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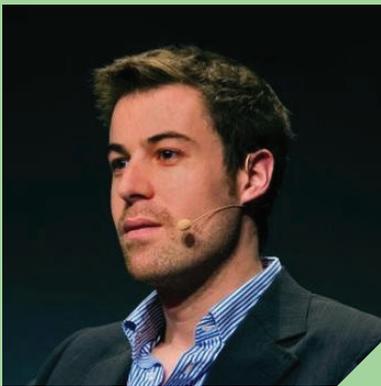
# AN AI STATE OF MIND

Professor Yves-Alexandre de Montjoye and  
Baird's Global Technology & Services Investment Banking Team

# INTRODUCTION

Artificial intelligence (AI) has immense potential to transform the way people manage tasks that typically require human input, making processes more efficient and creating value for users, customers and employees. This newfound potential has been unlocked by recent advances in AI driven by the availability of comprehensive datasets and computing power. AI has advanced on fundamental tasks – such as regression and classification – but also on domain-specific ones, ranging from conversational AI to self-improving robotic process automation. Businesses embracing this newfound potential with an AI State of Mind, using full automation or in conjunction with humans, are creating competitive advantages.

To display the business impact of AI, Baird Global Investment Banking's Technology & Services team partnered with Dr. Yves-Alexandre de Montjoye, Associate Professor of Applied Mathematics and Computer Science from the Department of Computing at Imperial College London, commissioned through Imperial Consultants, to provide an independent analysis on how nine different companies are using AI practically to improve their performance, create competitive advantages and better serve their customers.



**Imperial College  
London**  
Consultants

Yves-Alexandre de Montjoye is an Associate Professor at Imperial College London and the Director of the Algorithmic Society Lab. His research has been published in *Science* and *Nature Communications* and has enjoyed wide media coverage (*BBC*, *CNN*, *New York Times*, *Wall Street Journal*, *Harvard Business Review*, etc.). His work on the shortcomings of anonymization has appeared in reports of the World Economic Forum, FTC, European Commission, and the OECD. Yves-Alexandre worked for the Boston Consulting Group and acted as an expert for both the Bill and Melinda Gates Foundation and the United Nations. He received his Ph.D. from MIT in 2015 and obtained, over a period of six years, an M.Sc. from UCLouvain in applied mathematics, an M.Sc. (Centralien) from École Centrale Paris, an M.Sc. from KU Leuven in mathematical engineering as well as his B.Sc. in engineering from UCLouvain.

## Participating Companies



**Avaneesh Marwaha**  
Chairman (Former Chief Executive Officer)

Litera has been at the forefront of legal technology for 25+ years. As a global leader in workflow, AI-powered due diligence review and analysis, collaboration, and data management solutions, Litera provides legal teams with streamlined technology for creating, analyzing, and managing their documents, deals, cases, and data. Litera's solutions help law firms and legal teams around the world to work more efficiently, accurately, and competitively, and to provide their clients with usable and actionable information.

Baird Contact: [Kristy Obuchowski Wallen](#), [Shane Nelson](#)



**Adam Godson**  
Chief Product Officer

Paradox was built around a simple mission: To give every recruiter, hiring manager, and talent professional an assistant to get work done. Five years later, that mission is embodied by Olivia – Paradox's conversational AI assistant, who is saving the company's clients millions of hours of manual work every year by automating hiring tasks through smart, simple, mobile-first experiences. Ultimately, Paradox envisions a future where software becomes invisible – driven by conversations that untether people from their desktop through an assistant who gets work done for them.

Baird Contact: [Bret Schoch](#), [Shane Nelson](#)



**Bradley Killinger**  
Chief Executive Officer

Sapience Analytics provides an unprecedented level of operational visibility around enterprise resource investments in people, processes, and technology. Sapience Vue is an advanced analytics platform powered by business intelligence and machine learning that provides a fully automated multifaceted view of the Contingent Workforce and Enterprise Effort. Today, Sapience Analytics is used by more than 90 companies in 18 countries worldwide, with over one trillion work hours analyzed to date. Sapience Analytics is fundamentally changing the way companies operate, enabling businesses to build a better version of their organization every day for ultimate agility and competitive advantage.

Baird Contact: [Brian Cole](#), [Shane Nelson](#)



**Manish Pandya**  
SVP, Digital



**Cédric Wagrez**  
VP, Machine Learning

TaskUs is a provider of outsourced digital services and next-generation customer experience to innovative and disruptive technology companies, helping its clients represent, protect and grow their brands. Leveraging a cloud-based infrastructure, TaskUs serves clients in the fastest-growing sectors, including social media, e-commerce, gaming, streaming media, food delivery and ridesharing, HiTech, FinTech and HealthTech. Its main services include Digital CX, AI Services, Trust & Safety, and Consulting.

Baird Contact: [Kiran Paruchuru](#), [Shane Nelson](#)



**Siobhan Hanna**  
Managing Director, AI Data Solutions

TELUS International designs, builds and delivers next-generation digital solutions, including AI and content moderation, to enhance the customer experience (CX) for global and disruptive brands. The company's services support the full lifecycle of its clients' digital transformation journeys, enabling them to more quickly embrace next-generation digital technologies to deliver better business outcomes.

Baird Contact: [Kiran Paruchuru](#), [Shane Nelson](#)




**Tom Livne**  
Founder & Chief Executive Officer

The Verbit Company serves as an essential partner to 2,000+ businesses and institutions. Verbit's vertical-built voice AI solutions provide its partners with the tools they need to offer engaging and equitable experiences that not only meet accessibility guidelines but make verbal information searchable and actionable. In just a few years since its founding in 2017, Verbit has grown into a unicorn company with a \$2 billion valuation and a global presence. Verbit employs the largest professional captioner workforce in the world and has emerged as the leader in the \$30 billion transcription industry.

Baird Contact: [Brian Cole](#), [Shane Nelson](#)




**Dr. Muhammad Shoab**  
Team Leader AI / Data Science

Visible enables small and medium-sized industrial businesses to make products and services internationally accessible to purchasers. The company offers a broad range of specially tailored services for business customers to increase their digital reach. This includes a combination of company owned B2B platforms and online marketing services, such as Google Ads and retargeting campaigns. Platforms operated by Visible GmbH include wlv, which is the leading B2B marketplace in the D-A-CH region, as well as the European B2B platform EUROPAGES. Together, the two marketplaces reach more than 3.9 million B2B purchasers per month, looking for detailed company and product information.

