Bias and Fairness in Large Language Models for Financial Compliance: Risks and Mitigation

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Online – Octobre 2025

Why this research matters

Finance is highly regulated

LLMs can automate compliance tasks

Bias: risk to fairness, trust and legality

Regulatory Frameworks
Solvency II • IFRS 17 • Basel III • AMLD

↓

LLM Processing
GPT-4 · FinGPT · BloombergGPT

↓

Outputs
Obligations • Risk classification • Summarisation

References: ESMA & Turing, 2025.

Bias in compliance remains under-researched

Research Problem

Bias well studied in:

- Healthcare
- Hiring
- Criminal Justice

Gap: Little research in
Financial Compliance
(High stakes, under-studied)

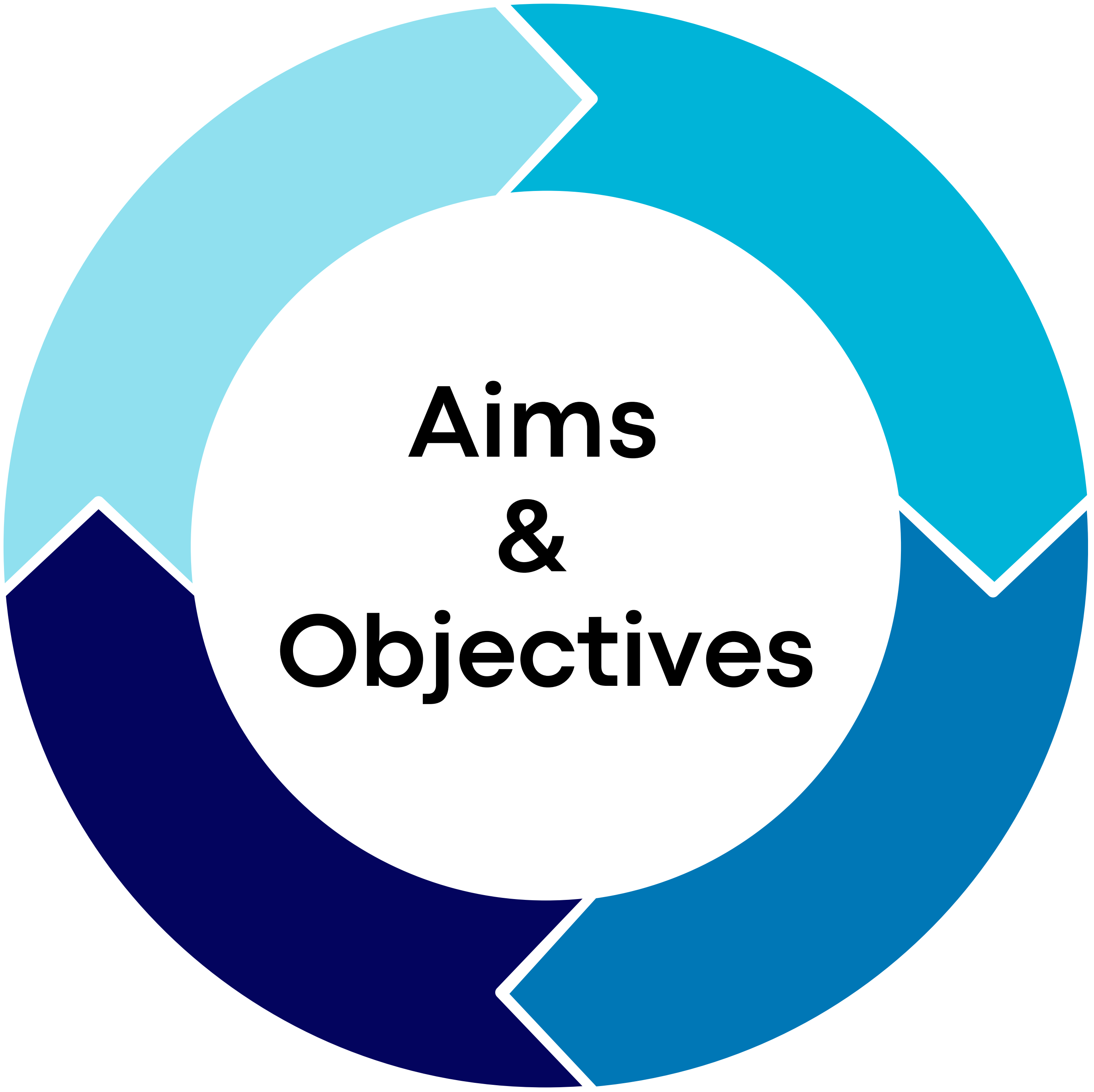
References: Bender et al., 2021; Mehrabi et al., 2021

How can bias and fairness be evaluated and mitigated in LLMs for compliance?

