

**Purpose:**

With wide use of CBCT in IGRT, extracting the 3D target trajectory from CBCT projection images would be useful to manage intra-fraction motion for motion inclusive, gated and tumor tracking delivery methods. The purpose of this work was to develop a target trajectory estimation method from CBCT by employing inter-dimensional correlation between each direction of target motion, and demonstrate its feasibility with a liver SBRT case.

**Methods:**

To estimate the target trajectory from CBCT projection images we utilize an inter-dimensional correlation between each direction of target motion:  $LR(t)=a_{LR}\times SI(t)+b_{LR}$ ,  $AP(t)=a_{AP}\times SI(t)+b_{AP}$ . The parameters of the simple linear correlation model were determined with least-squares estimation by minimizing the discrepancy between the measured and model-estimated projection positions on the imager coordinates.

The method was demonstrated using a CBCT projection images obtained during liver SBRT treatment for 3D/3D matching purpose using On-board imager of a Varian iX machine. From each projection image of the CBCT, positions of an implanted gold seed were extracted using Varian research tool (RPM-Fluoro). The estimated trajectory was compared with the marker trajectory obtained from 10-binned respiratory phase 4DCT.

**Results:**

In general the estimated trajectory followed well the reference trajectory from 4DCT in the case. Mean root-mean-square error of the model estimation was 0.67mm in lateral direction and 0.00mm in longitudinal direction on the imager coordinates.

**Conclusions:**

A simple 3D marker trajectory estimation method using CBCT projection images was developed. Preliminary results show that it could be used to accurately localize a moving tumor.