2021 ANNUAL REPORT

College Welcome

WE ARE EXCITED TO CELEBRATE

the COEIT community as it approaches an important milestone. This milestone allows us an opportunity to celebrate the past, present, and future of our College. As we look forward to a promising future we invite you to reflect on our path to becoming one of the most recognized colleges in the State of Maryland, and the immense efforts it took to get us here. We are particularly appreciative of the dedication and sacrifices of our members as we successfully navigated the myriad of challenges of the last two years.

The history of our programs began before we became a college at UMBC. It began in 1981 when computer science became the first bachelor of science program at UMBC. Information systems, originally approved as operations analysis (M.S. & Ph.D.) and later as information systems management to include the B.S. degree, had a more complex history before finding a home in what became COEIT in 2005. Both programs had their first UMBC bachelor's degree graduates in 1982. In 1984, the Maryland Higher Education Commission approved a B.S. degree in engineering (chemical engineering and mechanical engineering) and M.S. and Ph.D. degree programs (in aerospace, electrical, chemical, computer, and mechanical engineering) to be offered at UMBC as extensions of the College of Engineering at College Park. A year later, full undergraduate programs in mechanical engineering and chemical engineering were offered for the first time. As COEIT continued to grow during the ensuing years, undergraduate and graduate programs were approved; student organizations were created; enrollment and graduation numbers grew, and research funding increased. In 1992, UMBC's College of Engineering was officially approved and established, independent from the University of Maryland, College Park, and Dr. Duane Bruley, professor of chemical engineering, became the first Dean of Engineering at UMBC. The college was officially renamed the College of Engineering and Information Technology in 2005.

This year we celebrate thirty years as an independent college. During the past 30 years, the College has grown to include 261 faculty and staff, 4,022 undergraduate students, and 1,539 graduate students. The College now boasts four departments with six undergraduate programs, 30 graduate programs and certificates, and prestigious research centers such as the Center for Urban Environmental Research and Education (CUERE), the Center for Real-Time Distributed Sensing and Autonomy (CARDS), ▹

the Institute for Harnessing Data and Model Revolution in the Polar Regions (iHARP) and the Center for Advanced Sensor Technology (CAST). The College has established a strong commitment to promoting diversity in its student body. The Center for Women in Technology (CWIT) was created in 1998 to support women and other underrepresented groups to be successful in technology fields and it has expanded its mission and scope to have an even greater impact. Reflecting the hard work and commitment of COEIT community, the college currently has a 92% positive career outcome rate within six months of graduation providing a critical technical workforce to the region and the nation. The college's 30th anniversary also parallels with the historic career of President Freeman Hrabowski, who, after 30 years of service as UMBC's president retires at the end of June 2022. We are grateful for the leadership he has provided that supported the success of our students, staff, and faculty.

As we move forward into an exciting new era with UMBC now recognized as a Carnegie R1 institution, COEIT will continue to strive towards the fulfillment of our mission of educating and producing future technical leaders that demonstrate a commitment and responsibility to the betterment of our region. Thanks to the passion and dedication of past and present members of our community, the college is well-positioned to successfully meet the challenges and opportunities that the future holds. ▪

AS WE LOOK FORWARD TO A PROMISING FUTURE WE INVITE YOU TO REFLECT ON OUR PATH TO BECOMING ONE OF THE MOST RECOGNIZED COLLEGES IN THE STATE OF MARYLAND, AND THE IMMENSE EFFORTS IT TOOK TO GET US HERE.

RETRIEVER GRATEFUL

Note: Throughout this report, we have provided a partial timeline of college history. Please feel free to share with us additional milestones and achievements we might have missed as well as things you think we got wrong. We cherish that since at UMBC "Success is never final!"

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COEIT TIMELINE

1981

COMPUTER SCIENCE BECOMES UMBC'S FIRST BACHELOR OF SCIENCES PROGRAM.

1982

FIRST DEGREES IN COMPUTER SCIENCE AND INFORMATION SYSTEMS WERE AWARDED.

1984

MD STATE BOARD FOR HIGHER EDUCATION APPROVED THE FOLLOWING ENGINEERING PROGRAMS TO BE OFFERED AT UMBC AS EXTENSIONS OF THE COLLEGE OF ENGINEERING AT COLLEGE PARK: B.S. IN ENGINEERING (CHEMICAL ENGINEERING AND MECHANICAL ENGINEERING) AND M.S. AND PH.D. DEGREE PROGRAMS(IN A.E., E.E., CHE., C.E. AND M.E.).

DR. GEORGE DIETER IS THE DEAN OF THE COLLEGE OF ENGINEERING AT COLLEGE PARK AND UMBC. DR. ALBERT GOMEZPLATA SERVES AS THE FIRST ASSOCIATE DEAN AT UMBC.

1985

FULL UNDERGRADUATE PROGRAMS IN M.E. AND CH.E. OFFERED FOR THE FIRST TIME AT UMBC.

DR. SEVERINO KOH SERVES AS SECOND ASSOCIATE DEAN AT UMBC.

COLLEGE RESIDES IN TF1.

1986

UMBC GRADUATED ITS FIRST CLASS OF ENGINEERS: EIGHT BACHELOR'S DEGREES (5 M.E.'S AND 3 CH.E.'S) AND ONE MASTER'S DEGREE IN E.E.

ENGINEERING STUDENT ORGANIZATIONS ASME AND AICHE WERE ESTABLISHED.

30 years of COEIT

Allison Murray

IT'S BEEN 30 YEARS SINCE THE UNIVERSITY OF MARYLAND, BALTIMORE COUNTY'S COLLEGE OF ENGINEERING AND INFORMATION TECHNOLOGY (COEIT) WAS BORN. IN THOSE THREE DECADES, THE COLLEGE HAS SEEN YEARS OF GROWTH, THOUSANDS OF ALUMNI, GROUNDBREAKING RESEARCH, INNOVATIVE TEACHING, IMPORTANT LEADERSHIP, AND SO MUCH MORE. ▹

ASIDE FROM ADDING NEW DEPARTMENTS, THE COEIT HAS BEEN ABLE TO EXPAND ITS RESOURCES AND RESEARCH BY ADDING MULTIPLE RESEARCH CENTERS FROM LARGE GRANTS.

As of fall 2021, the COEIT now encompasses more than a dozen areas of study with 4,022 undergraduate students and 1,539 graduate students. The college's mission has been and continues to be "to educate future leaders and contribute to the professional workforce; to excel in research and innovation, and embrace a culture of service to and engagement with our communities and professions."

While it's easy to look back on the college's history as a bullet-pointed timeline, the stories of faculty and students truly make up the history of the COEIT.

THE EARLY DAYS

However, the storied history of the COEIT goes farther back than its inception. While the Engineering and Computer Science building opened and the college itself became a separate entity from UMBC in 1992, engineering at UMBC was created in 1985.

"The vision was to have the ability for people from the Baltimore area to attend engineering classes because College Park was perceived as mostly serving Washington [D.C.]. So, some thought that perhaps we should have an engineering presence here," said Dr. Govind Rao, a Professor of Chemical & Biochemical Engineering and Director of the Center for Advanced Sensor Technology.

When he arrived at the college in 1987, Dr. Rao said engineering wasn't well known to most people on the campus. However, he recalls being welcomed by the other departments and sharing resources as the COEIT grew into its own.

"We had very few resources, but especially the colleagues from biology and chemistry and the other sciences made us feel very welcome and at home," he said. "We basically were taken under their wing, and space was carved out of their resources to get us started."

Another long-time COEIT faculty member, Dr. Charles Nicholas, a professor in the Department of Computer Science and Electrical Engineering, remembers the temporary building the engineering and computer science department shared.

"There was not much in the way of lab facilities for anybody," he said. "The engineering college had almost all of its lab facilities at a place called the TRC [Technology Research Center]—it was not a resource-rich environment."

Once the Engineering and the Computer Science building opened in 1992, the college finally got its own space to grow.

GROWING PAINS

The first few years of the COEIT were figuring out what exact departments the college would be home to, and many were added throughout the years.

Dr. Nicholas said the computer science and engineering department merged with electrical engineering in 1995, but it was not received without struggle from some faculty members.

"There was some struggle with this unification, and the struggles lasted

Photo by Marlayna Demond '11 for UMBC.

for years and tension of that combined department," he said. "Now we're in a situation where it's all one department. So while it was controversial at the time, in hindsight, it was the right decision, and it turned out to be for the university's benefit."

Of course, perhaps one of the biggest examples of growth for the college was the addition of the Information Systems department. The Department of Information Systems was originally a part of the College of Arts, Humanities, and Social Sciences but made the move to what was then the College of Engineering around 2003 to serve as a model for creating symbiotic relations between engineering and related information technology transfer.

Dr. Nicholas said while it was a change for everyone, they welcomed the new department with open arms, and it has brought many opportunities to students over the years.

