CEIS

CENTER FOR EMERGING AND INNOVATIVE SCIENCES

ANNUAL REPORT 2014–2015

Research + Industry = Transforming Technology

CEIS

Contents

DIRECTOR'S MESSAGE

MARK F. BOCKO

PAUL H. BALLENTINE

The year 2015 has been an eventful year at CEIS! On July 27, Vice President Biden came to Rochester to announce that our region was chosen as the home of AIM Photonics, a $600 million Institute for Manufacturing Innovation (IMI) in Integrated Photonics. This was the culmination of several years of work by CEIS and our many partners across the state and the nation to establish such an institute and—importantly for our region—to locate it in Rochester.

The IMI award is our latest success in raising visibility and garnering federal support for our region's optics, photonics, and imaging industry. Through the combined efforts of CEIS and many others, Rochester has become the only community in the country that was awarded grants in all four of President Obama's manufacturing jobs initiatives programs: the Advanced Manufacturing Jobs and Innovation Accelerator Challenge (2012), the Investing in Manufacturing Communities Partnership program (2013), the Advanced Manufacturing Technology program (2014), and the Institutes for Manufacturing Innovation (2015). This is a tremendous achievement for the region, and we should share a great sense of community pride in these accomplishments.

In addition to the various federal initiatives, CEIS remains focused on our core mission of stimulating regional and state economic development through university-industry collaboration. In the past year, we supported 19 projects with 12 different companies and 19 principal investigators. Also in the past year, 13 entities reported economic impact totaling almost $36 million, including increased company revenues, job creation, and other metrics detailed in this report. This total included the creation of 17 new jobs and the retention of 26 positions.

And we acknowledge the continued support of NYSTAR, now a division of the New York State Department of Economic Development who announced in August 2015 that CEIS was selected for renewal as the state's Center for Advanced Technology (CAT) in optics, photonics, and imaging. We were thrilled to receive this good news, and we are grateful for the recognition and support of Governor Cuomo and New York State, and we look forward to continuing our work to make Rochester the leading center for optics, photonics, and imaging in the world.

In closing, we would like to thank the dedicated and resourceful staff at CEIS, including our business manager, Cathy Adams; the center's newly hired administrative assistant, Margaret Urzetta; our recently recruited information analyst, Devin Sandon; and our student assistants, Anya Khalid, Chee Kong, Lesley Mah, and Ervis Vukaj.

Sincerely,

Mark F. Bocko, *Director*

Paul H. Ballentine, *Executive Director*

Vice President Joe Biden and Rob Clark at the annoucement for AIM Photonics

To explore research project opportunities, please contact

Paul Ballentine
Executive Director, Business Development
(585) 273-2642
paul.ballentine@rochester.edu

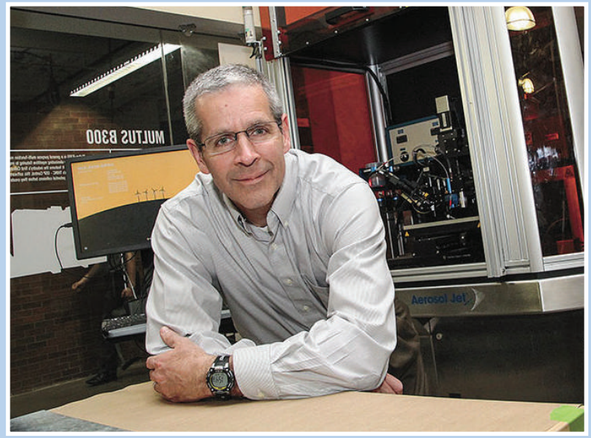
CEIS recognizes the need and tremendous potential for the Rochester region to prosper and reestablish itself as the imaging capital of the world. We are committed to help lead this effort in collaboration with our equally committed academic, industry, and government partners.

We are a research resource and partner to major global corporations and small startups—all with the purpose of developing and commercializing new technologies in New York State so that they can be brought to market in diverse applications while growing the regional economy.

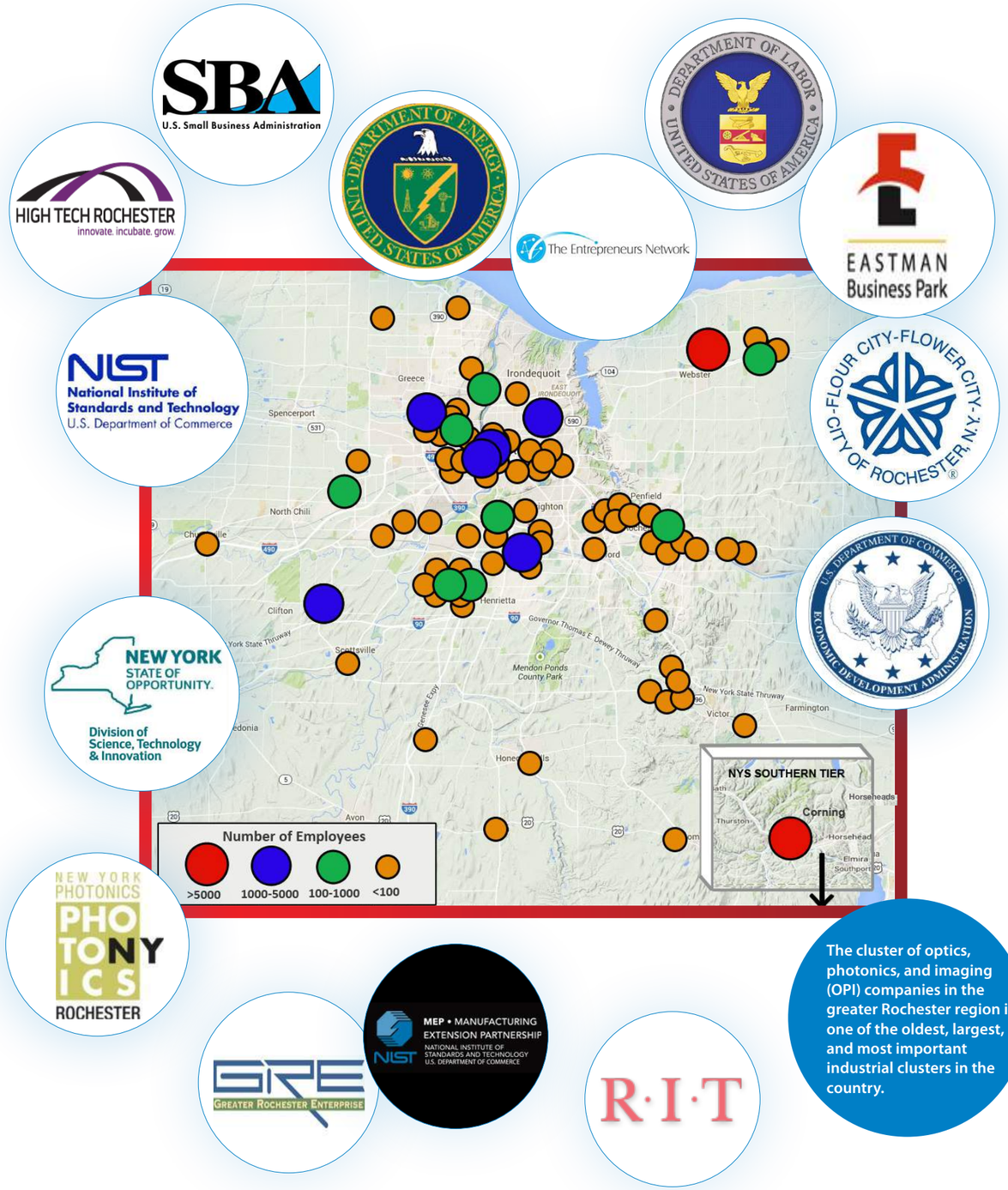
The faculty researchers highlighted in this report illustrate the wide array of interests that CEIS supports. This annual report includes the following overview of their scientific passions, projects, and patents. We hope that reading about their accomplishments and capabilities will spark the potential for a new collaboration. Contact us so that we can work with you to develop your company's next wave of products or services.

