Using Machine Learning to Predict Student Success and Combat Inequity

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UNIVERSITY OF OREGON
Academic Data Analytics

Welcome

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Academic Data Analytics

https://provost.uoregon.edu/analytics

- Office of the Provost
- Culture of data-driven decision-making
  - Shape policy
  - Prioritize equity
  - Increase transparency
- Focus areas:
  - Predicting student success
  - Understanding student feedback
  - Visualizing complex data
  - Understanding student and faculty progression

Session Roadmap

1. Project overview
2. Motivation
3. Our process
4. Early results and reflections
5. Discussion

Learning Goals

Understand applications of **machine learning**

Engage with interplay between machine learning and **equity**

Identify **implementation opportunities** at home institutions

Project Overview

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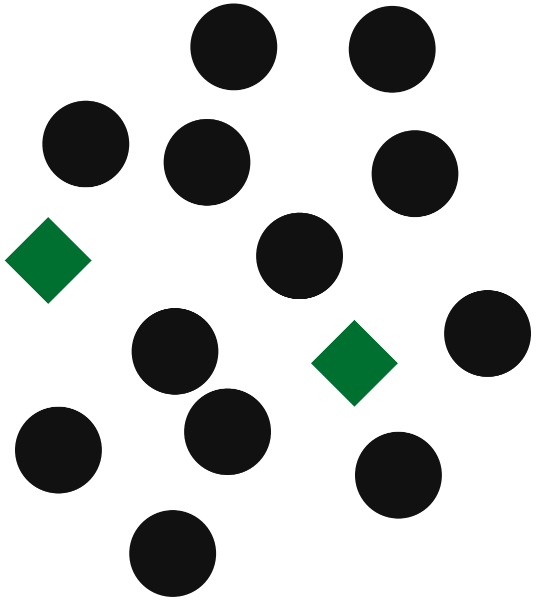
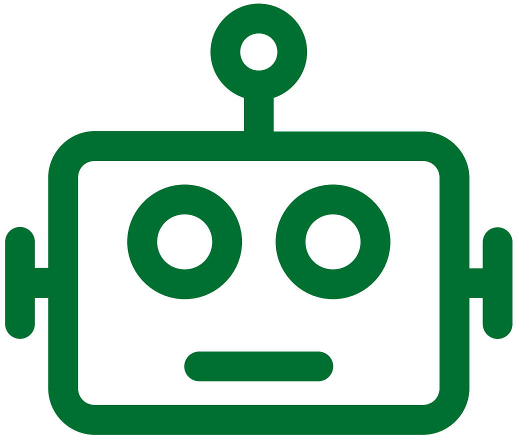
Prediction Task



Which incoming students will not persist to their second term?

- Predict **before students matriculate**
- Include all incoming **first-time first-year students**
- Each year, use predictions to **target early advising intervention**

- Many varieties; today's focus is **predictive analytics**
- Harnesses large amounts of **data** and **computing power**
- Searches for **relationships** between inputs and outputs
- Finds patterns **more complex** than human eyes and traditional methods can handle
- Not magical, but **powerful in the right situation**



Machine Learning

Motivation

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Central Challenge

Non-Retention

- **Damaging** to students and university
- Disproportionately impacts **most vulnerable** students

Timely Intervention

- **Difficult to recover** from early negative experiences
- **Proactive interventions are more effective** than reactive ones

Finite Resources

- **Fewer advisors** than students
- **Must choose** who receives a given intervention first

Central Challenge

*Can we **predict which incoming students will not persist** to their second term?*

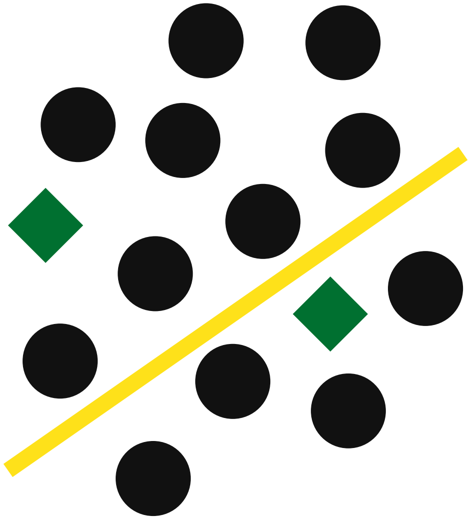
***How early** can we make our predictions?*

