THE IMPACT
OF ARTIFICIAL INTELLIGENCE
ON THE (RE)INSURANCE SECTOR

SCOR

The Art & Science of Risk

CONTENTS

This publication follows the SCOR Annual Conference that was held in Paris on September 28 and 29, 2017

INTRODUCTION

LOOKING FORWARD: THE IMPACT OF ARTIFICIAL INTELLIGENCE

For the past few years, Artificial Intelligence (AI) has been rolled out with spectacular speed in an increasing number of areas, such as medicine, the auto industry, finance, manufacturing, agriculture and marketing. This expansion lies at the crossroads of three major technological developments: the emergence of big data, the normalization of the interconnection between humans and machines, and advances in machine learning (technology that enables machines to learn from experience). AI is progressively transforming the way in which the economy and society operate.

The insurance industry is concerned by these changes on two fronts. Firstly, new risks associated with AI must be assessed, quantified, insured and mitigated against. The increasing use of AI raises numerous risk questions. For example, in an accident caused by an autonomous vehicle, who is liable – the user, the manufacturer or the creator of the algorithm behind the technology? What would be the insurance consequences of an AI bug or AI cyber-attack? Or, how can the insurer manage the shift in its risk profile due to impact of AI on biometric, property, casualty, financial, operational and strategic risks? Secondly, how can the insurance industry leverage off the potential of AI? For example, how can it be used to improve competitiveness, improve customer experience, reduce risk exposures and improve profits through greater use of automation, efficiency, refined underwriting and segmented pricing?

With this in mind, SCOR is committed to incorporating new technology into its business and devoted a series of presentations and discussions to the topic of AI during its Annual Conference 2017.

This publication brings together all of these presentations and also includes a new, specially written article on the risk management implications and applications of AI. Denis Kessler, Chairman and CEO of SCOR, talks about the insurance industry against the backdrop of AI – what are the challenges involved in this historic turning point? Nicolas Miailhe, Co-founder and President of The Future Society at Harvard Kennedy School, gives a broad outline of AI, looking at what it can do, but also, beyond all the fantasy, what it cannot (yet?) do. Jennifer Coleman, Senior Risk Manager at SCOR, provides an analysis of the Risk Management applications and challenges of AI for (re)insurance companies. The round table moderated by Will Thorne, Innovation Leader for the Channel Syndicate, queries the changes underway in the sector: what is changing for insurance companies, and how can they best incorporate these new opportunities into their strategies? To conclude, Laurent Alexandre, CEO of DNA Vision, gives an impartial view of a development that is impacting society as a whole. In his view, what needs to change is not insurance, but insurers.

HOW ARTIFICIAL INTELLIGENCE WILL IMPACT THE (RE)INSURANCE INDUSTRY
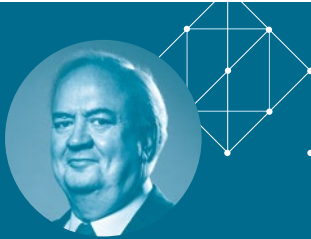
Denis Kessler, a French citizen, is a graduate of HEC business school (Ecole des Hautes Etudes Commerciales), holds a PhD in economics and advanced degrees in economics and social sciences, and is a Fellow of the French Institute of Actuaries.

He was Chairman of the Fédération Française des Sociétés d'Assurance (FFSA), Senior Executive Vice-President and member of the Executive Committee of the AXA Group and Executive Vice-President of MEDEF (Mouvement des Entreprises de France). He joined SCOR as Chairman and Chief Executive Officer on 4 November 2002. In January 2016, he was elected to join the Academy of Moral and Political Sciences of the Institut de France.

DENIS KESSLER
Chairman & CEO, SCOR

ARTIFICIAL INTELLIGENCE: A BURGEONING FIELD OF RESEARCH WHICH HAS TAKEN US INTO A NEW MACHINE AGE

New machines have arrived on the scene. The first machine age, known as the Industrial Revolution, resulted in the automation of physical labor. The machine age that we have now entered – the Digital Revolution – will further the automation of physical labor and drive the computerization of cognitive tasks through the rise of Artificial Intelligence (AI), i.e., "intelligence" exhibited by machines.

> **ARTIFICIAL INTELLIGENCE IS THE SCIENCE OF MAKING MACHINES DO THINGS THAT WOULD REQUIRE INTELLIGENCE IF DONE BY MEN**
>
> MARVIN MINSKY
> Leader in AI research in the 1950s

FROM FICTION TO REALITY

The concept of "intelligent" artificial beings is not new. Since the 19th century, history and literature have provided fantastical approaches to AI. The most striking example is Mary Shelley's creation of Frankenstein's monster two hundred years ago. The idea of this creature, incidentally,

In 1950, Alan Turing developed his famous AI test, which aims to measure the ability of a machine to exhibit behavior that is indistinguishable from that of a human.

The Turing test separates a human interrogator from two respondents – a computer and a human. If the interrogator is unable to tell who is responding, the machine is considered to be a successful AI tool.

came about during the gloom created by the 1815 volcanic eruption of Mount Tambora in Indonesia, which led to around three years of global climate upheaval, disrupting the rhythm of the seasons and disturbing temperatures and rainfall, causing famine, epidemics and social disorder.

The field of AI research was developed in the 1950s by pioneers such as Herbert Simon, Allen Newell, John McCarthy, Marvin Minsky and Arthur Samuel. All were optimistic about the future of AI, and had concluded that within twenty years, machines would be capable of accomplishing any human task. Minksy claimed that, "within the next generation, the problem of creating 'artificial intelligence' would substantially be solved." In hindsight, they failed to identify significant obstacles that lay on the path to achieving this goal.

In the years that followed, the field of AI went through several cycles, with periods of disappointment, criticism and funding cuts (called *AI winters*) alternating with brief periods of renewed interest.

THE COMEBACK

As we all bear witness today, the field of AI has made remarkable progress in the last 20 years, driven by a combination of factors:

◆ exponential growth in computing power and memory capacity;

◆ the development of cloud computing and distributed and parallel processing;

◆ the availability of large databases (to "train" algorithms);

◆ global connectivity of both humans and machines;

◆ and, last but not least, significant improvements in theoretical understanding.

Since the 1950s, the field of AI has evolved to cover an extensive range of concepts, including cognitive computing, natural language processing, robotics, image analytics, sensors and numerous areas of research.
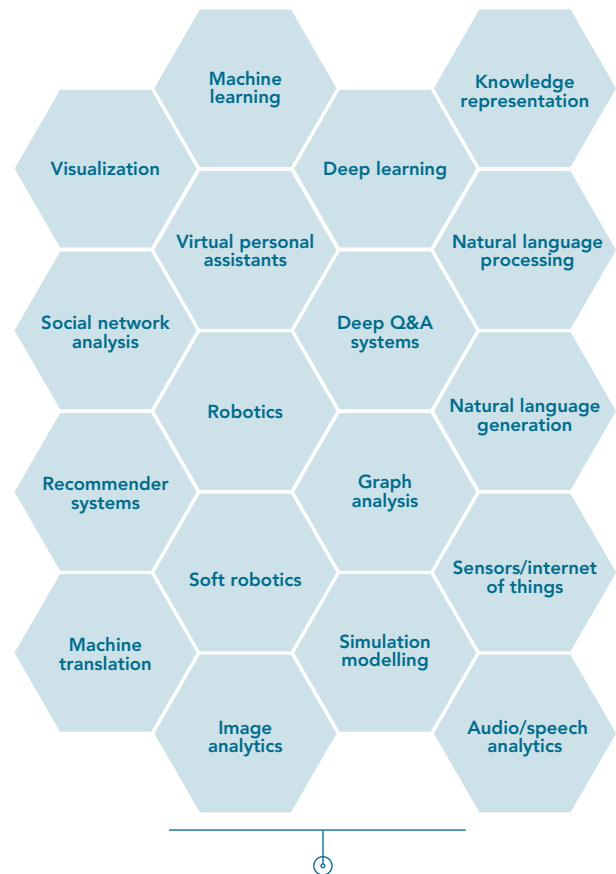

FIGURE 1: GLIMPSE OF THE MAIN RESEARCH FIELDS ENCOMPASSED BY AI
Source: PwC report "AI in Insurance: Hype or Reality?", March 2016

Machine learning, which can be defined as the science and engineering of making machines "learn", is at the heart of AI. These processes have already become ubiquitous in daily life, from search engines to virtual assistants and robo-advisors, and leave many to wonder where this burgeoning field of research could lead.

The AI revolution is a priority topic for decision makers, governments and private industries given the economic, geopolitical, social and business consequences it may have in the years to come.

WHY AI IS A GAME CHANGER FOR (RE)INSURANCE

The development of AI will have a threefold impact on the (re)insurance industry.

RETHINKING THE BASICS OF INSURANCE

Historically, the parties to an insurance contract – the insurer and the insured – have always had a different set of information. This is fundamental to understanding insurance economics, because asymmetry leads to strategic behaviors. The insurer will attempt to extract the maximum amount of data through questionnaires, observations and statistics, so as to infer how the insured will behave. The insured, for his or her part, may endeavor through strategic positioning to underestimate the risk, to maximize the value of the claim and to manipulate the price system to his or her advantage. As such, this information asymmetry leads directly to adverse selection and moral hazard, both of which are fundamental concepts in insurance economics.

Developments in AI and data collection stand to completely alter this asymmetry by bringing comprehensive and dynamic observability to the insurance transaction. Whereas information was previously incomplete, static, fragmentary and delayed, the new era of big data enables access to information that is comprehensive, accessible from multiple sources, ranked by quality and available on a real-time basis. Furthermore, the formerly high costs of obtaining information have been reduced to a minimal expense. Information is becoming a commodity, and AI will enable us to process all of it.

> By redefining the concepts that have always been part of the insurance industry, AI will constitute a quantum leap for the sector.

AI and data will take us into a world of ex-ante predictability and ex-post monitoring, which will change the way risks are observed, carried, realized and settled. This fundamental change will lead to profound changes to market balances and equilibriums in the (re)insurance sector, and will completely redefine the dynamics of the insurance market, on both the supply and the demand side.

Although (re)insurers might have an early advantage given that they have greater means and more tools and, for the time being, more data, AI will transform both sides of the insurance transaction in the long run. All parties to the insurance ecosystem, be they risk carriers, brokers, or even customers, will use AI tools. It is even likely that negotiations and discussions could take place between the AI systems of the different parties to the insurance contract! This might appear futuristic, but the idea of two AI systems dueling with each other and trying to "fool" each other already underpins generative adversarial networks (GAN) and the concept of adverse learning, which are used in research for video recognition and analysis.

