Autism Analysis and Detection using Neural Network Schema-A Review

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Abstract:

Autism spectrum disorder is a construct used to describe people with a specific combination of social communication deficits and repetitive behaviours, severely restricted interests, and/or sensory behaviours beginning early in life. The global prevalence of autism is just under 1%, but estimates in high-income countries are higher. Although gross brain pathology is not characteristic of autism, subtle anatomical and functional differences have been observed in autopsy, neuroimaging, and electrophysiological studies. Originally it was expected that accurate measurement of behavioural phenotypes would lead to specific genetic subtypes, but the genetic findings have mainly been applied to heterogeneous groups that are not specific to autism. Psychosocial interventions in children can improve specific behaviours such as joint attention, language, and social engagement, which may impact later development and reduce symptom severity. However, more research is needed to identify the long-term needs of people with autism and the treatments and mechanisms behind them that could lead to better independence and quality of life over time. Families are often the primary source of support for people with autism for much of life and must be considered, along with the perspectives of autistic people, in both research and practice.

1. Introduction

The problem of Autism Spectrum Disorder (ASD) is currently increasing rapidly in all age groups of the human population .Early detection of this neurological disorder can be of great help in maintaining the patient's physical and mental health. With the increase in the application of machine learning-based models in predicting various autism spectrum disorders, a complex developmental disorder is presented that is the result of a neurological disorder that interferes with the normal functioning of the brain. Sharing many of the same characteristics, ASD affects a person's ability to communicate, understand language, play, and relate to others. The term autism spectrum disorder is used because the symptoms can come in any combination and can range from very mild to fairly severe.

Human diseases now seem possible to be detected early on the basis of various physiological and health parameters. This factor motivated us to increase interest in the detection and analysis of ASD disorders in order to improve treatment methodology. Screening for ASD becomes challenging because there are several other mental disorders whose few symptoms are very similar to those of ASD symptoms, making this task difficult. Autism Spectrum Disorder is a problem related to human brain development. A person suffering from an autism spectrum

disorder is generally unable to interact socially and communicate with other people [1] or [3].A person's life is usually affected throughout his life.

It is interesting to know that both environmental and genetic factors can turn out to be causative factors of this disease. Symptoms of this problem can begin as young as three years old and last for life. It is not possible to complete the treatment of the patient suffering from this disease, however its effects can be temporarily reduced if the symptoms are recognized early.Assuming human genes are responsible, the scientist has not yet identified the exact causes of ASD. Human genes influence development by influencing the environment. Is there a risk factor that affects ASD, such as B. low birth weight, a sibling with ASD, and older parents?

Autism Spectrum Disorder is a neurodevelopmental disorder. These disorders are causes of hyperactivity, deficits in social communication, and learning and language deficits. Asperger's Syndrome can also be caused by inherited (genetic) chemicals, including those found in food. With a ratio of 1:68, the number of children with ASD is steadily increasing. ASD can be detected through a diagnosis, which can take 2-3 days depending on the severity of the ASD. Various groups of doctors observe the behaviour of a child in order to make a diagnosis. ASD can be manually detected at age 3 years or older. And you can see that from a young age. Machine learning can detect ASD faster. When older data is used to predict autism, machine learning takes less time.

Early detection and treatment are the most important steps to reducing the symptoms of Autism Spectrum Disorder and improving the quality of life of people with ASD. However, there is no medical screening procedure for autism screening. ASD symptoms are generally recognized through observation. In the older adults and adolescents who attend school, symptoms of ASD are usually identified by their parents and teachers. ASD symptoms are then evaluated by a special education team at School .This school team suggested that these children see their doctor for the necessary testing. In adults, identifying ASD symptoms is much more difficult than in older children and adolescents because some ASD symptoms can overlap with other mental health disorders. It is easier to detect behavioural changes in a child through observation, since they can be seen as early as 6 months of age, than autism-specific brain imaging, since brain imaging can be identified at 2 years.

2. Literature Survey

Autism Spectrum Disorders include autism and related disorders. There are five main diagnostic   terms that fall under this heading: Autism, Asperger's Syndrome, PDD-NOS, Rett Syndrome, and Childhood Disintegrative Disorder. While they all share common traits, there are slight differences between them. Autism is the longest recognized term. To receive a diagnosis of autism, the person must demonstrate impairment in each of the three core characteristics described above. These include social deficits, communication difficulties, and repetitive or restricted behaviours.

Asperger's Syndrome is a shape of ASD. The character with Asperger's Syndrome presentations extreme issues with social functioning and famous about repetitive pastimes or behaviours. An analysis of Asperger's Syndrome generally approach the character has sturdy

language capabilities acquainted with the social factors of verbal exchange, including g. talking or knowledge pictures.

