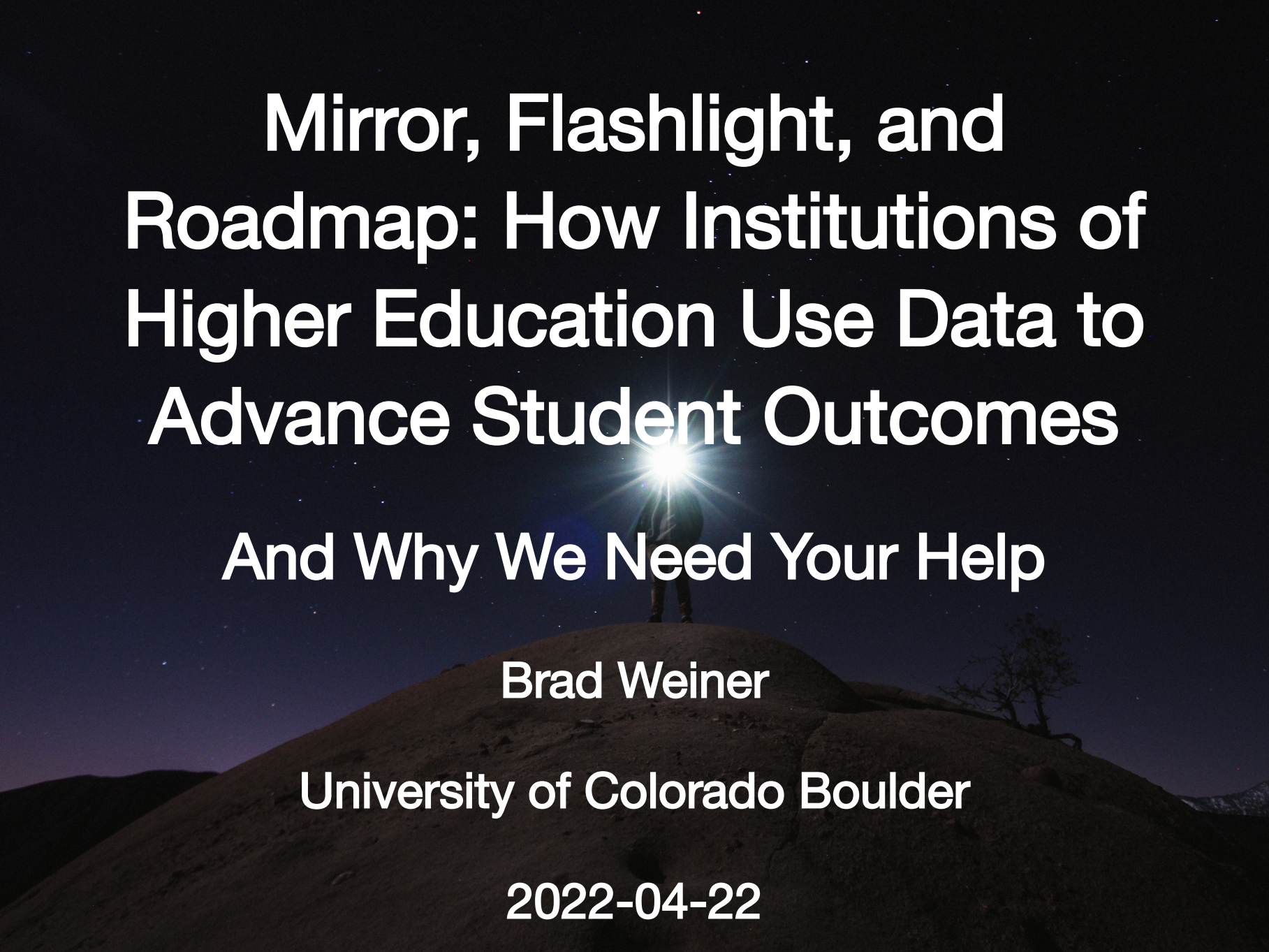

Mirror, Flashlight, and Roadmap: How Institutions of Higher Education Use Data to Advance Student Outcomes

And Why We Need Your Help

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About Me

Interim Chief Data Officer, University of Colorado Boulder

20 years experience in higher education

15 years on campus (Kansas, Vanderbilt, Minnesota, Colorado)

5 years in Ed-Tech/Consultancy

13 years Higher Ed Analytics/Data Science

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What Does a Research University Do?

✅ Create new knowledge in the form of academic research, scholarly output, and creative works

✅ Teach undergraduate and graduate students so they can be engaged members of society and informed, participatory citizens in a democracy

✅ Generate credentials to signal to society and the labor market that graduates have achieved certain skills

✅ Engage with the public in order to be broadly useful to society and so we may create economic and social value

✅ Play football

✅ Preserve knowledge through libraries, archives, curation, and art

✅ Heal patients and create life-improving treatments

✅ Act as an economic engine for local and global businesses

✅ Other stuff that we haven't even listed here


Who Does a University Serve?

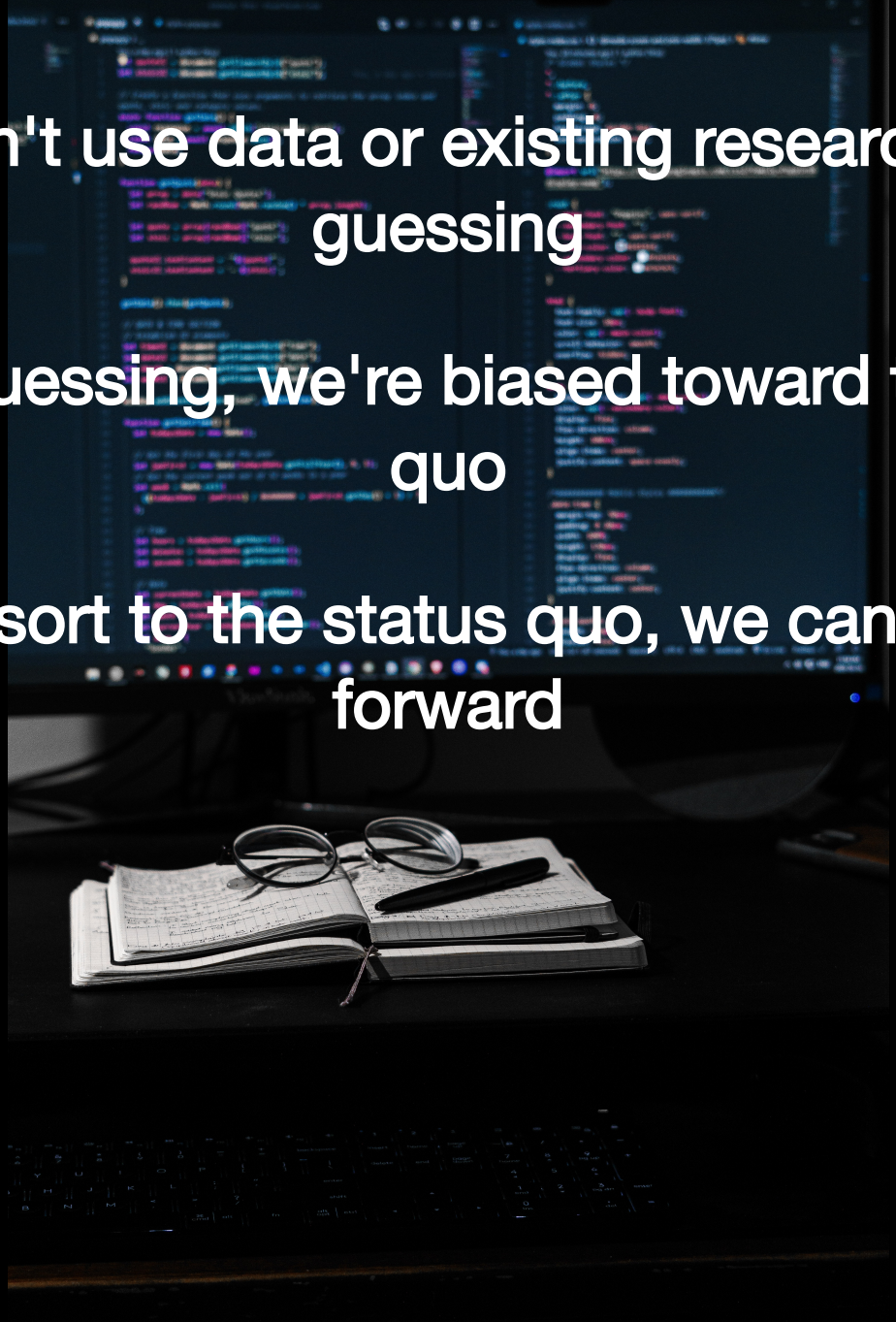
- Students
- Faculty
- Staff
- The Public
- Alumni, Friends, Fans, and Donors
- The Economy
- Its Local Community


