DIAGNOSTIC TASKS SOLVING ALGORITHMS OF COMPUTER-BASED EXPERT SYSTEM FOR DIAGNOSIS OF MAXILLOFACIAL DISEASES

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Abstract

The use of computer-based systems for diagnosis of maxillofacial diseases is becoming increasingly important in recent years. Difficulties in the creation of such intelligent diagnostic systems, are caused not only by the fact, that the clinical knowledge in the diagnostics of maxillofacial diseases field is difficult to systematize. The absence of a specific methodological approach in the diagnosis, blurring the boundaries descriptions symptomatic picture of diseases leads to ambiguous and contradictory description of the clinical picture of the patient's pathological condition. An accurate diagnosis based on scientific studies of this processes required , therefore the ability to get through differential diagnosis with similar diseases and the use of clinical knowledge embedded in the knowledge base of the system, what significantly facilitates routine of dentist-specialist. In the given article there are presented algorithms of work for expert systems for diagnosis of maxillofacial diseases

Keywords: expert systems. Diagnosis in dentistry. Working algorithms.

1. Introduction

Currently, a lot of information and expert systems are used in the field of diagnosis of diseases in the maxillofacial area. However, the use of information systems remains unsolved questions of principle relating to the withdrawal of the diagnosis. Such as the problem of the study of influence of features (semantics), diseases of the maxillofacial region in the structure of the mechanism for setting the diagnosis. And as a consequence, the methods used by the generation of diagnostic solutions do not allow an accurate diagnosis.

2. Main Part

The process of operation of computer-based expert diagnostic system can be described by the following sequence of algorithms. At the start of the system is determined by the user level in the system. There are three groups of users. "Hospital Administrator", "Dentist", "The expert of diagnostics". Thus, there are three modes of operation of the system(Fig. 1.). Let us consider user group of the algorithm "Administrator Clinic" (Fig. 2).

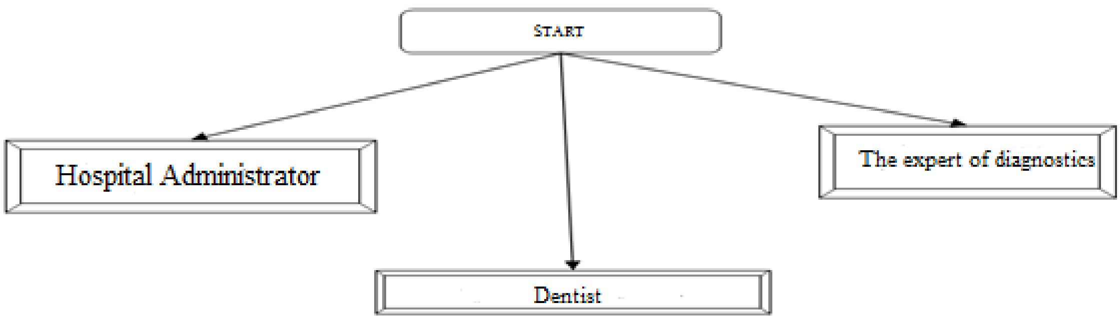
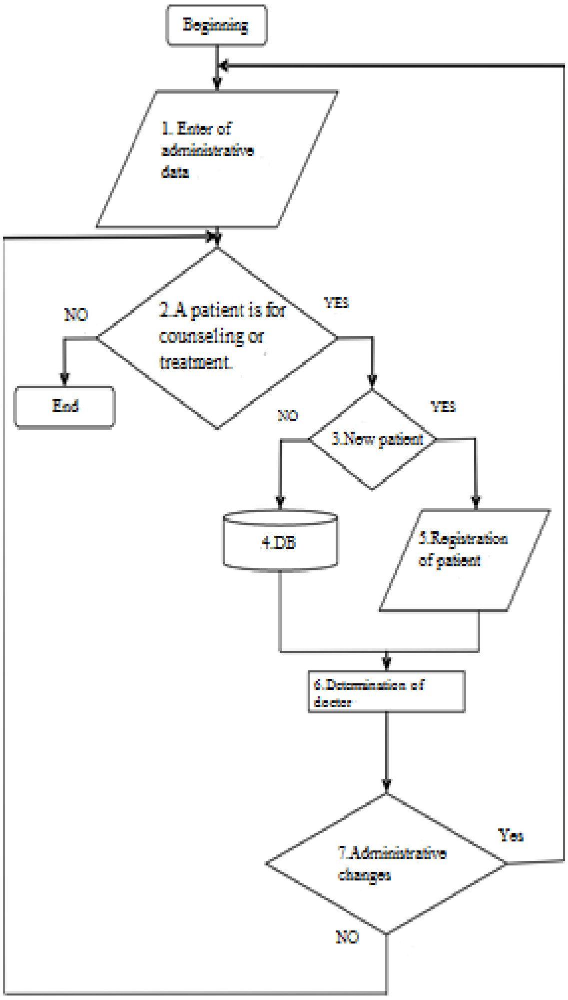


