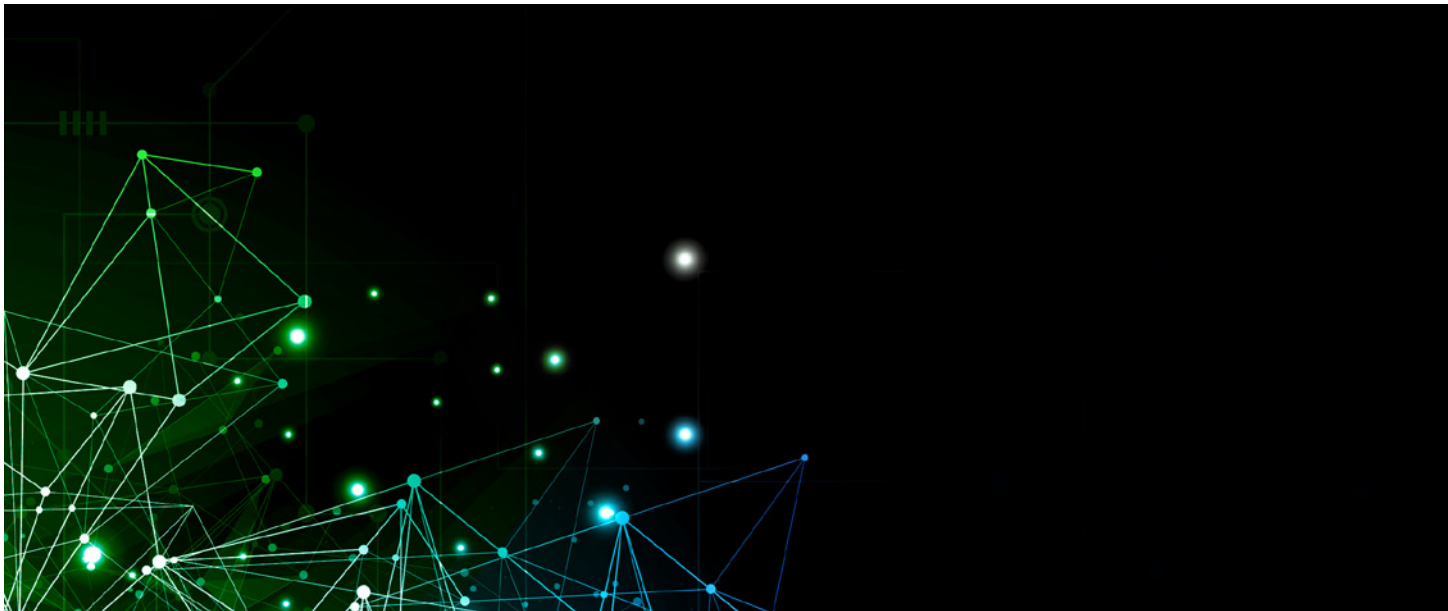




**Artificial Intelligence–
Entering the world of tax**

October 2019



Where should you place your bets?

The current tax environment is characterized by tax authorities requiring increased transparency across jurisdictions, sharing information with each other and applying determined approaches to the tax management and collection process, but with a lack of consistency across borders. This is expanding the compliance workload for businesses, while they are exposed to increased tax risk and uncertainty about the sustainability of current business models and group structures. To help overcome these challenges, businesses are centralizing compliance, using technology to aggregate, validate and report for compliance purposes, and using data analytics on the information they have gathered to identify anomalies and mitigate risk.

To manage this changing landscape, alongside the increased use of analytics, tax authorities and tax advisors are starting to explore the possibilities for deploying sophisticated data analytics and Artificial Intelligence (AI) in tax to facilitate compliance and assist professionals and their clients with commonly encountered questions. While data analytics has received a lot of attention, Artificial Intelligence in tax is a relatively new phenomenon.

What do we mean by AI?

AI is a very broad term comprising a variety of components. These include cognitive and machine learning (such as intelligent personal assistants like Siri and Cortana and at a much more simplistic level grammar and spell-checkers) and robotic learning where a person shows the machine how to perform a task and it then mirrors the steps taken (for example automatic invoice scanning and processing).