Universities have diffuse and sometimes competing goals
Universities have myriad stakeholders
Universities have to demonstrate our value to taxpayers and to society
Universities are resource constrained

If we don't use data or existing research, we're guessing

If we're guessing, we're biased toward the status quo

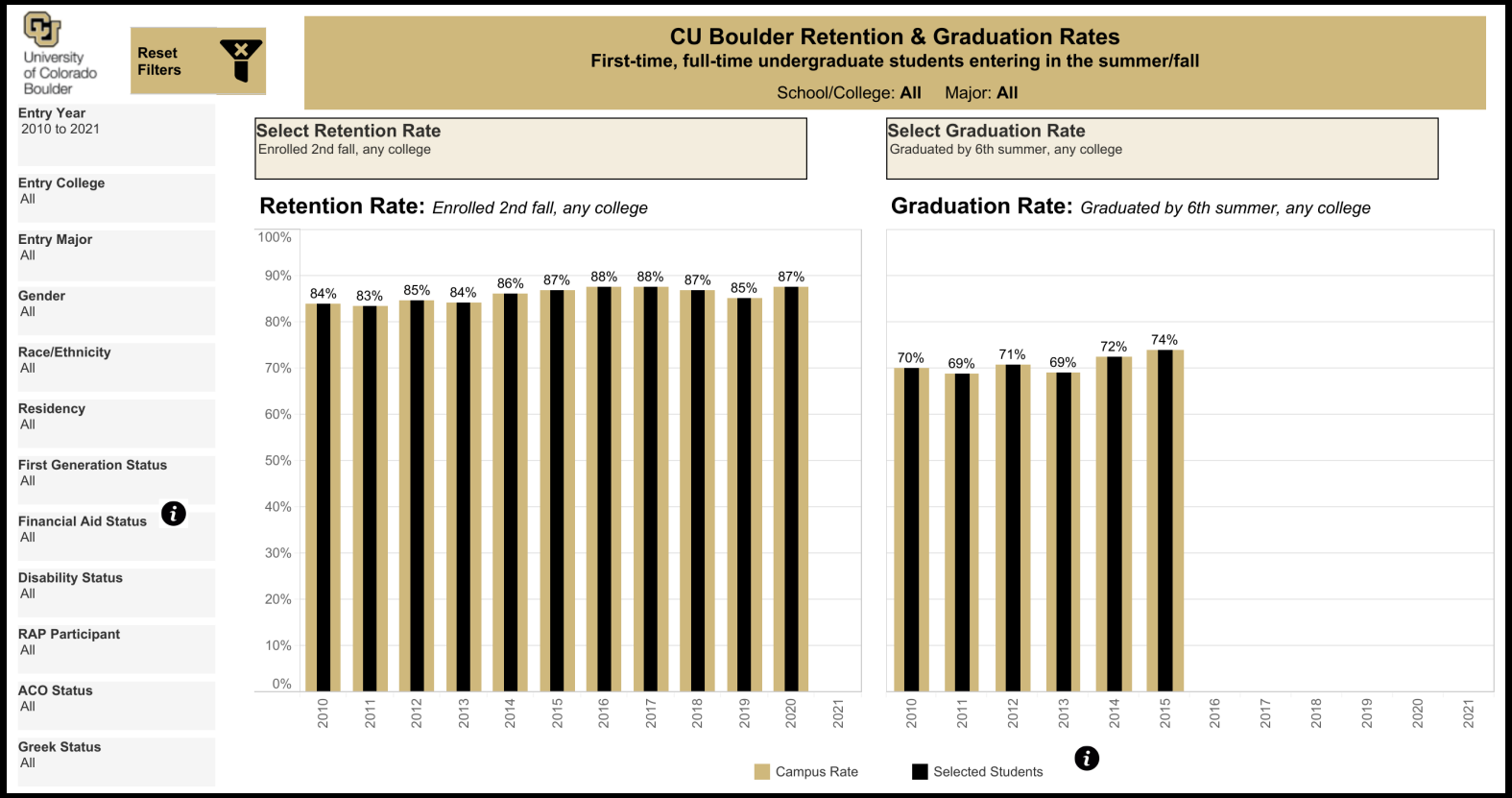
If we resort to the status quo, we can't move forward