Fig.1. Operating modes



The role of this group of users, refer to the operation system scripts. Enter administrative data, as described in section 1, includes the complete data about the clinic and the doctors. When a patient in the clinic (branch) in Block 2 is determined by the patient's intent, goal: counseling or treatment. In block 3 determines whether there is a basis of information about the patient clinic data. Extraction of patient data, ie, patient card is carried out in the block 4. Further, the block 5 is carried out patient registration, which includes filling the passport of the patient card. In block 6, a determination of the attending physician in view of its expertise, free time and the desire of the patient. In block 7 made administrative changes: changes in the schedule of doctors, the addition or removal of the doctors in the clinic records, etc. Here is a group of users working algorithm -"Dentist"(Fig.3).

Fig.2. User group "Hospital Administrator" working algorithm

In block 1 "Description microsituations" A_s is used to enter all clinical information about the patient. In block 2 - assignment to the active level of value - META level in the semantic network model in KB. In block 3 is conducted to summarize the operation of all the facts A_s of the initial microsituations. Next in block 4 is conducted comparing the operation with all the descriptions A_s of the active level. As a result determined by the set of coordinates of tolerance. In block 5 is determined by the maximum coordinate vector tolerance. Next, in block 6 the active level is checked whether it is the last, i.e. micro level. In block 7 made the transition to the next level of detail, otherwise the system refers to the unit 8, which is carried out differential diagnosis of these solutions. If necessary, missing symptom input (block 9), complemented microsituations A_s missing symptom in block 11, otherwise proceed to block 10 where the diagnostic decisions made formation. Further, the output unit 12 is performed diagnostic decisions. The block 13 is set generated solutions need explanation. In block 14, the system prompts the user for information to determine possible explanation solutions. In the next step in block 15 is performed explanation diagnostic solutions.

In block 16 is determined by the adequacy of explanations decision. In case of failure an explanation to the user proceeds to block 17, which provides additional information for making the explanation decision. Let us consider additional training algorithm for the system user "The expert on diagnosis" (Fig.4).

