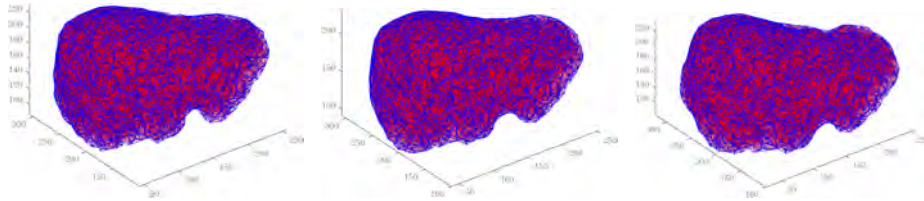


# Supplementary material: LIBR+: Improving Intraoperative Liver Registration by Learning the Residual of Biomechanics-Based Deformable Registration

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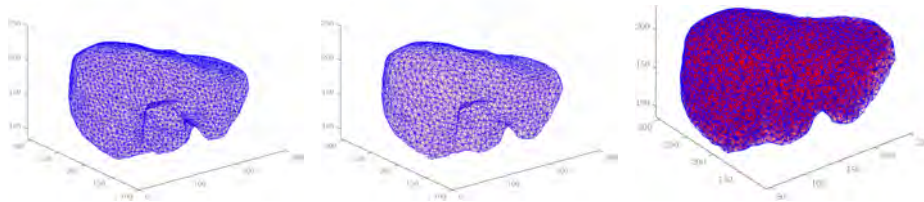
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(a) preoperative mesh of liver model 1 without before left forces applied. (b) LIBR-deformed mesh of liver model 1-L without before left forces applied. (c) GT deformed mesh of liver model 1-L after left forces applied.

Fig. 1: Similar topology of preoperative (a), LIBR (b) and GT (c) deformed mesh after data coarsening. This gives a verified support of the assumption that a shared tetrahedron topology could be extracted from these three meshes after data coarsening.



(a) Surface Detection (b) Surface Down-Sampling (c) Surface Reconstruction

Fig. 2: Pipeline of data coarsening process: (a) Surface Down-Sample, (b) Surface Down-Sampling, and (c) Surface Reconstruction. We take preoperative mesh of liver model 1 as an example.

Table 1: TRE separated by the category of intraoperative measurements used.

Data Splits	Edge TRE				Inner TRE			
	wICP	LIBR	V2S	SR-GCN	wICP	LIBR	V2S	SR-GCN
Surface data only	14.066	11.666	11.640	<b>4.405</b>	11.869	10.412	/	<b>4.412</b>
Surface + 1 US Plane	14.066	9.660	11.248	<b>4.389</b>	11.869	8.758	/	<b>4.402</b>
Surface + 2 US Planes	14.066	8.174	11.15	<b>4.326</b>	11.869	7.487	/	<b>4.338</b>
Surface + 3 US Planes	14.066	7.225	11.05	<b>4.324</b>	11.869	6.674	/	<b>4.345</b>
Surface + 16 US Planes	14.066	4.851	10.994	<b>3.292</b>	11.869	4.570	/	<b>3.341</b>
All Data	14.066	7.441	11.072	<b>3.289</b>	11.869	6.859	/	<b>3.322</b>

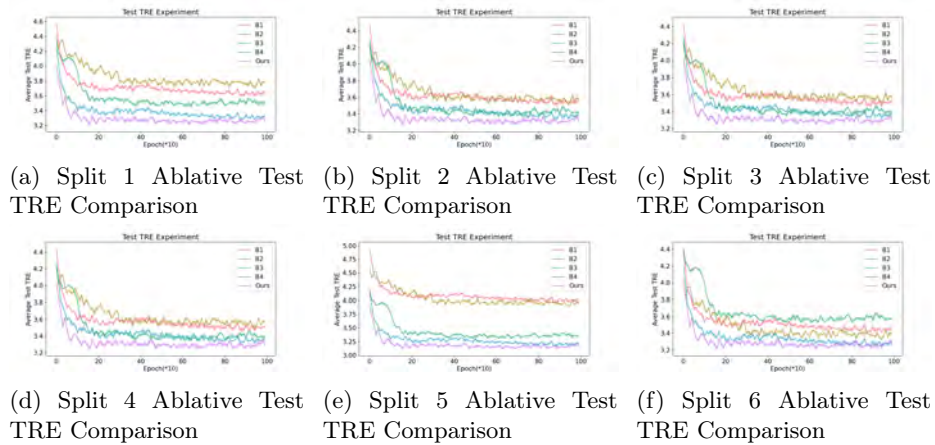


Fig. 3: Ablative Component Comparison on different data splits: (B1) preoperative mesh as model’s input. (B2) Concatenated preoperative and LIBR-deformed mesh as model’s input. (B3) Bipartite Branch Integration on top of (B2). (B4) Sparse loss supervision on top of (B2). (Ours) All components.