The Intelligence May Be Artificial, but the Liability Is Real

By Sridhar Ramamoorti, Lari B. Masten, and Darrell D. Dorrell

In July and December 2023, the first author, Dr. Sridhar Ramamoorti, delivered keynote addresses titled "We Know Smart Contracts Are Smart, but Are They Ethical?"[1] at NACVA[2] conferences in Snowbird, Utah, and Fort Lauderdale, Florida. He made the observation forming the title of this article in casual conversation with lawyers and judges at the NACVA conference in Las Vegas in December 2024.[3]

The observation resonated deeply with coauthors Lari Masten and Darrell Dorrell as well. They have helped provide a deeper interpretation of what it truly means for forensics and valuation practitioners and its overarching significance for human affairs in general. When applied in the context of emerging technologies—such as AI, smart contracts, and other autonomous systems—the quip captures a profound ethical tension when considering the stark disparity between technological capability and the lack of inherent accountability. It highlights the growing chasm between rapidly advancing technological capabilities and our lagging societal, legal, and ethical frameworks.

A central challenge brought up in the NACVA keynote addresses is the opacity of systems like self-executing smart contracts or AI algorithms. Dr. Ramamoorti's comment serves as a reminder that even the smartest systems lack the ethical judgment and transparency necessary to safeguard against harm. This, in turn, reinforces the reality that humans will ultimately bear the burden of addressing these failures.

The ubiquity of AI is undeniable. From medical diagnostics and financial trading to self-driving cars and personalized education, AI systems are making decisions that directly impact human lives. This proliferation means that the "intelligence" of AI is no longer confined to academic labs but is embedded in critical infrastructure and everyday tools.

The implication of this article's title then is that with every new deployment of AI, a potential new vector for harm and, consequently, liability, is created. If an AI system leads to a faulty or poorly performed forensics or valuation engagement, misdiagnosis of a patient, a financial collapse, or an accident involving an autonomous vehicle, the AI itself cannot be sued or held responsible. The real liability, however, falls squarely on human shoulders—the developers, deployers, operators, or even the organizations benefiting from the AI. This creates a complex chain of accountability that is often unclear and can lead to significant legal and financial repercussions. The scale of AI's integration means that the potential for such real liability is enormous and widespread.

Unleashing the Tremendous Potential of AI in Forensics and Valuation

The rise of AI agents and agentic AI—systems capable of autonomous planning, reasoning, and tool use to achieve complex goals[4]—presents a transformative opportunity for valuation and forensic services. See the Appendix for a clear articulation of terminology and associated capabilities of large language models (LLMs), generative AI, AI agents, and agentic AI.

For NACVA members (CVAs[5] and MAFFs[6]), this technology serves as a powerful augmentation tool—not a replacement—enhancing efficiency, accuracy, and depth of analysis while requiring human oversight and professional judgment, especially with respect to agentic AI, which can orchestrate a whole decision-making process on its own.

The following section outlines key AI applications across specialized valuation and forensics areas, which can be performed in adherence with applicable professional standards issued by various valuation professional organizations (VPOs).[7]

1 See Sridhar Ramamoorti, "We Know Smart Contracts Are 'SMART,' but Are They Ethical?," *Quickread*, September 20, 2023, https://quickreadbuzz.com/2023/09/20/practice-management-sri-ramamoorti-we-know-smart-contracts-are-smart-but-are-they-ethical/.

2 National Association of Certified Valuators and Analysts.

3 Dr. Ramamoorti attended the session on the implications of AI, moderated by Michael Kaplan with distinguished panelists the Honorable Judge Steven Platt and the Honorable Judge Timothy Driscoll, all of whom encouraged further elaboration of this observation.

4 Agentic AI refers to artificial intelligence systems that operate with a high degree of autonomy, initiative, and goal-directed behavior, often performing tasks without needing step-by-step instructions from a human user. Agentic AI can perform tasks independently without constant human oversight, e.g., autonomous vehicles (self-driving cars) and trading bots (algorithmic trading). This is further clarified in the Appendix.

