

*Communicating with Purpose:
How to Make Your Research Understandable
and Valuable*

BUTLER



Matthew A. Lanham, Ph.D., CAP-X, ACE
Assistant Professor of Business Technology & Analytics
Butler University Lacy School of Business
mlanham1@butler.edu
MatthewALanham.com

About Prof L

Matthew A. Lanham, Ph.D., CAP-X, ACE
Assistant Professor of Business Technology and Analytics
Lacy School of Business
Butler University
Dugan Hall DH317
4600 Sunset Avenue | Indianapolis, IN 46208
Email: mlanham1@butler.edu | Office: 317-940-9419

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Top 50 Undergraduate Business Professors 2025
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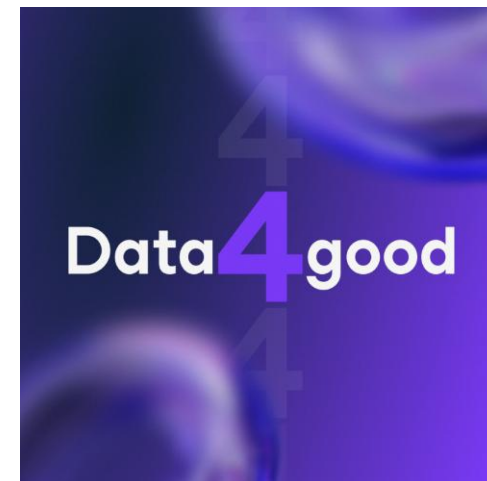
ABOUT PROF L

Professor Matthew Lanham joined Butler University's **Lacy School of Business (LSB)** as a tenure-track Assistant Professor of Business Technology and Analytics in August 2025. **In 2025, he was named one of Poets&Quants' Top 50 Undergraduate Business Professors and received the inaugural INFORMS Data Mining Society Teaching Award.** Previously, he served as clinical faculty in the Quantitative Methods Department at Purdue University's Daniels School of Business (2016–2025), where he led the M.S. in Business Analytics & Information Management (BAIM) program to record outcomes—including nearly 100% placement annually, a prestigious aCAP Pathways designation, and the 2023 UPS George D. Smith Prize (2022 Finalist) for excellence in preparing analytics practitioners.

Matthew earned multiple university-level teaching and service awards

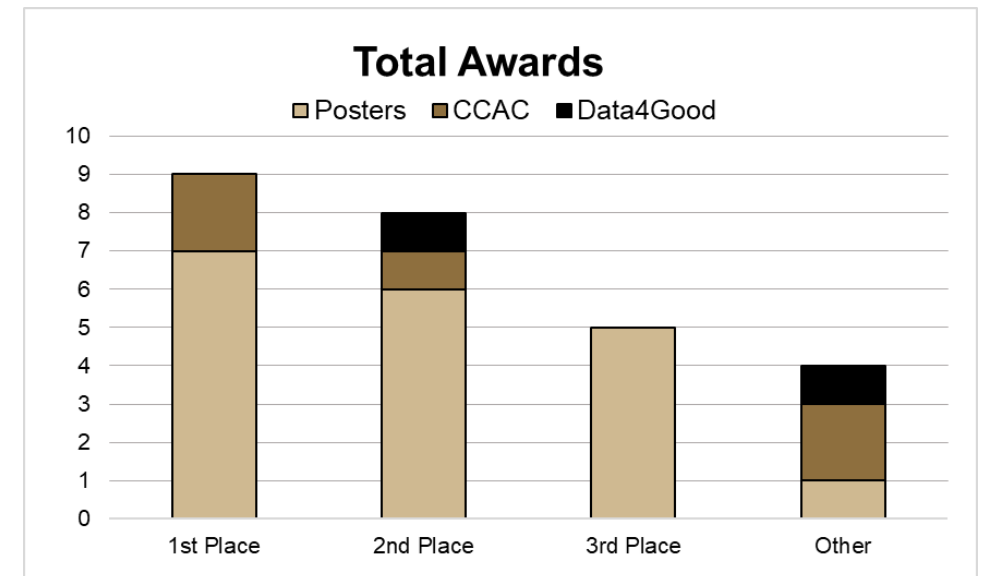
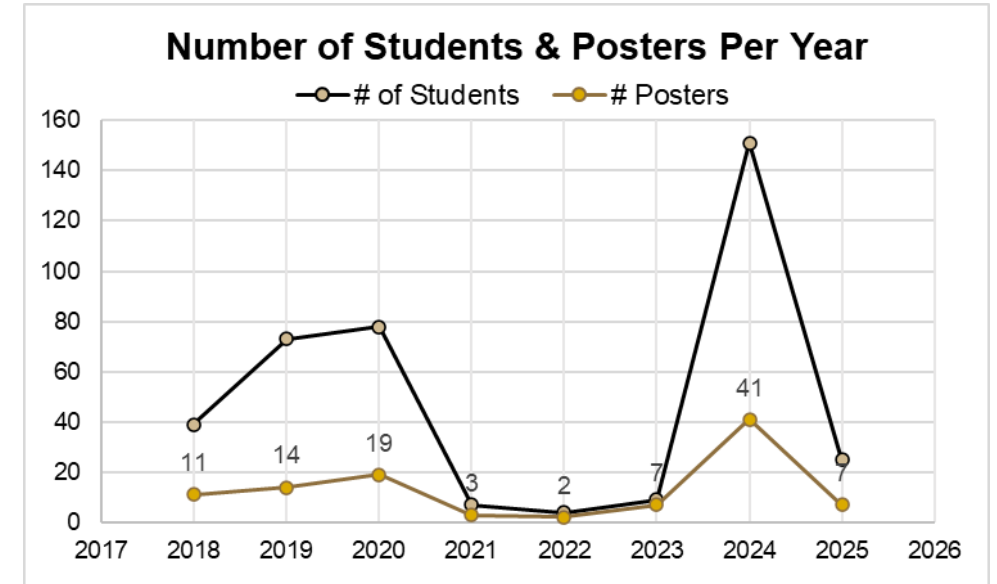


MatthewALanham.com



- MS 365 Predictive Analytics
- MS 389 Prescriptive Analytics (Spring 2027)

