



Expert System For Autism Prediction in Children With Web-Based Forward Chaining Method

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ABSTRACT

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Autism is one of the categories of children with special needs, namely brain nerve development disorders that affect the ability to communicate and interact socially. Autism is divided into 5 types: Autistic Disorder, Asperger's Disorder, Perspective Developmental Disorder-Not Otherwise Specified (PDD-NOS), Rett's Disorder, Childhood Disintegrative Disorder (CDD). This research was conducted to predict the type of autism that occurs in children using a web-based expert system with the method of forward chaining, using data collected through various sources about autism. The data will be implemented into the system, so the system can provide information about the types of autism that exist, as well as the symptoms experienced by each type of autism. This system will also be able to diagnose patients by giving a number of questions to the symptoms that occur then providing appropriate treatment solutions through various therapies.

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1. Introduction

Many people mistakenly think autism is a disease. But the reality of autism or autistic spectrum disorder (asd) is a condition of growth disorders exceptional child cool by itself, resulting in a difficult child to socialize [1]. Currently the number of people with autism in Indonesia continues to grow, not comparable with the number of doctors who can diagnose properly, as well as the high cost of consultations made parents reluctant to consult [2] [3]. Hence the role of parents is the most important thing to do early detection of autism in children is based on the everyday behavior [4]. Autism itself is divided into several subgrup include autistic disorder, Asperger's disorder, persasive developmental disorder-not otherwise specified (PDD-nos), Rett disorder, childhood disintegrative disorder (cdd) [5]. Along with the times, the development of computers is progressing very rapidly, which was originally used only for academic purposes and military [6]. Now it began to be used in various other fields, one of them in the health sector, namely the expert system [7]. An expert system is a computer-based information system that uses expert knowledge to achieve high performance level decisions in a narrow problem domain [8]. Dildalam expert system, there are three major components that looks virtually including the knowledge base, the inference engine and user interface [9]. The knowledge base is a collection of facts obtained from one or more experts who are used as knowledge that will be given expert system. The inference engine is the brain of the expert system, in the form of a given program methodology for the reasoning of the information contained in the knowledge base to get a conclusion. There are two methods of doing inference, the method of forward chaining and backward chaining [10]. Forward chaining is a search method that is based on the fact that there is then advanced through the premise to the conclusion [11]. While backward chaining is a search method that starts from the conclusion first and then look for the appropriate facts in the knowledge base to test the truth of this conclusion. Based on the above made expert system with forward chaining method that can help parents to predict the kind of autism in children based on the visible symptoms daily. The purpose of this study is to help the parents to predict autism in children using a web-based expert system application using





forward chaining method, prior conduct designed to further examination kepakarnya. And provide solutions for the proper handling of the disruption suffered by patients.

2. Research Methods

In this study, the research method used is described into the flowchart below:

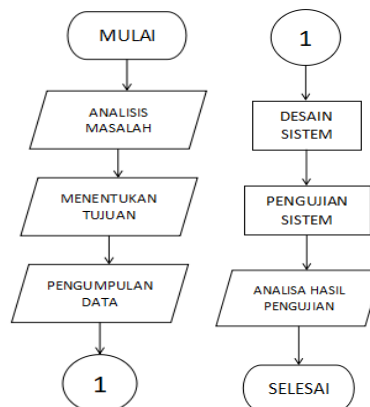


Fig 1. Flowchart Prediction Expert System Research Autism In Children

A. Analysis Problem

The lack of basic knowledge about autism in the elderly, causing many parents are confused to deal with autism in their children appropriately. Therefore, a system which is given the knowledge of an autism expert to handle such problems [12].

B. Setting Goals

Based on the above, the purpose of this research is to create an expert system to diagnose autism in children. By providing the symptoms caused conceded types of autism along with proper handling.

C. Data Collection

Data collection was conducted from various sources including through the internet, journals, thesis, and books relating to this research. Then studied to add knowledge about the rules, concepts, theories, and other insights that will be implemented into this expert system.

D. System Design

Once the data is collected, then, is that some rules as needed based on the knowledge of experts. Some rules are then diinferensi using forward chaining method [8]. Forward chaining method is a reasoning that starts from the facts to the conclusion of that fact. so the search is performed by using a rule that matches the facts obtained from the user to obtain new facts, and the process will continue until it was concluded from the fact that there [10].