REDEFINING THE DISTRIBUTION OF INSURANCE PRODUCTS AND SERVICES, STRONGLY ENHANCING EFFICIENCIES IN UNDERWRITING AND CLAIMS PROCESSING, REFINING OUR KNOWLEDGE AND MODELING OF RISKS, AND EVEN FOSTERING PRODUCT DEVELOPMENT AND INNOVATION

As AI stands to be integrated into nearly every part of the insurance ecosystem, from customer experience to product innovation, it will drive other significant changes for the (re)insurance industry, notably in the way that it delivers its products and services.

The main developments are summarized in the table.

In short, AI will enable the (re)insurance industry to both improve the customer experience and to enhance efficiencies in underwriting, claims processing, risk analysis and product development. Tasks that once took months to finish can be completed in a matter of minutes, opening the gate for insurers to reap sizable cost savings. Further, in enabling (re)insurance professionals to focus on value-added tasks and by alleviating administrative and process-related burdens, AI will augment (re)insurers' capabilities to analyze risk and design new products.

As a result, (re)insurers will know their customers and risks more thoroughly, price and underwrite more accurately, better identify fraudulent claims, and detect and monitor evolving risks. They will be able to tailor products and services to the exact needs of their customers, when and as those needs appear and evolve.

PROCESS AREAS	...THROUGH	WHAT'S IN THE PIPELINE?
Redefining the value proposition	Personnalized customer experience	Exploiting social data to predict customers' needs and behaviors, and personalizing interactions and tailoring offers
Redefining the distribution of products and services	Digital financial advice	Analyzing household balance sheets and income statements to recommend, monitor and alter financial goals and portfolios for customers
Enhancing efficiency in underwriting	Augmented and automated underwriting	Automating underwriting, whilst highlighting key considerations for human decision-makers
Enhancing efficiency in claims processing	Robo-claims analyzers and adjusters	Automating claims analysis, insight and settlement as well as fraud detection and complaint response
Improving product innovation	Emerging risks and trends detection systems	"Man Machine Learning" i.e. combining human creativity with automated analysis and synthesis of large volumes of data

TABLE 1: ENHANCING (RE)INSURANCE OPERATIONS THANKS TO AI

Main source: PwC report "AI in Insurance: Hyper or Reality?", March 2016

TRANSFORMING OUR RISK UNIVERSE

Through the creation of more rigorous and systematic detection systems for fraud, errors and risks, AI can solve many of today's challenges in the risk universe. However, to think that AI will eliminate risk entirely is a fallacy. Like all technological developments, it also creates new "intrinsic" risks, which could potentially be very significant.

As an example, if AI software were to be poorly programmed or if a bug were to be introduced, the resulting output could lead to the making of an extremely suboptimal decision. Cyber-risk – whether unintentional (e.g., program error or bug) or intentional (malicious cyber-attacks) – will become increasingly more significant as AI technology becomes widely adapted.
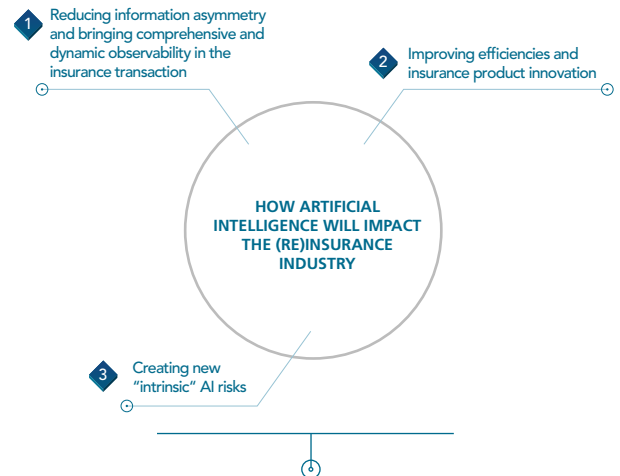

1 Reducing information asymmetry and bringing comprehensive and dynamic observability in the insurance transaction

2 Improving efficiencies and insurance product innovation

HOW ARTIFICIAL INTELLIGENCE WILL IMPACT THE (RE)INSURANCE INDUSTRY

3 Creating new "intrinsic" AI risks

FIGURE 1: THE IMPACT OF AI ON THE (RE)INSURANCE INDUSTRY WILL BE THREEFOLD

Source: SCOR

COPING WITH THE DISRUPTION CAUSED BY AI REQUIRES TIMELY ADAPTATION THROUGH INTEGRATION AND TRAINING

Provided that its integration is well-designed and correctly executed, AI will be an overall positive development for the (re)insurance industry. Most notably, it will contribute to bridging the protection gap, enhancing risk knowledge, offering a better and more granular match between risk and the price of risk, improving efficiencies, pushing the frontiers of insurability and fostering prevention and precaution.

Enjoying the full benefits of AI requires (re)insurers to embrace this new technology and to regard it as a remarkable opportunity – the openness to change should run deep within companies.

THE RELEVANT ATTITUDE FOR (RE)INSURERS IS TO INTEGRATE AI RAPIDLY

Potentially disruptive technologies should not be feared; they should be invested in and adopted. This means that the first step for (re)insurers is to fight the risk-adverse culture of the industry, which has not historically been viewed as an early adopter of new technologies. "Think big, start small": the transformation of the industry will follow an evolutionary path. Experimenting and (potentially) failing are part of the process.

(Re)insurers have to therefore embrace and incorporate the digital revolution rapidly within their processes and business models. They will have to invest individually, but collective investment in tools and technologies shared by market participants will also be necessary, because connectivity is

key. Standards must be set to ensure that the AI tools of the (re)insurance industry all speak a common language, which can only be driven by industry-wide projects. On this matter, SCOR is proud to be an active member of B3i, the Blockchain Insurance Industry Initiative, which lays the groundwork for platforms to develop AI tools.

Insurance, like any other economic sector, is an industry in which constant innovation and adaptation are necessary to maintain a competitive position. The more (re)insurers integrate AI, the less contestable they will be.

(RE)INSURANCE PROFESSIONALS WILL NEED TO LEARN TO COOPERATE AND COLLABORATE WITH AI

AI will inevitably affect the way (re)insurance professionals are recruited and trained, and how they perform their duties. Tomorrow is not about men or machines: it is about men and machines working together. Technology is an enabler.

To avoid the perception that AI is in direct competition with human capital, proximity between employees and AI must be established. Training should be put in place so that people understand the basics of the underlying technology and what happens inside the "black box". Therefore a shift – or, to be more precise, a complement – to the skillset of those who work in the sector will be necessary. Analytical skills will need to be supplemented by software development skills, and actuarial science by data and AI science.

WHERE SCIENCE ENDS AND ART BEGINS

The idea that virtually all human labor will eventually be replaced by low-cost, highly efficient AI has gained traction. I do not believe in this fantasy.

There are three distinctly human elements that are fundamental to value creation:

⬩ Judgment: integrating soft considerations on top of technical and analytical considerations;

⬩ Innovation, creativity and heuristics: imagining and designing new systems and modes of operation;

⬩ Accountability: being a decision-maker capable of explaining and sharing views, while also taking responsibility for actions and their consequences.

AI will not replace our usefulness; on the contrary, it will enable us to focus our thinking and efforts on value-added tasks.

We should never forget that risk management, which lies at the heart of our industry, is both a science and an art. Reinsurance is firstly based on science – the understanding and modeling of risk. But while analytical considerations are highly important, they only account for one part of the equation. The scientific aspect of our profession must always be complemented by an artistic or artisanal approach. Relationships that foster trust on both sides of the transaction take time to develop, and the experienced underwriter's ability to follow his instincts has not been – as of yet – put into an equation.

The combination of theoretical and analytical considerations on the one hand, and empirical and instinctive considerations on the other, make reinsurance one of the most fascinating industries. It is no coincidence that SCOR's tagline is "The Art and Science of Risk." You need both, because alchemy is as important as chemistry. From that perspective, I am convinced that the human touch that resides in our business is irreplaceable by AI.

Denis Kessler Chairman & CEO, SCOR

COMPETING IN THE AGE OF ARTIFICIAL INTELLIGENCE:
THE STATE-OF-THE-ART OF AI & INTERPRETATION OF COMPLEX DATA

Nicolas Miailhe, Co-founder and President of The Future Society[1] at Harvard Kennedy School, has highlighted key issues linked to the rise of AI and its capacity to disrupt the insurance sector. Artificial intelligence is a powerful tool that will help to improve risk profiling. However, this process in itself creates new risks.

NICOLAS MIAILHE
Co-founder and President of The Future Society at Harvard Kennedy School

THE COLLECTIVE IMAGINATION OF AI

The notion of AI has always been highly contested. In many ways, a collective imagination subsists and the field suffers from a sort of mystification. The general opinion concerning the rise of AI is that it will existentially transform our very nature as human beings. This debate stems from, and is often contaminated by, the lack of articulation between the existential and more menial, day-to-day, business-related questions concerning the impact of the rise of AI. Qualifying AI correctly helps to dispel the mystification that surrounds it.

WHAT IS ARTIFICIAL INTELLIGENCE ?

AI encompasses all intelligent "agents" (computer systems) that have the capacity to learn, adapt and successfully operate in dynamic and uncertain environments. They are mostly immaterial, or machines without motor functions. The field of AI lies at the intersection of three mega-trends: big data, cloud supercomputing and machine learning. Many scientists and engineers claim there is another convergence - between AI and neuroscience - by asserting that artificial neural networks emulate the brain.

Metaphorically, and in terms of certain concepts such as deep neural networks, we are borrowing from the brain. However, the convergence between the fields of statistics, information technology and neuroscience is largely overestimated.

Nevertheless, this convergence could potentially occur in the next ten to twenty years, through the development of knowledge about the brain and the deep bio-chemical processes that are involved in its make-up.

1. The Future Society, a think tank incubated at the Kennedy Harvard School of Government in Boston, specializes in impact issues in the governance of emerging technologies. Their goal is to open up the discussion on the rise of AI and other emerging technologies such as neurotechnologies and biotechnologies. Join the discussion at www.aicivicdebate.org (a global participatory debate on AI governance in 5 languages)

FIGURE 2: AI SITS AT THE INTERSECTION OF THREE MEGA-TRENDS

Source: Nicolas Miailhe

Once that knowledge and understanding have been acquired, they can be applied to AI. With this new convergence, a number of new questions will arise, such as automation, delegation of power and tensions between values.

THE KEY ROLE OF DEEP LEARNING

No neural network can exist without "Big Data", or huge, constantly growing stocks and flows of data, which must then be processed. This data is now available and can be processed by a growing computing force, scalable on the cloud. This has created a new opportunity; an old branch of computer science theorized in the 1950s, namely machine learning, is now capable of delivering value.

Many disciplines are involved in machine learning, but one stands out in the current revolution: deep machine learning. It relies on complex statistical models and algorithms with multiple layers of parallel processing that loosely model the way a biological brain works. These systems, which run on powerful computers (GPUs), are both self-learning and trained; we assign a goal to the machine and feed it with a huge amount of data. When deep learning neural networks were theorized in the fifties, they lacked the necessary computing technology and Big Data to support them, and started off with only three or four layers. This capacity has now been extended to hundreds of layers in one system.

