



*What Got You Here Won't Get You There*  
**UMBC's Data Analytics Journey**

Inside Higher Ed, November 2022

# Agenda

- Introductions
- The evolution of data analytics at UMBC and in higher education
- Designing a comprehensive platform for your institution
  - Build vs. Partnership pros and cons
- Next generation analytics: machine learning & predictive modeling
- Q&A

# Today's Presenters

## Jack Sues

VP of IT & CIO  
University of Maryland Baltimore Campus



## Bob Carpenter

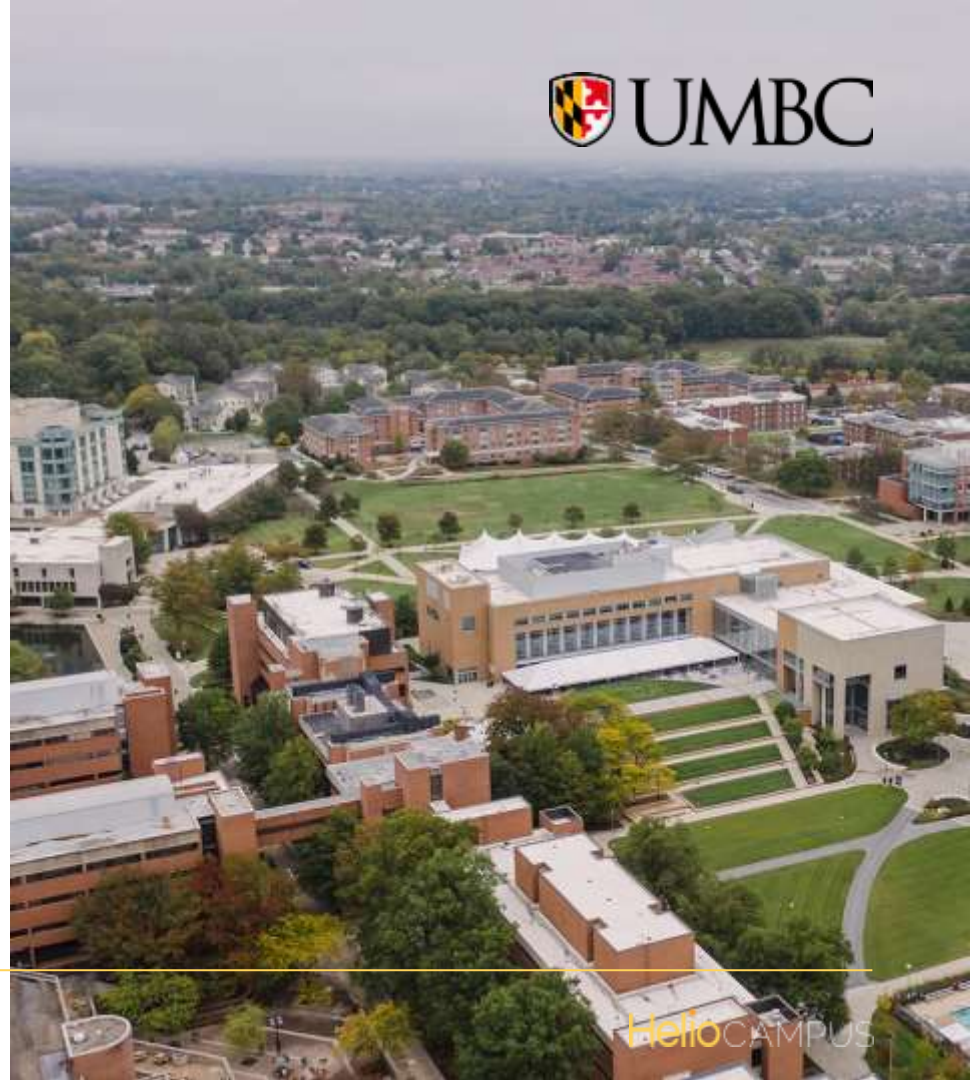
Deputy CIO & Associate Provost for Analytics  
University of Maryland Baltimore Campus