Baird Contact: [Simon Pearson](#), [Chelsea Smith](#)




**Chris Grebisz**  
Chief Innovation Office

Welocalize offers innovative language and content services, enabled by AI. Welocalize works with many leading global brands to support their globalization programs, helping them reach audiences around the world in 250+ languages and is supported by a network of 250,000 in-country linguistic resources. Its range of managed language solutions include machine translation, digital marketing, patent translation, validation and testing, interpreting, and AI-enablement services including conversational AI, NLP consulting, and developing high-quality datasets for training multilingual AI products.

Baird Contact: [Kiran Paruchuru](#), [Shane Nelson](#)




**Shoeb Javed**  
Chief Strategy & Product Officer

Worksoft provides Connective Automation for the world's leading global enterprises, automating the full lifecycle of a business process from process intelligence to testing to RPA. Its codeless automation empowers business users and IT to accelerate automation and arms organizations with process data insights to prioritize automation efforts and extend the value into RPA for maximum efficiency and scalability. With Worksoft, enterprises can speed project timelines and ensure data-driven quality for their complex end-to-end business applications, including SAP, Oracle, Salesforce, Workday®, SuccessFactors, ServiceNow, and more.

Baird Contact: [Simon Pearson](#), [Chelsea Smith](#)

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# EXECUTIVE SUMMARY

We interviewed nine companies to get their firsthand insights on using AI in practice. This report shares learnings and observations from those discussions, highlighting how the companies are using AI to improve performance, create competitive strategies and better serve customers.

Participating companies emphasized four benefits of AI they say drive value and improve performance in their organizations. Its **scalability** is invaluable, rendering tasks that would take many humans thousands of hours to be completed in less time with fewer hands. Contrary to popular belief, our discussions revealed, few jobs are at risk of being replaced by AI. Rather, it creates **efficiency gains** that will not only help employees be more productive, but also make their work more interesting. AI also **improves quality** by thoroughly checking every single detail and reducing errors. Finally, AI generates **new insights** for companies on both their business and clients.

Companies also highlighted the importance of data when building AI models. All companies we interviewed emphasized how the **performance of AI models is largely a function of the quality of the data and labels** the model relies on to learn. Furthermore, they emphasized the **risk for AI systems and datasets to create or perpetuate bias** – and thus it is critical to ensure data used is truly representative and bias-free, labels are generated by a diverse population, and feedback loops are put in place to help ensure the system functions as intended and to limit the risks of bias.

When asked to consider the future of AI, the companies we interviewed believe **AI will continue to grow in popularity outside the traditional tech players**. This is in part thanks to its democratization, e.g., through the availability of pretrained large language models and increasingly mature deployments of AI, with tech and business teams working closely to solve problems with the help of AI. Finally, most companies believe additional regulation is coming, but its impact on use cases is still a topic of debate. The general consensus was **some form of regulation is welcomed** as it could help build trust in AI and its deployment. All participating companies planned to invest more in AI to reach their ambitious near- and long-term goals.

# AI MISSION (IM)POSSIBLE: PERFORMANCE DRIVERS

## Scalability

AI's most impressive and impactful outcome is its ability to condense the time taken to complete certain manual tasks from thousands, if not tens of thousands, of hours to a matter of days or hours. Equally, it provides instant scalability and dramatically simplifies "data crunching" – and in some cases largely automates these workflows to limit the need for significant human work, which enables businesses to reallocate people into more productive roles.

AI is a massive time saver. Dr. Muhammad Shoaib, Team Leader AI / Data Science at Visable, for instance, semi-automatically extracted an ontology from large amounts of unstructured data (e.g., company websites, trade reports, etc.). Using pre-trained language models and natural language processing (NLP) techniques, his team was able to create simplified and intuitive taxonomies guiding users in their search for new suppliers, across 1 million companies and 60+ industries, something that would have been impossible to do before AI. Their solution is easily scalable to textual data in multiple languages for millions of companies.

“ We finished the whole project from the collection and structuration of the data to the creation of the taxonomy and search engine in six months for 64 different industries. This would simply not have been possible without AI.

– Dr. Shoaib, Visable

The ability of AI to learn from huge, labeled datasets drives its prediction capabilities and enables tasks to be performed rapidly and at scale. Companies interviewed emphasized how modern AI dramatically improved performance on classical tasks such as recognizing objects or landmarks in pictures. Beyond these, robustly labeled data has unlocked AI's ability to perform more subtle tasks that were previously only possible via human intelligence

and intervention. Siobhan Hanna, Managing Director, AI Data Solutions at TELUS International discussed labeling and image annotation, the largest part of the company's AI business, and the impact it has on enabling better user experiences for their clients. For example, a very large project was recently completed around global landmarks – annotating key points in each photo to enhance the user experience and increase engagement with those images online.

On a more complex level, TELUS International manages projects around video annotation which is a very important element in computer vision and in the development of autonomous vehicle functionality. Regardless of the use case, high-quality, human-powered data annotation and labeling provides machine learning models the inputs needed to understand patterns and improve AI performance in practice. The result is better user experiences in multiple formats like search engine results, autonomous vehicle functionality, interactive speech recognition, digital map interactions, and even more realistic chatbots experiences.

Similarly, TaskUs has been a key partner of autonomous vehicle companies by annotating very large quantities of images from LiDAR – which requires advanced trainings of annotators. A leading global autonomous vehicle company partnered with TaskUs to help them rapidly and exponentially scale, refine, and enhance AI training through high-precision data. By hiring the right people and training them to become "super experts" – establishing a quality management framework, and establishing a weekly headcount forecast – the client's agile development strategy expanded to 16 simultaneous projects including semantic mapping, feature extraction, multilayer object classification, and LiDAR sensor fusion. More so, TaskUs indicated that AI helped them "exceed targets set by the client, including accuracy and quality assurance scores and attrition rates."

## Efficiency Gains

Although much has been said about AI eliminating jobs, it is more so the case that only a select group of jobs are likely to become fully automated in the near future. AI is more likely seen as a complement to existing workflows and is already driving significant productivity gains, enabling people to work on higher-level tasks, more intelligently and faster. According to McKinsey estimates, 60% of occupations have at least 30% of their activities that can be automated.<sup>1</sup>

“ Our talent does not want to have 80% of their work be repetitive. AI is allowing us to remove administrative activity from workflows and services, ultimately making work a lot more interesting.

– **Chris Grebisz, Welocalize**

Another example is Olivia, Paradox’s conversational AI and workflow tool for recruitment. By simplifying the application process (i.e., apply by text), managing interview schedules, and answering more than 30 million questions from candidates per year, Olivia has made recruitment more efficient and increased quality application rates for companies. For example, having Olivia respond to typical candidate queries has freed up HR employees’ time, helping them focus on high quality talent searches and managing the job application processes. Importantly, it also made the process a lot quicker, engaging, and seamless for the candidates, ultimately leading to better outcomes for both parties.

