

# **2019 Predictive Analytics Symposium**

## **Session 17: ALL - Auditing your Models for Bias**

[SOA Antitrust Compliance Guidelines](#)  
[SOA Presentation Disclaimer](#)



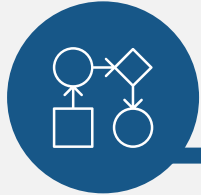
# Auditing your Models for Bias

September 2019

NOT IF, BUT HOW

Munich RE 

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Data Science Framework

2



Fairness Metrics

3



Demo

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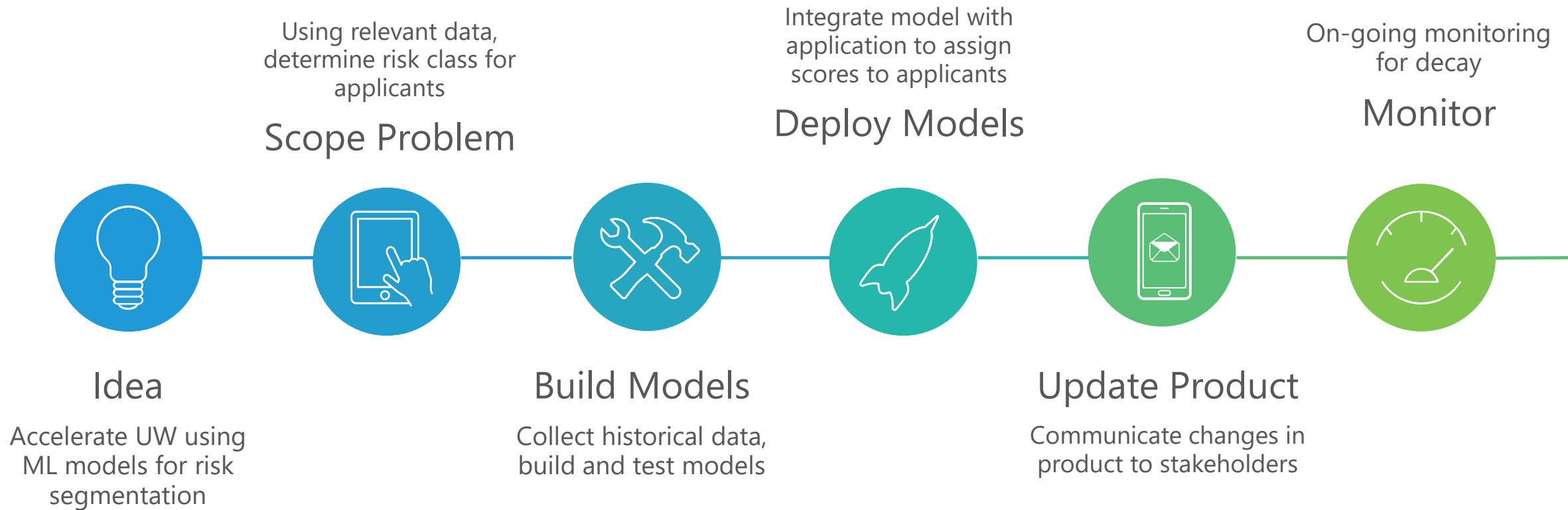


Questions

# Data Science Framework



# From Idea to Application: Data Science Life Cycle



# Important Touchpoints for Privacy and Bias

- Data Sourcing & 3<sup>rd</sup> Party Data
  - Decide on appropriate data (internal and external) to build model; talk with subject matter experts to define relevant data sources
- Fairness Considerations
  - Based on data, decide on appropriate model design
  - Based on possible interventions, define metrics for model selection
  - Query model results for transparency and bias

3 questions to think about when using 3<sup>rd</sup> party data

**1. What is the benefit of external data for the use case?**

- In some cases, we want to use supplemental information to request less information from clients and make for an easy application process
- In some cases, want to use it to verify statements that people make

**2. Do you satisfy specific policy requirements around the use of 3<sup>rd</sup> party data?**

**3. Are there proper procedures in place for storage and access to 3<sup>rd</sup> party data?**

- Is there access control? Procedures in case of breach?
- When matching external data to internal data, is this done in a robust, reproducible way?

