Draft Pending Adoption

Draft: 12/12/23

Big Data and Artificial Intelligence (H) Working Group
Orlando, Florida
December 1, 2023

The Big Data and Artificial Intelligence (H) Working Group of the Innovation, Cybersecurity, and Technology (H) Committee met in Orlando, FL, Dec. 1, 2023. The following Working Group members participated: Elizabeth Kelleher Dwyer, Chair (RI); Amy L. Beard, Co-Vice Chair (IN); Doug Ommen, Co-Vice Chair (IA); Adrienne A. Harris, Co-Vice Chair, represented by John Finston (NY); Kevin Gaffney, Co-Vice Chair (VT); Lori Wing-Heier (AK); Sheila Travis (AL); Tom Zuppan (AZ); Michael Conway, (CO); Andrew N. Mais and Wanchin Chou (CT); Karima M. Woods (DC); Rebecca Smid (FL); Weston Trexler (ID); Erica Weyhenmeyer (IL); Abigail Gall (KY); Tom Travis (LA); Rachel M. Davison (MA); Kathleen A. Birrane (MD); Timothy N. Schott and Sandra Darby (ME); Phil Vigliaturo (MN); Cynthia Amann (MO); Robert Croom (NC); Colton Schulz (ND); Christian Citarella (NH); Judith L. French (OH); Teresa Green (OK); Michael McKenney, Gary Jones, Lindsi Swartz, and Shannen Logue (PA); Michael Wise (SC); Tony Dorschner (SD); Randall Evans (TX); Tanji J. Northrup (UT); Eric Lowe (VA); Bryon Welch (WA); and Nathan Houdek and Lauren Van Buren (WI). Also participating were: Alan McClain (AR); John F. King (GA); and Matt Gendron (RI).

1. Adopted its Summer National Meeting Minutes

Director Wing-Heier made a motion, seconded by Commissioner Mais, to adopt the Working Group's Aug. 13 minutes (*see NAIC Proceedings – Summer 2023, Innovation, Cybersecurity, and Technology (H) Committee, Attachment One*). The motion passed unanimously.

2. Received a Report on the Life AI/ ML Survey

Commissioner Gaffney said the life artificial intelligence (AI)/machine learning (ML) survey was conducted to accomplish three goals: 1) gain a better understanding of the insurance industry's use and governance of AI; 2) seek information that could aid in the development of guidance or potential regulatory framework to support the insurance industry's use of AI; and 3) inform state insurance regulators of companies' current and planned business practices.

Commissioner Gaffney said the survey was conducted under the market examination authorities of 14 requesting states: Colorado, Connecticut, Illinois, Iowa, Louisiana, Minnesota, Nebraska, North Dakota, Oregon, Pennsylvania, Rhode Island, Vermont, Virginia, and Wisconsin. He said it was completed by active insurers either having at least $250 million in national life insurance premium for 2021 and having covered at least 10,000 lives by issuing term insurance in 2021 or they are an identified InsurTech company.

Out of 161 companies completing the survey, Commissioner Gaffney said 94 companies currently use, plan to use, or plan to explore using AI/ML as defined for this survey. This equates to approximately 58% of reporting companies. For comparison, Commissioner Gaffney said approximately 88% of the companies responding to the private passenger auto (PPA) survey and approximately 70% of the companies responding to the home survey reported they currently use, plan to use, or plan to explore using AI/ML.

By life insurer operation, Commissioner Gaffney said companies reported implementing 36% of the total AI/ML models for marketing, 34% for underwriting, 18% for pricing, and 11% for risk management. The most common reason reported for not using, not planning to use, and not exploring the use of AI/ML was "no compelling business reason." The second and third most common reasons were "lack of resources and expertise," and "reliance on legacy systems requiring IT, data, and technology upgrades."

For marketing life insurance products, companies reported using AI/ML models mostly for target online advertising, followed by provisions of offers to existing customers, identification of recipients of mail or phone advertising, and identification of potential customer groups, among other uses. In pricing and underwriting, companies reported using AI/ML models mostly to reduce the time needed to issue policies but also reported that models were also used for automated and non-automated approval/denial decisions and assigning a risk class through underwriting. As far as the level of decision-making, in marketing, more than half of the total AI/ML models augmented human decision-making for marketing, while nearly half of the AI/ML models are used to automate decision-making for pricing and underwriting.

Regarding the sources of AI/ML models used by life insurers, Commissioner Gaffney said roughly half were developed in-house, and roughly half were developed by third parties. He said this was the case for the surveyed auto and home insurers in marketing as well, but that most auto and home insurers developed their pricing and underwriting models in-house. Commissioner Gaffney said life insurers reported demographic data as the most used data for marketing, and medical data is the most commonly used for pricing and underwriting. Demographics, driving behavior, and credit-based insurance scores are also used for pricing and underwriting.

Regarding whether information was provided to policyholders about how their data is being used other than what is required under the federal Fair Credit Reporting Act (FCRA), Commissioner Gaffney said 37% of companies reported "yes" for the data used for marketing, 41% reported "yes" for pricing and underwriting, and 23% reported "yes" for risk management. As far as providing opportunities to customers to correct their data, above what is required under the FCRA, 34% reported "yes" for the data used for marketing, 46% of companies reported "yes" for pricing and underwriting, and 26% reported "yes" for risk management.

Regarding governance programs and documented components, Commissioner Gaffney said approximately 60% of the life insurers responded to the survey section addressing governance. The responses from these insurers indicated the following: 53% reported their governance program includes documented compliance with laws and regulations; 53% have accountability for intended or unintended impacts; 60% documented the resources needed to ensure compliance; 62% provide transparency and notices to consumers about their data and methods for correction; and 57% reported they document assurance of safe, secure, and robust systems including decision traceability. Commissioner Gaffney said 47% of the Actuarial Standards Board companies responded they follow guidance from other established standards, such as the (ASB), American Academy of Actuaries (Academy), Society of Actuaries (SOA), or the National Institute of Standards and Technology (NIST).

Commissioner Gaffney said the potential next steps include exploring insurer AI/ML model usage and the level of decision-making, evaluating the regulatory framework about the use of third-party models, determining whether additional white papers on best practices would be useful on subjects in the AI/ML space, and exploring the use of AI/ML at the life insurance product level.

Superintendent Dwyer said she helped lead the development of the auto survey with Wisconsin and recognized the amount of work involved in drafting the survey questions and the ongoing refinement of questions as the AI/ML surveys have been issued. Commissioner Gaffney agreed and said the states working on the life AI/ML survey were careful in phrasing questions so that they were not too narrow or too broad in order to obtain accurate responses.

Commissioner Ommen said insurers' use of third parties reflects the significance of technology and data being supplied from third parties to insurance companies. Because of this, Commissioner Ommen said the use of third parties is an area that warrants further review.

Superintendent Dwyer asked if there were any interested parties who would like to provide any comments or ask any questions. Hearing none, Superintendent Dwyer concluded the discussion on the report of the life AI/ML survey.

