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Early Prediction of Cognitive Disorders among children using Bee Hive Optimization Approach. (CODEO)

M.S. MYTHILI and A.R.MOHAMED SHANAVAS

[1]Department of Computer Applications, Bishop Heber College, Tiruchirappalli - 620 017, India.
[2]Department of Computer Science, Jamal Mohamed College, Tiruchirappalli 620 020, India.

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ABSTRACT

The occurrence of autism and other cognitive disorders like dyslexia and delirium among children of various age groups is one of the principal demanding situations confronted through the health professionals these days. Defining cognitive disabilities need broader research factors, as people with cognitive disabilities are determined to have issue with numerous forms of intellectual tasks. Despite the fact that the reasons behind those problems are not exactly diagnosed by the researchers on this area, there may be usually a high precedence for the prediction of these disorders at an early age. Children and individuals identified with cognitive disorders are found to reveal in problems towards society and people. These difficulties regularly bring about their reduced ability to easily and effectively engage in social and communication interactions. Capability to recognize emotions is also decreased, as there is a loss of attention to the facial region. However, face processing abilities can be advanced through effective training. The research work incorporates out the essential goal of disease prediction among children and in presenting support to maximize the possibilities of gaining knowledge. A vital predictive mechanism desires elements such as recognition and comprehension of verbal and non-verbal cues like facial expressions or eye contact. The research demanding situations embody diverse approaches to classify and categorize cognitive disorders affected children based at the intensity of their learning skills and knowledge in understanding a subject. The need for the early identification of this disorders and right treatment is very important for the growth of these children as well to their family who endures with such disorders.

Key words: Cognitive, children, knowledge, prediction, CODEO.

INTRODUCTION

The paper discusses about a multiple cognitive disorder issues springing up out of children of their early length of boom. As medical record notices different types of cognitive disorder is happening among children along with autism, dyslexia and delirium being taken as a primary part of discussion. Autism may be a large set of disorders with uncoordinated and impartial signs and symptoms that are complicated to pick out as nicely assessments the intellectual disability which may be felt due to multiple reasons. Cognitive disorders were analysed based totally on clinical setups and experimental analysis which suggests greater than 60 gene mutations which have been implicated[12, 15], but they are linked to only about 20% of all the instances, which helps best single gene mutation and which are being correlated very weakly with autism.

Cognitive disorder disabilities specifically comprises of more than one variety of developmental disabilities inclusive of autism, Asperger syndrome and different pervasive developmental disorders. Any Individual children suffering from autism disease often conflict with massive problems over communication, social, and

behavioral challenges. Such children also reveal in problems in recognizing and comprehending non-verbal cues which includes facial expressions[3] Baron-Cohen, Golan, Ashwin 2009, Baron-Cohen 1997, Begeer et al. 2008, Kuusikko et al. 2009) and retaining eye contact. These difficulties frequently result in a reduced ability to easily and efficiently interact in social and communication interactions. Also, a lack of attention to the facial region may account for a decreased potential to recognize emotions (Grossman and Tager-Flusberg 2008, Kuusikko et al. 2009). However, Faja et al. (2008) had discussed that face processing abilities can be advanced though powerful training.

The study provides an evaluation of the factors towards knowledge the cognitive disorder problems and hidden aspects of design of a computational selection making methods to predict disorder issues among children with ASDs recognize, understand, and generalize feelings from facial expressions. Similarly children affected with different disorders such as delirium and dyslexia are determined to be lagging in figuring out key words for an extended knowledge, or identifying their own belongings, organizing time for improved efficiency, listening competencies, or following path guidelines and self-advocacy skills.

The paper work suggests on the subsequent goals:

a) To discover the factors lying behind learning issues among autism children
b) To enhance the cognitive disorders prediction rate
c) To perceive and propose an adaptive learning method for children affected with cognitive disorders at an early age.

The demanding situation proposes various approaches to categorize the disorders affected children based on their depth of affection and knowledge of understanding. The treated children can be also categorised based on their intensity of learning and help closer to adapting to changing situation[9]. The research work being carried out applies computational algorithms and classification models which fit on pinnacle of computational methods for steady and adaptive decisive making methods.

Survey and Analysis

Major current research shows[1] that the best outcomes for children with ASD are accomplished while health and educational professionals work collaboratively with care and knowledge along with computational primarily based prognosis technique along with a group method to offer excessive requirements of interventions. Children are predicted to work on dealing with interventions, to trouble shoot and recognize specific commands with version on frequent comments and exercise. For this reason the need for intelligent computational approach is felt.

