WHU-TLS BENCHMARK

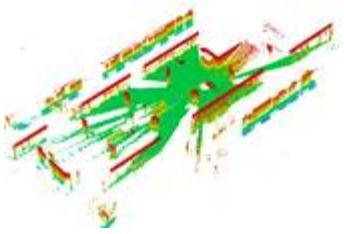
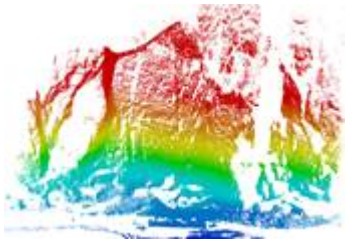
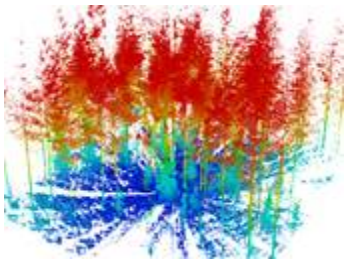
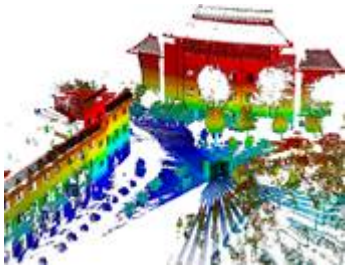
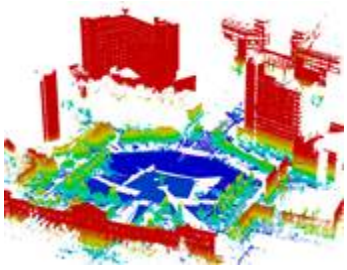
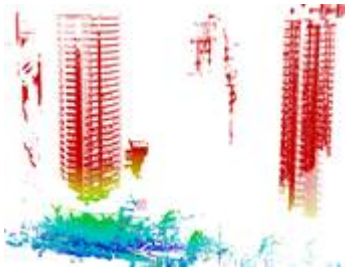
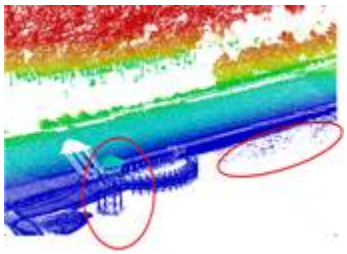
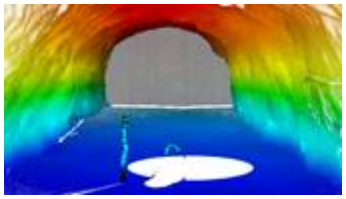
http://3s.whu.edu.cn/ybs/en/benchmark.htm

Background

Deep learning-based methods have become the de-facto baseline for image registration tasks in the field of computer vision, but due to the lack of large benchmark datasets, they have not yet led to a true milestone for 3D point cloud registration. The large-scale benchmark datasets would promote the benchmarking of state-of-the-art algorithms in this field, and provide better comparisons and insights into the advantages and disadvantages of different registration methods on a common base.

WHU-TLS benchmark dataset

The proposed the benchmark dataset consists of 115 scans and, in total, over 1740 million 3D points collected from 11 different environments (i.e., subway station, high-speed railway platform, mountain, forest, park, campus, residence, riverbank, heritage building, underground excavation and tunnel) with varying point density, clutter, and occlusion. The ground-truth transformations, the transformations calculated by **Dong et. al. (2018)** and the registration graphs are also provided for researchers, which aims to yield better comparisons and insights into the strengths and weaknesses of different registration approaches on a common base. We hope the benchmark meets the needs of the research community and becomes an important dataset for the development of cutting-edge TLS point cloud registration methods. In addition, the proposed benchmark also provides suitable datasets for the applications of safe railway operation, river survey and regulation, forest structure assessment, cultural heritage conservation, landslide monitoring and underground asset management. The benchmark data sets are shown in Fig.1. Table 1 shows the detailed descriptions of the WHU-TLS data sets in terms of the data acquisition equipment, number of scans, number of points, range covered, organization of the environment, location of the environment, and the minimum and maximum overlaps between pairwise point clouds.

	
(a) WHU-TLS Subway station	(b) WHU-TLS Railway
	
(c) WHU-TLS Mountain	(d) WHU-TLS Forest
	
(e) WHU-TLS Park	(f) WHU-TLS Campus
	
(g) WHU-TLS Residence	(h) WHU-TLS River bank
	
(i) WHU-TLS Heritage building	(j) WHU-TLS Excavation

(k) WHU-TLS Tunnel

Fig. 1 The WHU-TLS data set

Table 2. Details of the WHU-TLS benchmark data set

Name	Scanner	#Scans	#Pts(million)	Overlap (%)	
				Min	Max
WHU-TLS Subway station	IMAGER 5010C	6	237.57	23.7	64.3
WHU-TLS Railway	VZ-400	8	49.86	10.9	66.1
WHU-TLS Mountain	ScanStation C5	6	19.61	13.4	42.3
WHU-TLS Forest	Leica HDS6100	5	149.45	34.6	55.5
WHU-TLS Park	VZ-400	32	160.24	24.4	82.8
WHU-TLS Campus	VZ-400	10	109.05	5.6	49.6
WHU-TLS Residence	Leica P40	7	43.70	1.0	91.4
WHU-TLS River bank	VZ-400	13	93.11	22.6	49.6
WHU-TLS Heritage building	VZ-400	9	238.16	28.7	69.4
WHU-TLS Excavation	VZ-400	12	482.42	9.0	72.8
WHU-TLS Tunnel	VZ-400	7	157.02	5.50	32.0