Thank you for taking a few moments to peruse this latest volume of the CEIS annual report. It has been another eventful and successful year at our center.

We began the year with the good news that CEIS was renewed by the State of New York as one of its 15 Centers for Advanced Technology. Our center has been awarded $9.2 million in funding over the next 10 years, which will enable us to continue our mission of promoting economic development across New York State through technical partnerships between industry and academia. In the past 10 years, the Center for Emerging and Innovative Sciences has accrued $740 million of direct economic impact and created more than 400 jobs across New York State. In the last year alone CEIS had an economic impact of $110 million stemming from 27 different projects; this includes 61 new jobs created, 28 jobs retained, and increased company revenue of $18 million, with the balance in cost savings and new funds acquired. All of this has been possible through the continued support of NYSTAR, Empire State Development’s Division of Science, Technology and Innovation, and the collaborative efforts of our many corporate partners and university researchers.

Throughout the last year Rochester continued to build its profile as the national hub for photonics and imaging with the establishment of the headquarters of AIM Photonics in Rochester. AIM Photonics is a $600 million initiative including $110 million of federal funds, $250 million in state funding, and the balance in industry investments. Many faculty members from the University of Rochester and Rochester Institute of Technology are playing key roles in the development of AIM Photonics, and we look forward to many future successes made possible by this incredible opportunity.

In other CEIS activities, the 17th annual CEIS Technology Showcase drew a crowd of more than 200 people, and during that event Mark Mayton of Flint Creek Resources was recognized by CEIS for his outstanding leadership in the Rochester technical and business community. Our workforce training program, which is sponsored by a grant from the federal government under the Department of Labor, saw 13 of 19 participants (2015–16) attain employment in the advanced manufacturing sector. Through our federally sponsored AMJIAC (Advanced Manufacturing Jobs and Innovation Accelerator Challenge) program, CEIS will continue to assist trainees in achieving employment in our region’s photonics industries. With the generous support of Governor Andrew Cuomo and the State of New York, we look forward to continuing our work over the next decade and to initiating new projects on topics as diverse and far ranging as photonic packaging to virtual reality and new media.

In closing, and as always, we would like to thank our dedicated and talented staff at CEIS without whose efforts our center’s activities would come to a grinding halt; this is the CEIS business manager, Cathy Adams; the center’s administrative assistant, Margaret Urzetta; and our student program assistants, Anya Khalid, Lesley Mah, and Vitumbiko Kambilonje.

Sincerely,

Mark F. Bocko, Director

Paul H. Ballentine, Executive Director
This map depicts the cluster of optics, photonics, and imaging (OPI) companies in the greater Rochester region—one of the oldest, largest, and most important industrial clusters in the country.

The important work of CEIS is supported by a number of governmental agencies and economic development partners, shown here.
These letters represent a portion of the overwhelming support that CEIS has received from a large number of partners, including the Greater Rochester Chamber of Commerce, as well as industrial partners such as government officials in the U.S. Senate and House of Representatives.

AIM participation is growing, leveraging this Federal and NYS investment to bring new and exciting opportunities to Rochester and the region. OIDA is pleased to express our support for AIM Photonics and thank you and your team at CEIS for the tremendous leadership you have shown. We look forward to continuing to work with CEIS to further our shared goals in economic development and photonics manufacturing.

Sincerely,

[Letter Signatures]
In addition to providing financial support for industry/university collaboration, CEIS has continued to promote economic development through a number of outreach activities and federal grants.

Our AMJAC grant, known as the Rochester Regional Photonics Accelerator, is winding down after four years. The RRPA program was funded by five different federal agencies and helped us bring together several key stakeholders to strengthen the region’s optics, photonics, and imaging cluster. The participants included the University of Rochester, Rochester Institute of Technology, the Rochester Regional Photonics Cluster, High Tech Rochester, and the Finger Lakes Workforce Investment Board. The RRPA produced a number of successful outcomes, including helping Flint Creek Resources expand its polishing slurry reclamation business and helping to jump start a workforce-training program developed by Finger Lakes Advanced Manufacturers’ Enterprise (FAME).

Our second federal grant comes from NIST under the AMTech (Advanced Manufacturing Technology Consortia) program. We are using this grant to develop a set of roadmaps for optics, photonics, and imaging industries and to expand photonics manufacturing in New York. The AMTech grant has allowed CEIS to go beyond helping to bring AIM Photonics to Rochester and to play a lead role in defining collaborations in advanced optics manufacturing, lasers, and the intersection of data science and imaging. These three areas have been the subjects of proposals to the Finger Lakes Regional Economic Development Council (FLREDC) for funding under the Upstate Revitalization Initiative.

Our industry outreach continued along several fronts this past year. In addition to the University Technology Showcase, CEIS worked with the U.S. Department of Commerce to bring a delegation of investors from China to Rochester. The Rochester-China Business Exchange (RCBE) consisted of 20 Chinese delegates meeting with 71 New York companies. The event spanned five days and was extremely well received by those involved. As a result of the RCBE, there are multiple investment discussions taking place, and there is an effort under way to establish a permanent organization that will expand foreign investment and international trade with China and other countries. There has already been one local optics manufacturer helped by this activity. Attracting investment is a key part of growing the region’s OPI industry.

Other outreach activities include our leadership roles in the FLREDC Optics, Photonics, and Imaging workgroup and New York Photonics. In addition, we are working with AIM Photonics to help identify opportunities for collaborating with small and medium-sized OPI companies in the Rochester region.

We are pleased with what CEIS has accomplished this past year, and we continue to look for synergistic opportunities to leverage state, federal, and community resources to further our economic development mission.
For the fiscal year July 1, 2015, to June 30, 2016, the total documented dollar value of the economic impact of CEIS-supported research and outreach was more than $110 million. This self-reported data (new and retained jobs, increased sales, cost savings, capital investments and additional funds acquired) from thirteen of our partners continues to be a promising indicator of the region's economic position.

A special shout out to Harris Corporation: the local RF and Space & Intelligence Systems divisions topped the chart, reporting more than half the retained jobs during the reporting period and $19 million in non-job impacts. In the small company category, Adarza BioSystems led the way, reporting ten retained jobs and nearly $5.5 million in non-job impact. Last but not least, the AIM Photonics initiative reported forty newly created jobs and $72.6 million in monetary impacts.

### CAT PROGRAM FINANCIAL INFORMATION

**Funding from NYSTAR**

- **Research Expenditures**
  - Personnel Related: $141,919
  - Non-Personnel Related: $181,786

- **Operational Expenditures**
  - Personnel Related: $346,207
  - Non-Personnel Related: $284,379

**Total NYSTAR Contribution**: $956,311

**Other Sources of Funds**

- **Cash from Companies**
  - Personnel Related: $383,526
  - Non-Personnel Related: $549,759

**Total Other Sources**: $933,285

*Combined financials for CAT-funding period overlap
**Research- and Center-related, including applicable overhead**

### Companies Reporting Economic Impact in 2015–16 from CEIS Interactions

- AIM Photonics
- Adarza BioSystems, Inc.
- Clerio Vision, Inc.
- Corning, Inc.
- Exelis (now Harris Space & Intelligence Systems)
- Flint Creek Resources, Inc.
- Harris Corporation
- LightTop Tech Corporation
- Optiporo Systems, LLC
- Ovitz Corporation
- SIMPore, Inc.
- Thermo Fisher Scientific
- UR Ventures Technology Development Fund
SEPTEMBER 17, 2015
The New York Photonics annual meeting held at the Rochester Museum and Science Center was sold out. Bob Bicksler, CEO of JML Optical Industries, received the RRPC Entrepreneur Award; the RRPC leadership award went to Duncan Moore; and the RRPC Education Award recipient for 2015 was East High School science teacher Paul Conrow (left).

