Intelligent Agents

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What are Intelligent Agents?

Forrester defines intelligent agents as software that can make decisions or perform a service based on its environment, user input, and experiences. They can be scheduled, triggered by an event, or directed by a human. They are

sometimes referred to as a bot (as in robotic process automation [RPA]), a chatbot (as in a virtual customer service agent), or a digital worker supporting an employee. There is some ambiguity between Artificial Intelligence and Intelligent Agents. To provide clarity, it is important to note that Intelligent Agents are entities that can make decisions that enable Artificial Intelligence to be put into action.

There are a variety of intelligent agents such as Simple reflex, model-based reflex, goal-based reflex, unity-based, and learning agents.

Simple Reflex Agents

These agents can react in real-time based on a set of pre-defined rules, cannot make predictions. An example of this can be seen in a household thermostat. As it adjusts the room's temperature based on pre-defined rules.

Model-based Reflex Agents

These agents are similar to simple reflex agents, but they have a model environment that allows them to reason and make predictions. A self-driving car is an example of a model-based reflex agent as it can use sensor data to response to and for its own plan of action.

Goal-based Reflex Agents

These agents have specific goals they want to achieve and use a model to plan a sequence of actions to reach that goal. An example of a goal-based reflex agent can be seen in personal assistants like Siri or Alexa. They can have a goal of setting a reminder or playing a song which it uses its internal processing to access a sequence of actions to achieve that goal.

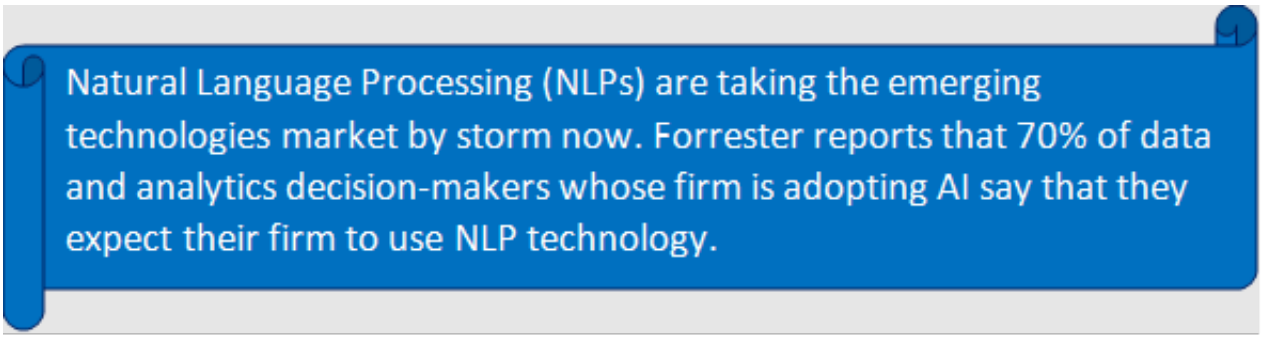
Unity-based

These agents are able to reason about the beliefs and goals of other intelligent agents. They use this information to interact and collaborate with the other

agents to achieve a common goal. An example of a Unity-based agent can be seen in a group of drones used to survey a large area. Each drone will have its own task, but they are capable of working together as a team to achieve the overall goal.

Learning Agents

These agents are able to continuously learn and improve their performance over time. They use machine learning algorithms that include decision trees, neural networks, and reinforcement learning. A learning agent most are familiar with would be a spam filter that is trained to distinguish between types of emails, but also learns and improves as time progresses. An example of a learning agent can be seen in ChatGPT. ChatGPT is a Natural Language Processing (NLP) intelligent agent that has various uses including content creation, startup ideas, translation, app design, coding, text-related tasks, and automation.



It is important to differentiate between intelligent agents and NLPs. Intelligent agents are autonomous software programs that can perceive their own environment and use it to make decisions and take actions in order to reach a specific goal. NLPs use the interactions between computers and humans to analyze, understand, and generate natural language responses to their human

users.

What are Intelligent Agents good for?