3. Received Updates on Federal and International Insurance Regulation of AI

Shana Oppenheim (NAIC) said NIST released its AI Risk Management Framework in January. This framework is intended for voluntary use and to improve the ability to incorporate trustworthiness considerations into the design, development, use, and evaluation of AI products, services, and systems. In March, NIST launched the Trustworthy and Responsible AI Resource Center to facilitate implementation of the AI Risk Management Framework.

Oppenheim said the U.S. House of Representatives and Senate have conducted a variety of hearings on AI, including: a Senate Banking Committee hearing on AI in financial services; a Senate Homeland Security and Governmental Affairs Committee hearing on the philosophy of AI; a Senate Health Education Labor and Pensions Committee hearing on the use of AI in health care; and a Senate Agriculture Committee hearing on innovation in American agriculture.

Oppenheim said Rep. Greg Murphy (R-NC), co-chair of the GOP Doctors Caucus, called for AI in health care to be regulated at the state level first. Rep. Brittany Pettersen (D-CO) and Rep. Mike Flood (R-NE) introduced the Preventing Deep Fake Scams Act (H.R. 5808), which would establish a task force to examine AI in the financial services sector. A bipartisan federal AI bill from Sen. Mark R. Warner, chairman of the Senate Select Committee on Intelligence, and Sen. Jerry Moran (R-KS) would require federal agencies to follow the safety standards for AI that NIST developed earlier this year.

Oppenheim said that on Oct. 31, President Joe Biden issued an executive order on the safe, secure, and trustworthy development and use of AI. This executive order is a comprehensive plan to ensure the responsible innovation, development, and use of AI across the federal government and the broader economy. The order aims to set new standards for AI, emphasizing safety, security, privacy protection, equity, consumer protection, and workforce support. The order outlines eight key principles for responsible AI development and use, and it directs federal agencies to take several steps to implement these principles. The eight principles of responsible AI development and use are: 1) prioritizing safety, security, and transparency in AI systems, including measures to understand and mitigate risks; 2) promoting responsible innovation, competition, and collaboration through investments in AI education, training, and research; 3) committing to supporting American workers by adapting job training and education to AI, while ensuring fair and open marketplaces; 4) ensuring AI policies are consistent with advancing equity and civil rights, protecting against discrimination and bias in AI systems; 5) protecting consumer interests by enforcing existing consumer protection laws and principles in critical fields where AI may pose risks; 6) safeguarding privacy and civil liberties by implementing measures to secure data collection and use, including the use of privacy-enhancing technologies; 7) managing risks from the federal government's own use of AI and increasing internal capacity to regulate and govern AI responsibly; and () leading international efforts to develop a global framework for responsible AI use and engaging with allies and partners to promote common approaches to AI-related challenges.

Ryan Workman (NAIC) said the International Association of Insurance Supervisors (IAIS) has a FinTech Forum, which is a forum for insurance supervisors from around the world to exchange insights and practices relative to new and emerging fintech developments and digital innovations. The Forum met in September and received an update from its various subcommittees, which include the decentralized finance/distributed ledger technology subgroup, the application programming interface/open data subgroup, and the AI/ML subgroup. The Forum also discussed jurisdictional updates on recent FinTech developments affecting the insurance sector and insurance supervisors, including supervisory responses to the use of ChatGPT.

Workman said that in October, the IAIS, the European Insurance and Occupational Pensions Authority (EIOPA), and the Bank for International Settlement's (BIS') Financial Stability Institute (FSI) jointly organized a member-only webinar on harnessing AI's potential in insurance. The first session of the webinar focused on real-life examples of AI applications in the insurance industry, highlighting their impact on the insurance value chain and analyzing the challenges of its adoption. The second session focused on the unique risks associated with AI adoption in the insurance sector and the regulatory considerations that supervisors need to be aware of.

Workman said there is a EU/U.S. Insurance Dialogue Project, which included a public forum in June 2023 on the work of its three workstreams, which includes one on technology and innovation. In 2024, this project will focus on the following: 1) ongoing regulatory developments affecting insurers' use of big data AI/ML and the importance of developing adequate governance, risk management, and controls by insurers; 2) regulatory and supervisory initiatives to enhance the digital operational and cyber resilience of insurers; and 3) developments in open insurance.

Having no further business, the Big Data and Artificial Intelligence (H) Working Group adjourned.

SharePoint/NAIC Support Staff Hub/Committees/H CMTE/2023 Fall/WG-BDAI/Minutes-BDAIWWG120123.docx

Draft Work Plan

1. **The Big Data and Artificial Intelligence (H) Working Group will:**

   A. **Research the use of big data, artificial intelligence (AI) and machine learning (ML) in the business of insurance. Proactively communicate findings and present recommendations to the Innovation, Cybersecurity, and Technology (H) Committee.**

Projects could include:

- Collaborating with the Center for Insurance Policy and Research (CIPR) on additional analysis of survey results contrasting responses to already filed data for each company.
  o Timeline is pending discussions with CIPR staff to scope the project.

- Collaborating with NAIC staff to compare survey results to the Model Bulletin to understand if there are particular areas of the survey that should be redone to better align with the Model Bulletin's content or highlight certain risk management practices that require further discussion and/or training.
  o Timeline: Complete by the Summer National Meeting, if not earlier.

- Supporting the development and analysis of the Health AI/ML Survey
  o Timeline is pending discussions with Health AI Survey leads but would likely target completion by the Fall National Meeting.

- Considering the development of a rotational plan for Survey work to continue the initiative on an ongoing basis.
  o Timeline: Initial discussion will take place at the Spring National Meeting, with the plan finalized by the Fall National Meeting.

   B. **Monitor state, federal, and international activities on AI, including working with the Innovation, Cybersecurity, and Technology (H) Committee, to (i) respond to such activities, where appropriate; and (ii) address potential impacts on existing state insurance laws or regulations.**

Projects could include:

- Receiving a report from the volunteer group comparing the Model Bulletin to the White House Executive Order.
    - This could be a regulator-only project.
    - The summary report is to be available by the Summer National Meeting.

- Continuing to receive reports or presentations related to federal and international updates on AI.
    - This task is ongoing.

      C. Oversee the completion of the work of the Collaboration Forum on Algorithmic Bias, including:
          a. Monitor and support adoption of the *Model Bulletin on the Use of Artificial Intelligence Systems by Insurers*.
          b. Explore the creation of an independent synthetic data set to support testing of predictive models for unfair discrimination, in collaboration with the CIPR, as appropriate.
          c. Finalize and maintain a glossary/lexicon to guide state insurance regulators as they engage in AI and technology-related discussions.

Projects could include:

- Bulletin Adoption—Work with NAIC legal staff to track adoption of the Bulletin.
    - Timeline: This task will be ongoing through 2024 and beyond.

- Independent Synthetic Data Set
    - Timeline is further discussion and planning.

- Glossary/Lexicon—Develop and maintain a reference document of relevant AI/ML terms to aid state insurance regulators' understanding of technical concepts.
    - Timeline is pending discussion with NAIC staff.