JULY 10, 2015
Harris Corporation announced that its new Communications Systems segment will be based in Rochester.

JULY 27, 2015
Vice President Joe Biden was in Rochester to announce the region had been awarded a $600 million Institute for Manufacturing Innovation (IMI) in Integrated Photonics, and the headquarters for AIM Photonics would be in Rochester.

AUGUST 2015
RIT joins the network of 15 Centers for Advanced Technology. RIT’s CAT will focus on 3D printing, additive manufacturing, and functional printing.

SEPTEMBER 17, 2015
The New York Photonics annual meeting held at the Rochester Museum and Science Center was sold out. Bob Bicksler, CEO of JML Optical Industries, received the RRPC Entrepreneur Award; the RRPC leadership award went to Duncan Moore; and the RRPC Education Award recipient for 2015 was East High School science teacher Paul Conrow (left).

JANUARY 6, 2016
The University of Rochester was awarded $411,738 to support its photonics research efforts. The money will help scientists at the university investigate quantum photonics in order to develop new materials to support the next generation of photonic devices.

JANUARY 8, 2016
CEIS hosted a Rochester Optics, Photonics, and Imaging Speed Dating event. More than 100 people attended, and fifty-three companies presented to their peers followed by break-out session discussing optics, photonics, and imaging.

JANUARY 19, 2016
Rochester-based Omni-ID, Inc. has raised $21 million in new funding to expand its global presence and its product portfolio.

FEBRUARY 24, 2016
Cardiac is starting a three-year, 28-country clinical trial that will test respiratory and cardiac safety.

FEBRUARY 25, 2016
The Wearable Technologies annual conference named ADAMM—Automated Device for Asthma Monitoring and Management—the best innovation in the Healthcare and Wellness category. The ADAMM was developed through a collaboration between Mark Bocko, Chair and Distinguished Professor of Electrical and Computer Engineering, and Hyekyun Rhee, Associate Professor of Nursing.

MAY 2, 2016
SiMPore and the University of Rochester were awarded a National Science Foundation grant for almost $200,000. SiMPore hopes to make affordable sensors that can be used in biometric health screenings, hazard detection, and chemical quality control.

JUNE 16–17, 2016
CEIS was instrumental in hosting the Rochester China Business Exchange, an effort to attract Chinese investment to the Rochester region with a focus on optics, photonics, and imaging. Twenty delegates from China representing nine industrial companies, two banks, and two economic development entities participated.

JUNE 17, 2016
The Communications Systems segment at Harris Corporation was awarded a contract worth up to $1.7 billion through the U.S. Foreign Military Sales program.

APRIL 7, 2016
More than 200 people attended the 17th-annual CEIS Technology Showcase. Walt Johnson of Xerox PARC and Mikael Totterman of Clerio Vision, Inc. were the featured speakers. Mark Mayton of Flint Creek Resources was recognized for his work.
2016–2017 PROJECT ABSTRACTS

Accelerating Optical Biosensor Development with Polymer Microgels
Benjamin Miller
University of Rochester
Adarza Biosystems, Inc.

Adarza BiSystems, a company with research and development headquarters in Henrietta, New York, and manufacturing operations in St. Peters, Missouri, is commercializing Arrayed Imaging Reflectometry (AIR), an optical biosensor platform that enables detection of up to hundreds of analytes in a biological sample (such as a drop of blood) using a simple work flow. This proposal seeks to address a significant challenge in Adarza’s product development and manufacturing by testing the utility of antibody-conjugated polymer microgel particles on the AIR platform. We anticipate these will dramatically simplify the development process and provide substantial performance enhancements.

Mathematical Model and Computer Simulation of the Motion of a Contact Lens During and After a Blink
David Ross and Kara Maki
Rochester Institute of Technology

In recent work supported by Bausch & Lomb, we developed a model of the suction pressure induced in the tear film by a symmetric contact lens conformed to a rigid, symmetric eye. Here we will extend that work and model the motion of an asymmetric lens that is displaced by a blink and which resettles under the influence of shear stresses produced by gradients in the suction pressure. We will produce a code in collaboration with Bausch & Lomb engineers that can be used in development and design work.

Adaptive optics bench testing for presbyopia-correcting contact lenses
Geunyoung Yoon
University of Rochester
Bausch & Lomb

Presbyopia is a visual condition that all adults over the age of approximately 40 years face. Individuals with presbyopia lose their ability to focus on nearby objects, which significantly impacts quality of life. Although extending depth of focus via a multifocal contact lens to overcome presbyopia is increasingly popular, clinical outcomes with these lenses are variable and often unpredictable. A better understanding of the role of practical factors when a multifocal lens is on the corneal surface improves our ability to predict its performance. The project is aimed towards the evaluation of through-focus performance of multifocal contact lens designs in which these realistic factors are simulated by using an adaptive optics bench testing system.

Compressive Beamforming for Portable Ultrasound
Zeljko Ignjatovic
University of Rochester
Carestream Health, Inc.

We propose a Compressive Parallel-Beamforming ultrasound imaging method that is a dramatic departure from conventional approaches and has the potential to disrupt the state-of-the-art in ultrasound imaging. Rather than using an expensive linear array with hundreds of transducer elements and associated electronics, the new method eliminates the expensive electronic components (amplifiers, A/D and D/A converters) connected to each element of the array and replaces them with a single channel that is shared by the entire array to significantly reduce array complexity and allow genuinely portable implementations. The proposed system uses unfocused imaging of the target medium via a binary-coded aperture, which gives much improved spatial resolution and reduces the sidelobe artifacts commonly seen in traditional ultrasound systems and allows a significant speedup of image acquisition. This method could have a profound impact on health and quality of life for humans by providing a compact, portable, and easy-to-use ultrasound imaging system with improved performance.

Towards Automated Clinical Evaluation of Tendon through Shear Wave Elastography
Stephen McAleavey
University of Rochester
Carestream Health, Inc.

Musculoskeletal (MSK) conditions, including rotator cuff and ACL injuries, are the leading cause of disability in the United States. The realignment of health care delivery in the United States toward “accountable care” necessitates the development of effective yet low-cost methods to diagnose MSK conditions. Ultrasound shear wave elastography (U-SWE) is a promising technology with high potential to address this need, but existing implementations are challenged in their ability to characterize a tendon. Building on our expertise in U-SWE and tendon biomechanics, we will experimentally measure shear wave propagation in a tendon, characterize the interaction of tendon, bone, and ultrasound, and develop a tendon-appropriate U-SWE implementation.