The concept of AI is suffering the fate of previous waves of new technology, namely a partial understanding of its capabilities coupled with an assumption that it can do far more than is realistically possible, in the short term. This is fueled by a combination of market

hype and a real appetite for technology-enabled tax solutions. In this environment, it is important to manage expectations as to what AI can do in the short to medium term and its actual and practical limitations.

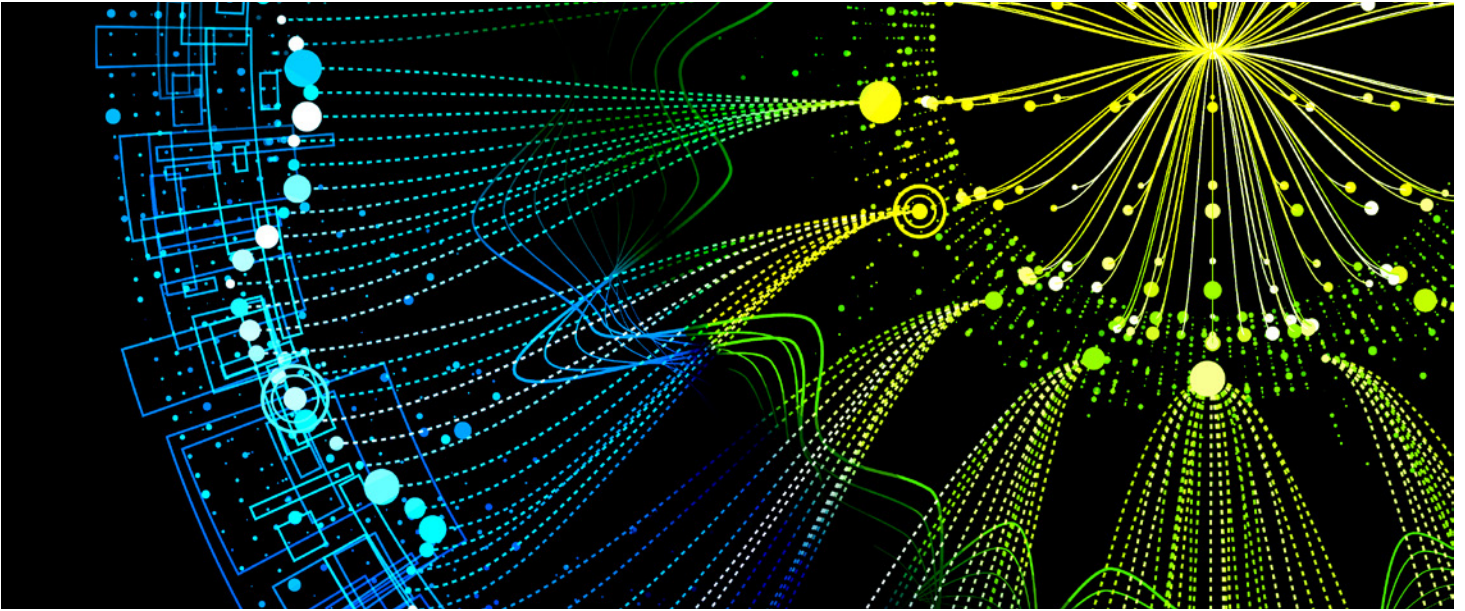
Getting started

To date, the most successful AI initiatives have taken small incremental steps rather than pursuing a mega-project. These help to break down skepticism, proving the concept with limited investment and building the appetite for wider-scale adoption.

For many organizations, the starting point is to have a data strategy driven by both higher internal expectations of what the tax function could deliver, and external compliance requirements—such as the Common Reporting Standard and the OECD's Base Erosion and Profit Shifting project. Data is important because most practical approaches use historical data, as a basis for training the AI solution.

In order to get started with AI, the first step is to decide what the issue is that you are trying to solve, and then to identify what manual work can be eliminated or augmented through AI, and what additional insights can be generated from the machine's work.

