Support system for breast cancer treatment

SNEZANA ADZEMOVIC

Civil Hospital of Cacak, Cara Lazara bb, 32000 Cacak, SERBIA

Abstract: The aim of this paper is to seek out optimal relation between diagnostic and therapeutic methods for breast cancer treatment. Bone metastases cause significant morbidity due to pain, pathological fracture, hypercalcaemia and spinal cord compression, as well as contributing to mortality. The pathophysiology of bone metastases includes increased bone turnover, imbalance and uncoupling of the processes of resorption and remodelling. This paper presents information support system, expert system for breast cancer diagnosis and treatment.

Keywords: Breast, cancer, diagnosis, therapy, characterization, criteria.

1 Introduction

Randomized controlled trials in women with either early breast cancer or advanced breast cancer comparing: treatment with a drug with the same treatment without a drug, and treatment with one drug with treatment with a different drugs. Breast cancer bone metastases are predominantly osteolytic or mixed osteolytic and osteoblastic, with only a small proportion being osteoblastic alone. Studies including at least one of the following outcome were considered for evaluation skeletal events, quality of life, bone pain, and survival.

The primary outcomes was the number of skeletal events defined as any one of the following events: new bone metastases, pathological fractures, spinal cord compression, irradiation of or surgery on bone, the development or progression of bone pain.

The secondary outcomes were time to a skeletal event, overall survival, quality of life, hypercalcemia, adverse, drug related events, extraskeletal recurrence or progression of breast cancer. Subgroup analyses included, where possible, comparisons of subgroups according to age, previous or concomitant chemotherapy, previous or concurrent endocrine therapy, menopausal status, the presence of skeletal disease.

Until recently, the management of symptomatic bone disease was depended on analgetics, radiotherapy, endocrine therapy, and chemotherapy. Despite these frequently effective treatments, progressive skeletal destruction often leads to ongoing symptoms and deterioration of quality of life.

From an expert system expect to act an intelligent assistant in some task, or to solve an important problem that would otherwise have to be solved by a human expert. However, as the field has developed, it has come to expect more. Because the expert knowledge that people have, may change with time, it would like an expert system to be flexible in integrating new knowledge incrementally, into in existing store of knowledge. Indeed, increasingly expect an expert system to assist in the transfer of knowledge. This knowledge may be declarative about the nature of a task or procedural about how to do task.

2 Selection criteria

The framework used in modelling of one type of medical systems, structural therapeutical system can be depicted as a sequence of steps shown in
It can be indicated two possible approaches to complex breast cancer system modelling. The first, identified with structural knowledge, follows a deductive reasoning approach in which one tries to deduce from an existing theory model relationships for a given problem. The second, identified with a posterior empirical knowledge, follows an inductive approach in which one tries to develop a model from the sampled data. Ideally, these two approaches act as complementary stages of the modelling process. One follows all six steps with model calibration and model validation serving as an empirical test bed for a prior model as a learning tool. Yet, in some situations characterized by difficulties in obtaining empirical data due to a budget and time constraints or preliminary scope of the analysis, the model specification may be reduced to the a priori stage.

In the traditional view of modelling the behavior of natural system these six steps, although logically connected, comprise separate tasks. Therefore, the development of an operational medical therapy structure model is a rather lengthy and expensive undertaking. There is a strong need for a more integrated framework for modelling of medical system in general that would better link the steps leading to model development and implementation. In this paper, it was demonstrated how modelling and knowledge based simulation can integrate steps required to model medical structure of breast cancer. This work motivated by the need to provide a more flexible than existing approaches modelling framework for simulating changes in therapy structure in particular, and for predicting the behavior of breast cancer systems in general. For the application domain, system simulation has been selected chemotherapy, radiotherapy or concurrent, generaly.

Yet, despite the well structured domain, the specification of an operational model for prediction of changes can not be considered a simple and quick undertaking. It still requires a considerable amount of human expertise and other resources. Therefore it is important to provide an integrated modelling framework which would help a modeler reduce time and effort required to specify an operational model pertinent to a problem at hand.

3 Data and knowledge acquisition
Knowledge based system must represents information abstractly so that it can be stored and manipulated effectively. Although experts have difficulty formulating their knowledge explicitly as rules and other abstractions (Fig.1). They find it easy to demonstrate their expertise in specific performance situations. Schemes for learning abstract representations, or concepts, from examples to interact directly with systems to transfer their knowledge.

