AbstractID:9687Title :Evalua tionoffree -formB -splinedeforma blereg istrationsfor noisyCB CT/SimCTim ages

Purpose: Accuratelyr egisteringnoisyc one-beamCT (CBCT) imagestosimulatio n CT(SimCT)is acha llengingta sk. The g oalofthisstudyis toevaluate B -splineb ased free-formdeformable registration sw ithnoisy CBCTima ges.

Methods and Mate rials: CBCT i mages wer e retrospectively selected with large rectumg ases and/or significantm otionartifactsaroundbones .Then,theywe re registered to corresponding Sim CT ima ges using *Elastix*, a software packag e implemented in conjunctionwith *ITK(InsightSegme ntationandRegistrationToolk it)*.Eachre gistration consistedofthree sequentialstage s; translation,affine,a ndB -spline.E ach stagehad three resolutions to avoid lo cal minima and to reduce the overall registration time. The B - spline grid spacing in the fi nest resolut ion was $(8, 8, 2)$ voxelin the (x, y, z)direc tions respectively. M utual i nformation (MI) was chos en as similarity metric with random samplingper iteration.T he sampling sizewas10%o fth eimagesize.Re gistrationswere evaluatedusing an interactiveblendingsoftware.

Results: External skin boundarie s were found to match well, but intern al org an registration included notable errors, especially ne ar a reas c ontaining large amount of rectum gas. E rrors we re also observed around the top and bott om slices of the inp ut CBCTim ages,where t heboneswe reshown to" stretch"inthe superior/inferiordir ection.

Conclusions: Based on the preliminary re sults, the metric MI with free -form deformationalone is inadequatef ornoisy CBCT/SimCT registrations. Our futurestudy includes using rig idity constra ints on bones and customar y constrain ts on deformable organs.