization of AI in stroke imaging, explicitly concentrating on its specialized standards, clinical application, and future points of view [19].

A. Machine and Deep Learning

Machine learning (ML) is a method of AI that is generally utilized in deciphering restorative pictures. It

978-1-7281-3621-9/19/$31.00 ©2019 IEEE

perceives examples of imaging data and renders therapeutic judgments [3]. Administered and unsupervised learning are broadly utilized ordinary ML types. Deep learning is a more newly established method, which copies the human mind, utilizing numerous layers of artificial neuronal network [24]. In Figure 1 a schematic workflow of supervised machine learning is presented.

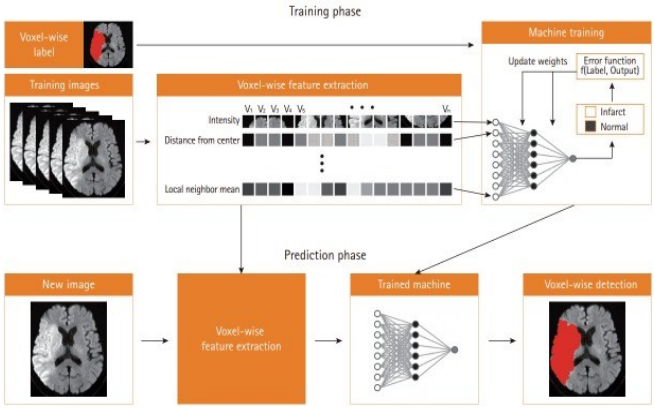

Fig.1 Schematic workflow of supervised machine learning [4]

At the point when an individual has a stroke, various sclerosis or cerebrum damage, the vast majority of the neurons that assist flag muscles to move are broken. This prevents the cerebrum from having the capacity to send signs to certain muscle bunches guiding them to move. A stroke can wreck a huge number of cerebrum cells that are expected to allow us to tie our shoes, pick up a parcel or venture into the wardrobe. To increase lost capacity, recovery is utilized to concentrate on showing patients how to make up for their physical deficiencies [12].

B. Cone beam imaging (CBI)

The new CBI technology takes into account the precise discovery of discharge, impediment site, ischemic center, and danger tissue [6]. A year ago, another stroke imaging innovation called cone bar imaging was discovered [6]. It takes into consideration the precise discovery of discharge, impediment site, ischemic center, and in-danger tissue. This innovation could diminish interruptions in patient consideration by as long as 60 minutes.

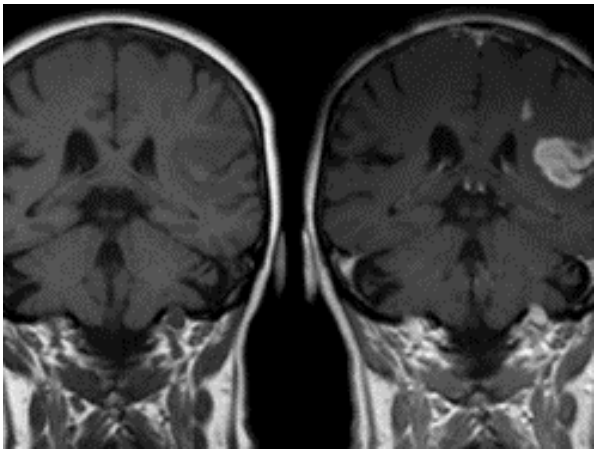

Fig.2 Cone beam imaging [5]

C. Cerebrotech stroke detecting visor (CSDV)

The CSDV device can distinguish emergent substantial vessel impediment in presumed stroke patients with a precision of 92% [6], [7]. The device has been intended to distinguish stroke within seconds and to identify the blockages.

Fig.3 Cerebrotech stroke detecting visor [7]

V. Implementation of New Technologies in Cerebral stroke Treatment and Rehabilitation

By engaging and stimulating the brain, the new technologies help it to heal itself in new extraordinary ways.

