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DECISION INFORMATION SYSTEM

Peter L. Stanchev, Elen K. Stancheva, Kaloian T. Kaloianov

The present paper is devoted to the description of a Decision Information System (DIS), developed for the purposes of two systems: Medical Diagnosis Program System and Decision Support Program System, and is decision making problems oriented. DIS is written in FORTRAN IV and runs on the Bulgarian "BK" microcomputers.

1. INTRODUCTION. Commonly speaking, a medical decision [1], [2], [8], is the result of a comparison of the information derived from the numerous indicators gathered on the patient and the information accumulated as medical knowledge.

When it is computer - aided, the medical decision implies the utilization of an information system, which automates the collection, maintenance and usage of the following two types of information: (1) large numbers of patient records in which every solved medical case is described as an ordered set or vector of elements of evidence, and (2) the "medical knowledge" aggregated and permanently updated from the new records.

Harbouring an extensive, documented records of health states, clinical decisions and their results, such an information system can assist the physician in several ways:

- a) to suggest diagnosis, treatment, etc., in situations with which the physician may not be fully familiar;
- b) to verify diagnosis, prognosis, therapy, etc. in situations in which the physician is uncertain;
- c) to amplify the clinician's reasoning and conclusions by bringing to his attention relevant considerations, experiences, etc.;
- d) to simulate possible effects of contemplated decisions;
- e) to assist in student education;
- f) to carry out different kinds of clinical research.

The Decision Information System - DIS, described in the present paper

is a part of a Medical Diagnosis Program System (MDPS) [5], [6], and was developed to fulfil the needs of information, as far as decision making problems are concerned. DIS does not consider other health care problems, as administrative, organizational, etc.

There exist great many information systems in the field of Medicine, with different conception and implementation, with different aids. There are integral hospital information systems [3], there are decision information systems [4], there are fuzzy knowledge information systems [9], etc.

DIS does not resemble some of the known decision information systems, because it is developed to work with systems MLPS [5] and LSPS [7] which are specifically developed themselves.

2. DIS DATA. The DIS elementary data could be: (a) fixed value: integer or real numerical or alphanumeric; b) interval value - a pair of two fixed values (presenting bounds of a closed interval).

The data are kept in files with equal structure. Every file could contain:

(1) patients' data - results from subjective and objective examinations of the patient - questioning of the patient, physical check-ups, blood tests, electrical tests and images, etc. We will call them diagnostic parameters, as well. The patients' data are identifiable by the patient's name;

(2) medical knowledge - results from accumulated medical experience in particular class of diseases. The medical knowledge is identifiable by the name of the disease class.

The information is kept as matrices with rows: values characterizing the fluctuation of every diagnostic parameter for the particular disease from the class, or the values of the diagnostic parameters for a particular patient; and columns: values characterizing the fluctuation of a certain diagnostic parameter for every disease from the class, or the values of a certain diagnostic parameter for all the patients from the group. The value in both cases are from the upper mentioned types - fixed or interval.

The following denotations will be used for both cases:

	dp_1	dp_2	...	dp_m	
obj_1	v_{11}	v_{12}	...	v_{1m}	δ_1
obj_2	v_{21}	v_{22}	...	v_{2m}	δ_2
	\vdots	\vdots		\vdots	\vdots
obj_n	v_{n1}	v_{n2}	...	v_{nm}	δ_n

dp_1, dp_2, \dots, dp_m - diagnostic parameters;

$obj_1, obj_2, \dots, obj_n$ - diseases or patients' names;

v_{ij} ($i=1,2,\dots,n; j=1,2,\dots,m$) -

values characterizing the fluctuation of the j -th diagnostic parameter for i -th disease, or the value of the j -th diagnostic parameter for the i -th patient from the population;

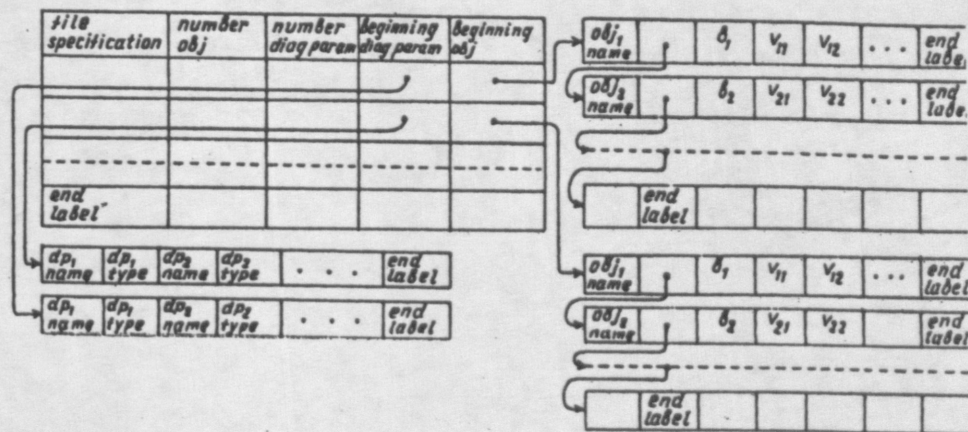
b_i ($i=1,2,\dots,n$) - number of patients' data included in the calculation of v_{ij} ($i=1,2,\dots,n; j=1,2,\dots,m$).