THE MARCH TOWARDS ARTIFICIAL GENERAL INTELLIGENCE (AGI), OR "STRONG AI"

A boundary has been set between "weak" or "narrow" Artificial Intelligence (ANI) – the general and current standard for AI - and "strong" or "general" Artificial Intelligence (AGI), which is an AI that would replicate the entire range of lateral cognitive functions that human brains can deliver. The crossing of that line would result in a major revolution, with the potential to disrupt entire industries.

However, if the boundary between AGI and ANI is defined this way, the industry could be creating major blind spots. Current knowledge of the human brain is still incomplete, so the boundary has been built in relation to something that is as of yet not fully understood. Therefore, the current definition of AGI should be reexamined, reconstructed and consolidated in order to respond to the current dynamics of the rise of AI.
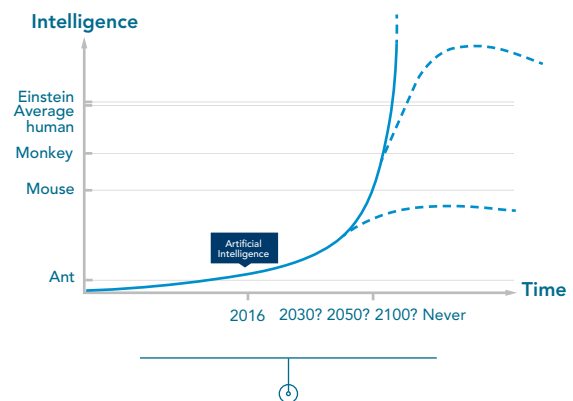

FIGURE 3: THE MARCH TOWARDS ARTIFICIAL GENERAL INTELLIGENCE

Source: Nicolas Miailhe

WILL THIS GLOBAL AI RACE BECOME THE 4TH INDUSTRIAL REVOLUTION?

Defense and security, techno-scientific advances, global strategy competition, competing national interests, the need for solutions for global emerging challenges and many more are both the cause and the accelerators of the growth of the AI market. It has accelerated in such a way that this market is gradually turning into a full-blown revolution whose disruption is so widespread that it could well be the next industrial revolution.

THE RISE OF AI

The development of AI has always been driven by a techno-scientific revolution propelled by Defense and Security. Its acceleration is due to the global strategy competition

of various national interests and the ensuing arms race which is increasingly taking place in the cyber world where we are witnessing a convergence between cyber-weapons and machine learning.

The most visible example of convergence took place during the "Cyber Grand Challenge" organized in the summer of 2016 by DARPA, the US Defense Advanced Research Projects Agency. Building upon a well-established tradition of grand challenges aimed at disrupting entire industries, the agency selected teams from the best universities in the country. During the competition, each team's Cyber Reasoning System (CRS) automatically identified software flaws, and scanned a purpose-built, air-gapped network to identify affected hosts.

When Facebook and Apple deployed their own strategies, their goals were to maximize their profit. The competition is bound to deliver productivity gains and therefore accelerate the development and deployment of AI tools. Because these tools learn through vast, growing stocks of data, they will ultimately respond to a law of concentration.

The rise of AI is also at the center of security issues, such as the war against terrorism. For example, IARPA, the Intelligence Advanced Research Projects Activity, is the equivalent of DARPA for the US intelligence community. When the CIA or NSA wants to harness the power of technology to find solutions to the main issues confronting it, they apply to IARPA. As an example, IARPA is currently leading the "Diva" program to fund the development of deep neural networks capable of delivering a search engine based on videos using image recognition technology. What is their objective? In certain cases, Jihadists train other extremists around the world by filming "how to" videos to teach each other how to build bombs. The video is then uploaded to a platform such as YouTube without being described or "tagged", and sent by other means to another people who will be able to retrieve the information and learn from it. Because these videos disseminate extremist propaganda, it is essential that they be located, despite the fact that they are not labeled as hateful or as having a terrorist content. Image recognition makes this possible and it is this type of project that IARPA is actively working on.

TOWARDS AN ASYMMETRIC GLOBAL OLIGOPOLY?

Although it remains a contested field, the AI market is growing. Some experts say that it will be worth 40 billion dollars by 2020, while others advance smaller figures. The general consensus remains that the market is on the brink of a revolution, which will be characterized by an asymmetric global oligopoly.

It is global for obvious reasons. The world is interconnected — everyday, we "import" AI from the U.S. to Europe each time we perform a web search or language translation, for instance. We can expect the same to happen with regard to China as Alibaba and Tencent start rolling out their solutions globally.

The market is qualified as oligopolistic because of the association between the scale effects and network effects which drive concentration. The value of Facebook depends on the network effect, or the fact that our personal network uses that particular social media. Combined with scale effects in relation to how data is needed to fuel AI algorithms, this explains why there cannot be multiple Facebooks.

If the differentiating factors, due to the rise of deep learning networks, turn out to be as powerful as they are expected to be, then a winner-takes-all paradigm can be anticipated, which in turn will accelerate the race. Today, two opposing global blocks, GAFA and BATX[2], have emerged from the two largest world markets: the U.S. and China. Smaller countries will find it very difficult to stand on their own, because they lack the critical mass market needed to generate substantial and sufficient flows of data. The right scale is probably continental, which is why the market is currently dominated by the US and China.

EMERGING GLOBAL CHALLENGES

While the global market strategy accelerates the AI race, emerging global challenges are bound to appear. Climate change is one of these, although it is still a disputed issue. If societies and governments are to place the fight against climate change at the core of their social model, technology and AI will be required to profile that risk and understand its dynamics, at both a macro and micro level.

There are two main ways of addressing climate change:

◆ Behavioral change: by adapting consumption behaviors in order to correct past and ongoing damage caused by climate change

◆ A techno-scientific revolution: history has shown that Humans are not collectively adept at adjusting their behavior, because of their need for comfort. The solution to this shared human weakness is to demand more from technology and more from AI. This seems to be almost an evolutionary trend.

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2. BAFA stands for Google, Apple, Facebook and Amazon, and BATX for Baidu, Alibaba, Tencent and Xiaomi, their Chinese counterparts.

SECURITY, PRIVACY, CONTROL… WHAT IS AT STAKE?

The rise of AI represents an important conundrum; the opportunities that it engineers are inextricably connected with its various risks and bring with them an era of tension. These tensions can often be traced back to the "black box" aspect of AI tools, meaning that their granular level of operation is not fully understood – even by those who design and run them - and their level of complexity is constantly increasing.

ACCESS TO SERVICES VS. PRIVACY, FAIRNESS AND DIGNITY

The asymmetric global oligopoly of the AI market poses a problem in itself because of its segmentation. On the one hand, global companies address global markets and consumers, not citizens. On the other hand, regulators operate on a national level and generally address the interests of national consumers or citizens. There is (as yet?) no international convention on privacy protection. The ability of nation states to coordinate and regulate the tensions that exist at the heart of the digital revolution – between access and privacy and between access and control, for example – does not exist at the present time.

Through the rise of algorithms capable of processing more and more data, meaningful access to services has been considerably developed: access to credit, insurance, justice, personalized medicine, etc. By profiling risk from high resolution data and extrapolating from it, the delivery price of services has indeed been lowered. But this lower cost of access contains a hidden cost - privacy. Because the development of AI is driven by global competition, the desire for productivity gains has created a form of legitimacy for the increasing extraction of data at a more granular level without striking the right balance with other elements. We need to work at aligning market and social incentives, which will not be easy.

For example, the cost of access to capital for farmers in India oscillates between 20% for micro-credits and over 500% for usury rates, which have been linked to high mass suicide rates. It is essential to give this population the possibility of lowering their cost of access to capital. Machine learning, by processing data carried through mobile phones, will create a number of situations in which insurers will able to offer micro-credit and micro-insurance products at very interesting rates and prices. But more often than not, this will mean that the insured must relinquish control, and at times, the ownership of data. The delivery of these new services will intrude heavily on privacy. Because there are slightly over a billion citizens with a critical need to access capital at a lower cost, the rules of political economics will heavily influence this trade-off between access and privacy, and this is very likely to extend to other markets since innovation is known to travel.

AUDITABILITY

In delivering the ability to profile risk more efficiently, new risks are being created. These are caused by delegating the risk-profiling process to computer systems that run software based on "black box" algorithms which are very difficult to explain in detail. We are thus moving towards an era of massive correlation and away from causation, in which performance in increasing on the whole, especially to the benefit of the majority. The issues of auditability, certification and tension between transparency and competitive dynamics are becoming apparent and will play a key role in facilitating or hindering the dissemination of AI systems.

This can be illustrated by the situation of US courts today. For example, it is estimated that several million citizens enter or leave jail every year and a correspondingly large number of cases must be heard by the judiciary. As a result, many of them have been outsourced to experts, which means that the question of criminal/recidivism risk profiling could be delegated to algorithms. Although this is not the current situation, these cases could potentially be processed in the near future by machines based on machine-learning algorithms.

When detainees are refused bail because of an algorithm's results, it is virtually impossible to appeal the decision or even to check how the risk concerned was determined by the algorithm. If questioned by a judge, the designer of the algorithm usually declines to explain the reasoning behind the results, on the grounds of trade secrecy. Because bail hearings are in the public domain, any explanation would become public knowledge, thus interfering with the designer's competitive advantage. Tension therefore subsists between the need for transparency and the right for companies to compete in order to deliver the best product and drive productivity gains.

ALGORITHMIC BIAS

In the case of machine learning or deep learning, bias can, on occasion, infiltrate algorithms. Software is not free of human influence. Algorithms are written by people, and machine-learning algorithms adjust what they do according to people's behavior. With image recognition, deep learning operates by educating an algorithm to discriminate between different types of faces, such as that of a man and a woman. This is accomplished by assembling a training data set with tens of millions of data. The data is then fed to the algorithm. As the neural network processes the data, it is able to "learn". The role of the engineer who assembles the training set is central, and the training set is paramount. More often than not, it is the way in which humans assemble training data sets that imports bias into an algorithm. When mismanaged or badly trained, algorithms can reinforce human prejudices. When applied to the judiciary system, for example, bias in algorithms could lead to racial profiling even though it was not intended by the engineers who collected the data or created the algorithm.

RISK MANAGEMENT IMPLICATIONS AND APPLICATIONS OF ARTIFICIAL INTELLIGENCE WITHIN THE (RE)INSURANCE INDUSTRY

Jennifer Coleman is an Irish citizen; she is a graduate of University College Dublin and is an Actuary. She joined SCOR in 2009 and currently works as a Senior Risk Manager within SCOR.