"The more traditional engineering disciplines have prospered over the years, but not how Computer Science and Information Systems has, which has doubled and tripled in size," he said.

Aside from adding new departments, the COEIT has been able to expand its resources and research by adding multiple research centers from large grants. Some of these grants were in the seven- and eight-figure range, which resulted in research centers that still exist today.

For example, the Center for Urban Environmental Research and Education (CUERE) was created out of a 2001 grant and fosters interdisciplinary approaches to environmental science, engineering and public policy. In addition, the Center ▹

Charles Nicholas in 2018. Photo by Marlayna Demond '11 for UMBC. Note: All maskless photos were taken prior to COVID-19 pandemic.

for Real-Time Distributed Sensing and Autonomy (CARDS) was set up just last year in collaboration with the U.S. Army Research Laboratory to advance AI-based autonomy. Also new to the college as of last year is the Institute for Harnessing Data and Model Revolution in the Polar Regions (iHARP). The center—which was granted $13 million in September for the next five years—will focus on using data science, machine learning, and artificial intelligence to analyze climate data to help address the challenges related to climate change, sea level rise, and the rapidly changing Arctic.

"The growth of these centers really put our college and our university on the map in terms of what other major players in academic research are doing," Dr. Nicholas said.

Another notable center is the Center for Advanced Sensor Technology (CAST) that was created in 2006 to focus on disruptive innovations and game-changing approaches to common problems in sensor technology. Since its inception, CAST has completed over 20 projects and has received funding from major corporations like Pfizer, DuPont, and Genentech.

Many students have participated in the critical research these centers are conducting, which provides them with a unique experience you can't get everywhere.

"I think students are attracted by our faculty and the research they're doing," said Catherine Bielawski, the assistant dean of undergraduate student services who has been with the college for the past 20 years. "At UMBC, students can participate in research as an undergraduate, and many schools' students can't do that."

MILESTONES & ACCOMPLISHMENTS

Every year in the college's 30-year history has brought with it achievements that can only be attributed to the hard work of the students and faculty. The college has received 28 of UMBC's 40 National Science Foundation Career Awards and a 92% career outcome rate within six months of graduation.

Other milestones include in 2009, when UMBC had the highest percentage of science-and-technology bachelor's degree recipients (45%) among private and public institutions in Maryland, with the exception of the Naval Academy. And, in 2006, when UMBC joined with ▹

MANY STUDENTS HAVE PARTICIPATED IN THE CRITICAL RESEARCH THESE CENTERS ARE CONDUCTING, WHICH PROVIDES THEM WITH A UNIQUE EXPERIENCE YOU CAN'T GET EVERYWHERE.

Govid Rao in 2015. Photo by Marlayna Demond '11 for UMBC. Note: All maskless photos were taken prior to COVID-19 pandemic.

1987

MD STATE BOARD FOR HIGHER EDUCATION APPROVES DEGREE PROGRAM FOR M.S. IN ENGINEERING MANAGEMENT, TO BE JOINTLY ADMINISTERED BY UMBC AND UMUC.

FIRST M.S. IN CHEMICAL ENGINEERING GRADUATED.
NATIONAL SOCIETY OF BLACK ENGINEERS (NSBE) STUDENT CHAPTER ORGANIZED.

MECHANICAL ENGINEERING GRADUATES FIRST M.S

1988

COLLEGE MOVES FROM TF2 TO THE RENOVATED TECHNOLOGY RESEARCH CENTER (TRC) THAT WAS THE PREVIOUS HOME OF THE CHILDREN'S DETENTION CENTER IN ARBUTUS.
SOCIETY OF WOMEN ENGINEERS (SWE) STUDENT CHAPTER FOUNDED.

1989

GROUND WAS BROKEN FOR THE NEW ENGINEERING-COMPUTER SCIENCE BUILDING.

ENGINEER OF THE YEAR PRESENTED TO RICHARD A. LINDER, WESTINGHOUSE.

ENGINEERING FACULTY SURPASSES $1M IN RESEARCH FUNDING FOR THE YEAR.

THE ACCREDITATION BOARD FOR ENGINEERING AND TECHNOLOGY (ABET) OF THE ENGINEERING ACCREDITATION COMMISSION GRANTED INITIAL ACCREDITATION TO THE B.S. IN ENGINEERING PROGRAMS IN M.E. AND CH. E. AT UMBC, INDEPENDENT OF UMCP.

FIRST ENGINEERING DAY CELEBRATED AT UMBC. FIRST ENGINEERS OF THE YEAR PRESENTED TO: WILLARD HACKERMAN, WHITING TURNER CONTRACTING AND GEORGE V. MCGOWAN, B.G.& E. CO.

1990

FIRST MINI BAJA CARS RACE INVITATIONAL WAS HELD BY UMBC, WITH STUDENT-DESIGNED CARS ENTERED BY SUCH INSTITUTIONS AS BUCKNELL, PENN STATE, RPI AND VIRGINIA TECH.

UMBC TAU BETA PI ENGINEERING HONORARY CHAPTER CREATED UNDER THE AUSPICES OF THE UMCP CHAPTER.

ENGINEER OF THE YEAR PRESENTED TO NORMAN R. AUGUSTINE, CHAIRMAN AND CEO OF MARTIN MARIETTA CORPORATION.

1991

DR. GARY CARTER BECOMES INTERIM ASSOCIATE DEAN.

THE FIRST PH.D. IN ELECTRICAL ENGINEERING WAS AWARDED, AS WELL AS THE FIRST MASTER'S DEGREES IN ENGINEERING MANAGEMENT.

THE FIRST PRESIDENTIAL YOUNG INVESTIGATOR AWARDS WERE PRESENTED TO UMBC ENGINEERING FACULTY MEMBERS JAY HUMPHREY, GOVIND RAO AND JAY GORE.

DR. DUANE BRULEY BECOMES THIRD ASSOCIATE DEAN AT UMBC.

UMBC SOCIETY OF AUTOMOTIVE ENGINEERING (SAE) COMPETED FOR THE FIRST TIME IN TWO REGIONAL MINI-BAJA COMPETITIONS.

UMBC COLLEGE OF ENGINEERING BROKE THE $3M MARK IN RESEARCH FUNDING

1992

UMBC'S COLLEGE OF ENGINEERING WAS OFFICIALLY APPROVED AND ESTABLISHED, INDEPENDENT FROM THE UNIVERSITY OF MARYLAND, COLLEGE PARK. DR. DUANE BRULEY BECOMES FIRST DEAN OF ENGINEERING AT UMBC.

COLLEGE MOVES INTO THE NEWLY CONSTRUCTED ENGINEERING COMPUTER SCIENCE BUILDING LATER RENAMED AS THE ENGINEERING BUILDING (E).

NSF YOUNG INVESTIGATOR'S AWARD PRESENTED TO DR. CHENG S. LEE.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE) STUDENT SECTION ESTABLISH IN ELECTRICAL ENGINEERING. FIRST PhD IN CHEMICAL AND BIOCHEMICAL ENGINEERING GRADUATED.

ENGINEER OF THE YEAR AWARDED TO DR. JOHN M. KLINEBERG, DIRECTOR, NASA GODDARD SPACE FLIGHT CENTER.

1993

UMBC'S TAU BETA PI CHAPTER, MD DELTA, WAS FOUNDED AS THE 217TH CHAPTER OF THE TAU BETA PI ASSOCIATION ON DECEMBER 11, 1993.

HUGE GROWTH IN UNDERGRADUATE DEGREES GRANTED IN ENGINEERING AND INFORMATION TECHNOLOGY (54 IN 1983 TO 353 IN 1993).

1994

DR. GARY CARTER BECOMES ACTING DEAN OF THE COLLEGE.

COMPUTER SCIENCE DEPARTMENT JOINS THE COLLEGE OF ENGINEERING AND MERGES WITH THE ELECTRICAL ENGINEERING DEPARTMENT BECOMING THE COMPUTER SCIENCE AND ELECTRICAL ENGINEERING (CSEE) DEPARTMENT.

Catherine Bielawski. Photo by Marlayna Demond '11 for UMBC. Note: All maskless photos were taken prior to COVID-19 pandemic.

Princeton to create a new Engineering Research Center (ERC) to revolutionize optics.

As the college has grown, so has its progression in inclusiveness and diversity in both students and faculty. Recent NSF data also shows that UMBC is the largest producer of African American undergraduate students of Natural Sciences and Engineering who go on to get PhDs. This is thanks to the Meyerhoff Scholars Program founded in 1988 to advance diversity in the sciences and engineering departments. The Meyerhoff Program has been extremely successful with nearly half of its recent graduates being COEIT students and having over 1400 alumni and 256 current students.

The college has been encouraging women to enter the fields of engineering and technology since 1998, when the Center for Women in Technology (CWIT) was created to provide CWIT scholars in the COEIT departments global leadership in achieving women's full participation in all aspects of information technology. CWIT now supports several scholars and leads efforts to support equity and inclusion.