In order to implement a data strategy and start realizing the benefits of analytics and AI, it isn't necessary to have perfect data. Worrying about data quality can prevent companies from getting started, whereas in most cases all that is needed is some data to experiment with and the AI will still be effective with noisy or imperfect data. That said, Deloitte has considerable experience in helping clients to locate, extract and clean up the data, so that it can be put to work. Once you have the data that will address the issue you are trying to solve, to take advantage of AI it is necessary to build the corpus of knowledge to be fed into or ingested by the technology so that it can work on the data. This is a big task. The second big task is to teach the



machine the relevant language—in this case the language and context of tax. Building the skills necessary to curate information for the corpus and to design learning methods is an important investment. For example, depending on the context of the AI solution, the corpus and training need to be tailored to the tax policy, statutes, and case law precedents of the relevant jurisdiction(s). Once these steps have been completed, the third big task is to feed the machine with lots of questions, teach it the answers, or teach it the correct answers when it provides wrong ones, with a view to getting to a high level of confidence that the machine's answers will be correct. Machine learning can struggle with new scenarios, but is excellent for recognizing patterns and avoiding past mistakes that have had to be manually corrected. Most AI solutions will talk in terms of confidence levels of the answers or recommendations, as there is usually not a single correct or incorrect answer to a question. It is the training and feedback loop that helps refine the algorithms, with the objective of raising the confidence levels of the answers.

The process to load, train, and keep the information up-to-date can be very time consuming, so the use case needs to be sufficiently frequent to generate the efficiency gains which justify the effort involved. So far, many of the areas in which AI has been deployed are ones which, while having a tax component, have been performed by non-tax professionals such as processing invoices or reclaiming VAT on overseas expenses.

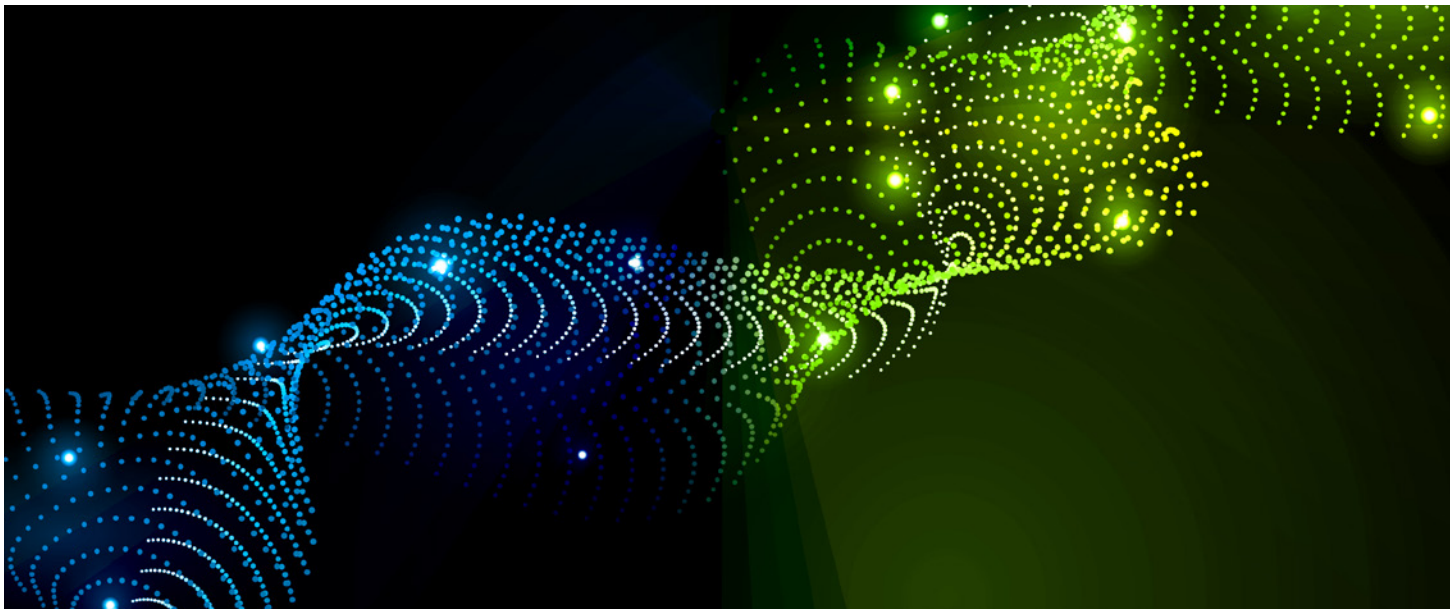
In Canada, a software start-up has spent 18 months developing an AI application to support several classifier questions, that arise in the Canadian tax regime; for example, to assess whether a person should be classified as an employee or a contractor in a particular business context. In order to be able to do this, the tool's creators needed to know how to build the right corpus of information and then train the machine. It is not enough to feed in all potential sources of information—part of the skill, at this stage of the process, is being able to identify both the best sources and also those which should

