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Case-Based Reasoning System for Diagnosis of Neuropsychiatric Abnormality

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ABSTRACT

At the present time in medical field, neuropsychiatry abnormality diagnosis is limited and discussed partially in research papers, books and journals. It was very difficult to diagnose neuropsychiatric abnormality, by doctors, research groups and related agencies. There are many similar syndromes availability had caused difficulties to diagnose neuropsychiatric abnormality. Therefore, it was necessary to implement the algorithm, computerized method or software tool to diagnose the neuropsychiatric abnormality. In this paper for the diagnosis Case Based Reasoning (CBR) is used. CBR system includes four phases such as retrieve, reuse, revise, and retain. The first phase of the CBR (retrieve) makes cases from the previous knowledge. This method has been developed conceptually by using similarity factor. This method is used for basis of further programming development. By using this method, diagnosis of similar cases that occurred normally in neuropsychiatric abnormality is easily diagnose and will be given the appropriate solution.

KEYWORDS: *Neuropsychiatry, CBR, similarity factor*

I. INTRODUCTION

Neuropsychiatric is the branch of medical science which is dealing with psychological, cognitive, and physical parameters [1]. In this for the diagnosis of neuropsychiatric disease EEG and FMRI parameters is also included. Neuropsychiatric is the branch of mental disorder which consider both type of disorder that are associated with dis- functioning of brain due structure as well as due to behavioral changes. We can create table for syndromes abnormality description (Table-1) of neuropsychiatric abnormality on the basis of their three important syndromes: Psychophysical syndromes, EEG parameters and brain image (FMRI) analysis [2]. Psychophysical parameter is again divided into three sub parameters: Psychological parameters containing of 11 syndromes such as: Hyper Activity (HA),Anxiety (AX), Abnormal Behavior (AB), Delusion (DE), Anger (AN), Need of Perfection (NP),Agitation (AG), Distraction of Work (DW), Hallucination (HL), Fear (FR), Stress (ST), ; and Cognitive parameters containing of 8 syndromes such as: Speech (SH),Confusion in Decision Making (CD), Forgetting Memory (FM), Learning (LR), Reasoning (RS), Judgment (JG), Hearing (HR), Speech (SH) and Vision (VS); and Physical symptoms consisting of 8 syndromes such as: Vision (VS), Climbing (CL), Over Sleeping (OS) , Walking (WL), Hearing (HR), Speech (SH), Locomotion (LO), and Hygiene (HG). The EEG signal characteristics are ACC (AC),

Temporal (TL),CG (CG), Frontal (FL), Parietal (PL) and Occipital (OL).The Image (FMRI) characteristics are ACC (AC), Frontal (FL), CG (CG), Parietal (PL), Temporal (TL), BG (BG) and Occipital (OL). In Table-1 first Coolum contains ten different cases of five different diseases. The second column contains different syndromes of the diseases. The respective columns contain "1" if the corresponding syndrome is present in the disease in that row. For example, Mood Disorder has Psychological syndrome such as: Agitation (AG), Anger (AN), Abnormal Behavior (AB), Stress (ST), Anxiety (AX), Distraction of Work (DW), Therefore, the columns contain "1" as in Table-1.The third and fourth columns of the Table-1 consist EEG and FMRI parameters such that respective row contain "1" or "0" depending upon whether the particular parameter present or not.

Computers as a evidence of the development of science, technology and telecommunication have been well-known by community. Computer technology had developed to utilize the computer act as human being. Development of computer science both hardware and software that simulate human intelligence and behavior is called Artificial Intelligence. According to [7], Artificial Intelligence consider: NLP, Computer Vision, Pattern

recognition, Robotics, Speech Recognition, ANS, Expert System, RBR and the upcoming latest development of Artificial Intelligence is CBR. However, the application of CBR is rarely used for the diagnosis of diseases.

The main goal of this research is to build and design a system that can provide information about the neuropsychiatric abnormality accurately and quickly, perform design engineering systems that can provide information on how to diagnose neuropsychiatric abnormality quickly and effectively, and design an interactive computerized system using the method CBR system. The advantage deliver from this study is as a input to develop science and technology, especially computers and neuropsychiatry field to be developed and exploited to a wider domain in future, for the doctors/patient as users can utilize this system to help solve the problems of neuropsychiatric abnormality accurately, quickly and efficiently. Furthermore, users are expected to evaluate, reasons behind the emergence of a abnormality.