“ Working with one of our large restaurant clients, we managed to dramatically reduce the time it took for someone to be hired. From 14 days to 3 days. And that 11 days was really all waiting for someone to do something.

– **Adam Godson, Paradox**

Efficiency gains also come when AI is used to optimize business processes, which are often composed of thousands of steps across hundreds of different activities and involve multiple countries. Indeed, business processes can quickly become very complex and inefficient. Worksoft uses AI to automatically analyze current processes in a

company, cluster them, and extract best practices that can be replicated across an organization. Additionally, with the help of predictive analytics, Worksoft can also help companies optimize these processes for certain parameters and drive significant time and cost efficiencies.

## Improved Quality, Consistently

AI can also help businesses improve performance by reducing errors and increasing overall quality. While humans might get tired and make mistakes, computers will systematically and rigorously check every detail, helping ensure the highest quality of the final product. For example, this is what Litera’s AI is doing for one of the most detail-oriented industries: the legal profession. Litera’s Contract Companion platform detects and directly addresses issues within complex legal documents, ranging from incorrectly written numbers to missing references, as well as formatting issues. Additionally, Litera’s acquisition of Kira Systems, enabled the company to provide total diligence for the transaction and deal management lifecycle through its advanced machine learning contract search, review and analysis software.

“ Due diligence [for legal contracts] today is basically counsels agreeing on a budget which will allow like 3% of all the agreements to be reviewed. Kira allows buyers to conduct total due diligence. It analyzes every single agreement there is and helps the buyers’ counsel decide what to prioritize. This helps the buyer know as much as possible what they’re actually acquiring and what the risks might be versus the 3% sample if this were done the ‘old-fashioned’ way.

– **Avaneesh Marwaha, Litera**

Another area where AI continues to make significant quality impacts is in the Language Service Provider (LSP) industry. Welocalize, a leading LSP Super Agency<sup>2</sup>, provides professional translation, localization, adaptation and machine automation services to help customers navigate digital transformation globally in their business. In doing so, the company leverages AI to allocate, and in some cases complete, work for thousands of translations daily and ensure the work quality meets their customers’

requirements. Welocalize uses natural language processing (NLP) and machine learning to quickly evaluate the complexity of a task (e.g., the difficulty of sentence construction, lengths, use of adverbs/adjectives, etc.) and routes it to the best translation resources available on their platform across the globe, reducing delivery time and ensuring consistent, high-quality results. Simple sentences for instance might first be automatically translated, while complex ones would be directly sent to domain translation experts. NLP is also used to identify the level of editing necessary for machine translation output to reach the expected quality standards. This shows how AI as a product (machine translation) can be paired as a workflow tool with human input to drive efficient and high-quality outcomes.

## New Insights

The rapid acceleration of digital transformation has provided the data needed to create high-quality AI models that drive new business intelligence and predictive insights for companies. Insights about their clients but often also about their own operations. Indeed, beyond the well-known examples of AI recommending what movie people should watch next based on selected criteria similar to the one they are looking at, the companies interviewed emphasized how AI gives businesses new insights about their own processes and where improvements can be achieved to deliver better customer outcomes.

“ We are often the one equipping executives with trends occurring in their business, insights and data about how their business really works, and new ways of working that are occurring in their business to improve alignment between people, processes and technology.

– **Bradley Killinger, Sapience Analytics**

One of the key benefits of Worksoft’s efforts to reverse engineer process flows is to provide executives a data-driven perspective on how their business functions. These insights are essential for any modern business to make both operational and strategic decisions.

“ When they see visualizations of their business processes, executives often realize that what they thought they were doing is actually not what they do. There’s a discrepancy between the idealized state of that process that they think they need to do, versus what’s actually happening.

– **Shoeb Javed, Worksoft**

Killinger at Sapience Analytics shares similar views that such insights are much needed in the current discussion on the “future of work.” Determining the new operating model across remote, in-person, and hybrid workplaces is increasingly high on the agendas of executives globally. Companies are spending millions on real estate, yet employees have expressed preference for more flexibility. But how does this impact productivity? AI-powered analytics on optimal work hours, location, etc., might help businesses and executives identify the right balance of worker flexibility vis-à-vis maximizing productivity and retention.

## HUMAN-IN-THE-LOOP

Nearly all the companies interviewed mentioned the importance of keeping a human-in-the-loop element when deploying AI technology. This is an acknowledgement of the fact that most AI works alongside instead of replacing humans and requires human oversight. For instance, ensuring a level of manual control and quality assurance over the decisions made by algorithms. Visable's algorithm, for instance, detects company profiles that might be duplicates but given the cost of a mistake, a human will always be the one making the decision to take down pages. Interestingly, the companies interviewed indicated that human-in-the-loop in AI implementations were, in their opinion, more important than initiatives around explainable or interpretable AI.

To share an experience from TaskUs: An autonomous vehicle technology development company needed a team of Fleet Response Specialists who could monitor the health and performance of vehicles and ensure the safety of passengers as they navigate public roads. TaskUs hired and trained over a hundred specialists for the Fleet Response Program, providing real-time assistance in the vehicles. TaskUs also takes pride in their safety and fatigue management. As a result, TaskUs indicated they "surpassed client's targets of fleet response correctness and collision alarm response," all with the help of human-in-the-loop AI.

Another great example of utilizing a human-in-the-loop model is Verbit's deployment of speech-to-text models. The company processes live transcription in real time through its speech-to-text model. However, before it appears on the screen, two different people see the sentence written by the model. Using a specifically designed interface, they can then correct mistakes made by the model in seconds and before the text is shown on the screen to audiences.

“ For every session, we have two professional transcribers reviewing the text suggested by the AI. If it's correct, they just click enter and then it appears on the viewer's screen. If there's a mistake, they have auto-suggestions which they can click on and other tools at their disposal for an efficient process. It's a machine-human transcription system, which we invested in heavily to build.

– Tom Livne, Verbit

With human-in-the-loop AI in mind, Paradox also built Olivia. The answers the system provides candidates are based on inputs written and pre-approved by HR departments based on a general knowledge base and frequently asked questions by candidates. When asked a question, Olivia leverages an NLP engine to deliver the most appropriate response to the question from its vast database. Given the diversity of questions ranging from simple like "Can I bring my dog to work?", to questions with more serious ramifications and possibly legal implications if an incorrect answer is provided (e.g., a company's benefit packages or right-to-work stats) Paradox has designed Olivia to work alongside human colleagues and direct candidates to them when questions become too complex.