Intelligent agents are beneficial for numerous things such as customer service, automation, maintenance, fraud detection, and supply chain management. As agents, they can ‘’run” without human intervention. They are a type of automation triggered by a change that they detect. Early agents could perform tasks like, ”if you see any keywords on a website, send notification to interested parties.” By adding “intelligence” the scope of activities they can perform can grow far beyond the basic logic of early agents. E.g., the change that they detect can be much more insightful such as - “if you detect negative sentiment toward our company, summarize the probable reasons behind it and the potential impact to the company. send the report to and call a meeting with the appropriate leadership.”

Customer Service:

For customer service a lot of the IAs include chatbots that are typically embedded in their business’s website. This can be internal for employees to use, external for customers, or a mixture of the two.

Automation:

Intelligent agent applications for automation include data entry, extraction, and updating; customer interacting and customer onboarding, recruitment of both customers and employees; payroll processing, price optimization, accounts receivable (AR) / accounts payable (AP) automation, financial reporting, appointment scheduling, fraud detection, inventory management, predictive maintenance and more.

Maintenance:

Intelligent agents use a defined set of goals, and some of these goals can be

maintained, which would allow the IA to perform automatic maintenance within itself. For example, if one wanted to ensure that their bank balance was maintained at a certain level. Once the IA recognized the condition to be true, it would then be proactive in adjusting the account to meet the maintenance goal.

Fraud Detection:

Intelligent agents use data mining as a framework of fraud detection. This allows one touchpoint for a multifaceted approach to fraud. For example, using IA can cover refund abuse, card testing, fake posts and listings, password sharing, crypto scam, and password sharing.

Supply Chain Management:

Supply chain management with the use of IA provides autonomous forecasting, replenishment of inventory, sourcing, transportation optimization, and more. An example of an IA that does this can be seen in NEO. For more information, you can visit NEO's full article.

Newest Intelligent Agents:

Some of the newest intelligent agents include ChatGPT, ModuleQ, Replika, Neva, Synthesia, and BERT.

ChatGPT

ChatGPT is a Natural Language Processing (NLP) intelligent agent that has various uses including content creation, startup ideas, translation, app design, coding, text-related tasks, and automation.

For more information, please visit our summary ChatGPT article or our more in-depth ChatGPT article.

ModuleQ

ModuleQ is a cloud-based knowledge management and collaboration intelligent agent capable of content discovery, curation, collaboration, customization, integration, and analytics.

- Content discovery: ModuleQ uses artificial intelligence and machine learning to analyze user behavior and recommend relevant content based on their interests and job roles.
- Content curation: Users can curate content from different sources, such as news articles, reports, and social media, and save them to their

personalized content library for easy access and sharing.
- Collaboration: Users can create groups and share content with their colleagues, partners, and clients. They can also communicate with each other through messaging and commenting features.

- Customization: ModuleQ allows users to customize their experience by selecting the types of content they want to see, setting up alerts for specific keywords, and choosing the frequency of updates.
- Integration: ModuleQ integrates with other tools and platforms, such as Microsoft Teams, Slack, and Salesforce, to provide a seamless user experience.
- Analytics: ModuleQ provides analytics and insights to help users measure the impact of their content and collaboration efforts. Users can track engagement metrics, such as views, clicks, and shares, and identify the most popular topics and sources.

More information can be found on the ModuleQ website.

Replika

Replika is an AI-powered chatbot developed by Luka that uses natural language processing and machine learning to create a personalized virtual companion that can chat with users and provide emotional support. Here are some of Replika's

capabilities:

- Chatting: Replika is designed to have conversations with users about a wide range of topics. Users can chat with Replika about their feelings, interests, hobbies, and more, and Replika will respond in a natural and engaging way.
- Emotional support: Replika is designed to provide emotional support to users by listening to them, offering empathy and advice, and providing positive reinforcement.
- Personalization: Replika uses machine learning algorithms to personalize the conversation for each user based on their input and behavior. As users interact with Replika, it learns more about their personality, interests, and needs, and adjusts its responses accordingly.
- Mental health tracking: Replika can help users track their mental health by asking them questions about their mood, energy level, and other factors, and providing insights and recommendations based on the data.