II. RESEARCH METHOD

This paper is the developing system/method, which is used with computer software [20]. According to Pressman process of software engineering measures must be initiating from requirement gathering and analysis, design, implementation (programming) and testing.

Case based reasoning system design that has been worked as follows (Fig-1). When a new problem is comes, the CBR system *retrieves* most similar cases. By using retrieved solutions, after that *reuse* stage denotes a suggest solution, then *revision* stage corroborate the solution, and then *retain* stage can store the new case into the previous case base.

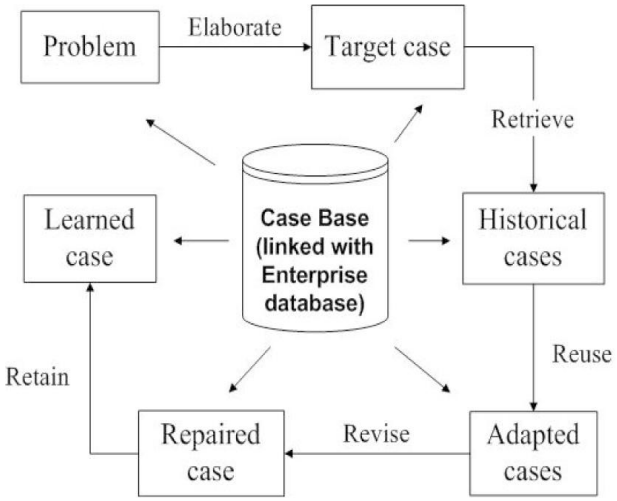

Fig. 1 CBR system for Neuropsychiatric abnormality
Fig 1 CBR system for fish disease Case

III. RESULTS AND DISCUSSION

Basic requirement in the development of Computer-Based Reasoning System for diagnosis of neuropsychiatric abnormality cases are:

A. Acquisition Database **of** *Cases*

This requirement is gathered from DSM-4, experts or Doctors having authority various reference sources about various cases of neuropsychiatric abnormality [1], [2], [3], [4], [5], [6], [11], [13], [14], [15], [21], [22], [23], [24], [25].

B. New Case Search

The design of this method is to help users to identifying neuropsychiatric abnormality by giving the value to the different syndromes. After given value, the system will search for cases which is similar to the new cases or similar cases in the database.

CBR techniques to diagnose the neuropsychiatric abnormality including: the representation of the different cases, introduce cases, the new problem identification phase , and selection stage.

C. Representation of different cases

Representation form in the case of computer-based reasoning system for the identification of fish disease cases are as follows (Fig. 2):

The first data from database:

Neuropsychiatric Abnormality
Parameters:

1. Psychological
   a. AN : 1
   b. AB : 1
   c. AX : 1
   d. AG : 1
   e. DW : 1
   f. HA : 1
2. Cognitive
   a. HR : 1
   g. JG : 1
   h. LR : 1
   i. VS : 1
3. Physical
   j. CL : 1
   k. HR : 1
   l. VS : 1
   m. HG : 1
4. EEG
   n. FL : 1
5. Image
   o. CG : 1
   p. FL : 1
   q. PL : 1
   r. TL : 1

Disease Diagnose: ADHD

Fig. 2 Representation form case for ADHD disease
Fig.-2 The second data from the Data Base

D. Retrieve

Retrieve stage search cases by using CBR system for diagnosis of neuropsychiatric abnormality cases using the nearest neighbor technique. Nearest neighbor is a technique for search that supplies a measure of similarity of new case cases with original case. In the nearest neighbor method, to find a suitable case, the case should be matched with the saved case within a case base. Similarity is calculated for each index. Similarity calculation is done for selecting the most suitable cases or the most relevant. Different stages in the retrieve process are:

- Problem Identification phase
- Matching phase
- Selecting

1) *Problem Identification phase: P*roblem identification phase includes the following steps: the user selects different syndromes from table-1.

2) *Match Stage:* At this stage in the process includes the following steps: computer CBR system will perform a search process in the different cases as well as syndromes that are determined, then the search process result data associated with particular disease as well as the corresponding syndromes. After that, data from table-1 diseases previously obtained, find its value, and then process of calculation is done for each data similarity for different neuropsychiatric diseases.

