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# COGNITIVE FINANCE PAPER™

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# Welcome to the Cognitive Finance Paper

Spring edition 2017

2017 has started with good news for Cognitive Finance Group. Our Partnership has grown to six Partners and we have substantially increased our Advisory Board.

We have also made substantial progress with our **CF Investments** practice. We have strengthened our investment management team and will launch our A.I. investments fund to a select investors.

Therefore, we will focus to serve our advisory clients and fund investors, reinforcing our deep sector knowledge across:

- **CF Advisory:** strategic A.I. advisory & implementation for financial services clients
- **CF Investments:** investment management specialised in A.I. technology

It is with great pleasure to announce two further additions to our Strategic Advisory Board: **Ryan Thomas** and **Steve Ardire**. Steve needs no introduction. He's highly regarded in the international A.I. community with a long list of successful exits attached to his name, and he is based in Shelton, Washington. Ryan is a former Google and U.S. Airforce and is based in Silicon Valley, California.

This issue of **Cognitive Finance Paper™** focuses on Insurance, Ethics and Boards.

**Francesco Corea**, our Partner and Head of Research, showcases a few companies, some of which are perhaps lesser known to the insurance sector. The ever growing importance of Ethics in A.I. is showcased by **Kay Firth-Butterfield**, our Partner AI Governance and by **Dr. Alison Lui**, Professor at the School of Law, Liverpool John Moores University, UK.

We believe that change stems from the top. The conversation on selecting and implementing A.I. to solve real problems requires Board level engagement. Our Managing Partner, **Clara Durodié** examines the typology of leadership on Boards as A.I. becomes a catalyst for change in financial services.

In the spirit of collaboration, we welcome constructive comments, ideas and topics which you might want us to cover. Let us know at [alex@cognitivefinance.ai](mailto:alex@cognitivefinance.ai)

Yours,

*Cognitive Finance Group*



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# Thought Leadership

## Boards and Artificial Intelligence: a strategic alliance



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Artificial Intelligence (A.I.) is a “*red hot*” topic for 2017 and beyond.

Financial services companies show clear signs of understanding that A.I. is not just a “red hot” topic. In general, their Boards of Directors are beginning to understand two main points about this technology:

**1 - A.I. in business.** The Boards understand that A.I. is a **strategic capability** which Boards need to **take seriously**. A.I. is creating deep **structural shifts in business models** as it permeates legacy structures and uncovers efficient ways to solve cumbersome and longstanding inefficiencies.

**2 - A.I. in Boards.** A.I. might solve one of the Boards’ most burning problems: to summarise the Board paper which for financial services Boards could be as much as 400 pages for each Board meeting.

I shall address these two points in two separate articles, the first published below, and the second to be published in the next edition of this Paper.

### A.I. in business: a strategic capability

Board members have had ample time over the past 24 months to **ask the right questions**, choose the **right advisers**, and to draft a strategic vision centred on A.I. By Q1 2017, intelligent boards already know that they must have an A.I. architecture strategy which has to

be implemented before their competitors. They have also signed off budgets for newly created Data Science teams. They know that **now** is time for action.

The past 24 months have been the catalyst for revealing three main types of Board and senior executives:

**1 - The Visionaries.** They understand A.I. and have the determination to lead their business through implementing it.

**2 - The Comfortables.** They understand A.I. but lack the desire to correctly prioritise the matter and are “a little bit preoccupied with other matters”, as one of them candidly described

**3 - The Unawares.** They don’t understand A.I. and don’t want to find out more, purely because “This. A.I. is just another fad. Our clients will always want to interact with people”.

### The Visionaries

This is a rare breed. They have already chosen their A.I. advisers carefully, those advisers are **not** necessarily the usual suspects. Visionary leaders can identify trends. They are driven to be ahead of their competition. They are intellectually curious and keep themselves informed well beyond the usual sources: The Financial Times and The Economist. They know where to direct their business to increase market share and profitability. They have written comprehensive Board papers on A.I. in business, and have actively pushed them to approval. They constructively challenge their

fellow Board members. Like other leaders, their diaries are exceptionally busy. Unlike other leaders, **they make the time** to inform themselves. They are in a relentless quest to find a new technology angle to to preserve their market share and serve their clients better.

They also know that choosing their **advisers** is the key to a successful A.I. architecture implementation. They know that A.I. is a vast and complex field, which can **only** be navigated safely with the help of advisers who have an indisputable **pedigree** in A.I. That pedigree is a measure of the advisers' depth and breadth of A.I. knowledge, their sole focus on A.I. and, critically, of **their ability to implement the A.I. solutions which they recommended**. An indisputable and unique pedigree **is not** a well-known 'big-four consultants' which advises with almost every financial services company there is.

The Visionaries know that Boards that use a big four consultant for their A.I. strategic adviser, will receive the same advice which everyone else receives and most likely liaising with junior staff rather than Partner level. There is no intrinsic and strategic value to appointing advisers which everyone else uses! More importantly, the 'big-four consultants' do not focus on A.I. and the lack of A.I. specialism is evident in their work.

**“Investing in the wrong A.I. system is another way to destroy value in a business”**

Finally, the Visionaries know that there is a limited window for A.I. adoption from which a strategic advantage can be leveraged. They are unstoppable. They live to reshape their business in a technology fit enterprise, ready to take market share from their competitors. They have already deployed A.I. in their enterprise with



“Okay, now give me ‘disruptive.’”

great success and have proven that this is an essential technology.

### The Comfortables

You can find them as a minority in almost every Board. They sit somewhere between the Visionaries and the Ignorants. They understand that the A.I. narrative is not going to disappear. They usually exist in businesses which have recently started to understand that **A.I. is a need** not a want. In some cases, they are leaders of services businesses which have, for long time, benefited from (1) labour arbitrage, namely charging UK fees for services provided by a workforce usually domiciled in India or more recently Poland and (2) client captivity, meaning that they have made it so expensive and cumbersome for their clients to change service providers that clients choose to stay put over moving.