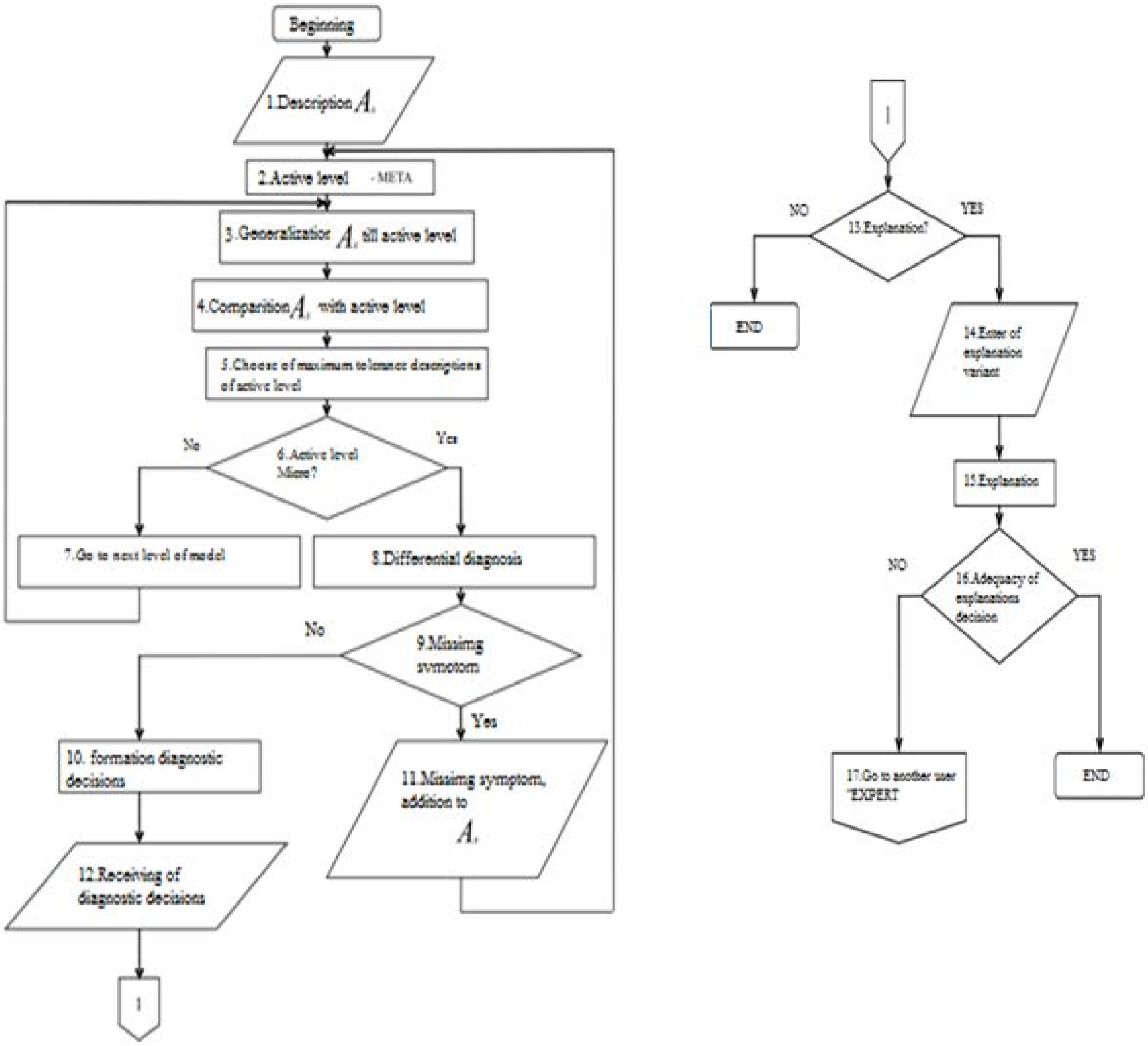
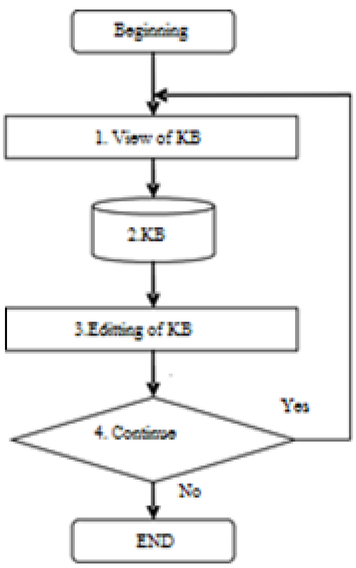