And while the college is known and recognized for academic achievements, there have also been non-academic achievements over the years that are just as important. For example, in 2009, the college's Society of Automotive Engineers' Mini Baja team ranked seventh out of 100 teams at the SAE Baja East Race, and they continue to have similar success. In addition, chemical engineering students took second place in the national ChemE Jeopardy competition in 2020 and 2021.

The college has also had some of its students play in the UMBC Chess Team and even been named national collegiate team chess champions multiple times: in 2003, 2004, 2005, 2006, 2009, and 2010.

"An intellectual sport is something we can play, hold our own in, and occasionally win in," Dr. Nicholas said. "So that's a very nice thing for a college of our age and our size to be able to boast about in a modest and appropriate fashion. We want UMBC to continue to be reckoned with in intercollegiate competition."

LOOKING TO THE FUTURE

In looking to the next three decades—and beyond—those involved with the college hopes to see more of the same drive and accomplishments.

"I'm hoping that we continue to attract good students and continue to attract financial support for our research," Dr. Nicholas said. "That's very important because if you're doing work, that's a value to society."

Dr. Nicholas said he is incredibly proud of the valuable work that has come out of the college. He said the college works on finding solutions to problems that matter and that it has been very gratifying to see through the years.

"We want to do more to work on the problems that humanity needs to have solved and the value that we give to our students and the community," he said. "Not just our neighbors in Baltimore, but the community meaning the federal agencies that come to us with problems that need to be solved."

The college has grown alongside the growth of technology and the possibilities and opportunities that come with it. Dr. Rao said he hopes the college continues to be at the forefront of these emerging technologies and research.

"The hope is that we'll make the appropriate pivot to these amazing technologies that are empowering people to essentially make their own stuff, such as 3D printing, laser cutting, microfabrication, microfluidics, etc.," he said. "The new paradigm will hopefully empower more people to be more creative and unleash entrepreneurship to take advantage of what the future holds."

More than anything, the future for the college brings with it excitement for what's to come and what kind of things can be accomplished.

"It has been exciting to watch this university, and this college, in particular, go from what it was to what it has become," Dr. Nicholas said. "We want people to think of UMBC as a place where you can go and hire very smart and very capable people. We want our students to get skills that will serve them for a lifetime." ▪

COEIT TIMELINE

1995

ENGINEER OF THE YEAR AWARDED TO GENERAL EMMETT PAGE, JR., ASSISTANT SECRETARY OF DEFENSE FOR COMMAND, CONTROL, COMMUNICATIONS AND INTELLIGENCE.

1996

DR. SHOMO CARMI BECOMES THE SECOND DEAN OF THE COLLEGE OF ENGINEERING.

1997

THE MARYLAND HIGHER EDUCATION COMMISSION (MHEC) APPROVES A BACHELOR OF SCIENCE IN COMPUTER ENGINEERING FOR UMBC.

UMBC WAS ONE OF SIX INSTITUTIONS IN THE NATION TO RECEIVE THE FIRST PRESIDENTIAL AWARDS FOR EXCELLENCE IN SCIENCE, MATHEMATICS AND ENGINEERING MENTORING.

1998

THE CENTER FOR WOMEN IN TECHNOLOGY (CWIT) IS FOUNDED BY JOAN KORENMAN – A PROFESSOR OF ENGLISH AND DIRECTOR OF THE UMBC GENDER AND WOMEN'S STUDY PROGRAM.

1999

MHEC APPROVES JOINT M.S. PROGRAM IN ENGINEERING MANAGEMENT BETWEEN UMBC AND THE UNIVERSITY OF BALTIMORE. THE PREVIOUS PROGRAM OFFERED JOINTLY WITH THE UNIVERSITY OF MARYLAND UNIVERSITY COLLEGE WAS DISCONTINUED.

2000

ENGINEER OF THE YEAR AWARDED TO CHRISTIAN H. POINDEXTER, CHAIRMAN , PRESIDENT AND CHIEF EXECUTIVE OFFICER, CONSTELLATION ENERGY GROUP INC. AND BALTIMORE GAS & ELECTRIC COMPANY (BGE).

OUR STUDENTS

Students at hackUMBC. Photo courtesy of Karan Luthria '22.

Megan Hanks

HackUMBC 2021 Brings Together 1,400 creative Students from 26 Countries to Solve Challenges in their Communities

NEARLY 1,400

students from 90 institutions across 26 countries, including Egypt, Switzerland, and Ethiopia, participated in hackUMBC's annual fall hackathon. The 36-hour event encouraged students to collaborate with each other to develop projects addressing a range of real-world challenges.

Participants primarily connected with each other online, through Discord. UMBC students also had the opportunity to attend a limited number of in-person events, with social distancing and masking in place. They vied for a total of $7,300 in prize money through awards from Best Hack overall to Best Financial Hack, Best Data Driven Application, Best Use of Google Cloud, and more.

HackUMBC President Karan Luthria '22, bioinformatics, was pleased with the event's ability to attract both virtual and in-person participants from around the world. "It's challenging to engage with virtual participants, but we did it successfully," he says. This includes many first-time hackers curious to connect with a like-minded community, Luthria notes.

INSPIRED HACKS

UMBC students participated in each of the three winning teams at the hackathon. The first place team developed Babel Fish, which allows people to use their phones to translate voice recordings into audio recordings in other languages. John Hair '24, computer engineering; Nolan Smith '24, mechanical engineering; Gerald Watson II '24, computer science; and Nyle Pope '24, computer science were inspired by a device in The Hitchhiker's Guide to the Galaxy. They decided to try to create a simple version of this technology during the hackathon.

The hack that received second place is a social media app called Adventure Addict. The app allows people to create interactive stories, where readers can choose the path that the story takes at various points. According to a video overview, Adventure Addict "creates a connection between the author and the reader that is unparalleled." As readers consume and interact more with stories and content, the app recommends additional authors, posts, and stories that the reader might find of interest. The Adventure Addict team includes UMBC student David House '16, psychology, M.P.S. '21, data science, as well as a Maryland high school student, and students studying at universities in India and Canada.

In third place was a team that developed Status Bar, a device that culls through the day's headlines and displays top highlights on a table top screen. The Status Bar can also provide a range of other highlights of value to the user, from weather updates to the prices of popular video games, in real time. UMBC students Tamoor Hamid, Ezekiel Ajayi, ▷

Karan Luthria. Photo by Marlayna Demond '11 for UMBC.

"IT IS ALWAYS AMAZING TO SEE STUDENTS FROM ACROSS UMBC AND THE GLOBE COME TOGETHER OVER A WEEKEND FOR A TIME OF LEARNING, COLLABORATING, AND BRAINSTORMING."

Karan Luthria '22

Avi Singh, Craig Stone, all studying computer engineering and graduating in 2022, developed Status Bar.

Awards were provided through robust sponsorship from over a dozen companies, including diamond sponsors T. Rowe Price, Northrop Grumman, and General Dynamics Mission Systems.

COMMUNITY CONNECTIONS

Beyond the top three prize winners, several notable projects focused on ideas for improving the UMBC community. For example, Retriever Helper provides an interactive map allowing users to more easily find locations (specific rooms, floors, and buildings) on UMBC's campus, to view the operating hours of UMBC's dining options, and to read a feed from UMBC's student newspaper, The Retriever.

Kristina Eyombo '25, computer science, and Dan Hyatt '25, bioinformatics, collaborated on the project. Eyombo learned all the JavaScript, HTML, and CSS required to execute the project within that weekend.

"Something we aim for at hackUMBC is to welcome all first-time hackers, regardless of major or background, to bring out their creativity to find solutions to real-world problems," Luthria shares.

Another UMBC-focused project included Fetch&Retrieve, which hopes to decrease waste by helping students give away things they no longer need.

Whether they produce projects geared toward UMBC or broader issues, "It is always amazing to see students from across UMBC and the globe come together over a weekend for a time of learning, collaborating, and brainstorming," says Luthria. "I hope hackUMBC inspires more students to be a part of the hackathon community and continue to spend their weekends bringing ideas to life." ■

Photo by Marlayna Demond '11 for UMBC.

Joshua Slaughter '22, computer engineering, has received the Marshall Scholarship and will pursue his Ph.D. in informatics at the University of Edinburgh. Photo by Marlayna Demond '11 for UMBC.

UMBC graduates more Black students who go on to earn doctorates in natural sciences and engineering than any other U.S. college

Sarah Hansen

AS A TRIFECTA OF CRISES

upended life in 2020, the need for a diverse scientific and medical community grew ever more clear. George Floyd's murder elicited worldwide protests against racial injustice. COVID-19 affected all of our lives and had an outsize impact on Black and brown communities. And COVID-19's economic fallout only exacerbated extreme wealth inequality.