Types of bias?

General vs domain-specific models?

Effective mitigation strategies?



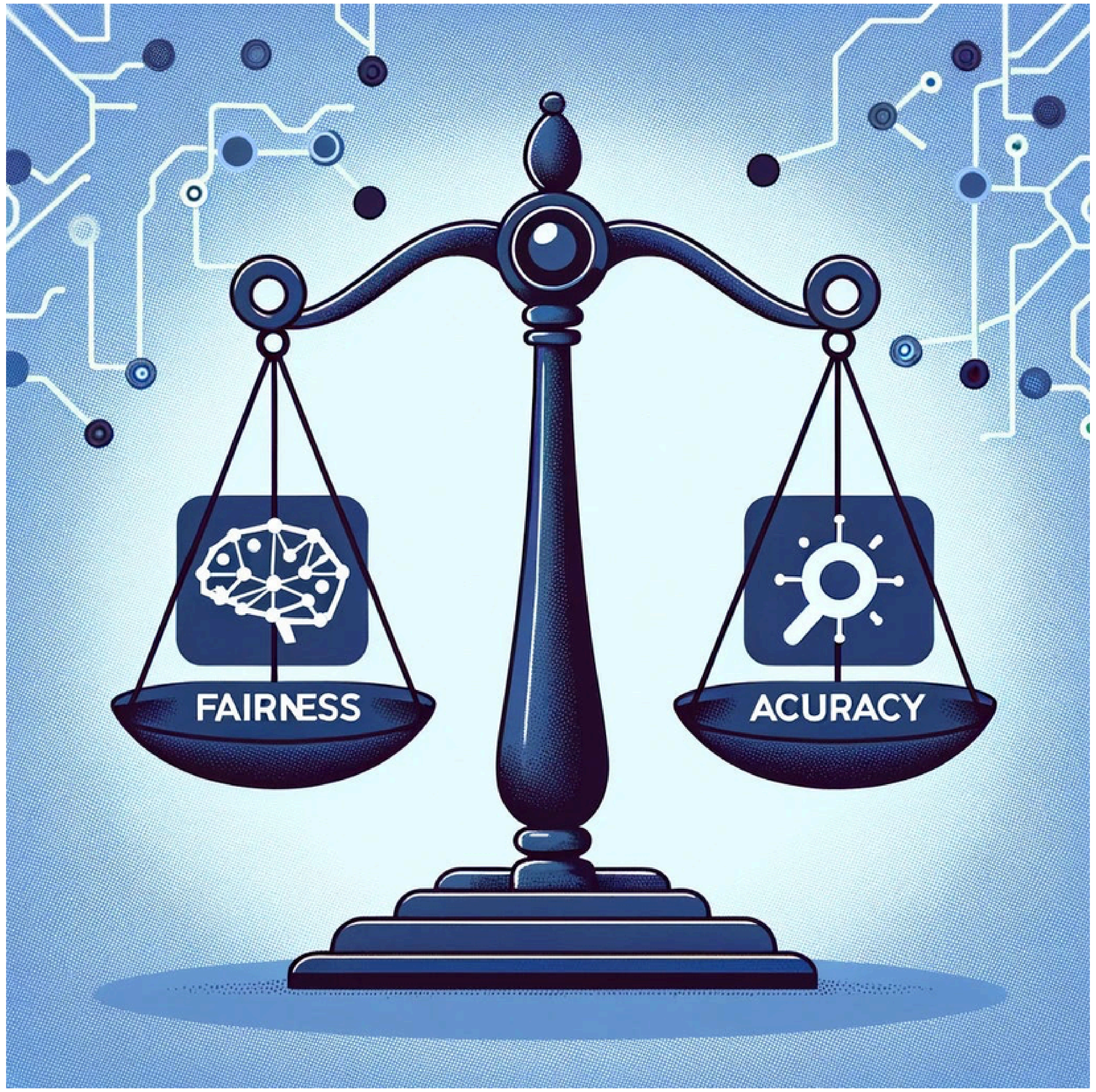
1. Detect bias
2. Compare models
3. Test mitigation
4. Build auditing framework

Literature Review (Bias & Fairness)

"Stochastic parrots" risk
(Bender et al., 2021).

