Ryuji Hirayama

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https://ryujihirayama.github.io/web/

Research Interests

Volumetric display, Holography, Steganography, Human–Computer Interaction, Computational fabrication

Education

Ph.D., Engineering **04/2014 – 03/2017**
Graduate School of Engineering, Chiba University, Japan
Theme: Volumetric display containing multiple 2D images
Advisor: Professor Tomoyoshi Ito

M.S., Engineering **04/2012 – 03/2014**
Graduate School of Engineering, Chiba University, Japan

B.S., Engineering **04/2008 – 03/2012**
Faculty of Engineering, Chiba University, Japan

Experiences

Postdoctoral Researcher **04/2017 – present**
Graduate School of Engineering, Chiba University, Japan
Advisor: Professor Tomoyoshi Ito

Research Fellow **04/2015 – present**
Japan Society for the Promotion of Science
Theme: Volumetric display exhibiting multiple 2D information
Advisor: Professor Tomoyoshi Ito

Research Assistant of the ImPACT Program **11/2014 – 03/2015**
Graduate School of Engineering, Chiba University, Japan
Theme: Acceleration of a cell searching algorithm for the Serendipiter
Project Leader: Professor Tomoyoshi Shimobaba

Teaching Assistant **10/2014 – 03/2015**
Faculty of Engineering, Chiba University
Lecture: Experiment of electrical and electronics engineering III

Student Assistant **07/2013 – 10/2014**
Academic Link Center, Chiba University
Job: Leaning support for undergraduate students

Research Grants

Grant-in-Aid for JSPS Fellows, No. 16J30007 **04/2016 – present**
Japan Society for the Promotion of Science
2,300,000 JPY / 2 years

Grant-in-Aid for JSPS Fellows, No. 15J07684 **04/2015 – 03/2016**
Japan Society for the Promotion of Science
1,200,000 JPY / 1 year

Honors and Awards

Inoue Research Award for Young Scientists **02/2018**
Inoue Foundation for Science

Young Researcher Award **01/2018**
Kenjiro Takayanagi Foundation

President Award for the Excellent Record **03/2017**
Chiba University

Dean Award for the Excellent Record **03/2017**
Graduate School of Engineering, Chiba University

Global Prominent Research Program to Support Sending Graduate Students Abroad **12/2016**
Chiba University

Program to Support Sending Graduate Students Abroad **10/2016**
Chiba University

JSPS Ikushi Prize **03/2016**
Japan Society for the Promotion of Science

KONICA MINOLTA Science and Technology Foundation Award **06/2015**
The Optical Society of Japan

Scholarship Loan Forgiveness for Academic Excellence (Full Amount) **05/2015**
Japan Student Services Organization

Best Poster Award (FORUM 8 Award) **03/2015**
Computer Graphic Arts Society

Outstanding Paper Award for Young C&C Researchers **01/2015**
NEC C&C Foundation

Scholarship Loan Forgiveness for Academic Excellence (Full Amount) **05/2014**
Japan Student Services Organization

Program to Support Sending Graduate Students Abroad **04/2014**
Chiba University

Grants for Researchers Attending International Conferences **04/2014**
NEC C&C Foundation

President Award for the Excellent Record **03/2014**
Chiba University

Dean Award for the Excellent Record **03/2014**
Graduate School of Engineering, Chiba University

Journal Papers

1. T. Shimobaba, Y. Endo, T. Nishitsuji, T. Takahashi, Y. Nagahama, S. Hasegawa, M. Sano, **R. Hirayama**, T. Kakue, A. Shiraki, and T. Ito,"Computational ghost imaging using deep learning," Optics Communications (accepted).
2. T. Shimobaba, K. Matsushima, T. Takahashi, Y. Nagahama, S. Hasegawa, M. Sano, **R. Hirayama**, T. Kakue, and T. Ito, "Fast, large-scale hologram calculation in wavelet domain," Optics Communications **412**, 80–84 (2018).
3. A. Shiraki, M. Ikeda, H. Nakayama, **R. Hirayama**, T. Kakue, T. Shimobaba, and T. Ito, "Efficient method for fabricating a directional volumetric display using strings displaying multiple images," Applied Optics **57**(1), A33–A38 (2018).
4. T. Shimobaba, N. Kuwata, M. Honma, T. Takahashi, Y. Nagahama, M. Sano, S. Hasegawa, **R. Hirayama**, T. Kakue, A. Shiraki, N. Takada, and T. Ito, "Convolutional neural network-based data page classification for holographic memory," Applied Optics **56**(26), 7327–7330 (2017).