5 Certified Valuation Analyst.

6 Master Analyst in Financial Forensics.

7 E.g., NACVA Professional Standards, American Institute of Certified Public Accountants (AICPA) Statement on Standards for Valuation Services No. 1 (SSVS No. 1), American Society of Appraisers (ASA) Business Valuation Standards (BVS).

Key Applications in Specialized Areas

1. Business valuation (purchase/sale transactions, tax planning, etc.)

- Dynamic market benchmarking: Use agentic AI to continuously monitor and compare a subject company against thousands of guideline public companies and completed transactions in real time, instantly flagging new relevant deals, adjusting selected multiples, and providing dynamic ranges of value as market conditions change.
- Intangible asset valuation: Use natural language processing to analyze unstructured data (pertaining to contracts, patents, customer reviews, social media sentiment) to more robustly quantify the value of intangible assets, such as brand reputation, intellectual property, and customer loyalty.
- Forecasting and predictive modeling: Build sophisticated machine learning models to generate more accurate and dynamic financial forecasts, testing hundreds of what-if scenarios (e.g., changes in interest rates, new regulations, supply chain disruptions) to better inform discounted cash flow or capitalized earnings models.

2. Mergers and acquisitions due diligence

- Automated due diligence and risk assessment: Use agentic AI to autonomously scan and synthesize thousands of legal, financial, and operational documents (e.g., contracts, leases, human resources files, internal communications) in minutes, flagging inconsistencies, nonstandard clauses, and undisclosed liabilities, dramatically accelerating the due diligence timeline.
- Synergy quantification: Use predictive models to estimate the magnitude and timing of potential cost and revenue synergies post-merger, analyzing the integration challenges based on internal documents and historical integration data.

3. Forensic services and litigation support

- Fraud and bankruptcy litigation
  - o Real-time anomaly detection: Implement continuous transaction monitoring to immediately flag suspicious activities, such as round-number payments or transactions just below authorization thresholds, significantly improving the speed and scope of fraud investigations.
  - o Data ingestion and cleansing: Automate the extraction, cleaning, and structuring of data from diverse, often poor-quality, sources (e.g., scanned bank statements, handwritten ledgers, fragmented email logs) using enhanced optical character recognition (OCR) and data validation agents.
  - o Network mapping: Use AI to map and visualize complex relationships between entities, accounts, and individuals (internal/external) to uncover patterns of collusion or money laundering that would be invisible to the human eye.
- Matrimonial litigation
  - o Lifestyle analysis: Use agents to automatically analyze bank statements, credit card data, and other financial records to reconstruct personal spending habits, efficiently identifying discretionary spending and commingled funds to aid in equitable distribution and support calculations.
  - o Source and use of funds tracing: Automate the tracing of funds across numerous accounts and time periods to determine the source, disposition, and characterization (e.g., separate vs. marital) of assets.[8]
- Transactional advisory services and compliance
  - o Compliance review: Use AI to monitor transactions and documents against a library of regulatory requirements (e.g., tax law, anti-money laundering regulations) and firm-specific policies, ensuring compliance and flagging deviations before an external review.

In all these activities, it is paramount that the CVA/MAFF maintains professional skepticism and applies final judgment to all AI-generated outputs. As NACVA and other governing bodies emphasize, AI is a powerful tool for automating repetitive and data-intensive tasks, but the ultimate responsibility for interpreting the results, making normalization adjustments, reconciling value indications, and issuing a conclusion rests with the human analyst. Agentic AI allows professionals to shift their focus from data processing to high-level analysis, strategic thinking, and client advising, thereby ushering in a "golden age" of service quality and efficiency.

8 See, e.g., Sridhar Ramamoorti, Barry Jay Epstein, Darrell D. Dorrell, and Viswanathan Varadarajan, "The Proof of Cash Should Be King Among Forensic Auditing Techniques," *Journal of Forensic & Investigative Accounting* 9, no. 2 (July–December 2017).

The need for human oversight and responsibility is unavoidable, as liability will inevitably fall upon the creators, users, and other beneficiaries of these technologies.

