

DAKOTA STATE UNIVERSITY

RESEARCH WEEK SYMPOSIUM

THURSDAY, MARCH 26
1 P.M. - 4:30 P.M.

THE BEACOM INSTITUTE OF TECHNOLOGY

2026





WELCOME TO RESEARCH WEEK!

Peter Hoesing, PhD, CRA

*Associate Vice President
Research & Economic Development*

GREETINGS AND A WARM WELCOME TO
ANOTHER DSU RESEARCH WEEK!

This is our time to celebrate all the ways research is rising at DSU. A week that seems to get fuller and more exciting each year, this week we welcome the Seoul Media Institute of Technology, dozens of DSU doctoral students, Student and Faculty Research Initiative grantees, and Keynote Speaker Philip Niedermair of the Technology Advancement Center, all ahead of another exciting DakotaCon 13 coming up this weekend.

The annual Research Symposium is a university-wide showcase of research and creative activity. We welcome you, our students, faculty, and staff, local elected officials, alumni, and friends of the university, to engage, ask probing questions, and experience our best university ambassadors, our students. This year's Symposium has a new feature: Digital Arts and Design faculty Wendy Romero, MFA and Peter Britton, MFA have organized a juried exhibition that will give many students their first experiences with this important form of peer review.

With the Beacom Institute of Technology more packed than ever with research and creative activity, here's a quick guide to the updated Symposium layout:

- » The main collaboration space will host poster presenters as we have done the past
- » Downstairs classrooms 112 and 117 will host conference-style presentations
- » Downstairs classroom 135 and the adjacent rooms down the east hallway of the building will host creative activities
- » Upstairs classroom room 213 will host yet more conference-style presentations
- » Upstairs conference room 235 will host virtual poster presenters
- » Food and beverage stations can be found throughout the building on both floors.

We invite you to peruse all the offerings, entering and exiting as respectfully as possible if you must move mid-session. Posters are numbered this year ease navigation. To all presenters alike: we congratulate you! Thank you for sharing your work with us. Thank you for your commitment to lifelong learning, for solving challenging problems, and especially for transforming those challenges into impactful careers and lives of positive purpose.

KEYNOTE SPEAKER



BEACOM INSTITUTE OF TECHNOLOGY

3:30 P.M.
COLLABORATION
SPACE (ROOM 106)



**WATCH
HERE**

Philip Niedermair

Senior executive, board chair, and strategic advisor

Philip Niedermair is a senior executive, board chair, and strategic advisor with more than 30 years of leadership experience in cybersecurity, national security, technology, and governance. He has advised leaders across government, industry, nonprofit organizations, and academia, with a focus on building partnerships, strengthening governance, and advancing mission-driven growth.

He currently serves as Chairman of the Advisory Board for the Technology Advancement Center (TAC), a nonprofit established by the NSA and U.S. Cyber Command to support cybersecurity workforce development, innovation, and collaboration across government, industry, and academia. In this role, he provides strategic oversight and helps guide initiatives that strengthen national resilience and talent development. He also serves as Senior Advisor to the Cyberspace Solarium Commission 2.0.

Throughout his career, Niedermair has served on numerous boards and advisory councils and has advised major organizations in both domestic and international settings. His leadership emphasizes strong governance, financial stewardship, risk management, and institutional accountability to support long-term stability and trust.

RESEARCH POSTERS

BIT 106: Collaboration Space | 1 p.m. - 3 p.m.

Posters are numbered to assist attendees in locating specific projects.

UNDERGRADUATE POSTERS

1

Interactions of Bad Actors with Honeypots

Maryam Aliyeva

Mentor: Dr. Andrew Kramer

Malware, including ransomware, brute force attacks, and spyware, poses a threat to exposed network services, underscoring the need to deepen our understanding of malicious actor behaviors. This project examines various command-line behaviors and the frequently exhibited attacker demographics through honeypots – security mechanisms that mimic public domains and track malicious activity. For this project, we deployed Cowrie – a medium- to high-interaction SSH and Telnet honeypot – on a publicly accessible DigitalOcean Ubuntu virtual machine server hosted in Atlanta, GA operating over the course of 55 days. During this period, the honeypot logged attacker patterns including credential attempts and metadata, such as IP indicators. In the next phase of the research project, we plan to establish a script capable of analyzing further command line behaviors. Analysis of these logs is significant for cybersecurity both on an individual and an industrial level due to its potential to broaden the understanding of bad actors and their attack patterns. By examining these interaction patterns, our findings are directed to support stronger preventive measures against cyberattacks, as well as raise awareness of common attacker methodologies.

2

Habitat Characteristics and Nest Success of a First-Year Great Blue Heron Rookery

Basbo Ayelazono

Mentor: Dr. Kristel Bakker

A newly established Great Blue Heron (*Ardea herodias*) rookery was documented near Madison, Lake County, South Dakota, representing the first recorded nesting of this species at this location. Four nests were monitored from May through August 2025 to characterize local and landscape-level habitat, nest placement, timing, and reproductive success. Nest heights ranged from 17 to

22.5 m, with three of four nests successfully fledging a combined 13 young. One nest did not proceed to egg laying. Nest success and habitat characteristics were generally consistent with those reported for Great Blue Heron colonies elsewhere in the Prairie Pothole Region (PPR). These findings provide baseline data on a newly initiated colony and contribute to a growing understanding of Great Blue Heron colony initiation and habitat selection in the PPR.

Hardware Side-Channel Security of Quantum System Controllers: A Timing Attack Perspective

Darpan Basnet and Anshu Bista

Mentor: Dr. Varghese Vaidyan

3

Quantum computers use classical embedded processors to sequence control pulses. On STM32-class microcontrollers, firmware emits operation classes (gates (X, Y, Z), measurements (MEAS), and timing barriers (WAIT)) at precise intervals. If execution time depends on a secret value, an attacker with a logic analyzer can recover that secret. This classical control plane is a largely overlooked attack surface. This work presents a simulation-based investigation of timing side-channel leakage in quantum-control firmware sequencers. We model the STM32 control plane as a pulse sequencer operating over a canonical seven-operation sequence, and we generate synthetic logic-analyzer timing traces incorporating realistic 100 MHz clock quantization (10 ns resolution) and Gaussian scheduler jitter ($\sigma = 0.3 \mu\text{s}$). Timing traces are generated with 100 MHz clock quantization (10 ns resolution) and Gaussian scheduler jitter ($\sigma = 0.3 \mu\text{s}$). Then compare two firmware designs. The leaky design adds a secret-dependent delay of $\sim 7 \mu\text{s}$ after MEAS operations. The padded design always executes to worst-case time, following constant-time programming practice. We quantify leakage across $N = 1,200$ traces using three metrics: Cohen's d (distribution separation), mutual information (MI), and threshold classifier accuracy. The leaky firmware scores Cohen's $d = 0.92$, $MI = 0.21$ bits, and classifier accuracy = 1.00. A $7 \mu\text{s}$ delay is fully recoverable despite realistic jitter. Padding reduces these to Cohen's $d = 0.11$, $MI = 0.04$ bits, and accuracy ≈ 0.50 . It is a near chance. These results show that timing leakage in quantum firmware is measurable and exploitable. Also, constant-time padding is an effective countermeasure. This study uses a synthetic model; leakage is planted by construction rather than discovered from real hardware. Validation against real STM32 firmware and quantum control frameworks such as Qiskit Pulse and QUA is planned as future work.

4

Post-Quantum Cryptography: Applications for Secure Communication, IoT, and Blockchain

Nidhish Pradeep Bhanse

Mentor: Dr. Mark Spanier

This project explores how post-quantum cryptography (PQC) can help secure digital systems against the emerging threats posed by quantum computing. It will survey candidate algorithms from the NIST standardization process, evaluate their performance, and analyze their potential applications in secure communications, IoT devices, and blockchain platforms. The goal is to provide practical recommendations that balance security with efficiency.