      D. Facilitate and coordinate foundational and contextual educational content for state insurance regulators on topics related to the use of Big Data and AI techniques, tools, and systems in the insurance industry.

- Projects for this charge are pending the advancement of Innovation, Cybersecurity, and Technology (H) Committee-related initiatives to avoid duplication of effort.

Hot Research Topics in Data Science

March 16, 2024

Dorothy L. Andrews, PhD, MAAA, ASA, CSPA
Senior Behavioral Data Scientist and Actuary, NAIC

Purpose of Today's Presentation

A survey of research activities related to Big Data, Artificial Intelligence, Fairness, Bias and Bias Detection, and AI Governance of regulatory importance. This presentation will cover research activities conducted by the American Academy of Actuaries, the Society of Actuaries, the International Association of Actuaries, the United Nations, the National Institute for Standards and Technology, and recent academic research.

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DSAC Charge

"To further the actuarial profession's involvement in the use of artificial intelligence, data science, big data, machine learning, and other advanced analytics and modeling capabilities as it relates to actuarial practice. To monitor federal and state legislation and regulatory activities, and develop comments and papers intended to **educate** the public and other stakeholders and provide guidance to actuaries."

Chairperson: Dorothy L. Andrews, Ph.D.

Data Science and Analytics Committee

Data Science and Analytics Committee

Technical Paper Series

Discrimination: Considerations for Machine Learning, AI Models, and Underlying Data, August 2023

An Actuarial View of Data Bias: Definitions, Impacts, and Considerations, July 2023

Big Data and Algorithms in Actuarial Modeling and Consumer Impacts, October 2022

An Actuarial View of Correlation and Causation - From Interpretation to Practice to Implications, July 2022

Big Data and Algorithms in Actuarial Modeling and Consumer Impacts, November 2021

Big Data And The Role Of The Actuary, October 2019

Auditing Algorithms for Bias, [In Press]

Defining Big Data [In Press]

Natural Experiments – An Alternative to Randomized Control Trials. [In Press]

Roadmap for Valuing Data and Algorithms [In Press]

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P&C Committee on Equity & Fairness

Recent Webinar on P&C Bias Issues – Q&A

- Given human-cognitive bias is inherently due to human subjectivity, is there any way to incorporate consideration of this kind of bias into regulation in an objective fashion? Would we be opening the door to a different kind of bias in making regulatory standards more unclear and treatment more subjective?

- I think we have cases of companies unilaterally eliminating rating variables due to bias concerns, regulators banning variables, and industry getting together to work on standards. Do we have examples of industry getting together to ban a variable due to otherwise unresolved bias concerns?

- Is there a clear definition that contrasts bias versus fair discrimination?

- Are there states trying to be active in regulating bias? What have those states been doing?

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P&C Committee on Equity & Fairness

Recent Webinar on P&C Bias Issues – Q&A

- Most bias analyses assume you have protected class information about your insureds. How are insurers expected to get this source of truth information? Are we supposed to collect it from insureds? What about for commercial carriers? How would we determine bias by protected class?

- Isn't asking policyholders to self-report protected class status also problematic? Many would refuse for a variety of reasons.

- Is there any research into how to protect people who are disabled from unfair discrimination through models to identify if marketing/underwriting/rating methodologies are unintentionally biased against them?

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Dennis Kapylou, MAAA, FSA, CERA

An Actuarial View of Data Bias

Definitions, Impacts and Considerations

Academy **Webinar**

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# General Problems Associated with Data Biases

Incorrect conclusions

I may end up with wrong predictions

My data may not reflect reality

I may perpetuate existing biases without knowing

Unwanted consequences

I may be surprised by the spurious correlations in the outcome

My results "did not make sense" or "missed the point"

General Problems Associated with Data Biases
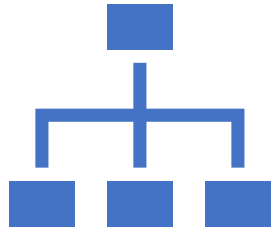
Inadequate system performance

My system exhibits uneven performance among subgroups
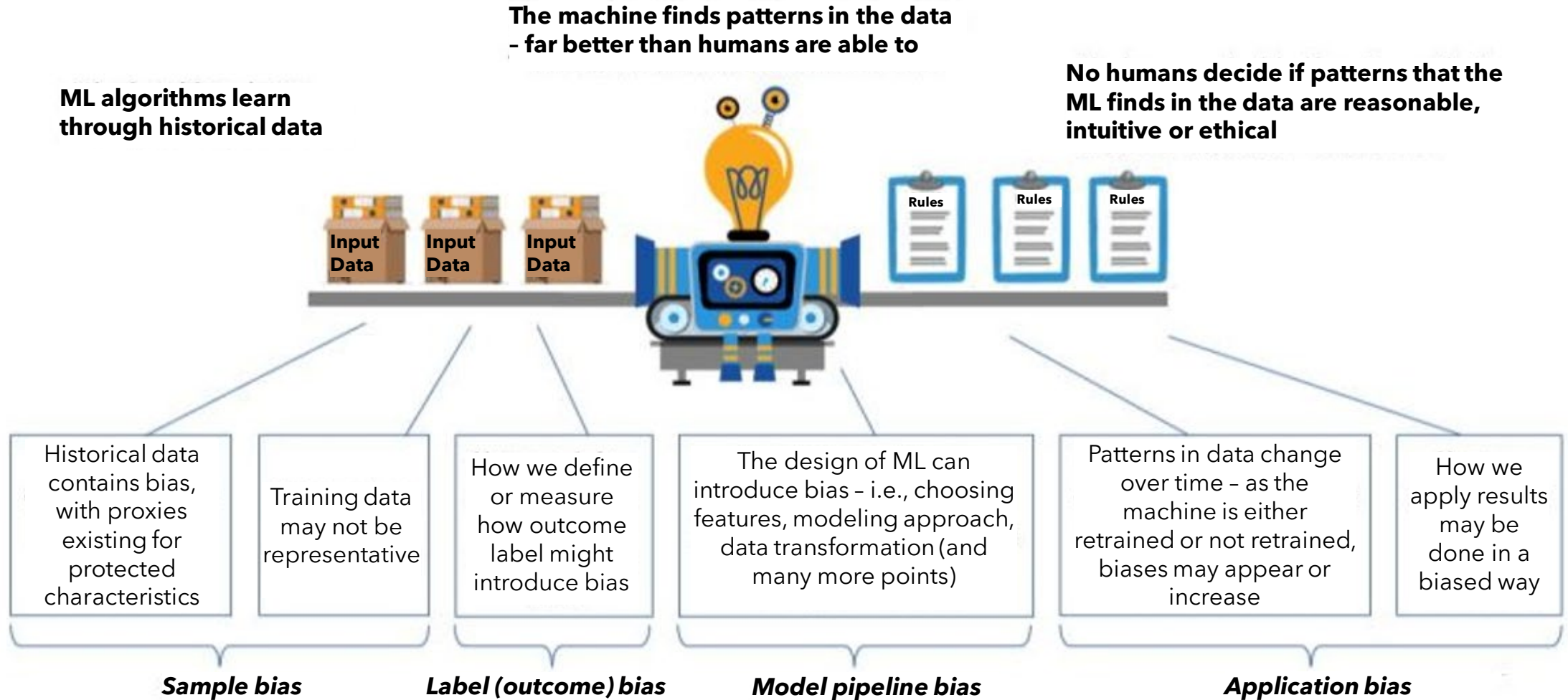
I cannot trust the system in all situations

Misinformed policy decisions

I need to be reminded that other people may be impacted by the decisions made by the system

I may under-correct or over-correct mistakes, or overlook signals that indicate serious problems

HOW DOES AI UNFAIRNESS HAPPEN?

