

## Chloe A. LeGendre

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**RESEARCH STATEMENT** I develop and apply computer vision and computational photography techniques to solve problems in computer graphics, towards the goal of creating compelling, photo-realistic content for people to enjoy. I strive to bring film-quality visual effects to all, especially to mobile platforms for augmented reality (AR).

**EDUCATION** **University of Southern California**, Los Angeles, CA **August 2015 - May 2019**  
Ph.D., Computer Science  
Dissertation: "Compositing Real and Virtual Objects with Realistic, Color-Accurate Illumination"  
GPA: 3.82

**Stevens Institute of Technology**, Hoboken, NJ **September 2012 - May 2015**  
M.S., Computer Science  
GPA: 4.00

**University of Pennsylvania**, Philadelphia, PA **September 2005 - May 2009**  
B.S. in Engineering, Chemical and Biomolecular Engineering  
GPA: 3.69

**RESEARCH INTERESTS** Computational Photography, Appearance Capture, Lighting Capture, Color Imaging & Measurement, Augmented Reality, Computer Vision for Computer Graphics

**RESEARCH EXPERIENCE** **Graduate Research Assistant** **August 2015 - May 2019**  
Vision and Graphics Lab, USC Institute for Creative Technologies, Playa Vista, CA

- Advisor: Professor Paul Debevec
- Research topics: Multispectral imaging, lighting reproduction, computational photography, appearance capture, spectroscopy, high-resolution facial scanning.
- Transferred technology of multispectral lighting reproduction to multiple clients.
- Led high resolution facial scanning efforts for film production clients, including training lab technicians and directing high profile actors (2016 - 2017).
- Led cloud-based rendering efforts to develop datasets for machine learning.

**Graduate Research Assistant** **January 2014 - July 2015**  
Department of Computer Science, Stevens Institute of Technology, Hoboken, NJ

- Advisor: Professor Philippos Mordohai
- Research topics: 3D reconstruction, binocular and multiview stereo vision from video and high resolution images.

**PROFESSIONAL EXPERIENCE** **Google Daydream (VR/AR)**, Los Angeles, CA **June 2019 - Present**  
Software Engineer - Augmented Reality

- Core technology research and development for mobile AR.

**Google Daydream (VR/AR)**, Los Angeles, CA **December 2017 - May 2019**  
Student Researcher - Augmented Reality

- ML-based lighting estimation technique was published at CVPR 2019 and shipped as the Environmental HDR Lighting Estimation module for ARCore in June 2019.
- Developed production-ready, tested software in Python (Tensorflow) and C++.

- Organized and prepared data for model development.
- Trained ML models using distributed Tensorflow environment.

Software Engineering Intern - AR Stickers **June 2017 - August 2017**

- Developed mobile AR lighting estimation techniques for Google Pixel Phone's AR Stickers camera mode (Playground).
- Developed software in Unity (C#), OpenGL/GLSL, and C++.
- Techniques were deployed in AR Stickers application.

**L'Oréal USA Research & Innovation**, Clark, NJ

Senior Scientist I/II, Emerging Technologies **May 2013 - June 2015**

- Sourced core computer vision technology partner and managed color rendition experiments for *Makeup Genius*, an augmented reality mobile application that uses facial feature tracking to virtually apply cosmetic products in real time (over 9M downloads globally).
- Developed embedded machine learning algorithms for *Skintone Pro*, a low-cost spectrophotometer device for cosmetic product recommendations (US Patent 9,924,778).

Scientist, Instrumentation and Imaging Laboratory **September 2011 - April 2013**

- Developed clinical instrumentation and multimodal image capture and analysis methods to assess changes in skin conditions over time.

**Johnson & Johnson Consumer Products Company**, Skillman, NJ

Scientist I/II, R&D Leadership Program **June 2009 - August 2011**

- Developed instrumentation and imaging methods for skin health assessment.

## PUBLICATIONS

**LeGendre, C.**, Yu, X., Liu, D., Busch, J., Jones, A., Pattanaik, S., and Debevec, P. 2016. Practical Multispectral Lighting Reproduction. *ACM Transactions on Graphics (TOG)*, 35, 4 (July): 32 (SIGGRAPH 2016).