5

A Context-Driven Framework for Fairer Ranking Across Real-World Systems

Pawan Chaudhary

Mentor: Justin Schroeder, PhD

Ranking systems that rely on outcomes alone produce a fundamentally incomplete picture of performance. By treating each result as independent, they discard the relational structure that gives those results meaning: who was involved, what conditions surrounded the encounter, and where each competitor sits within the broader network of interactions. This absence of context is not a minor oversight; it is a structural limitation embedded in how most evaluation frameworks are designed. This research treats the network itself as the answer. Competitors are modeled as nodes and interactions as edges, where the weight of each edge is determined by the full contextual depth of the encounter. Not merely who prevailed, but how dominantly, against whom, and under what circumstances. From this structure, latent hierarchies emerge that conventional standings cannot surface, positions of genuine influence that only become visible when the entire network is considered simultaneously. The framework then applies linear algebraic operations to this graph structure, translating network position into a ranking that accounts for the full depth of each competitor's history within the system. Performance is no longer measured in isolation. It is measured in context.

6

Comparative Analysis of Shipping Costs Across Multiple Routes Using FedEx API Data

Valerija Curikova

Mentor: Andrew Kramer, PhD

This study analyzes shipping cost differences between multiple U.S. zip codes over a month period using data collected through API calls. The API was used to retrieve real-time shipping rate information for several FedEx service types, including First Overnight, Priority Overnight, Two-Day, Express Saver, and Ground. For each day, shipping rates were gathered for shipments between four different zip codes in both directions to observe how route direction and service type affect price. The dataset included base charges, fuel surcharges, and total shipping costs. Using Excel, the data was organized and analyzed to identify daily price trends, the cheapest shipping days, and the most cost-efficient shipping routes. Pivot tables and graphs were used to compare costs across service levels, routes, and dates. Analysis showed that shipping costs follow a small but noticeable pattern over time. The price changes were usually minor and would likely not affect individuals who only ship a few packages. However, for companies that ship large numbers of packages, even small cost changes can add up overtime and increase overall shipping expenses in the long term. This approach demonstrates how API-generated logistics data can be used to support data-driven decision making in transportation and supply chain analysis.

7

LLM Security Agents: Harness Design and Static vs Dynamic Challenges

Joseph Hammond

Mentor: Austin O'Brien, PhD

LLM security agent performance depends on two factors: harness design and challenge type. A poorly designed harness prevents models from recovering from failures, while challenge type determines baseline difficulty. We tested these factors across two experiments. In Experiment 1, we evaluated 6 harness-model combinations against 5 live HackTheBox machines requiring scanning, enumeration, exploitation, and privilege escalation across SSH, SMB, FTP, HTTP, and DNS. In Experiment 2, we benchmarked 10 frontier models via Claude Code Router on 5 challenges from Cybench spanning pwn, forensics, web, reverse, and crypto categories using a Pass@3 metric. Our experiments show models achieving 100% with one harness but scoring 0% with another, and the same model solves ~90% of static challenges but only ~20%

of dynamic ones. The key insight is that dynamic challenges are solvable when the harness enables both efficient routine operations and a failure-recovery loop.

8

Postmortem Analysis of Israel's 7 October 2023 Intelligence Failure

Emily Helgeson

Mentor: Bill Bendix, PhD

This project examines Israel's failure to anticipate Hamas's October 7, 2023, attack through postmortem analysis to identify the primary causal factor. Existing scholarship identifies multiple contributing factors for this intelligence failure, including flawed strategic assumptions (conceptzia), political dysfunction, organizational sexism, and overreliance on surveillance technology. While these explanations are plausible, most studies treat these factors as analytically equivalent, offering lists rather than assessing their relative causal importance. As a result, the literature has yet to identify the primary driver of failure. To address this gap, this study adopts a postmortem approach, borrowed from forensic pathology. This approach requires a two-step analysis. First, the paper presents a chronology of relevant security and political developments spanning from 2006 to the first twelve hours of the October 7 attack. It then uses counterfactual analysis and backward causal reasoning to identify the proximate, intermediate, immediate, and contributory causes behind the intelligence failure. Not only does this study determine why Israeli defenses were taken by surprise, but it also shows how analytical methods from forensic medicine can be used effectively in nonmedical investigations.

9

Neuromuscular fatigue and motor unit behavior in adolescent sprinters: Physiological mechanisms and training implications

Blake Hofer

Mentor: Shane Scholten, PhD

Neuromuscular fatigue influences performance in adolescent sprinters through the mechanisms of the central and peripheral nervous system. This review analyzed how neuromuscular fatigue affects motor unit recruitment in high neural demand sprint training for adolescents. A better understanding of how neural fatigue can impair performance can give better knowledge of how to program to fit the needs of these adolescent athletes.

Peer-reviewed studies analyzed EMG activity, motor unit recruitment, jump tests, and sprint performance in sprinters or

adolescent athletes who use high neural demand activities and strength training. Outcomes included motor unit firing rates, jump test results, and changes in sprint velocity during training. RESULTS: Studies have shown reductions in motor unit firing and an increase in recruitment thresholds. There was also a decrease in countermovement jump and sprint performance. CONCLUSION: Evidence suggests central fatigue may result in an early decrease in performance of adolescent athletes. This shows the importance of monitoring neuromuscular output using equipment such as EMG. These findings can measure fatigue in sprint training to improve performance and reduce the risk of overtraining.

10

An OWASP Aligned Static Analysis Approach for Detecting and Remediating Security Misconfigurations in Django Web Applications

Diksha Janaki Raman

Mentor: Robert Richardson, MS

In the most recent OWASP Top 10, Security Misconfiguration has changed from the fifth to the second most severe risk category. As software becomes increasingly configurable, the potential attack surface for these misconfigurations continues to rise. Real-world incidents, such as the 2017 Equifax Breach, show the impact that improper security configurations. This research presents a security auditing script to identify insecure configurations within Django-based applications through the use of Static Analysis. The script evaluates ten critical vulnerabilities, mapping each finding to the most recent OWASP Top 10 framework. After detection, the project provides automated remediation steps for every vulnerability identified, offering a clear path toward system hardening. The results demonstrate that by analyzing the code structure in a configuration file, the script can detect misconfigurations that standard deployment checks tend to overlook. Ultimately, this research attempts to provide a scalable framework for security integration, by filling the gap between configuration and security compliance.

11

Comparing Classical and Quantum Machine Learning for Cyberattack Detection in Smart Grids

Tracey Kwarteng and Grace Dushime

Mentor: Mariam Gado, PhD

Smart grids use digital technology and automation to make electricity distribution efficient and reliable, relying on central control nodes to manage flow. If attackers compromise these nodes,

they can disrupt load management, overload the system, and cause blackouts in critical locations like hospitals and factories. Classical machine learning has improved smart grid intrusion detection but struggles to handle large, unbalanced data, adversarial attacks, and real-time scalability. This project compares a classical Support Vector Machine (SVM) against a Quantum Support Vector Machine (QSVM) to evaluate which is more effective at detecting cyberattacks versus safe signals. Both models are evaluated on accuracy, precision, and training speed and trained on the Edge-IIoTset dataset, a realistic IIoT network traffic dataset capturing attacks across devices that share industrial protocols common to smart grid environments. Using a locally hosted simulation, the results were as following: the classical SVM model produced 98.35% accuracy and 100% precision in 0.15s training time while its quantum counterpart gave 85% accuracy and 85% precision in 2.99s training time. Future efforts include testing both models on an actual quantum computer hosted by IBM Quantum Platform to test the effects of noise on the model performance metrics. By directly testing quantum methods against classical approaches on real attack data, this project provides students, researchers, and infrastructure defenders with practical insights into whether quantum machine learning is ready to strengthen the security of the energy systems modern society depends on.

12

Using Momentum to Determine Loading Strategies for Loaded Jumps

Grayson Madsen and Bria Wasmund

Mentor: Luke Chowning, PhD

Loaded jump training is widely implemented to enhance lower-body power and explosive performance. Loading strategies are traditionally based on maximizing power output (force \times velocity); however, power may not adequately account for changes in system mass. Momentum (mass \times velocity), derived from Newtonian mechanics, may provide a more appropriate metric because it quantifies the magnitude of motion and inherently incorporates system mass. Furthermore, prescribing loads relative to body mass may be more practical than using back squat one-repetition maximum (1RM). This study aims to (1) evaluate momentum as a primary metric for determining optimal loading in loaded jumps and (2) compare body mass-based load prescription strategies.