be avoided. In AI terms, this is referred to as curating the content. The solution doesn't only provide an answer and a percentage-based indicator of confidence in the answer, it also presents its reasons for arriving at that answer and provides the relevant statutory provisions, case law and commentaries, on which the answer is based. In this way, over time AI will be a valuable tool in the training of less experienced advisors who may be unaware of a particular source of information, until it is provided to them by the machine. This is a clear example of the way in which AI will augment the advisor and educate the specialist community, rather than usurp their role.

What are the barriers to adoption?

The tax world is characterized by a culture where knowledge is king. The profession attracts people who like working with a myriad of rules that must be applied to a unique set of facts, and are good at complex problem solving. Experimentation with unfamiliar technology is not encouraged—especially where it is seen as a threat—or where people misunderstand the operational risk of adopting it. Since AI is inherently probabilistic, there are inevitably situations where the machine comes up with an answer which a panel of authorities would judge to be “wrong”. But this is to ignore the fact that many of these questions are currently being answered by non-experts who don't always arrive at the right answer, either. So, any risk assessment needs to consider whether AI decreases the risk of an incorrect conclusion, rather than the absolute error rate of an AI application.

The second barrier is a derivative of the first. In order for the machine to learn, it requires curated content and it is a reality of some of the more sophisticated classification issues that qualified specialists may not all classify things in the same way. So, if a classifier is coded according to the logic of one specialist (or even a panel), the results will not necessarily align to the recommendations of other equally qualified specialists.



The OECD's recent publication, *Advanced Analytics for Better Tax Administration*, uncovered a number of challenges that tax authorities are facing when using analytics and AI. These include balancing centralization with the need to integrate solutions and share experience on the ground, uncertainties around being able to develop models which deliver a tangible impact on performance, the complex range of choices between analytics solutions, having the skills available to build their own solutions using open-source tools, and seeing their data as an asset rather than a by-product of their processes.

These challenges are mirrored in the corporate world, with stakeholders unsure about what can be achieved and the associated scale of investment to benefit from AI solutions: the more it can do, the more it must cost.