Welcoming RIT's AMPrint Center to the CAT Family!

This past August, Empire State Development named RIT's AMPrint Center as the newest member of the state's network of 15 Centers for Advanced Technology. AMPrint's focus will be on 3D printing, additive manufacturing, and functional printing and is being led by Professor Denis Cormier, RIT's Earl W. Brinkman Professor of Industrial and Systems Engineering. All of us at CEIS welcome AMPrint to the network of CATs, we wish you great success with the new center, and we look forward to finding collaborative opportunities in the future.



Denis Cormier

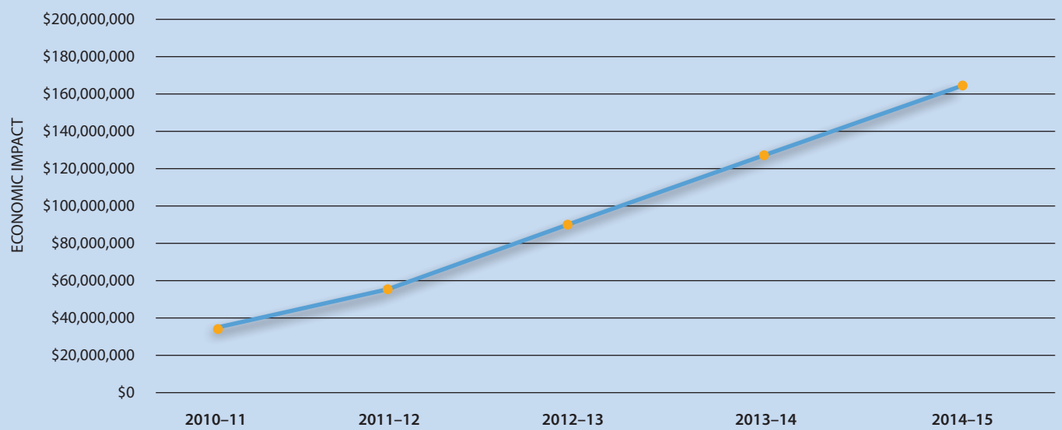


The cluster of optics, photonics, and imaging (OPI) companies in the greater Rochester region is one of the oldest, largest, and most important industrial clusters in the country.

ECONOMIC IMPACT

For the fiscal year July 1, 2014, to June 30, 2015, the total documented dollar value of the economic impact due to the research CEIS helped support was more than $35 million. This impact, due to the value of new and retained jobs, increased sales, decreased costs, additional funding acquired, and capital investment remains a good indicator of the region's economic health. This research helped create or retain 43 jobs. Thirty-one of these jobs are with the small companies we work with; 100 percent of the newly created jobs were reported by these small companies. We believe this is the most important metric in the current economic environment of high unemployment.

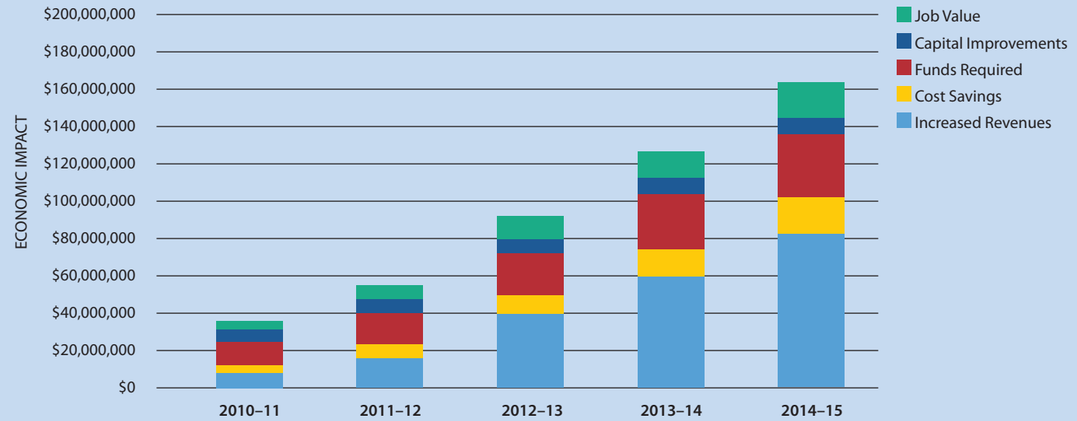
FIVE-YEAR CUMULATIVE ECONOMIC IMPACT



FIVE-YEAR SUMMARY OF ECONOMIC IMPACT

Year	2010–11	2011–12	2012–13	2013–14	2014–15	Total
Increased Revenues	$9,287,081	$7,493,412	$22,058,613	$20,816,657	$22,548,794	$82,204,557
Cost Savings	$3,842,000	$3,444,000	$3,146,200	$6,276,553	$1,989,100	$18,697,853
Funds Acquired	$11,801,946	$4,040,141	$7,380,774	$3,103,808	$8,050,720	$34,377,389
Capital Improvements	$5,591,664	$176,000	$679,000	$792,806	$263,421	$7,502,891
Job Value	$4,559,006	$3,015,652	$4,921,362	$4,245,605	$2,810,477	$19,552,102
New Jobs	25.5	7.75	28.35	21	17	100
Retained Jobs	42.3	34.5	43	40	26	186
Total Impact	$35,081,697	$18,169,205	$38,185,949	$35,235,429	$35,662,512	$162,334,792
Total Cumulative Impact	$35,081,697	$53,250,902	$91,436,851	$126,672,280	$162,334,792	$162,334,792

FIVE–YEAR ECONOMIC IMPACT



CAT PROGRAM FINANCIAL INFORMATION

	7/1/2014–6/30/2015
FUNDING FROM NYSTAR	
Research Expenditures	$248,907
Operational Expenditures *(Research and Center Related including applicable overhead)*	$387,480
Total NYSTAR Contribution	$636,387
OTHER SOURCES OF FUNDS	
Cash from Companies	$913,314
Other Contributions	$66,200
Total Other Sources	$979,514

COMPANIES REPORTING ECONOMIC IMPACT IN 2014–15 FROM CEIS INTERACTIONS

Adarza Biosystems, Inc.
Caliber ID, Inc.
Clerio Vision, Inc.
Corning, Inc.
Exelis (now Harris)
Flint Creek Resources, Inc.
Flux Data
Harris Corporation
LighTop Tech Corporation
Optipro Systems, LLC
Ovitz
SiMPore, Inc.
Thermo Fisher Scientific

FEDERAL INITIATIVES

This past year CEIS made substantial progress together with the federal government to expand the optics, photonics, and imaging industry in the Rochester region and across the state. The highlight of the year was the DOD-sponsored Integrated Photonics Institute for Manufacturing Innovation award to New York State. The institute, called AIM Photonics, will be headquartered in Rochester. Two key technology development operations will also be in Rochester: Test, Assembly, and Packaging and Photonic Integrated Circuit Sensors.