Non-Retention

Timely Intervention

Finite Resources

- **Early advising** already in place
- **Mathematical model** already in use
    - Predicts **first-term GPA**
    - Traditional **linear regression**
    - **Unable** to predict second-term retention
- A useful tool, but a **compromise**
- Not evaluated for **equity**



Status Quo

Promises

- Greater **predictive power**
- Better equipped for **challenging outcomes**
- Harnesses **bigger, messier data**

Concerns

- Will **human stakeholders** lose their voice?
- Might the algorithm be **biased or inequitable**?
- How much **transparency** will be offered?

Machine Learning

Our Process

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Process Commitments

PARTICIPATORY

Engage meaningfully with a range of stakeholders

TRANSPARENT

Report honestly and accessibly on process and outcomes

EQUITY-ORIENTED

Apply lens throughout; demonstrably advance equity

Process Highlights

Participatory

- Partner closely with **Undergraduate Education and Student Success**
- **Converse** with other offices
- Reflect student body through **diverse data sources**

Transparent

- **Report actively** to UESS throughout
- **Publicly disseminate** methods and results
- Acknowledge **strengths and limitations**

Equity-Oriented

- With stakeholders, **define** equity standards
- Ground our work in **existing scholarship**
- Thoroughly **vet model** for equity and revise as necessary

Early Results & Reflections

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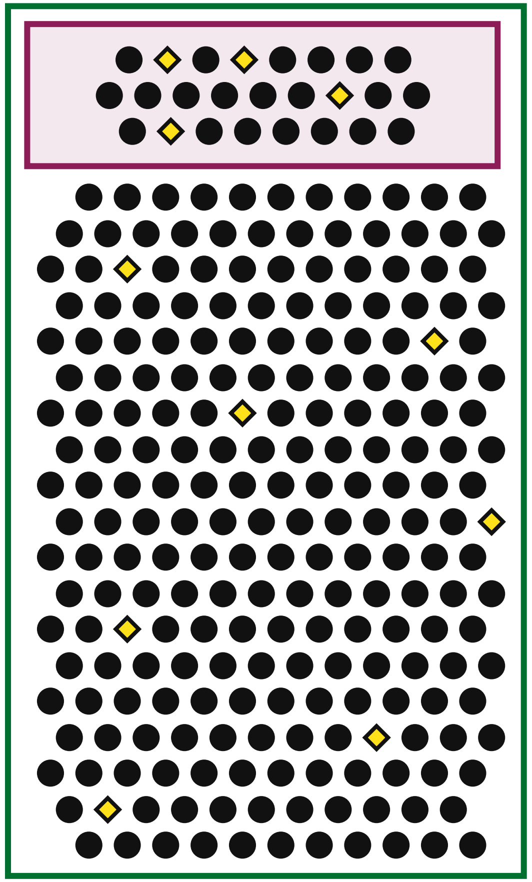
Model Performance, 2021 Cohort

