Trustworthy and responsible AI in health care and life sciences

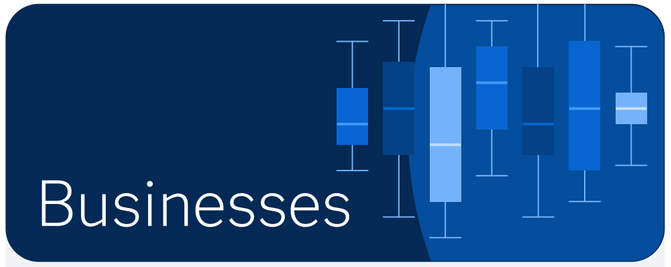
A leadership perspective

Mark Lambrecht, PhD, Global Head of Health and Life Sciences Advisory

Responsible and trustworthy AI involves the ethical, transparent, and fair application of AI technologies, ensuring they benefit all patients while minimizing risks and biases

National Academy of Medicine, USA - https://nam.edu/artificial-intelligence-in-health-health-care-and-biomedical-science-an-ai-code-of-conduct-principles-and-commitments-discussion-draft/

AI Impacts Everyone

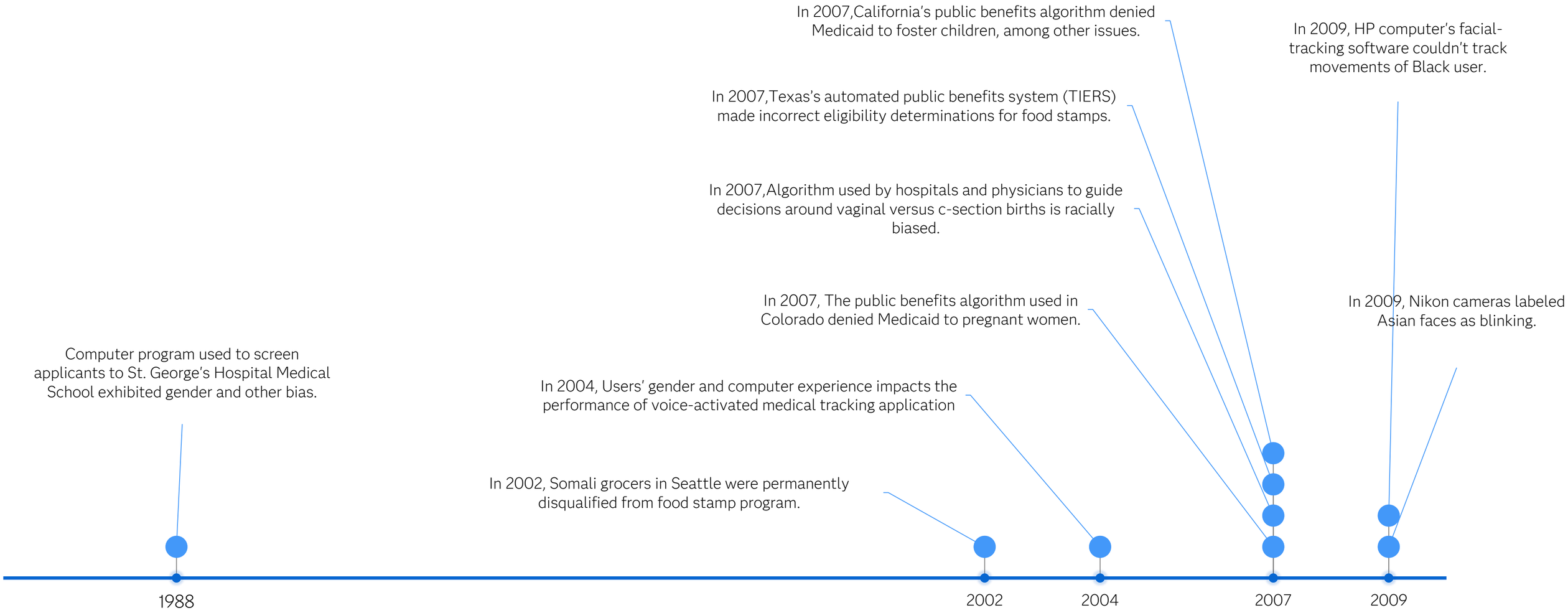


- Can we make sense of our data?
- Do customers trust us?
- Are we complying with the law?

- Does AI make fair decisions?
- Is it transparent?
- Is it safe for consumers?

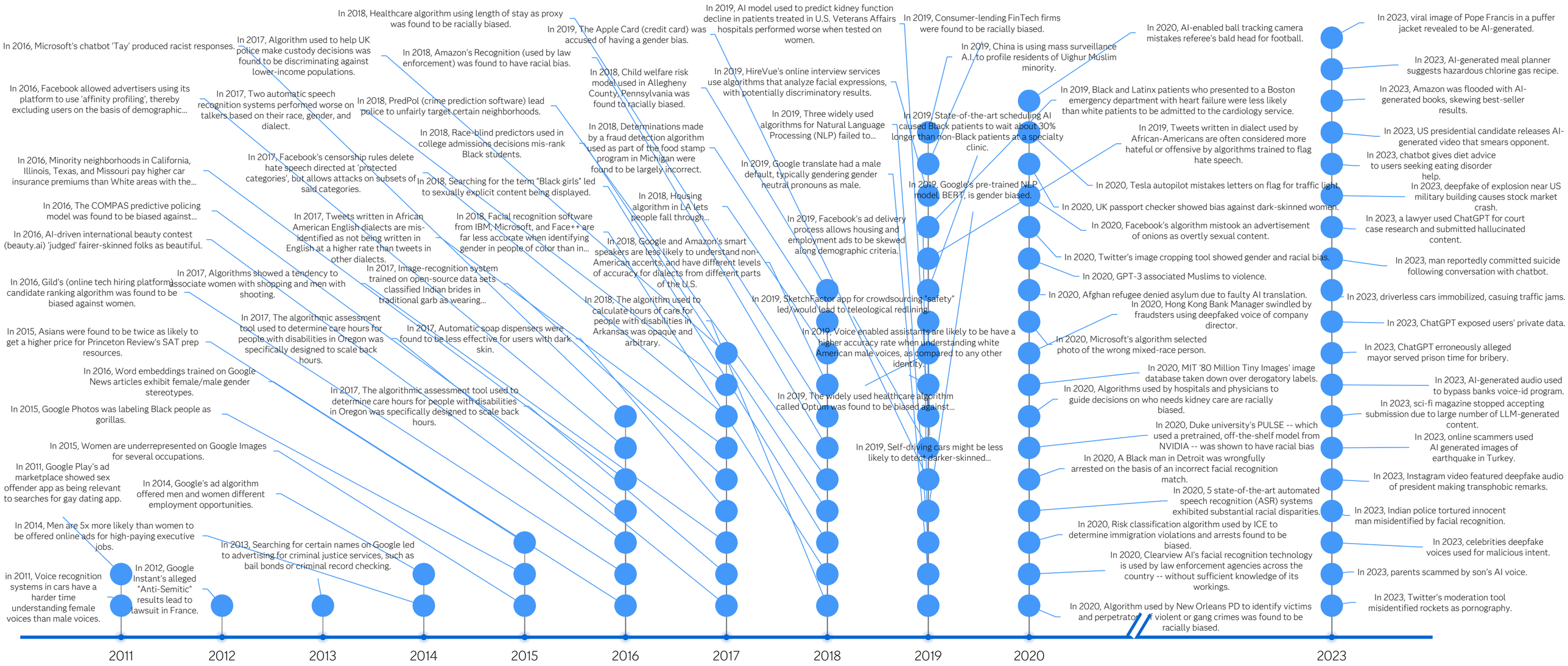
- Is my privacy protected?
- Am I being treated fairly?
- What can I change for a more positive outcome?

Unintended harms occur…



BERKELEY HAAS CENTER FOR EQUITY, GENDER & LEADERSHIP Examples of Bias in Artificial Intelligence

...now at **MASSIVE** scale



The Business Imperative

A.I. is getting more powerful, faster, and cheaper—and that's starting to freak executives out

BY JEREMY KAHN

March 9, 2021 at 11:58 AM EST

ChatGPT is biased and offensive, creators admit

OpenAI compares fine-tuning to training a dog

'There is no standard': investigation finds AI algorithms objectify women's bodies

Guardian exclusive: AI tools rate photos of women as more sexually suggestive than those of men, especially if nipples, pregnant bellies or exercise is involved

IBM Abandons Facial Recognition Products, Condemns Racially Biased Surveillance

June 9, 2020 · 8:04 PM ET

Amazon built an AI tool to hire people but had to shut it down because it was discriminating against women

Isobel Asher Hamilton Oct 10, 2018, 5:47 AM

The Verge

The Verge / Tech / Reviews / Science / Entertainment / AI / More +

HEALTH / SCIENCE / ARTIFICIAL INTELLIGENCE

Hospitals use a transcription tool powered by a hallucination-prone OpenAI model

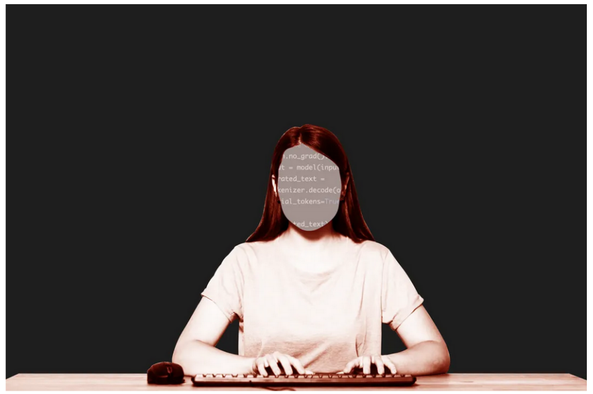


Image: The Verge

/ Researchers have found that Whisper frequently invents entire passages of text when presented with moments of silence.

