DAKOTA STATE UNIVERSITY

RESEARCH WEEK SYMPOSIUM

THURSDAY, MARCH 20
12:30 P.M. - 4 P.M.

THE BEACOM INSTITUTE OF TECHNOLOGY

2025

WELCOME TO RESEARCH WEEK!

Peter Hoesing, Ph.D., CRA
Associate Vice President
Research & Economic Development

Welcome Researchers and Guests!

DSU's Annual Research Week brings together the brightest minds from across all disciplines represented among DSU students, faculty, and collaborators. We are honored to welcome our distinguished guests; thank you for celebrating DSU research and creative activity with us! Here are a few highlights from the week:

» Our College of Business and Information Systems kicked off the week with its Data Analytics Competition, sponsored by Sanford Health

» Thanks to the leadership of Dean Hawkes and his staff, our annual Doctoral Residency has been in session all week. Doctoral students come during Research Week to discuss their research, meet with faculty, hear from alumni, and defend both proposals and dissertations. Congratulations to all who have chalked major degree milestones this week!

» To inspire doctoral residents' entrepreneurial thinking, we also welcomed 2024 Governor's Giant Vision winner Will Cromarty of Kirkwall Defense, Inc. for a lunch and talk sponsored by the Paulson Cyber and Economic Development Center

Now we turn toward our annual Research Symposium, which serves as a platform for student and faculty researchers to share their groundbreaking work. This is a prime opportunity to experience and foster intellectual community, encourage intellectual growth and celebrate discovery. We welcome you to enjoy the research posters and to ask good, juicy, challenging questions that will propel future work. Check out a new feature of the Symposium in classroom 117, where we'll have conference-style talks by three faculty there with some student collaborators.

Please stick around for networking and snacks during the transition to our 3 p.m. Keynote Address by Dennis Eger, and we'll see you at DakotaCon 12 this weekend!

KEYNOTE SPEAKER

Dennis Eger

Senior Executive
Department of Defense

Mr. Dennis Eger serves as the Senior Executive for the U.S. Army's Open-Source Intelligence Program. Mr. Eger's government career spans 37 years, 33 of which were within U.S. Army Intelligence, having performed in senior leadership and senior executive positions for the last 19 years.

Mr. Eger's assignments include supporting the National Security Agency (NSA), the Intelligence Center of Excellence (ICOE), NATO Headquarters in Brussels Belgium, Director of senior enlisted executive education and personnel, Pentagon, and culminating as the Senior Advisor for U.S. Army intelligence in the Pentagon. He led and advised numerous organizations, supporting over 60,000 personnel on intelligence and matters of national security. Mr. Eger also spent time in industry as a Director of Programs within the Veterans Administration, designing and leading education programs for civilian employees. He is a guest lecturer at several higher-education institutions, a seasoned public speaker, and is pursuing his doctoral degree from Vanderbilt University.

Dennis holds a master's degree in human resources, a bachelor's in behavioral science and certifications as a coach, resiliency trainer, facilitator, and instructor. Mr. Eger's speaking roles focus on his passions for crisis leadership, program/process evaluation, change management, organizational leadership, and leadership development.

FACULTY RESEARCH POSTERS

ANDY BEHRENS, PH.D. AND CHERIE NOTEBOOM, PH.D.
COLLEGE OF BUSINESS & INFORMATION SYSTEMS

Provider Perspectives on Sociotechnical Alignment of Intelligent Clinical Decision Support Systems

AI is being perceived more as an integral component to intelligent clinical decision support systems (ICDSS). However, AI is still viewed as a significant concern of providers as it is being integrated into their decision-making process. Current resistance is due to the implication of AI changing their workflow and contributing to information overload. Consequently, research shows that fewer providers share this viewpoint and view it as an assistant. The ICDSS can be used strategically to assist providers to provide better patient care. There are current concerns with how the decisions are calculated, explained, justified, recommended, designed, and demonstrated within the ICDSS. Providers understand the utility of the system but there are still concerns that burden them. The purpose of this study is to understand the perspectives of providers on ICDSS. These findings can be further used to inform design principles or be implemented as a prototype in future research endeavors.

CHAD R. FENNER, PH.D., THE BEACOM COLLEGE OF COMPUTER & CYBER SCIENCES, CHERIE BAKER NOTEBOOM, PH.D., COLLEGE OF BUSINESS & INFORMATION SYSTEMS

Digital Divide to Digital Isolation: Perceptions of Native American Students

The rapid advancement of emerging technologies, such as Artificial Intelligence (AI) and quantum computing, is exacerbating the digital divide in many Native American communities. Access to broadband and the development of digital literacy are increasingly critical for securing job opportunities, accessing knowledge and information, receiving emergency notifications, and utilizing essential services. However, less than fifty percent of Native American households have reliable Internet access. This study employed a qualitative research approach involving open-ended interviews with Native American students. An analysis of the interview data, using open-coding techniques through a theoretical lens, identified key themes related to cost, geographic location, access to technology, digital literacy, technical skills, and knowledge gaps. The findings highlight not only the challenges of affordability and infrastructure limitations but also the scarcity of guidance on technology adoption and use. Public access to broadband and digital devices remains constrained outside of educational institutions and central community hubs. This research underscores the need to further investigate the persistent barriers contributing to the digital divide from the perspectives of Native American students, offering critical insights for Information Systems researchers and practitioners seeking to address digital inequality in under-served communities.

