AbstractID: 6916 Title: Artificial Neural Networks Approach For Clinical Portal Dose Image Comparison

Purpose: This work uses Artificial Neural Networks (ANN) to compare measured portal images with their corresponding predicted images in order to determine the underlying problems causing any differences.

Materials and Methods: In external beam radiation therapy, a dose may be incorrectly administered to the patient due to patient set-up errors and/or treatment delivery errors. In this work we focus on incorrect dosage due solely to geometric patient set-up errors, consisting of in-plane rotation, out-of-plane rotation, two-dimensional translations, and magnification. Using an anthropomorphic pelvic phantom on a Varian Medical Systems linear accelerator with an aS1000 EPID, sets of images that emulate these errors were obtained. The angle (about the z axis) was varied from 0 ^{o} to ± 45 ^{o} in (2 ^{o} – 5 ^{o}) increments, and the translational distance was varied from 0 mm to ± 60 mm in (2 mm – 20 mm) increments. A two-layered, backpropagation ANN unit was created with 10 neurons in the hidden layer and 5 outputs. The difference images were analyzed using PCA and were input to the network, which was trained to classify the images according to their error types, and then tested for its robustness and generalization ability.

Results: Preliminary results demonstrate that ANN unit is capable of classifying clinical difference images that it has not seen before. It was found that the unit performed best when presented with images containing in-plane rotational errors.

Conclusions: A reduction in patient set-up errors is of paramount importance, since they can result in substantial dose reduction in the tumour and increase dose to the surrounding normal tissues. Preliminary results demonstrate that the ANN unit is adequate as an automatic tool for on-line verification of patient set-up errors. Modifications to the network architecture and a larger training set will hopefully improve the current results.