Fairness metrics
(Mehrabi et al., 2021).

Context-dependence
(Blodgett et al., 2020).



Literature Review (Governance)

Right to explanation
(Goodman & Flaxman, 2017).

GDPR/AI Act
Finance = “high risk”
(Veale & Edwards, 2018).

RegTech governance issues
(Zetzsche et al., 2020).

Literature Review (LLMs in Finance)

Model	Type	Training Data	Strengths	Limitations
GPT-4	General-purpose	Broad internet corpus	Strong general NLP, versatile, state-of-the-art reasoning	Not finance-specialised, may hallucinate
FinGPT	Finance-specific (open-source)	Financial texts & datasets	Domain-tuned, open-source, adaptable for fine-tuning	Still emerging, smaller scale vs GPT-4
BloombergGPT	Finance-specific (proprietary)	Large-scale financial data	High accuracy on financial NLP benchmarks, industry-validated	Closed model, limited access

BloombergGPT & FinGPT: strong performance (Bloomberg, 2023).

Empirical results but little fairness testing.

ESMA & Turing (2025): call for fairness in financial AI.

Research Design Overview

Regulatory Data

Solvency II · IFRS 17 · Basel III · AMLD

Public documents (PDF/HTML → text)

Models

GPT-4 (general)

FinGPT (finance)

BloombergGPT (benchmarks)

Tasks

Obligation extraction

Risk classification

Regulatory summarisation

Outputs assessed for Accuracy (P/R/F1, ROUGE) and Fairness (consistency, calibration, parity)

Evaluation & Fairness Metrics

Accuracy Metrics

Precision
Recall
F1

ROUGE/BERTScore

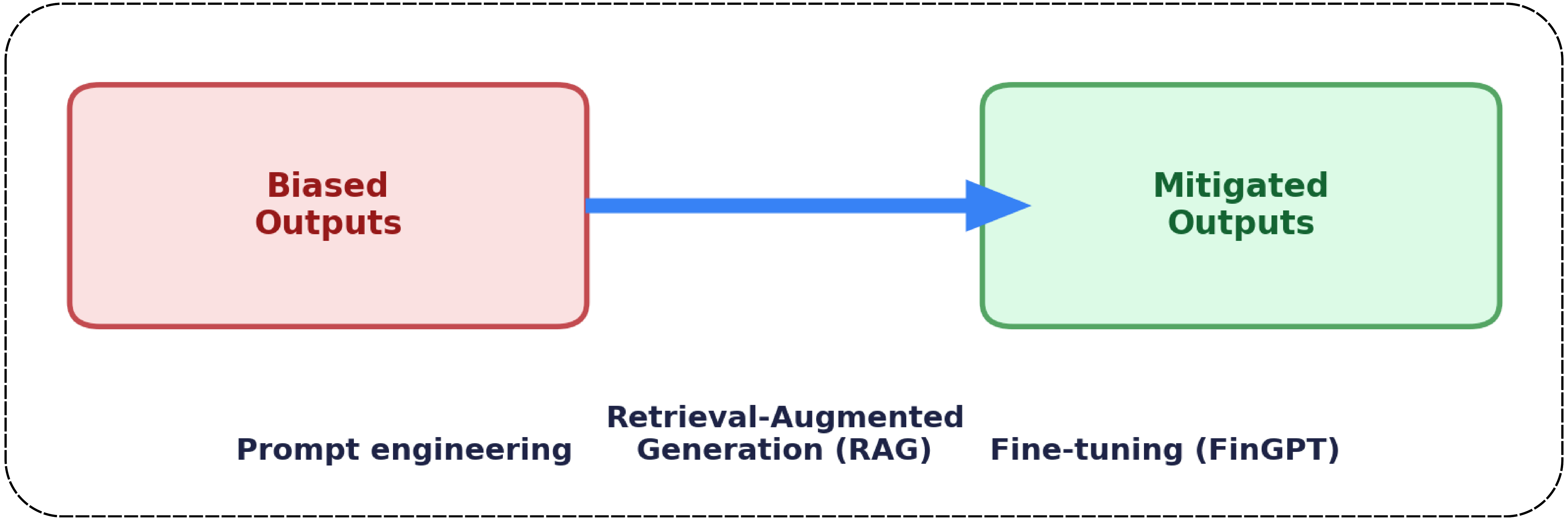
Fairness Metrics

Consistency
Calibration

Parity Skew Review
(Mehrabi et al., 2021)

