

AbstractID: 1746 Title: Network-based models for Static Multi-Leaf Collimator Sequencing

We introduce a network-based model to solve the *multi-leaf collimator* (MLC) sequencing problem. The MLC sequencing problem has been shown to be *NP-hard*; hence, it is unlikely to be solvable in polynomial time. The heuristics currently used in practice are based on iteratively extracting apertures from a given intensity matrix in an *ad-hoc* manner. As a result, the apertures extracted might not satisfy all the constraints (such as, interleaf motion and tongue and groove constraints). In that case, the apertures are changed iteratively to find a solution which does not violate any constraints. Since the constraint violation is dealt with after the apertures are extracted and these two steps are not integrated, this could result in extracting very inefficient shapes. We present a network-based formulation to integrate the extraction process with constraint enforcement. We have also developed very efficient methods to perform the extraction process on these networks. This formulation can emulate most of the existing methods to solve the MLC sequencing problem and can also potentially improve them. Our formulation can thus serve as a unified platform to compare the different formulations in the literature. We also propose a novel method to extract the apertures. Our method outperforms the best reported method both in terms of beam-on-time and number of set-ups used. The run time of our algorithm is on the order of a fraction of a second.