Pervasive Developmental Disorder Not Other Specific (PDD-NOS) is described through deficits in social interplay with marked demanding situations in verbal exchange or the presence of restrictive and repetitive behaviours. The capabilities are just like the ones of autism, however the might not be as severe, ensuing within side the character now no longer assembly all the standards for autism. Rett syndrome and child disintegrative ailment are very rare. Severe types of ASD have one of a kind preliminary styles and, with inside the case of Rett syndrome, a particular genetic basis.

Every person is different. However, there are primary traits associated with ASDs. The main characteristics are 1) poorly developed social skills, 2) difficulty of expressive and receptive communication, and 3) presence of restrictive and repetitive behaviours.

Young children with poorly developed social skills may have inadequate play skills. You may not be able to use items, including toys and games, in a functional or age-appropriate manner, or your ability to do so may be delayed. Adolescents and young adults may not understand social rules such as B. knowing which jokes to tell a peer and which to tell an adult. The person with autism often has difficulty interacting with people, including doing and maintains relationships with each other. The person with ASD may seem to want to be alone. Some people with ASD can develop typical language, while others have difficulty with expressive and/or receptive communication. For example, a person with ASD may use single words or short phrases to communicate; another may be nonverbal.

The language, if any, may have a restricted function or content. For example, the person may only use words to request a desired item instead of speaking in sentences. Also, the speech may sound different, and the person may speak loudly or with a robotic quality. A person with ASD may exhibit unusual behaviour or stereotypical body movements. This could be represented by hand movements, jumping or lining up blocks, or spinning the wheels of a car instead of playing with the object as intended.

The person may also have difficulty transitioning from one activity to another or worry about changes in the environment. Individuals with ASD may also demonstrate secondary characteristics. These are characteristics that are common to ASD but do not need to be present for the person to have a diagnosis of ASD. Remember that no two individuals with an ASD are the same! Each person has a mixture of characteristics. Each has a distinct personality, strengths, and interests that make him or her unique! A few of the secondary characteristics are as follows.An unusual response to sensory stimuli.

A person with ASD might be overly or under sensitive to sounds, touch, smells, tastes, or sights.Uneven skill development or "splinter skills." An individual may develop some skills normally or have advanced skills for his or her age; while other skills may be delayed.Difficulties with changes in surroundings. Many individuals with ASD like to have things in the same place and become upset when their environments change.Strength with visual processing. A person with ASD may find it easier to process information presented in a visual format, thus compensating for deficits in auditory processing.

3. Dataset

The dataset for research purposes was collected from the UCI repository, which are publicly available [12] or [15] or [16]. Three main types of data sets were used in this study. Below is the detailed summary of the data set.

Sl. No.	Dataset Name	Sources	Attribute Type	Number of Attributes
1	ASD Screening Data for Adult	UCI Machine Learning Repository [12]	Categorical, continuous and binary	21
2	ASD Screening Data for Children	UCI Machine Learning Repository [15]	Categorical, continuous and binary	21
3	ASD Screening Data for Adolescent	UCI Machine Learning Repository [16]	Categorical, continuous and binary	21

Table 1: List of ASD datasets

Attribute Id	Attributes Description
1	Patient age
2	Nationality
3	The patient suffered from Jaundice problem by birth
4	Any family member suffered from pervasive development disorders
5	Who is fulfilment the experiment
6	The country in which the user lives
7	Screening Application used by the user before or not?
8	Screening test type

Table 2: List of Attributes in the dataset

Autism spectrum disorders include autism and related disorders. They are usually detected during early childhood and are lifelong developmental disabilities. They are characterized by impairments in social interaction, deficits in verbal and nonverbal communication, restricted, repetitive behaviours and unusual responses to sensory stimuli. It should be remembered that individuals with ASD vary widely in their abilities, interests and strengths.

3.1 Alzheimer disease

Dementia is defined as the deterioration acquired in cognitive abilities that interferes with the satisfactory performance of activities of daily living . Alzheimer's Disease (AD) is a type of progressive dementia that has memory deficit as one of its earliest and most pronounced symptoms [4].

As a general rule the patient progressively deteriorates, exhibiting perceptual, language, and emotional problems as the disease progresses. This deterioration is due to the fact that the nerve cells, or neurons, that allow cognitive function in the brain have been damaged and no longer function normally. In addition, Alzheimer's disease usually occurs in combination with other types of dementia, which is called mixed dementia.

AD has become a major social problem for millions of families and national health systems

2.2 Energy Aware Routing Environment in Wireless Sensor Networks:
Both conceptual ingredients of these networks are interrelated and necessary for secure, safe, efficient, successful and effective connectivity between the communicating nodes of close or far-reaching networks. Both these logical elements are weighed, finished and used at the node. In addition, the wireless sensor network incorporates wireless connectivity, sensor and networking systems synergistically.