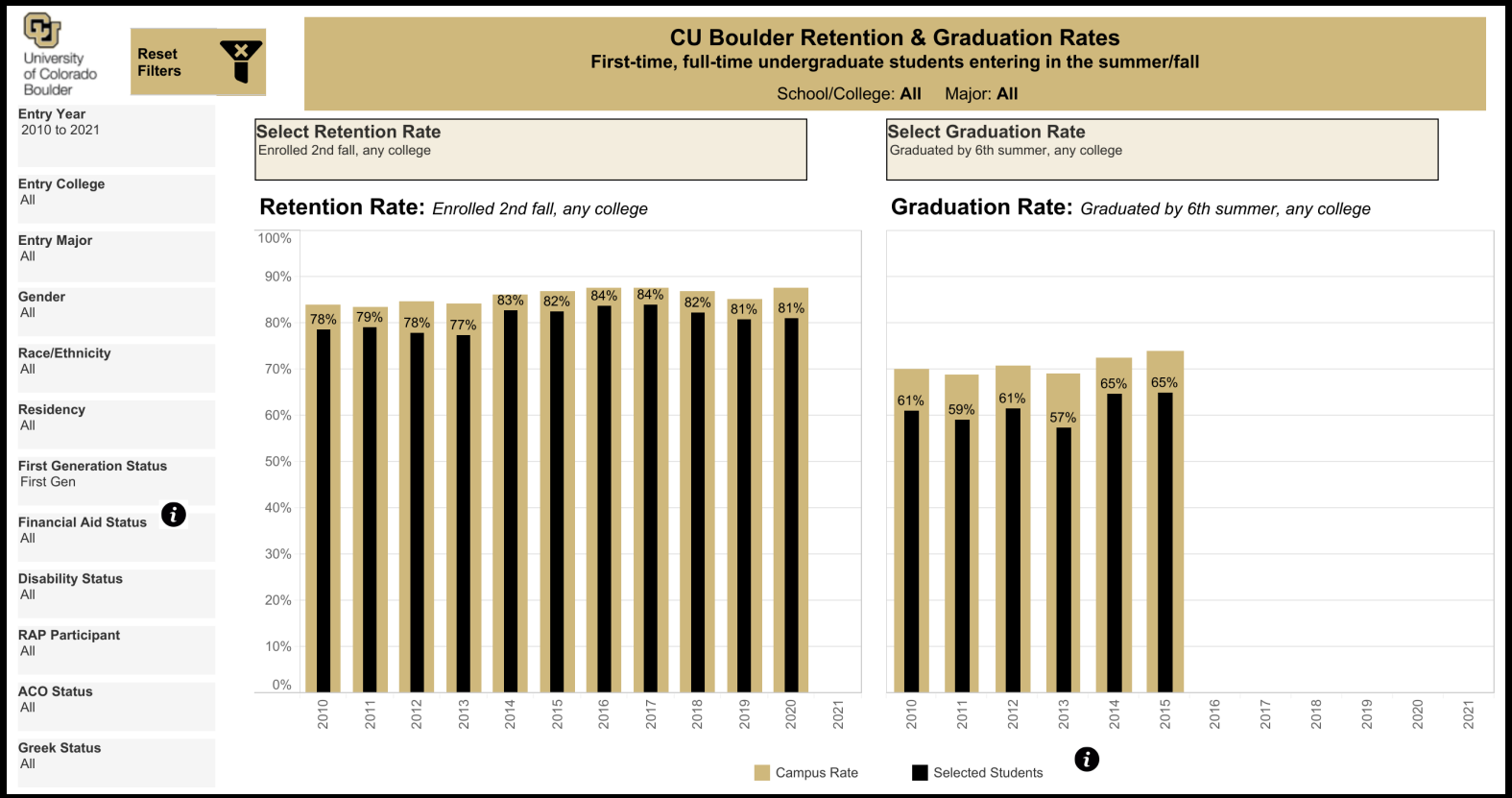
Universities use data as a "mirror" to see how we're doing

Universities use data as a "flashlight" to find areas for improvement


Descriptive Statistics and Reporting



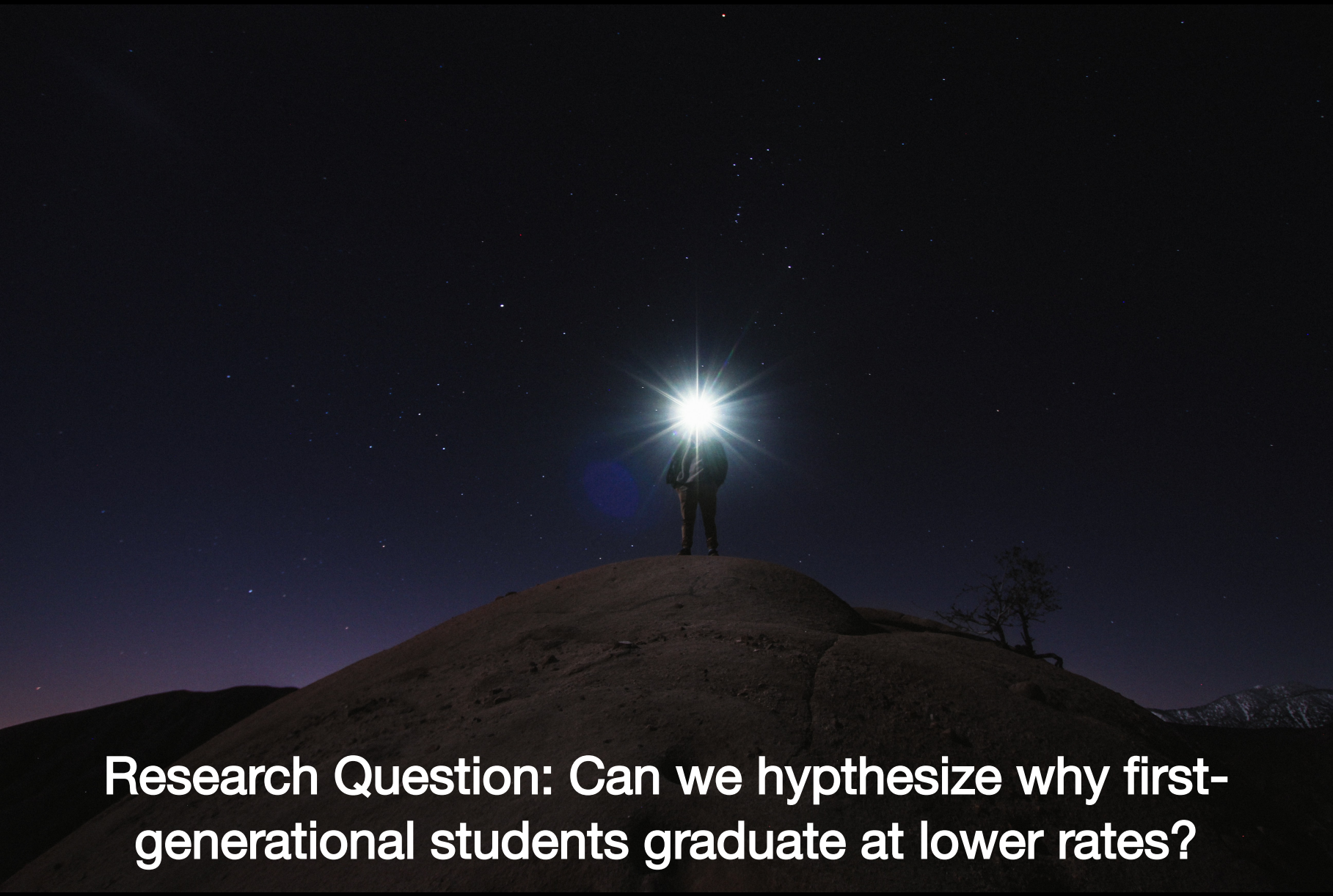
These are historical retention and graduation rates for CU Boulder for first-time, full-time undergraduates



These are historical retention and graduation rates for CU Boulder for first-time, full-time undergraduates who are ALSO first-generational

It appears as though, on average, first-generational students are retained and graduate at a lower rate than peers whose parents attended college.