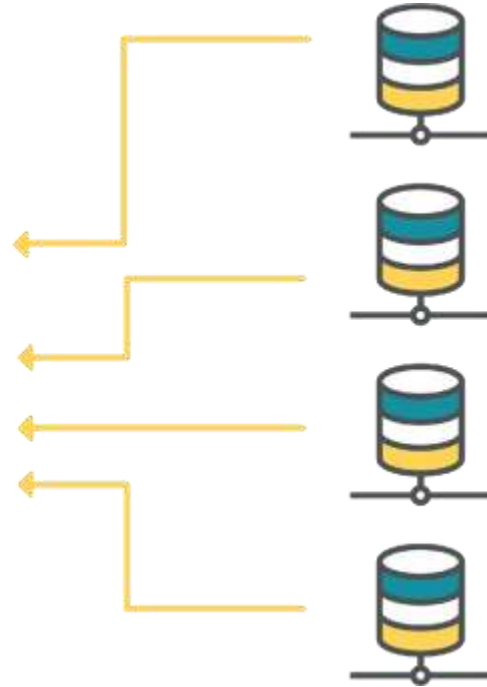
**Moderator: Todd Bloom**, Managing Director, Common Group

# About UMBC

- Founded: 1966 as one of three research institutions in University of Maryland System
- Located 10 minutes from Baltimore, Maryland and 40 minutes from Washington, DC
- Student Enrollment, Fall 2020
  - Undergraduate: about 11,000
  - Graduate: about 3000
  - Total: about 14,000
  - Currently about  $\frac{1}{3}$  of students are transfers
  - Approximately 50% enter as STEM majors
- Carnegie Classification – R1 as of May 2022!

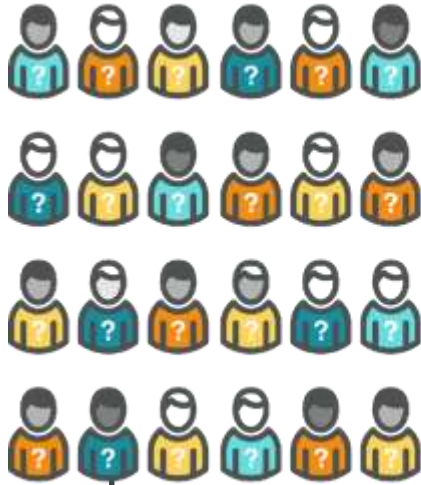


# Traditional IR Offices Are Overwhelmed



“ I have an enrollment question.”