The Accountability Gap

It is crucial to recognize that AI (and machine intelligence in general) is insentient, has no morals or scruples, no shame, and, unlike human beings, is not influenced by rewards and punishments. AI thus effectively operates outside the court system, so it cannot realistically be held accountable in any meaningful sense. This fact underscores the fundamental disconnect between human notions of accountability and the nature of AI. AI, by definition, lacks consciousness, emotions, and a moral compass. It processes data and executes algorithms based on its programming and training, not on ethical reasoning or a sense of responsibility.[9] The need for human oversight and responsibility is unavoidable, as liability will inevitably fall upon the creators, users, and other beneficiaries of these technologies. Moreover, professional ethical codes of conduct currently assume human judgment as central, yet they fall short when applied to human-machine interactions. Smart contracts, for instance, automate decision-making in ways that may obscure bias or lead to unethical outcomes, but the technology itself cannot be legally or morally liable.

Accordingly, attributing blame or punishment to an AI system in a traditional legal sense is meaningless. One cannot fine an algorithm, imprison a neural network, or shame a dataset. This void in accountability presents a significant challenge. When an AI system causes harm, who is truly at fault? Is it the programmer who wrote the code? The data scientist who curated the training data? The company that deployed it? Or the user who interacted with it? Without a clear legal and ethical framework for assigning responsibility, there is a risk of a "blame vacuum," where victims of AI-induced harm struggle to find justice. The lack of shame or scruples also means AI will not self-correct its harmful behaviors unless explicitly programmed to do so, emphasizing the need for robust human oversight and ethical design.

As Stanley and Steinhardt point out, the progression from human decision-making to human reliance on autonomous systems creates weaker chains of accountability, which they label the "bigger monster, weaker chains"[10] dilemma. This characterization aligns with the implication that while the "intelligence" powering these systems is artificial, the risks and responsibilities they generate are real.

Given the challenges discussed above, "human-in-the-loop" (HITL)[11] arrangements become paramount and nonnegotiable. This involves designing AI systems where human review, intervention, and oversight are built into the decision-making process. For example, in a business valuation context, AI may be used to identify trends and anomalies, but it is the valuation analyst who reviews and interprets the data before issuing conclusions. HITL ensures professional judgment governs the final valuation opinion. In such HITL arrangements, the human agent retains ultimate responsibility and can exercise judgment in complex or ethically ambiguous situations.

Why HITL matters in professional services (like forensics and valuation):

- Maintains credibility by keeping expert judgment central to the process
- Reduces liability by avoiding blind reliance on automated outputs
- Supports professional standards, which require reasoning and documentation that automation cannot fully replicate

9 Most importantly, these systems do not understand "the meaning of meaning," discussed in the authors' companion article in this issue. Sridhar Ramamoorti, Darrell D. Dorrell, and Lari B. Masten, "Morals, Ethics, and Values in the Age of AI: Perspectives from *The Meaning of Meaning*," *The Value Examiner*, January/February 2026, 4.

10 Jay Stanley and Barry Steinhardt, *Bigger Monster, Weaker Chains: The Growth of an American Surveillance Society* (American Civil Liberties Union, 2003), https://assets.aclu.org/live/uploads/publications/aclu_report_bigger_monster_weaker_chains.pdf. This report discusses the increasing surveillance capabilities of governments and corporations, warning that legal and ethical constraints on these technologies are failing to keep pace.

11 HITL means a human monitors, supervises, or intervenes in the automated system. It is used when decisions require contextual understanding, ethical reasoning, or risk management and often applies in areas where outcomes affect people, finances, or legal responsibilities. In fact, as Dr. Brigitte Muehlmann, CPA, CMA, CFM, CVA, of Babson College has pointed out, we are already going beyond HITL to human-on-the-loop (HOTL) and human-out-of-the-loop (HOOTL). (See Appendix.)

The emergence of the chief AI officer (CAIO) role is a direct response to the need for organizational accountability. A CAIO is typically a senior executive responsible for:

- Developing and implementing ethical AI policies—Ensuring that AI systems are designed and used responsibly, transparently, and fairly.
- Managing AI-related risks—Identifying and mitigating potential harms, including biases, security vulnerabilities, and unintended consequences.
- Ensuring regulatory compliance—Navigating the evolving legal landscape around AI.
- Fostering a culture of responsible AI—Educating employees and stakeholders on ethical AI practices.
- Being the point of contact for accountability—When an AI system within the corporation causes harm, the CAIO (and by extension, the corporation) is held accountable, providing a clear human and institutional locus for liability.

