Automatic Contouring Methods for Adaptive Radiotherapy in Cancer Patients Using Artificial Intelligence and a Virtual Mobile Robotic Assistant

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Contouring organs can be rigorous and time consuming. This problem is compounded by the fact that tumors morph and shift over time. The hypothesis of this project was that, using artificial intelligence and machine learning algorithms, a software agent can be coded using the Matrix Laboratory to perform automatic contouring in medical images of cancer. The program detects edges in an image and creates a region of interest (ROI) using the outermost edges as 2-D boundaries. A machine learning algorithm with an artificial neural network is trained using pre-contoured images. The pre-contoured images have a default ROI that is translated based on where the edges of the image the physician intends to contour are in comparison to the reference image. Using gradation detection, the program morphs the ROI to better fit the organ. We then utilize the Medical Consideration Function (MCF) to check the accuracy of the contour and adjust. The contour is 90% accurate using solely variables in the code. Adding in a few manual, one-time numerical adjustments nearly perfected the code. The program correctly contours images over 95% of the time and can contour an entire set of images in less than 5 minutes, depending on the number of organs necessary and the complexity of the image. This speed is nearly 300 times faster than a physician's manual contours. The software has already been implemented in research requiring an abundance of contoured images and is planned to be implemented into patient treatment and resident training.

Awards Won:

Fourth Award of $500

Association for the Advancement of Artificial Intelligence: Honorable Mention