The Comfortables have a vague understanding that A.I. has been redefining market forces which determines who stays in business and who ‘goes away’. They usually partner with lone voices inside their company who have the strength of character and vision to say that “if we don’t employ A.I. we’ll lose our jobs”. Despite all of this, the Comfortables lack the focus and grit to pursue an A.I. strategy. They

find superficial excuses like “we are a little bit preoccupied with other things right now”.

In some cases, this often transpires because they lack **proper advice**. They go ahead with whatever A.I. solution comes their way because everyone is talking about, endeavouring to be an early embracer of A.I. technology, they simply set themselves up for “*told you so, it doesn't work*” and “*stop chasing those shiny things*”. A.I. systems are not created equal, and pouring resources into the wrong A.I. system is another way to destroy value in a business and damage one's reputation and standing.

### The Unawares

They are seen less and less. However, they are prevalent in sectors like wealth management / private banking where the main belief is that their business models will continue to exist just because their clients prefer to engage face to face.

## “Why rock the boat now? ”

The Unawares are defensive and dismissive. They dismiss any conversation around the topic of A.I. They are not curious about what A.I. is and what this technology can do to grow their business. They actively dismiss any information on A.I. provided to them. You'd see them leave events right **before** the applications of A.I. in wealth management section. Nothing, absolutely nothing, could convince them otherwise. However, deep down they are aware that this technology is shaking up the status-quo. But they also know that they'll retire in a few years' time or they'll move jobs, so why rock the boat now? This is a **cause of significant concern**, because the well-being of a business should be an ongoing concern which is more important than one person's retirement or place of work. Executives should be genuinely and actively concerned in equal measure with

preserving shareholders' value as well as protecting their employees and their clients. When the Unawares win the argument, it's a Pyrrhic victory.

### All change

Financial Services as a business space is unforgiving. The market forces which have been taught in business schools are changing shape and scope. The large management consultancies have been rushing to develop new frameworks, new names and have published new insightful strategy papers. Boards may read them all, but they are left with a massive challenge ahead: **how do we make it happen?**

There are numerous examples of successful companies which lacked the leadership when they needed it the most: when market forces have changed and when only visionary leaders were able to steer their business away from an inevitable crash.

Unsurprisingly, Goldman Sachs and Blackrock have been amongst the first to advance A.I. solutions within business processes. It is unsurprising that Boards of large organisations benefit from the headspace needed to evaluate their business strategies in the context of transformational A.I. developments. Upon close inspection of their Board composition, it becomes clear that ‘Visionaries’ always form the largest majority.

### A.I. is a business need

In 2017, 50% of organisations are planning to use machine learning (a subset of artificial intelligence technologies) to better understand customers while 48% percent are planning to use machine learning to gain a greater competitive advantage.

Top future uses of machine learning include:

- automated agents/bots (42%),
- predictive planning (41%),

- sales & marketing targeting (37%), and
- smart assistants (37%).

375 qualified respondents participated in the study<sup>1</sup>, representing a variety of industries, with the majority being from technology-related organisations (43%), business services (13%) and financial services (10%). Many

## “It is good Board governance to implement A.I.”

organisations spend years amassing customer data. By the time this data is entered into CRM solutions, it's often already outdated and almost useless. This is why salespeople often ignore customer information their company provides to them.

A.I. changes this by using both up-to-date internal and external sources – including cloud, social, mobile and Internet of Things (IoT) – to arrive at meaningful and actionable recommendations. Soon, marketers will use A.I. to augment their intelligence about stakeholders for every campaign they run, helping them develop precise and relevant messaging to the right customers, in the right places based upon their current needs, desires and sentiments.

The Boards and business leaders who understand the implications of A.I. will use it to reinvent how they interact with customers at every point of contact, including sales, marketing and customer service and to identify efficiencies in middle and back office as well as investment management functions. These executives understand their role as leaders.

## Choose your advisers carefully

The visionary leaders understand that A.I. is a strategic alliance which will help define and achieve business profitably for decades to come. These are the people who have the power to make a business flourish.

These executives are our clients at Cognitive Finance Group. Our Advisory practice was established to **assist with scoping, selecting and implementing the right A.I.** solutions for sustainable growth and competitive advantage.

Our **sole specialism** in A.I. for financial services is helping our clients to inform their own thinking at the scoping stage (what is A.I. and how it will help my business?) all the way to the implementation stage (can you build a prototype and then roll it out?). We cover a dynamic and ever expanding ecosystem of about **14,000 A.I. and robotics companies**.

We make recommendations based on technical merit alone. We don't take any incentivised commissions from the A.I. vendors, thereby preserving our objective assessment of A.I. systems. Our independent recommendation is guaranteed.

Stay tuned for our next **Cognitive Finance Paper**, where I'll discuss various A.I. systems which can assist Boards in streamlining their paperwork using document summarisation A.I. technology to enable a more efficient decision making and reduce the time devoted to Board papers.

*Clara Durodié is a business technologist specialised in artificial intelligence (A.I.) with Board experience having served in leadership roles in asset & wealth management in the UK, Switzerland and Luxembourg. Clara is the Managing Partner of Cognitive Finance Group, an advisory and investment company specialised in applied artificial intelligence, working with CEOs and Boards of Directors on means of capitalising on business growth using A.I.*

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<sup>1</sup> These and many other insights are from a recent survey completed by MIT Technology Review Custom and Google Cloud, Machine Learning: The New Proving Ground for Competitive Advantage.



# Industry Insight: Insurance

## Artificial Intelligence in insurance



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Artificial Intelligence (AI) is revolutionising every industry, and insurance will be affected as well.

AI today is perceived in three different ways: it is something that might answer all your questions, with an increasing degree of accuracy (“the Oracle”); it could do anything it is commanded to do (“the Genie”), or it might act autonomously to pursue a certain long-term goal (“the Sovereign”).