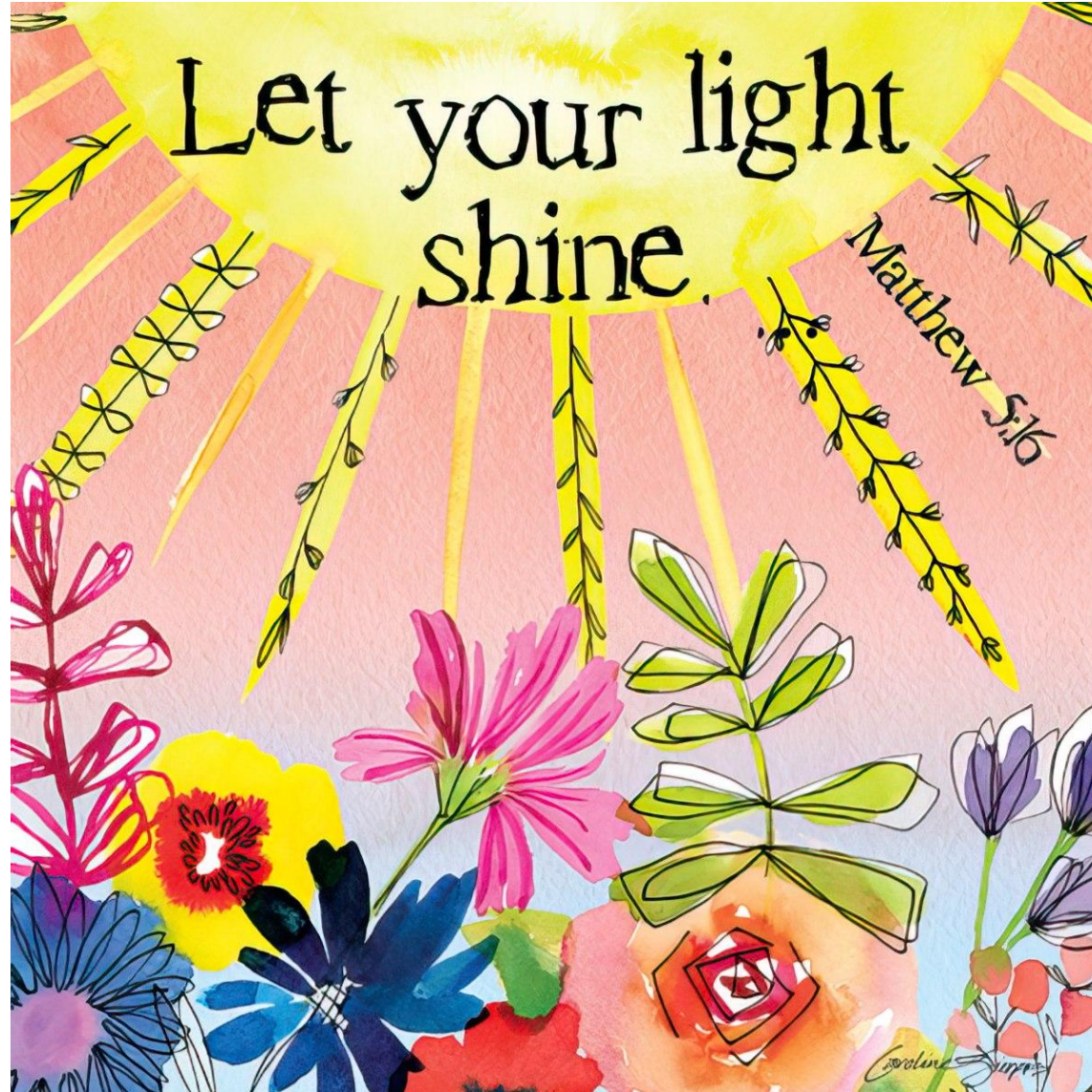
Mentored 200+ posters over the last decade



What's the goal of your research work?

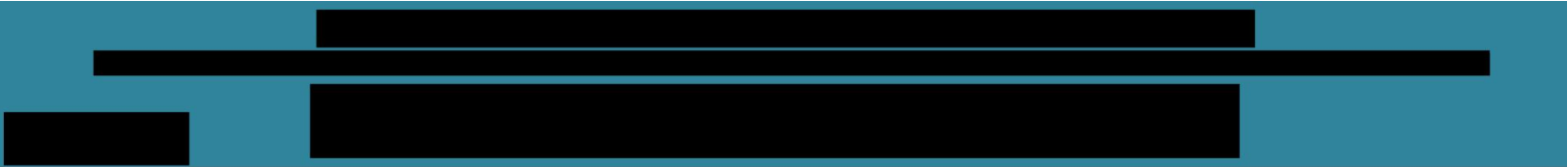


What's the goal of your research work?



The Balance of Art and Science with Posters

What do you think about this poster?



Abstract

A deeper understanding of inter-tumor and intra-tumor heterogeneity is a critical factor for the advancement of next generation strategies against cancer. Under the hypothesis that heterogeneous progression of tumors is mirrored by their metabolic heterogeneity, detection of biochemical mechanisms responsible of the local metabolism becomes crucial.

We show that network analysis of co-localized ions from mass spectrometry imaging data provides a detailed chemo-spatial insight into the metabolic heterogeneity of tumor. Furthermore, module preservation analysis between colorectal cancer patients with and without metastatic recurrence suggests hypotheses on the nature of the different local metabolic pathways.

Introduction

Mass spectrometry imaging (MSI) represents a powerful tool for the identification of molecular spatial distributions in biological specimens. Current standard techniques, such as MALDI, DESI and SIMS, have proved to be capable to detect mass spectral signatures associated with cancerous tissue. The large amount of extracted information, however, represents one of the most challenging aspects in the understanding of the underlying biochemical mechanisms associated with the observed different molecular distributions. For this scope, network analysis represents a natural choice, since it is capable to elegantly generate models of ion co-localization patterns that can be interpreted as possible representations of the local metabolic pathways.

Under such assumption, network analysis models suggest hypotheses on the biochemical interactions responsible of the observed co-localization patterns. The additional spatial dimension, characteristic of MSI, provide a further test for the plausibility of the detected patterns, when compared with the morphological properties of the tissue. Furthermore, differences between groups of patients in terms of these patterns can be used to generate hypotheses on the mechanisms responsible of the different observed clinical outcomes.