Data Science and Predictive Analytics


Research Question: Can we hypthesize why first-generational students graduate at lower rates?

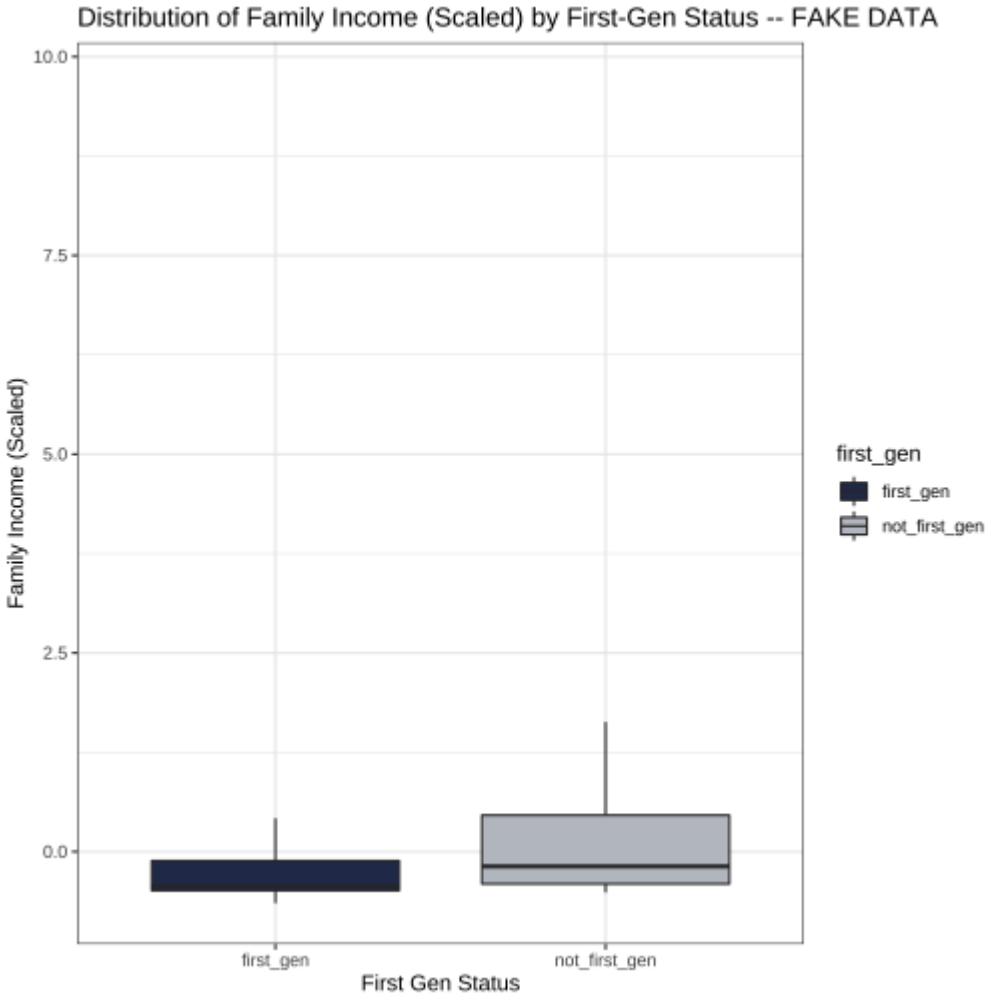
Compile the Raw Data (Not Real Data)

student_id	1	2	3	4	5	6
retained	0	1	1	1	0	0
income_group	Pell Eligible	No Aid	Pell Eligible	No Aid	Pell Eligible	Pell Eligible
sex	male	female	female	female	male	male
age	22	38	26	35	35	NA
siblings_enrolled	1	1	0	1	0	0
peers_from_hs	0	0	0	0	0	0
residency	Resident	Non-Resident	Resident	Resident	Resident	International
total_peer_group	1	1	0	1	0	0
first_gen	first_gen	not_first_gen	not_first_gen	not_first_gen	first_gen	first_gen
family_income	283	2783	309	2073	314	330

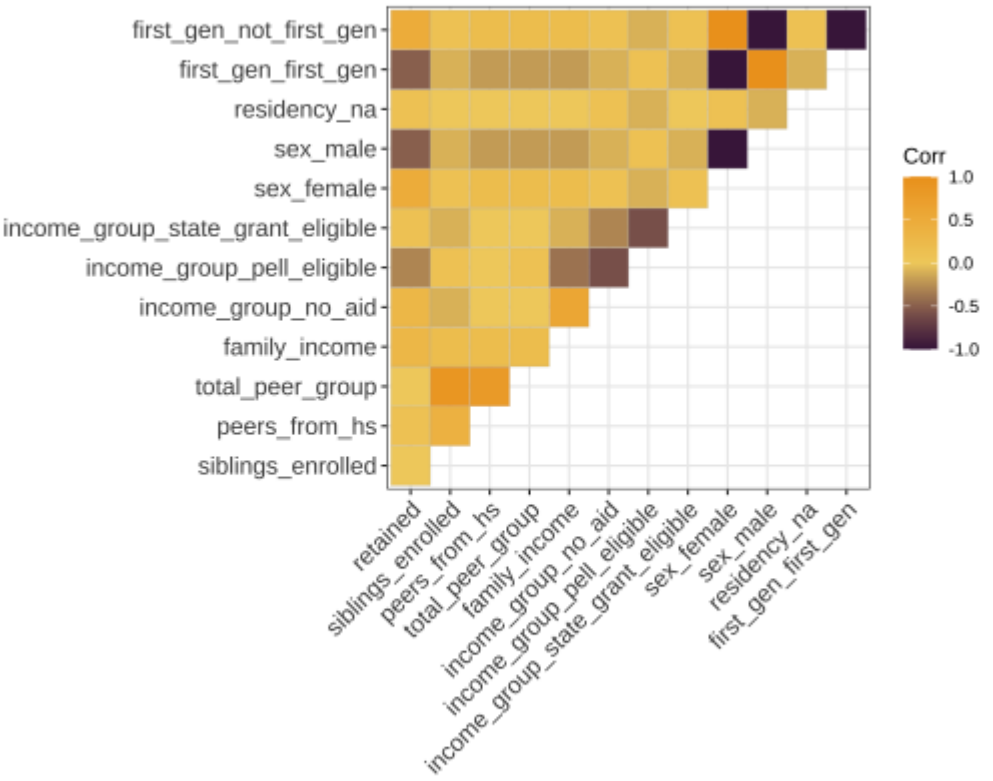
Pre-Process the Data (Again Not Real Data)