The machine finds patterns in the data – far better than humans are able to

ML algorithms learn through historical data

No humans decide if patterns that the ML finds in the data are reasonable, intuitive or ethical

Input Data · Input Data · Input Data

Rules · Rules · Rules

| Historical data contains bias, with proxies existing for protected characteristics | Training data may not be representative | How we define or measure how outcome label might introduce bias | The design of ML can introduce bias – i.e., choosing features, modeling approach, data transformation (and many more points) | Patterns in data change over time – as the machine is either retrained or not retrained, biases may appear or increase | How we apply results may be done in a biased way |

Sample bias   ***Label (outcome) bias***   ***Model pipeline bias***   ***Application bias***

Graphic source: Luke Vilian, Data Ethics and Generative AI at UBS

Three Tests of Bias

\# 1: Class Imbalance (CI) Test
\# 2: Difference in Proportions of Labels (DPL)
\# 3: Conditional Demographic Disparity (CDD)

There are other pretraining bias tests:
- Kullback-Leibler Divergence (KL)
- Jensen-Shannon Divergence (JS)
- Lp-norm (LP)
- Total Variation Distance (TVD)
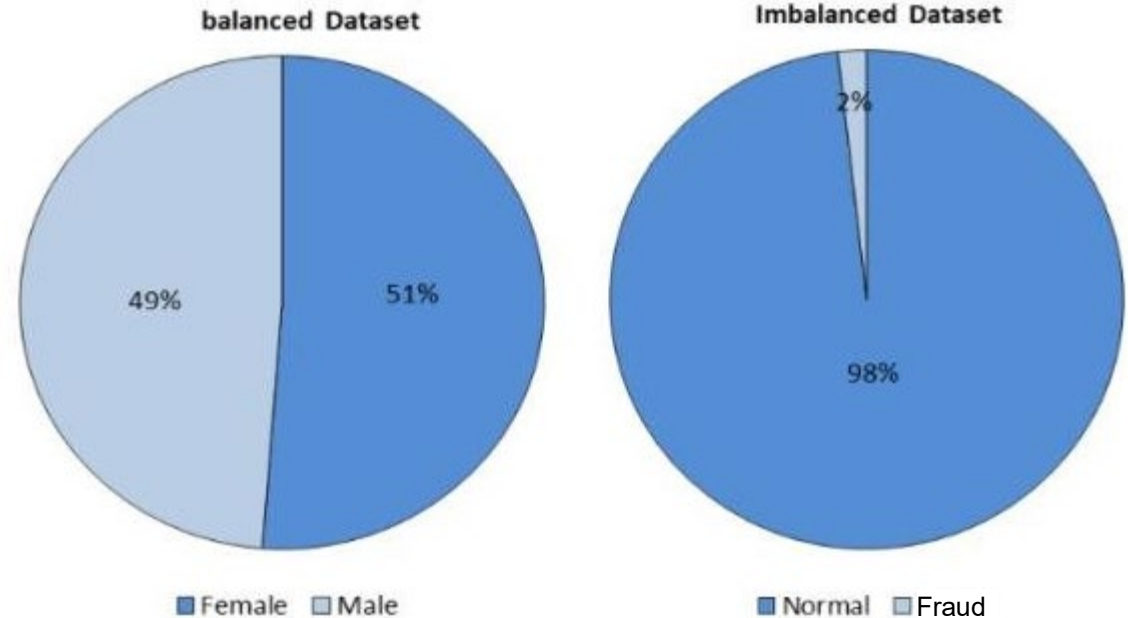- Kolmogorov-Smirnov (KS)

Pretraining Bias
Key question: Equal representation from
different Facet Values?

Three Tests of Bias

1: Class Imbalance (CI) Test

Tests whether you have enough data for the disadvantaged group to make balanced predictions. Bias is often generated from an underrepresentation of the disadvantaged group in the dataset.

A common rule of thumb is that if the minority class in your dataset constitutes less than 10-20% of your total data, it can be considered imbalanced.