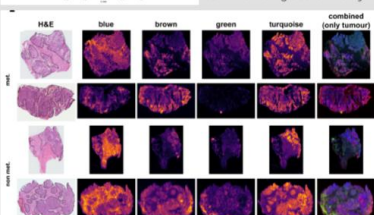
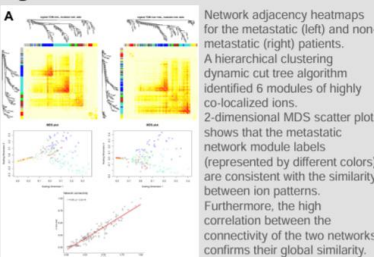
Materials & Methods

Weighted co-expression gene network analysis (WGCNA)¹ was applied to detect the metabolic differences between two groups of patients (e.g. patients with or without metastatic relapse). A consensus network is defined using the signed adjacencies from MSI data of each sub-cohort patients' MSI data. Afterwards, module detection is applied to the topological overlap matrix, in order to identify highly co-localized subsets of ions. Finally, modules with different network topologies between the two sub-cohort networks are detected using a module preservation analysis^{2,3} (based on a permutation test). A null hypothesis of modules independence from patients' status is performed running N=100 times the entire analysis on 2 networks generated after shuffling the patients' sub-cohort membership labels. A cohort of 32 colorectal cancer patients was tested for determining metabolic differences between patients with and without metastatic relapse (in a follow-up period of up to 5 years after the surgical removal). The tested cohort consisted of 8 patients with metastatic relapse and 24 patients without a metastatic relapse.

Results

WGCNA applied to DESI-MSI⁴ (negative ion mode) data from specimens collected at the center of the tumor revealed the presence of 6 ion modules in the metastatic-related network. The module preservation analysis revealed that one of the 4 tissue-related metastatic network modules was not preserved in the non-metastatic network. The presence of PGs and Arachidonic acid in the unpreserved module suggests that this module represents a local activity of phospholipase A2, related with an inflammatory response of the host. This is confirmed by the visual inspection of the associated spatial regions in the optical images of the H&E stained tissues. Free lipid droplets and macrophages were observed in those regions, suggesting a local inflammatory condition that has previously associated with an increased risk tumor infiltration⁵.

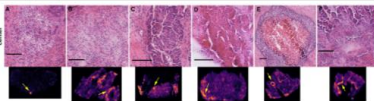
Figures



The spatial distribution of the 4 tissue-related ion modules captures the heterogeneity of tumor and its microenvironment. The 'turquoise' module is mainly associated with the tumor tissue (delineated in the optical image of the H&E stained tissue).



The unpreserved metastatic network module in the non-metastatic network consists of phosphatidylglycerols (PG) and PUFAs. The presence of Arachidonic acid (C20:4) in the selected module suggests the hypothesis that an inflammatory related mechanism is responsible of the occurrence of a metastatic relapse in the analyzed patients.



The spatial distribution of the unpreserved module ions in 6 examples of metastatic (A-B-C) and non-metastatic (D-E-F) samples is compared with the H&E stained tissue. In the metastatic samples, the module corresponds to the presence of macrophages and lipids droplets, whereas in the non-metastatic corresponds to necrotic tissue.

Conclusion

For the first time, we show that network analysis, in particular WGCNA, can be employed for exploratory analysis in mass spectrometry imaging data. The application of WGCNA efficiently reveals patterns of co-localized ions and their spatial distributions through their eigen-metabolite (analogous to the standard eigen-gene vectors).

The assumption that co-localized ions represent the different local metabolic pathways is exploited here to make hypothesis on the biochemical mechanisms associated with tumor heterogeneity. Furthermore, the module preservation analysis allows the identification of groups of co-localized ions in patients with metastatic recurrence that do not occur in the non-metastatic patients. This technique is used to identify hypotheses on the different local metabolism that can be associated with the different clinical outcome.

The presented method can be easily extended to datasets from other tissue types.

Acknowledgements

Full ethical approval was obtained from the institutional review board at Imperial College Healthcare NHS Trust (REC reference numbers 07/H0712/112, 11/LO/0686). The project was funded by the European Research Council (ERC Consolidator Grant 'MASSLIP' Contract No: 617896), the National Institute for Health Research through the Imperial Biomedical Research Centre and Cancer Research UK Grand Challenge Program (Project title: "A Complete Cartography Through Multiscale Molecular Imaging"). Datasets and scripts are publicly available at <https://doi.org/10.4121/uuid:f06dee0d-1d2e-4d67-b978-5bac4087d346>.

Contact Information

For further info: p.inglese14@imperial.ac.uk

References

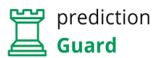
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- ³Langeheide, P. & Horvath, S. Eigengene networks for studying the relationships between co-expression modules. *BMC Syst Biol* 1, 54, doi:10.1186/1752-0509-1-54 (2007).
- ⁴Talbot, Z., Wiseman, J. M. & Crooks, R. G. Ambient mass spectrometry using desorption electrospray ionization (DESI): instrumentation, mechanisms and applications in forensics, chemistry, and biology. *Journal of Mass Spectrometry* 40, 1261-1279 (2005).
- ⁵Rizzo, P. T. & Vitek, J. P. Lipid droplets in inflammation and cancer. *Prostaglandins Leukot Essent Fatty Acids* 82, 243-250, doi:10.1016/j.plefa.2010.02.005 (2010).
- ⁶Ingole, P., Sattelmair, N., Gora, L., Meier, A., Spiller, A., Poynter, L., & Nicholson, J. K. (2018). Network analysis of mass spectrometry imaging data from colorectal cancer identifies key metabolites common to metastatic development. *bioRxiv*, 230522.

The Balance of Art and Science with Posters



Mitchell E. Daniels, Jr.
School of Business

LLM-Powered Agents for B2B Sales Pipeline



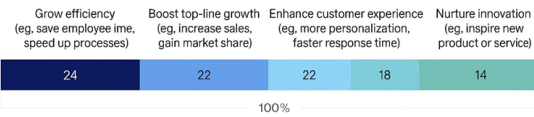
Tirth Patel, Yash Kothari, Vishnu Anand, Chhaya Tundwal, Kshitij Chauhan, Yu-Yang Ho, Matthew A. Lanham

pate2202@purdue.edu; kothar37@purdue.edu; anand173@purdue.edu; ctundwal@purdue.edu; chauha69@purdue.edu; ho291@purdue.edu; lanhamm@purdue.edu
Purdue University, Department of Management, 403 W. State Street, West Lafayette, IN 47907

BUSINESS PROBLEM FRAMING

BCG has found that more than 70% of sales leaders plan to invest in GenAI. Likewise, Salesforce has found that almost 70% of tech leaders have prioritized GenAI over the next 18 months - BCG Analyst Reports, 2024

Top potential benefit of generative AI (gen AI) in B2B selling, % of commercial leaders¹ that have fully implemented gen AI in B2B buying and selling (n = 320)



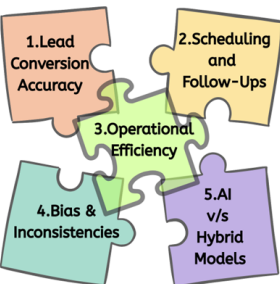
Source: McKinsey Global B2B Pulse Survey 2024

However, enterprises struggle with inefficiencies in lead qualification, demo scheduling, and follow-ups. While AI-driven sales solutions offer efficiency gains, businesses face challenges in data privacy, decision transparency, and balancing automation with human oversight. To address this, the company aims to develop an AI-driven sales simulation framework to assess automation levels and optimize the balance between AI and human intervention. This solution will enhance internal sales processes while serving as a scalable model for enterprises seeking responsible AI integration.

