



Meeting the Challenge of Artificial Intelligence

What CPAs Need to Know

By Paul Lin and Tom Hazelbaker

The rapid advance of technology has resulted in CPA firms hiring more nonaccounting graduates in order to integrate new tools into their practice. For example, one national firm leader reported that more than 25% of its new entry-level hires are science, technology, engineering, and math (STEM) majors (Allan Koltin, opening remarks at Advisory Board's Winning is Everything Conference, Dec. 13, 2017, <http://bit.ly/2wrh091>). Specifically for the accounting profession, the integration of artificial intelligence (AI) with

robotic process automation (RPA) can create intelligent virtual workers to improve productivity. On facing the challenge of AI, Barry Melancon, AICPA CEO and president, has said, "With AI the whole ramification of jobs in society is a huge issue, and those that embrace it will be the most successful" (Michelle Perry, "AICPAs Barry Melancon on the Challenge of Change in Accountancy," ICAS website, Oct. 6, 2017, <http://bit.ly/2Wajgkm>).

While AI is still an evolving technology, many applications have recently made impressive leaps. For example, computers

can defeat chess champions, help drive cars, instruct drones to return automatically, provide medical diagnoses, perform as virtual assistants, and navigate vacuum cleaners through a furnished house. The AI applications for business involve training computers to do tasks employees can perform, learning from experiences and adjusting to new data, if needed. Currently, CPA firms can use intelligent robots to count inventories, inspect fixed assets, handle bank audit confirmations, and read contracts or other documents to generate meaningful insights.

Some CPAs may assume that, like big data or blockchain, AI is a relatively recent development. To the contrary, AI research started even before the creation of the Accounting Principles Board, FASB's predecessor, in 1959. Subsequently, several subfields of AI have emerged, including robotics, perception (vision and speech), machine learning (ML), and expert systems (ES). This article will help CPAs understand AI and the current AI-enabled tools in accounting. In addition, it offers suggestions on how to embrace this powerful technology to benefit CPAs and CPA firms.

Development of the AI Field

Alan Turing, who played a pivotal role in breaking Germany's Enigma code during World War II, is considered by many as the father of AI. In his milestone paper, "Computing Machinery and Intelligence," Turing raised the question, "Can machines think?" and discussed how to build intelligent machines (*Mind*, October 1950, <http://bit.ly/2MgwNCq>). The term "artificial intelligence" was first coined by John McCarthy, who defined it as "the science and engineering of making intelligent machines." In 1955, McCarthy coauthored a research proposal to study AI with Marvin Minsky, Nathaniel Rochester, and Claude Shannon (*A Proposal for the Dartmouth Summer Research Project on Artificial*

Intelligence, <https://stanford.io/2KdBeeK>), which launched it as a research field. Unfortunately, contemporary computers could not store enough data or process it fast enough to exhibit intelligence. As research interest subsided, so did funding (Rockwell Anyoha, "The History of Artificial Intelligence," Harvard University blog, Aug. 28, 2017, <http://bit.ly/2VZgQzU>).

In the 1980s, AI research was reignited thanks to refined development tools (e.g., Lisp, Prolog, EMYCIN, VP-Expert) and increased funding. Consequently, there was a proliferation of business-related AI projects using ML

on, ANN evolved into deep learning, in which there are multiple layers between the input and output layers.

An ES is a computer program that emulates the decision-making process of human experts. It is designed to solve complex problems by reasoning through a collection of existing experiences and knowledge, generally represented as "if-then" rules. An ES is divided into two subsystems: the knowledge base and the inference engine. The knowledge base represents facts and rules, while the inference engine applies the rules to the known facts to deduce new facts. Inference

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and ES. ML studies the algorithms and statistical models that computers use to effectively perform a specific task (e.g., predicting corporate financial stress or bankruptcy). ML algorithms can generate a model from the available data—known as the "training sample"—that can then be used to make predictions or decisions without being explicitly programmed by humans. One of the models for ML is the artificial neural network (ANN), a collection of connected units or nodes called artificial neurons that emulates a human's biological neural network and develops algorithms from a set of given samples. Specifically, an artificial neuron can process the data it receives and then pass them on to connected artificial neurons. Initially, artificial neurons were subclassified into three layers—input, hidden, and output. Later

engines can also include explanation and debugging abilities. David Yang and Miklos Vasarhelyi reported that there were 167 accounting-related ES studies in the '80s and '90s covering five areas: auditing, taxation, financial accounting, personal financial planning, and management accounting ("The Application of Expert Systems in Accounting," *Artificial Intelligence in Accounting and Auditing*, vol. 4, Markus Wiener Publishers, 1995, <http://bit.ly/2KaW3Y1>).