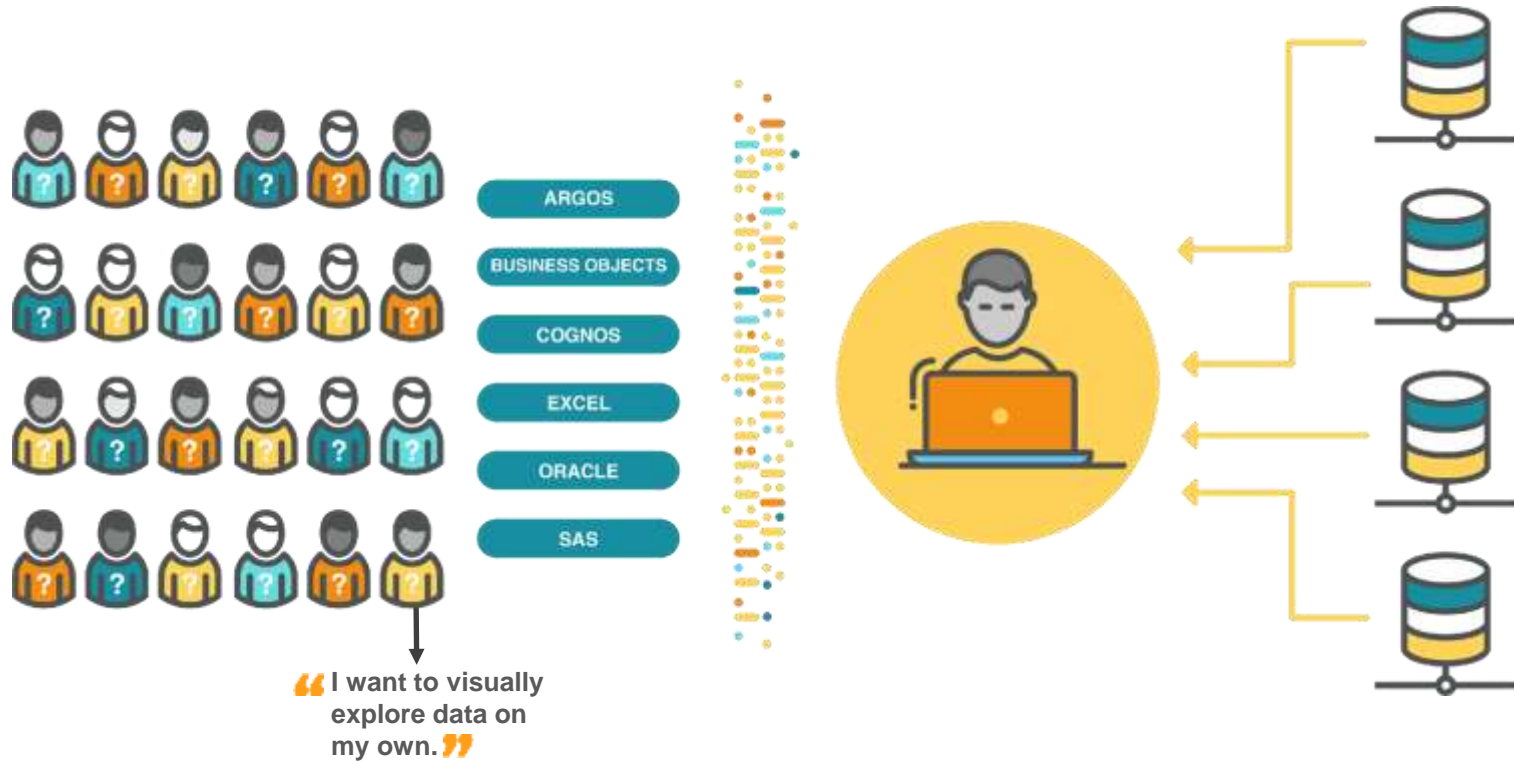
# A Shortage of Report Writers and Programmers



“ I have a more complex question. ”



# Adding Reporting Tools Is Not Enough



# UMBC's Journey With Analytics

**2003**

Attempted PeopleSoft Performance Management system implementation

**2009**

Developed strong partnership with Institutional Research during PeopleSoft implementation

**2014**

Developed a complete financial data warehouse

**2018**

Developed our own data science team under Dr. Carpenter, eliminated Civitas.

**2020**

Purchased HelioCampus in July 2020

**2007**

Implemented iStrategy

**2011**

Learning Analytics warehouse on top of the Blackboard LMS

**2015**

Implemented Civitas using data warehouse to support student success.

**2019**

Moved our iStrategy data warehouse to AWS

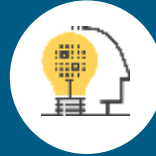


# UMBC IT Strategic Initiatives

Utilize digital platforms to deliver exceptional service and support.



Advance and support digital innovation in curriculum and pedagogy across all modalities.



Advance and support digital innovation in research and creative achievement.



Advance our Use of Data to continuously innovate and improve.



Utilize digital platforms to advance and support the student experience.



Expand digital skills training for students, staff, and faculty.



Visit [doit.umbc.edu/strategy](https://doit.umbc.edu/strategy) for more information.