YOUSSEF HARRATH, PH.D., JIHENE KAABI, PH.D., AND ETHAN PRICE
THE BEACOM COLLEGE OF COMPUTER & CYBER SCIENCES

Utilizing Ensemble Learning Techniques to Improve Corn Price Prediction: A Case Study in South Dakota

Accurate prediction of crop prices is a critical component of agricultural decision-making, directly impacting economic planning and risk management for farmers and industry stakeholders. While machine learning algorithms have demonstrated significant advancements in agricultural price forecasting, ensuring model reliability and accuracy remains a persistent challenge. This study explores the application of stacking, an ensemble learning technique, to enhance predictive performance in forecasting corn prices across various regions in South Dakota. To achieve this, we propose a hybrid ensemble architecture that integrates Long Short-Term Memory (LSTM) networks and Transformer Neural Networks, leveraging their complementary strengths to improve forecast precision. Utilizing eleven years of historical corn price data, the results indicate that the stacked model significantly outperforms its individual base components and established industry benchmarks. The proposed model demonstrates robust predictive capabilities within a one-month forecasting horizon, achieving a maximum mean absolute error (MAE) of 6%.

These findings underscore the potential of ensemble learning techniques in agricultural price forecasting. Future research should investigate the incorporation of additional explanatory variables, including weather conditions, crude oil prices, and market demand, to further enhance predictive accuracy and support the development of an advanced decision support system for agricultural stakeholders.

YOUSSEF HARRATH, PH.D., WITH BHUTTA MUHAMMAD, OSWALD ADOHINZIN, AND NIRVIK KC, THE BEACOM COLLEGE OF COMPUTER & CYBER SCIENCES

Optimized Face Recognition Using Reinforcement Learning and Deep Learning Feature Extraction

Face recognition is a technology that is steadily increasing with systems involving security and user-authentication to only cite a few. However, accurate and robust face recognition is not easy to achieve in a system, due to varying conditions such as lighting, facial orientations, and obstructions. These limitations show the need to strike a balance between accuracy, robustness and efficiency when implementing face recognition. This paper proposes a robust and adaptive face recognition system based on lightweight deep learning models: MobileNetV2 and EfficientNetB0. An SVM classifier is used for accurate classification. Reinforcement Learning (RL), implemented through Q-learning, is employed to dynamically optimize the contribution weights (α and ß) for both feature extractors. The system preprocessed input images, generated hybrid embED.D.ings through a weighted combination of deep features and changed those weights to attain optimal performance. Results on the training dataset were excellent, with an accuracy of 100% and the predictions were verified through confusion matrix analysis. Testing on unseen images demonstrated the applicability of the system, yielding accurate predictions of all processed samples, and with low processing times. The main contributions of this work include: the efficient integration of hybrid embED.D.ings for complementary feature representation, a dynamic RL-based weight optimization, and a robustness of the model against variations in lighting, facial orientations, and obstructions. Future work will target scaling the system to larger datasets, improving real-time performance and applicability across diverse demographic groups.

JASON MIXON, PH.D., AUSTIN O'BRIEN, PH.D., STEPHEN KREBSBACH, PH.D., MARK SPANIER, PH.D., CHERIE NOTEBOOM, PH.D.
THE BEACOM COLLEGE OF COMPUTER & CYBER SCIENCES
COLLEGE OF BUSINESS & INFORMATION SYSTEMS

Bone Surface Modification Dataset Synthesis for Computer Vision Models Using LoRA Tuned Latent Diffusion Models

This research leverages generative artificial intelligence to address the challenges of data scarcity in training computer vision models for archaeological analysis. A generative diffusion model was fine-tuned using Low-Rank Adaptation (LoRA) on an existing dataset of bone surface modification images to produce a larger dataset of synthetic images. These images were utilized both alone and combined with the original dataset to train computer vision models tasked with identifying and classifying whether bone surface modifications occurred on bones with or without meat.

Testing evaluated various model configurations, including activation functions and optimizers, with performance metrics such as accuracy, loss, and F1 scores. Results demonstrated that incorporating synthetic data significantly improved model performance, especially for those limited by smaller, original datasets. The combination of real and synthetic datasets amplified accuracy and F1 scores, highlighting this method as a robust solution for enhancing computer vision applications in archaeological research and beyond.