A. Vivistim nerve stimulation treatment (VNST)

This VNST device is aiming to shorten the recuperation time of engine abilities for stroke patients through vagus nerve incitement. This incitement prompts the fortifying of the neural routes in the mind related to engine capacity, learning and memory [8]. Every time the vagus nerve is invigorated, it sends a flag up to the cerebrum, which triggers the arrival of synapses extensively over the mind including the engine cortex, in this manner empowering neuroplasticity to expand engine work.

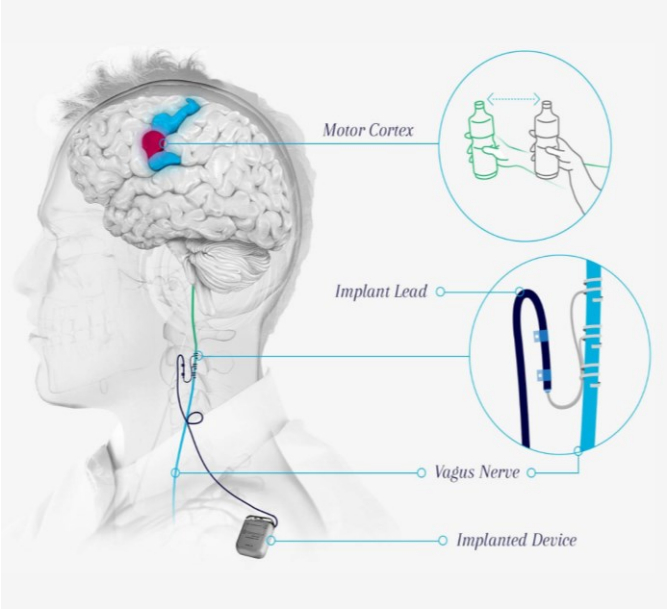

Fig.4 Vivistim nerve stimulation treatment [8]

B. Cerenovus aneurysm device (CAD)

The CAD device has been intended to divert blood stream from an aneurysm, which consequently diminishes the danger of burst and a potential haemorrhagic stroke. The device is currently among Cerenovus wide array of devices utilized in these stroke treatments [9].

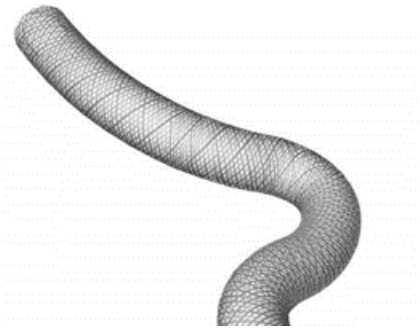

Fig.5 Cerenovus aneurysm device [9]

The new technologies bring more practice to the patient as compared to the traditional movement trainings [20]. It is more interactive by grabbing the attention and increasing the motivation of the patient.

Fig.6 New technologies engaging and stimulating brain [6]

C. Video games assistance

This is one of the most innovative and exciting ways of stroke rehabilitation. In contrast to the traditional stroke therapy which is repetitive and boring, video games engage the patients by grabbing their attention and evoking emotions, making it easy to incorporate and continue training at home. The videos will help the patients by stimulating the muscle movement, the brain and the body simultaneously. For example, games which enable the patient ty to control an animated animal movement.

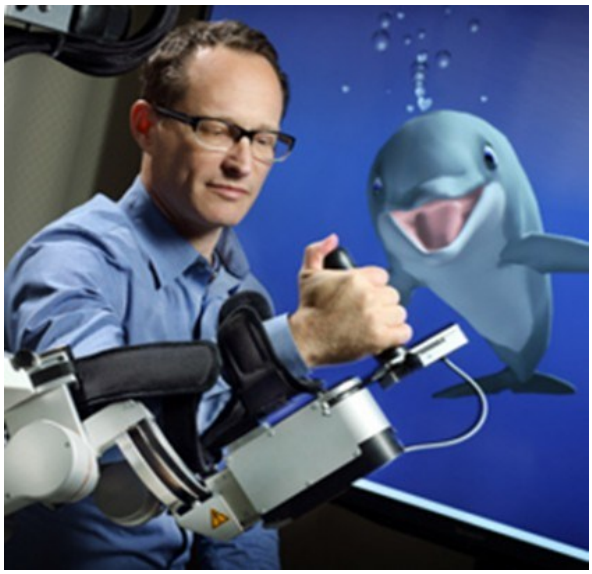

Fig.7 Video games assistance [6]

D. Bio-robotics support

Among the news tools are robotics which is the most commercial one but is also helpful. They attach legitimately to the influenced piece of the body to encourage or empower development, for example, leg and arm [10] support that recovers the impulse from the brain to the muscle. They are useful because they are adjustable.