ANALYTICS PROBLEM FRAMING

The goal of our analysis, is to evaluate how AI-powered sales agents compare to human-led processes across key sales pipeline stages and determine the optimal balance between automation and human involvement. Comparison is done by simulating the pipeline stages and comparing to industry benchmarks for B2B sales pipelines.

CHALLENGES

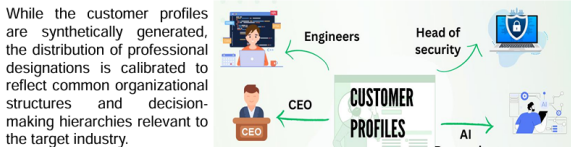
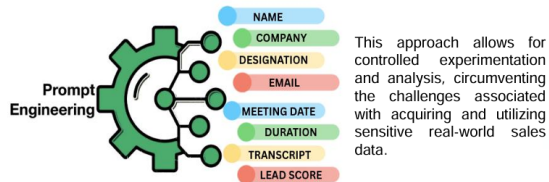


APPROACH

- Performance Benchmarking
- Risk Assessment
- Simulation Testing
- Efficiency Metrics
- Scalability and Adoption

SIMULATING SALES PROCESS (DATA)

The efficacy of the proposed LLM-driven sales agent hinges on the availability of a robust and representative dataset for simulation, evaluation, and iterative refinement. To address this need, we constructed a synthetic dataset meticulously designed to mirror the complexities and nuances of real-world enterprise sales interactions.



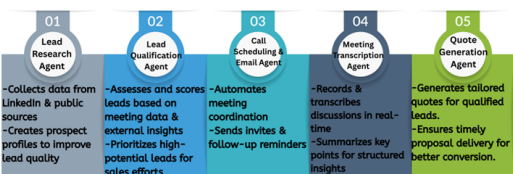
METHODOLOGY

Our strategy was to first understand the current sales pipeline and identify key stages where AI-driven automation could enhance efficiency. By analyzing the end-to-end sales workflow, we designed a system where each critical phase is handled by a dedicated AI agent, ensuring a seamless and intelligent sales process.

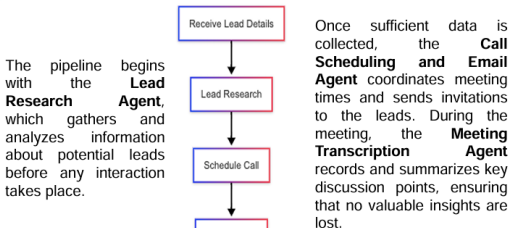
CURRENT SALES PIPELINE



The AI sales pipeline is structured around five distinct stages, each designed to automate a specific stage of the sales process:



MODEL BUILDING



Once sufficient data is collected, the **Call Scheduling and Email Agent** coordinates meeting times and sends invitations to the leads. During the meeting, the **Meeting Transcription Agent** records and summarizes key discussion points, ensuring that no valuable insights are lost.

Following the meeting, the **Lead Qualification Agent** evaluates the transcript data and research insights to determine the quality and potential of the lead. If the lead is deemed viable, the **Quote Generation Agent** prepares and delivers a customized quote to the prospect, completing the pipeline.

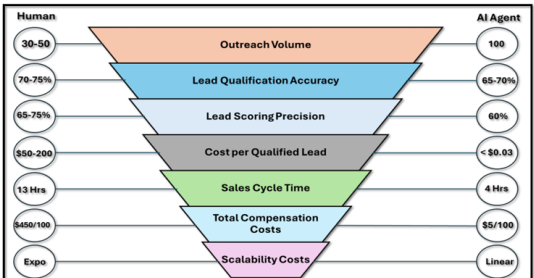
This AI-driven approach enables automation, improves accuracy in lead assessment, and enhances the decision-making process for sales teams. By strategically integrating AI at each stage, we ensure a streamlined, data-driven, and efficient sales pipeline.

PERFORMANCE BENCHMARKING RESULTS (Deployment and Life Cycle Management)

Using synthetic data as input for our agentic workflow we created a realistic testing environment to compare our AI-driven approach with traditional, human-led sales methods.

We observed the following impact:

- Outreach Volume**: AI agents engaged with 2-3x more leads than human teams.
- Lead Qualification Accuracy**: AI achieved competitive accuracy, with faster lead identification.
- Lead Scoring Precision**: AI effectively prioritized leads using large datasets.
- Cost per Qualified Lead**: Significant cost savings through automated tasks.
- Sales Cycle Time**: AI reduced cycle time by over 65%.
- Total Compensation Costs**: AI lowered operational expenses.
- Scalability Costs**: AI scaled predictably, unlike costly human expansion.



CONCLUSIONS

This study shows how AI-driven agents can enhance B2B sales pipelines by automating tasks like lead research, qualification, scheduling, and proposal generation—boosting efficiency, cutting costs, and expanding outreach. While AI outperforms human-led processes in speed and workload reduction, it lacks the human touch needed for complex negotiations and relationship building. As AI adoption grows, businesses must balance automation with human expertise and address potential biases to build scalable and ethical sales systems.

ACKNOWLEDGEMENTS

We would like to thank Professor Matthew Lanham, Purdue University, INFORMS and our industry partner Prediction Guard for this opportunity, their guidance, and support on this project.



See Examples: <https://matthewalanham.github.io/experiential-learning.html>

AI tools can be helpful to create figures



PROCESS FOR DETERMINING NCAA AT-LARGE FAIRNESS.