An artificial engine can also be classified in three ways: a narrow AI, which is nothing more than a specific domain application or task that gets better by ingesting further data and “learns” how to reduce the output error. An example here is DeepBlue for the chess game, but more generally this group includes all the functional technologies that serve a specific purpose. These systems are usually quite controllable because limited to specific tasks.

When a program is instead not programmed for completing a specific task, but it could eventually learn from an application and apply the same bucket of knowledge to different environments, we face an Artificial General Intelligence (AGI). This is not technology-as-a-service as in the narrow case, but rather technology-as-a-product. The best example for this subgroup is Google DeepMind, although it is not a real AGI in all respects.

The final stage is instead called Superintelligent AI (ASI): this intelligence exceeds largely the

human one, and it is able of scientific and creative thinking; it is characterised by general common wisdom; it has social skills and maybe an emotional intelligence.

Regardless of the current stage of AI development, **the insurance industry will be disrupted from several perspectives: first** of all, every process which is done manually today will be automatised in a smart way (e.g., claims processing and management) to reduce costs and improve the UX. This would turn into a better fraud detection as well as more efficient loss prevention. The **second** block is obviously telematics and Internet of Things applications because innovative devices collect new data that can widen the horizon of insurable risks as well as refine the customised pricing. More generally, underwritings and more granular pricing will be better defined using machine learning techniques that spot out unknown meaningful correlations.

Finally, customer acquisition and experience in a sector which is historically reserved for human agents will become completely digital: chatbots, more effective customer classification and targeting, and personalised contents and policies are the main immediate benefits from investments in AI technologies.

Historically, insurance is sold, not bought. But AI is coming, and it will undermine this principle. Is the insurance industry ready for such a change?

# Industry Insights: Insurance

## What you are too afraid to ask about A.I. in insurance



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### I. A bit of background

The insurance sector is one of the most old-fashioned and resistant-to-change space, and this is why AI will have a greater impact on that with respect to more receptive industries. The collection of data of new types (i.e., unstructured data such as reports, images, contracts, etc.) and the use of new algorithms are disrupting the sector in several ways.

Traditionally, an insurance company followed this type of process:

- Identifying pool of customers whom might be risk-assessed;
- Targeting those customers and assessing the risk for each class;
- Selling differently priced policies spreading the risks over the pool of customers;
- Try to retain those customers as long as possible offering lower price for longer contracts.

This is a really simplistic representation of the insurance business in the last fifty years, and I am aware that insurance experts might disagree with me in many different ways. There are a couple of further features to be pointed out: first of all, insurance has historically been *sold not bought*, which means that brokers and agents were essential to tracking new customers and to

even retain old ones. In addition, it is an industry which is by definition rich of data because they collected anything they could, but is also one of the less advanced because either many of those data are unstructured or semi-structured, or the model used are quite old and simple.

Most of those data were easy to obtain because they were required to correctly price the coverage, while additional complimentary data were provided only by good customers who had incentives in providing as much data as possible to get a cheaper policy. Of course, this works the other way for bad customers, and this is a perspective on the phenomenon of “*adverse selection*” (i.e., bad customers are going to ask an insurance because they feel they will need it).

The adverse selection issue is though only one of the intrinsic challenges of the sector: *strong regulation*, high level of *fraud* attempts, and *complexity* are other features any incumbents should take care of. It is interesting to notice though that some of those are also specific barriers to entry for startups: they might attract indeed people who normally can get affordable insurance with a bigger competitor (adverse selection) and they usually have the capabilities for breaking down the risk complexity but not to support the funding need for risk coverages (so they need to work with incumbents rather than trying to replace them).



In spite of those problems, in the last decade, we noticed a new trend emerging. Insurances, in the effort of trying to reduce *moral hazard* problems, they started offering *premium discounts to their final customers in order to get extra information*. This occurred either through a questionnaire (asking **directly** the customer for further data in exchange for a lower price) or **indirectly** through devices (healthy devices, black boxes, etc.). The real issue though has been the engagement side of this proposal, because of the opposite nature of information, rewards, and human nature. The rewards offered were indeed either temporary or provided only once and people got lazy very quickly, while the information stream needed to be constant.

## “People didn't have the motivation to track down their improvements”

The following step has been the introduction of apps to let customers monitor by themselves their own data and behavior, sometimes even given away for free the device itself. Leaving the customer with full power on his

data had though an inverse effect, because people did not have the motivation in tracking down their improvements, and they got upset at the same time because they felt they were not getting the most out of that opportunity.

Regardless of the specific innovative way in which insurers engaged customers, the process used in the insurance business did not change much in the past century. *Expert systems* and *knowledge engineering* dominated the sector setting the rules to be followed in internal workflows, but this is slowly changing with intelligent automation systems. We are actually migrating from rule-based decision systems to statistical learning and eventually machine learning

## II. So how can AI help the insurance industry?

AI is helping (or disrupting, depending on how you see the matter) the sector in different ways. First of all, it can help *increasing the customer engagement and retention* problem which has been just mentioned. The abundance of data can be used indeed to refine the customers' segmentation and provide personalised offers based on personal features. It also helps in *reducing the costs* through smart automatisisation or RPA (robotic process automation).

Second, AI is making people *more aware of the risks as well as habits*, and it is driving them toward better behaviours.

Furthermore, the better pricing and risk assessment that AI is introducing analysing more granular data will make some people *uninsurable* (i.e. too risky to be fairly priced and covered) as well as to turn back some previously uninsurable people into insurable customers again. The governments or central regulatory agencies should then start thinking about a “*pricing/risk threshold*” in which they intervene subsidising the cost of relevant insurances (e.g., basic health coverage) in order to “*guarantee the uninsurables*”.

Finally, it might be useful to think in terms of what an insurable risk is in order to see how AI can help with that.

