THE UNIVERSITY OF ARIZONA
Wyant College of Optical Sciences

INDUSTRIAL AFFILIATES WORKSHOP

5-MIN RAPID FIRE PRESENTERS

GREGORY NERO, PH.D. STUDENT

Tuesday, February 21, 2023 | 3:10 p.m.
Title: "Solar Ptychography"
Advisor: David Brady

Abstract: Using the Sun as an angularly diverse source, we hope to achieve sub-GSD resolution of small reflective targets.

Bio: Gregory is a third year PhD student developing techniques to enable all-day-wearable augmented reality display glasses and super-resolution computational imaging systems by leveraging how coherent light interacts with microstructures. They also intern part-time for Arizona Optical Metrology (AOM) where they are developing processes for manufacturing computer-generated holograms.

REBECCA SU, PH.D. STUDENT

Tuesday, February 21, 2023 | 3:15 p.m.
Title: "Deflectometric Measurement of Unique Spectacle Lenses"
Advisor: Jim Schwiegerling

Abstract: As humans surpass their young adulthood, their eyes lose the ability to accommodate resulting in difficulty focusing on items close to their eyes. This is called presbyopia. Advances in eye care technology have yielded presbyopia aids such as progressive addition lenses, intraocular lenses, and diffractive contact lenses. The unique shapes of presbyopia aids render traditional lens measuring devices unable to properly measure these surfaces. Hexapod Enabled Deflectometry is an alternative method that allows for non-contact surface profile measurement with high dynamic range.

Bio: Rebecca Su is a third year PhD student in Dr. Jim Schwiegerling's Ophthalmic Optics Lab. She graduated with her Bachelor's Degree in Optical Engineering and a minor in Nanomedicine in 2020 from Rose-Hulman Institute of Technology. She has held two internships at ACUVUE Contact Lenses and worked with developing smartphone vision care devices at EyeQue Corporation in the summer of 2022. When Rebecca is not in the lab, she enjoys cooking, reading, and playing the cello.

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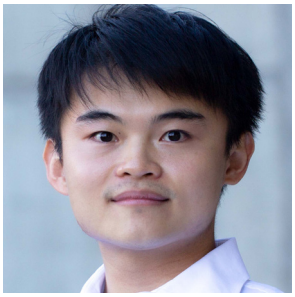

JEFF CHAN, M.S. STUDENT

Tuesday, February 21, 2023 | 3:20 p.m.
Title: "DMD-based diffractive FOV steering for real time lidar by 2D multi-pixel photon counter"
Advisor: Yuzuru Takashima

Abstract: We demonstrated a real-time lidar system applying a Digital Micromirror Device (DMD) as a field of view (FOV) expander of a lidar receiver employing a 2D Multi-Pixel Photon Counter (MPPC). By temporally synchronizing the transitional state of micromirrors with returning photons from lidar, receiver FOV is diffractively steered to the targets' direction enabled by nano-second pulse laser. With a nanosecond 905nm laser transmitter, time-of-flight (ToF) lidar images were captured across 7 diffraction orders with the expanded 35 degrees full field of view lidar scanning range.

Bio: Jeff Chan is a 2nd-year master's student from Wyant College of Optical Sciences at the University of Arizona. His research is focusing on wide FOV real-time lidar systems, DMD, and ToF cameras in Advanced Lidar & Display Lab supervised by Dr. Yuzuru Takashima. He has a bachelor's degree from the Department of Photonics at National Cheng Kung University in Taiwan. His senior design project was ultraviolet nanolaser and LED device fabrication. After graduating from college, he joined Research Center for Applied Sciences in Academia Sinica (the national academy of Taiwan) as an optical research assistant, focusing on ultrafast laser systems and pump-probe spectroscopy. He was also a Hardware Development Engineer Intern in Camera Perception Team at Amazon Prime Air, working on camera calibration, rain mitigation testing, reliability testing, and image quality analysis. He designed a camera focal length calibration program with live MTF analysis by Python OpenCV on Linux platform.

YEXIN PEI, M.S. STUDENT

Tuesday, February 21, 2023 | 3:25 p.m.
Title: "Illumination and diffractive hybrid image steering for ultra compact AR display engine"
Advisor: Yuzuru Takashima

Abstract: To enable wearable augmented reality displays throughout the day, engineering solutions must be compact, while still meeting requirements such as wide field-of-view (FOV) and high resolution. Our solution, using a Digital Micromirror Device (DMD) and a pulsed laser in synchronization, utilizes diffractive image steering to decouple the FOV of the projected image from the display size, resulting in a reduction of the display panel's lateral extent by several factors. By combining diffractive image steering with a prism array positioned at the exit pupil of the projection lens, we can increase the field-of-view by a factor of 2x5 while maintaining a small form factor. This approach reduces the number of required pixels, making it ideal for eventual installation in small form factor head-mounted displays.