Plane Wave and Elastographic Imaging of AAA and Carotid Arteries
Michael Richards
University of Rochester
Carestream Health, Inc.

The overall goal of the proposed research is to improve the patient-specific assessment of the pathological severity associated with the onset of cardiovascular disease such as aneurysm and atherosclerosis. The recent development of clinical ultrasound (US) based tissue mechanical property measurements (e.g., elastography) has motivated the use of these technologies to measure the spatial variations in in-vivo vascular mechanical properties in real time or pseudo real time. The patient-specific information gathered in a diagnostic or screening mode can be then used to improve treatment recommendations for a variety of life-threatening vascular diseases.
Visual Acuity of Clinically Relevant Refractive Correctors Using LIRIC
Jonathan Ells
University of Rochester
Clerio Vision, Inc.

Our long-term goal is to use femtosecond micromachining to customize refractive corrections in human eyes, be it in the cornea, contact lenses, or implanted IOLs. This requires high-numerical aperture (NA) lenses (>0.6), placing severe limits on optical scanning. We have used previous CEIS support to develop a scalable manufacturing platform for manufacturing clinically relevant refractive devices. Our goal now is to use this platform to build arbitrary refractive corrections in contact lenses and assess the visual acuity of the refractive correction.

Polarization-Time-Space Multiplexer for Femtosecond Micromachining of Ophthalmic Devices
Wayne Knox
University of Rochester
Clerio Vision, Inc.

Our ultimate goal is to use femtosecond micromachining as a nondamaging method of custom correcting refractive error in human cornea and intraocular lenses (IOLs). The proposed experiments will investigate new methods of writing high-density line patterns faster using a new polarization-time-space multiplexer.

Light Diffusing Fiber as a Disinfectant or Antimicrobial Agent
Paul M. Dunman
University of Rochester
Corning, Inc.

Antibiotic resistance has emerged as a major health care concern that has compromised common medical procedures, resulted in enormous mortality. In response, the World Health Organization (WHO) has highlighted the need to develop new antimicrobial approaches, warning that the population is facing a return to the pre-antibiotic era, in which patients will succumb to common bacterial infections, and therapeutic interventions that limit the patient immune status will be severely impacted (e.g., organ transplant and cancer). To that end, the application of high-intensity violet light (λ = 405 nm) is an exciting and newly appreciated approach to mitigate bacterial disease that is distinct from ultra-violet treatment and has far-reaching applications. The current proposal is designed to investigate the antimicrobial therapeutic utility of a newly developed Corning, Inc. product, Light Diffusing Fiber, as an antimicrobial λ = 405 nm delivery vector.

Hyperspectral Imaging for noninvasive, comprehensive measurement of microvascular function in humans
Anthony P. Pietropaoli
University of Rochester
Corning, Inc.

The purpose of this project is to determine whether hyperspectral imaging is capable of noninvasively quantifying microvascular blood flow, microvascular reserve, tissue respiration, and vascular permeability in healthy human subjects. Hyperspectral imaging has the potential to overcome current barriers to practical, precise, comprehensive, and noninvasive measurements of microvascular function. If so, this technology could provide an innovative window into the common and deadly microcirculatory derangements that occur in patients with sepsis and other acute and chronic illnesses. The business applications would include job growth and increased revenue at Corning Incorporated during the invention, design, and commercialization of this novel technology for biomedical applications.

Computer Modeling of Telecom Signals in Multimode Optical Fibers
Gevery P. Agrawal
University of Rochester
Corning, Inc.

In this project, my research group will work with Dr. William Wood of Corning, Inc. to develop a comprehensive computer model for studying transmission of optical pulses through multimode and/or multimode fibers capable of supporting several optical modes. A computer model will be developed in stages and tested through experimental verification whenever possible. This work is important to Corning because multimode and multicore fibers are likely to be used in the near future for implementing the technique of space-division multiplexing.

Further Development of THz Imager Array in Support of Harris’s Commercial THz Imaging Development
Zeljko Singaravelu
University of Rochester
Harris’ Space and Intelligence Systems

Our group at the University of Rochester proposes to conduct a variety of THz measurements and parameter characterization and develop design methodologies for THz focal plane arrays in standard CMOS technologies in support of Harris’ (formerly ITT Exelis, Inc.) THz imaging initiative. Preliminary experimental results indicate that our technology shows a great deal of promise in detecting THz radiation up to 2 THz with responsivities that far exceed that of more expensive and less scalable pyroelectric detectors. During 2016–17 academic year, we will begin tests on the fourth generation of our CMOS THz prototype imagers designed and fabricated during the 2015–16 project period. The results of this analysis will be used to model and optimize noise performance of our THz focal plane array, which will be fabricated and tested subsequently. In addition, we will explore the use of our direct detection method in CMOS based on thermionic emission for long-infrared imaging.

Diffusing Fiber, as an antimicrobial λ = 405 nm delivery vector.

A tunable, multiplied Gunn diode is the current primary radiation source, with plans to move toward a tunable source with multiple bands from 0.1 to 1.0 terahertz. The ultimate goal of this multiyear effort is to build a (near) room-temperature, compact THz imaging system that our sponsor (Harris) can market to commercial (e.g., package inspection, security screening, and terahertz radiation responsivity.

A tunable, multiplied Gunn diode is the current primary radiation source for testing, with plans to move toward a tunable source with multiple bands from 0.1 to 1.0 terahertz. The ultimate goal of this multiyear effort is to build a (near) room-temperature, compact THz imaging system that our sponsor (Harris) can market to commercial (e.g., package inspection, crowd monitoring) and military (e.g., aero-dynamic) customers.
Further Studies and Development of THz Detector Arrays
Judith Pipho
University of Rochester
Hams Space and Intelligence Systems
This project aims to continue development of THz detector arrays to be used in cameras for security and surveillance applications for standoff distance threat detection, package inspection, medical imaging, and material testing, and to extend performance to the infrared (1–10 μm). Our lab has designed the enclosures (vacuum-tight, cold) and has constructed and operates an array controller that can be programmed for each generation of array. Each generation has exhibited improvements; derived from experimental results from the prior generation. Each generation focal plane (for past and future arrays which are not all-digital) requires changes to clocking and biasing, and our lab executes those programs, which we also address single pixels with our array controller design. We continue to support RIT colleagues with their needs—e.g., designing and constructing fanout boards, helping with thermoelectric coolers, consulting on radiometry. This year we will concentrate on completing the generation 3 testing and will work in tandem with the RIT group on testing of the various THz test structures, as well as verifying performance of the IR test structures. Once an IR focal plane is produced, we will work on that.

Smart Sensor for Classical and Quantum Data Links
Roman Sobolewski
University of Rochester
HYPRES, Inc.
The objective of the project is to explore the possibilities to develop the “smart sensor”—the superconducting nanowire single photon detector (SNSPD) integrated with Josephson junction based mixed-signal circuits and piezoelectric force exciter arrays and the necessary control electronics to provide readout, tuning, and control of the detector. This digitally assisted sensor will have performance characteristics far surpassing those of the traditional analog SNSPDs and will unlock straightforward scalability to larger SNSPD arrays. We will target high-value applications in quantum networks for quantum information applications, including high-data rate quantum key distribution. Our smart sensor will also find many applications in classical data channels for energy-efficient computing, LINIAR, and laser communications.