**LeGendre C.**, Yu, X., and Debevec, P. 2016. Efficient Multispectral Reflectance Function Capture for Image-Based Relighting. In *Proc. of IS&T Color Imaging Conference (CIC) 24*, 2016.

**LeGendre C.**, Yu, X., and Debevec, P. 2016. Optimal LED Selection for Multispectral Lighting Reproduction. In *ACM SIGGRAPH 2016 Posters*, ACM, SIGGRAPH 2016.

Holm, J., Maier, T., Debevec, P., **LeGendre, C.**, Pines, J., Erland, J., Joblove, G., Dyer, S., Sloan, B., di Gennaro, J., and Sherlock, D. 2016. A Cinematographic Spectral Similarity Index. In *Proc. of Annual Technical Conference & Exhibition, Society of Motion Picture and Television Engineers (SMPTE) 2016*.

**LeGendre C.**, Yu, X., and Debevec, P. 2017. Optimal LED Selection for Multispectral Lighting Reproduction. In *Proc. of IS&T Electronic Imaging 2017 Material Appearance Conference*. *[Best Student Paper Award]*

**LeGendre C.**, Hyunh, L., Wang, S., and Debevec, P. 2017. Modeling Vellus Facial Hair from Asperity Scattering Silhouettes. *SIGGRAPH 2017 Talks*.

**LeGendre C.**, Bastos, K., and Mordohai, P. 2017. High-Resolution Stereo Matching based on Sampled Photoconsistency Computation. *British Machine Vision Conference 2017*.

**LeGendre C.**, Krissman, D., and Debevec, P. 2017. Improved Chromakey of Hair Strands via Orientation Filter Convolution. SIGGRAPH 2017 Posters. [1st Place Winner, Graduate Category, ACM SIGGRAPH 2017 Student Research Competition]

**LeGendre C.**, Bladin, K., Kishore, B., Ren, X., Yu, X., and Debevec, P. 2018. Efficient Multispectral Facial Capture With Monochrome Cameras. In Proc. of IS&T Color Imaging Conference (CIC) 26, 2018. [Best Student Paper Award]

**LeGendre C.**, Bladin, K., Kishore, B., Ren, X., Yu, X., and Debevec, P. 2018. Efficient Multispectral Facial Capture With Monochrome Cameras. In ACM SIGGRAPH 2018 Posters, ACM, SIGGRAPH 2018. [3rd Place Winner, Graduate Category, ACM SIGGRAPH 2018 Student Research Competition]

Huang Z., Li, T., Chen, W., Zhao, Y., Xing, J., **LeGendre C.**, Luo, L., Ma, C., and Li, H. 2018. Deep Volumetric Video From Very Sparse Multi-View Performance Capture. European Conference on Computer Vision (ECCV) 2018.

Bondi E., Craddock J., Funke R., **LeGendre C.**, and Tiwari V. 2018. Using Artificial Intelligence to Maximize the Spread of Sexual Health Information in a Multimodal Communication Network of Young Black Women. Conference of the Society for Social Work and Research (SSWR) 2018.

Bondi E., Craddock J., Funke R., **LeGendre C.**, and Tiwari V. 2018. Maximizing the spread of sexual health information in a multimodal communication network of young Black women using artificial intelligence. American Public Health Association Annual Meeting 2018.

**LeGendre C.**, Ma, W-C., Fyffe, G., Flynn, J., Charbonnel, L., Busch, J. and Debevec, P. 2019. DeepLight: Learning Illumination for Unconstrained Mobile Mixed Reality. CVPR 2019.

**LeGendre C.**, Ma, W-C., Fyffe, G., Flynn, J., Charbonnel, L., Busch, J. and Debevec, P. 2019. DeepLight: Learning Illumination for Unconstrained Mobile Mixed Reality. SIGGRAPH 2019 Talks.

Zhao, Y., Huang Z., Li, T., Chen, W., **LeGendre C.**, Ren, X., Xing, J., Shapiro, A. and Li, H. Learning Perspective Undistortion of Portraits. ICCV 2019.

BOOK CHAPTER Bondi E., Craddock J., Funke R., **LeGendre C.**, and Tiwari V. Maximizing the spread of sexual health information in a multimodal communication network of young black women. In *Artificial Intelligence for Social Welfare*, Cambridge University Press.