To date, nine participants (8 males and 1 female) were recruited for this study (age = 21.1 ± 1.4 y; height = 1.7 ± 0.3 m; mass = 77.7 ± 19.9 kg). Participants performed vertical jump-landings under

four conditions: unloaded, 25%, 50%, and 75% body mass. Ground reaction force was collected using an AMTI force platform and processed to obtain jump height, takeoff velocity, and concentric power variables. Momentum was calculated as system mass \times takeoff velocity. A one-way repeated measures ANOVA compared conditions ($\alpha = 0.05$) and Cohen's d effect size was calculated to supplement statistical analysis. RESULTS There was a significant main effect for jump height ($F[3,8] = 185.9$; $p > 0.01$), peak power ($F[3,8] = 197.7$; $p > 0.01$), and momentum ($F[3,8] = 28.2$; $p > 0.01$). CONCLUSION Data collection is ongoing, but the data suggests that momentum is a more robust option for prescribing training loads for loaded jump training.

13

Can Abstract Interpretation Based Static Analysis Tools be Used to Find Greater Than Trivial Bugs in Free Open Source Software

Kodiak McClure

Mentor: Jared Soundy, PhD

The increasing importance of Free and Open Source Software (FOSS) in critical applications has raised concerns over undiscovered bugs. This study investigates whether abstract interpretation-based static analysis can uncover non-trivial bugs in widely used FOSS projects. Six C-based repositories are analyzed using three static analyzers that range from general-purpose to concurrency-focused to safety-critical. By running each analyzer (Astrée, IKOS, Goblint) on each chosen repository (cURL GnuTLS, Libping, git, LMBD, Nginx), recording their results with the goal is to see if these repositories are using abstract interpretation static analysis and if not, what they may be missing without it, while also determining some of the risk-related errors found in these repositories.

14

Investigating the Relationship Between Stylopodial Circumference and Mass in Bats

Kierra Miller

Mentor: Alex Dececchi, PhD

Accuracy in size and mass estimates proves to be a persistent challenge in paleontology, specifically within the exploration of ecological implications for organisms. Although there has been great progress made in methodology for making these estimates, uncertainty remains, especially for groups without close living relatives, such as pterosaurs, an extinct clade of fliers. Lack of extant analogs for pterosaurs creates a challenge for testing scaling relationships; however, bats offer an opportunity for comparison.

Bats are volant mammals that share many functional similarities with pterosaurs including pneumatized skeletons, elongated forelimbs, and flight membrane bound fore and hindlimbs. Previous work has shown a strong correlation between stylopodial circumference and mass in quadrupedal terrestrial tetrapods. One study examined a large comparative dataset, but it did not include bats, leaving uncertainty about volant taxa. Our study aims to address this gap by measuring femur circumference of bat specimen that have a known living mass to test if bats fit within the established stylopodial circumference-mass relationship. By establishing if this relationship fits the previous relationship, we can assess whether terrestrial scaling equations can be reliably extended to flying clades, assisting with pterosaur mass estimations and improving ecological interpretations for a multitude of clades.

15

The Impact of Packet Schedulers on a Variety of Traffic Types within a Simulated Environment

Landon Mohr

Mentor: Pat Engebretson, DSc

Packet scheduling determines the order in which packets are transmitted when multiple data flows compete for access to an output port. Because schedulers operate on every packet that flows through modern networks, they directly influence latency, jitter, loss, and throughput. Although individual scheduling algorithms have been extensively studied and compared, fewer studies evaluate their behavior under heterogeneous mixed-traffic workloads representative of modern networks. Historically, comparative studies offered little practical value in live networks because engineers could only pick among few provided default schedulers based on non-clearly defined traffic. Now, as programmable and software-based packet schedulers become increasingly accessible, engineers are gaining greater flexibility in selecting scheduling policies suited to their network environments. This study evaluates three common scheduling disciplines across five representative traffic classes in a controlled bottleneck topology. By examining performance under mixed-traffic conditions, the study investigates whether scheduler selection produces statistically significant performance differences across traffic classes and characterizes the resulting trade-offs among latency, jitter, packet loss, throughput, and fairness.

16

Evaluating the Antibacterial Potential of Bee Defensin-1 in Honey Against Human and Plant Pathogens

Derek Moreno

Mentor: Andrew Sathoff, PhD

Bee Defensin-1, an antimicrobial peptide (AMP) detected in all honey, is produced by bees and incorporated into honey through their salivary secretions. It is hypothesized to be responsible for the antimicrobial activity of alfalfa honey. Defensins have demonstrated an ability to break down bacterial membranes, but the antibacterial effects of Bee Defensin-1 against diverse human and plant pathogens remain incompletely characterized. The antibacterial activity of chemically synthesized Bee Defensin-1 gamma core was evaluated against *Staphylococcus epidermidis*, *Escherichia coli* K-12, *Agrobacterium tumefaciens*, *Clavibacter michiganensis*, *Erwinia carotovora*, and *Pseudomonas syringae*. Using spread plate and microdilution assays, the IC50 value (the concentration of antimicrobial agent required to inhibit bacterial growth by 50%) was calculated. Gram positive bacteria, like *S. epidermidis*, showed the strongest response to Bee Defensin-1 γ -core by demonstrating a low IC50 value of $\sim 2.5 \mu\text{g/mL}$. Bee Defensin-1 γ -core exhibited strong, selective antimicrobial activity against Gram-positive bacteria, while Gram-negative bacteria showed minimal or no susceptibility. These results show promise for the use of Bee Defensin-1 to combat antibiotic resistant bacteria that affect agricultural and human health.

17

Lightweight CNN Deployment on ARM-Based MCUs for Onboard Forest Fire Detection in Nano-Satellites

Sakshyam Pandey

Mentor: Andrew Kramer, PhD

Nano-satellites, given their standardized models and minimal size, weight and power (SWaP) requirements significantly reduces satellite manufacturing and launching costs - giving developing countries an easier entry to space technologies. Developing countries also face significant problems due to forest-fires which pose a threat to human lives and property. Traditional nano-satellite based wildfire warning systems relied heavily on transmitting large volumes of raw images to ground for analysis. This results in delays in warning and depletion of resources and bandwidth. This project explores the feasibility of performing on-board wildfire detection by developing and running a Lightweight deep learning model in the MCUs of nano-satellites. For this project, development and deployment of forest-fire detection models in ARM processors, a

widely adopted MCU for nano-satellites, is conducted and studied. A Convolutional Neural Network (CNN) was developed and trained on publicly available satellite-imagery dataset containing fire and non-fire images to develop a binary classification model. The dataset consisted of approximately 3480 fire and 2820 no-fire images, divided into training, validation and test sets in the ratio of 0.70, 0.15 and 0.15 respectively. They were trained in a batch size of 16 over 30 epochs. The model achieved a test accuracy of 0.9482 and loss of 0.1604 during the testing. The next steps include model optimization, evaluating compression techniques and successfully running it in an ARM microprocessor. Once complete, this research contributes to better implementation of on-board forest fire detection systems and early warning systems which directly helps mitigate the loss of lives and property.

18

Building an Explainable RAG-based Clinical Decision Support Prototype

Irina Pecherskaia

Mentor: Jason Mixon, PhD

Clinical Decision Support Systems (CDSS) increasingly leverage artificial intelligence to provide evidence-based recommendations, yet adoption is limited by concerns of transparency and trust. Retrieval-Augmented Generation (RAG) models, which combine information retrieval with generative language models, offer powerful knowledge synthesis but still lack sufficient explainability. After conducting an extensive literature review, we identified explainability gaps and produced the following design principles for explainable RAG-enhanced CDSS: data protection, workflow alignment, patient-centered contextualization, human-centered oversight, and reliable clinical evidence delivery. This project advances the previous work by developing and evaluating a prototype system grounded in the design principles. The system integrates curated clinical sources (e.g., PubMed abstracts and guidelines) with explainability features such as evidence traceability, rationale generation, and uncertainty indicators. This project contributes AI in healthcare by combining theory and practice, advancing the development of trustworthy clinical decision support tools. The novelty of our research lies in implementing the explainability features. Through our research, we aim to determine to what extent the added explainability features implemented in our model increase explainability, accuracy, and transparency in the CDSS tools.