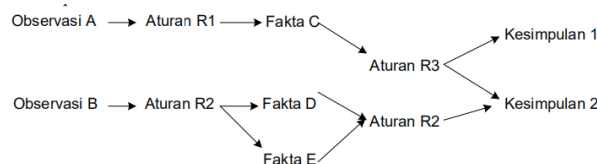


Fig 2. Reasoning Forward Chaining

The reasoning then implemented into a web-based expert system with the flow as follows:

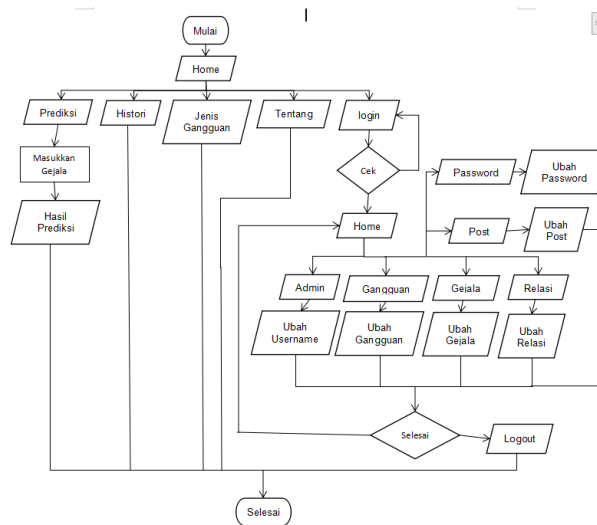


Fig 3. Flowchart Prediction Expert Systems Applications Autism In Children

E. Testing Systems

This experiment is testing the accuracy of the system. Testing accuracy of the system is a test that compared the results of the expert diagnosis decision with predicted results system [13].

F. Analysis Results

If all systems were running smoothly, didapatkanlah results as expected.

3. Results and Discussion

A. Knowledge Representation

Representing knowledge by creating rules and facts that will be used by an expert system prediction of autism in children. In order to simplify the system to determine the diagnosis based on the existing rules [14]. Here are the facts and the rules that have been made:

Table 1.

Type of Autism Disorders in Children

code Disorders	name Disorders
P01	Asperger's Disorder
P02	Autistic Disorder
P03	PDD-NOS
P04	Rett's Disorder
P05	CDD

Table 2.

List of Symptoms of Autism in Children





Kode Gejal	Gejala
G001	terlambatan berbicara
G002	perempuan dengan perkembangan kepala yang lambat (kepala kecil)
G003	kadang bicara monoton seperti robot
G004	sangat sensitif dengan penilaian orang lain
G005	kesulitan berteman
G006	menghindari kontak mata
G007	kesulitan menggunakan petunjuk sosial non-verbal
G008	bermain sangat monoton atau bila senang dengan satu mainan tidak mau mainan yang lain
G009	bila menginginkan sesuatu ia menarik tangan orang terdekat dan mengharapkan tangan tersebut melakukan sesuatu untuknya
G010	keterampilan motoriknya lemah
G011	tidak atau kurang memiliki rasa empati kepada orang lain
G012	dapat berbicara dengan baik namun tidak terlibat dalam pembicaraan dua arah
G013	marah jika ada perubahan dari lingkungannya
G014	tidak mampu memahami perspektif orang lain
G015	sulit memahami kata-kata (harus disertai bantuan gerakan tubuh agar bisa mengerti)
G016	kadang mengeluarkan kata-kata yang tidak dimengerti orang lain
G017	memunculkan karakteristik seperti menyeringai, mengepak-kepak tangan, berjalan dengan ujung jari, menggoyang tubuh, atau memutar kepala
G018	memiliki ekspresi emosi tampak datar, berlebihan, atau tidak sesuai dengan situasi
G019	mudah teralihkan perhatiannya oleh berbagai hal
G020	suka meniru nyanyian atau kata-kata tanpa mengerti artinya
G021	tidak menoleh ketika dipanggil atau menolak ketika dipeluk
G022	bila dedaketi untuk bermain justru menjauh
G023	tidak suka berbagi kesenangan dengan orang lain
G024	sangat hiperaktif atau terlalu diam
G025	jika tidak mendapatkan apa yang diinginkan sering mengamuk tak terkendali
G026	memiliki gangguan dalam persepsi sensoris
G027	suka mencium, menggigit, atau menjilat mainan atau benda apa saja
G028	bila mendengar suara keras langsung menutup telinga
G029	suka berteriak, tertawa terbahak-bahak, atau menangis tanpa alasan yang jelas
G030	kehilangan atau menurunnya kemampuan yang sudah dikuasai saat kecil
G031	mundurnya kemampuan berkomunikasi dan berinteraksi sosial
G032	sering mengompol dan BAB tak terkendali setelah berusia lebih dari 3 tahun
G033	sulit makan diusia 6-18 bulan
G034	kesulitan bergerak (ketika ingin duduk, merangkak, atau berjalan) diusia 6-18 bulan
G035	rewel diusia 1-4 tahun dan tidak rewel diusia 2-10 tahun
G036	tidak seimbang saat berjalan diusia 1-4 tahun dan mulai membaik diusia 2-10 tahun
G037	sulit tidur diusia 1-4 tahun
G038	kejang diusia 2-10 tahun
G039	pola napas tidak teratur diusia 2-10 tahun
G040	mengalami skoliosis (kelengkungan tulang belakang)
G041	lemah dan kaku otot hingga dewasa
G042	tidak mampu berjalan hingga dewasa