This role shifts the "real liability" from an amorphous concept to a concrete individual and department, making accountability tangible.

The "Learned Helplessness" Phenomenon

Learned helplessness is another distressing development that demands thoughtful consideration. In the context of AI, learned helplessness refers to the psychological phenomenon where individuals, consistently relying on AI to perform tasks or make decisions, lose their own cognitive skills, critical thinking abilities, and sense of agency.[12] If AI always provides the "answer," humans may stop asking critical questions, verifying information, or developing their own problem-solving skills.[13] Because many younger forensic and valuation professionals are using LLMs and generative AI models to help them write, extending the notion of "cognitive debt," we are likely to see not only a loss of problem-solving skills, but also weakened writing skills.[14]

The implication here is a deskilling of humanity. Overreliance on tools can erode valuation judgment—much like goodwill in a distressed acquisition. If forensics and valuation professionals depend heavily on AI for assistance in conducting complex engagements, such a tendency might adversely affect their technical ability and professional judgment and thus stunt their future professional growth. Similarly, if doctors rely solely on AI for diagnoses, their own

12 Martin E. Seligman and Steven F. Maier, "Failure to Escape Traumatic Shock," *Journal of Experimental Psychology* 74, no. 1 (1967):1–9, https://doi.org/10.1037/h0024514. Seligman and Maier first identified learned helplessness as a phenomenon in the 1960s. These psychologists conducted experiments on dogs, finding that, when exposed to repeated shocks that they could not control, the animals refrained from taking action when they could prevent the shocks. Learned helplessness is a phenomenon where repeated exposure to uncontrollable stressors results in people failing to use any methods to control their response to those stressors that are at their disposal in the future. More recently, "learned helplessness" suggests the failure of human beings to pursue, utilize, or acquire adaptive instrumental responses (e.g., depressed individuals without hope or motivation).

13 A recent MIT study found that using AI tools like ChatGPT for writing essays can lead to "cognitive debt" (a state where outsourcing mental effort weakens learning and critical thinking). The study involved 54 participants who wrote essays using ChatGPT, a search engine, or their own brains. Key findings include:

- **Brain engagement:** Participants using AI showed significantly lower brain engagement compared to those using their own brains or a search engine.
- **Memory recall:** Users of AI struggled to recall quotes from their essays, with 83 percent unable to quote even one sentence from their most recent essay.
- **Sense of ownership:** AI users reported a lower sense of ownership over their writing, while those using their own brains felt more engaged and had better memory recall.

The study raises concerns about the long-term implications of relying heavily on AI for writing tasks, suggesting potential cognitive harm and a decrease in learning skill. Nataliya Kosmyna et al., *Your Brain on ChatGPT: Accumulation of Cognitive Debt When Using an AI Assistant for Essay Writing Task*, MIT Media Lab, June 10, 2025, preprint, arXiv, https://arxiv.org/abs/2506.08872.

14 Just as equestrian skills faded when autos replaced horses between 1910 and 1930, one might predict that critical thinking and writing skills will deteriorate—or even atrophy—with the proliferation of AI LLMs.

The danger is that our "paleolithic emotions" (fear, greed, hunger for power) will leverage "godlike technology" through "medieval institutions" that are too slow or ill-equipped to regulate them.

diagnostic acumen might atrophy. If pilots trust autonomous systems completely, their ability to handle emergencies might diminish. This extreme reliance can make humans vulnerable when AI systems fail, when they encounter novel situations they were not trained for, or when they are maliciously manipulated. The "real liability" in such scenarios extends beyond direct harm to a societal erosion of human capabilities and resilience. It creates a dependence that, ironically, makes us less naturally intelligent and more susceptible to the flaws of our "artificial intelligence."