19**Exploring Digital Sound in the Real World***David Provance**Mentor: Tate Carson, MFA, PhD*

The aim of this initiative is to create a replicable system that defines and highlights the acoustic differences between recordings by changing microphone layout, their positioning, and the room itself. Traditional studies for recording techniques often rely on live instruments which provide a natural and dynamic sound, however no two performances will ever be exactly the same. This makes precise replication difficult. Traditional speakers can be replicated precisely, but because they are directional, the sound field (the way sound spreads and behaves in a space) is unrealistic. To overcome this, I propose using a spherical speaker as the sound source. Unlike traditional speakers, a spherical speaker emits sound uniformly in all directions, producing a more natural sound field while remaining fully replicable

20**Testing Display Peripherals for Firmware Vulnerabilities***Gabriel Severs**Mentor: Andrew Kramer, PhD*

This research investigates the security of display peripherals, a category of devices that has received limited scrutiny compared to other computer-connected hardware. This project began with a broad exploration of potential attack surfaces — including firmware behavior and auxiliary communication interfaces — to assess whether untested, legacy display peripherals expose overlooked vulnerabilities. By applying this approach to a consumer monitor not previously examined in prior studies, this work identifies an undocumented I2C-accessible interface that provides full firmware access, underscoring the need for deeper evaluation of display-peripheral security.

21**Towards a Design Theory for Explainable Clinical Decision Support Systems***Andrew Smith**Mentor: Andy Behrens, PhD*

The integration of Retrieval-Augmented Generation (RAG) into Clinical Decision Support Systems (CDSS) has the potential to transform clinician decision-making. However, conventional Large Language Models (LLMs) produce hallucinations that damage clinician trust. This study develops a clinician-centered design theory for Explainable AI (XAI) in CDSS, grounded in the Extended

Cognitive Fit Model (ECFM) and Information Systems Design Theory (ISDT). Five design principles are proposed: data protection, workflow alignment, patient-centered contextualization, human-centered oversight, and reliable clinical evidence delivery. The XAI-CDSS design theory facilitates clinician trust while advancing transparent AI systems. Future work will instantiate and evaluate the theory in prototype form.

22

Exploring Environmental Bacteriophages for Mycobacterial and Alfalfa Pathogen Control

Amélie Steins and Derek Moreno

Mentor: Andrew Sathoff, PhD

Bacteriophages are viruses that infect bacteria. They are a possible alternative to antibiotics as bacterial resistance continues to become a bigger problem in both human health and agriculture. In this study, multiple environmental samples were collected from Lake Herman State Park in Madison, SD and screened for bacteriophages that could infect *Mycobacterium smegmatis*, which is the model species for the pathogen that causes tuberculosis. The first steps of the isolation process, including direct isolation and plaque assays, were repeated multiple times, but the results were inconsistent. Using the double agar overlay assay, plaques of different sizes and shapes were observed, which suggests that phages were present in several of the collected samples. However, attempts to isolate and amplify specific plaques through spot testing were unsuccessful. Because of these obstacles, this project has now moved toward isolating phages against *Pseudomonas* sp., which are the most economically important bacterial pathogens of alfalfa. Although a stable phage isolate was not successfully obtained from *M. smegmatis*, this work still shows both the potential and the difficulty of environmental phage isolation.

23

Effects of ischemic preconditioning on max effort 200-yd swim in female swimmers

Mason Usselman and Kiley Walker

Mentor: Shane Scholten, PhD

Ischemic preconditioning (IPC) has been proposed as a potential ergogenic aid, but research involving female athletes and middle-distance swimming events remains limited. The purpose of this study was to examine the effects of IPC on a 200-yd time trial in competitive female swimmers. Four female swimmers completed a randomized, counterbalanced crossover study involving IPC and sham treatments. The IPC protocol consisted of three cycles of

5-min bilateral thigh occlusion at individualized personal tourniquet pressure (PTP) followed by 5-min reperfusion, while the sham treatment involved three cycles of 1-min occlusion and reperfusion at the same pressure. Following treatment, participants performed a standardized warm-up and a race-paced 200-yd swim. Mean swim time following IPC (137.48 ± 11.19 s) was faster than after the sham condition (138.23 ± 12.20 s), representing an average improvement of 0.75 s. Individual responses varied, but results suggest IPC may provide a small performance benefit in high-intensity swimming events lasting approximately two minutes. These findings contribute to the limited literature on IPC in female athletes and suggest that individualized occlusion pressures may be an effective approach for IPC protocols. Further data collection is needed to reach a sample size to satisfy the minimum requirements for statistical analysis.

24

EXAIM: Real-Time Summarization Middleware for Multi-Agent Clinical Workflows

Abem Woldesenbet

Mentor: Andy Behrens, PhD

Multi-agent Large Language Models (LLMs) offer diverse diagnostic perspectives but generate verbose, interleaved reasoning traces that overwhelm clinicians. We present EXAIM, a middleware artifact that transforms streaming multiagent reasoning into structured, schema-constrained summaries aligned with standard clinical communication protocols (SBAR (Situation, Background, Assessment, Recommendation) / SOAP (Subjective, Objective, Assessment, Plan)). In contrast to heuristic turn-based approaches, EXAIM employs semantic event-driven buffering to trigger summary updates when the stream indicates clinically meaningful semantic transitions (e.g., relevant, novel, completed reasoning units; topic shifts; critical alerts), thereby decoupling update frequency from generation rate.

GRADUATE POSTERS

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25

Employee Capabilities and Analytics for Green Manufacturing Sustainability Presentation

PhD Candidate, Ahmed Alghamdi, College of Business and Information Systems, Department of Information Systems

Mentor: Abeer Alkhwaldi, PhD

Environmental sustainability is a critical priority for the manufacturing sector, yet the integration of human capabilities with analytical technologies remains underexplored. Grounded in the Resource-Based View (RBV), this study examines how employees' environmental awareness, environmental knowledge, and business intelligence and analytics (BI&A) skills collectively drive green sustainability outcomes in U.S. manufacturing companies. The research model proposes that the use of BI&A technologies serves as a vital mediating mechanism, enabling organizations to transform intangible human resources into measurable environmental benefits. By utilizing data-driven insights to analyze energy use and resource consumption, these capabilities support aligned decision-making that enhances eco-efficiency and waste reduction. Employing a quantitative, cross-sectional survey design and Partial Least Squares Structural Equation Modeling (PLS-SEM), the study expects to demonstrate that employee capabilities become a definitive source of sustainable competitive advantage only when integrated with analytical systems. These findings will provide practical guidance for firms seeking to optimize environmental performance and strengthen their market position through the strategic combination of people and analytics.

26

Evaluating the Impact of AI and Blockchain for Supply Chain Risk Mitigation: A Predictive Analytics Based Approach

Sai Neelima Seru, Graduate Research Assistant, PhD Student in Information Systems

Mentor: David Zeng, PhD

Global supply chains face increasing operational risks, including delivery delays and data integrity issues. Artificial Intelligence (AI) enables predictive analysis of logistics disruptions using large datasets, but its "black-box" nature limits transparency and trust in multi-party environments. In contrast, blockchain technology

provides secure and immutable records but lacks predictive capability. This study evaluates whether integrating predictive AI with a permissioned blockchain improves supply chain risk management. Using the Brazilian Olist e-commerce dataset with over several machine learning models - Logistic Regression, Random Forest, Decision Tree, and HistGradientBoosting were developed to predict delivery delays using temporal validation. A permissioned blockchain ledger was prototyped to record shipment milestones and anchor AI-generated alerts, creating a tamper-evident record of predicted and actual events. The findings show that AI models achieve strong delivery risk prediction, while blockchain ensures secure and tamper-evident event records. The integrated analysis provides both predictive accuracy and data integrity by anchoring AI alerts to a verifiable blockchain ledger. This research contributes to Information Systems theory by offering design guidance for secure and transparent governance in modern supply chain management.

27

Privacy-Preserving Synthetic Data Generation for Federated Learning in Imbalanced Credit Card Fraud Detection: A Comparative Analysis of SMOTE vs. GAN Approaches

Muhammad Ali Bhutta, PhD Student, Computer Science
Mentor: Abid Mehmood, PhD

Credit card fraud is a costly problem for banks and consumers. Unfortunately, due to privacy regulations, banks are not allowed to share data with each other, making it difficult to develop a good fraud detection model, as fraud cases are extremely rare. In this research, the potential of synthetic data generation for improving fraud detection models will be investigated. Two privacy-preserving approaches will be studied for generating synthetic fraud data. Federated-SMOTE generates new fraud examples by combining existing rare cases from multiple sources, while Federated-GAN uses generative models to learn fraud patterns and create synthetic examples. Both approaches will be evaluated using the popular credit card dataset split into multiple simulated banks to take into account real-world differences between banks. These approaches will be compared in terms of their impact on credit card fraud detection accuracy, cost, and privacy preservation. The validation of the generation of synthetic data for privacy-preserving credit card fraud detection is expected to lead to better fraud detection models, which can be evaluated based on statistical similarity measures and improvements in fraud detection models' performance.

