AbstractID: 1804 Title: Monte Carlo simulation of Bayes risk and Bayesian statistical decision theory in adaptive radiotherapy

In adaptive radiotherapy individual patient characteristics are measured during treatment and used in the refinement of the therapy. A widely studied application is the correction of systematic setup error and individualizing margins of treatment fields. The inter-fraction setup variations are measured for the patient. By applying decision theory based on the Bayesian statistical method we attempt to combine the information available in the prior population distribution seamlessly with the patient specific measurements to generate a posterior distribution pertinent to that particular patient. The systematic setup error and margin are not determined by estimated means and standard deviations but by minimizing estimated risk in remaining future treatments based on the posterior distribution. In the Monte Carlo simulation, patients with normally distributed setup errors are drawn from a gamma-normal distribution of their means and precisions (reciprocal of standard deviation). A risk function is defined according to the position of the treatment field boundary relative to the CTV boundary. They are then treated for a given number of treatments according to a choice of imaging protocols. At a given set of time points during the treatment course the posterior distribution is computed and Monte Carlo simulations of remaining fractions are performed to minimize the expected future risk by adjusting systematic setup error and margins. The cumulated risk of the sample of patients is recorded. Comparison of cumulated risk of simulations of different adaptive schemes and traditional weekly portal films will be presented. Supported by NIH grant number PO1CA59827.