By Wes Davis, a weekend editor who covers the latest in tech and entertainment. He has written news, reviews, and more as a tech journalist since 2020.

Oct 28, 2024, 12:19 AM GMT+1

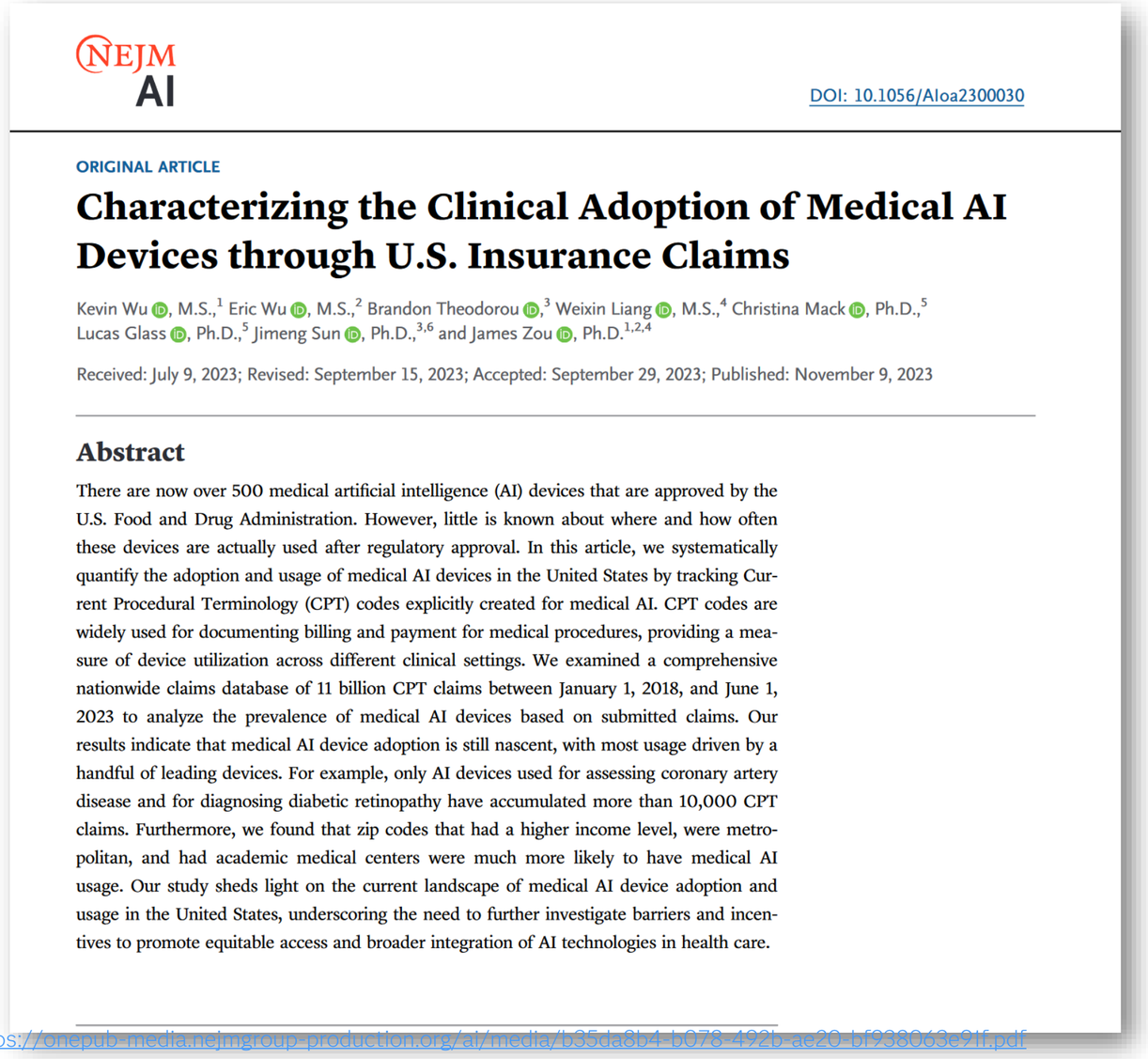
27 Comments (27 New)

A few months ago, my doctor showed off an AI transcription tool he used to record and summarize his patient meetings. In my case, the summary was fine, but researchers cited by *ABC News* have found that's not always the case with OpenAI's Whisper, which powers a tool many hospitals use — sometimes it just makes things up entirely.

Whisper is used by a company called Nabla for a medical transcription tool that it estimates has transcribed 7 million medical conversations, according to *ABC News*. More than 30,000 clinicians and 40 health

https://www.theverge.com/2024/10/27/24281170/open-ai-whisper-hospitals-transcription-hallucinations-studies

More AI devices making it through approval, but what about to the clinic?



NEJM AI

DOI: 10.1056/AIoa2300030

ORIGINAL ARTICLE

Characterizing the Clinical Adoption of Medical AI Devices through U.S. Insurance Claims

Kevin Wu, M.S.,[1] Eric Wu, M.S.,[2] Brandon Theodorou,[3] Weixin Liang, M.S.,[4] Christina Mack, Ph.D.,[5] Lucas Glass, Ph.D.,[5] Jimeng Sun, Ph.D.,[3,6] and James Zou, Ph.D.[1,2,4]

Received: July 9, 2023; Revised: September 15, 2023; Accepted: September 29, 2023; Published: November 9, 2023

Abstract

There are now over 500 medical artificial intelligence (AI) devices that are approved by the U.S. Food and Drug Administration. However, little is known about where and how often these devices are actually used after regulatory approval. In this article, we systematically quantify the adoption and usage of medical AI devices in the United States by tracking Current Procedural Terminology (CPT) codes explicitly created for medical AI. CPT codes are widely used for documenting billing and payment for medical procedures, providing a measure of device utilization across different clinical settings. We examined a comprehensive nationwide claims database of 11 billion CPT claims between January 1, 2018, and June 1, 2023 to analyze the prevalence of medical AI devices based on submitted claims. Our results indicate that medical AI device adoption is still nascent, with most usage driven by a handful of leading devices. For example, only AI devices used for assessing coronary artery disease and for diagnosing diabetic retinopathy have accumulated more than 10,000 CPT claims. Furthermore, we found that zip codes that had a higher income level, were metropolitan, and had academic medical centers were much more likely to have medical AI usage. Our study sheds light on the current landscape of medical AI device adoption and usage in the United States, underscoring the need to further investigate barriers and incentives to promote equitable access and broader integration of AI technologies in health care.

https://onepub-media.nejmgroup-production.org/ai/media/b35da8b4-b078-492b-ae20-bf938063e91f.pdf

How many AI algorithms/devices are reimbursed (in the USA) out of the 1000 devices approved by the FDA?

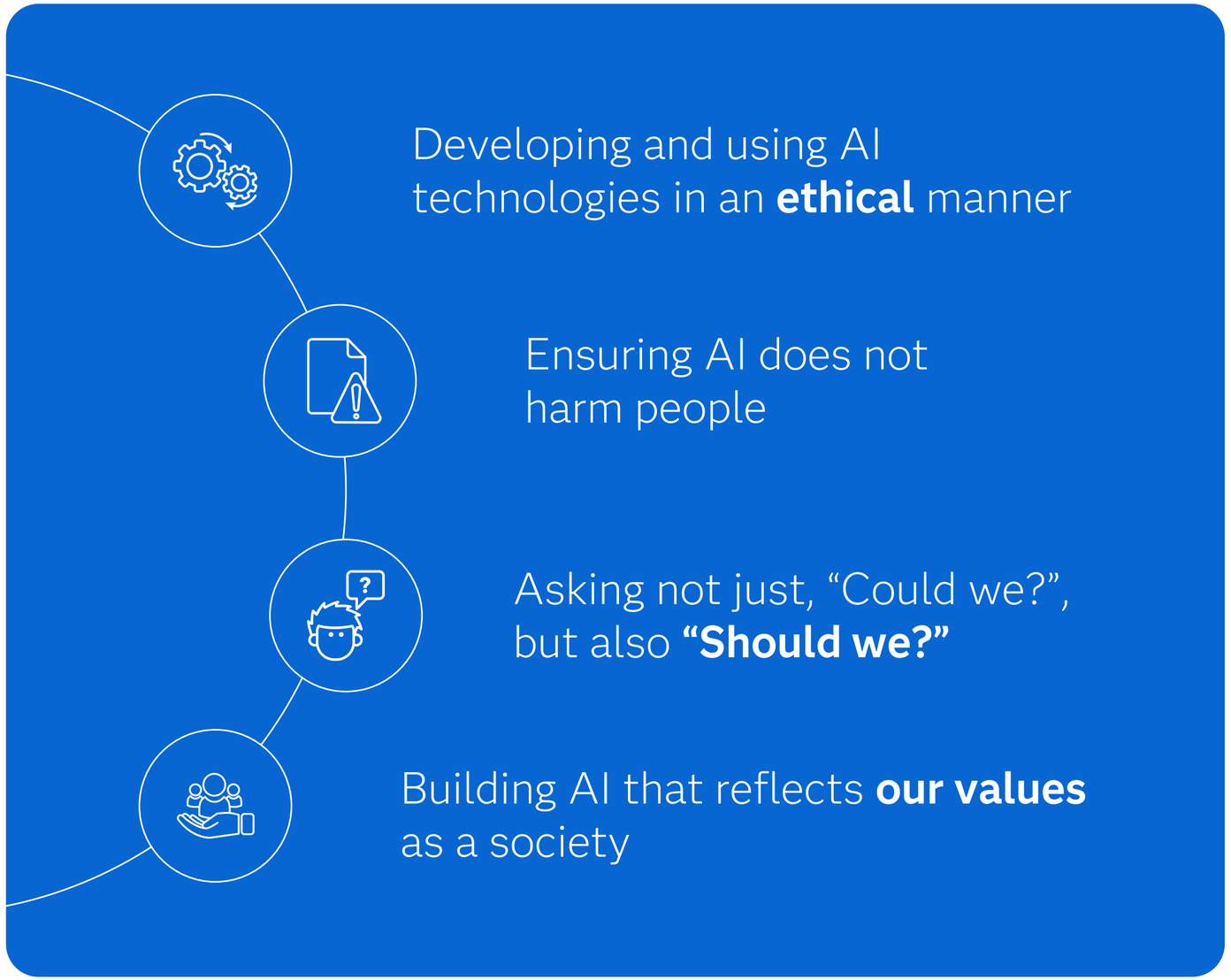
We need more randomized clinical trials for medical AI.