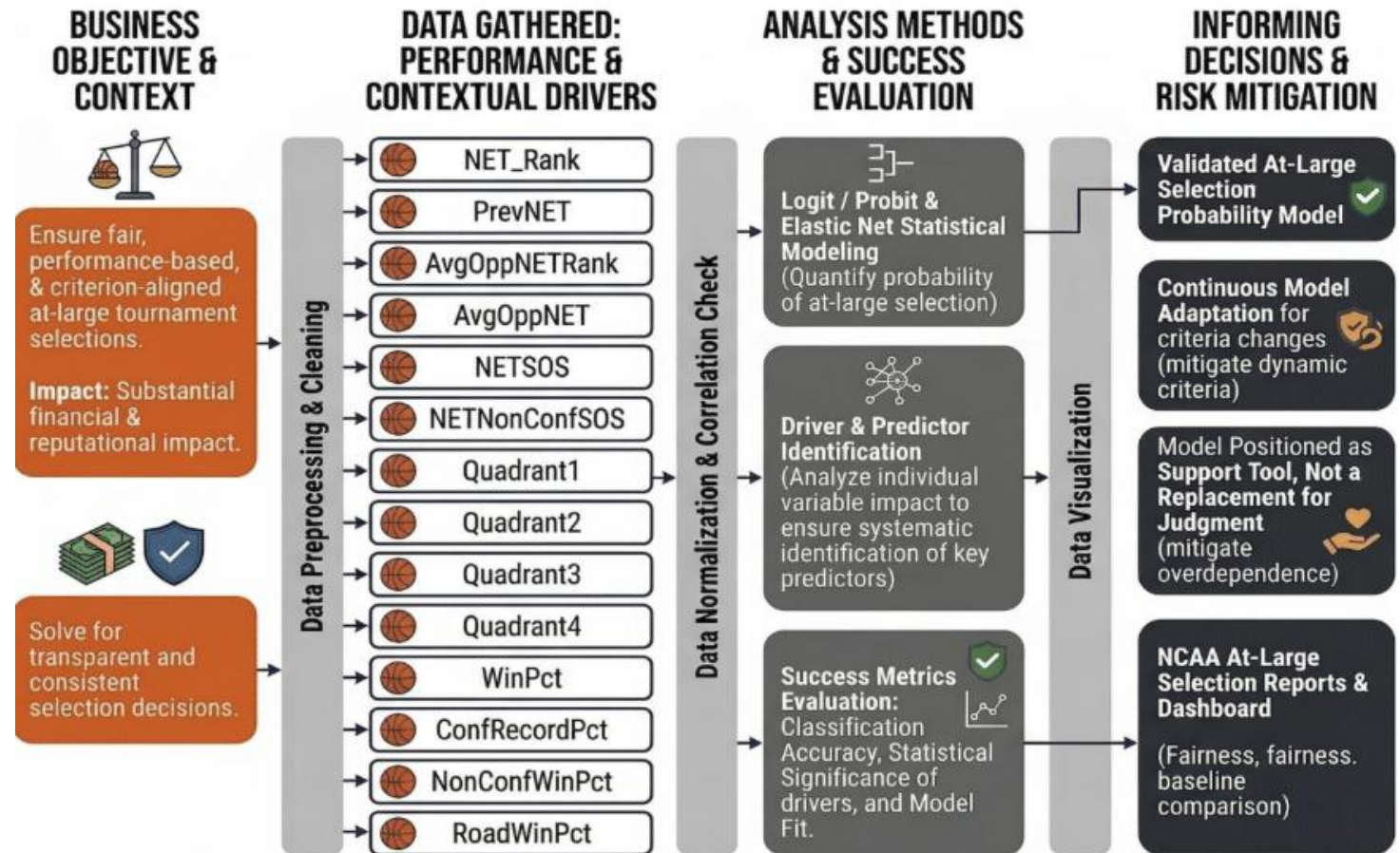


Fig 2. Methodology

See Examples: <https://matthewalanham.github.io/experiential-learning.html>

AI tools can be helpful to create figures



METHODOLOGY

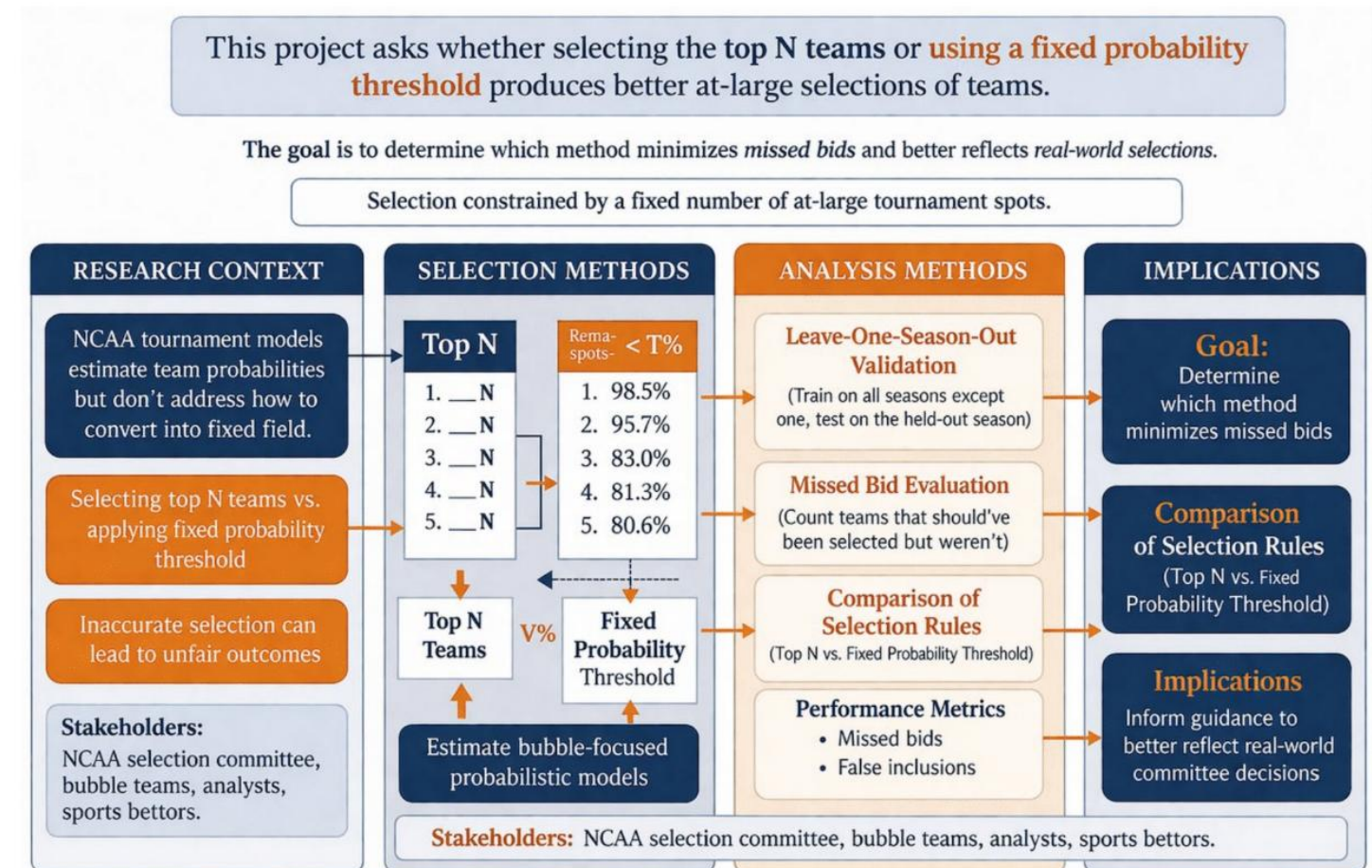


Fig 2. Example Methodology

See Examples: <https://matthewalanham.github.io/experiential-learning.html>

Future Edelman Impact Award

Idea came from serving as an Edelman Coach

GAMIFYING
MATH OPTIMIZATION

Players introduced to optimization using burritos

AI4OPT EDUCATION
INITIATIVE UNDERWAY

AI Institute bridges the opportunity gap

FUTURE EDELMAN
IMPACT AWARD

Purdue University program addresses student needs

UNDERGRADUATE
COURSE SCHEDULING

Program scheduling an optimization problem

AMPLIFYING
MILITARY EDUCATION

Turning lifelong learners into leaders

August 2022 | Volume 49, Number 4

ORIMSI

TODAY

informs

As leaders and directors of analytics programs, one of the best things we can do for our students is proactively get them involved in professional societies such as INFORMS.

INNOVATIVE
EDUCATION ISSUE

COLLABORATION IS KEY

Inside the Academic-Industry Ecosystem

GRADUATE STUDENT SUPPORT

Richard MERRIAM, program manager, co-chaired in 2016 when I began my Purdue journey as a clinical faculty member. With just one cohort in the books, C2I was up and running. I was able to bring on a number of students who were very interested in the program. I was able to bring on a number of students who were very interested in the program. I was able to bring on a number of students who were very interested in the program.