Data relate the rules obtained by the interference of the table name the type of disorder and the symptoms of a table listing the symptoms based on data obtained from various sources. Then represented using a forward chaining method in the form of if-then (if-then). Here are the rules used by this expert system:

Table 3.
Rules Data Type Autism, symptoms, as well as their respective weights.

RULES		
IF	THEN	WEIGHT
G003, G004, G005, G007, G008, G010, G011, G012, G013, G014	P001	$1/10 \times 100\% = 10\%$
G001, G003, G005, G006, G008, G009, G011, G012, G016, G018, G020, G021, G022, G023,	P002	$1/20 \times 100\% =$





G024, G025, G026, G027, G028, G029		5%
G001, G005, G006, G009, G013, G015, G016, G017, G018, G019, G021, G029	P003	$1/12 \times 100\% = 8\%$
G001, G002, G006, G008, G017, G029, G030, G033, G034, G035, G036, G037, G038, G039, G040, G041, G042	P004	$1/17 \times 100\% = 5\%$
G017, G030, G031, G032	P005	$1/4 \times 100\% = 25\%$

Table 4.
Weights Scale User Answers

INFORMATION	WEIGHT
No	0
Do not know	0.2
slightly sure	0.4
sure enough	0.6
Sure	0.8
Very sure	1

Of the rules that have made it, so it can be made a decision tree as follows:

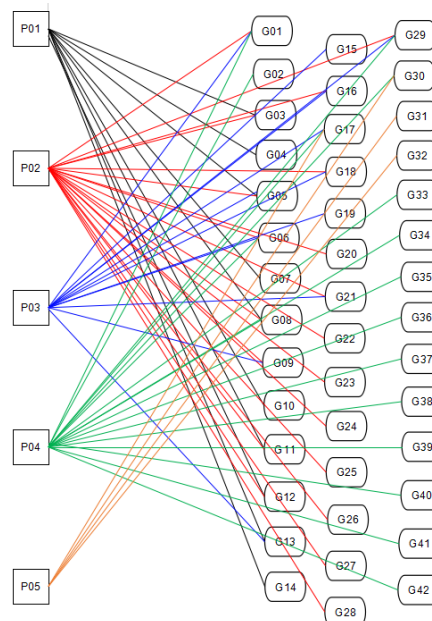


Fig 4. The decision tree type Autism Disorders in Children

B. Sample Case

Suppose the user selects the following symptoms:

Table 5.
Case Analysis Expert System Predicts Autism In Children

CODE SYMPTOMS	USER WEIGHT
G01	0.4
G02	0.8
G03	0.6
G04	0.8
G05	1

With these symptoms, most likely experience problems:

$$P01 = (0.6 + 0.8 + 1) \times 10\% = 24\%$$

$$P02 = (0.4 + 0.6 + 1) \times 5\% = 10\%$$

$$P03 = (0.4 + 1) \times 8\% = 11.2\%$$

$$P04 = (0.4 + 0.8) \times 5\% = 6\%$$

$$P05 = 0 \times 25\% = 0\%$$

From the above calculation, be concluded impaired type of P01 with the greatest weight is 24%.





No	Kode	Gejala yang dideteksi (deteksi)	Pilihan
1	GG01	terlambatan berbicara	Ya
2	GG02	perempuan dengan perkembangan kepala yang lambat (kepala kecil)	Tidak
3	GG03	kelembing bicara monoton seperti robot	Ya
4	GG04	sangat sensitif dengan perubahan orang lain	Ya
5	GG05	kesulitan berinteraksi	Tidak

Hasil Prediksi
Jenis penyakit yang dideteksi adalah:
Asperger Disorder / 24 %

Fig 6. Calculation Result Prediction Expert Systems Applications Autism In Children

Can be seen in the case of the above example that the calculation of the same system with manual calculations.