Sharma *et al.,*[2] discusses on a look at comprising of 50 children affected with ASD as patients finished in an open society environment encompassing detailed description of morphological variants of disease manifestations and their correlation with cognitive disorders[11]. The age of child, individuals IQ, weight, probable time of first excessive-risk behaviour and eventual counts were observed. Whole medical history and physical examination of children as patients need to assist most excellent assessment and analysis of cognitive disorders. The diagnosis was based on medical standards in most of the cases.

Fuzzy Cognitive Map[4] provides an adaptive learning frame work which identifies ASD children based on their depth of studying and adaptive skills. Training models are advised and evaluated at each step to identify the learning capability of children. To apprehend the factors which affect the ASD, recurrent multi-variate analysis approach is being adopted.

Fuzzy Symbolic Dynamics modelling approach[3] is used for the visualization of disorder metrics in the semantic layerof the neural model of studying. Many proposed theories of autism were analyzed, assisting implicating genetics (genesbeing linked to ASD), perinatal and environmental factors, stress, infections,vaccines, influence of various chemicals, etc but such ASD theories has predictive strength, and cautioned that each one genetic correlations are not coercive in nature.

The complex behavioral disorder observed among cognitive disorders encompass on variety of attitude based symptoms which can be understood through social interaction disabilities, miscommunication, empathy as nicely accompanied via unusual restricted, repetitive behaviors deficits (Volkmar, 2005). As not much objective diagnostic tests for autism is identified, a general well known diagnosis is recommended which is based on behaviour[7], using the Diagnostic and Statistical guide of Mental Disorders[5], DSM-IV, TR as standard.

A list of disorder diagnostic criteria is analyzed where few criteria's are exhibited with pre-favoured conditions prior to evaluation. The analysis consists of metrics relating to behaviour among societal aspects and cognitive abnormalities.

Need for Computational Models

Soft computational models support in higher prediction and improved higher cognitive process. Computational models evolve from decision supported CODEO

The swarm supportive mining algorithms plays a significant role in prediction of cognitive disorder diseases and its connected applications[7] that pertains to knowledge extraction and consistent update of disease information. The paper adopts Bee Hive Cluster approach to get and predict cognitive disorder datasets that helps in parameters and metrics associated with cognitive behavioural aspects of a growing child and hence decision making.

The Bee Hive cluster approach works on cognitive heterogeneous data sets maintained as repositories or clusters of interconnected cells over a hive. Bee Hive performs higher compared over neural inter-connective network[8], Bayesian classification[9], and support vector machines or weighted decision tree. Neural network and support vector are often primarily applied to single flat relations and Bayesians depends on probability metrics.

The survey on bee hive and colony algorithms[13] had been dole out with specific suggestions on cluster based on bee's food foraging behaviours criteria and honey gathering analysis.Design and development of algorithms are supported the bee's foraging behaviour of bee colony and food source searching behaviour associated with bee's nest site searching and storing. Clustering approaches of data mining facilitate to accomplish fore-mentioned goals by extracting or detecting hidden metrics of child growth characteristics, cognitive metrics with reference to a child learning perspective and understanding attitudes or behaviour from massive databases. The most important metrics (Fig.1) of child growth cooperate together to enable predictive cognitive disorder prediction additionally to specific socio-demographic attributes.

Design of CODEO

The vectors of food sources population Xm's are initialized (X=1...FS , FS: food sources size) and its control parameters Rn(R=1...n , n: control metrics) are being set. Since each food source, Xm, employer bee B_o (P=1...z ,z:Bee population) are solution vector to the optimization problem, each Xm vector holds n variables, (Xmi, i=1.....n) , which are to be optimized so as to minimize the objective function O(y). The initialization equation can be defined as follows:

Xmi= li + {rand(0,1)*(ui–li)} .....(1), here li and ui are the lower and upper bound of the
Control parameter of food source, Xmi, respectively. Bee hive optimization problem can be defined as set of bees finding the parameter vector 'y' that minimizes an objective function, O(y), as below:

Minimize O(y), y=(y1, y2 , ... , yi,..., yn-1, yn) $\in$ Rn...(1) which is constrained by the following inequalities and/or equalities:

$$li \leq yi \leq ui, \text{ where } i=1,...,n \quad ...(2)$$

$$gi(y) \leq 0 , \text{ for } j=1,...,p \quad ...(3)$$

$$hj(y)=0 , \text{ for } j=p+1,..... p+n \quad ...(4)$$

O(y)is defined on a search space, S , which is defined under'n' dimensional rectangle in Rn(S $\hat{I}$Rn,B_o). The variable domains gi(y) and hj(y) are limited by their lower and upper bounds, the problem is also known as constrained optimization

problem. If it is an unconstrained optimization problem, then both p=0 and q=0.

