

In Practice

Authors Adriano Koshiyama, UCL; Emre Kazim, UCL and Charles Kerrigan, CMS

Towards algorithm auditing in financial services

We are witnessing a rapid development and adoption of algorithms. At the same time, we need to develop the monitoring and managing of their safety. In the algorithmic age companies are (and should be) increasingly concerned about potential harm that their systems can cause, both in terms of reputation and financially. Knight Capital's experience (~\$450m) caused by a glitch in its algorithmic trading system is a paradigmatic example. As such, in addition to societal, legislative and regulatory pressures, companies themselves are keen to assure their systems are trustworthy.¹

The success of the algorithmic age turns on the ability of users of algorithms to ensure trustworthiness – both ethically and, more concretely, legally. Current developments are a new phase of the broader “digital revolution”, what we call “Big Algo” (cf. Big Data). Repurposing Big Data's 5V's as first suggested in *Algorithms in Future Capital Markets*:²

- **Volume:** soon there will be “billions” of algorithms interacting with each other.
- **Velocity:** algorithms are increasingly making real-time, crucial decisions with minimal human intervention.
- **Variety:** algorithms will be ubiquitous, from autonomous vehicles to medical treatment, employment, and in all corporate systems.
- **Veracity:** the critical characteristics of algorithms such as reliability, legality, fairness, accuracy, must be assured before wide adoption.
- **Value:** business and government will launch a proliferation of new services as sources of customer support, revenue, cost-savings, etc.

Whereas the last decade's focus was on “data privacy”, our view is that this decade will be characterised by “algorithm conduct”.

With minimal intervention, there will be innumerable AI algorithms making decisions that were once handled directly by human intelligence. This presages not an incremental upgrade, but a “Cambrian explosion” of new use-cases that will reshape the capital markets; driven by:

- accessibility of vast amounts of (alternative) data;
- availability of “unlimited” (cloud) computing infrastructure; and
- technology maturity and open-access to the state-of-art in AI/ML algorithm libraries.

ALGORITHM AUDITING IN FINANCIAL SERVICES

As has been the case for decades with financial audit, governments, business and society will soon require algorithm audit: formal

assurance that algorithms are legal, ethical and safe. A novel industry of *Auditing and Assurance of Algorithms* will arise with the task of validating autonomous systems.

As set out in *Algorithm Auditing*,³ drawing from the burgeoning space of RegTech start-ups, the “algorithm audit” industry will play a critical role in shaping and driving innovation. Examples of applications where auditing will be used include:

- **credit scoring:** to monitor bias and discrimination against minority (and other protected) customers, and lack of transparency when using AI systems;
- **systematic trading:** to monitor the robustness and performance of the algorithms being used to create the trading signals, and execute the trading;
- **NLP (Natural Language Processing) and sentiment analysis:** to monitor that a system is fit for purpose, although in this case the algorithmic risks are low as long as there is enough “human-in-the-loop”.

KEY RISKS TO MONITOR

Risks associated with algorithmic systems can be framed in terms of the following:

- **Systematic risk:** here opacity (the “black-box”) can amplify systemic risk for a number of reasons:
 - **Intensifying volatility:** algorithms can react instantaneously to market conditions and during volatile markets may greatly widen their bid-ask spreads, or temporarily stop trading thereby diminishing liquidity.
 - **Flash crash:** increased algorithm and market integration means a meltdown in a major market or asset class often has a ripple effect across other markets.
 - **Uncertainty:** non-transparent algorithms can stoke investor uncertainty.
 - **Rogue algorithms:** due to speed and lack of transparency one errant or faulty algorithm can cause large losses in a very short period.
 - **Algorithm uniformity:** a lack of diversity in (trading) algorithms can reduce robustness in a market.
- **Automating reporting:** Regulators themselves are increasingly automating their monitoring and reporting. Here algorithms can be used to dramatically increase the efficiency and scoping of financial services. In order to maximise that benefit, computer-executable code – reflecting regulatory requirements – can be used. This can fully automate compliance and do so in real-time and within specific jurisdictions as set out in Financial Regulation of Fintech.⁴ This risk is associated with the trustworthiness of

Biog box

Adriano Koshiyama is a Research Fellow in Computer Science at UCL and Co-founder of Holistic AI, a start-up focused on providing assurance of AI systems.

Email: adriano.koshiyama.15@ucl.ac.uk

Emre Kazim is a Research Fellow Computer Science at UCL and Co-founder of Holistic AI.

Email: e.kazim@ucl.ac.uk

Charles Kerrigan is a Fintech partner at CMS London. Email: charles.kerrigan@cms-cmno.com

the systems (validation of code, ensuring code genuinely reflects regulation, processing vast amounts of reporting data, etc). There is likely to be significant assurance and auditing activity within this space in the next year or so.

- **Interpretability/explainability:** Within the computer science vernacular, concerns with “explainability” and “interpretability” (terms often used synonymously) has become a central risk of using AI systems. This engineering problem – in explaining how and why a system works/makes decision – bleeds into broader concerns of transparency and accountability. This is often referred to as “AI governance”. Systems of governance that are scalable and rational, which can be audited without extensive knowledge of cutting-edge engineering expertise, ie effective AI governance, are needed.
- **Compliance and regulation:** Algorithmic systems must be developed and deployed in a lawful manner. Within the context of AI the legislative framework has not been settled. Indeed, there is a continuing and vibrant discourse regarding whether new legalisation, regulation and standards are required, or whether existing regulation and standards can be appropriated, applied and if need be amended, or whether self-regulation is the most appropriate way forward. Another dimension is juridical, where national and international legislation and standards are concerned (this is particularly acute for multinational companies and operations). Within the context of financial services, national financial regulators will develop standards and collaborate closely with their peers.⁵

CONCLUSION

New technology begets new regulation and legal overview.

The adoption and increasing sophistication of algorithms that underlie the automation of financial services has given rise to a new industry with the task of certifying quality assurance, fitness for purpose and legality. This new industry is populated by computer scientists and lawyers working together. This collaboration will be a notable feature of lawyers’ roles in many tasks from now on. ■

- 1 As described in: *A High-Level Overview of AI Ethics*. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3609292
- 2 Koshiyama, A, Firooze, N, & Treleaven, P (2020). Available at SSRN: <https://ssrn.com/abstract=3527511>
- 3 Koshiyama, A, Kazim, E, & Treleaven, P (2021) (forthcoming).
- 4 Treleaven, P, (7 November 2015) *Journal of Financial Perspectives*, Vol. 3, No. 3, 2015, Available at SSRN: <https://ssrn.com/abstract=3084015>
- 5 See AI transparency in financial services – why, what who and when? <https://www.fca.org.uk/insight/ai-transparency-financial-services-why-what-who-and-when> (accessed 14 January 2021) FCA. Mueller, H, & Ostmann, F (2020).