# EDUCAUSE 2023 Top-10 IT Issues



## Leading with Wisdom

### 1. A Seat at the Table

Ensuring IT leadership is a full partner in institutional strategic planning

### 3. Evolve, Adapt, or Lose Talent

Creating a workplace that allows for and supports movement up, down, and sideways to accommodate shifts in personal and professional goals and to foster healthier work/life balance

### 5. Enriching the Leadership Playbook

Leading with humility and candor to engage, empower, and retain the IT workforce



## The Ultra-Intelligent Institution

### 2. Privacy and Cybersecurity 101

Embedding privacy and cybersecurity education and awareness in the curriculum and in the workplace

### 4. Smooth Sailing for the Student Experience

Using technology, data, insight, and agility to create a frictionless student experience

### 6. Expanding Enrollments and the Bottom Line

Focusing data and analytics initiatives on identifying academic programs with high potential for recruitment ROI

### 7. Moving from Data Insight to Data Action

Converting data analytics into action plans to power institutional performance, enhance operational efficiency, and improve student success



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# EDUCAUSE 2023 Top-10: The Ultra-Intelligent Institution



## The Ultra-Intelligent Institution

Data and analytics can provide institutions with intelligence offered through ongoing, useful, and increasingly sophisticated insights.

### **2. Privacy and Cybersecurity 101**

Embedding privacy and cybersecurity education and awareness in the curriculum and in the workplace

### **4. Smooth Sailing for the Student Experience**

Using technology, data, insight, and agility to create a frictionless student experience

### **6. Expanding Enrollments and the Bottom Line**

Focusing data and analytics initiatives on identifying academic programs with high potential for recruitment ROI

### **7. Moving from Data Insight to Data Action**

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## 2022 - Current Efforts in Analytics

- We have already deployed two playbooks supporting student success... 1st year and 2nd year retention models.
- We will launch a new financial reporting system built on HelioCampus and Tableau in January!
- We are completing efforts to bring over twenty years of data together and are on-track to do official reporting in Helio for Fall 2023.
- We are executing a plan to replace over 1000 existing data warehouse reports with Tableau and HelioCampus by the end of 2023.



# What This Means

- Using HelioCampus, we have operationalized our data science efforts and we are working to integrate the data insights into our advising and student success systems in an intelligent way.
- Using Tableau, we are moving from reports featuring a “wall of numbers” to visualizations that provide better insights (and allow us to quickly see both level and trend)!
- Partnering with our Institutional Research group, we are on-track to recreate the original strengths, official reporting, and longitudinal census data in our HelioCampus system.
- Using AWS natively for HelioCampus we are taking advantage of new advances in AWS to better move and integrate our data lakes and HelioCampus using a common tool framework from Informatica.

## Question 1

How would you qualify your data and analytics capabilities today?

- A. Limited by our in-house knowledge and resources
- B. Invested in bringing expertise in-house and is core to our strategic plan
- C. Technology and vendor partnerships are core investments to increase capacity
- D. Both B & C



# Early Analytics Initiatives & Goals

- The issues we initially attacked are **driven by our strategic plan, accreditation process, “first generation” analytical efforts**, and the intuition of subject matter experts
  - We needed a few quick wins
  - We had not yet developed sufficient depth in what were then “rocket science” machine learning predictive algorithms
- Insights are helpful when they lead to action. We wanted to **combine analytics with messaging and behavioral economics** to leverage the power of information technology

## We knew where pinch points existed:

- Success in math is key for many UMBC students
- Our first pilot was focused on students repeating classes in the calculus sequence
  - We used descriptive analytics (basic and advanced) to scale the problem and measure treatment effects
  - We then used this as a foundation for basic prescriptive analytics (which isn't always hard). Then closed the loop by measuring the response

# Early Partners

One way to think of the choice between Do it Yourself (DIY) and using an outside partner is to think about what's required to build a house:

- **Do I have the skills to build it?**
  - The answer is frequently, some, but not all
- **Do I have the time to maintain it?**
  - The answer for busy people is frequently, not always, not everywhere





## Do It Yourself

The first steps in the path forward - a blend of DIY and partners. Some DIY Analytics advantages:

- The average university's challenges may not be your challenges.  
Vendors tend to stay near the middle as they're building out capabilities .
- Outsourced partners may not always have flexible models (and so don't take advantage of some of the data you have).
- The campus can often trust internal efforts (but not always).