Edelman Award winners to be the "best" which I define as an Edelman winner. Inspired by that competition, the students are asked to use their Edelman Award winners to be the "best" which I define as an Edelman winner. Inspired by that competition, the students are asked to use their Edelman Award winners to be the "best" which I define as an Edelman winner.

What are the major practical (e.g., Edelman award, revenue increase) and conceptual (e.g., process innovation, customer satisfaction) impacts of the work? The Edelman award was the work of the Edelman award.

Emphasis	Delivery	Layman	Impact
20%	20%	20%	20%

Once the top three teams are identified, they work with a rubric to create a three-minute video that would appear on a wide, general audience. This is similar to what Edelman Award finalists would work with their starting teams to create a high-level pitch video about their project. A great example is the first video of the Purdue Business Analytics team submission from 2011 (1).

Made-to-Order: Targeted Marketing in F...

Watch later

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BUSINESS ANALYTICS AND
INFORMATION MANAGEMENT

Watch on YouTube

PURDUE
UNIVERSITY

Mitchell E. Daniels, Jr.
School of Business

18,180
YouTube views

5,669
YouTube likes

Creating a short (3 min.) video

- You're much more than a resume, a poster, or paper.
- People need to hear and see you communicate.
- You don't work by yourself, but with others.
- How can you differentiate yourself?



Basic (just first minute or two)



Medium (Interview Style + B-roll)



Advanced (Using Canva for animations)

Consider a 60-second pitch video about yourself

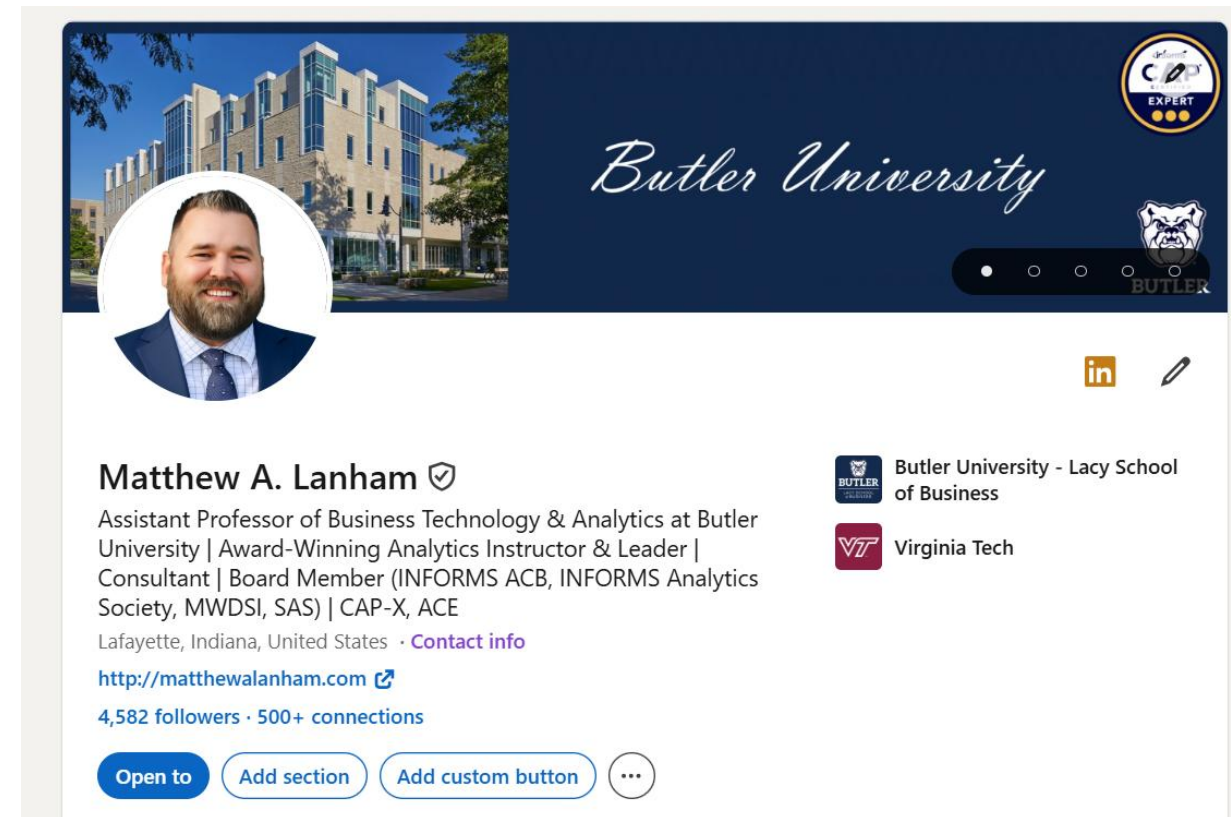


LinkedIn (<https://linkedin.com/>)

- It's a digital world now. This is THE **professional** social platform.
- Let me walk through it with you - <https://www.linkedin.com/in/mattlanham/>