Fig.1 Knowledge and data collection

Expert systems can be used to develop rules, based models and augment other types of models. Since can capture the experience, of experts, they can be used to forecast problems, advice, operators, validate data and ensure that the results from other are reasonable.

A functional approach to designing expert simulation systems was proposed many authors. They chose the differential games models is described using semantic networks. The model generation methodology is a blend of several problem solving paradigms, and the hierarchical
dynamic goal system construction serve as the basis for model generation. Discrete event approach, based on the geometry of the games, can obtain the solution generally in much shorter time. Cooperation between systems is achieved through a goal hierarchy.

Many expert systems have been introduced in such areas as medical diagnosis, chemical and biological reaction synthesis, pharmaceutical manufacturing, mineral and oil exploration, circuit analysis and equipment fault diagnosis.

These expert systems have emphasized the development of the knowledge acquisition process, the knowledge base, the inference procedure or control structure and maintaining the independence of each of these functions. Many days, computers have been widely used in simulation, but the use has been limited almost exclusively to purely algorithmic solutions. Many engineering problems are partial structured problems that deal with the non-numeric information and non-algorithmic procedure, and suitable for the application of artificial intelligence techniques. Expert systems provide programming methodology for solving non-structured problems which are difficult to be handled by purely algorithmic methods. The experience from building expert systems has shown that their power is most apparent when the considered problem is sufficiently complex.

In simulation, both qualitative and quantitative analysis are often applied together. Usually, qualitative decision efficiently made with symbolic and graphic information, and quantitative analysis is more conveniently performed by numerical information. Both methods often complement each other. Any numerical solution is only an approximation to the true solution, which is always represented analytically. Analytical solutions can only be obtained by symbolic processing.

4 System entity structure

Multifaceted methodology denotes a modelling approach which recognizes the existence of multiplicities of objectives and models in any simulation project. It provides formal representation schemes that support the modeler in organizing the model construction process, in aggregating partial models, and in specifying simulation experiments. Modelling objectives drive three fundamental processes in the methodology; they facilitate the representation of model’s structure, retrieval, and manipulation of structures, the specification of model’s behavior, and the specification of experimental conditions under which models are evaluated by a simulation study.

As a step toward a complete knowledge representation scheme for modeling support, it has combined the decomposition, taxonomic and coupling relationships in a knowledge representation scheme called the system entity structure. Previous works identified the need for representing the structure and behavior of systems, in a declarative scheme related to frame theoretical and object based formalisms. The elements represented are motivated, on the one hand, by system theory concepts of decomposition, how a system is hierarchically broken down into components and coupling how these components may be interconnected to reconstitute the original system. On the other hand, systems theory has not focused on taxonomic relations, as represented for example in frame hierarchy knowledge representation schemes. In the system entity structure scheme, such representation concerns the admissible variants of components in decompositions and the further specializations of such variants.

A system entity structure is a labeled tree. Nodes of the tree are classified as entities, aspects, specializations, and multiple decompositions. Variables can be attached to nodes. They are called attached variables types. An entity signifies a conceptual part of the system being represented by the entity structure. An aspect is a mode of decomposing an entity.
Fig. 2  Breast cancer system therapy
A specialization is a mode of classifying an entity. An entity may have several specializations or decompositions, each specialization may have several entities. The original entity is called a general type relative to the entities of a specialization. The entities of a specialization are called specialized types. Since each entity may have several specializations, a hierarchical structure called taxonomy results. A multiple decompositions is a means of representing varying number of entities. An attached variable type is an attribute of an object represented by the entity with which the variable type is associated.

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5 An expert system for breast cancer treatment

Breast cancer is the most common cancer and the most common cause cancer death in women worldwide.

Randomized controlled trials were identified and evaluating skeletal events in women with metastatic breast cancer and early breast cancer. Data were extracted from the published papers.

6 Conclusion

In this paper an expert system which assists to elicit, integration, structuring and transfer knowledge about breast cancer diagnosis and therapy was developed. The paper presents information support system, for breast cancer diagnosis and treatment. The problem at hand is a problem of diagnosis, in which a major part of the solution consists of informing the patient about the disease category.

The obtained results in the frame of this investigation show clinical information processing.

The results of this investigation can be applied in the other domain.

7 References


