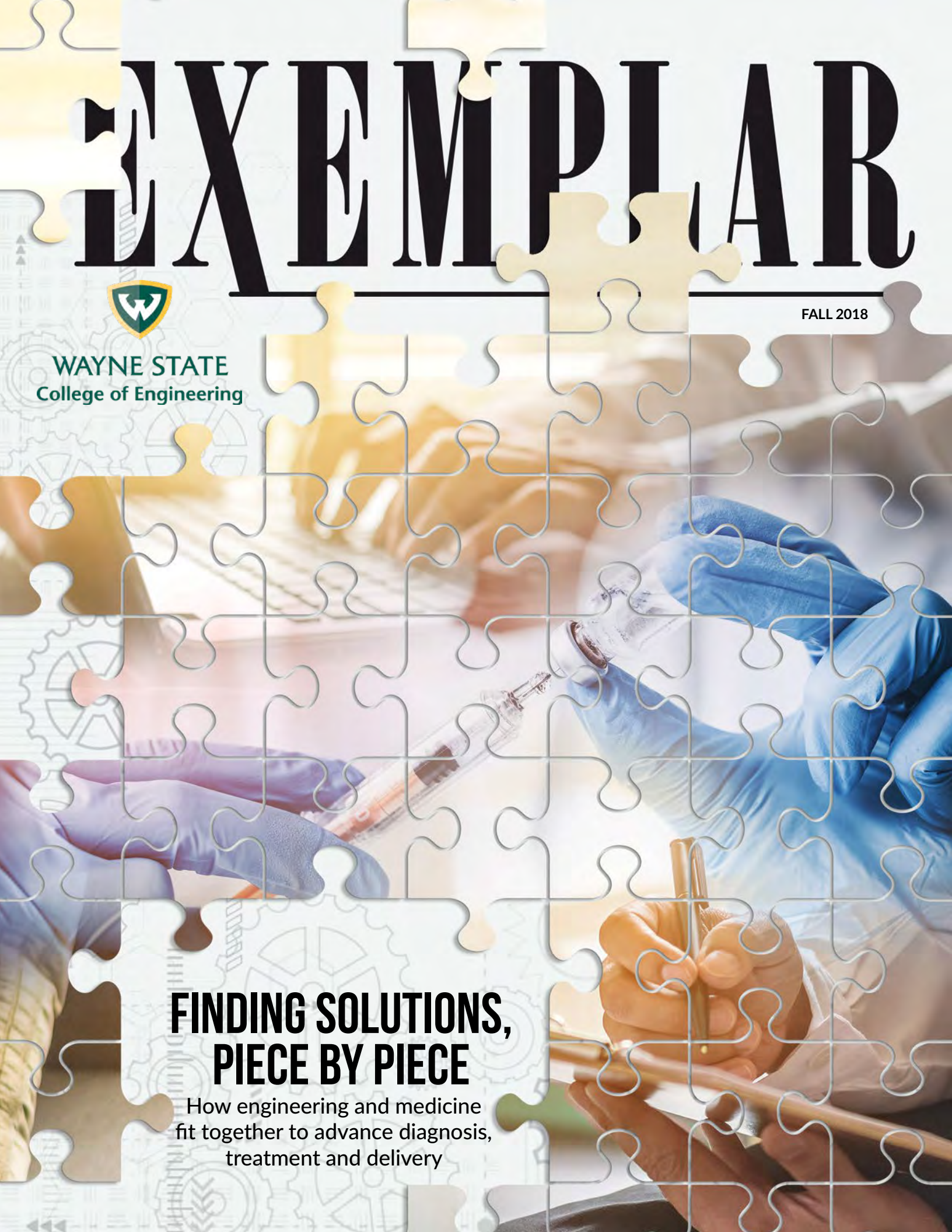
EXEMPLAR

FALL 2018

WAYNE STATE
College of Engineering



FINDING SOLUTIONS, PIECE BY PIECE

How engineering and medicine fit together to advance diagnosis, treatment and delivery

WAYNE STATE
College of Engineering

CONTENTS

FALL 2018

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Wayne State University
College of Engineering Group

Wayne State University
(Engineering Albums)

GREETINGS FROM **THE DEAN**

Dear alumni and friends,

Whenever you go to the doctor, you benefit not only from the expertise of physicians and medical scientists, but from engineers as well. Consider as you read this edition of *Exemplar* how pervasive engineering is to the medical profession. From electronic health records, to diagnostic devices, to rehabilitative and regenerative treatments, to personalized medicine, the impact engineers and computer scientists have on medicine is more evident every day.

Advancements in diagnostic imaging have led to fewer surgeries and other invasive procedures. When surgery is unavoidable, the talented physicians who perform those operations may have had the benefit of training on advanced robotic systems that make the most intricate movements more manageable. Data analysis and automation provides physicians with more real-time information than ever before, accelerating decision-making, improving health care delivery and furthering health equity across all populations.

We are closing the gap between engineering and medicine. Researchers in our college possess immense problem-solving skills, and their knack for innovation combined with the medical expertise of health care professionals and our collaborators in the School of Medicine is breaking new ground for how we diagnose, monitor and treat patients.

The work we are doing in this space is inspiring, as are the many stories of innovation and entrepreneurship, community outreach, and alumni success that are presented in *Exemplar*. This pioneering spirit drives our growth. As the university lauded the largest freshman class in its history this fall, engineering welcomed 550 first-year students, an increase of nearly 12 percent from last year. Almost a quarter of our student body is female, continuing an upward trend, and the 46 countries represented by our current students demonstrates our commitment to fostering a diverse learning atmosphere. We also bolstered our already-renowned faculty with seven new scholars ready to lend their expertise to many of our thrust areas of research and academia.

We are in a reflective mood in 2018 as the university celebrates its sesquicentennial. While I'm proud of where the College of Engineering has been, I'm even more excited about where we are going. *Exemplar* will provide you a glimpse of how we are shaping the future, but please be sure to visit our campus in Detroit or connect with us online to hear more of our story — and to tell us yours.

Sincerely,

Farshad Fotouhi
Dean

College of Engineering
FUNDING
2012-19

Medical-Biological
42%
$43,363,910

Traditional Engineering
58%
$64,209,816

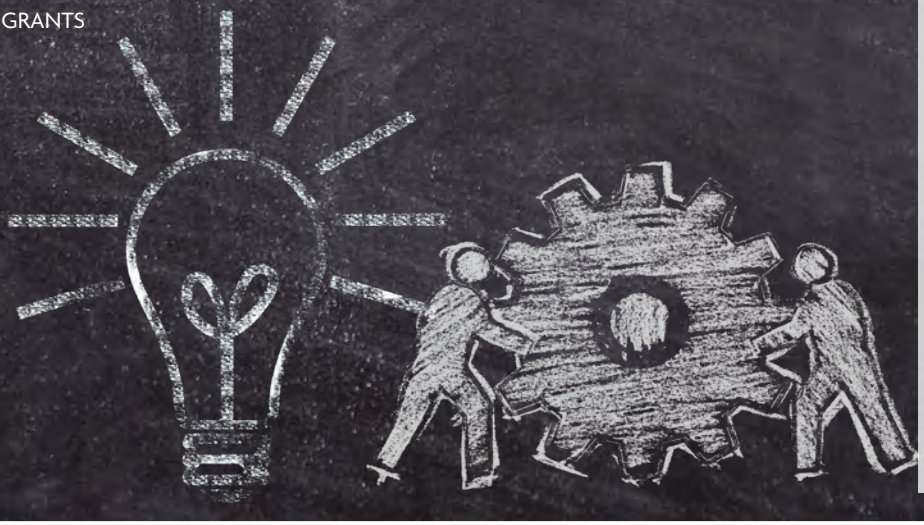
Total
$110,573,726

FUNDING SOURCES

- National Science Foundation
- National Institutes of Health
- Michigan Economic Development Corporation
- U.S. Department of Defense
- Epilepsy Foundation
- Juvenile Diabetes Research Foundation
- Susan G. Komen for the Cure

GRANTS AT
College of Engineering
2012-19

% = BIOMEDICAL GRANTS		TOTAL GRANTS
100%	BIOMEDICAL ENGINEERING	$24,301,618
51%	CHEMICAL ENGINEERING	$17,262,978
24%	CIVIL ENGINEERING	$17,022,094
87%	COMPUTER SCIENCE	$17,947,336
21%	ELECTRICAL & COMPUTER ENGINEERING	$13,675,785
0%	ENGINEERING TECHNOLOGY	$1,511,178
59%	INDUSTRIAL & SYSTEMS ENGINEERING	$13,678,051
0%	MECHANICAL ENGINEERING	$5,174,686



COLLABORATORS

- Barbara Ann Karmanos Cancer Institute, Wayne State University
- DMC Detroit Medical Center
- Henry Ford Health System
- Wayne State School of Medicine

The Engineering in Medicine research and education program in the College of Engineering is a vibrant enterprise that draws strength from diversity and collaborative spirit, scientific rigor and creativity, and a sense of community surrounding medical research at Wayne State University, including the School of Medicine, the Eugene Applebaum College of Pharmacy and Health Sciences, and the College of Nursing.

The major goal of the Engineering in Medicine initiative is to remove the boundaries separating the engineering and clinical disciplines. Interactions both within and outside the Engineering in Medicine program provide excellent opportunities to form multi-disciplinary collaborative teams that include engineers, clinicians and basic researchers. These teams develop and implement innovative engineering solutions for current unmet clinical needs, for preparation of competitive grant applications, for cross-disciplinary training of the next generation of medical engineers, and for innovation and spin-off industrial activities.

The research and educational activities in this program follow the same principles with an open-bay configuration, interdisciplinary group meetings and a focus on highly challenging cutting-edge problems. The Engineering in Medicine program aims to redefine the frontiers of health care technologies and organize concerted efforts at Wayne State University that push the envelope.

Sincerely,
Juri Gelovani
Director, Engineering in Medicine
Professor, Biomedical Engineering

engineering.wayne.edu/engineering-medicine/

MOHAMMAD AVANAKI
Assistant Professor,
Biomedical Engineering

AMAR BASU
Associate Professor,
Electrical and
Computer Engineering

ZHIQIANG CAO
Associate Professor,
Chemical Engineering
and Materials Science

MING DONG
Professor,
Computer Science

SORIN DRAGHICI
Professor,
Computer Science

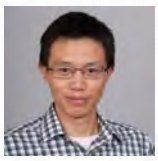
CAROLYN HARRIS
Assistant Professor,
Chemical Engineering
and Materials Science

KYOUNG-YUN KIM
Professor,
Industrial and
Systems Engineering

ULRIKE KLUEH
Associate Professor,
Biomedical Engineering

ALEX KOTOV
Assistant Professor,
Computer Science

MAI LAM
Assistant Professor,
Biomedical Engineering



HAIPENG LIU
Assistant Professor,
Chemical Engineering
and Materials Science

SHIYONG LU
Associate Professor,
Computer Science

HOWARD MATTHEW
Professor,
Chemical Engineering
and Materials Science

MOHAMMAD MEHRMOHAMMADI
Assistant Professor,
Biomedical Engineering

ALI OZBEKI
Lecturer,
Mechanical Engineering

ABHILASH PANDYA
Associate Profesor,
Electrical and
Computer Engineering

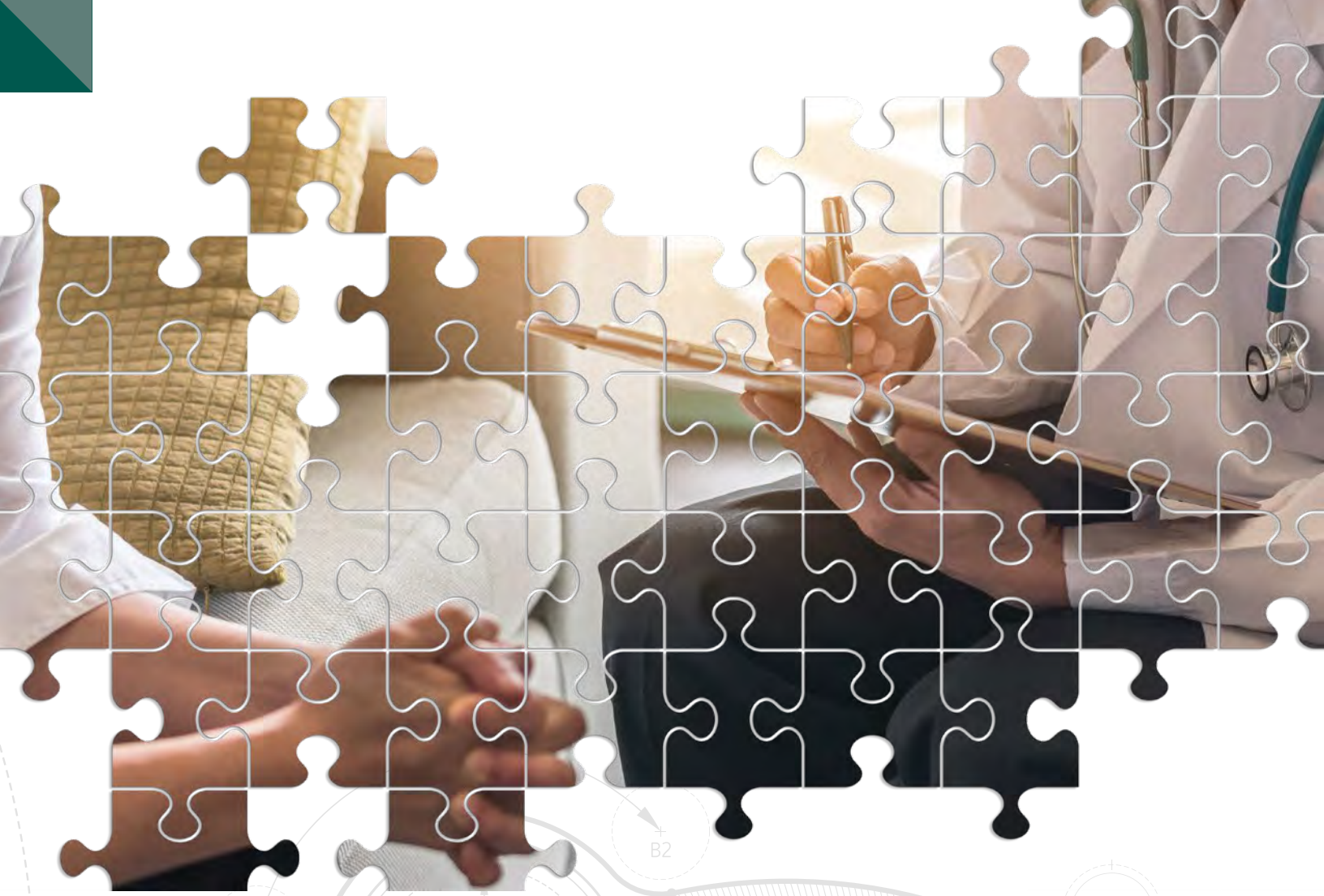
WEI-PING REN
Associate Professor,
Biomedical Engineering

HARINI SUNDARARAGHAVAN
Associate Professor,
Biomedical Engineering

YONG XU
Professor,
Electrical and
Computer Engineering

KAI YANG
Professor,
Industrial and
Systems Engineering

DONGXIAO ZHU
Associate Professor,
Computer Science



DIAGNOSIS

The interaction between engineers and members of the medical community is especially critical at the diagnostic stage of the health care journey. Engineers address the practical aspects of research, working closely with physicians and scientists to identify needs in the medical field and determine how to apply research into real-world solutions with advanced diagnostic capabilities.