References: Raji et al., 2020

Mitigation Strategies



Artefact & Framework

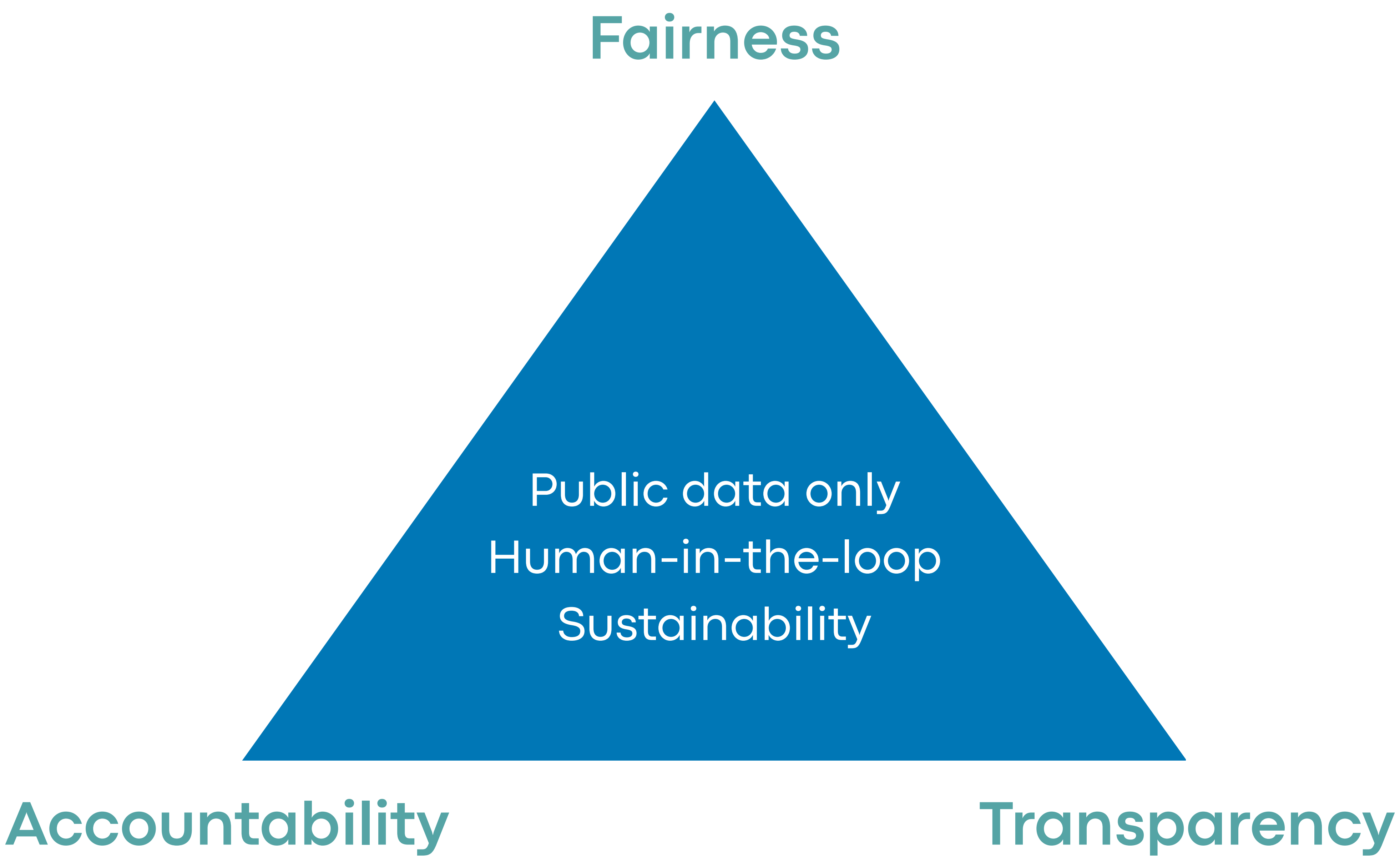
Framework Document

Guidelines
Indicators

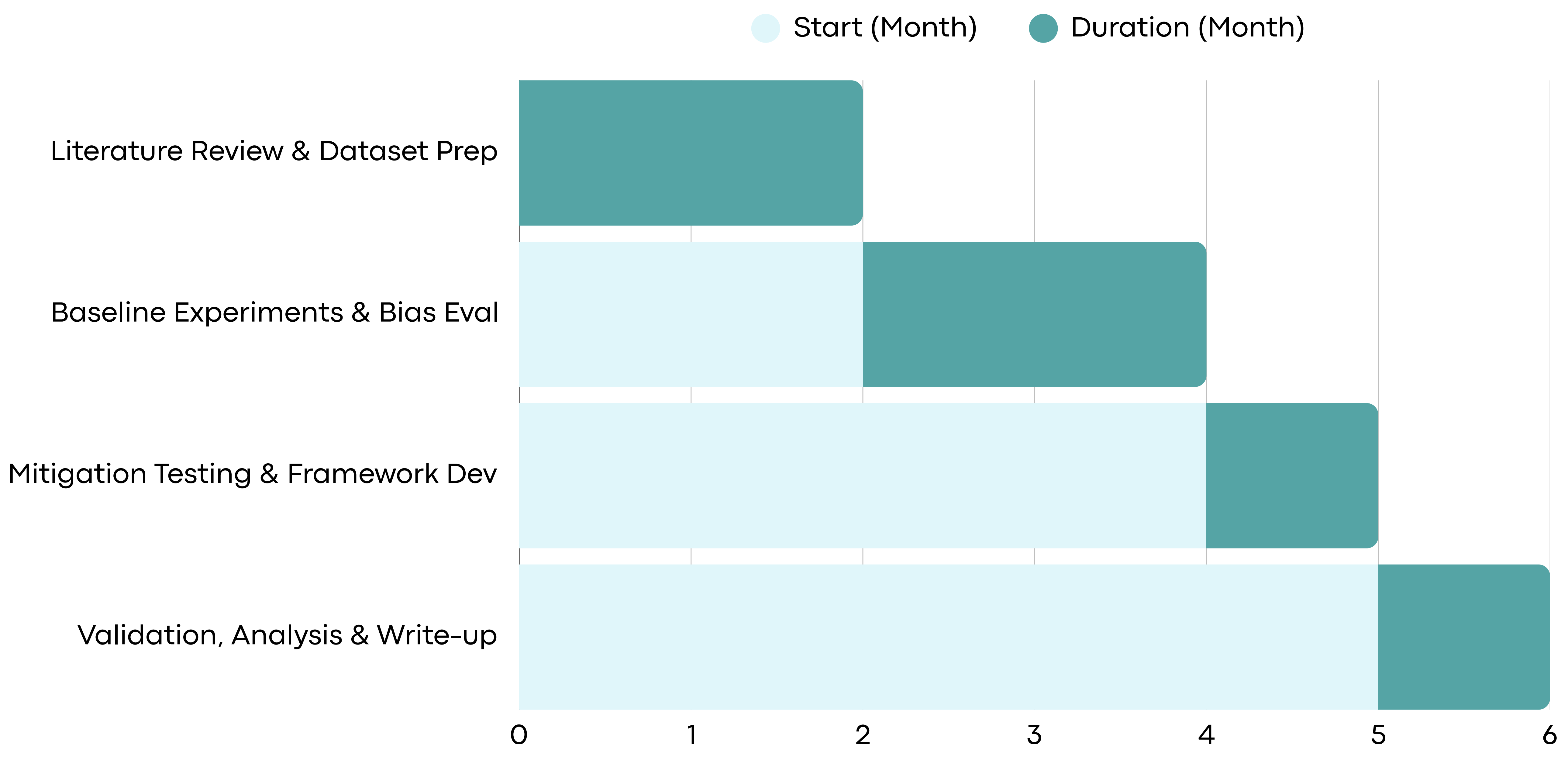
Prototype Tool

