

# YUMI IWASHITA, PhD

4800 Oak Grove Drive, Pasadena, CA 91109, USA  
(818) 393 0126

[Yumi.Iwashita@jpl.nasa.gov](mailto:Yumi.Iwashita@jpl.nasa.gov)

[https://www-robotics.jpl.nasa.gov/people/Yumi\\_Iwashita](https://www-robotics.jpl.nasa.gov/people/Yumi_Iwashita), <http://robotics.ait.kyushu-u.ac.jp/~yumi>

NASA Jet Propulsion Laboratory

## RESEARCH EXPERTISE

Computer vision for robotics and Intelligence, Surveillance, and Reconnaissance (ISR) applications. People tracking and 3D geometrical modeling using laser range finders. Experience with motion capture system using multiple cameras and people tracking system using cameras. Biometrics and pattern recognition for security systems, such as people recognition on both ground and aerial surveillance cameras. (Pioneer/co-inventor of shadow biometrics technology, which allows aerial recognition of people based on the dynamics of their body shadows.) Medical image processing for the purpose of a navigation system for a surgical robot. Range data processing for building a huge-scale structure with multiple robots and people tracking.

## EDUCATION

**Kyushu University, Japan** 2004-2007  
Ph.D. Information Science and Electrical Engineering  
*"Motion Capture System Robust in Target Occlusion using Fast Level Set Method"*

**Kyushu University, Japan** 2002-2004  
M.S. Information Science and Electrical Engineering  
*"3D Shape Reconstruction using Fast Level Set Method"*

## WORK HISTORY

**Research Technologist, Robotics Section, Jet Propulsion Laboratory, USA** 2016-PRESENT

**Affiliate researcher, Robotics Section, Jet Propulsion Laboratory, USA** 2011-2016

**Associate Professor, School of Information Science and Electrical Engineering, Kyushu University, Japan** 2014-2016

**Assistant Professor, School of Information Science and Electrical Engineering, Kyushu University, Japan** 2007-2014

**Visiting researcher, Department of Electrical and Electronic Engineering, Imperial College London, UK** 2007

## RESEARCH EXPERIENCE

**Gait recognition from extreme low resolution** APR 2015-PRESENT  
*Associate Professor, Kyushu University*  
Research with graduate student at Kyushu University. The goal is to recognize people from gait images which are extreme low resolution.

<p><b>First-person activity recognition</b>  <i>Associate Professor, Kyushu University</i>  Research with Dr. Michael Ryoo. The goal is to recognize activities from first-person vision.</p>	APR 2013-PRESENT
<p><b>People tracking from aerial images</b>  <i>Affiliate researcher, Jet Propulsion Laboratory</i>  Research with Dr. Curtis Padgett and the Computer Vision for Aerial Applications Group. The goal is to track people from aerial images robustly to occlusion, noise, and parallax.</p>	OCT 2011-PRESENT
<p><b>People recognition from shadow biometrics</b>  <i>Assistant Professor, Kyushu University</i>  <i>Affiliate researcher, Jet Propulsion Laboratory</i>  Research began in collaboration with Dr. Adrian Stoica at JPL and has continued. The goal is to recognize people from their shadows for the purpose of wide area security operations.</p>	2009-PRESENT
<p><b>People recognition from gait</b>  <i>Visiting Researcher, Imperial College London (till Sep. on 2007)</i>  <i>Assistant Professor, Kyushu University</i>  Research began at Imperial College London in collaboration with Prof. Maria Petrou and has continued. The goal is to recognize people under various changes, such as appearance changes and walking on curved trajectories.</p>	2007-PRESENT
<p><b>3D modeling of large-scale architectural structures with multiple robots</b>  <i>Assistant Professor, Kyushu University</i>  Research was undertaken at Kyushu University with Prof. Kurazume. Developed an automatic 3-D laser measurement system of an environmental structure using the cooperation of multiple mobile robots.</p>	2007-2011
<p><b>Classification of vehicles using a laser range finder</b>  <i>Assistant Professor, Kyushu University</i>  Research was undertaken at Kyushu University with Prof. Kurazume. Developed a system to identify in real time the kind of the vehicles (car, bike, bus...) and in the special case of buses to read the company name.</p>	2009-2010
<p><b>Target tracking using laser range finders</b>  <i>Assistant Professor, Kyushu University</i>  Research was undertaken at Kyushu University with Prof. Kurazume. Developed a system to track multiple people with distributed laser range finders and cameras.</p>	2007-2010
<p><b>3D reconstruction of a femoral shape using 2D fluoroscopic images</b>  <i>Assistant Professor, Kyushu University</i>  Research was undertaken at Kyushu University in collaboration with Prof. Sato at Osaka University. Developed a system to reconstruct precise 3D shapes of living organisms or bones from a few conventional 2D fluoroscopic images.</p>	2007-2009
<p><b>Fast 2D-3D Registration for Navigation System of Surgical Robot</b>  <i>Graduate student researcher, Kyushu University</i>  Research was undertaken at Kyushu University with Prof. Kurazume. Developed a system to superimpose a tumor model on an endoscopic image</p>	2005-2006