CHERIE NOTEBOOM, PH.D. WITH SAI MOUNIKA CHINTALAPUDI AND VAHINI ATLURI
COLLEGE OF BUSINESS & INFORMATION SYSTEMS

From Grandfathers to Grand Futures: An AI-Driven Radiology Change & Education SLR

Radiology is undergoing a transformation as Artificial Intelligence (AI) become increasingly integrated into clinical workflows, reshaping the roles and responsibilities of radiologists. This systematic literature review, conducted in accordance with PRISMA guidelines, synthesizes findings of peer-reviewed studies published between 2019 and 2024. In response to the multifaceted challenges posed by AI integration, we propose the GrandFusion Framework—an innovative, integrated model that fuses insights from seminal theories from the Grandfathers of AI, IS, Change and Education, including Roger's Diffusion of Innovations, Davis's Technology Acceptance Model, Lewin's Change Management Theory, Simon's Theory of Bounded Rationality, and Dewey's Educational Philosophy. By merging the intellectual legacies of the "grandfathers", the GrandFusion Framework provides a perspective on how educational and organizational change can be effectively managed as AI is integrated within radiology. Our review provides themes surrounding AI technologies integration and highlight change management with focused education are crucial to bridging the gap between AI technologies and traditional radiology practice preparing radiologists to leverage AI as an augmentive tool rather than a replacement for human expertise. The GrandFusion Framework not only offers a robust theoretical foundation for understanding current trends but also delivers actionable insights and recommendations for innovation in radiology education and practice.

CHERIE NOTEBOOM, PH.D. WITH SAI MOUNIKA CHINTALAPUDI AND VAHINI ATLURI
COLLEGE OF BUSINESS & INFORMATION SYSTEMS

From Technology to Patient Care: A Meta-Analysis of AI in Radiology Aligned with the 2PDT Framework and Quadruple Aim

This study investigates the transformative influence of Artificial Intelligence (AI) on radiology through the lens of the 2PDT framework—People, Process, Data, Technology—while aligning insights with the Quadruple Aim: enhancing patient experience, improving population health, reducing costs, and advancing healthcare providers' work life. We conducted a systematic review of 13 literature reviews published between 2019 and 2024, examining AI technologies such as deep learning, Convolutional Neural Networks (CNNs), Generative Adversarial Networks (GANs), and large language models like ChatGPT. By classifying current research within the 2PDT framework and juxtaposing it against the Quadruple Aim, this paper provides an overview of AI's potential to transform radiology. Our findings reveal that these AI-driven tools reduce radiologists' workload, improve diagnostic accuracy, and streamline imaging analysis. However, literature shows a predominant focus on technological innovation, with comparatively less attention to the people, process, and data components. This imbalance highlights research gaps in cost efficiency and the work life of healthcare providers. The study emphasizes the need for a balanced integration of AI in radiology—one that leverages technological advancements while ensuring that human factors, process optimization, and data management are equally prioritized—to achieve sustainable improvements in healthcare outcomes and provider well-being.

MEGAN SCHUH, ED.D. AND JENNIFER NASH, PH.D.,
COLLEGE OF EDUCATION & HUMAN PERFORMANCE
RYAN YOUNG, ED.D., BLACK HILLS SPECIAL SERVICES COOPERATIVE

The Lived Experiences of Rural, Undergraduate Students Enrolled in an Online Teacher Apprenticeship Education Program

This phenomenological study explores the lived experiences of first-semester undergraduate students enrolled in Dakota State University's teacher apprenticeship pathway, a program designed for full-time paraprofessionals in K-12 schools. This research builds on prior studies, providing insights that can influence DSU's coursework, enhance other online programs, and inform teacher education initiatives in rural states facing similar shortages. In this study, ten participants from rural K-12 schools were interviewed, with transcripts coded to identify key themes that transcended individual cases. The findings aim to inform best practices for supporting non-traditional, online learners, working full time in rural settings. Given teacher recruitment and retention challenges, especially in rural areas, alternative preparation programs, such as the teacher apprenticeship pathway, can offer promising solutions.

ABBIE STEUHM, MLIS
KARL MUNDT LIBRARY

If You Have Nothing to Hide, You Still Have Something to Fear: How Libraries Can Support Alternative Information Channels

Libraries in the U.S. have seen massive increases in book challenges in recent years. Since books are one of the library's vital resources, censoring books can have a great impact on libraries and patrons. To counteract the effects of censorship, libraries need to adopt and support alternative information channels so information can still be accessed through other channels even if one is shut down. When researching the behaviors of marginalized communities, most of them rely on the Internet to access vital information from various channels such as online support groups and social media. If libraries are to fully support marginalized patrons, then it is vital for them to provide Internet access while also protecting patron privacy. By adopting cybersecurity measures and implementing security culture within libraries, librarians can continue to provide access to information for marginalized communities.

GRADUATE STUDENT RESEARCH POSTERS

ABDERREZAK ALLALEN
COLLEGE OF BUSINESS & INFORMATION SYSTEMS
FACULTY MENTOR: OMAR EL GAYAR, PH.D.