AIM photonics
AMERICAN INSTITUTE for MANUFACTURING INTEGRATED PHOTONICS

Even though AIM Photonics has not yet begun operation, the increased visibility of the region's OPI industry has significantly stimulated activity here. For example, applications to the Optical Systems Technology degree program at Monroe Community College sharply increased this fall. The program has had past difficulty attracting enough students to fill area job openings. And foreign photonics companies have expressed increased interest in establishing a presence here. The U.S. Department of Commerce International Trade Administration also has stepped in and offered to help local OPI companies expand foreign trade and attract foreign investment. As a result, one company was able to navigate the International Traffic in Arms Regulations (ITAR) and keep an important customer, which will protect jobs in the region. We anticipate seeing many more such positive outcomes.

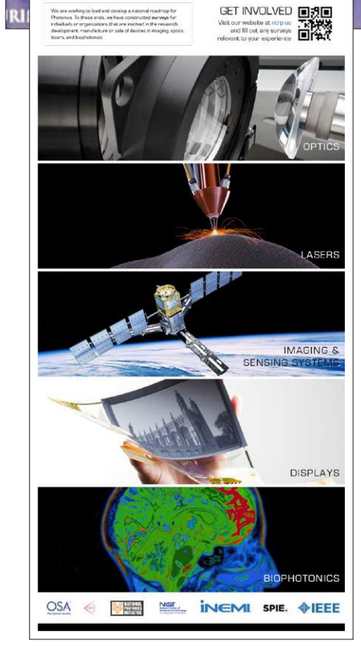
This marks the third year of our Advanced Manufacturing Jobs and Innovation Accelerator Challenge (AMJIAC) program, which we call the Rochester Regional Photonics Accelerator (RRPA). This five-agency grant has allowed CEIS and our partner organizations—RIT, Monroe Community College, High Tech Rochester (HTR), Rochester Regional Photonics Cluster (RRPC), and Finger Lakes Workforce Investment Board—to help local small and medium-sized OPI companies grow. Funding from the Economic Development Administration has been used to help RRPC represent the OPI cluster at foreign trade shows for the first time. Research funding from the Department of Energy has allowed Flint Creek Resources to substantially expand its business of recycling optical polishing slurry. Funding from the Department of Labor's Employment and Training Administration (ETA) has been used to provide scholarships to 121 people who are looking for jobs in the OPI industry. Recently we began to use ETA funds to

A map of photonics-related businesses, universities, and organizations across New York State

offset the costs for local businesses to hire long-term unemployed individuals as interns. The program, known as the 5% Pledge, is sponsored by the Finger Lakes Advanced Manufacturing Enterprise (FAME), which is part of the Finger Lakes Workforce Investment Board. A NIST MEP grant has allowed HTR to provide growth services to 24 OPI companies in the Rochester region. HTR's services helped one company develop a commercialization plan for a Phase-II SBIR grant and helped another company acquire an optical coating test instrument. And a grant from the Small Business Administration has allowed HTR to help launch five OPI startup companies and provide more than 50 more with services ranging from SBIR grant applications to entrepreneurship boot camp training. Perhaps the most important part of the RRPA program is the teamwork that has been established between the six grant partners to establish and carry out a comprehensive and coordinated program to expand the region's OPI industry.

Our second federal grant to grow the Rochester OPI industry is the Advanced Manufacturing Technology (AMTech) award from NIST. This two-year, $500,000 award is being used for three purposes: to establish a set of road maps for the U.S. OPI industry, to establish a consortium to address manufacturing challenges identified in the road maps, and to develop a strategy for expanding OPI manufacturing in New York State. We are happy to report we are

Vice President Joseph Biden and New York Governor Andrew Cuomo announce that Rochester will be the headquarters for the nation's newest manufacturing innovation hub, AIM Photonics. The announcement was made at the Canal Ponds Business Park in Greece, where some of the institute's activities will be based.



A banner produced by CEIS for display at conferences and events across the country

making excellent progress on all three of these goals. Our roadmapping effort has gained national attention. The information we are developing will be used to grow the national as well as our regional OPI industry. The establishment of AIM Photonics in Rochester satisfies the second goal. In addition, we are now working on concepts for a second regional center focused on optics, lasers, and imaging. As part of this work, CEIS is heavily involved with the Optics and Photonics Workgroup of the Finger Lakes Regional Economic Development Council. This activity supports the third goal of the AMTech grant.

CEIS is committed to growing the Rochester economy by working with local businesses, universities, and nonprofits as well as local, state, and federal government agencies. While our primary focus remains the OPI industries, our work has become a catalyst for growth in other industries as well. We are fortunate to be working in a community with unparalleled strengths in optics, photonics, and imaging. Our goal is nothing less than to recreate much of what has been lost by the downsizing of the major OPI companies in Rochester over the last few decades.

Research + Industry = Transforming Technology

CEIS leads the call for a National Photonics Technology Roadmap

Executive Director, Paul Ballentine, speaks at New York Photonics Annual Meeting

Jay Eastman and Tom Battley at the New York Photonics Annual Meeting

President Barack Obama cites MCC as an example of success

> "Monroe Community College is leading a group of community colleges that received funding from the U.S. Department of Labor to develop partnerships with local businesses, particularly in the optics industry. At one local company, Optimax, many employees have participated in MCC's courses."

Rob Clark announces Rochester's status as part of a consortium that is a finalist for a new Integrated Photonics Institute

The International Year of Light

CEIS annual University Technology Showcase poster session

harris × exelis = ingenuity²

Harris Corporation announces plan to acquire Exelis, Inc.

Vuzix launches retail prescription lenses for its smart glasses

Partner Appreciation Award winner Mark Schrader from High Tech Rochester

YEAR IN REVIEW

July 1, 2014
CEIS hosts a kick-off meeting and webinar for the recent NIST–funded AMTech award to develop a National Photonics Technology Roadmap

Aug. 2, 2014
In a *Democrat and Chronicle* guest essay, President Obama and Vice President Biden cite MCC's partnership with the optics industry, funded through the Advanced Manufacturing Jobs and Innovation Accelerator (AMJIAC), as an example of a successful job-training initiative, one which they would like to see duplicated throughout the country

Sept. 4, 2014
New York Photonics Annual Meeting honors Jay Eastman with the Leadership Award and Steve Jacobs with the Education Award

Oct. 30, 2014
Paul Ballentine presents "Rochester, New York, and the Finger Lakes Region: A Manufacturing Power House and the Imaging Capital of the World" at the inaugural IMCP Summit in Washington, D.C.