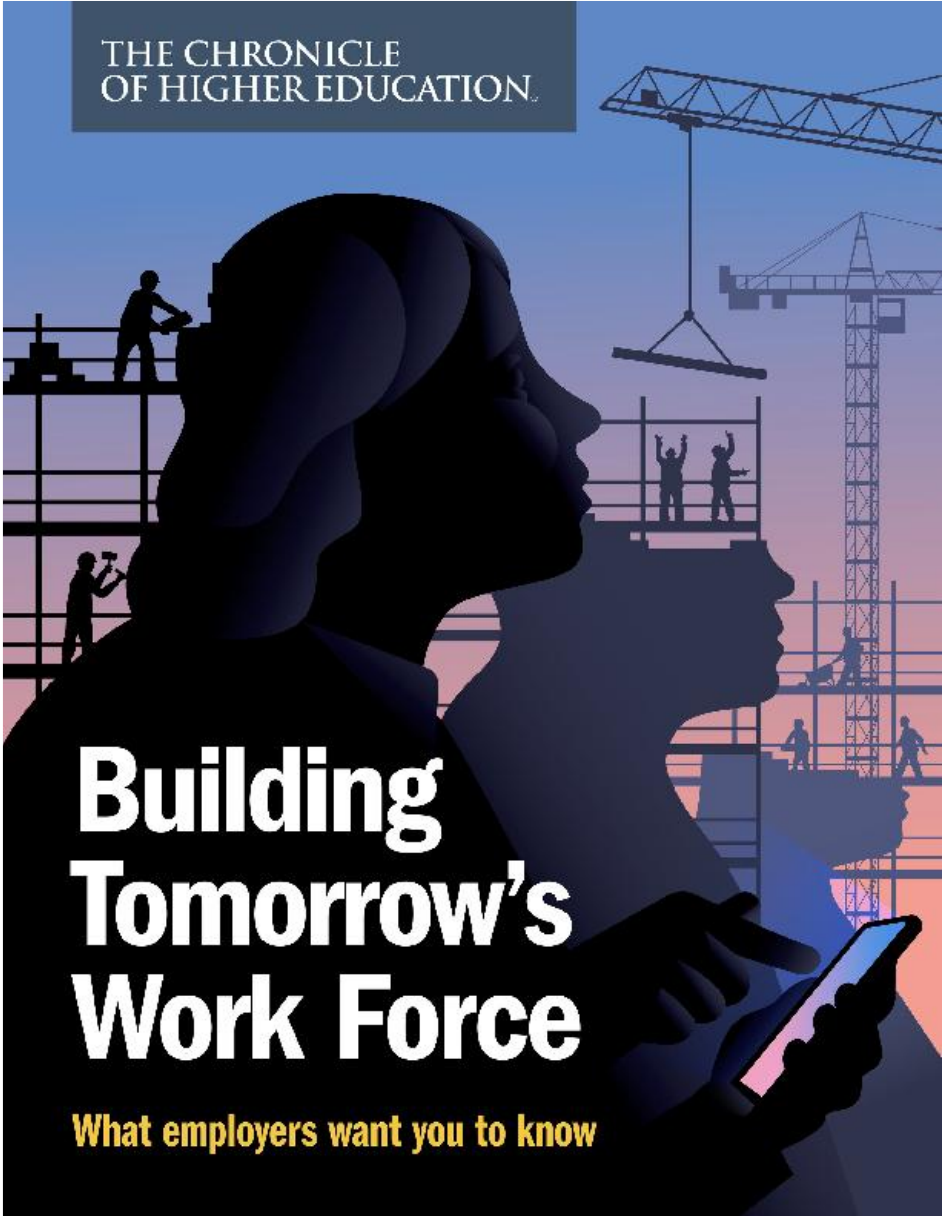
Ideas

- ☐ Connect with people that are in your field, companies you'd like to work at, and of course your peers.
- ☐ Share what you're doing – tell people what you're at Butler URC doing today!
 - ☐ If you have a poster or video, ask for feedback.
 - ☐ **[Increase response rate!]** People are more willing to respond to your message, if you ask for feedback.



Showcase your work, people will notice

THE CHRONICLE
OF HIGHER EDUCATION



Building Tomorrow's Work Force

What employers want you to know

SPOTLIGHT

Purdue University Is Making Matches

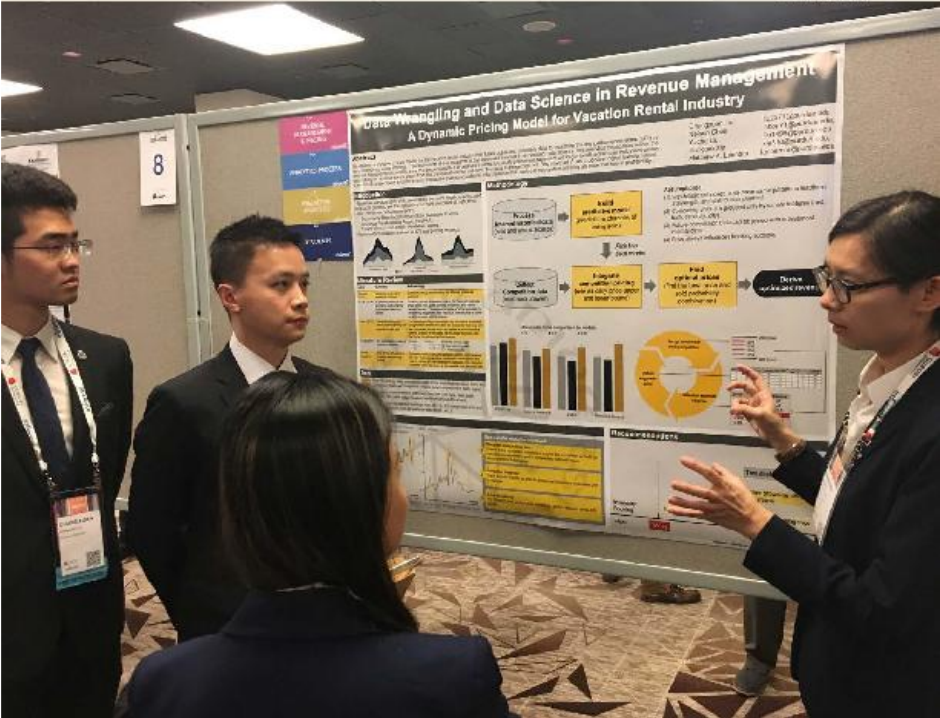
NEBUSINESS SCHOOLS, "the M.B.A. was always the flagship program, the expensive one that kind of kept the lights on," says Matthew A. Lanham. But at Purdue University, the lead program goes by a much more unwieldy acronym: MSBAIM, or the master of science in business analytics and information management.