# Measuring Fairness





Fairness and Model Audits is a new industry

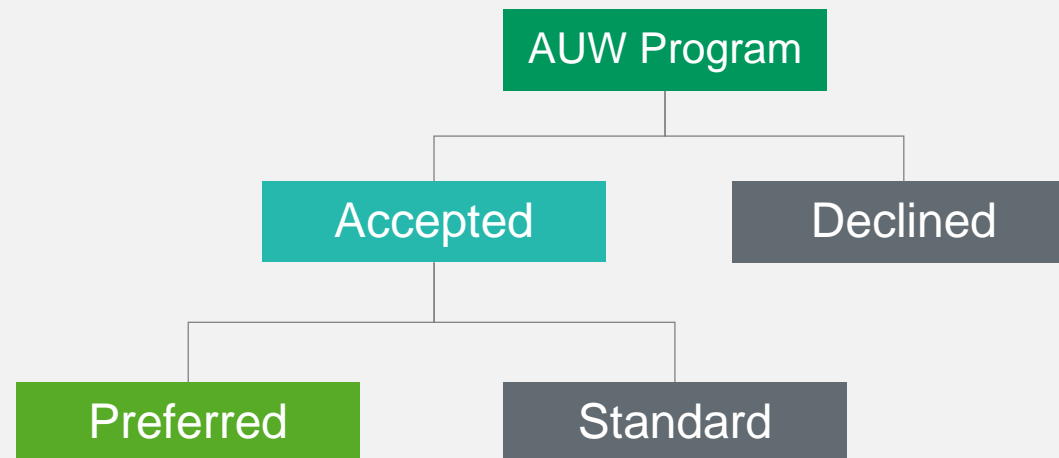
- Cathy O’Neill, author of Weapons of Math Destruction offers a “Model Audited for Bias” certification through her consulting firm ORCAA
- Other consulting firms like McKinsey also offer a model audit solution
- Aequitas, developed by center for Data Science and Public Policy is an open source tool that can help you audit your models for bias
- IBM AI 360, developed by IBM can calculate many fairness metrics
- All of these approaches specify metrics that can be used to determine if your model is fair/biased

**In addition to a model performance metric, how do you incorporate a fairness metric in your model selection process?**

# Case Study: Model Development

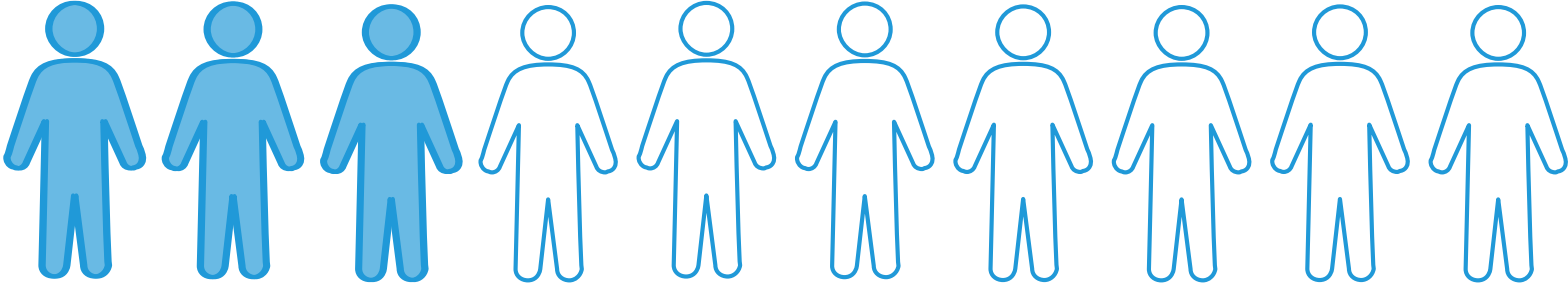
Exercise: Identify Privacy and Bias Concerns at each stage in the model and product cycle

- Problem: For an AUW program, how can we increase STP of Preferred candidates?
- Intervention: Based on a model score, the top scoring accepted candidates will be assigned a Preferred Class.



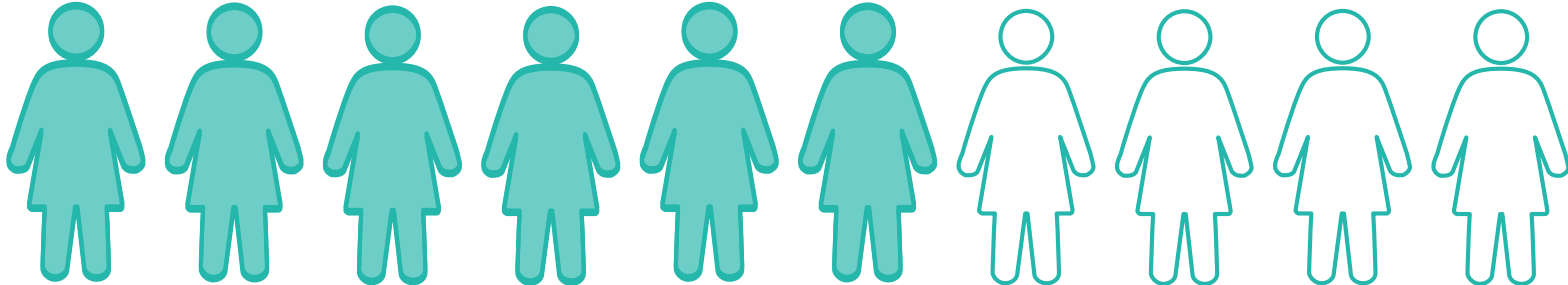
# Model Results

## Protected Attributes



**30%**

Men are flagged as Preferred



**60%**

Women are flagged as Preferred

# FAIRNESS TREE

Do you want to be fair based on disparate representation or based on disparate errors of your system?

Representation

Errors

Do you need to select equal # of people from each group OR proportional to their percentage in the overall population?

