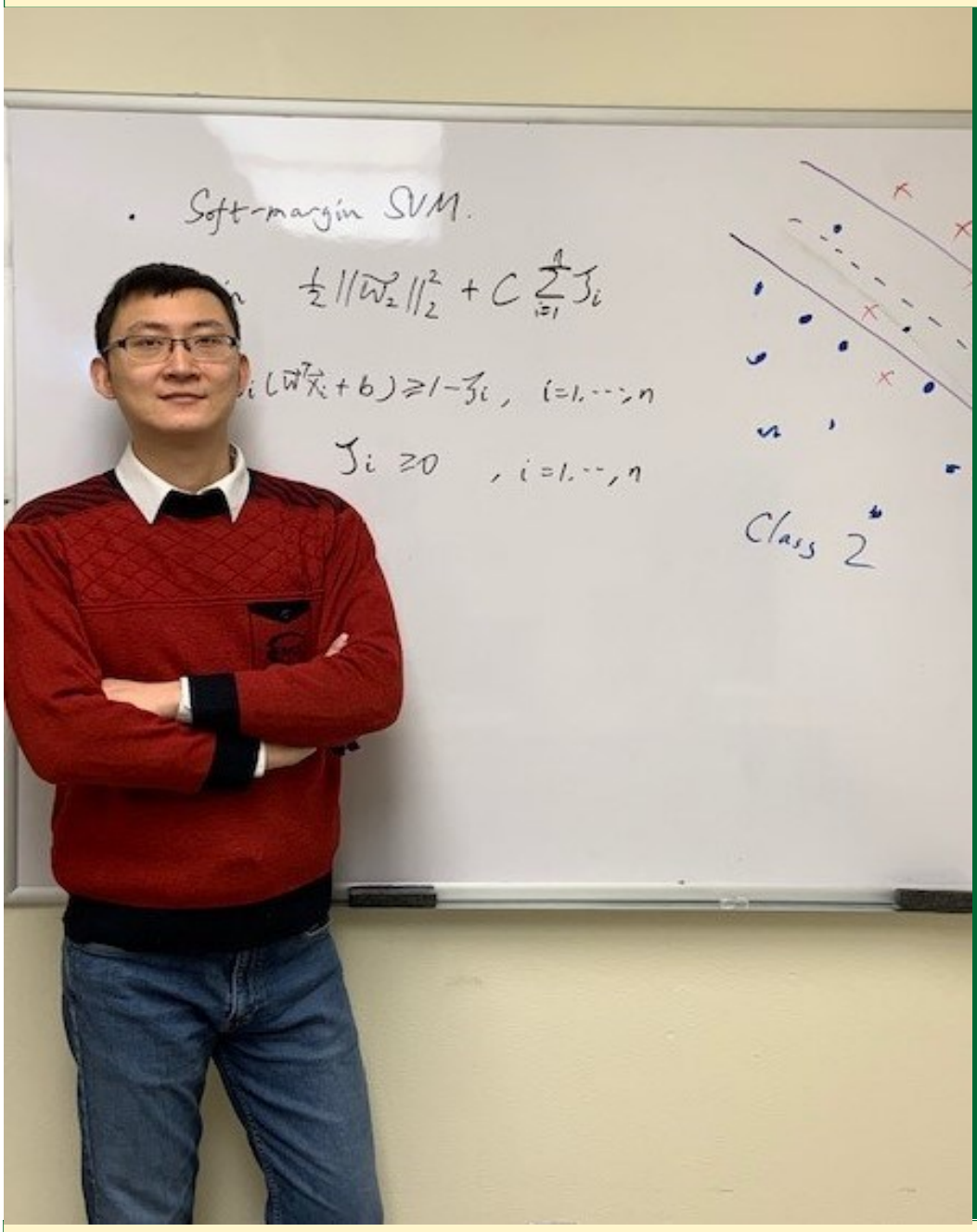
NDSU INDUSTRIAL AND MANUFACTURING ENGINEERING

Issue 4 Fall 2020

IME NEWSLETTER



Inside this Issue:

Dates to Remember:

- Spring 2020 Classes begin Jan. 11th
- Spring Career Fair every Thurs. in February
- Mar. 15th-19th Spring Break
- April 29th Capstone Presentations
- April 30th Capstone Banquet
- April 30th Spring Advisory Board Meeting
- May 15th Spring Commencement

Cover Story: Machine Learning in Engineering

COVER STORY: Machine Learning in Engineering— by Dr. Xu

The following narrative is written by Dr. Xu, an assistant professor in the IME department. He has a PhD in Systems & Industrial Engineering which he received at the University of Arizona in 2015 and is the instructor for our machine learning course.

