Digital Vision for AI

Global opinion paper - March 2019

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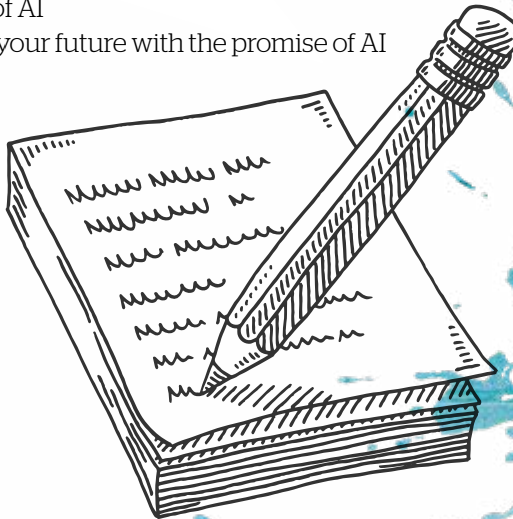
ARTIFICIAL
INTELLIGENCE

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Atos

Atos Digital Vision series aims to provide a thoughtful and informed view of the opportunities brought about by digital services. It demonstrates how these opportunities are being harnessed by governments, markets and businesses to help deliver innovative solutions that benefit their customers and citizens, today and into the future.

This opinion paper features contributions from Atos global experts and from leading thinkers from other major industry organizations and leadership bodies.
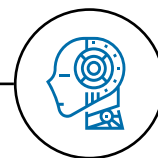
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Foreword: Digital vision for artificial intelligence

Thierry Breton
Atos Chairman & CEO

The challenge of artificial intelligence is no longer about machines getting smarter: it is how far we can expand human intelligence.

Today, human intelligence alone is no longer sufficient to understand and explore the deluge of data we are witnessing. Every eighteen months, the volume of data we produce doubles. This growth is the fuel of the AI revolution – but three conditions must be met for companies to fully embrace it.

- First, they need to identify the situations and use cases where AI makes the most sense and brings the greatest value.

- Second, they need to have access to the computing power that can process and explore these massive amounts of data.

- Lastly, as explored in our thought leadership publication Journey 2022[1], they need to ensure that they can manage AI in the most appropriate and secure way. This implies resolving the dilemmas arising around its use from security of personal data, the employment of people and equality of decision making.

Atos is uniquely positioned to support companies with these three challenges and therefore help them understand, use and leverage artificial intelligence.

Our clients have tremendous knowledge of their industries and challenges, and, to fully benefit from artificial intelligence, they need a partner who knows their business as well as they do; a partner with hand experience of meeting regulatory needs. A partner who can provide them with best-in-class people, technologies, computing capabilities and alliances.

These are all essential elements to make AI a reality today.

AI at the heart

x2

Every 18 months, the volume of data that is produced doubles, fuelling the artificial intelligence (AI) revolution

