Research Proposal for SURGE 2022

Title: Adding Colour Information to LiDAR using Camera Calibration

Aim:
Add colour information to 3D LiDAR models using camera calibration and machine learning tools.

Research Problem:
The 3D models generated using LiDAR lack colour and texture information in them. The research problem is to add colour information to the models using LiDAR-Camera Calibration.

Abstract:
In recent years, 3D sensing system has aroused increasing attention due to their vast potential applications, such as autonomous driving and mobile robotics. These tasks have high demands for various applications in different field domains. Nowadays, with the popularity of crew-less vehicles, the navigation problems inherent in mobile robots are gathering even greater attention. One of the fundamental problems is the localisation or calibration between different sensors.

LiDAR technology can gather 3D points with an effective range of up to 200 meters. In addition, LiDAR can be used in low-textured scenes and scenes with varying lighting conditions. However, the 3D model data generated by LiDAR is sparse and lacks colour information. A camera is a portable and cheap device that can obtain colour information. However, it needs to correspond to feature points during calculation, which will be time-consuming and sensitive to light. A combination of cameras and LiDAR requires obtaining transformation parameters between the coordinate systems of the two kinds of sensors. The calibration procedure leads to the determination of the transformation parameters, namely the rotation matrix and translation vector, the alignment of the two coordinate systems, and the correspondence between 3D points and 2D images. The 3D point cloud of the LiDAR is combined with the 2D image of the camera to create a 3D LiDAR model with colour information.

Keywords:
LiDAR-Camera; Calibration.

References:
1. https://www.mdpi.com/1424-8220/20/21/6319
2. https://arxiv.org/abs/2101.04431
3. https://ieeexplore.ieee.org/document/8665256

Roll Number:	200100	**Student Name:**	AMAN KUMAR SINGH
Programme:	B TECH	**Department:**	CIVIL ENGINEERING (CE).
Current CPI:	6.38	**Current Course Credits:**	157

Disclaimer: The credits shown below are based on data migrated from earlier systems of IIT Kanpur. In case of any discrepancy, you are request to contact DOAA department for resolution.

S.No.	Academic Session	Semester	Course ID	Course Name	Course Type	Grade	Credits	Repeat/Substitute	Repeat/Substitute Course
1	2020-21	1	ESC101A	FUNDAMENTAL OF COMPUTING	IC	B	14		
2	2020-21	1	MTH101A	MATHEMATICS I	IC	C	11		
3	2020-21	1	PE101A	MORNING EXERCISE	IC	S	3		
4	2020-21	1	PHY103A	PHYSICS-II	IC	D	11		
5	2020-21	1	PSY151A	INTRODUCTION TO PSYCHOLOGY	HS1	C	11		
									CPI/SPI --6.1 / 6.1
6	2020-21	2	MTH102A	MATHEMATICS - II	IC	C	11		
7	2020-21	2	CHM101A	CHEMISTRY LABORATORY	IC	A	3		
8	2020-21	2	LIF101A	INTRODUCTION TO BIOLOGY	IC	D	6		
9	2020-21	2	TA101A	ENGINEERING GRAPHICS	IC	D	9		
10	2020-21	2	CHM102A	GENERAL CHEMISTRY	IC	B	8		
11	2020-21	2	PHY102A	PHYSICS-I	IC	B	11		
									CPI/SPI --6.3 / 6.4
12	2021-22	1	CE241A	SUSTAINABLE BUILT ENVIRONMENT	DC	B	9		
13	2021-22	1	ENG123A	INTRODUCTION TO LITERATURE	HS1	B	11		
14	2021-22	1	COM200	COMMUNICATION SKILLS: COMPOSITION	IC	S	5		
15	2021-22	1	ESO202A	MECHANICS OF SOLIDS	ESO	D	11		
16	2021-22	1	MSO203B	PARTIAL DIFFERENTIAL EQUATIONS	ESO	C	6		

S.No.	Academic Session	Semester	Course ID	Course Name	Course Type	Grade	Credits	Repeat/Substitute	Repeat/Substitute Course
17	2021-22	1	PHY101A	PHYSICS LABORATORY	IC	B	3		
18	2021-22	1	ESO204A	FLUID MECHANICS AND RATE PROCESSES	ESO	C	11		
19	2021-22	1	TA202T	MANUFACTURING PROCESSES II	IC	B	3		
									CPI/SPI --6.4 / 6.6

Current Course(s)

S.No.	Academic Session	Semester	Course ID	Course Name	Course Type	Credits	Repeat/Substitute	Repeat/Substitute Course
NO DATA FOUND								

INDIAN INSTITUTE OF TECHNOLOGY, KANPUR
CENTRE FOR CONTINUING EDUCATION
SURGE Program

Recommendation for SURGE-2022 Program

To be filled by IIT Kanpur Applicant Only

Name of Applicant: Aman Kumar Singh **Name of Recommender:** Alakesh Chandra Mandal

Address of Recommender: Department of Aerospace Engineering, IIT Kanpur

Applied for Internship SURGE-2022 Program @IIT Kanpur:

Dear Colleague:

We would appreciate your fair and objective opinion on the applicant who is applying for SURGE 2022. All recommendations are confidential and should be submitted in a sealed envelope.

Thank you.

(B. V. Rathish Kumar)
Head, CCE

To be filled by Recommender
How long have you known the applicant and in what capacity? (50 Words)

I Know Mr. Aman Kumar Singh since July, 2021. Also, I taught him a course of Fluid Mechanics and Rate Processes (ESO-204A) in the first semester of the academic year 2021-2022.

What are your personal impressions of the applicant's (i) scholarship; (ii) personality; (iii) drive and enthusiasm, (iv) curiosity and creativity, (v) thoroughness and persistence in finishing projects. (300 Words)

As a teacher, I found him to be very sincere and regular in the class. I found that he is an intelligent student and his main focus was on learning the fundamentals. Specially, I found that his analytical, problem formulation, and solutions abilities were very strong. He was one of the brilliant students in the class. I strongly feel that, given a chance, he can come up with some meaningful research outcomes, as he is an intelligent student. Therefore, I strongly recommend him without any reservation or hesitation.

Alakesh Chgandra Mandal

Name of Recommender

31/01/2022

(Signature of Recommender)

Centre For Continuing Education, Outreach Building, IIT Kanpur, Kanpur, 208016
Contact Number: 512-259-6491, Email Id: surge@iitk.ac.in