The Business Imperative

By 2026, organizations that operationalize AI **transparency**, **trust and security** will see their AI models achieve a **50% result improvement** in terms of adoption, business goals and user acceptance.

Source: Gartner

What is Trustworthy AI?



Principle-Driven Approach

Human-Centricity

Promote human **well-being**, human **agency** and **equity.**

Inclusivity

Ensure **accessibility** and include **diverse perspectives** and **experiences.**

Accountability

Proactively identify and mitigate adverse impacts.

Transparency

Explain and **instruct** on usage openly, including potential risks and how decisions are made.

Robustness

Operate **reliably** and **safely**, while enabling mechanisms that assess and manage potential risks throughout a system's lifecycle.

Privacy & Security

Respect the privacy of data subjects.

Oversight
AI Governance, Strategy and Enforcement

Operations
SOPs with Supporting Infrastructure

Compliance
Performance and Risk Management

Culture
Ethically Systemic Norms and Practices

Technology

Data Management
- Data Quality
- Variable Metadata
- Data Preparation
- Data Asset Catalog

Explanation
- Natural Language Explanation
- Explainable ML
- Counterfactual Explanation
- Surrogate Model Interpretation
- Causal Inference

Detection
- Bias Detection
- Fairness Assessment

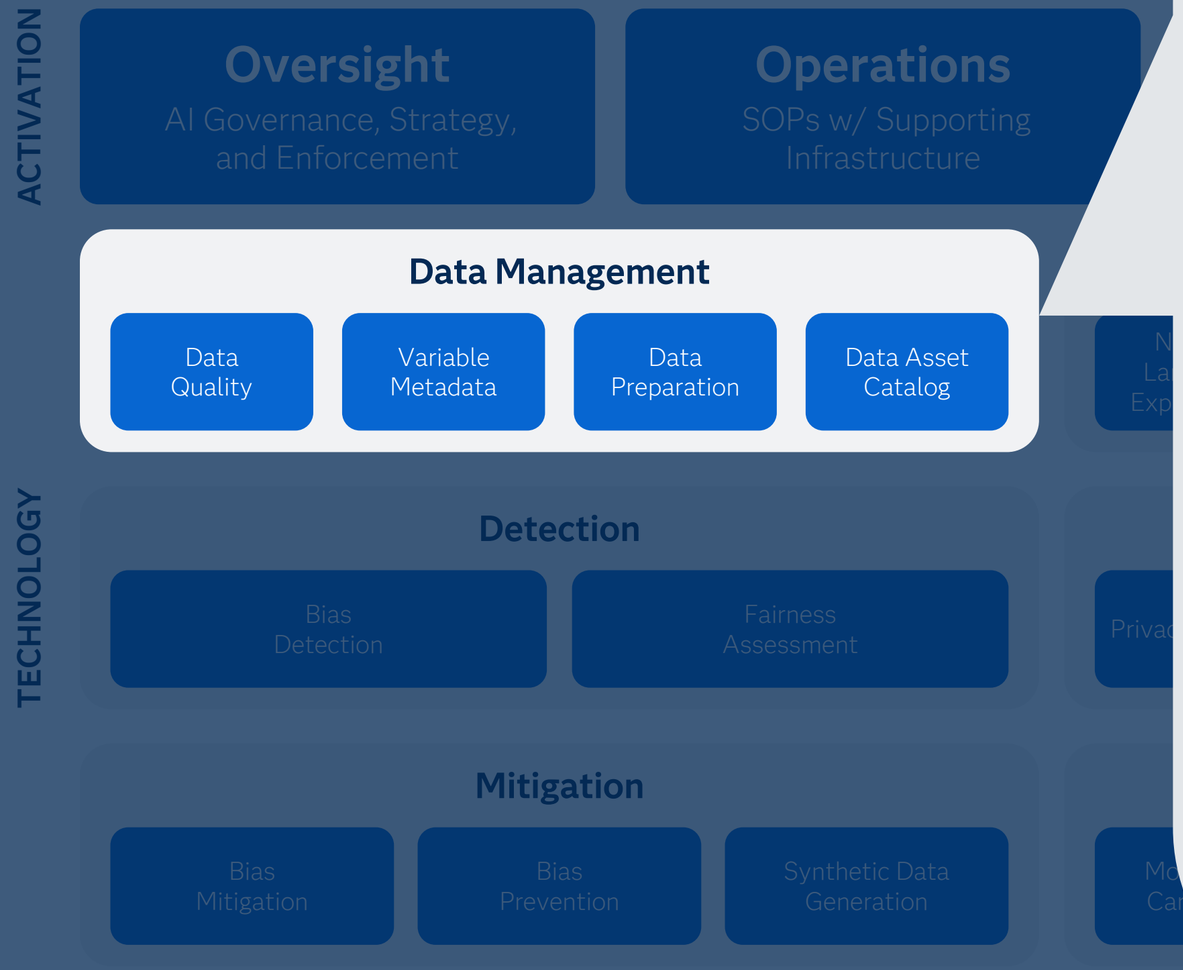
Privacy & Security
- Privacy Preservation
- Model Security
- Autonomy Preservation
- Consent and Control

Mitigation
- Bias Mitigation
- Bias Prevention
- Synthetic Data Generation

Model Ops
- Model Cards
- Decisioning
- Life Cycle Management
- Metric Monitoring
- Model Robustness
- Model Oversight

- GxP / pharma regulations
- Patient Trust
- HCP/HTA
- Standards
- Traceability

Trustworthy AI Landscape



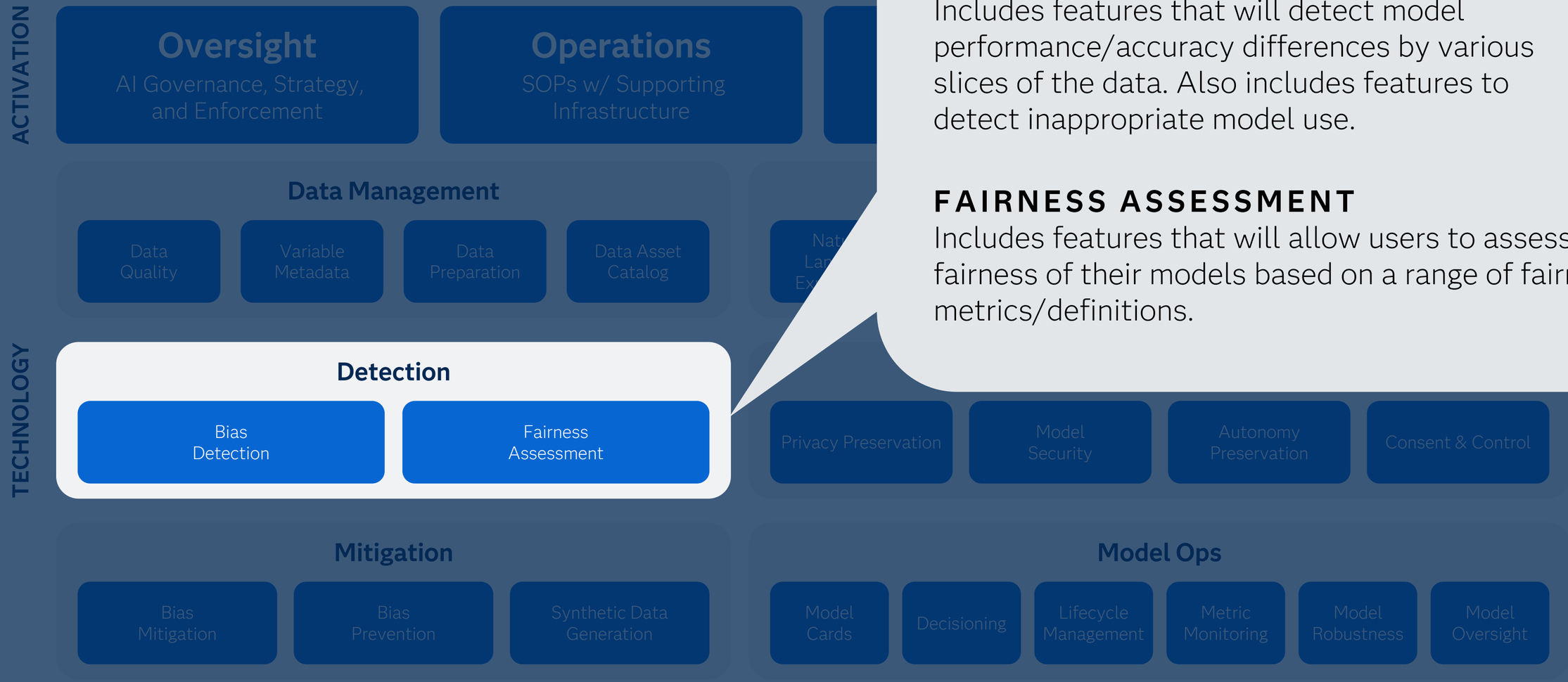
DATA QUALITY
Includes features that address data quality concerns that have the potential to lead to pre-processing bias.