Global Surveillance Augmentation for Deep Learning
Andreas Savakis
Rochester Institute of Technology
Kiloware, Inc.
In this project we plan to explore deep learning in algorithms for global surveillance applications, including object detection and change detection in satellite images. Our first goal is to train deep convolutional neural networks (DCNNs) for the detection of important object classes in panchromatic and color satellite imagery. To accomplish this goal, we will generate a dataset of augmented data that is sufficiently large and diverse for training DCNNs. Another goal is to develop change detection algorithms that identify important changes in satellite imagery taken at different times

Determination of the Attributes of Aesthetically Pleasing Images and Methods to Improve Consumer Images to Make Them More Aesthetically Pleasing
David Messinger
Rochester Institute of Technology
Axiol-Alaris
Kodak Alaris has selected RIT to conduct research to develop image-processing algorithms for improvement of consumer images through application of certain heuristics to make the images more aesthetically pleasing. Kodak Alaris will use these algorithms in their software to assist in the creation of imaging products that consumers find more appealing and pleasing.

Video Analysis and Summarization Research
Carl Salvaggio
Rochester Institute of Technology
Axiol-Alaris
The goal of the research will be to propose and validate a unified Video Analytics Framework for automatically processing, analyzing, segmenting, and summarizing “unstructured” and “unrestricted” consumer videos published to the Internet (YouTube, Facebook, etc.). This research will also investigate and prototype new video and multimedia applications using the proposed framework and related algorithms developed.

Nondestructive/noninvasive three-dimensional imaging with Gabor-domain optical coherence microscopy
Jannick Rolland
University of Rochester
LightSageTech Corporation
Real-time, high-resolution nondestructive inspection methods are needed to characterize materials, including plastics, glass and human tissue, through their depth. Fast, accurate metrology brings value to the manufacturing industry by improving quality, increasing productivity, and reducing costs. This project will advance the development of a Gabor-domain optical coherence microscopy (GD-OCM) instrument, the ExploreIR™, to qualify materials in the manufacturing process. Hardware and software tools will be developed for fast, nondestructive microscopy of contact lenses in manufacturing. GD-OCM will be applied to on-line, automated characterization of contact lenses.

Multimodal Displays: Sight, Sound, and Touch for Personal Computing Devices
Mark Bocko
University of Rochester
Synaptics, Inc.
In this collaborative project with Synaptics Incorporated, we will employ flat panel audio and haptic (touch feedback) technology developed at the University of Rochester to create integrated multimodal displays that provide users with visual, sound, and touch interfaces in handheld devices. The research plan is focused on developing low-cost piezoelectric force exciter arrays and the necessary control electronics for integration with ultra thin OLED displays in smartphones and other handheld intelligent devices.

Estimating the UV/VUV sensitivity of CMOS Image Sensors
Zoran Ninkov
Thermo Fisher Scientific
This project continues our effort to improve the UV/VUV ray sensitivity of CMOS image sensors by coating the arrays with quantum dots (QD) that fluoresce at visible wavelengths. This year’s work will proceed with developing the techniques to utilize aerosol jet deposition of commercially produced quantum dots onto CMOS detector arrays supplied by Thermo Fisher Scientific. In order for Thermo Fisher to proceed with the plans for commercialization, two key measurements are required. These tests are (a) radiation testing of the CMOS and (b) deep UV/VUV ray absolute sensitivity measurements of the QD-coated devices. If these two tests are positive, these devices would see widespread application in the markets served by Thermo Fisher Scientific, namely UV/VUV ray safety and radiation hard applications. We will be conducting the two tests at (a) the NIST SURF III Cyclotron Facility in Gaithersburg, Maryland, and (b) the Texas A&M Cyclotron. One exciting commercial application for these devices is to build an X-ray spectrometer on a CMOS chip where discrete areas of the chip are coated with different-sized quantum dots that have a cross-section for fluorescence tuned to specific X-ray wavelengths. NASA has already expressed interest in such devices to enable the use of miniaturized X-ray detecting spacecraft.
2015–2016 PROJECT ABSTRACTS

Exploring Advanced Image Processing and Segmentation Tools for Patient-Specific Anatomical Modeling and 3D Printing for Advanced Therapy Planning, Simulation and Guidance
Cristian A. Linte, PhD
Rochester Institute of Technology
Carestream Health, Inc.

We propose the development of methods to extract anatomical objects from CT data sets and translate them into 3D printed replicas for use in orthopedic applications. A life-size model that is specific to the patient allows for pre-procedural simulation, training, and practice (i.e., visual inspection of the anatomy and how a surgical intervention will proceed), leading to superior treatment planning and better patient outcomes. The availability of life-size models of patient-specific anatomy will also represent a significant training component, enabling students, trainees, residents, and fellows to conduct and practice emulating procedures on realistic anatomic models. Lastly, the project will also investigate the development of methods to translate CT data directly into 3D printed models without the need for an intermediate file data format, thereby reducing artifacts and other unintended challenges.

Pathway towards in-vivo IRIS: Femtosecond micromachining system for writing refractive corrections
Jonathan Ellis
University of Rochester
Clerio Vision, Inc.

Our long-term goal is to use femtosecond micromachining to customize refractive corrections in human eyes, be it in the cornea, contact lenses, or implanted IOLs. This requires high-numerical-aperture (NA) lenses (>0.6), placing severe limits on optical scanning. To achieve high throughput either for manufacturing or clinical applications, high-speed scanning over a 6.5 mm field is needed with synchronized laser intensity control and applanation to the patient/material. Our goal is to develop an optical scanner capable of micromachining with high NA lenses in <5 minutes over a large area and with intensity modulation. These properties together are necessary for writing customized corrective structures for ophthalmic applications.

Pathway towards in-vivo LIRIC: Modeling and Optimizing the LIRIC Writing Process
Paul D. Funkenbusch
University of Rochester
Clerio Vision, Inc.

LIRIC is a multi-photon absorption process that is used to locally change the refractive index of cornea tissue and hydrogels. The LIRIC process requires a high-numerical-aperture beam with a known optical quality that is scanned rapidly through the material. This process depends on numerous parameters, including NA, beam quality, pulse width, laser repetition rate, focal spot velocity, and material properties. This project will establish a framework model of the LIRIC writing process and design experiments to determine the coupling between parameters. The overall objective is to optimize the LIRIC process for both hydrogel and cornea tissue applications.

Biological Impact of Blue-IRIS in the Cornea
Krystel Huxlin
University of Rochester
Clerio Vision, Inc.

Our long-term goal is to use femtosecond micromachining as a nondamaging method of custom-correcting refractive error in humans. The proposed experiments focus on corneal applications of this technology and will assess the biological and biomechanical impact of inscribed patterns in cat corneas. These experiments are critical to establish parameters that impact optical outcomes of this laser refractive procedure, which is being proposed for use in human patients.