3) Selecting:

EXAMPLE of similarity calculation

a. Data from the user (Fig. 3):

```
Neuropsychiatry
Parameters
    1. Psychological
        a.  AN          : 1
        b.  AB          : 1
        c.  AX          : 1
        d.  AG          : 1
        e.  FR          : 1
        f.  NP          : 1
    2. Cognitive
        g.  CD          : 1
        h.  JG          : 1
        i.  LR          : 1
        j.  RS          : 1
    3. Physical
        k.  WL          : 1
        l.  VS          : 1
    4. EEG
        m.  AC          : 1
        n.  CG          : 1
        o.  FL          : 1
        p.  PL          : 1
        q.  OL          : 1
        r.  TL          : 1
    5. Image
        s.  AC          : 1
        t.  CG          : 1
        u.  FL          : 1

Disease : ?
```

Fig. 3 Data input from users

b. Data from database of different neuropsychiatric abnormality. Search results from data types and syndromes of different diseases is (Fig. 4 and Fig. 5):

The second data from database:

```
Neuropsychiatry
  Parameters
    1.  Psychological
        a.  AN          : 1
        b.  AB          : 1
        c.  AX          : 1
        d.  AG          : 1
        e.  HA          : 1
        f.  SW          : 1
    2.  Cognitive
        g.  CD          : 1
        h.  HR          : 1
        i.  JG          : 1
        j.  RS          : 1
    3.  Physical
        k.  WL          : 1
        l.  HR          : 1
        m.  VS          : 1
    4.  EEG
        n.  AC          : 1
        o.  FL          : 1
        p.  PL          : 1
        q.  TL          : 1
    5.  Image
        r.  AC          : 1
        s.  CG          : 1
        t.  PL          : 1

Disease : OCD
```

Fig. 4 The second data from the Data Base

c. Then count the value of each syndromes against each disease data derived from search results

d. Comparison of results and similarity values of input data is by the user (Fig. 3) with the first data of the search results in Fig. 4 can be seen in Table-2.

TABLE -2 LOCAL SIMILARITY TABLE OF THE FIRST DATA ON DATABASE

Neuropsychiatry

Syndromes	Weight
Psychological	0.8
Cognitive	1
Physical	0.6
EEG	0.2
Image	0.4

Similarity1=1/41[1*0.8+1*0.8+1*0.8+1*0.8+1*1+1*1+1*0.6+1*0.2+1*0.4+1*0.4]
=0.1463

TABLE 2 SIMILARITY TABLE OF THE SECOND DATA ON DATABASE

Neuropsychiatry

Syndromes	Weight
Psychological	0.8
Cognitive	1
Physical	0.6
EEG	0.2
Image	0.4

Similarity2=1/41[1*0.8+1*0.8+1*0.8+1*0.8+1*1+1*1+1*1+1*1+1*0.6+1*0.6+1*0.2+1*0.2+1*0.2+1*0.2+1*0.4+1*0.4]
=0.2194

From the calculation similarity1 and similarity2, the calculation of the greatest is 0.4285.This result diagnose that patient is suffer from OCD.

E. Reuse

In case based reasoning system for diagnosis of neuropsychiatric abnormality using the reuse of the result from the search solution that are resemble (using the calculation of similarity) with new cases. Once previous known cases which are similar to the new case, then the solution of most similar cases will be replaced to be propose to the user as an result from the system. This method reuse a case like this is.

F. Revise

There are two main tasks of this phase: evaluation of result and correction of errors. Evaluation of result is how the results obtained after analyze the solutions with the actual situation. Betterments include the introduction of a new case made an error free result and take or make an explanation of the error. Revise process on this case based reasoning system for diagnosis of neuropsychiatric disease can only be done by experts in that field.

G. Retain

In this process of retaining, using result of similar cases are treated as the new cases. This New cases will be recorded as new cases until any expert has said the new cases as a valid new cases. Then the case is updated into the base case.

H. Adaptation

During the process of adaptation in this Case based reasoning system for diagnosis of neuropsychiatric disease is the null adaptation technique. Null adaptation techniques do not take any adaptation. This null adaptation technique is simply to take whatever result given from the search results equal to the case of a any new case. None of this adaptation is very useful for problems that include complex reasoning but with a simple solution.