### **Key considerations:**

- Costs that are on the order of point solution partners.
- Sometimes requires particular expertise and skills (unicorns) that may introduce risk.
- Requires solid infrastructure, which some may not have. DIY builds technical debt.

Which path requires an assessment of existing infrastructure and skills, fit between partner products and institutional needs, and an assessment of organizational structure and needs.

**“Are you willing to act on what you learn?”**

# Building trust and confidence: The “black box problem”

Why we enjoy working with HelioCampus:

- The “Helio black box” has a lid that opens
- Their model tracks ours fairly closely
- We partnered to use what we learned to improve the joint product
- We can off load the “technical debt” to HelioCampus



## Here's the big challenge

**91.9%**

of Fortune 1000 firms report increased pace of investment in Big Data projects

**24%**

say their organization was data-driven

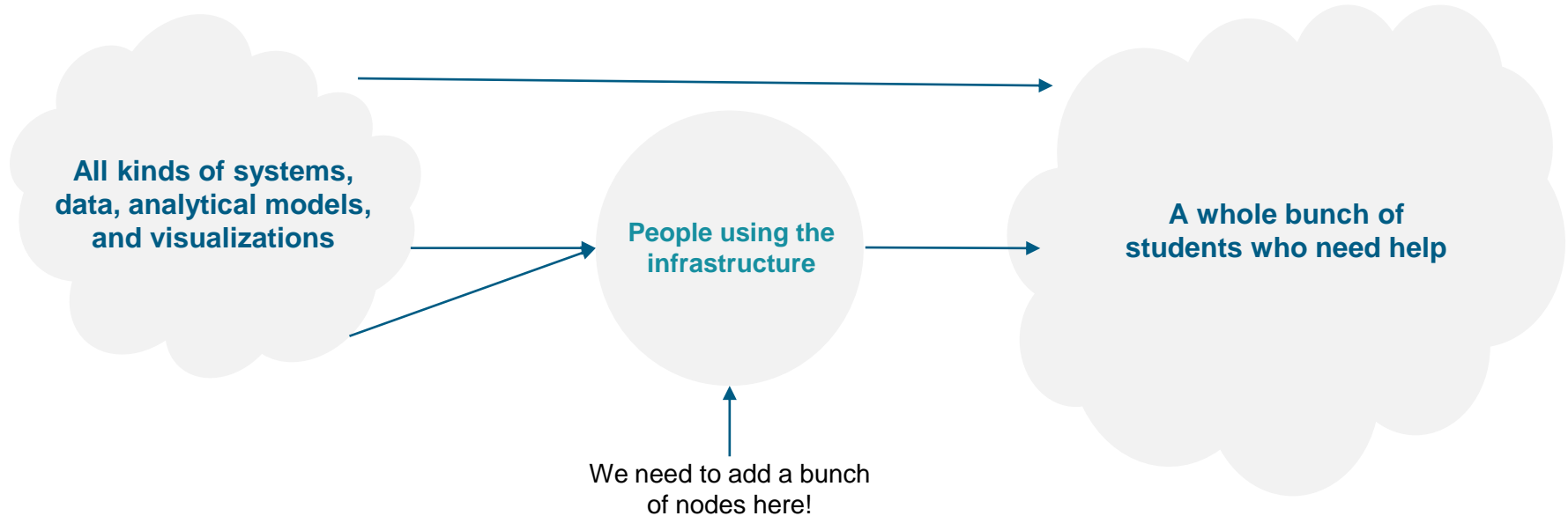
**29.2%**

report achieving transformation business outcomes

# Right information, right person, right time, *right place*

**Workflow. Here's a picture of what we have.**

- How can we better share the information from this and other models to make it easier to find, easier to understand, and easier to use



## Question 2

Where are you on the use of predictive modeling?