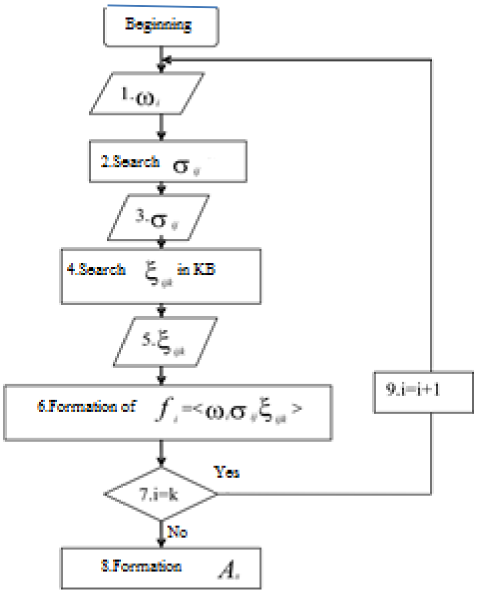
Fig.3. Users group "Dentist" working algorithm



The algorithm includes a correction, addition and modification of clinical information in the knowledge base system. Once logged in, "The expert on diagnosis" makes viewing the knowledge base (block 1). Further, the block 3 is done editing the knowledge base. The need to continue the work process is determined in block 4.

Fig.4. Users group "The expert of diagnostics "working algorithm

Consider the specific algorithms of some units, as described in the above algorithms. The algorithm input process symptomatic of the facts presented to the (Fig.5).



In block 1 is used to enter the clinical facility, then the system's knowledge base in search of all kinds of properties being introduced object (block 2). Enter the necessary properties is made in block 3. The block 4 is searched all possible values stored in the system of knowledge properties introduced above. In block 5 is made entering the desired value. Formation of symptomatic facts carried out in block 6. In block 7 checks whether there is another symptom entry. The unit 8 is carried out forming a plurality of symptomatic facts describing the initial microsituations.

Fig.5. The algorithm of the initial process microsituations A_s description

The algorithm unit procedure "generalization" of the same algorithm is shown in (Fig. 6.).

In block 1 is used to enter of the facts of As and indicated α th level of generalization. In block 2 are defined fuzzy linguistic values. In block 3 is used to enter fuzzy properties. The unit 4 searches in graphs FLM properties from the knowledge base. In block 5 is determined FLM. In a determination unit 6, corresponding to FT scale. In block 7 searches the target value of the model. Next, in block 8 are defined a set of objects and values of the knowledge base of relevant objects and clear values. In block 9, respectively, the level of generalization in the knowledge base and the values are objects including a plurality of objects defined in the preceding block.

In block 10 are defined the characteristics of objects α level . If in the knowledge base present such characteristics, then proceeds to block 12 where the level of α facts formed. Otherwise, in block 11 is performed an appeal to the user "The expert on diagnosis" for the purpose of additional training.

