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DIAGNOSIS AND TREATMENT OF NEUROLOGICAL DISORDERS IN CHILDREN AND ADOLESCENTS USING ADVANCED IT TECHNOLOGIES AND ARTIFICIAL INTELLIGENCE

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Abstract

The current study addresses the application of the latest information technologies and AI in assisting doctors in detecting and treating different cases of neurological disorders in children and teens efficiently and in time. It should be noted that different diseases must be revealed in time because they occur in children who face developmental issues, memory problems, motor problems, speech problems, and problems with attention. However, the latest technology has ensured that there are different computerized programs capable of checking magnetic resonance imaging and electroencephalogram data, besides monitoring the child wearing special sensors, alerting healthcare providers about any unusual events in real time. Apart from that, there are robotic assistive devices for rehab, VR technology tools, and telemedicine technology being increasingly used to ensure that the process of therapy becomes more convenient even for patients staying in remote locations with no access to large hospitals and healthcare centers whatsoever. The final section highlights the importance of AI technology development in pediatric neurology in the coming years.

Keywords: Information technologies, artificial intelligence, diagnostics, treatment, neurology, children, adolescents, machine learning, MRI analysis, EEG analysis, computer vision, epilepsy, cerebral palsy, developmental delay, big data, robotic rehabilitation, virtual reality, telemedicine, monitoring sensors, mobile medical apps, remote observation, individualized therapy, digital medicine, smart technologies, data security, modern solutions in healthcare.

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Introduction

The matter of the occurrence of nervous disorders in children and adolescents has been one of the most relevant in modern healthcare. These diseases are connected with the functioning of the nervous system and related processes in the human body, such as the functioning of the brain, speech, memory, motion, and so on, while significantly limiting one's prospects in life. There was an increase in cases related to diseases of the nervous system in recent years, namely cases related to epilepsy, cerebral palsy, delayed physical and mental development, and so on.

The quality of pediatric healthcare can be improved by modern information technology tools and artificial intelligence. Today, there are technologies in the healthcare sector that can analyze magnetic resonance imaging and electroencephalogram results, monitor the condition of the child with the help of sensors, and help the doctor spot any abnormalities in the child instantly. The significance of the study is relevant in terms of the application of these technologies in order to ease the process of detecting neurological disorders in children and to improve the efficiency of therapy. The significance of the practical task lies in the fact that it makes it possible to understand to what extent technological innovations currently help children with neurological disorders and can further improve the efficiency of healthcare in the future. The significance of the study is relevant in terms of the application of these technologies in order to ease the process of detecting neurological disorders in children and to improve the efficiency of therapy.

1. Contemporary Diagnostics of Pediatric and Adolescent Neurological Diseases with the Application of IT Technology and AI

At the moment, the field of pediatric neurology is experiencing a phase of deep technological change in terms of diagnostic methods. The application of highly informative technology solutions instead of purely clinical methods has increased the speed and accuracy of diagnostics in pathologies of the central and peripheral nervous systems.

The healthcare industry has been digitally enhanced, thereby increasing the capabilities of neurologists in terms of data interpretation from instrumental methods of diagnostics. For instance, the capability to objectively evaluate

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neuroimages and avoid subjective errors in diagnostic decisions has been made possible by smart algorithms in image processing.

The key areas in digital diagnostics are:

1.1 Computerized Neuroim

The application of machine learning in the evaluation of MRI and CT imaging makes it possible to detect epileptogenic foci, neoplasms, congenital brain malformations, and hypoxic-ischemic injuries earlier.

1.2 Intelligent Systems for Electroencephalography

The automatic detection of epileptiform activity allows for higher accuracy in diagnosing epilepsies and significantly alleviates the workload on neurophysiological experts.

1.3 IT Technologies for Neurological Status Monitoring.

Mobile apps, sensors, and telemetric equipment allow patient data to be gathered in natural settings, thus ensuring high quality in anamnesis data collection processes.

1.4

Genetic Diagnostics Enhanced by AI Algorithms

Rapid DNA sequencing and the automation of variant interpretation help in the early detection of inherited neuromuscular disorders.

1.5 Telemedicine in Pediatric Neurology

Teleconsults and telediagnostics enhance the accessibility of specialist healthcare to remote communities, especially pediatric patients who may not be very mobile.

The inclusion of artificial intelligence in the diagnostic process ensures:

• reduction of diagnostic errors
• analysis of large amounts of data in the healthcare field
• Personalization of monitoring and treatment approaches
• enhanced accessibility to high technology healthcare services

The alignment of AI algorithms with clinical protocols must be standardized, properly regulated, and strictly safeguarded to respect children's privacy with regards to their personal healthcare information. This shall be explored in-depth in the coming sections.

