

Hype Cycle for Natural Language Technologies, 2022

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By Analyst(s): Bern Elliot, Adrian Lee

Initiatives: [Artificial Intelligence](#)

Advances in artificial intelligence and machine learning are enabling innovative approaches and advances in the field of natural language technologies. This report will assist IT leaders in assessing how and where these new opportunities and methods can best be applied.

Additional Perspectives

- [Summary Translation + Localization: Hype Cycle for Natural Language Technologies, 2022](#)
(22 August 2022)

Analysis

What You Need to Know

Natural language technology (NLT) encompasses technologies and methods that enable human-language-based communication between humans and systems, as well as the analysis of those communications. NLT includes natural language understanding (NLU), natural language generation (NLG), text analytics, dialogue systems, language knowledge graphs, machine translation, text summarization, speech technology and neural symbolic language models.

A new generation of capabilities has emerged that uses deep neural network (DNN) machine learning (ML) methods. These new capabilities, combined with existing methods are enabling significantly improved functionality.

IT leaders should understand the technologies outlined in this report in terms of how they can be composed to produce useful and differentiating capabilities. Often, the value emerges when the language techniques are combined and integrated with other business applications and processes.

The following Hype Cycles cover related technologies and trends:

- [Hype Cycle for Artificial Intelligence, 2022](#)
- [Hype Cycle for Data Science and Machine Learning, 2022](#)

The Hype Cycle

This Hype Cycle focuses on innovations where machine learning using deep neural networks is enabling significant advances in natural language capabilities.

NLT is not a single market or industry, but rather a broad set of capabilities. Functionality is sometimes delivered as either:

- A stand-alone, commoditized capability
- Multiple functions that are combined to deliver a targeted solution or platform
- Functionality embedded in existing solutions

The fragmentation in the NLT market is largely due to three factors:

- Many NLTs are broad solution enablers. As a result, functionality may be purchased as a general tool, or it may be embedded in applications targeting specific markets.
- Many emerging NLT capabilities disrupt solutions that are already established in the market but are based on an earlier generation of technologies. These emerging solutions may both disrupt preexisting markets and enable new markets.
- Regional language differences. This creates fragmented NLT markets.

Due to the rapid and recent advances enabled by applying DNN methods, take care to separate hype from what is actually delivering consistent results. While most IT leaders select NLT solutions from vendors that fit specific needs and use cases, there is a trend toward developing in-house language skills that can act as a resource to internal users.

New technology entrants this year:

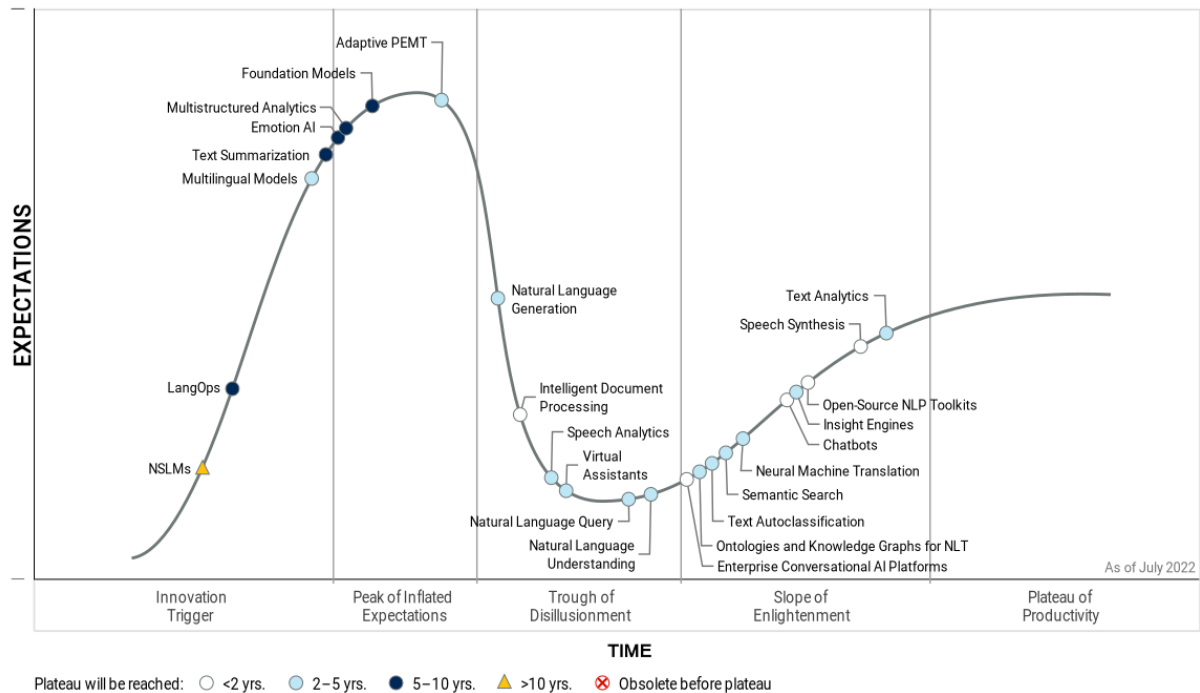
- LangOps
- Multilingual models
- Multistructural analytics
- Natural language query