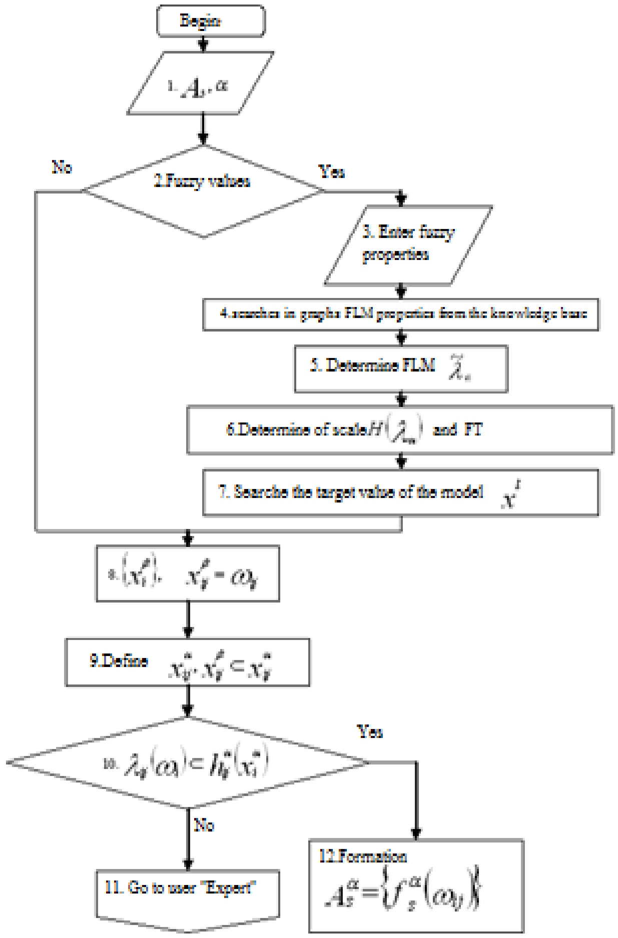


Fig.6. Generalization algorithm

Block 4 algorithm "Comparison with descriptions of the active level," presented at the (Fig. 7.). The purpose of this block is the set of facts comparison with all descriptions and formation. In block 1 is used to enter general description and descriptions on active α level management model. In block 2, the choice of the initial description. In block 3 defines two descriptions for comparison. The unit 4 is made to build a matrix tolerance. Combining elements of the matrix is performed in the block 5. The unit 6 determines whether there is another description of the active level. In block 7 formed vector active tolerance level. In block 8 moves to the following description of the active level.

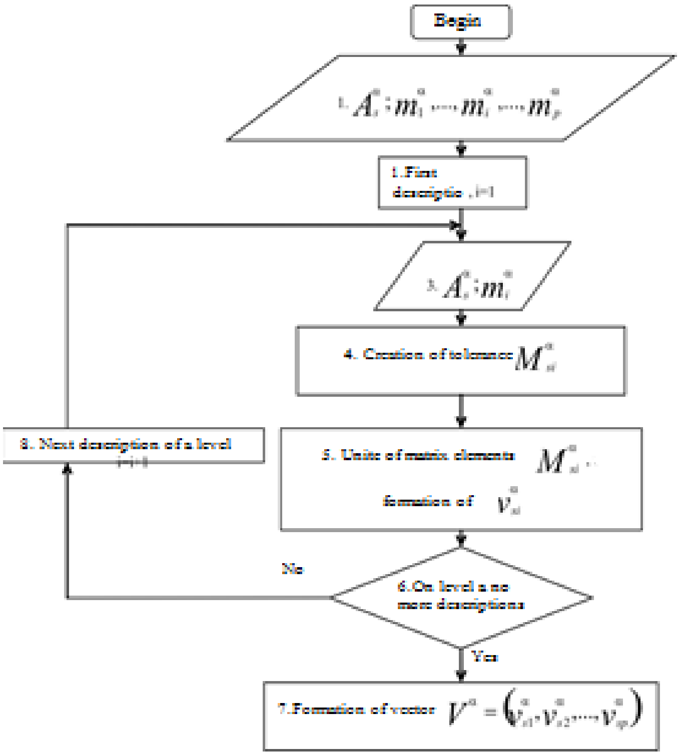
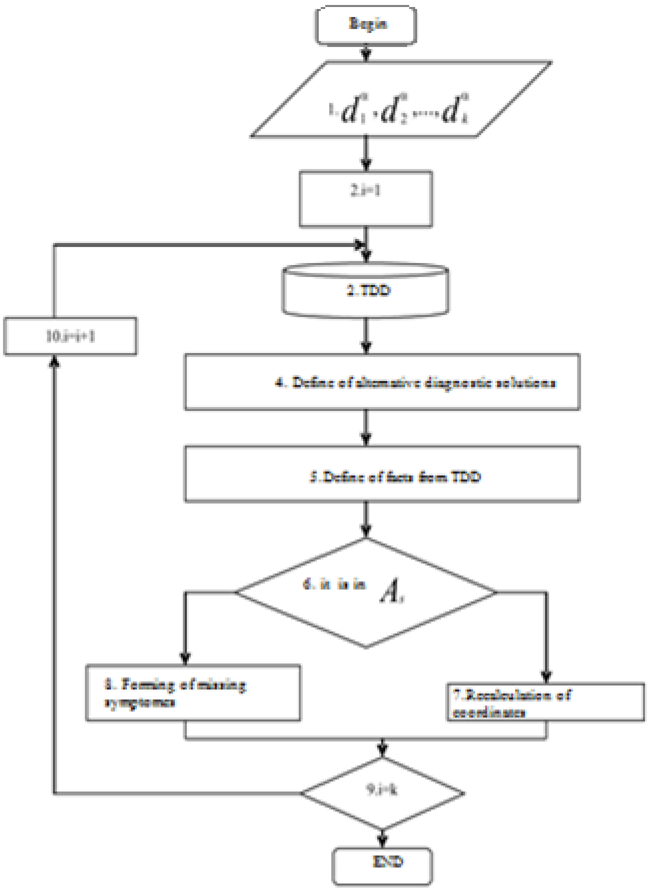


