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The Idea of an International Project for Developing Expert System for Planning the Choice of Healthy Food for Elderly Diabetics People

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Abstract: - Expert system (ES) is a consultation intelligent system uses the artificial intelligence concepts and reasoning methodologies to solve problems in a specific domain. This system contains the knowledge and experiences of many experts in such domain. The purpose of an ES is not to replace the experts, but simply to make their knowledge and experience more widely available. ES permits others to increase their productivity, improve the quality of their decisions, or simply to solve problems when as expert is not available. This paper discusses the idea of an international project for developing expert system for planning the choice of healthy food for elderly diabetics people.

Key-Words: - Expert systems, Health informatics, Diabetes, Knowledge engineering

1. INTRODUCTION

Food is one of life's pleasures, whatever our age. In addition to the enjoyment which we get from it, good food is also essential to keep us healthy and fit and to keep us full of energy. An important part of a good diet is the provision of variety and choice. This can be difficult at any age, but can be a particular challenge in older people.

Diabetes is a disease in which blood glucose levels are above normal. Most of the food we eat is turned into glucose, or sugar, for our bodies to use for energy. The pancreas, an organ that lies near the stomach, makes a hormone called insulin to help glucose get into the cells of our bodies. When you have diabetes, your body either doesn't make enough insulin or can't use its own insulin as well as it should. This causes sugar to build up in your blood. Diabetes can cause serious health complications including heart disease, blindness, kidney failure, and lower-extremity amputations. For more information, see [1, 2, 3].

On the other side, expert systems (ES) is a subfield of AI. It is consultation intelligent system that contains the knowledge and experience of one or more experts in a specific domain that anyone can tap as an aid in solving problems. It consists of a knowledge base that stores the expertise, inference engine that thinks and reasons, and interface that communicates with the user. Expert knowledge is the key component of the success of the ES software for any application. The knowledge consists of

facts, concepts, theories, procedures and analyzed to make it understandable and applicable to problem solving or decision making. Valuable knowledge is a major resource and it often lies with only a few experts. It is important to capture that knowledge so others can use it. Books can capture some knowledge, but they leave the problem of application up to the reader. For more information ,see [4,5,6].

2. MEDICAL ASPECTS ABOUT DIABETES

2.1 The symptoms of diabetes

People who think they might have diabetes must visit a physician for diagnosis. They might have some or none of the following symptoms:

- Excessive thirst
- Frequent urination

- Unexplained weight loss
- Extreme hunger
- Sudden vision changes
- Tingling or numbness in hands or feet
- Feeling very tired much of the time
- Very dry skin
- Sores that are slow to heal
- More infections than usual.

Nausea, vomiting, or stomach pains may accompany some of these symptoms in the abrupt onset of insulin-dependent diabetes, now called type 1 diabetes [7, 8].

2.2 The types of diabetes

Type 1 diabetes, which was previously called insulin-dependent diabetes mellitus (IDDM) or juvenile-onset diabetes, may account for about 5% of all diagnosed cases of diabetes. **Type 2 diabetes**, which was previously called non-insulin-dependent diabetes mellitus (NIDDM) or adult-onset diabetes, may account for about 90% to 95% of all diagnosed cases of diabetes. **Gestational diabetes** is a type of diabetes that only pregnant women get. If not treated, it can cause problems for mothers and babies. Gestational diabetes develops in 2% to 10% of all pregnancies but usually disappears when a pregnancy is over. **Other specific types of diabetes** resulting from specific genetic syndromes, surgery, drugs, malnutrition, infections, and other illnesses may account for 1% to 5% of all diagnosed cases of diabetes [9.10].

2.3 The risk factors for diabetes

Risk factors for type 2 diabetes include older age, obesity, family history of diabetes, prior history of gestational diabetes, impaired glucose tolerance, physical inactivity, and race/ethnicity.

African Americans, Hispanic/Latino Americans, American Indians, and some Asian Americans and Pacific Islanders are at particularly high risk for type 2 diabetes.

Risk factors are less well defined for type 1 diabetes than for type 2 diabetes, but autoimmune, genetic, and environmental factors are involved in developing this type of diabetes.

Gestational diabetes occurs more frequently in African Americans, Hispanic/Latino Americans, American Indians, and people with a family history of diabetes than in other groups. Obesity is also associated with higher risk. Women who have had gestational diabetes have a 35% to 60% chance of developing diabetes in the next 10–20 years.

