

The objective of radiation therapy is the delivery of a lethal dose of ionizing radiation to a tumor while minimizing the damage to the surrounding healthy tissues. Precise radiation field placement is required for curing cancer, particularly with the advent of conformal therapy techniques. Since 1991, our cancer treatment centre has made clinical use of a BEAMVIEW system for on-line portal imaging. Extensive off-line analysis of recorded electronic portal images has shown that subjective on-line evaluation results in only major and obvious localization errors being detected. Furthermore, only a small sample of electronic treatment portals can be reviewed by radiation oncologists. In the present study we examine the use of artificial neural networks (ANN) and of the k-nearest neighbor (kNN) method in determining whether or not a particular treatment would be acceptable as evaluated by an oncologist. A collection of 328 portal images were anatomically registered with their diagnostic x-ray counterparts acquired during simulation, and treatment field placement was then evaluated, on a scale from 1 to 10, by an oncologist. A score of 5 and above was deemed acceptable. Quantitative measurements of field placement errors provided inputs to the ANN and kNN algorithms. Both methods reproduced the oncologist's scoring very well: the kNN method gave a correlation factor of 0.87 with 3 false negatives and 30 false positives whereas the ANN technique gave a correlation factor of 0.78 with no false negatives and 18 false positives. These results indicate the feasibility of on-line automated expert evaluation of portal images.