Wayne State engineers are breaking new ground in microfluidics, sensors, monitoring devices and imaging instrumentation. These technologies are steering biomedical research and health care to levels of unparalleled progression.

Imaging technologies and the future of

DIAGNOSTIC MEDICINE

Diagnostic imaging offers physicians and scientists critical visual representations of internal body structures, greatly enhancing clinical analysis and medical intervention. Researchers continue to break new ground on how various imaging technologies can provide a better understanding of the human body.

Mohammad Avanaki, assistant professor of biomedical engineering at Wayne State University, has adapted several instrumentations to address current unmet clinical needs.

Transfontanelle photoacoustic imaging: A new way to scan an infant's brain

In a study funded by the Michigan Translational Research and Commercialization (MTRAC) program, Avanaki led a research team seeking to improve the current diagnostic methods used to detect birth-induced brain complications in premature infants.

His lab has developed a compact and portable device, called a multispectral transfontanelle photoacoustic imaging (MTPAI) probe, to image the brain of premature infants for any sign of hemorrhage or hypoxia. The imaging technique reflects laser light off blood cells in the brain to create an acoustic sound that can be picked up and interpreted.

MTPAI addresses many of the limitations of ultrasound or MRI technology, including a low sensitivity to blood. The probe, according to Avanaki, "for the first time should allow for non-invasive structural and functional imaging of the infant brain."

The project is a collaboration between the WSU Department of Biomedical Engineering, Boston Children's Hospital and Harvard Medical School.

Eyes could be window to predicting Alzheimer's

Alzheimer's is a progressive disease that destroys memory and other important mental functions. Nearly 500,000 new cases of the disease will be diagnosed this year. One of the hallmarks of Alzheimer's is the accumulation of amyloid plaques between nerve cells, or neurons, in the brain.

With support from the Albert and Goldye J. Nelson Research Fund, Avanaki's lab is exploring a straightforward method to diagnose Alzheimer's in early stages. He has adapted fluorescent imaging techniques to see through the retina of the eye, an extension of the brain and central nervous system, to detect amyloid plaques.

"The technique is non-invasive and safe," said Avanaki, who works with clinicians from the WSU Department of Neurology to test this custom-made system. He hopes that this procedure will be a routine diagnostic tool in the near future.

A novel methodology for early diagnosis of melanoma

Malignant melanoma is by far the most dangerous form of skin cancer, causing more than 15,000 deaths in the U.S. yearly. Melanoma is most likely curable if detected early (melanoma in situ). Visual inspection of lesions using so-called "ABCDE criteria" is the first step in a physician's decision to conduct a biopsy for definitive histopathologic diagnosis. However, interpretation of visual findings is highly subjective and leads to low diagnostic specificity (roughly 59 to 78 percent).

"To reduce the number of unnecessary biopsies and to increase the sensitivity and specificity of melanoma diagnosis, several non-invasive imaging techniques have been developed to date," said Avanaki. "These devices suffer various drawbacks that result in a limited specificity for differentiation between melanomas and benign skin lesions. Therefore, none of these imaging devices have been widely adopted by clinicians."

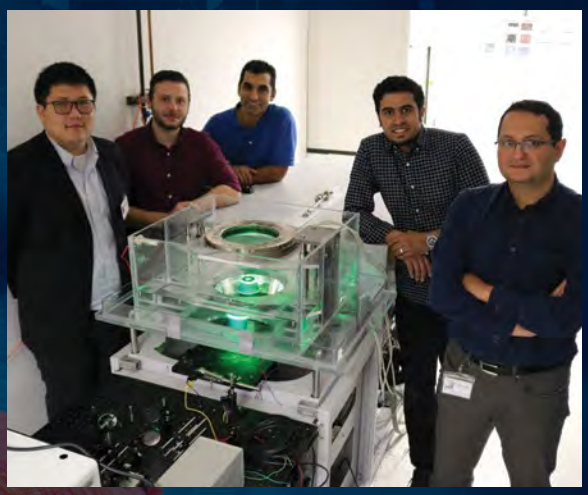
Avanaki's lab has developed an approach called small nanoparticle aggregation-enhanced radiomics of tumors (SMART) optical coherence tomography (OCT) for early detection of melanoma with a high specificity and sensitivity. SMART-OCT uses ultra-small fragments of galectin-3, a protein which is overexpressed in melanomas but absent in benign skin legions. Imaging signals are amplified by these aggregated proteins, forming large reflective surfaces that would help validate the need for a biopsy to make a diagnosis.

The project has received funding from the Karmanos Cancer Institute on behalf of the American Cancer Society as well as the Mi-Kickstart program. ▪

WAYNE STATE RESEARCHERS

using photoacoustics to develop new breast cancer diagnostic tool

A Wayne State University College of Engineering team led by Mohammad Mehrmohammadi, assistant professor of biomedical engineering, is developing an innovative diagnostic tool that combines ultrasound and photoacoustic technology to enhance screening and diagnosis of breast cancer. The project recently earned $375,000 in funding from the Department of Defense's Congressionally Directed Medical Research Programs (CDRMP) initiative.

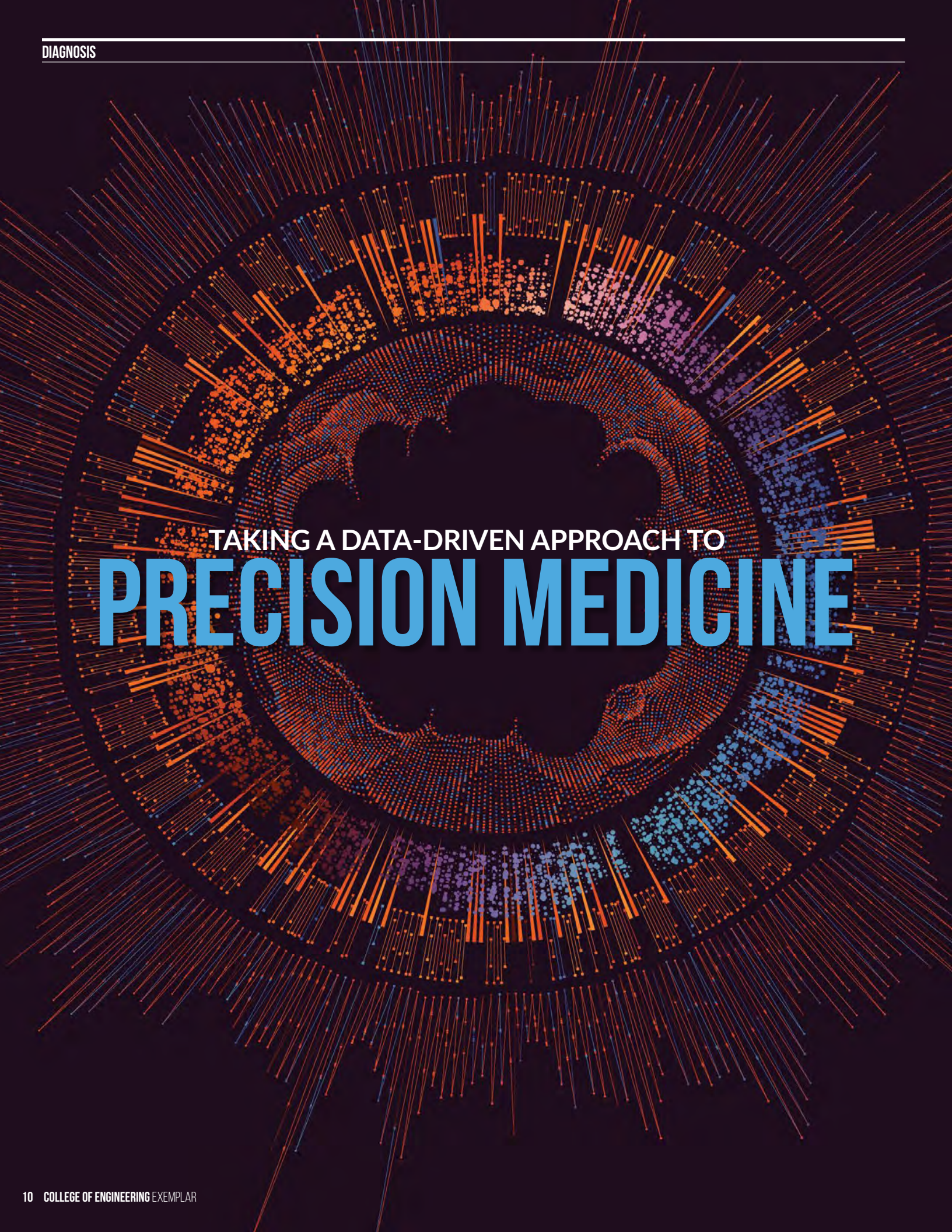


Biopsies have long been the primary diagnostic procedure used to determine whether a patient has breast cancer. The good news, according to the National Breast Cancer Foundation, is that 80 percent of women who undergo a biopsy do not have breast cancer. The bad news is that biopsies can result in physical and emotional distress, as well as pose a financial burden on the patient or health care provider.

On its own, ultrasound has a high sensitivity to invasive cancer and is effective for scanning dense tissue but lacks in specificity and predictive value. Adding photoacoustic tomography — in which non-ionizing laser pulses are delivered to biological tissues and converted into ultrasonic emissions that can be analyzed as images — to the process may lead to a point-of-care screening and diagnosis process that is fast, accurate and non-invasive, reducing the number of biopsies performed by physicians.

"Combining ultrasound and photoacoustic provides a whole new range of diagnostic information such as blood vasculature density and tissue hypoxia, which are known biomarkers for more accurate diagnosis and classification of breast lesions," said Mehrmohammadi. "In addition, developing photoacoustic tomography of a breast opens a lot of opportunities for future development of molecular targeted contrast agents for differential diagnosis of breast cancer sub-types."

The technology will be implemented and tested at the Karmanos Cancer Institute, with researchers from the Molecular Imaging and Diagnostics Program. ▪

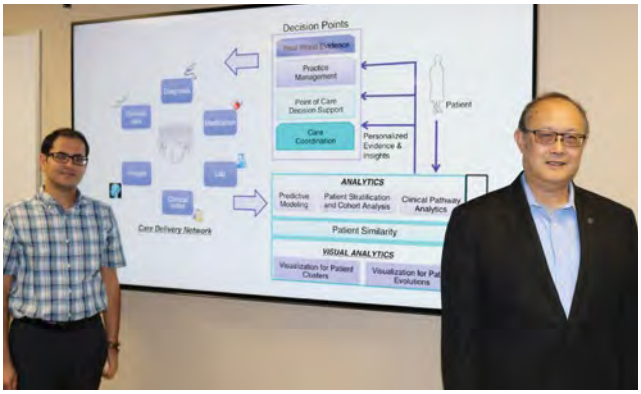


TAKING A DATA-DRIVEN APPROACH TO

PRECISION MEDICINE

Precision medicine, or personalized medicine, combines data science tools with medical knowledge to enable physicians to more accurately predict disease susceptibility or prognosis, and develop a tailor-made treatment or prevention plan. In other words, the goal is to provide the right treatment to the right patient at the right time.

Data science research using electronic medical records has accelerated progress in the field of precision medicine. Kai Yang, professor of industrial and systems engineering, and Ph.D. student Milad Zafar Nezhad lead an interdisciplinary team of Wayne State researchers developing two novel predictive and feature learning approaches to precision medicine.



A deep learning method termed SAFS (Stacked Auto-encoders Feature Selection) presents a fresh approach to disease risk factor selection and prediction.

"Feature selection means 'important variable selection' or important factor selection.' It allows us to select the most critical factors — such as BMI, weight, blood sugar — for certain diseases,'" said Yang.

SAFS employs a powerful, unintuitive and indirect methodology based on neural networks for feature representation, or converting raw data to features, because many raw data are not directly meaningful factors. One study focused on African Americans at high risk for hypertension and other cardiovascular complications. The SAFS model was applied to find risk factors that affected left ventricular mass indexed to body surface area (LVMI), a major indicator of cardiovascular disease. Analysis of data obtained from more than 700 patients at Detroit Receiving Hospital showed that SAFS outperformed other popular methods in term of predicting LVMI and discovering critical risk factors of the disease.

The team also proposed a survival analysis framework using deep learning and active learning called Deep Active Survival Analysis (DASA). The motivation for this study comes from either literature gaps or application needs in several health care domains where the labeled data is scarce and high-dimensional.

"Survival analysis is a kind of statistical modeling where the main goal is to analyze and model time until the occurrence of an event of interest, such as patient death," said Nezhad. "DASA is able to improve the survival analysis performance significantly for risk prediction and survival time estimation, and provide treatment recommendations."

In this study, researchers used SEER-Medicare prostate cancer data to evaluate the performance of their approach and provide specific racial therapy insights based on different treatment plans among African American and white patients.

SAFS and DASA each offer unique characteristics to further precision medicine and the customization of health care. Among Yang and Nezhad's collaborators for these studies were Dongxiao Zhu, associate professor of computer science; Jennifer Beebe-Dimmer, associate professor in the WSU School of Medicine and the Karmanos Cancer Institute; Julie Ruterbusch, a research assistant at Karmanos and the School of Medicine; and Phillip Levy, M.D., M.P.H., the Edward S. Thomas Endowed Professor of Emergency Medicine and assistant vice president of Translational Science and Clinical Research Innovation for WSU. ■

TREATMENT

Every medical device is tangible evidence of the interdisciplinary collaboration of engineers that challenge technological boundaries and physicians seeking better ways to treat patients. Experts at Wayne State University are pushing the envelope in biomaterials, wearable and implantable devices, and tissue engineering. Their work applies to numerous developing technologies that will revolutionize testing, treatment and preventative care to improve health or combat a diagnosed problem.

Applications that enhance capability of treating early-stage diseases will provide greater defense against the leading causes of death such as cancer and heart disease. Devices that help patients more effectively manage their conditions will improve their quality of life while diminishing the need for more advanced treatments.

Identifying shunt failure mechanisms in

NEUROLOGICAL DISEASE TREATMENTS

Hydrocephalus is a condition in which an accumulation of cerebrospinal fluid (CSF) on the brain causes increased pressure in the skull. It affects approximately one million people in the U.S., including one out of every 1,000 newborns.

The only effective treatment of hydrocephalus is surgery and usually involves placement of a shunt system. Carolyn Harris, professor of chemical engineering and materials science at Wayne State, is a renowned expert on neurological disorders such as hydrocephalus, and has sought to evaluate and improve shunt designs.

Shunts reduce intracranial pressure by generating a pathway to drain excess CSF from the brain, but complications often occur — an estimated 50 percent of shunts in pediatric patients fail within two years. Harris notes that shunts can disconnect, become infected, develop blockages due to infiltrating cells or tissues, or create other reactions due to it being a foreign body with no physiological properties.

"How these responses occur and what we can do to reduce the incidence of shunt blockage are keys to improving patient care," said Harris.

These phenomena are not well understood because of variances in cell type and activity across patient subpopulations. Astrocytes and microglia are predominant in response to shunt systems because they bind directly to the catheter and create an environment for other cells to adhere. Harris's lab fabricated 3-D hydrogel scaffolds to model shunt failure due to cell and tissue obstruction, with the data indicating that cell migration may begin around the shunt inlet holes.

