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自己紹介

所属: 東京大学大学院 工学系研究科 精密工学専攻 特任助教

国籍: インド

生年月日: 1991年8月14日

性別: 男

主な研究分野: ロボットビジョン, 360度センシング, 3次元計測, 自己位置推定

学歴

インド工科大学 マドラス校 設計工学専攻

Indian Institute of Technology Madras, Department of Engineering Design

2009年8月～
2014年9月

Bachelors and Masters in Engineering Design

with Specialization in Automotive Engineering (学士・修士一貫コース)

修士論文: “Improving Gradient Histogram Based Descriptors for Pedestrian Detection”

(和文: 歩行者検知の精度向上のためグラジエントヒストグラムディスクリプタの改良)

指導教員: Asokan Thondiyanath 教授 (設計工学専攻), Anurag Mittal 准教授 (コンピュータ工学専攻)

東京大学大学院 工学系研究科 精密工学専攻

2014年10月～
2017年9月

博士(工学)

博士論文: “Motion Estimation of Spherical Cameras and 3D Reconstruction
Based on Sparse and Dense Pixel Flows”

(和文: スパース・デンスピクセルフローに基づく全天球カメラの運動推定と3次元復元)

指導教員: 山下 淳 准教授

職歴

東京大学大学院 工学系研究科 精密工学専攻

2017年10月～
2018年3月

特任研究員

- 内閣府総合科学技術・イノベーション会議の戦略的イノベーション創造プログラム（SIP）「インフラ維持管理・更新・マネジメント技術」（管理法人：NEDO）
- ドローンによる橋梁点検に関する研究開発
- 360度全天球カメラを用いたドローンの位置姿勢推定

東京大学大学院 工学系研究科 精密工学専攻

2018年4月～
2020年3月

日本学術振興会 外国人特別研究員

- 災害対応のため360度センシングに関する研究開発
- 3次元計測, 自己位置推定, 可視化

東京大学大学院 工学系研究科 精密工学専攻

2020年4月～
現在に至る

特任助教

- インテリジェント施工システムに関する研究開発
- ロボットの位置姿勢推定, 可視化

学術論文

1. Yoshiro Hada, Manabu Nakao, Moyuru Yamada, Hiroki Kobayashi, Naoyuki Sawasaki, Katsunori Yokoji, Satoshi Kanai, Fumiki Tanaka, Hiroaki Date, **Sarthak Pathak**, Atsushi Yamashita, Manabu Yamada and Toshiya Sugawara: “Development of a Bridge Inspection Support System Using Two-Wheeled Multicopter and 3D Modeling Technology”, *Journal of Disaster Research*, Vol. 12, No. 3, pp. 593-606, June 2017.
doi:10.20965/jdr.2017.p0593
2. **Sarthak Pathak**, Alessandro Moro, Hiromitsu Fujii, Atsushi Yamashita, and Hajime Asama: “Spherical Video Stabilization by Estimating Rotation from Dense Optical Flow Fields”, *Journal of Robotics and Mechatronics*, Vol. 29, No. 3, pp. 566-579, June 2017. **(Best Paper Award 2018)**
doi:10.20965/jrm.2017.p0566
3. **Sarthak Pathak**, Alessandro Moro, Atsushi Yamashita, and Hajime Asama: “Optical Flow-based Epipolar Estimation of Spherical Image Pairs for 3D Reconstruction”, *SICE Journal of Control, Measurement, and System Integration*, Vol. 10, No. 5, pp. 476-485, September 2017.
doi:10.9746/jcmsi.10.476
4. Binbin Xu, **Sarthak Pathak**, Hiromitsu Fujii, Atsushi Yamashita, and Hajime Asama: “Spatio-temporal Video Completion in Spherical Image Sequences”, *IEEE Robotics and Automation Letters*, Vol. 2, No. 4, pp. 2032-2039, October 2017.
doi:10.1109/LRA.2017.2718106
5. 後藤 翼, **Sarthak Pathak**, 池 勇勳, 藤井 浩光, 山下 淳, 浅間 一: “人工物環境における全天球カメラの位置姿勢推定のための直線特徴に基づく3D-2Dマッチング”, 精密工学会誌, Vol. 83, No. 12, pp. 1209-1215, December 2017. **(FA財団論文賞受賞)**
doi:10.2493/jjspe.83.1209
6. 野田 純平, **Sarthak Pathak**, 藤井 浩光, 山下 淳, 浅間 一: “計測点の信頼度を考慮した全天球ステレオカメラの運動推定”, 精密工学会誌, Vol. 85, No. 6, pp. 568-576, June 2019.
doi:10.2493/jjspe.85.568
7. Dabae Kim, **Sarthak Pathak**, Alessandro Moro, Atsushi Yamashita and Hajime Asama: “SelfSphNet: Motion Estimation of a Spherical Camera via Self-Supervised Learning”, *IEEE Access*, Vol. 8, 2020.
doi:10.1109/ACCESS.2020.2977109
8. Irem Uygur, Renato Miyagusuku, **Sarthak Pathak**, Alessandro Moro, Atsushi Yamashita and Hajime Asama: “Robust and Efficient Indoor Localization Using Sparse Semantic Information by a Spherical Camera”, *Sensors*, Vol. 20, No. 15, 4128, pp. 1-20, August 2020.
doi:10.3390/s20154128
9. 陽 東旭, 樋口 寛, **Sarthak Pathak**, Alessandro Moro, 山下 淳, 浅間 一: “色情報と3次元距離情報に基づく全天球カメラの位置姿勢推定 ―キーフレーム毎のデプスマップ更新による連続位置姿勢推定―”, 精密工学会誌, , Vol. 86, No. 12, pp. 1014-1019, December 2020.
doi:10.2493/jjspe.86.1014