C. System Implementation

- 1) Home page

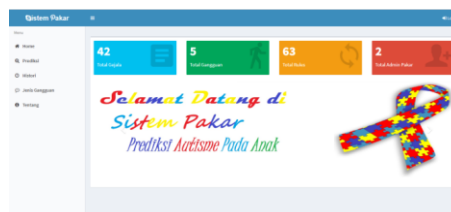


Fig 7. Home page Expert Systems Applications Predict Autism In Children

The home page is the first menu the user sees after a successful login. On this page there are a variety of menus including no menu predictions to start predicting types of autism, and navigation history to see all the results of the predictions that have been done user diakukan it, then there is a menu type of hearing to see all kinds of disturbances that exist in autism along with understanding, then there menu on the application for information about the system.

- 2) Weather Prediction

No	Kode	Gejala	Pilih Sesuai
1	GG01	terlambatan berbicara	Ya
2	GG02	perempuan dengan perkembangan kepala yang lambat (kepala kecil)	Tidak
3	GG03	kelembing bicara monoton seperti robot	Ya
4	GG04	sangat sensitif dengan perubahan orang lain	Ya
5	GG05	kesulitan berinteraksi	Tidak
6	GG06	menghindari kontak mata	Tidak
7	GG07	kesulitan menggunakan petunjuk sosial non verbal	Pilih (jika sesuai)

Fig 8. Weather Prediction type Autism Disorders in Children

On page questionnaire questions predictions will display symptoms that occur in patients. After the user gives the symptoms that occur in a patient, the system concludes the type of disorder that occurs in patients using forward chaining method with the added weight calculation of each symptom in each disorder. From the results of these calculations, taken interference with the greatest weight will be displayed yard predicted results.

- 3) Prediction Results

No	Kode	Gejala yang dideteksi (deteksi)	Pilihan
1	GG01	terlambatan berbicara	Ya
2	GG02	perempuan dengan perkembangan kepala yang lambat (kepala kecil)	Tidak
3	GG03	kelembing bicara monoton seperti robot	Ya
4	GG04	sangat sensitif dengan perubahan orang lain	Ya
5	GG05	kesulitan berinteraksi	Tidak
6	GG06	menghindari kontak mata	Tidak

Hasil Prediksi
Jenis penyakit yang dideteksi adalah:
Asperger Disorder / 12 %

Fig 9. Prediction Result Type Autism In Children





On the resulting page displays patient data prediction, the prediction results disorder based on symptoms is given along with the understanding of the disorder, then topped with providing solutions appropriate handling of this type of the disorder.

D. Examination

In this study, tests were conducted to measure the accuracy of testing how accurately predicted results compared with the results of the diagnosis system experts [20].