Interesting measures had conjointly been known just in case study, wherever the socio economic aspects of child growth that are associated with environmental problems and demographic field outs are thought of responsible. The performance of system and prediction precision degrades when traditional data mining algorithm makes an attempt to search out patterns in large massive complicated datasets. In order to attain optimum performance, cognitive disorder type ought to be classified based on cognitive defects and its connected behavioural attributes which may extract relationship patterns among cognitive defective metrics defined as objects.

CODEO Algorithmic program predicts the factors poignant the cognitive disorder and therefore its disability. Multiple factors contribute to the disability and hence play a primary role in predicting the disorder at an early stage. Fig-2 shows the factors which contribute to the outcome of disorder, along with its corresponding values.

Algorithm Analysis

Detailed analysis on design factors CODEO supports various factors related to disorder prediction. Definition : I = Set of factors and values related to Disorder prediction

J = disorder and related parameters

(1). Input : Populate instance of x ÎI, y Î J

(2). Initialize : Set Iteration parameters
: H = Cells in BeeHive
: Randomize the disorder_dataset {I1,I2,...Ix }, candidate_dataset {J1,J2,..Jy }
: Select B, from bee set { scout bee[ ], Queen bee[ ],...}

(3). Evaluate the goodness of fit from bee population

(4). While .NOT. Terminate_Condition
fori=1; i<n;
Select neighbourhood_sites [i] = H(i)
i++

(5). Recruit Bees random (B) for best sites H(i), over cognitive disorder Ii and Candidate dataset Ji

(6). Evaluate fitness value fv

(7). Select the fitness bee B and assign the remaining bees for search
Step -(4).
End While

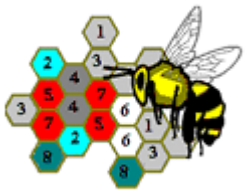
(8). Update Iteration parameters, Fitness Value, Bee Search Criteria

(9). If Fitness Value gft = “Terminate_Condition” then
Stop

The algorithmic rule CODEO works on the idea of employment of scout bees working over massive data set of autism disorder among children varying between 2 to 12 years of age. The scout bees are classified supported totally on different parameters of autism disorder disease. Any increase in range of scout bees cause a rise in autism disease metrics. The iteration is about for maximum set of autism parameters being clustered that is modified for every iteration. Any modification in metric ends up in modification in fitness value. The iteration is raised step wise over multiple sessions and several fitness values is updated, that is dependable upon varying disorder metrics and its relation to an individual.

RESULTS AND DISCUSSION

The overall performance of CODEC is analysed with other conventional methods along with genetic algorithm and Ant Colony Optimization algorithm. The experiment is taken over for multiple iterations where the prediction rate increases for any increase in time. As time proceeds, additional metrics of cognitive disability as Autism (Fig-3) provide advanced steady prediction rate. The analysis has been accomplished for Autism



Abnormal Emotional Regulation	1
Difficulty in coordination	2
No response to queries	3
Abnormal eye gaze	4
No body gestures	5
Abnormal body language	6
No social interaction	7
No facial expressions	8

Fig. 1: Factors influencing Cognitive Disorder among children using Bee Hive foraging approach

cognitive disorder over variable dataset accrued for each half yearly as 2009 to 2014.

From the analysis it is able to be recognized that CODEO shows initially low prediction rate compared to genetic algorithm. Initially CODEO suffers for 50 ms in prediction rate and improves after a supportive time period such that the difference of CODEO with Genetic algorithm is observed to be an average of 23.48% in prediction rate.

Similarly CODEO indicates an advanced performance of 14.82% in prediction rate in comparison to ACO. From each stage itself CODEO plays higher than ACO. Fig-4 indicates performance of CODEO with ACO as age with prediction rate. CODEO always indicates advanced prediction rate as age of child also increases compared to ACO.

