



VIEWPOINT CALIBRATION METHOD BASED ON POINT FEATURES FOR POINT CLOUD FUSION



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INTRODUCTION

In this paper a viewpoint calibration method is proposed for point cloud fusion, which makes use of the combination of advantages between FPFH and 3D-SIFT. In our method, firstly, 3D-SIFT keypoints are extracted, and then in order to find feature matching, FPFH features are computed on these keypoints. Our method has some advantages. For one thing 3D-SIFT keypoints are distinguishing among millions of points even in different viewpoints, for another we compute FPFH features at these keypoints which to a great extent can avoid feature matching errors.

VIEWPOINT CALIBRATION

The whole process of the proposed algorithm is shown in Figure1.

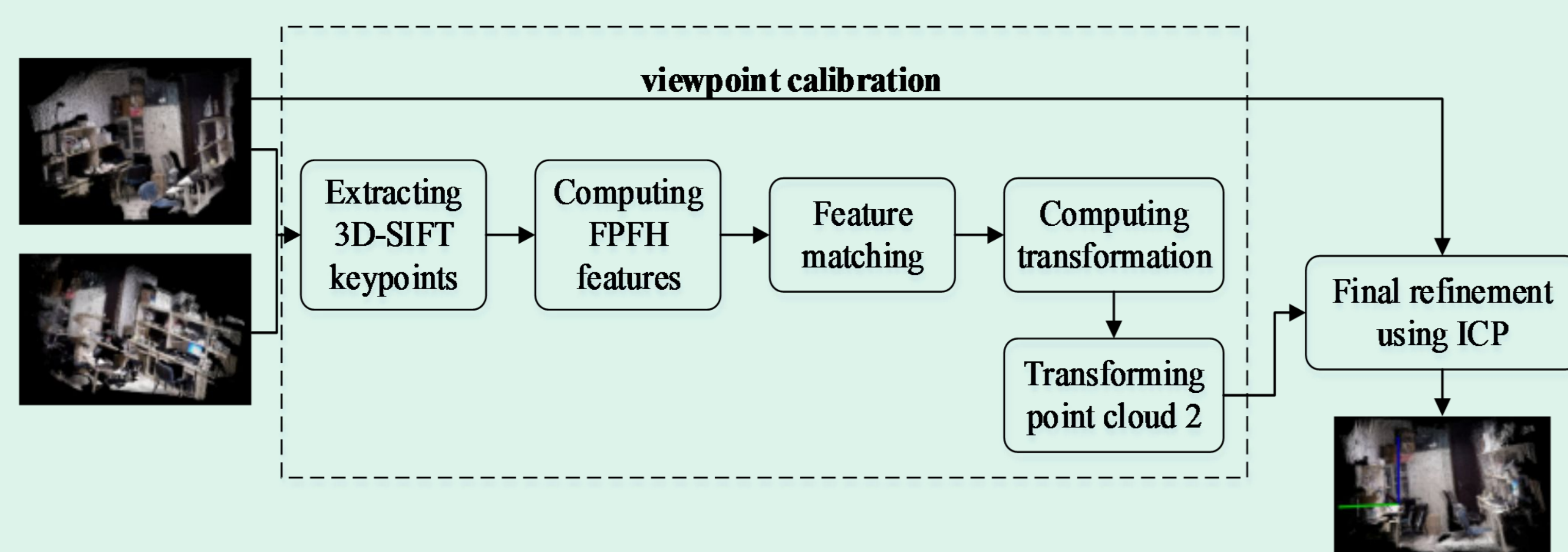


Fig.1. Flowchart of the whole process

EXPERIMENTAL RESULTS

In our experiment, three different point cloud datasets are used to verify the advantage of proposed algorithm. In order to evaluate the performance of different methods, we use transformation accuracy (T_a) computed by formulas:

$$T_a = N / \sum_{i=1}^N \|q_i - q_i'\|^2$$

$$q_i' = Rp_i + T$$

We divide the transformation accuracy of different methods into 10 intervals, and number from 1 to 10 represents the level of accuracy. The number is bigger the result is better. Table 1 shows the time consumption and accuracy comparison.