student_id	1	2	3	4	5	6
retained	0	1	1	1	0	0
income_group	Pell Eligible	No Aid	Pell Eligible	No Aid	Pell Eligible	Pell Eligible
sex	male	female	female	female	male	male
age	-0.5300051	0.5714304	-0.2546462	0.3649113	0.3649113	NA
siblings_enrolled	0.4325504	0.4325504	-0.4742788	0.4325504	-0.4742788	-0.4742788
peers_from_hs	-0.4734077	-0.4734077	-0.4734077	-0.4734077	-0.4734077	-0.4734077
residency	Resident	Non-Resident	Resident	Resident	Resident	International
total_peer_group	1	1	0	1	0	0
first_gen	first_gen	not_first_gen	not_first_gen	not_first_gen	first_gen	first_gen
family_income	-0.5021568	0.7865640	-0.4887541	0.4205673	-0.4861766	-0.4779288
income_group_no_aid	0	1	0	1	0	0
income_group_pell_eligible	1	0	1	0	1	1
income_group_state_grant_eligible	0	0	0	0	0	0
sex_female	0	1	1	1	0	0
sex_male	1	0	0	0	1	1
residency_international	0	0	0	0	0	1
residency_non_resident	0	1	0	0	0	0
residency_resident	1	0	1	1	1	0

Explore the Data (Again Not Real Data)



Explore the Data (Again Not Real Data)



Model the Outcome: Split Into Test and Training Sets

retn_train$retained	n	percent
0	412	0.6158445
1	257	0.3841555

retn_test$retained	n	percent
0	137	0.6171171
1	85	0.3828829

Model the Outcome: Build Basic Regression Model (This is Hacky and Poorly Specified)

```
mod.1 <- glm(retained ~
               total_peer_group +
               family_income +
               first_gen_first_gen,
             data = retn_train,
             family = "binomial")
```

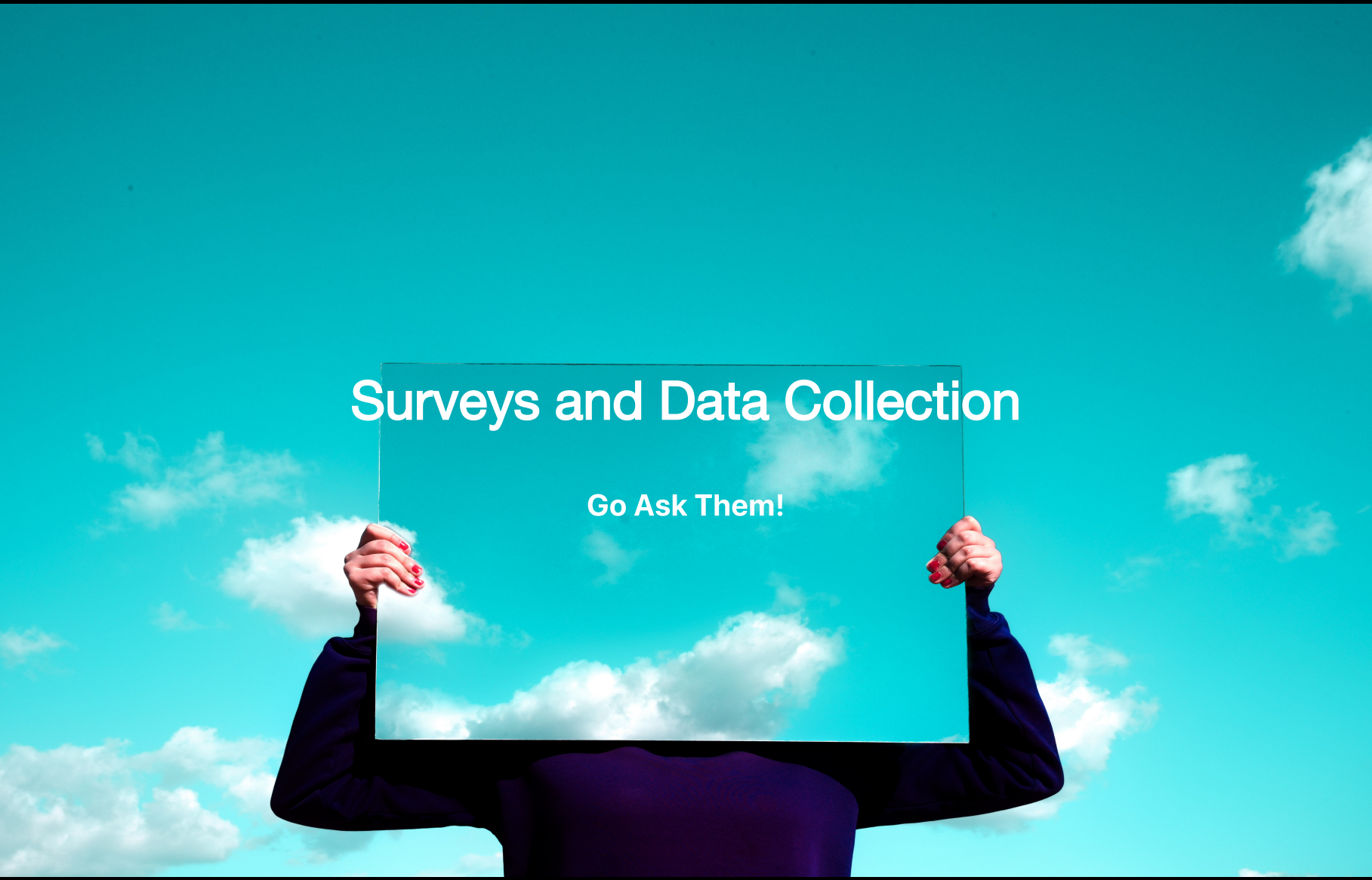
Review and Interpret the Results

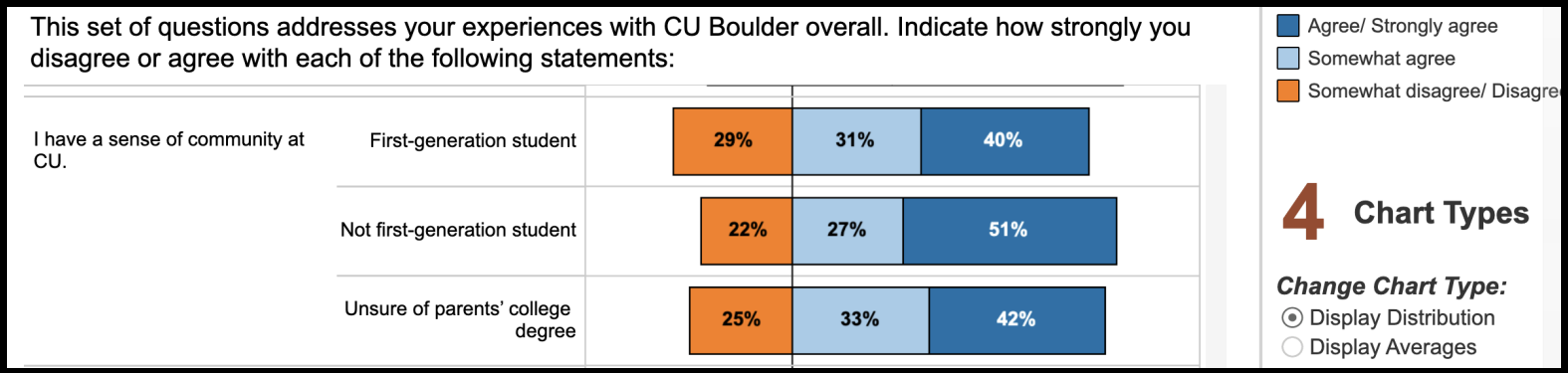
term	estimate	std.error	statistic	p.value
(Intercept)	4.59998	0.19685	7.75218	0.00000
total_peer_group	0.72952	0.07324	-4.30613	0.00002
family_income	2.11703	0.15248	4.91882	0.00000
first_gen_first_gen	0.06219	0.21840	-12.71770	0.00000