Table 6.
Testing Results Prediction Expert Systems With Diagnose Results

No.	symptom	Results System	Results Experts	matching
1.	G01, G02, G03, G04, G05.	P01 (20%)	P01	Suitable
2.	G05, G06, G08, G09, G11	P01 (20%)	P01	Suitable
3.	G01, G05, G06, G09, G15.	P03 (30%)	P03	Suitable
4.	G13, G14, G15, G16, G17.	P05 (25%)	P03	Not suitable
5.	G01, G06, G10, G30, G31.	P05 (35%)	P05	Suitable
6.	G06, G09, G16, G18, G20.	P03 (26%)	P03	Suitable
7.	G24, G25, G26, G27, G28.	P02 (18%)	P02	Suitable
8.	G04, G15, G16, G17, G21.	P03 (21%)	P03	Suitable
9.	G02, G29, G39, G40, G41.	P04 (16%)	P04	Suitable
10.	G22, G23, G27, G30, G33.	P05 (25%)	P05	Suitable
11.	G07, G10, G12, G22, G35.	P01 (22%)	P02	Not suitable
12.	G10, G17, G25, G30, G31.	P05 (65%)	P05	Suitable
13.	G12, G13, G14, G15, G16.	P01 (20%)	P01	Suitable
14.	G17, G20, G21, G24, G25.	P05 (20%)	P01	Not suitable
15.	G18, G19, G22, G23, G24.	P02 (14%)	P02	Suitable
16.	G13, G15, G19, G21, G23.	P03 (21%)	P03	Suitable
17.	G09, G13, G16, G20, G22.	P03 (16%)	P03	Suitable
18.	G07, G13, G14, G16, G22.	P01 (24%)	P01	Suitable
19.	G22, G23, G26, G28, G29.	P02 (17%)	P02	Suitable
20.	G09, G13, G17, G24, G26.	P05 (25%)	P05	Suitable
21.	G12, G14, G32, G34, G35.	P05 (25%)	P03	Not suitable
22.	G02, G36, G37,38, G39.	P04 (14%)	P04	Suitable
23.	G09, G12, G13, G15, G16.	P03 (24%)	P03	Suitable
24.	G09,G11, G13, G18, G19.	P03 (22%)	P03	Suitable
25.	G18, G21, G30, G31, G36.	P05 (20%)	P05	Suitable
26.	G11, G12, G16, G26, G30.	P05 (25%)	P05	Suitable
27.	G05, G08, G14, G33, G36.	P01 (24%)	P01	Suitable
28.	G27, G29, G36, G37, G38, G39, G40, G41, G42.	P04 (28%)	P04	Suitable
29.	G03, G05, G08, G11, G15, G18.	P01 (32%)	P01	Suitable
30.	G17, G19, G24, G29, G33.	P05 (20%)	P05	Suitable
31.	G04, G08, G11, G12, G15.	P01 (36%)	P01	Suitable
32.	G09, G20, G24, G25, G29.	P02 (29%)	P02	Suitable
33.	G19, G21, G25, G26, G27.	P03 (14%)	P03	Suitable
34.	G09, G10, G13, G15, G19.	P03 (27%)	P03	Suitable
35.	G05, G08, G12, G14, G15.	P01 (38%)	P01	Suitable
36.	G02, G15, G17, G18, G37.	P03 (16%)	P04	Not suitable
37.	G10, G12, G18, G19, G20.	P03 (16%)	P03	Suitable
38.	G09, G10, G16, G17, G18.	P03 (27%)	P03	Suitable
39.	G01, G04, G05, G08, G13.	P01 (32%)	P01	Suitable
40.	G07, G10, G17, G24, G28.	P05 (25%)	P02	Not suitable
41.	G14, G15, G25, G26, G27.	P01 (10%)	P01	Suitable
42.	G14, G15, G16, G22, G23.	P02 (13%)	P02	Suitable
43.	G09, G15, G17, G18, G27.	P03 (26%)	P03	Suitable
44.	G29, G30, G34, G36, G37.	P05 (25%)	P04	Not suitable
45.	G03, G07, G09, G11, G18, G19, G20.	P01 (24%)	P01	Suitable
46.	G05, G06, G13, G14, G18.	P01 (30%)	P01	Suitable
47.	G01, G09, G13, G22, G23, G25.	P02 (20%)	P02	Suitable
48.	G08, G16, G20, G21, G29.	P02 (22%)	P02	Suitable
49.	G04, G13, G20, G22, G28.	P01 (16%)	P01	Suitable
50.	G02, G36, G38, G39, G40.	P04 (22%)	P04	Suitable
51.	G11, G12, G13, G18, G19.	P01 (28%)	P01	Suitable
52.	G09, G16, G20, G21, G22.	P02 (21%)	P02	Suitable
53.	G22, G24, G27, G29, G30.	P02 (17%)	P02	Suitable
54.	G05, G06, G07, G13, G14.	P01 (38%)	P01	Suitable





No.	symptom	Results System	Results Experts	matching
55.	G06, G08, G12, G27, G28.	P02 (20%)	P02	Suitable
56.	G10, G11, G24, G25, G29.	P02 (19%)	P01	Not suitable
57.	G18, G19, G28, G30, G31.	P05 (40%)	P05	Suitable
58.	G11, G14, G18, G19, G26.	P01 (16%)	P01	Suitable
59.	G12, G16, G17, G26, G27, G35.	P05 (25%)	P05	Suitable
60.	G05, G06, G14, G16, G28, G29.	P03 (29%)	P03	Suitable
61.	G08, G10, G11, G18, G19, G26.	P01 (26%)	P01	Suitable
62.	G04, G06, G10, G11, G14.	P01 (34%)	P01	Suitable
63.	G05, G11, G15, G19, G20, G21.	P03 (27%)	P03	Suitable
64.	G05, G09, G20, G21, G23, G33.	P02 (23%)	P02	Suitable

From the table above it can be concluded that the expert system predictive of autism in children using forward chaining obtain satisfactory results, namely:

Accuracy: $56/64 \times 100\% = 87.5\%$ (1)

4. Conclusion

Based on the results of the research conducted, it can be concluded that the resulting research data is a piece of software on an expert system to predict autism in children based on web. This system can interact like an expert consultation that is used as a medium. So as to provide convenience to parents who have children with symptoms of autism to be able to learn more about the disorder that occurs in children and how to handle it early on. After going through the stages of analysis, design, and testing of the system, this application can be said to be feasible for use by the public.

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