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2. The Application of Advanced Information Technologies and Artificial Intelligence in the Treatment and Rehabilitation of Children and Adolescents Suffering from Neurological Disorders

Treatment and rehabilitation in pediatric neurology involve careful attention to individual features of the growing body. The latest information and communication technologies and artificial intelligence technologies are creating new methods that improve therapy efficacy, safety, and accessibility.

Contemporary technologies allow for constant monitoring of the disease process, individualized programs of therapy, and inclusion of rehabilitation activities in the child's daily life. These processes involve big data analysis, automatic detection of significant patterns in the data, and predicting therapy outcome results.

The key areas of AI and IT system implementation in therapy are:

2.1 Personalized Therapeutic

Machine learning algorithms are employed to identify the best pharmacological therapy, predict treatment efficacy, and minimize the occurrence of adverse reactions for patients with epilepsy, cerebral palsy, and neurodegenerative diseases.

2.2 Rehabilitation Systems with Virtual and Augmented Reality

VR/AR technology supports the rehabilitation of motor and cognitive functions via motivational gaming mechanisms. These programs offer varying levels of difficulty to suit the capability of the patient.

2.3 Neuro-R

The application of robotic rehabilitation tools promotes neuroplasticity and accelerates the restoration of walking functions and balance in patients who suffer from stroke or injuries in the central nervous system.

2.4 Tele-Rehabilitation and Monitoring

Information technology platforms facilitate rehabilitation therapy under remote supervision by experts. This is especially useful to families in rural areas who may not easily access very specialized healthcare programs.

2.5 Biofeedback Based on Digital Recording of Physiological Parameters

AI-based analyses of motor functions, muscle tension, and EEG values facilitate real-time optimization of therapy schemes.

The results of the use of intelligent technologies show essential advantages over conventional methods:

• shortened rehabilitation period

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• enhanced treatment compliance
• comprehensive functional status evaluation
• Improved quality of life for patients and their families

The implementation of digital therapy must occur in an integrated approach involving neurologists, rehabilitation experts, neuropsychologists, software developers, and practitioners of ethics in healthcare.

It becomes clear that the combination of medical knowledge and AI technology represents a new level of quality in healthcare, especially in the vulnerable group of children and adolescents.

3. Telemedicine and Remote Technologies in Pediatric Neurology

The study not only involves clinical aspects related to the treatment process but, through the application of digital technology, has explored organizational opportunities as well. Telemedicine is one of the most prominent areas of progress in pediatric neurology and provides patients with access to high-quality healthcare regardless of where they live.

The provision of telemedicine services is especially relevant to families who are geographically far from major healthcare centers. Under such circumstances, children are left with delayed diagnoses and required therapy, resulting in the worsening of illness prognosis.

The essential telemedicine functions include:

3.1 Telecommunications Specialist Consult

The neurologist can evaluate the patient condition remotely through video communication, access diagnostic information in electronic form, modify the therapy plan, and write prescriptions for further examinations.

3.2 Remote Monitoring of Health Status

The data gathered by wearable devices and mobile apps involves motor functions, seizure events, sleep patterns, and cognitive functions. The data is automatically sent to a clinic where it is processed by algorithms in AI technology.

3.3 Support for Parents and Training in Care Skills

Telemedicine provides education to the family on prevention of complications, correct organization of daily activities, and conducting rehabilitation exercises at home.

3.4 Reduced Load on Medical Facilities

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The remote format reduces the need to visit hospitals frequently, thereby saving time for doctors and decreasing patient queues.

3.5 Monitoring Treatment Compliance

Patient programs can provide reminders to take medication, record changes in condition, and prompt automatic notifications to physicians about possible deteriorations in condition.

Telemedicine provides an integrated model of healthcare for children with epilepsy, cerebral palsy, autism, post-trauma injuries, and other neurological disorders to facilitate interaction between the patient and the doctor to improve the efficacy of the healthcare process and minimize complications associated with healthcare provision.

Nevertheless, the implementation of remote technologies must take into account the juridical issues, coordinate data protection protocols, and provide access to cyberspace across different parts of the globe.

4. Limitations, Risks, and Ethical Issues in Implementing IT Technologies and Artificial Intelligence

Exploring the potential of digital medicine reveals that its advancement often comes with specific challenges, especially in pediatric neurology, where decisions can significantly impact a child's health and future. Therefore, it is crucial to identify the primary risks and limitations associated with modern technologies.