IV. CONCLUSION

This paper has produced a system of Case based reasoning system to diagnose neuropsychiatry abnormality conceptually Retrieve phase (search cases) by using CBR system for diagnosis of neuropsychiatric abnormality cases using the nearest neighbor technique. Nearest neighbor is a technique for search that supplies a measure of similarity of new case cases with original case. In the nearest neighbor method, to find a suitable case, the case should be matched with the saved case within a case base. Similarity is calculated for each index. Similarity calculation is done for selecting the most suitable cases or the most relevant The basic thought used is that similar cases will have similar solutions as well as. reuse method is abnormality using the reuse of the result from the search solution that are resemble (using the calculation of similarity) with new cases. Once known case which are same as to the new case, then the solution of same cases will be recommended to the user as a result from the system. Result is referred to diagnosis of neuropsychiatric disease. Evaluation of result and correction of errors. This process can only be c by completed experts. In the process of In this process of retaining, using result of similar cases are treated as the new cases. This New cases will be recorded as new cases until any expert has said the new cases as a valid new cases. Then the case is updated into the base case .In adaptation process null adaptation process is used. Null adaptation techniques do not take any adaptation. This null adaptation technique is simply to take whatever result given from the search results equal to the case of a any new case.

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Disease	Psychophysical																									EEG						Image						
	Psychological											Cognitive								Physical																		
	AN Anger	AB Abnormal Behavior	AX Anxiety	AG Agitation	DE Delusion	DW Distraction of work	FR Fear	HL Hallucination	NP Need of Perfection	[illegible] Stress	A [illegible]	CE Decision Making	HR Hearing	JG Judgment	[illegible] Learning	M Forgetting Memory	RS Reasoning	SH Speech	VS Vision	[illegible] Climbing	L Walking	HR Hearing	LO Locomotion	VS Vision	SH Speech	[illegible] Over Sleeping	G Hygiene	AC ACC	CG CG	FL Frontal	PL Perietal	OL Ocipetal	TL Temporal	AC ACC	CG CG	FL Frontal	PL Perietal	OL Ocipetal	TL Temporal	BG BG
ADHD1	1	1	1	1	0	1	0	0	0	0	1	0	1	1	1	0	0	0	1	1	0	1	0	1	0	0	1	0	0	0	0	0	0	1	1	0	1	0
ADHD2	1	1	1	0	1	1	0	1	0	0	1	0	0	1	0	1	1	1	1	1	1	0	0	0	1	0	0	1	0	0	1	1	0	1	0	1	1	1	0	1
Dementia1	0	1	1	1	0	1	1	1	1	1	0	1	0	1	1	1	1	1	0	0	0	1	0	1	0	1	1	0	0	1	0	1	1	0	0	1	1	0	1	1
Dementia2	0	1	1	1	0	0	1	1	1	1	0	1	1	0	0	1	1	1	1	0	0	0	0	1	1	0	1	1	1	0	1	0	1	0	1	1	1	0	0	1
Mood Disorder1	1	1	1	1	0	1	0	0	0	1	0	1	0	0	1	1	1	1	0	0	0	0	0	1	1	1	0	0	0	1	0	0	0	1	0	1	0	0	1	0
Mood Disorder2	1	1	1	1	0	1	0	0	0	0	1	1	1	0	0	1	1	1	1	0	0	0	1	0	0	1	1	0	0	0	0	1	0	0	1	0	0	0	0	1
OCD1	1	1	1	1	0	0	1	0	1	0	0	1	0	1	1	0	1	0	0	0	1	0	0	1	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0
OCD2	0	1	1	1	0	0	1	0	1	0	1	0	1	0	1	0	0	1	1	0	0	1	0	0	1	0	0	1	1	1	1	0	0	1	1	1	1	1	0	0
SI1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	0	0	1	0	0	0	1	1	0	1	0	0	0	1	0	1	1	0	1	1	1	0	1	0	0
SI2	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	1	0	1	0	0	0	1	0	1	1	1	0	1	0	1	1	0

Table-1

Neuropsychiatry
Parameters
1. Psychological
   a. AN : 1
   b. AB : 1
   c. AX : 1
   d. AG : 1
   e. HA : 1
2. Cognitive
   f. CD : 1
   g. HR : 1
   h. JG : 1
   i. LR : 1
   j. SH : 1
3. Physical
   k. WL : 1
   l. LO : 1
   m. SH : 1
4. EEG
   n. CG : 1
   o. PL : 1
   p. OL : 1
5, Image
   q. AC : 1
   r. CG : 1
   s. FL : 1
   t. OL : 1

Disease : SI

Case Representation table