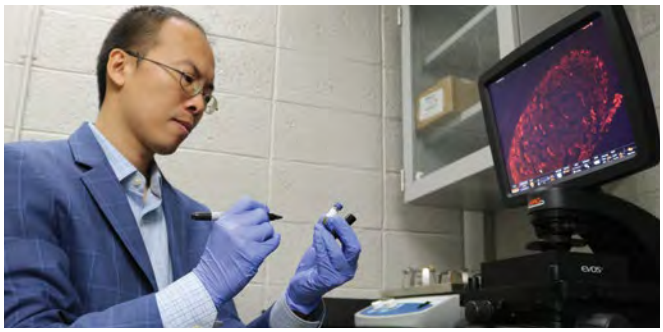
"When we know the mechanisms that drive cell attachment and activity on the shunt, we will be able to define strategies for biology-driven engineering improvements," said Harris, who noted that in more than 60 years since the inception of the shunt, fewer than 40 substantial modifications have been implemented to inhibit blockage, and none have produced significant improvements in treatment. ■

How "SMART" INSULIN can revolutionize Type 1 Diabetes treatment

Type 1 Diabetes (T1D) develops when the patient's immune system attacks and destroys pancreatic beta cells, the only cells that can make the hormone insulin. Over one million individuals in the U.S. are affected by T1D, and there are approximately 100,000 new cases annually.

Insulin injections are the most common treatment methods, while alternative approaches such as transplantation or immune therapies are being studied. However, another promising treatment to consider is "smart" insulin, or glucose-responsive insulin, which could supplant more invasive traditional procedures and ensure ideal glucose control for patients every day.

Zhiqiang Cao, associate professor of chemical engineering, leads a research team that has been awarded nearly $3 million in funding from the National Institutes of Health, the National Science Foundation and the Juvenile Diabetes Research Foundation. Cao's group is developing an implantable technology with glucose-responsive insulin release and long-term therapeutic capabilities. It adjusts the dose of working insulin as needed, similar to a healthy pancreas.



Compared with even the most state-of-the-art methods, this technology shows a superior capability to achieve insulin independence for T1D patients.

"The formulation is expected to function for weeks after administration, or even longer depending on the dose, and is retrievable and replaceable to extend the therapeutics for an even longer period of time," said Cao.

Cao believes this technology is the next milestone for smart insulin development, significantly improving the life of T1D patients by offering long-term blood glucose control.

VACCINE ADJUVANT RESEARCH
earns Liu prestigious NSF CAREER award

Haipeng Liu, assistant professor of chemical engineering at Wayne State University, is working to address the effectiveness and safety concerns of adjuvants in cancer vaccines. Adjuvants are substances that are added to vaccines to improve the body's immune response and decrease the amount of vaccine needed

His project, "Engineering Molecular Adjuvants for Cancer Vaccines," garnered a five-year, $539,422 Faculty Early Career Development (CAREER) award from the National Science Foundation to advance more clinical studies.

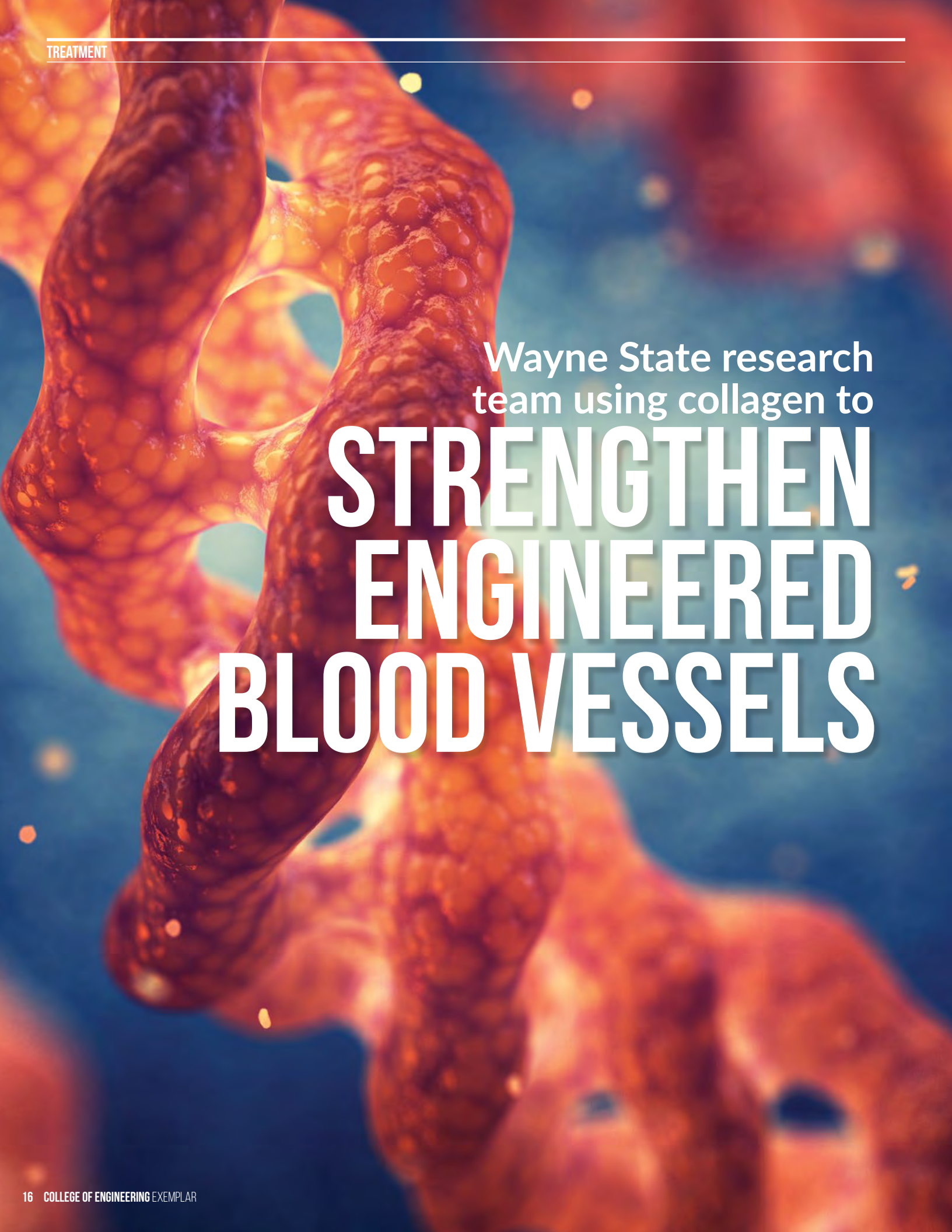
"This project focuses on integrating molecular engineering and immunology to gain fundamental insight into important aspects of how to rationally design molecular adjuvants for therapeutic cancer vaccines that are safe and can overcome tumor related immune suppression," said Liu.

Liu's strategy is to construct a series of chemically modified physical models to predict how a molecule's structure will affect its functionality and to study the adjuvant-immune system interactions at the tissue, cellular and subcellular levels.

"The knowledge gained through these efforts will bridge the gap between synthetic chemistry and immunology, and give rise to the design of the next generation of molecular adjuvants for cancer vaccines," said Liu.

To integrate research and education, a key component of the NSF CAREER award, Liu will leverage his research to enhance the college's graduate certificate program in polymer engineering, with the goal of attracting underrepresented students to the field.

Liu joined the Wayne State faculty in 2013. Liu's research focuses on the integration of synthetic chemistry and materials engineering for improving vaccines against infectious diseases and cancer. He holds a Ph.D. in chemistry from Purdue University, has co-authored three patents and more than 30 scientific manuscripts, and has had his research cited more than 1,600 times.

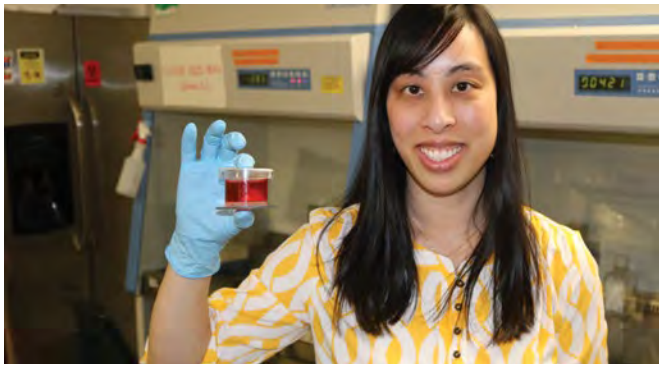


Wayne State research team using collagen to

STRENGTHEN ENGINEERED BLOOD VESSELS

Collagen is a common ingredient in products ranging from cosmetics and body lotion to vitamin supplements. It is also the most abundant protein in our bodies, found in our muscles, bones, skin, blood vessels, digestive system and tendons.

Recently, collagen use has gained momentum in biomaterials and regenerative medicine applications. Its strength, elasticity, wide availability and biocompatibility make collagen advantageous for such purposes. A research team led by Mai Lam, assistant professor of biomedical engineering at Wayne State University, and Ph.D. student Bijal Patel is using a collagen-based hydrogel to reinforce tissue-engineered blood vessels seeded with human fibroblast cells.



"Tissue engineering blood vessels is an important endeavor for clinical care due to the limited availability of autologous replacement vessels," said Lam.

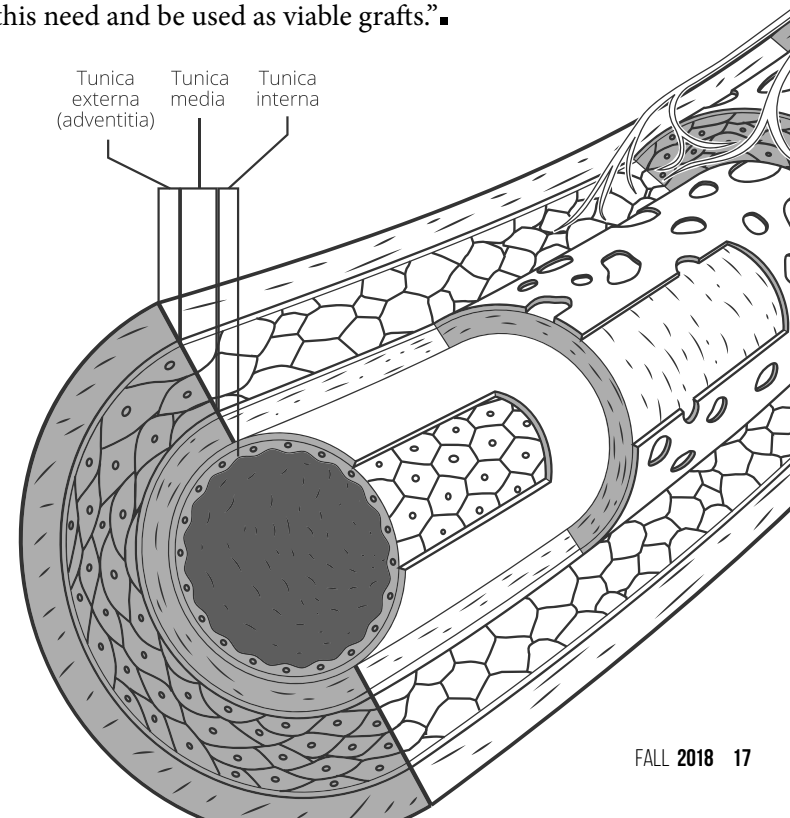
The tunicae of blood vessels are three layers: an inner (intima), middle (media) and outer (adventitia) layer. Lam's team specifically looked at the tunica adventitia because of its crucial role as structural support to prevent rupture under high pressure.

"In surgery, during endarterectomies, surgeons can strip the vessel of all the intima and most of the media, leaving the adventitia as the main strength layer to hold suture and close the vessel," according to the team's research paper, which was published in *Scientific Reports* in February 2018. "It is well known that the collagen content in the vessel wall is the main strength of the blood vessels."

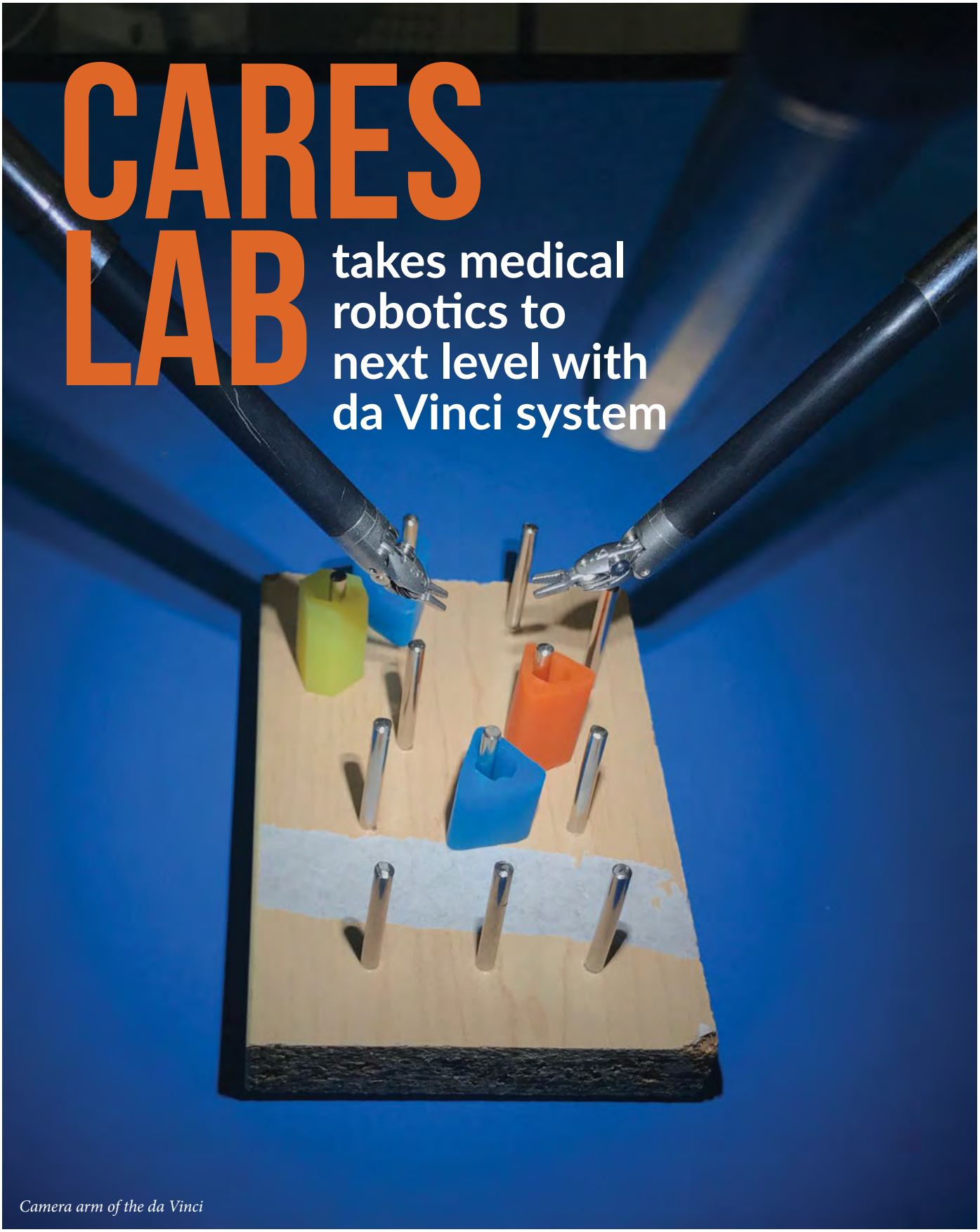
Other vascular grafts using fibroblast cells have required a significant maturation period to reach full strength. Lam's team modified its novel "ring stacking method" — assembling rings of vascular tissue around a center post to create a tubular structure — to formulate fibroblast stacks, and supplemented the rings with collagen gel while using other factors such as ascorbic acid to stimulate additional collagen production.