At the same time, while some Black and brown people were reluctant to take the vaccine because of a negative history with the medical establishment, there was no one better than Kizzmekia Corbett '08, M16, biological sciences and sociology, to reach out to "vaccine inquisitive" folks, as she describes them. Corbett rose to fame in 2020 as the lead of the NIH team developing the Moderna vaccine and as the first Black woman in the world to create a vaccine. ▷

Scores of Meyerhoff Scholar alumni and current students with President Hrabowski (seated front, left) and Robert Meyerhoff (seated front, right). Photo by Marlayna Demond '11 for UMBC.

REPRESENTATION MATTERS

It is in this context that UMBC President Freeman Hrabowski and Peter Henderson, senior advisor to the president, published their latest article in Issues in Science and Technology, "Nothing succeeds like success," which addresses the persistent and urgent need to diversify the group of professionals in STEMM (science, technology, engineering, mathematics, and medicine).

"When we have greater diversity of representation, we also have greater diversity of information, knowledge, lived experience, and perspectives—each of which enhances discovery and innovation," Hrabowski and Henderson write. "When the science and engineering community looks like the United States, we find greater trust in and support for that community across groups in the population."

The Meyerhoff Scholars Program at UMBC, and its more than a dozen replications elsewhere, have made great strides in supporting the success of underrepresented students in STEMM. Hrabowski and Henderson argue that the U.S. should frame the need for a diverse scientific workforce as a national priority and invest in it accordingly. Programs like the Meyerhoff Scholars that have proven their ability to move the needle, they write, should be short-listed for that investment, because "nothing succeeds like success."

IMPRESSIVE OUTCOMES

"According to NSF data, UMBC is the number one baccalaureate institution for African American undergraduates who go on to earn Ph.D.s in the natural sciences and engineering, as well as doctorates in the life sciences, mathematics, and computer science," Hrabowski and Henderson report. And, "according to the Association of American Medical Colleges, UMBC is the number one baccalaureate institution for African American undergraduates who go on to earn M.D./Ph.D.s."

At the same time, "Over the past 30 years, our six-year completion rate [at UMBC for all students] has doubled, and the gap in completion rates between white and Black students has disappeared," they write.

At UMBC, more than 1,400 undergraduate Meyerhoff Scholars, all of whom are committed to diversity in STEMM, have earned their undergraduate degrees. More than 800 of those have earned advanced degrees, and 300 more are currently completing graduate programs at top institutions across the country.

A ROLE MODEL

And yet, this powerful example of progress exists in a nation that has seen minimal growth, and, in some fields, a backslide in minority participation in STEMM in the last decade, Hrabowski and Henderson explain. But programs like Meyerhoff have shown that big change is possible, and how to make it happen.

For example, for over 30 years the program has offered academic, social, and financial support. UMBC instructors have also invested time in completing significant course redesigns that shift the focus from "weeding out" to promoting success, and end up helping all students. More recently, an increased focus on faculty diversity has taken shape and begun to have

an impact. Those efforts have led to impressive outcomes and a profound culture shift.

The Meyerhoff Scholars program has inspired several other student success initiatives at UMBC that offer various forms of support for students, including a cohort model that enhances a sense of belonging. For example, STEM BUILD is an NIH-funded program designed to help diversify the biomedical sciences. Programs in other fields, such as the Sondheim Public Affairs Scholars and the Linehan Artist Scholars, also follow some of the same principles.

Other institutions have taken note. Programs at Pennsylvania State University and University of North Carolina at Chapel Hill have replicated the principles of the Meyerhoff Scholars with great success. UC San Diego and UC Berkeley have begun their own replication efforts. And programs at other institutions with similar principles, such as University of Florida and the historically Black Howard University, have also seen dramatic change in their graduation rates for underrepresented students in science, technology, engineering, and math.

INVESTING IN THE FUTURE

In early 2021, a group of scientists wrote in *Science* recommending the formation of a new National Science and Engineering Diversity Initiative (NSEDI). They suggested NSEDI should allocate $10 billion per year for several years to improve diversity in science.

"These and any other funds that target increasing diversity should be allocated judiciously," Hrabowski and Henderson argue. "Financial resources should flow to institutions that most successfully contribute to greater diversity—regardless of institutional type."

In the end, "producing scientists is about more than increasing the numbers. It is about changing attitudes and transforming the lives of people," Hrabowski and Henderson write. "It is about showing our society what is possible when we invest in the talent of all our youth."

> "WHEN WE HAVE GREATER DIVERSITY OF REPRESENTATION, WE ALSO HAVE GREATER DIVERSITY OF INFORMATION, KNOWLEDGE, LIVED EXPERIENCE, AND PERSPECTIVES–EACH OF WHICH ENHANCES DISCOVERY AND INNOVATION."
> *President Freeman Hrabowski*

As the pandemic, widening economic inequality, and rising demands for racial justice demonstrate, there is still much work to be done. "The message is clear," Hrabowski and Henderson declare. "Investing in young people, replicating best practices of effective programs, and committing substantially more money to support Black and minority scientists can indeed move the needle and also tackle fundamental scientific and public health problems for humankind." ▪

Meyerhoff Scholars at an annual dinner. Photo by Marlayna Demond '11 for UMBC.

UMBC alumnus Kafui Dzirasa is named an HHMI Investigator, elected to the National Academy of Medicine

Megan Hanks

Kafui Dzirasa '01, M8, chemical engineering, recently earned two highly prestigious honors distinctive even among leaders in the medical and life sciences: an HHMI Investigator award and election to the National Academy of Medicine.

Dzirasa is the K. Ranga Rama Krishnan Associate Professor of psychiatry and behavioral sciences at Duke University. He earned both his MD and his PhD in neurobiology and neurosciences at Duke. Today, he examines the role of the brain's electrical activity in psychiatric illness, including depression, bipolar disorder, and addiction, with the goal of creating mechanisms to disrupt these disorders.

ACHIEVEMENT AND SERVICE

Dzirasa is one of 100 new members elected to the National Academy of Medicine this year. The announcement recognizes his "seminal contributions to the neuroscience of emotion and mental illness" as well as his pioneering research methods. It also honors his "contributions to society through science policy and advocacy, a commitment to mentoring, and support for efforts to build a diverse and inclusive scientific workforce," carrying forward the values of UMBC's Meyerhoff Scholars Program.

Election to the National Academy of Medicine recognizes leaders in health and medicine who have demonstrated both outstanding professional achievement and a commitment to service. The National Academy of Medicine has more than 2,200 elected members worldwide, with new members limited to 100 per year.

ANSWERING TOUGH QUESTIONS

Last month, Dzirasa was also named a Howard Hughes Medical Institute (HHMI) Investigator. He joins a cohort of 33 new Investigators from across the U.S. Each was selected for their ability to "dive deep into tough questions" and address some of the most challenging issues in biomedical research.

HHMI is investing about $300 million in Dzirasa and the other members of the new cohort. The institute also recently announced a plan to invest $2 billion in work to accelerate inclusion and equity throughout the academic science pipeline—a goal championed by Dzirasa, other Meyerhoff alumni, and UMBC President Freeman Hrabowski.

There are approximately 250 HHMI Investigators across the U.S., including UMBC's Michael Summers, Robert E. Meyerhoff Chair for Excellence in Research and Mentoring and Distinguished University Professor. His chemistry lab focuses on understanding how HIV-1 and other retroviruses assemble and how they package their genetic material. The long-term goal is to make possible new therapeutic approaches to treat AIDS and other diseases. ▪

Kafui Dzirasa presents a GRIT-X talk at UMBC, 2017.

UMBC's Jordan Troutman to continue algorithmic fairness research as Knight-Hennessy Scholar at Stanford

Jordan Troutman on UMBC's Academic Row. Photo by Marlayna Demond '11 for UMBC.

Sarah Hansen

JORDAN TROUTMAN '21,

M29, computer science and mathematics, first discovered algorithmic fairness during a summer research program at Rutgers University after his first year at UMBC. The field focuses on how computer algorithms, such as those responsible for facial recognition or the content in our social media feeds, can foster fairness or unfairness. The effects include anything from attempting to identify someone who committed a crime to curating the content we see in ways that influence how we think about others.

"Because these algorithmic systems are being used to make a lot of life-changing decisions," Troutman says, "now we have to make sure that the tools and technologies we're developing have some type of guarantees or safeguards to make sure that they don't have unintended consequences towards minority groups specifically, or just any unintended actions."

When Troutman returned to UMBC from his summer at Rutgers, he sought out James Foulds, assistant professor of information systems. He's researched these issues under Foulds's mentorship for the past three years.

This fall, Troutman will take his research interests to Stanford University, where he'll pursue a Ph.D. in computer science as UMBC's first Knight-Hennessy Scholar. The international Knight-Hennessy Scholarship is open to students applying to graduate school at Stanford in any area of study. In addition to funding, it offers robust leadership and community-development training. Troutman was selected as exemplifying the scholarship's core values: independence of thought, purposeful leadership, and civic mindedness.