$3.9 trillion

AI-derived business value is projected to reach up to $3.9 trillion by 2022*

€40 billion

Expected worldwide spending on AI in 2020**

$$z = \sigma(Wx + b)$$

$$\sum_{t=1}^{T} f_t(x)$$

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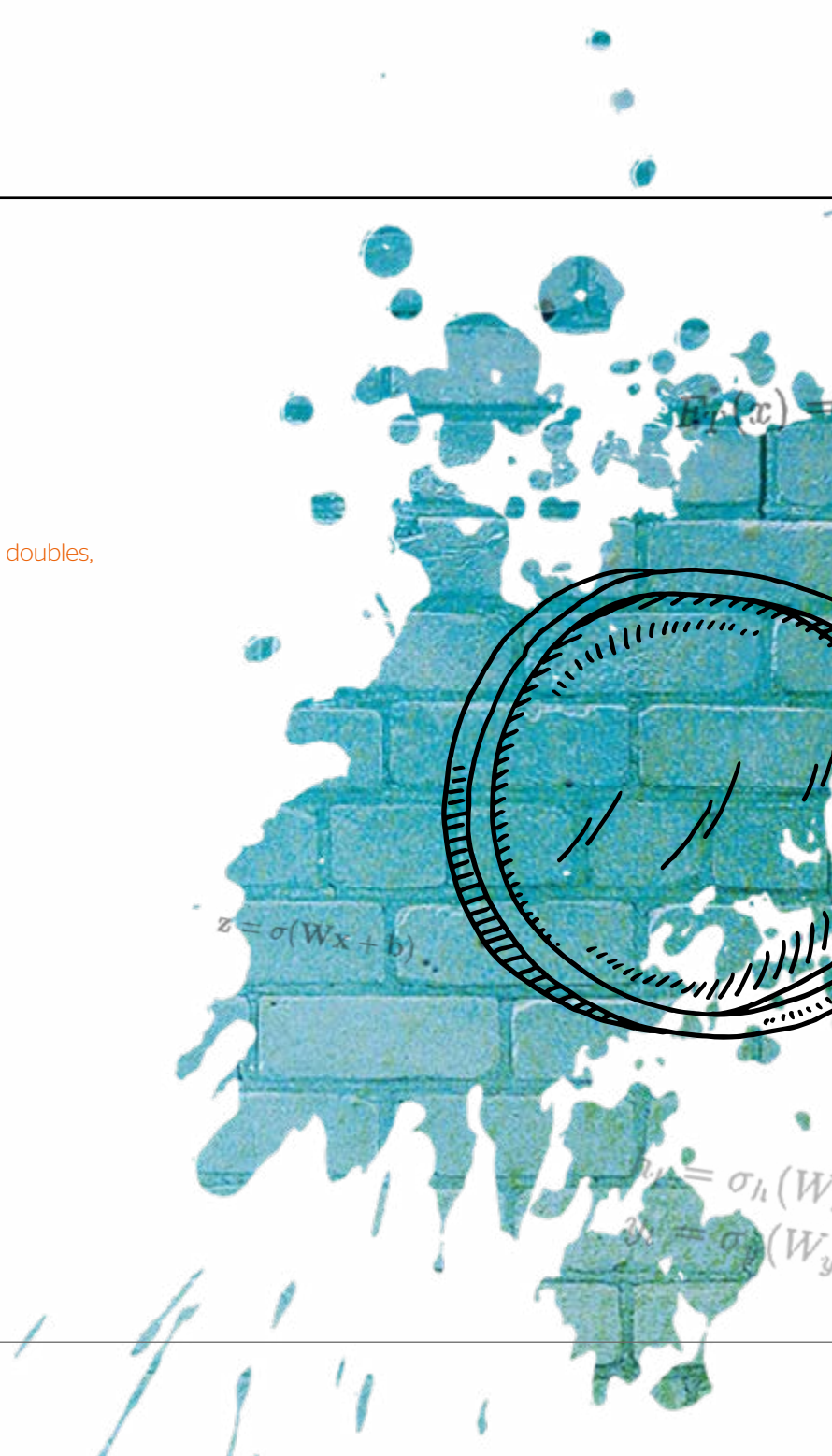
40%

of new enterprise applications implemented by service providers will include smart machine technologies by 2021*

'AI pioneer of the year'

National Business Awards 2018 has shortlisted Atos as 'AI pioneer of the year'

50%

of all business analytics software will include prescriptive analytics built on cognitive computing functionality by 2021**

Arnaud Bertrand, Atos Fellow, SVP, Strategy & Innovation, Big Data and Cybersecurity

Three pillars of AI: fully embracing the revolution

Every 18 months, the volume of data that is produced doubles, fuelling the artificial intelligence (AI) revolution. However, organizations need more than just data to fully embrace this high-speed change. They also need to consider three key pillars to ensure that when AI is deployed, they are tackling an identified problem, with the best solution, to bring the greatest value and security.

1) Identifying the right use cases

Organizations are typically deploying AI in two dimensions. On the one hand, they are using AI to execute the most repetitive actions, such as sorting and filing information; on the other, they are using it for actions that require a high-level of technical knowledge. In the latter case, AI is often used in strategic and critical environments to reduce risks and biases.

The smart city

The City of Berlin wanted to leverage the power of AI in traffic management. Using data which is generated by some 12,000 smart sensors deployed throughout the city, it is transformed into actionable intelligence that allows the city to optimize its traffic flow. Using AI solutions, the 4-hour forecast has enabled an accuracy of over 80% – a figure extremely high compared to all existing systems deployed in other cities. Machine-to-machine potential for traffic light management is also leveraged, resulting in faster travel for commuters and better air quality.

The cognitive data center

AI has also been used in the energy sector when a global leader in energy, had a cognitive data center deployed with two objectives. First, identifying malfunctions quickly and providing the right diagnosis. Second, by looking at the early warning signs, ensuring that the next problem could be solved even before it occurs.

As a result, identification becomes faster and much more accurate, and in case of failure, AI is also able to reliably predict the root cause and the probability of its reoccurrence. A second advantage is the optimization of energy consumption, with the data centre so eco-friendly and consuming less energy, it enables the company to reallocate resources in the most efficient way..

2) Accessing sufficient computing power

While the first AI algorithms were originally developed in the 1950s, the current re-emergence of AI is fuelled by the parallel increase in data volumes and in computing power. If organizations have access to sufficient computing power to process and explore the massive amounts of data, these two forces enable companies to finally transform data into value by using AI. However, businesses can't just stay in the 'now', they also need to be looking forward at the next leaps in computing to ensure they continue to capitalize on the fast-paced changes.