Scalable Fiber Lasers for Optimized Femtosecond Micromachining of Ophthalmic Materials
Wayne Knox
University of Rochester
Clerio Vision, Inc.

Our long-term goal is to use femtosecond micromachining as a nondamaging method of custom correcting refractive error in humans. The proposed experiments will investigate which femtosecond laser conditions are optimum for writing refractive index changes into hydrogels and cornea. We will use current lasers and also build new scalable fiber lasers to investigate new conditions in order to find optimum laser parameters. In particular, we will investigate effects of doping on the 1030 nm wavelength response of hydrogels and cornea and build a repetition-rate scalable fiber laser to investigate repetition rate dependence of writing efficiency and damage thresholds.

Polycrystalline Silicon and Metal Oxide Thin Film Transistor (TFT) Development
Karl D. Hirschman
Rochester Institute of Technology
Corning, Inc.

The purpose of this project is to investigate the influence of alternative glass formulations on the electrical characteristics of fabricated TFTs and develop innovative process integration strategies. The project involves process development, device fabrication, and parameter extraction of TFTs on glass substrates prepared by Corning incorporated. Semiconductor materials include low-temperature polycrystalline silicon (LTPS) and Indium-Gallium-Zinc-Oxide (IGZO). Glass substrates will be prepared by Corning. Device fabrication will be done at the Semiconductor & Microsystems Fabrication Laboratory (SMFL) at RIT, with certain thin-film deposition processes and treatments performed at the Corning clean room facility.
Discrete, fabrication and testing of a compact THz focal plane
Zoljko Ignjatovic
University of Rochester
Harris Geospatial Systems
Our group at the University of Rochester proposes to conduct a variety of THz measurements and parameter characterization and develop design methodologies for THz focal plane arrays in support of Harris’ THz imaging initiative. The proposed work is a continuation of our current efforts with Harris. Preliminary experimental results indicate that our technology shows a great deal of promise in detecting THz radiation up to 2THz with responsivities that far exceed that of more expensive and less scalable photodetector. This year the THz arrays fabricated during 2015–16 academic year, will be tested on the CMOS THz prototype imager fabricated during 2014–15. The results of this analysis will be used to model and optimize performance of our THz focal plane array, which will be subsequently fabricated and tested.

Nondestructive/noninvasive three-dimensional imaging with Gabor-domain optical coherence microscopy
Jannick Rolland
University of Rochester
Lightopath Corporation
Real-time, high-resolution nondestructive inspection methods are needed to characterize materials—including plastics, glass, and human tissue—through their depth. Fast, accurate metrology brings value to the manufacturing industry by improving quality, increasing productivity, and reducing costs. This project will advance the development of a Gabor-domain optical coherence microscopy (GD-OCM) instrument, the Explorer™, to qualify materials in the manufacturing process. Hardware and software tools will be developed for fast, nondestructive measurement of contact lenses in manufacturing. GD-OCM will be applied to on-line, automated characterization of contact lenses.

Design, fabrication and testing of THz detector arrays
Judith Pipher
University of Rochester
Harris Geospatial Systems
This project aims to develop THz detector arrays to be used in cameras for security and surveillance applications for stand-off-distance threat detection, package inspection, medical imaging applications, and material testing. In collaboration with colleagues from the Department of Electrical and Computer Engineering at the University of Rochester, the Chester F. Carlson Center for Imaging Science at RIT, and physicists and engineers from Harris, we have made steady progress in the development, understanding of detection mechanisms, and characterization of THz arrays designed by our ECE colleague and fabricated by MOSIS. Each generation has exhibited improvements derived from experimental results on the prior generation. We expect new deliverables in July. Our team will write new code/latex read software for the arrays and will characterize their operation.

Hyperspectral imaging for non-invasive, comprehensive measure- ment of microvascular function in humans
Anthony P. Pietrovoli
University of Rochester
Corning, Inc.
The purpose of this project is to determine whether hyperspectral imaging is capable of noninvasively quantifying microvascular blood flow, microvascular reserve, tissue respiration, and vascular permeability in healthy human subjects. Hyperspectral imaging has the potential to overcome current barriers to practical, precise, comprehensive, and noninvasive measurements of microvascular function. If so, this technology could provide an innovative window into the common and deadly microcirculatory derangements that occur in patients with sepsis and other acute and chronic illnesses. The business applications would include job growth and increased revenue at Corning Incorporated during the invention, design, and commercialization of this novel technology for biomedical applications.

Nanomembranes for Artificial Lungs
Tara Vaz
University of Rochester
Ovitz Corporation
Ovitz Corporation is a small startup developing a portable ocular medical device with combined wavefront sensor and keratometer. They have tested the device extensively in simulated laboratory settings but have had limited access to human subjects. The University of Rochester’s Paulus Eye Institute and Strong Vision Optical have both expertise in the technology and active clinics to provide controlled, ethical human testing. Small-scale testing (12 patients) has already been completed and provided important but limited inputs for design modifications. A database of 100 additional measurements/eyes (190 subjects) will be created and delivered to Ovitz with wider prescription ranges and more diverse demographics for further study.

Further Studies and Development of THz Detector Arrays
Jannick Rolland
University of Rochester
Lightopath Corporation
This project will explore the applicability of a Gabor-domain optical coherence microscopy (GD-OCT) instrument to quantify the sub-micrometer thickness of layers within the stratum corneum of skin with nanometer precision. Numerical tools will be developed to implement a maximum-likelihood unbiased estimator for thickness and number of layers estimation of subcomponents making the stratum corneum.

Support for Distributed Computing and Network Management in Mobile Ad Hoc Networks
Wendy Heinzelman
University of Rochester
Harris Corporation
Performing communication and computation in an ad hoc network of mobile devices is challenging yet critical for next-generation military networks. Not only must we ensure that data can be communicated within the network. The goal of this research is to optimize the networks. Our lab has developed a technique that makes any material permanently super water repellent (superhydrophobic) using high-powered lasers. This approach is both cost-effective and scalable compared to current techniques. This technique could provide an innovative window into the common and deadly microcirculatory derangements that occur in patients with sepsis and other acute and chronic illnesses. The business applications would include job growth and increased revenue at Corning Incorporated during the invention, design, and commercialization of this novel technology for biomedical applications.

Determinations of the Attributes of Aesthetically Pleasing Images and Methods to Improve Consumer Images to Make Them More Aesthetically Pleasing
David Messinger, Fijemes Forwarda
Rochester Institute of Technology
Kodak Alaris
The project will determine what attributes make an image aesthetically pleasing along with methods and heuristics used by professional photographers to create aesthetically pleasing images and use that work to develop automated methods and algorithms that can be applied to typical consumer images to make them more aesthetically pleasing. These algorithms will then be incorporated into Kodak-ALR's imaging systems for creation of more pleasing products with increased sales.

