MindBridge

Navigating AI: fundamentals, concepts and applications for accounting and finance

The motivating need for an AI-based approach

What is AI?

Emeritus Stanford Professor John McCarthy coined the term artificial intelligence (AI) in 1955. He defined it as "the science and engineering of making intelligent machines"[1]. The Oxford Dictionary defines artificial intelligence as "the capacity of computers or other machines to exhibit or simulate intelligent behavior; the field of study concerned with this"[2]. Examples of such intelligent behavior include visual perception, speech recognition, decision-making, and translation between languages.

Historically, researchers have defined and pursued AI in several ways, some defining intelligence in terms of fidelity to human performance, while others using a more abstract definition of intelligence based on *rationality*. The subject matter also varies; some consider intelligence an attribute of the thought processes, while others more broadly attribute it to *behavior*. The above definition based on intelligent or rational behavior is the most general and amenable to scientific developments and has prevailed throughout the history of AI[3].

AI has gained widespread popular acceptance and adaptation in the past couple of decades, expanding it from an academic research topic to a commonplace aspect of daily life. Most people use AI daily ("OK, Google, what's the weather like today?"). AI has a wide range of use cases in businesses. According to a Forbes Advisor survey, AI is perceived as an asset for improving decision-making (44%), decreasing response times (53%), and avoiding mistakes (48%). Businesses also expect AI to help them save costs (59%) and streamline job processes (42%)[4]. While some have expressed concerns over an AI takeover, it is generally believed that rather than serving as a replacement for the human workforce, artificial intelligence will play a supporting role as an enabling tool[5].

In audit and finance, AI is widely used to find patterns and anomalies in the data, which can, in turn, indicate sources of risk and/or inefficiencies in processes. AI enables complete populations of data to be tested, rather than relying on samples, replacing manual detective work. Consequently, AI-enabled workflows can result in substantial improvement in accuracy and efficiency.

So, how does that translate into ease of use and success for business professionals in finance and accounting? Let's first look at the broader landscape of AI.

[1] https://hai.stanford.edu/sites/default/files/2020-09/AI-Definitions-HAI.pdf. Accessed August 14, 2023.

[2] https://www.oed.com/search/dictionary/?scope=Entries&q=artificial%20intelligence. Accessed August 14, 2023.

[3] Stuart Russell and Peter Norvig, *Artificial Intelligence: A Modern Approach*, 4th edition (Hoboken: Pearson, 2020).

[4] "How Businesses Are Using Artificial Intelligence In 2023 – Forbes Advisor," accessed August 21, 2023, https://www.forbes.com/advisor/business/software/ai-in-business/.

[5] "How Artificial Intelligence Is Transforming Business - Businessnewsdaily.Com," Business News Daily, accessed August 21, 2023, https://www.businessnewsdaily.com/9402-artificial-intelligence-business-trends.html.

Branches of AI

For the computer to exhibit intelligent behavior, it would need the following capabilities:

- **Natural language processing** to comprehend and communicate in a human language
- **Automated reasoning** to enable decision-making **(expert systems)**
- **Machine learning** to adapt to new circumstances and to detect and extrapolate patterns
- **Computer vision** and **speech recognition** to perceive the world
- **Robotics** to manipulate objects and move about

These constitute the main branches of AI. Each of these branches can be further split into sub-branches (see Figure 1).

Of these branches, **anomaly detection** and **large language models** (highlighted in bold font in Figure 1) have relevance to accounting and finance and have received considerable attention from these fields. This paper investigates these applications and sheds some light on the related requirements and ethical considerations.