In the 21st century, the applications of AI have become increasingly widespread; *Exhibit 1* presents several popular applications. There may, however, be some drawbacks for users, depending to a great extent upon individual experiences, expectations, and preferences.

Exhibit 1
Examples of AI Applications in Daily Life

Applications	Examples	Benefits
Automatic emergency braking (AEB) on vehicles	Once an impending collision is detected, a warning is generated for the driver. If the collision becomes imminent, the system can apply the brakes without any driver input.	AEB can avoid vehicle collisions. In March 2016, the National Highway Traffic Safety Administration announced that AEB is required on nearly all new cars sold in the United States by 2022.
E-mail filters*	Google uses AI to ensure that the e-mail showing up in users' inboxes is authentic. The filters can sort e-mails into the following six categories—primary, social, promotions, updates, forums, and spam.	The filters help organize e-mails so that users can find important messages quicker. Also, Google claims that AI-powered filtering prevents more than 99% of spam from getting into users' inboxes.
Intelligent cruise control	This technology uses radar and a camera to adjust a car's speed automatically to maintain a preset distance from the vehicle ahead.	This feature, already on many new cars in 2019, allows the driver to relax, especially during a long trip.
Navigation assistance*	Google Maps can calculate the traffic time for various routes and suggest the quickest one to a destination given the real-time traffic.	Drivers can take a detour to avoid getting stuck in slow or standstill traffic due to accidents or construction.
Suicide/Self-harm prevention*	In 2017, Facebook launched a proactive detection feature that scans posts to detect patterns that may indicate if a user may be considering self-harm. Facebook supports this AI-powered program with human resources such as trained moderators, partnerships with local mental health organizations, and local first-responders when appropriate.	Detecting suicidal thinking patterns, the AI-powered program sends mental health resources to the person and, sometimes, also to friends. In one case, the local police were notified and able to locate the woman, rush her to the hospital, and save her life.

*Source: Rhonda Bradley, "16 Examples of Artificial Intelligence (AI) in Your Everyday Life," The Manifest, Sept. 26, 2018, <http://bit.ly/2EGGJjH>.

AI Projects by CPA Firms

CPA firms often develop and use cutting-edge tools to stay competitive, and adopting AI is no exception. By integrating AI with RPA, CPA firms can increase productivity and improve job performance. AI is, however, an evolving technology, and not every firm is willing to commit the required resources to adopt AI into its practice. Nonetheless, the Big

Four have already invested in AI, as illustrated by the sample projects in *Exhibit 2*. While the Big Four are at the forefront in developing AI-enabled tools, smaller firms should not preclude themselves from reaping the benefits. For example, Gursey Schneider LLP used AI-enabled audit tools to process a massive amount of client data and compile enough evidence to move forward with a \$2.8 mil-

lion criminal fraud case (Solon Angel, "How AI Could Protect Your Business from Financial Fraud," *Forbes.com*, Feb. 14, 2019, <http://bit.ly/2KaY0lS>). According to the *Accounting Today* 2019 Regional Leaders Report, Gursey Schneider is a "small" firm in California with 16 partners and 192 total employees (<http://bit.ly/2HL6iAR>).