28

Constructing Information Systems: Technology Frames and Career Interest Among Middle School Students

*Sai Mounika Chintalapudi, Student - PhD in Information Systems,
Dakota State University, College of BIS*

Mentor: Cherie Noteboom, PhD

The Information Systems (IS) discipline faces ongoing challenges in attracting students to the field despite its growing societal importance. Previous studies have examined how factors such as gender gaps and STEM identities shape career aspirations; however, there is limited understanding of how early interpretations of the IS discipline shape career interest. This research adapts the TFR (Technology Frames of Reference) theory to examine how middle school students develop understandings of IS. Using qualitative survey data through a deductive approach to identify the Nature of IS, the Purpose of IS, and IS-in-Use, misalignment, and career interest. Misalignment reflects limited knowledge of IS, with students primarily viewing it as coding-oriented and technical, which reduces career interest. This study extends TFR into educational contexts and highlights the importance of early understanding of the IS discipline by focusing on longitudinal studies to monitor the development of the extended TFR.

29

Hospital Readmission, Data Integrity, and Policy Value in New Zealand

*Christopher Elce, M.S. student in Analytics and Applied Artificial
Intelligence*

College of Business and Information Systems, Dakota State University

Mentors: Martinson Ofori, PhD and Andy Behrens, PhD

Acute 28-day hospital readmission rates are widely used in New Zealand as indicators of hospital quality and system performance. Their policy value depends on data integrity and the stability of rates across districts and time. This study analyzes six quarterly datasets published by the New Zealand Ministry of Health and restructures the aggregated reports into a DHB-quarter analytical dataset. Exploratory analysis and multivariable models were used to examine relationships among discharge volume, observed readmissions, and benchmarked predictions across Districts of Service. Results suggest that observed variation is strongly shaped by discharge volume and benchmarking discrepancy signals, with some smaller districts exerting disproportionate influence consistent with denominator sensitivity and potential measurement artifacts. Māori versus non-Māori equity impacts were not tested in this analysis and are identified as a priority for future work.

This is because stratification can reduce subgroup denominators and increase volatility in rate-based metrics. Strengthening data validation, stability checks for low-volume strata, and equity-focused monitoring would improve confidence in readmission indicators for policy use.

30

Spoofing Tire Pressure Monitoring to Reveal System Vulnerabilities

Ashton Ruesch, M.S. student in Computer Science with Cyber Operations Specialization

Tire Pressure Monitoring System (TPMS) sensors broadcast unencrypted, unauthenticated packets at 315 and 433 MHz, transmitting sensor ID, pressure, and temperature to a vehicle's onboard receiver. This project demonstrates that cheap SDR hardware can capture, decode, and spoof these transmissions across three production vehicles: a 2013 Ford Taurus, a 2017 Jeep Cherokee, and a 2024 Subaru Ascent. An RTL-SDR and rtl_433 decode common TPMS protocols. Its flex decoder handles unknown protocols through raw capture analysis. A HackRF One is being used to craft packets triggering false low-pressure warnings on real dashboards, targeting a spoofing vulnerability present across most vehicles today.

31

Beyond Binary: A Prescriptive Theory for Nuanced Analysis of User Engagement in Mental Health Applications

*Khaleel Al-Rababah, College of Business and Information Systems
Mentor: Cherie Noteboom, PhD*

Despite the rapid growth of mental health applications (mHealth), achieving sustained user engagement remains a major challenge, highlighting a disconnect between app design and user needs. Existing analytical approaches, which depend on binary sentiment analysis and static metrics, lack the depth to capture the complexity, ambiguity, and evolving nature of user feedback, limiting actionable insights for developers. To address this, we introduce a novel hybrid analytical framework grounded in Self-Determination Theory (SDT). Following Gregor's (2006) taxonomy, we present a Type V "Theory for Design and Action"—a prescriptive framework outlining meta-requirements and design principles for nuanced engagement analysis. Our methodology combines fuzzy logic to assess engagement along a graded spectrum, topic modeling to associate sentiments with specific app features, and natural language processing (NLP) to interpret complex linguistic elements such as negation, metaphor, and temporal shifts. A case study of the Youper

app illustrates that while traditional analytics overlook narratives of disenchantment, our framework uncovers the psychological factors driving engagement and disengagement. We conclude that moving beyond binary, static analytics is crucial for decoding user experience, providing researchers and developers with robust methodological guidance for designing more effective mental health tools.

32

Radiologists' Perspectives on Artificial Intelligence A Pilot

Qualitative Exploration

Sumana Haldar, College of Business and Information Systems

Mentor: Cherie Noteboom, PhD,

The rapid integration of artificial intelligence (AI) in radiology is transforming medical imaging workflows, yet the perspectives of radiologists remain insufficiently explored. This pilot study aims to examine radiologists' perceptions, expectations, and concerns regarding AI in medical imaging, particularly its impact on workflow efficiency, diagnostic accuracy, job satisfaction, burnout, trust, and decision-making autonomy. Guided by the Quadruple Aim, the Job Demands–Resources (JD–R) model, and Agency Theory, the study seeks to understand how AI adoption may influence patient experience, population health outcomes, healthcare cost efficiency, and radiologist well-being. Using semi-structured interviews, this pilot will gather insights from radiologists across different levels of professional experience. The study will explore how radiologists believe AI will affect workflow efficiency and diagnostic decision-making, how AI adoption may influence professional satisfaction and burnout, and what factors shape trust in AI systems. The pilot is expected to identify key themes related to radiologists' interactions with AI, including perceived benefits, challenges, and trust determinants. Findings will generate preliminary insights that inform the design and methodology of a larger study and contribute to developing strategies for AI implementation that improves patient care while supporting the sustainability of the radiology workforce.

Public Discourse on AI Governance: Analyzing Social Media Sentiment Toward Artificial Intelligence Regulation

Vahini Atluri, PhD student in Information Systems

Mentor: Cherie Noteboom, PhD

The rapid deployment of artificial intelligence (AI) has intensified public debate on governance, regulation and ethical oversight. This study analyzes social media conversations on AI governance from January 1st, 2025 through March 9th, 2026, using Brandwatch to monitor discussions on X (formerly Twitter) and Reddit. The analysis identifies dominant topics, trends and public sentiment around AI regulation, transparency and human oversight. Results reveal that ethical considerations and the need for human review dominate discourse, particularly in areas such as surveillance, autonomous systems and employment impacts. Regulatory debates are framed around U.S. government policies, legal challenges and industry resistance, with transparency and accountability emerging as key public demands. Neutral sentiment dominates, though negative discussions highlight concerns about job displacement, privacy and corporate influence. These findings illustrate how online discourse reflects societal expectations for responsible AI development and provide policymakers and researchers with insights into public priorities in shaping AI governance frameworks.

FACULTY POSTERS

BIT 106: Collaboration Space | 1 p.m- 3 p.m.

Posters are numbered to assist attendees in locating specific projects.

34

Streamlining Literacy Assessment

Katie Anderson, EdD, College of Education and Human Performance
Sheila Mulder, EdD, College of Education and Human Performance
Samuel W. Flint, PhD, Beacom College of Computer and Cyber Sciences

Reading proficiency scores are low throughout the nation. Reading proficiency is a foundational skill that supports academic success across all content areas. Skilled reading involves multiple interrelated components. Assessment can support teachers to identify skill deficits and inform instruction; however, rural teachers lack the time, resources, and specialized support to translate the data into effective instruction and interventions. To better contextualize this need, we received 59 surveys from South Dakota teachers with 23 of the surveys being valid responses, finding that teachers feel prepared to teach reading and struggling readers. Teachers reported that they spend relatively little time in assessment, and they frequently make data-backed decisions. However, on the assessment knowledge survey questions, respondents showed low actual preparedness to use assessment data based on their responses. Proposed Solution: To help teachers translate the assessment data they have, we are developing and testing a data-driven tool to aid teachers to efficiently identify student skill deficits, through research-backed selection of diagnostics. From this diagnostic data our tool groups and suggests efficient, relevant, evidence-based interventions. Ultimately with the goal that rural teachers receive the critical support and structure to effectively use reading assessment data to increase student literacy outcomes.