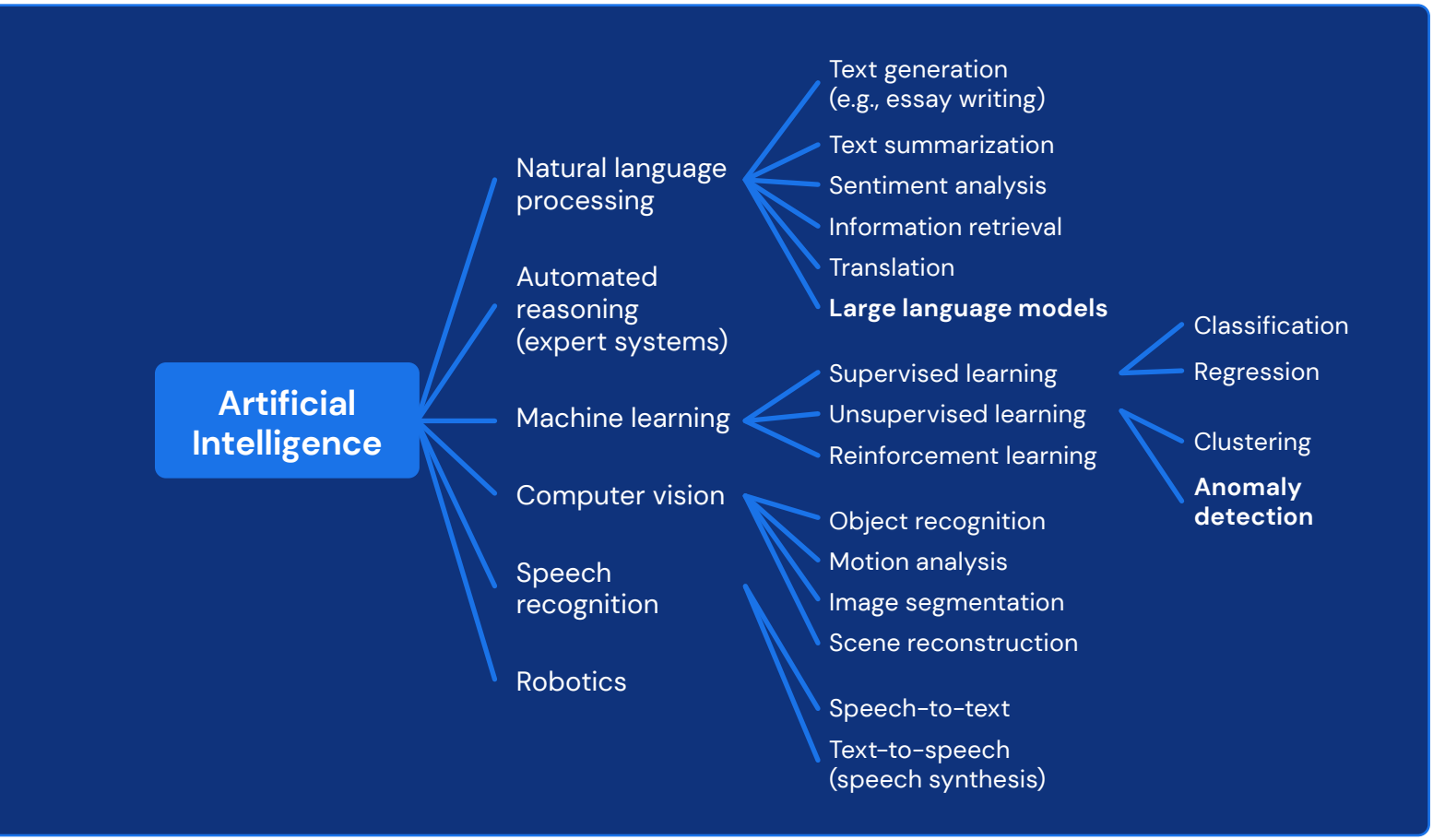

Figure 1 - main branches of AI. Anomaly detection and large language models (highlighted in bold font) have particular relevance to accounting and finance and have received considerable attention from these fields.

[6] Russell and Norvig, *Artificial Intelligence.*

[7] In any conversion about AI, it is likely that the term *deep learning* will come up. Deep learning refers to models based on artificial neural networks with many (more than 2) layers. Deep learning is not listed as a branch in Figure 1 however it is a class of models that can be used in most of those branches.

The motivating need for an AI-based approach to accounting

The rapid growth in the availability of data and computational resources, which, in turn, has driven significant technical advancements in artificial intelligence, has resulted in widespread adaptation and use of AI in many industries, including accounting. According to CPA Canada, AI is transforming accounting and is set to create unprecedented and unimagined possibilities[8].

McKinsey Global Survey on AI reported in 2018, organizations surveyed found that more than 5% of their digital budgets went to AI vs. 52% in 2022[9]. According to Fortune Business Insights, the global big data analytics market was valued at $271.83 billion in 2022 and is projected to grow to $655.53 billion by 2029, with a CAGR of 13.4% during the forecast period[10].

The adaptation of AI-automated technologies in accounting results in increased accuracy and efficiency in the workflow.