Renamed:

- Foundation models (previously called Transformers)
- Ontologies and knowledge graphs for NLT (previously called Ontologies and Knowledge Graphs)

Figure 1: Hype Cycle for Natural Language Technologies, 2022

Hype Cycle for Natural Language Technologies, 2022



Gartner

Source: Gartner (July 2022)

The Priority Matrix

The Priority Matrix maps the benefit rating for each innovation profile (IP) against the amount of time each IP requires to achieve mainstream adoption. The benefit rating provides an indicator of the potential of the IP in general, but the rating may not be applicable to all organizations. As a result, IT leaders should identify which of the IPs offer significant potential benefits to their own organization based on their own use cases. This can then guide investment decisions. IPs offering more significant near-term benefits should be carefully considered, as they can offer both strategic and tactical benefits. Innovations with longer-term benefits should be considered if they offer strategic value.

As the Priority Matrix illustrates, many of the IPs reviewed in this report offer relatively near-term benefits. This reflects the tremendous impact that new AI methods have on NLP methods. Conversational AI platforms represent a particular area of significant exploration and investment among enterprises. Adoption has been assisted by the availability of application development tools. Apart from neural machine translation (NMT), the tools in many of the other IPs outlined in this Hype Cycle are not very mature. As a result, IT leaders should consider how to approach solution development when they review these areas.

Table 1: Priority Matrix for Natural Language Technologies, 2022

(Enlarged table in Appendix)

Benefit ↓	Years to Mainstream Adoption			
	Less Than 2 Years ↓	2 - 5 Years ↓	5 - 10 Years ↓	More Than 10 Years ↓
Transformational	Enterprise Conversational AI Platforms	Natural Language Understanding Neural Machine Translation Virtual Assistants	Emotion AI Foundation Models	NSLMs
High	Chatbots Intelligent Document Processing Open-Source NLP Toolkits	Insight Engines Natural Language Generation Ontologies and Knowledge Graphs for NLT	LangOps Multistructured Analytics	
Moderate	Speech Synthesis	Adaptive PEEMT Multilingual Models Natural Language Query Semantic Search Speech Analytics Text Analytics Text Autoclassification	Text Summarization	
Low				

Source: Gartner (July 2022)

Off the Hype Cycle

- **Natural language processing:** This profile was removed several years ago because it generated confusion. NLP encompasses many of the innovations profiled in this report, so, in many ways, is redundant with the term natural language technology. Relevant elements of the NLP description have been incorporated into this broad report.
- **Transformer models:** This profile was replaced with the term foundation models. The transformer term itself replaced the term large-scale pretrained language models, which had been used in the prior year. This shifting of terminology as a technology matures is common.
- **Speech recognition:** The maturity and adoption level has moved this to the mainstream.