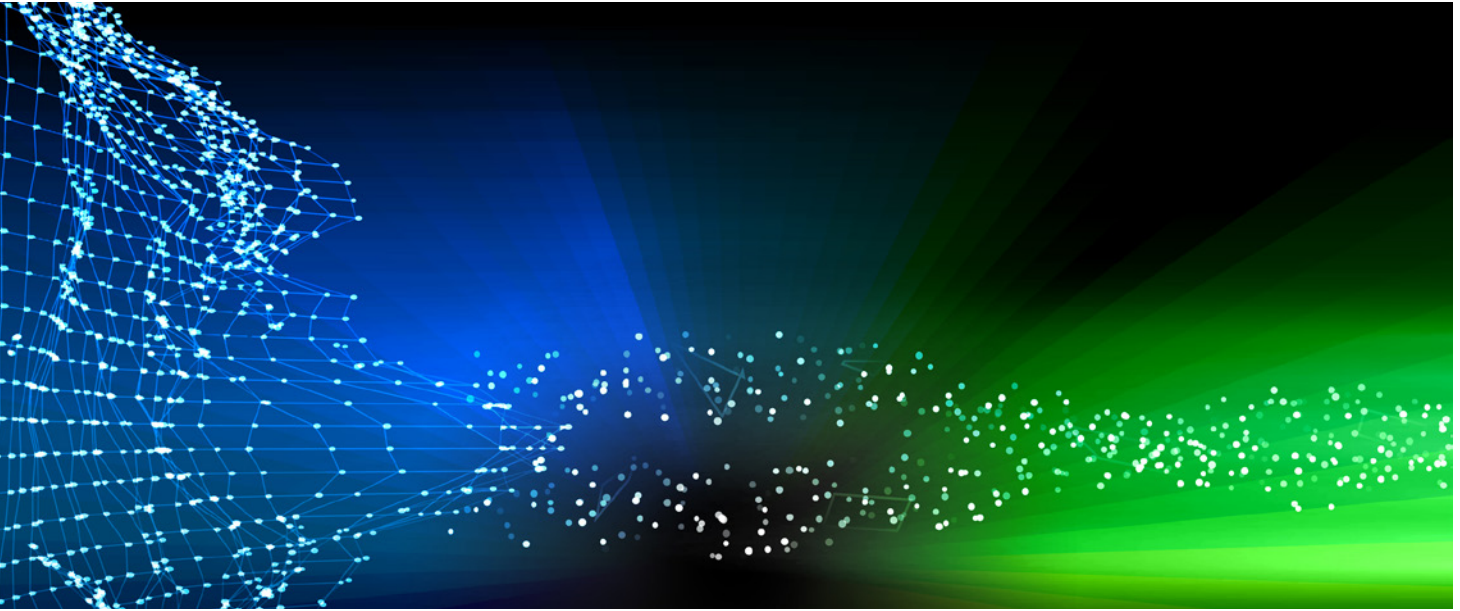
Unsurprisingly, therefore, cost plays a large part in the decision on whether to start using AI. In a recent survey by Deloitte of participants in Dbriefs on tax analytics, up to a third of audiences across the US, Asia Pacific and EMEA cited budget constraints or unclear return on investment as their biggest challenge, in pursuing an analytics strategy. It is reasonable to extrapolate these responses to the adoption of AI.

Organizations which decide to take the plunge with AI, need to recognize that training machines is difficult and they are not as developed as humans. This means that in order to teach the machine and build confidence in its accuracy, skill is required to know what questions should be asked and what the optimal answer is to each question. Practitioners who have the skills and experience to build the corpus, ask the right questions and coach the machine in the correct answers, and have the time to dedicate to this process in preference to high-paying advisory projects, are very thin on the ground. This could be a major practical barrier to the adoption of AI in tax.

Another barrier to entry is the attitude of both tax professionals themselves and their clients. There remains a wariness of the new, especially as to the reliability of the results, which means that both parties to an engagement want the reassurance that a human subject matter specialist has reviewed and confirmed the results of the machine's work. This is compounded by the natural reaction of many tax professionals, that the use of AI will erode their perceived added value while heightening engagement risk. The reality is that by allowing the professional to focus on the more intractable problems rather than the low-level tasks which machines can do, there is scope for AI to accentuate the value that the individual contributes.

There is also a limit on the types of tax problems which merit the investment in developing an AI solution. Many issues arising in the tax advisory field are characterised by a unique fact pattern, which makes the issue as a whole impossible to solve efficiently using AI. Nonetheless, if it is broken down into its component parts, it may be that some aspects fall into the high-volume, fuzzy matching, classifier problem for which this technology is particularly well-suited. The key to seizing such opportunities is becoming sufficiently confident in the accuracy of the machine's outputs that, professionals and clients are happy to have AI as a component of the team.