**2D-3D alignment based on geometrical consistency** 2005-2006

*Graduate student researcher, Kyushu University*

Research was undertaken at Kyushu University with Prof. Hara. The goal was to develop a system to align a 3D geometrical model to a 2D image, which is robust for initial registration errors, for reconstructing a realistic 3D model of indoor scene settings.

**Motion capture system using multiple cameras** 2003-2007

*Graduate student researcher, Kyushu University*

Research was undertaken at Kyushu University with Prof. Kurazume. Reconstructed 3D models of multiple people in real-time. In this system the Fast Level Set Method was applied to stereo range data captured by multiple stereo cameras.

## **AWARDS and HONORS**

**NISTEP AWARD, National Institute of Science and Technology Policy (NISTEP), 2017** 2017

**Best Paper in the Machine Vision Workshop , Int. Conf. on Emerging Security Technologies (EST 2015), UK** 2015

**The Tenth Joint Workshop on Machine Perception and Robotics (MPR14) Best Poster Session Award, Beijing** 2014

**Postdoctoral Fellowships for Research Abroad, Japan Society for the Promotion of Science** 2011-2013  
Jet Propulsion Laboratory, USA

**T.J.Tarn Best Paper in Robotics, 2010 IEEE Int. Conf. on Robotics and Biomimetics (ROBIO 2012), China** 2010

**Best Oral Presentation Award , Int. Conf. on Emerging Security Technologies (EST 2010), UK** 2010

**Best Oral Presentation Award, Image and Vision Computing New Zealand** 2008

**Postdoctoral Fellowships for Young Scientists, Japan Society for the Promotion of Science** 2007  
Imperial College London, UK

**IEEE Robotics and Automation Society Japan Chapter Young Award** 2005

## **GRANT**

[G1] **JPL Division Technologist Discretionary Task Proposal (DTD)** 2018  
*Principal Investigator*  
*Virtual sensors determined through machine learning*

[G2] **JPL Spontaneous Research & Technology Development (R&TD)** 2018  
*Principal Investigator*

*Terrain Classification for Mars Rovers with Visible and Thermal Images*

- [G3] **JGC-S Research Foundation** 2014-2015  
*Principal Investigator*  
*Early Gait Recognition using parametric shape and walking models*
- [G4] **Grant-in-Aid for Scientific Research (C), Japan Society for the** 2011-2014  
**Promotion of Science**  
*Principal Investigator*  
*Gait Recognition System using Invisible Lights*
- [G5] **Grant-in-Aid for Scientific Research (B), Japan Society for the** 2011-2014  
**Promotion of Science**  
*Researcher*  
*Development of 3D Scanning System using Multiple Robots*
- [G6] **Grant-in-Aid for Scientific Research (B), Japan Society for the** 2010-2012  
**Promotion of Science**  
*Researcher*  
*Supporting Robotic Activities in Informationally Structured Environment*
- [G7] **Project for Future Generation Robots, New Energy and Industrial** 2010-2012  
**Technology Development Organization**  
*Researcher*  
*Development of Informationally Structured Environment for Robots*
- [G8] **Grant-in-Aid for Scientific Research (B), Japan Society for the** 2009-2010  
**Promotion of Science**  
*Principal Investigator*  
*Motion Capture System using Parametric 3D Shape Model*
- [G9] **Grant A-Step, Japan Science and Technology Agency** 2009  
*Principal Investigator*  
*Gait Recognition Robust to Appearance Changes using 4D Gait Database*
- [G10] **Project for Intelligent Medical Robots, New Energy and Industrial** 2007-2010  
**Technology Development Organization**  
*Researcher*  
*Development of Endoscopic Operation Robot*

## **PUBLICATIONS**

### **Journals**

- [J1] K. Nakashima, H. Jung, Y. Oto, Y. Iwashita, R. Kurazume, O. Mozos, 2018  
"Learning Geometric and Photometric Features from Panoramic LiDAR scans for Outdoor Place Categorization", *Advanced Robotics, Volume 32, Issue 14, pp.750-765, 2018, doi:10.1080/01691864.2018.1501279*
- [J2] R. Kurazume, S. Oshima, S. Nagakura, Y. Jeong, Y. Iwashita, "Automatic large-scale three dimensional modeling using cooperative multiple robots", *Computer Vision and Image Understanding. Vol.157. pp.25-42. 2017*