Equal Numbers

Proportional

Equal Parity

Also known as Demographic or Statistical Parity

Proportional Parity

Equivalent to Disparate Impact

Are your interventions punitive or assistive?

Punitive (could hurt individuals)

Assistive (will help individuals)

Are you intervening with a very small % of the population?

Yes

No

False Discovery Rate Parity

Equivalent to Precision (or PPV) Parity

False Positive Rate Parity

Equivalent to True Negative Rate Parity

Are you intervening with a very small % of the population?

Yes

No

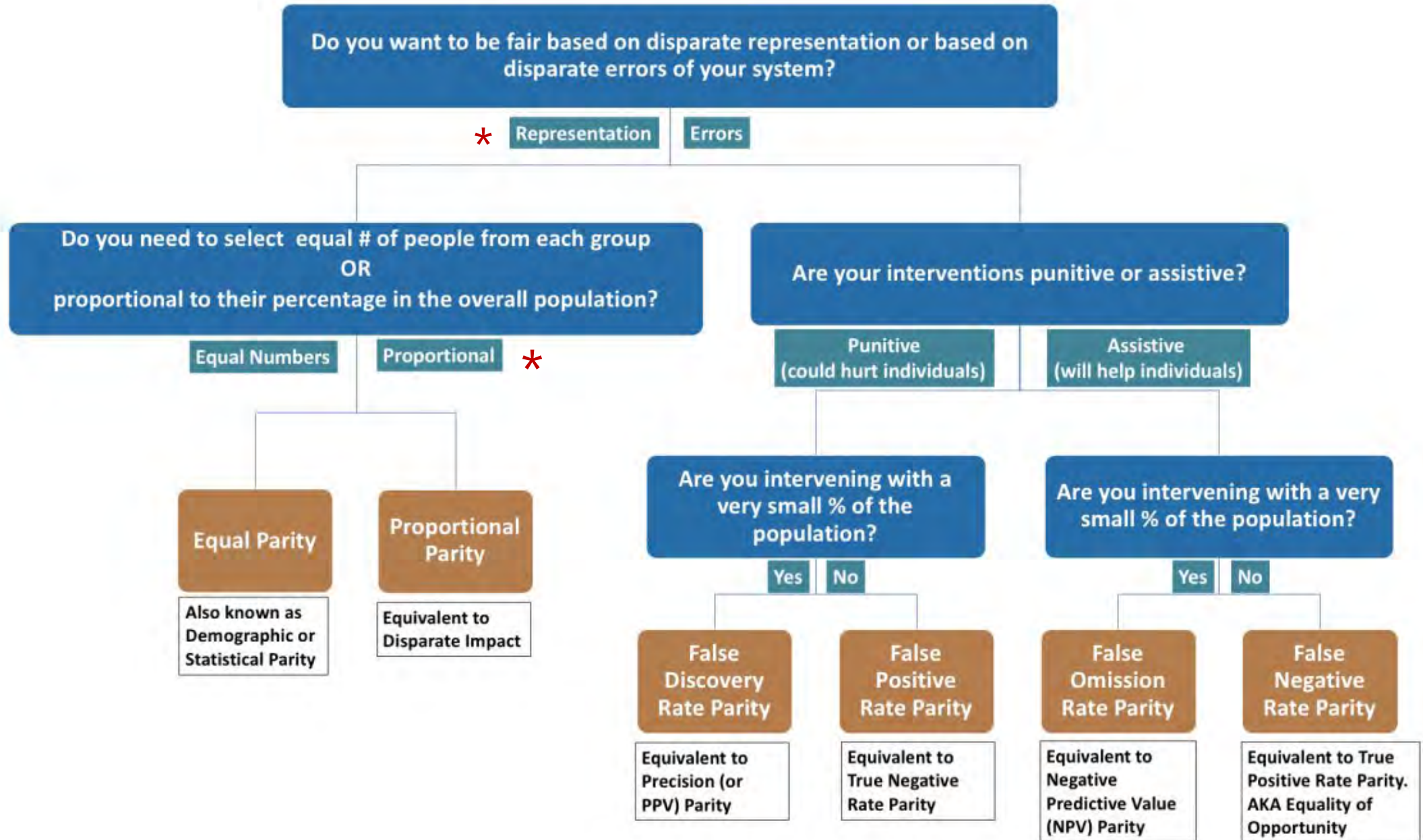
False Omission Rate Parity

Equivalent to Negative Predictive Value (NPV) Parity

False Negative Rate Parity

Equivalent to True Positive Rate Parity. AKA Equality of Opportunity

# FAIRNESS TREE



- Privacy and bias considerations of the modelling process are real
- Uncertainty about what is required from a regulatory perspective
- To account for such considerations:
  - Design a model that takes into account the process which it supports
  - Document all decisions made around model selection
  - Audit models for bias and incorporate bias metrics into model selection process
  - Work with legal to be in compliance with policy requirements around 3<sup>rd</sup> party data

Questions?





Thank you.

NOT IF, BUT HOW

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