While the group found an optimal combination for tensile strength and fiber maturity — in less time than most prior research — with the stability and functionality afforded by the ring stacking, subsequent studies will focus on methods to achieve a level of strength closer to that of native adventitia as well as an improved immune response.

"For the millions of patients undergoing bypass surgery annually, limited availability of patient vessels for self-donation is the greatest issue," said Lam. "With further development, engineered vessels such as these could fill this need and be used as viable grafts."



CARES LAB takes medical robotics to next level with da Vinci system



Camera arm of the da Vinci

The Computer-Assisted Robot-Enhanced Systems (CARES) Laboratory was established in the WSU College of Engineering to develop surgical technologies that integrate image-guidance, augmented/virtual reality, and robotics. The lab is led by Abhilash Pandya, associate professor of electrical and computer engineering, and Luke Reisner, an assistant research professor in the department. Their efforts are buoyed by the support of robotic surgeons such as David Edelman, M.D. general surgeon at the DMC; Hans Stricker, M.D., urologist at Henry Ford Health System; Ho-Sheng Lin, M.D., chair of the Wayne State University Department of Otolaryngology; and Michael Klein, M.D., pediatric surgeon at DMC Children's Hospital.

In 2014, Henry Ford Health System donated a da Vinci Standard Surgical System to the CARES Laboratory, facilitating greater collaboration with the School of Medicine and some of the top surgeons and pathologists in the region. Four years later, WSU researchers have made significant advancements in medical robotics and provided unparalleled experiential learning opportunities for students.

The da Vinci system features a 3D HD vision system for a clear and magnified view inside a patient's body. A surgeon controls the system's EndoWrist instruments, which bend and rotate far greater than the human wrist, to create precise movements that better enable complex and routine procedures through small openings.

"Current systems in the field are completely controlled by the surgeon," said Pandya. "We are looking to advance surgical robotics by adding true intelligence — AI and machine learning — and immersive feedback that will assist the surgeon."

When the system was donated, Wayne State University was one of just 14 institutions worldwide with a fully programmable system. Currently, they are the only system in Michigan. Pandya even took a sabbatical to Johns Hopkins University's Laboratory for Computational Sensing and Robotics in 2014 to immerse himself in the system's hardware and software.

Published and funded research from the CARES Lab includes innovations in autonomous camera systems as well as augmented reality and image-guided surgeries. These techniques aim to enhance surgeon accuracy, reduce operation times, lessen the learning curve and streamline surgical training.

One project uses a VR headset to control the camera of the robot. This allows the surgeon to feel present inside the patient, helping the surgeon to navigate and treat the patient. Another project allows complex surgical procedures to be recorded and replayed (seen and felt) at the surgeon's console. When combined with augmented reality annotations and audio narration, this will provide novice surgeons with a more engaging training experience.

Many undergraduate and graduate students researching kinematic analysis and autonomous movements have appreciated the opportunity to interact with the da Vinci system. Pandya has also developed related robotics courses to enrich the electrical and computer engineering curricula.

"Robotics is an increasingly popular field that has a strong potential at WSU to draw in both more students and the employers that want to hire them," said Reisner.

A da Vinci Surgical System user controls the camera arm of the da Vinci using a VR headset. The worksite is projected to the headset screens to generate a 3D image. This gives the user a sense of presence: the feeling that she is operating from inside the body.

Watch additional information at the following links:

CARES lab autonomous camera control:
https://www.youtube.com/watch?v=mb8f259PBMo

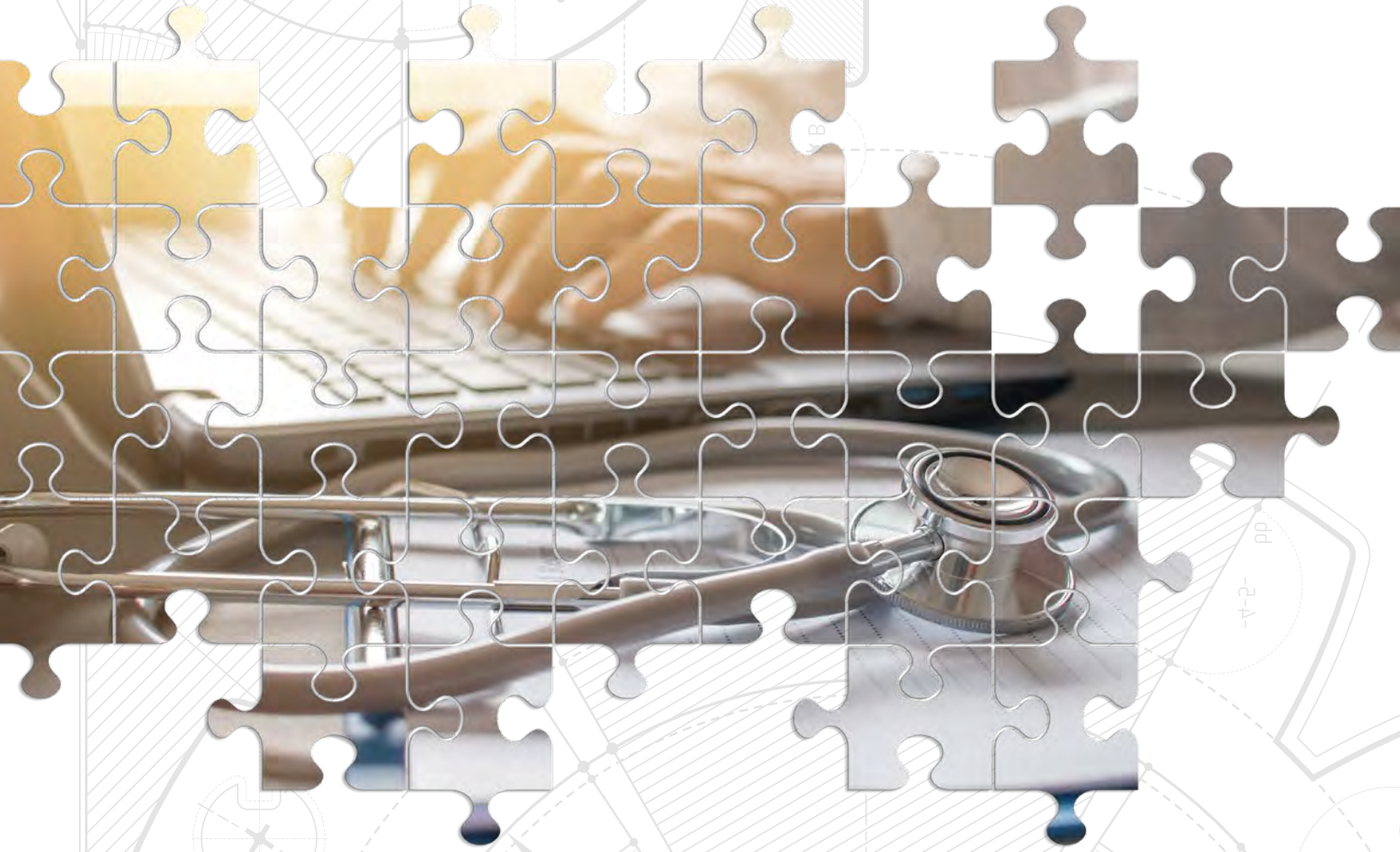
CARES lab record and playback for training:
https://www.youtube.com/watch?v=btgeu8B_qdQ&t=15s

CARES lab VR headset with da Vinci:
https://www.youtube.com/watch?v=IexLETUmvvA&t=45s

DELIVERY

Engineering is progressing more personalized medicine. Beyond simply developing new diagnostic or therapeutic devices, engineers make use of data collected from patient monitoring and treatment, which benefits physicians who then have a clearer picture to create more targeted intervention strategies.

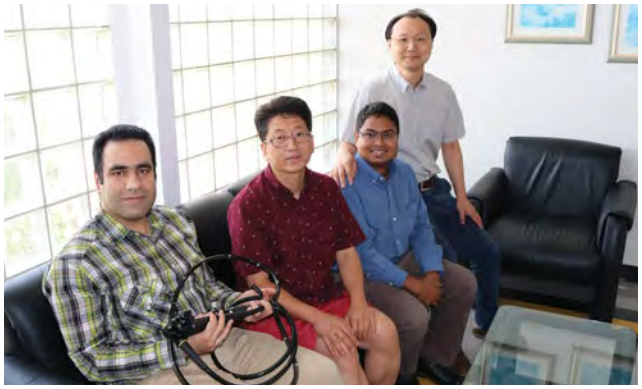
Health informatics bridges information technology, computer science, statistics, data analytics, management science, systems engineering, social science and other fields to improve the health care workflow, enable better clinical processes, support decision making, identify patients risk, and provide information to enhance patient safety and quality. Researchers at Wayne State University are using health informatics and systems engineering to counteract health disparities and bolster effectiveness, efficiency, safety and quality in health care education, systems management and medical research.



MANAGING MEDICAL DEVICES:

Researchers bring legacy life-cycle analytics to modernized platforms

The viability of medical devices, like most products and services, can be analyzed using the Customer Services Life Cycle (CSLC) framework, which presents four stages — requirements, acquisition, ownership and retirement. However, most current design analytics systems in the medical device space do not consider the costs associated with the latter two stages, and processes of auditing these devices to ensure regulatory compliance as well as patient safety are often unstructured and laborious.



Kyoung-Yun Kim, professor of industrial and systems engineering at Wayne State University, is developing a platform called MEEDA — Medical Equipment Evaluation and Decision Analysis — that aims to centralize equipment maintenance processes and provide physicians or hospital administrators a clearer picture of device life cycles.

"Many hospitals struggle with legacy systems, and information is not often digitized or integrated properly," said Kim, who is also a site director for the National Science Foundation Center for e-Design, a consortium of seven universities that work with businesses and government entities to research and develop digital design and manufacturing methods.

Kim works with e-Design researchers to create learning algorithms to improve cost forecasting by identifying the relationship between design and process characteristics. This technology can analyze a complex set of repair history data; detect outliers and abnormal cases; and produce an index to determine reliability of a device, potential for reprocessing, and risk of device use.

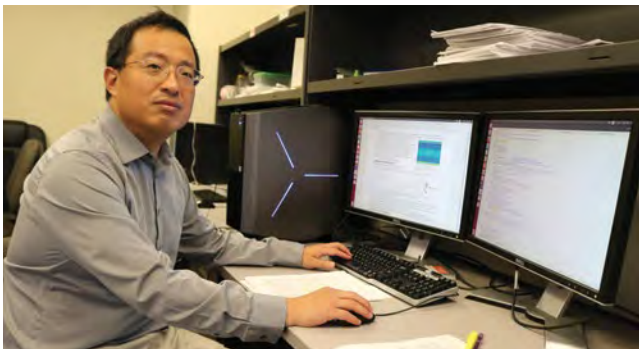
Using datasets from nonprofit hospitals such as the VA Medical Center in Detroit, Kim's team conducted pilot studies to validate its research and present outcomes to organizations ranging from medical and hospice facilities to manufacturing and reprocessing companies. The MEEDA system provides a curated knowledge base, analytical tools, and pathways for improved collaboration between customers and product or service providers.

"This information will be useful for medical device tactical and strategic planning," said Kim, who noted that while this research can have a significant economic impact, "safety is far more important than other factors."

Prioritizing the risk factors of OBESITY

Obesity is a serious epidemic in the United States. Prevalence of the disease has more than tripled since 1980 among children aged 2 to 19, while 27 percent of adults in the U.S. are obese. This number climbs to approximately 31 percent in Detroit and the state of Michigan as a whole.

Identifying the underlying obesity risk factors (ORFs) of this disease is a crucial step to treatment and prevention, and while analysis of these factors is often done using a single-task learning (STL) approach, this method may not tell the whole story.



"Obesity is a multi-faced health outcome," said Ming Dong, professor of computer science. "Some ORFs are highly specific to a certain subpopulation and others are universal to the entire population."

Recognizing the complexity of the issue and the disadvantages of STL approaches, Dong and his collaborators sought solutions using various multi-task learning (MTL). This method makes it possible to capture the data heterogeneity in the population while also utilizing shared information among subpopulations.

ORFs can be classified in three groups: health conditions (e.g. diabetes), social behaviors (e.g. smoking or alcohol use), and demographic characteristics (e.g. age or family size).

"Obesity may influence some subpopulations more than others," said Dong. "Since people in various regions, ages and races are vastly different from each other, the subpopulations can be immensely distinguished in terms of ORFs."

The research team's analysis on a public dataset, using both multi-task feature learning (MTFL) and clustered MTL models, outperformed STL to demonstrate multi-level risk factor prioritization, which would enable a more precise intervention systems.

"Identifying the salient risks for obesity and variance among subpopulations is imperative to optimize prevention efforts and treatment," said Dong. ▪

CHANGING HUMAN BEHAVIOR WITH AI:

How machine learning can automate motivational interviewing

Motivational interviewing (MI) is a strategy used by clinical psychologists to elicit behavior change in patients through focused, goal-oriented counseling. An integral step in developing effective MI interventions is analysis of the counselor-patient interactions, which is traditionally done by hand.

"Analyzing sequences of assigned behavior codes allows clinicians to better understand the patient's thought process during the course of the interviews, without having to wade through entire transcripts over and over again," said Alex Kotov, assistant professor of computer science at Wayne State University. "Such understanding, in turn, leads to further specification of the mechanisms of effect for behavioral intervention models, which can then be used to refine theory and guide clinical practice."

As manual analysis is both time consuming and labor intensive, researchers have begun investigating machine learning techniques to find an efficient alternative.