Thickness estimation with Gabor-domain optical coherence microscopy
Jannick Rolland
University of Rochester
Lightopath Corporation
This proposal aims to integrate ultrathin nanomembranes into conventional stirred cells and tangential flow filtration cartridges for bioprocess applications. SiMPore’s unique silicon-based nanomembranes are typically fabricated on silicon wafers with relatively small active areas that limit use to unique applications and microscale laboratory separations. The development of lift-off fabrication techniques by the Gaborski laboratory is enabling large-scale production of these membranes for biomedical applications such as hemodialysis. The goals of this proposal are to determine the feasibility of using this new class of ultrathin membranes for biomolecule separations and purifications typically performed in the biopharmaceutical industry.

Feasibility of Bioprocess Filtration Using Large Area Ultrathin Nanomembranes
Thomas Gaborski
Rochester Institute of Technology
SiMPore, Inc.
This project aims to integrate ultrathin nanomembranes into conventional stirred cells and tangential flow filtration cartridges for bioprocess applications. SiMPore’s unique silicon-based nanomembranes are typically fabricated on silicon wafers with relatively small active areas that limit use to unique applications and microscale laboratory separations. The development of lift-off fabrication techniques by the Gaborski laboratory is enabling large-scale production of these membranes for biomedical applications such as hemodialysis. The goals of this proposal are to determine the feasibility of using this new class of ultrathin membranes for biomolecule separations and purifications typically performed in the biopharmaceutical industry.

Nanomembranes for Artificial Lungs
James McGraith
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SiMPore, Inc.
An estimated 30 million Americans now live with chronic obstructive pulmonary diseases (COPD) such as emphysema and chronic bronchitis. While artificial hearts have revolutionized the treatment of patients with heart failure, artificial lungs have lagged far behind because of a technical inability to build systems with the efficiency of the natural lung. This exploratory project will examine the ability of SiMPore’s high-permeability membranes to revolutionize artificial lung technology. We are developing MEMS devices featuring SiMPore’s membranes and will test the membranes for efficient gas exchange and hemocompatibility. Devices will be scaled to prepare for small-animal experiments.
Enhancing the UV/VUV sensitivity of CMOS Image Sensors
Zoran Ninkov
Rochester Institute of Technology
Thermo Fisher Scientific

This project continues our effort to improve the UV/VUV sensitivity of CMOS image sensors by coating the arrays with quantum dots (QD). This year’s work will proceed with detailed testing of the devices that are now routinely coated with QD. In order for Thermo Fisher to proceed with the plans for commercialization, two key measurements are required. These tests are (a) radiation testing of the CMOS and (b) deep UV/VUV absolute sensitivity measurements. If these two tests are positive, these devices would see widespread application in the markets served by Thermo Fisher Scientific, namely UV/VUV spectroscopy and radiation hard applications. We will be conducting the two tests at (a) the NIST SURF III Cyclotron Facility in Gaithersburg, Maryland, and (b) the Texas A&M Cyclotron.

Multi-view 3D Displays with no head-worn component
John Howell
University of Rochester
UR Ventures Technology Development Fund

We propose to build a high-brightness and portable volumetric display and a virtual window, a multi-viewer continuous-view flat panel stereoscopic display. Both systems use technology that obviates the use of head-worn components required by multi-viewer traditional 3D displays.

Fiber Laser for Display Applications
John Marciante
University of Rochester
UR Ventures Technology Development Fund/Toptica Photonics Inc.

We have recently developed a technique to obtain high-efficiency direct lasing at green wavelengths in a fiber laser without the use of inefficient and expensive nonlinear frequency conversion crystals. The challenges associated with this concept require the balance of multiple physical phenomena and the design of a unique optical fiber. In this program, the unique fiber will be procured and tested. A laser cavity will be built using this fiber, and efficient green laser emission will be demonstrated for the first time in a fiber laser.
Innovating and transforming the world of vision correction.

**ADARZA BIOSYSTEMS, INC.**
www.adarzabio.com
Adarza Biosystems Inc. is an early-stage medical diagnostics company developing a rapid and label-free biological assay platform for measuring clinical and point-of-care (POC) samples. In addition to performing sophisticated clinical tests within minutes, this technology is fully amenable, potentially allowing hundreds of tests to be run simultaneously on a single chip. Adarza’s proprietary platform, Arrayed Imaging Reflectometry (AIR), achieves high sensitivity by detecting intensity changes in images of antireflective chips functionalized with highly specified detection molecules (proteins, DNA, etc.).

**BAUSCH AND LOMB**
www.bausch.com
Bausch & Lomb offers one of the world’s most comprehensive portfolios of eye health products. B+L markets five broad categories of products: contact lenses, lens care, pharmaceuticals, cataract and vitreoretinal surgery, and refractive surgery.

**CALIBER I.D.**
www.caliberid.com
New York State–based Caliber Imaging & Diagnostics (formerly Lucid Inc.) is a medical technologies company that designs, develops, and markets innovative imaging solutions that shows tissue at the cellular level. Caliber I.D. Inc. is currently the only company in the world to offer in vivo confocal microscopes designed specifically for imaging skin and other tissue. Caliber I.D.’s Rapid Cell I.D. technology enables scientists and physicians to characterize intact normal and abnormal cellular architecture that is otherwise invisible to the naked eye.

**CARESTREAM**
www.carestream.com
Carestream is a dynamic global company with more than 100 years of leadership. In today’s rapidly changing global health care environment, where the mandate to provide better outcomes has never been greater, we add value by delivering personalized, affordable, and practical options to help our customers advance. Medical providers large and small, from clinics and single hospitals to large networks and even entire countries, are upgrading their radiology and IT systems using our latest solutions.

**CLERIO VISION**
www.cleriovision.com
Clerio Vision is developing a novel vision correction procedure based on technology licensed from the University of Rochester. Instead of changing the shape of the cornea, as current LASIK-based approaches do, its approach is to use a femtosecond laser to change the refractive index of the cornea with small pulses to “write” a corrective prescription onto the cornea non-invasively. Because this approach doesn’t thin the cornea, it can be repeated as needed to correct vision changes over a person’s lifetime. The approach, called LIRIC, is being commercialized by some of the original architects of the world’s first LASIK systems. Clerio’s core technology has been in development for over a decade and is based on more than 40 issued and pending patents. Currently more than 150 million individuals in the United States alone require some form of vision correction.

**CORNING INC.**
www.corning.com
Corning Inc. is a diversified technology company that develops breakthrough technologies that significantly improve people’s lives. Corning pursues innovation and focuses on high-impact growth opportunities in the telecommunications, flat panel display, environmental, life sciences, and semiconductor industries.

**FLINT CREEK RESOURCES**
www.flintcr.com
Flint Creek Resources is a unique company that offers services to make your used rare earth and zirconia glass polishing compounds better than new. Spent polishing compounds are processed through a proprietary system that removes glass, polishing pad fragments, and contamination from the slurry. The resulting clean polishing particles are then custom formulated to produce excellent stock removal, surface finish, suspension, and cleanability.