VARIABLE METADATA
Includes features that apply appropriate metadata and transparency principles to variables to ensure that downstream analytics can use this information for bias detection and mitigation.

DATA PREPARATION
Includes features that apply appropriate metadata and transparency principles to variables to ensure that downstream analytics can use this information for bias detection and mitigation.

DATA ASSET CATALOG
Includes features that allow a user to track data assets throughout the analytic lifecycle through the use of data sheets and lineage diagrams.

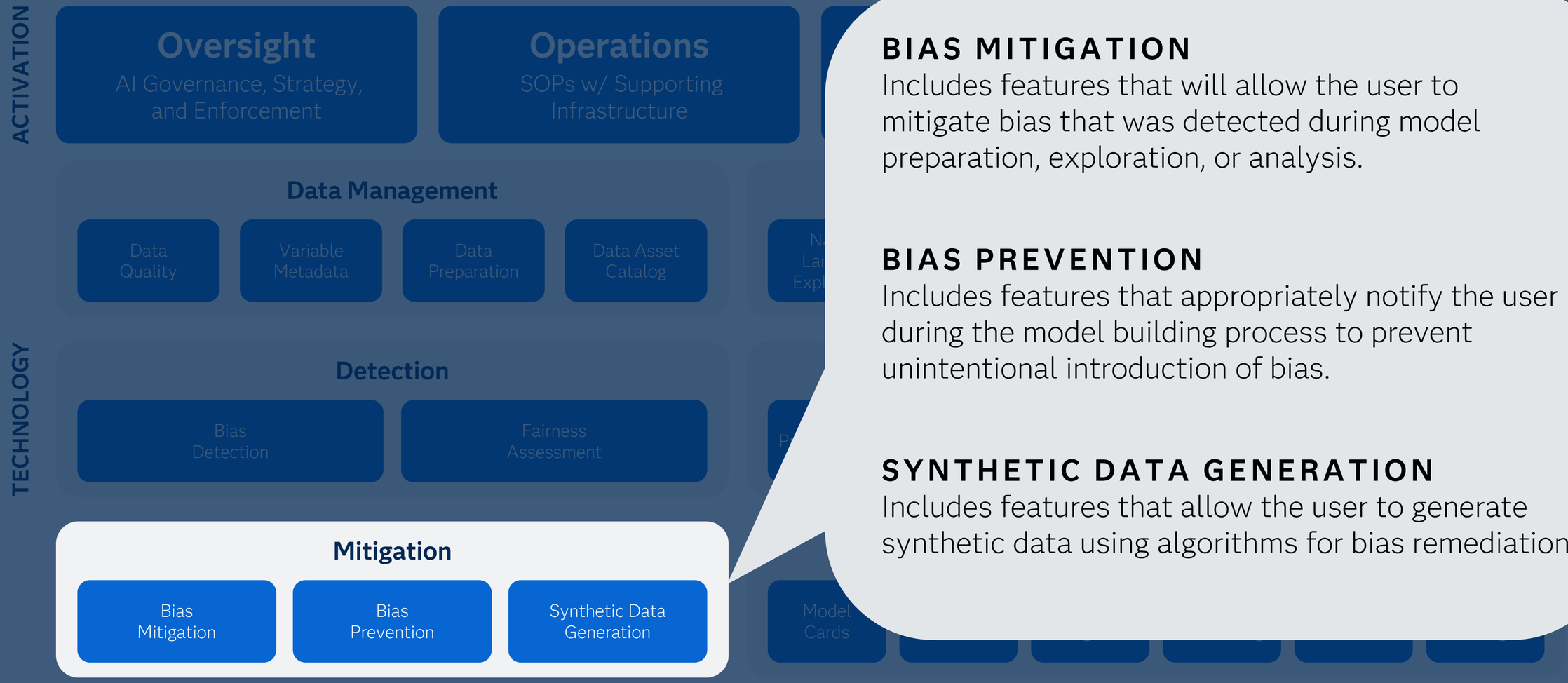
Trustworthy AI Landscape



BIAS DETECTION
Includes features that will detect model performance/accuracy differences by various slices of the data. Also includes features to detect inappropriate model use.

FAIRNESS ASSESSMENT
Includes features that will allow users to assess the fairness of their models based on a range of fairness metrics/definitions.

Trustworthy AI Landscape

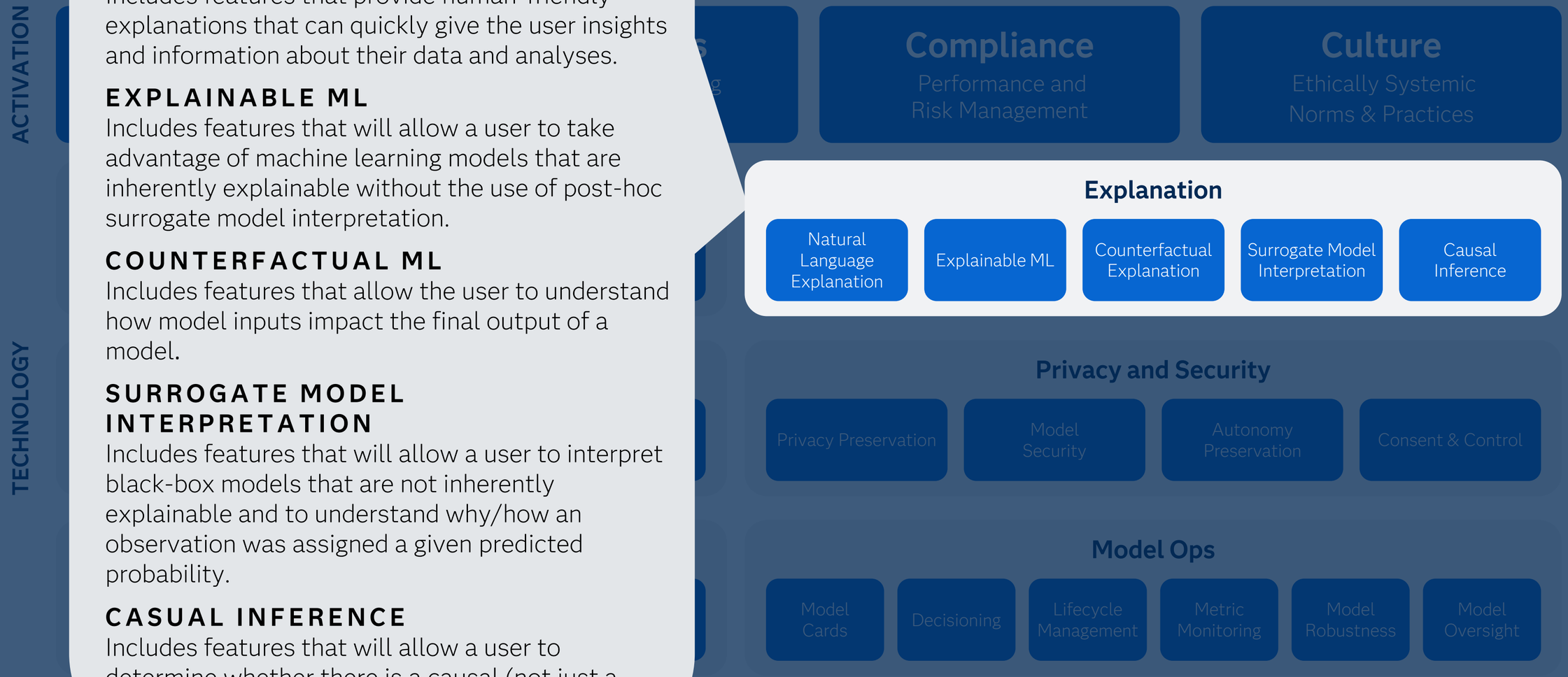


BIAS MITIGATION
Includes features that will allow the user to mitigate bias that was detected during model preparation, exploration, or analysis.

BIAS PREVENTION
Includes features that appropriately notify the user during the model building process to prevent unintentional introduction of bias.

SYNTHETIC DATA GENERATION
Includes features that allow the user to generate synthetic data using algorithms for bias remediation.

Trustworthy AI Landscape



NATURAL LANGUAGE EXPLANATION
Includes features that provide human-friendly explanations that can quickly give the user insights and information about their data and analyses.

EXPLAINABLE ML
Includes features that will allow a user to take advantage of machine learning models that are inherently explainable without the use of post-hoc surrogate model interpretation.

COUNTERFACTUAL ML
Includes features that allow the user to understand how model inputs impact the final output of a model.

SURROGATE MODEL INTERPRETATION
Includes features that will allow a user to interpret black-box models that are not inherently explainable and to understand why/how an observation was assigned a given predicted probability.

CASUAL INFERENCE
Includes features that will allow a user to determine whether there is a causal (not just a correlative) relationship between two factors.