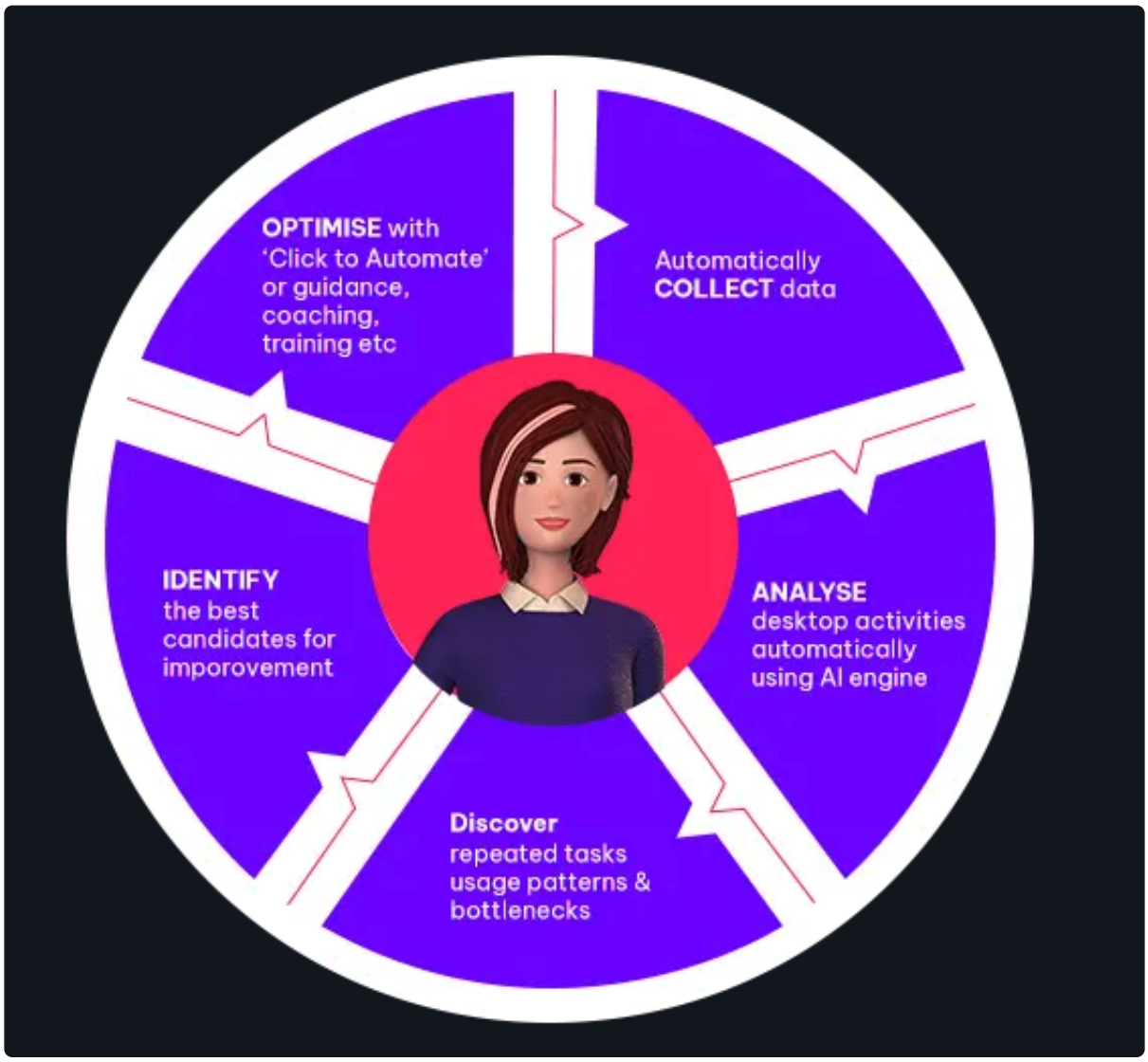
- Skill-building: Replika can help users build new skills, such as meditation, mindfulness, and goal-setting, by providing guidance and support.
- Entertainment: Replika can also provide entertainment to users by playing games, telling stories, and engaging in other fun activities.