Nov. 6, 2014
The U.S. Department of Defense issues a call for concept papers for the establishment of an Integrated Photonics Institute for Manufacturing Innovation (IP-IMI). A New York contingent attends the proposer's day held November 19 in Arlington, Va.

Jan. 1, 2015
International Year of Light officially begins

Feb. 1, 2015
A consortium that includes the University as a key participant is named one of three finalists for a new Integrated Photonics Institute for Manufacturing Innovation

Feb. 5, 2015
Omni-ID is awarded the 2014 Customer Value Leadership Award for Radio Frequency Identification (RFID) in Manufacturing for the second time by global research organization Frost & Sullivan Inc.

Feb. 6, 2015
Harris Corporation announces plan to acquire Exelis, Inc. in a $4.75 billion deal

April 16, 2015
CEIS annual University Technology Showcase, Building on Our Strengths to Secure Rochester's Economic Future, hosts nearly 200 attendees and 46 poster presentations. Mark Schrader from High Tech Rochester (HTR) is honored by Rochester Regional Optics, Photonics, and Imaging Accelerator (RRPA) with the Partner Appreciation Award

May 1, 2015
Rochester team receives National Eye Institute grant for restoring vision through retinal regeneration

June 22–25, 2015
The Rochester Regional Photonics Cluster (RRPC) delegation attends Laser Munich, the largest photonics conference in Europe

June 23, 2015
Vuzix launches retail prescription lenses for its smart glasses

2015–2016

ABSTRACTS

2015–2016 PROJECT ABSTRACTS

Investigation of Drone Imaging Applications for Precision Agriculture
Carl Salvaggio
Rochester Institute of Technology
Agrinetix Computing Systems, LLC

Crop consulting is entering a new era with the accessibility of unmanned-aerial systems (UAS) and miniaturized spectral imaging systems. Never have remote sensing and crop scientists been able to collect imagery over farms and orchards at such high spatial resolution, repeat rates, and relatively insignificant cost. RIT proposes to construct a simple, low-cost sensor for UAS platforms to collect precise NDVI data to aid crop consultants in optimizing yield and minimizing resources for producers. RIT will perform experiments to design next-generation products to identify and locate particular water, fungal, and/or insect-induced stresses plaguing crops prevalent in New York State.

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 preprocedural 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 less than five minutes over a large area and with intensity modulation. These properties together are necessary for writing customized corrective structures for ophthalmic 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 Incorporated. 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 cleanroom facility.

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.

Support for Distributed Computing and Network Management in Mobile Ad Hoc Networks
Wendi 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 where it is needed, when it is needed, we must also ensure that computation can be accomplished quickly using available resources within the network. The goal of this research is to optimize the formation, monitoring, and evolution of a robust network to support communication and computation within a mobile ad hoc network environment.

Design, Fabrication, and Testing of a Compact THz Focal Plane
Zeljko 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 standard CMOS technologies in support of Harris's 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 2 THz with responsivities that far exceed that of more expensive and less scalable pyroelectric detector. During 2015–16 academic year, we will begin tests on the CMOS THz prototype imagers fabricated during 2014–15. The results of this analysis will be used to model and optimize noise performance of our THz focal plane array, which will be subsequently fabricated and tested.

THz Modeling and Testing
Zoran Ninkov
Rochester Institute of Technology
Harris Geospatial Systems

This effort will determine the ideal pixel structure and configuration for optimal responsivity, allowing the imaging array design to move forward. A custom low noise enclosure and cabling setup, along with a source measurement unit perform MOSFET voltage and current sweeps for transconductance, channel conductance, and resistance measurements and terahertz radiation responsivity. A 188 GHz Gunn diode is the current primary radiation source under test, with plans to move toward a tunable source with multiple bands from 0.1 to 1.0 terahertz. Results of these tests have provided input for next-generation design. This year we plan to produce a THz Imaging Prototype System that can be used by Harris for future product development.

Further Studies and Development of THz Detector Arrays
Judith Pipher and Craig McMurtry
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 ECE, UR; Imaging Science, 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 clock/bias/read software for the arrays and will characterize their operation.

Determination of the Attributes of Aesthetically Pleasing Images and Methods to Improve Consumer Images to Make Them More Aesthetically Pleasing
David Messinger and James Ferwerda
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 Alaris imaging systems for creation of more pleasing products with increased sales.

2015–2016 PROJECT ABSTRACTS

Nondestructive/Noninvasive Three-Dimensional Imaging with Gabor-domain Optical Coherence Microscopy
Jannick Rolland
University of Rochester
LighTopTech Corp.

Real-time, high-resolution nondestructive inspection methods are needed to characterize materials through their depth, including plastics, glass, and human tissue. 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 Explorer4D™ to qualify materials in the manufacturing process. Hardware and software tools will be developed for fast, nondestructive metrology of contact lenses in manufacturing. GD-OCM will be applied to online, automated characterization of contact lenses.

Femtosecond Laser Blackening Pt/Rh Alloy for Space Cooling Applications
Chunlei Guo
University of Rochester
Moog-ISP

A spacecraft, such as a satellite, requires a propulsion system to accurately control its position and motion. The lifespan of satellites is essentially over once their propulsion system ceases to function. This limited lifespan of the propulsion system is mainly due to the nozzle degradation from severe heat during propulsion. If the nozzle temperature can be lowered during propulsion, the lifespan of the spacecraft/satellites will be prolonged significantly. In collaborating with Moog-ISP, we plan to create a highly absorptive and highly radiative metal used for nozzles. The lifespan of the nozzle made from this material is expected to be prolonged significantly.

Feasibility of Bioprocess Filtration Using Large Area Ultrathin Nanomembranes
Thomas Gaborski
Rochester Institute of Technology
SiMPore

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 larger-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 McGrath
University of Rochester
SiMPore

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.

Algorithms and Control Electronics for Audio Displays
Mark Bocko
University of Rochester
Synaptics, Inc.

The goal of the proposed research is to bring audio display technology recently developed at the University of Rochester to a level of maturity required to provide compelling technology demonstrations for mass-market applications such as smartphones, tablets, notebook computers, and larger displays, including computer monitors and television sets. The proposed work will focus on two areas. The first is to continue the development and optimization of force actuator configurations and algorithms for audio displays, and the second is on the development of transparent force actuator arrays and audio display panels for integration with displays and touchscreens. The corporate partner, Synaptics, is a major provider of display and touch panel drivers to the smartphone and computer industry and is exploring the area of audio displays and display drivers as a possible new line of business for the company.

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 U/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.