In some jurisdictions, policies are evolving to require that the rationale and data used to come up with an answer that affects an individual, is made available and accessible. This is the case with the EU's General Data Protection Regulation which takes effect in 2018. Article 11 contains specific restrictions on "automated individual decision making". While the measures are designed to protect the personal data of individuals being used for profiling purposes (and so does not apply to most applications in the corporate tax arena), the breadth of the Regulation and the severity of the penalties for breaching it may prejudice some organizations against the use of artificial intelligence if only as an exercise in risk mitigation.



Deloitte applications – case studies in the application of Artificial Intelligence in tax

In the tax field, machine learning is particularly useful for classifier problems, which are inherently fuzzy but which come up time and time again. Deloitte has worked on a variety of point solutions using AI. These experiments are already delivering added value to our clients whilst allowing us to demonstrate proof of concept, both internally and to the market.

A complete solution to a new compliance challenge

In January 2015, the Dutch Tax Authority introduced a new scheme for work-related costs which imposed a requirement on employers to administer and monitor costs, according to new rules. The implications for employers were onerous and required extensive changes to systems, and an investment in low-value-added manual effort from various functions including HR, payroll and tax. In response, Deloitte Netherlands developed an end-to-end analytics solution which analyzes the company's employment taxes obligations, and by analyzing and aggregating the data, allows the company to manage its tax position and control costs.

The tool uses fuzzy matching to analyze the company's data and label it. The tool has already been preloaded with curated Deloitte knowledge including—business rules, training data, and a dictionary so that the machine understands the relevant work-related costs terminology. Having been equipped with this material and educated in the relevant provisions by Deloitte specialists, it is loaded—in a Deloitte-hosted secure environment—with company data extracted from the expenses, general ledger, accounts payable, and payroll systems, which is then categorized based on text descriptions within the raw data according to the different types of employment-related expenditure. This analyzed and labelled data is then visualized on the tool's dashboard with multiple views, to enhance understanding and highlight items which the machine has not been able to label

with confidence, or has labelled incorrectly. Human intervention at this point assists the machine to learn, thereby enhancing its future performance. This solution is particularly attractive for clients, as it requires no changes to the source systems from which the data comes.

In addition to the appropriate classification of work-related costs, the data can be analyzed for trends and other insights to add operational value. The tool is now being taken a step further to incorporate a VAT component, since anything which is treated as wages is disallowable for VAT reclaim purposes.

Classifying trusts for compliance purposes

Deloitte US has developed a classical supervised machine learning tool, which is being deployed in the tax function across a variety of use cases. The tool uses natural language processing and machine learning to automatically extract clauses in contracts, deeds and other legal documents. By constructing sophisticated probabilistic models from contextual language features, such as synonyms and word proximity, the tool is able to improve its accuracy over time.

The primary target is data in the form of unstructured text. In one instance, the tool is being used to review high volumes of trust agreements to classify the trust type for tax purposes. In this case, for a client wrestling with high volumes of lengthy documents, the tool is expected to yield a reduction in annual hours spent on trust compliance activities. Significant efficiency gains benefit the client, and allows the tax professionals to focus on higher added value activities, rather than the review of trust documents which is both time-consuming and yields little value, compared to a professional's cost.

As a by-product of this analysis, the tool is also gathering additional, useful information which would be time-consuming to gather

manually, such as the power to add beneficiaries or a change in entitlement on the beneficiary reaching their majority. This has a commercial value to the client where Deloitte US is able to offer tailored advice and services, based on the specific terms of each trust. Once the primary and additional information have been gathered, these can be aggregated to see the occurrence of each type of trust, the use of particular clauses or trends such as the geographical spread of trusts or introducers. Where the machine is unsure about a classification (expressed in terms, of a confidence level), human intervention applies to provide the answer and help the machine to learn, just as an inexperienced professional develops through training, mentoring and review.