JENNIFER COLEMAN
Senior Risk Manager, SCOR

INTRODUCTION

The term Artificial Intelligence (AI) was first coined in 1956 by the scientist John McCarthy as "the science and engineering of making intelligent machines". Today AI is still the simulation of human intelligence in machines and includes processes such as learning, reasoning and self-correction. AI is used as an umbrella term for everything from process automation, to robotics and to machine learning, a form of AI where the machine is trained using past data, it can learn from this data and make predictions without having to be explicitly programmed. AI is being applied in all fields and sectors, examples include healthcare, agriculture, mining, manufacturing, transportation, education and financial services. AI has become a critical tool for business, particularly (re)insurance. It is helping to shape the Fourth Industrial Revolution which involves "new technologies that are fusing the physical, digital and biological worlds, impacting all disciplines, economies and industries, and even challenging ideas about what it means to be human[3]". AI is driving a lot of these new technologies and Bloomberg predicts that in the next few years AI could be a feature in all software.

AI is expected to change society. It could especially impact social and ethical risks. AI will create new behaviours, new ways of living and different interactions between people and machines. Human and AI interactions may prove a challenge in the short to medium term as new and evolving roles and responsibilities are established. AI will impact society in areas such as people's ability to find employment. Secondary effects of AI could be social unrest, for example if people believe AI has created greater inequality between the rich and poor.

For now, it is difficult to predict exactly how AI will impact the (re)insurance industry. AI may redefine the insurance basics, such as reducing information asymmetry between insurers and insured due to enhanced data and allowing better predictability and monitoring of risks. As a second order effect, AI will improve efficiencies and product innovation but also create new intrinsic AI risks.

In June 2017, consulting company Accenture published a paper on how AI boosts industry profits and innovation. In its report, it is noted that financial service companies' profits[4] could increase by 31% by 2035 due to AI technologies.

Most (re)insurance companies are not at a stage where they can harness the benefits of AI within their business models. To get to this point, many (re)insurers have embarked on ambitious projects to digitalise their business, improve

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3. Professor Klaus Schwab, Founder and Executive Chairman of the World Economic Forum, from his book *The Fourth Industrial Revolution*.

4. Accenture approximated profits by subtracting labour compensation from Gross Value Added (GVA). That gave the gross operating surplus (GOS) per industry (GOS describes the surplus generated by operating activities after the labour factor input has been subtracted).

their data management and partner with technology experts to leverage off advanced analysis tools and technologies. Currently AI in insurance is mainly used in the areas of claims management, risk selection, pricing, fraud detection and intelligent chatbots for customer advice. However, some (re)insurers are expanding into some transformative AI technologies to improve their operations and risk management.

This paper assesses the implications and applications of AI for risk management with a focus on the (re)insurance industry. The paper looks at how AI is changing the business model and risk landscape for (re)insurance along with how AI is impacting the modelling and management of risk by Chief Risk Officers (CROs), risk managers and supervisors.

AI AND THE NEW INSURANCE BUSINESS MODEL

In the past, insurance has mainly been an "after the fact" business model where (re)insurers pay the client after the event has happened and after providing some effort in risk prevention advice. AI is changing this "after the fact" characterisation. In the future (re)insurers could be helping its clients avoid some of the events altogether. The Internet of Things (IoT) and increased use of sensors means that massive amounts of data now exist. With the use of Big Data technologies such as MapReduce, these larger datasets can be better managed and interpreted. AI will improve the efficiency of insurance prevention activities. (Re)insurers with the use of AI technologies can help clients collect, analyse and make sense of their data to prevent accidents or illnesses. The insurance business model may evolve where (re)insurers could play a larger role in risk management advice and services instead of risk transfer, under this new role they could also be competing against risk management advisers from non-insurance backgrounds. (Re)insurers may have to reassess their underwriting based on how the nature of risks left to insure will have changed due to AI.

Technology in the insurance sector (InsurTech) is being used to create savings and efficiency in the insurance value chain. InsurTechs are using AI technologies to exploit areas such as claims processing, customer service and compliance. InsurTechs are also using new streams of data from internet-enabled devices to improve areas such as pricing and underwriting and offering ultra-customised policies. A well-known example of an InsurTech's successful use of AI is Lemonade, a New York based start-up launched in 2016. Lemonade uses AI in chatbots, cognitive automation and robotics to provide a streamlined, automated and quick insurance experience for its customers. A well-publicised achievement for the company was its ability to settle a claim in three seconds using its claims bot "AI Jim". AI Jim reviewed the claims details, checked the policy documentation, ran eighteen anti-fraud algorithms and then approved the claim. Not only was this a plus from a customer satisfaction standpoint but also from the insurer's perspective in terms of cost efficiency. InsurTechs are having a profound impact on the insurance market with their innovation and drive to improve customer experience.

Some (re)insurers are partnering with InsurTechs and tech start-ups as a quick and easy way to enhance technological capabilities. However, (re)insurers must be conscious of operational risk (e.g. outsourcing risks, data risks, legal risks) in terms of its third-party partnerships. Re(insurers) may also use InsurTechs as service providers or brokers, with (re)insurers providing the capacity.

AI is being used to improve customers' experience with insurance companies and make it easier for them to take out a policy (e.g. by using chatbot advisors). Customers are now also better informed about their insurance needs through the use of health sensor data, face mapping tools, AI enabled genetic predictors and AI personal assistants. All of this could lead to potentially reducing the insurance gap.

AI has also had an impact on corporate organisations in terms of employee collaboration, task automation and the creation of new data-related jobs. Companies can now use AI software to help them identify and select candidates for roles and to assess job satisfaction within their organisation. Companies are also creating more data related positions within their organisations so that they can better utilise their data and harness the opportunities provided by AI. However, AI is also a threat to employment. The Japanese insurer Fukoku Mutual Life hit international headlines in January 2017 when it announced that it would be replacing 34 employees with IBM's Watson AI system.

Insurance is built on the principal of pooling risks and (re)insurers ability to band together large groups of similar people or risks. At any given time, the (re)insurer will have to pay out on claims in that pool but should have enough money in the pool from the premium collected. However, AI and the use of big data breaks down this principal of pooled risks and cross-subsidisation especially for certain lines of business. (Re)insurers are now able to provide much more specific pricing and policies for clients' particular needs meaning that the need to pool broad groups disappears. In other words, people with safer risks pay less, people with higher risks pay more, and insurance could become a luxury affordable only for the very well off. Regulations or government may intervene to prevent such a shift in insurance practices and to ensure minimum insurance levels.

THE THREATS AND OPPORTUNITIES OF AI ON PARTICULAR RISKS

AI is changing the risk landscape for (re)insurers and will impact some of the life, property, casualty, strategic, financial and operational risks of (re)insurers.

LIFE RISKS

Much has been published on health and lifestyle sensory technologies that provide data on numerous indicators that can be analysed and interpreted into insurance need predictions. Consumers may be more self-aware of their health and what insurance they need. For example, consumers can access genetic predictive tools (such as face mapping mobile applications) which use machine learning AI technologies to predict potential future illnesses. The use of such applications greatly increases the anti-selection risk for (re)insurers especially where (re)insurers are prohibited from accessing genetic testing results for underwriting purposes. In some regions, (re)insurers are already increasing their pricing to reflect the cost of this increased anti-selection risk in the market.

However, on the flip side, the increased data available from lifestyle type sensors provides the opportunity for (re)insurers to better price risks. The IoT means that there is abundant medical data available to better price and underwrite risks. Deep learning technologies allow (re)insurers to better identify data connections and forecast results. (Re)insurers are also providing smart sensor services as part of their products with the aim of improving customers' health monitoring and encouraging a healthier lifestyle while at the same time, providing the (re)insurer with access to a larger data pool for health statistics. For example, Gen Re announced in October 2017 that it would be partnering with TrackActive a digital health management provider (incorporating AI technologies) to help deliver innovative solutions to its life and health clients.

These improved technologies are also changing the profile of biometric risks. Take for example the ageing Baby Boomers generation. Older people are now more able to live at home independently while being monitored remotely by a caregiver. (Re)insurers' future medical expenses, long term care and longevity profiles will change because of these smart sensor technologies improving older people's quality of lives, reducing hospital stays and costs and improving older age mortality rates.

PROPERTY RISKS

Autonomous machines such as self-driving cars, autonomous equipment for medical care, manufacturing, farming, mining, telematics and warfare may have profound implications for property insurance. As human error is the main cause of accidents, a wider use of autonomous machines might lead to a transition from loss frequency to severity, and property losses may accumulate in new ways. Defining and assigning liability will be more challenging for (re)insurers due to grey areas on who is liable when a technology fails and an accident occurs. As manufacturing becomes more technologically and intelligently advanced, challenges will arise on assessing liabilities, D&O covers and policy wording. For example, claims may be filed against not just manufacturers but also the companies providing their manufacturing technologies. (Re)insurers will also need to assess their risks in the medium and long term especially in the context of transition periods when human and autonomous machines coexist.

Autonomous machines also include lethal autonomous weapons (LAWs) and military drones which have potentially negative impacts for property lines of business in relation to terrorism risk, geopolitical risk and war risk.

However, autonomous machines will also provide many opportunities for (re)insurers in terms of improved risk management, especially in the context of risk prevention and disaster mitigation. Drone aerial intelligence ('Aerobotics') enables (re)insurers to assess geospatial information to improve the granularity of underwriting for farming crop insurance. Aerobotics also allow easy access to isolated and dangerous areas after man-made or natural disasters occur. After US hurricane Harvey (August – September 2017), two US insurance companies (Allstate and Farmers Insurance) launched drones to assess property insurance damage. Farmers Insurance noted that the drone technology allowed their claims adjusters to process three houses an hour as opposed to three houses a day.

In addition to drone technologies, AI-enabled image recognition APIs (application programme interfaces) are also helping insurers to speed up claims assessments. For example, a policyholder can now take a photo of their car after a crash and pass it onto the insurer to start the claims process and access any of the insurer's crash support services. Ageas UK Ltd is working on providing AI-enabled visual appraisals to its policyholders to speed up the claims process, reduce claims costs and improve the policyholder's claim experience.

CASUALTY RISKS

Multiple aspects of the workers' compensation insurance and related medical markets could dramatically change in the future due to AI technological advancements employed across underwriting and claims spectrums.

In underwriting, AI could directly influence risk selection and pricing accuracy in two regards. First with respect to deployment of AI monitoring tools, dynamically capable of proactive controls in dangerous or accident-prone environments (e.g., refineries, ateliers), and second through loss and pricing data processing improvements carriers use to define sub-market strategies and client targeting. With no clear vanguards, multiple insurance and new-market entrants are working to supplement underwriting's abilities to reduce losses, and more accurately price risks commensurate to more granular sub-profiles.

In claims, AI could materially change the nature of claims avoidance and processing. Today, carriers have already begun incentivizing employers to incorporate AI as worker wearables to monitor both macro-(workplace wide) and micro-(individual workspace) environments to alert of worker fatigue or machinery over-heating. With respect to processing, AI improvements could markedly improve medical services injured workers require and the subsequent coordination and steering of workers to the proper medical facilities and required scale.