Fig.7. Comparison algorithm on the active level of descriptions A_s



Block 8 "Differential diagnosis solutions" algorithm of the user group "dentist" can be represented in the form (Fig. 8.). In block 1 is used to enter the micro-level diagnostic solutions.

In block 2 is selected first diagnostic solution. In block 3 made reference to the table of differential diagnosis of the knowledge base. alternative for tackling other diagnostic solutions are defined in section 4. In block 5 selects all the facts that share descriptions of active diagnostic solutions and alternatives. In block 6 checks for certain symptomatic facts in describing the initial microsituations. If there is symptomatic these facts, the conversion unit 7 is carried coordinates. The unit 8 is carried out forming a plurality of missing symptomatic facts.

In the absence thereof, in unit 9 checks whether there is another diagnostic solutions for the differential diagnosis. In block 10, the diagnostic algorithm can form solutions.

Fig.8. The algorithm of differential diagnostics of decisions

Submit a detailed block 10 by the following algorithm (Fig. 9.) in block 1 is used to enter all the received diagnostic solutions. In the case of the presence of more than one diagnostic solution proceeds to block 3, where available diagnostic solutions combined into a complex diagnostic solution. Otherwise a transition to the block 5. In block 6, the user moves to the "expert in the diagnosis" to additional training system. At box 7, considering the data of the previous block is carried on the diagnostic decisions forming the active layer. In block 8 moves to the next level. In block 9 checked the level corresponding to the active. If the active level - micro then proceeds to block 10 where the output of the tuple is carried out diagnostic solutions.