SOCIALLY-MINDED SCHOLARSHIP

In the 2019 – 2020 academic year, Troutman represented the student perspective as a voting member of the Maryland Higher Education Commission (MHEC), which establishes policies for every college in the state. At UMBC, Troutman took on leadership roles in the Student Government Association (SGA), the National Society for Black Engineers (NSBE), and as a teaching assistant and tutor supporting fellow students. In 2020, he received another prestigious honor, the Barry Goldwater Scholarship.

Troutman is a Meyerhoff Scholar and a member of the Honors College, and he's one of two UMBC valedictorians for 2021. In addition to Rutgers, he's ▹

conducted summer research at the University of California, Berkeley and in the Fairness, Accountability, Transparency, and Ethics (FATE) research group at Microsoft. Troutman has also been involved with UMBC's Center for Democracy and Civic Life (CDCL), and he counts its director, David Hoffman, among his mentors.

"Jordan embodies the kind of creativity that transcends disciplinary boundaries, and has found dazzling ways to weave his social concerns into his scholarship," Hoffman shares. "I'm confident he will thrive in the Knight-Hennessy program, and that we will have many more occasions to celebrate his civic contributions."

Jordan Troutman, left, and Dan Barnhart, former director of The Commons and student life at UMBC, who recommended Troutman apply for the MHEC position. Photo by Marlayna Demond '11 for UMBC.

Participating in leadership has also given Troutman the chance to get to know other leaders. His experience with MHEC demonstrated what true leadership looks like. "It's really powerful to see how—when you are passionate about something, and you care about the people, and not the power or the position—you can do good work and effect good change."

FROM INTENTION TO IMPACT

With the Knight-Hennessy Scholarship, as well as a highly competitive Graduate Research Fellowship from the National Science Foundation, Troutman will have the freedom to pursue research of his choice at Stanford. He values the opportunity to be creative in his approach and thinks of his research as "computational social sciences"—interdisciplinary by definition. His computer science and math courses have prepared him for the work; so have courses in the liberal arts and his experiences with campus engagement.

Elective courses in philosophy "helped me understand broadly how to articulate these non-quantitative concepts," such as fairness, Troutman says. A particular Honors College course about how the media uses faces and how we internalize what the faces represent stuck with him.

Social media algorithms "are everywhere. So if these algorithms are unfair in any way, then the way we're consuming this media may not necessarily be representative of the world we live in," Troutman says. "I think that's a super important problem, and because I've taken these other classes, it's given me a broader context of how important this problem is and has reaffirmed my interest in doing this kind of research."

Troutman is looking forward to collaborating with the other Knight-Hennessy Scholars on some of these big ideas. He also appreciates the leadership training offered through the program, which he sees as being about "trying to figure out how to be a well-intentioned person, and then making really good work out of what your intentions are for the world."

SUPPORTIVE COMMUNITY

Troutman shares that several UMBC experiences were instrumental in helping him build his confidence and understand the powerful difference he can make.

Roles in SGA and participating in UMBC's STRiVE student leadership retreat and Alternative Spring Break "helped me understand my own sense of agency and my ability to make an impact," Troutman says. He realized that solving massive, intimidating problems often starts with a single person, and says, "Learning that has just made me believe that I literally could do anything."

The Meyerhoff Scholars Program helped him internalize some of the same ideas. "Meyerhoff gave me this idea that you can really make a change in your life," Troutman says. "You can be whoever you want to be. You just have to be active about it and to believe in yourself and use the support and community around you to get where you want to be." ▹

"IF THESE ALGORITHMS ARE UNFAIR IN ANY WAY, THEN THE WAY WE'RE CONSUMING THIS MEDIA MAY NOT NECESSARILY BE REPRESENTATIVE OF THE WORLD WE LIVE IN."

Jordan Troutman '21

NSBE also played a role in Troutman's growth. NSBE "helps students feel that they belong in science," he says. "It's helped to center me and to help me really understand what it means to build community. Now, I hope to go and help to foster more communities at these other places that I go in my life."

And Foulds, his research mentor, "has given me really good insight, perspective, and guidance on how to do research, think about problems, and especially how to overcome a lot of different pitfalls that happen in research," Troutman says.

AN ETHICAL LEADER

All these programs, communities, and experiences are representative of the culture at UMBC, Troutman says. "You can really be yourself and be engaged and very intentional with people, and you can be as cool or kooky as you want—there's a space for you at UMBC," he says.

In the Knight-Hennessy application process, students submit a video addressed to their future Knight-Hennessy cohort. "Jordan's video demonstrated how to do a gymnastics flip. Not the kind of thing you'd expect from a computer scientist—but it was a way to showcase his other interests and let his personality shine," April Householder, director of undergraduate research and prestigious scholarships, observes. "Lately, UMBC has been winning very prestigious scholarships, and I think part of the success has to do with encouraging our students to be themselves throughout the process."

"I think that's the beauty of this school," Troutman shares. "You can be whoever you want. And it's not just something that you say to get people in here. It's like, no, they're actually backing it up with the things that they do. It's really about the students."

For Troutman, his research, civic engagement, and leadership are all about one thing: making positive social change.

"While Jordan was working in my lab, I was gratified to see his enthusiasm grow as he realized that his technical research could be a part of the efforts he was already making toward creating positive change in our society," Foulds says. "Jordan is on a path toward becoming an ethical leader and a thought leader who can help steer the course of progress in AI technology in the right direction."

Ultimately, Troutman says, "What I want to do is just help people see their ideas come true." ■

Jordan Troutman, far left, attends a lab meeting in fall 2019 with James Foulds (right rear, green shirt) and his peers. Photo by Marlayna Demond '11 for UMBC.

COEIT TIMELINE

2001

ENGINEER OF THE YEAR AWARDED TO GINO J. GEMIGNANI, JR., SENIOR VICE PRESIDENT, WHITING-TURNER CONTRACTING COMPANY.

INFORMATION SYSTEMS RECEIVES NEW CODE TO DISTINGUISH IS ONLINE MASTER'S STUDENTS FROM IS MASTER'S STUDENTS ENROLLED ON CAMPUS.

2002

ENGINEER OF THE YEAR AWARDED TO JAMES F. PITTS, VICE PRESIDENT AND GENERAL MANAGER, AEROSPACE SYSTEMS NORTHROP GRUMMAN CORPORATION ELECTRONIC SYSTEMS SECTOR DIVISION.

2003

THE INFORMATION TECHNOLOGY/ENGINEERING BUILDING OPENED, SERVING AS A MODEL FOR CREATING SYMBIOTIC RELATIONS BETWEEN ENGINEERING AND RELATED INFORMATION TECHNOLOGY TRANSFER.

THE MARYLAND HIGHER EDUCATION COMMISSION (MHEC) APPROVES UMBC'S REQUEST TO OFFER AN M.S. AND PH.D. IN COMPUTER ENGINEERING.

2004

ENGINEER OF THE YEAR AWARDED TO MICHELLE BROWN DUTTON, DIRECTOR OF NETWORK PLANNING AND ENGINEERING FOR VERIZON'SWEST VIRGINIA, WESTERN CENTRAL AND NORTHEASTERN PENNSYLVANIA AREAS.

THE MARYLAND HIGHER EDUCATION COMMISSION (MHEC) APPROVES UMBC'S REQUEST FOR TITLE CHANGES FOR THE MASTER'S AND DOCTORAL DEGREE IN CHEMICAL ENGINEERING TO CHEMICAL AND BIOCHEMICAL ENGINEERING.

MHEC APPROVES UMBC'S REQUEST TO CHANGE THE THE NAME OF THE BACHELOR OF ARTS DEGREE IN INFORMATION SYSTEMS TO BUSINESS TECHNOLOGY ADMINISTRATION.

2005

INFORMATION SYSTEMS IS FOLDED INTO THE COLLEGE OF ENGINEERING CREATING THE COLLEGE OF ENGINEERING AND INFORMATION TECHNOLOGY (COEIT).

COEIT BY THE NUMBERS

Bachelor's Degrees by the Numbers

42%
INCREASE IN BACHELOR'S DEGREES 2016 – 2021

130%
INCREASE IN AFRICAN AMERICAN DEGREES 2016 – 2021

92%
INCREASE IN FEMALE DEGREES 2016 – 2021

96%
INCREASE IN HISPANIC/LATINX DEGREES 2016 – 2021

Graduate Degrees by the Numbers

54%
INCREASE IN MASTER'S DEGREES 2016 – 2021

207%
INCREASE IN APPLICATIONS 2016 – 2021

93%
INCREASE IN INTERNATIONAL MASTER'S DEGREES 2016 – 2021

89%
INCREASE IN HISPANIC/LATINX MASTER'S DEGREES 2016 – 2021

The College by the Numbers

39%
INCREASE IN ENROLLMENTS (HEADCOUNT) 2012 – 2021

58%
INCREASE IN CREDIT HOURS 2012 – 2021

83%
INCREASE IN RESEARCH AWARDS 2012 – 2021

77%
INCREASE IN RESEARCH EXPENDITURES 2012 – 2021

136%
INCREASE IN F&A RECOVERIES 2012 – 2021

COEIT TIMELINE

2006

DR. WARREN R. DEVRIES BECOMES THE THIRD DEAN OF THE COLLEGE OF ENGINEERING AND INFORMATION TECHNOLOGY (COEIT).