4.1 Unequal Access to High-Tech Healthcare

Despite the rapid growth of IT-based medicine, some areas still lack reliable internet access, modern equipment, or qualified professionals. As a result, children receive differing levels of medical care, contributing to an ongoing digital divide.

4.2 Confidentiality and Protection of Medical Data

A major concern is the security of information. Children's medical records, including MRI scans, EEG data, and genetic information, need to be thoroughly protected. System failures or cyberattacks could lead to data breaches, which are unacceptable in the healthcare sector.

4.3 Liability for Artificial Intelligence Errors

While AI supports healthcare professionals, it does not replace them. When an algorithm misinterprets data, questions about accountability arise. It's unclear whether the responsibility falls on the software developer, the medical institution, or the physician, as legal frameworks are still being developed.

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4.4 Insufficient Competence of Medical Specialists

Not all doctors feel comfortable using digital systems. To enhance the quality of care, the following steps are necessary:

- Training specialists to work with AI
- Ongoing professional development
- Integrating digital skills into medical education

4.5 Ethical Challenges of Technology Use in Children

In pediatrics, decisions are typically made by parents and physicians, and children may not always be able to provide informed consent. This leads to important questions:

- Should parents have complete access to their child's digital medical data?
- How should the opinions of adolescent patients be considered?
- How can we prevent technology from negatively impacting a child's mental well-being?

In conclusion, while digital technologies offer significant advantages for children, their implementation must be guided by a robust legal and ethical framework. Only then can the integration of AI be both safe and beneficial for patients.

5. Future Developments in Digital Technologies for Pediatric Neurology

An examination of current scientific trends shows that digital medicine in pediatric neurology is set to progress swiftly, resulting in notable enhancements in healthcare organization and treatment quality in the near future. Children with neurological disorders will benefit from quicker and more precise care, regardless of their location or the severity of their condition.

5.1 Intelligent Clinical Decision Support Systems

Advancements in artificial intelligence algorithms will allow doctors to:

- Identify diseases at their earliest stages
- Anticipate disease progression
- Choose the best treatments based on extensive data

AI is anticipated to serve as a personal digital assistant for every neurologist.

5.2 Complete Personalization of Treatment

Modern technologies are moving away from one-size-fits-all treatment approaches. In the future, medical decisions will take into account:

- Individual brain characteristics

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- Genetic data
- Behavioral patterns and developmental changes

Such personalized methods are expected to improve both safety and treatment effectiveness.

5.3 Increased Opportunities for Home-Based Rehabilitation

Rehabilitation systems will become more accessible, featuring:

- VR-based gaming applications for motor recovery
- Smart training devices that adjust to a child's progress
- Remote monitoring by specialists

This will lessen financial burdens for families and help maintain the child's emotional well-being.

5.4 Next-Generation Neurointerfaces

Emerging technologies will have the potential to:

- Restore motor skills
- Enhance cognitive functions
- Assist children who have lost the ability to speak or move

These neurotechnologies are expected to be groundbreaking for patients with severe neurological disabilities.

5.5 Integration of Telemedicine into a Unified Healthcare System

The ongoing improvement of digital infrastructure will lead to:

- Better management of chronic conditions
- Shorter waiting times and fewer hospitalizations
- Equal access to high-quality care across all regions

In summary, the future of IT development in pediatric neurology points toward a more precise, accessible, and patient-centered healthcare system. The adoption of these innovations will offer thousands of children the chance for a better and fuller quality of life.

Conclusion

After examining modern IT technologies and the role of artificial intelligence in pediatric neurology, I have come to the conclusion that digital medicine is increasingly becoming essential for the effective prevention, diagnosis, and treatment of neurological disorders in children and adolescents. These technologies enhance the precision of examinations, enable early detection of conditions, and

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facilitate personalized treatment plans for each child. Advanced analysis of MRI and EEG data, along with the use of wearable sensors, robotic rehabilitation systems, and virtual reality, opens up new avenues for helping children with significant disabilities regain their functions. Telemedicine minimizes the need for frequent trips to healthcare facilities, allows doctors to monitor treatment remotely, and ensures that qualified care is accessible in all areas. However, my research also highlighted some challenges associated with the adoption of digital technologies. Key concerns include safeguarding personal data, determining legal accountability for AI mistakes, and ensuring equitable access to advanced medical services for all patients. Tackling these challenges will require government support, development of infrastructure, and training for healthcare professionals. By merging medical knowledge with the analytical power of artificial intelligence, we can make treatments for children more effective and user-friendly. Continued progress in digital technologies will offer children with neurological disorders better opportunities for a fulfilling and
successful life.

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