Fig.2. The 1st and 2nd column represent the source point cloud and target point cloud. The 3rd and the 4th column represent our method results

METHOD	DATASET1		DATASET2		DATASET3	
	Time(s)	Accuracy	Time(s)	Accuracy	Time(s)	Accuracy
ICP	185	7.52	failed	-	failed	-
NDT	165	7.38	failed	-	failed	-
FPFH+ICP	154	7.65	286	6.42	455	5.76
FPFH+NDT	133	8.02	298	6.16	568	6.25
3D-SIFT+FPFH+ICP (ours)	102	9.08	209	8.89	287	8.88
3D-SIFT+FPFH+NDT (ours)	86	8.92	215	8.76	326	8.64

Table.1. Methods' Comparison

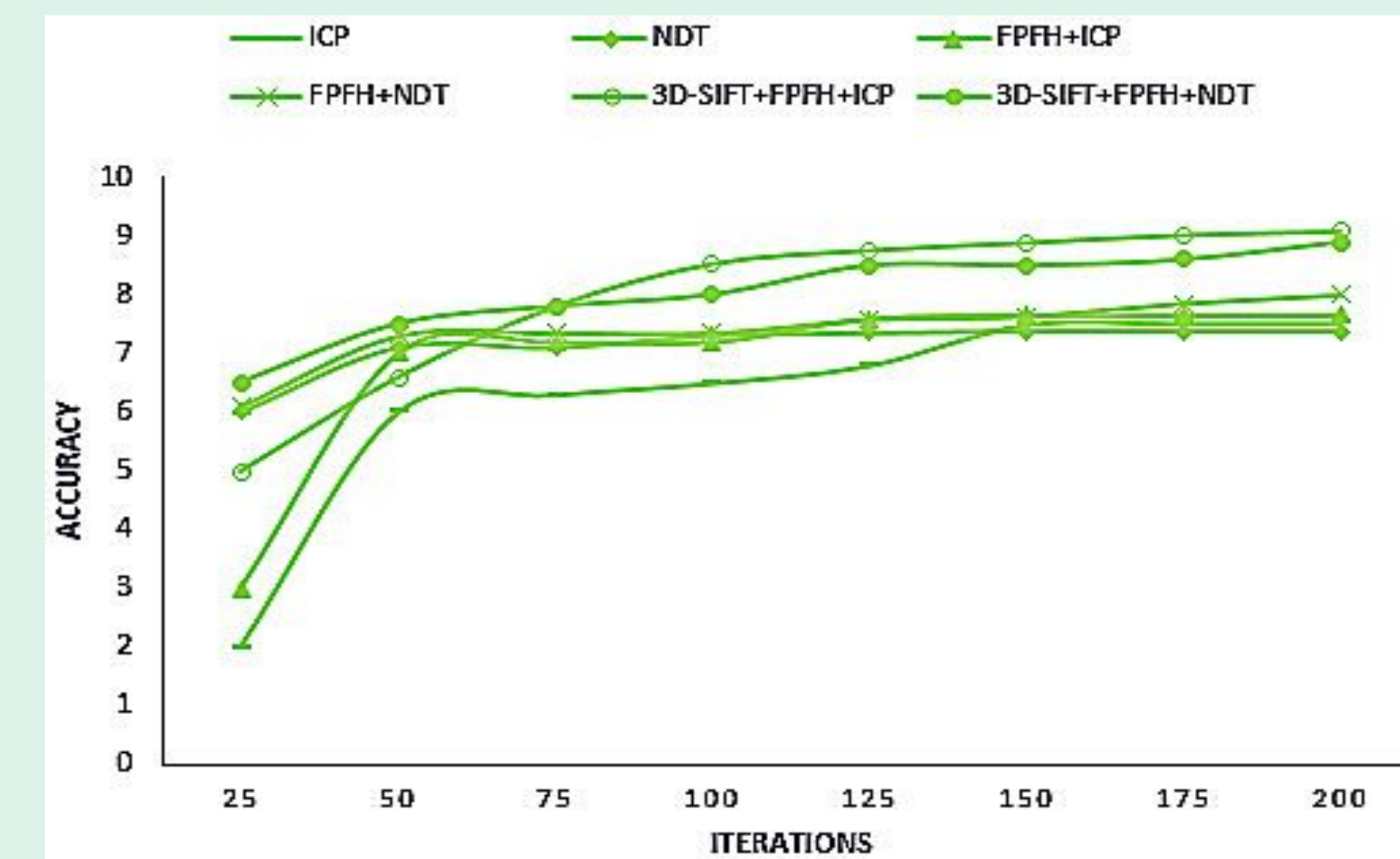


Fig.3. The relationship of iterations and accuracy in dataset1.