Edge computing

The goal of the evolution of computing is to provide computing power capable of running AI workloads in complex environments. We will need more power at the edge, putting the computing power closer to complex live environments: that is, closer to the person, the camera, object action and so on. Currently in prototype stage for example, the Atos Edge Computing Box makes it possible to provide some of the AI computing power in close proximity to the users and Internet of Things components. If for security or infrastructure capacity reasons information transmission cannot be subject to the least fraction of a second of lag (for example autonomous car), applications can be deployed to address this. The peripheral server is also able to extract and process real-time resources, as close as possible to the data source.

Quantum computing

If AI can now rely on unprecedented levels of computing power, its fundamentals are still based on a century-old computer science and we are currently reaching some of its limits. Looking forward, quantum computing may be one of the most promising solutions to some of these problems. For example, the Atos Quantum program has achieved some world firsts, such as the simulation of quantum noise to make simulation even more realistic.
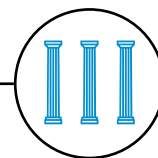
3) Ensuring trust and compliance

The world of computing is growing increasingly hybrid, combining traditional IT, private, managed and public clouds with an amalgamation of on-site computing, private cloud, and edge computing. To fully take advantage of AI capabilities, enterprises will need to leverage flexibility, scale and incorporate data with other solutions to create a hybrid solution. Fusing data across multiple computing environments increases the risk of compromise to the availability, integrity and confidentiality of such data.

The challenge for widespread adoption of AI by enterprises is therefore trust and confidence in the cloud. Data has become one of the most valuable assets for organizations and because of its value, companies may still be reluctant to move their data to the cloud. Using cloud, CIOs can spend more of their IT budgets on business outcomes, with agile technology infrastructures virtualised in cyberspace. Organizations therefore also need to invest in the security controls needed to safeguard their sensitive data, wherever it is located.

Safeguarding the value provided by AI

Measures to protect data and AI platforms themselves are essential both to defend assets from hackers, but also protect against accidents and data loss. For AI running in the cloud, while no additional security may be needed, integrating all security controls into one overall security posture is essential. And as the cyber threat evolves, security must also evolve while acting as an enabler for the business value expected from that AI investment.

Atos' approach is to adapt and apply the National Cyber Security Centre's 10 steps to cybersecurity to AI solutions. We help organizations invest in the relevant security controls in the right places quickly, while also laying the foundations for prescriptive security and futureproofing AI as technologies advance.

Just as edge-based processing and swarm computing offer real efficiencies in computing, these must be combined with rapid threat diagnosis and context-aware interpretation so that organizations can monitor, predict and pre-empt cyberthreats as they emerge.

'Regulation dimension' of compliance

The era of 'data Wild West' is over thanks to regulations such as the General Data Protection Regulation (GDPR). Organizations now need to understand and implement these regulations while also having guarantees against any form of 'regulated intrusion' into their data.

Checklist

When reviewing the security profile of an AI environment, organizations should consider the following questions.

- How well do you understand the cyberthreat facing your organization, not just the data you process, but also the stakeholders you work with and the supply chain that you operate in?

- Taking account of GDPR and NIS, are you investing in the right places to achieve the correct levels of security for how your sensitive data should be protected across the cloud?

- Are your current security controls providing sufficient visibility, context and insight to the threat facing your sensitive data?

- How could automation reduce time taken to diagnose, react and recover from security incidents that could affect your AI platform?

- How ready is your organization's Leadership Board, security and commercial teams to manage the consequences of a high-profile cyberattack?

Ronald van Loon, AI Influencer & Director, Adversitement

Artificial intelligence in motion

Artificial intelligence is rapidly growing as an up and coming technology, and considering all that it has to offer, there are certainly no doubts regarding its benefits.

The developments in recent years into the field of AI are largely unprecedented and have opened the doors toward a lot of new pathways – so much in fact that the technology is now at the stage of consistent development.

Within this changing eco system, three core ingredients have led this change, all of which have seen key developments in their own area at around the same time, enabling AI to develop at an increasing pace.

• **Data:** This is the essential fuel of all AI. Without the unprecedented wave of data, we wouldn't be able to implement so many machine learning techniques, get predictive analysis, and implement changes. Data is the raw material that AI needed to develop.

• **Knowledge:** Algorithms play an important part in AI as well. While data is extremely important in itself, it is the knowledge that we use to extract sense from it that dictates the way into the future. Going into the future requires the implementation of unprecedented changes and learning methods. Machine Learning and other methods have given data the platform it needed to become a source of AI.

• **Computing power:** This is at the heart of today's revolution. Neural networks have existed since the 90s, but it is the power of computers in the world today that has led to a bigger change in AI. The fast pace of quantum computing can be accredited with the change here, as it has made the smooth running of heavy machine learning systems possible.