As an example, in October 2017 Aon Benfield announced a partnership with Clara Analytics, a company providing AI tools to help employees get back into the workforce. These technologies would help ensure employees are quickly matched to the most appropriate treatments to help speed up their recovery times.

STRATEGIC RISK

AI technologies are impacting the strategic risk of (re)insurers in terms of the changing demand for insurance (e.g. increased insurance on demand), new distribution channels, alternative pricing and increased competition (e.g. from InsurTechs). A 2017 MIT Sloan Management Review survey of 3,000 business executives, managers and analysts from global organizations noted that almost 85% of those surveyed believe AI will provide their companies with a competitive advantage. These competitive and strategic advantages could include greater operational efficiency and improved insights from data. Yet, even though respondents acknowledge the strategic advantages of AI, less than 39% of respondents have an AI strategy in place. Within the (re)insurance industry the difference between the different AI strategies is striking. For example, the Chinese insurer Ping An Insurance (Group) Co invested over USD$1bn in technological research in 2017, with AI being the focus of this R&D. Many other (re)insurers' AI capabilities are only focusing on chatbots.

FINANCIAL RISKS

(Re)insurers' business activities include asset management and many companies have in-house investment managers. AI technologies may help in the liquidity and credit risk management of (re)insurers investment activities.

To date, investment managers have mainly used bid/offer spreads to calculate liquidity costs. Now information on transaction costs and volumes, how likely large fund flows are expected to be and how long it takes to liquidate such positions can be collected to help better understand potential liquidation costs in extreme events. Non-parametric neural networks can incorporate hundreds of factors to improve probability assessments of large flow redemptions. Asset managers are developing their machine learning capabilities to harness the benefits of AI in combining market risk and liquidity risk analysis to support fund managers' investment, risk management and regulatory duties (e.g. to meet the new Securities and Exchange Commission (SEC) risk management rules (Dec 2018)).

Deep learning techniques are being used in asset management to make better use of Big Data for quantitative trading techniques such as high frequency trading and algorithmic trading. Enhanced data analytics has improved the timing and cost of trading but does pose additional challenges such as the inability of deep learning to think over the long term and factor in external factors, e.g. central bank and competitor decisions. There is also the increased risk of a systemic crash as investors may all be using similar AI tools or because these AI tools could rapidly destabilise the market creating a liquidity crisis similar to the 2010 flash crash in the US market.

(Re)insurers could also use AI to better manager credit risk. AI is being successfully used in credit risk management by FinTech lenders such as Kabbage who use machine learning algorithms together with data from public online profiles and other data factors to rate small businesses online before lending them money. Machine learning enables companies to leverage off non-traditional data sources (e.g. social medial, news reports, ATM usage) to build more complete credit risk profiles of business and individuals. In addition to machine learning, credit risk management is being improved

by the use of cognitive technologies to process unstructured data in due diligence exercises more quickly, thoroughly and cost efficiently. Such technology could help a (re)insurer assessing credit risks as part of financial transactions with large amounts of underlying contracts, treaties and addenda to review. When a due diligence exercise is limited by budget, deadlines and resources, it might not be possible to review all documents. Instead only a sample may be tested meaning that a credit risk assessment may be incomplete or inaccurate. If AI technologies were used in the same due diligence, all materials could have been reviewed, mitigating the risk of missing something vital.

OPERATIONAL RISKS

AI can help (re)insurer in terms of operational risk management, not just by reducing operational risk with process automation, but by improving operational risk detection and prevention.

The benefits of AI to operational risk management have been widely documented in terms of streamlined processes and reduced human error. I.B.M. previously noted that approximately 61% of all telephone support calls fail due to human customer-support employees being unable to provide complete or correct information. AI can be used for fraud prevention, detecting money laundering, corruption and improved company compliance. For example, intelligent chatbots enable insurers to provide customer support and financial advice 24 hours a day 7 days a week and are not limited by normal working hours. Intelligent chatbots can be trained to cover all types of products, all types of financial advice and all possible questions which may not be achievable for human customer-support personnel.

However, not all operational enhancements from AI are positive. For example, (re)insurers need to assess its cyber risk in the context of new AI technologies. (Re)insurers may look at using AI to improve its cyber risk management but should acknowledge that the ability of AI to predict and prevent potential cyber-attacks is dependent on the training input data used and the ability of the machine to self-train from this data. With the ever-changing cyber threat landscape, it may be difficult to train AI applications unless the initial datasets capture a complete base set of threats. Cyber risk may also be increased by the fact that companies are becoming more reliant on technologies, meaning that the potential impact of a cyber-attack, could be even more destabilising.

Big Data and AI go hand in hand. AI enables (re)insurers to avail of data that might not otherwise be accessible and data allows AI technologies such as machine learning to be trained and taught. Data has become very valuable and in May 2017 The Economist noted that "the world's most valuable resource is no longer oil, but data". As noted above, the increased access to and analysis of data due to AI has improved the visibility and understanding of biometric, P&C, investment and operational risks of (re)insurers. However, there are data risk challenges arising from AI such as having insufficient access to data (the data is available but the (re)insurer does not legally have access to it), increased data regulatory risks (General Data Protection Regulation) and ambiguous data responsibilities due to increased outsourcing an AI's impact on the insurance value chain.

CHALLENGES AND OPPORTUNITIES OF AI IN RISK MODELLING

The risk manager is experiencing a shift in the way modelling is used. Most current models are based on thoroughly selected variables, using economic theories or statistical methods such as Principal Component Analysis. The use of AI in risk modelling is changing this. One of the most common applications of AI in modelling is the use of machine learning. Machine learning algorithms automatically select variables of interest for building predictive models, without a-priori on the variables to use. The two main classes of machine learning algorithms are:

◆ Supervised learning: The algorithm tries to predict a certain variable (the y) based on a set of existing variables (the observations $x_1, \ldots, x_n$). Algorithms such as decision trees, artificial neural networks or even linear regressions are different examples of supervised learning.

◆ Unsupervised learning: In that case, the algorithm does not predict a variable but tries to use observations in order to find the hidden structure in the data. Clustering algorithms are the main example of unsupervised learning.

Other classes exist such as reinforcement learning or transfer learning but they are far less used in (re)insurance.

OPPORTUNITIES

Traditional risk models have become increasingly incapable of processing the new vast amounts of data available. By using AI tools, (re)insurers can better clean and process their data and identify indicators for known and unknown risks.

This way AI can improve the output from risk models by providing additional layers of granular results and identifying additional predictive factors or dependencies that cannot be captured by traditional techniques (e.g. copulas).

AI can also be used to help in the model validation process. Model validation is typically a long and labour intensive process done once a year but with AI algorithms, model validation may be ran on a continuous basis throughout the year, at least for particular parts of the model. Machine learning algorithms could be thought to test repetitive parts of a model, freeing up time for risk managers and model validators to assess more complex model validation issues.

CHALLENGES

However, machine learning has several downsides. Like traditional models it is reliant on past data and is backward-looking: it is trained using past data to predict the future. Machine learning can accurately use past health data for diagnosing future health risks from CT scans. However, this may be less so for some emerging risks or financial risks that are less suited, in terms of modelling risks, to using past data. For example, the next global financial crisis may not arise from market conditions similar to what triggered the 2008 crisis. This paradigm entails that some types of events, the 'Black Swans' or the ones that have never occurred in the past, cannot be captured in the models.

Moreover, there is a dilemma between accuracy and interpretability in machine learning for a risk manager. A model cannot be performant and transparent at the same time. For example, a decision tree is very simple and transparent. Based on an observation, the tree asks several yes or no questions to decide whether the observation is in class A or in class B. But this type of algorithm fails when the datasets become too important. On the contrary, random forest, which is an algorithm made of a significant number of aggregated decision trees, is more robust but also seen as a "black box", for which the predictions are impossible to explain. The complexity and "black box" nature of some AI technologies is a real disadvantage when trying to communicate results of a model to the senior management, Boards, Supervisors and customers.

Also, in opposition to traditional algorithms which are easily interpreted, the risk of bias and injustice should also be considered. AI may incorporate human biases from the data they were trained with. A well-known extreme example of this is Microsoft's attempt at launching an AI chatbot on Twitter. Microsoft launched a Twitter account for "Tay" on the 23rd March 2016 and within 16 hours the Twitter account had to be shut down. Tay's tweets became racist, political and inflammatory. Twitter trolls trained Tay by tweeting it provocative comments causing the AI chatbot to learn and develop an offensive bias. This example highlights the risk of bias in data and how algorithms should be well validated and audited to avoid such problems.

In addition, AI could expose (re)insurers to systemic risks. There is a risk all (re)insurers rely on the same types of algorithms and the same streams of data for certain tasks. In such a case, there could be an accumulation of losses if all the algorithms have the same flaw. The Financial Stability Board (FSB) published a paper (November 2017) on AI and machine learning in financial services which discusses the potential financial stability implications of AI. The paper notes that new and unexpected forms of interconnectedness between financial markets and institutions could be created due to uses of data. Also, the use of partnerships for AI technologies could create third-party dependencies which could lead to new systemically important providers. Apart from AI, the increasing connectivity is another reason for the rise in systemic risk.

THE CRO AND RISK MANAGEMENT DEPARTMENT

AI will make risk management for (re)insurers easier. However, implementing it may not be as easy. Risk managers need to assess a wide range of AI companies offering different risk management solutions to see if they would be a suitable fit for their business. Implementing the AI may require significant investment and resources. In addition to this, risk managers will need to spend time educating themselves on their AI tools, integrating, testing and vetting the AI technologies, getting comfort with results and educating senior management, the Board and possibly regulatory supervisors on the AI technologies and models being used.

Risk models are being enhanced with complex AI algorithms allowing risk managers to get a better understanding of risks, allowing improved risk selection and pricing, risk mitigation and risk capital management. However, on the flip side, these technologies make it more difficult for risk managers to explain model outputs or to assess where or why something has gone wrong.

A significant benefit of AI in risk management is that it will free up the CRO's and risk manager's time by taking over more mundane and labour intensive tasks. Think of the amount of free time that could be created by using algorithms to automatically clean data, produce charts and intelligently document model results.

This would allow more time for risk managers to focus on risk analysis, enhance risk culture and improve risk management. Certain responsibilities may increase as risk managers will need to complement the AI technologies, such as:

⬥ Applying judgement and integrating gut instincts

⬥ Innovation - risk managers will have a greater capacity to imagine and design new tools given they are less limited by technological capabilities

⬥ Accountability - taking responsibility for actions and consequences based on the outputs from AI risk management technologies.

How will risk management departments look in the future? AI is a threat to the workforce with particular lower skilled jobs already identified as potentially redundant with AI. However, AI is expected to increase productivity, competitiveness and business opportunities. Demand is expected to increase for higher skilled workers who will complement AI technologies. Risk management departments will evolve to include broader skillsets such as science, technology, computing, engineering and advanced mathematics. Risk managers' roles in their current form may change but their contribution to (re)insurance will remain valuable. For example, future risk management departments will more than likely need data scientists who can combine and analyse data from a wide range of sources by harnessing the IoT, connected devices and smart sensors, etc.