Other specific types of diabetes, which may account for 1% to 5% of all diagnosed cases, result from specific genetic syndromes, surgery, drugs, malnutrition, infections, and other illnesses [11].

2.4 The treatment for diabetes

Risk factors for type 2 diabetes include older age, obesity, family history of diabetes, prior history of gestational diabetes, impaired glucose tolerance, physical inactivity, and race/ethnicity. African Americans, Hispanic/Latino Americans, American Indians, and some Asian Americans and Pacific Islanders are at particularly high risk for type 2 diabetes.

Risk factors are less well defined for type 1 diabetes than for type 2 diabetes, but autoimmune, genetic, and environmental factors are involved in developing this type of diabetes.

People with diabetes must take responsibility for their day-to-day care, and keep blood glucose levels from going too low or too high.

People with diabetes should see a health care provider who will monitor their diabetes control and help them learn to manage their diabetes. In addition, people with diabetes may see endocrinologists, who may specialize in diabetes care; ophthalmologists for eye examinations; podiatrists for routine foot care; and dietitians and diabetes educators who teach the skills needed for daily diabetes management.

2.5 Causes type 1 diabetes

The causes of type 1 diabetes appear to be much different than those for type 2 diabetes, though the exact mechanisms for developing both diseases are unknown. The appearance of type 1 diabetes is suspected to follow exposure to an "environmental trigger," such as an unidentified virus, stimulating an immune attack against the beta cells of the pancreas (that produce insulin) in some genetically predisposed people. Researchers are making progress in identifying the exact genetics and "triggers" that predispose some individuals to develop type 1 diabetes, but

prevention remains elusive. A number of studies have shown that regular physical activity can significantly reduce the risk of developing type 2 diabetes. Type 2 diabetes is associated with obesity [12].

2.6 Approaches to cure for diabetes

In response to the growing health burden of diabetes, the diabetes community has three choices: prevent diabetes; cure diabetes; and improve the quality of care of people with diabetes to prevent devastating complications. Several approaches to "cure" diabetes are currently under investigation:

- Pancreas transplantation
- Islet cell transplantation (islet cells produce insulin)[13].
- Artificial pancreas development
- Genetic manipulation (fat or muscle cells that don't normally make insulin have a human insulin gene inserted — then these "pseudo" islet cells are transplanted into people with type 1 diabetes).

Each of these approaches still has a lot of challenges, such as preventing immune rejection; finding an adequate number of insulin cells; keeping cells alive; and others. But progress is being made in all areas. For more information, see the Diabetes Care article [14].

3. EXPERT SYSTEMS METHODOLOGY

Expert systems provide a direct means of applying expertise. An expert system consists of three major components: a ***knowledge base***, an ***inference engine,*** and a ***user interface***. The *knowledge base* contains all the facts, ideas, relationships, and interactions of a narrow domain. The *inference engine* analyzes the knowledge and draws conclusions from it. The *user interface* software permits new knowledge to be entered into the knowledge base and implements communication with the user [15].

3.1 Rule-Based Expert Systems (RBESs)

RBES solves problems by taking an input specification and then "chaining" together the appropriate set of rules from the rule base to arrive at a solution. Given the same exact problem situation, the system will go through exactly the same amount of work to come up with the solution. In other words rule-based systems don't inherently learn. In addition, given a problem that is outside the result-based system's original scope, the system often can't render any assistance. Finally, rule-based systems are very time-consuming to build and maintain because rule extraction from experts is labor-intensive and rules are inherently dependent on other rules, making the addition of new knowledge to the system a complex debugging task.

3.2Case-Based Expert Systems (CBESs) .4

The new generation of ES uses a new AI paradigm of inference called, case-based reasoning (CBR) [16, 17]. CBR is appropriate methodology for all medical domains and tasks for the following reasons; cognitive adequateness, explicit experience, duality of objective and subjective knowledge, automatic acquisition of subjective knowledge, and system integration. The case-based systems solve new problems by adapting solutions that were used for previous and similar problems. The methodology of case-based expert systems can be summarized in the following steps:

1. The system will search its Case-Memory for an existing case that matches the input problem specification.
2. If we are lucky (our luck increases as we add new cases to the system), we will find a case that exactly matches the input problem and goes directly to a solution.
3. If we are not luck, we will retrieve a case that is similar to our input situation but not entirely appropriate to provide as a completed solution.
4. The system must find and modify small portions of the retrieved case that do not meet the input specification. This process is called "case-adaptation".
5. The result of case adaptation process is (a) completed solution, and (b) generates a new case that can be automatically added to the system's case-memory for future use.