10. Dabae Kim, **Sarthak Pathak**, Alessandro Moro, Atsushi Yamashita and Hajime Asama: “Self-Supervised Optical Flow Derotation Network for Rotation Estimation of a Spherical Camera”, *Advanced Robotics*, Vol. 35, No. 2, pp. 118-128, January 2021.
doi:10.1080/01691864.2020.1857305

査読付き国際学会論文

1. Binbin Xu, **Sarthak Pathak**, Hiromitsu Fujii, Atsushi Yamashita, and Hajime Asama: “Robot Body Occlusion Removal in Omnidirectional Video Using Color and Shape Information”, *Proceedings of the 6th International Conference on Advanced Mechatronics (ICAM2015)*, pp. 49-50, Tokyo (Japan), December 2015. **(ICAM2015 Honorable Mention)**
2. **Sarthak Pathak**, Alessandro Moro, Atsushi Yamashita, and Hajime Asama: “Rotation Removed Stabilization of Omnidirectional Videos Using Optical Flow”, *Proceedings of the 6th International Conference on Advanced Mechatronics (ICAM2015)*, pp. 51-52, Tokyo (Japan), December 2015.
3. Prashanth Balasubramanian, **Sarthak Pathak**, and Anurag Mittal: “Improving Gradient Histogram Based Descriptors for Pedestrian Detection in Datasets With Large Variations”, *Proceedings of the the IEEE Conference on Computer Vision and Pattern Recognition (CVPR) Workshops (CVPRW2016)*, pp. 104-113, Las Vegas (USA), June 2016.
4. **Sarthak Pathak**, Alessandro Moro, Atsushi Yamashita, and Hajime Asama: “A Decoupled Virtual Camera Using Spherical Optical Flow”, *Proceedings of the 2016 IEEE International Conference on Image Processing (ICIP2016)*, pp. 4488-4492, Phoenix (USA), September 2016.
5. **Sarthak Pathak**, Alessandro Moro, Atsushi Yamashita, and Hajime Asama: “Dense 3D Reconstruction from Two Spherical Images via Optical Flow-based Equirectangular Epipolar Rectification”, *Proceedings of the 2016 IEEE International Conference on Imaging Systems and Techniques (IST2016)*, pp. 140-145, Crete Island (Greece), October 2016.
6. **Sarthak Pathak**, Alessandro Moro, Hiromitsu Fujii, Atsushi Yamashita, and Hajime Asama: “3D Reconstruction of Structures using Spherical Cameras with Small Motion”, *Proceedings of the 16th International Conference on Control, Automation and Systems (ICCAS2016)*, pp. 117-122, Gyeongju (Korea), October 2016. **(Student Best Paper Award)**.
7. Binbin Xu, **Sarthak Pathak**, Hiromitsu Fujii, Atsushi Yamashita, and Hajime Asama: “Optical Flow-based Video Completion in Spherical Image Sequences”, *Proceedings of the 2016 IEEE International Conference on Robotics and Biomimetics (ROBIO2016)*, pp. 388-395, Qingdao (China), December 2016.
8. Tsubasa Goto, **Sarthak Pathak**, Yonghoon Ji, Hiromitsu Fujii, Atsushi Yamashita, and Hajime Asama: “Spherical Camera Localization in Man-made Environment Using 3D-2D Matching of Line Information”, *Proceedings of the International Workshop on Advanced Image Technology 2017 (IWAIT2017)*, Penang (Malaysia), January 2017. **(Best Paper Award)**
9. **Sarthak Pathak**, Alessandro Moro, Hiromitsu Fujii, Atsushi Yamashita, and Hajime Asama: “Virtual Reality with Motion Parallax by Dense Optical Flow-based Depth Generation from Two Spherical Images”, *Proceedings of the 2017 IEEE/SICE International Symposium on System Integration (SII2017)*, pp. 887-892, Taipei (Taiwan), December 2017.