“ We have many NLP measures of the quality of a conversation: confusion rate, whether the conversation is clear, happiness, whether the person would seem angry, so doing some sentiment analysis on what that looks like helps us understand and pinpoint where we can improve our conversation. We have human trainers that look at past conversations and then train our AI to specific things that they may have missed.

– Adam Godson, Paradox



# THE UNREASONABLE EFFECTIVENESS OF DATA

In order to deliver the practical potential of AI and the performance drivers outlined above, it is important to recognize that data is a critical factor in driving the advances seen in AI models over the past decade. Back in 2009, Peter Norvig, Google’s former director of research and search quality, was already calling for AI developers to “follow the data.” While his argument was mostly about natural language processing, the title of his paper “The Unreasonable Effectiveness of Data” has become a catchphrase, reminding us that any advances in AI will be dependent on the availability of high-quality datasets and labels.<sup>3</sup>

Is AI “just” big data on steroids? AI, like traditional analytics capabilities, uses mathematical and statistical models to extract valuable insights from both structured and unstructured data. The ability of modern AI techniques (see Section 3 later in this paper) to learn increasingly general rules and extract patterns from large amounts of data is, however, what truly sets AI models apart.

Making effective use of these new technologies requires large amounts of high-quality data, most often labeled. While it of course depends on the application considered and the required accuracy, it is generally accepted that thousands to tens of thousands of data points are often necessary for neural networks techniques to be applied and solve a general classification problem. At the other end of the spectrum, large language models such as GPT-3 are trained on hundreds of billions of words. For example, Tesla has accumulated three billion autopilot mileage data points for its AI-based self-driving systems.<sup>4</sup>

## Digital Transformation as a Precursor to AI

Digital transformation simplifies and often changes the way business is done by creating data that can be

converted into digestible insights. The transition from analogue to digital has also supercharged the creation of the vast datasets that can be used by modern AI algorithms. For example, digital customer service interactions and internal workflow processes now generate unique datasets on how employees handle customer relationships and work gets done. Similarly, the shift to the cloud continues to enable large global organizations to work and produce information in standardized digital formats at a low cost – all of which, lends itself to the petabytes of data being generated daily that can potentially drive high-quality AI models.

“ Digital transformation leads to high-quality and large datasets that AI models can be applied to for innovative solutions. Organizations must actively pursue innovation and seek solutions to disrupt the current business landscape. This would allow them to compete with the disruptors who are far ahead in the digital journey and to strive to provide the best digital customer service possible.

– Manish Pandya, TaskUs

Killinger at Sapience Analytics noted that collecting the right operational data can “move organizations from being reactive and led by their gut instinct into being true data-driven organizations.” Sapience Analytics uses specialized IoT sensors, desktop and laptop data collection software, and other digital footprints to provide unique insights into how, when, and where work gets done, so businesses can allocate resources more efficiently and maximize the value of their human capital investments – both employee and contingent.

Similarly, digital transformation has provided tailwinds for the Language Service Provider (LSP) industry, with vast amounts of data being created daily from localized, digital

content. Moreover, LSPs can achieve productivity gains by harnessing this data through AI driven digital platforms. For example, Welocalize recently fully migrated Pantheon, its enterprise ecosystem, to a digital cloud platform which allows it to allocate, monitor and complete projects quickly and accurately on a single platform that can scale projects rapidly. The company now manages everything in the cloud, including its professional linguistic network, translations tasks and learning management systems, as well as its financial software. This transformation allows them to decompose and process tens of thousands of tasks a day across hundreds of language pairs such as English to Spanish but also rarer and more complex ones such as Chinese to Hmong. This also automatically creates metadata from their projects, which they use to further train machine learning algorithms that are capable of analyzing over 250 different features of a project and flag risks of projects requiring more resources to fit their project deadlines.

“ In the absence of having that infrastructure in place, it would be impossible to do this at scale. And we have many, many hundreds of local pairs, which requires any number of resources to process those local pairs. AI is how we identify the best resources to process incoming work and ensure its quality.

– **Chris Grebisz, Welocalize**

## When Data Is Not Available, It Is Created

However, high-quality data availability continues to be an issue when it comes to effectively training an AI algorithm. This can be for legal reasons or because the AI is being used to produce a new innovative product that does not exist yet. In these cases, high-quality custom-made training data is created to meet the needs of specific machine learning applications.

TaskUs, for instance, has recently created custom-made datasets focusing on computer vision for AR and VR systems. In order to mitigate the risk of bias, it has been crucial to identify a large pool of participants from a diverse background.

The business of synthetic data creation is booming, generating audio and images data as well as text and video formats. And demand is not only coming from the large tech companies but also companies active in financial services, healthcare, automotive and manufacturing, as well as governments, who are all on the digital transformation curve.

“ In this age of AI, data is the new gold and when it comes to training AI, the quality, quantity and diversity of that data is exceptionally important. Otherwise, as they say, it’s garbage in, garbage out.

– **Siobhan Hanna, TELUS International**

## High Performance AI Requires High-Quality Data

At a fundamental level, AI is a set of general algorithms that intelligently learns from training data. Ensuring training data is high-quality is therefore of the utmost importance and can determine the ultimate usefulness of the AI tool. Firstly, this means ensuring that data is as accurate as possible.

“ Quality has always been the most important part of training data. To achieve the highest levels of quality training, you want your data to be as clean and comprehensive as possible. In our experience, improving your algorithm is not about slightly changing your model or tweaking the hyper parameters, but actually about keeping your model as is and improving the quality of the data.

– **Cédric Wagrez, TaskUs**

Quality also means that the data needs to be representative and unbiased. If the data features bias, the AI algorithm will learn this and make incorrect and biased decisions. Limiting bias starts at the data collection phase. Wagrez also points out, “We have all heard or read stories of bias in AI models like face recognition, for instance. In some cases, lapses or failures in these models prevent certain individuals from entering their own office because the system doesn’t recognize them. In the worst cases, it can end up in a false or incorrect arrest from

law enforcement. Indeed, the seriousness and possible ramifications stemming from this issue cannot be understated.”

More generally, quality means that the data is suitable for an algorithm to efficiently and appropriately learn and make decisions. For instance, capturing the right information required for the algorithm to disentangle two related but different outcomes. In practice, some of the companies we talked to emphasized that successfully creating training data requires close work between AI developers and data creators, with several rounds of iteration required to collect the right kind of data and to review it for the algorithm considered.