Reinforcement Learning-Guided Genetic Algorithms with Self-Adaptive Mutation and Crossover for Feature Selection in Imbalanced Datasets
To address the limitations of genetic algorithms (GA), such as over-exploitation and premature convergence, we integrate reinforcement learning (Q-learning) with GA. Our approach dynamically adjusts mutation rates and crossover strategies, balancing exploration and exploitation through adaptive parameters that evolve with the population. By incorporating mechanisms like exploration bonuses, adaptive epsilon decay, and a penalty for minority class performance, our method enhances GA's ability to explore the search space more effectively. This reduces the risk of premature convergence and leads to more robust feature selection, particularly in imbalanced datasets.

SALIM ARFAOUI
COLLEGE OF BUSINESS & INFORMATION SYSTEMS
FACULTY MENTOR: OMAR EL GAYAR, PH.D.

Real-Time Privacy-Preserving Threat Detection in IoT Environments Using Federated Learning and Differential Privacy
Motivated by the need for real-time, privacy-preserving threat detection in Internet of Things (lo T) environments, this Design Science Research develops a conceptual framework integrating federated learning and differential privacy. The proposed artifact enables collaborative threat detection across lo T devices while ensuring data privacy. Addressing key lo T challenges like limited computational resources and device heterogeneity, the research evaluates the artifact's feasibility within existing lo T security architectures, focusing on balancing privacy, detection accuracy, and system performance. Contributions include advancing theoretical knowledge and providing practical, privacy-preserving solutions for securing sensitive data in connected lo T ecosystems.

ANUSREE DOMMARAJU AND PREKSHITH VATTIGUNTA
THE BEACOM COLLEGE OF COMPUTER & CYBER SCIENCES
FACULTY MENTOR: YOUSSEF HARRATH, PH.D.

An Enhanced Crypto Coupon System Using Blockchain

In today's marketplace, coupons and discounts play a pivotal role in consumer decision-making and brand loyalty. Traditionally, companies have relied on out dated technologies, such as scratch cards and printed vouchers, to distribute and redeem coupons. These methods are often cumbersome, prone to fraud, and lack the flexibility needed to adapt to modern consumer expectations. To address these challenges and innovate the coupon ecosystem, we are proposing the development of a crypto currency-based coupon system The core idea of this project is to revolutionize the coupon industry by integrating crypto currency technology into the coupon distribution and redemption process.

LAXMI GORUGANTU
COLLEGE OF BUSINESS & INFORMATION SYSTEMS
FACULTY MENTOR: OMAR EL GAYAR, PH.D.

Exploring the Co-Morbidities Among MS Patients Using Topic Modeling Methods: A Comparative Analysis

Multiple sclerosis (MS) is a chronic neurological disease associated with various physical and cognitive impairments. Individuals with MS might experience comorbidities that can exacerbate the severity of the disease and its associated symptoms. Hence, there is a critical need to identify these additional health conditions essential for optimizing comorbidity management and the patient's overall well-being. This research study uses social media data and topic modeling techniques to explore the frequently occurring comorbidities among MS patients worldwide. Such understanding can further prioritize and guide interventions aimed at tailoring MS and comorbidity management strategies to address the specific needs of MS patients.

YESU VARA PRASAD KOLLIPARA
COLLEGE OF BUSINESS & INFORMATION SYSTEMS
FACULTY MENTOR: OMAR EL GAYAR, PH.D.

Enhancing Climate Change Mitigation: Am AI-Based System for Real-Time Monitoring of Environmental Changes Using Satellite Data

This research project proposes developing an advanced Al-driven system for real-time environmental monitoring using satellite data, focusing on enhancing climate change mitigation efforts. Leveraging deep learning models such as Convolutional Neural Networks (CNNs) for image analysis and Recurrent Neural Networks (RNNs) for temporal prediction, the system will process high-resolution datasets from Landsat-8, Sentinel-2, and MODIS. Utilizing cloud platforms like Google Cloud and AWS, the project aims to provide scalable, real-time insights for policymakers. This work addresses critical gaps in predictive environmental monitoring, advancing both Al applications and climate science.

DEEPENDRA MALLA
COLLEGE OF BUSINESS & INFORMATION SYSTEMS
FACULTY MENTOR: OMAR EL GAYAR, PH.D.

A Comprehensive Framework for Benchmarking Machine Learning Models: Integrating Performance Metrics, Explainability Techniques, and Robustness Assessments

Traditional benchmarking of machine learning models mainly focuses on performance metrics like accuracy and precision. Still, metrics often fall short in accounting for the model's transparency and robustness when the models get complex with varying conditions. This research proposes a comprehensive framework for benchmarking machine learning models that incorporate traditional accuracy- and precision-based performance evaluation with explainability and robustness to ensure the model's efficiency, transparency, and stability in the presence of adversarial attacks, noise, and data shifts. By holistically addressing performance, explainability, and robustness in tandem, this framework enhances the reliability and trustworthiness of ML models in dynamic real-world applications.