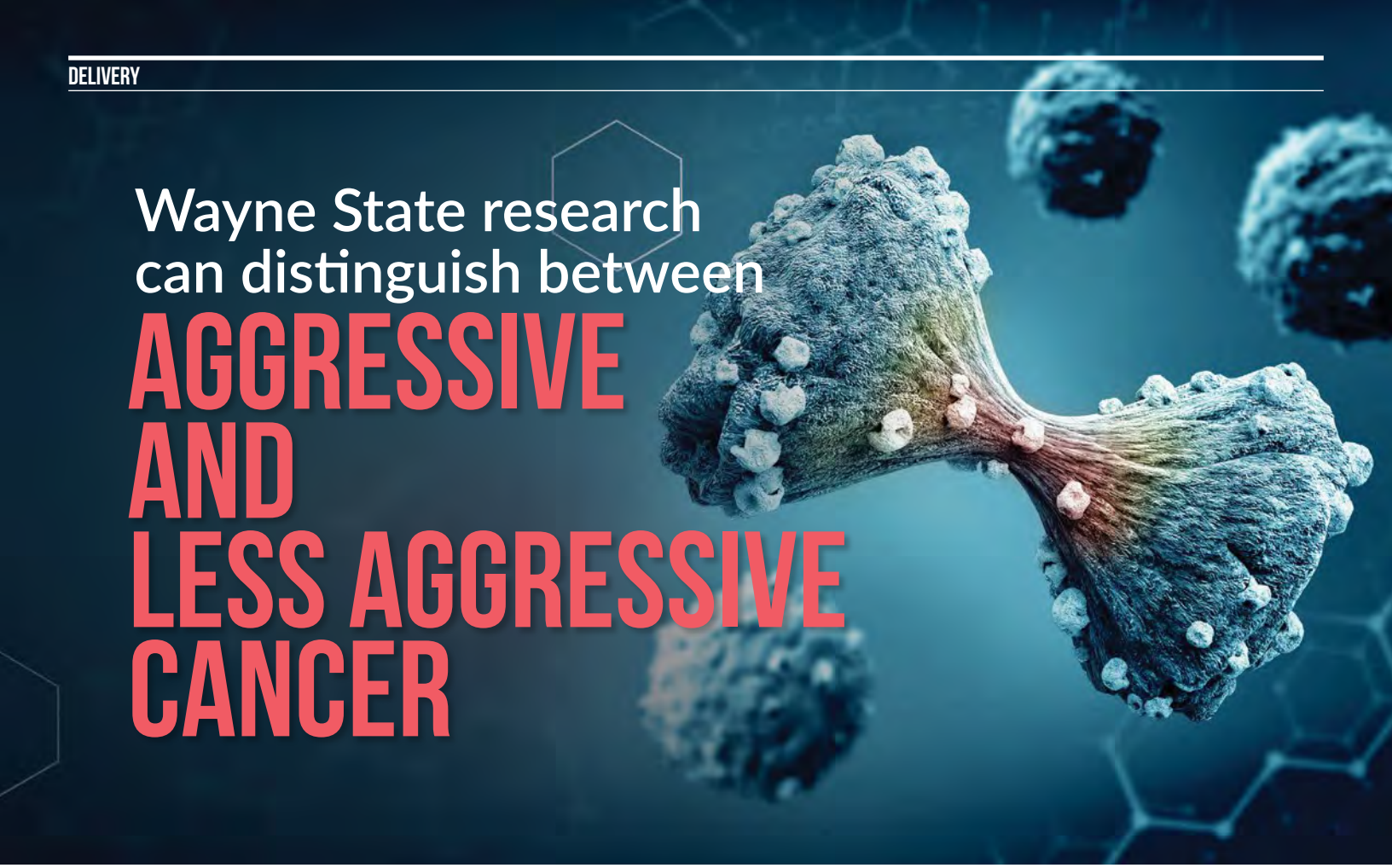
Kotov teamed up with Gwen Alexander, from Henry Ford Health System, and April Carcone, an assistant professor in the WSU School of Medicine, in a collaborative effort to automate behavioral coding to advance MI's effect on patients. This work has been funded by the National Institutes of Health.

The team developed a system to automate segmentation of exchanges in e-coaching sessions, or behavioral counseling using e-mail or other electronic platforms, into communication behaviors and assignment of behavior codes to identified segments. It also proposed an algorithm to identify sequences and patterns in successful and unsuccessful sessions, leading to a greater understanding of effective MI strategies.

One specific type of e-coaching on which the team focused was with adolescent patients with unhealthy eating habits that lead to obesity or other health issues. However, Kotov notes that this technology can be applied much more broadly to other types of MI.

"We are aiming to help patients with a wide spectrum of behavioral disorders," said Kotov. "The goal is to determine which strategies work best and automate the entire MI process."

The experimental results were comparable to those obtained with human coders, demonstrating the promise of ML methods for more efficient behavioral coding and analysis. Kotov's plan for the future is to develop a system for fully-automated analysis and real-time monitoring of MI sessions.



Wayne State research can distinguish between AGGRESSIVE AND LESS AGGRESSIVE CANCER

A technology developed by a team of researchers from Wayne State University and its biotech startup Advaita Bioinformatics makes it possible to distinguish between aggressive and less aggressive types of disease. Partially funded by a grant from the National Science Foundation and the Robert J. Sokol MD Endowment, this research combines multiple types of data in a single analysis to ultimately reduce the number of patients who do not receive necessary treatments, while also avoiding unnecessary treatments.

WSU's research was sparked by a 2012 report by The New York Times, which revealed that over the past 30 years, more than 1.4 million women have unnecessarily undergone surgery, chemotherapy or radiation. These treatments cost nearly $23,000 per patient, resulting in a societal cost of $32.2 billion, while there are still patients who may relapse and die because they do not receive necessary treatments.

"It's critically important that we align each subtype of disease with the appropriate treatment," said lead researcher Sorin Drăghici, professor of computer science, associate dean for innovation and entrepreneurship, and director of the James and Patricia Anderson Engineering Ventures Institute. "Patients who really need an aggressive treatment will be identified early and treated aggressively, while patients who do not need such treatments will be spared the suffering and cost, for a total savings to the society estimated in tens of billions [of dollars]."

Drăghici added that Wayne State's technology can also be used by pharmaceutical companies to distinguish between patients who will and will not respond to a given drug, thus increasing the success of clinical trials and allowing more drugs to reach the market. The framework has been validated on thousands of cancer samples using gene expression, DNA methylation, non-coding microRNA and copy number variation data available from the Gene Expression Omnibus, the Broad Institute, The Cancer Genome Atlas and the European Genome-phenome Archive.

FIRST ON THE SCENE:

How drones could change pre-hospital care

In situations in which minutes and seconds mean the difference between life and death, drones could get to the scene before the first responders and deliver much-needed medical supplies. This model is particularly applicable for cities in which the number of ambulances available does not satisfy the number of patients who beckon their services.

As a historically under-resourced city, Detroit in particular is ripe for low-cost, high-potential interventions that address health issues. The growing trend of opioid misuse and overdose locally and nationally has fueled efforts to find novel, lasting solutions.

First-year medical student Matthew Tukel, along with MedStart student Connor Tukel and 2017 College of Engineering graduate Albert Jose, started the company Medella after discovering, and falling in love with, the capability of drones.

"My project aims to demonstrate the viability of using drones to get to the scene of an emergency overdose faster than traditional first-responders in order to deliver pre-hospital interventions, namely Naloxone, that can be rapidly administered by bystanders, thus decreasing the amount of time the patient goes without treatment and improving outcomes," Tukel said.

"Without altering current emergency procedures, the project looks to enhance and supplement existing medical protocol to provide a solution with an increasingly immediate response," added Jose. "On average, 115 Americans die every day from an opioid overdose. A review of Emergency Medical Services data found that when given Naloxone, 93.5 percent of people survived their overdose."

The group presented its project in early May at the Ignite to Innovate: Global Shark Tank competition, taking the top honors which included a cash prize and mentoring for commercialization from the James and Patricia Anderson Engineering Ventures Institute. The competition was part of a week-long series of events held by the Global Health Alliance, a multidisciplinary consortium of Wayne State University faculty that serves to more efficiently and strategically leverage collective global health resources for collaboration and transformative solutions.

The event attracted students and faculty from the School of Medicine and College of Engineering, as well as medical students and undergraduates from other universities.

Tukel and Jose helped found Detroit Aerial Innovations while taking undergraduate classes at WSU. The group wanted to enhance and supplement student education through an extensive hands-on curriculum to learn the basics of drone technology — what they're made of, how to build them and how to fly them — in a safe and controlled laboratory environment.

"Unmanned Aerial Vehicles, or UAVs, and Unmanned Humanitarian Vehicles, or UHVs, are redefining technological paradigms and allowing for innovation across myriad sectors. In addition to being more dynamic and more cost effective than their vehicular counterparts, drones make available the airspace above cars and below planes that, to this point, has gone largely unutilized," said Tukel.

Having the ability to take advantage of this untouched territory will enable the streamlining of many processes that span both the civic and private sectors. The implications are especially significant for the field of emergent public health, as drones may be capable of "shrinking" sprawling urban hubs, Tukel explained, by markedly expediting the rate at which treatment can be accessed and doing so in an efficient, affordable way. ■

Wayne State and Cisco

team up to accelerate digital manufacturing

Wayne State University has partnered with Cisco Systems to develop a digital manufacturing center within the College of Engineering — one of several investments Cisco is making in Michigan as part of the State Digital Acceleration (SDA) initiative.

The 25,000-square-feet high bay area of the college's Manufacturing Engineering Building at 4815 Fourth Street will be converted into the Smart Manufacturing Demonstration Center (SMDC), an innovation and validation hub focused on developing the next generation of digital manufacturing professionals and leaders in automation and robotics. Students and researchers will have access to real-time manufacturing and design data through Cisco Systems platforms and other processes.

"As Michigan emerges as a leader in the high-tech global marketplace, faculty and students in the Wayne State University College of Engineering are working tirelessly to deliver advanced manufacturing solutions that ensure convenience, safety and efficiency," said Dean Farshad Fotouhi. "This partnership with Cisco aligns perfectly with our innovative and proactive approach to challenges facing traditional manufacturers."

The SMDC will house a variety of advanced manufacturing equipment and software, connected with Cisco's secured systems infrastructure. These resources will enable research and education in domains such as collaborative robots, additive manufacturing, computed tomography (CT) scanning, automated laser scanning, and resistance spot welding. The lab will also allow researchers to explore areas to digital manufacturing and the Internet of Things, including data management, storage, infrastructure and security.

Officials and government leaders, including Governor Rick Snyder, announced the launch of the SDA program at the 2017 North American International Cyber Summit last October. Michigan is the first state to join the program, a three-year collaboration modeled after Cisco's Country Digital Acceleration program that has launched in 16 countries around the world.

"Michigan has made great strides to overcome setbacks faced during the Great Recession, and the economy is coming back in a big way, thanks in large part to the state's push to accelerate digital innovation and strengthen its workforce," said Alison Gleeson, senior vice president for Cisco Americas.

In addition to the partnership with Wayne State, Cisco has also planned a "connected roadway" pilot project with the Michigan Department of Transportation that focuses on autonomous vehicles and infrastructure, as well as expansion of IT training through the Cisco Networking Academy.

The goal of the SDA project is to help Michigan and other states advance their digital agenda in order to bolster financial growth, attract new investment and increase innovation potential. ▪

MICHELLE JACOBS, MARCIS JANSONS, MOHSEN AYOOBI, JEFFREY POTOFF

Wayne State receives $1 million NSF grant

to support commuter students in engineering

A team of Wayne State University faculty was awarded $1 million from the National Science Foundation's Scholarships in Science, Technology, Engineering and Mathematics (S-STEM) initiative for a new program called ACCESS: Achieving Commuter Engagement and Success.

ACCESS aims to increase the retention and six-year graduation rates of targeted students while also providing insight to factors that affect how commuters engage with the campus community. By funding 84 scholarships over the next five years, ACCESS will support students who show high potential for success in STEM disciplines and wish to pursue a bachelor's in engineering at Wayne State yet face unique challenges as commuter students with low-income socioeconomic status.

In addition to financial support, the program includes summer engineering boot camps; mentoring from peers, faculty and working engineers; and experiential learning through internships and co-ops.

"This project really has the heart of Wayne State in it, and it builds on the best of what our faculty and staff across campus are doing to promote the success of our students," said Jeffrey Potoff, principal investigator on the ACCESS project and associate dean for academic and student affairs in the Wayne State University College of Engineering.

ACCESS is one of several initiatives the College of Engineering has established over the last few years to bolster student success. In 2015, the college received $1.2 million from the DTE Foundation to revamp EOS, a program that provides educational and mentoring support to first- and second-year engineering students. Ford Motor Company established an endowed scholarship to support economically challenged engineering students, and Wayne State faculty have implemented evidence-based teaching innovations for basic engineering, engineering technology and computer science through a number of NSF-funded S-STEP awards.

"Our students are extremely hardworking and dedicated to the pursuit of their engineering degrees," said Potoff. "We are equally dedicated in our efforts to provide our students with the highest quality experience both inside and outside the classroom."

Co-principal investigators on ACCESS include Michelle Jacobs, assistant professor of sociology; Marcis Jansons, associate professor of mechanical engineering and director of early engineering programs; and Mohsen Ayoobi, assistant professor of engineering technology.

The grant number for this National Science Foundation award is 1742486. ▪

Leela Arava

earns NSF CAREER award for next-generation battery research


LEELA ARAVA

Leela Arava, assistant professor of mechanical engineering at Wayne State University, received a National Science Foundation Faculty Early Career Development (CAREER) award, the organization's most prestigious accolade for up-and-coming researchers. The five-year, $519,241 grant will support Arava's exploration in next-generation battery technology that can revolutionize energy storage systems.

Arava's project, "Designing Interfaces for Electrochemical Energy Storage: A Mechanistic Perspective," focuses on the comprehension of fundamental electrochemical principles of lithium-sulfur (Li-S) batteries, which promise lower cost and higher capacity in next-generation energy storage systems, electric vehicles, micro-sensors and wearable technology. The batteries are hindered, however, by poor cycle-life issues and adverse chemical reactions.

"The crux of the electrochemical reactions in a battery system transpire at the electrode-electrolyte interface," said Arava, who also noted that Li-S battery capacity is most negatively affected by what is known as the polysulfide shuttle effect, in which polysulfides spontaneously form and pass through the battery cathode, tainting the electrolyte and thereby inhibiting performance. Arava's lab is developing a novel in-situ battery material characterization tool – atomic microscopy-based scanning electrochemical microscope coupled with Raman spectroscopy. This innovative combination of fundamental yet distinct approaches will provide a nanoscale-level view of the battery's reaction kinetics.

"While ultimately we all aim for enhanced efficiency and durability of batteries, in our pursuit of the best battery material we often encounter many problems or challenges," said Arava. "To gain an understanding of these challenges at the atomic level gives us a perspective that has not been gained to date."

NSF CAREER awards emphasize the integration of research and education to build a firm foundation of leadership. Arava takes a proactive role in fostering STEM education to K-12 schools in Detroit and surrounding areas through outreach efforts such as his Mobile Energy Lab. This project provides another avenue for students to gain more hands-on experience, with potential opportunities to obtain summer internships in Arava's lab.

Arava joined the Wayne State faculty in 2013 and, among several scientific achievements, co-holds eight patents and has authored a book chapter and several influential articles in journals such as *Nature Scientific Reports* and *Journal of American Chemical Society*. He has co-authored over 90 peer-reviewed publications and his research has been citied more than 7,730 times. Arava holds a Ph.D. in physics from the Indian Institute of Technology in Madras, India.

The grant number for this National Science Foundation award is 1751472. ■

Facebook awards

Wayne State's Weisong Shi for edge computing infrastructure


WEISONG SHI

Wayne State University Professor of Computer Science Weisong Shi has received a Facebook Hardware and Software Systems Research Award, as the social media giant continues to invest in research essential to developing systems that will amplify the company's societal impact.

Shi and his contemporaries will each be awarded a research gift of up to $50,000 from Facebook. Only eight researchers' projects were chosen out of more than 170 hopefuls from around the world who applied.

The project, "DIME: A Dynamic Resource-Driven Optimal Scheduling Infrastructure for ML on the Heterogeneous Edge Platforms," brings machine learning applications into the edge computing domain as a way of bypassing some of the issues facing cloud-based applications, such as latency, bandwidth, privacy and security.

"The sheer volume of data generated at the edge of the network fueled by the wide adoption of Internet of Things requires the immediate processing of the data at the edge," said Shi, who also directs the university's new graduate certificate program in cyber-physical systems. "Therefore, many cloud service providers are eager to deploy their applications and services close to the sources of the data, making the edge more intelligent."

