# Ryuji Hirayama

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## Research Interests

Volumetric display, Holography, High-performance computing, Acoustic levitation, Multimodal system, Haptics, Parametric audio, Human-computer interaction, 3D Ambigram, Computational fabrication

## Education

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|---|---|
| 03/2014–04/2017 | **PhD in Engineering**<br>Graduate School of Engineering, Chiba University, Japan<br>Theme: Volumetric display containing multiple 2D images |
| 03/2012.–04/2014 | **Master of Engineering**<br>Graduate School of Engineering, Chiba University, Japan |
| 03/2008–04/2012 | **Bachelor of Engineering**<br>Faculty of Engineering, Chiba University, Japan |

## Experience

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|---|---|
| 07/2022–present | **Lecturer**<br>Department of Computer Science, University College London, UK |
| 07/2020–06/2022 | **Postdoctoral Research Fellow**<br>Department of Computer Science, University College London, UK |
| 04/2019–06/2020 | **Postdoctoral Research Fellow**<br>Interact Lab, School of Engineering and Informatics, University of Sussex, UK |
| 01/2019–03/2019 | **Rutherford Research Fellow**<br>Interact Lab, School of Engineering and Informatics, University of Sussex, UK |
| 04/2018–12/2018 | **Research Fellow of the Japan Society for the Promotion of Science (PD)**<br>Masuda Lab, Faculty of Industrial Science and Technology, Tokyo University of Science, Japan |
| 04/2018–09/2018 | **Visiting Research Fellow**<br>Interact Lab, School of Engineering and Informatics, University of Sussex, UK |
| 04/2017–03/2018 | **Research Fellow of the Japan Society for the Promotion of Science (PD)**<br>Itot Lab, Graduate School of Engineering, Chiba University, Japan |
| 04/2015–03/2017 | **Research Fellow of the Japan Society for the Promotion of Science (DC2)**<br>Itot Lab, Graduate School of Engineering, Chiba University, Japan |
| 11/2014–03/2015 | **Research Assistant of the ImPACT Program**<br>Graduate School of Engineering, Chiba University, Japan |
| 10/2014–03/2015 | **Teaching Assistant (Experiment of electrical and electronics engineering III)**<br>Faculty of Engineering, Chiba University |
| 07/2013–10/2014 | **Student Assistant (Leaning support for undergraduates)**<br>Academic Link Centre, Chiba University |

## Journal Papers

1. **R. Hirayama**, G. Christopoulos, D. M. Plasencia and S. Subramanian, 'High-speed acoustic holography with arbitrary scattering objects', Science Advances **8**, eabn7614 (2022).
2. D. M. Plasencia, **R. Hirayama**, R. Montano and S. Subramanian, 'GS-PAT: High-speed multi-point sound-fields for phased arrays of transducers', ACM Transactions on Graphics **39**, 138 (2020).
3. **R. Hirayama**, D. M. Plasencia, N. Masuda and S. Subramanian, 'A volumetric display for visual, tactile and audio presentation using acoustic trapping', Nature **575**, 320–323 (2019), featured in Nature.
4. D. Matsumoto, **R. Hirayama**, N. Hoshikawa, H. Nakayama, T. Shimobaba, T. Ito and A. Shiraki, 'Interactive directional volumetric display that keeps displaying directional image only to a particular person in real-time', OSA Continuum **2**(11), 3309–3322 (2019).
5. **R. Hirayama**, H. Nakayama, A. Shiraki, T. Kakue, T. Shimobaba and T. Ito, 'Projection of multiple directional images on a volume structure with refractive surfaces', Optics Express **27**(20), 27637–27648 (2019).
6. Y. Yamamoto, N. Masuda, **R. Hirayama**, H. Nakayama, T. Kakue, T. Shimobaba and T. Ito, 'Special-purpose computer for electroholography in embedded systems', OSA Continuum **2**(4), 1166–1173 (2019).
7. A. Shiraki, D. Matsumoto, **R. Hirayama**, H. Nakayama, T. Kakue, T. Shimobaba and T. Ito, 'Improvement of an algorithm for displaying multiple images in one space', Applied Optics **58**(5), A1–A6 (2019).