balanced Dataset

49% 51%

■ Female □ Male

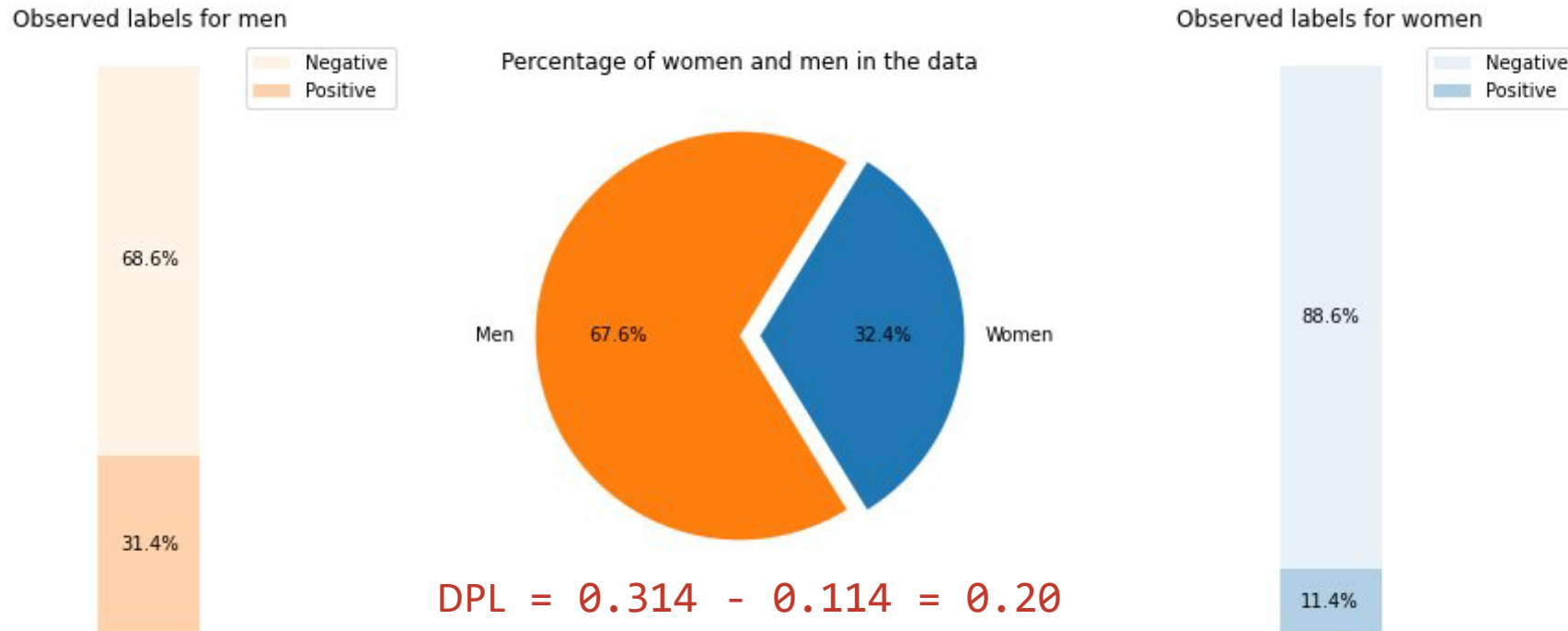CI = 0.51 - 0.49 = 0.02

Imbalanced Dataset

2%

98%

■ Normal □ Fraud

CI = 0.98 - 0.02 = 0.96

Source: Sharafaldin, I., Habibi Lashkari, A., & Ghorbani, A.A. (2018). Toward Generating a New Intrusion Detection Dataset and Intrusion Traffic Characterization. *International Conference on Information Systems Security and Privacy.*

Three Tests of Bias

2: Difference in Proportions of Labels (DPL)

Tests whether "positive" labels for both groups are relatively equally distributed.

Observed labels for men

Negative / Positive

68.6%

31.4%

Percentage of women and men in the data

Men 67.6%　Women 32.4%

Observed labels for women

Negative / Positive

88.6%

11.4%

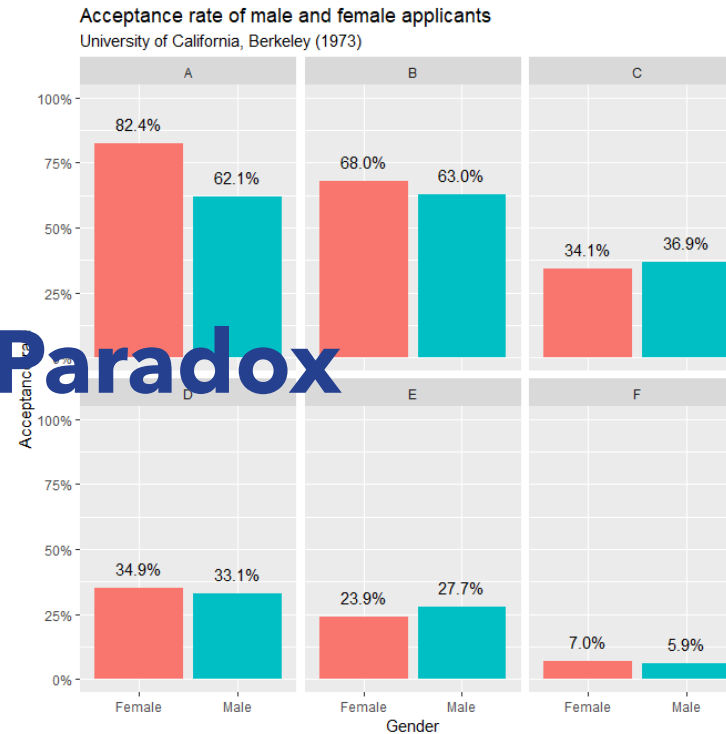$$DPL = 0.314 - 0.114 = 0.20$$

Three Tests of Bias

3: Conditional Demographic Disparity (CDD)
Measures the disparity of outcomes between different groups and by subgroups.