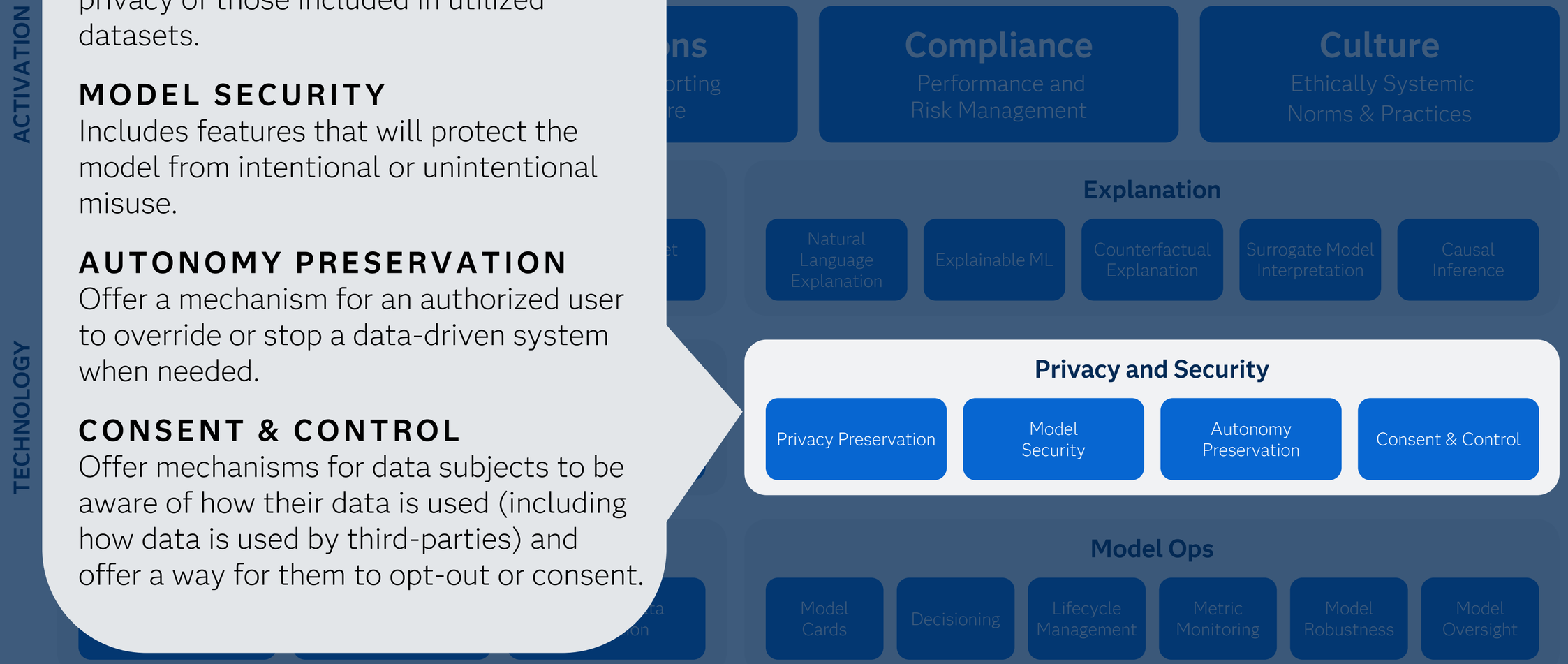
Tr…dscape

PRIVACY PRESERVATION
Includes features that will help protect the privacy of those included in utilized datasets.

MODEL SECURITY
Includes features that will protect the model from intentional or unintentional misuse.

AUTONOMY PRESERVATION
Offer a mechanism for an authorized user to override or stop a data-driven system when needed.

CONSENT & CONTROL
Offer mechanisms for data subjects to be aware of how their data is used (including how data is used by third-parties) and offer a way for them to opt-out or consent.



MODEL CARDS
Includes features that allows users to document the intended use case, performance, limitations, model information/settings

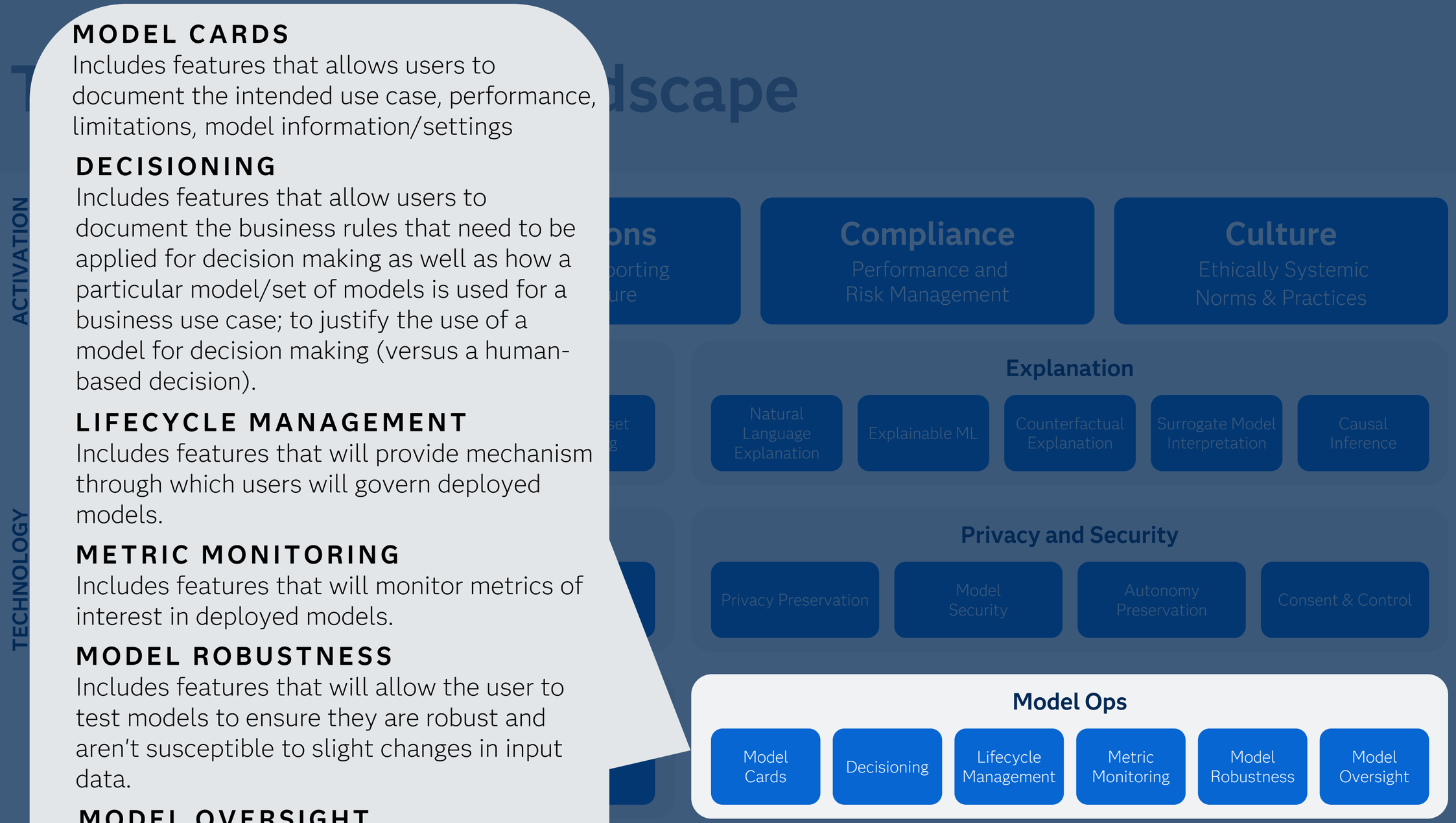
DECISIONING
Includes features that allow users to document the business rules that need to be applied for decision making as well as how a particular model/set of models is used for a business use case; to justify the use of a model for decision making (versus a human-based decision).

LIFECYCLE MANAGEMENT
Includes features that will provide mechanism through which users will govern deployed models.

METRIC MONITORING
Includes features that will monitor metrics of interest in deployed models.

MODEL ROBUSTNESS
Includes features that will allow the user to test models to ensure they are robust and aren't susceptible to slight changes in input data.