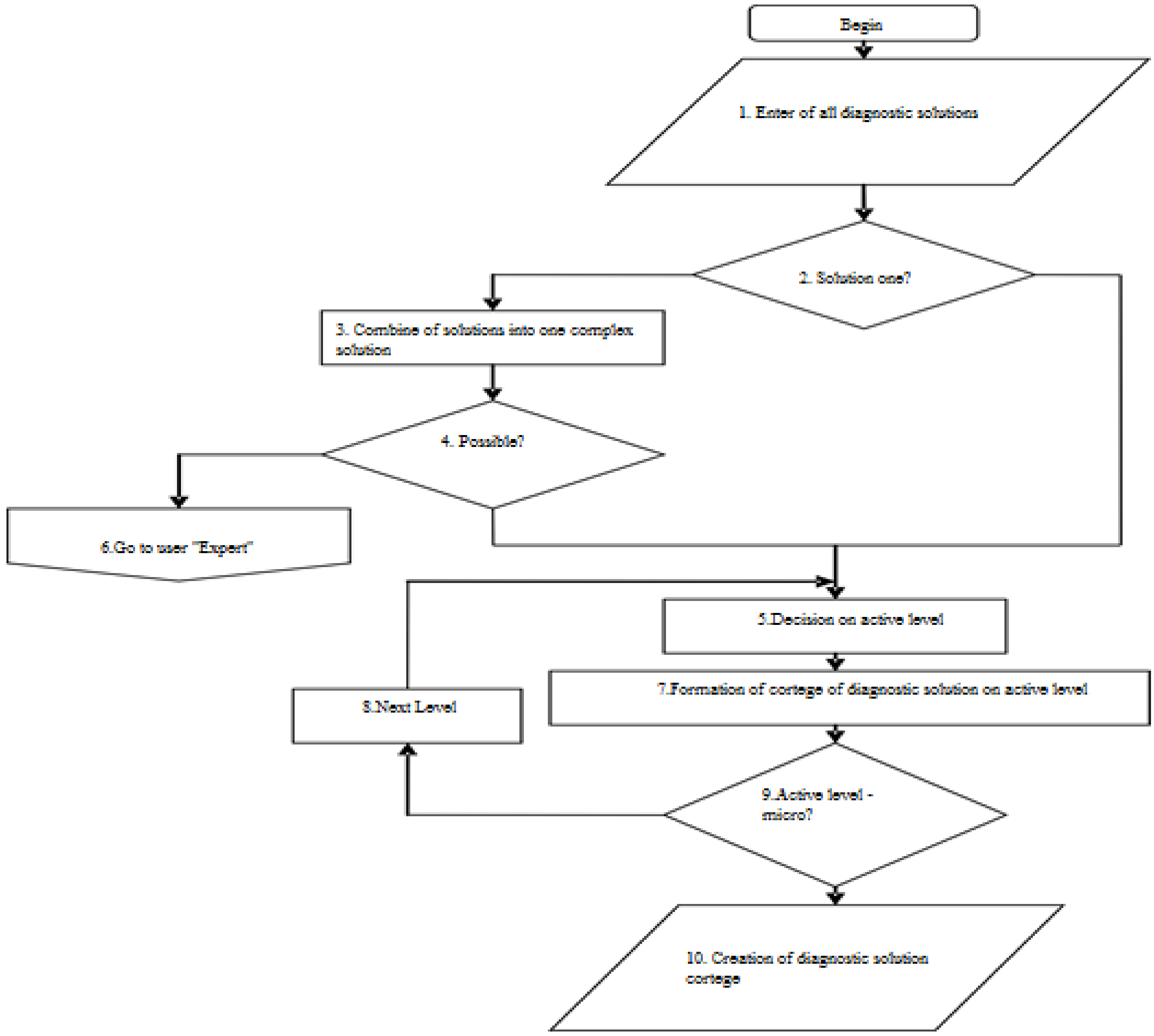


Fig.9. The algorithm of the formation of diagnostic solutions

In block 15, the user of the algorithm - "the dentist" made a table explaining the formation of diagnostic solutions.

This unit will present the following algorithm (Fig. 10). In block 1 is used to enter the level of explanations and diagnoses, which are to be explained. In block 2 checks for more than one diagnosis. In the case of the presence of a diagnosis to be an explanation (unit 3), defined by symptomatic generalized facts to the active level.

Next in block 4 are output of the facts as an explanation for the decision in a sequence specific measures of tolerance. In the case of the presence of more than one diagnosis to be an explanation in Block 5, we construct a table explaining the decision. In block 6 are output table with symptomatic facts explaining diagnostic solutions