- [J3] H. Jung, O. Mozos, Y. Iwashita, R. Kurazume, "Local N-ary Patterns: a local multi-modal descriptor for place categorization", *Advanced Robotics*, Vol. 30, No. 6, pp.402--415, 2016, doi:10.1080/01691864.2015.1120242 2015
- [J4] Y. Iwashita, K. Ogawara, and R. Kurazume, "Identification of people walking along curved trajectories", *Pattern Recognition Letters*, Vol. 46, pp. 60-69, 2014 2014
- [J5] Y. Iwashita, K. Uchino, and R. Kurazume, "Gait-based person identification robust to changes in appearance", *Sensors*, Vol. 13, No.6, pp.7884-7901, 2013 2013
- [J6] Y. Iwashita, A. Stoica, and R. Kurazume, "Gait identification using shadow biometrics", *Pattern Recognition Letters*, Vol.33, pp.2148-2155, 2012 2012
- [J7] Y. Tobata, R. Kurazume, Y. Noda, K. Lingemann, Y. Iwashita, T. Hasegawa, "Laser-based geometrical modeling of large-scale architectural structures using co-operative multiple robots", *Autonomous Robot*, Vol.32, No.1, pp. 49-62, 2012 2012
- [J8] S. Oishi, R. Kurazume, Y. Iwashita, T. Hasegawa, " Smoothing Range Image using Trilateral Filter and Reflectance Image", *Journal of the Institute of Electrical Engineering of Japan*, Vol.132, No.2, Sec.C, pp.291-298, 2012 (in Japanese) 2012
- [J9] J. Yongjin, Y. Iwashita, R. Kurazume, "Study on CPS-SLAM Improvement of Measurement Precision and Application for Tunnel Shape Measurement System", *Journal of the Robotics Society of Japan*, Vol.30, No.2, pp.180-187. 2012 (in Japanese) 2012
- [J10] A. Tamura, K. Morooka, R. Kurazume, Y. Iwashita, "Trachea and Esophagus Classification by AdaBoost", *Journal of the Institute of Electronics, Information and Communication Engineers*, Vol.J92-D, No.12, pp.2249-2260, 2010 (in Japanese) 2010
- [J11] R. Kurazume, H. Yamada, K. Sokabe, K. Murakami, Y. Iwashita, T. Hasegawa, "Simultaneous Tracking of Multiple Targets Using SIR/MCMC Particle Filters by Distributed Cameras and Laser Range Finders", *Journal of the Robotics Society of Japan*, Vol.27, No.1, pp.65-76. 2010 (in Japanese) 2010
- [J12] R. Kurazume, K. Nakamura, O. Okada, Y. Sato, N. Sugano, T. Koyama, Y. Iwashita, T. Hasegawa, "3D reconstruction of a femoral shape using a parametric model and two 2D fluoroscopic images", *Computer Vision and Image Understanding*, vol.113, no.2, pp.202-211, 2009 2009
- [J13] Y. Kabashima, K. Hara, R. Kurazume, Y. Iwashita, K. Morooka, S. Uchida, T. Hasegawa, "2D/3D Registration by Back Projection and Geometrical Constraints", *Journal of the Institute of Electronics, Information and Communication Engineers*, Vol.J91-D, No.5, pp.1380-1392, 2008 (in Japanese) 2008
- [J14] Y. Iwashita, R. Kurazume, K. Konishi, M. Nakamoto, N. Aburaya, Y. Sato, M. Hashizume, T. Hasegawa, "Fast Model-Image Registration using 2D 2007

Distance Map for Surgical Navigation System", *Advanced Robotics*, Vol.21 No.7, pp.751-770, 2007

- [J15] Y. Iwashita, R. Kurazume, K. Hara, S. Uchida, K. Morooka, T. Hasegawa, "Fast 3D Shape Reconstruction of Moving Objects by Parallel Fast Level Set Method", *Journal of the Institute of Electronics, Information and Communication Engineers*, Vol.J90-D, No. 8, pp.1888-1899, 2007 (in Japanese) 2007
- [J16] Y. Iwashita, R. Kurazume, T. Tsuji, K. Hara, T. Hasegawa, "3D Tracking of Multiple Moving Objects using Fast Level Set Method", *Journal of the Robotics Society of Japan*. Vol.23. No.7. pp.813-820. 2005 (in Japanese) 2005
- [J17] Y. Iwashita, R. Kurazume, S. Konishi, M. Nakamoto, M. Hashizume, T. Hasegawa, "Fast Alignment of 3D Geometrical Models and 2D Grayscale Images Using 2D Distance Maps", *Journal of Institute of Electronics, Information and Communication Engineers*, Vol.J88-D-II, No.9, pp.1889-1899 2005 (in Japanese) 2005
- [J18] R. Kurazume, S. Yui, T. Tsuji, Y. Iwashita, K. Hara, T. Hasegawa, "Fast Level Set Method and Realtime Tracking of Moving Objects in a Sequence of Images", *Journal of the Information Processing Society of Japan*, Vol.44, No.8, pp.2244-2254, 2003 (in Japanese) 2003