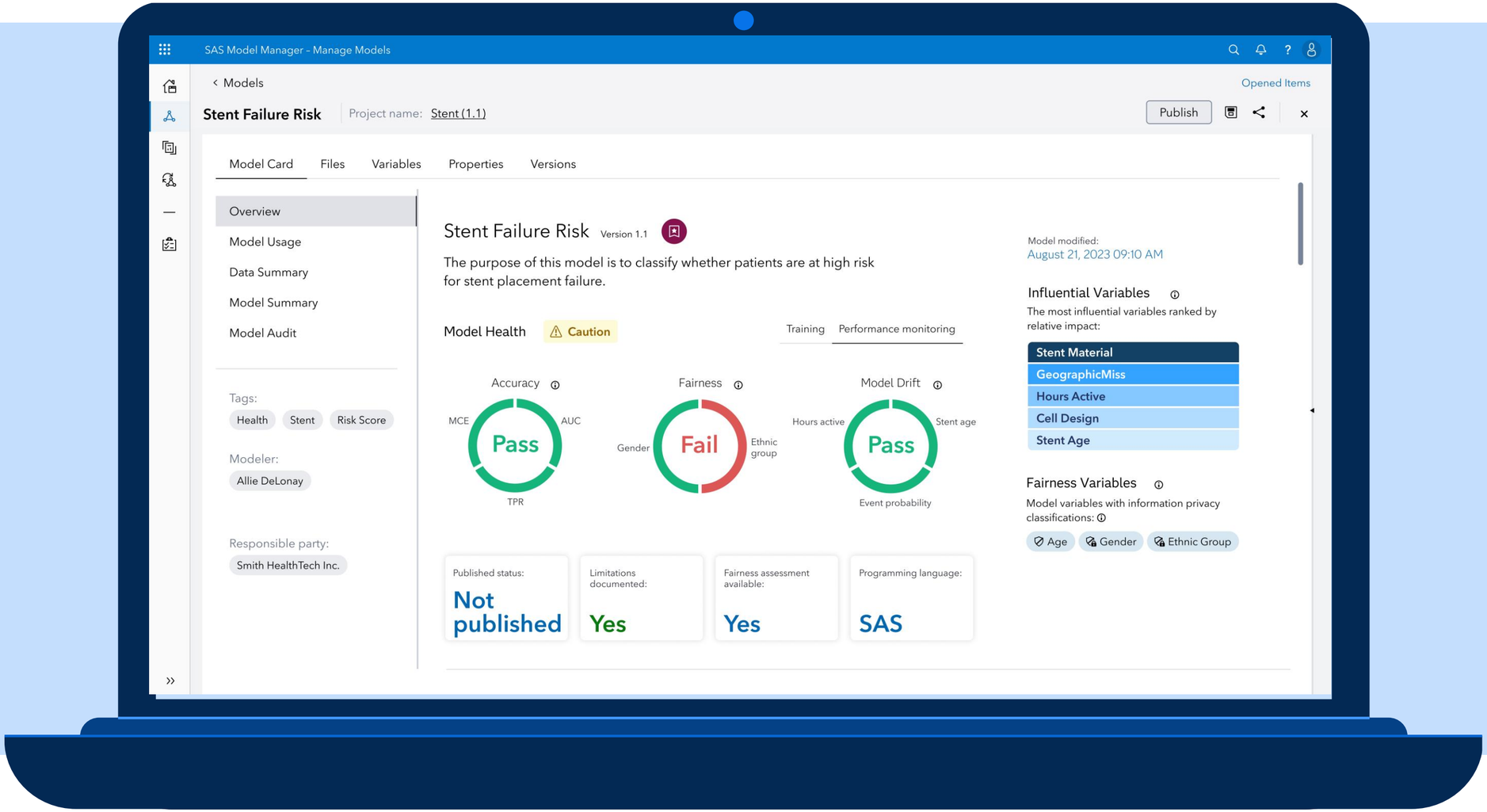
MODEL OVERSIGHT
Includes features that will allow help users assess their models for compliance.



What are Model Cards?

"Nutrition labels for models" provide critical insight

Model cards generate a summary of a model's training data, intended use and performance - demonstrating whether models are accurate, transparent and fair.



Fosters Trustworthy AI ● Provides Consumable Insights ● Enables Ethical Decision-Making ● sas

Stent Failure Risk

Project name: Stent (1.1)

Publish

Model Card | Files | Variables | Properties | Versions

- Overview
- Model Usage
- Data Summary
- Model Summary
- Model Audit

Tags:

Health | Stent | Risk Score

Modeler:

Allie DeLonay

Responsible party:

Smith HealthTech Inc.

Stent Failure Risk Version 1.1

The purpose of this model is to classify whether patients are at high risk for stent placement failure.

Model modified:
August 21, 2023 09:10 AM

Model Health

⚠ Caution

Training | Performance monitoring

Accuracy

MCE

Generalizability

MCE Difference

Fairness

Results are calculated with default thresholds. Modify your settings on the Properties tab of the project that contains this model for personalized results.

Project status:	Limitations documented:	Fairness assessment available:	Training code type:
Not published	Yes	Yes	SAS

Influential Variables

The most influential variables ranked by relative impact:

1. Stent Material
2. GeographicMiss
3. Hours Active
4. Cell Design
5. Stent Age

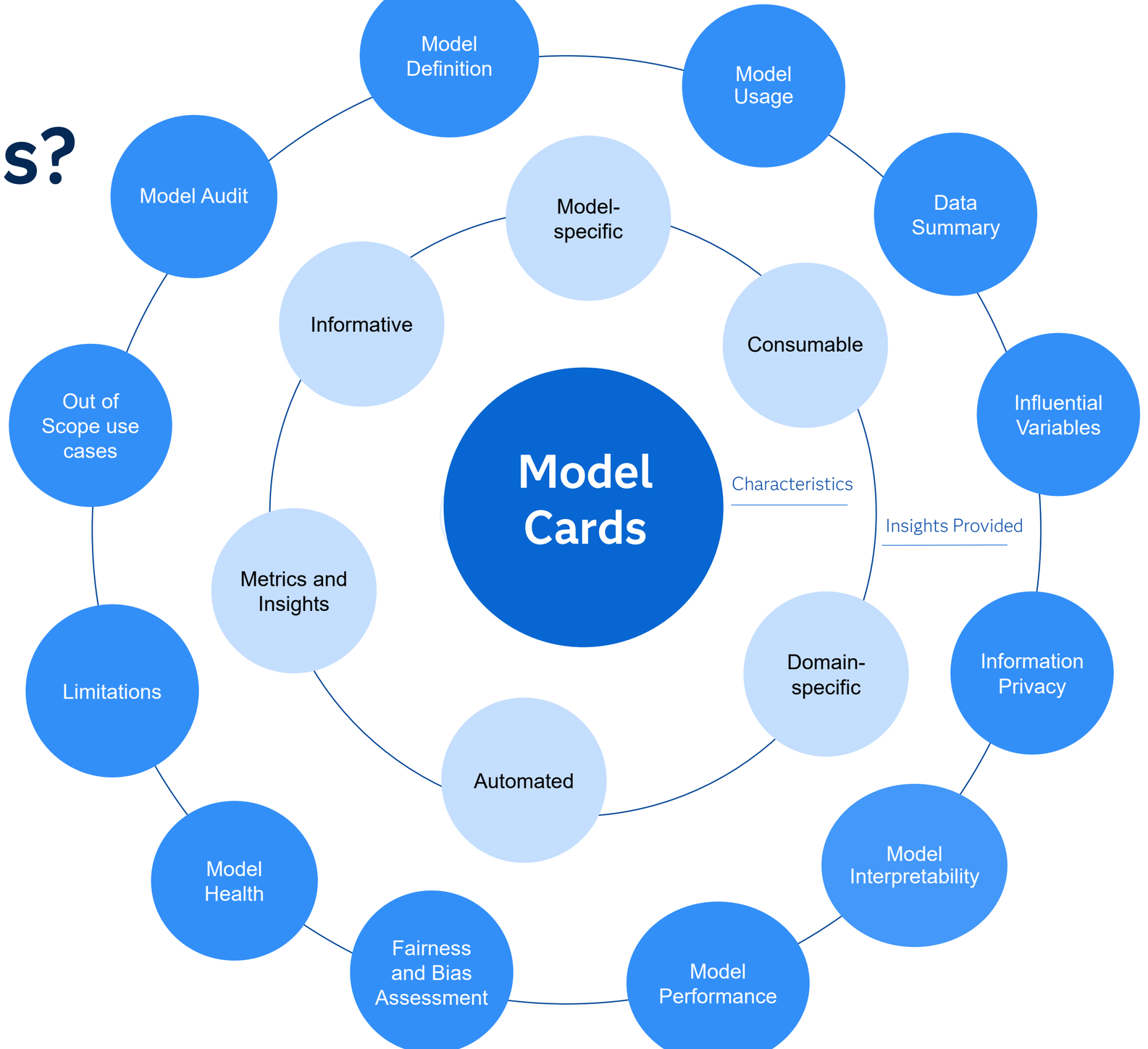
Fairness Variables

Model variables with information privacy classifications:

Age | Gender | Ethnic Group

What are a Model Cards?