Lanham, MSBAIM's academic director, says it's high stakes for all involved: The students, most of whom come from India, pay \$50,000 for the 11-month program in the hopes that they will land a job with a starting salary of about \$120,000 — the average for graduates these days, but it keeps going up.

"You can't come to this program on a

Students in Purdue U.'s MSBAIM program (master of science in business analytics and information management) display their skills at a data-analytics conference.

COURTESY OF PURDUE U.



Made-to-Order: Targeted Marketing in F...

Watch later

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MASTER OF SCIENCE IN

BUSINESS ANALYTICS AND INFORMATION MANAGEMENT

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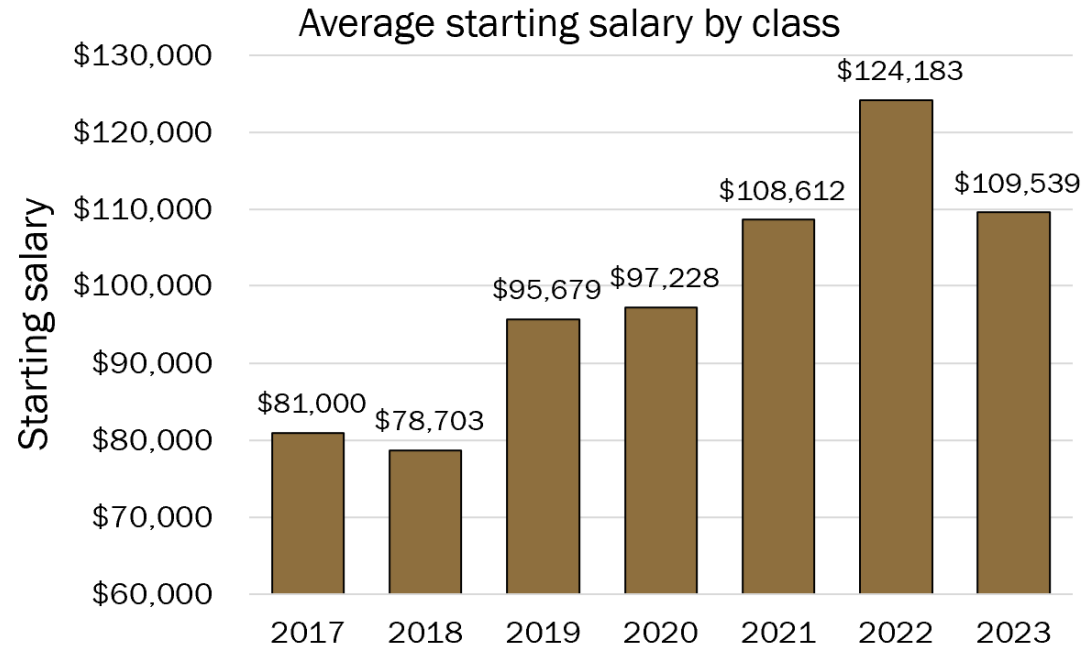
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YouTube views

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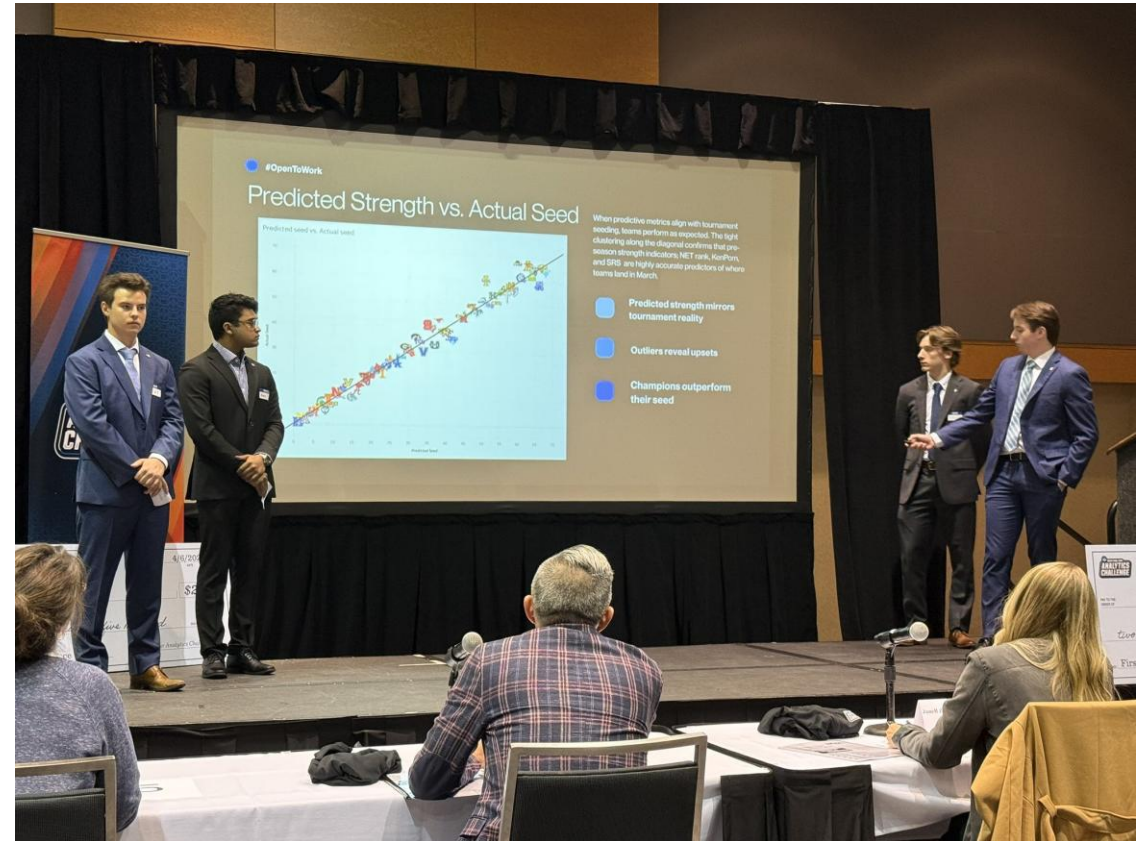
YouTube likes

I believe it will lead to great outcomes, too!



LSB students presenting Predictive Analytics projects

- I have 11 LSB teams presenting posters this afternoon at 2-3-pm.
- They seem nervous 😊. Check them out and see how they are implementing some of my suggestions.



See Examples: <https://matthewalanham.github.io/experiential-learning.html>