More accurate results

A key advantage of AI is its ability to test complete populations (rather than samples) of huge data sets to identify patterns and anomalies in extensive data in a way that no human can[11]. Subsequently, high-risk entities (e.g., transactions, processes, accounts, etc.) can be identified and prioritized for closer investigation. Additionally, AI enables a *multivariate*[12] approach to risk detection, where a holistic view of risk is generated by simultaneous examination of multiple variables and risk indicators (see section Anomaly detection and financial risk discovery below). These result in a substantial increase in anomaly detection accuracy.

More efficient workflows

Furthermore, AI enables control owners to reduce tedious workloads and get faster results through automation. AI and digital technologies have the power to create a more efficient and accurate workforce that costs 40% less and can be easily scaled to meet evolving demands[13].

[8] "How Are Big Data and AI Transforming Accounting and Finance?," accessed August 16, 2023, https://www.cpacanada.ca/en/business-and-accounting-resources/other-general-business-topics/information-management-and-technology/publications/ai-impact-on-accounting-and-finance.

[9] "The State of AI in 2022—and a Half Decade in Review | McKinsey," accessed August 21, 2023, https://www.mckinsey.com/capabilities/quantumblack/our-insights/the-state-of-ai-in-2022-and-a-half-decade-in-review.

[10] "Big Data Analytics Market Size, Share | Growth Statistics [2030]," accessed August 21, 2023, https://www.fortunebusinessinsights.com/big-data-analytics-market-106179.

[11] Abby Dorland, "Staying up to Speed with Artificial Intelligence in Accounting," Tax & Accounting Blog Posts by Thomson Reuters, June 16, 2023, https://tax.thomsonreuters.com/blog/staying-up-to-speed-with-artificial-intelligence-in-accounting/.

[12] Having multiple variables

[13] "How Are Big Data and AI Transforming Accounting and Finance?"

How MindBridge delivers AI

MindBridge uses AI to enable users to perform risk assessments to identify sources of risk and determine their impact and the level of controls needed to mitigate such risk.

For example, this can enable gaps in preventative controls, such as restricting user access, workflow approval, segregation of duties, etc., to be spotted. At the core of MindBridge's technology is anomaly detection – a category of unsupervised machine learning models that identify items or events that deviate from "normal" (see Figure 1 above).

Supervised vs. unsupervised machine learning
The objective of machine learning is to learn from examples. The terms supervised and unsupervised learning refer to the learning process rather than an external supervision of the model's performance (e.g., quality control or human oversight). In supervised learning, the model observes data-label pairs and learns how to predict the label from a given data point. Supervision refers to the existence of labels, and the objective of the learning process is to accurately predict labels for new unseen data points that do not come with a label. In unsupervised learning, on the other hand, the objective is to find patterns or clusters in the data.

In this case, lack of supervision refers to the absence of labels, which are not needed for these applications. There is no inherent advantage for one over the other. The choice of supervised vs. unsupervised learning depends on the application (learning input-out relationships or finding patterns). Anomaly detection is an unsupervised category aiming to find anomalous behavior patterns in the data. The following describes MindBridge's use of anomaly detection in more detail.

Anomaly detection and financial risk discovery

Anomaly[14] detection (also known as outlier detection) is the identification of rare items, events, or observations that deviate significantly from the majority of the data and do not conform to a well-defined notion of normal behavior[15]. Anomaly detection is an unsupervised machine learning technique (Figure 1) that does not require labeled training data.

MindBridge uses anomaly detection methods to detect various types of anomalies in financial data. The outcome of each method is quantified as a **control point** score. This approach replaces manual detective control, usually based on sampling (testing a sample vs. whole population) and a single attribute (univariate vs multivariate anomaly detection) and provides insights into processes using a full view of data incorporating 100% of the data. As a result, this approach provides high accuracy and reliability to detect sources of risk and ineffective preventative controls.

[14] The Oxford dictionary defines anomaly as "something that deviates from what is standard, normal, or expected".

[15] Varun Chandola, Arindam Banerjee, and Vipin Kumar, "Anomaly Detection: A Survey," *ACM Computing Surveys 41*, no. 3 (July 30, 2009): 15:1-15:58, https://doi.org/10.1145/1541880.1541882.