8. T. Nishitsuji, Y. Yamamoto, T. Sugie, T. Akamatsu, **R. Hirayama**, H. Nakayama, T. Kakue, T. Shimobaba and T. Ito, 'Special-purpose computer HORN-8 for phase-type electro-holography', Optical Express **26**(20), 26722 (2018).

9. T. Kakue, Y. Wagatsuma, S. Yamada, Y. Endo, Y. Nagahama, **R. Hirayama**, T. Shimobaba and T. Ito, 'Review of real-time reconstruction techniques for aerial-projection holographic displays', Optical Engineering **57**(6), 061621 (2018).

10. T. Sugie, T. Akamatsu, T. Nishitsuji, **R. Hirayama**, N. Masuda, H. Nakayama, Y. Ichihashi, A. Shiraki, M. Oikawa, N. Takada, Y. Endo, T. Kakue, T. Shimobaba and T. Ito, 'High-performance parallel computing for next-generation holographic imaging', Nature Electronics **1**, 254–259 (2018).

11. 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 **413**, 147–151 (2018).

12. 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).

13. 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).

14. 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).

15. **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).

16. **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).

17. 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).

18. 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).

19. **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).

20. 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).

21. **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).

22. 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).

23. 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).

24. 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).

25. **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*

26. 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).

27. 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).

28. 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).

29. 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).

30. 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).

31. 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).

32. 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).

33. 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).

## Conference Proceedings

1. **(invited) R. Hirayama**, 'Multimodal 3D display using ultrasound', 3DSA 2021, Online (12/2021).

2. **(invited) R. Hirayama**, D. M. Plasencia, R. Montano and S. Subramanian, 'Paradigm shift from high-speed single-point to high-speed multipoint algorithms for multimodal acoustic displays', IDW 2021, Online (12/2020).

3. **(invited) R. Hirayama**, D. M. Plasencia, N. Masuda and S. Subramanian, 'Multimodal acoustic trapping display', IDW 2020, Online (12/2020).

4. **(invited) R. Hirayama**, D. M. Plasencia, N. Masuda and S. Subramanian, 'Acoustic levitation for multimodal volumetric display', SPIE Optics + Photonics 2020 (Proc. SPIE 11463), Optical Trapping and Optical Micromanipulation XVII; 114630Q, Online (08/2020).

5. D. M. Plasencia, **R. Hirayama**, R. Montano and S. Subramanian, 'GS-PAT: High-speed multi-point sound-fields for phased arrays of transducers', SIGGRAPH 2020 Technical Papers, Online (08/2020).

6. D. Matsumoto, **R. Hirayama**, N. Hoshikawa, H. Nakayama, T. Shimobaba, T. Ito and A. Shiraki, 'GPU acceleration of algorithm to design directional volumetric display for real-time', IDW 2019 / 3DSA 2019, Sapporo, Japan (11/2019).

7. T. Murase, **R. Hirayama**, N. Hoshikawa, H. Nakayama, T. Shimobaba, T. Ito and A. Shiraki, 'Development of volumetric display capable of transmitting information in different languages using language identification', IDW 2019 / 3DSA 2019, Sapporo, Japan (11/2019).

8. M. Baba, **R. Hirayama**, N. Hoshikawa, H. Nakayama, T. Shimobaba, T. Ito and A. Shiraki, 'Implemented of images and sounds person tracking system using directional volumetric display', IDW 2019 / 3DSA 2019, Sapporo, Japan (11/2019).

9. D. Matsumoto, T. Murase, **R. Hirayama**, H. Nakayama, T. Shimobaba T. Ito, and A. Shiraki, 'Subjective image quality evaluation to compare algorithms for designing a directional volumetric display', IDW 2018, Nagoya, Japan (12/2018).

10. T. Murase, D. Matsumoto, **R. Hirayama**, H. Nakayama, T. Shimobaba, T. Ito and A. Shiraki, 'Image quality improvement for 3D structure exhibiting multiple 2D patterns using convolutional neural networks', IDW 2018, Nagoya, Japan (12/2018).

11. D. Matsumoto, A. Shiraki, **R. Hirayama**, H. Nakayama, T. Kakue, T. Shimobaba and T. Ito, 'Improvement of the algorithm for designing a 3D object exhibiting multiple 2D images', 3DSA 2018, Taipei, Taiwan (08/2018).