On the Rise

NSLMs

Analysis By: Van Baker

Benefit Rating: Transformational

Market Penetration: Less than 1% of target audience

Maturity: Embryonic

Definition:

Neural symbolic language models are a form of composite AI that combines deep neural networks' learning abilities with symbolic models' reasoning abilities to create a new class of language-processing model. NSLMs are designed to transcend the inductive bias of neural network language models (NNLMs) by adding symbolic reasoning that can address the issues that NNLMs face. These include spatial or temporal properties in language that can be represented by logical or mathematical expressions.

Why This Is Important

Deep neural networks can provide advanced NLP capabilities, but still have significant limitations. Prior efforts to process language via symbolic models using symbolic constructs have delivered tangible results for years, but progress has slowed. Neural symbolic language models' (NSLMs') combination of the two is starting to see results that derive commonsense models from very large language models. Other models that combine large language models with symbolic injection are showing some improved performance over the large language model.

Business Impact

Neural symbolic models can improve the performance of standard language models and facilitate new solutions, assuming early advances are repeatable and sustainable. Further disruption of language-processing technologies are expected as there are increasing advances in the very large language space and to the NSLM solutions. The investment required to remain competitive in this market may force small vendors to rethink strategies and choose to partner with hyperscalers to remain competitive.

Drivers

- Demand for language AI technology is expanding, due to the inherent value associated with language solutions, including conversational solutions as well as text analytics.
- Natural language processing technology continues to enable increasingly complex solutions. These incorporate transactional capabilities and automated decision making and workflow solutions, such as robotic process automation (RPA) and intelligent document processing.
- The creation of very large language models has had a significant impact on language processing. In addition to advancing the performance of natural language processing, they have shown some abilities to answer questions about subjects they have not been trained on. Language technology continues to evolve at a rapid pace, and new approaches, such as NSLMs, promise continued improvement.
- Composite AI techniques have started to show remarkable results in addressing complex business and engineering problems.
- Neuro-symbolic models have already demonstrated the capability to outperform state-of-the-art deep learning models in domains such as image and video reasoning (see [Neuro-Symbolic AI: An Emerging Class of AI Workloads and Their Characterization](#), from Cornell University).
- Some evidence suggests that neuro-symbolic AI systems can be trained with significantly less data than what is required for other methods (see [Neuro-Symbolic AI](#), from MLearning.ai).

Obstacles

- Neural symbolic models are a fundamentally different approach that requires two dramatically different approaches to AI model building.
- Combining deep machine learning and symbolic models may prove to be very challenging, and the different camps within the AI community add to the challenge.
- Renewed advances from very large language models have reinvigorated the deep learning approach to language AI solutions.
- The lack of ModelOps methodologies is a challenge for these models.
- NSLMs are likely to come from the large cloud providers, which may constrain access to and availability of solutions that use these models.

User Recommendations

- Assume that many natural language solutions will keep evolving rapidly, with a range of different technical approaches to addressing language solutions.
- Expect volatility among language AI vendors to be high, as technical advantages will emerge that disrupt language solutions.
- Plan for continued instability in the natural language processing market. This will fuel deployment of rapidly evolving language-processing-based solutions, especially modular or composite solutions that enable swapping of core services (such as the natural language understanding model).
- Assume that language-focused AI models will increasingly be applied to complex tasks and not be limited to simple solutions, as advances in language technologies are likely to deliver substantial improvements in language understanding.

Sample Vendors

IBM; Microsoft; OpenAI

LangOps

Analysis By: Bern Elliot, Soyeb Barot

Benefit Rating: High

Market Penetration: Less than 1% of target audience

Maturity: Embryonic

Definition:

Enterprise natural language operations (LangOps) are practices that support management of the full life cycle of the language models and solutions implemented within enterprise architectures. This includes the development and curation of training data and AI models and the continuous delivery of retrained models and functionality integrated with the relevant business processes and applications.