The phrase, "fodder for algorithms," paints a stark picture of a future where human autonomy and dignity are severely diminished. It suggests that individuals are reduced to data points, their behaviors and preferences continuously analyzed and manipulated by algorithms to serve external goals (e.g., corporate profit or social control) without any meaningful recourse or understanding of why decisions are being made about them.

In such a scenario, despite recent progress with "explainable AI" (XAI), there is largely:

- No attributability. It becomes impossible to trace the origin of a decision or outcome back to a specific human or even a clear algorithmic rule. Decisions emerge from complex, opaque AI models.
- No answerability. When questioned about an AI's decision, there is no human or clear explanation readily available. The answer might be "that is what the algorithm determined," leaving individuals frustrated and disempowered.
- No accountability. If there is no clear attribution or answerability, then meaningful accountability (legal, ethical, or social) becomes impossible to enforce.

The ultimate casualty is governance. If decisions are made by inscrutable algorithms without human oversight or mechanisms for redress, then the principles of justice, fairness, and democratic control are undermined. This moves us towards a system where power is exercised opaquely by machines, effectively rendering human governance impotent.

Edward O. Wilson's poignant observation, "The problem with humanity is paleolithic emotions, medieval institutions, and godlike technology," perfectly encapsulates the existential crisis we face.[15]

- Paleolithic emotions. Our fundamental human drives, biases, tribal instincts, and short-term thinking, forged in a distant evolutionary past. These remain largely unchanged despite technological leaps.
- Medieval institutions. Our slow-moving, often bureaucratic, and geographically bound legal, political, and social structures. These are ill-equipped to rapidly adapt to technological change.
- Godlike technology. AI, biotechnology, and other exponential technologies that grant us powers once only dreamed of by deities: the ability to reshape life, information, and reality itself.

As we approach singularity (Kurzweil's predicted point where AI surpasses human intelligence, leading to uncontrollable growth), autonomous systems will only accelerate this imbalance.[16] The danger is that our "paleolithic emotions" (fear, greed, hunger for power) will leverage "godlike technology" through "medieval institutions" that are too slow or ill-equipped to regulate them.

15 Edward O. Wilson (1929–2021) made this insightful observation during a debate at the Harvard Museum of Natural History on September 9, 2009. His statement highlights the tension between human nature, societal structures, and rapidly advancing technology.

16 Ray Kurzweil has written extensively about the concept of the technological singularity, particularly in his book, *The Singularity Is Near: When Humans Transcend Biology* (Viking Press, 2005). In this work, he discusses his Law of Accelerating Returns, predicting exponential advancements in fields like AI, nanotechnology, and robotics, leading to a future where machine intelligence surpasses human intelligence. Kurzweil estimates this transformation will occur around 2045.

What Can Be Done?

While the outlook can appear bleak, a dystopian future is not inevitable. Instead, we can ensure that the advent of AI becomes the harbinger of a golden era of forensic and valuation services. However, proactive and concerted efforts are crucial:

1. Prioritize ethical AI design and development

- "Ethics by design": Integrate ethical considerations from the very beginning of AI tool development, not as an afterthought. This includes fairness, transparency, accountability, and privacy.
- XAI: Develop AI models that can explain their decisions in a human-understandable way, fostering trust and enabling scrutiny.
- Robust testing and validation: Rigorous testing to identify and mitigate biases and unintended consequences before deployment.

2. Strengthen HITL frameworks

- Mandatory human oversight: For critical AI applications (e.g., healthcare, defense, finance), mandate human review and override capabilities.
- Reskilling and upskilling: Invest in education and training to empower humans to work alongside AI, developing critical thinking and problem-solving skills that complement AI capabilities.
- Defined roles for CAIOs: Legally define the responsibilities and liabilities of chief AI officers and similar roles to ensure clear accountability within organizations.

3. Develop agile and adaptive governance and regulation

- Proactive legislation: Governments must develop forward-looking laws and regulations that address AI's ethical and societal impacts, rather than reacting after problems emerge.
- International cooperation: AI is a global phenomenon. International collaboration is vital to establish common standards, principles, and regulatory frameworks to prevent a "race to the bottom" in AI ethics.
- Public-private partnerships: Encourage collaboration between governments, industry, academia, and civil society to share knowledge, best practices, and develop solutions.