THE MARYLAND HIGHER EDUCATION COMMISSION (MHEC) APPROVES UMBC'S REQUEST TO OFFER M.S. AND PH.D. PROGRAMS IN HUMAN CENTERED COMPUTING.

MARIE DESJARDINS, ASSISTANT PROFESSOR OF CSEE RECEIVED A NATIONAL SCIENCE FOUNDATION (NSF) CAREER AWARD

2007

MORE THAN 500 MIDDLE-SCHOOL YOUTH AND THEIR FAMILIES PARTICIPATED IN THE ANNUAL FIRST LEGO LEAGUE STATE TOURNAMENT AT UMBC. THE COMPETITION BUILDS STUDENTS' ABILITY TO DESIGN AND PROGRAM LEGO ROBOTS, AND THE UNIVERSITY PROVIDES FACULTY AND STAFF SUPPORT, COORDINATED BY ANNE SPENCE, ASSISTANT PROFESSOR OF MECHANICAL ENGINEERING. SPENCE RECEIVED THE 2007 VOLUNTEER OF THE YEAR AWARD FROM THE FIRST LEGO LEAGUE OF MARYLAND FOR HER WORK WITH THE LEAGUE, PROJECT LEAD THE WAY AND STUDENTS AT UMBC.

MHEC APPROVES NEW M.S. DEGREE PROGRAM IN SYSTEMS ENGINEERING.

2008

A CHEMICAL ENGINEERING STUDENT–SIMON GRAY '08--WAS ONE OF THREE UMBC GRADUATES TO RECEIVE ONE OF THE WORLD'S MOST SELECTIVE ACADEMIC AWARDS, THE GATES CAMBRIDGE FELLOWSHIP.

2009

THE SOCIETY OF AUTOMOTIVE ENGINEERS (SAE) MINI BAJA TEAM RANKED 7TH OUT OF 100 TEAMS AT THE 2009 SAE BAJA EAST RACE..

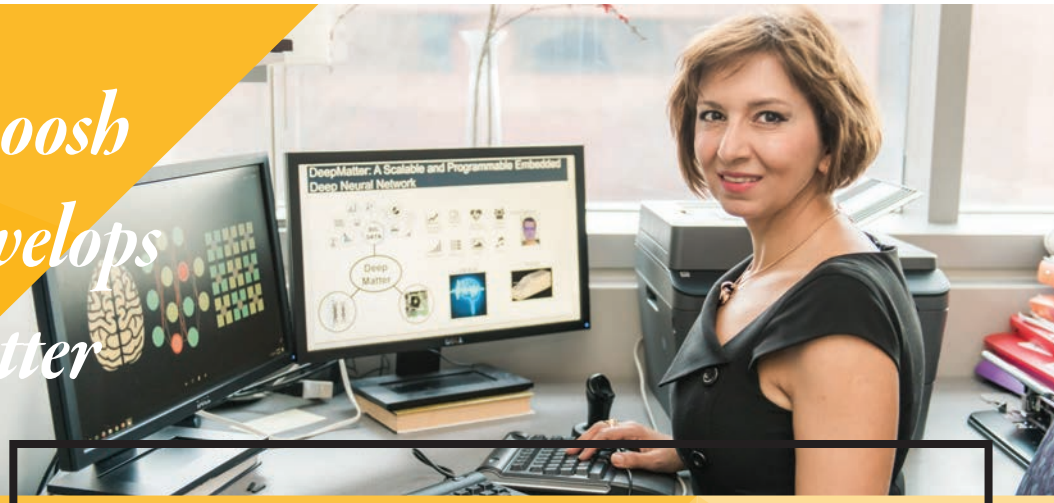
2010

UMBC MINI BAJA TEAM BECOMES ELIGIBLE FOR THE IRON TEAM AWARD THAT IS THAT IS GIVEN TO THE TOP THREE TEAMS AS DETERMINED FROM ALL THREE RACES IN NORTH AMERICA. THIS IS THE FIRST TIME THAT UMBC COMPETED IN ALL THREE RACES. UMBC FINISHED SECOND BEHIND A CANADIAN UNIVERSITY AND TOOK HOME THREE TROPHIES: 1ST IN COST, 5TH OVERALL, AND 2ND IN NORTH AMERICA AND THE TOP USA TEAM.

COLLEGE GROWS TO 126 FACULTY AND STAFF (77 TENURE/ TENURE TRACK, 12 LECTURERS, 2 PROFESSORS OF THE PRACTICE AND 35 STAFF).

FACULTY ACCOMPLISHMENTS AND RESEARCH

UMBC's Tinoosh Mohsenin develops COVID-Matter framework to determine severity of respiratory disease



Tinoosh Mohsenin. Photo by Marlayna Demond '11 for UMBC.

Megan Hanks

WHEN COVID-19 upended daily life a year and a half ago, scientists and engineers worldwide responded with new research on detecting, tracking, and managing cases. UMBC's Tinoosh Mohsenin, associate professor of computer science and electrical engineering, has partnered with Mohammad Sajadi, associate professor at the Institute of Human Virology at University of Maryland, Baltimore (UMB) to develop COVID-Matter. It's a technology to identify respiratory disease, associated symptoms, and their severity.

COVID-Matter collects a broad range of complex physiological data and then applies machine learning techniques to understand the data and assess the severity of a patient's respiratory disease. The data collected include the sound and frequency of a patient's speech, cough, and breathing sounds.

From these sounds, the tool can extract important information, such as breathing rate, used to identify shortness of breath. The framework can also include facial recognition and patients' reported levels of fatigue and confusion, to further improve its accuracy. ▹

REAL-TIME, ACCESSIBLE SOLUTIONS

The research team recently published a peer-reviewed conference paper describing their reconfigurable software-hardware machine learning framework for automatic detection of respiratory symptoms. They've also contributed a chapter in Healthcare Technology Solutions for Pandemics – A Roadmap, to be published by Springer Nature.

"Our vision is to provide a machine learning detection framework that can provide early detection for anyone and anywhere," explains Mohsenin. "The globally collected data from such a framework can be used to study the spread of COVID-19 as well as other viral respiratory diseases among different populations and locations, and to inform and educate the population about how these diseases spread in real time."

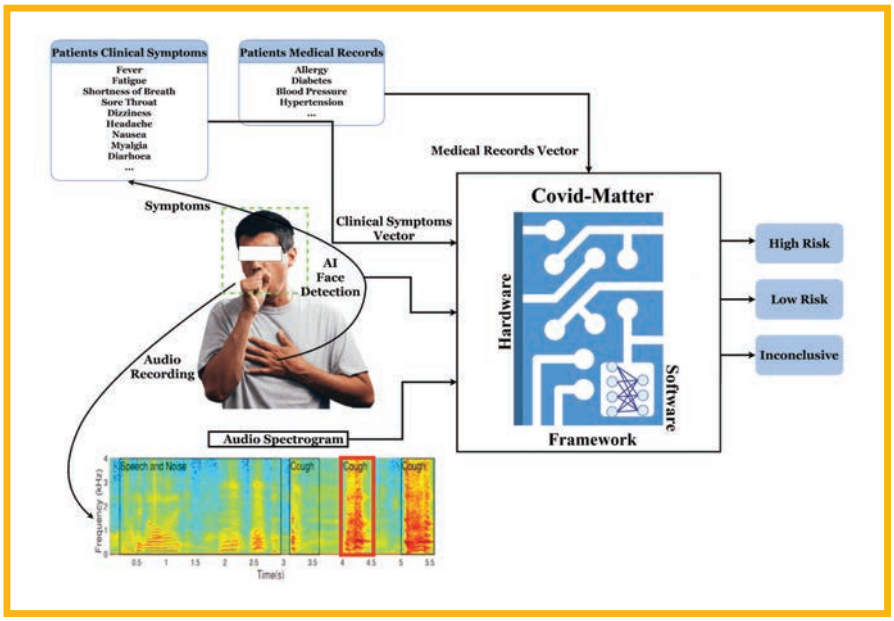
Sajadi says that this COVID-Matter technology will be helpful to him in his practice of medicine. "Being an infectious diseases physician, since the start of the pandemic I have fielded many questions from COVID-19 patients from around the world," he explains. "When I am talking to a patient, one of my main concerns is determining when they should seek more intensive medical help such as a trip to the ER. A tool such as the one we are developing would be extremely helpful in these situations."