Simpson's Paradox

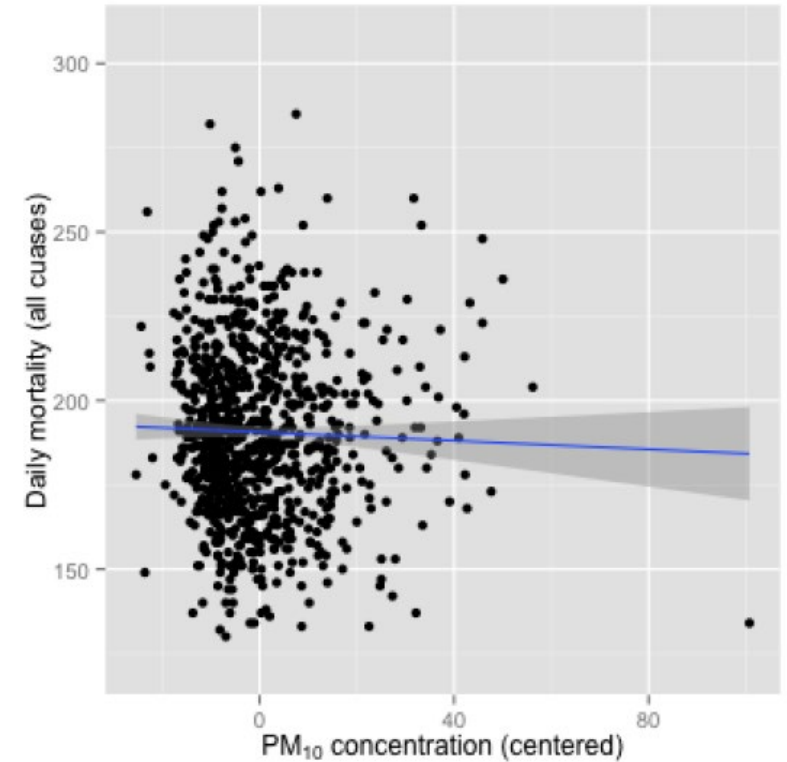Source: https://rpubs.com/barajap1/gbias
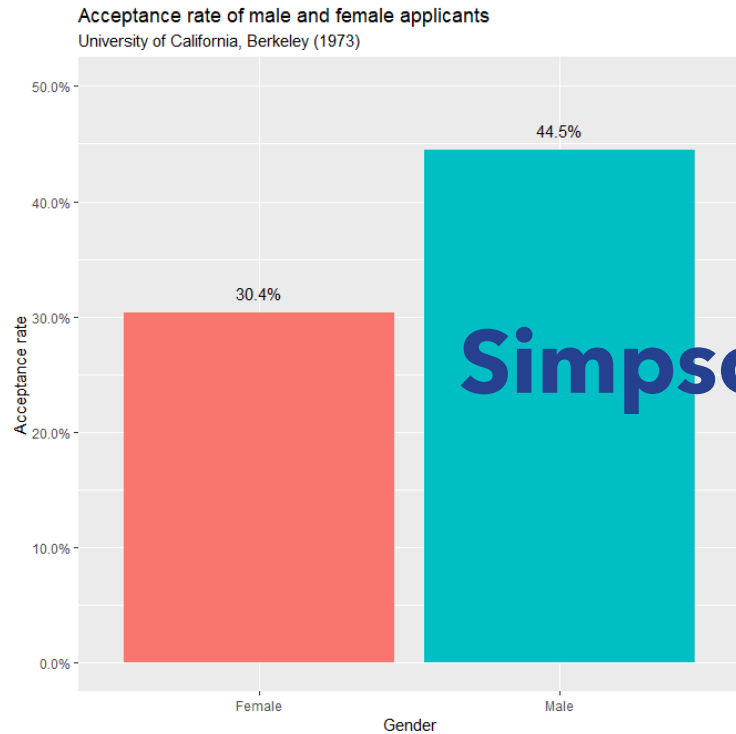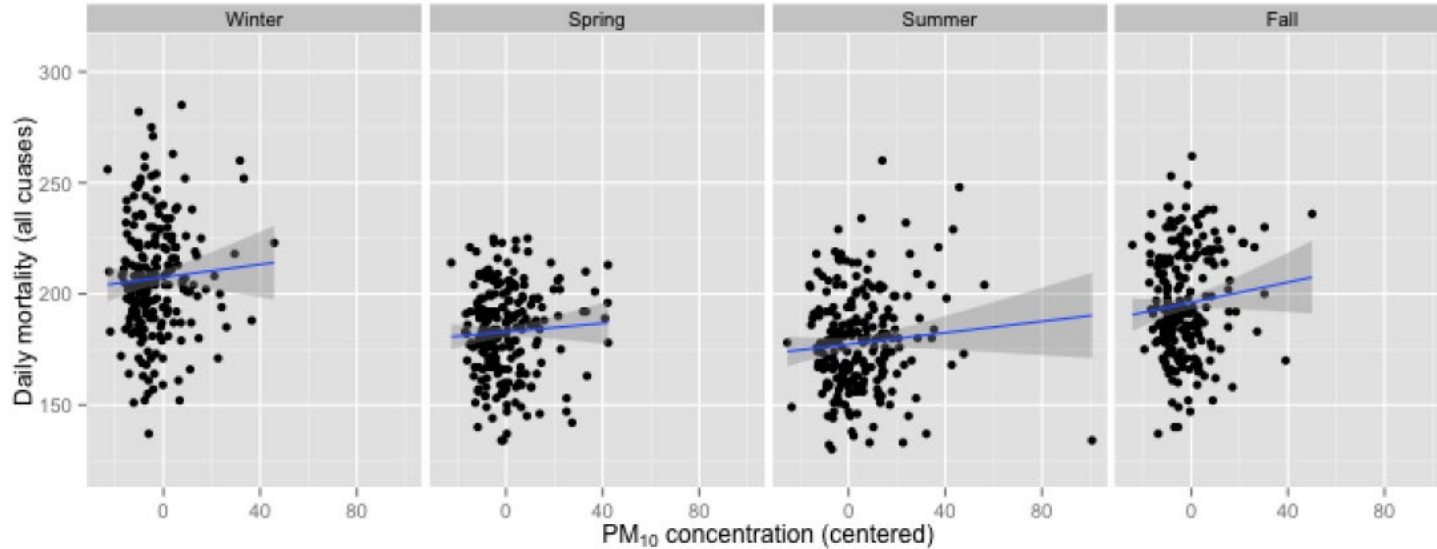
Simpson's Paradox
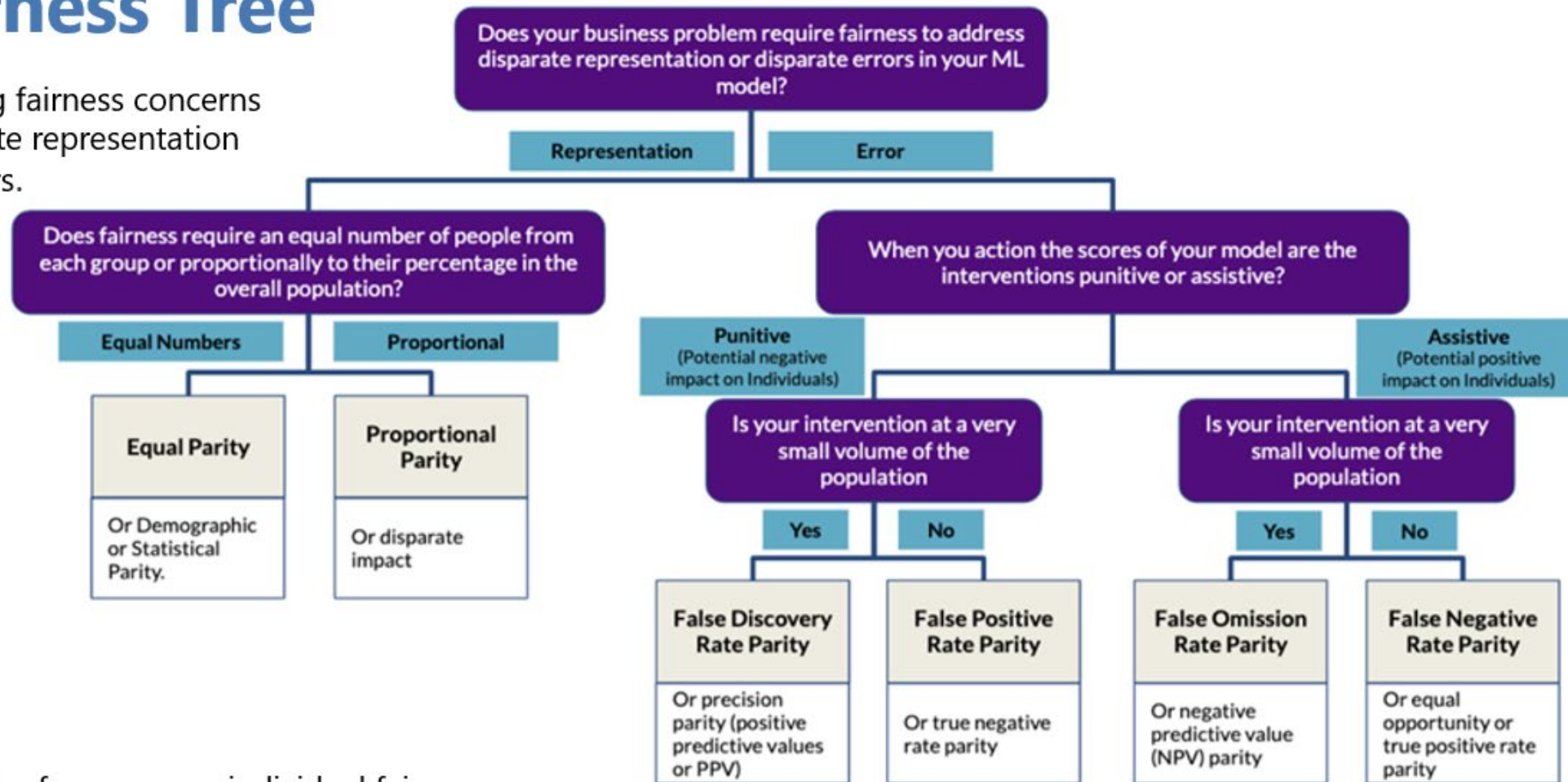

PM10 and mortality in New York City by season

Simpson's Paradox: A phenomenon in probability and statistics, in which a trend appears in several different groups of data but disappears or reverses when these groups are combined.