KHANH NGUYEN
THE BEACOM COLLEGE OF COMPUTER & CYBER SCIENCES
FACULTY MENTOR: KHANDAKER MAMUN AHMED, PH.D.

Optimizing the Phi-2 Small Language Model for Real-time Chatbot Applications Using Parameter-Efficient Fine-Tuning (PEFT) with QLoRA Quantization

This project aims to optimize the Phi-2 Small Language Model (SLM) for real-time chatbot applications using Parameter-Efficient Fine-Tuning (PEFT) and Quantized Low-Rank Adaptation (QLoRA). By reducing the number of parameters and applying quantization, the research will lower memory usage by 40% while improving accuracy by 10%, measured via ROUGE scores. This approach addresses the challenges of deploying language models on resource-constrained devices, such as mobile phones and IoT systems, contributing to the advancement of AI applications in real-time scenarios like customer service and healthcare.

ARAVINDH SEKAR
COLLEGE OF BUSINESS & INFORMATION SYSTEMS
FACULTY MENTORS: CHERIE NOTEBOOM, PH.D. AND DEB TECH, PH.D.

Factors Influencing Blockchain Implementation in Supply Chain Management: An Exploratory Study

This proposal aims to explore factors influencing blockchain implementation in supply chains. Through qualitative methods, including semi-structured interviews, it identifies key influences on implementation. Insights gained from this pilot study will inform the flow and direction of subsequent research. By understanding these factors, the study seeks to pave the way for a comprehensive investigation. Grounded theory analysis will contribute to the development of a theoretical model, aiding decision-making, and strategic planning in supply chain management. This research contributes to supply chain management by enhancing understanding and guiding innovation.

SAI NEELIMA SERU
COLLEGE OF BUSINESS & INFORMATION SYSTEMS
FACULTY MENTOR: CHERIE NOTEBOOM, PH.D.

Public Perception and Adoption of Blockchain in Supply Chains: A Social Media Analytics Approach Using Twitter

Blockchain Technology, with its decentralized and immutable nature, is transforming supply chains by enhancing transparency, efficiency, and trust. This study explores how social media platforms, particularly Twitter (X), shape public perception and discourse around emerging technologies like blockchain. Specifically, it investigates how Twitter conversations influence blockchain adoption in supply chain management, focusing on public attitudes and technological acceptance. Using sentiment analysis and topic modeling, this research will analyze tweets, trending hashtags (e.g.,#Blockchain, #SupplyChain), and user interactions to assess positive and negative opinions on blockchain adoption. A key focus is a conceptual model identifying the factors shaping blockchain adoption on Twitter, including sentiment trends, hashtag popularity, influencer activity (e.g., CEOs, industry experts), and public engagement metrics (retweets, likes, comments). These factors collectively drive public awareness, acceptance, and concerns, influencing blockchain adoption in supply chains. Grounded in information systems theories, this research bridges social media analytics with blockchain adoption, highlighting the impact of how digital conversations shape the future trajectory of supply chain technologies.

UNDERGRADUATE RESEARCH POSTERS

KYLIE BORCHERT
COLLEGE OF ARTS & SCIENCES
FACULTY MENTOR: KRISTEL BAKKER, PH.D.

Does the Use of Audits Decrease the Infection Rate in a Medical Care Setting?

The most common mode of transmission of healthcare associated pathogens within the clinical environment is health workers' hands. The use of quality hand hygiene is the best measure that health professionals can take in reducing the proliferation of microorganisms and nosocomial infections. Numerous studies effectively demonstrate the critical role that healthcare workers' hand hygiene plays in the transmission of microorganisms from worker to patient or patient to patient. Working alongside LifeScape professionals in Sioux Falls, South Dakota, I measured the effectiveness of hand hygiene practices based on previous intervention and/or a failed audit. By observing, auditing, and presenting real-time feedback to healthcare workers, I provided an assessment on healthcare worker compliance with optimal practices. The information I deliver is beneficial in informing LifeScape about the efficacy of performing audits to increase compliance and decrease infection rates. With the conclusion of my research, the information I share will also be significant for the infection control committee of LifeScape in creating an action plan.

IVAN CASAMALHUAPA
THE BEACOM COLLEGE OF COMPUTER & CYBER SCIENCES
FACULTY MENTOR: ROBERT RICHARDSON, MS

Sequence Skipping and the Security Risk Associated

Through my research I discovered how Emergency vehicles (EVs) operate and what an Opticom is. I have managed to make a simulation of a traffic light as well as an Opticom and a Mobile Infrared Transmitter (MIRT) to act as an Emergency Vehicle Preemption (EVP) system, which is what allows EVs to skip a cycle. This is to show the dangers that a lack of security in public critical infrastructure can cause. I have also learned how to wire things together and code to external sources like an Arduino to execute commands.

LUKE CONSTANTINO
THE THE BEACOM COLLEGE OF COMPUTER & CYBER SCIENCES
FACULTY MENTOR: PAT ENGEBRETSON, D.SC.