Anomaly detection and large language models

Large language models and generative AI have recently gained widespread attention and popularity. KPMG called generative AI a "game changer"[16]. As larger language models with more parameters are developed, these models are becoming increasingly "better" at mimicking human responses. This, at least in part, is one of the factors driving the ever-increasing popularity of such models (e.g., ChatGPT). However, this has led to a false belief, among some users, that such models could replace the need for AI and data science. This view mistakenly equates large language models with AI. Such models are only a subset of the AI disciplines (see Figure 1 and section *Branches of AI* above) and therefore are limited in scope and capabilities.

Large language models are optimized for natural language understanding and generation. They have limited performance when solving arithmetic reasoning tasks and often provide incorrect answers[17]. This limits their applicability to solving machine learning problems such as anomaly detection. While large language models can be used as an assisting tool for code and/or content generation, they do not, at least in their current stage, replace machine learning models.

Ensemble AI

There exists a variety of anomaly detection methods within unsupervised machine learning. These methods differ in how they define and detect anomalies. For example, while some methods define anomalies in the context of the entire data set (global anomalies) – e.g., a transaction with an unusually high amount compared to all other transactions – some others look only at the "neighborhood" of a data point and define anomalies in relation to their neighbors (local anomalies) – e.g., a transaction with an unusually high amount compared to similar transactions created using the same account and by the same user, but the amount of which may not be exceptionally high compared to the average transaction amount. Additionally, different attributes may be used for anomaly detection depending on the use case – one use case may look at the number of transactions, while, in contrast, another may look at the amount of transactions.

MindBridge provides several control points based on various anomaly detection methods and using different attributes. Each control point is designed to target and identify a particular type of risk. The insights from multiple control points are combined to provide a comprehensive view of risk (Figure 2). This is called **ensemble AI** and can provide a more holistic view of the data, resulting in a more robust and improved anomaly detection performance[18].

[16] KPMG, "Game Changer," January 30, 2023, https://advisory-marketing.us.kpmg.com/speed/share_pov_genai?trid=1000118837528.

[17] Shima Imani, Liang Du, and Harsh Shrivastava, "MathPrompter: Mathematical Reasoning Using Large Language Models" (arXiv, March 3, 2023), https://doi.org/10.48550/arXiv.2303.05398.

[18] Charu C. Aggarwal and Saket Sathe, "Theoretical Foundations and Algorithms for Outlier Ensembles," *ACM SIGKDD Explorations Newsletter 17*, no. 1 (September 29, 2015): 24–47, https://doi.org/10.1145/2830544.2830549.