PM10 and mortality in New York City

The Fairness Tree

Aids in navigating fairness concerns based on disparate representation or disparate errors.

Does your business problem require fairness to address disparate representation or disparate errors in your ML model?

Representation   **Error**

Does fairness require an equal number of people from each group or proportionally to their percentage in the overall population?

When you action the scores of your model are the interventions punitive or assistive?

Equal Numbers   **Proportional**

Punitive (Potential negative impact on Individuals)

Assistive (Potential positive impact on Individuals)

Equal Parity

Or Demographic or Statistical Parity.

Proportional Parity

Or disparate impact

Is your intervention at a very small volume of the population

Is your intervention at a very small volume of the population

Yes   **No**

Yes   **No**

False Discovery Rate Parity

Or precision parity (positive predictive values or PPV)

False Positive Rate Parity

Or true negative rate parity

False Omission Rate Parity

Or negative predictive value (NPV) parity

False Negative Rate Parity

Or equal opportunity or true positive rate parity

Some methods aim for group vs. individual fairness.

Source: Bias and Algorithmic Fairness. The modern business leader's new... | by Jan Teichmann | Towards Data Science

Evaluating A Bias Analysis

General	Data	Model	Social Systemic
Purpose of Algorithm	Data Biases Tested	Parameter Assignment	Systemic & Social Links
Measures of Fairness	Links to Discrimination	Treatment of Offsets	Socioeconomic
Objective of Analysis	Demographic Diversity	Interrater Reliability	Behavioral
Bias Thresholds	Demographic Balance	Sensitivity Analysis	Telematics
Bias Sources Identified	Attribute Rate Analysis	Aggregation Bias Check	Crime & Census Data
Diversity of Reviewers	Historical Bias Presence	Model Success Definition	Consumer Data
Reference Groups	Historical Bias Tweaks	Outcome Harm Analysis	Price Optimization
Fairness Standards	Weight Assignment	False Positives & Negatives	Social Science Links
Error Analysis	Age of Data	Human Oversight Needs	Insurer Action Deltas

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Project Oversight Groups (POGs)

Statistical Methods for Imputing Race & Ethnicity

Quantitative Fairness Metrics

Violent Manner of Death Mortality by Race and Ethnicity Mortality Study

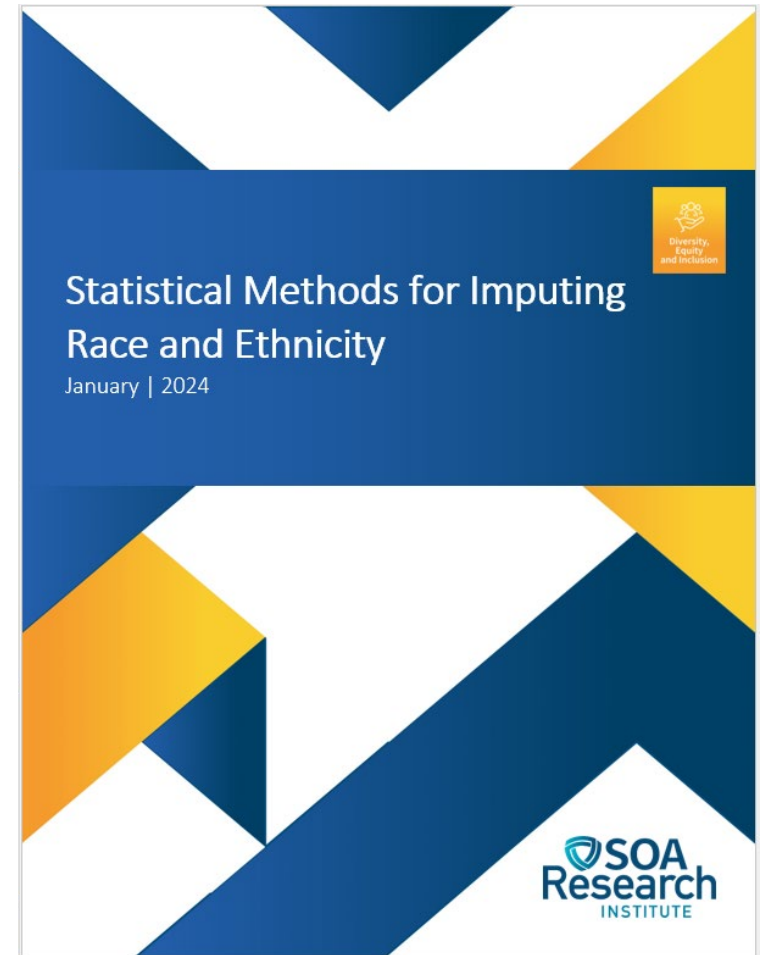Challenges and Opportunities with Rethinking Fairness Metrics for Life
   Insurance Processes

Quantitative Fairness Metrics

Artificial Intelligence & Unfair Bias

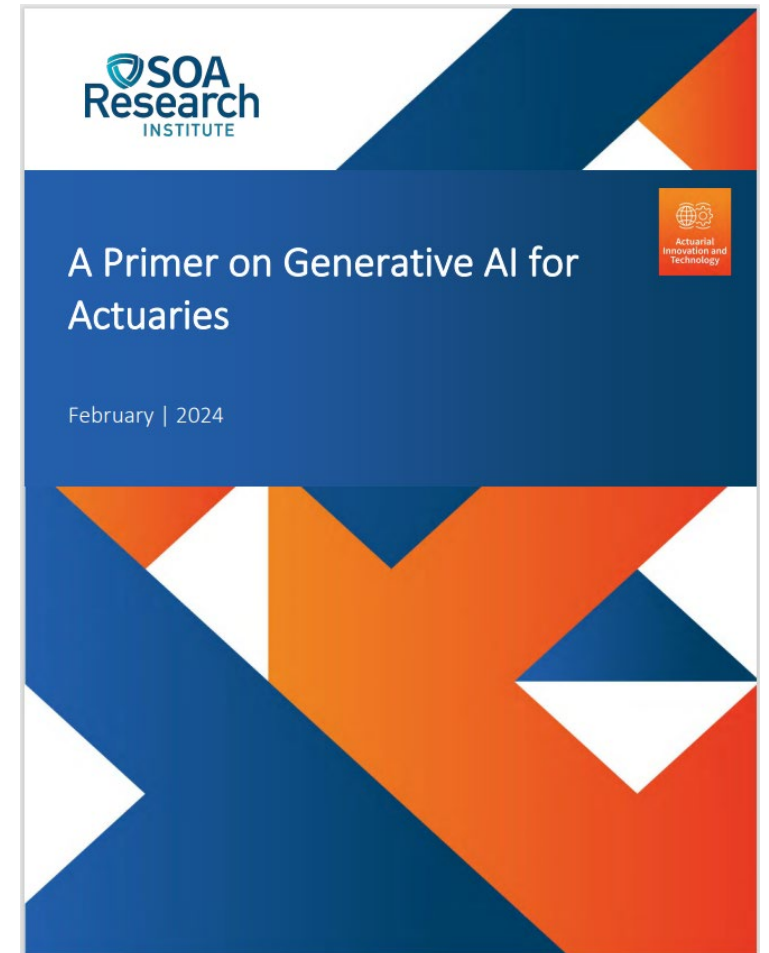Artificial Intelligence and Disparate Impact