Quantifying the Effectiveness of Dynamic Response in Web Application Honeypots

This research quantifies the effect dynamic response has on the effectiveness of web application honeypot systems. While much academic effort has been directed toward honeypot development, comparatively little has measured the effect of various honeypot tools and compared them against each other. This research measures the effectiveness of honeypot dynamism through a standardized experiment between a Tanner/Snare honeypot system, a Glastopf honeypot system, and a static honeypot system. Using the T-Pot framework, the study will analyze the duration of attacker engagement and their actions across various honeypots to identify the most effective honeypot and corresponding level of dynamism within a honeypot system. This research will help security professionals and honeypot developers make informed decisions about where best to direct their efforts, improving the overall cyber deception lanD.Sc.ape.

ALEXANDER DEAK
COLLEGE OF ARTS & SCIENCES
FACULTY MENTOR: WILLIAM BENDIX, PH.D.

People's Republic of China Cyber Method Preference For Influencing Democratic States

The People's Republic of China (PRC) has increasingly expanded its cyber influence campaigns against democratic states. Scholars largely agree that these campaigns align with the PRC's broader goal of regional and global hegemony and that China employs a range of cyber strategies to target democratic rivals. However, little research has examined what drives the PRC to adjust its online influence operations. This paper addresses that gap. Specifically, I compare the PRC's cyber influence campaigns across multiple democracies to identify the factors shaping its strategic choices. Using a comparative case-study approach, I analyze China's influence efforts in Canada, Taiwan, and the United Kingdom, assessing whether the PRC adapts its tactics based on specific domestic conditions in each target state. My preliminary findings suggest that China's primary objective is not election interference but rather the surveillance and repression of Chinese diaspora communities. The composition of these communities overwhelmingly shapes the nature of its campaigns.

HANNAH FESER AND WYATT OLSON
COLLEGE OF ARTS & SCIENCES
FACULTY MENTOR: JEFF ELBERT, PH.D.

Variations in Ethanol Concentrations in Gasoline

For this research project, we will be measuring the concentration of ethanol present in different types of gasoline from various gas stations. The purpose of this project is to analyze and determine whether there is a substantial variance in the concentration, especially if it is possibly detrimental towards gas mileage and the product you intend to purchase is not what you are receiving. Our results have potential to lead to further research and discovery depending upon if there is a significant variance found, this could mean a fault in the production or delivery lines of the gasolines.

CONNOR FORD
THE BEACOM COLLEGE OF COMPUTER & CYBER SCIENCES
FACULTY MENTOR: CODY WELU, PH.D.

Is AI Threat Detection an Effective Substitute for Current Real-Time Threat Detection Architectures and Methodologies

The growing complexity and volatility of modern cyber threats necessitate proactive defenses, driving significant interest in artificial intelligence (AI) for threat detection. While machine learning (ML) and deep learning (DL) have advanced intrusion detection, malware classification, and spam filtering, their real-world deployment grapples with real-world issues. Many models are deployed in a 'black box' manner, limiting transparency and hindering trust—a critical gap in high-stakes cybersecurity contexts. Explainable AI (XAI) methodologies, such as SHAP and LIME, are now being used to understand model decisions, enabling cybersecurity professionals to validate, trust, and refine AI-driven understanding. Current research evaluates these frameworks against standardized datasets, though reliance on legacy benchmarks like KDDCup99 calls attention to problems about relevance to contemporary attack vectors. Recent studies show that deep neural networks (DNNs), when paired with XAI techniques, achieve high accuracy (e.g., >98% F1-scores in malware detection) while providing interpretable decisions. However, challenges continue to persist, including adversarial robustness, dataset bias, and operational scalability. As the field matures, combining advanced AI with human-centric explainability will be critical to realizing adaptive, trustworthy cyber defenses.

CARTER GORDON
COLLEGE OF ARTS & SCIENCES
FACULTY MENTOR: TATE CARSON, MFA, PH.D.

P.A.C.E. (Prototyping-System for Audiovisual Creative Endeavors)

A programmable system to prototype new audiovisual performances and installations was built on a Python core that communicates between Teensy hardware controller inputs, SuperCollider audio synthesis, and Processing4 visual frameworks. Communication is accomplished through OSC messaging over UDP. This allows for real-time control for audiovisual parameters and proper communication of such. By using a mode-based configuration approach through YAML, we can rapidly prototype new audiovisual interactions. Built with the idea of modality and extensibility in mind to allow for the utmost creative capabilities and future additions to the system.

EMELYE JOSKO
COLLEGE OF ARTS & SCIENCES
FACULTY MENTOR: ANDREW SATHOFF, PH.D.