SERVICE Reviewer:  
ACM SIGGRAPH 2017  
ACM Transactions on Graphics (TOG) 2017  
IS&T Color Imaging Conference 2017, 2018, 2019.  
Member:  
Academy of Motion Picture Arts and Sciences - Science & Technology Council Committee on Solid State Lighting

TEACHING CSCI 576 - Multimedia Systems Design (TA, Spring 2018, USC)  
CSCI 420 - Computer Graphics (TA, Fall 2017, USC)

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| HONORS AND AWARDS          | <p>Annenberg Ph.D. Fellowship, University of Southern California (2015 - 2019).<br/>         First Runner Up, ACM SIGGRAPH Thesis Fast Forward (2019).<br/>         3rd Place Winner, Graduate Category, ACM SIGGRAPH Student Research Competition (2018).<br/>         1st Place Winner, Graduate Category, ACM SIGGRAPH Student Research Competition (2017).<br/>         Best Student Paper, IS&amp;T Color Imaging Conference (2018).<br/>         Best Student Paper, IS&amp;T Electronic Imaging Conference (2017).<br/>         Runner-up, Best Student Paper, IS&amp;T Color Imaging Conference (2016).<br/>         USC Stevens Center for Innovation Commercialization Award (2017, 2018).<br/>         Computing Research Association CRA-W Grad Cohort - Travel Stipend (2017).<br/>         Dean's List, University of Pennsylvania (2007 - 2009).<br/>         Stuart W. Churchill Individual Research Prize for Undergraduate Research in Chemical Engineering, University of Pennsylvania (2009).</p> |
| INVITED TALKS AND LECTURES | <p>"Practical Multispectral Lighting Reproduction." Digital Domain, Los Angeles, CA. July 2016.</p> <p>"Multispectral Lighting and Relighting." Imperial College, London, UK, Realistic Graphics and Imaging Group. September 2017.</p> <p>"Global Illumination in Rendering." USC CSCI 420 Computer Graphics, guest lecture with Professor Hao Li. October 2017.</p> <p>"Lighting Real and Virtual Humans." USC CSCI 576 Multimedia Systems Design, guest lecture with Professor Parag Havaladar. October 2017 and April 2018.</p> <p>"DeepLight: Learning Illumination for Unconstrained Mobile Mixed Reality." IEEE AIVR Workshop on Capturing and Rendering Digital Humans for AR/VR. December 2019.</p> <p>"DeepLight: Learning Illumination for Unconstrained Mobile Mixed Reality." USC Entertainment and Technology Center, Innovation Conference, August 2019.</p>   |
| PATENTS AND APPLICATIONS   | <p>G. Balooch, <b>C. LeGendre</b>, W. Jung, R. Jung, W. Sloan, P. Patel, and A. Loudermilk. Systems and methods for measuring spectra of skin and other objects and materials and making predictions based thereon. US Patent 9,924,778. Granted 27 March 2018.</p> <p>G. Balooch, <b>C. LeGendre</b>, A. Loudermilk, C. Luongo, P. Patel, W. Sloan. Systems and methods for measuring and categorizing colors and spectra of surfaces. Application No. WO 2015040110 A1. Filed 18 September 2014.</p> <p>P. Debevec, <b>C. LeGendre</b>, and S. Pattanaik. Multispectral Lighting Reproduction. US Patent 10,375,264. Granted 6 August 2018.</p> <p><b>C. LeGendre</b>, I. Neulander, and P. Debevec. Lighting for Inserted Content. Application No. US 62/568,116. Filed 4 October 2017.</p>  |
| PROGRAMMING                | C++, OpenCV, Python, Tensorflow, MATLAB.  |
| SOFTWARE                   | NUKE, Maya (MEL and Python scripting), Arnold Renderer, Adobe Creative (Photoshop, Illustrator, Premier), Zync cloud renderer.  |

LANGUAGE English (native), French (proficient).

MEMBERSHIP ACM (2013 - present).  
USC Chapter of the National Academy of Inventors (2017 - present).

VISUAL EFFECTS Bladerunner 2049 (2017)

CREDITS Logan (2017)  
Valerian and the City of a Thousand Planets (2017)