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

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

This project is a continued study of LTPS and metal-oxide (IGZO) TFT processes and devices at Rochester Institute of Technology (RIT). Baseline processes have been developed for thin-film transistor fabrication. The goals of this work are to investigate passivation materials and process integration techniques and device structures for improved IGZO TFT performance; investigate the use of Xe flash-lamp annealing along with other techniques for the crystallization of a-Si; and investigate the influence of alternative glass formulations on the electrical characteristics of fabricated devices. Glass substrates will be prepared by Corning Inc. 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 cleanroom facility. This proposal presents a plan of work to fabricate and characterize thin-film transistors on glass substrates.

Further Development of THz Imager Array in Support of ITT Exelis's Commercial THz Development
Zeljko Ignjatovic
University of Rochester
Exelis

This project 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 ITT Exelis's THz initiative. The proposed work is a continuation of our current efforts with ITT. During 2014–15 academic year, we will begin tests on the THz test imagers fabricated in 2013–14. The results of this analysis will be used to model the THz response of standard MOSFETs and design an optimal THz focal plane array, which will be fabricated and tested subsequently.

THz Modeling and Testing
Zoran Ninkov
Rochester Institute of Technology
Exelis

A group consisting of Exelis engineers, RIT scientists, and University of Rochester engineers and scientists have designed and manufactured a first-generation room temperature silicon imager, to be operated in plasmonic mode at THz frequencies. There are several pixel varieties that have been tested with varying design dimensions, including with and without antennas. The RIT group from the Chester F. Carlson Center for Imaging Science has developed a testing system for terahertz single pixel characterization. This effort will determine the ideal pixel structure and configuration for optimal responsivity, allowing the imaging array design to move forward. A custom low noise enclosure and cabling setup, along with a source measurement unit perform MOSFET voltage and current sweeps for transconductance, channel conductance and resistance measurements, and terahertz radiation responsivity. A 188 GHz Gunn diode is the current primary radiation source under test, with plans to move toward a tunable source with multiple bands from 0.1 to 1.0 terahertz. Results of these tests have provided input for next-generation design.

Further THz Array Development and Characterization
Judith Pipher and Craig McMurtry
University of Rochester
Exelis

Design, build, and characterize a THz detector array that operates at room temperature or if cooled only slightly. Test arrays on a chip will be characterized in our lab using the UR array controller, and test structures will be characterized independently in RIT and UR engineering labs. First results obtained with single pixels on the last designs have been very promising and have driven this year's design and project directions. A newly designed chip is being submitted for manufacture at the end of May 2014 for delivery within three months. Once our team receives final information from the design team on the pin-outs, the biases, and the clocking, appropriate interface boards to our system and new clocks for the array controller will be designed and constructed. While we do not need to cool the array to cryogenic temperatures, we use our dewar with an ultra-pure Si window as the mounting platform because it acts as a Faraday cage and has suitable interface to the array controller. If noise turns out to be a limiting factor in operation, we will cool the array to determine the temperature required to reduce thermally generated noise.

Laser Polishing for Additive Manufacturing
Jie Qiao
Rochester Institute of Technology
Harbec

Additive manufacturing technology allows for direct, cost-efficient manufacturing of high-quality metal tool inserts, prototypes, and end products. However, the current final finishing of additively manufactured metal parts is not satisfactory, especially for freeform products. Hand polishing is a required post-processing step, which is lengthy and costly, therefore cancelling out the net benefit of additive manufacturing. This project will develop a short-pulse-laser–based polishing technology to improve surface-finishing quality, increase flexibility, and decrease lead time. This is a partnership with a New York State innovative tooling, machining, prototype development, molding, and production company, synergizing state-of-the-art additive manufacturing and laser polishing technologies.

Support for Distributed Computing and Network Management in Mobile Ad Hoc Networks
Wendi 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 where it is needed, when it is needed, we must also ensure that heavy computation can be accomplished quickly using available resources within the network. To address these issues, we will (1) extend our current distributed computing system to support multihop routing of tasks and results, and (2) determine how best to monitor available resources, including communication, computation, energy, and connectivity, for devices in the ad hoc network. The eventual goal is to support robust communication and efficient task distribution in an ad hoc network environment.

Thickness Estimation of the Stratum Corneum with Gabor-domain Optical Coherence Microscopy
Jannick Rolland
University of Rochester
LighTopTech Corp.

This project will explore the applicability of a Gabor-domain optical coherence microscopy (GD-OCM) 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.

Development and Investigation of an Integrated Laser-based Optics Polishing/Manufacturing Technology
Jie Qiao
Rochester Institute of Technology
OptiPro

This project develops a short-pulse-laser–based advanced optics or metal manufacturing technology to overcome the limitation of conventional polishing technologies such as long processing time and polishing waste and high cost for manufacturing aspheric and freeform optics. This is a partnership with a world-leader manufacturer of high-precision optical polishing equipment.

Developing a Portable Shack-Hartmann Wavefront Sensor as a Vision Defect Scanner
Geunyoung Yoon
University of Rochester
Ovitz Corporation

The wave aberrations in the eye include lower-order modes (focus error and astigmatism) as well as higher order ones. The higher order wave aberrations cannot be measured using conventional clinical devices such as phoropters and auto-refractors. The ability to quantify these optical defects including both lower- and higher-order aberrations has been increasingly important in the field of ophthalmology and vision science. It is also essential for vision screening and advanced vision correction methods such as laser refractive surgery and specialty ophthalmic lenses. However, it has been difficult for this technology to be used widely due to the high costs of commercially available devices. We propose to develop a low-cost and portable wavefront sensor that can be utilized and tested on human patients without sacrificing its measurement performance.

2014–2015 PROJECT ABSTRACTS

Further Development of Alignment System for Wave-Front Sensor
Geunyoung Yoon
University of Rochester
Ovitz Corporation

Working off the already established relationship with Geunyoung Yoon, Ovitz Corporation in collaboration with Dr. Yoon is bringing high-end, wavefront-sensing technology to the primary eye care toolkit in a portable (handheld), fast, accurate, easy-to-use, and relatively inexpensive eye diagnostic device (autorefractor) called the EyeProfiler.

Feasibility of Large Area Nanoporous Silicon Nitride Membranes for Hemodialysis
Robert Carter and Thomas Gaborski
Rochester Institute of Technology
SiMPore, Inc.

This proposal concerns the development of a scale-up fabrication technique for a nanoporous silicon nitride membrane technology that is being examined as a high-performance filter to enable portable hemodialysis. The proposed fabrication technique is based on supporting the ultrathin (ca. 50 nm) membrane with a polymeric scaffold and then separating it from the silicon wafer substrate that it is grown on with a through-pore etch. This technique is termed "lift-off" and builds on recent success in our group involving similar thickness silicon nitride membranes with micropores that are used as a high-performance substrate for cell culture studies.

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 U/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.