35

The Security-by-Design Deficit in AI Agriculture

Cherie Noteboom, PhD, Abeer Alkhwaldi, PhD, Martinson Ofori, PhD, Vahini Atluri

Artificial intelligence (AI) is rapidly transforming agricultural systems through applications such as crop monitoring, disease detection, predictive modeling, and precision livestock management. As AI technologies become embedded in agricultural infrastructure, questions surrounding cybersecurity, privacy, and

responsible system design are becoming increasingly important. While existing research often emphasizes algorithmic performance and technological innovation, less attention has been given to how security and governance concerns are integrated into the broader AI–Agriculture research landscape.

This study examines the intellectual structure of AI–Agriculture adoption research using bibliometric network analysis. A dataset of 711 peer-reviewed publications (2019–2025) was compiled from six academic databases and analyzed using VOSviewer to identify thematic clusters and relationships among key research concepts. The analysis reveals four dominant clusters focused on technical AI development, predictive environmental modeling, livestock and production systems, and socio-organizational adoption contexts.

Despite the rapid growth of AI applications in agriculture, cybersecurity and privacy remain structurally peripheral within the knowledge network, appearing in only a small portion of the literature and largely disconnected from core technical development themes. These findings suggest a structural “security-by-design deficit,” where security considerations are treated as implementation challenges rather than foundational design principles. Addressing this gap presents an opportunity to strengthen the resilience, trustworthiness, and long-term sustainability of AI-enabled agricultural systems while advancing research on responsible and secure digital agriculture.

36

Evolution of Doctoral Research in IS: A Systematic Analysis of Dissertations

Cherie Noteboom, PhD, Sia Neelima Seru, Stephen Surlles, PhD, Man Wang

Doctoral education plays a central role in shaping the intellectual direction and disciplinary identity of Information Systems (IS). As technological innovation accelerates—particularly in areas such as digital transformation, analytics, and artificial intelligence, doctoral research must balance emerging technological trends with established socio-technical foundations. This study examines the evolution of IS doctoral research at Dakota State University (DSU) through an AI-assisted bibliometric analysis of 94 dissertations published between 2006 and 2025. Using GPT-5 for structured keyword extraction and VOSviewer for network analysis, we identify major thematic clusters, methodological orientations, and technological shifts over time. Findings reveal both continuity in core socio-technical perspectives and adaptive shifts toward

emerging digital technologies. The results provide longitudinal insight into how DSU's IS doctoral program reflects technological transformation while sustaining disciplinary coherence, offering implications for doctoral curriculum design and research strategy in rapidly evolving academic environments.

37

Risk-Aware Optimization of Honeybee Transportation Using Temperature–Humidity Modeling and Graph-Based Shortest Path Analysis

Dr. Youssef Harrath, Dr. Jihene Kaabi, and Karthik Pappu (PhD student)

Each year, millions of honeybee colonies are transported between the Northern Plains and other regions of the United States to support pollination and honey production. While essential to modern agriculture, long-distance transportation exposes colonies to environmental stressors that can increase mortality and reduce colony performance. We developed a mathematical risk optimization framework to quantify and minimize transport-related stress. The model integrates temperature and humidity data with geographic road networks and transportation logistics. We consider 42 transportation hubs distributed across 14 states (CA, OR, WA, ID, MT, ND, SD, MN, WI, TX, FL, GA, ME, NJ), constructing 42×42 risk matrices that quantify environmental stress between city pairs. Each edge weight represents a composite risk score derived from temperature- and humidity-based stress thresholds, combined with a distance-penalty cost function. The transportation network is modeled as a weighted graph, and the Floyd–Warshall algorithm, enhanced with a two-stage time-chain correction, is applied to identify minimum-risk routes for bidirectional transport. The proposed framework provides a scalable, data-driven decision-support tool for optimizing honeybee transportation while reducing environmental stress and improving colony resilience.

38

Understanding Farmer Adoption of Artificial Intelligence in Agriculture: A Systematic Review and Socio-Technical Model Grounded in Midwest Farming Systems

*Abeer F. Alkhwaldi, PhD and Cherie B. Noteboom, PhD
College of Business and Information Systems, Dakota State University*

Artificial intelligence (AI) is transforming agriculture systems, but its implementation is still scattered at the farm scale, especially in the U.S. Midwest area. This paper undertakes a “systematic literature review” (SLR) to 23 empirical studies published since 2020 to determine the main socio-technical factors affecting the introduction of AI and AI-enabled technologies among farmers.

Incorporating the insights of the Unified “Theory of Acceptance and Use of Technology” (UTAUT), “Technology-Organization-Environment” (TOE), and “Socio-Technical Systems” (STS) frameworks, the review demonstrates that the factors that influence adoption are interdependent and include technological (performance expectancy, effort expectancy, task technology fit), social (trust in technology, social influence) and contextual (facilitating conditions, data privacy concern) factors. Results are compiled into the “Socio-Technical Structural Equation Model” (STSSEM) that is used to explain the interaction of these determinants to impact the intentions of AI adoption among Midwestern farmers. The new model proposes mediating and moderating processes, namely the roles of trust, privacy and facilitating conditions that have been under-researched in previous studies. The work has a theoretical contribution, which is that it builds on a multi-level socio-technical conceptualization of digital agriculture and a practical contribution, which is the description of policy and design implications of encouraging trustful, inclusive, and region-specific AI implementation in U.S. agriculture.

39

Explainable Multimodal Machine Learning for PCOS

Christina Mulu, Zainab Albujaasim, Youssef Harrath, and Khatri Sanjeev

Polycystic Ovary Syndrome (PCOS) is a common endocrine disorder that affects women of reproductive age and is associated with hormonal imbalance, metabolic issues, and menstrual irregularity. Early and accurate prediction of PCOS is important for effective management and treatment. This work presents a framework for PCOS prediction that integrates clinical data and proteomic biomarkers. Clinical data include patient features such as hormones, menstrual irregularity, BMI, and insulin resistance, used as inputs. Proteomic biomarkers consist of PCOS-related proteins gathered from proteomic datasets and literature. A feature–protein–pathway mapping links clinical features to proteins and biological pathways using databases and literature. A multimodal classification approach combines clinical data and protein biomarkers to predict PCOS. In healthcare, model transparency is essential for trust and decision making. We incorporate explainable methods to identify key clinical features and proteins driving predictions and conduct heterogeneity analysis to reveal distinct PCOS subgroups for accurate diagnosis.

REMOTE POSTERS

BIT 235: Upstairs Conference Room | 1 p.m- 3 p.m.

40

Information Technology Investment Efficiency In Federal Government Agencies: A Data Envelopment Analysis Approach

Angel Blanchard Littlejohn, PhD Candidate, College of Business and Information Systems

Mentor: Omar El-Gayar, PhD

Federal agencies spend over \$115 billion annually on IT, yet lack systematic frameworks to evaluate whether these investments improve operational efficiency and mission outcomes. This dissertation examines the relationship between IT investment patterns and operational efficiency across 24 CFO Act agencies using federal IT Dashboard data from fiscal years 2021–2024.

The study employs a two-stage Data Envelopment Analysis (DEA) approach with output-oriented BCC models, using three IT spending categories as inputs—infrastructure, administrative, and mission IT—and agency performance metrics as outputs. Second-stage ANOVA tests whether efficiency varies across budget quartiles, agency age, and fiscal year groupings.

Findings reveal significant efficiency variation across agencies. Efficient agencies allocate more spending to infrastructure IT (48.6% vs. 34.7%) and maintain lower total IT budgets. Agency size moderates these relationships: infrastructure IT drives efficiency gains for smaller agencies, while mission-specific IT yields stronger returns for larger ones.

The research extends healthcare IT efficiency methodologies to the federal domain, offering the first systematic DEA-based assessment using mandated federal reporting data. Practically, it provides policymakers a quantitative framework for evidence-based resource allocation, identifies benchmark agencies, and sets improvement targets—supporting more effective FITARA implementation and improved government service delivery within existing budget constraints.