A mix of solutions
With these developments, the array of tools and capabilities that make up AI provide endless potential to provide a perfect mix of solutions across all industries and sectors. Indeed by using these, the world is growing hybrid, combining traditional IT, private, managed and public clouds. There are many ways in which this is being done, but Atos have captured the essence by creating a unique, hybrid experience including an amalgamation of on-site computing, private cloud, and edge computing (to ensure the security of data in the cloud, it is necessary that you incorporate the data with other solutions, to create a hybrid setting).

So how are these intelligent technology solutions being implemented in organizations, providing real-time solutions?
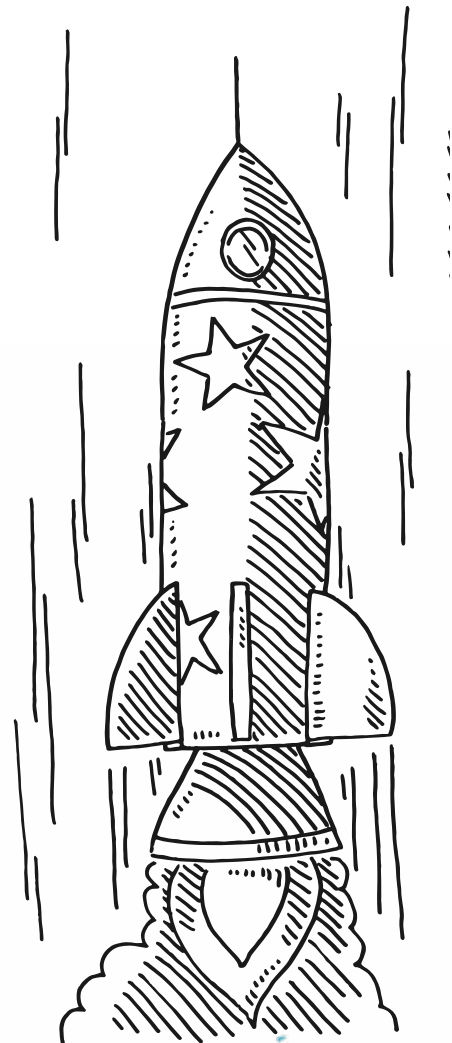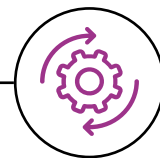
Connected Cooler

Objective: Coca-Cola Hellenic Bottling Company wanted to enhance customers' experience of over 300,000 vending machines in nearly 30 countries around the world.

Outcome:

- Unprecedented efficiency by enhanced methods of predictive maintenance and placement.
- Better inventory, product placement, and stock optimization using interactive AI methods.
- Increased sales by linking up targeted promotions with the connected consumers.

Prescriptive Maintenance

Objective: The State Department of Virginia was looking for a way to protect its technology infrastructure using the next generation of AI-powered cybersecurity solutions to identify and limit future attacks.

Outcome:

- The prescriptive Security Operation Centre recognizes hard to detect, isolated intrusions and uses the information for further detection.
- Detects all the signals left by attacks and alerts security managers about possible risk areas, even before the attack happens.
- Provides insight into how cyberattacks are most often carried out, and stops them from hindering services using threat detection to access point security and vulnerability management.

Digital Twin

Objective: Through an Atos and Siemens collaboration, the objective was to create a cloud-based operating system that allowed manufacturers the freedom to connect their physical infrastructure and legacy systems, to the digital world.

Outcome:

- Using Digital Twin technology (MindSphere platform), manufacturers can create a real-time digital replica of all physical assets for comparing and analysing them in the future.
- Creates the ability to find new ways for improving production processes.
- Allows engineers to create a prototype of a large or small product inside the digital world and undertake online testing, prior to physical testing.

Dominique Grelet, Group Vice President, Head of AI Technology & Services, Atos

The magic of AI: the next leap

Success with artificial intelligence will increasingly depend on the ability of organizations to integrate knowledge by blending different AI techniques.

Although AI encompasses a range of technologies and capabilities, until now, much of its value within organizations has been generated from one category of AI called 'supervised learning'. This can revolutionize speed and efficiency by automating a relatively simple mapping of A to B. So, for example, if A is a picture, then B is the name of the object shown in the picture (image recognition). Similarly, if A is an audio clip, then B is the text transcript (speech recognition); and if A is an email, then B is what kind of email it is (text recognition). These mappings are at the heart of successful AI applications such as predictive maintenance, IT servicing and support, customer services and marketing.