USING AI TO ANALYZE SYMPTOMS

The technology will be accessible on smartphones and tablets, which will make it easier for patients to send real-time symptom updates to their physicians. By applying artificial intelligence to analyze symptoms and determine disease severity, physicians can determine if the patient's symptoms need to be assessed in-person or if virtual care is more appropriate. This enables patients to avoid unnecessary doctor's office visits, and could potentially help free up medical resources without negatively impacting patient care.

"Our goal in this research is to allow machine learning models running on general computing processors, such as those found in smartphones and tablets, to assess patients in a way similar to what doctors do at triage and telemedicine," says Mohsenin. "We want to use passively recorded audio and video and self-declared information to bring proactive healthcare to users' fingertips. This tool will help users to estimate the urgency and necessity of whether they need to be further examined at a clinic or a specialized facility."

Making this technology available independent of a medical facility "is critical for early assessment of respiratory symptoms," she explains, which could help limit future disease spread. ▷



A diagram of the COVID-Matter technology. Image courtesy of Mohsenin.

IMPROVING PUBLIC HEALTH

The research team also includes researchers from the University of Maryland School of Medicine and received funding through the Accelerated Translational Incubator Pilot (ATIP) Program. Through a grant competition hosted by the UMB Institute for Clinical and Translational Research, the ATIP award provides seed funding for researchers at UMB and in the community to address issues related to COVID-19 and to improve public health.

ATIP brings together faculty at UMBC and UMB for high-impact multidisciplinary research collaborations. "This is the first time I am working with engineers and it has been an eye-opening experience, from learning the vocabulary to understanding the tremendous potential of AI-based projects. It is something I have enjoyed very much," says Sajadi.

"With the inputs that we receive from Dr. Sajadi we have been able to improve our machine learning models and assess our overall goals," says Mohsenin. "Together, we have made significant progress." ▪

Tinoosh Mohsenin, center, with her two Ph.D. students who are working on COVID-Matter. Photo courtesy of Mohsenin.

"OUR VISION IS TO PROVIDE A MACHINE LEARNING DETECTION FRAMEWORK THAT CAN PROVIDE EARLY DETECTION FOR ANYONE AND ANYWHERE."

Tinoosh Mohsenin

Some of the iHARP research team. Photo by Marlayna Demond '11 for UMBC.

UMBC to lead climate-focused NSF data science institute through $13M award

Megan Hanks

Tens of millions of people live in areas that are at risk for flooding due to climate change, sea level rise, and melting of glaciers. UMBC's Maryam Rahnemoonfar and a team of researchers are using data science, machine learning, and artificial intelligence (AI) to analyze enormous volumes of climate data, and Arctic and Antarctic observations in ways that could help populations prepare for and respond to these risks.

Rahnemoonfar, associate professor of information systems, is the principal investigator on a new five-year, $13 million grant from the National Science Foundation's Harnessing the Data Revolution (HDR) Big Idea program. Through the grant, she will launch and direct iHARP, the NSF HDR Institute for Harnessing Data and Model Revolution in the Polar Regions.

"It is so exciting to be selected as one of the five HDR institutes in the nation, however, this comes with huge responsibility," she says. "We are the first data science and machine learning institute in the world that is dedicated to research in polar regions."

DATA SCIENCE MEETS CLIMATE SCIENCE

Climate scientists rely on data that are incredibly challenging to disentangle, Rahnemoonfar explains. AI offers solutions to analyzing these large datasets, providing sophisticated models that make the most use of the quantity and quality of data available.

The researchers involved with this grant will reduce uncertainties in projecting sea level rise by combining physics modeling, machine learning techniques, and data analysis. The results of their work will inform policymaking to address national and global priorities related to the climate crisis. Further, Rahnemoonfar notes, the team will investigate novel data science techniques that can be applied to other disciplines encountering challenges related to complex data.

TACKLING CHALLENGES TOGETHER

This project builds on research from Rahnemoonfar's prior collaborative project, Intelligent Solutions for Navigating Big Data from the Arctic and Antarctic, supported by a 2018 NSF grant and a 2019 Amazon Machine Learning Research Award. The team will continue this work on a larger scale. ▹

Photo credit: Iceland by @shawnanggg on unsplash.com, published January 15,2019.

"I am proud of our strong convergence team with many members who are leaders in their fields, including our domain scientists and data scientists, and I am thrilled to lead this effort," says Rahnemoonfar. She is working with co-PIs Jianwu Wang, associate professor of information systems at UMBC; Mathieu Morligehm at Dartmouth College; Shashi Shekhar at the University of Minnesota; and Jan Lenaerts at the University of Colorado Boulder.

Project collaborators have expertise in computer and information science, electrical engineering, civil and environmental engineering, Earth science, atmospheric science, oceanic science, mathematics, statistics, physics, geology, glaciology, and data science. An interdisciplinary approach, supported by the nimble nature of information systems, is essential to the team's success, says Vandana Janeja, chair and professor of IS at UMBC.

"Dr. Rahnemoonfar's groundbreaking climate change research involves a highly multidisciplinary team within IS and across multiple institutions," says Janeja. "This grant is an example of our faculty's bold research agenda and strong teams. This type of work has both led to wide community impacts and also translated into curriculum innovations with strong student engagement."

In addition to working with UMBC faculty, Rahnemoonfar will lead a group of researchers from institutions across the country, as well as government and industry researchers. These partners include the University of Colorado Boulder, Dartmouth College, University of Minnesota, University of Alaska Fairbanks, Bowie State University, Amherst College, University of Texas at Austin, NASA Universities Space Research Association, NASA Jet Propulsion Laboratory, NVIDIA, IBM, and Amazon.

EDUCATIONAL IMPACT

The grant will also involve dozens of undergraduate and graduate students and postdoctoral researchers. Rahnemoonfar and her team will engage students from underrepresented groups by working with UMBC's Center for Women in Technology and similar programs, as well as the Baltimore's Women in Machine Learning and Data Science chapter, which she currently leads.

Additionally, the project will support educational and outreach activities, with an eye toward workforce development. This includes programming for K-12 and college students, and lectures and training opportunities for data science and domain science professionals. Students will work alongside partners including NASA, Amazon, and IBM, and will have internship opportunities with federal and industry partners.

The research teams also plan to develop museum exhibits to help public audiences access their work.

IMPACT OF MULTI-DISCIPLINARY TEAMS

"This major multi-institutional NSF award reflects so much hard work and ingenuity. National programs like iHARP, with its focus on some of the great challenges our society is facing, add to UMBC's growing reputation for innovation and excellence in public impact research," says Karl V. Steiner, vice president for research at UMBC.

"The College is experiencing extraordinary research growth. This is

made possible by both the development of multidisciplinary teams and our increased focus on leadership development," says Keith J Bowman, dean of the College of Engineering and Information Technology. "This project team, and others recently funded or pending, benefit from the tremendous faculty talent we have recruited in the last several years."

The solutions that are developed through this work will have applications beyond environmental issues. Rahnemoonfar anticipates the team's research will impact the future of medicine, autonomous driving, and remote sensing, and that the students working on the project will become the next generation of experts addressing these global issues.

In addition to Rahnemoonfar and Wang, the UMBC team also includes Janeja; Aryya Gangopadhyay, professor of information systems; Masoud Yari, research assistant professor in information systems; Karen Chen, assistant professor of information systems; Osman Gani, assistant professor of information systems; and Don Engel, associate vice president for research development, and assistant professor of computer science and electrical engineering. ■

"NATIONAL PROGRAMS LIKE IHARP, WITH ITS FOCUS ON SOME OF THE GREAT CHALLENGES OUR SOCIETY IS FACING, ADD TO UMBC'S GROWING REPUTATION FOR INNOVATION AND EXCELLENCE IN PUBLIC IMPACT RESEARCH."

Karl V. Steiner

UMBC and Georgia State receive $3M NIMH grant to improve data-driven diagnosis of mood disorders

Megan Hanks

Tulay Adali, professor of computer science and electrical engineering (CSEE). Photo provided by Adali.

UMBC and Georgia State University have received a $3 million five-year grant from the National Institute of Mental Health (NIMH) for research supporting the diagnosis of mood disorders. Tulay Adali, professor of computer science and electrical engineering (CSEE) and distinguished university professor, will lead UMBC's portion of the research, which will receive about $870,000 in support.

Mental illnesses and mood disorders are complicated and can be challenging to identify, says Adali. Diagnoses are often made based on symptoms that a person experiences, rather than using quantifiable measures, and descriptions of symptoms can be quite variable and subjectively observed and evaluated.

The research team hopes to improve doctors' ability to diagnose mood disorders through more quantitative, consistent measures. They will develop dynamic approaches to understanding how the continuously changing state of the brain is affected by mental illness. And their recommendations will include data from a range of sources, to more accurately reflect the complexity of mental illness.

NEUROIMAGING COLLABORATION

Adali will work with her former graduate student Vince Calhoun, Ph.D. '02, electrical engineering. Calhoun is currently the director of the Center for Translational Research in Neuroimaging and Data Science (TReENDS) at Georgia State University. Adali and Calhoun have worked together on multiple research grants in the past.