However, unlike the cloud data center, edge nodes usually have less computing power. Hardware makers are working to provide more computing capacity for traditional processors (e.g. CPU) and more advanced systems (e.g. GPU, FPGA, DSP) without sacrificing the power budget.

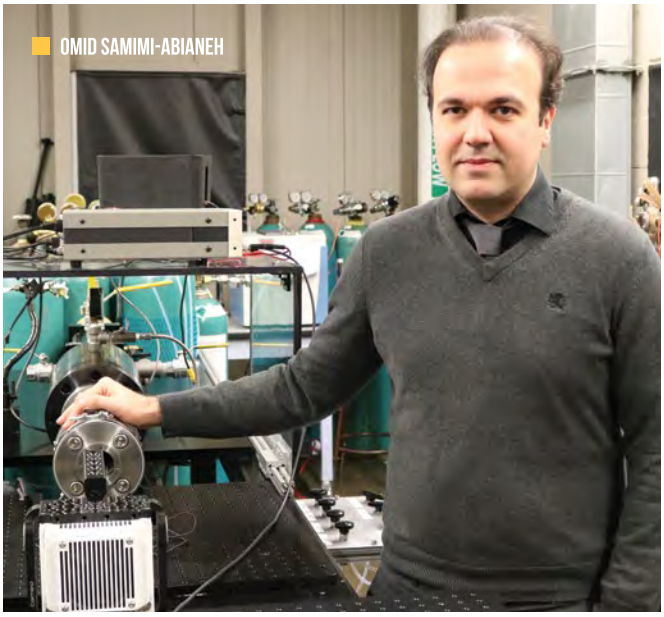
While edge computing's role has typically been to store and send data to cloud systems, there exists a need for systems to employ machine learning — computing and analyzing data — to realize the vision of edge intelligence. Shi's research uses multiple heterogeneous processing units with varying degree of processing power to make machine learning possible on the edge.

"In this proposal, specifically, we undertake the Deep Neural Networks (DNN) — a typical ML algorithm widely used for video analytics, such as object recognition and tracking — and build DIME, targeted at facilitating DNN functions on the edge node via model compression, dynamic task partition and optimal resource-task matched scheduling algorithms," said Shi.

Edge computing allows data produced by devices to be processed in real time, a need of organizations in many industries. Shi notes that an edge machine learning algorithm is valuable to Facebook and other digital companies such as Amazon or Microsoft, but also sees its potential impact in other domains, including autonomous vehicles, smart manufacturing and smart health. ■

Wayne State researchers working with U.S. Army to

optimize vehicle engine performance


OMID SAMIMI-ABIANEH

Army missions can be drastically impacted due to engine failures caused by erosion in fuel injectors. Fuel injectors are used in both air and ground vehicles that have reciprocating (piston) and gas turbine engines. Cavitation damage can alter the material and shape of the nozzles, which leads to erosion that can cause injector failure and a major decrease in vehicle power.

With the help of a grant totaling $101,453 from the U.S. Department of Defense's Army Research Laboratory (ARL), Omid Samimi-Abianeh, assistant professor of mechanical engineering in Wayne State University's College of Engineering, will work with the ARL to alleviate these issues and optimize engine performance in Army ground vehicles and aircraft.

Samimi's project, "Turbulent spray combustion measurements and model development," aims to develop a numerical model simulating the cavitating flow inside high-pressure injector nozzles, which are used in most transportation vehicles, including all Army air and ground vehicles. Performance of these vehicles is often hindered by engine failures due to material erosion.

According to Samimi, the research plan can alleviate several problems facing other investigative efforts.

"It is very challenging to visualize the flow inside the fuel nozzle to better understand the physics of cavitation and optimize the nozzle geometry," said Samimi. "Numerical modelling can shed light on internal nozzle flow and help resolve the problem by providing very detailed analysis of flow inside the nozzle."

The project will be a collaborative effort between ARL and Wayne State researchers and graduate students in WSU's Combustion Physics Laboratory and the DoD Supercomputing Resource Center.

The grant number for this Department of Defense project is W911NF-18-0042.

Mechanical engineering Ph.D. student

earns prestigious DoD scholarship


JOSHUA A. PIEHL

Joshua A. Piehl, a mechanical engineering Ph.D. candidate at Wayne State University, received a Science, Mathematics and Research for Transformation (SMART) scholarship from the U.S. Department of Defense, providing him with significant support as he continues to research the chemistry of fuel combustion.

The SMART program endorses undergraduate and graduate students pursuing technical degrees in STEM disciplines and aims to increase the number of civilian scientists and engineers working at DoD laboratories. Among the benefits Piehl will receive are full tuition, health benefits, paid summer internships, an annual cash stipend and post-graduation career opportunities.

"This scholarship is a wonderful blessing. Graduate school is difficult enough without having to worry about finances," said Piehl. "With this scholarship, I am able to focus on my studies and research to provide higher quality work."

SMART scholarships are highly competitive. In 2017, the DoD distributed awards to only 14 percent of the reviewed applicants nationwide.

"Josh demonstrates a strong commitment to research and has superior intellectual ability to move the combustion field forward," said Omid Samimi-Abianeh, assistant professor of mechanical engineering and Piehl's faculty advisor.

Piehl's dissertation objective is to identify and quantify the intermediate species formed during combustion. His research and industry experience includes a full-time position at Chrysler and internships at Detroit Diesel and the U.S. Army Research Laboratory.

"Working with the Army has been an exciting and rewarding experience. It is wonderful to meet and work with other researchers who are passionate about keeping our nation safe," said Piehl. "The projects are unique and state of the art, and will lead to innovations that benefit both the military and civilian sectors. It is a great experience to be able to give back to my country."

College of Engineering collaborates with technology, engineering groups to host

STEM expo for local girls

Wayne State University's chapter of the Society of Women Engineers and the Michigan Council of Women in Technology Foundation (MCWT) hosted a one-day interactive tech expo for fourth to twelfth grade girls on Thursday, April 19, in the Student Center Building.

Dubbed GET-IT Day (short for Girls Exploring Together-Information Technology), the event hosted more than 500 girls from Detroit Public Schools, Dearborn Public Schools, Southfield Public Schools and Walled Lake Consolidated Schools.

College of Engineering Community Engagement Director Jasmine Roberson said the goal of GET-IT Day was to inspire girls to study science, technology, engineering and mathematics (STEM) fields in college. Events like GET-IT Day are some girls' earliest introductions to robotics, science and computer coding.

"We want to support at a young age to help close the technology gap. When it comes to girls, we need diversity in the STEM field," Roberson said.

Wayne State University has hosted summer STEM workshops for K-12 students in the past, but this was the first such one-day workshop to be held on campus. The girls explored technology and computer science through demonstrations, activities and hands-on workshops.

Activities such as a "code maze" encouraged not only coding but also creativity and teamwork. In the code maze activity, the girls introduced code into a tablet-controlled robot — known as Sphero — so that the machine could navigate an interactive maze design.

"This program has been a huge success for MCWT since its inception, as we have really begun to make a difference in this community by exposing young girls to IT career paths at younger ages," said MCWT President Rebecca Bray. "As we continue our work toward addressing women in STEM, we are excited to partner with these organizations to showcase the possibilities for these young adults. These girls are our future talent here in Michigan."

Companies sponsoring GET-IT Day included Ford Motor Company, Summit Polymers, Mercedes-Benz Financial Services and Carhartt. AT&T, Cisco and Microsoft were co-sponsors.

The event was part of a broader push by Wayne State to encourage more young women to pursue careers in STEM. In the summer, the College of Engineering and the Department of Computer Science offered several camps designed to help elementary, middle and high school students develop skills in engineering and computer science, including the Camp Infinity effort, which provides STEM education to girls ages 9 to 13.

"Our college educates and invests in the next generation of innovators and entrepreneurs, which includes not only our current student body but also the youth that participate in programs on our campus, such as GET-IT Day," said College of Engineering Dean Farshad Fotouhi. "We want to develop a more diverse talent pool of engineers at the grassroots level while giving underrepresented people interested in STEM an opportunity to shine."

Biomedical engineering graduate uses degree to

fight global health care disparities

Tannia Rodriguez Valenzuela is using her biomedical engineering degree to become a doctor who fights for global health equity. She doesn't believe it is sufficient to receive a typical medical degree and wants to ensure her career as a doctor is backed with additional skills.

"If I'm a doctor and an engineer, I can make new devices and technology to directly help people," she said.

Before graduating in May 2017, Rodriguez Valenzuela worked on multiple prototypes, including a redesigned glucose monitor for the visually impaired and an app that turns spirometer exercises into an entertaining game. Currently, she works in a tissue engineering lab, where her research focuses on creating blood vessels from stem cells.

Rodriguez Valenzuela's fight against health care inequity began in 2013, when she and her brother founded the Wayne State University chapter of Timmy Global Health, an organization that provides reoccurring health care to international communities. Each year, the Wayne State chapter visits the Dominican Republic. These visits made Rodriguez Valenzuela determined to use her engineering skills to make global change.

"My goal as a future doctor is not to just make money and see patients. I want to volunteer my time," she said. "It's not enough to do things locally — that's just the first step. If you move abroad, you can make a bigger impact."

In recognition of these achievements, Rodriguez Valenzuela was granted the Student Spirit of Community Award in 2018. This award honors individuals who facilitate meaningful relationships within the Wayne State and Detroit communities.

Rodriguez Valenzuela is currently completing her master's in global health at the University of California San Francisco. This degree will tie together her skills in biomedical engineering and her dedication to making global change, she said. She hopes to return to Wayne State for medical school.

"I love Detroit, and there's so much work to be done here," she said. "This is the one place where I feel like I can accomplish a lot."▪

Engineering students use LEGOs

to engage young girls in Detroit with STEM

The Wayne State University chapter of the Association for Computing Machinery-Women received a $7,000 grant from Ford Community Corps to teach young girls about computer science and programming through LEGO WeDo 2.0 kits. Over 15 girls from Fisher Magnet Lower Academy in Detroit participated in the program. Each team was tasked with designing and programming a LEGO model to solve a water usage problem.

This WSU and Ford Community Corps collaboration is a subset of the Girl Scouts of Southeastern Michigan First program. GSSEM First aims to engage young girls in science, technology, engineering and mathematics fields by allowing them to develop innovative solutions to real-world problems.

Each team was led by a WSU student volunteer from the College of Engineering. The volunteers worked with their teams for over two months to prepare for the program's expo, which was held on June 1 at the Ford Resource and Engagement Center in Detroit. Each team presented a poster and explained how they used their programmable LEGO kits to tackle water conservation issues.

"There is a lack of women in computer science right now. Computer science needs diversity, and not just gender diversity, but all types," said ACM-W president and WSU computer science graduate student Diana Diaz Herrera. "By exposing young girls to women who are studying computer science, we hope they will start identifying themselves with it. Hopefully they'll grow up and think 'I can do that.'"

College of Engineering exhibits student innovations with

ANNUAL DESIGN DAY


FIRST PLACE HONORS

The Wayne State University College of Engineering hosted its fourth annual Student Design and Innovation Day, which showcased 79 unique student projects covering a wide range of applications and engineering disciplines.

Sponsored by the James and Patricia Anderson Engineering Ventures Institute, Student Design and Innovation Day demonstrates students' solutions to engineering challenges as well as commercial and social needs. The event offers up to $1,000 in cash prizes to the best projects, and reflects the mission of the Anderson Institute to foster entrepreneurism through investment in marketable technologies.

Taking first place honors was a four-member team of mechanical engineering students — Hana Bagomaan, Russell Charles, Anthony Bertucci, and John Toth — that designed a kit intended to convert a manual wheelchair into a power wheelchair at a significantly lower cost than existing technology but with equivalent functionality. It marks the second year in a row that a mechanical engineering team under the guidance of Professor Golam Newaz has come away with the top prize.

"We decided that engineering a retrofit electrification system for a manual wheelchair would be a good challenge that could have a substantial positive impact due to the lack of reasonably priced, high quality, easy to install systems on the market," said Toth.

"Offering a low-cost, affordable motorized wheelchair option opens a pathway for improved mobility to those who cannot afford the current market options," added Charles. "We don't believe someone should be restricted to limited mobility due to financial limitations."

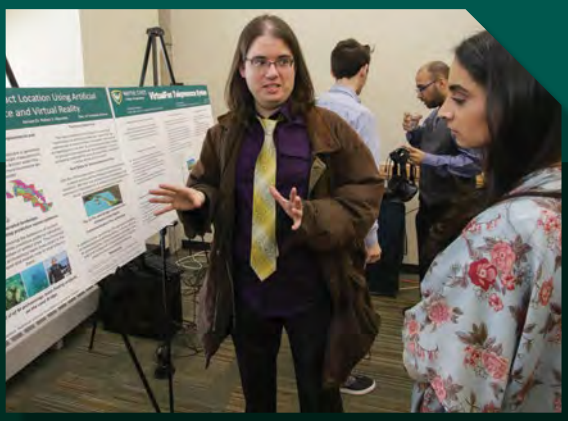
Other top projects included an economic and environmentally-friendly method of extracting rare earth elements, an optimized coronary artery bypass technique using Adipose-derived stem cells, and a real-time weather data platform for use in remote locations.

The Anderson Institute introduced two new prizes this year. The best app award, given to the top functional mobile software application, went to Car Pool, which helps users coordinate ride sharing. An award for the best three-minute video presentation went to a group that developed a predictive model to replicate underwater artifact locations using artificial intelligence and virtual reality.

Another new feature at Design Day was a pitch competition, for which 22 projects were selected as finalists. Students were invited to give an oral presentation for a panel of judges that included successful entrepreneurs, venture capitalists, senior managers from various companies, and Wayne State business and engineering faculty. Presenters were graded on technical quality, commercialization potential, and overall presentation quality.

"The judges were impressed by both the breadth and the depths of the topics presented," said Sorin Draghici, director of the Anderson Institute and associate dean for innovation and entrepreneurship. "The winning teams are eligible for coaching from senior Anderson Institute mentors, as well as funding for the purposes of perfecting their technology and starting a company."

Toth and Charles both acknowledged that working with the Anderson Institute bolstered the viability of their project. "Design Day served as a platform to expose our work to instructors, students, and professionals," said Charles. "We received great feedback from people at the event to improve further iterations of the design."



SUMMARY OF TOP PROJECTS

1st First Place
eDrive Wheelchair Conversion Kit

A kit that can convert a manual wheelchair into a power wheelchair at a significantly lower cost than existing technology but with equivalent functionality.

Students: Hana Bagomaan, Russell Charles, Anthony Bertucci, John Toth
Advisor: Golam Newaz

2nd Second Place
Development of Sorption Technology for Extracting Rare Earth Elements from Coal Fly Ash

An economic and environmentally friendly method of extracting REEs from coal and its by-products for high-tech applications critical to the U.S. economy.

Student: Bilal Syed
Advisor: Timothy Dittrich

3rd Third Place (tie)
Developing Vascular Graft from Adipose-derived Stem Cells

A method to optimize coronary artery bypass grafting by differentiating Adipose-derived stem cells into fibroblasts through the addition of platelet-derived growth factor (PDGF) into the culture media.

Student: Ashley Apil
Advisor: Mai Lam

3rd Third Place (tie)
Portable Weather Stations

A platform to provide the military and others real-time weather data in remote locations.