Toward unsupervised learning

To implement this kind of supervised learning, enterprises need access to plenty of computing power, which advances in computer architecture have brought in recent years. They also need large amounts of historical data in order to 'train' the AI to achieve high levels of accuracy. When it comes to industrializing AI, the challenge is that each sector – and each enterprise within a sector – has its own processes and terminologies. As a result, training AI to optimize a manufacturing or supply chain process, for example, can be challenging as the vast amounts of data required are not always available.

For this reason, to fully leverage the knowledge of an enterprise, it's necessary to incorporate other types of AI, including what is sometimes called 'old AI' (based on symbols and logic programming), as well as deep learning, natural language processing, and other techniques. With richer datasets and technologies, AI becomes even smarter.

Enterprise Knowledge Integration

At Atos, we are pioneering Enterprise Knowledge Integration, which enables a dialogue between the different technologies in the AI family. The results from each technology are used to feed the others, creating a virtuous circle between supervised learning and symbolic AI. Progress with Enterprise Knowledge Integration requires strategic investment and focus in three domains.

- Optimizing the power of high performance computing and building the very large infrastructures capable of running more complex AI workloads.
- R&D programmes with industry partners such as Siemens, to develop algorithms and models for highly demanding AI use cases (such as advanced video recognition and fraud management).
- Establishing a global network of AI labs, mixed teams of Atos specialists, partners and customers to collaborate on AI solutions, address key business issues, and add value to HR, the supply chain, marketing, contract management, finance, and other business areas.

Looking forward, via digital tools, AI will become more and more embedded, and invisible, within enterprises – just as we see with everyday consumer tools, particularly smartphones. At the same time, AI will become more knowledgeable about the data it is handling; for example, it currently may not have much intelligence about the value of the things it is recognizing (such as knowledge of the object in a picture). In the near future, we'll see more and more semantic understanding of the objects that are processed by AI. In other words, AI will become more intelligent by merging datasets and continuously integrating its knowledge. These kinds of advances are already accelerating because while AI has been around for decades, we are, in many ways, just at the start of its story.

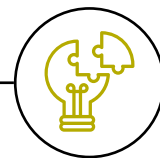$$z = \sigma(Wx + b)$$

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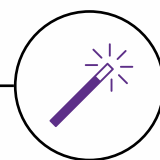
...every aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it.

John McCarthy, Computer Scientist & 'Father of AI', 1955

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$$h_t = \sigma_h(W_h x_t + U_h h_{t-1} + \dots$$

$$y_t = \sigma_y(W_y h_t + \dots$$

Philippe Vannier, Special advisor to Atos' Chairman and CEO, for Science, Technology and Cybersecurity

Unlocking the value of AI through industry and regulatory collaboration

Gartner recently released estimates on the projected value of AI. According to their research, the global enterprise value derived from AI will total $1.2 trillion this year, a 70 percent increase from 2017. AI-derived business value is projected to reach up to $3.9 trillion by 2022. For this reason, the AI industry is moving at pace with all the big players investing in research. AI will not only transform business but also the productivity and GDP potential of the global economy. This technology will be a global game-changer in the next few years.

How to deliver on the promise of AI

The best way to harness the benefits and control the risks of the AI revolution is for us all to collaborate.

The UK Government recently unveiled an artificial intelligence deal worth £1 billion, a combined effort between the Government and Industry.

President Macron, in France, unveiled investment plans and strategy on AI only a month earlier to promote research and business in this area.

These collaborations will move us all forward and as a global digital services company we are keen to be part of this journey.

We believe that a strong relevant regulatory framework, in consultation with industry, is needed to ensure that AI-driven innovation can and will be applied for the ultimate benefit of citizens and address concerns such as competition and data protection.

These checks and balances will enable a trusted partnership with consumers and in turn allow for a deeper level of innovation.

The first industries to benefit will be in the service sector, such as financial services, with improved customer experience and in the health sector where innovation will play a vital role in improvements and cost efficiencies.

Smart organizations will see compliance as a competitive advantage

The GDPR regulations are strengthening Europe's position in data protection, which will increase trust and compliance and ensure a smooth trajectory for development of AI in industry. But, it would be wrong to confine ourselves within geographical borders and not look to the innovation potential of the GAFA organizations.

Rather we must join in on this global journey through partnership frameworks like the one we have just signed with Google Cloud*.

Google has machine learning and AI capabilities that we could harness for the good of our customers. We bring the services knowledge and experience to their innovation.

Through collaborations such as this, European players can provide additional reassurance around compliance to our market, the "last mile" of the regulatory chain. Not only this, we also bring the local knowledge of our industries.

Through shared innovation, research and application of business knowledge we will be able to harness the potential of AI for ourselves, our customers and our economies.of AI will mean. Without a balanced and constructive discussion, we risk society not truly understanding the benefits AI can bring. This may then unintentionally stifle positive change or prevent organisations across the public and private sectors from embracing AI technologies, that have the potential to be a real force and power for social and economic good in the UK.

