

Decision Support for Post-Operative Breast Cancer Care

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Our project on decision support for post-operative breast cancer care raises a number of interdisciplinary questions in a complex and emotive area. The project is a collaboration between computer scientists, statisticians and clinicians which itself a complex arrangement. The nature of the subject involves life-threatening decisions. Clinicians and patients are faced with the most difficult decisions. From an HCI viewpoint we are also faced with supporting and not supplanting clinician's judgments. In addition the introduction of any new computer system would have to be undertaken under the terms of a clinical trial. There are also wider issues of the implications of our studies of historical clinical data and what that might mean for future approaches to prognosis.

Decisions on post-operative breast cancer treatment are currently guided by a set of NICE guidelines (National Institute for Clinical Evidence). The clinician uses available data with a staging method to put the patient into a risk category as suggested by the guidelines. The risk category is then used to determine the type of treatment that the patient would be offered. The aim of our project is three-fold; firstly to understand and support the clinician's decision making process within the NICE guidelines; secondly, to analyze historical data of breast cancer care to produce new rules for treatment choice. The third aim is to bring these two processes together so that treatment decisions can be guided by an evidence-based computer system.

The evidence-based approach to the delivery of medical care has gained wide recognition within the healthcare community, advocating that decision-making should use current knowledge and clinical evidence from systematic research. In breast cancer care, there are currently a few staging methods in widespread use by clinicians, namely the Nottingham and Manchester staging systems. However, there is no standard method to support oncologists' decision-making processes as to how and when to include new evidence, and how to validate emerging local patient data patterns or other models and practices from elsewhere. In a multi-disciplinary project settings involving; clinicians, statisticians, computer scientists and public health specialists, our project has started by understanding the current decision-making practices as a prelude to systems' implementations. This will be evaluated using a set of small-scale controlled trials involving both patients and clinicians. The proposed method, unlike traditional decision-making techniques, including multi-criteria, will provide breast cancer clinicians and patients with a flexible decision framework adaptive to their decision practices. It will also allow

for evolutions of decision models, decision resources (data) and users concerns. This novel approach will provide important insights into the development of an integrated decision support infrastructure for high assurance decision activities. Which will directly contribute to one of the NHS R&D high-priority area of Medical Devices Directives for cancer patient care.

Clinicians currently decide on treatment choices by using a staging model such as the Nottingham Prognostic Index (NPI). This uses data, such as, the fitness of the patient, the size of the tumor, whether they are pre- or post menopausal and other histological data. We have used this index to produce a simple rule-based system. However, the decision-making process is not as simple as the number of rules suggests. Firstly the data available to the clinician maybe incomplete, meaning that the clinician has to make their own judgment in making a decision branch. Secondly, there maybe a range of suggested treatments from this stage of the decision-making process. For example, different treatments may offer different levels of quality of life versus survivability, and these trade-offs have to be discussed between the clinician and patient. Currently, however, there is no systematic way for clinicians to answer complex “What-If?” questions about treatment choices at this stage. This is where the second main aim of our project comes into play. We are analyzing historical patient data to see if an artificial neural networks (ANN) categorization of patients (using NPI data) agree with the staging classification, i.e. was the patient put in the appropriate risk category for the chosen treatment? In theory this should give us a two-pronged approach to tackling the complexity of the “What if?” questions? Firstly the rule-based system gives a narrower range of possible treatments and secondly the ANN approach provides an evidence base against which to ask the “What if?” questions. The ANN approach may also lead to new sets of rules which mean that missing data can be filled in at the top of the decision tree.

In practice however this is just the beginning of our ethical considerations. Which data set do we use to support our decision system? The NICE guidelines are reviewed every five years so is historical data valid if prognostic indices change? Do data sets from different institutions agree? Do different methods of analysing the data (ANN vs. rule induction) agree? We hope to go some way towards answering these questions during our project.

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