**FLUXDATA, INC.**
www.fluxdata.com
FluxData develops and manufactures multispectral and polarimetric imaging systems for aerospace, defense, industrial, medical, and scientific markets. FluxData is a privately held, women-owned company located in Rochester, New York. FluxData’s imaging and system integration expertise helps guide customers from camera specification to delivery of the final system. Our staff of imaging experts work with customers to frame problems and deliver optimized systems based on a broad suite of options. Every product comes with FluxData’s commitment to first-rate customer support.

**GE OIL & GAS**
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As the world’s first digital industrial company, GE is transforming energy markets with software-defined machines and solutions that are connected, responsive, and predictive—bringing speed, scale, and greater insight to our oil and gas customers. And with the best minds and machines, we’re reducing equipment downtime, optimizing assets, and building new partnership models for the sector.

It will take more energy, ingenuity, and trust to fulfill our aspirations for the future. And GE Oil & Gas is ready to do its part. We’ve been an industry leader through constantly evolving energy sector dynamics and increasingly complex infrastructure challenges across the globe for more than 120 years.

We understand the entire energy value chain and know that oil and gas will continue to play a critical role. That’s why our technologies extract, transport, and refine oil and gas with productivity and the environment in mind.

**HARRIS CORPORATION**
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Harris provides advanced, technology-based solutions that solve government and commercial customers’ mission critical challenges. The company has approximately 58 billion in annual revenue and about 23,000 employees—including 9,000 engineers and scientists—supporting customers in more than 125 countries. Harris Corporation is a top-10 defense contractor providing mission-critical solutions through its Communication Systems, Critical Networks, Electronic Systems, and Space and Intelligence Systems segments.
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HYPRES, INC.
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Hypres Inc. manufactures superconducting microelectronics, including superconducting Integrated Circuits (IC). Its products include voltage-standard circuits and systems, wide bandwidth semiconductor-based amplifiers, and superconducting circuit foundry service. The company was founded in 1983 and is based in Elmsford, New York.

KITWARE
www.kitware.com

Kitware is a leader in the creation and support of open-source software and state-of-the-art technology. Through our long-standing commitment to open source, detailed in our open source mission statement, we have become one of the fastest growing software companies in the country. By fostering extended, collaborative communities, Kitware is able to provide flexible, cost-effective visualization, computer vision, medical imaging, data publishing, and quality software process solutions to a variety of academic and government institutions and private corporations worldwide.

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LIGHTOPTTECH
www.lightoptech.com

LightOptTech Corp., founded in 2013, is a women-owned optical technology company based in Rochester, New York. Our goal is to build innovative optical instruments to improve noninvasive imaging in medical and manufacturing fields.

OPTIPRO SYSTEMS LLC
www.optipro.com

OptiPro was founded on one revolutionary, yet simple, concept: optical fabricators deserve more. In the past 30 years, since we introduced the first affordable CNC machine designed specifically for the optics industry, we have consistently built a culture that cares—a culture of employees who live and breathe by our strong OptiPro values and a culture of best-in-breed customers who are collectively on a relentless pursuit of process efficiencies, design improvements, capability enhancements, and marketplace superiority.

OVITZ
www.o-vitz.com

Ovitz is an exciting medical device company specializing in developing, manufacturing, and marketing novel and portable ophthalmic equipment and accessories that facilitate the delivery of ophthalmic care in eye doctors’ and primary care physicians’ offices and in schools, rural areas, and developing nations.

SIMPORE INC.
www.simpore.com

SiMPore is a Rochester, New York-based nanotechnology company that designs and produces membranes and membrane-enabled products based on its unique patent-pending platform technology—the NanoBarrier™ UltraThin nanoporous silicon membrane. The NanoBarrier™ membrane is the world’s first membrane to offer both tunable nanometer-scale thickness and pore size. SiMPore is developing products that take advantage of these one-of-a-kind features, including filters for separating and concentrating biological molecules and nanoparticles, cell culture substrates for growing cells, and electron microscopy grids for preparing and imaging samples at the nanoscale.

SOLID CELL
www.solidcell.com

Solid Cell is a developer of stationary and portable solid-oxide fuel cell technologies for residential, commercial, industrial, and other critical off-grid applications. The company’s headquarters are located in New York City. Solid Cell’s principal product development and manufacturing center is in Rochester, New York. Solid Cell also supports R&D activities at research institutions in the cities of Novosibirsk and Yekaterinburg, Russia, where the company’s proprietary fuel cell technology was originally developed and where research continues on next-generation fuel cell technologies. The company’s European subsidiary is based in Dublin, Ireland, with further expansion in Europe planned in the near term. Solid Cell’s products provide clean energy using state-of-the-art fuel cell technology at commercially competitive costs. The company has targeted several specific applications to satisfy a wide variety of global power requirements. Widespread use of Solid Cell’s fuel cells will reduce reliance on scarce natural resources like natural gas and oil.

SYNAPTICS INC.
www.synaptics.com

We are the pioneers and leaders of the human interface evolution, bringing innovative and intuitive user experiences to intelligent devices. From usability and R&D to supply chain and support, we collaborate with our partners to invent, build, and deliver human interface solutions that integrate seamlessly and optimize system value. The improved ease of use, functionality, and aesthetics of Synaptics-enabled products help make the digital lives of people more productive, secure, and enjoyable.

Solid Cell is a developer of stationary and portable solid-oxide fuel cell technologies for residential, commercial, industrial, and other critical off-grid applications. The company’s headquarters are located in New York City. Solid Cell’s principal product development and manufacturing center is in Rochester, New York. Solid Cell also supports R&D activities at research institutions in the cities of Novosibirsk and Yekaterinburg, Russia, where the company’s proprietary fuel cell technology was originally developed and where research continues on next-generation fuel cell technologies. The company’s European subsidiary is based in Dublin, Ireland, with further expansion in Europe planned in the near term. Solid Cell’s products provide clean energy using state-of-the-art fuel cell technology at commercially competitive costs. The company has targeted several specific applications to satisfy a wide variety of global power requirements. Widespread use of Solid Cell’s fuel cells will reduce reliance on scarce natural resources like natural gas and oil.

SYNAPTICS INC.
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We are the pioneers and leaders of the human interface revolution, bringing innovative and intuitive user experiences to intelligent devices. From usability and R&D to supply chain and support, we collaborate with our partners to invent, build, and deliver human interface solutions that integrate seamlessly and optimize system value. The improved ease of use, functionality, and aesthetics of Synaptics-enabled products help make the digital lives of people more productive, secure, and enjoyable.
Thermo Fisher Scientific Inc. (NYSE: TMO) is the world leader in serving science, with revenues of $17 billion and 50,000 employees in 50 countries. Our mission is to enable our customers to make the world healthier, cleaner, and safer. We help our customers accelerate life sciences research, solve complex analytical challenges, improve patient diagnostics, and increase laboratory productivity. Through our four premier brands—Thermo Scientific, Life Technologies, Fisher Scientific, and Unity Lab Services—we offer an unmatched combination of innovative technologies, purchasing convenience, and comprehensive support.

UR Ventures develops University of Rochester innovations into valuable products and services to make the world ever better. Technology transfer functions are mandated by federal law. Even if they weren’t, we would still do it because it’s the right thing to do. Not only does the transfer of technologies make the world a better place, but the revenues generated are unrestricted and support the amazing research of the future. By rewarding our inventors, we also motivate them to solve real-world problems. Finally, the relationships we create help to attract and maintain industrial support for research.