According to Jin Park (Assistant Professor at IWU), an insurable risk is identifiable through the following five conditions:

- Large number of similar exposure units (mutuality);
- Accidental and unintentional loss (not predictable and independent from the insured customers);
- Determinable and measurable loss;

- Calculable chance of (not catastrophic/systemic) loss;
- Economically feasible premium.

AI is going to affect all those features: with a better and more detailed customer profiling, we won't need indeed to have such a large base of insured units. It will turn some frequent events into accidental (e.g., affecting drivers' behaviour it will reduce the basic accidents into rare events) and it will improve our ability to forecast and compute both the probability and magnitude potential losses even in those cases too hard to be managed before. All the previous improvements will make many more premium under budgets, and therefore the conclusion is that AI will "lower" the threshold of what we consider nowadays an insurable risk, and it will make then more risks insurable.

### III. Who are the sector innovators?

There are plenty of startups out there working at the intersection of AI and insurance, and it is essential to look at least at some of them to understand the future direction of the industry, as well as the kind of improvements AI is having in the insurtech space. An interesting thing to notice is that most of the innovation is happening in the UK rather than other countries, in all the segments proposed below.

**Claim processing:** [Shift Technology](#) skims the valid claims from the ones that deserve further validations; [Tractable](#) instead is trying to automatise experts task for insurances; [ControlExpert](#) has a specific focus on car claims; [Cognotekt](#) optimises internal business processes, as well as [Snapsheet](#) does; [Motionscloud](#) offers instead mobile claim management solutions; and finally [RightIndem](#) aims to help insurers to deliver on-premise smoothing the claiming flow.

**Virtual Agents & Chatbots:** [Spixii](#) is an automated insurance agent who helps you buying any insurance coverage you might want; [Cognicor](#) is a virtual assistant that offers customer care services; [Conversica](#) identifies which leads intend to purchase, while [Your.MD](#) is a personal health assistant that analyses symptoms and produces pieces of advice. [MedWhat](#) instead uses EMR (medical records) to assist the patient as it was a virtual doctor, and [Babylon](#) gives medical advice taking care of tight budget constraints. [Insurify](#) is another personal insurance agent who works as a comparator for car insurances.

What today is called simply chatbot is going to be renamed in a few years **robo-insurer**. There are already few examples of companies toward that goal: [Risk Genius](#) is indeed an intelligent comparator which identifies gaps in coverage for the customer and [PolicyGenius](#) looks for the best solution that fits customer's needs and characteristics, while [Drive Spotter](#) implements real-time video analytics to keep drivers safe(r). More generally, robo-insurers will be a quite wide class of agents who will end up providing different services, all of them with the final goal of helping the clients to undertake risk-mitigating actions and only cover the real (residual) risks.

**Customers engagement:** [Oscar](#) is probably the most successful insurtech company out there, with the final goal of making insurance simple and accessible to everyone through a great UX. Similar to Oscar is somehow [Stride Health](#), while [Brolly](#) is a tool that helps customers in understanding their own needs and facilitates in one place all the insurance coverages in place, in a similar fashion to [Knip](#). [Adtelligence](#) instead creates personalised offers and relevant products based on customer's characteristics. [Captricity](#) uses machine learning to convert handwritten files into structured data, and this can be used to better understand the

final customer. Finally, [ValChoice](#) ranks the service of insurers to the benefit of the client.

**Telematics:** connected cars and telematics is a pretty big area itself (see [CBinsights article](#) to know more about it), but it would be worthy to point out the work that [Greenroad](#), [Vnomics](#), and [Telogis](#) are doing in capturing driving behaviors and habits as well as computing fuel efficiency. [Cambridge Mobile Telematics](#) works similarly, although it uses smartphone data and mobile devices habits. [Navdy](#) is trying to revolutionizing the UI/UX within vehicles, displaying information in such a way that the driver does not get distracted. [Lytx](#) uses vision technology to provide real-time feedbacks to the driver.

**Underwriting:** AI can be (and actually is) used to spot out hidden correlations to granularly segment customers and risks in a more efficient way. Even though it might in theory possible to identify some algos that could perform better than others (see the work [Wipro did](#) for fraud detection), data always come first, at least for the next close future. Many companies operate in the space, as for instance [Carpe Data](#) that provides predictive algorithms and data products for property and casualty and life insurances through the analysis of public data (e.g., social media data). [Atidot](#) created a machine learning risk management platform, while [Tyche](#) uses unstructured data to optimise the underwriting and claims process. [Big Cloud Analytics](#) collects data from wearables and formulates health scores for a better risk assessment, while [Cape Analytics](#) uses computer vision techniques on geospatial data to improve the level of detail on current houses conditions. [Dreamquark](#) creates a more accurate representation of the medical datasets to be used for underwriting purposes by insurances, similarly to [FitSense](#) that offers also apps products. [Melody Health Insurance](#) provides also low-cost insurances, while [Uvamo](#) uses AI to assess the risk of policy applications. A more

accurate underwriting can even translate into covering events that are today quite risky (e.g., as [MeteoProtect](#) and [Praedicat](#), and are doing for weather risk management).

Finally, on a side, it is worthy to point out to pure technological enablers as [Instanda](#), which offers a management tool to the insurance providers to manage effectively and timely new products launched; [Insly](#), a cloud-based platform for insurance brokers; and finally, [SimpleInsurance](#) is instead an e-commerce provider for product insurances.

**P2P insurance:** [Lemonade](#), [Friendsurance](#), and [Guevara](#) are peer-to-peer insurance startups focusing respectively on property and casualty insurance the first two, and car insurance the latter one.

**Insurchain & Smart Contracts:** these are companies in the insurance sector that are driven by *blockchain technology*. [Elliptic](#) offers real-time AML for bitcoin specifically, while [Everledger](#) is a permanent immutable ledger for diamond certification. [Luther Systems](#) is instead a stealth-mode company working on the standardisation of smart contracts. [Dynamis](#) provides a P2P supplementary unemployment insurance product, while [Saldo.mx](#) provides micro-insurance policies on the blockchain. [SafeShare](#) covers multiple parties with insurance cover at short notice and for varying periods, and finally, [Teambrella](#) is another P2P insurance platform run on the blockchain.