## Supervised Learning and Labels

Labels provide the answer we would like the algorithm to learn: humans telling algorithms that this is a picture of a cat, that this email is spam or that this financial transaction is fraudulent. Labels are therefore a critical ingredient to training AI algorithms. Like data, labels can be organically present or specifically created for a task. An example of organically present labels would be a list of previously flagged transactions. As machines learn directly from them, high-quality labels free from bias are essential to creating effective AI models.

Labels can also be created for a broad range of tasks. This ranges from the traditional image annotation, telling the model what it should “see,” to helping models recognize words or translate sentences. Nowadays, labels are increasingly used to train models to recognize more subtle features of the data. For instance whether text is abusive or qualifies as hate speech, whether an ad is degrading user experience or whether a news source is reliable.

“ If we think about the role of ads in the online tools and platforms that we engage with every day, the organizations that manage those platforms are, of course, eager to make sure that advertising enhances the user experience as opposed to detracting. It comes down to understanding user preferences and reactions to a variety of advertising types, which can be achieved through ad scale and ad relevance

data training that an experienced AI data solutions provider like TELUS International can provide.”

– Siobhan Hanna, TELUS International

## The Need for Feedback Loops

AI models are not static. They are, in fact, highly dynamic and need to be kept up to date and continuously improved. For instance, Wagrez from TaskUs explained how detecting hate speech is “a game of cat and mouse.” Hate groups are using code words and specific sentences to communicate while avoiding detection and are always developing new tactics. A mix of outsourcing and reporting by users is used by most companies to provide a safe environment.

“ New tactics are developed all the time by individuals trying to avoid their content being removed. We have a team specializing in trust and safety, who searches hate speech on platforms, monitors its evolution and discovers new tactics of bad actors, and provides solutions to best handle such scenarios. This is a very important challenge for us.

– Cédric Wagrez, TaskUs

Feedback loops are also essential for models to keep improving and learn from their mistakes. The machine makes its best guess which is then verified, e.g., by a human. Verbit, for instance, has a network of over 35,000 freelancers working with their internal team to ensure high-quality transcription, both real-time and non-real-time, for its clients and improving its speech-to-text model. This provides rapid human-in-the-loop feedback to ensure the AI transcription models are not only working correctly, but also continually learning in real time. Their process makes it straightforward for the machine and the human professional to work closely together.

Livne at Verbit also discussed utilizing their platform to prioritize and allocate non real-time work, whereby vetted transcribers review the machine’s work for accuracy and make corrections as needed. This process provides feedback to the speech engines and allows them to get better and better over time.

## BIAS IN AI

AI has the potential to make fairer and better decisions by analyzing vast amounts of data quickly. However, when poorly done, AI can also perpetuate existing historical biases or, even worse, create new ones.

Bias can find its way into AI models through different means. One of these is when an AI model is trained on non-representative, or biased, datasets and labels. For instance, large language models have been shown to exhibit gender, racial and religious biases.<sup>5</sup>

“ Ensuring diversity and representation in our data to address and mitigate the impact of bias in AI is something that’s incredibly important to us and to our clients. This can, and should be, addressed at multiple levels. Firstly, by supporting our clients upstream and during product development, we can ensure a thoughtful plan is implemented for addressing and supporting their data training needs. We also take a proactive, thoughtful, and data-driven approach to ensure training data is reflective of the diversity amongst our participant communities that we build for our clients’ projects.

– Siobhan Hanna, TELUS International

Ensuring the data and labels used to train models are representative and free from biases is critical. Several of the companies we spoke to who help in the creation and annotation of data (e.g., TaskUs, TELUS International, Paradox, Sapience Analytics) strongly emphasized the need to understand and fight biases, and how having a diverse workforce is, in their opinion, often the best way to help this. For example, when creating voice data to train speech models, ensuring that participants are diverse from the perspective of age, race, gender, and accent is a great first step to avoiding inherent biases. Similarly, diversity is essential when labeling or annotating data as tasks often involve a level of personal and qualitative judgment from the labelers. To help make AI more equitable, TaskUs, TELUS International, and Welocalize leverage a crowdsourced model, allowing them to leverage an extremely diverse workforce across hundreds of countries for better and more representative inputs.

“ Bias in AI is a very serious issue, and our customers are very sensitive to that challenge. That’s why we work together with them to design the project to collect the data they need while preventing biases.

– Cédric Wagrez, TaskUs

Godson from Paradox has similarly been focused on eliminating the inherent biases in recruitment processes, and how if done right, AI might actually help fight biases. For example, Olivia, Paradox’s conversational AI tool, focuses on objective qualifications required for a position instead of people’s name, work history, address, etc.

“ Godson noted, “I have a lot of hope that we can get the structure right, and take out bias, while being really careful we don’t scale and add bias in.”

# WHICH AI?

The companies interviewed use a range of AI techniques. Among them, natural language processing and predictions were by far the two most popular applications mentioned in the interviews with clustering being a close third. We explore these in further detail below.

## Natural Language Processing

Natural language processing, or NLP, covers a wide range of techniques to analyze and understand text. NLP has seen strong improvements in the last couple of years with the rise of increasingly large language models. For instance, BERT from Google is composed of 345 million parameters while OpenAI's GPT-3 already has 175 billion parameters. These models have quickly replaced the traditional, more hand-crafted NLP techniques. Most pre-trained models have been made available freely for public-use or sometimes for a fee. This has led, as mentioned by several companies, to a democratization of NLP models, allowing companies with limited resources to leverage multi-million-dollar models. Importantly, this also limits the environmental impact of training these models.

“ For medium-size companies like us, relying on pre-trained models like BERT which we then fine-tune, and libraries like fastText makes a lot of sense. It allows us to limit the costs and deploy products much faster.

– Dr. Shoaib, Visible

Given the importance of text, ranging from ads to websites and contracts, it is not surprising that natural language processing is the most popular set of techniques amongst companies we talked to. For example, TaskUs uses fine-tuned GPT-3 based NLP to evaluate language proficiency of their workforce at scale for a fraction of a cost while Visible uses it to transform text into vectors independently of the language of the text. Given the products they develop, NLP is of course also central to Paradox's efforts to further improve the capabilities of conversation AI

algorithms, including finding answers to questions asked by candidates, and to Litera in finding alternative clauses for clients and to review due diligence documents. Finally, both NLP and machine translation (MT), a subfield of NLP, are used by Welocalize to pre-translate some of the text and to intelligently route content. For example, if the content is highly complex, it may be more efficient to simply send the work directly to a human translator or only use minimal MT and then let a human manage the rest of the content adaptation. However, if the work is fairly straightforward, a good MT engine can likely complete the majority of the work automatically with minimal human intervention. Having best-in-class NLP technology running seamlessly in a workflow ecosystem is critical to scaling operations and delivering timely high-quality work.