To help CPAs learn more about developing AI-enabled tools, the authors present the following excerpt from a post on the Association of Certified Fraud Examiners (ACFE) website written by Gary Krausz of Gursey Schneider and John Colthart of MindBridge Ai, explaining how and why they used AI to enhance the fraud audit (<http://bit.ly/2HN45F7>):

The client had \$120 million in annual sales. ... They had suspected fraud to have occurred across three years and requested an examination of their general ledger for the period between 2014 and Q2 2018, to the tune of 6.2 million transactions. ... AI gave us the ability to take very big data sets and make them manageable, as it took all the data and knew how to put different thoughts together and infer relationships between items. Unlike the traditional methods in our industry of relying on hunches and instinct to pick an account and start digging, AI offered up its own "intuition" based on the current data set and the learnings from prior analysis. In this case, without any tuning by us, the AI analyzed the entire data set from the client's general ledger and flagged the fraudulent transactions in a very short amount of time, including identifying items of large amounts posted into unusual accounts and items posted by the same person multiple times. ... AI offers the opportunity to ingest and inspect 100% of a client's accounting transactions and go beyond simple rules reporting (sorting and filtering). It allows examiners to dig deeper into insights

based on the behavior of the data and to augment professional judgment with insights that replicate what an army of the world's best experts can do.

This case illustrates how an AI-enabled tool can significantly improve audit efficiency with effective analytics and auditing of the entire transaction dataset. In the end, Krausz and Colthart concluded that firms are advised to start planning their AI adoption strategies now.

How to Embrace AI

In its 2018 report on the annual Rosenberg Survey, the *CPA Journal* noted that “the CPA profession is on the cusp of arguably its greatest transformation” due to technological innovations such as blockchain and AI. The survey also concluded that this change “will dramatically transform how a CPA firm is managed and staffed, and what it will mean to be a CPA” (*CPA Journal*, December 2018, <http://bit.ly/2MiAyHz>). Thus, the authors would like to offer some suggestions on how to embrace AI in the accounting profession.

For accountants. The modern technology-driven business approach drives accountants to evolve from information providers to business enhancers. AI opens the door for business enhancement, and CPAs can contribute to AI projects with their extensive knowledge in business operations and data. Accountants who are willing to embrace AI-enabled tools can develop advanced skills for career development. For example, to prepare the training samples for AI projects, CPAs need to have data management skills in order to collate the data and prepare it in a format that can be used for ML. The authors suggest accountants learn and use a database management system (e.g., MS Access) or generalized audit software (e.g., ACL, IDEA) to slice, join, and merge the data coming from various platforms.

To start learning AI, accountants and

accounting students are encouraged to take advantage of free online courses available at edX, MIT OpenCourseWare, Coursera, Udacity, Codecademy, Youtube, or numerous universities; these courses often offer self-paced lessons directed at varying levels of personal experience, existing knowledge, and needs.

For accounting professors. To help accounting students adapt to new technology, the Association to Advance Collegiate Schools of Business adopted Accounting Standard A7 in 2013 and called for adding “the development of skills and knowledge related to data creation, data sharing, data analytics, data mining, data reporting, and storage within and across organizations” to the curriculum. Although the AACSB aims to ensure that students are well prepared for career development, the applications of AI and RPA, not yet included in A7, have

authors suggest integrating data management, AI, and RPA within accounting curricula to prepare the next generation of accountants. Furthermore, accountants need to know computer programming because coding requires performing tasks in proper sequence and creating a clear roadmap for problem solving (“Should Accounting Students Learn to Code,” AICPA website, Jul. 14, 2015, <http://bit.ly/2RyYVyi>). Taking even one semester of computer programming would allow accounting students to evolve from knowing how to use computers to understanding how to make computers solve problems. Knowledge of coding would also help accountants collaborate with IT professionals to develop AI-enabled tools.

For accounting firms. Scott Showalter, chair of the Federal Accounting Standards Advisory Board,

CPA firms that embrace AI will likely continue to prosper, but those who do not may end up being left behind.

become increasingly important for businesses. Critics still claim that “our education system is doing a dismal job of preparing accountants to work deeply with technology” (Daniel Hood, “The Profession’s Biggest Challenges,” *Accounting Today*, Oct. 1, 2018, <http://bit.ly/2KkANzl>).