Wine Recommendations for Grocery Shoppers
Jiebo Luo
University of Rochester
Wegmans Food Market

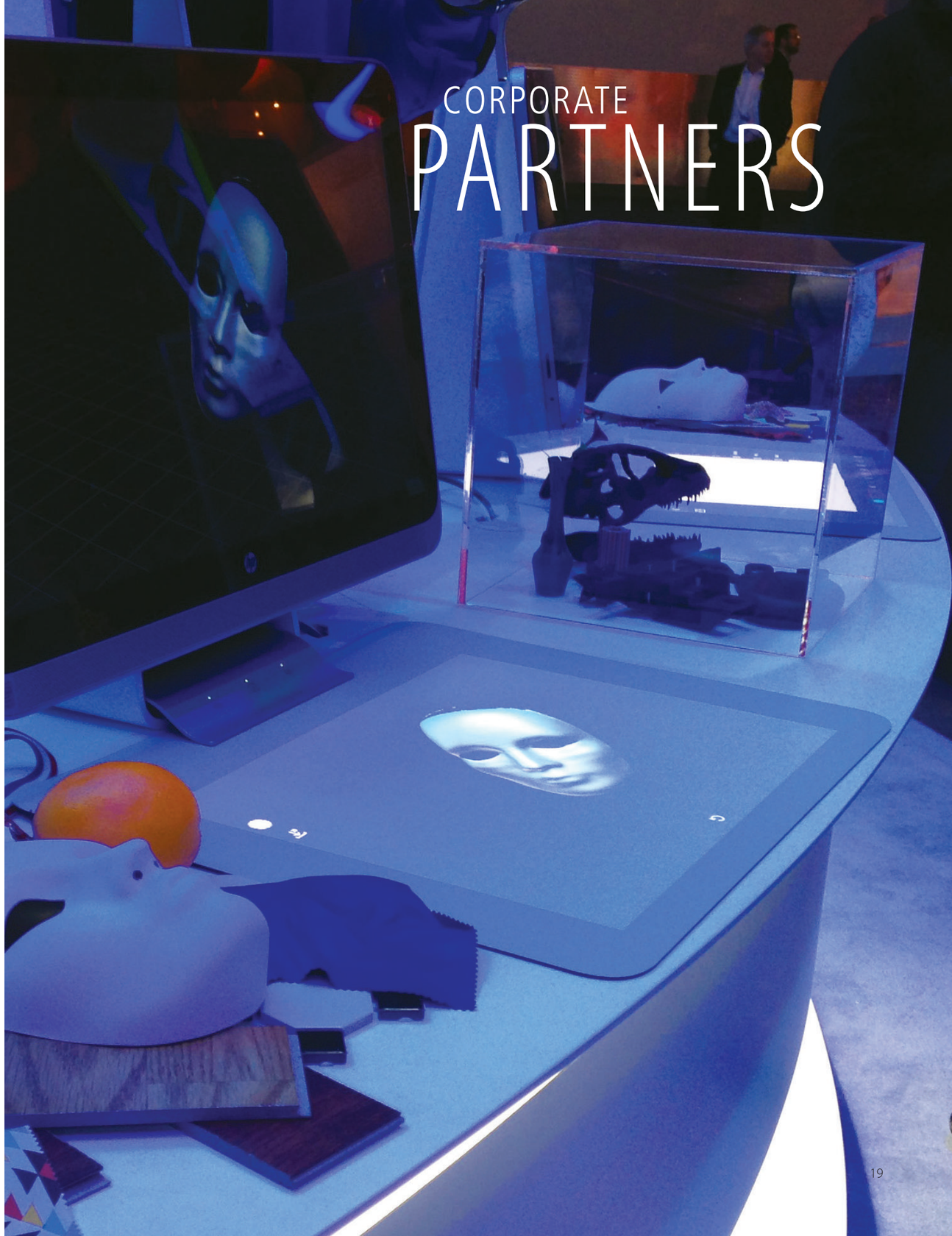
Wegmans Food Markets maintains a Shopper's Club and keeps a record of each member's shopping history. There is interest in utilizing this big data to increase wine sales in Century Liquor & Wine stores that Wegmans also owns throughout the Northeast. In this project, we investigate customer clustering, collaborative filtering, and content filtering to build a prototype recommender system that can generate a high customer response.

Non-Contact Video-based Detector of Cardiac Arrhythmias: A Proof-of-Concept Study
Jean-Philippe Couderc and David Huang
University of Rochester
Xerox Corporation

We propose to investigate whether new contactless video-based monitoring technology is valuable to monitor patients with an increased risk for life threatening arrhythmias. The proposed project aims to get insights into the interest of using facial video-plethysmography (VPG) signals to monitor the electrical state of a patient's heart. Our working hypothesis is: the short occurrence of cardiac arrhythmia could be associated with specific and detectable facial VPG patterns that could ultimately be used to identify patients with an increased risk for life-threatening arrhythmias.

Fine-Grained User Profiling from Multiple Social Multimedia Platforms
Jiebo Luo
University of Rochester
Xerox Corporation

Increasingly rich and large-scale social multimedia data (including text, images, audio, and video) are being generated and posted to social networking and media sharing websites. A user's sharing and posting behavior in social media can reveal a variety of useful information about the user and, hence, user profiling and demographics analysis from social media have attracted the attention of both academia and industry. In this project, we propose to analyze social media data from multiple social media platforms and build comprehensive user profiles by integrating information retrieved from multiple social media platforms.



CORPORATE PARTNERS

CORPORATE PARTNERS

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 arrayable, potentially allowing hundreds of tests to be run simultaneously on a single chip. Adarza's propriety chip-based 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.).

AGRINETIX COMPUTING
www.agrinetix.com

ANX is the frontrunner in cutting-edge advanced agronomy technology. We're experts in the science behind higher crop yields and efficient farming. We have more than 30 years of experience in the business of crop consulting, and our staff is full of industry professionals and former farmers.

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 show tissue at the cellular level. Caliber Imaging & Diagnostics, 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 ID 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 revolutionary product for the global refractive surgery market based on technology licensed from the University of Rochester.

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.

EXELIS

Exelis is now part of Harris Corporation. Exelis was acquired by Harris Corporation, creating a company with greater scale, capabilities, core franchises, and more balanced business portfolio. The combined company has a broad portfolio of advanced, technology-based solutions to solve government and commercial customers' mission-critical challenges.

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.

HARBEC
www.harbec.com

HARBEC's mission is to provide tightly toleranced prototypes, tooling, machined components, and quality injection-molded parts in a sustainable manner with a social conscience. We provide superior customer service, satisfaction, and timely delivery of custom-engineered solutions. We proudly foster an atmosphere of encouragement and respect for the health and prosperity of our customers, employees, and the global community.

HARRIS CORPORATION
www.harris.com

Harris provides advanced, technology-based solutions that solve government and commercial customers' mission-critical challenges. The company has approximately $8 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.

CORPORATE PARTNERS

KODAK ALARIS
www.kodakalaris.com/ek/US/en/Kodak_Alaris.htm

We're a new company born from one of the world's most iconic brands. A company that is passionate about using technology to transform organizations and improve people's lives across the planet. From our digital scanners and intelligent state-of-the-art software services that power some of the world's largest companies to our photographic paper production, printing kiosks, and suite of consumer apps that help people capture and connect with the emotional moments that define all our lives. We're on a mission to unlock the power of images and information for the world. We work behind the scenes, making the connections, pushing the boundaries of technology, and helping you to make sense of and exploit the ever-expanding volume of data that is the hallmark of the 21st century.