“ With easy access to pre-trained NLP language models from GPT-3, AWS Lex and others, it is now possible to have fully functional, effective, and innovative solutions such as language assessments, conversational chatbots, predictive text-based solutions, and text analytics.

– Manish Pandya, TaskUs

“ I think our differentiation comes from using machine translation as a standard part of our workflow with translation memories continuously improving it. It also comes from the other NLP tools we are using for content transformation, allowing us to provide more intelligence to the routing of content, the type of machine translation model it should go to, etc.

– Chris Grebisz, Welocalize

Another key area in which NLP has been driving business success is automated proofreading of documents. At first to identify spelling or formatting errors and now increasingly to look for industry-specific textual issues or

cross references in complex areas such as the legal field. NLP engines can identify these errors within minutes across large documents (hundreds to thousands of pages) that previously would have taken hours or days to review by humans. One of the market leaders in the legal space is Litera which has applied its years of experience in the area to its software development process, creating a bespoke focus on the customer and end user and how its software can interact with them at the right place and at the right time. This has been a key advantage for them to develop AI technology to help clients understand where users may be doing things wrong and then suggesting changes to make documents better.

“ It’s not just about creating the machine or creating the models. You have to understand where and when the user’s going to leverage those models and how effectively they need to run, or how quickly it needs to run, or what the outputs in the UI or UX look and feel like.

– Avaneesh Marwaha, Litera

## Predictions

Based on labeled data, AI models learn to make predictions. When the prediction is categorical – for instance whether a piece of text qualifies as hate speech or not – the task is called classification. When the result of a prediction is continuous – for instance the price of a house – the task is called a regression task. Traditional algorithms to make predictions were based on manually built features, such as the number of black pixels in an image, and included algorithms such as support vector machines (SVM) and XGBoost. When enough data is available, traditional “feature-based” algorithms are increasingly outperformed by deep learning techniques, a new paradigm in machine learning where algorithms learn from the raw data. These algorithms include for example convolutional neural networks (CNN) which are composed of multiple layers and are typically used for images or graph neural networks (GNN) which operates on graph structure e.g., to detect fake accounts in social networks.

Prediction algorithms, used alone or combined with NLP, are very popular with the companies we interviewed. For

instance, Welocalize uses NLP and prediction algorithms to predict when users will engage with specific content, while Worksoft uses them to estimate the efficacy and efficiency of business processes. TELUS International annotates and at times generates data to train predictive models for a wide range of tasks including identifying what is in an image or to evaluate the veracity of a news source.

Another tool used in enterprises is time-series prediction models such as ARIMA. These can be used to produce accurate and dependable forecasts for planning short-term business results. Using these models, businesses can make better forecasting and planning decisions for things like production, sales and staffing, specifically in non-stationarity or cyclical patterns. For example, Sapience Analytics has collected and analyzed massive amounts of workforce data allowing them to develop a predictive retention AI algorithm reaching accuracies over 90%. They see this as creating significant opportunities to predict which employees might be at risk for getting burned out or quitting, or what future staffing needs will be by turning vast amounts of data into consumable information that managers can use to make better business decisions.

“ There are so many use cases and applications to what you can do with work data and insights. Leaders can immediately shift from trying to manage based on gut feel and instincts to leveraging their own data to validate opinions or establish predictive models that support informed business decisions.

– Bradley Killinger, Sapience Analytics

## Clustering

Clustering algorithms recognize similarities between objects and group them without needing the data to be labeled. While slightly less popular than prediction algorithms, clustering algorithms were used by several of the companies we interviewed.

For instance, Worksoft uses clustering algorithms to group process flows. This allows them to learn directly from the data when process flows share similarities yet

are approached in different ways by employees trying to achieve the same outcome. Similarly, Visable uses clustering algorithms to uncover groups of products in their data and provide easier ways for clients to find the right supplier.

“ Companies often have numerous ways to do the same thing. The way our algorithms learn which processes are achieving the same goal, being essentially variants of the same process, is by using clustering algorithms. This is the only way to do this at very large scale.

– **Shoeb Javed, Worksoft**

## New Applications of AI

AI spans a broad range of techniques, from statistical models to the latest graph neural networks. While predictions – in the broad sense – remains one of the most popular applications of AI, new applications are emerging. These include for instance data generation techniques and decision-making algorithms. Popular algorithms to generate data include the well-known Generalized Adversarial Networks (GANs) as well as a range of synthetic data generation algorithms. Decision-making is often associated with the (deep) reinforcement learning algorithms that have been winning against world champions in both traditional games such as Go, as well as the popular computer game StarCraft.

Important recent developments, driven by the availability of large datasets, also include the rebirth of neural networks under the term Deep Learning, the rise of large language models such as GPT-3 and BERT, and – very recently – the development of self-supervised learning algorithms, algorithms that learn mostly from unlabeled data.

Some companies we talked to also rely on more specific algorithms. For instance, Verbit developed a proprietary speech-to-text model for machine transcription, which is fine-tuned for specific topics. Similarly, Worksoft developed their own algorithm to detect changes in applications, a feature they refer to as “self-healing,” which fixes inherent issues related to automated processes breaking with simple changes in UX or minor updates to process workflow.

“ We have our general speech-to-text model. Then, whenever we onboard a new customer, we create a new model specifically for them. As they use our service, the model learns from the corrections we make and becomes more accurate for their specific field over time. This is what we are doing for a living: creating highly accurate transcripts for our customers and improving their models with every use.

– **Tom Livne, Verbit**

In other cases, companies give clients the ability to fine tune or train the model directly, depending on how well-versed their staff is with training AI models. In the latter case, clients would typically have dedicated resources such as AI expert data scientists on staff. For example, Litera’s Kira product allows those clients that have bespoke needs to use their own staff to train the AI in areas of a new practice that would only be good ~10% out of the box. This provides clients the opportunity to create their own models that are highly reliable and tailored to their needs.

“ So there are some end users and customers out there that are really excited about working on models and making them available to the general marketplace. Others prefer to keep it to themselves. It has been an interesting journey to kind of see those different cultures at firms and how they view their opportunity to make an impact.

– **Avaneesh Marwaha, Litera**

# TRENDS AND THE FUTURE OF AI

So, what are the trends and what does the future of AI hold? We asked the companies to tell us more about what they see coming in their industry and beyond.