5. **R. Hirayama**, A. Shiraki, H. Nakayama, T. Kakue, T. Shimobaba, and T. Ito, "Operating scheme of a light-emitting diode array for a volumetric display exhibiting multiple full-color dynamic images," Optical Engineering **56**(7), 073108 (2017).

6. **R. Hirayama**, T. Suzuki, T. Shimobaba, A. Shiraki, M. Naruse, H. Nakayama, T. Kakue, and T. Ito, "Inkjet printing-based volumetric display projecting multiple full-colour 2D patterns," Scientific Reports **7**, 46511 (2017).

7. T. Shimobaba, Y. Endo, **R. Hirayama**, Y. Nagahama, T. Takahashi, T. Nishitsuji, T. Kakue, A. Shiraki, N. Takada, N. Masuda, and T. Ito, "Autoencoder-based holographic image restoration," Applied Optics **56**(13), F27–F30 (2017).

8. T. Shimobaba, Y. Endo, **R. Hirayama**, D. Hiyama, Y. Nagahama, S. Hasegawa, M. Sano, T. Takahashi, T. Kakue, M. Oikawa, and T. Ito, "Holographic micro-information hiding", Applied Optics **56**(4), 833–837 (2017).

9. **R. Hirayama**, A. Shiraki, M. Naruse, S. Nakamura, H. Nakayama, T. Kakue, T. Shimobaba, and T. Ito, "Optical Addressing of Multi-Colour Photochromic Material Mixture for Volumetric Display," Scientific Reports **6**, 31543 (2016).

10. T. Shimobaba, M. Makowski, Y. Nagahama, Y. Endo, **R. Hirayama**, D. Hiyama, S. Hasegawa, M. Sano, T. Kakue, M. Oikawa, T. Sugie, N. Takada, and T. Ito, "Color computer-generated hologram generation using the random phase-free method and color space conversion," Applied Optics **55**(15), 4159–4165 (2016).

11. **R. Hirayama**, H. Nakayama, A. Shiraki, T. Kakue, T. Shimobaba, and T. Ito, "Image quality improvement for a 3D structure exhibiting multiple 2D patterns and its implementation," Optics Express **24**(7), 7319–7327 (2016).

12. T. Sanpei, T. Shimobaba, T. Kakue, Y. Endo, **R. Hirayama**, D. Hiyama, S. Hasegawa, Y. Nagahama, M. Sano, M. Oikawa, T. Sugie, and T. Ito, "Optical encryption for large-sized images," Optics Communications **361**, 138–142 (2016).

13. T. Shimobaba, T. Kakue, Y. Endo, **R. Hirayama**, D. Hiyama, S. Hasegawa, Y. Nagahama, M. Sano, M. Oikawa, T. Sugie, and T. Ito, "Improvement of the image quality of random phase-free holography using an iterative method," Optics Communications **355**, 596–601 (2015).

14. T. Shimobaba, T. Kakue, Y. Endo, **R. Hirayama**, D. Hiyama, S. Hasegawa, Y. Nagahama, M. Sano, M. Oikawa, T. Sugie, and T. Ito, "Random phase-free kinoform for large objects," Optics Express **23**(13), 17269–17274 (2015).

15. **R. Hirayama**, M. Naruse, H. Nakayama, N. Tate, A. Shiraki, T. Kakue, T. Shimobaba, M. Ohtsu, and T. Ito, "Design, implementation and characterization of a quantum-dot-based volumetric display," Scientific Reports **5**, 8472 (2015), *highlighted in Nature Japan*

16. D. Arai, T. Shimobaba, K. Murano, Y. Endo, **R. Hirayama**, D. Hiyama, T. Kakue, and T. Ito, "Acceleration of computer-generated hologram using tilted wavefront recording plane method," Optics Express **23**(2), 1740–1747 (2015).