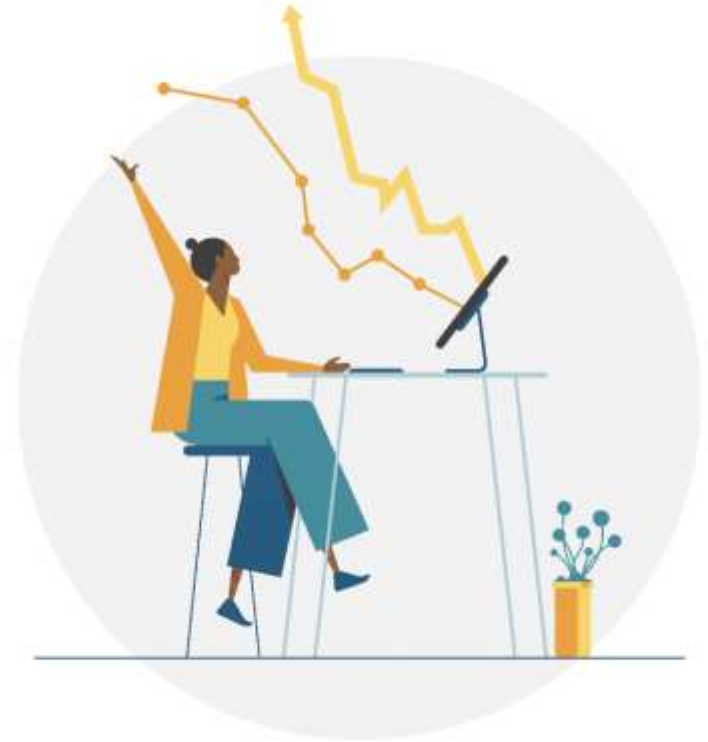
- A. Limited to regression and basic statistical techniques
- B. Beginning to dabble in thinking about machine learning
- C. Piloting an early set of models
- D. Link output of predictive models to system in action



# A (very) brief introduction to predictive modeling using Machine Learning



## Next Generation Analytics: A use case



# Retention as a moral imperative / Retention as a business necessity

- We lose about 22 percent of our freshmen over the first two years, on average
  - That's either disappointed dreams or disappointed expectations
  - This is one of our big “pinch points” for students and a revenue loss for the institution

Cohort Term	Cohort #	New Freshman, Full-Time, Degree Seeking									
		UMBC Retention Rates					UMBC Graduation Rates				
		Ret After 1 Sem	Ret After 1 Yr	Ret After 2 Yrs	Ret After 3 Yrs	Ret After 4 Yrs	Grad Within 4 Yrs	Grad Within 5 Yrs	Grad Within 6 Yrs	Grad Within 8 Yrs	
Fall 2016	1,517	95.1 %	88.3 %	78.8 %	73.2 %	26.7 %	46.5 %	64.7 %			
Fall 2017	1,759	95.5 %	87.2 %	76.9 %	72.4 %	24.1 %	48.1 %				
Fall 2018	1,777	96.4 %	87.2 %	78.2 %	71.8 %						
Fall 2019	1,692	95.9 %	87.0 %	77.9 %							
Fall 2020	1,651	94.7 %	87.0 %								
Fall 2021	2,035	95.0 %									
<b>Total</b>	<b>10,431</b>	<b>95.4 %</b>	<b>87.3 %</b>	<b>77.9 %</b>	<b>72.4 %</b>	<b>25.3 %</b>	<b>47.4 %</b>	<b>64.7 %</b>			