LIGHTOPTECH
www.lightoptech.com

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

MOOG-ISP
www.moog.com

Moog-ISP, formerly AMPAC In-Space Propulsion (ISP), is a leading developer and supplier of liquid rocket engines, tanks, and propulsion systems for commercial, defense, and spacecraft launch vehicles. Our leading position and reputation for quality, reliability, and value pricing is derived directly from our more than 60-year heritage and commitment to innovation for the future. Through ongoing R&D activities and corporate initiatives, our experienced team of scientists and engineers are developing higher performance engines and innovative propulsion systems. We use lean manufacturing practices to ensure continued affordability, high-performance, and high-value products.

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

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.

SYNAPTICS, INC.
www.synaptics.com

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.
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WEGMANS FOOD MARKET
www.wegmans.com

Wegmans Food Markets, Inc. is a family-owned U.S. regional supermarket chain headquartered in Gates, New York. Wegmans has 83 stores in the mid-Atlantic region, in New York, Pennsylvania, New Jersey, Maryland, Massachusetts, and Virginia. Founded in 1916 in Rochester, Wegmans has appeared on *Fortune*'s annual "100 Best Companies to Work For" list since its inception in 1998 and has ranked among the top 10 for eight consecutive years.

XEROX CORPORATION
www.xerox.com

For more than a half a century, Xerox has been a leader in document technology and services. We continue to build on this heritage of innovation. We now are the world's leading enterprise for business process and document management, offering global services from claims reimbursement and automated toll transaction to customer care centers and HR benefits management. The new Xerox is dedicated to innovation, service, and giving our customers the freedom to focus on what matters most: your real business.

FACULTY RESEARCHERS

FACULTY RESEARCHERS

Mark Bocko

Professor of Electrical and Computer Engineering and of Physics and Professor of Music Theory at the Eastman School of Music, University of Rochester

Education: PhD, University of Rochester Physics, 1984

MS, University of Rochester, Physics and Astronomy, 1980

BS, Colgate University, Physics and Astronomy, 1978

Research Interests: Imaging microelectronics • Wireless sensors • Multimedia signal processing

Recent Research Projects: Digital audio watermarking and steganography • Image sensors with built-in image compression • Digital CMOS image sensor read-out circuits

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Thomas G. Brown

Professor of Optics and Director, Robert E. Hopkins Center for Optical Design and Engineering, University of Rochester

Education: PhD, University of Rochester Optics, 1987

BS, Gordon College Physics, 1979

Research Interests: Optical polarization and metrology • Optoelectronic modeling Integrated optoelectronics

Recent Research Projects: Enhancing image contrast using polarization correlations • Stress engineering for polarimetry and imaging • Polarization control of optical nanostructures • Nonlinear properties of microstructured optical fibers

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Education: PhD, North Carolina State University

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Research Interests: Rapid Prototyping • Rapid Manufacturing

Recent Research Projects: Cu Ink Adhesion Solutions

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Education: PhD, National Institute of Applied Science (France) Biomedical Engineering, 1997

MBA, Simon Business School, Health Sciences Management, 2003

MS, Medical Specialties Non-Medical School (France), 1994

Research Interests: Computational science and engineering • Numerical analysis • Applications of computer science in electrophysiological signaling stabilization • Refractometry • Flexure systems • Stage metrology

Recent Research Projects: Noncontact video-based detector of cardiac arrhythmias

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Assistant Professor of Optics and of Mechanical Engineering, University of Rochester

Education: PhD, Delft University of Technology (the Netherlands), Mechanical Engineering, 2010

MSc, BS, University of North Carolina at Charlotte, Mechanical Engineering

Research Interests: Linear displacement interferometry • High-power gas laser frequency stabilization • Refractometry • Flexure systems • Stage metrology

Recent Research Projects: Designing and developing smart optical sensors for compact, remote displacement sensing and for multi-DOF interferometry

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Associate Professor in the Munsell Color Science Laboratory and in the Center for Imaging Science, Rochester Institute of Technology

Education: PhD, Cornell University, Experimental Psychology, 1998

MS, Cornell University Computer Graphics, 1987

BA, Cornell University Psychology with Honors, 1980

Research Interests: Computer graphics • Digital imaging • Data visualization • Visual perception • Low vision • Assistive technologies

Recent Research Projects: Effects of image dynamic range on apparent surface gloss

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Thomas Gaborski

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BS, Cornell University, Biological and Environmental Engineering, 2002

Research Interests: Nanomaterials and membrane fabrication • Microfluidics, separations, and device design • Cellular biophysics • Quantitative fluorescence imaging

Recent Research Projects: cellular co-culture screening assays

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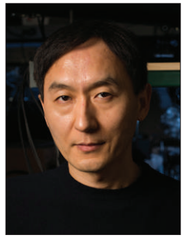

Chunlei Guo

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Education: PhD, Physics, University of Connecticut, 1999
BS, Physics, Changchun Institute of Optics and Fine Mechanics, 1994

Research Interests: Femtosecond Laser-Matter Interactions at High Intensities

Recent Research Projects: Superwicking cooling devices for computer CPU and microelectronics

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BS, Cornell University, Electrical Engineering, 1995

Research Interests: Multimedia communication • Wireless sensor networks • RFID systems • Cloud computing • Heterogeneous networking

Recent Research Projects: Developing RFID systems for inventory management • Designing a QoS-aware protocol architecture to support real-time multimedia data transmission • Optimizing video-based sensor networks

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Research Interests: Medical imaging system characterization • Ultrasound tissue characterization • Non-destructive evaluation techniques • Digital image processing

Recent Research Project: Designing an image processing toolkit to view through light scattering materials

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MS, Rochester Institute of Technology, Electrical Engineering, 1992
BS, Rochester Institute of Technology, Microelectronic Engineering, 1990

Research Interests: Silicon device integration on nontraditional substrates • Metal-oxide semiconductors for thin-film electronics • Silicon-based optoelectronics

Recent Research Projects: Development and characterization of high-performance transistors on glass (Corning, Inc and NYSTAR/CEIS) • Development of bipolar and MOS high-power microwave transistors (Spectrum, Devices Corporation, Hatfield, Pa.)