Even if CROs and risk managers are not currently using AI, they are monitoring its development closely. The CRO Forum Emerging Risk Initiative's 2016 Risk Radar categorised AI as a medium risk that may have significant risk impacts within the next one to five years.

IMPACT OF AI ON COMPLIANCE AND REGULATIONS

AI is being applied in areas with existing governance regimes meaning that most new AI technologies are falling under pre-existing rules and regulations. For example, US bankers using AI as part of their models need to demonstrate to the Federal Reserve that they are complying with SR 11-7 Guidance on Model Risk Management. The Insurance Distribution Directive (IDD) assumes that most insurance is sold to policyholders based on advice from brokers meeting face to face with customers. With AI, the boundaries of IDD rules on treating customers fairly are being pushed with technologies like chatbot's advising on insurance products. Under IDD rules, are AI generated decisions fair to customers if they cannot be easily explained by the (re)insurers management to customers?

The new General Data Protection Regulation (GDPR) also brings about additional challenges for (re)insurers using AI for data analysis and data management. Many of the AI technologies available for (re)insurers have been developed in the US and abide by US data rules but may not be allowable under the new GDPR rules. One such practice, data scraping using machine learning algorithms is common in the US but would be difficult to translate to Europe within GDPR regulations.

From an (re)insurer's perspective, AI may be beneficial in meeting compliance requirements on sanctions and embargos. Cognitive computing and machine learning algorithms can review millions of historical 'Know Your Customer' (KYC) files and use this data to make a probabilistic judgment on a new policyholder or client being compliant. (Re)insurers can now run more accurate and efficient KYC checks and improve their monitoring against sanctions and embargo lists. These technologies can also be used for enhanced fraud detection and money laundering checks across numerous jurisdictions making regulatory compliance easier for (re)insurers. However, on the flip side, supervisors may not fully approve of (re)insurance companies using such black box technologies if they struggle to explain their model outputs.

Regulators generally follow the common supervisory principles of technological neutrality and proportionality while considering consumer protection and market integrity. Within these principles regulators are embracing the following approaches to AI and other technological developments:

⬥ Regulatory Sandboxes, a controlled financial testing environment for new technologies to be tested within an existing regulatory framework which ensures protection to all those participating.

⬥ Innovation hubs, regulators aiding technological developers who may not be familiar with specific financial regulations.

⬥ Public-private partnerships, providing support and encouraging sharing resources, experiences and cooperating in funding of innovative developments.

Governing AI is complex, overly onerous restrictions will delay innovation but too lax an approach may result in irresponsible uses of AI. Often regulations may be slow to react to technological advancements, however AI is not an area where regulation should lag. Instead regulations should be more proactive and a driver of controls. In fact, in the 2016 World Economic Forum Global Risks Perception Survey 46% of respondents stated that they felt AI and robotics needed better governance. Governance is especially crucial in specific fields of AI such as automated weapons.

In August 2017, 116 founders of AI and robotic companies wrote a letter to the UN calling for the ban of "killer robots".

Supervisors are engaging developing technologies to help in their day to day operations. The Bank of England (BoE) launched its FinTech Accelerator program in June 2016, which is a partnership with technology firms to explore innovations such as Big Data analytics and AI for the BoE's supervisory duties. European Insurance and Occupational Pensions Authority (EIOPA) has engaged with stakeholders from the insurance industry in roundtable sessions on InsurTech with specific breakout sessions on AI. It was noted during the EIOPA round table discussions that supervision of P&C insurers may be less challenging than Health and Life insurers due to the social and ethical complications associated with AI in life and health insurance and the sensitivity of medical data for consumers.

CONCLUSION

It is becoming clearer and clearer that AI will become a geopolitical stake in the future. There is a risk that some regions or companies dominate in terms of AI technologies meaning that those slow to adopt or lagging behind suffer in terms of potential economical and personal growth.

The expectations of AI and how it can impact the (re)insurance industry are high and very much hyped. At least for now, limitations of AI can be clearly seen (an AI cannot have feelings about something and cannot actually think at all). AI has been around since the late 1950s with many peaks and troughs in its advancement since then.
Those peaks and troughs were mainly driven by the availability of hardware and financial investment. Today AI technologies have the critical mass in terms of computing power, low cost of storage, data availability, breakthroughs in data science and investment to make an impact. There is greater public awareness about AI, AI technologies are becoming a part of day-to-day life such as Google Translate, Apple's Siri assistant and self-driving car technology.

Currently the main benefits and uses of AI are from machine learning capabilities. However, it can be expected that AI becomes more and more powerful, eventually improving itself in exponential time (The Law of Accelerating Returns by Ray Kurzweil). It has yet to be seen if AI will be a threat and the "biggest risk we face as a civilisation" (Elon Musk, Tesla and SpaceX CEO), or something that will considerably improve the lives of everyone.

What can be seen is that AI will be a game changer for all parties involved in (re)insurance. Customers purchasing insurance will have greater access to data to make more informed decisions and will benefit from a more efficient and streamlined insurance process. (Re)insurers will have more data available to make more informed decisions, offer improved risk management services to complement the transfer of risk, reduce manual processes within their organisations and enhance their risk management capabilities.

GLOSSARY

Aerobotics: AI data analytics from aerial drone technology.

Artificial Intelligence (AI): the area of computer science that deals with machines and their ability to demonstrate human intelligence. An AI device/machine perceives its environment and take actions to maximize its chance of achieving some goal. AI includes processes such as learning, reasoning and self-correction.

Big Data: extremely large data sets (structured and unstructured) that can be analysed computationally for patterns, trends and associations.

Black Swan: Black Swans refer to unexpected significant events. Nassim Nicholas Taleb developed the Black Swan Theory in his 2007 book "The Black Swan".

Cluster analytics: it is an analysis based on grouping objects into data groups more similar to each other than other data groups. It is used in machine learning, pattern recognition and image analysis.

Cognitive Technologies: AI technologies that perform tasks that only humans used to be able to do. Examples include speech recognition, computer vision and natural language processing.

Data scraping: a process whereby a computer program extracts data from other programs and websites.

Deep Learning: this is a sub category of machine learning which models data with a high level of abstraction using non-linear transformations and mathematical objects such as neural networks.

General Data Protection Regulation (GDPR): EU regulation adopted 27 April 2016 and enforceable from 25 May 2018. The regulation strengthens data protection for all individuals within the EU and controls the export of personal data outside of the EU. It creates a harmonised strict data compliance regime for all companies processing data of EU individuals. There are severe penalties for non-compliance with fines up to 4% of annual global turnover.

InsurTech: InsurTech refers to the use of technological innovation to disrupt / transform the insurance industry and/or increase its efficiency.

Intelligent chatbot: a chatbot (computer program that conducts a conversation using audio or text) that uses AI technology such as natural language processing.

Internet of Things (IoT): a network of devices which have embedded software and network connectivity enabling the devices to collect and exchange data. Examples include smart phones, smart watches, heart rate monitors, house sensors, car sensors and biochip transponders.

Machine Learning: Machine learning is a form of AI where the machine is trained using past data, it can learn from this data and make predictions without having to be explicitly programmed.

Natural language processing (NLP): a field of AI associated with a computer being able to understand spoken human language based on machine learning algorithms for processing language.

Neural networks: artificial neural networks are a way for a computer to connect and learn from data similar to a human brain. It is used in situations where rule based programming would not be possible. Examples of the use of neural networks include computer vision and medical diagnosis.

Summary of the panel discussion on
HOW ARTIFICIAL INTELLIGENCE AFFECTS/HELPS THE INDUSTRY AND THE (RE)INSURANCE INDUSTRY

WILL THORNE
Innovation leader,
The Channel Syndicate

Will Thorne is responsible for Channel's innovation initiatives, including new product and distribution development. Channel's Innovation team looks at how new thinking and new technology can help insurance respond more directly to the problems that our clients face, using a collaborative approach to product development.

Will joined the Channel Syndicate in 2012 following three years spent at Omega Insurance and has an underwriting background in a variety of different classes. He is also involved in several insurtech industry initiatives, including sitting on the UK Treasury/Tech City Fintech Delivery panel.

CÉCILE WENDLING
Head of foresight, AXA

Cécile Wendling is in charge of Foresight at AXA, working on long-term topics of strategic importance for the group. She is also an associate researcher and sociologist at the Centre de sociologie des organisations (CNRS-Sciences Po Paris).

Her main topics include the future of data privacy, the ethics of algorithms, blockchains, cybersecurity and artificial intelligence. Cecile Wendling teaches foresight, the sociology of risks and crisis management at various universities.
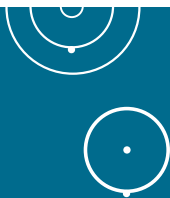
RICHARD HARTLEY
Co-founder and CEO, Cytora

Richard Hartley is a co-founder and CEO of Cytora, a technology startup that leverages new data sources and machine learning to enable insurers to write more premium at higher loss ratios. Cytora was incubated at the Judge Business School and spun out of the University of Cambridge.

Previously, Richard worked in product management at eBaoTech in Shanghai - a core system technology vendor. Today, Cytora works with world-leading insurers to deliver data and insight across the underwriting lifecycle in Europe and North America.

Richard holds a BA in history from the University of Manchester and a Masters in Political Science from University College London.

RICHARD DE SOUSA
Managing Director for Europe and the Americas, ReMark international

Richard De Sousa is Managing Director of Europe & Americas at ReMark International, the world leader in insurance direct marketing and a key part of SCOR Global Distribution Solutions.

Richard began his career as an entrepreneur and partner in two companies in Canada. After completing an MBA in Finance, Richard joined ReMark in 2008 and has been responsible for development and growth in some of ReMark's most dynamic and challenging markets in Europe, Latin America and North America.

From auto-underwriting solutions to e-health platforms, Richard's expert understanding of market forces and consumer behavior ensures that ReMark's clients – and their customers – benefit from technological solutions which create seamless customer journeys for a better experience on the pathway to purchase.

AI, BOARDS & GOVERNANCE

WHY IS AI A BOARD ISSUE?

According to Cécile Wendling, AI is a subject that should be discussed at board level for three reasons:

◆ Technical issues: the black box nature of AI makes it difficult to manage and control, which leads to various questions. For example, when training an algorithm through machine learning, how much should the algorithm be trained? An algorithm learns on the basis of a data set, and if the data set is flawed then the service provided, or the pricing, will be flawed as well. These technical issues of algorithm training and deviation are very concrete.

◆ Regulation: many changes are occurring in the regulatory environment which will strongly affect the use of AI in the insurance industry. For instance, general data protection regulations would give customers a new right -the right to object to data processing.