What is machine learning?

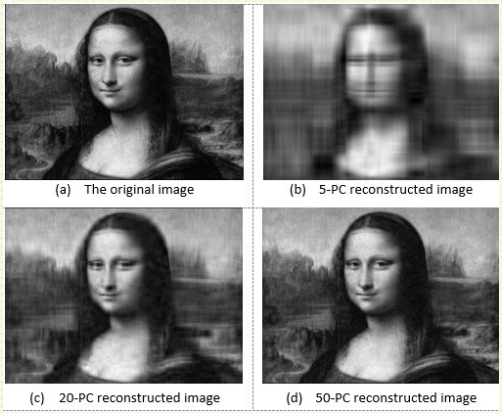
Machine learning (ML) uses interdisciplinary techniques such as optimization, statistics, and linear algebra to create systems that can sift through large volumes of data at high speeds to make predictions or decisions. ML algorithms directly build models based on sample data (i.e., the "training data") to make automated predictions/decisions *without being explicitly programed* to do so, as opposed to traditional algorithms. Simply stated, "ML is a subfield of artificial intelligence (AI) based on the idea that systems can learn from data, identify patterns, and make decisions with minimal human intervention".

Why is machine learning so important in our world today?

We are in an era of "big data", and clearly the big "trend" in society is towards digitalization and automation. However, it is impossible for us to explicitly program everything, as there are too many detailed incidences that need to be considered and explicitly coded. This requires us to apply ML algorithms to let the machine learn by itself. The application of ML and its benefits can already be witnessed by anyone using today's technologies. From self-driving cars, speech recognition, digital searches for web and music, voice commands, to social media (e.g., Facebook friend suggestions, YouTube interests and ads), and robots to vacuum our floors and medical image analysis systems. As an engineer, it is extremely important for us to know these ML techniques and apply them to improve the world now and in the future. ML is a continuously developing field. As big data keeps getting bigger, and computing becomes more powerful and affordable, ML will drive greater efficiency in our lives.

The importance of machine learning in engineering.

For any engineer looking to pursue a career in a cutting-edge field, ML provides an exciting option that opens up a multitude of possibilities in research and development. Combining the skill set of an engineer with the power of ML to create entirely new ways to use data and technology is very compelling. The IME Department strives to prepare their students for the future by offering relevant course material. We now offer, *IME 465: Introduction to Machine Learning* and hope to get approved *IME 765: Data Analytics*. In IME 465, we start from the very beginning Python coding, and introduce fundamental topics of ML, including but not limited to: regression analysis, model selection, classification, clustering, and feature learning. The focus of IME 465 is on application and coding. The images seen here are some of the applications discussed in the course.



PC reconstruction of "Mona Lisa Smile"


(a) The original film


(b) Film by 2-means clustering

Tumor detection from MRI film

DEPARTMENT NEWS…

IME department working together with the Jamestown Regional Entrepreneur Center

Thanks to one of our newest graduate students, Katherine Roth, the IME department is working together with the Jamestown Regional Entrepreneur Center (JREcenter)! Katherine is the Executive Director of the JREcenter which was established to create rural startups in nine counties in the Jamestown area. They offer entrepreneurship events to gather and network individuals interested in various industries. They also provide customized training and individual technical assistance to help with starting and building a business—all free of charge!

Katherine has been a great conduit for our department. She has opened the door for NDSU to participate this past October in the 4th annual Manufacturing Day at the University of Jamestown campus organized by the JREcenter. Manufacturing Day is held to give students in grades 9-12 an idea of what career opportunities exist in the manufacturing industry. It's a great way to learn about employment opportunities as well as the educational tracks that can help them reach their goals. Through the JREcenter, Katherine has also introduced us to several startup companies looking for help with specific problems. One such introduction has led to one of our senior capstone sponsors, Dakota Fiber Mill out of Kindred, ND.

We look forward to working with Katherine and the JREcenter for continued success and opportunities!

Saeid Rasti, PhD recipient

Fall Graduates:

Congratulations to all of our graduates!