The technology of case-based reasoning directly addresses the following problems found in rule-based approach.

(a) Knowledge Acquisition: The unit of knowledge is the case, not the rule. It is easier to articulate, examine, and evaluate cases than rules.

(b) Performance Experience: A CBES can remember its own performance, and can modify its behaviour to avoid repeating prior mistakes.

(c) Adaptive Solutions: By reasoning from analogy with past cases, a CBES should be able to construct solutions to novel problems.

(d) Maintaining: Maintaining CBES is easier than RBES since adding new knowledge can be as simple as adding a new case.

3.3 Benefits of the Expert Systems Approach to Healthcare

The benefits of using ESs approach in the healthcare and medical diagnosis sector are linked mainly with patients' treatment [18, 19, 20].We may enumerate several areas in which expert systems bring benefits, these are:

(a)*Treatment choice* – may be easier with the use of if-then rules of an expert system; following the rules, a physician is able to infer treatment adequate to symptoms and/or to a specific illness;

(b)*Diagnosis support* – this comes both from rule-based systems as well from case based ones. If-then rules enable encoding of knowledge linking symptoms to illnesses, while case-based reasoning enables finding the illness by comparing patients' symptoms to these stored in case-based knowledge base;
(c)*Analysis of treatment options* – rule-based knowledge enables a so-called what-if analysis: what is probable to happen if we use a specific treatment?
(d)*Keeping medical history* – is easy with case-based expert systems, where individual patients' cases may be stored both for statistical purposes and for case-based reasoning.

4. KNOWLEDGE ENGINEERING GUIDELINES FOR DEVELOPING THE PROPOSED ES OF ELDERLY DIABETICS PEOPLE

In order to develop the expert systems for our mentioned objective, ES of elderly diabetics people, we should take into account the following knowledge engineering aspects and technical guidelines;

1-The knowledge of the domain must be collected and codified. It must be organized, outlined, or otherwise arranged in a systematic order. This process of collecting and organizing the knowledge is called knowledge engineering. This task is the most difficult and time-consuming process.

2- Knowledge representation techniques offer potentially powerful tools for the development of intelligent learning software. The variety of such techniques enables the design of robust expert systems. The key to the success of such systems is the selection of the knowledge representation scheme that best fits the domain knowledge and the problem to be solved. That choice is depends on the experience of the knowledge engineer[19,20]. There are several techniques to representing and managing knowledge; e.g. logic, lists and trees, semantic networks, frames, scripts, production rules, cases and ontology.

3- The selection of the reasoning approach is very important for the development of robust expert systems software[20,21]. The research area in this field covers a variety of topics, e.g.; automated reasoning, case-based reasoning, commonsense reasoning, fuzzy reasoning, geometric reasoning, nonmonotonic reasoning, model-based reasoning, probabilistic reasoning, causal reasoning, qualitative reasoning, spatial reasoning and temporal reasoning.

4- Case-based reasoning automates applications that are based on precedent or that contain incomplete causal models. In rule-based systems an incomplete mode or an environment which does not take into account all variables could result in either an answer built on incomplete data or simply no answer at all.CBR methodology attempt to get around this shortcoming by inputting and analyzing problem data, then retrieving a similar case from the case memory library, and finally displaying a solution based on examination of these previous cases [21,22].

5.CONCLUSION

Case-Based reasoning presents an appropriate methodology for building intelligent information system for planning and choice of healthy food for elderly diabetics people. Such system can aid significantly in improving the decision making of the physicians. This system help physicians and doctors to check, analyze and repair their solutions. The physicians inputs a description of the domain situation and his (her) solution and the system can recalls cases with similar solutions and presents their outcomes to the patient. Also attempts to analyze the outcomes to provide an accounting of why the proposed type of solution succeeded or failed. For future work, the project can be extended to includes the developing of expert systems for elderly people that have high pressure and cholesterol.