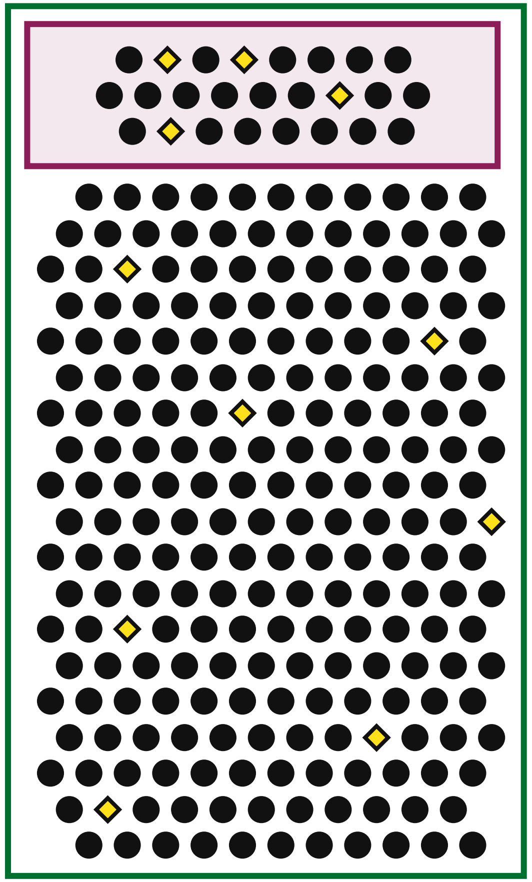
ADA Model

All Students

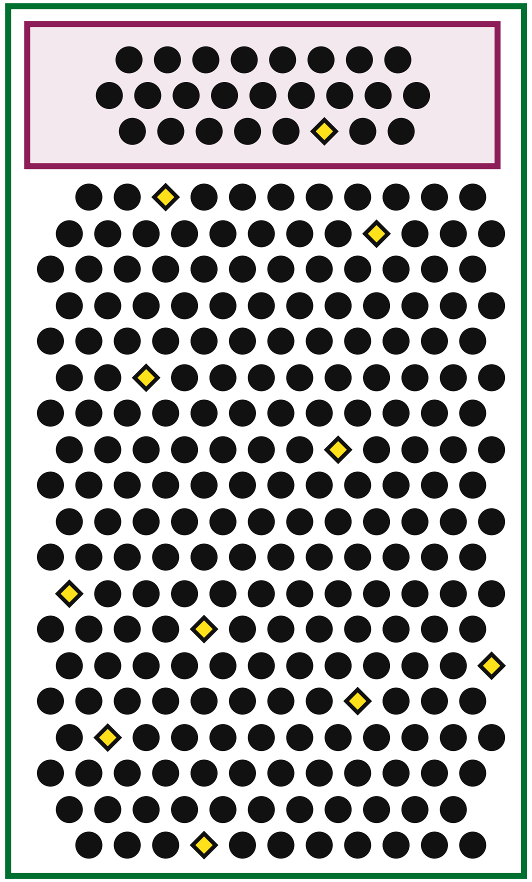


Model Performance, 2021 Cohort

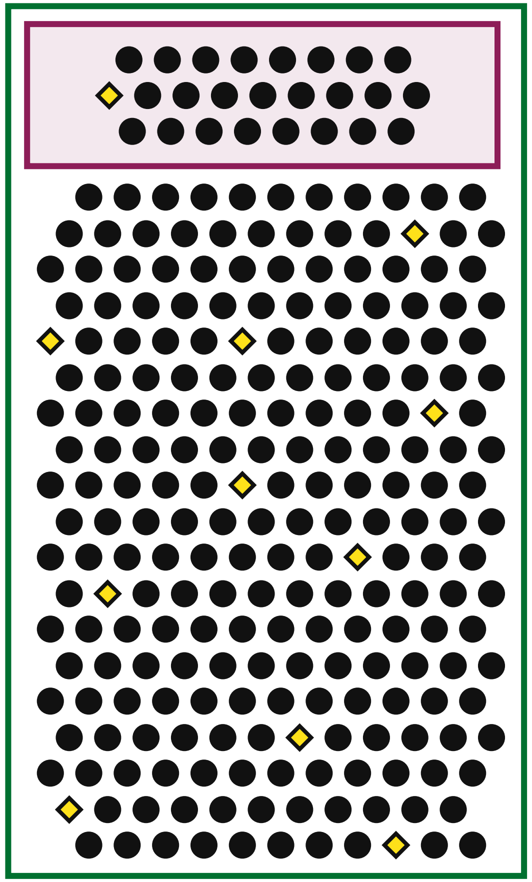
ADA Model
All Students



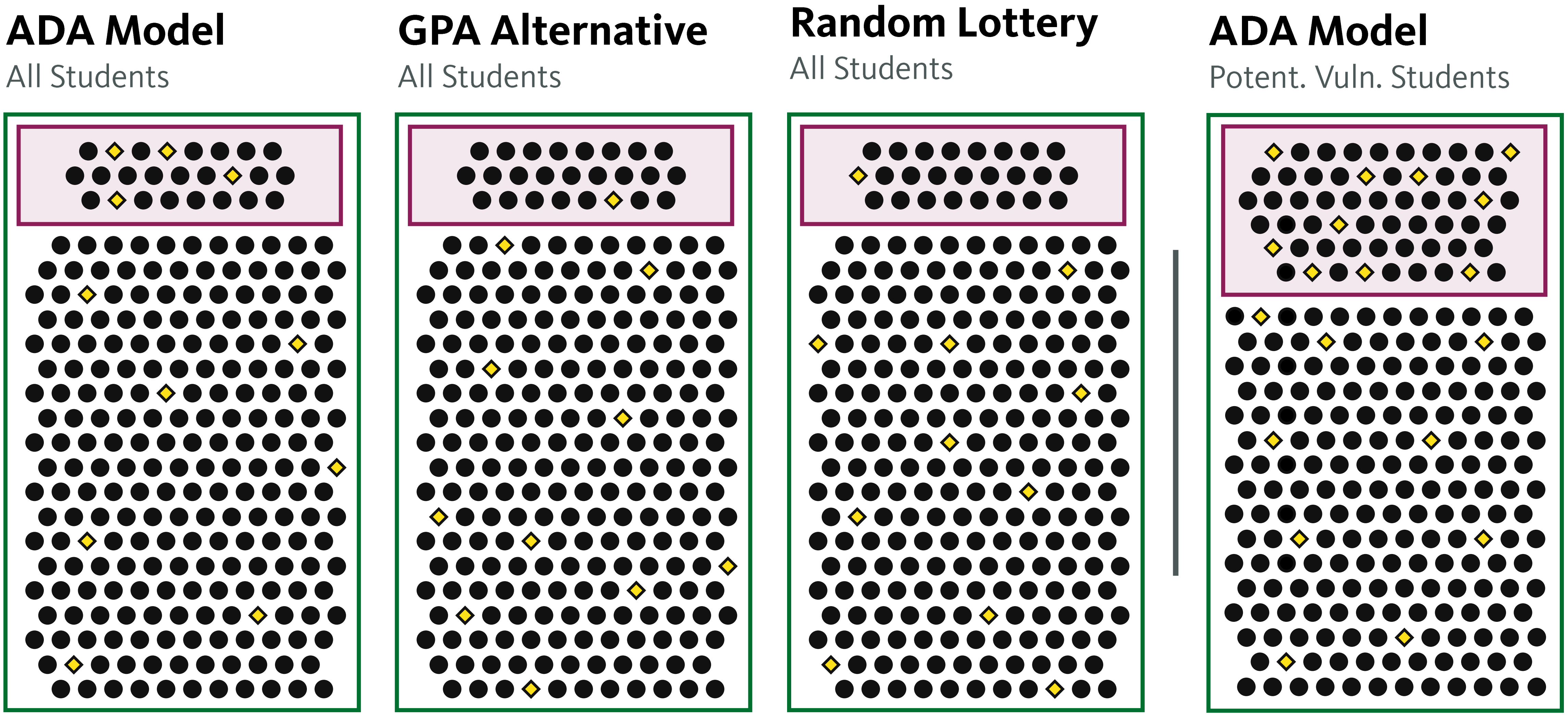
GPA Alternative
All Students



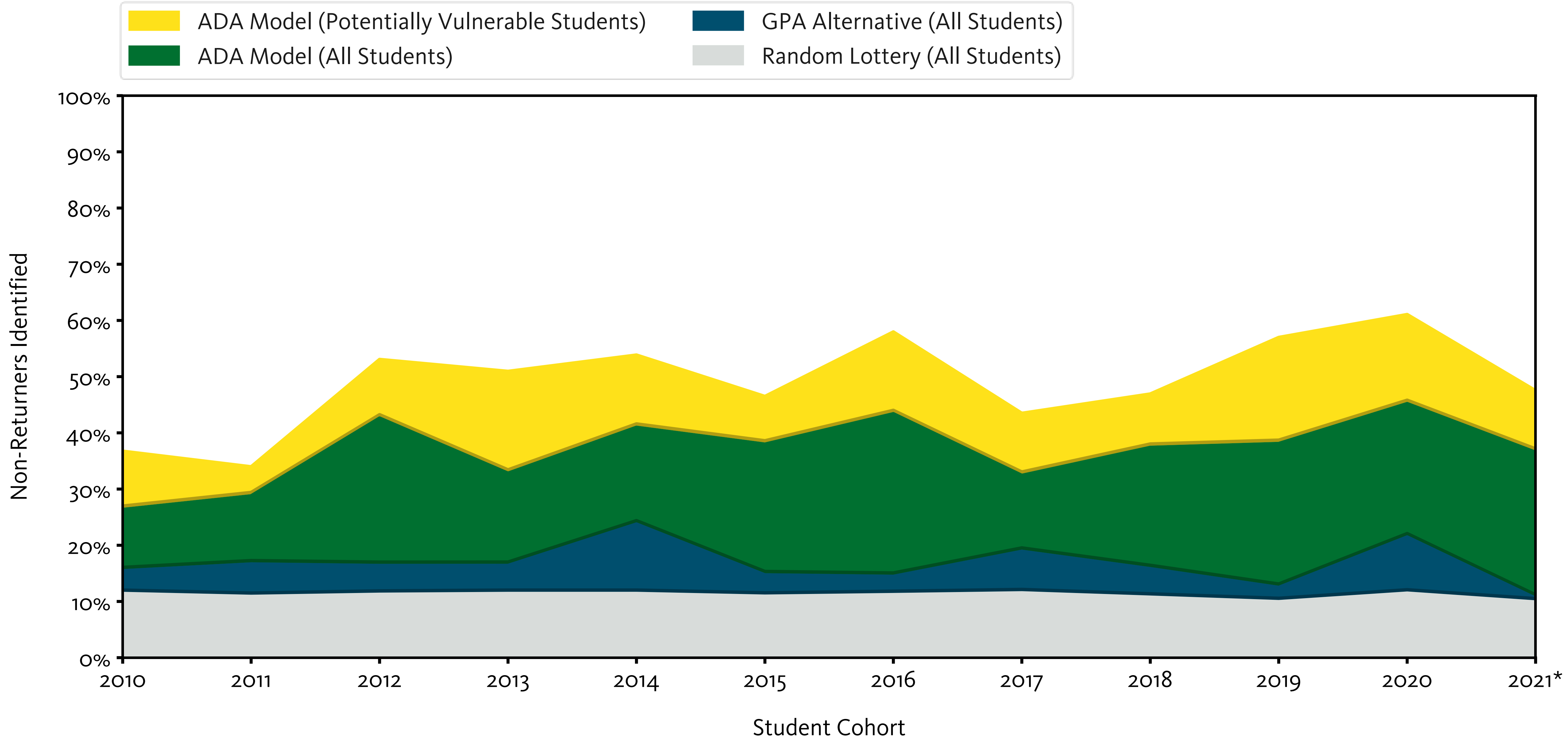
Random Lottery
All Students



Model Performance, 2021 Cohort



ADA Model Out-Performs Alternatives

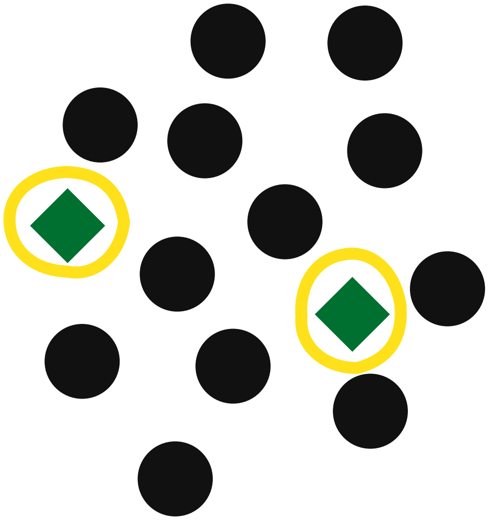


** The 2021 cohort was hidden from the model during development. Each cohort's performance is based on a model trained with all cohorts' data, except the cohort in question and 2021.*

Ongoing Work

- Refine model **performance**
- Expand **equity analysis**; make any necessary **adjustments**
- **Deploy for incoming students** this year

Reflections



- Confident that **performance exceeds alternatives**
- Room to **continue improving**
- Growing confidence in **model equity**
- **Process** was extremely successful
- Thoughtful approach, plus working in-house, enables **responsible machine learning**
- Ultimately, **harnessed powerful new tools without undermining** human stakeholders or potentially vulnerable students

Discussion

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Open Discussion

Thank you!

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