Kulveer Ranger, Senior Vice President, Strategy & Communications, Atos UK&I

AI: The Debate

In addition to our ongoing AI development work, throughout 2019 we will be exploring and debating the application of AI using the prism of ethics and transparency with the aim to raise awareness and understanding of this increasingly influential technology. We will be engaging with industry experts, academics, and political stakeholders to discuss three areas:

• What is AI?;

• Is it a force for good?;

• Do we need to future-proof for protection from potential risks?

We want to demystify AI as a technology and answer the question 'what's inside the black box?', before looking more closely at how AI is increasingly making, or could make a tangible difference to citizens and society.

Finally, with AI increasingly making an impact on our everyday lives, we will explore the broader discussion of what protection might be needed to resolve potential risks and issues emerging from this technology in this fast-paced and changing area.

As a cohort of practitioners, data scientists, and strategic experts in AI, we believe Atos is ideally placed and has a responsibility to facilitate and engage in this important and multi-faceted debate.

Marianne Hewlett, Senior Vice President and member of the Scientific Community, Atos

How AI will power the Future of Work

Imagine having a digital assistant to schedule your next meeting or speaking to a chatbot to help you finalize a challenging task at work. Forward-thinking companies are implementing AI already, with Amazon launching Alexa for Business last year and Google recently trialling its Duplex human-sounding AI. A recent report from Gartner suggests that technology like this will be more commonplace, with one in five workers set to have a machine as their 'co-worker' by 2022.

Improving employee experience and productivity

For businesses to thrive in the future of work, humans will need to work in tandem with AI. Get this right, and they'll have the tools they need to increase productivity and master a more personalized experience for their employees.

During our recent Atos Technology Days event in Paris, we introduced CHO, your own Chief Happiness Officer in your pocket. The technology is operated via a smart mobile assistant and user interface with two-way communication. The CHO can monitor moods and gather actionable insights for both the employee and manager.

Each CHO is unique – over time it will learn from your behavior and data insights to provide you with personal advice. For example, it can take regular pulse measurements to gauge your mood before, during or after an activity or event. On an aggregated level, managers can gain real-time insights into mood, receive feedback and make decisions suited to the individual which in turn, can greatly improve employee experience. The CHO belongs to our extensive Employee-Experience-as-a-Service offering, which will go-to-market later this year.

AI creates opportunities

While there are some concerns about the impact of automation on jobs, AI is not about replacing people. Instead, it's much more focused on elevating certain skills, optimizing jobs and creating opportunities for more interesting work. For example, AI can free up time for staff to carry out tasks that are better suited to humans, such as complex problem solving, critical thinking and creativity.

These are the top three skills deemed essential by the World Economic Forum.

A recent McKinsey report[1] estimates that by 2030, robotics and AI will take human jobs in less than 5% of roles. But on the other side of the coin, it has also been reported technology will enhance 60% of jobs, rather than displace humans altogether. To prepare for this, it's essential for employers to consider relevant training and reskilling programs to help their existing workforce adjust and excel in the working environment.

We recently conducted a survey[2] amongst 100 CIOs to determine their readiness for the future of work. 75% felt concerned about the impact of automation and digitalization on their organizations and around half were aware that some roles were under pressure from AI. However, only a third had a plan in place to address the challenges that lie ahead.

How to prepare for the AI revolution

At the same time, new organizational structures, flexible working, the increasingly global talent pool and multi-generational workforce add to the challenges and stress levels of both managers and employees.
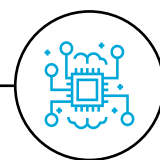
In this constantly changing environment how can organizations ensure a great employee experience that will help to accelerate digital transformation and deliver better business results?

To prepare for the AI revolution, employers need to become more data-driven and use technologies at their fingers tips to improve working practices.

Here I've outlined my top three pointers to consider to support staff through the future of work:

[1] McKinsey report: www.mckinsey.com/featured-insights/future-of-organizations-and-work/
[2] Atos survey: https://atos.net/wp-content/uploads/2018/06/atos-cio-watercooler-transitioning-to-the-future-of-work-cio-views.pdf

- **Establish a culture of collaboration to unleash innovation** – learning from each other in an environment where it is safe to make mistakes will be essential to ensure new techniques and working practices can be tested
- **Drive intelligent productivity** – empower employees to focus their time, energy and brain power on the issues that really matter to them and to the organization. This will help to keep employees engaged and keen to learn more
- **Make company assets accessible** – by having a culture of openness, information and knowledge can be shared easily, helping talent can thrive

AI is rapidly changing the world of work as we know it, from digital assistants to robot colleagues. Akin to the Industrial Revolution before this, employers will need to prepare their employees to adapt and thrive in the future of work. AI is not something to be feared, but a necessary movement to propel society into the next age where technology can improve the lives of individuals, businesses and the wider community.