Facial Recognition Bias

Statistical Methods for Imputing
Race and Ethnicity
January | 2024

SOA Research INSTITUTE

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Explores future potential of Generative AI:

- General Productivity
- Coding and Software Development
- Model Documentation and Governance
- Enriching, Manipulating, and Analyzing Data
- Scenario Analysis – "What if" Analysis
- Automation and Efficiency
- Claims Processing and Assessment
- Risk Classification - Underwriting

SOA Research INSTITUTE

A Primer on Generative AI for Actuaries

Actuarial Innovation and Technology

February | 2024

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Publications

Insurance Psychology 101, The Actuary, December/January 2019

Big Data—You've Rocked My World!, Predictive Analytics & Futurism Newsletter, SOA, 12/2019

Welcome to Media Psychology, The Actuary, April/May 2019

The Psychology of Visual Data, Predictive Analytics & Futurism Newsletter, SOA, 12/2018

Model Governance in an Open-Source World, The Actuary, June/July 2018

InsurTech: The Next Disruptor to the Insurance Industry, Predictive Analytics & Futurism Newsletter, SOA, 8/2018

Predictive Model Building 101, Predictive Analytics & Futurism Newsletter, SOA, 6/2017

Let's Chill Out, The Actuary, April/May 2018

Internal Controls – The COSO Way, Risk Management Newsletter, March 2006

Operational Risk Management, Risk Management Newsletter, July 2005

Chief Risk Officer: The New Frontier for Actuaries, Risk Management Newsletter, July 2005

International Actuarial Association
Association Actuarielle Internationale

AI Task Force (AITF)

- Engage with Full Member Associations (FMAs) and their regional bodies on this topic.
- Scan the AI environment relevant to actuaries, create awareness, and support the education of actuaries in this field.
- Address professionalism aspects of AI as it impacts actuaries.
- Identify threats and opportunities for the profession.

International Actuarial Association
Association Actuarielle Internationale

Governance Workstream

- Monitor and evaluate governance frameworks, policies, and regulations
- Identify gaps and areas where actuarial expertise can contribute.
- Participate in policy discussions, consultations, and industry forums
- Emphasize the actuarial perspective, advocating for fair and transparent AI practices.
- Engage with regulators, standard-setting bodies, and policymakers
- Contribute actuarial insights to the development of AI governance frameworks.

Auto Insurance Rating and Social Justice Issues

Dorothy L. Andrews, PhD, MAAA, ASA, CSPA
Senior Behavioral Data Scientist & Actuary
National Association of Insurance Commissioners (NAIC)

THE ALGORITHMIC LINK BETWEEN AUTO INSURANCE

PRICING AND UNFAIR DISCRIMINATION

A dissertation submitted

by

DOROTHY L. ANDREWS

to

FIELDING GRADUATE UNIVERSITY

in partial fulfillment of the
requirements for the degree of

DOCTOR OF PHILOSOPHY IN PSYCHOLOGY

With an Emphasis in Media Psychology

This dissertation has been accepted for
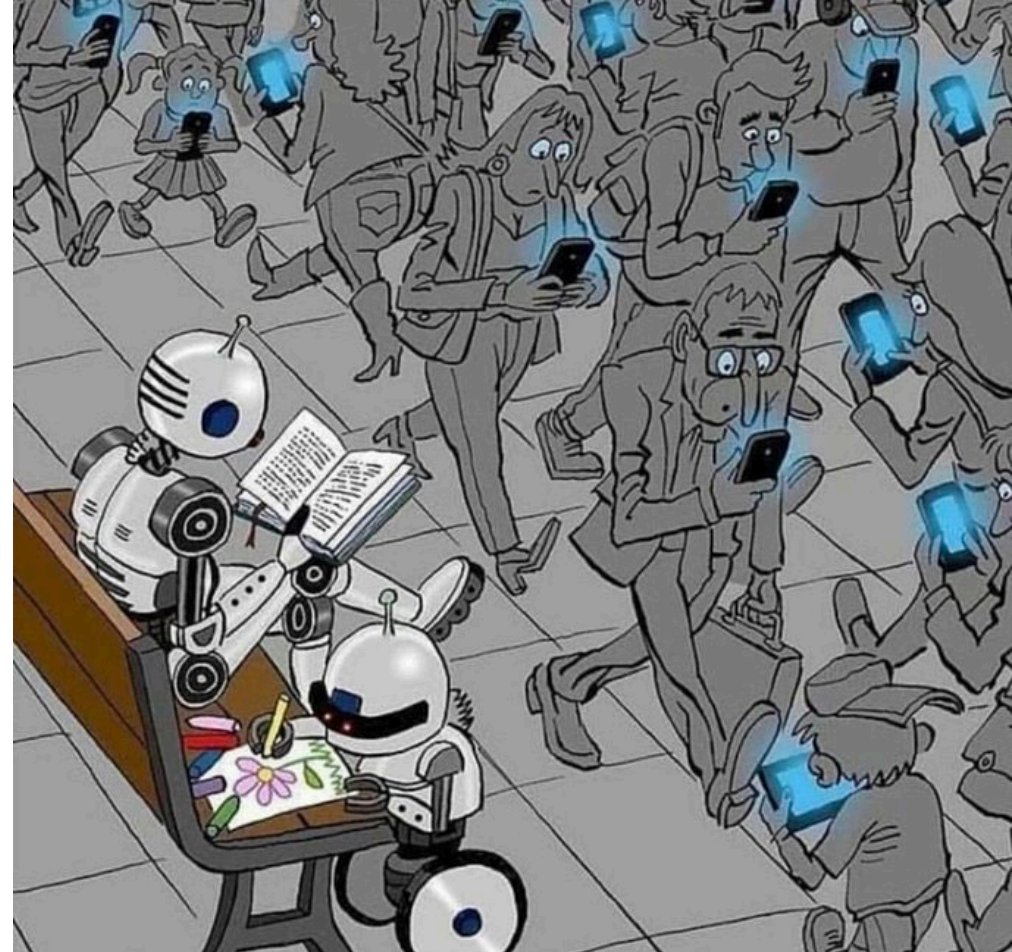the faculty of Fielding Graduate University by

Pamela Rutledge, PhD
Committee Chair

Committee:

Patrick Sweeney, PhD, Faculty Reader
Cathy O'Neil, PhD, External Examiner

Humans are hooked, machines are learning!