Python notebook
Fairness checks

Ethical Considerations

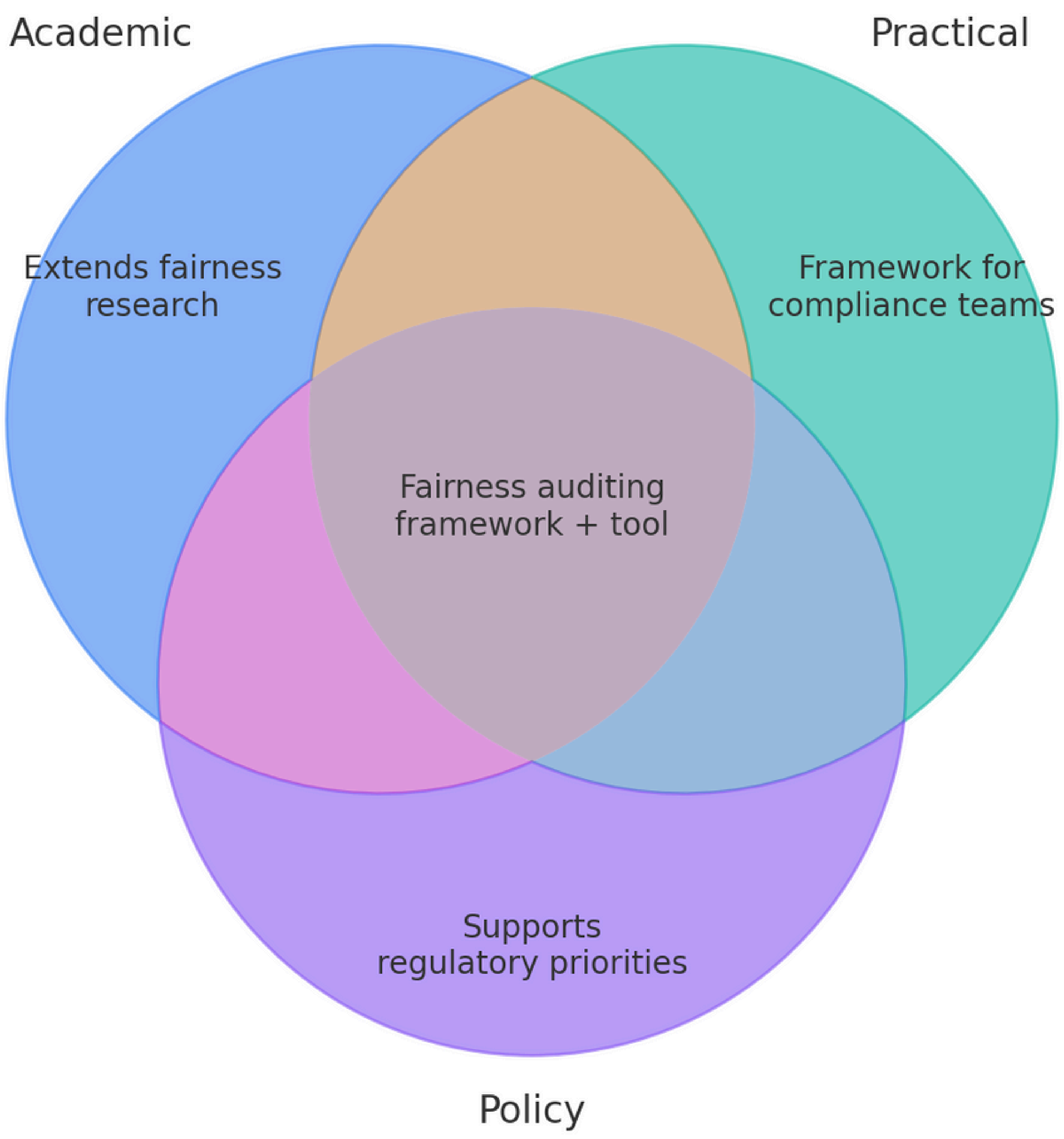


Timeline



Start (Month)
Duration (Month)
Literature Review & Dataset Prep
Baseline Experiments & Bias Eval
Mitigation Testing & Framework Dev
Validation, Analysis & Write-up
0
1
2
3
4
5
6

Contribution



Conclusion

Bridging Data Science, Finance, and Regulation

Key References

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