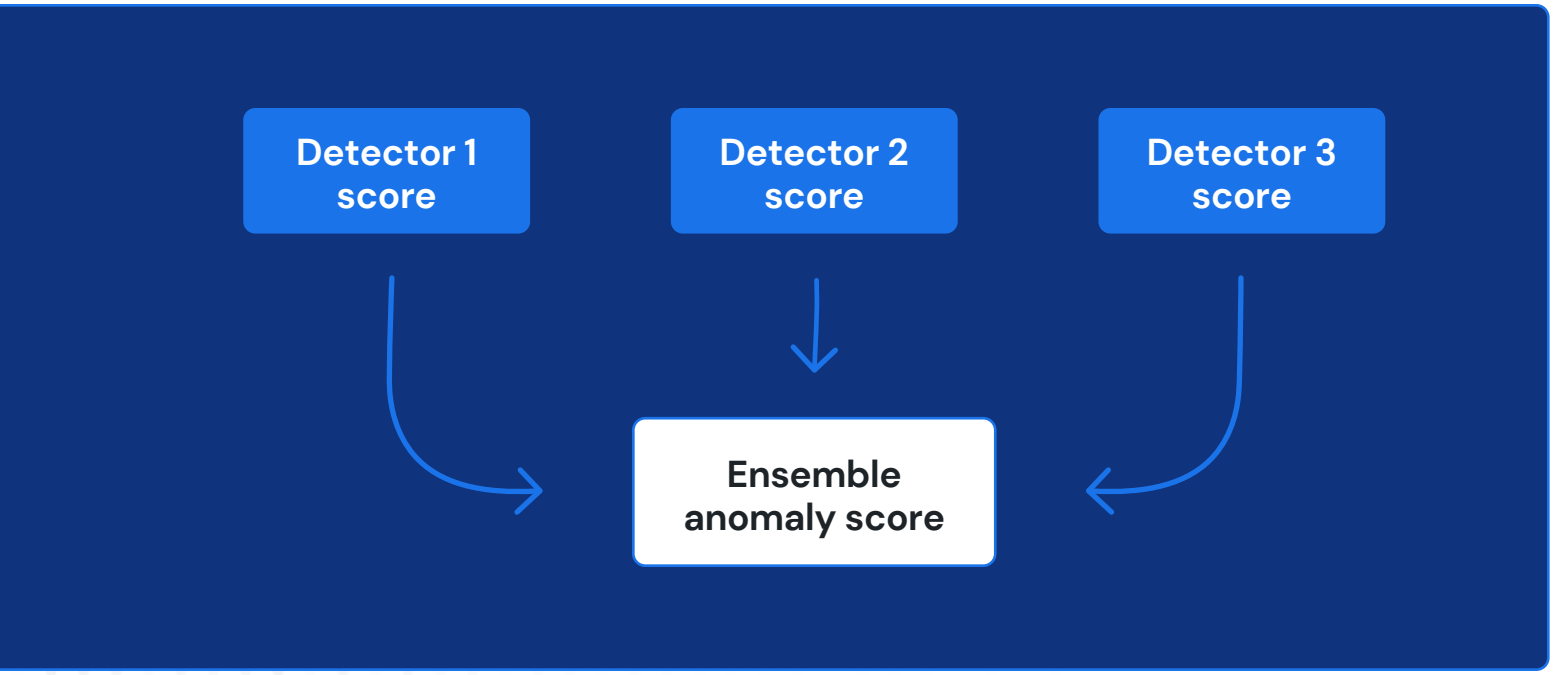

Figure 2 - Ensemble anomalies

An example of ensemble AI currently used by several organizations using MindBridge's platform is GL transaction risk scoring. Each journal entry is simultaneously run through 32 control points designed to capture a particular aspect of risk in the data. Ensemble AI combines these individual risk indicators to provide a holistic view of financial risk in the data.

MindBridge's approach to ensemble risk additionally provides a hierarchical view, where the risk score can be aggregated and viewed by different operating units or sub-processes within a business. The hierarchical nature of the ensemble risk score provides a segmented view of risk. Organizations can easily identify the highest-risk divisions, departments, users, accounts, and other operating units.

Explainable AI

Having transparent and explainable AI models is crucial to building trust in those models and ensuring the accuracy and fairness of the results. Therefore, it is vital to ensure the results are generated and presented transparently and are explainable. However, as the complexity of models increases, they become less transparent and less intrinsically explainable. Many tools and techniques within the field of explainable AI can provide high levels of transparency and explainability both in the model outputs and in the presentation of the results.

Data handling, confidentiality, compliance, and validation

As a growing company with offices in Canada, the US, and the UK, MindBridge is committed to building credible, validated, and compliant AI. MindBridge has partnered with Holistic AI to perform an independent external review of the technology, demonstrating leading best practices and standards for our AI systems and algorithms.

MindBridge has built its strengths on transparent AI, and we want to ensure we perform safely, legally, and ethically. MindBridge was the first private sector signatory to the Montreal Declaration for a Responsible Development of Artificial Intelligence. The declaration reinforces our commitment to an ethical framework for AI technology development. MindBridge has completed its SOC 2® and SOC 3® attestation and ISO 27001, 27017, and 27018 exams.

How can you incorporate MindBridge's technology into your business process?

MindBridge enables companies and organizations to use the power of AI for anomaly detection and risk assessment on their financial data, including general ledger and sub-ledger data such as receivables, payables, vendor analytics, payroll, and operating expenses.

This enables the identification of patterns and anomalies on complete data populations, resulting in more accurate and efficient workflows (see section *How MindBridge delivers AI* above). The implementation process is built around the use case and data strategies.

The implementation starts with identifying pain points as well as gaps and/or manual controls in the business process towards incorporating anomaly detection AI. Once the use case strategy is identified, the next step is the identification and preparation of the data required for the analysis (data strategy). An essential aspect of the data strategy is the **extraction, transformation, and loading (ETL)** into the MindBridge platform (Figure 3). Data often resides in ERP systems, which can be extracted (e.g., into data lakes). Following data extraction, data is transformed to put them into a format suitable for anomaly detection before loading into the MindBridge platform.