**Selected Refereed Conference Papers (17 papers out of 60 papers)**

- [C1] Y. Iwashita, M. Kakeshita, H. Sakano, R. Kurazume, "Making gait recognition robust to speed changes using mutual subspace method", *IEEE Int. Conf. on Robotics and Automation*. 2017 2017
- [C2] M. Shinzaki, Y. Iwashita, R. Kurazume, K. Ogawara, "Gait-Based Person Identification Method Using Shadow Biometrics for Robustness to Changes in the Walking Direction", *IEEE Winter Conference on Applications of Computer Vision*, pp.670-677, 2015. 2015
- [C3] Y. Iwashita, A. Takamine, R. Kurazume, M. S. Ryoo, "First-Person Animal Activity Recognition from Egocentric Videos", *International Conference on Pattern Recognition (ICPR) 2014*. 2014
- [C4] Y. Iwashita, M. Ryoo, T. Fuchs, C. Padgett, "Recognizing Humans in Motion: Trajectory-based Aerial Video Analysis", *British Machine Vision Conference (BMVC)*. 2013. 2013
- [C5] Y. Iwashita, K. Ogawara, R. Kurazume, "Expanding gait identification methods from straight to curved trajectories", *IEEE Workshop on the Applications of Computer Vision (WACV)*, 2013. 2012
- [C6] Y. Iwashita, R. Baba, K. Ogawara, R. Kurazume, "Method for gait-based biometric identification robust to changes in observation angle", *International Conference Image and Vision Computing New Zealand*. 2011 2011
- [C7] R. Kurazume, Y. Iwashita, K. Murakami, and T. Hasegawa, "Introduction to 2011 2011

the Robot Town Project and 3-D Co-operative Geometrical Modeling Using Multiple Robots", *International Symposium on Robotics Research* , 2011

- [C8] Y. Tobata, R. Kurazume, Y. Iwashita, and T. Hasegawa, "Automatic laser-based geometrical modeling using multiple mobile robots", *IEEE International Conference on Robotics and Biomimetics (ROBIO 2010)* , pp.363-369 2010 2010
- [C9] Y. Iwashita, A. Stoica, R. Kurazume, "Person Identification using Shadow Analysis", *British Machine Vision Conference* , pp.35.1--10, 2010 2010
- [C10] Y. Iwashita, R. Baba, K. Ogawara, R. Kurazume, "Person identification from spatio-temporal 3D gait", *Int. Conf. on Emerging Security Technologies* , pp.30-35. 2010 2010
- [C11] Y. Iwashita, R. Kurazume, T. Mori, M. Saito and T. Hasegawa, "Model-based motion tracking system using distributed network cameras", *IEEE Int. Conf. on Robotics and Automation* , pp.3020-3025, 2010. 2010
- [C12] Y. Iwashita and R. Kurazume, "Person identification from human walking sequences using affine moment invariants", *IEEE Int. Conf. on Robotics and Automation* , 2009 2009
- [C13] Y. Iwashita and M. Petrou, "Person identification from spatio-temporal volumes", *Int. Conf. Image and Vision Computing New Zealand* , 2008 2008
- [C14] Y. Iwashita, R. Kurazume, K. Hara, S. Uchida, K. Morooka, and T. Hasegawa, "Fast 3D Reconstruction of Human Shape and Motion Tracking by Parallel Fast Level Set Method", *IEEE Int. Conf. on Robotics and Automation* , pp.980-986, 2008 2008
- [C15] R. Kurazume, H. Yamada, K. Murakami, Y. Iwashita, and T. Hasegawa, "Target Tracking Using SIR and MCMC Particle Filters by Multiple Cameras and Laser Range Finders", *IEEE/RSJ International Conference on Intelligent Robots and Systems*, pp.3838-3844, Sep. 2008 2008
- [C16] Y. Iwashita, R. Kurazume, K. Hara, T. Hasegawa, "Robust Motion Capture System against Target Occlusion using Fast Level Set Method", *IEEE Int. Conf. on Robotics and Automation* , pp.168-174, 2006 2006
- [C17] Y. Iwashita, R. Kurazume, K. Konishi, M. Nakamoto, M. Hashizume, T. Hasegawa, "Fast 2D-3D Registration for Navigation System of Surgical Robot", *IEEE Int. Conf. on Robotics and Automation* , pp.909-915, 2005 2005