In addition, node energy in the WSN domain is another constraint. The cause of the overwhelming problem is the unattended deployment of WS nodes with the general battery activity. Battery refill is almost unlikely since the nodes of most systems are unavailable and remotely deployed. As the node energy is the key factor involved in the execution of any task relevant to this problem, any solution proposed in any part of the WSN domain takes this very factor in mind. Sensing, computing, receiving and distributing are all tasks done in / by the WS node. Transmission on the MAC layer only requires protected media access, while transmission is the roundabout of routing and is the heart of the network layer on the network layer.

3. Routing Protocols

The following section deals with the various routing protocols, its mechanism, merits and demerits.

3.1 Simple Energy Efficient Routing Protocol (SEER):
This protocol uses hop-count, the residual energy of SNs and the interval between SN and BS to achieve energy efficiency [20]. The source node is used to start a base routing algorithm and to achieve energy savings across a uniform network. The authors note that if the sensors are spread equally and the BS is located in the middle of the network, a reasonable degree of energy efficiency can be obtained. This reveals that the protocol is not appropriate for WSNs arbitrarily used.

3.2 Energy Efficient Dynamic Source Routing (E2DSR):
E2DSR is based on a Dynamic Source Routing protocol which uses the current control packet structure [21]. The Dynamic Source Routing protocol is based on E2DSR. In addition, the protocol alters sensor node routing habits, generates a new 'energy table' and creates a new algorithm for caching paths and selection. E2DSR uses a basic discovery method on demand using tiny routing tables to calculate a path priority. However, the protocol can manage resource consumption between various nodes in the network, but it also requires overheads for storage and connectivity.

3.3 Energy-efficient Asynchronous low Duty-Cycle Routing (E-ADCR):
It is paired with an asynchronous, blind and opportunistic MAC protocol running at a low-duty period and E-ADCR is an

important flood-based routing protocol. While the E-ADCR protocol allows the shortest possible use of simplicity and usefulness, it is not ideal for mission-critical applications in WSNs. In comparison, the flood-based process absorbs a large amount of node power and thus contributes to fast network partitions.

3.4 Improved Ad-hoc On-Demand Distance Vector (IAODV): The IAODV protocol has been proposed to reduce the number of RREQ packets based on an existing location-aided routing (LAR) protocol [23]. Through applying the LAR control routing lookup technique, the protocol restricts the search field. The algorithm also uses a path selection function to maximize energy consumption and extend the length of the network. The benefits of the single-way protocols are their flexibility, scalability, structure-related reliability, capacity efficiency and their sensitivity to large networks. However, due to the flood-based path discovery process it causes delays and requires a large amount of energy to transfer data packets. Therefore, one-way routing on a basis is less energy efficient than location-based routing protocols and hierarchical protocols.

3.5 Linked Cluster Algorithm (LCA): LCA is an early wireless network routing algorithm [24, 25]. This process of clustering is split in five steps. The first stage is topology sensing, with each node using a probe message to discover its neighbours. A sample message is the message broadcast from each node. It is a defect tolerant and offers optimum network access and mobility for nodes that benefit from the LCA protocol. The protocol is not energy efficient, however, and low energy nodes can be chosen as CHs.

3.6 Threshold sensitive Energy Efficient Sensor Network protocol (TEEN): TEEN is the first protocol developed for temperature sensing applications for reactive networks [26]. There are two more limits. Next, the node sensing this value needs to turn the transmitter on and record the absolute value of the sensed attribute above a hard threshold (ht). Second, when the sensed attribute value is greater than the soft threshold (ST), the node turns on and records the sensed data. The key limitations of this arrangement are: I it cannot be implemented in real time and (ii) realistic execution need to ensure that no cluster collisions occur. This dilemma can be avoided by using the TDMA schedules, but the reporting of vital data would be delayed [27].

3.7 Low Energy Adaptive Clustering Hierarchy (LEACH): Low Energy Adaptive Clustering Hierarchy (LEACH) is a clustering protocol that constructs clusters based on signal intensity and utilizes cluster heads to communicate with stations in the base[28]. LEACH is a complementary clustering mechanism. LEACH's key constraint is the probabilistic option of cluster head. Therefore, the option of a low-energy node as a CH is more possible. The entire cluster becoming inefficient until this node runs out of control.

3.8 Power-Efficient Gathering in Sensor Information Systems (PEGASIS): PEGASIS is an energy dissipation chain protocol that expands the network's existence by allowing nodes that only connect with nearer neighbours [29]. Each node is presumed to know all other nodes' location information.