**Insurance on-demand:** this class of startups put in customers' hand the entire insurance buying process. [Trov](#) is probably the best example of this new class of players and it allows to ensure things by simply taking a picture of them. [Cuvva](#) is quite similar but with a focus on

car insurance, [Sure](#) and [Airsurety](#) on travel policies, and [Back me up](#) is another example of on-demand insurance. But this class does not include only the proper on-demand business model, but also insurance startups which provide products that vary by location, time, use, or customer. In other words, pay-per-mile business model ([Metromile](#)), micro-insurance policies ([Neosurance](#)), or eventually Insurance-as-a-service models ([Digital Risks](#)).

#### IV. Concluding Thoughts

[Yan identifies four elements](#) which constitute the insurance profit structure: premium earned and the investment income from one hand, and underwriting cost and claim expenses from the

other. AI is and will be able to improve the cost structure, increasing at the same time the competitiveness and enlarging the customer base accessible to insurers, while optimizing internal processes and enhancing the transparency and robustness of the compliance flow.

The greatest challenge I still see in insurance is the *cultural mindset* which might prevent insurance to adopt early AI solutions, although this won't probably have a long life given the incredible pressure to innovate the insurance providers are undergoing through.

Please get in touch with us, should you wish to discuss any of these A.I. companies  
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# Thought Leadership

## Ethics and Artificial Intelligence: the new green



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Just three years ago few people were thinking about the wide scale impact of artificial intelligence on the world. Now, everyone is talking about artificial intelligence and the fact that businesses which do not espouse it will become the dinosaurs of our age.

However, along with this understanding of the importance of AI in our world has come the understanding that **AI is such a powerful tool that it can cause problems as well as solve them.**

Stephen Hawking and others said, in 2014, that AI may be our greatest invention or our last, and since then a plethora of organisations have grown up to help think about the way we can ensure that we use AI in the best possible way for humanity.

This is all the more important in a world where fake news can be made believable by creating the voice of a politician and putting that with an altered image of the politician so that she seamlessly appears to say words which she has never used. The impact of this utterly believable and hard to disprove news could be catastrophic.

A quick survey of the organisations involved in thinking about AI ethics shows that it is not limited to academic institutions but includes business, governments and inter-governmental agents; a non-exhaustive list includes the following:

- Centre for the Study of Existential Risk – University of Cambridge
- Future of Humanity Institute – University of Oxford
- Centre for the Future of Intelligence – Universities of Oxford, Cambridge, Berkley and Imperial College
- Machine Intelligence Research Institute – California
- Open AI Project – worldwide but based in US
- Campaign to Stop Killer Robots – worldwide but based in UK
- Campaign against Sex Robots - UK
- AI Partnership – members are Google, Deep Mind, IBM, Amazon, Apple, Facebook
- Singularity University - US
- UN AI Centre, The Hague
- Future of Life Institute, funded by Elon Musk MIT
- Foundation for Responsible Robotics - European
- Institute Electrical and Electronic Engineers - Global Initiative for Ethical Considerations in Artificial Intelligence and Autonomous Systems - worldwide

Together with various Centres and Consortia based at Universities such as Carnegie Mellon, Harvard, MIT and the University of Texas

Additionally, reports on AI and the impact of AI have been created by the US Obama Government, UK Government and the EU. Both



Japan and Korea have developed codes of ethics for their robots.

It is obvious that business cannot afford to ignore this wellspring of interest in AI and its impact upon future society. Articles from numerous research groups agree that automation will mean that about 50% of jobs in the USA will disappear within the next 8 years. None of those studies expect that the same number will be created; some of this will be because of AI. The impact will be felt in business, the way the economy works and our political institutions.

### Two pieces of work are of particular note

- (1) the IEEE Global Initiative for Ethical Considerations in Artificial Intelligence and Autonomous Systems and
- (2) the 23 Principles created at Asilomar by the attendees at a Future of Life Institute event in January 2017.

The IEEE Initiative has been working since December 2015 and by the time it created its Report in December 2016 had gathered expertise from over 100 experts from across the spectrum who are working on trying to create standards for the ethical design of AI or autonomous systems. It has 12 subject matter

committees all of which are working on various areas of the design of AI. Additionally, it has now created 10 ideas for IEEE standards which are in the pipeline process towards becoming a standard. The brief overview can be seen here and the whole report is open for responses until the middle of May 2017.

**The Asilomar meeting** brought together a similar number of experts working in this area for discussions about AI, the future economy, law, ethics and lethal autonomous weapons. During that time we created 23 Principles on which over 95% of attendees were agreed for the ethical design of AI. An overlap with the work of the IEEE is obvious and deliberate.

**Ethics is a very misunderstood word and tends to have negative connotations as 'impeding innovation' but, in fact, responsible innovation is to the benefit of everyone working in AI.** Good policy and governance of emerging technology helps acceptance, one only has to look at the debacle of the GMO story in the EU, for an example of what can go wrong if the public turns against a technology. Unless we espouse responsible development and use of this technology the short term negative effects could outweigh the benefits and may have profound effects on the institutions we hold dear.