Natural Bone Human Educational Skeletons: Investigating Restoration and Ancestry

Students can learn human anatomy on natural bone human educational skeletons by using hands-on practices, but this usage wears out the skeletons and damages can emerge. Currently, there is little research available to guide the restoration of natural bone human educational skeletons for instructional purposes. Using three real bone human skeletons in varying rates of disarray found in the Dakota State University Science Center, this research is aimed to restore both the appearance of these skeletons and their backgrounds. The skeletons underwent maintenance and restoration procedures that allowed them to be used as classroom materials again. A noninvasive method was used to extract DNA from skeletons' teeth and was sent for genetic ancestry testing. Upon receiving this ancestry data, our research will continue to investigate the backgrounds of the skeletons and catalog them. Additionally, modern educational activities were created, which incorporate these newly restored skeletons.

KIERRA MILLER
COLLEGE OF ARTS & SCIENCES
FACULTY MENTOR: ALEX DECECCHI, PH.D.

Investigating the Energetics and Feeding Ecology of a Range of Azhdarchid Pterosaurs

Azhdarchid pterosaurs, a lineage of Mesozoic flying archosaurs, include the largest flying animals ever known. Larger representatives, such as Quetzalcoatlus nortropi, had a wingspan of over 10 m, a large head, massive wingspans, a shoulder height equivalent to an extant giraffe and a weight of more than 200 kg. Because of their large features, these pterosaurs have ecological interpretations as major predators. Here we examine the probability of that from an energetics perspective. 200 kg is very light for the size of these giants. On top of this, the body length (gleno-acetabular distance) of these pterosaurs is relatively small (a volume of ~1.5 times that of an average sized human male for Q. northropi). When factoring in lung volume, this restricts the gut capacity and thus prey size. This measurement allows us to explore the Basal Metabolic Rate (BMR), Field Metabolic Rate (FMR), and Daily Energy Expenditure (DEE) of various azhdarchid species using extant mammalian and avian measurements. We explore the potential of flight and terrestrial stalking using soaring and walking, also from mammalian and avian measurements. This data gives great insight into the true ecology of these giants and refutes the interpretation of them being major predators.

VANESSA OCANSEY AND BASO AYELAZONO
COLLEGE OF ARTS & SCIENCES
FACULTY MENTOR: KRISTEL BAKKER, PH.D.

Survey of Prairie Lakes for Microplastics in Eastern South Dakota

Microplastics are plastics that have been worn down into small fragments that invade aquatic environments and have cultivated themselves into most corners of the world. They are less than 5 mm in size and categorized as either primary (manufactured small) or secondary (broken down from larger plastics). Microplastics have been found in ocean surface water and deep-sea benthic zones as well as freshwater systems. They can be harmful to organisms, ecosystems, and human health, though the full extent of their impact is not yet known. The purpose of our project is to survey prairie lakes for the presence of microplastics in eastern South Dakota, a region where little research on microplastics has been done, and compare findings with other regions of the U.S. We surveyed five prairie lakes for the presence of microplastics by collecting samples from the shore and water in each cardinal direction at each lake, as access allowed. The samples were analyzed for the presence of microplastics using sifting, vacuum filtration, and microscopy techniques. We will present information on the presence and/or absence of microplastics in prairie lakes. Determining if microplastics are present in prairie lakes in eastern South Dakota will allow us to compare levels found in a less densely populated region to other areas of the United States and hypothesize about how they accumulate.

SURAH SAN
THE BEACOM COLLEGE OF COMPUTER & CYBER SCIENCES
FACULTY MENTOR: MARK SPANIER, PH.D.

Natural Language Processing Applications in Medical Data

Natural Language Processing (NLP) is the utilization of Artificial Intelligence in understanding human language. NLP is increasingly being applied in the realm of healthcare as it can make information processing highly efficient through data summarization. In this modern day of technology, data is increasing at an unprecedented pace, and AI can assist in organizing unstructured information. In this use case, Named Entity Recognition, which is the classification of words, can recognize key terms in medical information. This study provides in depth research on the foundations of Natural Language Processing for healthcare use cases. Furthermore, comparison of AI models were put in place to apply information gained in order to see which models are most effective in Named Entity Recognition for the purpose of healthcare term. Specifically, open-source models like BERT and SpaCy were fine-tuned to process medical texts. In some cases, synthesized data was created to generate more results in a controlled environment.

DIJESH SHRESTHA AND SHISIR PROUDEL
COLLEGE OF BUSINESS & INFORMATION SYSTEMS
FACULTY MENTOR: YEN-LING CHANG, PH.D.

Evaluating the Feasibility of Blockchain Technology for Secure Voting System: A Systematic Mapping

Blockchain technology is a peer-to-peer, immutable, and secure ledger system that has emerged as a possible solution to address the problems of centralized ballot and online voting systems, which are prone to risks regarding electoral integrity. This research evaluates the feasibility of blockchain-based voting technologies, analyzing their benefits and security assessments. Adopting a systematic mapping methodology, we extracted and analyzed relevant academic papers from multiple scientific databases that focus on blockchain frameworks applied to voting systems. Our evaluation is guided by three critical questions concerning the overall architecture, scalability, and security of blockchain-based voting systems. We aim to categorize and describe gaps and trends in existing literature, identifying areas that may require further research. Overall, the study identifies the benefits and limitations of blockchain voting technology from a robust democratic perspective.