Interpretation (Fake Data)

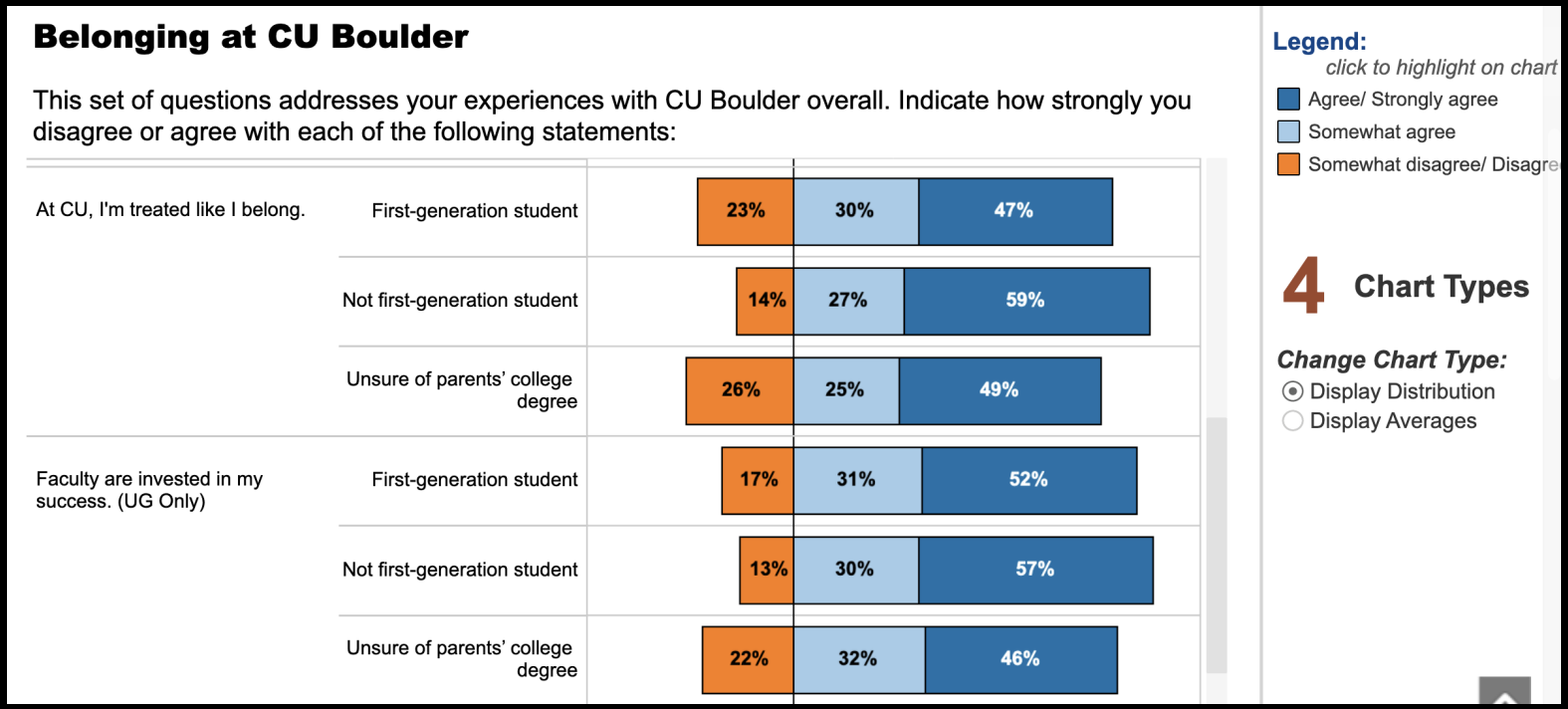
Being classifed as first-gen_first_gen is correlated with being 0.6 times less likely to be retained in the second year when controlling for other factors in the model.

For each additional 'unit' of family_income, a student is 2.11 times more likely to be retained in the second year when controlling for other factors in the model.

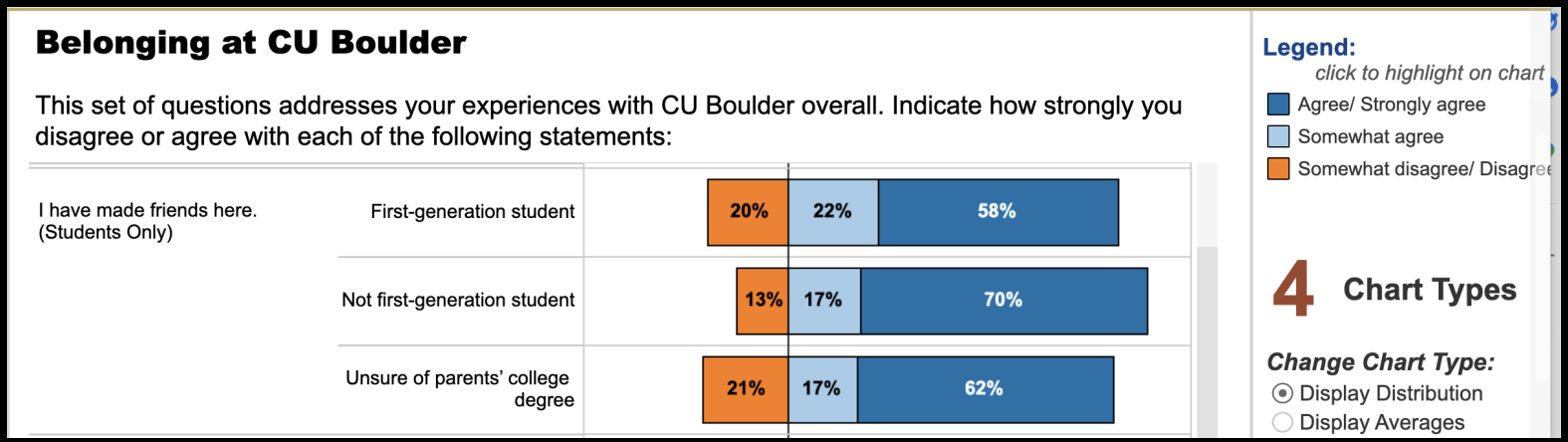

Surveys and Data Collection
Go Ask Them!