41

AI Adoption for Supply Chain Management

Lordt Becklines – PhD Student – Information Systems

Artificial intelligence is increasingly deployed in supply chain management, yet many organizations struggle to align adoption

efforts with process readiness, data quality, governance, and workforce capabilities, and they still lack validated supply chain specific roadmap for assessing readiness, sequencing investments, and reducing implementation risk. This study develops and evaluates a Capability Maturity Model for Artificial Intelligence Integration in Supply Chain Management to address that gap. Using a design science research approach, the study synthesizes prior literature and practitioner knowledge to define maturity dimensions, capability indicators, and staged progression levels for AI integration in supply chain contexts. The artifact and assessment instrument were iteratively refined and validated through expert review using a Delphi based process to strengthen relevance, clarity, and practical usability. The resulting model enables organizations to assess current capability, identify priority gaps, and plan improvement actions aligned with operational goals across planning, design, and execution activities. A case-based application demonstrates how the instrument produces an organizational maturity profile and supports decision making on capability development priorities. This research contributes a practitioner ready assessment and planning tool and advances scholarship by offering a validated framework for staged and performance aligned AI integration in supply chain management.

42

PII Leakage From Home Networks: a Design Science Approach

Hajar Niroomand, College of Business and Information Systems

Personally identifiable information (PII) leakage from home networks presents significant identity-theft risk. While enterprise environments deploy firewalls, intrusion detection systems, and data-loss prevention tools, comparable outbound protections rarely exist in domestic settings. As smart devices expand the home attack surface, vulnerable populations, including children, elderly users, and remote workers, remain exposed.

This design science research proposes Secure-Home, a prototype outbound inspection tool that detects and redacts cleartext PII before data leaves home networks. The system applies rule-based detection and selective redaction to provide a practical, privacy-preserving last line of defense tailored to domestic environments. Evaluation using controlled synthetic datasets demonstrates accurate detection, correct allow/redact decisions, and selective artifact generation without unnecessary storage growth. By bridging the gap between enterprise-grade controls and home network protection, Secure-Home contributes both a defensible framework and empirical evidence supporting outbound PII inspection in non-enterprise environments.

CREATIVE ACTIVITIES

BIT 135: Classroom and Adjacent Rooms | 1 p.m- 3 p.m.

PAX: Apathy Invades

Ashlyn Johnson

Mentor: Daniel Welynn

PAX: When Apathy Invades is a comprehensive 1-minute original animated short. In addition to original animation, PAX will feature an original script, voice acting, and full audio production. This animation is an allegory to society's increasingly blind trust in polarizing news outlets and willful ignorance of pollution and climate change. The world of PAX is a dramatized one, where a starship looms over the small town of Piermoore without upsetting the status quo. PAX is a call to action, a plea for society to look up and see the real issues: environmental, political, and social, that loom overhead. Drawing from the dark humor and bold and angular art style of TV show *Invader Zim* and the science fiction mystery of *Gravity Falls*, PAX has the air of looming dread and a strong feeling that something big is about to happen. Will the impending issues tip society into action before it is too late?

Bardella and the Curse of Silence

Karl Lexvold

Mentor: Tate Carson, MFA, PhD

Bardella and the Curse of Silence is a short demonstration Metroidvania video game that involves Wwise middleware audio integration with a heavy emphasis on audio output as not just an artistic element, but a narrative and gameplay element as well. Heavily influenced by works such as *Hollow Knight* and *Ori and the Will of the Wisps*, this demonstration is a glimpse into a larger world where music is wielded as a magical force, and a curse of silence devastates the land. This project was created using a large variety of tools, including Unity, REAPER, MuseScore, and Wwise. Despite its importance to a complete experience, sound and music are often an afterthought when it comes to video game development. As a musician and sound designer, I created this project as a testament to the importance of audio and music, and to demonstrate some techniques in which sounds can tell a story. This project will provide an enjoyable experience to the players of the demonstration and has given a unique experience to the DSU community, as most of the music in the demonstration was performed by DSU SoundLabs band members.

Hollow

Levi Jaacks

Mentor: Tate Carson, MFA, PhD

Hollow. A simple title for a seemingly simple film, yet representative of a deeper, troubling mental phenomenon. For some years I've pondered this feeling and the circumstances and symptoms of its development in a person, and finally took it upon myself to have a shot at giving perspective to it in the form of a short film. I've found it's a feeling that can be evoked equally in both the most joyous and connecting of moments as well as the loneliest times of solitude. I've found it permeates the most foundational concepts of purpose and desire as though their antithetical lover: opposing yet inseparable. For without purpose one can find themselves feeling internally hollow, yet even in pursuit of things we recognize as being the core reason for our being one can end up feeling just the same. I don't pretend to hold the key to understanding this phenomena – hence the ending I've chosen to depict – but from explicit experience both know what it feels like as well as the things I've found can break through that stupor, and have simply attempted to my best efforts to give a small taste of that within this work.

Drift

Tate Carson, MFA, PhD, Assistant Professor of Digital Sound Design

Tim Murray, MFA, Assistant Professor of Computer Graphics

College of Arts and Sciences

Drift is a sculptural sound art project that reconceptualizes the white noise machine from a utilitarian device into a platform for creative expression. The project explores how technologies used for sonic self-control can be reframed as artistic instruments that illuminate the continuum between noise and music. Drawing on theories of Orphic Media, which describe technologies that reshape perception and experience, Drift examines how everyday media modulate listening, attention, and environment. Developed through an interdisciplinary collaboration between Tate Carson (sound design and programming) and Tim Murray (design and fabrication), the sculpture uses microcontrollers, servo motors, and resonant materials such as brass and wood. Drift produces sound physically through motion and vibration, operating autonomously as a kinetic sound sculpture. As visitors move through the installation, the ambient soundscape gradually shifts from masking noise toward emergent musical structures, encouraging sustained listening and reflection on everyday sonic environments. Drift contributes to contemporary sound art discourse by reframing familiar noise technologies as instruments for artistic and perceptual exploration.

JURIED STUDENT EXHIBITION

BIT 135: DAD Classroom and Adjacent Rooms | 1 p.m. - 3 p.m.

Brian Aranki

Unwrapped Glossiness

The Preserves: Lucas Erikson Flight Sequence

McKenzie Calderwood

Paperclip: Complementary Photo Design

Upside-Down Knight

Intimate Airiness - wire abstract

Grace Clark

Bear in the Woods

When Do You Belong

Autumn Colors

Holly Davis

DSU Theater Company's Production of Macbeth

Madison Gaikowsky

Cozy Bed

Ashlyn Johnson

"Pax" Character Turnaround

Contact

Juniper Kerns

Macbeth: The Stringed Fates of Life

The Empress: Holly

Kieran Klein, Matthew Rusche, and Jordan Hopf

UNTUMBRA

Brianna Linedman

Wire Abstract

Just a Tool

Braden Loudon

Layermask

Aryn McIlravy

Freyr: Spinner of Yarn

Cheyenne Milbrandt

Untitled (project work)

Bella Mutchelknaus

City Life

David Provance

Using a Spherical Speaker to Explore Sound

Cora Red Leaf

Creator's Trickster

Japan Travel Poster

Ethan Sip

Just Me

Autumn Field

Spilling Sun

Pete Welborn

New Recruit

Guy V. Lobo

Special thanks to adjudicators for the juried exhibition:

Justin Blessinger, PhD

Peter Britton, MFA

Tate Carson, MFA, PhD

Konrad Lightner, Computer Graphics Generalist

Tim Murray, MFA

Kai Nunnery, MM

Erik Pederson, MS

Wendy Romero, MFA

PRESENTATIONS

BIT 117: Downstairs Classroom

Formulae, Strategy, and LLMs in Mathematics and Computer Science

1 p.m.

Exploring 3-CNF Formulas Generated From Partial Steiner Triple Systems

Wyatt Olson, Beacom College of Computer and Cyber Sciences

Mentors: Jared Soundy, PhD, Beacom College of Computer and Cyber Sciences

Justin Schroeder, PhD, College of Arts and Sciences

Steiner triple systems (STS) and subsets of these known as partial STS (PSTS) are combinatorial objects that have received substantial interest from mathematicians since their introduction in 1847. Over the last three decades P/STS have found applications in diverse fields ranging from digital circuit testing to wireless transmission. Perhaps unsurprisingly, the “triple” in P/STS allows for a mapping to 3-conjunctive normal form (3-CNF), the Boolean formula used as input to 3-SAT. Prompted by this ready conversion of P/STS to 3-CNF formulas and the numerous real-world applications, we explore the intersection of P/STS with 3-SAT and its counting version $\#3$ -SAT. We explain the properties of P/STS-generated 3-CNF formulas in terms familiar to the SAT community and experimentally compare them against randomly-generated 3-CNF formulas. We find that PSTS-3-CNF formulas are statistically distinct from randomly generated 3-CNF formulas. Additionally, we produce benchmark sets of P/STS-3-CNF formulas for the community that are to be submitted to the SAT Competition 2026 and the Model Counting Competition 2026.