Fall Undergrads:
IEM – 13
Mfg – 6

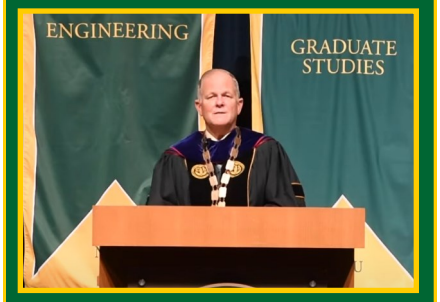
Grad students:
Saeid Rasti received his PhD in IME. His dissertation was on "Two Applications of Combinatorial Branch-and Bound in Complex Networks and Transportation"

Mahabubur Rahaman received his PhD in IME. His dissertation was on the "Study of Organizational Transformation from Socio-Technical Perspective"

Fall Commencement

NDSU's winter commencement was held virtually due to COVID-19 restrictions. You can view the ceremony that was held on December 18th using the QR code below.

The online celebration includes messages from President Dean L. Bresciani, Provost Margaret Fitzgerald, college deans and our very own IME student speaker Darby Beyer!



President Dean Bresciani

Darby Beyer

AWARDS & RECOGNITION…

IME student, Darby Beyer, chosen to speak as the class representative for Fall 2020 Commencement

"We students have loved our time here at NDSU, we are lucky to have been given many opportunities and we will always be Bison."

During her time at NDSU, Beyer has been active in the Society of Women Engineers, participating in two national and two local conferences. She also took part in the NDSU chapter of the Institute of Electrical and Electronics Engineers and student government. In addition, she was a member of the Tau Beta Pi honor society and a past member of the Eta Kappa Nu electrical engineering honor society. She also belongs to the Kappa Alpha Theta sorority.

Based on her personal experiences, Beyer doesn't hesitate when she's asked if she would suggest NDSU to others who are considering higher education. "NDSU was absolutely the best choice for me," she said. "NDSU was the perfect size for me to flourish by giving me the ability to know all of my professors personally, while allowing me to be involved nationally with organizations. Being in Fargo has been great because the community is supportive and welcoming of NDSU students."

Congratulations Darby! Best wishes as you start your career as a systems engineer with Honeywell in Minneapolis.

Dr. Kambiz Farahmand named as member of the NDSU Chapter of the National Academy of Inventors (NAI)

Dr. Farahmand, IME Professor, was 1 of 3 NDSU faculty awarded memberships in NAI this fall. Dr. Farahmand has been involved in joint research and consulting with DOE, ARMY, NAVY, NASA, VHA, and many other industries. As part of his research with U.S. Navy, he invented an oral heat probe designed to measure heat and mass transfer coefficient inside the oral cavity. The probe is a unique tool for determining the effects of various respiratory apparatuses, protective masks, and face garments on ventilation. He also invented a heat probe for intra-airway nasal cavity heat and vapor transfer measurement. The probe is designed to be inserted inside the nasal cavity to collect temperature and humidity data from both the airway and surrounding tissue.

NAI 2020 recipients: Dr. Braaten (ECE), Dr. Farahmand (IME), and Dr. Nawarathna (ECE) presented by the Dean of CoE, Dr. Kessler

The NAI is a member organization comprised of U.S. and international universities, and governmental and non-profit research institutes. It recognizes and encourage inventors with patents issued from the United States Patent and Trademark Office, enhances the visibility of academic technology and innovation, encourages the disclosure of intellectual property, educates and mentors students, and translates the inventions of its members to benefit society.

NOTE WORTHY HAPPENINGS…

The Fall Advisory Board Meeting was held via zoom on October 2nd. Theodore Zipoy was nominated and voted onto the board, giving the board roster 20 current members. The new student body ex officio is Ben Nordmark. Highlights of the meeting were discussions regarding the new hyflex teaching model, enrollment trends, ABET curriculum assessment and review, Dr. Val Marinov's retirement, and an update from Dean Kessler.

NDSU's 5th Annual Giving Day Crushes Fundraising Record

In spite of this year's pandemic and economic hardships, the generosity of alumni and friends of NDSU surpassed everyone's expectations. Benefactors gifted more than $1.3 million through more than 1,700 gifts (previous record was $936k). The College of Engineering raised $378k with a total of $14.5k for the IME department which helps update lab and classroom equipment, fund student organizations and IME scholarships!

For those who are not familiar with Giving Day, it is a 24-hour grassroots digital fundraising campaign designed to bring together multiple NDSU communities to inspire giving in support of the university and its students. Commitments from benefactors prior to Giving Day to establish matches and challenges are used to inspire others to give. A **BIG SHOUTOUT** to fellow IME alumni, Paul Madson and his wife Sharon, for their generosity in providing a match in the College of Engineering!