[19] https://www.holisticai.com/
[20] https://montrealdeclaration-responsibleai.com/

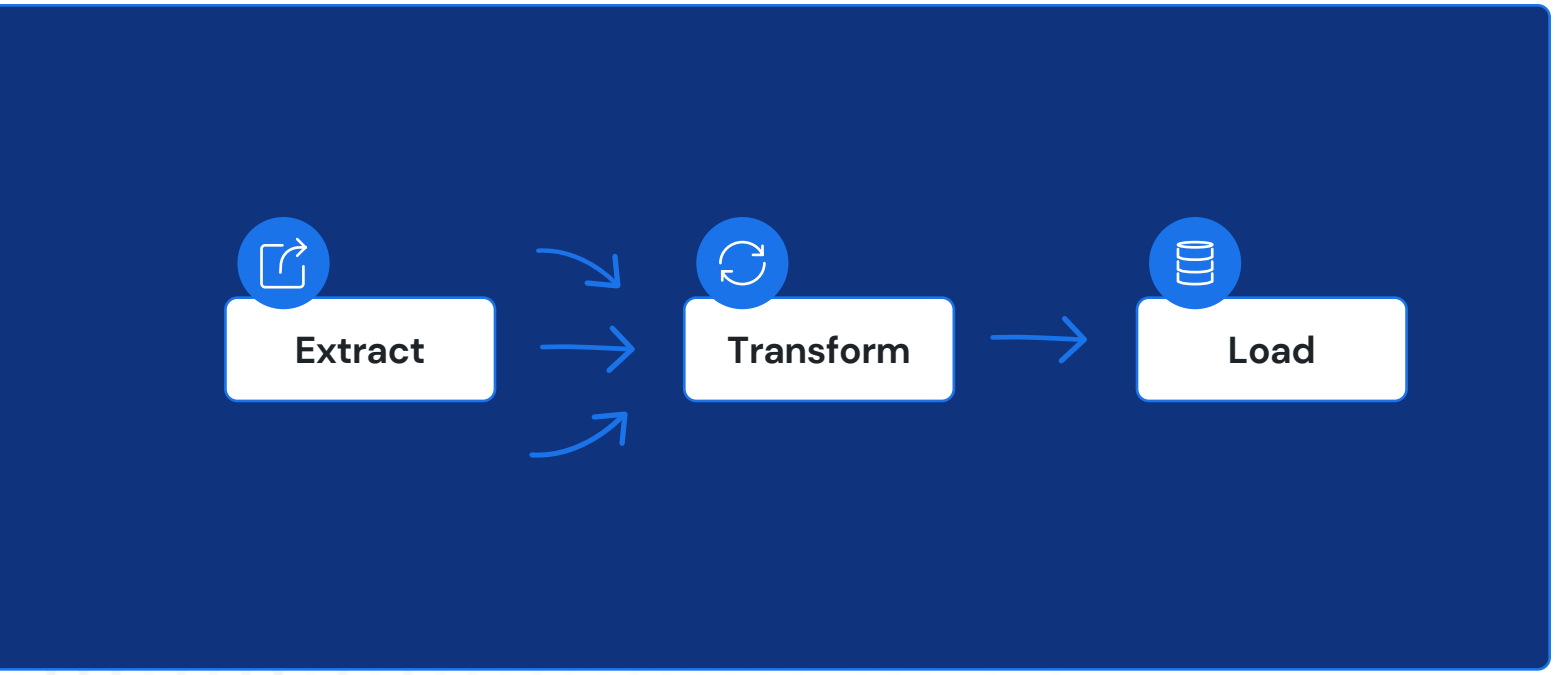

Figure 3 - Extract, transform, load (ETL) process

MindBridge's application programming interface (API) allows the automation of the above ETL process by providing a communication interface between MindBridge and other pieces of software. The API allows software applications to directly send requests and receive responses from the MindBridge platform (Figure 4). Using APIs enables MindBridge to seamlessly integrate into the existing technology stack and workflow toward building an efficient and accurate ETL process.