4. Foster AI literacy and public discourse

- Educate the public: Increase public understanding of how AI works, its capabilities, and its limitations. This empowers citizens to demand accountability and make informed decisions.
- Ethical deliberation: Facilitate ongoing public and expert discussions on the ethical dilemmas posed by AI, ensuring a diverse range of perspectives are heard.

5. Reevaluate societal values and human purpose

- Redefine "work" and "value": As AI automates more tasks, society needs to grapple with what constitutes meaningful human endeavor and purpose beyond traditional employment.
- Prioritize human-centric AI: Ensure that AI serves humanity, rather than the other way around. This means designing systems that augment human capabilities, enhance well-being, and uphold human rights.
- Embrace the humanities: Reemphasize the importance of ethics, philosophy, social sciences, and arts in understanding the human condition and guiding technological development. These disciplines are essential to navigate the complex moral landscapes AI presents.

The future of humanity in the age of AI depends on our collective ability to align our godlike technology with our highest human ideals rather than letting our paleolithic emotions be amplified by powerful tools within medieval institutions. It requires intentional design, robust governance, continuous adaptation, and a renewed commitment to our shared humanity.

The message is loud and clear: We cannot abdicate responsibility to machines. The seductive efficiency of "smart" systems masks the ethical complexities they introduce. Humans must remain the custodians of accountability, both in designing these systems and in managing their societal impact. NACVA and other professional bodies must take proactive steps in integrating guidance on emerging ethical risks from AI and machine intelligence technologies. While the liability is real, it must be addressed through deliberate and robust ethical frameworks tailored to the realities of technology.

In summary, the future is very much in our hands. AI agents and agentic AI can revolutionize valuation and forensic services by automating complex analyses, improving accuracy, and accelerating workflow for NACVA members and other professionals. Properly conceived and implemented, and with safeguards and guardrails in place, it is possible to develop AI applications and deploy them responsibly. But that will require a concerted and coordinated effort to anticipate risks and envision solutions before the fact. We are confident that professional organizations like NACVA will lead the way by:

- Crafting professional standards that are responsive to the rise of agentic AI,
- Providing a forum for dialogue and deliberation,
- Developing training and professional development programs designed to build the requisite competencies and skills, and
- Establishing a continuous learning framework to guide practitioners in the responsible use of AI in valuation and forensic engagements.

By leveraging AI agents, valuation and forensic professionals can dramatically improve efficiency, accuracy, client service, and risk management across all phases of the engagement. This promises not only a golden age for forensic and valuation analytics, but a rise in practitioner effectiveness and new service capabilities. The trick is going to be how we exploit the upside opportunities afforded by AI and simultaneously manage the downside risks. We are pleased to be part of the conversation that will allow the forensics and valuation profession to grow from strength to strength. VE

Practice Management Takeaways

Sample Disclosure of HITL in Valuation: Use of Analytical Tools and Human Oversight

- Automated tools and data-processing technologies were utilized to assist in organizing financial information, identifying trends, and preparing preliminary analytical outputs.
- Human-in-the-loop (HITL) task arrangements ensure that professional standards of judgment, context-specific reasoning, and subject-matter expertise remain central to the valuation process.
- The analyst reviewed all outputs generated by automated systems to verify accuracy, relevance, and applicability to the specific facts and circumstances of the engagement. No output was produced or accepted, and no conclusions were developed, without independent validation and the application of professional judgment.
- Consistent with professional valuation standards from VPOs (e.g., NACVA Professional Standards, AICPA SSVS No. 1, and ASA BVS), all critical judgments—such as the selection of valuation approaches and methods, normalization adjustments, cost of capital determinations, and application of discounts—were made by the undersigned credentialed valuation analyst.

If using AI/ML tools specifically:

- While machine learning tools were employed to enhance efficiency in data review and trend identification, they operated under the oversight of a credentialed valuation professional. The use of such tools did not replace professional judgment, and all final conclusions were determined through independent human analysis.
- While technology assisted in data handling, all conclusions were reviewed, interpreted, and approved by the analyst. The final opinion of value is the product of human expertise applied in light of the facts and circumstances specific to this engagement.