10. Tsubasa Goto, **Sarthak Pathak**, Yonghoon Ji, Hiromitsu Fujii, Atsushi Yamashita, and Hajime Asama: “Line-based Global Localization of a Spherical Camera in Manhattan Worlds”, *Proceedings of the 2018 IEEE International Conference on Robotics and Automation (ICRA2018)*, pp. 2296-2303, Brisbane (Australia), May 2018.
11. **Sarthak Pathak**, Alessandro Moro, Hiromitsu Fujii, Atsushi Yamashita, and Hajime Asama: “Distortion-Robust Spherical Camera Motion Estimation via Dense Optical Flow”, *Proceedings of the 2018 IEEE International Conference on Image Processing (ICIP2018)*, Athens (Greece), October 2018.
12. **Sarthak Pathak**, Alessandro Moro, Hiromitsu Fujii, Atsushi Yamashita, and Hajime Asama: “Distortion-Resistant Spherical Visual Odometry for UAV-Based Bridge Inspection”, *Proceedings of the 2019 Joint Conference of the International Workshop on Advanced Image Technology (IWAIT2019) and the International Forum on Medical Imaging in Asia (IFMIA2019)*, pp. 110491O-1-110491O-6, Singapore (Singapore), January 2019..
13. Irem Uygur, Renato Miyagusuku, **Sarthak Pathak**, Alessandro Moro, Atsushi Yamashita and Hajime Asama: “A Framework for Bearing-Only Sparse Semantic Self-Localization for Visually Impaired People”, *Proceedings of the 2019 IEEE/SICE International Symposium on System Integration (SII2019)*, pp. 319-324, Paris (France), January 2019.
14. Dabae Kim, **Sarthak Pathak**, Alessandro Moro, Ren Komatsu, Atsushi Yamashita and Hajime Asama: “E-CNN: Accurate Spherical Camera Rotation Estimation via Uniformization of Distorted Optical Flow Fields”, *Proceedings of the 2019 IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP2019)*, pp. 2232-2236, Brighton (UK), May 2019.
15. Wanqi Yin, **Sarthak Pathak**, Alessandro Moro, Atsushi Yamashita and Hajime Asama: “Improving 3D Measurement Accuracy in Epipolar Directions via Trinocular Spherical Stereo”, *Proceedings of the 2019 IEEE Global Conference on Consumer Electronics (GCCE2019) - Organized Session on Consumer Electronics Meets Robots (CER)*, pp. 1005-1006, Osaka (Japan), October 2019.
16. Wanqi Yin, **Sarthak Pathak**, Alessandro Moro, Atsushi Yamashita and Hajime Asama: “Accurate All-round 3D Measurement Using Trinocular Spherical Stereo via Weighted Reprojection Error Minimization”, *Proceedings of the 21st IEEE International Symposium on Multimedia (ISM2019)*, pp. 86-93, San Diego (USA), December 2019.
17. Weijie Chen, **Sarthak Pathak**, Alessandro Moro, Atsushi Yamashita and Hajime Asama: “Extrinsic Parameters Calibration of Multiple Fisheye Cameras in Manhattan Worlds”, *Proceedings of the International Workshop on Advanced Image Technology 2020 (IWAIT2020)*, pp. 115151X-1-115151X-6, Yogyakarta (Indonesia), January 2020.
18. **Sarthak Pathak**, Irem Uygur, Shize Lin, Renato Miyagusuku, Alessandro Moro, Atsushi Yamashita, and Hajime Asama: “Localization in a Semantic Map via Bounding Box Information and Feature Points”, *Proceedings of the 2021 IEEE/SICE International Symposium on System Integration (SII2021)*, Iwaki, Fukushima (Japan), pp. 126-131, January 2021. January 2021.