Students: Brandon Jackson, Brian Atiyeh, Trevor Malarkey, Jeswanth Kodali
Advisors: Khayyam Hashmi, Sam Bryfczynski

Best App
Car Pool

A mobile app that matches users with similar commutes to coordinate ride sharing, compensate drivers and process payments.

Students: Muamer Besic, Evan Clifford, Omer Khan, Matthew Prigorac
Advisors: Khayyam Hashmi, Sam Bryfczynski

Best Video
Underwater Artifact Location Using Artificial Intelligence and Virtual Reality

A predictive model that replicates ancient Lake Huron landscapes and inhabitants to map experiences of hunters to assist archaeologists in their field work.

Students: Thomas Palazzolo, Samuel Dustin Stanley, Paul Janiczek, Angela Allen, Olubukola Akintoroye, Bailey Walker
Advisor: Robert Reynolds

"OUR MISSION IS TO SAVE LIVES; WE WANT TO REDUCE THE AMOUNT OF INSECT-RELATED DEATH WORLDWIDE."

WSU engineering graduate

FIGHTS INSECT-BORNE ILLNESS

with natural product line

Iyinoluwa Omishope, who recently graduated from Wayne State University with a bachelor's in industrial and systems engineering, is curating a line of all-natural skincare products and insect repellents to fight insect-borne illness worldwide.

"It doesn't make sense that people are dying at exponential rates from something that's completely preventable. That is the whole point of being an engineer: We make lives better," said Omishope. "If we can't do that for people who are in the most need, then there's no point of getting the degree and putting on the little ring."

Omishope got the idea to create her product line, It Comes Naturally, after being bitten on the cheek by a mosquito in her mother's garden. Her mother advised Omishope to use something from the garden to treat the bite, so she rubbed spearmint on it. When the swelling and redness reduced immediately and her sensitive skin was not agitated, she knew she needed to commercialize a natural remedy for those who need it most.

"For me, the insect bite was a nuisance, but there are people who suffer on a daily basis from horrible diseases such as malaria and Lyme disease," said Omishope. "Our mission is to save lives; we want to reduce the amount of insect-related death worldwide."

Omishope will accomplish this by donating her products to countries and individuals with a high risk of contracting insect-borne illnesses. She is also committed to environmental sustainability, creating a program that will incentivize customers to return used product containers to the company, where they will be recycled.

Omishope has received support from a variety of sources, including the James and Patricia Anderson Engineering Ventures Institute, the Innovation Warrior Fund, OptimizeWayne, TechTown Detroit's DTX Launch Program, and a full team of advisors and mentors. After initially pitching her idea, Omishope received $5,000 from the Anderson Institute to continue her research and product development. She said it was the Institute's willingness to believe in her idea that gave her the motivation to grow it into the success it is today.

"Someone seeing something and saying, 'well, maybe this can work,' is how every great company gets started," Omishope said. "I think that's what the Anderson Institute is doing. They're taking on these little ideas and they're not discouraging people from shooting for the stars."

BUILDING ON A LEGACY **OF INNOVATION**

Detroit is a city built by engineering, and its revitalization is fueled by discovery and innovation. The College of Engineering is seizing new opportunities while creating pathways to emerging industries. Students are empowered to be creative, collaborative professionals in diverse fields including biomedical engineering, automotive systems, clean water and energy, and big data to name a few. As the innovation economy strengthens, the College of Engineering will lead the way.

PIVOTAL MOMENTS CAMPAIGN

Wayne State University's Pivotal Moments campaign was an ambitious effort with a goal to raise $750 million by September 2018. The College of Engineering's goal was to raise $50 million. It is with great pleasure that we announce both the college and the university have surpassed these goals, and endowments for the college have increased substantially. We thank all of you who have partnered with the college to achieve this goal. We are continuing to move forward with the momentum already achieved to focus on the college's five high-impact practices for this coming year.

HOW YOU CAN PARTNER WITH THE COLLEGE

We need your assistance in taking the College of Engineering to the next level and pave the way as our innovative economy strengthens. We would welcome your thoughts on ideas on how to move the college forward. How do you want to help change the lives for others at Wayne State? This is your opportunity to directly engage with the college and help future generations of students, faculty and community members.

Please contact our development professionals to see how you can change lives at Wayne State:

KRISTYN THEISEN
Senior Director of Development
313-577-8576 | kristyn.theisen@wayne.edu

CLAIRE BRENDER
Senior Major Gift Officer
313-577-4707 | cmbrender@wayne.edu

AUDREY STEPHENS
Alumni and Donor Relations Officer
313-577-6810 | audrey.stephens@wayne.edu

GIVING TO THE COLLEGE OF ENGINEERING

The College of Engineering has focused on five high-impact practices to strengthen student experiences and success. These priorities represent shared focus areas of strategic importance throughout the college and university.

Experiential learning

Through internships and co-ops, students learn interdisciplinary skills that translate across a variety of professional settings. You can support this practice through scholarships and professional development funding.

Global Perspective

Engineers must be global citizens, able to navigate diverse cultures and economies around the world. To develop students' global perspectives, you can support study abroad scholarships.

Undergraduate Research

Research opportunities for undergraduate students set Wayne State apart from its peers. You can support improved laboratories; renovated workspaces; research awards; and endowed chairs, professorships and fellowships.

Hands-on Experience

Students gain valuable skills in national engineering competitions, building everything from Formula-style racing cars and robots to concrete canoes and model steel bridges. You can provide real-world experiences by supporting flexible learning spaces, equipment and programs.

Community Engagement

The College of Engineering offers programs that introduce K-12 students to teaching labs and research facilities, providing a glimpse of higher education and career opportunities. You can support this practice by investing in youth science and engineering programs.

MENTORSHIP FOSTERS FUTURE LEADERSHIP

for Wayne State engineering students

When Vincent Allen and John Carew, two of the senior leaders of the AIChE student chapter at Wayne State, asked Guangzhao Mao what they could do to benefit the Department of Chemical Engineering, she stressed the importance of mentorship. That conversation and their initiative was the genesis of the Industry Mentor Program.

The program was launched as a pilot program in 2017 as a joint effort between the Department of Chemical Engineering and the Office of Alumni Relations. It has since spread to other departments in engineering and across the university.

Thirteen alumni and industry leaders were invited to partner with chemical engineering students in that first year to give students a glimpse of career prospects in that field. The program concluded in the spring with both mentors and protégés gathering for a luncheon featuring student and professional speakers.

"The Industry Mentor Program had a significant impact on students' understanding of the connection between academics and a career in chemical engineering," said Tracy Castle, academic advisor for the chemical engineering department.

The students worked with and even shadowed their mentors to get advice on future career paths. Gabriel Yurko participated in the program in 2017 and believes that it was one of the more helpful experiences she's had at Wayne State.

"It helped to put my classwork in perspective; it gave me a vision for what I want to do in the future and I was able to learn how to get there," said Yurko. "I am so thankful that this program gave me the opportunity to learn from someone in chemical engineering who has been so successful."

Mao's interest in mentoring comes from personal experience. Since becoming department chair in 2015, she often asked students why they chose to study chemical engineering and what they think chemical engineers do. Mao said students did not often have good answers to these questions.

"Many of our students are the first generation in their family to go to college and do not have immediate easy access to career guidance," said Mao. "When I was making a career decision at the end of my Ph.D. study, my advisor took me aside one day, and that 15 minute talk changed my life. Now looking back, I know that my advisor knew me better than I knew myself."

Mentors share information about their own career paths and provide guidance, motivation, and emotional support. They help with setting goals and developing a network of contacts, while also providing students with role models in the professional world.

Mao and others know that the growth of this program is dependent on a high level of engagement from alumni. "I am sure that when you look back at your own career, you can also think about similar instances when your mentors and their advice made a big difference in your career," she said. "How can we all work together and get more of our colleagues involved in mentoring the next generation of highly competent and socially responsible engineers?"

College of Engineering alumni who would like to participate in this program or would like more information may contact Audrey Stephens at 313-577-6810 or audrey.stephens@wayne.edu. ■

Wayne State alumni develop portable defibrillator to combat CARDIAC DISEASE IN INDIA

Cardiovascular disease (CVD) is a global dilemma. According to a 2016 report of the Global Burden of Disease (GBD) Institute for Health Metrics and Evaluation, over 17 million deaths worldwide can be attributed to CVD. While Detroit has some of the highest rates of CVD in the U.S. and sudden cardiac arrest is a leading cause of death across North America and Europe, the death rate in India is nearly four times higher than that of developed countries.

To tackle this issue, Wayne State University alumni Ashish Gawade and Aniruddha Atre co-founded Jeevtronics, a company that creates affordable medical devices for under-developed and rural areas. They have innovated a dual-powered defibrillator that works on electricity but can also be hand-cranked when electricity is not available, a common scenario in small villages and remote regions of India.

The device is designed to be portable as well as extremely durable. It can be used by anyone from first responders to everyday citizens. Most importantly, it has the potential to save countless lives.

A CRASH COURSE IN SOCIAL ENTREPRENEURSHIP

Gawade and Atre are lifelong friends — they met in fifth grade and actually share the same birthday. They came from India to the United States together in 1999, working at Ford Motor Company by day and taking classes in the mechanical engineering graduate program at WSU in the evening.

"Wayne State was a natural choice," said Atre, who noted that he and Gawade were particularly drawn to the pioneering research of Professors King-Hay Yang and Albert King in finite element analysis as it related to vehicle crash safety.

They each earned a master's in 2001, but a desire to develop their business acumen led them to the M.B.A. program at the University of Michigan, where they met C.K. Prahalad, a renowned professor and author of *The Fortune at the Bottom of the Pyramid*. The book used case studies to demonstrate how companies were concurrently profitable and bring positive social changes to impoverished communities.

"We were inspired, and wanted to develop a product that would be useful in the bottom of the pyramid," said Gawade.

In 2006, about 400 million people in India did not have access to electricity. At the time, solar power was too expensive and wind energy had geographical limitations. So, they went another direction.

"We thought, 'Why don't we invent something that would better allow people to generate power on demand?'" said Gawade.

This idea materialized into a power-generating stationary bike. Gawade left Ford and returned to India to bring this idea to life, and Atre later joined him.

"It was a risk," said Atre. "But we really wanted to take this journey."

Navigating some bumps in the road as they developed industry connections and learned the ins and outs of social entrepreneurship, the product eventually reached 500 households. However, the company was unable to scale up as solar energy became more affordable and accessible.

"We figured if you can't beat them, join them," said Gawade, so he and Atre started making their own solar lamps and founded the appropriately-titled company Bottom of Pyramid Energy and Environmental Innovations. Using high-quality materials including circuits and lithium ion batteries, they gained a reputation as having the longest-lasting solar lamps in the world.

"Our Wayne State education and experience at Ford Motor Company came in particularly handy for durability testing," said Gawade. "Toughness became part of our DNA."

Exploring other social issues with ties to energy, Gawade and Atre later discovered the need for defibrillators in rural India, Africa, Asia and South America. With research funding from the Indo-U.S. Science and Technology Forum and the Government of India, they collaborated to develop a prototype, and Jeevtronics was born.

A SENSE OF PURPOSE

The business value of Jeevtronics can be measured using a "triple bottom line," which extends the focus on financial success to also include social and environmental responsibilities. The company's defibrillator, which has been in development over the last four years, fits this framework to a tee.

In India, external defibrillators can be cost-prohibitive. Hospitals may only have one per floor, serving 50 to 100 patients (compared to one per three ICU beds in the United Kingdom). The Jeevtronics device can be produced for a quarter of the cost of leading defibrillators.

The odds of survival of a patient in cardiac arrest decline by 7 to 10 percent per minute of delay in defibrillation. This device can be charged and ready to use in five to nine seconds.

According to the Food and Drug Administration, nearly one-quarter of all automatic external defibrillators (AED) failures occur because of battery power problems, a problem that is rendered moot with a device capable of being human-powered. This quality also makes its ecological footprint practically nonexistent, as does the sustainability of the device itself. Defibrillator charge/discharge cycle standards require a device to last 2,500 shocks. Though rigorous testing, already a hallmark of Gawade and Atre's business strategy, the Jeevtronics device has surpassed 16,000 shocks.

Jeevtronics is preparing to bring this defibrillator to the market in India, but Gawade and Atre are learning that a need exists for this technology in the U.S. and other countries. Its applications can range from EMT and ambulance units to athletics and recreation, and to rural and farming communities.

The company's prosperity and global impact will be a direct reflection of the passion of its founders, who have dedicated themselves to making the quality of life for those in the "bottom of the pyramid" a little better.

"The sense of purpose we have to be able to do something to help people is the most fulfilling part," said Gawade. ▪

HALL OF FAME EVENT

celebrates rich history of engineering at Wayne State

The Wayne State University College of Engineering honored 11 prominent alumni at its 2018 Hall of Fame awards dinner on Friday, April 20, at the NextEnergy Center in Detroit.

Deming Xiao, M.S. '89, and Krish Panu, B.S. '81, M.B.A. '84, composed the Hall of Fame class of 2018 and brought membership to 144 honorees since the Hall of Fame's inception in 1983.

The College of Engineering also recognized distinguished engineers or computer scientists from each of its eight departments. The event coincided for the first time with the college's annual Student Design and Innovation Day, presented by the James and Patricia Anderson Engineering Ventures Institute.

Xiao joined Monolithic Power Systems (MPS) in 2001 and has served in various executive positions, including senior vice president of operations and president of Asia operations. Xiao is in charge of worldwide manufacturing and supply chains, corporate technology developments, product and testing engineering, quality, reliability, and corporate IT. Since Xiao joined MPS, the company has scaled from a startup to reach a valuation of nearly $5 billion as one of the fastest-growing companies in analog semiconductors. Xiao's prior experience includes numerous engineering and management positions with Supertex Inc., National Semiconductor and Fairchild Imaging. Xiao holds a bachelor's in semiconductor physics from Sichuan University in Chengdu, China, and a master's in electrical engineering from Wayne State University.

Panu has more than two decades of business strategy, engineering and operational experience having built successful technology businesses that have created multibillion dollar markets. He founded @Road in 1998 and grew it into a worldwide leader in mobile resource management solutions before merging the company with Trimble Navigation for nearly half a billion dollars. Today, Panu is the co-founder and managing director of PointGuard Ventures, a private equity and venture capital firm based in Menlo Park, California. He holds a bachelor's in electrical engineering and master's of business administration from Wayne State.

The distinguished engineers and computer scientists included:

BIOMEDICAL ENGINEERING
Annette Irwin, M.S. '93, Ph.D. '94
Technical Fellow, General Motors Global Safety Center

CHEMICAL ENGINEERING AND MATERIALS SCIENCE
Keith Donaldson, B.S. '85
President, Engineered Materials Inc.

CIVIL AND ENVIRONMENTAL ENGINEERING
Palencia Mobley, M.S. '04
Deputy Director and Chief Engineer, Detroit Water and Sewerage Department

COMPUTER SCIENCE
Frank Riviera, B.S. '86
Vice President of Product Development, Nexsys Technologies

ELECTRICAL AND COMPUTER ENGINEERING
Anurag Kumar, M.S. '87
Founder and CEO, iTexico

Vandana Kumar, M.S. '89
Program Director, PowerAI Developer Ecosystem, IBM

ENGINEERING TECHNOLOGY
Frank Kunick, B.S. '99, M.S. '09
Senior Manager, Test Laboratory Operations Dept., Nissan Technical Center North America

INDUSTRIAL AND SYSTEMS ENGINEERING
Mark Dolsen, M.S. '90, Ph.D. '17
President, TRQSS, Inc.