17. T. Shimobaba, M. Makowski, T. Kakue, N. Okada, Y. Endo, **R. Hirayama**, D. Hiyama, S. Hasegawa, Y. Nagahama, and T. Ito, "Numerical investigation of lensless zoomable holographic projection to multiple tilted planes," Optics Communications **333**, 274–280 (2014).

18. T. Shimobaba, T. Kakue, N. Okada, Y. Endo, **R. Hirayama**, D. Hiyama, and T. Ito, "Ptychography by changing the area of probe light and scaled ptychography," Optics Communications **331**, 189–193 (2014).

19. T. Shimobaba, T. Kakue, M. Oikawa, N. Takada, N. Okada, Y. Endo, **R. Hirayama**, and T. Ito, "Calculation reduction method for color computer-generated hologram using color space conversion", Optical Engineering, **53**(2), 024108 (2014).

20. T. Shimobaba, T. Kakue, M. Oikawa, N. Okada, Y. Endo, **R. Hirayama**, N. Masuda, and T. Ito, "Non-uniform sampled scalar diffraction calculation using non-uniform fast Fourier transform," Optics Letters **38**(23), 5130–5133 (2013).

21. T. Shimobaba, M. Makowski, T. Kakue, M. Oikawa, N. Okada, Y. Endo, **R. Hirayama**, N. Masuda, and T. Ito, "Lensless zoomable holographic projection using scaled Fresnel diffraction," Optics Express **21**(21), 25285–25290 (2013).

22. T. Shimobaba, H. Yamanashi, T. Kakue, M. Oikawa, N. Okada, Y. Endo, **R. Hirayama**, and T. Ito, "Inline digital holographic microscopy using a consumer scanner," Scientific Reports **3**, 2664 (2013).

23. H. Nakayama, A. Shiraki, **R. Hirayama**, N. Masuda, T. Shimobaba, and T. Ito, "Three-dimensional volume containing multiple two-dimensional information patterns," Scientific Reports **3**, 1931 (2013).