REFERENCES

[1] http://www.diabetes.niddk.nih.gov/dm/pubs/type1and2/index.aspx

[2] http://www.cdc.gov/diabetes/consumer/learn.htm

[3] http://www.diabetes.niddk.nih.gov/dm/pubs/type1and2/index.aspx

[4] Waterman, D.A. "A guide to expert systems". *Addison-Wesley Publishing Comp* 1986.

[5] Wider hold, G., "The Role of Artificial Intelligence in Information Systems". *Journal of Intelligent Information System*, Vol. 1, PP. 35-55, 1992.

[6] Cornelius T. Leondes , Expert systems: the technology of knowledge management and decision making for the 21st century, pp 1–22, 2002.

[7] Centers for Disease Control and Prevention. National Diabetes Fact Sheet: General Information and National Estimates on Diabetes in the United States. Atlanta, Georgia: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2011.

[8] Brown AF, Mangione CM, Saliba D et al. California Healthcare Foundation/ American Geriatrics Society Panel on Improving Care for Elders with Diabetes. Guidelines for improving the care of the older person with diabetes mellitus. J Am Geriatr Soc ;51(Suppl. Guidelines):S265– S280,2003.

[9] Narayan KM, Boyle JP, Geiss LS et al. Impact of recent increase in incidence on future diabetes burden: U.S., 2005–2050. Diabetes Care; 29:2114–2116,2006.

[10] Selvin E, Coresh J, Brancati FL. The burden and treatment of diabetes in elderly individuals in the U.S. Diabetes Care ; 29:2415–2419, 2006.

[11] Centers for Disease Control and Prevention. Diabetes public health resource, Available at http://www.cdc.gov/diabetes Accessed September 27, 2012.

[12] Schu¨ tt M, Fach EM, Seufert J et al. Multiple complications and frequent severe hypoglycaemia in 'elderly' and 'old' patients with type 1 diabetes. Diabet Med ;29:e176–e179, 2012.

[13] http://www.cdc.gov/diabetes/consumer/research.htm#9

[14] http://care.diabetesjournals.org/content/32/11/2133.full.pdf

[15] Salem, A.M. "Expert Systems Tools: Knowledge Engineering Languages". *Proceedings of ISMM International Symposium on Mini and Microcomputers and Their Applications*, Sant Feliu de Guixols, Gerona, Barcelona, Spain, 27-30, 258-260, 1988.

[16] Salde, S. "*Case-Based Reasoning: A Research Paradigm*", AI Magazine, Vol. 12, No. 1, 42-55, 1991.

[17] Kolodner, J. Case-Based Reasoning, Morgan Kaufmann, San Mateo, (1993).

[18] Salem, A. M. and Roushdy, "*Developing a Case-Based Expert System for Diagnoses of Upper Respiratory Infect*ions", Proceedings of the Fourth International Conference on Artificial Intelligence Applications, Cairo, Egypt, pp 46-55, 1996.

[19] Abdel-Badeeh M. Salem , Bassant M. El Bagoury, A Case-Based Adaptation Model for Thyroid Cancer Diagnosis Using Neural Networks, Proceedings of the sixteenth international FLAIRS Conference, AAAI Press, pp.155-159, (2003)

[20] Salem A.B.M, Roushdy M., and El-Bagoury, B.M., An Expert System for Diagnosis of Cancer Diseases, Proceedings of the 7th International Conference on Soft Computing, MENDEL, pp. 300-305, (2001)

[21] Abdel-Badeeh M. Salem and Rania A. HodHod, A Hybrid Expert System Supporting Diagnosis of Heart Diseases, Proceedings of IFIP 17th World Computer Congress, TC12 Stream on Intelligent Information Processing, Kluwer Academic Publishers, Montreal, Quebec, Canada, pp. 301-305 ,(2002).

[22] Abdrabou, E. A. M. & Salem, A. B., Case-Based Reasoning Tools from Shells to Object-Oriented Frameworks. Advanced Studies in Software and Knowledge Engineering-Supplement to the International Journal "INFORMATION TECHNOLOGIES & KNOWLEDGE" Ed. Krassimir Markov, Krassimira Ivanova, Ilia Mitov Sofia: Institute of Information Theories and Applications FOI ITHEA. 37-44, 2008.