国内学会発表

1. **Sarthak Pathak**, Alessandro Moro, Atsushi Yamashita, and Hajime Asama: “Complete Omnidirectional Rotation Estimation for Flying Robots using Lines”, *Proceedings of the 33rd Annual Conference of the Robotics Society of Japan (RSJ2015)*, RSJ2015AC2G2-01, pp. 1-4, Tokyo (Japan), September 2015.
2. 後藤 翼, **Sarthak Pathak**, 池 勇勲, 藤井 浩光, 山下 淳, 浅間 一: “直線特徴に基づく2D-3Dマッチングを用いた全天球カメラの位置姿勢推定”, 第34回日本ロボット学会学術講演会予稿集 (RSJ2016), RSJ2016AC2X1-01, pp. 1-4, 山形, September 2016.
3. 野田 純平, **Sarthak Pathak**, 藤井 浩光, 山下 淳, 浅間 一: “計測点の信頼度を考慮した全天球ステレオカメラによる運動推定”, 第18回計測自動制御学会システムインテグレーション部門講演会講演論文集 (SI2017), pp. 608-612, 仙台, December 2017.
4. Dabae Kim, **Sarthak Pathak**, Alessandro Moro, 小松 廉, 山下 淳, 浅間 一: “正距円筒オペティカルフローパターンを均等化したE-CNNによる全天球カメラの回転推定の精度向上”, 第19回計測自動制御学会システムインテグレーション部門講演会講演論文集 (SI2018), pp. 2976-2980, 大阪, December 2018.
5. 陽 東旭, 樋口 寛, **Sarthak Pathak**, Alessandro Moro, 山下 淳, 浅間 一: “環境の3Dモデルと全天球カメラ画像を用いた色差最小化によるカメラの位置姿勢推定”, 動的画像処理実利用化ワークショップ2020講演論文集 (DIA2020), pp. 1-6, 沖縄, March 2020.
6. 山下 淳, ルイ笠原 純ユネス, **Sarthak Pathak**, 小松 廉, 筑紫 彰太, 浅間 一, 谷島 諒丞, 濱崎 峻資, 永谷 圭司, 小澤 一雅: “ロボット・AI・センサ情報処理技術を活用したi-Constructionの推進”, 第2回i-Constructionの推進に関するシンポジウム発表論文集, ⑥-1, pp. 1-4, July 2020.
7. 菅沢 佑太, 筑紫 彰太, 小松 廉, ルイ笠原 純ユネス, **Sarthak Pathak**, 谷島 諒丞, 濱崎 峻資, 永谷 圭司, 千葉 拓史, 茶山 和博, 山下 淳, 浅間 一: “測域センサと魚眼カメラの統合による油圧ショベルの俯瞰映像内におけるダンプトラックの3次元モデルの提示”, 第38回日本ロボット学会学術講演会予稿集 (RSJ2020), RSJ2020AC2C3-01, pp. 1-4, October 2020.
8. 井倉 幹大, **Sarthak Pathak**, 山下 淳, 浅間 一: “ダイレクトドライブモータを用いた計測範囲の能動的変更が可能な三次元形状計測システムの提案”, 第21回計測自動制御学会システムインテグレーション部門講演会講演論文集 (SI2020), pp. 1395-1400, December 2020.