1:30 p.m.

The Underpromoter’s Riddle: A Computational Analysis of the Knight Promotion in Chess

Yelarys Seidin, College of Arts and Sciences

Mentor: Justin Schroeder, PhD

This research addresses a classic question in chess strategy: why do players sometimes underpromote to a knight (worth 3 points) instead of a queen (worth 9 points)? The goal is to move beyond decades of anecdotal discussion to quantitatively determine if knight underpromotion is primarily a tool of tactical necessity or a matter of stylistic choice, and whether players miss hidden opportunities by defaulting to queen promotion. While chess databases track

the frequency of underpromotion, they offer little insight into the rationale for the choice. Prior work has focused on general player performance, but no large-scale quantitative analysis has leveraged modern chess engines to classify the comparative outcomes of knight versus queen promotion decisions. This study fills this gap by analyzing the consequences of the decisions. We will consider a large database of high-level online chess games, examining promotion decisions from two complementary angles: when players chose knight promotion and when they chose queen promotion. The first angle addresses whether knight underpromotion represents tactical necessity or stylistic choice. The second angle examines whether players miss superior knight promotions by defaulting to queen. Utilizing the Stockfish chess engine in custom Python scripts, we will compare the outcome of the actual promotion choice to the outcome of the hypothetical alternative (knight if queen was chosen, or queen if knight was chosen) and classify the results through a 5-tier system: Brilliant, Optimal, Equivalent, Suboptimal, and Blunder. The findings will reveal whether knight underpromotion serves as a tactical tool versus a stylistic preference, and whether cognitive bias toward the conventional choice causes players to miss game-winning opportunities. This analytical framework will replace subjective opinion with objective data, providing an evidence-based answer to a classic question in chess strategy and serving as a model for analyzing human decision-making in complex environments.

2 p.m.

Mid-Generation Jailbreaks in Open-Source LLMs Using a Pause-and-Edit Attack

Aman Singh, Komal Subhash More, Beacom College of Computer and Cyber Sciences

Mentor: Mark Spanier, PhD

Large Language Models (LLMs) are widely used in modern AI systems but ensuring that they consistently follow safety guidelines remains a challenge. Most existing defenses assume that safety must be enforced at the beginning of a response. However, this assumption may fail if the model's output is manipulated during generation. In this research, we introduce a pause-and-edit jailbreak attack that interrupts an LLM while it is generating a refusal response, removes the refusal text, and inserts a cooperative continuation before allowing generation to resume. Because LLMs generate text autoregressively, this modification can redirect the model's internal context and cause it to abandon its earlier safety decision. We evaluated this method using 390 harmful

prompts across 13 categories on several open-source models including Mistral-7B-Instruct-v0.2, Qwen3-14B, and CodeLlama-7B. Our results show that mid-generation manipulation can significantly increase harmful response rates, achieving conversion rates of up to 99.7% in some models. These findings highlight an important vulnerability in current LLM safety mechanisms and emphasize the need for defenses that monitor and enforce safety throughout the entire generation process rather than only at the beginning.

NEXT GENERATION RESEARCH FOR AGRICULTURE

BIT 112: Downstairs Classroom

1 p.m.

The Conservation Reserve Program at 40: Trends and Future Challenges for South Dakota Land Owners

Russell Graves, PhD, College of Arts and Sciences

Enacted on December 23, 1985, the Conservation Reserve Program (CRP) has served as the primary mechanism for federal farmland conservation efforts over the past 40 years. Through the CRP, as well as associated wetland and wildlife initiatives, a more comprehensive approach to addressing farm-related environmental concerns has emerged. Despite a legacy of garnering support from a politically diverse set of stakeholders, today the nearly 25 million acres of CRP land nationwide face an uncertain future, especially given the program's potential non-renewal amid a climate of federal cost-saving initiatives. In South Dakota, nearly 2.5 million acres of land remain locked into various CRP contracts (the second-highest national acreage total, behind Colorado). Future support depends not only upon fostering a deeper understanding of the program's benefits for enhancing the ecological health of farmland, but also touting its economic advantages for improving wildlife habitat and hunting tourism. This presentation will look briefly at the history of the CRP's development, then track the program's effects and changes from 1985 to 2025 in South Dakota through a series of composite maps. Finally, this research will examine the future likelihood of maintaining the program's goals and benefits in a climate of uncertain federal support.

1:30 p.m.

Cultivating the Digital Frontier: A Socio-Technical Analysis of AI Adoption in Midwestern Agriculture

Abeer Alkhwaldi, PhD, Cherie Noteboom, PhD and Amir A. Abdulmuhsin, PhD

College of Business and Information Systems, Department of Information Systems

Agricultural production faces unprecedented challenges from climate volatility, labor shortages, and rising costs. While Artificial Intelligence (AI) offers transformative predictive and autonomous capabilities, its adoption remains uneven across the Midwestern United States. This study develops a comprehensive socio-technical model by synthesizing the Unified Theory of Acceptance and Use of Technology (UTAUT) with the Task-Technology Fit (TTF) framework, incorporating regional variables such as environmental risk, broadband access, and policy support. Using Partial Least Squares Structural Equation Modeling (PLS-SEM) to analyze data from 489 Midwestern farmers, the research validates 11 hypothesized relationships. Findings indicate that performance expectancy, effort expectancy, and trust are the primary drivers of adoption, while data security concerns and financial constraints serve as significant deterrents. Furthermore, results highlight that robust broadband infrastructure and targeted policy support are critical for improving perceived ease of use. These insights provide a strategic roadmap for policymakers and ag-tech developers to bridge the rural digital divide, ensuring more equitable access to resilient, data-driven farming systems for small- and medium-sized operations.

2 p.m.

Risk-Aware Optimization of Honeybee Transportation Using Temperature–Humidity Modeling and Graph-Based Shortest Path Analysis

Youssef Harrath, PhD, Jihene Kaabi, PhD and Karthik Pappu, PhD student

Each year, millions of honeybee colonies are transported between the Northern Plains and other regions of the United States to support pollination and honey production. While essential to modern agriculture, long-distance transportation exposes colonies to environmental stressors that can increase mortality and reduce colony performance. We developed a mathematical risk optimization framework to quantify and minimize transport-related stress. The model integrates temperature and humidity data with geographic road networks and transportation logistics. We

consider 42 transportation hubs distributed across 14 states (CA, OR, WA, ID, MT, ND, SD, MN, WI, TX, FL, GA, ME, NJ), constructing 42×42 risk matrices that quantify environmental stress between city pairs. Each edge weight represents a composite risk score derived from temperature- and humidity-based stress thresholds, combined with a distance-penalty cost function. The transportation network is modeled as a weighted graph, and the Floyd–Warshall algorithm, enhanced with a two-stage time-chain correction, is applied to identify minimum-risk routes for bidirectional transport. The proposed framework provides a scalable, data-driven decision-support tool for optimizing honeybee transportation while reducing environmental stress and improving colony resilience.

APPROACHING DATA FROM VARIOUS DISCIPLINES

BIT 213: Upstairs Classroom

1 p.m.

Above the heads of dinosaurs: New approaches for understanding Mesozoic Aerial ecosystems

Kierra Miller, Department of Biology, College of Arts and Sciences
Mentor: Alex Dececchi, PhD

Vertebrate flight is one of the most energetically costly yet evolutionarily advantageous traits to have appeared in tetrapod evolution. In total there are three known occurrences of powered flight, as well as numerous gliding events, spanning across the last 250 million years. Each of these origins of powered flight has its unique setting, timing and ecological context, but they all lead to major diversification events in their respective lineage with long term major implications across continents and ecosystems. Though all are well studied, there remains fundamental uncertainties and questions surrounding questions such as: why, how and how fast? These and other topics occupy the Dececchi lab and fuel its collaborations both national and worldwide. Here Dr. Dececchi and his student Kierra Miller will discuss some of the recent advances and ongoing projects in our lab. This includes the energetics and ecology of the largest flyers of all time, the pterosaurs, as well as more detailed modeling of air flow and its effect of the flight capacity of small feathered theropods (birdlike dinosaurs). We also will discuss how, at a teaching focused undergraduate based institution, students can gain experience and produce high quality, publication worthy material.

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