Bio: I am a Master student from Wyant College of Optical Sciences, University of Arizona. I am working on a project that utilizes DMD-based Diffractive beam steering technology for FOV expansion in the AR/VR industry. My expected graduation time is Aug 2023.

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AAFAQUE KHAN, PH.D. STUDENT

Tuesday, February 21, 2023 | 3:30 p.m.
Title: "Developing a Vacuum Ultraviolet test setup for Quantum efficiency characterization of UV enhanced delta-doped EMCCDs"
Advisor: Erika Hamden

TIANYAO ZHANG, M.S. STUDENT

Tuesday, February 21, 2023 | 3:35 p.m.
Title: "Method for large field of view and eye-box of holographic waveguide display based on LED illumination"
Advisor: Yushi Kaneda

Abstract: Holographic waveguide has been widely used for augmented reality (AR) and head-up display (HUD) applications due to its lightweight, low cost, high transparency, and the ability to support pupil expansion. However, the system's field of view is very limited when incoupling and outcoupling holographic optical elements (HOEs) reading out by coherent light source like laser. Here, we propose a method to segmentize the FOV in angular region with multilayer in- and out-couplers or waveguides constructing different angular regime based on broadband light source like LED. The eyebox can be enlarged by larger size of outcoupling HOE to allow image having multiple interactions to achieve pupil expansion. Both raytracing simulation model and experimental demonstration will be presented.

Bio: Tianyao Zhang is a graduate student from the Wyant College of Optical Sciences at the University of Arizona. His current research focuses on optical design and prototyping for AR/VR/HUD display applications, waveguide design, holography, as well as lens design.

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KEVIN CHEW FIGUEROA, PH.D. STUDENT

Tuesday, February 21, 2023 | 3:40 p.m.
Title: "Computational Polarimetric Imaging & Inverse Rendering for Neural Depth Densification"
Advisor: David Brady

Abstract: In this work, conducted at (Facebook) Meta Reality Labs, we present and analyze a Computational Polarimetric Imaging & an Inverse Rendering Pipeline for recovering dense depth maps from single shot polarimetric imaging and sparsely sampled depth. While existing methods for Depth Densification utilize sparsely sampled depth with single shot RGB imaging, we recognize that beyond RGB's sampling of multiple wavelengths, the wave equation possess alternative phenomena rich with unique information capable of being utilized for scene understanding and depth retrieval; phase, polarization, and quantum phenomena. Towards this thinking, we build upon recent advances in Shape from Polarization (SfP), Inverse Rendering, and Deep/Machine Learning to develop a novel physics-based synthetic polarization data generation and network training pipeline. With this pipeline we prototype a digital clone of our polarimetric camera, considering optical distortions, scene lighting, object's material properties (pBRDFs), and other physics-based phenomena in order to actualize the potential of our Polarimetric Neural Depth Densification system. We compare results of Polarimetric Neural Depth Densification and Intensity-only Neural Depth Densification within our synthetic system as well as on data physically collected from within the lab. With these contributions, we push the validity of using physics-based synthetic data and adoption of polarimetric imaging systems.

Bio: Kevin Chew Figueroa, a PhD student at the University of Arizona College of Optical Sciences & recent MS graduate of the USC Computer Science (Data Science) Program, is a National GEM Consortium PhD Fellow, recipient of the Joseph W. Goodman Graduate Student Endowed Scholarship in Optical Sciences, recipient of the Achievement Rewards for College Scientists (ARCS) Scholarship, recipient of the University of Arizona Wyant College of Optical Sciences Scholarship, and was one of two finalist in the international Meta (Facebook) Photonics & Optics 2022 Ph.D. Research Fellowship Competition. He has a wide breadth of lab experience across a myriad of fields. From wet lab/Biochemistry work synthesizing chemotherapy drug-loaded nanoparticles, to dry lab/hardware work in Semiconductor Design, Circuit Analysis, Signal Processing, Microcontroller and Microprocessor Design, Digital Control Systems, and development of a 16-bit RISC Single Cycle Processor implemented on a FPGA. His more recent graduate work is in Optical Sciences, Computational Imaging, Deep Learning, Computational/Discrete Differential Geometry, Array Cameras, Light Field 3D Displays, Photorealistic 3D Computer Generated Holography, Physics-based Computer Generated Polarimetric Imaging, Computational Polarimetric Imaging, Physics-Based Rendering, Geographic Information Systems, and Computer Vision Research. This past year, he conducted research at Meta Reality Labs on Computational Polarimetric Imaging & Inverse Rendering for Neural Depth Densification.