*Kay is an international authority in law and ethics in AI. For the past three decades, Kay has worked as a barrister, mediator, arbitrator, professor and judge. In her previous role, as Chief officer of the Ethics Advisory Panel of Lucid.ai, she led ethical design, development and use of AI.*

*Kay is co-founder of the Consortium for Law and Policy of Artificial Intelligence and Robotics at the Robert E. Strauss Center, University of Texas and teaches a course at the UT Law School for the Consortium: "Artificial Intelligence and emerging technologies: Law and Policy".*

*Kay is also a Distinguished Scholar of the Robert E Strauss Centre at the University of Texas and Vice Chair of the IEEE Industry Connections "Global Initiative for Ethical Considerations in the Design of Autonomous Systems. Kay is a regular speaker and special policy adviser, with upcoming and previous work with the Max Planck Institute, The British Academy, EU Parliament, British Parliament, Royal Society, National Academies of Science and the White House.*



# Thought Leadership

## Removing class bias in algorithms?



**Dr Alison Lui**

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### Gender, race and algorithms

As a Chinese woman, the voice recognition software at my utility provider has never understood my surname. It always informs me that there is a problem after three repetitions of 'Lui'. My 'unusual' surname and/or my gender may have caused some difficulties.

Whilst this is not evidence of race or gender bias, Rachael Tatman's research of 2016 shows that Google's speech recognition contains gender bias. This is manifested by a more consistent performance by Google's speech recognition on male voices than female—a phenomenon commonly known as the 'white guy' syndrome in algorithms.

Scientists have realised that machine learning programmes can discriminate on the protected characteristics of race and gender. Men receive more high-paying Google search job advertisements than women. Predictive text in Google shows that the Chinese are 'rude', 'cruel' and 'horrible' when one types in the phrase 'Chinese are...'.

### Decisions and algorithms

Complex algorithms and the lack of transparency make lending decisions difficult to analyse. Rather than focusing on the opaque decision-making process by machines made in black boxes, three Google researchers, Hardt,

Price and Srebro analysed the decisions made by machines.

In 2016, they devised a test for discrimination by analysing the data going into a programme and the decisions made afterwards. Their approach is called 'Equality of Opportunity in Supervised Learning'. Using a case study, their methodology excluded two principles of discrimination, namely 'fairness through unawareness' and 'democratic parity'. By eliminating these principles, Hardt, Price and Srebro submit that people who can repay a loan should be given be granted one regardless of any sensitive attributes--the equal opportunity principle.

Hardt, Price and Srebro's research helps detect discriminatory processes. However, the use of black box predictors attracted criticism from Sharkey, an Emeritus Professor in robotics and artificial intelligence at the University of Sheffield. Sharkey argues that black box predictors are great for construction projects such as planning the best way to lay down an oil pipeline. When it comes to making decisions impacting on human lives however, he believes that black box predictors are unsuitable for lack of transparency. Srebro acknowledges that this can be a problem in some cases although he believes that black box predictors can be suitable when individual stakes are lower.

## Class and algorithms

In banking, I would argue that Hardt, Price and Srebo's methodology needs to be improved to include class bias. Black box predictors also need to be transparent to protect consumers. In the period before the most recent financial crisis, some customers signed contracts without fully understanding them because they felt that they did not have many options. This is mainly due to the problem of access to the financial market. Access to the financial market has not been equal in some cases as a result of higher prices charged to customers with lower salaries.

There is evidence in the UK that customers with lower salaries have to pay more for banking

very wealthy customers belong to the 'Mayfair' category, the middle category is called the 'mass affluent', and the bottom category is called the 'mass market'. The whistle-blower argues that this segregation was unfair for the following reasons.

First, the 'mass market' customers were most vulnerable and needed the most protection but they were offered the least advice. They had "five lines of advice when the wealthy people had twelve lines of advice". Secondly, staff advising the 'mass market' class had fewer qualifications, and customers' access to financial products was restricted.

The practical effect is that 'mass market'



services and products because of restricted access to credit due to lower credit scores. This 'poverty premium' phenomenon will be demonstrated in the account of a former employee and whistle-blower who worked for one of the big four banks in the UK.

## Putting customers first

The whistle-blower's main grievance is about the unfair sales segmentation policy. Consumer protection at his former employer is manifested by segregating customers into three classes:

customers were sold more expensive financial products compared to 'mass affluent' customers purchasing the same products. 'Mass affluent' sales advisors earned the most since they were well qualified and sold the most expensive commission products such as insurance bonds which generated a commission of 5-7%.

The segregation sales policy essentially discriminated against 'mass market' customers and ignored the principle of 'Putting Customers First' in the bank's Code of Conduct.

This incident highlights the issue of unequal access to information and credit due to class bias. The lack of timely information received by consumers is a key factor of information asymmetry.

In the financial sector, information problems facing consumers include complex products; financial illiteracy and opaque pricing.

However, these limitations are further aggravated when financial institutions do not disclose sufficient information to customers about complex financial products. Unless lenders explain financial products to customers in a simple manner, disclosure per se would not assist.

Hardt, Price and Srebo's research includes customers' incomes in their case study of predicting whether customers will default on loans. However, the consequential factors of restricted access to credit and information asymmetry due to lack of advice to poorer customers have to be considered as well.

Unless the banking culture changes, machine bias will remain.

### Treat customers fairly

The Financial Conduct Authority sets out in Principle 6 of PRIN 2.1 FCA Handbook that: 'A firm must pay due regard to the interests of its customers and treat them fairly'. This principle has to be taken seriously for the removal of class bias. After all, artificial intelligence reflects the values of its creators. Mathematical models in artificial intelligence can identify problems such as class bias.

Nevertheless, a multi-disciplinary approach in artificial intelligence is required to remove such issues. Legislation is often reactive and lags behind technology. It is also prone to the cycle of over-regulation, deregulation and re-regulation. As such, soft law, in the form of self-regulation by industry participants complement hard legislation. Banking and finance experts need to work with regulators to eliminate class bias.