In this project, the UMBC group led by Adali will focus on diagnostic methods, particularly the use of medical imaging data, including functional magnetic resonance imaging (fMRI). Adali and her team will develop multivariate data-driven models to help capture changes over time and space. They will apply these models to large datasets to evaluate their performance as diagnostic tools. The researchers will assess the reproducibility and replicability of the methods that are developed.

"I am especially excited about our proposal to identify homogeneous subgroups of subjects in a completely data-driven manner from neuroimaging data," says Adali. "We hope this will enable us to better define subtypes of mental disorders, and will help inform effective and personalized forms of therapy." ▪

COEIT TIMELINE

2011

THE CHEMICAL AND BIOCHEMICAL ENGINEERING DEPARTMENT AND THE CIVIL AND ENVIRONMENT ENGINEERING DEPARTMENTS ARE MERGED TO FORM THE DEPARTMENT OF CHEMICAL, BIOCHEMICAL AND ENVIRONMENTAL ENGINEERING (CBEE).

2012

UMBC COEIT HOLDS A MAJOR DIVERSITY SUMMIT WITH PANEL MEMBERS FROM CORPORATIONS AND ACADEMIA. THE PANEL COMPRISED OF AFRICAN AMERICAN WOMEN DEFINED DIVERSITY AND WHY IT MATTERS IN BOTH CORPORATE AND ACADEMIC ENVIRONMENTS. SPECIFIC STRATEGIES AND TO: SET APPROPRIATE GOALS FOR DIVERSITY AND INCLUSION IN YOUR ENVIRONMENT; OVERCOME COMMON CHALLENGES AND BARRIERS; BUILD SUBSTANTIAL PRACTICES FOR YOURSELF AND YOUR GROUP, DEPARTMENT OR COLLEGE; AND, LOOK AT DIVERSITY THROUGHOUT THE TALENT MANAGEMENT PROCESS (FROM ACQUISITION TO RETIREMENT).

2013

CIVIL ENGINEERING M.S. AND PH.D DEGREES REAMED AS ENVIRONMENTAL ENGINEERING.

TOTAL COEIT RESEARCH EXPENDITURES IS $11.87M WITH 216 TOTAL PROJECTS OF COEIT FACULTY IN DEPARTMENTS AND CENTERS.

2014

DR. JULIA M. ROSS BECOMES THE FOURTH COEIT DEAN AND THE FIRST WOMAN DEAN OF COEIT.

2015

UMBC COLLEGE OF ENGINEERING AND INFORMATION TECHNOLOGY AND THE DEPARTMENT OF MECHANICAL ENGINEERING HOSTS BAJA SAE MARYLAND 2015 COMPETITION. MORE THAN ONE HUNDRED TEAMS INCLUDING 30 INTERNATIONAL TEAMS FROM 8 COUNTRIES GATHERED AT BUDDS CREEK MOTOCROSS RACE TRACK FOR THE NATIONAL AUTOMOTIVE ENGINEERING AND DESIGN EVENT.

2016

COEIT AWARDS OVER 1,000 DEGREES FOR THE FIRST TIME (634 UNDERGRADUATE AND 370 GRADUATE DEGREES).

TOTAL COEIT RESEARCH EXPENDITURES IS $14.7M WITH 206 TOTAL PROJECTS OF COEIT FACULTY IN DEPARTMENTS AND CENTERS.

UMBC to partner with UMD, Army Research Lab to advance AI and autonomy through $68M collaboration

B. Rose Huber for UMBC News

Aryya Gangopadhyay and Nirmalya Roy with several students. Photo by Marlayna Demond '11 for UMBC.

From surveillance tools to autonomous machines, countries around the world are ramping up their military artificial intelligence (AI) assets. Such robust technologies are necessary to protect the United States from surprise attacks, which occur these days not only on the ground, but also on the cloud.

Advancing AI-based autonomous systems for military use will be the goal for a team of UMBC researchers that has recently been awarded a $20-million subcontract. UMBC will partner with the University of Maryland, College Park (UMD), and the DEVCOM Army Research Lab (ARL) on the $68-million, five-year endeavor, which ARL is funding. The goal is to strengthen Army AI technology so it is able to meet the demands of today's national defense.

"The question we're trying to solve is: Can we design and develop tools, techniques, algorithms, software, and hardware that can work autonomously and make their own decisions, but also collectively, interfacing with human decision makers?" says UMBC's principal investigator Aryya Gangopadhyay, professor of information systems. "The landscape of war is changing, and we must build systems that can make human-like decisions in real time and under real-world pressure." ▷

SECURE, EFFECTIVE, AND RESILIENT

The project, AI and Autonomy for Multi-Agent Systems (ArtIAMAS), aims to advance science and technology around three core research areas: collaborative autonomy; harnessing the data revolution; and human-machine teaming.

"As one of the research institutions in the University System of Maryland, we are delighted with this exciting next step in our statewide partnership with our colleagues at UMD and at the Army Research Lab," says Karl V. Steiner, vice president for research at UMBC. "Artificial intelligence is one of the key technologies in the ongoing transition to autonomous systems, both in the defense and civilian sectors, and it does take researchers from a variety of backgrounds to innovate and develop the most promising solutions. This alliance builds on the expertise and commitment of many of our colleagues."

TODAY'S CONFLICT LANDSCAPE

In the battlefield, there are soldiers with body cameras, guns with sensors, as well as ground-based and airborne machines operating in rough and volatile terrains. Retrieving data and making decisions from these multi-model sources can be difficult, especially in challenging networking conditions. Understanding and developing adaptable cross-domain solutions for these environments will be at the forefront of the work of co-principal investigator Nirmalya Roy, associate professor in information systems.

"There may not be time to send data to an army base or the cloud, so some of the processing, computing, and interference may be done on the devices themselves. How do you navigate the available computing resources in-hand and process data on the devices themselves to make an informed decision, and in real time? These are the concepts I'll be working on," Roy says. UMBC's role in the project will center on the second and third research thrusts.

More specifically, the UMBC team will develop solutions for AI-based networking, sensing, and edge computing — which brings data storage and computation closer to a location — for battlefield Internet of Things (IoT). This will allow them to deliver secure, effective, and resilient U.S. Army assets including AI systems related to search-and-rescue, surveillance, robots and machinery, and augmenting humans in performing decision-making tasks.

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Sensors that will be used for research. Photo by Marlayna Demond '11 for UMBC.

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With the work set to begin in mid-May 2021, the UMBC team will initially include more than eight researchers from the departments of information systems and computer science and electrical engineering, as well as scientists and engineers from the ARL. The Center for Real-time Distributed Sensing and Autonomy (CARDS) will lead the research being conducted by UMBC faculty.

Eventually, the team will grow to nearly 50 researchers, and future projects will include other University System of Maryland institutions. Together, the group will publish fundamental research and identify similar and cross-cutting research endeavors, improving collective information-sharing.

"This is an opportunity for UMBC to bring together talented researchers from across departments to participate in fundamental, and potentially groundbreaking, research," says Gangopadhyay. "To make a big impact in the research space, you need long-term, multi-institutional partnerships and collaborations. Working with the University of Maryland, College Park and the Army Research Lab will allow us to collectively advance AI in the military space."

In addition to Gangopadhyay and Roy, the UMBC team also includes Anupam Joshi, Tinoosh Mohsenin, Dmitri Perkins, Sanjay Purushotham, Maryam Rahnemoonfar, Jianwu Wang, and Ting Zhu. The ArtIAMAS cooperative agreement is led by PI Derek Paley, director of UMD's Maryland Robotics Center. ■

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>
> *Nirmalya Roy*

2017

DR. KEITH J. BOWMAN BECOMES THE FIFTH COEIT DEAN AND LIKELY FIRST OUT GAY MAN TO LEAD A BIOENGINEERING COLLEGE AT A PUBLIC RESEARCH UNIVERSITY.

NAOMI MBURU, '18, CHEMICAL ENGINEERING, BECOMES UMBC'S FIRST RHODES SCHOLAR.

2018

ENGINEERING AND COMPUTING EDUCATION PROGRAM (ECEP) CREATED AND APPROVED.

COLLEGE GROWS TO 146 FACULTY AND STAFF (84 TENURE/ TENURE TRACK, 16 LECTURERS, 3 PROFESSORS OF THE PRACTICE AND 43 STAFF).

2019

NEW ASSOCIATE DEAN FOR RESEARCH AND FACULTY DEVELOPMENT POSITION TAKEN ON BY DR. ERIN LAVIK, A PROFESSOR IN CBEE.

COEIT AWARDS 1,076 UNDERGRADUATE AND GRADUATE DEGREES (726 UNDERGRADUATE AND 350 GRADUATE DEGREES).

2020

A GLOBAL PANDEMIC IMPACTS US ALL.

2022

UMBC NAMED A CARNEGIE R1 INSTITUTION.


UMBC