◆ Ethics: although ethics typically results in issues such as the MIT moral machine[5] or the driverless car, the reality is that ethics concerns the way business is conducted, what can or cannot be done using AI. For this reason, fundamental research on responsible AI needs to be financed through research funds. In France at present, and as a result of this technological and ethical upheaval, CNIL, the French information commissioner's office, is conducting a consultation on ethics and algorithms.

In Richard Hartley's opinion, another factor which explains why the integration of AI should be a board issue is how to balance short and long-term goals. In the short term, a majority of insurers will attempt to entrench and improve their broker relationships, which is of considerable importance for short-term revenue targets and profitability. However, in the long term, the question of "going direct" will arise and here AI can play a direct role. The tradeoff is difficult, because technological investment requires a long-term horizon in terms of value realization over the course of time and success will go to those capable of balancing these two notions. The newspaper industry is an interesting example. Newspapers that have attempted to maintain a print business alongside an online media business have shown how difficult it is to achieve a balance. However, those that are now leading the industry have done so by accelerating the decline of the old and investing more in the new. The question is: can both be done at once? Is a heterogeneous model of this type possible or is it better to focus on one particular area at a time? That is a question that needs to be answered at board level.

TAKING AI TO THE BOARD OF DIRECTORS

Richard Hartley observes that it is important for boards to work with people who truly understand new technologies. Generically, however, insurers have a talent problem, in that the talents that insurers are trying to attract tend to be driven by engineering problems and engineering cultures, which is why they usually seek out tech companies and structures, such as Google and MIT. It is difficult for large insurers to attract these specialists, as they do not believe they can have the same impact on an insurance company as they would have elsewhere. The type of profile that would be of interest to the board of directors of an insurance company, which ideally has an analogical dimension, is an AI specialist from an industry such as credit risk, sports betting or advertising, where pricing approaches are more generic and where external data is used for pricing.

Richard De Sousa explains that despite different data sources and different applications, the opportunities and challenges of AI are quite similar for both P&C and Life insurance. Companies such as Lemonade, a renters' and home insurance company, are extensively applying AI to marketing, claims management and customer service completely based on blockchains. AI has enabled these new digital start-ups to enter the market.

WILL AI REPLACE BOARD MEMBERS?

As stated by Cecile Wendling, there is concern about the implications of AI and how it will affect corporate governance. In Japan, there was the case of AI being integrated into the board of a venture capital company which claimed that AI had efficiently closed two of their deals. The efficiency of such a choice, however, would depend on the type of business concerned. Generally speaking, it could be interesting for the board to increase human skills with a conversational agent that would provide quick access to relevant information, rather than delegating the entire mission to AI.

For this type of issue, the use of fiction and critical design could be useful, as they allow for a systemic encompassing view of the depth of the disruption. According to Cecile Wendling, it is less difficult to predict technological change than to predict social, political and business impacts. The use of fiction designed to learn from future possibilities prepares industry for drastic changes in the way business is carried out.

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5. The Moral Machine is a platform for gathering a human perspective on moral decisions made by machine intelligence, such as self-driving cars.

INTERNALIZING AI OR OUTSOURCING?

In Richard Hartley's experience, the decision to outsource or internalise AI is primarily economic. It will depend on whether or not the company has the ability to attract talent and whether it has the right culture of innovation within its corporate structure. In terms of workforce and risk, is it better to deliver AI internally or to go through a partner? Many insurers have opted for the partnership approach, driven by cost and speed as well as a lack of operational know-how. Through a partnership, an insurer can benefit from knowledge and know-how built up over many years and, as a result, make a faster transition to AI. However, part of the industry is afraid of certain partnerships such as the deal between AIG and Two Sigma because they give large insurers the possibility of selecting the best risks and, in time, seeing their competitors risk suffer from adverse selection. Speed becomes even more of an issue, because if an insurer doesn't have the same level of information as its peers, it will not be selected, which has both very short-term and long-term ramifications on their portfolio.

Despite this, some insurers have sought external aid with regard to AI. For example, some try to use AI to support their underwriters and deal with issues such as human and recency bias. It is important to think of AI as both fundamentally innovative and resulting in an immediate incremental improvement in underwriting decisions, reduced volatility and better underwriting discipline, which are easier for the insurer to consume in the more immediate short term.

APPLICATIONS OF AI

BENEFITS OF AI FOR THE INSURANCE INDUSTRY

According to Richard Hartley, there is typically a board-level consensus that AI will bring an improvement of 10 to 15% to the loss-ratio or combined operating ratio of a primary commercial insurer. In terms of practicality, AI can boost an underwriter or automate the underwriting approach of standardized and homogeneous areas of risk. There is a kind of practicality that relates to the regulatory side and also to model interpretability. For instance, if an underwriter is using selection recommendations based on AI, they need to know why a particular risk has received a particular grade in order to interpret a model.

When examining the benefits of AI for Life insurance, Richard De Sousa advances that the use of interactive chatbots in customer service has caused a decrease in the use of call centers and a gain in efficiency. New sources of underwriting, such as genomic underwriting, have emerged. With facial analytics, smokers/non-smokers can be detected just by processing images. Health and wellness have equally been affected by the rise of AI, where the availability of IoT, connected devices and various sensors (phones, watches,

scales, etc.) are changing the amount of data generated and the pricing of insurance.

THE IMPORTANCE OF DATA, MODELS AND SETS

According to Richard Hartley, one of the most important aspects of an AI tool is that the model on which it is based corresponds to the exact situation in which it will be used. The simplest explanation is the following: several years of data are taken and fused with many types of external data, acquired through algorithm scraping. This, in turn, is tested against unseen data so that, as submissions come in, it is possible to select them continually and determine, in the course of time, whether the loss ratio of an insurer is improved by better risk selection and the avoidance of bad risk. This fine-tuning process is necessary to prove to insurers that the tool has improved profits, either by better risk selection or by selecting more risks than they actually rejected at the time of submission. This can be accomplished in a statistically rigorous way using a six-year backtest. When the success criteria have been met, the model can be implemented.

In terms of version control, Richard Hartley explains that by updating models on a quarterly basis and allocating each model a different name, everything remains quite clear. The new model can then be back processed, or run against the existing model in order to evaluate all the changes made. For instance, in the case of a UK commercial property model, sprinkler data was added, which created an incremental lift where the quality of the risk selection decision increased on the sole basis of a single external data set. The change was implemented transparently, and fully audited by the insurance company concerned by the change, in order to incorporate the new model version. This model is helpful not only at portfolio level to identify the best segments with the best burn rate, but also at individual underwriting level for individual risk selection decisions.

AI & UNDERWRITING

From what Richard De Sousa has observed in the US, implementation is key to combining underwriting with AI. Through the use of parallel models, it is possible to test whether the use of AI will result in the same underwriting decisions as a traditional underwriter. This is done in parallel and in a closed environment; consumers remain unaware of the transition. A human underwriter is continually on hand when the model is being phased in, testing its validity and identifying any potential bias that might have been incorporated.

In Cecile Wendling's experience, underwriters are eager to learn and to improve their systems, and therefore equally receptive to the arrival of new tools. However, in anticipation of a lack of understanding with regards to AI, reverse monitoring and AI explainability (making notions easier to size for a human brain) can also prove effective. Younger data scientists for whom the use of tools such as gradient boosting is part of their everyday lives, will explain to others how the tools work, by means of figures and diagrams.

AI APPLICATION ISSUES IN THE INSURANCE INDUSTRY

According to Cecile Wendling, there are a number of issues that can arise during the implementation of AI systems:

◆ Discrimination: it is becoming increasingly difficult to differentiate segmentation and discrimination. For example, European law forbids gender discrimination for car insurance pricing. But with an AI, there are multiple proxies, such as the color of the car, which can cause implicit discrimination. A model would never be programmed to discriminate against women, but the inputted data can accidently recreate side-effects or bias that a human would never have voluntarily incorporated into the system.

◆ Transparency: to what extent should consumers be informed of whether they are interacting with an AI tool or a human? For instance, with the appearance of chatbots, consumers no longer know who they are talking to. With regards to explainability and transparency, the following question arises: should users be told that "this is an answer that was produced by a bot" or "this is an answer that was produced by a human"?

◆ Accountability & Safety: more discussions are gradually taking place amongst insurers about the safety of AI applications and the question of who is accountable in the case of an incident. For instance, if a navigation system sends a driver in a certain direction, but the direction is wrong and results in an accident, does the fault lie with the human who turned the wheel towards the danger or the application which gave the direction? This type of question requires that a specific tree of decision be developed, in order to determine who is responsible for a resulting incident, and whether or not the impact is critical and physical.

These questions concern tools that can be either very basic or very sophisticated, but can be found at every step in the implementation process and in very different time frames.

MONITORING AND REGULATING AI

As stated by Cecile Wendling, many issues regarding AI have made their way into the press and have subsequently raised various issues such as a chatbot that turns racist, the Uber model in which demand regulates the price of a taxi applied to the case of terrorist attacks, etc. In the face of these problems, a need for monitoring and regulation has arisen. For example, the European parliament report submitted by Mady Delvaux, MP, called for the creation of an AI agency or AI regulatory body. It was the first instance of a political institution raising the question of AI governance control.

Another potential solution to these issues is auditing, whether internal or external, so that models can be checked for bias, racism, discrimination, etc. Once biases have been identified, it is possible to learn from them, correct them and mitigate them but more importantly, make sure that they do not occur too often. This also concerns training; teams need to be trained to identify problems with their models and tools.

Insurers are particularly concerned by AI issues, because they will not only be using AI, but also insuring AI. This means that insurers will need to develop databases to learn from AI incidents and accidents, which will enable them to price AI insurance. This learning effect is important as it will be provide future proof that insurers are capable of insuring the world of tomorrow.

AI EMPOWERING THE CUSTOMER

Another trend that insurers will soon encounter, according to Richard De Sousa, is increasing control at the consumer end of the transaction. Although this trend is growing at a lower rate than for insurers, end consumers and businesses are acquiring more tools. These tools will enable them to choose the insurer that best corresponds to their own needs, instead of the current situation in which insurers target consumers and sell their products.

Based on that notion, Richard Hartley explains how AI will contribute to the proper pricing of consumers' risks. What is often seen in commercial lines are risks that are intrinsically different, with different characteristics, but identical pricing due to a lack of data. This is bad for business because, even if the consumer's risk is good, if the broker doesn't provide the relevant information, the price will be inaccurate.

An increasing amount of available data, generated at an increasingly low cost, can lead to fairer, more accurate and heterogeneous pricing for a given risk. Often, before they have integrated AI, insurers price in bands. Each individual piece of business is priced in the same way, although this business may be very different. Larger amounts of data will allow for price differentiation, which would be a considerable advantage for the industry.