Presentations

1. **R. Hirayama**, H. Nakayama, A. Shiraki, T. Kakue, T. Shimobaba, and T. Ito, "Controllable color particles in a 3D crystal projecting multiple dynamic full-color images," ACM SIGGRAPH 2017 Posters, 73, Los Angeles, USA (July 2017).
2. **R. Hirayama**, T. Suzuki, T. Shimobaba, A. Shiraki, M. Naruse, H. Nakayama, T. Kakue, and T. Ito, "Inkjet-printed 3D structure projecting multiple full-color images," OPIC IP2017, IP-20AM-1-5, Yokohama, Japan (Apr. 2017).
3. F. Kawashima, **R. Hirayama**, A. Shiraki, H. Nakayama, T. Kakue, T. Shimobaba, and T. Ito "Gradation expression by overlap of voxels in volumetric display composed of photochromic materials," IDW / AD 2016, 3DSAp2/3Dp2-1, Fukuoka, Japan (Dec. 2016).
4. **R. Hirayama**, A. Shiraki, H. Nakayama, T. Kakue, T. Shimobaba, and T. Ito, "3-D crystal with a curved surface projecting multiple 2-D images," ACM SIGGRAPH Asia 2016 Posters, 41, Macao, China (Dec. 2016).
5. **R. Hirayama**, A. Shiraki, H. Nakayama, T. Kakue, T. Shimobaba, and T. Ito, "Refraction-compensating algorithm for a 3D glass structure exhibiting multiple 2D images," FiO / LS 2016, JTh2A-68, Rochester, USA (Oct. 2016).
6. M. Oikawa, D. Hiyama, **R. Hirayama**, S. Hasegawa, Y. Endo, T. Sugie, N. Tsumura, M. Kuroshima, M. Maki, G. Okada, C. Lei, Y. Ozeki, K. Goda, and T. Shimobaba, "A computational approach to real-time image processing for serial time-encoded amplified microscopy," SPIE Photonics West BIOS 2016 (Proc. SPIE 9720), 97200E, San Francisco USA (Mar. 2016).
7. (invited) A. Shiraki, H. Nakayama, **R. Hirayama**, T. Kakue, T. Shimobaba, and T. Ito, "Volumetric display containing multiple two dimensional information patterns," IDW 2015, PRJ1-1, Otsu, Japan (Dec. 2015).
8. **R. Hirayama**, A. Shiraki, H. Nakayama, T. Kakue, T. Shimobaba, and T. Ito, "3-D crystal exhibiting multiple 2-D images with directivity," ACM SIGGRAPH Asia 2015 Posters, 1, Kobe, Japan (Nov. 2015).
9. **(invited) R. Hirayama**, A. Shiraki, H. Nakayama, T. Kakue, T. Shimobaba, and T. Ito, "3-D crystal exhibiting multiple 2-D images with directivity," VRCAI 2015, 33, Kobe, Japan (Oct. 2015).
10. **R. Hirayama**, A. Shiraki, M. Naruse, H. Nakayama, N. Tate, T. Kakue, T. Shimobaba, and T. Ito, "Optically controlled quantum-dot-based volumetric display exhibiting multiple patterns," JSAP-OSA Joint Symposia 2015, 15p-2F-10, Nagoya, Japan (Sep. 2015).
11. **(invited) R. Hirayama**, M. Naruse, H. Nakayama, A. Shiraki, T. Kakue, T. Shimobaba, and T. Ito, "Optically controlled volumetric display exhibiting multiple two-dimensional patterns," CC3DMR 2015, 340–341, Busan, South Korea (June 2015).
12. **R. Hirayama**, H. Nakayama, A. Shiraki, T. Kakue, T. Shimobaba, and T. Ito, "Development of volumetric display based on multi-bit color LED," APCCAS 2014, 547–550, Okinawa, Japan (Nov. 2014).
13. **R. Hirayama**, H. Nakayama, A. Shiraki, T. Kakue, T. Shimobaba, and T. Ito, "Volumetric display containing multiple two-dimensional color motion pictures," SPIE DSS 2014 (Proc. SPIE 9117), 911717, Baltimore, USA (May 2014).
14. (invited) T. Kakue, N. Masuda, Y. Endo, **R. Hirayama**, N. Okada, T. Shimobaba, and T. Ito, "Special-purpose computer for real-time reconstruction of holographic motion picture," OIT 2013 (Proc. SPIE 9042), 90420B, Beijing, China (Nov. 2013).
15. **R. Hirayama**, R. Omura, Y. Kobayashi, A. Shiraki, H. Nakayama, T. Kakue, N. Masuda, T. Shimobaba, and T. Ito, "Development of a digitized volumetric display containing multiple two-dimensional patterns," 3DSA 2013, P7-2, Osaka, Japan (June 2013).
16. **R. Hirayama**, H. Ando, A. Shiraki, H. Nakayama, T. Kakue, N. Masuda, T. Shimobaba, and T. Ito, "Image-quality improvement of multiple two-dimensional patterns contained in three-dimensional volume,"3DSA 2013, S11-1, Osaka, Japan (June 2013).
17. **R. Hirayama**, T. Shimobaba, H. Nakayama, A. Shiraki, T. Kakue, N. Masuda, and T. Ito, "Optical encryption using three-dimensional volume containing multiple two-dimensional information patterns," DHIP 2012, C015, Tokushima, Japan (Sep. 2012).

Media

1. **R. Hirayama**, A. Shiraki, T. Kakue, T. Shimobaba, and T. Ito, "Optical addressing method for full-color 3D display," SPIE Newsroom (2016).

Membership

Association for Computing Machinery (ACM) **10/2016 – present**

The Optical Society (OSA) **08/2016 – present**

The Japan Society of Applied Physics (JSAP) **01/2014 – present**

Skills

Programming
C, C++, Python, CUDA, Matlab, VHDL, HTML/CSS

Others
3D printer, Laser cutter, FPGA design, GPU computing, Microcomputer, Photoluminescence materials, Photochromic materials, Illustrator, LaTeX, Maya