Characteristics and Insights

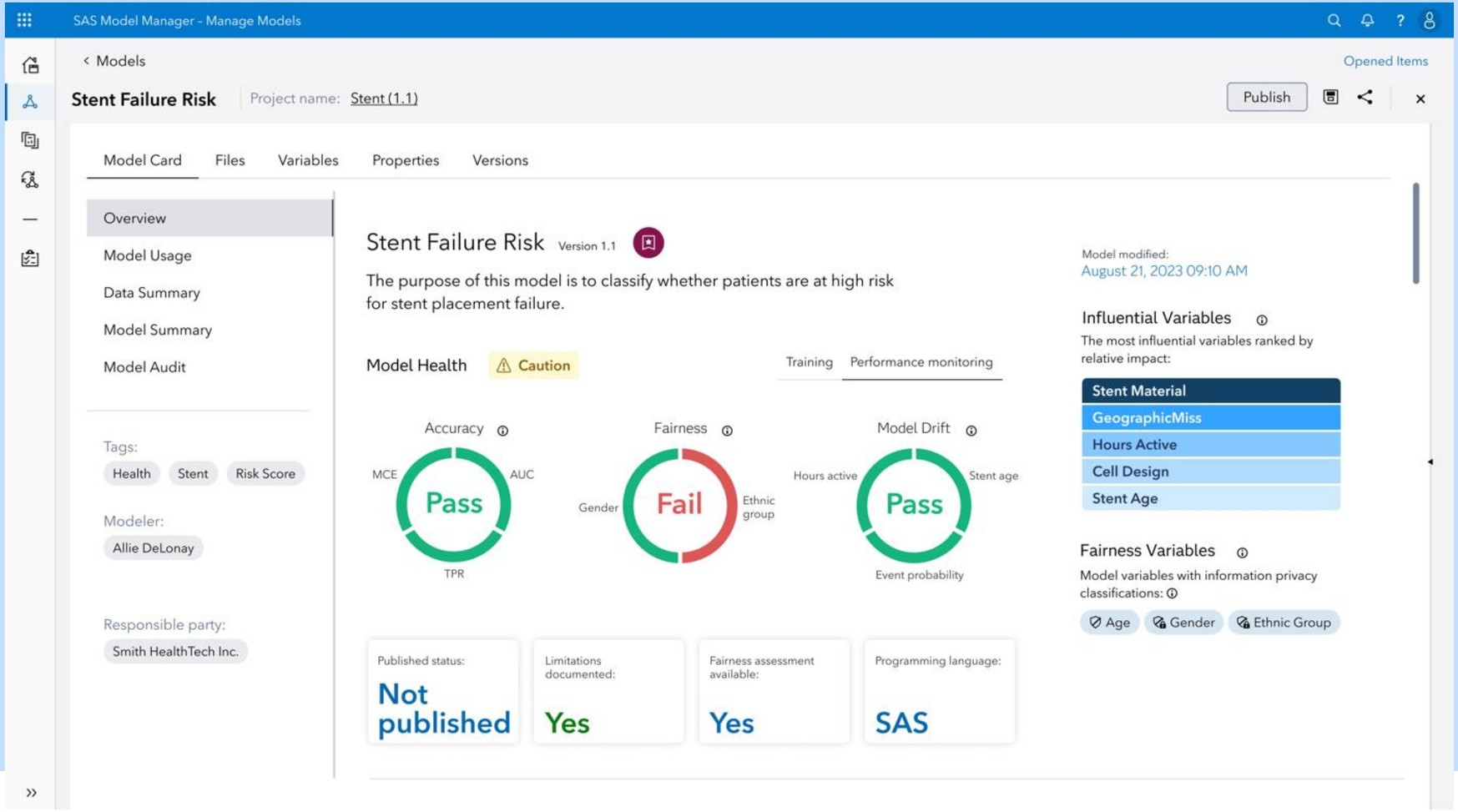


Overview Tab

Key Insights and Use Cases

Summary of model performance, reliability compared to selected metrics and key influential variables.

Helps decide whether to put the model in production.

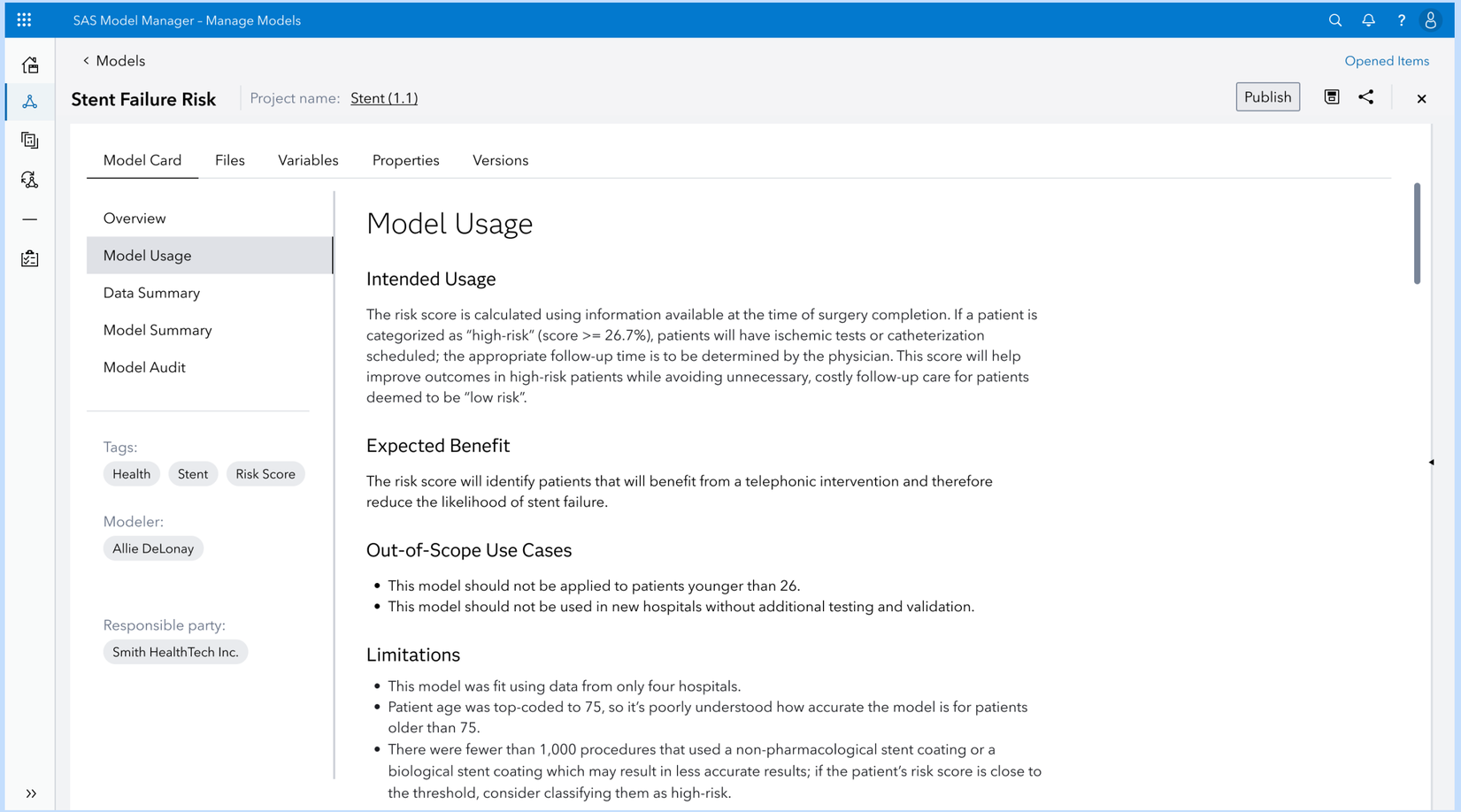


Model Usage Tab

Key Insights and Use Cases

Document intended use of the model, appropriate and out of scope use cases.

Prevent misuse and promote responsible deployment by making users aware of inappropriate applications and the model's limitations.



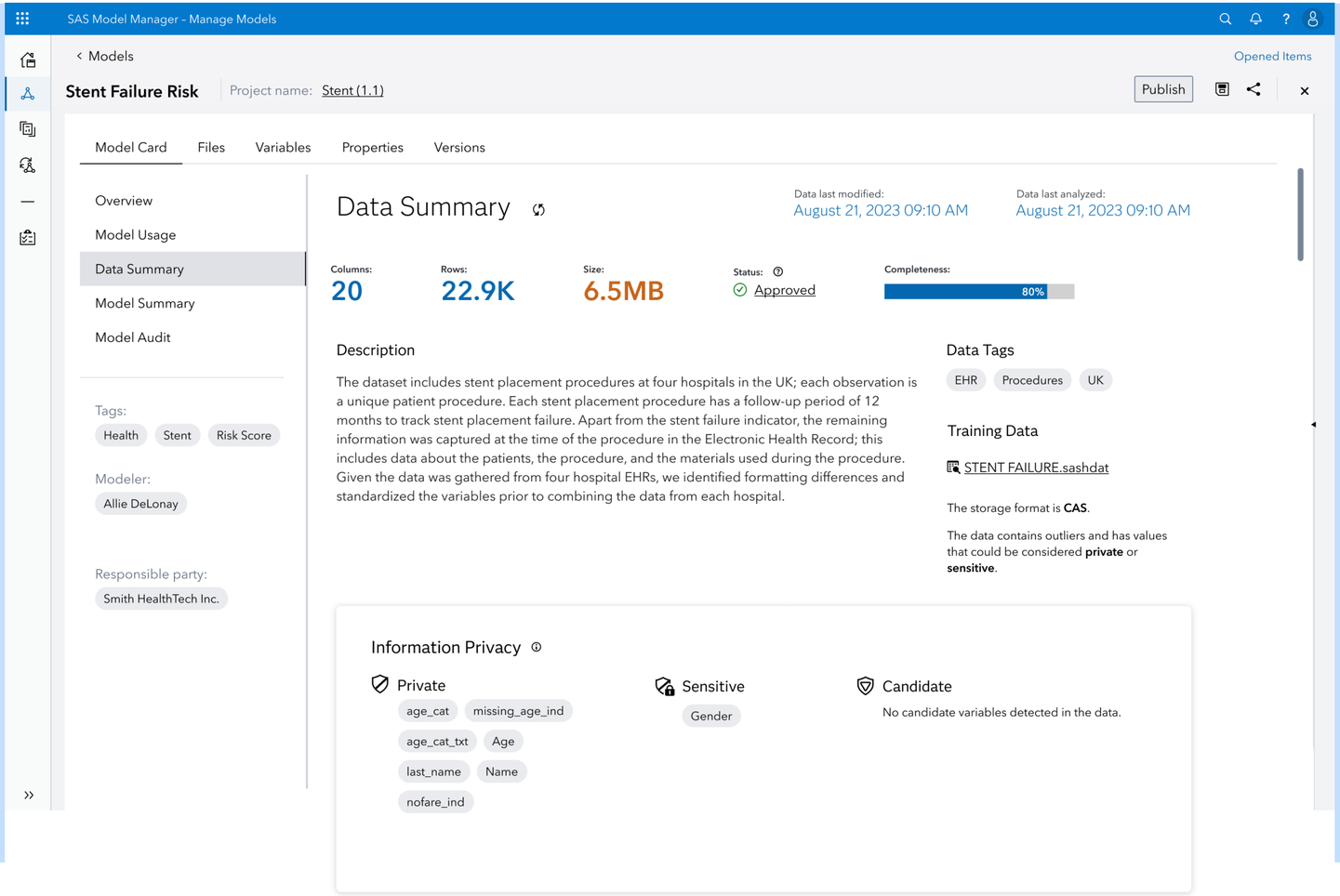
Data Summary

Key Insights and Use Cases

Analyze training data for insight into the AI's decision-making process.

Includes data source, data privacy considerations, data tags to indicate data types, data description, data relevance in training the model.

Includes analyses of data completeness, approval status and potential outliers.



