Radhika **Ravi**

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research interests

3D point cloud reconstruction from **LiDAR and photogrammetric data**, intrinsic and extrinsic **calibration** of airborne and terrestrial mobile mapping systems comprising laser scanners and cameras.
Interested in extending my research to applications of **Computer Vision and Machine Learning** Techniques to Photogrammetry, LiDAR and Remote Sensing

education

Master of Science (Thesis-based)
Dept. of Civil Engg. (Geomatics)
Purdue University
CGPA: 4.0/4.0 (2016–Present)

Bachelor of Technology, Dual Majors
Dept. of Civil Engg. and Dept. of Electrical Engg.
Indian Institute of Technology Kanpur
CGPA: 7.5/10 (2011–2016)

All India Senior School Certificate Examination
Central Board of Secondary Education
Percentage: 88.4 (2011)

All India Secondary School Examination
Central Board of Secondary Education
Percentage: 95.8 (2009)

publications

Journal Papers

Ravi, R., Lin, Y.J., Elbahnasawy, M., Shamseldin, T., Habib, A.,"Bias Impact Analysis and Calibration of Terrestrial Mobile LiDAR System with Several Spinning Multi-beam Laser Scanners", *IEEE Transactions on Geoscience and Remote Sensing* (undergoing review since Aug '17)

Ravi, R., Lin, Y.J., Elbahnasawy, M., Shamseldin, T., Habib, A., "Simultaneous System Calibration of Multi-LiDAR Multi-Camera Mobile Mapping Platform", *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing* (undergoing review since Oct '17)

Lin, Y.J., **Ravi, R.**, Elbahnasawy, M., Shamseldin, T., Habib, A., "Lane Width Estimation from a LiDAR-based Mobile Mapping System", *Sensors* (undergoing review since Oct '17)

Conference Papers

Lin, Y.J., **Ravi, R.**, Habib, A., "Comparative Analysis of Potential Calibration Alternatives for a Multi-unit LiDAR System", *In proceedings of the 10th International Symposium on Mobile Mapping Technology, May 6-8, Cairo, Egypt*

scholastic achievements

Achieved **All India Rank (AIR) 1934** in IIT-JEE 2011 amongst 0.5 million candidates

Selected for **KVPY Scholarship**, 2011 by Dept. of Science and Technology, Govt. of India

Secured **International Rank 17** in International Mathematics Olympiad, 2011

Secured **AIR 77** in National Level Science Talent Search Examination, 2011 by Unified Council (ISO 9001:2000 Certified Organisation)

Certificate of Merit for being placed in **Statewise Top 1%** in National Standard Examination in Physics

Secured **AIR 57** and 99.55 Percentile in National Science Olympiad, 2011

Qualified National Level Olympiads of Mathematics (INMO) and Astronomy (INAO) in 2010

Acknowledged with **Best Presentation-cum-Internee** Award by Civil Engineering Department, IIT Kanpur for "Estimation of Evapotranspiration using Trained ANN Hydrologic Models"

research experience

LiDAR **Bias Impact Analysis and Calibration of Systems with Multiple Spinning Multi-beam LiDAR Units** Jan'17–Aug'17

Mentor: Prof. Ayman Habib

– Proposed an optimal configuration of target primitives and drive-runs by extensively analyzing the potential impact of bias in mounting parameters of a LiDAR unit on resultant point cloud (theoretically and using experimental simulations)
– Devised an outdoor multi-unit LiDAR system calibration procedure for a terrestrial mobile mapping platform
– Designed an experiment based on bias impact analysis and validated accuracy of calibration strategy

LiDAR **Bias Impact Analysis and Development of Optimal Flight-line Configuration for Calibration of UAV-based Mobile Mapping Systems** Aug'17–Present

Mentor: Prof. Ayman Habib

– Conducted a theoretical analysis of 3D LiDAR point positioning equation to estimate the potential impact of bias in mounting parameters of a LiDAR unit (onboard a UAV) on resultant point cloud
– Devised an optimal flight-line configuration for an efficient calibration and designed experiments to validate the accuracy of calibration

LiDAR **Lane Width Estimation from a LiDAR-based Mobile Mapping System** Jan'17–Oct'17

Mentor: Prof. Ayman Habib

– Proposed a methodology for lane width estimation using LiDAR point cloud from a mobile mapping system
– Conducted comprehensive experimental testing to compare performance of different laser scanners, validate the precision and accuracy of lane width estimation, and study the effect of calibration on derived lane width estimates

LiDAR **Reconstruction of Complex Digital Building Models from LiDAR Point Clouds through a Tightly-integrated Recursive Minimum Bounding Rectangle and Least Squares Adjustment Procedure** Jan'17–Aug'17