Originally limited to university labs and large tech companies, AI is – according to the participants – more accessible now than ever before. Hanna from TELUS International, for instance, emphasized how their client list for essential AI elements such as annotation is growing quickly beyond the large tech companies. Wagrez from TaskUs calls it the great democratization of AI. Thanks to algorithms and language models being open-source and data being a lot more available than before, AI is becoming widely available.

“ A lot of very good models are open source. We’re seeing people taking these models and having a lot of success tweaking them to fit new applications. There are now a lot of companies you would never really think about as a company that would be developing their own AI, but they do. They use one of those models and do transfer learning.

– Cédric Wagrez, TaskUs

Importantly they say, the democratization of AI is not limited to data science and research teams. Previously, AI algorithms were developed by R&D departments that were fairly disconnected from the business. This has led to plenty of unsuccessful proof-of-concepts. Mature organizations have now learned that AI is about much more than just the algorithm, something Sylvain Duranton from BCG Gamma calls the 10/20/70 rule. AI is 10% about algorithms, 20% about technology and 70% about business process transformation. Algorithms alone will not get you very far.

“ AI will make you more productive and efficient by automating repeated tasks. If you’re an executive or entrepreneur, these are the problems I would be looking for, problems with high friction and low efficiency, that you can solve with technology and AI.

– Tom Livne, Verbit

From a business perspective, they also emphasized how AI can be a disruptive force. There is always the risk that one of the large tech companies will come along and solve the problem you are tackling with a breakthrough. While still far out on the horizon, it’s possible that more complex speech-to-text or machine translation models could become so good that human input could be minimized in the future. Similarly, the recent trend where models are increasingly trained using self-learning algorithms could limit the need for high-quality labeled data. While acknowledging them, companies we talked to saw the risk of unforeseeable breakthroughs as fairly limited. Instead, many saw sector-specific AI to be enhancing and potentially replacing traditional business processes.

All companies had plans for new AI deployments in the medium to long term. Marwaha from Litera told us about how AI algorithms might, in the medium term, be able to look at all the past cases from specific courts and judges and help lawyers and clients make more informed decisions on whether to pursue a case and how to do it. Hanna from TELUS International told us about how she sees computer vision as an area with great development potential with the metaverse allowing for the convergence of physical, augmented and virtual reality. Finally, Javed from Worksoft envisions a world where bots will increasingly communicate with other bots across company boundaries. They would find suppliers, negotiate prices with suppliers and organize deliveries automatically,

blurring the boundaries between intelligent automation and enterprise applications.

Several companies however also cautioned that reaping the benefits of AI requires careful consideration. In particular, they emphasized the need for clear dialogue between the technical team and the C-suite to understand what AI could do. This requires technical teams to truly understand the business but also teams across the company from management to legal to better understand what AI is. Similarly, several companies emphasized how it is important for small- and medium-sized companies to be realistic about their ability to deploy AI. This means going beyond buzzwords and focusing on the use cases where AI will bring clear benefits in the short term using as much as possible existing technologies such as large language models.



I think the most important challenge when developing AI solutions is to pick the right problems to solve. I know it's very easy to say but, in a lot of companies, the problems are often selected by the product management teams based on business priorities. This is important of course but without AI-awareness, it can also lead to a disconnect between the problems AI is asked to solve and the ones it would be good at solving. Therefore, we need more AI-awareness at the product management level and in general across whole organizations.

– Dr. Shoaib, Visable

## REGULATION

It is impossible to talk about the future of AI without talking about legislation currently being discussed to regulate it. The most advanced out there is arguably the AI Act, the framework proposed by the European Commission for high-risk AI. It focuses on ensuring the development of trustworthy AI through obligations on data quality and representativeness, robustness of algorithms or the monitoring of performances once the system is deployed. It is anticipated that like GDPR, the AI Act might become a de facto standard for the regulation of AI under what has been dubbed the “Brussels Effect.”

Companies we talked to were very conscious of the risk AI can pose and were generally positive about the idea of AI being regulated when it had a strong impact on individuals. They emphasized, for instance, questions about the representativity and quality of the data being used to train an AI system and the need for

systems developers to be aware of the risk of potential bias being built into AI systems. They also thought that while regulations were going to create challenges in the short term and barriers to entry, they would also help build trust in AI and expedite its deployment.



I think the biggest effect of regulation will be that people who use AI will really have to understand it. That sounds simple but it will force vendors to be really good at how they explain both business perspective and technically how exactly the AI works, how it is making decisions, and how it is potentially impacting bias. And it will likely also require testing. And I think those are all really good things that will happen in the long term.

– Adam Godson, Paradox

# CONCLUSION

AI is already a crucial part of how a lot of businesses operate. Trends we have identified, from the great democratization of AI and the maturity of organizations to the rise of self-supervised machine learning techniques, all point towards AI soon impacting most industries and functions to drive scale, create efficiency gains, improve quality, and generate new insights. AI is, however, not going to replace humans, sending us on endless vacation. Current AI instead excels at working alongside humans and under their control. It automates the boring repetitive tasks, makes work more interesting and allows us to focus on the tougher tasks including developing and training the next AI models. Industry leaders deploy AI solutions that increase efficiency so they and their clients can focus on their core competencies.

AI learns from data. Ensuring the data used to train AI models and the labels they are given are of very high quality and free from biases is of the utmost importance. If the data is not representative or the labels are of bad quality, it'll be "garbage in, garbage out." The quality of data and labels is a major area of focus for companies collecting and creating data. Regulation is also quickly catching up with the advances in AI. The EU AI Act, the most advanced piece of regulation, aims to ensure the trustworthiness of high-risk AI through a set of quality and monitoring obligations on models and data.

Finally, AI is often intrinsically linked to digital transformation as a source of data but also to allow AI models to be deployed quickly at scale and shouldn't be pursued in isolation. AI will bring value by combining investments in deep technical expertise, engineers being able to quickly fine-tune and repurpose existing architectures to new problems and enabling joint technical and business teams able to identify AI opportunities across the organization. Support from the C-suite for AI projects combining short- and medium-term goals with a long-term vision of how AI will impact the industry are key to An AI State of Mind and to reap the benefits of the AI revolution.

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# Glossary

Disclaimer: The Glossary below is non-exhaustive and represents the most canonical definitions and examples / applications of each term. These have been simplified for commercial understanding and are not meant to represent precise technical descriptions.