Note: This kind of language helps maintain transparency, ensures alignment with professional standards, and protects credibility—especially in litigation or regulatory contexts.

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Notably, Mr. Dorrell developed the Forensic Accounting/Investigation Methodology© (FA/IM©) and, for the U.S. Department of Justice, co-authored three issues of the United States Attorneys' Bulletin: *Vol. 53, No. 2 (March 2005), "Financial Forensics I—Counterterrorism: Conventional Tools for Unconventional Warfare"; Vol. 53, No. 3 (May 2005), "Financial Forensics II—Forensic Accounting: Counterterrorism Weaponry"; and Vol. 60, No.2 (March 2012), "Financial Intelligence: People and Money Techniques to Prosecute Fraud, Corruption, and Earnings Manipulation." Email: darrelld@financialforensics.com.*

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Appendix

Understanding Key Distinctions[17]

LLM ≠ Generative AI ≠ AI Agents ≠ Agentic AI
These are all distinct and cannot be lumped together as one group. When doing task analysis, it is critical to understand to what extent these distinct types are used and how they are integrated into substantive auditing tasks. "Each serves a different purpose, operates at a different level of complexity, and solves a different class of problems."[18]

LLM: "Predicts tokens based on patterns in data. No memory. No intent. No task execution. Just input ▸ output."[19]

Generative AI: "Builds on LLMs to create text, code, images, etc. It understands latent space and can generate novel content—but it still waits for instructions."[20]

AI agents: "Execute predefined tasks. They detect intent, call tools or APIs, and handle responses. They're modular and functional—but not autonomous."[21]

Agentic AI: "Operates with goals, plans, context, and memory. It reasons, adapts, calls sub-agents, monitors progress, and decides what to do next—without human instruction."[22] (In other words, it has "a mind of its own.")

"This isn't just a progression of features. It's a shift in system design—from prediction to orchestration, from commands to autonomy. If you're building with AI, clarity on where your system fits in this stack determines everything: architecture, tooling, risk, and value."[23]

Understanding Ethics and Accountability: HITL, HOTL, and HOOTL

Germán Perez Trozzi describes the transition from HITL to HOTL to HOOTL as follows:

> **Three Models, One Transition**
>
> In the book "AI-Driven Autonomous Networks," Matías Lambert clearly categorizes these models:
>
> - **Human-in-the-Loop (HITL):** Automated decisions require human validation before execution. This model prevails during initial phases when perceived risk is high or systems are still maturing.
> - **Human-on-the-Loop (HOTL):** Systems operate autonomously but under human supervision. Humans don't approve of every action but are prepared to intervene when anomalies or unexpected behaviors arise.
> - **Human-out-of-the-Loop (HOOTL):** The system functions completely autonomously within predefined boundaries. Humans define the objectives, constraints, and success criteria but do not intervene in routine operations.
>
> This phased approach ensures a secure transition toward higher autonomy levels while establishing a clear framework for responsibilities, risks, and governance.[24]

17 Adapted from B.K. Pandey, LinkedIn post, August 9, 2025, https://www.linkedin.com/posts/brijpandeyji_llm-generative-ai-ai-agents-agentic-activity-7359988910942236672-9Fjj/.
18 B.K. Pandey, LinkedIn post.
19 Ibid.
20 Ibid.
21 Ibid.
22 Ibid.
23 Ibid.
24 Germán Perez Trozzi, "Navigating the Loop: HITL → HOTL → HOOTL in Autonomous Networks," Iquall Networks, July 22, 2025, https://iquall.net/insights/navigating-the-loop-hitl-hotl-hootl-in-autonomous-networks/. Note: Some commentators have identified additional models, including human-above-the-loop (HATL), where humans establish development and governance guidelines, and human-behind-the-loop (HBTL), where humans analyze AI outputs to identify improvements. See, e.g., Pawel Rzeszucinski, "AI, Humans and Loops," *Medium*, February 29, 2024, https://medium.com/@pawel.rzeszucinski_55101/ai-humans-and-loops-04ee67ac820b.