> **"**
> By 2030, technology will enhance 60% of jobs, rather than displace humans altogether.
> **McKinsey report**

Will Tanner, Director, Onward

The politics of AI

The ethics of artificial intelligence is arguably the most interesting debate policymakers are yet to have. It is also one of the most urgent. The pace of algorithmic innovation and scale of deployment mean it is no longer sustainable for businesses to decide ethical dilemmas in isolation. Politicians and regulators must engage.

This is because, after decades of false starts, AI is finally approaching critical mass. The number of global machine learning patents is growing at a compound annual growth rate of 34%, big tech companies spent an estimated $20 billion on AI R&D and acquisitions in 2016, and 95% of business leaders recently told Forbes that they planned to boost spending on AI in the coming year. The next industrial revolution has finally arrived.

With it will come great benefits - this much we know. Autonomous vehicles will not only save thousands of lives but also free up millions of hours for more productive activity. Intelligent homes will cut energy use by orders of magnitude, not increments, as Deepmind has already shown with Google's servers. New drugs will be discovered and invisible diseases treated by seeing patterns in unimaginably large datasets.

But the ethical challenges are equally profound. If an autonomous car crashes into a driven vehicle - who is liable, driver or computer? If an automated legal decision leads to wrongful imprisonment, who is at fault? If algorithms systemically amplify existing bias, how is prejudice challenged and diversity encouraged? If algorithms are constantly iterating in order to improve, what failsafes can or should we design in to prevent unintended or harmful consequences?

The reality is that the policy and legal frameworks for these quandaries have not been written, leaving companies so far to largely set their own rules. To their credit, many industry leaders recognize the imperative: Elon Musk of Tesla, Demis Hassabis of Deepmind, Jaan Tallinn of Skype, and numerous other big players have all invested time and resources into developing common safety and ethical frameworks for AI. But self-regulation has natural limits in legitimacy.

Here, the Government's new Office for AI and similar steps by Barack Obama's White House are welcome steps towards filling the void. Like the growth of internet protocols and systems, if the UK and US can get these questions right, we have an opportunity to set the rules not just for our own markets, but globally. But this will require developing core principles and dynamic protocols that can at least keep up with, and at best stay one step ahead of, rapidly changing technologies. There is no value in regulation that is outdated before it gets on the statute book.

To my mind, this means focusing on transparency, user choice and soft power, rather than blunt rules that will only strangle industry. Tools like sand-boxes, where algorithms are road tested within a safe environment using trial data, could be used to assure products before they get to market. For consumer products, users could be asked to set or approve the principles assumed by autonomous systems, such as how prominently different voices appear on social media or how autonomous vehicles should drive in certain environments, to ensure humans, not lines of code, remain accountable. Public procurement rules could be used to set core standards for technology used in public services without imposing heavy regulations across the entire economy.

Most important, though, is that policymakers start a meaningful public debate about the level of decision-making we are prepared to delegate to machines and in what domains, and which decisions should remain in the hands of humans. As with other political debates, this will require weighing up public opinion against public benefit: AI approaches to healthcare are unlikely to be popular but could save, and extend, many lives. But it is essential if the inevitable growth of AI is to retain public legitimacy and for people to feel they still have power and control over their own lives.

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Artificial intelligence is set to become one of the most disruptive technological developments ever. Understanding the associated opportunities and threats from a human-centric perspective is key to ensuring acceptance and delivering maximum business benefit.

Journey 2022 - Resolving Digital Dilemmas
atos.net/journey2022

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Frédéric Oblé, Eric Monchalin, members of the Atos Scientific Community
Guillaume Lefebvre, Worldline R&D

Reinventing your future with the promise of AI

Wave goodbye to the Mobile-First era. AI is now all the rage. AI will soon spread everywhere: from mobile apps becoming smarter and smarter, through objects with distributed AI, to data analytics that goes far beyond predictive capabilities. Every company in every industry is under pressure to figure out how the magic of AI will disrupt its business.

Nevertheless, we should not hurry to wipe the slate of the past clean. The Mobile-First era underlined, among many other things, how important APIs are for fuelling applications with data. After all, with advanced and heavy analytic technologies reigning in today's world, the value of APIs will be reinforced by the deluge of connected things that will soon spill data over us.

As we jump in AI-First era, let's explore how we can leverage AI insights from research labs to businesses to boost value extraction from data and optimize the outcomes of every decision.

The AI tsunami

AI is on the brink of revolutionizing industries as diverse as banking, healthcare, aerospace, and manufacturing.

As previously shared in this paper, major providers of market intelligence such as Gartner or IDC agree the AI market is exploding. They anticipate an AI tsunami will engulf the world: Asia on one side will see a CAGR of 74% from 2016 to 2021, and Occident on the other will see a CAGR of 45%.