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Research Interests: Internal Medicine • Clinical Cardiac Electrophysiology • Cardiovascular Diseases

Recent Research Projects: Non-contact video-based detector of cardiac arrhythmias

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FACULTY RESEARCHERS

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Education: PhD, University of Sydney, Neuroscience, 1994
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Research Interests: Optics of the eye • Femtosecond laser micro- machining in cornea and lens • Visual perception and psychophysics • Biomedical imaging

Recent Research Projects: Femtosecond laser micromachining • Effect of corneal wound healing on physiological optics of the eye • Perceptual learning with a damaged visual system

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BS, University of Novi Sad, Electrical Engineering and Computer Science, 1999

Research Interests: A/D conversion • CMOS analog circuits • Low power circuit architectures • Image sensors

Recent Research Projects: Developing and investigating focal plane compression techniques where majority of multiplication computations required by the compression are rendered unnecessary

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BS, University of Rochester, Institute of Optics, 1979

Research Interests: Ultrafast laser physics and prototyping • Ultra-broadband laser systems • Biomedical optics using novel ultrafast lasers • Femtosecond micromachining of polymers • Nonlinear fiber and semiconductor devices

Recent Research Projects: Femtosecond micromachining of ophthalmic polymers

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John Lambropoulos

Professor of Mechanical Engineering and of Materials Science, Director of Materials Science Program, and Senior Scientist in the Laboratory of Laser Energetics, University of Rochester

Education: PhD, Harvard University, Mechanical Engineering, 1984
MS, Harvard University, Applied Sciences and Mechanical Engineering, 1981
BS, Brown University, Applied Mechanics, 1980

Research Interests: Describing macroscopic behavior of solids by examining underlying microstructural features • Mechanical, electrical, and/or optical affects to response of homogenous or heterogeneous materials

Recent Research Projects: Optimization of optics manufacturing techniques such as deterministic microgrinding, loose abrasive lapping, Magnetorheological Finishing (MRF), and loose abrasive finishing of optical glasses and ceramics

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2006, MA, Biomedical Engineering, University of Western Ontario
2004, BS, Mechanical and Material Engineering, University of Windsor

Research Interests: Development, evaluation, and pre-clinical 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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Education: PhD, University of Rochester, Electrical Engineering, 1995
MS, University of Science and Technology of China, Electrical Engineering, 1992
BS, University of Science and Technology of China, Electrical Engineering, 1989

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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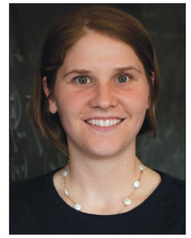

Kara Maki

Assistant Professor, School of Mathematical Science, Rochester Institute of Technology

Education: PhD, University of Delaware, Applied Mathematics, 2009
MS, University of Delaware, Applied Mathematics, 2006
BS, University of New Hampshire, Mathematics, 2003

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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Kenneth Marshall

Senior Research Engineer, Laboratory for Laser Energetics, University of Rochester

Research Interests: Electro-Optical Device Applications in Novel Liquid Crystal Systems • Phase-Shifting Point-Diffraction Interferometer for Microgravity Fluid Physics • Polymer LC Flake Technology and Applications in Electronic Imaging • Lyotropic Polysaccharide Liquid Crystal Systems for Optical Applications

Recent Research Projects: Improving reclamation process efficiency of spent polishing slurries

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FACULTY RESEARCHERS

James L. McGrath

Associate Professor of Biomedical Engineering, University of Rochester

Education: PhD, Massachusetts Institute of Technology, Biological Engineering, 1998
MS, Massachusetts Institute of Technology, Mechanical Engineering, 1994
BS, Arizona State University, Mechanical Engineering, 1991

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 co-cultures

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David Messinger

Professor and Director, Chester F. Carlson Center for Imaging Sciences, Rochester Institute of Technology

Education: PhD Physics, Rensselaer Polytechnic Institute, 1998
BS Physics, Clarkson University, 1991

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 textural attributes • Knowledge-Based Automated Road Network Extraction System Using Multispectral Images

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Benjamin Miller

Associate Professor, Dermatology, University of Rochester

Education: PhD, Organic Chemistry, Stanford University, 1994
BS, BA; Chemistry, Mathematics, and German; Miami University, 1988

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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Zoran Ninkov

Micron Technology Professor of Microelectronic Engineering, Rochester Institute of Technology

Education: PhD, University of British Columbia, Astronomy, 1985
MS, Monash University, Physical Chemistry, 1980
BS, University of Western Australia, Physics, 1977

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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Anthony P. Pietropaoli

Associate Professor, Department of Medicine, University of Rochester

Education: 2008, MPH, Clinical Investigations, University of Rochester
1994, MD, Medicine, SUNY Upstate Medical University
1986, BA, English and Premed, College of the Holy Cross

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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Judith L. Pipher

Professor Emeritus of Physics and Astronomy, University of Rochester

Education: PhD, Cornell University, Astronomy, 1971
MS, Cornell University, Astronomy, 1970
BS, University of Toronto, Physics and Astronomy, 1962

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 NEOCam (Near Earth Object Camera) • Characterization of Raytheon long wavelength HgCdTe detector arrays • FIRE spectrometer development • Persistent surveillance-driven projects

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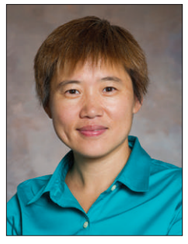

Jie Qiao

Associate Professor, Chester F. Carlson Center for Imaging Science, Rochester Institute of Technology

Education: PhD, University of Texas at Austin, Electrical and Computer Engineering, 2001
MBA, Simon Business School, 2012
MS, Tsighua University (Beijing), Precision Instruments and Fine Mechanics, 1997

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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Jannick Rolland

Brian J. Thompson Professor of Optical Engineering, Professor of Optics and of Biomedical Engineering, Professor in the Center for Visual Science, University of Rochester

Education: PhD, University of Arizona–Tucson, Optical Science, 1990
MA, University of Arizona–Tucson, Optical Science, 1987
Diplôme Grandes Ecoles, Institut d'Optique (France), 1984

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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FACULTY RESEARCHERS

David Ross

Professor, Center for Applied and Computational Mathematics, Rochester Institute of Technology

Education: PhD, New York University, Mathematics, 1985
BA, Colombia University, Mathematics, 1980

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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Carl Salvaggio

Professor of Imaging Sciences, Chester F. Carlson Center for Imaging Sciences, Rochester Institute of Technology

Education: PHD, Environmental Resource Engineering, SUNY ESF
MS, Imaging Sciences, Rochester Institute of Technology
BS, Imaging Sciences, Rochester Institute of Technology

Research Interests: Three-dimensional geometry extraction from multi-view 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 ISP Signatures and SWIR Measurement Support

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Associate Professor of Ophthalmology, of Optics in The Institute of Optics, and in the Center for Visual Science, University of Rochester

Education: PhD, Osaka University, Laser Optics, 1998
MS, Osaka University, Laser Optics, 1995
BS, SungKyunKwan University, Physics, 1990

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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Associate Professor, Institute of Optics, of Dermatology and of Biomedical Engineering, University of Rochester, and Director, Center for Institute Ventures

Education: PhD, The Institute of Optics, University of Rochester, 1988
BS, The Institute of Optics, University of Rochester, 1981, High Honors

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-model tumor mapping systems • Handheld Enhanced Reflectance Confocal Microscopy for Neuropathy Screening

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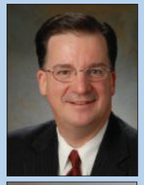

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Cover photo: University of Rochester Institute of Optics professor Chunlei Guo has developed a technique that uses lasers to render materials hydrophobic, illustrated in the image taken in his lab.
By J. Adam Fenster, University of Rochester, University Communications

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