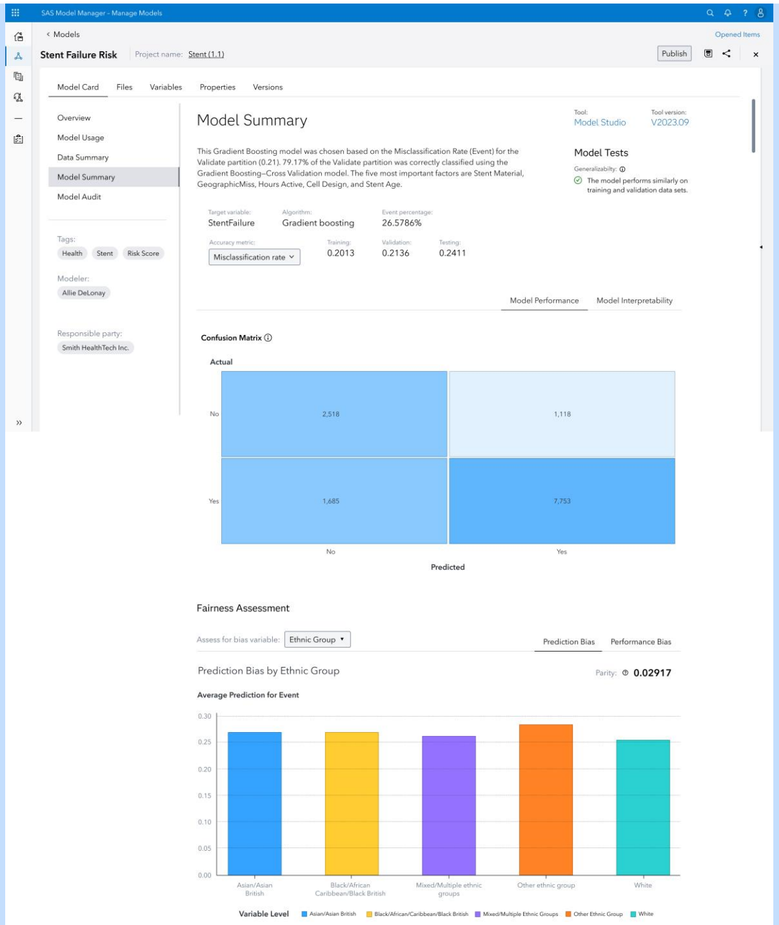
Model Summary

Key Insights and Use Cases

Understand granular model performance results, fairness assessment results, and generalizability metrics.

Review model interpretability, which indicates the variables most useful for model predictions.

Include governance details like the modeler, responsible party and model version.

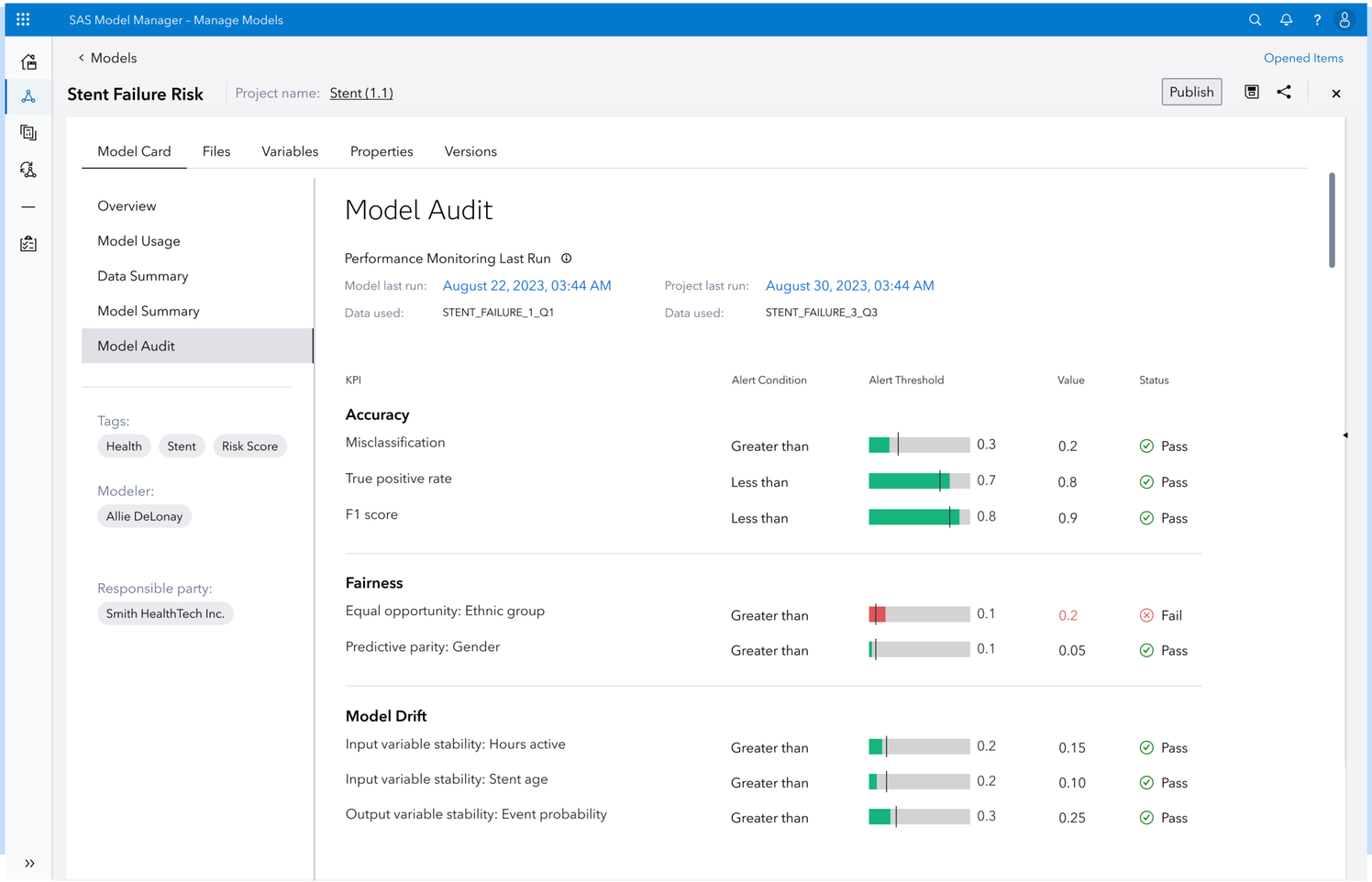


Model Audit

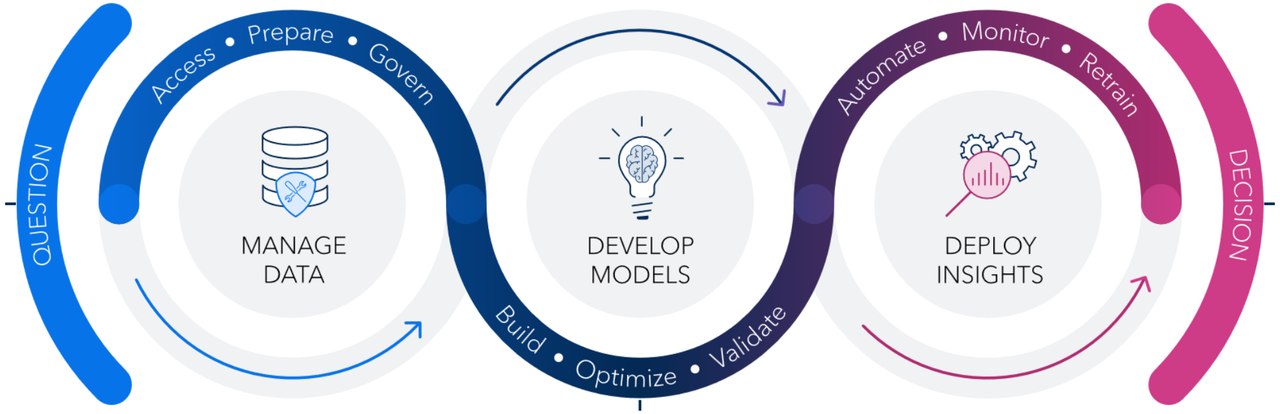
Key Insights and Use Cases

Monitor an AI model over time to ensure accuracy, fairness, and avoid model drift.

Understand when the AI model was last evaluated, and which data was used for performance evaluation.



Model Cards are an important element of your investment in Trustworthy AI



- Data Quality
- Data Exploration
- Information Privacy
- Data Masking
- Data Suppression
- Data Lineage
- Synthetic Data Generation
- Semantic Type Remediation

- Natural Language Insights
- Model Interpretability
- Fairness Assessment
- Bias Mitigation

- Model Governance
- Model Monitoring
- Decision Accountability
- Model Cards

Trustworthy AI Workflow

Benefits

1

Foster Trustworthy AI with ‘at-a-glance’ view of the model

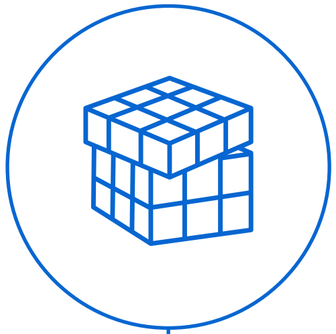
2

Consumable insights accessible to all personas involved in analytics process

3

Automatically populate model cards as the model is developed, managed and deployed in SAS Viya

The AI toolbox of the pharmaceutical company



Open,
interoperable,
Ecosystem

Standards (DDF, CDISC,
OMOP, FHIR)

Productive, fast,
collaboration

Human in the Loop !

Extensive AI toolbox,
multi-lingual

Analytics
Architecture
in Life
Sciences

Governance
Traceable
Reproducible
Trustworthy