Three factors are fostering that AI tsunami:

- **Data** is everywhere and accessible. You can expand AI beyond narrow uses cases and solve more valuable challenges.
- Data is rich and explained well through semantics, enabling a paradigm switch that transforms data into **knowledge**.
- We have broken the 'AI speed barrier,' and intensive **Machine Learning** is now at hand for every business.

AI through the ages

While there is now more buzz around AI than ever, AI has been at stake for almost 60 years. In the early stages, algorithms were simply "I repeat" capabilities. These have progressed over time. Today "I learn to learn" algorithms allow us to create ever smarter machines, even ones that can learn by themselves. The next generation "I contribute, I exchange" algorithms will make distributed AIs cooperating a reality. They're already there in the most advanced research labs.

Industry today boasts its own specific AI implementation model: Machine Intelligence (MI). But take a step into the future to discover an advanced version of this model. We call it the 'Machine Intelligence Brain Model'.
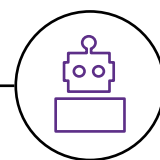
Inside the Machine Intelligence brain

The model's Perception Layer allows machines to understand their environment. It applies a first processing to information arising from various sources, including sensors that gather structured and unstructured data to make them accurate and reliable.

The 'intelligence' lies within the Cognition Layer where complex algorithms combine to deliver the specific Machine Intelligence sought. This Cognition Layer prepares the knowledge and understanding required for decision making.

The Decision Layer has all it needs to get the job done. Its forward-looking decisions take context into account, with those decisions influenced through the Anticipation Loop.

Finally, the system's Memory stores all the data gathered, enriched information accumulated as knowledge, and algorithm models.

Ready for specific use cases

The Brain Model allows Machine Intelligence capabilities to be architected as a stream of services with weak or narrow dependencies. Each step can be optimized and improved independently. The more accurate the Perception Layer, the better the model can infer the importance of contextual detail in the Cognition Layer, for instance.

We have already applied the Brain Model to various use cases such as anomaly detection, stream context processing, chatbots, cybersecurity, video security, and fraud in payment.

Mastering deployment

Mastering an AI development model is not enough. The infrastructure and tooling are at stake too, as we highlighted in the three key factors. This leads us to another challenge: making industrial deployment of AI capable solutions a reality.

Imagine an efficient ecosystem that covers the entire MI value chain from raw data to AI deployment into businesses across all markets, allowing many actors to collaborate to make MI happen. To achieve this, we must focus on:

- Building data pipelines to gather the real-time data stream
- Running AI Factories
- Creating knowledge and mastering the life cycle of this knowledge
- Deploying the MI system into business applications with the appropriate level of reliability and trust.

Nevertheless, you don't have to imagine the age of Machine Intelligence. It's already here, just ahead of Machine Consciousness.

And you? Are you ready to jump into the 'Era of AI'?

$$h_t = \sigma_h(W_h x_t + U_h h_{t-1} + b_h)$$

$$(W_y h_t + b_y)$$
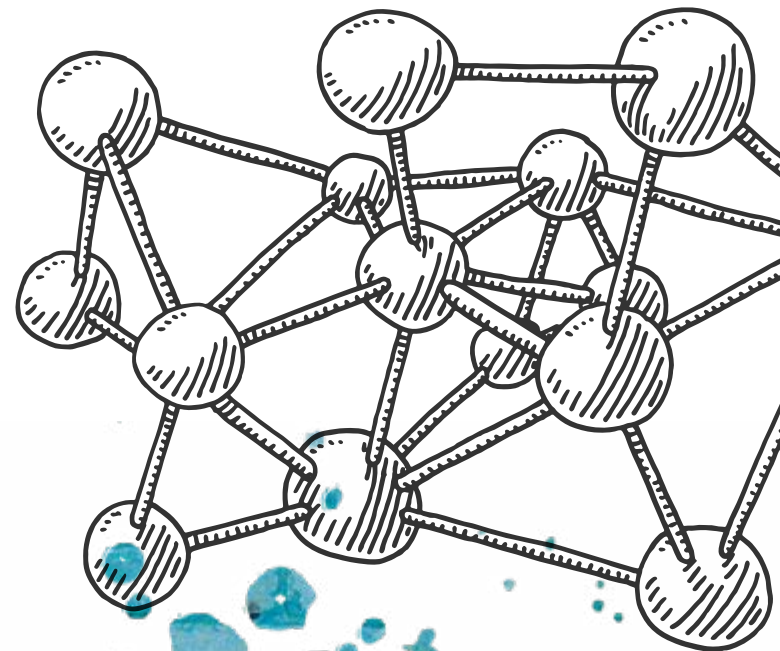
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