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Xerox Corporation

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Research Interests Development, evaluation and preclinical integration of image guidance environments for surgical navigation of minimally invasive cardiac interventions
Recent Research Projects Predicting target vessel location in robot-assisted CABD interventions; using feature-based CT to US registration
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Research Interests Computer vision, Machine learning, Social media data mining, Human computer interaction, Biomedical informatics, Mobile and pervasive computing, Computational photography
Recent Research Projects Fine-grained user profiling from multiple social multimedia platforms; Wine recommendation for grocery shoppers
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Research Interests Physical systems and industrial problems pertaining to flows of biological and complex fluids, Modeling, Ordinary and partial differential equations, Scientific Computing
Recent Research Projects Affect of contact lens distortion on exchange of tears, Model for suction pressure under a contact lens
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Research Interests Lasers, Waveguides, Fiber Optics
Recent Research Projects Large-mode area fibers, Visible Fiber lasers, brightness semiconductor lasers, Fiber laser for display applications, High efficiency fiber amplifiers, All-fiber optical components
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Research Interests Use of motion-tracking techniques to enhance the contrast of ultrasound images, Acoustic Radiation Force Impulse (ARFI), Magnetically induced vibration of brachytherapy seeds

Recent Research Projects Acoustic radiation force imaging techniques, Spatially Modulated Ultrasound Radiation (SMURF) imaging, Single tracking location (STL) Shear wave elastography imaging (SWEI)

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Research Interests Nanoparticle and molecular separations, Nanotechnology, MEMS and micro fabrication, Cell culture technologies

Recent Research Projects The interaction of nanoparticles with cells and protein mixtures, Ultrathin silicon-based nanomembranes for filtration of molecules and nanoparticles, Ultrathin silicon-based nanomembranes for biological cell cultures

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Research Interests Remote sensing and image exploitation, Advanced mathematical approaches for spectral image processing, Target detection in hyperspectral imagery

Recent Research Projects Spatial segmentation of multi/hyperspectral imagery by fusion of spectral-gradient texture attributes, Knowledge-Based Automated Road Network Extraction System Using Multispectral Images

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Research Interests Biomedical nanotechnology, Combinatorial chemistry, Biophysical methods, Biosensors

Recent Research Projects The AIR Flu Chip: A Multiplex Optical Biosensor of Influenza Serology

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Research Interests Novel 2-D CMOS detector arrays, Fundamental limitations of visible and IR arrays, Miniaturized multispectral systems

Recent Research Projects Development of novel two-dimensional detector arrays, Development of image processing techniques for optimal analysis of such two-dimensional astronomical image data

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Research Interests Internal Medicine, Pulmonary Disease, Critical Care Medicine

Recent Research Projects Protocols and Hospital Mortality in Critically Ill Patients: The United States Critical Illness and Injury Trials Group Critical Illness Outcomes Study

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Research Interests Cellular and molecular characterization of fibroblasts, Control of normal and malignant lymphocyte activation

Recent Research Projects Ocular surface metrology and inflammatory mediator response to topical administration of anti-inflammatory drugs

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Research Interests Infrared observations of star-forming regions, Infrared detector array development and applications to astronomy and to persistent surveillance

Recent Research Projects Teledyne HgCdTe 10 micron cutoff detector arrays for use in future space experiments with particular emphasis on NEDCAM (Near Earth Object Camera), Characterization of Raytheon long-wavelength HgCdTe detector arrays, FIR spectrometer development, Persistent surveillance-driven projects

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Research Interests Optical metrology, Optical instrumentations, Adaptive and active optics, Segmented large-scale optics alignment and testing, Pulse compression, ultrafast laser systems and applications, Optical system design and performance evaluation
Recent Research Projects Development and investigation of an integrated laser-based optics polishing and manufacturing technology, Laser polishing for additive manufacturing
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Research Interests Biomechanics of soft tissues and measuring the change in mechanical properties of diseased tissues using clinical imaging modalities
Recent Research Projects Development, validation, and implementation of elasticity imaging, or elastography, for diagnosing vascular diseases
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Research Interests Optical system design for imaging and non-imaging optics, Physics-based modeling, Image quality assessment
Recent Research Projects Gabor-domain optical coherence microscopy for detection of defects in manufacturing, Optical coherence tomography for quantification of contact lens properties
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Recent Research Projects Novel optical technologies for sensing of nucleic acids and proteins, Mechanistic studies of electronic polymers used in luminous devices, Plasmonic enhancement of molecular absorption and luminescence, Small fragment removal for next-generation sequencing
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Research Interests Statistical physics of protein mixtures, Cell signaling dynamics, Fluid mechanics and solid mechanics of contact lenses and tear film
Recent Research Projects Affect of contact lens distortion on exchange of tears, Model of suction under contact lens
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Research Interests Three-dimensional geometry extraction from multiview imagery, Material optical properties measurement and modeling, Still and motion image processing for various applications, Thermal infrared phenomenology, exploitation, and simulation, Design and implementation of novel imaging and ground-based measurement systems
Recent Research Projects Signatures Modeling, Derivation, and exploitation, RIT Immersive Living Room, START-X SIP Signatures and SAR Measurement Support
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Research Interests Real-time computer vision, Multimedia systems, Medical imaging
Recent Research Projects Real-time systems for object tracking and activity recognition, Algorithms and systems for robust scene categorization and object classification in consumer photography, Document processing algorithms for thresholding, compression, and rendering in high-speed scanners, Digital Image Processing, and Computer Vision
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Research Interests Ultrafast optoelectronics, Quantum optoelectronic and spintronic devices, Ballistic transport in electronic nanodevices, Quantum communication and information
Recent Research Projects Quantum key distribution using polarized infrared single photons for practical quantum cryptography and deep space optical communications, Subpicosecond electro- and magneto-optic characterization of electronic, optoelectronic, and spintronic materials and systems, Smart sensor for classical and quantum data links
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Research Interests: Contact lenses, Lens solution, Ophthalmic drops
Recent Research Projects: High and low contrast visual acuity measurements in spherical and aspheric soft contact lens wearers, Continued development of portable low-cost wavefront sensors
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Research Interests: Adaptive optics and in-vivo ocular surface and intraocular imaging, Customized vision correction, Presbyopic correction
Recent Research Projects: Large stroke adaptive optics for correcting highly aberrated eyes, Investigation of accommodation and presbyopic lenses (multifocal and accommodative intraocular lenses)
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Research Interests: Improving the performance of optical imaging systems, Optical design, Optical fabrication, Optical design using anisotropic optical materials, Tolerancing of optical systems
Recent Research Projects: Multi-modal tumor mapping systems, Handheld Enhanced Reflectance Confocal Microscopy for Neuropathy Screening
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Cover photo: A section of 3D-printed vertebrae in the lab of Michael Richards, a research assistant professor in the Department of Surgery at the University of Rochester Medical Center. Photo by J. Adam Fenster.