*Dr Alison Lui is a Senior Lecturer at Liverpool John Moores University (LJMU). Dr. Lui obtained her LL.B (European Legal Studies) from the University of Bristol. She holds a LL.M (Corporate and Commercial Law) at the London School of Economics and a doctorate degree from the University of Liverpool. Dr. Lui qualified as a Solicitor and practised commercial law before joining LJMU. She teaches a number of business related modules on the LL.B, LL.M and LPC programmes.*

*Alison's research interests are predominantly in financial regulation, ethics and artificial intelligence in financial regulation and corporate governance. She has published articles and book chapters. Her monograph "Financial stability and prudential regulation: A comparison between the regulators and central banks of the United Kingdom, the United States, Canada, Australia and Germany" was published in September 2016 with Routledge. She has also appeared in radio programmes.*

*Alison has won a number of awards to date. These include a Winston Churchill Fellowship, a Max Planck Society Fellowship, an Academic Fellowship with the Honourable Society of the Inner Temple, London and a Fellowship with the Royal Society of Arts.*

## Companies we follow

### QuanTemplate

"let the A.I. lighten the rod of data management in insurance "

As we mentioned above, the insurance sector is historically data rich but it also suffers from many data management issues because the market is far less developed with respect to the wider financial services industry.

QuanTemplate was created with this goal in mind: building one complete user-friendly solution for high-performance data management through artificial intelligence and integrated analytics tools. In fact, it is a technology that enables business users to clean and harmonise raw data coming from different sources and allows insurance players to gain actionable insights.

The SaaS platform runs in the web browser and allows insurance and reinsurance firms to revolutionise their approach to analytics using a specifically designed interface for insurance and reinsurance players. The platform sits on top of existing systems (which lowers the adoption barriers) and the interface is highly customisable.

The platform is also ISAE 3402 certified for its security and even though standardly run on Amazon Web Services, it can be adapted to be internally managed or hosted on different cloud services.

Technically speaking, they use **X-Stitch** for data processing (a Scala backend platform to create in-memory SQL datasets) and **Mafic** for data presentation (also on tablets), and they were able to process up to **50 million rows of data in about 900 milliseconds**.



It is indeed an out-of-the-box product which requires no coding skills (it has *drag and drop* options) at all and that can handle multiple data sources (XLS, XML, TSV, CSV, JSON etc).

The use 'Crowdsourced learning' to feed the AI engine, which it is used to automate reporting (easing the burden of regulatory Solvency II compliance) and to reduce the cost and pain of constant manual mapping and re-keying. It also allows users to query across multiple datasets and integrate third-party feeds in one report, supporting also advanced insurance functions as well as incurred but not reported (IBNR) loss development modules.

They also have a standard process in place to start with their products:

- 1) **Consultation:** the first step is a meeting/series of meeting to identify the problems and show how the platform works and how it could solve those issues;
- 2) **Pilot:** They implement a 'fitness-for-purpose' pilot project, typically within a specific operational area of the business;
- 3) **Extension of Scope:** once the pilot is complete (and it was successful) they extend the use of the platform across business areas.

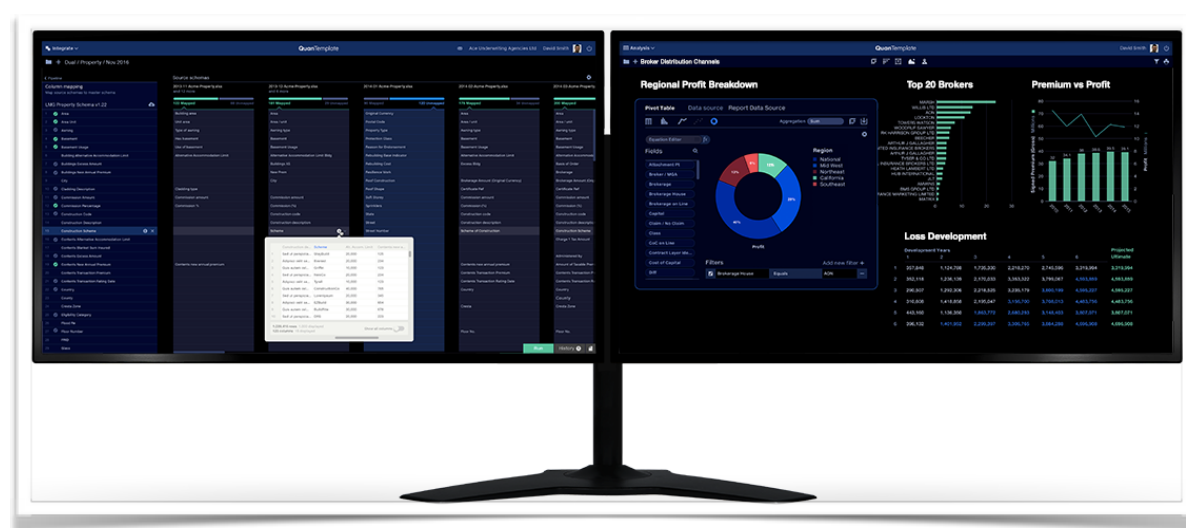
We met the team a lot of time ago and they are extremely knowledgeable, mixing an eye for details and love for UX with a strong quant machine learning modelling approach, and they own a deep experience in the insurance industry, which positions them really well to serve players which are in a profound transformative period.

They have been supported by smart investors up to date (mainly Techstars, Anthemis Group, Route 66 and Allianz Ventures) and they are growing organically both in terms of the team as well as revenues and fund raised. The major insurance players are nowadays using QuanTemplate solution and the company has also recently been named a European FinTech Top50 company and a Global InsurTech Top21.

Let's also be clear: QuanTemplate does not aim to replace insurers and to substitute them in any respect. Its goal is to work with insurers in order to finally reach a data democratisation scenario, where a culture of collaboration between fintech companies and incumbents can foster a central (standardized) data management.

We would also suggest having a look at their blog, they have a number of [interesting insights in there!](#)

NB: All the images are taken from QuanTemplate website <https://www.quantemplate.com>



## COGNITIVE FINANCE GROUP

is an advisory & investment company specialised in artificial intelligence (A.I.)

We are leading experts in artificial intelligence. We help CEOs, Chairmen and C-suite members with the long-range support they need in order to adopt artificial intelligence. We help executives unlock business growth and build powerful strategic A.I. capabilities.