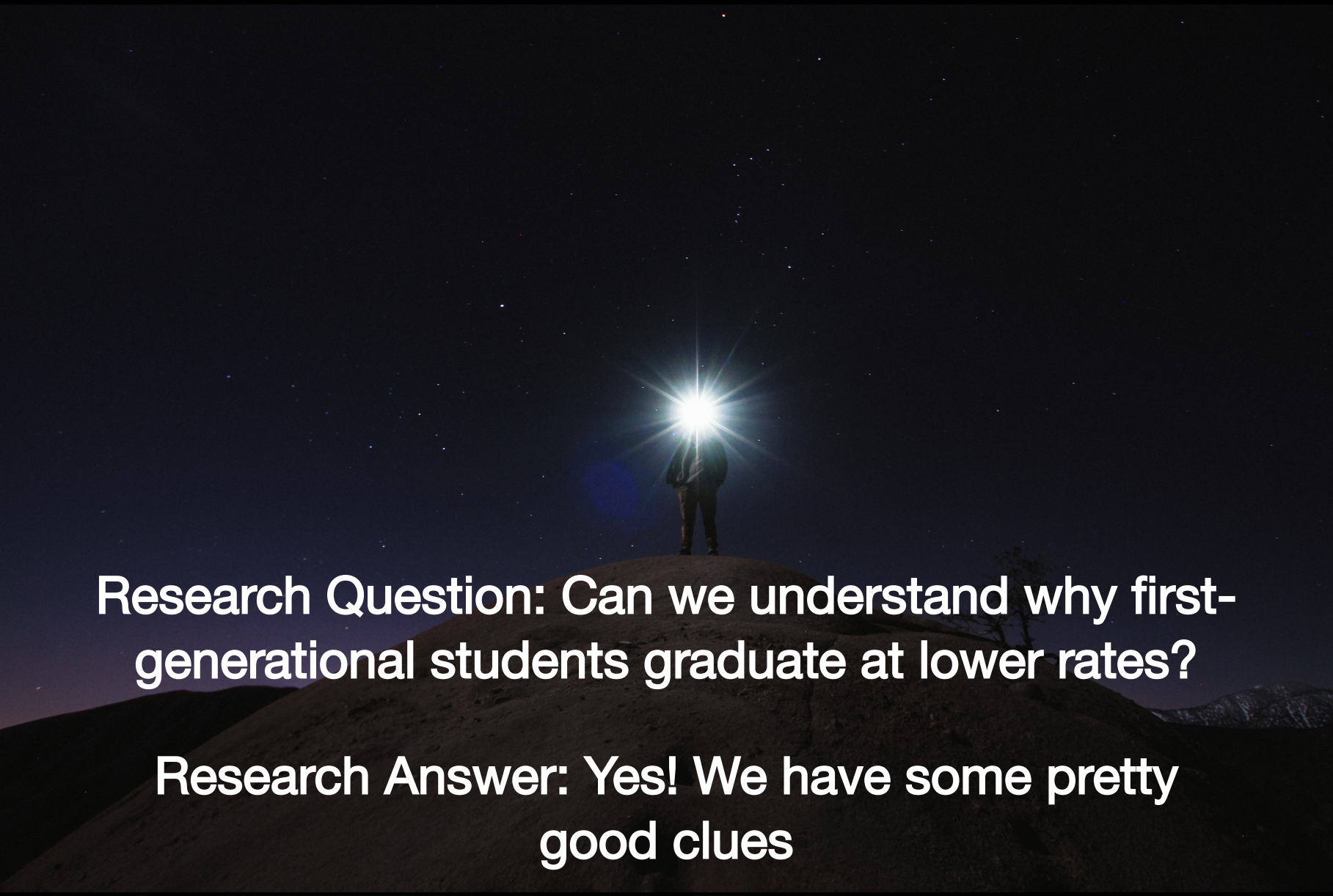
First-generational students disagree that they have a sense of community at CU Boulder 7% more than non-first-generational students.



First-generational students disagree that are treated like they belong 9% more than non-first-generational students.



First-generational students disagree that they have made friends here 7% more than non-first-generational students.



Research Question: Can we understand why first-generational students graduate at lower rates?

Research Answer: Yes! We have some pretty good clues

✅ Retention and graduation are key indicators of student and institutional success

✅ Differential rates in retention and graduation are inequitable and demand attention

✅ Theoretical evidence posits many theories as to why first-generational students are less likely to persist until graduation.

✅ Our fake data and clunky model specification indiciated two things:

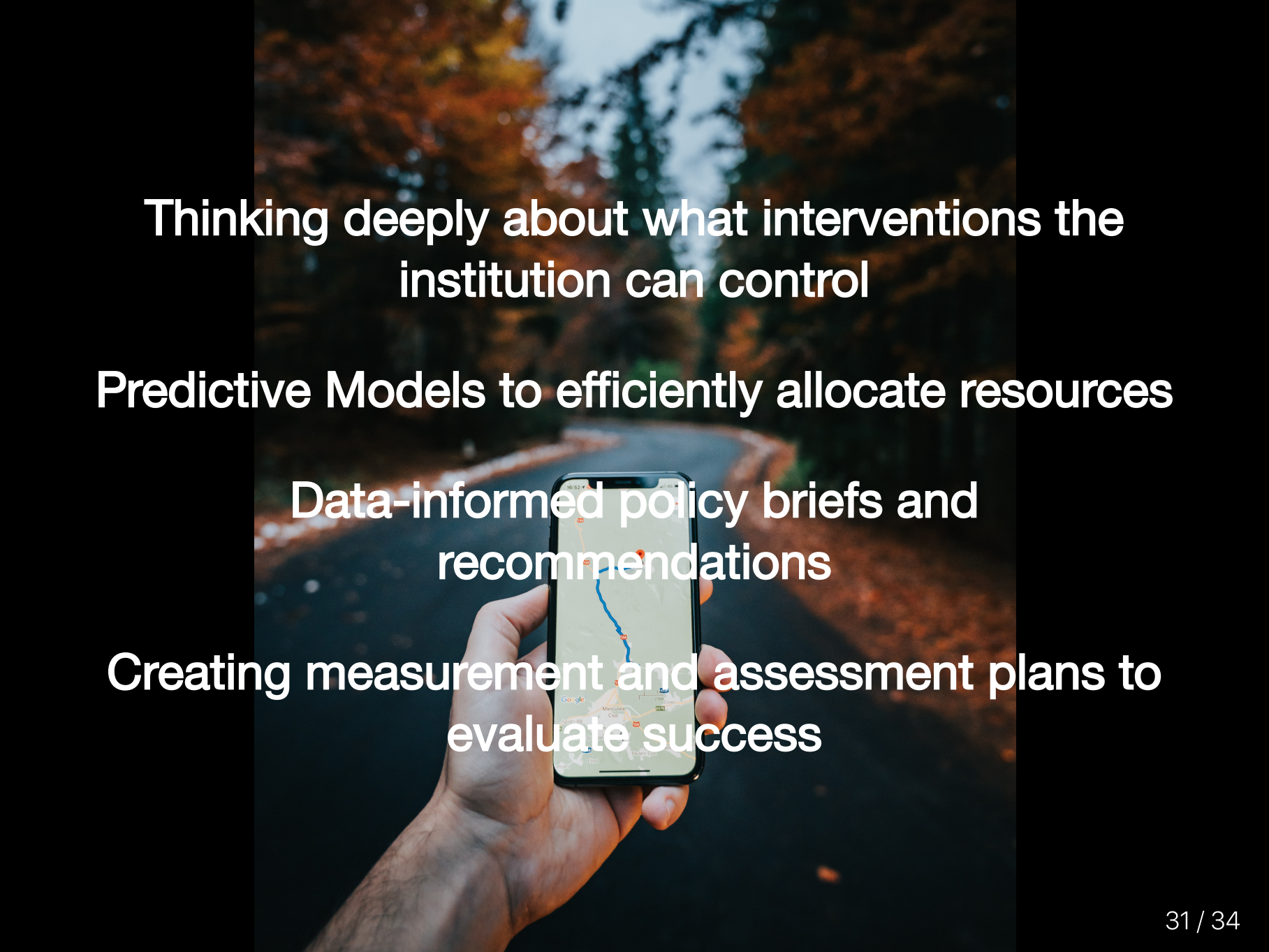
✅ That family income is also highly correlated and something institstutions can impact through financial aid. And...