3.9 Hybrid Energy-efficient Distributed (HEED):
Algorithm:
HEED is an algorithm spread that takes energy and coordination costs into account when choosing CHs.
HEED is a balanced clustering system that is energy efficient. It also offers a stable and flexible environment. The protocol has one drawback: several iterations will lead to additional charges. In comparison, the HEED Protocol does not fix the fault-tolerance dilemma either.

3.10 Maximum Energy Cluster Head (MECH): As TEEN and PEGASIS do, it is proposed to boost the efficiency of LEACH's Maximum Energy Cluster Head (MECH) routing protocol [31] MECH builds clusters based on the number and propagation spectrum of clusters. In a given transmission range, MECH guarantees that there is not more than one cluster head. This protocol is limited mainly by allowing the initial CH selection process to choose a low energy node.

3.11 Power Efficient and Adaptive Clustering Hierarchy (PEACH): By utilizing the over heading functionality of wireless networking, the PEACH protocol forms cluster without any extra overhead [32]. With adaptive multi-level clustering and lowered overhead transmission costs, PEACH increases the network life and energy usage greatly. However, all network SNs are considered to be similarly appropriate by the protocol. PEACH cannot however be matched to heterogeneous WSNs.

3.12 Broadcasting: Radio casting is the serious rivalry of energy-aware routing; this is a crucial component of most of the routing features such as the formation of the clusters, the cluster head preference, the cluster head rotation and route setting. Given its central value, proposals are floated and strategies suggested for minimizing the broadcasting of messages [33] and for the sharing of light messages [34]. The research community appreciates a routing algorithm with minimal diffusion in the strict energy factor setting. The broadcast's straightforward solution is blind flooding [35] where each node is forced to retransmit the packet after the packet has first been sent. Blind floods produce several transmissions that are redundant. These redundant sending may create the problem of a broadcast storm [36], a problem in which the congestion and contention created by redundant packets.

3.13 Forwarding Node Selection: The node which makes it possible for a node to exchange its packet with other nodes in a network or the base station shall be called the forwarding node, which is called the forwarding node selection process. The required resources and special concentration resulting in increased energy consumption and, hence, a lower energy utilization of the routing protocol are provided for an accurate, precise forwarding node collection. In comparison, the competing selection parameters often need better trade off [38]. For e.g., time and distance to destination (BS) are competing factors in the sense of real-time application energy [39]. His literary rich article was submitted by Wu and Lou [37]. This article reflects on the joint effects of the node radio transmittal and propagation in the creation of protocols for narrow networks.

3.14 Route Discovery: The ultimate aim of a wireless network sensor routing protocol is to relay the sensed/generated data to the sink node from the source node. These transient nodes are best chosen to collect on a better path to the base station. The typical characteristics of a desirable and efficient path are less energy consumption, less end-to- end delays, less length of path (hop number or distance), less transient nodes, increased benefit for output assessment or the combination of these [40-42].

3.15 Reroute Discovery: Reroute Discovery is an expansion of the method of path searching. Death or node defect may cause the defined route to be breached which can result in network partitioning. Therefore, the new direction must be found. This path setting up process is called the exploration of the road, which was started by breaking the existing path. This method is essentially the same as that of path exploration, which was addressed with a variation in the original cause in the previous paragraph. In addition, choosing the forwarding node is an indistinguishable feature of route finding. If a node is death, it is a phase of redirect exploration that restores the disconnected path. In contrast to a static ad hoc network [43] this routine failure solution is more frequently required in the mobile ad hoc network (MANET) [44].

3.16 Network Clustering: Clustering is the unified feature of clustering nodes. The nodes can be independent if one node is known to be the head and other nodes are regarded as members. The category is

referred to as a grouping. The appointed head is referred to as the cluster head (CH) and other members are referred to as cluster members (CM). The node not yet included in either cluster is referred to as the undecided node. The clustered architectural network is supported by energy efficiency. A well located Cluster head, a gateway and a high energy supply, plays an important part in solving the target [45] in this sort of network. The distributed network architecture is known as the most energy-efficient because of its fast route exploration, data aggregate, defect tolerance and final latency. [46]. The other alternative is distributed, after knowledge transfers between neighbouring nodes, before the distributed cluster designing [47] has been chosen for CH with its members.

4. Conclusion

Since limited battery power is the main source of energy in WSNs, it is highly recommended that WSN protocols should function in an efficient way in order to extend the lifetime as much as possible. Energy is highly affected when both security mechanism and multi-path routing are combined together. Hence, designing lightweight and robust security protocols is a challenging task. Due to the complexity and variety of security solutions, it is not possible to design a single solution that can achieve all security goals. Rather, depending on the applications, security measures have to be carefully chosen to maintain a balance between the security level and minimal utilization of available resources routing protocols.

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