

OVERVIEW Strong background in research, algorithm development, and software engineering. Core areas include Surface Reconstruction, Computer Graphics, Computational Geometry, SLAM, Multiview Stereo, Signal Processing, and Computer Vision.

EDUCATION **University of California - Berkeley**
Ph.D. in Electrical Engineering and Computer Sciences May 2015
M.S. in Electrical Engineering and Computer Sciences May 2013
GPA: 4.00/4.00

Carnegie Mellon University
B.S. in Electrical and Computer Engineering May 2011
QPA: 3.91/4.00 - Dean's List
Minors in Physics, Computer Science

WORK EXPERIENCE **Google** 03/2016 - Present
Staff Software Engineer - AR Team
- Tech lead on ARCore Depth API, developing novel depth algorithms and use-cases across Google product areas.
- Developed real-time passive depth sensing on mobile hardware.
- Tech lead on real-time 3D reconstruction techniques with noisy depth on smartphones.
- Daydream AR/VR - Tech lead on foveated rendering techniques for mobile VR headsets.
- Developed custom hardware-foveation displays for VR.
- *11 patents filed.*

Indoor Reality, Inc. 06/2015 - 03/2016
Chief Technology Officer (CTO) and cofounder
- Principal Investigator (PI) on multiple federal grants totalling \$2 Million.
- Tech lead in developing hardware, software, and algorithms used for automatic and rapid indoor building 3D modeling via backpack-mounted scanning system.
- Developed software for data collection, algorithmic processing, and visualization.
- Supervisor for visualization and deployment development team.
- *3 patents filed.*

Signetron, Inc. 07/2015 - 03/2016
Software Architect
- Algorithm and software development for rapid indoor modeling, automatic building energy audits, and virtual tours from handheld scanning system.
- Principal engineer on software and hardware development, including localization and 3D modeling algorithms.
- Supervisor for team of software engineers.

EECS Department - UC Berkeley 01/2015 - 05/2015
Graduate Student Instructor
- Course EE 122: Introduction to Communication Networks
- Taught discussion sections, held office hours, graded homeworks/exams.

@Maps 08/2014 - 12/2014
Principal Engineer

- Developed hardware systems and surface reconstruction software algorithms for indoor building 3D modeling.
- Research and development of camera calibration procedures.

Speir Technologies 01/2013 - 01/2014

Software Development Consultant

- Developed prototype demo application and 3D modeling algorithms for remote viewing medical ultrasound scanning.
- Developed client-server model for remote medical scanning, sensor drivers interface, and 3D meshing techniques for live streaming of patient geometry.

MIT Lincoln Laboratory 05/2011 - 08/2011

Summer Intern - Group 104: Intelligence and Decision Theory

Developed algorithms for creation of synthetic test data for Synthetic Aperture Radar (SAR) Coherent Change Detection (CCD) track-finding.

ECE Department - Carnegie Mellon 01/2011 - 05/2011

Teaching Assistant

Course 18-391: Noisy Signal Processing

Wrote homework reference solutions, taught weekly office hours.

Qualcomm 05/2010 - 08/2010

Software Summer Intern - QCT Modem Integration Team

Developed/automated methodology for optimizing and removing redundancies in client specs of processor builds.

Flatirons Solutions 05/2008 - 08/2008

Summer Intern

Developed flight path modeling application for FAA. Wrote application to estimate cost/efficiency analysis for air traffic routes, interfaced with Google Earth.

**RESEARCH
EXPERIENCE**

Video and Image Processing Lab - U.C. Berkeley 08/2011 - 05/2015

Ph.D. Graduate Student

3D and 2D surface reconstruction algorithms for architectural modeling. Automatic reconstruction of indoor building environments from LiDAR and imagery data on an ambulatory backpack-mounted scanning system. System hardware design and assembly, including developing sensor drivers and processing architecture. Analysis of building geometry for room-layout and energy efficiency modeling.

Spiral Project - Carnegie Mellon 08/2010 - 05/2011

Honors Research Undergraduate

Analysis of efficiency and error for Synthetic Aperture Radar (SAR) algorithm for logic-in-memory implementation.

Spiral Project - Carnegie Mellon 05/2009 - 08/2009

Summer Research Undergraduate

Implementation and analysis of search techniques for Spiral's code optimization engine. Developed genetic search algorithm for optimization of hardware-dependent software implementations of DCT, FFT, and Matrix Multiplication.

Robotics Institute - Carnegie Mellon 09/2008 - 12/2008

Research Assistant

Design of user interface for LiDAR scans exported from variety of autonomous robotic systems.