NORAH ZOLLER
COLLEGE OF ARTS & SCIENCES
FACULTY MENTOR: ALEX DECECCHI, PH.D.

Flying Through the Air with the Greatest of Ease? Evaluation of Glide Capability in Basal Maniraptoran Theropods

Paravian theropods, bats, and pterosaurs are the only three lineages of tetrapods known to have evolved powered flapping flight. Gliding flight and parachuting behaviors, however, are known to have evolved several dozen times among tetrapods over the past 250 million years. Because of its frequent occurrence, gliding—and the body plans associated with such locomotion—has often been suggested to have been a "stepping stone" on the path from terrestrial non-avian theropods to flying early birds, followed by multiple occurrences of derived flightlessness. We are investigating if such claims could plausibly explain a crucial intermediate stage that describes the origin of the avian wing. We did the bulk of our evaluation using wing area estimates based on models we constructed from over 50 specimens of small coelurosaur theropods, and we found that wing loading values greatly exceeded those of any known extant or extinct tetrapod, until paraves, which is still at the upper end of the range for most taxa within the clade. Thus, we have found that patterns in feathering and wing structure present in basal Maniraptora likely had other non-volant drivers for their origin and evolution.

RESEARCH TALKS

The Beacom Institute of Technology (BIT) Room 117, 1 - 2:30 p.m.
Note to attendees: conference-style talks offer a new feature of DSU's Annual Research Week Symposium this year. This was motivated by faculty feedback via our University Research Committee.

The talks will run concurrent with part of the poster session. Please attend and support these, our colleagues who have graciously volunteered to help us carry out this little experiment!

ALEX DECECCHI, PH.D.
COLLEGE OF ARTS &SCIENCES

Its Habit Forming: Examining the Origins of Prolonged and Habitual Use of Powered Flight in Non-avian Theropods
Understanding how ancient organisms lived is more than knowing the anatomical parts, it's also understanding how they routinely behaved and moved about. One means of assessing this is to look at cost of transport and daily energetic expenditures. Here I will discuss some of my labs recent work on this including looking at the evolution of habitual flight in the earliest birds and their dinosaurian ancestors. We re-evaluated the ability of potential powered flying early birds and close relatives to sustain powered flight using two criteria: (1) available power output and maximum flight performance, (2) the energetic cost of transport. These criteria suggest that the iconic Late Jurassic bird Archaeopteryx and the Early Cretaceous early-diverging dromaeosaurid Microraptor were not only functionally flapping flyers as previously proposed, but were habitual flyers. We find that later-diverging birds then build up this early flight habituality, evolving greater performance and lower costs of transport flight, as expected with their more derived flight systems. Thus, flight habituality starts to appear by at least the Late Jurassic and had a complex and non-linear pattern, expanding the context for the rise of modern birds.

MOHAMMAD TAFIQUR RAHMAN, PH.D.
COLLEGE OF BUSINESS AND INFORMATION SYSTEMS

Knowing My Institution: Students' Expectations from a University Website

Businesses today primarily rely on electronic media to reach customers, especially in the post-COVID era, and academia is not exempt from this trend. Academic institutions can gain global recognition by sharing their achievements through well-organized and informative websites. These sites serve as the main resource for anyone seeking information about the institution for study, teaching, or service. It is evident that all academic institutions carefully select the content for their websites; however, they often overlook the experience of end users. Since students are the true end users of a university's website and the primary driving force behind any academic institution, authorities should always consider their remarks regarding presentation, quality, and depth of web content. In this research, I plan to investigate whether the information shared on a university's website meets students' needs by addressing their queries during their study periods, before admission, and after graduation. To achieve this, the study will explore how students used the website prior to their admission, how they are using it now, and how they will use it after graduation. The findings from this research will help academic institutions in selecting their website content to effectively communicate with potential students, thereby fostering growth and sustainability.

JUSTIN SCHROEDER, PH.D. WITH JOSHUA GANSCHOW
COLLEGE OF ARTS & SCIENCES

Learning to Count: How Do We Tell Things Apart?

Steiner triple systems have many applications to other areas of mathematics and computer science. However, Steiner triple systems exhibit a phenomenon known as "combinatorial explosion", making them extremely difficult to count and categorize. For example, there are only 80 Steiner triple systems of order 15, but over 11 billion of order 19 and over 14 quadrillion of order 21 (beyond that, we don't even know how many there are!). Since Steiner triple systems are so numerous, it is advantageous to have systems that exhibit specific properties. In this project, we initiate the study of antiperfect Steiner triple systems and prove their existence for all possible orders, with special attention given to Steiner triple systems of order 21 and 25. Moreover, we show how antiperfect Steiner triple systems with small circumference can be used to address a problem on graph coloring proposed at the 22nd British Combinatorial Conference.

THANK YOU RESEARCH WEEK SPONSORS AND PARTNERS

SANFORD HEALTH

KIRKWALL