Having dealt with financial data, accountants can play an important role in transforming unique insights into competitive advantages. In addition to structured transaction data, big data projects often include unstructured and external data to generate analytical insights. Consequently, the

has stated that the impact of new technology is the greatest change to the profession since the passage of the Securities Exchange Act of 1934, and that “no matter the discipline, whether audit, accounting, tax or advisory, all will be affected by these innovations” (Hood 2018). Thus, after assessing the impact of AI on their practice and identifying the potential niche of new technology, CPA firm leaders should keep staff informed regarding their vision and implementation plans; firms can then acquire or develop the new skills to use intelligent tools.

Exhibit 2
Examples of AI Applications in Accounting

Firm	AI Projects	Benefits/Goals
Deloitte	Deloitte developed an AI-enabled document-reviewing process in 2014. The system automates the process of reviewing and extracting relevant information from various documents.	Deloitte claims that this technology has helped reduce the time spent reviewing legal contract documents, invoices, financial statements, and board minutes by up to 50%.
	Working with IBM Watson, Deloitte is developing cognitive-technology-enhanced business solutions for its clients.	LeasePoint is powered by IBM Tririga and utilizes Deloitte's industry knowledge to develop an end-to-end leasing portfolio. Automated Cognitive Asset Inspection uses IBM's Maximo technology to improve the efficiency of asset inspection.
EY	EY applied AI to the analysis of lease contracts.	EY claims that the use of AI has made it easier to capture relevant information, including lease commencement date, amounts to be paid, and renewal or termination options.
	EY (Australia) has adopted AI-enabled auditing technology.	50% of its bank audit confirmations were lodged using an AI-enabled system that can accept and confirm audit requests, process them, and provide auditors with relevant documentation for final analysis and judgment.
	EY has launched an AI project using computer vision to enable drones to monitor inventory during the auditing process.	Drones can count the number of vehicles in a production plant and communicate data directly into the global audit digital platform, EY Canvas.
	EY is using deep learning to analyze unstructured data such as e-mails, social media posts, and conference call audio files.	EY claims this system reduces the administrative time spent on reviewing audit documents, giving employees more time for judgment and analysis.
PwC	Collaborating with H2O.ai, PwC developed an AI-enabled system (GL.ai) capable of analyzing documents and preparing reports.	PwC claims that GL.ai learns and becomes more capable with every audit and has already been trained on audit data from Canada, Germany, Sweden, and the United Kingdom.
	PwC claims to have made a significant investment in natural language processing (NLP), an AI-enabled technology to process unstructured data efficiently.	PwC claims that NLP can make sense of complex lease agreements, revenue contracts, and board meeting minutes to generate meaningful insights.
KPMG	KPMG built a portfolio of AI tools, KPMG Ignite, to enhance business decisions and processes.	Call Center Analytics Engine uses NLP to convert customer calls to unstructured text, which is then streamlined to identify keywords, gauge customer sentiment, and predict future trends. AI Anomalous Event Predicting Tool predicts future business events. Document Compliance Assessment Engine reads documents to generate relevant information.
	Working with Microsoft and IBM Watson, KPMG is developing tools to integrate AI, data analytics, cognitive technologies, and RPA.	KPMG's goal is to consistently deliver high-quality audit services.

Source: Daniel Faggella, "AI in the Accounting Big Four--Comparing Deloitte, PwC, KPMG, and EY," Emerj website, May 17, 2019, <http://bit.ly/2Qwzqyf>.

Many CPA firms' entry into the AI field may be accelerated by focusing their hiring to include recent college graduates who have been exposed to some level of AI knowledge through coursework or internship. It generally takes longer for existing staff to develop and learn new skills, and they require adequate support to complete the transformation to an AI-enabled workplace. Furthermore, in addition to online courses, CPA firms can take advantage of seminars, workshops, and CPE training—already required as part of annual CPE requirements—to facilitate additional knowledge-based training in AI.

Generally, large firms tend to discern the economic benefits of utilizing new technologies first, and smaller firms follow suit. This wait-and-see approach, however, is no longer an option due to AI's disruptive potential. CPA firms that embrace AI will likely continue to prosper, but those who do not may end up being left behind. Consequently, a firm's management teams—including IT, audit, tax, advisory, and HR—need to work together to identify where AI can be best utilized to build on their existing strengths, create new ones, and develop strategies for deploying AI-enabled tools in the workplace. □

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