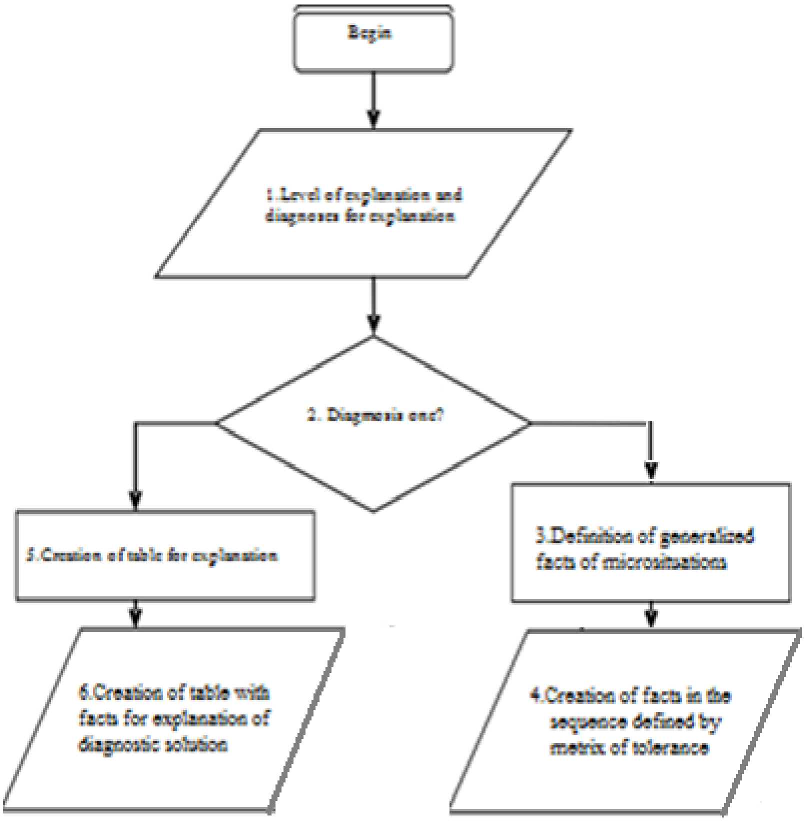


Fig.10. Algorithm of decision explanation process

3. Conclusion

On the bases on all above mentioned questions it is possible to make conclusion that for proper work of expert system in stomatology it is very important to develop correct algorithms for a sequence of output of diagnostic decision, differential diagnosis and an explanation of diagnostic solutions.

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АЛГОРИТМЫ РАБОТЫ ЭКСПЕРТНОЙ СИСТЕМЫ ДИАГНОСТИКИ ЗАБОЛЕВАНИЙ ЧЕЛЮСТНО-ЛИЦЕВОЙ ОБЛАСТИ

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Резюме

Использование экспертных систем в диагностике заболеваний челюстно-лицевой области (ЧЛО) в последние годы становится все более актуальным. Трудности, возникающие при создании подобных интеллектуальных систем диагностики, обусловлены не только тем, что клинические знания в области диагностики заболеваний ЧЛО сложно систематизировать. Отсутствие конкретного методологического подхода в диагностике, размытость границ описаний симптоматологической картины заболеваний приводит к неоднозначному и под час противоречивому описанию клинической картины патологического состояния пациента. Постановка точного диагноза на основе изучения необходимых в процессе диагностики симптомов и проявлений заболеваний в ЧЛО, способность проведения дифференциального диагноза с похожими заболеваниями и использование клинических знаний, заложенных в базу знаний системы, значительно облегчит деятельность специалиста-стоматолога. В данной работе предлагаются алгоритмы работы экспертной системы для диагностики заболеваний челюстно-лицевой области.

ყბა-სახის დაავადებათა დიაგნოსტიკის ექსპერტული სისტემის მუშაობის ალგორითმები

სერგო მანუკოვი, მიხეილ მანუკოვი, მედეა თევდორაძე
საქართველოს ტექნიკური უნივერსიტეტი

რეზიუმე

ექსპერტული სისტემების გამოყენება ყბა-სახის დაავადებათა დიაგნოსტიკაში ბოლო წლებში ხდება სულ უფრო აქტუალური. სირთულეები, რომლებიც წარმოიშვება მსგავსი ინტელექტუა-ლური სისტემების შექმნის დროს განპირობებულია არა მარტო იმით, რომ ამ სფეროს კლინიკური ცოდნის სისტემატიზაცია რთულია. არ არსებობს კონკრეტული მეთოდოლოგიური მიდგომა დიაგნოსტირებისადმი, არა მკაფიოა დაავადების სიმტომატური სურათის საზღვრები, რასაც მივყევართ პაციენტის პათოლოგიური მდგომარეობის კლინიკური სურათის არაერთგვაროვან და ხშირად ურთიერთ საპირისპირო აღწერასთან. ზუსტი დიაგნოზის დასმა სიმპტომების დ დაავადების გამოვლენების შესწავლის საფუძველზე, დიფერენციალური დიაგნოსტირების ჩატარების შესაძლებლობა და კლინიკური ცოდნის გამოყენების შესაძლებლობა, რომლებიც მოთავსებულია სისტემის ცოდნის ბაზაში, ამარტივებს სტომატოლოგის საქმიანობას. მოცემულ ნაშრომში წარმოდგენილია ექსპერტული სისტემის მუშაობის ალგორითმები ყბა-სახის დაავდებათა დიაგნოსტირებისათვის.