

AbstractID: 14110 Title: Characterization and Identification of Artifacts for Helical 4D CT Image

Purpose: To characterize the artifacts occurring in helical 4D CT imaging and propose a method to identify the artifacts automatically.

Method and Material: Given two adjacent stacks obtained from same respiration phase, we seek to determine if there are artifacts between them. The proposed method uses a “bridge” stack strategy to connect two stacks. Using normalized cross correlation convolution (NCCC), two stacks are mapped to the “bridge” stack and the best matching positions can be located. Using the position information, the method can determine if there is an artifact or not between the two stacks. Furthermore, by combining the matching positions with NCCC values, the performance can be improved. To validate the method, sensitivity and specificity are used as the metrics to evaluate the method with 500 hundred stacks on five patients which are labeled by three physicists independently.

Results: Three types of artifact sources are categorized: low frequency respiration, high amplitude period and low amplitude period. Low frequency respiration can cause blurring. Both amplitude period and low amplitude period can cause anatomy gap and overlap occur depend on different anatomy motion directions. The artifacts identification results show that four of the five patients’ data are validated using the proposed method. The average sensitivity is about 83% and the average specificity 84%. Furthermore, the results show that the method improves sensitivity to 87.8% and specificity to 89% when combining matching positions with NCCC values.

Conclusion: This study shows that the spatial artifacts during 4D CT imaging are characterized and can be located by the proposed method. It is valuable to quantify the quality of 4D CT image and reduce the artifacts directly from the reconstructed images.