AI, PEOPLE & THE FUTURE OF WORK

TRANSITIONING TO A HUMAN/MACHINE SYSTEM

In light of the widespread fear that workers will be replaced by robotics, Cécile Wendling explains that the first step to combat this fear is education. For example, AXA has established a partnership with the online teaching platform Coursera. There are two objectives. The first is to provide their entire workforce with access to key courses which will enable employees to upscale their skills and obtain certification. The second is to guarantee that AI tools will replace the tiresome, boring, repetitive tasks of human workers: bureaucratic, administrative, etc. The goal is to empower human workers, create proximity with the customer base and develop knowledge through robotic process automation, for example, by adding a conversional agent to a team in order to improve their process.

These steps and measures are integral parts of neuro-ergonomics, or the question of which part of a decision process should be automated and which should be handled by humans. The transition from a purely human system to a human/machine system is not only about technology but also about the social environment and the efforts required to make it a success, all of which are necessary to avoid the risk of unsuccessful implementation.

JUDGEMENT VS. PREDICTION

As stated by Richard Hartley, the right level of abstraction is represented by the relationship between data, predictions and judgment. As more data is generated, the cost of machine prediction decreases and the quality of machine prediction increases. Human competency should be seen as either complementary or a substitute.

This relationship differs depending on the industry. In the case of medicine, there are many ways of generating data (blood tests, x-rays, etc.), which means that the cost of prediction is decreasing and the number of predictions is increasing. With such a large number of predictions about different potential treatments, the role of the doctor is to weigh these options and select the best course of action using their personal judgment.

This is how human judgment can be complementary to machine prediction. In other cases, such as navigation, automation is being more extensively developed as humans are less capable of making relevant predictions than machines. In the insurance industry, machine predictions will surpass human predictions for large sections of commercial risk, as the businesses concerned, namely small SMEs, are fairly standardized. Here the automation of underwriting

will be easier and should develop in a five-to ten-year timeframe. In more ambiguous areas in which risk is more heterogeneous and data is less available, a strong case can be made for human judgment and human-driven underwriting. Space is another such area; fewer repetitious events occur, generating less data which creates a higher need for human judgment.

CULTURAL DIFFERENCES

In Richard De Sousa's experience, a cultural difference subsists with regard to new technologies and how willing people from different cultures and parts of the world are to accept change and share information.

In some of the Latin American countries and the US, data availability, including medical records, is quite high, but accessing the data is more complicated. In some parts of Asia, for example, the environment is very different. Certain countries have bypassed older technologies and plunged straight into digital AI transactions such as WeChat. Europeans tend to be more guarded about new technologies and sharing data. Their reticence can be explained by the current data protection and information laws.

TRANSHUMANISM: THE FUTURE IMPACT OF ADVANCED TECHNOLOGIES ON SOCIETY AND ON THE INSURANCE INDUSTRY

Laurent Alexandre, surgeon and graduate of HEC and ENA in political science, is the founder of the medical website Doctissimo.fr.

A specialist in decoding the genome, he is an expert specialized in transhumanist issues.

LAURENT ALEXANDRE
CEO of DNA Vision

A new age is dawning, one in which this generation could be the last to experience death, in which industries no longer belong to themselves but are the potential prey of technological giants from the Silicon Valley and China, and in which governments face the possibility of societal upheaval as a result of the new knowledge economy. These are the worst-case scenarios, but they must be taken seriously if governments and industries are to take the necessary steps to avoid them.

THE TRANSHUMANIST MOVEMENT SEEKS TO SUPPRESS RISK AND DEATH

THE RULE OF TRANSHUMANISM HAS SPREAD TO THE SILICON VALLEY

Over the course of the past two decades, a new belief has gradually developed amongst the AI community, namely transhumanism, or the belief that the human race should evolve beyond its current physical and mental limitations through science and technology. Today, the reach of transhumanists extends worldwide and their presence has gained China and the Silicon Valley, through companies such as Google, Apple, Facebook, Amazon and Tesla. As a result of their vast resources and the acquisition of first-rate data scientists, they have gradually become key players in the data industry, with the insurance industry in danger of becoming a marginal player.

In 2013, Google launched Calico, a mysterious project "focused on health and well-being, in particular the challenge of aging and associated diseases."

REMOVING BIOLOGICAL LIMITS AND EMBRACING AI

Transhumanism thought rests upon five goals:

- "Death of death" (or immortality)
- The suppression of human risk (or the eradication of diseases)
- The creation of a multi planetary humanity
- The enhancement of the capabilities of biological brains
- The merging of biological brains with artificial intelligence

29th September, 2017 - Elon Musk announced his intention, through his YouTube channel, of creating a network of intercontinental rocket flights. A trip from London to New York would take 29 minutes.

THE RISK-FREE TRANSHUMANIST WORLD WITHOUT RISK

The overall objective of transhumanists is to create a risk-free world. But, without succumbing to the dystopian fears, the future may be more complex than transhumanists believe.

Although it is difficult to assess, a balance will be reached between a decrease in risk as the result of profiling, for example, and the exponential growth of new risks linked to AI: new kinds of terrorism, genetic problems and errors, social dysfunction, and so on.

SOCIETY WILL FACE DIFFERENT TYPES OF AI-RELATED RISKS

EACH TECHNOLOGICAL REVOLUTION OF THE PAST HAS BEEN FOLLOWED BY SOCIAL RISK

Twenty years ago, at the beginning of the commercial web era, experts thought that Internet would bridge the gap between rich, dynamic regions and poorer regions, and that democratic values would be spread across the globe. The reality has proven to be quite different, with the gap between the poor and the rich only widening.

Although forecasting is difficult, we can derive knowledge from similar situations in history. There is a region in the US that extends from the Great Lakes to the Upper Midwest States called the Rust Belt, in reference to the economic decline and urban decay caused by the deterioration of its once-dynamic industrial sector. This region has now fallen victim to an explosion of opioid consumption, where the number of overdoses has tripled in the last five years.

THE MOMENT AI IS NO LONGER SUBSERVIENT TO HUMANS, GRAVE RISKS CAN BE EXPECTED

There are two types of AI: strong AI and narrow AI. These two concepts are separated by a powerful border – consciousness. Narrow AI is subservient to human interest and obeys the direct order of the human intelligence that operates it.

Strong AI would have a consciousness of its own, with specific, personal goals having the theoretical potential to destroy humans. At present, strong AI does not exist but many experts have tried to assess the grave risks that mankind would have to face if such technology is ever developed. However, no consensus has ever been reached regarding the risk of a strong AI.

NEW RISKS AND OPPORTUNITIES

In May 2017, Mark Zuckerberg, the co-founder, chairman and CEO of Facebook, announced that the company was developing telepathic headphones which would allow users to communicate from brain to brain, brain to computer and computer to brain. The first prototype will be on the market in 500 days. This product will have far-reaching implications, in the very near future, for business, education, training and many other sectors.

In March 2017, Elon Musk, CEO of Space X and Tesla, launched Neuralink, a company dedicated to developing implantable brain-computer interfaces that could improve our IQ, memory and neural capabilities.

These endeavors are not just dreams of a far-off future; they are projects being developed by entrepreneurs and visionaries now. They could, however, provide an exciting landscape for insurers, as they will surely open up new business possibilities, such as the brain protection insurance industry which is no longer as far-fetched as it seemed before.

IN 2030, WE WILL BECOME GODLIKE WHEN WE CONNECT OUR BRAIN TO THE CLOUD

RAY KURZWEIL, Singularity University, September 2015
Author, entrepreneur, futurist and inventor employed by Google

SOCIETY HAS IMPLEMENTED THE KNOWLEDGE ECONOMY WITHOUT DEMOCRATIZING BIOLOGICAL INTELLIGENCE

There is a serious gap between the school of transistors and the school of neurons. A deep learning specialist working in the Silicon Valley earns up to 100 times more than the best paid teacher. Immense funding is directed towards AI and so far the political response to its development has been to propose a universal basic income for the populations that will be marginalized by technology, instead of allocating resources to education, without which it is unlikely that

democracy would survive in a knowledge economy. Karl Polanyi, a 20th century German economist, explained that a technological revolution must be accompanied by a change of institution. If not, political revolution can ensue.

The need to train people and develop their competitiveness has never been as strong. Complementarity between efficient AI systems and biological intelligence must be implemented quickly through education.

WILL THE INSURERS OF TODAY BE THE INSURERS OF TOMORROW?

AI IS CHANGING THE DYNAMICS OF VARIOUS INDUSTRIES – THE CASE OF THE MEDICAL INDUSTRY

The value migration caused by the development of AI is growing rapidly in many professions, including the medical industry. Invisalign is competing with dentists specializing in orthodontics, by producing orthodontic devices that use incremental transparent aligners calculated by AI to adjust teeth. The process is simple: the patient's jaw and teeth are scanned, the data is processed in Silicon Valley and then by AI to produce 3D imprints that will adjust the teeth, like braces. Five million patients have already been treated by Invisalign.

In August 2017, Google released its latest study which proved that a single retina screening could deliver as much information as a global cardiovascular checkup. However, this breakthrough was not the most interesting aspect of the study; where typical medical studies usually range from a hundred to a thousand patients, Google's study was conducted on a sample of 300,000 patients. Their conclusion that their sample was not significant and that AI medical studies should be tested on at least a million patients, could redefine the medical industry. These are not the only such examples; new medical AI companies are redefining the landscape of their industry and pushing back today's boundaries.

INSURERS MUST EVOLVE TO ADAPT TO THE NEW DATA ECONOMY

As of now, AI expertise in the insurance industry is not sufficient. Insurance companies whose top management is not strongly involved in AI will not keep their place in the new landscape created by AI. In the middle term, shareholders can be expected to part with management teams who do not possess sufficient AI capabilities. Insurers will have to reevaluate their insurance segmentation and learn to deal with new risks: existential risks, hyper risks, global risks, etc. Their ability to forecast will have to surpass the complexity of AI, in order to secure their business, remain leaders of their own market and become leaders of the data economy.

Insurance used to be the industry of data. Today, the real industry of data is IT. Insurance is becoming a marginal player in what used to be its core expertise. The raw material used to assess, control and price risks comes from new sources that are controlled by new players. The link between the amount of data and the power of AI is very strong. Insurance companies need to increase the amount of data that they currently use by one thousand to one million. This is a major issue as insurance has very little data in comparison with GAFA[6]. For the first time, traditional insurance stakeholders face a challenge that could destroy them. The big question is whether insurers can address the risk posed by this new threat. When a doctor is ill, he doesn't treat himself; he goes to another doctor. Can an insurance company control its own risk?

The insurance business will not disappear. But it is not clear whether insurance companies will continue to run the insurance business in the middle term. Time is of the essence for insurers as IT companies have gained a significant head start and are rapidly developing their new technologies. The future of the insurance industry will depend on the psychology of insurers. Will GAFA enter the insurance business? If the big IT companies believe that insurers are unable to become data specialists, they will launch an attack. And they will win.

6. Google, Apple, Facebook, Amazon

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