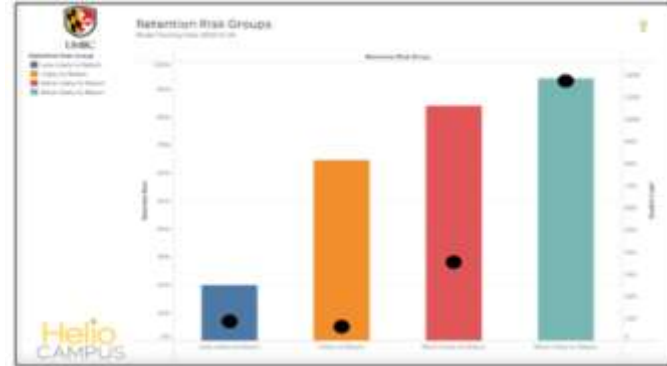
Delta	12.7%	9.4%	5.5%
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## Model Scoring



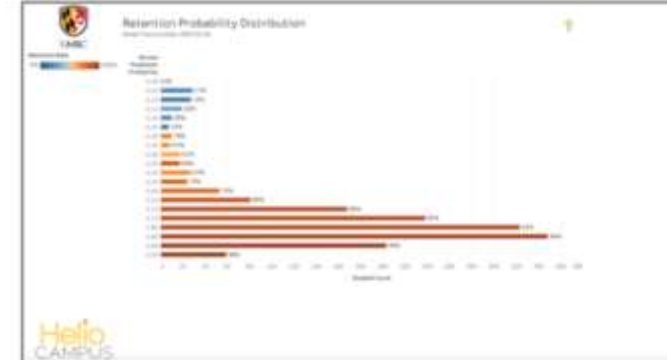
## Retention Risk Groups



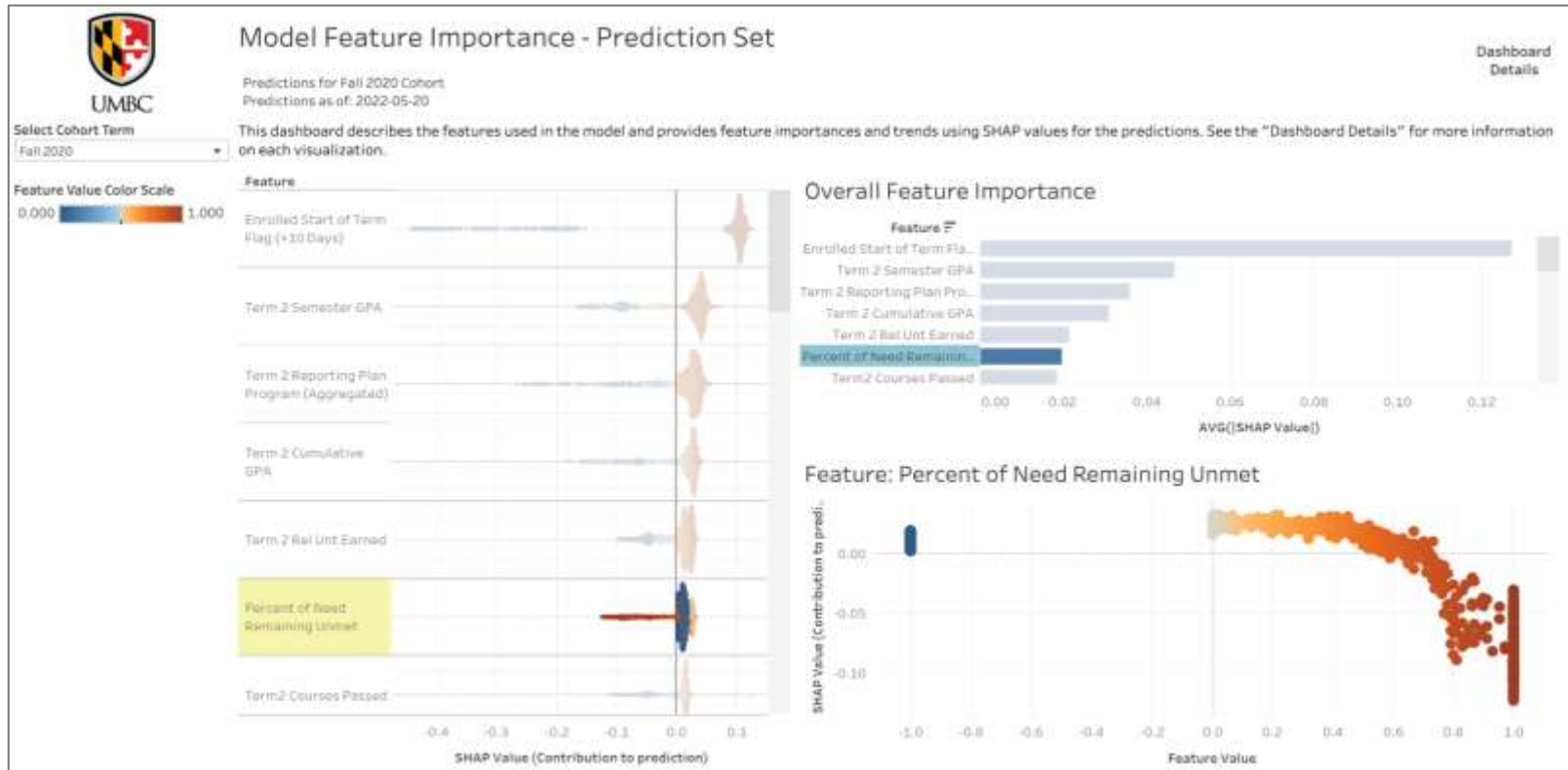
## Feature Importance



## Retention Probability Distribution



# Feature importance is a help and a hindrance

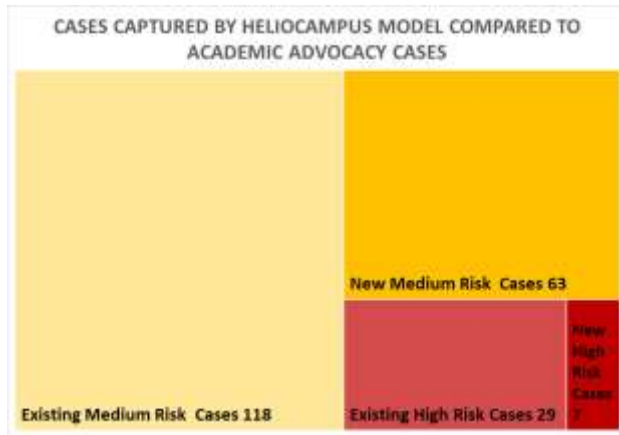


# How is the model being used?

- We have a set of “academic advocates” They have established a set of risk indicators and intervene when more than four are tripped.