TECHNICAL SKILLS

Programming Languages: C/C++, Java, Python, Matlab, BASH, x86
Markup Languages: HTML, LaTeX, Markdown
Software: Unity, Autodesk Revit, Recap, Navisworks, AutoCAD, SolidWorks, Visual Studio, Git, SVN
Frameworks: Eigen, Boost, OpenCV, PCL, OpenGL, GLSL, Halide, Qt, Android, Google Tango, Doxygen

AWARDS

Awarded Best Student Paper - GRAPP 2014 01/2014
9th International Joint Conference on Computer Vision, Imaging, and Computer Graphics Theory and Applications

Awarded NSDEF Fellowship 09/2013 - 05/2016
Funded by Office of Naval Research (ONR)

CMU Meeting of the Minds 05/2011
- Won First Place Lockheed Martin ECE Undergraduate Project
- Won Third Place CIT Honors Research Poster Competition

PUBLICATIONS

Learned Monocular Depth Priors in Visual-Inertial Initialization, ECCV 2022

DEPTHLAB: Real-Time 3D Interaction with Depth Maps for Mobile Augmented Reality, ACM UIST 2020

Depth from Motion for Smartphone AR, SIGGRAPH Asia 2018

Limits of Peripheral Acuity and Implications for VR System Design, Journal of Society for Information Display 2018

Sensitivity to Peripheral Artifacts in VR Display Systems, Society for Information Display 2018

Phase-Aligned Foveated Rendering for Virtual Reality Headsets, 25th IEEE Conference on Virtual Reality and 3D User Interfaces 03/2018

Foveated Pipeline for AR/VR Head-Mounted Displays, Information Display 11/2017

Identification of Energy Conservation Measures Towards Zero Carbon Building Energy Performance with the Rapid Building Energy Modeler and the Energy Analysis Engine, ZCB 2016 09/2016

Automatic Indoor 3D Surface Reconstruction with Segmented Building and Object Elements, Fifth Joint 3DV Conference 10/2015

3D Modeling of Interior Building Environments and Objects from Noisy Sensor Suites, Ph.D. Thesis, Department of Electrical Engineering and Computer Sciences, University of California Berkeley 05/2015

Multistory Floor Plan Generation and Room Labeling of Building Interiors from Laser Range Data, Communications in Computer and Information Science 2014

Fast, Automated, Scalable Generation of Textured 3D Models of Indoor

Environments, Journal of Selected Topics in Signal Processing 08/2014

Image-Based Position of Mobile Devices in Indoor Environments, Multi-modal Location Estimation of Video and Images 2014

Floor Plan Generation and Room Labeling of Indoor Environments from Laser Range Data, GRAPP 2014 01/2014

Reduced-Complexity Data Acquisition System for Image Based Localization in Indoor Environments, IPIN 2013 10/2013

Image Based Localization in Indoor Environments, International Conference on Computing for Geospatial Research and Applications 07/2013

Watertight Planar Surface Meshing of Indoor Point-Clouds with Voxel Carving, Third Joint 3DV Conference 06/2013

Watertight Floor Plans Generated From Laser Range Data, Master's Thesis 05/2013

Inserted Simulated Tracks into SAR CCD Imagery, Society for Modeling & Simulation International (SCS) 2013 Autumn Simulation Multi-Conference (Autumn-Sim'12) 10/2012

Watertight As-Built Architectural Floor Plans Generated from Laser Range Data, 3DIMPVT 10/2012

Sharp Geometry Reconstruction of Building Facades Using Range Data, ICIP 2012 09/2012

Local Interpolation-based Polar Format SAR: Algorithm, Hardware Implementation and Design Automation, Japan Society for the Promotion of Science 06/2012

Polar Format Synthetic Aperture Radar in Energy Efficient Application-Specific Logic-in-Memory, ICASSP 2012 05/2012

Energy Efficient Application-Specific Logic-in-Memory for Interpolation in Synthetic Aperture Radar, High Performance Embedded Computing (HPEC) 09/2011

AWARDED PATENTS

PHASE ALIGNED FOVEATED RENDERING, Patent 17801804.0 - 1216 July 17, 2019.

DUAL-PATH FOVEATED GRAPHICS PIPELINE, Patent 17783618.6 - 1209 06/19/2019

EARLY SUB-PIXEL RENDERING, Patent 17778139.0 - 1210 06/19/2019

METHODS FOR INDOOR 3D SURFACE RECONSTRUCTION AND 2D FLOOR PLAN RECOVERY UTILIZING SEGMENTATION OF BUILDING AND OBJECT ELEMENTS, Patent 10,127,718 11/13/2018

PATENTS UNDER FILE

GP-303816-00-US, "Achieving Metric Scale of the Face Using Phone Front-Facing Camera"
Filed March 2022

GP-303334-00-US, "Visual Inertial Odometry Initialization With Machine Learning Depth on Mobile Devices"
Filed October 2021

GP302840-00-PCT, "Merging Outdoor Building Facades into AR Depth Images"
Filed June 2021

GP-300969-00-PCT, "Surfel-based Temporal Fusion for Depth Processing"
Filed May 2020

GP-203795-00-PR, "DEPTH FROM MOTION FOR SMARTPHONE AR"
Filed February 2019

GP-202593-00-US, "5DOF PHASE-ALIGNED FOVEATED RENDERING"
Filed November 2017

GP-201053-02-US, "LOW RESOLUTION RGB RENDERING FOR EFFICIENT TRANSMISSION,"
Filed November 2016