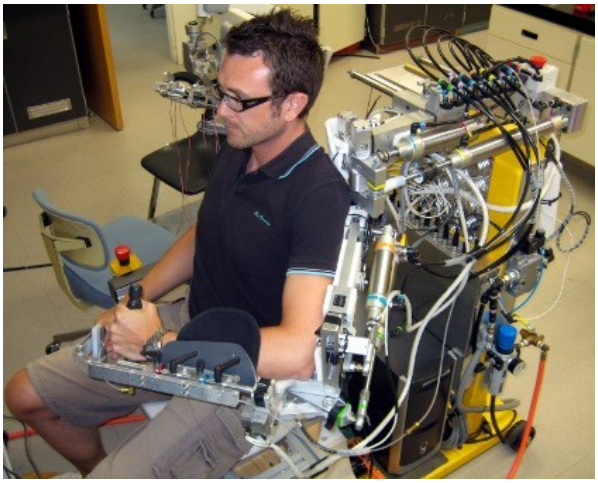

Fig.8 Bio-robotics support [10]

E. Innovative Stroke Recovery Devices

Fig.9 Robotic Hands Orthoses [11],[12]

Nowadays, studies demonstrate that neural elasticity (the capacity of the mind to fix itself) can be applied successfully for improved results and upgraded practical capacities. To do this effectively, the focal sensory system must look for supplementary neural network paths and discover new associations that sidestep the harmed regions. With a slight assistance from useful electrical incitement, which is low vitality electrical heartbeats, the procedure to locate the new associations is somewhat simpler [12], [22].

For better hand work, the orthosis fits the lower arm and wrist, and interconnects remotely with the control unit. Inside the orthosis, cathodes convey gentle heartbeats to invigorate muscle constriction [12].

Smart Gloves stimulate, connect and control the fingers, thumb, wrist and forearm. They help the patient perform normal movement. They are digital gloves, which are considered to encourage plasticity and faster reactions.

F. *Video Conferencing with doctors*

As the speed of treatment is very important after cerebral stroke, each second of recovery is serious. By having video conferences patience could stay constantly connected with their doctors and achieve a legitimate analysis and treatment. All of this is possible thanks to internet and Voice Over IP technologies for Video calls.

Fig.10 Video Conferencing with doctors (Source: Froedtert) [9]

VI. Conclusion

Cerebral stroke is among the most common socially significant diseases. Tracking the quality of life in dynamics is crucial for both the patients themselves and their possible re-socialization, as well as reducing the engagement of relatives, social workers and society. This disease is a subject of neurology. Neurologists and pharmacists are closest to the patients in such diseases. In the present study, we have tried to analyze the high-tech capabilities of AI, both for timely diagnosis and follow-up of patients' quality of life and their rehabilitation. Fast and full recovery with improved quality of life are particularly important in the demographic collapse in our region and the opportunity of returning part of the sick people to the labor market.

New technologies are an expensive solution. However, they should be implemented in the health care system of every country. The importance of life quality and treatment of such patients should be number one priority during therapy. New technologies make it possible to provide better conditions for post-recovery and further improvement. They also help the patient adjust to the new way of life.

Acknowledgments

The first author expresses her deep gratitude to her students T. Kirilova, E. Hashim, P. Keremidchieva, K. Raykov and P. Batolski from the E-Management Master Degree Program at ELFE, TU-Sofia for the AI application overview. The publication fee was paid within the framework of R&D Project in support of PhD student (session 2019), contract № 192ПД0023-15.

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