MECHANICAL ENGINEERING
Kelley Clark, M.S. '95
Global Vehicle Integration Manager, Ford Motor Company

The honorees had the opportunity to attend Design Day in the afternoon and peruse a showcase of Wayne State students' capstone projects and startup companies, all of which presented solutions to engineering challenges and commercial or social needs in the spirit of entrepreneurship.

Dean Farshad Fotouhi and the Engineering Alumni Association then welcomed the honorees and their families — as well as colleagues, alumni and industry leaders — to the awards dinner, with proceeds benefiting scholarships and student programs. ▪

BIOMEDICAL ENGINEERING

PH.D. STUDENT ELIZABETH STEEL won the Three Minute Thesis competition at the WSU Graduate and Postdoctoral Research Symposium for her presentation, "Conductive Biopolymer Nanofibers for Neural Regeneration", while doctoral candidate Suhail Salem Alshahrani was one of several first-place winners in the poster competition, demonstrating research on a photoacoustic tomography system for diagnosing breast cancer.

A COLLECTION OF CO-AUTHORS that included John Cavanaugh, professor and interim chair, and Srinivasu Kallakuri, a research assistant professor, was awarded Best Poster Presentation at the BrainStorm symposium after presenting a study, funded by the U.S. Army Medical Research and Materiel Command, to understand the mechanisms of primary blast injury to the brain.

MOHAMMAD MEHRMOHAMMADI, assistant professor of biomedical engineering, and Dr. Loay Kabbani, a vascular surgery specialist with Henry Ford Health System, are developing a photoacoustic imaging technique to enhance endovenous laser ablation for patients with venous reflux disease, which received an Mi-Kickstart Award from the MTRAC for Life Sciences Innovation Hub.

ASSOCIATE PROFESSOR MICHELE GRIMM was elected to the Class of 2018 Fellows for both the Biomedical Engineering Society and the American Institute for Medical and Biological Engineering.

CHEMICAL ENGINEERING AND MATERIALS SCIENCE

ASSOCIATE PROFESSOR ERANDA NIKOLLA was among 37 scientists and engineers from around the world selected to the inaugural class of Influential Researchers by the editors of *Industrial & Engineering Chemistry (I&EC) Research*, a weekly journal published by the American Chemical Society.

PH.D. CANDIDATE JULIANA CARNEIRO, whose research focuses on optimizing oxygen electrocatalysis to create more efficient batteries, fuel cells and electrolyzers, received the Best Poster Award at the 2018 Gordon Research Conference on catalysis.

CIVIL AND ENVIRONMENTAL ENGINEERING

THE GREAT LAKES WATER AUTHORITY renewed its partnership with Wayne State University to focus investigations on the areas of drinking water monitoring system enhancement and contaminants of emerging concern regarding drinking water treatment, backed by research from Professor Carol Miller and Assistant Professor Yongli Zhang.

ASSISTANT PROFESSOR TIMOTHY DITTRICH received an ORAU Ralph E. Powe Junior Faculty Enhancement Award, which provides funds to enrich the research and professional growth of young faculty.

COMPUTER SCIENCE

ASSOCIATE PROFESSOR NATHAN FISHER received a Most Influential Paper award for his 2005 presentation, "A Polynomial-Time Approximation Scheme for Feasibility Analysis in Static-Priority Systems with Bounded Relative Deadlines," at the 2017 International Conference on Real-Time Networks and Systems 25th anniversary event in Grenoble, France.

PH.D. STUDENT LALEH GHALAMI was awarded at two national conferences—first place in the Association for Computing Machinery (ACM) Student Research Competition and second place at the STARS Computing Corps Celebration—for her poster, "A Parallel Approximation Algorithm for Scheduling Parallel Identical Machines."

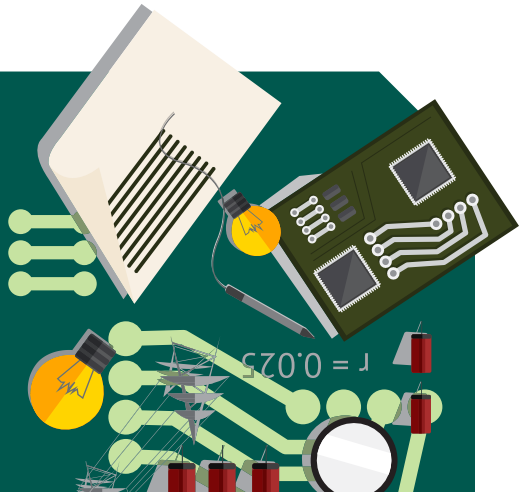
PH.D. STUDENT JIE CAO AND ALUMNA MINGYANG XU co-authored a collaborative project titled, "MyPalmVein: A Palm Vein-based Low-cost Mobile Identification System For Wide Age Range," that received a Best Paper Award from the IEEE eHealth Technical Committee.

ASSISTANT PROFESSOR FENGWEI ZHANG AND HIS COLLABORATORS received an Outstanding Paper Award from the 33rd Annual Computer Security Applications Conference for their project, "Supporting Transparent Snapshot for Bare-metal Malware Analysis on Mobile Devices."

PROFESSOR SHIYONG LU AND A TEAM OF STUDENTS won a Best Paper Award for their project, "Diagnosis Recommendation Using Machine Learning Scientific Workflows," at the 2018 IEEE International Congress on Big Data.

ELECTRICAL AND COMPUTER ENGINEERING

PROFESSOR MOHAMMED ISMAIL ELNAGGAR co-authored a paper with former colleagues at Khalifa University titled, "Graphene Oxide-Nylon ECG Sensors for Wearable IoT Healthcare," that received a Best Paper Award at the 2017 Sensors, Networks, Smart and Emerging Technologies (SENSET) conference in Lebanon.



ENGINEERING TECHNOLOGY

PROFESSOR GENE LIAO contributed two chapters — "Automotive Engineering" and "Roadmap of Vehcile Electrification and Hybridization" — that were published in the 12th edition of *Marks' Standard Handbook for Mechanical Engineers*.

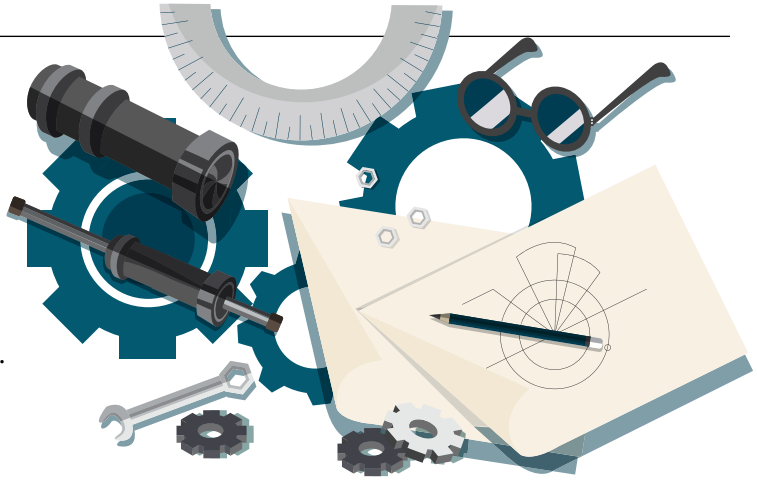
INDUSTRIAL AND SYSTEMS ENGINEERING

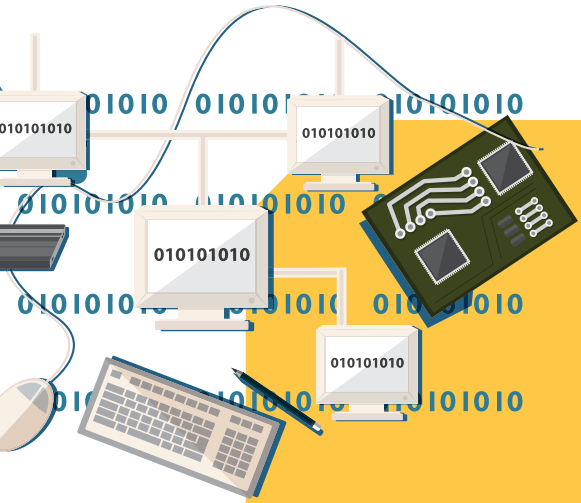
PH.D. STUDENT HOSSEIN BADRI was named lead editor of *OR/MS Tomorrow*, a student membership magazine for the Institute for Operations Research and the Management Sciences (INFORMS).

ASSOCIATE PROFESSOR KYOUNG-YUN KIM was awarded as a Fellow of the Society of Design and Process Science (SDPS).

MECHANICAL ENGINEERING

THE "MICROBUOY" TEAM, mentored by Assistant Professor Leela Arava, received the Technology Innovation Award and a $15,000 cash prize plus supportive services for its real-time water quality assessment sensor technology at the 2017 Internet of H2O water innovation competition, hosted by the Cleveland Water Alliance in Port Clinton, Ohio.





INTERDISCIPLINARY

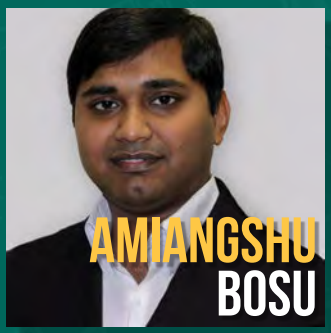
ASSISTANT PROFESSOR YONGLI ZHANG (CEE), PROFESSOR WEISONG SHI (CS), AND PH.D. CANDIDATE JAVAD ROOSTAEI (CEE) received an Azure Award from Microsoft for a project called "AI for Earth: A Cloud-based Analytics for Real-time Monitoring of Landfills/Superfund Sites and the Adjacent Watershed," which aims to address the issue of water contamination in Michigan caused from leakage of toxic and superfund sites.

THE WAYNE STATE UNIVERSITY COLLEGE OF ENGINEERING

is pleased to announce the addition of seven outstanding scholars to its faculty.

CIVIL AND ENVIRONMENTAL ENGINEERING

Tierra Bills joined the University of Michigan as an assistant professor and Michigan Society Fellow in the Department of Civil and Environmental Engineering in 2016 after spending three years as a research scientist at IBM Research Africa. Her research interests include discrete choice analysis and behavioral modeling, transportation planning, and emerging data sources in transportation modeling. She develops activity-based travel-demand models to investigate individual and household-level transportation-equity effects, for the purpose of designing transportation systems that will provide more equitable returns to society. Bills holds a B.S in civil engineering technology from Florida A&M University, and an M.S. and Ph.D. in transportation engineering from the University of California, Berkeley.



COMPUTER SCIENCE

Amiangshu Bosu is a former assistant professor of computer science at Southern Illinois University Carbondale, where he led the SOFTSEARCH (SOFTware engineering reSEARCH) group. His research spans empirical software engineering, peer code review, software security, android security, malware detection, mining software repositories, and social network analysis. He was selected as the outstanding graduate researcher of computer science at University of Alabama in 2014 and 2015. Prior to joining SIUC, Bosu was a postdoctoral associate at Virginia Tech. He holds a B.S. in computer science and engineering from Bangladesh University of Engineering and Technology, and a M.S. and Ph.D. in computer science from the University of Alabama.

COMPUTER SCIENCE

Marco Brocanelli received his Ph.D. in electrical and computer engineering from Ohio State University in 2018. He has been a visiting scholar at OSU between October 2010 and May 2012, working on hypersonic vehicle non-linear control (published in AIAA'12). His research interests are power-aware computer systems and mobile computing. Brocanelli received a B.S. and M.S. in control engineering from the University of Rome Tor Vergata in Italy.

Mechanical Engineering

Azad Ghaffari received his Ph.D. in engineering sciences from the University of California, San Diego. His research interests include control design for safety critical cyber-physical systems, distributed supervisory controller design for swapping modularity over smart networks, control of state-dependent sampled rate systems, high-precision motion control of servo-systems, aggregate demand response in power systems, extremum seeking and its application to maximum power point tracking in photovoltaic and wind energy conversion systems, sliding mode control, and linear matrix inequalities. He has completed postdoctoral appointments at UCSD as well as the University of Michigan, and has six years of industrial training on control, automation and instrumentation of various power systems. Ghaffari holds a B.S. and M.S. from K. N. Toosi University of Technology in Tehran, Iran.

Civil and Environmental Engineering

Steven Lavrenz is the former technical programs manager for the Institute of Transportation Engineers in Washington, D.C. He was also the director of technical services for the National Operations Center of Excellence. Lavrenz is an expert on policy and research pertaining to transportation safety, planning, and operations, and has been involved with several Transportation Research Board committees and the National Cooperative Highway Research Program. He also served as an adjunct professor at Catholic University in Washington, D.C., teaching courses in econometrics and transportation systems management. Lavrenz received his B.S. and M.S. degrees in civil engineering from Iowa State University, and his Ph.D. in civil engineering from Purdue University.

Electrical and Computer Engineering

Dimitrios Sounas spent the last six years at the University of Texas at Austin as a postdoctoral fellow and then a research scientist. He also completed appointments as a postdoctoral fellow at Polytechnique Montreal and as a visiting researcher at FOM Institute AMOLF in the Netherlands. His research interests span electromagnetics, plasmonics, optics and acoustics, with a particular emphasis on the design of nonreciprocal, nonlinear and active devices. His contributions in the area of magnetless nonreciprocal components has drawn interest from the industry and the military for inclusion in next-generation RF and optical communication systems. Sounas earned his B.S., M.S. and Ph.D. from Aristotle University in Thessaloniki, Greece.

Industrial and Systems Engineering

Murat Yildirim received his B.S. and Ph.D. from the Georgia Institute of Technology, and spent the last two years there as a postdoctoral researcher. His main research pursuits lie at the intersection of statistical data analytics and mathematical programming. He is specifically interested in addressing fundamental computational and scalability challenges related to the integration of classic decision optimization models with real-time analytics capability as well as the unique modeling challenges arising from applying this framework across numerous industrial domains.

3,637 Total Enrollment

LEVEL

Undergraduate
2,505
69%

Graduate
1,132
31%

FULL/PART TIME

Full Time
2,567
71%

Part Time
1,070
29%

GENDER

Female
894
25%

Male
2,743
75%

RESIDENCY AND LEVEL

In-State Undergraduate — 2,368 STUDENTS

In-State Graduate — 490 STUDENTS

Out-of-State Undergraduate — 137 STUDENTS

Out-of-State Graduate — 642 STUDENTS

CLASS LEVEL

Freshman 550
Sophomore 417
Junior 567
Senior 963
Master's 825
Doctorate 306

FACULTY AND STAFF

Full-Time Staff 69
Full-Time Faculty 137

DEGREES AWARDED IN 2017-18

Bachelor's 394
Master's 582
Ph.D. 48
Certificate 6

COUNTRIES REPRESENTED BY CURRENT STUDENTS 46

LIVING ALUMNI 28,563

STUDENT ORGANIZATIONS AND TEAMS 19

RESEARCH EXPENDITURES $18,403,000

2017 fiscal year

By Source

National Institutes of Health	$654,000
National Science Foundation	$2,688,000
Department of Energy	$193,000
Department of Defense	$1,697,000
All other fed/state/local agencies, private industry, etc.	$13,171,000

**All figures represent fall 2018 unless otherwise indicated*

WAYNE STATE UNIVERSITY

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