3. PHYSICAL ORGANIZATION OF DIS DATA. DIS supports files represented in linearly linked lists. The physical organization of the data is illustrated in Fig. 1. Every v_{ij} value occupies one or two fields, with different length according to the data type.

4. DIS DATA MANIPULATION LANGUAGE. There are two types DIS calls: (1) with the help of commands - interactively the system itself asks for, and accepts the values of the parameters; (2) by means of other systems calls to DIS subroutines.

The DIS commands with their parameters and functions are:

Fig. 1



ADD <file specification> concatenates files

<file specification>

[<,file specification>...] ;

ALL { <NDPS> transfers the control to one of the systems
 { <LP> } ;
 { <DSPS> }

CREATE <file specification> creates a file

<number diag param>

(<dp₁ name> ,<dp₁ type>)

[, (<dp₂ name> ,<dp₂ type>)...] ;

(<obj₁ name> <b₁> <v₁₁> [, <v₁₂> ...])

[; (<obj₂ name> <b₂> <v₂₁> [, <v₂₂> ...])

...] ;

ELDP <file specification> deletes dp_j values

<dp_j name > ; in the file

ELF <file specification> ; deletes the file

ELOBJ <file specification> ; deletes obj_j values

<obj_j name > ; in the file

IRECTORY ; shows the names of

the files, the number

of diag. param. and obj

initially prepares

file spaces

NSERT <file specification> adds a new object to

(<obj_j name> <b_j> <v_{j1}> [<v_{j2}> ...]) a file

[; (<obj_{j+1} name> <b_{j+1}> <v_{j+11}>

[, <v_{j+12}> ...]) ...] ;

NOWLEDGE <file specification> <obj_{j1} name> adds patients' data

<file specification> <obj_{j2} name> , obj_{j2} to obj_{j1} of a

medical knowledge

LECT <file specification> selects objects

{ <number> } according to the lo-

{ <list> } <logical condition> ; gical condition

; disactivates the sys-

tem

TYPE <file specification> extracts and types t

[<dp_{j1} name> [, <dp_{j2} name> ...]] ; wanted information

[<obj_{j1} name> [, <obj_{j2} name> ...]] ;

UPDATE <file specification> sets a new v_{ij} value

<obj_j name> <dp_j name> <v_{ij}> ;

Some of the applied denotations need more explanation:

- (1) <file specification> -the name of the file,
- <number> -a number is to be typed,
- <list> -a list is to be typed
- <NDPS> -Medical Diagnosis Program System [5]
- <LP> -Linguistic Processor [7]
- <DSPS> -Decision Support Program System [7]
- <logical condition> -is (<arg> <log oper>) [, <arg> <log oper>) ...] , where :
- <arg>
- | | |
|--|-----------|
| -is { <dp _j > } <comparison oper> | numerical |
| { <obj _j > } | constant |
| | alphanu- |
| | merical |
| | constant |
- <comparison oper>
- LT., .GT., .LE., .GE., .EQ
- .NE., .BE., .NB., where :
- BE. - belongs to the interval
- .NB. - doesn't belong to the interval
- .AND., .OR., .NOT., .END.,
- where
- .END. - end of a logical expression;

(2) When data are replaced from one file to another, their type is converted to the type of the correspondent data in the second file;

(3) Some commands, dealing with alphanumerical data gather additional information with the help of questions.

5. AN EXAMPLE. The example developed as an illustration of the DIS functioning is presented in Appendix 1. It performs the following functions: creates a file named CHILD. DAT with medical knowledge for infantile disorders creates a single record file with data for one patient, named NAME. DAT; adds

patient data to the medical knowledge of infantile disorders; types all the information from the CHILDE. DAT file; selects all the records from CHILDE. DAT file which fulfil the following logical condition: temperature greater than, or equal to 39°C and leucocytes less than or equal to 10 thousand and age in the range of 15 to 20 years.

6. REALIZATION. The first version of the DIS was developed just to explore the effectiveness of such information system with the described features. The presently developed version includes some conceptual and practical changes. Problems as data protection, data confidentiality of Medical data, etc. are not considered still.

The system is written in FORTRAN IV and runs on Bk microcomputers.

7. CONCLUSION. The DIS system was developed to support decision making process. That is why, it is entirely applicable to the LSIS [7], which is a general purpose decision support system. All the described in the article concepts could be referred to LSIS only by the following conventions:

- patients' data - experts' opinion;
- medical knowledge matrix - decision matrix;
- diagnostic parameters - alternatives or criteria;
- objects - objects.

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ИНФОРМАЦИОННА СИСТЕМА КЪМ СИСТЕМА ЗА ВЗЕМАНЕ НА РЕШЕНИЯ

Петър Л. Станчев, Елен К. Станчева, Калоян Т. Калоянов

Постоящата статия описва информационната система DIS, създадена за дите на две съществуващи програмни системи - Система за медицинска диагностика (MDPS) и Система за вземане на решения (DSPS). Информационната система е ориентирана към проблеми за вземане на решения. DIS е написана езика ФОРТРАН IV и е предназначена за българските микрокомпютри БК.

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