✅ That students from first-generational backgrounds feel less connected, less engaged and less likely to have friends or support.

✅ So what can we do about it?


Universities have diffuse and sometimes competing goals
Universities have myriad stakeholders
Universities have to demonstrate our value to taxpayers and to society
Universities are resource constrained

How Do We Use Data To Improve the University?



Thinking deeply about what interventions the institution can control

Predictive Models to efficiently allocate resources

Data-informed policy briefs and recommendations

Creating measurement and assessment plans to evaluate success

We Need Your Help

The public and non-profit sectors need descriptive, predictive, and presriptive analytics to advance prosocial outcomes

These sectors aren't as far along as the private sector. This provides lots of room for innovation!

Find a business problem you care about. For me, that's helping colleges and universities, but there are endless ways to make a difference.

Some Blue Sky Projects in ODA and Higher Ed

NLP Model to Detect Incidents of Self-Harm in Survey Responses

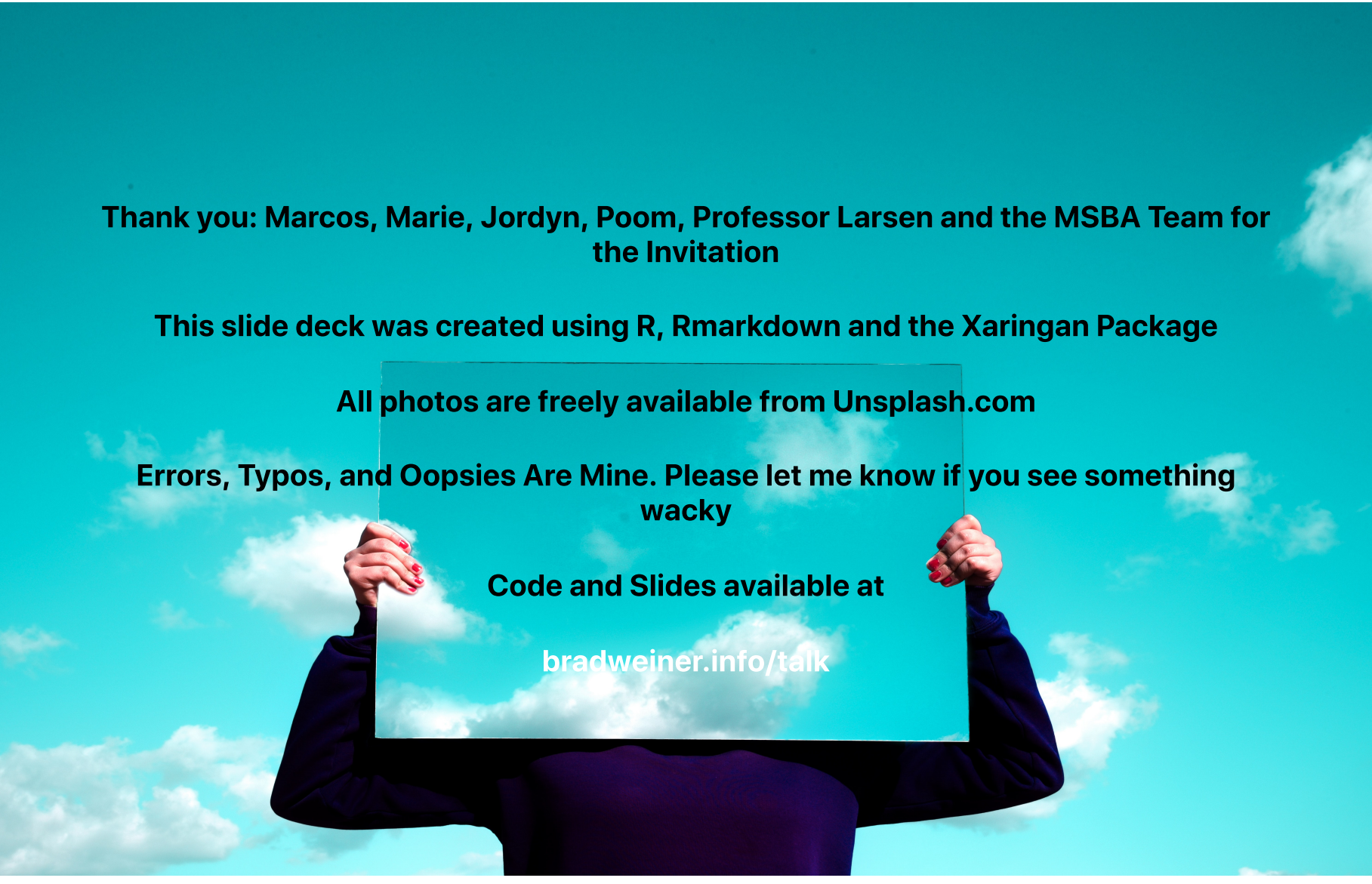
IoT Experiment for Rapid, Random Surveys via Smart Phone

Deep Learning exploration of optimal curricular pathways

Recommender Systems for Courses, Instructors, Majors

Prescriptive Models for Guiding "Next Likely Action" for students and advisors

[Your Great Idea Here]


Thank you: Marcos, Marie, Jordyn, Poom, Professor Larsen and the MSBA Team for the Invitation
This slide deck was created using R, Rmarkdown and the Xaringan Package
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