

Supplementary Tables

Table S1: Example systems in which feedback loop failure might occur.

Domain	Target Parameter(s)	Issues contributing to failure	Feedback mechanism	Consequences	Related work
Predictive policing	Localized crime rates	Crime is discovered more often in neighborhoods with more police presence.	Rates of discovered crime inform police presence, which shapes discovered crime rates.	Neighborhoods are subject to disproportionate police presence.	1,2
Ranking and recommender systems (e.g. media, news)	Popularity ranking model	Item popularity may not capture “quality” or “benefit.” Recommendations influence future popularity.	Popularity of an item determines rank or recommendation probability, influencing popularity.	Low-value popular items increase in popularity; High-value unpopular items remain obscure. A “filter bubble” effect ³ may arise.	4–7
Diagnosis	Disease symptoms and risk factors	Diagnosed vs. actual disease cases are not equivalent.	Diagnosed cases shape understanding of prevalence, symptoms, and risk factors used in the diagnostic process.	Disproportionate overdiagnosis or underdiagnosis, with a misunderstanding of disease etiology	This paper. Examples in heart attack ⁸ autism ^{9,10} , and risk modeling ¹¹

References for Table S1

1. Lum K, Isaac W. To predict and serve? *Signif (Oxf)* 2016; 13: 14–19.
2. Ensign D, Friedler SA, Neville S, et al. Runaway Feedback Loops in Predictive Policing. In: Friedler SA, Wilson C (eds) *Proceedings of the 1st Conference on Fairness, Accountability and Transparency*. PMLR, 23--24 Feb 2018, pp. 160–171.
3. Pariser E. *The Filter Bubble: How the New Personalized Web Is Changing What We Read and How We Think*. Penguin, 2011.
4. Germano F, Gómez V, Le Mens G. The few-get-richer: a surprising consequence of popularity-based rankings? In: *The World Wide Web Conference*. New York, NY, USA: Association for Computing Machinery, 2019, pp. 2764–2770.
5. Milano S, Taddeo M, Floridi L. Recommender systems and their ethical challenges. *AI Soc* 2020; 35: 957–967.
6. Stemler A. Feedback Loop Failure: Implications for the Self-Regulation of the Sharing Economy. *Minn JL Sci & Tech* 2017; 18: 673–712.
7. Demange G. Collective attention and ranking methods. *J Dyn Games* 2014; 1: 17–43.
8. Aggarwal NR, Patel HN, Mehta LS, et al. Sex Differences in Ischemic Heart Disease. *Circ Cardiovasc Qual Outcomes* 2018; 11: e004437.
9. Loomes R, Hull L, Mandy WPL. What Is the Male-to-Female Ratio in Autism Spectrum Disorder? A Systematic Review and Meta-Analysis. *J Am Acad Child Adolesc Psychiatry* 2017; 56: 466–474.
10. Fombonne E, MacFarlane H, Salem AC. Epidemiological surveys of ASD: advances and remaining challenges. *J Autism Dev Disord*. Epub ahead of print 17 April 2021. DOI: 10.1007/s10803-021-05005-9.
11. Lenert MC, Matheny ME, Walsh CG. Prognostic models will be victims of their own success, unless.... *J Am Med Inform Assoc* 2019; 26: 1645–1650.