

Michael Ludwig

Curriculum Vitae

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Personal Statement

A research emphasis on image-based rendering, material and lighting models, and an internship at Google developing photometry techniques in unconstrained environments makes me highly qualified to pursue research related to rendering, computer vision, and perception. Additional human-subjects research experience as an undergraduate in the GroupLens research lab and an internship at HP Labs characterizing 3D printed materials makes me an effective researcher at the intersection of these fields. Work as a systems administrator and engineer, an independent contractor, and multiple internships have afforded me strong technical skills in multiple programming languages and technologies, and has taught me how to quickly adapt and learn in new environments.

Education

- 2012–2018 **PhD in Computer Science**, *University of Minnesota*.
Thesis: A Computational Framework for Predicting Appearance Differences.
- 2007–2010 **BS in Computer Science**, *University of Minnesota*, summa cum laude.
Graduated with high distinction and an emphasis in human-computer interaction and graphics.

Experience

Academic

- 2012– **Research Assistant**, *Graphics and Color Lab*, under Professor Gary Meyer.
Research emphasis on appearance perception and modeling, image-based rendering, light fields, and material capture, with applications in 3D printing, design and cultural heritage.
- 2013–2017 **Teaching Assistant**, *University of Minnesota*, Department of Computer Science.
Notable courses:
▶ CSCI 4107 - Introduction to Computer Graphics, spring 2013.
▶ CSCI 5608 - Advanced Computer Graphics, spring 2014, spring 2016.
▶ CSCI 5611 - Animation and Planning in Games, fall 2015, spring 2017.
- 2007–2010 **Undergraduate Research Assistant**, *GroupLens HCI Lab*, under Professor Loren Terveen, and Professor John Riedl.
Major contributions to Cyclopath and started the BookLens recommender service.

Professional

- 2018– **Software Engineer**, *Google*.
Skia graphics group.
- 2017 **Research Intern**, *HP Inc.*
Summer internship with HP Labs researching appearance characterization for 3D printing.
- 2015 **Research Intern**, *Google*.
Summer internship with Google Research exploring computer graphics, vision, and photometry.

2014–2017 **Independent Contractor**, *Metropolitan Library Service Agency*.
Update the Twin Cities' many libraries' online catalogs to include ratings, predictions, recommendations, and reviews by integrating with the BookLens recommender service.

2011-2012 **Software Engineer**, *GroupLens HCI Lab*.
Maintained the systems and machines of the lab, administered GroupLens' production servers and databases, and assisted students with development and design work.

Open-source Software

ImaJe, <http://bitbucket.org/mludwig/imaje>.
Comprehensive image and color library, including HDR formats and ICC color profiles.

Spherical Harmonics, <http://github.org/google/spherical-harmonics>.
Spherical harmonics library targeting graphical applications released while interning at Google.

Entreri, <http://bitbucket.org/mludwig/entreri>.
Entity-component framework written in Java.

Ferox, <http://bitbucket.org/mludwig/ferox>.
Hardware accelerated real-time graphics and rigid-body physics engine in Java.

Skills

Knowledge Areas	Physically-based rendering, color science, image processing, computer vision, human-subjects research and analysis, material scanning and fitting, 3D geometry and modeling, machine learning, deep learning
Software Development	Varied experience across many project domains, including web servers, front-end sites, user interfaces, GPU programming, real-time rendering, data processing, and databases
Languages	<i>Java, C++, MATLAB, Python, GLSL, JavaScript, TypeScript, SQL</i>
Libraries	<i>Java: LWJGL, Apache Commons, Struts, Hibernate, Guice, Maven</i> <i>C++: OpenGL, std, Qt, OpenCV, Microsoft Visual Studio</i> <i>MATLAB: Computer Vision Toolkit, Neural Network Toolkit, PsychToolbox</i> <i>JavaScript: YUI, JQuery, Node.js, Vue, npm</i>
Version Control Systems	<i>Mercurial, git, svn</i>

Awards and Activities

- Dissertation Fellowship 2017-2018 recipient of the University of Minnesota's Doctoral Dissertation Fellowship; 25% acceptance rate.
- Best Paper Awarded best student paper in the Measuring, Modeling, and Reproducing Material Appearance conference (Electronic Imaging '2016) for [9].
- ACM ICPC International Collegiate Programming Contest: 1st place of 225 teams in 2010 North Central Region, and competed in the 2011 Internationals in Orlando.
- FIRST Robotics Programming mentor from 2012 to 2015 for a local high school FIRST robotics team. Helped teach programming, networking, driver controls, and computer vision.

Publications

- [1] **Ludwig, Michael**, Priedhorsky, R., and Terveen, L. "Path Selection". In *CHI*. 2009, pp. 2309–2318. DOI: 10.1145/1518701.1519055.
- [2] Ekstrand, M. D., **Ludwig, Michael**, Kolb, J., and Riedl, J. T. "LensKit". In *RecSys*. 2011, pp. 349–350. DOI: 10.1145/2043932.2044001.
- [3] Ekstrand, M. D., **Ludwig, Michael**, Konstan, J. A., and Riedl, J. T. "Rethinking the recommender research ecosystem". In *RecSys*. 2011, pp. 133–140. DOI: 10.1145/2043932.2043958.
- [4] Levandoski, J. J., Ekstrand, M. D., **Ludwig, Michael**, Eldawy, A., Mokbel, M. F., and Riedl, J. T. "RecBench". In *VLDB*. 2011, pp. 911–920.
- [5] Berrier, S., Tetzlaff, M., **Ludwig, Michael**, and Meyer, G. "Improved appearance rendering for photogrammetrically acquired 3D models". In *Digital Heritage*. 2015, pp. 255–262. DOI: 10.1109/DigitalHeritage.2015.7413879.
- [6] **Ludwig, Michael**, Berrier, S., Tetzlaff, M., and Meyer, G. 3D shape and texture morphing using 2D projection and reconstruction. *Computers & Graphics* 51 (2015), pp. 146–156. DOI: 10.1016/j.cag.2015.05.005.
- [7] **Ludwig, Michael** and Meyer, G. "Environment map based lighting for reflectance transformation images". In *Digital Heritage*. 2015, pp. 385–388. DOI: 10.1109/DigitalHeritage.2015.7413909.
- [8] Ekstrand, M. D. and **Ludwig, Michael**. Dependency Injection with Static Analysis and Context-Aware Policy. *JOT* 15.1 (2016), pp. 1–31. DOI: 10.5381/jot.2016.15.1.a1.
- [9] **Ludwig, Michael** and Meyer, G. "Effects of Mesoscale Surface Structure on Perceived Brightness". In *MMRMA*. 2016, pp. 1–7. DOI: 10.2352/ISSN.2470-1173.2016.9.MMRMA-367.
- [10] **Ludwig, Michael** and Meyer, G. Brightness Perception of Surfaces with Mesoscale Structures. *JIST* 61.2 (2017), pp. 1–14. DOI: 10.2352/J.ImagingSci.Technol.2017.61.2.020504.
- [11] **Ludwig, Michael**, Moroney, N., Tastl, I., Gottwals, M., and Meyer, G. "Perceptual Appearance Uniformity in 3D Printing". In *Electronic Imaging*. 2018, pp. 1–12.