Term	Definition	Typical Example / Applications
<b>GENERAL AI</b>		
AI	General term for a set of techniques and tools aiming at making algorithms “intelligent.” It encompasses statistical machine learning techniques but also other techniques such as optimization or logic	N/A
Machine Learning	More specific term for algorithms, e.g. neural networks, that learn from data and experience. This encompasses both feature-based and deep learning techniques. Learning can be unsupervised, supervised, and self-supervised	N/A
Unsupervised Learning (Clustering)	Type of learning where the algorithm learns patterns from unlabeled data. It is typically not trained on human input	Webscraping to create categories for indexing; Grouping customers into segments for market research
Supervised Learning	Type of learning where the algorithm learns from labeled data for a specific task. Similar to how a student would be taught by a teacher through examples. Typical algorithms include SVM, XGBoost, and Random Forests	Prediction of the most appropriate response to a question; Determining whether a project is at risk of running late
Self-Supervised Learning	More recent type of learning considered to be “between” supervised and unsupervised learning. General patterns are learned from unlabeled data and then used for a specific task	Image classification and prediction; Speech recognition
Feature-Based Machine Learning	Machine learning algorithms that learn from human-generated features  Example models: Random Forest, XGBoost, SVM, Perceptron	Using mobile phone data to build a customer profile; Leveraging personal data to build a credit scoring algorithm
Deep Learning	“Feature-less” machine learning. Algorithms that learn directly from the raw data  Example models: CNN, GNN, Transformer, LSTM but also language models such as GPT-3 or BERT	Identifying fake accounts / fraud; Self-driving cars
<b>DATA</b>		
Big Data	Datasets that are too large or complex for traditional tools such as Excel to manage	N/A
Unstructured Data	Data that does not follow a pre-defined data model	Image and video data, textual data with no consistent header / position. E.g. images of lung X-rays, text location on a Wikipedia page, etc.

<b>Structured Data</b>	Data that follows a pre-defined data model (e.g. Excel columns)	Data where its position / header is meaningful and consistent across different samples. E.g., defined responses to a survey, inventory of a retailer, stock price, etc.
<b>Synthetic Data</b>	Artificial data generated entirely by a statistical or machine learning model	Often used in combination with privacy-preserving techniques to allow data to be shared while limiting privacy concerns
<b>Metadata</b>	Data that provides additional information about other data	Caption of an image; Time a text message was sent; Where a video was taken
<b>Generative Adversarial Network (GAN)</b>	Neural technique to generate synthetic data	Creating deep fakes, synthetic humans / profiles
<b>Custom-Made (Training) Data</b>	Data created with a specific circumstance / application in mind	Training data for speech recognition in cars need to consider noisy environments and/or certain types of instructions
<b>Labeling / Annotation</b>	Process of humans telling the machine what the expected outcome is, what we would like the algorithm to be able to predict. This data is then used in supervised or self-supervised learning	An image represents a certain animal or that a piece of text is considered hate speech
<b>AI MODELS</b>		
<b>Hyperparameters</b>	A parameter that controls the learning process of an AI model	Learning rate of a CNN, or the margin in an SVM
<b>Feedback Loops</b>	Leveraging the output of an AI system and corresponding end-user actions to retrain and improve models over time	A CNN which learns to better recognize inappropriate content through user reports
<b>Reinforcement Learning</b>	An area of machine learning where agents take action and receive rewards. The goal is to maximize cumulative rewards	Video Games; Traffic optimization; AI playing boardgames
<b>Pre-Trained Models</b>	A model that has been trained for a general task using large amount of training data. It is then fine-tuned for specific tasks	GPT-3 or EfficientNet
<b>Classification (Prediction)</b>	When the prediction made by an AI system is categorical	Whether a text qualifies as hate speech or not
<b>Regression (Prediction)</b>	When the prediction made by an AI system is continuous	Evolution of house prices
<b>AI USE-CASES</b>		
<b>Machine Translation</b>	Subfield of AI focusing on machines translating text from one language to another	Translating documents, pictures, videos, etc. from one language to one or multiple other languages
<b>Natural Language Processing (NLP)</b>	Subfield of AI focusing on manipulating text data	Word2vec transform words into vectors which can then be used by other machine learning models, e.g. determining native language of the writer
<b>Conversational AI</b>	Subfield of AI aiming for the machine to interact with humans, recognize speech and text inputs from customers and answering to them	Virtual Assistants; Chatbots; Virtual Agents

Sentiment Analysis	Subfield of AI focusing on machine understanding emotions	Recognizing whether a person is smiling or whether a Tweet is ironic
Computer Vision	Subfield of AI focusing on recognizing / manipulating images and videos	Recognizing a monument or detecting objects in a picture
Speech Recognition	Subfield of AI focusing on recognizing / manipulating speech data	Transcribing audio into text
<b>OTHER</b>		
Human-in-the-Loop	A model requiring human interaction / oversight	Testing autonomous vehicles; Human-machines transcription
Bias in AI	A lot of different definitions exists for what constitute bias in AI. It can occur when results cannot be generalized widely, e.g. because of preferences or exclusions in training data. It can also occur because of how data is labeled (societal bias), how algorithms are designed, or how AI outputs are interpreted	Bias can take many forms. For instance gender, racial, age, or religious

<sup>1</sup>Manyika, J., Chui, M., Miremadi, M., Bughin, J., George, K., Willmott, P., & Dewhurst, M. (2021, July 2). Harnessing Automation for a future that works. McKinsey & Company. Accessed via <https://www.mckinsey.com/featured-insights/digital-disruption/harnessing-automation-for-a-future-that-works>

<sup>2</sup>Slator Language Service Provider Index -by SlatorOn February 25, Slator, Boostlingo, Locaria, & Transifex. (2021, July 26). The slator 2020 language service provider index. Accessed via <https://slator.com/the-slator-2020-language-service-provider-index/>

<sup>3</sup>2016: What do you consider the most interesting recent [scientific] news? what makes it important? Edge.org. (1970, January 1). Accessed via <https://www.edge.org/response-detail/26587>

<sup>4</sup>Andrej Karpathy - AI for full-self driving at Tesla - YouTube. Accessed via <https://www.youtube.com/watch?v=hx7BXih7zx8>

<sup>5</sup>Lavie, A., & Maroti, C. (2020, December 6). We can reduce gender bias in natural-language AI, but it will take a lot more work. VentureBeat. Accessed via <https://venturebeat.com/2020/12/06/we-can-reduce-gender-bias-in-natural-language-ai-but-it-will-take-a-lot-more-work/>; O'Sullivan, L., & Dickerson, J. P. (2020, August 10). Here are a few ways GPT-3 can go wrong. TechCrunch. Accessed via <https://techcrunch.com/2020/08/07/here-are-a-few-ways-gpt-3-can-go-wrong/>

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