- The Helio model has, crucially, helped to identify a large number of additional medium risk cases

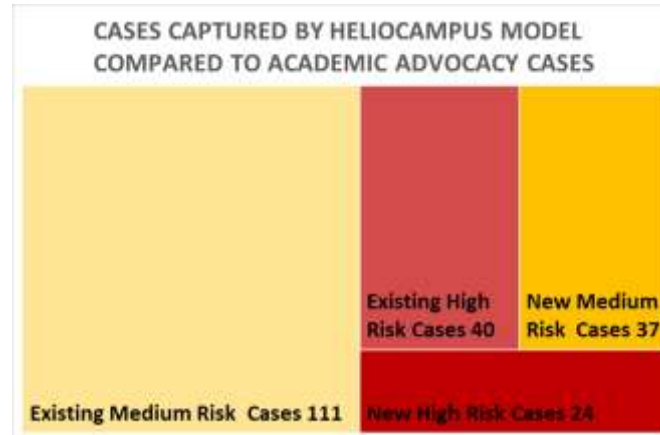
## January Model

**High Risk: 36**  
**Medium Risk: 181**



## February Model

**High Risk: 64**  
**Medium Risk: 148**



A woman in a dark sleeveless top and glasses stands at the front of a meeting room, gesturing with her hands as if presenting. She is holding a small device in her right hand. The room has a stone wall background and several people are seated at desks, looking towards her. The entire image is overlaid with a semi-transparent orange filter.

Questions?

**Thank You!**