Mentor: Prof. Ayman Habib

– Devised a strategy for modeling of buildings from airborne LiDAR point cloud data using Recursive Minimum Bounding Rectangle (RMBR) and Least Squares Adjustment (LSA)
– Developed and validated (using experiments) a water-tight building model strategy to remove gaps between contiguous building models

LiDAR/Photogrammetry **Simultaneous System Calibration of Multi-LiDAR Multi-Camera Mobile Mapping Platform** Jan'17–Oct'17

Mentor: Prof. Ayman Habib

– Devised a calibration procedure using conjugate points and geometric features to directly estimate mounting parameters for multiple spinning multi-beam laser scanners and cameras onboard an airborne or terrestrial mobile platform
– Validated accuracy of calibration strategy by analyzing experimental results for three different types of mobile mapping platforms

LiDAR/Photogrammetry **Interface Development to Link 3D Point Clouds with Images through Forward and Backward Projections** Nov'17–Present

Mentor: Prof. Ayman Habib

Developing an interface integrated with CloudCompare to add the following functionalities with respect to a multi-LiDAR multi-camera Mobile Mapping System:

– Forward projection: Navigate through the sequence of images captured by the MMS and identify the closest point in LiDAR point cloud to the pixel selected by the user
– Backward projection: For a point selected in 3D point cloud, identify the corresponding pixel in the closest captured image

Computer Vision **Implementation of Obstacle Navigation System for Visually Impaired People using Stereo Vision** Jan-Dec'15

Mentors: Prof. Bharat Lohani, Prof. K. S. Venkatesh

– Implemented 3D Data Acquisition System using two web-cameras and Stereo-Vision Algorithms
– Coded the entire framework in C++ using OpenCV to isolate the closest obstacle and convey distance information through amplitude of sound

relevant projects

Surveying

Thumb Rule to Locate Optimal Point of Observation to Determine Tower Height Using REM (Remote Elevation Measurement) Technique Jan-Dec'14
Mentor: Prof. Bharat Lohani
Performed Analytical Computations, MATLAB Simulations, Field Experiments and analysis using Genetic Algorithm to invent a method to increase the accuracy in measuring the height of high-rise towers and suggested a thumb rule to determine position of observation

Computer Vision

Knock! Knock! Who is it?" Probabilistic Person Identification in TV-Series Jan-Apr'16
Mentor: Prof. Vinay P. Namboodiri

Implemented the paper by *M Tapaswi et al. (2012)*. Executed different algorithms for scene and shot change detection in an episode, face detection and tracking, and clothing detection in the video. Integrated these results in a probabilistic manner to identify and tag the person(s) in each frame.

Image Processing

Data Hiding using Discrete Wavelet Transform (DWT) based Steganography Aug-Dec'15
Mentor: Prof. Sumana Gupta

Used OpenCV to implement DWT based Steganography to maximise embedded confidential data (invisible to human perception) and protect the data from external attacks: Rotation, Cropping, Scratching of image

Remote Sensing

Statistical Analysis of Multispectral Images in MATLAB Aug-Dec'14
Mentor: Prof. Bharat Lohani

Computed the OIF for two multispectral images from LANDSAT 8 and WorldView 2. Identified the best 3-band combination in each image for identification and extraction of various features present in the region of interest.

Software Development

Nesting Algorithm to Optimize the Layout of Slices of 3D Model in 123D Make Software (Autodesk) May-July'14
Organisation: Autodesk India (Full-time Internee)

Developed algorithms to slice a 3D model and lay out the irregularly shaped slices on 2D Sheets with minimal wastage of material (filling holes and adjusting notches) and in minimal amount of time (unlike heuristic algorithms)

work experience

Half-time Research Assistant, Jan'17-Present
Geomatics: LiDAR and Photogrammetry
Lyles School of Civil Engineering
Purdue University, U.S.A.

Half-time Teaching Assistant, Aug'16-Dec'16
Recitation Instructor for Calculus-1
Department of Mathematics
Purdue University, U.S.A.

relevant courses

Geomatics
Surveying and Geoinformatics
Adjustment of Geospatial Observations
Laser Scanning
Digital Photogrammetric Systems
Multi and Hyperspectral Remote Sensing

Mathematics
Calculus
Linear Algebra and Its Applications
Probability and Statistics
Partial Differential Equations
Optimization Methods for System and Control
Random Variables

Computer Science
Machine Learning
Computer Vision and Image Processing
Deep Learning
Data Structures and Algorithms
Data Mining and Knowledge Extraction

Electrical Engineering
Digital and Statistical Signal Processing
Digital Electronics
Principles of Communication
Mathematical Structures of Signals and Systems
Microelectronics
Power Systems and Power Electronics