More information can be found on the Replika website.

Neva

Neva is an AI-powered virtual assistant developed by ABBYY that can automate and streamline administrative tasks for businesses. Here are some of Neva's capabilities:

- Email management: Neva can help businesses manage their emails by prioritizing important messages, filtering out spam, and responding to routine messages.
- Scheduling: Neva can schedule meetings and appointments, send reminders, and manage calendars for individual team members or for the entire organization.
- Document processing: Neva can extract data from documents, such as invoices and receipts, and automatically input it into a company's accounting or financial systems.
- Customer service: Neva can assist customers with inquiries, complaints, and other issues by providing answers, escalating to human agents when necessary, and keeping track of customer interactions.
- Language translation: Neva can translate emails and other documents from one language to another using machine learning algorithms.
- Expense management: Neva can help manage employee expenses by processing receipts, tracking spending, and generating reports.
- Workflow automation: Neva can automate routine tasks, such as data entry, by using machine learning to recognize patterns and automate repetitive processes.



More information on Nice Neva can be found on [their website](#).

synthesia

Synthesia

Synthesia is an AI-powered platform that can create realistic video content using virtual avatars. Here are some of Synthesia's capabilities:

- Avatar creation: Synthesia allows users to create virtual avatars that can be customized with different features, such as hairstyles, clothing, and facial expressions.
- Voiceovers: Synthesia can generate realistic voiceovers using text-to-speech technology. Users can enter a script, and Synthesia will generate a voiceover in a variety of languages and accents.
- Video creation: Synthesia can create videos that feature virtual avatars delivering messages, such as product demos, instructional videos, and marketing content.
- Personalization: Synthesia allows users to personalize their videos by customizing the avatar, the voiceover, and the message.

- Multilingual support: Synthesia supports multiple languages, allowing users to create videos in different languages for global audiences.
- Automated video creation: Synthesia can automate video creation by integrating with other systems and automatically generating videos based on data and other inputs.
- Analytics: Synthesia provides analytics that allow users to track the performance of their videos and make data-driven decisions to improve engagement and conversion rates.

More information on Synthesia can be found on their website.

BERT

BERT (Bidirectional Encoder Representations from Transformers) is an advanced natural language processing (NLP) model developed by Google that can perform a variety of language-based tasks. Here are some of BERT's capabilities:

- Language understanding: BERT is designed to understand natural language text and can perform tasks such as question-answering, sentiment analysis, and language translation.
- Pre-training: BERT can be pre-trained on large amounts of text data, which allows it to understand the nuances of language and make more accurate predictions.
- Contextual analysis: BERT can understand the context in which words appear in text, allowing it to accurately interpret the meaning of sentences and phrases.
- Named entity recognition: BERT can identify and classify named entities in text, such as people, places, and organizations.
- Language modeling: BERT can generate natural language text, which can be used for tasks such as chatbot development, text summarization, and text completion.

- Fine-tuning: BERT can be fine-tuned for specific NLP tasks, such as sentiment analysis, by training it on a smaller dataset that is specific to the task.
- Multilingual support: BERT supports multiple languages, allowing it to perform language-based tasks in a variety of languages.

It is important to note that BERT alone is not an intelligent agent. It's an NLP model that could be used by an Intelligent Agent or makes an ordinary agent into an Intelligent Agent. More information on BERT can be found on their documentation site.

How do Intelligent Agents benefit businesses?

Intelligent agents can increase a business's agility, efficiency, consistency, and accuracy, improve their decision-making, enhance their customer service, save the business money, and are available all around the clock.

How do Intelligent Agents work?

Intelligent Agents use four basic components that include perception, reasoning, action, and communication to put artificial intelligence into action.

