Ryan Crabb, PhD

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PROFESSIONAL SUMMARY

Computer vision algorithm and characterization engineer with experience ranging from designing software for depth and vision-based touch screens and gesture interfaces, to test suites for leading skeletal tracking and AR devices. Curious and compassionate, driven to tackle interesting and impactful problems with efficient solutions. Highly proficient in Cost Optimization, Bayesian Statistics, Stochastics, Linear Algebra, Signal Processing, and their applications in Computer Vision and Machine Learning.

PROFESSIONAL EXPERIENCE

Verification Engineer Dec 2015–Oct 2018
Microsoft, Mountain View

- Oversaw development of test suite for characterization of time-of-flight (TOF) depth sensors and devices such as HoloLens, Kinect, and leading prototypes, and managed day-to-day operations of lab
  - Directed mechanical engineers in creation of the test apparatus, including design, construction and execution, for efficient setup, reliability, safety, and utility
  - Managed test engineers, including schedules, tasks, and tracking; identified, prioritized, coordinated, and tracked tasks for each data collection run
  - Applied computer vision techniques to testing stations, using OpenCV for automated motion control, device calibration and alignment; Identified and ordered opto-mechanical equipment, improved run time by 25% and enabled unattended testing and increased department efficiency
- Created a model of a camera trajectory with 6 degrees of freedom (6DoF), numerically optimizing on 800 positions to improve ground truth uncertainty from between 1cm-5cm down to 1.5mm-4mn, achieving a result that was beyond corporate expectations
- Collaborated with internal camera system hardware and software engineers to understand requirements and opportunities that led to development of new tests and setups
- Collaborated on the development of multi-camera data fusion to create 3D-printed “portraits”.
  - Managed production of registration targets and integrated 5 different cameras into a single point cloud
  - Performed smoothing on resulting 3D mesh, providing a more faithful reproduction in 3D printed surface
- Managed multiple project priorities while ensuring contractor issues are efficiently resolved, performed interim management role of team while senior verification engineer was on leave during two different time periods, in addition to managing two characterization test engineers

Computer Vision Algorithm Engineer Oct 2007–Nov 2010
Canesta, Inc

- Led design for software engine of depth and vision-based touch screen and gestural interface that was strategic product that led to acquisition by Microsoft
- Built a prototype touch screen, in partnership with a mechanical engineer, to garner concept adoption by upper management that led to its adoption as the primary strategic focus for the company; managed development through production
  - Applied computer vision and machine learning approaches to enable detection of touch, tap, and pointing, in addition to smoothly tracking up to 10 fingers
  - Collaborated with hardware team to define depth camera performance specifications
- Developed algorithms for 3D tracking for gestural interfaces for television
- Implemented method for depth-map upsampling from paired RGB, for which a patent was issued
- Devised a sensor fusion: real-time depth based alpha matting technique−virtual “green screen”

Computer Vision Intern Summer 2007

Vidient

- Developed method to evaluate distance metrics in visual tracking
- Collaborated on a patented optical flow based method of crowd movement tracking

Teaching Assistant 2004 –2007

UC Santa Cruz

- Assisted instruction of undergraduate and graduate courses: CE 16 Discrete Math (6 terms), CE 107 Stochastic Processes, CE 100 Logic Design Lab, CE 200 Research

EDUCATION

University of California, Santa Cruz Dec 2015

Ph.D. in Computer Engineering

- Research topics: Time-of-flight 3D depth sensor phase unwrapping with surface illumination model, RGB+D sensor data fusion, probabilistic graph optimization, visual recognition and tracking, efficient object representation
- Invented algorithm to triple effective frame rate of depth camera
- Constructed multiple-hypothesis framework for object tracking

Harvey Mudd College

B.S. in Computer Science

Graduated with distinction; industry collaboration for text classification; Dean's List each semester; focus in philosophy and ethics

SKILLS

Programming: C++, MATLAB, Python

Packages: OpenCV, NumPy, Matplotlib, TensorFlow

Computer Vision & Sensors: Calibration, Registration, Tracking, Segmentation, Object/Event detection, HCI, Error Modeling

PUBLICATIONS

- Ryan Crabb and Roberto Manduchi. "Fast Single-Frequency Time-of-Flight Range Imaging." Proc. IEEE 4th International Workshop on Computational Cameras and Displays, Boston, June 2014.
- Ryan Crabb and Roberto Manduchi. "Probabilistic Phase Unwrapping for Single-Frequency Time-of-Flight Range Cameras." Proc. International Conference on 3D Vision (3DV 14), Tokyo, 2014.
- R. Crabb, C. Tracey, A. Puranik, J. Davis, "Real-time foreground segmentation via range and color imaging," Computer Vision and Pattern Recognition Workshops 2008, pp. 1-5, June 2008.
- Steve Scher, Ryan Crabb, James Davis, "Making real games virtual: Tracking board game pieces," Proc. Internal Conference on Pattern Recognition, 19th ICPR, pp. 1-4, Dec. 2008.
- Feng Tang, Ryan Crabb and Hai Tao, "Representing Images Using Non-orthogonal Haar-like Bases," IEEE Trans. Pattern Analysis and Machine Intelligence (PAMI) vol. 29, no. 12, pp.2120-2134, Dec. 2007.
- Hai Tao, Ryan Crabb, and Feng Tang, "Non-orthogonal binary subspace and its applications in computer vision", Proc. IEEE ICCV, October 2005.