12. M. Ikeda, A. Shiraki, **R. Hirayama**, T. Kakue, T. Shimobaba and T. Ito, 'Simulation of the projection mapping to a directional volumetric display', IDW 2017, Sendai, Japan (12/2017).

13. **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 (07/2017).

14. **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 (04/2017).

15. 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 (12/2016).

16. **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 (12/2016).

17. **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 (10/2016).

18. 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 (03/2016).

19. (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 (12/2015).

20. **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 (11/2015).

21. **(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 (10/2015).

22. **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 (09/2015).

23. **(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 (06/2015).

24. **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 (11/2014).

25. **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 (05/2014).

26. (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 (11/2013).

27. **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 (06/2013).

28. **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 (06/2013).

29. **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 (09/2012).

30. **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 (2012.09).

## Other Talks

1. **R. Hirayama**, 'A Multimodal Volumetric Display Using Acoustic Holography', OSA Webinar: Novel Displays for Future Vision Science (2021).

## News Articles

1. **R. Hirayama**, A. Shiraki, T. Kakue, T. Shimobaba and T. Ito, 'Optical addressing method for full-color 3D display', SPIE Newsroom (2016).

## Patents

1. **R. Hirayama**, G. Christopoulos, D. M. Plasencia and S. Subramanian, 'High-speed acoustic holography with arbitrary scattering objects', UK Patent Application, No. GB2207885.1 (2022).

2. **R. Hirayama**, D. M. Plasencia and S. Subramanian, 'Multimodal acoustic trap display (MAT)', UK Patent Application, No. 1914174.6 (2019).

3. T. Ito, **R. Hirayama,** A. Shiraki, T. Kakue and T. Shimobaba, '3D display device and its display method', Japanese Unexamined Patent Publication, No. 2017-191255 (2017).

4. T. Shimobaba, **R. Hirayama**, T. Sugie, Y. Endo, M. Oikawa, K. Goda and M. Ugawa, 'Signal data processing device', Japanese Unexamined Patent Publication, No. 2017-134044 (2017).

5. T. Ito, M. Naruse, **R. Hirayama,** H. Nakayama and T. Kakue, 'Quantum-dot display and its display method', Japanese Unexamined Patent Publication, No. 2015-165611 (2015).

## Grants and Awards

1. **UKRI guarantee funding for ERC Starting Grants**, No. 101039211, 'FabDisp: Acoustic holography for multimodal 3D display and fabrication', UKRI, €1.5M (09/2022–09/2027).

2. **Grant-in-Aid for JSPS Fellows**, No. 18J01002, Japan Society for the Promotion of Science, ¥1.3M (~£9.7K) + salary (~£24.2K) (04/2018–12/2018).

3. **Inoue Research Award for Young Scientists**, Inoue Foundation for Science, ¥500K (~£3.7K)  (02/2018).

4. **Young Researcher Award**, Kenjiro Takayanagi Foundation, ¥2M (~£14.9K) (01/2018).

5. **President Award for the Excellent Record**, Chiba University (03/2017).

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

7. **GP Program to Support Sending Graduate Students Abroad**, Institute for Global Prominent Research, Chiba University, ¥136K (~£1.0K) (12/2017).

8. **Program to Support Sending Graduate Students Abroad**, Chiba University, ¥136K (~£1.0K) (10/2017).

9. **Grant-in-Aid for JSPS Fellows**, No. 16J30007, Japan Society for the Promotion of Science, ¥2.3M (~£17.1K) + salary (~£35.7K) (04/2016–03/2018).

10. **JSPS Ikushi Prize**, Japan Society for the Promotion of Science, ¥2M (~£14.9K) (03/2016).

11. **KONICA MINOLTA Science and Technology Foundation Award**, The Optical Society of Japan, ¥50K (~£0.4K) (06/2015).

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

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

14. **Outstanding Paper Award for Young C&C Researchers**, NEC C&C Foundation, ¥200K (~£1.5K)  (01/2015).

15. **Grant-in-Aid for JSPS Fellows**, No. 15J07684, Japan Society for the Promotion of Science, ¥1.2M (~£9.0K) + salary (~£17.9K) (04/2015–03/2016).