Based on dataset observed and accumulated from children whose age are between 2 years to 12 years, which possess around 120 MB of datasize, an approximate of 5000 records for the years 2009 to 2014. The dataset keeps the consistency among records collected. Fig-5 elaborates on the % of dataset used for analysis.

Fig-5 suggests the data used for analysis at some point of an early prediction of cognitive disorder among children of differing ages analysed over varying period. Overall performance of CODEO was turned into stronger because of huge range of datasets getting used for analysis compared to Genetic algorithmic method which consumes lesser dataset. The prediction rate of genetic algorithm reduces as time and data in analysis increases at the same time as the prediction rate increases as for CODEO for the equal capabilities.

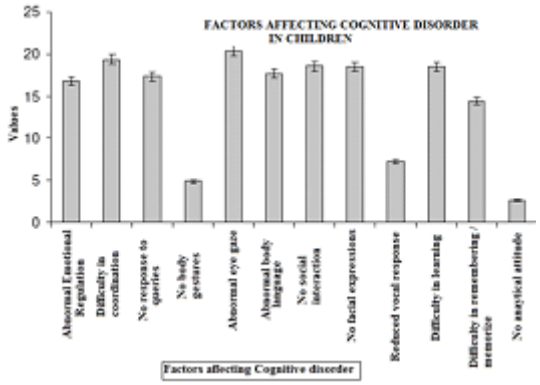


Fig. 2: CODEO - Factor influencing Cognitive disorder and analysis

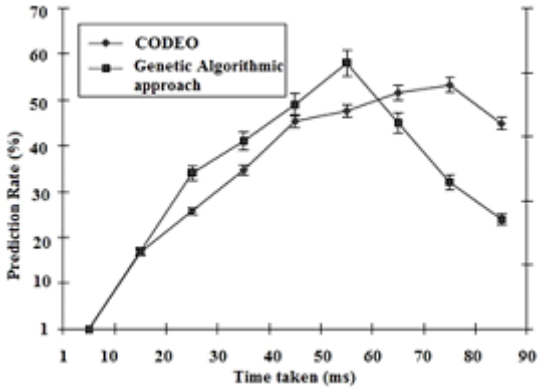


Fig. 3: CODEO - Prediction rate analysis with genetic algorithm approach

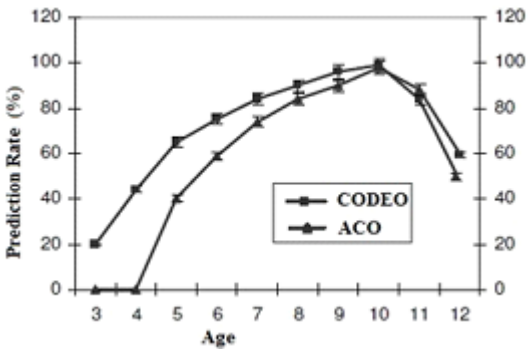


Fig. 4: CODEO - Prediction rate analysis with ACO approach

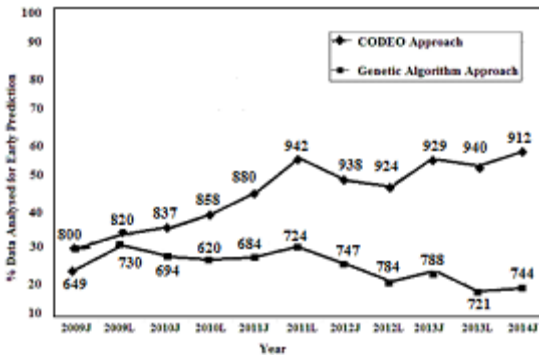


Fig. 5: Analysis on data used for early prediction

The performance of CODEO scheme using autism dataset for ASD analysis suggests the higher prediction rate and stepped forward information usage for evaluation. The analysis was carried out for differing a long time and behavioural attitude observed among children. Genetic algorithm as properly ACO can be once more carried out for analysis for autism as well different similar cognitive disorders.

CONCLUSION

CODEO as a research work is executed primarily based on data analysis of diverse cognitive behavioural approaches as being advised for ASD affected children and their consistent consequences on this work. This approach adopts the findings received from a various associated survey on ASD and similar platform which is suggested to diagnose social skills, cognitive behaviour and functioning in autism. The assessments are accomplished using Autism Spectrum Quotient as a metric to identify the intensity of disorder in any children and as nicely assist with the early detection of ASD or remedy to be provided.

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