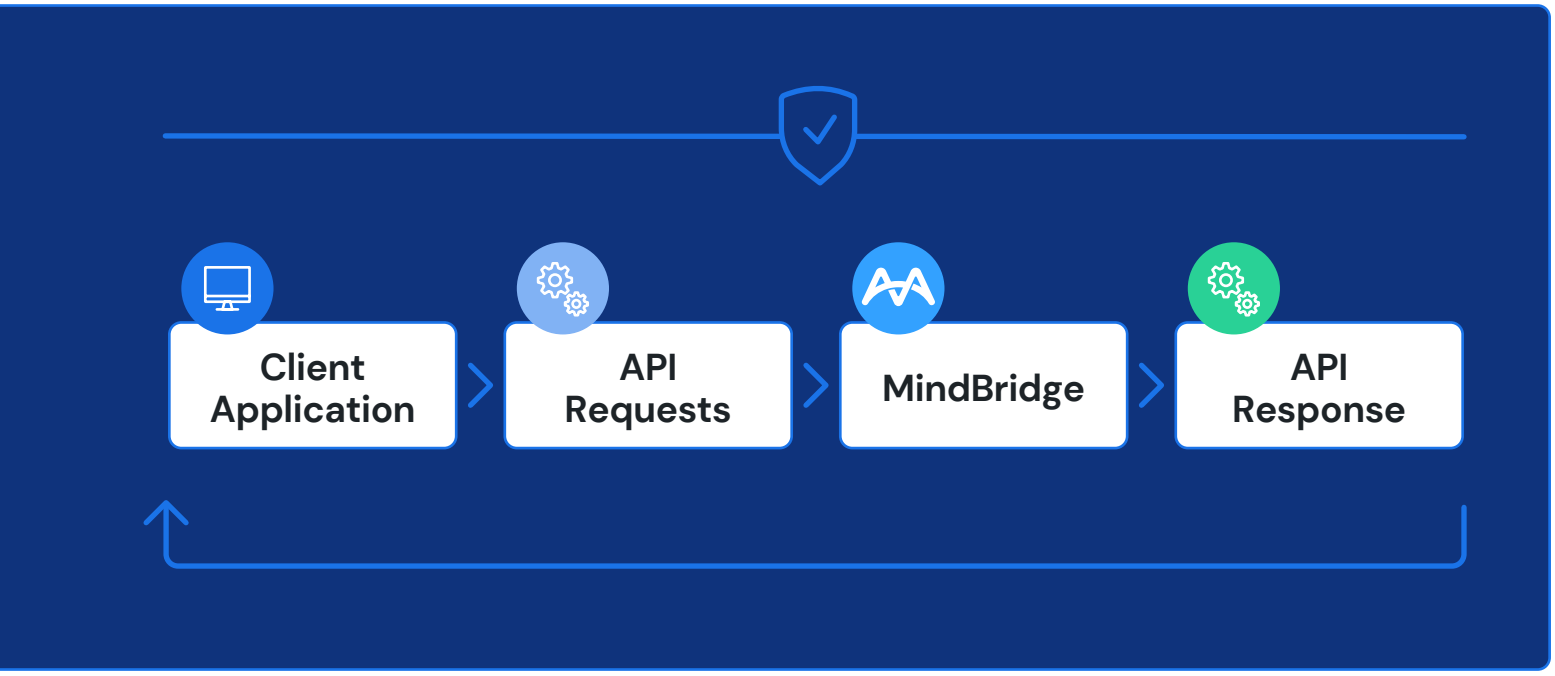

Figure 4 - MindBridge API allows software applications to send requests and receive responses from the MindBridge platform directly.

Summary

MindBridge delivers an AI cloud solution for anomaly detection and financial risk discovery, enabling organizations to enhance their accounting and audit process using the power of AI to ensure accuracy and trust in reporting and deliver operational transparency by identifying, surfacing, and analyzing risk across their financial datasets.

Domain-specific control points

Machine learning anomaly detection algorithms are optimized to create many domain-specific control points targeting specific areas of financial risk.

Ensemble AI

MindBridge combines insights from different control points using ensemble AI methods to provide a holistic, top-down view of risk.

Explainability

Transparency and explainability are critical considerations throughout the analysis and the presentation of the results. The Explainability of the results enables control owners to identify the key drivers of risk.

Independent validation

Independent external validation of the algorithms provides high transparency and assurance in MindBridge's technology.

Confidentiality/compliance

MindBridge has completed its SOC 2® and SOC 3® attestation and ISO 27001, 27017, and 27018 exams.

Contact info@mindbridge.ai today or get a demo.

Talk to us about how MindBridge can help your organization, including our AI in an Afternoon program and see what we can do for you in just a few hours on site or virtually.