## PROFESSIONAL ACTIVITIES

### Associate Editor

- [AE1] International Conference on Intelligent Robots and Systems (IROS 2012) 2012
- [AE2] Symposium on Image Recognition and Understanding 2011 (Japanese) 2011

### Executive Committee

- [EC1] General Chair of International Conference on Emerging Security 2015

	Technologies (EST)	
[EC2]	Program Chair of International Conference on Emerging Security Technologies (EST)	2014
[EC3]	Technical Committee on Biometrics (BioX), IEICE	2013-PRESENT
[EC4]	Chair of Computer Vision Workshop, International Conference on Emerging Security Technologies (EST)	2012, 2013
[EC5]	IEEE Japan Council Women in Engineering	2010-PRESENT

#### **Program Committee**

[PC1]	Int. Conf. Pattern Recognition (ICPR 2016)	2016
[PC2]	International Conference Image and Vision Computing New Zealand	2015
[PC3]	The 12th Asian Conference on Computer Vision	2014
[PC4]	IEEE Int. Conf. Space Mission Challenges for Information Technology (SMC-IT)	2014
[PC5]	Int. Conf. Pattern Recognition (ICPR 2014)	2014
[PC6]	The 11th World Congress on Intelligent Control and Automation	2014
[PC7]	International Conference Image and Vision Computing New Zealand	2013
[PC8]	International Conference on Emerging Security Technologies (EST)	2013
[PC9]	European Conference on Modelling and Simulation (ECMS)	2013
[PC10]	International Conference Image and Vision Computing New Zealand	2012
[PC11]	IEEE International Conference on Robotics and Biomimetics (ROBIO)	2012
[PC12]	International Workshop on Depth Image Analysis	2012
[PC13]	International Conference on Emerging Security Technologies (EST)	2012
[PC14]	IEEE International Conference on Robotics and Biomimetics (ROBIO)	2011
[PC15]	International Conference on Intelligent Robotics and Applications (ICIRA)	2011
[PC16]	China-Japan-Korea Joint Workshop on Pattern Recognition (CJKPR2010)	2010
[PC17]	International Conference on Intelligent Robotics and Applications (ICIRA)	2010
[PC18]	Asian Conference on Computer Vision (ACCV)	2010
[PC19]	IEEE International Conference on Robotics and Biomimetics (ROBIO)	2010
[PC20]	Advanced Technologies for Enhanced Quality of Life (AT-EQUAL)	2010
[PC21]	International Conference on Emerging Security Technologies (EST)	2010
[PC22]	International Workshop on Human Behavior Sensing (HBS)	2010
[PC23]	ECSIS Symposium on Learning and Adaptive Behavior in Robotic Systems	2010

#### **Reviewer for Journals**

[RJ1]	Elsevier, Image and Vision Computing	2014-PRESENT
[RJ2]	Elsevier, Pattern Recognition	2013-PRESENT
[RJ3]	Elsevier, Engineering Applications of Artificial Intelligence	2012
[RJ4]	Journal of the Institute of Electronics, Information and Communication Engineers	2008-PRESENT
[RJ5]	Journal of Control, Measurement, and System Integration	2012
[RJ6]	Advanced Robotics	2010-PRESENT
[RJ7]	IEEE Trans. On Systems, Man and Cybernetics - Part B	2010
[RJ8]	Elsevier, Medical Image Analysis	2010

#### **Reviewer for Conferences**

[RC1]	International Conference on Robotics and Automation (ICRA'16)	2016
[RC2]	IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS'16)	2016
[RC3]	International Conference on Robotics and Automation (ICRA'15)	2015
[RC4]	IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS'14)	2014
[RC5]	IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS'13)	2013
[RC6]	International Conference on Robotics and Automation (ICRA'13)	2013
[RC7]	International Conference on Robotics and Automation (ICRA'12)	2012
[RC8]	IEEE International Conference on Pattern Recognition (ICPR'12)	2012
[RC9]	International Conference on Robotics and Automation (ICRA'11)	2011
[RC10]	Asian Conference on Computer Vision (ACCV'10)	2010
[RC11]	Asian Conference on Computer Vision (ACCV'09)	2009

**Citizenship**

Japan (U.S. Permanent Resident)