Every gift made on NDSU's Giving Day counts toward the $400 million goal of "In Our Hands: The Campaign for North Dakota State University," which publicly launched in Oct. 2019. As of Oct. 31, 2020, the campaign has raised more than $377,800,000 to enhance the NDSU experience. *Thank you to all who gave!!!!*

CB ^{2} Annual Fall Meeting

Center for Bioplastics and Biocomposites

The Center for Bioplastics and Biocomposites (CB²) held its Fall meeting virtually November 17-18. The meeting began with a virtual social hour to kick off the two days of meetings. While many enjoyed the virtual format again, there is hope to return to meeting in person again soon once Covid-19 is under control and business can resume travel. The total attendance for the meeting was 85, with 33 Industry Advisory Board members, 29 faculty members, 6 staff, 10 students, and 7 guests. The IAB reviewed 18 proposals for 2021 CB^2 projects and voted to approve 10 of them for funding, with a total of $582,613. The center also welcomed its newest members at the meeting. The Agricultural Utilization Research Institute and Amazon both joined CB^2, bringing the total of current member companies up to 31.

CB^2 also submitted their proposal to the National Science Foundation for Phase II of the Industry-University Cooperative Research Program. Each of the four university sites, Iowa State University, North Dakota State University, Washington State University, and the University of Georgia, all submitted their respective proposals for Phase II awards. Phase II of the center is proposed to last 5 years and will carry the center towards "graduation" from NSF after that. CB^2 is excited for the growth and looks forward to continuing its progress into 2021.

For more information regarding CB², please use the QR code on the right.

SPOTLIGHTS...

Alumni Spotlight..... Kim Heinle Nelson

Kim Heinle Nelson, is a 1991 NDSU IME alum. She is now a Senior Quality Engineer Manager for Digi-Key Electronics. Kim states, "As a Senior Quality Engineer Manager, I lead cross-functional business teams, identify engineering excellence priorities, and apply engineering philosophy and operations research to business models and design improvements". Kim was featured in the November 2020 issue of *Design World* magazine for "Women in Engineering". When asked who helped shape her decision to become an engineer, "My advisor at North Dakota State University, Professor Elvin Isgrig, was such an inspiration and great mentor. I was enrolled in the General Engineering and Architecture Program when he presented an introduction to Industrial Engineering. His presentation is why I changed my major to Industrial Engineering and Management. Professor Isgrig even visited my workplace many years after graduation because he was interested in what I was doing and what I had accomplished since college." When asked what lessons she has learned in her 29 year career at Digi-Key, Nelson stated, "One of my greatest compliments came from the president of our company when he said, "You are not the typical engineer because you know how to get along with people." I am successful by listening to people around me, taking a hands-on approach, thinking creatively, and approaching projects with a positive attitude.

To read the full article, use the QR code on the right.

RESEARCH/GRANTS...

ND EPSCoR Seed Grant

Dr. Yodo received a $10,000 seed grant awarded to help find new bio materials for 3-D printing with data harvesting .

ND EPSCoR Seed Grant

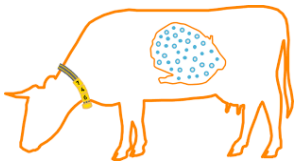
Dr. Narayanan received $40,000 to put towards the purchase of a bio printer for tissue engineering research and teaching.

ND EPSCoR Seed Grant

Dr. Tim Q. Le received $33,500 to purchase a bed side monitor and polysomnography system for the sleep lab.

Cargill

Dr. Grewell was awarded $111,963 to research rumen roughage replacement

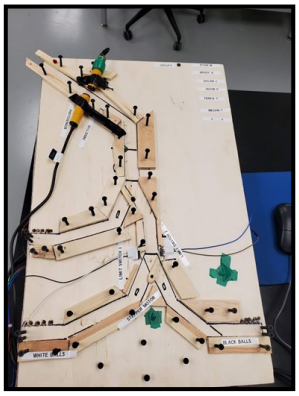


ND Soybean Council

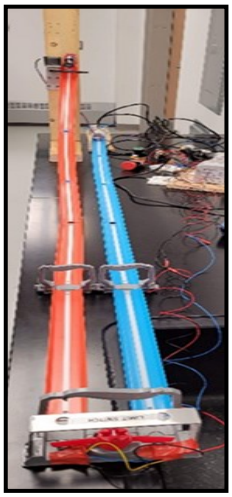
An award of $27,125 was received by Dr. Yodo to develop cost-effective soy based garden pots.

