Proceedings of the International Workshop on Intelligent Information Systems
IIS'2011, September 13-14, 2011, Chisinau, Republic of Moldova

Decision Support System for Ultrasound Diagnostics SonaRes. Report Generation

Irina Frinea

Abstract: In this paper the problem of report generator development for investigations carried out using decision support systems is addressed.
Keywords: decision support system, investigation report.

1 Introduction

Area of application of the decision support systems (DSS) is large. Anywhere in the human activity a decision is required as a result of analysis of concrete situations. Environment and environmental impact assessment, agriculture, forestry, manufacturing, business and organizations, infrastructure, medicine – these are just few areas, where DSS are applied successfully.

Clinical Decision Support System (CDSS) is an interactive DSS, designed to assist physicians and other professionals in health domain with decision making tasks such as performing patient diagnostics. The success of a CDSS depends on: integration in clinical workflow; providing assistance in decision making in the appropriate time at the place of patient care; guidance for the treatment, not just.

2 The Decision Support System Ultrasound Diagnostics for SonaRes

Ultrasound is an imaging method of investigation, images are obtained in real time, making possible to visualize the internal organs structure and their movement.

Ultrasound proved to be one of the paraclinical investigations easy to use, being of non-invasive character and extremely effective. It is accurate in its area of application and is easily performed by a well trained specialist. However the ultrasound has some limitations like any other procedure. These limitations are often expressed through images false –

positive or false – negative, sometimes are conditioned by the limited capacity of the physician – examinator to obtain qualitative images or to interpret them.

The SonaRes system aims to assist the doctor in quick and accurate information about a pathology / anomaly specific to examined organ, diminishing operator dependence and increasing level of the patient diagnostics and appropriate treatment [1].

3 Components of the SonaRes System

SonaRes combines both main approaches used in the development of DSS, related to medical imaging: knowledge – based systems and systems based on image processing and classification.

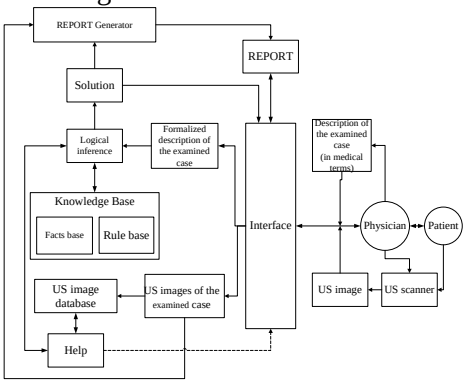

Figure 1. Components of the SonaRes system.

A joint approach includes [2]: systemic medical description of organ pathologies and anomalies; knowledge acquisition methods based on characteristics, specific for ultrasound examination; knowledge base; tool for validation of rules; database of annotated ultrasound images; algorithms for fast search in the database; adaptive and ergonomic interface; report generator.

Diagnostics is the main scope of the CDSS, being the most difficult task in the current medical activities [3]. To obtain a correct diagnosis it is necessary information collection, analysis, communication, refinement, and completion. Although the manifested national will for error reduction in medicine is focused on necessity of computer medical applications, there is only one element of this process considered by physicians as

beneficial – information. Indeed, providing complete medical information and organizing of the report system are easier to implement and to adopt by health care workers than other priorities of the systems [4].

Any consultation is finalized with a document where a section is assigned for results of each group of factors that characterize the patient. This document is called ultrasound report and serves as a report of examination, which should contain specific information about the patient over time, which will allow the physician to have the correct view on trends, and developments in health progress and sources of patient problems, as well as treatment recommendations.

4 Report Generator

In fact, the report generator performs the system function of the SonaRes DSS to present of the ultrasound report.

An ultrasound report should contain:

- *Information about the patient:* patient name, surname, age, gender, etc.;
- *Examined organ description* depending on the examined organ the structure of ultrasound report may change. As an example, we need the following information for gallbladder: gallbladder location (typical, atypical), size (normal, increased, decreased), shape (normal, deformed), tonicity (normal, hypotonic, atonic), etc. which can be detailed below;
- *Examination conclusion.* Initial the conclusion field is filled automatically by the system with information obtained from the logical inference module. Then the physician has possibility to modify the content of this field;
- *Observation* allows the physician to make some reminders (notes) that need to draw his attention at the next examination.

Ultrasound report is generated automatically by the system and is structured according to a predetermined pattern. The physician has possibility to interfere in replacing some words, phrases generated by the system by synonyms or other formulations he needs. The final report is signed by the physician who assumes responsibility for all data and recommendations contained in the report.

Ultrasound investigation procedure using the SonaRes system is similar on to common practice. It allows to choose the type of investigation in dependence of: physician experience or preferences, investigation scope, investigation conditions.

As a result of patient ultrasound investigation the physician gets an image (or a set of images) and formulates a description of the case in medical terms. Then graphic information is processed and stored in the ultrasound images database the SonaRes system. The case description is formalized and sent to the logical inference module. Basing on the formalized knowledge and decision rules, the SonaRes system generates solution appropriate to the examined case. The generated solution and image(s) corresponding to the case are transmitted to report generator. As a result, we obtain the ultrasound examination report, which meets the following requirements: representation is standardized; is clear; is stored in an accessible format; allows printing in a format preferred by the user; offers possibility of content supplementing (in the conclusion and observation fields); interoperability with other systems.

5 Conclusion

The report generated by the SonaRes system contains conclusions and observations on pathologies and anomalies detected. An important part of the ultrasound report is conclusion obtained basing on facts, observed during the examination process.

References

[1] S. Cojocaru, C. Gaindric. *Decision support system in ultrasound investigation.* Proceedings XIII-th International conference KDS, ITHEA, Sofia, v.1 (2007), pp. 241-246.

[2] L. Burtseva, S. Cojocaru, C. Gaindric, E. Jantuan, O. Popcova, I. Secrieru, D. Sologub. *SONARES – A decision support system in ultrasound investigations*. Computer Science Journal of Moldova, no. 2(44), vol. 15 (2007), pp. 153-177.

[3] M. Novac. *Sisteme-Multiexpert medicale*. Sfântul Ierarh Nicolae (2010).

[4] William Bria. *Phase of Clinical Decision Support*. http://mthink.com/content/integrated-results-reporting-information-system-first-phase-clinical-decision-support.

Irina Frinea

Institute of Mathematics and Computer Science of the Academy of Sciences of Moldova, E-mail: irina.frinea@math.md