受賞

1. **Best Paper Award 2018**, Journal of Robotics and Mechatronics, Fuji Technology Press Ltd., 2018
対象論文: **Sarthak Pathak**, Alessandro Moro, Hiromitsu Fujii, Atsushi Yamashita, and Hajime Asama: “Spherical Video Stabilization by Estimating Rotation from Dense Optical Flow Fields”, *Journal of Robotics and Mechatronics*, Vol. 29, No. 3, pp. 566-579, June 2017. doi:10.20965/jrm.2017.p0566
2. **FA財団論文賞 2018**
対象論文: Tsubasa Goto, **Sarthak Pathak**, Yonghoon Ji, Hiromitsu Fujii, Atsushi Yamashita, and Hajime Asama: “3D-2D Matching of Line Features for Spherical Camera Localization in Man-made Environment”, *Journal of the Japan Society for Precision Engineering*, Vol. 83, No. 12, pp. 1209-1215, December 2017. (In Japanese)
doi:10.2493/jjspe.83.1209
3. **Best Paper Award**, International Workshop on Advanced Image Technology (IWAIT 2017)
対象論文: Tsubasa Goto, **Sarthak Pathak**, Yonghoon Ji, Hiromitsu Fujii, Atsushi Yamashita, and Hajime Asama: “Spherical Camera Localization in Man-made Environment Using 3D-2D Matching of Line Information”, *Proceedings of the International Workshop on Advanced Image Technology 2017 (IWAIT2017)*, Penang (Malaysia), January 2017.
4. **Student Best Paper Award**, International Conference on Control, Automation, and Systems (ICCAS 2016),
対象論文: **Sarthak Pathak**, Alessandro Moro, Hiromitsu Fujii, Atsushi Yamashita, and Hajime Asama: “3D Reconstruction of Structures using Spherical Cameras with Small Motion”, *Proceedings of the 16th International Conference on Control, Automation and Systems (ICCAS2016)*, pp. 117-122, Gyeongju (Korea), October 2016.
doi.org/10.1109/ICCAS.2016.7832307
5. **Honorable Mention**, 6th International Conference on Advanced Mechatronics
対象論文: Binbin Xu, **Sarthak Pathak**, Hiromitsu Fujii, Atsushi Yamashita, and Hajime Asama: “Robot Body Occlusion Removal in Omnidirectional Video Using Color and Shape Information”, *Proceedings of the 6th International Conference on Advanced Mechatronics (ICAM2015)*, pp. 49-50, Tokyo (Japan), December 2015
doi.org/10.1299/jsmeicam.2015.6.49

研究予算

- 科学研究費 研究活動スタート支援: 360-Degree Camera based Fast Indoor Localization using Image Gradients , 日本学術振興会,
2020年9月11日 ~ 2022年3月31日, 研究課題/領域番号 20K22383, 2860千円
- 科学研究費 特別研究員奨励費: 災害対応のため360度センシング , 日本学術振興会,
2018年4月25日 ~ 2020年3月31日, 研究課題/領域番号 18F18109, 2300千円

その他の援助金

- 東京大学IIT大学院留学支援プログラム
博士後期課程奨学金, 2014年10月～ 2017年9月
- 海外渡航旅費援助 for IWAIT/IFMIA 2019, Marubun Foundation
- 海外渡航旅費援助 for IEEE ICIP 2018, Precision Measurement Technology Promotion Foundation
- 海外渡航旅費援助 for IEEE IST 2016, Telecommunications Advancement Foundation

学会活動

- **Program Committee Member**
IEEE/SICE International Symposium on System Integration (SII 2017)
- **Special Session Organizer**
2019 IEEE 8th Global Conference on Consumer Electronics
OS-CER: Consumer Electronics Meets Robotics
- 学術雑誌論文査読 (**Journal Paper Reviewer**)
Robots and Autonomous Systems (Elsevier)
Intelligent Service Robotics (Springer)
Computer Vision and Image Understanding (Elsevier)
Sensors (MDPI)
Pattern Recognition Letters (Elsevier)
電気学会共通英文論文誌 *C* (電気学会)
- 国際会議論文査読 (**Conference Paper Reviewer**)
2021 International Conference on Computer Vision (ICCV 2021)
IEEE International Conference on Computer Vision and Pattern Recognition (CVPR 2020, 2021)
IEEE International Conference on Robotics and Automation (ICRA 2019)
IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2018)
IEEE Computer Society Winter Conference on Applications of Computer Vision (WACV 2015, 2016, 2017, 2018, 2019)
IEEE/SICE International Symposium on System Integration (SII 2017, 2021)
The 15th International Conference on Ubiquitous Robots (UR 2018)
21st International Conference on Research and Education in Mechatronics 2021 (REM2021)