FALL AUTOMATION PROJECTS…

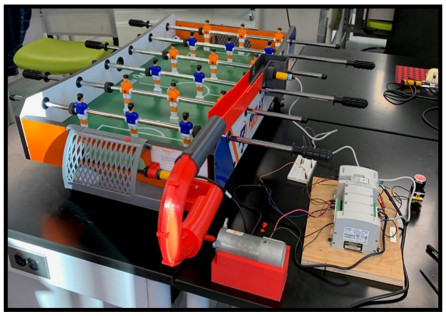
In IME 482 (Automated Manufacturing Systems) students learn how to use automation software, tools and equipment such as plc's (programmable logic control). The course it taught by Dr. Narayanan and involves a final group project which requires designing a simple automation system. The following designs are from this year's demonstrated projects. Group/lab work was no small feat considering COVID-19 restrictions this semester!



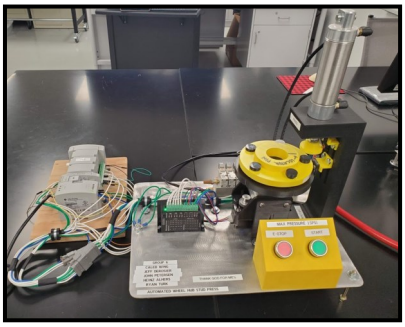
Marble Sorting
A system to differentiate and sort black marbles and clear marbles.



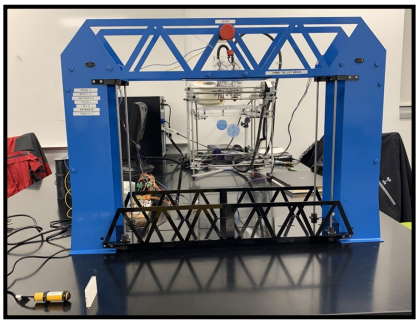
Hot Wheels Racetrack
A prototype hardware system for judgement of winner in a Hot Wheels Racetrack set that is powered by a motor and pneumatic cylinder.



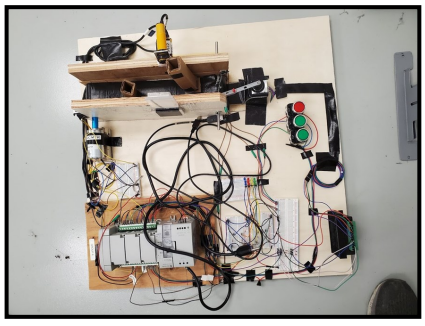
Automated Foosball Return
An automatic foosball return that would return the ball to gameplay after the ball was scored on one of the goal ends.



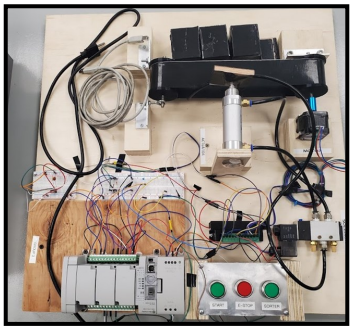
Wheel Hub Stud Press
An automated pneumatic stud press that was able to rotate the hub to 5 different positions and press each stud into a hub.



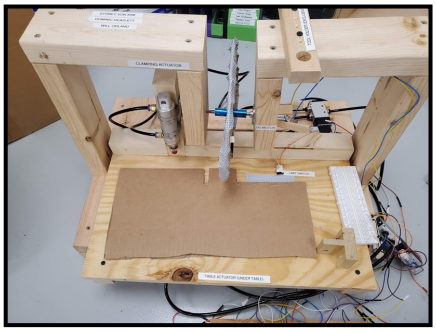
Lift Bridge
A vertical lift bridge system with the ability to move the bridge when a vehicle approaches the sensor, to safely position the bridge up or down, and to stop its motors by the pressing of an emergency button.



Automated Conveyor System
A small-scale automated conveyor system, with the ability to sort parcels based on their height.



Sorting System
An automated programable control system that can distinguish between different sizes of packages that are manually placed on the conveyor belt.



Automatic Saw
An automatic saw that can detect and cut material to length when placed.

Looking for more information about the IME department or past newsletters?

Check us out on our website at: NDSU.edu/ime

You can also connect with us on Facebook!

Industrial & Manufacturing Engineering

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