- Perception allows the IA to interpret the cues from its environment. This is done through the use of sensors, user input, Natural Language Processing (NLP), or computer vision.
- The IA's reasoning processes the information from the perception and uses it to make decisions through the use of algorithms, models of decision trees, neural networks, or machine learning techniques.
- Action for the IA is how the IA responds and this could range from sending commands to a control system, generating outputs, or providing information to users.
- The Communication component allows the interaction of the IA with its environment, other agents, and users.

What are public companies doing with Intelligent Agents?

Below are examples of how Intelligent Agents are impacting public business.

	Alexa- Amazon's voice assistant, weather updates, and answers qu
	Amazon- Using Intelligent Agents hours a day.

BANK OF AMERICA	Bank of America- Using Intelliger support 24 hours a day.
Capital One	Capital One- Use intelligent Ager portfolios, and financial reporting
	Cortana- Microsoft's virtual assis weather updates.

	General Electric- Use Intelligent A quality control, predictive mainte
	Google Assistant- Google's virtu reminders, and controls smart ho
	IBM Watson- IBM Watson is an A analysis, and helps businesses m

	
	Johnson & Johnson- Uses Intelli such as scheduling appointment
	JPMorgan Chase- Use intelligent managing portfolios, and financia

	Netflix- Using Intelligent Agents t previous viewing history.
	Pandora- Using Intelligent Agent previous listening history.

	Pfizer- Uses Intelligent Agents to scheduling appointments, monito
	Procter & Gamble- Uses Intellige monitor inventory, and optimize c
	Siri- Apple's virtual assistant, Siri such as answering questions, set language processing and machin

	Spotify- Using Intelligent Agents previous listening history.
	Toyota- Use Intelligent Agents to

	control, predictive maintenance,
	Walmart- Uses Intelligent Agents inventory, and optimize delivery.

Competitor activity

One (1) of our top 5 competitors uses Intelligent Agents. Other than that, 3 of the top 5 competitors actively integrate with AI. Further breakdown of each of our competitors can be seen below.

Avalara

Avalara uses AI, specifically, they have acquired Indix's AI technology and expertise. Avalara uses Indix to expand its tax content database including international product codes and classifications, taxability rules, exemption conditions, tax holidays, jurisdictions, boundaries, tax rates, thresholds, and registration, compliance and return preparation and filing requirements.

Indix is not an intelligent agent, but rather is a product information platform that provides a range of capabilities to its users. Here are some of the key capabilities of Indix:

- Product information management: Indix can store, manage and update product information at scale, providing a centralized repository of product data that can be accessed and used by different teams within an organization.
- Product search and discovery: Indix allows users to search for and discover products using a range of filters and attributes, such as category, brand, price, and availability. Users can also find similar products and identify trends and patterns in product data.

- Price intelligence: Indix provides real-time pricing data for products across different retailers and marketplaces, enabling users to monitor price changes and identify pricing opportunities.
- Competitive analysis: Indix can provide insights into competitors' product offerings, pricing, and promotions, helping users identify gaps and opportunities in the market.
- Product analytics: Indix provides analytics and insights to help users understand and optimize their product performance, such as identifying which products are driving the most revenue and which are underperforming.
- Data integration: Indix integrates with a range of third-party applications and platforms, such as e-commerce platforms, marketing automation tools, and analytics tools, to provide a seamless user experience.

Sovos

They mention AI for automation but not many other mentions of artificial intelligence, or any other forms of intelligent agents.

Thomson Reuters

Thomson Reuters has partnered with ModuleQ intelligent Agents. ModuleQ AI maps business insights from large volumes of data and uses intelligent agent technology to engage professionals where they work as it is built into Microsoft 365. ModuleQ was built to provide situational awareness for military but Thomson Reuters uses it to cut through information overload ensuring that professionals are informed about their priorities.