### ADVISORY

#### FOR financial services firms

Cognitive Finance Advisory partners to deliver strategic change. We strive to be the trusted adviser to financial services' Boards and senior management for selecting and implementing A.I. systems in their businesses.

Our team draws on years of experience driving technology change in blue-chip financial institutions. We apply this depth of experience in delivering strategic programmes for the adoption of A.I.

We have deep knowledge of the A.I. systems vendors. *We remain impartial and will always recommend the most suitable A.I. system.*

In addition to the A.I. industry and regulatory knowledge, we leverage a network of smart and experienced consultants to help prepare for and implement A.I. in your organisation.

We deliver

1. short & focused strategic analysis of business problems, examining how A.I. can be used to address concrete issues faced by your organisation
2. structured programmes or work with your teams to design change programmes for the adoption of A.I.
3. implementation of A.I. focused programmes and projects

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### INVESTMENTS

#### FOR professional investors

Cognitive Finance Investments is an institutional grade investment platform focused on A.I. companies.

In order to access the next generation of business growth, we are currently developing a unique investment proposition to serve institutional investors

- pension funds
- university endowment funds
- charitable foundations
- family offices
- investment funds and trusts

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# COGNITIVE FINANCE GROUP

## PUBLIC SPEAKING ENGAGEMENTS and BOARDS in 2017, Q1

### FINANCIAL SERVICES

- “A.I. & customer engagement: what to do with it” invitation-only dinner, London, Jan 2017
- Pension Administration Forum, London, January 2017, an Incisive Media event
- Robo-Investing Conference, panel with Paolo Sironi, Francesco Brenna (IBM), Richard Peers (Microsoft), Blake Wood (Envestnet), Alois Pirker (Aite Group), London, February 2017
- Digital Transformation in Wealth & Asset management Summit, London, February 2017
- ITAS asset management annual conference, Neumunster, Luxembourg, February 2017
- A.I. in wealth management, invitation only roundtable, London, February 2017
- Use cases in insurance, invitation only private dinner, London, March 2017

### PUBLIC POLICY AND A.I. GOVERNANCE

- NAS/Royal Society panel with Vint Cerf, Greg Corrado, Peter Stone, Austin, TX, January 2017
- member Expert Advisory Board of the All Party Parliamentary Group on AI at UK Parliament, March 2017
- IEEE Global Initiative for Ethical Considerations in Artificial Intelligence, Austin, TX, March 2017
- “Artificial Intelligence” documentary Canadian Broadcasting Co. Radio March 2017
- Interview on AI with French National TV station France 24 March 2017

### DATA SCIENCE

#### Webinars on [Brighttalk.com](http://Brighttalk.com)

- **Panel Discussion - AI & Machine Learning in Cyber Security.** A live online panel discussion focused on the debate around AI and machine learning and how they can automate cyber security; catch more threats and malicious attacks and prove a useful weapon against cyber crime.
- **Data Science Apps: Beyond Notebooks with Apache Toree, Spark and Jupyter Gateway** Jupyter notebooks are transforming the way we look at computing, coding and problem solving. This webinar sketched how you could use Jupyter to create interactive and compelling data science web applications and provide new ways of data exploration and analysis.
- **AI in Finance: A.I. in regulatory compliance, risk management, and auditing** How A.I. identifies and prevents risks, above and beyond traditional methods. Techniques and analytics that protect customers and firms from cyber-attacks and fraud. Using AI to quickly and efficiently provide evidence for auditing requests. Learn how to use Machine learning and cognitive computing for:
  - Regulatory Compliance
  - Process and Financial Audit
  - Data Management

#### Public Talks

- **GLOBAL ARTIFICIAL INTELLIGENCE CONFERENCE, Santa Clara, CA, USA, January 2017** A.I. and in particular ML and DL can be very effectively applied to financial services. This presentation illustrated a number of use cases such as transaction fraud prevention and credit

authorisation using A.I. and machine learning techniques. Starting from there, the presentation will show how those problems can be solved with A.I. techniques with code snippets and live demos using Keras, Tensorflow and Scikit-Learn applied to some financial datasets. It will then describe how techniques such as deep learning, t-sne, dimensionality reduction can be used as the "data engines" for the next-gen financial applications both in retail and commercial banking.

- **PREDICTIVE BUSINESS ANALYTICS & DATA MANAGEMENT FORUM Milan, Italy Feb 2017**

How Cognitive Computing is emerging from Machine Learning Algorithms, Big Data Tools, and Cloud Services. Prescriptive analytics is the ultimate analytical step which goes beyond predictions into the realm of goal-oriented recommendations. As such, we could consider prescriptive analytics as a particular sort of cognitive computing. In 2017, how far are we from cognitive computing actually? Will Cognitive Computing emerge from Machine Learning Algorithms, Big Data Tools, and Cloud Services?

- **DATA DRIVEN INNOVATION, Open Summit, Rome, Italy, March 2017**

Data Science Apps: Beyond Notebooks

Jupyter notebooks are transforming the way we look at computing, coding and problem solving. But is this the only "data scientist experience" that this technology can provide? This talk will sketch how you could use Jupyter to create interactive and compelling data science web applications and provide new ways of data exploration and analysis. In the background, these apps are still powered by well understood and documented Jupyter notebooks.

## Tutorials

### SAFARI Book online

- Geolocated clustering and prediction services with scikit-learn (Oriole Online Tutorial)
- Geo-Located Data: Extracting Patterns from Mobile Data Using Scikit-Learn and Cassandra (an introduction to extracting patterns from geo-located data and building geo-located microservices)

## Software built

### github.com

- jupyterhub-ansible-deploy  
Provisioning a datalab with jupyterhub and data science libraries for Python, R, & Scala
- ansible-role-centos-jupyterhub  
Jupyterhub on CentOS 7, configurable spawner (sudo, docker), jupyter lab support