Predicting post-radiotherapy outcomes for prostate patients using artificial neural networks.

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Radiotherapy is a common treatment used in the management of many types of cancer. Each patient who receives this treatment has an individualized treatment plan devised by a team including clinicians and physicists, and based on knowledge that has been accumulated over many years. The fundamental consideration is what will the outcome be for the patient. Will it stop the tumor from growing? How will it affect the parts of the body that are unavoidably irradiated?

A number of model-based methods have been developed to correlate the radiation dose distribution calculated for a patient receiving radiotherapy to the effect this will have. The work presented here considers an alternative method for predicting specific responses for patients treated for prostate carcinoma using an artificial neural network (ANN). ANNs are computational models of the way that the brain learns. Examples of known input-output pairs are used to train the network to learn how the two are related. Once the relationship has been learned, it is possible for an ANN to quickly predict results for new cases. This allows the knowledge built up about the response to treatment of previous patients to be used to predict the results for the future patients. The results presented predict tumor control defined using prostate specific antigen measurements and also bladder and rectal side effects.

Although the results are modest in terms of the successful prediction of outcome for groups of test cases with 66% predicted correctly for tumor control and 62% for side effects it was possible to analysis the workings of the ANNs to highlight input information which was instrumental in making the decision. Improvements in the amount of data available to train the ANN should lead to an improvement in the accuracy of the predictions.