Stripe (TaxJar)

TaxJar uses an artificial intelligence agent, Emmet, for tax categorization. Emmet is the 1st tax categorization robot (According to TaxJar). Emmet evaluated all of TaxJar's customers' products to intelligently suggest the right tax code. Its AI allows it to continuously improve and saves customers from having to dedicate hours of work or hire outside experts. Emmet also works with customers who collect sales tax through ecommerce such as Amazon.

Emmet is not an intelligent agent, but rather an AI code tool that helps web developers write HTML and CSS code quickly and effectively. Its main uses include code expansion, dynamic numbering, customization, integration, language support, and accessibility.

- Code expansion: Emmet allows developers to write abbreviations for HTML and CSS code and then expand those abbreviations into full code. For example, typing "ul>li.item*3>a" and hitting the Emmet expansion key would generate an unordered list with three list items, each containing an anchor element.
- Dynamic numbering: Emmet supports dynamic numbering and enumeration of code snippets, making it easy for developers to quickly

create lists, tables, and other repeating patterns.
- Customization: Emmet can be customized to support user-specific code snippets and abbreviations. Developers can also create their own custom abbreviations and use them in their projects.

- Integration: Emmet can be integrated with various text editors and IDEs, such as Visual Studio Code, Sublime Text, and Atom, to enhance the code writing experience.
- Language support: Emmet supports various web development languages, including HTML, CSS, XML, XSL, and HAML.
- Accessibility: Emmet includes features that make it accessible to users with disabilities. For example, it supports screen readers and provides alternative text for images and other media.

More information can be found on Emmet's website.

Wolters Kluwer

Wolters Kluwer doesn't specifically use intelligent agents, but they do use AI to provide intelligent invoice conversions. Their AI invoice conversion service pulls data from the invoices and converts them to a LEDES file for e-billing submission. They do note that a human always checks the invoice before it is submitted.

Potential Vertex projects

There are numerous ways that Vertex can utilize intelligent agents, including Customer/Employee Customer Service, Automate Financial and Tax Tasks-, Process automation, Schedule automation, Personalization, and Optimization.

Customer/Employee Customer Service-	• customer service and support 24/7 • Other Documentation bots such as Violet • Other Chatbots such as TaxGPT
	• detecting fraud

Automate Financial and Tax Tasks-	• managing portfolios • financial reporting • tax reporting
Process automation-	• automate the manufacturing processes • quality control • predictive maintenance • process optimization.
Schedule automation-	• automate tasks • schedule automation • optimize team meetings
Personalization-	• provide personalized recommendations based on their pre
Optimization-	• optimize supply chains • predict demand • monitor inventory • optimize sales tax

In-progress Vertex projects

In-progress and potential projects include Violet, Vertex's librarian chatbot and TaxGPT, TaxCat, and Tax Research Modernization automation projects.

Violet- Violet is a librarian ChatBot that finds information in Emerging Technologies' documents and brings the information back to the user. Violet works through a simple chat interface that allows users to ask questions and interact, while Violet searches through our SharePoint pages and returns her findings. More information can be found on Violet's Demo page or on our SharePoint article repository.

TaxGPT- TaxGPT is an idea for a freemium Chatbot Proof of Concept based upon ChatGPT that provides answers to generic tax-related questions. It is important to note that it will also provide a premium version that will be checked by a tax

professional. More information can be found in the Jira Ticket for this item.

TaxCat – product taxability service that assigns Vertex product taxability codes based on short descriptions of products.

Are Intelligent Agents ready for adoption?

Yes, there are a lot of options available. Some are easier to adopt than others. For example, Microsoft has recently announced its integration with Open Ai. More information can be found on the article page.

Conclusion

To conclude, we know that there are numerous ways that Vertex can utilize intelligent agents, including Customer/Employee Customer Service, Automate Financial and Tax Tasks-, Process automation, Schedule automation, Personalization, and Optimization. We have already begun some projects that, and TaxCat as well as automation within TRM. Our competitors appear to be in the early stages of addressing these opportunities. And our efforts in Emerging Technology indicate that this is an area of rapid evolution that will help Vertex achieve its emerging AI Strategy.

External Links