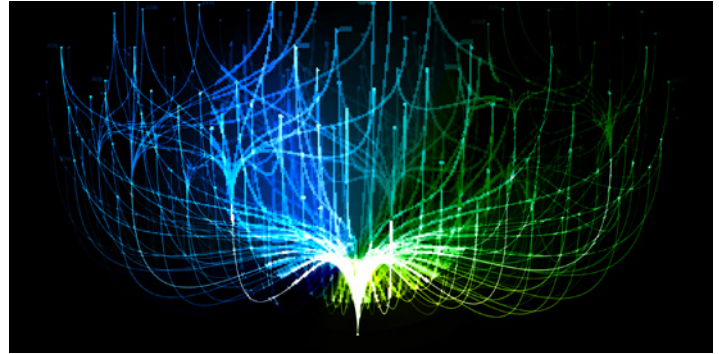
Further use cases for the tool include:

- Reviewing licensing agreements to establish whether the parties involved in research and development qualify for R&D tax credits or other government incentives. This is an application in which the manual process would be extremely laborious and susceptible to error.
- Analyzing notices from tax regulators, some of which are “for information” while others require action to avoid unfavourable consequences. The format is standard and the volumes are high, which make this an obvious area for the deployment of Artificial Intelligence. With the tool performing the initial review of the notices, prioritizing the ones which require immediate action will be considerably simplified.
- Domestic Earnings and Profits and Stock Basis studies require the analysis of tax return disclosure statements to identify significant transactions. This is currently a time-consuming manual process, given the number of tax returns that may need to be reviewed. AI can help scope projects more accurately, make the analysis more efficient, and capture significant transactions that might otherwise be overlooked.

Classifying expenses for correct treatment in corporate or indirect tax returns

Deloitte UK has developed a tax-related application which goes beyond rules-based solutions, using ‘human eye matching’ (fuzzy) and Artificial Intelligence, where the tool ‘learns’ from the user’s tax decisions. The tool can rapidly analyze complete sets of data, eliminating both the risk of human error and sampling risk. In addition to its versatility which allows it to cater to a variety of compliance-related needs, this tool offers a fully documented process which reports on the decisions made and tax positions taken. Software features allow the reviewer to focus on the most important or contentious decisions, which can be manually overridden if the reviewer is uncomfortable with the machine’s decision. Time savings are realized immediately as analyses that would otherwise be done manually have been automated, while the evolving rule set can be rolled forward to future years which builds further efficiency over time. All in all, the tool makes a considerable contribution to effective tax risk management at a time when tax authorities are bringing increased pressure to bear on taxpayers.

As these examples demonstrate, AI is certainly changing the tax field and is having the greatest impact today—where it is used to assist tax practitioners in performing baseline tasks, such as voluminous data review and freeing up the professional to apply their judgment and creativity to the extracted information and insights.



What’s coming next?

Assuming that the various barriers to entry will be overcome in time, the next level of AI-enabled tax solutions will be equipped with a corpus and training which doesn’t just reflect the relevant tax law and practice, but also the particular policies of the “parent” organization. This will allow for advisors and their clients to differentiate between a company’s technology solutions, as they do now between the knowledge and experience of individual, human advisors. Again, this reflects the way in which machines and humans will collaborate to deliver solutions to clients, using the best mix of artificial and human intelligence.

AI offers the possibility of taking content from tax websites and then restructuring that content, based on the way users search it. By learning from the way it is used, the technology will also be able to provide additional guidance in the form of “Have you considered....?” questions.

For compliance purposes, AI can only be used to complete the most straightforward tax returns, as it is unusual to do a return without needing to look something up and machines are bad at dealing with unfamiliar situations or ones where they haven’t already been taught the answer. Nevertheless, while AI is by no means a universal panacea, those advisors and clients that seize the potential of AI and analytics will move closer to being insight-driven organizations with improved decision-making leveraged from their data.

Deloitte is investing heavily in innovation to bring new technology-powered solutions to our clients. We’ve chosen not to “bet the farm” in one area—say a cognitive online tax advisor—but launched multiple projects designed to uncover the most fertile areas in which tax can benefit from AI. Our approach is pragmatic, but our goal is to be a visionary leader.

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