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

17. **Program to Support Sending Graduate Students Abroad**, Chiba University, ¥150K (~£1.1K) (04/2014).

18. **Grants for Researchers Attending International Conferences**, NEC C&C Foundation, ¥200K (~£1.5K) (04/2014).

19. **President Award for the Excellent Record**, Chiba University (03/2014).

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

## Media

1. **BBC Earth Kids** (YouTube video), 'Can sound kill you?' (04/2022).

2. **New Scientist Video** (YouTube video), 'Watch sonic tractor beams lift and manipulate objects with sound waves' (09/2021).

3. **IEEE Signal Processing Magazine** (Technical magazine), 'Three New Imaging Technologies That Are Worth a Look' (09/2020).
4. **El Hormiguero 3.0** (Prime-time Spanish TV show), 'LEVITACIÓN ACÚSTICA' (02/2020).
5. **ITV News** (British TV show), 'How holograms could be the future of medicine, advertising and entertainment' (11/2019).
6. **BBC Radio** (British radio channel), 'Science in Action' (11/2019).
7. **The Guardian** (British Newspaper), 'Hologram-like device animates objects using ultrasound waves' (11/2019).
8. **Discover Magazine** (American science magazine), 'With a Floating Bead, This Device Makes Truly 3D Holographs' (11/2019).
9. **Scientific American** (American science magazine), 'Hearing Is Seeing: Sound Waves Create a 3-D Display' (11/2019).
10. **Science Magazine** (News site of AAAS/Science), 'See the new Star Wars–like display that could 'revolutionize' virtual reality' (11/2019).
11. **NBC News** (American news site), 'With a single bead of plastic, scientists tease interactive 3D' (11/2019).
12. **NewScientist** (British science magazine), 'We can now make animated 'sound holograms' that you can touch' (11/2019).
13. **日本経済新聞** (Japanese Newspaper), '立体映像とともに音・触感を再現　英大学が技術' (11/2019).
14. **Dagens Nyheter** (Swedish Newspaper), 'Ny teknik skapar 3D-bilder som låter och känns' (11/2019).
15. **NRC Handelsblad** (Dutch Newspaper), '3D-beeld gevangen in geluidsgolven' (11/2019).
16. **Neue Zürcher Zeitung** (Swiss Newspaper), 'Fast ein richtiges Holodeck' (11/2019).
17. **Cité des sciences et de l'industrie** (French museum webcite), 'Du virtuel au bout des doigts!' (11/2019).
18. **OSA Publishing, Image of the Week**, 'Projection of multiple directional images on a volume structure with refractive surfaces' (10/2019).
19. **OSA Publishing, Image of the Week**, 'Image quality improvement for a 3D structure exhibiting multiple 2D patterns and its implementation' (04/2016).
20. **科学新聞** (Japanese scientific newspaper), '育志賞 - 18人に' (03/2016).
21. **TBS** (Japanese TV show), '未来の起源' (09/2015).
22. **日経産業新聞** (Japanese newspaper), '紫外線当て3D表示—千葉大など装置考案' (04/2015).
23. **日刊工業新聞** (Japanese newspaper), '光を当てると各面に異なる画像を表示—千葉大, 新原理の立体ディスプレー開発' (02/2015).
24. **テレビ東京** (Japanese TV show), 'ワールドビジネスサテライト (トレンドたまご)' (09/2013).
25. **日刊工業新聞** (Japanese newspaper), '見る位置で違う映像に—千葉大ディスプレイ開発' (09/2013).
26. **日刊工業新聞** (Japanese newspaper), '見る方向で違い—千葉大技術開発' (06/2011).

## Membership

| 10/2016–present | Association for Computing Machinery (ACM) |
|---|---|
| 08/2016–present | The Optical Society (OSA) |

## Skills

**Programming**

C, C++, C#, Python, CUDA, OpenCL, Matlab, VHDL, Verilog HDL, OpenGL, OpenCV, HTML/CSS

**Others**

Electronics (FPGA design and Microcontroller), Real-time system (GPU computing, Multi threads, and FPGA), Fabrication (3D printer, Laser cutter, and Luminescent materials), Projection mapping, 2D/3D design (Illustrator and Maya).