

Preface

Algorithms are increasingly impacting our lives. They promote healthy habits by recommending activities that minimize risks, facilitate financial transactions by estimating credit scores from multiple sources, and recommend what to buy by profiling purchasing patterns. They do all that based on data that is not only directly disclosed by people but also inferred from patterns of behavior and social networks.

Algorithms affect us, yet the processes behind them are hidden. They often work as black boxes. With little transparency, wrongdoing is possible. Algorithms could recommend activities that minimize health risks only for a subset of the population because of biased training data. They could perpetuate racial discrimination by refusing mortgages based on factors imperfectly tied to race. They could promote unfair price discrimination by offering higher online shopping prices to those who are able to pay them. Shrouded in secrecy and complexity, algorithmic decisions might well perpetuate bias and prejudice.

This book offers design principles for better algorithms. To ease readability, the book is divided into three parts, which are tailored to readers of different backgrounds. To ensure transparent mining, solutions should first and foremost increase transparency (Part I), plus they should not only be algorithmic (Part II) but also regulatory (Part III).

To begin with Part I, algorithms are increasingly used to make better decisions about public goods (e.g., health, safety, finance, employment), and requirements such as transparency and accountability are badly needed. In Chapter “The Tyranny of Data? The Bright and Dark Sides of Data-Driven Decision-Making for Social Good”, Lepri et al. present some key ideas on how algorithms could meet those requirements without compromising predictive power. In times of “post-truth” politics—the political use of assertions that “feel true” but have no factual basis—also news media might benefit from transparency. Nowadays, algorithms are used to produce, distribute, and filter news articles. In Chapter “Enabling Accountability of Algorithmic Media: Transparency as a Constructive and Critical Lens”, Diakopoulos introduces a model that enumerates different types of information

that might be disclosed about such algorithms. In so doing, the model enables transparency and media accountability. More generally, to support transparency on the entire Web, the Princeton Web Transparency and Accountability Project (Chapter “The Princeton Web Transparency and Accountability Project”) has continuously monitored thousands of web sites to uncover how user data is collected and used, potentially reducing information asymmetry.

Design principles for better algorithms are also of algorithmic nature, and that is why Part II focuses on algorithmic solutions. Datta et al. introduce a family of measures that quantify the degree of influence exerted by different input data on the output (Chapter “Algorithmic Transparency via Quantitative Input Influence”). These measures are called quantitative input influence (QII) measures and help identify discrimination and biases built in a variety of algorithms, including black-boxes ones (only full control of the input and full observability of the output are needed). But not all algorithms are black boxes. Rule-based classifiers could be easily interpreted by humans, yet they have been proven to be less accurate than state-of-the-art algorithms. That is also because of ineffective traditional training methods. To partly fix that, in Chapter “Learning Interpretable Classification Rules with Boolean Compressed Sensing”, Malioutov et al. propose new approaches for training Boolean rule-based classifiers. These approaches not only are well-grounded in theory but also have been shown to be accurate in practice. Still, the accuracy achieved by deep neural networks has been so far unbeaten. Huge amounts of training data are fed into an input layer of neurons, information is processed into a few (middle) hidden layers, and results come out of an output layer. To shed light on those hidden layers, visualization approaches of the inner functioning of neural networks have been recently proposed. Seifert et al. provide a comprehensive overview of these approaches, and they do so in the context of computer vision (Chapter “Visualizations of Deep Neural Networks in Computer Vision: A Survey”).

Finally, Part III dwells on regulatory solutions that concern data release and processing—upon private data, models are created, and those models, in turn, produce algorithmic decisions. Here there are three steps. The first concerns data release. Current privacy regulations (including the “end-user license agreement”) do not provide sufficient protection to individuals. Hutton and Henderson introduce new approaches for obtaining sustained and meaningful consent (Chapter “Beyond the EULA: Improving Consent for Data Mining”). The second step concerns data models. Despite being generated from private data, algorithm-generated models are not personal data in the strict meaning of law. To extend privacy protections to those emerging models, Giovanni Comandè proposes a new regulatory approach (Chapter “Regulating Algorithms’ Regulation? First Ethico-Legal Principles, Problems, and Opportunities of Algorithms”). Finally, the third step concerns algorithmic decisions. In Chapter “What Role Can a Watchdog Organization Play in Ensuring Algorithmic Accountability?”, AlgorithmWatch is presented. This is a watchdog and advocacy initiative that analyzes the effects of algorithmic decisions on human behavior and makes them more transparent and understandable.

There is huge potential for data mining in our society, but more transparency and accountability are needed. This book has introduced only a few of the encouraging initiatives that are beginning to emerge.

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