Why This Is Important

The use of natural language technologies is expanding rapidly across multiple areas within enterprises. Language solutions are increasingly being used broadly and combined to deliver advanced functionality working with semistructured and unstructured data. Additionally, enterprises increasingly want to customize and adopt capabilities based on business requirements. To be successful, enterprise leaders must operationalize their approach with the implementation of natural language technologies and techniques. This practice is called LangOps.

Business Impact

Enterprise natural language operations are the activities that are required to manage and operate natural language technologies — allowing the enterprise to fully integrate these technologies across enterprise applications. LangOps may initially be limited in scope to a single natural language technology area, such as text analytics, conversational platforms or translation. But over time, synergies across multiple NLT areas will drive language centers of excellence and development of broader cross-functional enterprise LangOps streams.

Drivers

- Use of natural language technology by business areas is increasing rapidly. The business requirements are becoming more complex, and the underlying use of natural language technology is being used across increasingly broad business domain areas.
- The need for sophisticated data and modeling practices is increasing as is the volume of data. There is also demand for sharing of training data and data-handling tools for semistructured and unstructured content.
- Existing AI ModelOps and XOps practices may not generalize to language areas. This drives a need for specialized streams in some language areas.
- Natural language solutions must draw from diverse technology and business skills. LangOps allows these diverse participant efforts to be organized and focused.
- Desire to share best practices for ingesting, managing, storing, governing, and using large sets of unstructured data (for instance, call logs).
- Cross functional uses for language technology include translation model customization, which might be used across multiple areas, including marketing, customer service, and websites. Text analytics models and approaches are another use case. These can be used for speech analytics of customer satisfaction, evaluation of social media, or analysis of financial reporting material. Additionally, there is potential for the use of common graph methods and specific knowledge graphs to support diverse applications that are operating on the same business model or using common technologies and tools.

Obstacles

- **Immature practices and methods:** The overall maturity of many emerging natural language technologies is accompanied by immaturity of the best practices for managing the full solution life cycle. Additionally, LangOps will need to fit with existing ModelOps and XOps practices. Implementing human in the loop (HITL) practices for training may be nonstandard to Ops practices.
- **Language applications span different natural language technology (NLT) platforms:** This causes inconsistencies for LangOps across platforms.
- **Organizational issues:** The cross-functional nature of LangOps requires that people with different skills and reporting responsibilities work together. This can pose challenges that can be complicated by the potential for conflicting “turf” and budget control issues. For instance, a single language solution may be used by different areas of the business. Previously, separate solutions were handled by each business area. LangOps will need to address these conflicts.

User Recommendations

- Develop an informal community of interest that includes business users of language technology as well as AI, data science, machine learning and language experts. For many organizations, thinking about language technology as an interconnected area is a new concept. This community will assist in socializing this concept.
- Define a strategic enterprise NLT roadmap. This will start by viewing language initiatives as part of a broader portfolio, not as discrete projects. Allow projects to advance at their own pace, but look for how and where synergies across the organization will be useful. Provide guidelines for operationalizing NLT projects.
- Enlist the support of CxO level sponsors as part of the planning. Diverse business areas will eventually be involved, so this allows different groups to better work together and to reduce “turf” conflicts.
- Focus initially on language areas already in use where added technical support will improve operations.

Sample Vendors

IBM; Unbabel; Veritone

Gartner Recommended Reading

[Market Guide for AI-Enabled Translation Services](#)

[Toolkit: AI-Enabled Translation Services – Vendor Profiles for Market Guide](#)

[Vendor ID Toolkit: Natural Language Technologies](#)

[2021 Strategic Roadmap for Enterprise AI: Natural Language Architecture](#)

[Demystifying XOps: DataOps, MLOps, ModelOps, AIOps and Platform Ops for AI](#)

Multilingual Models

Analysis By: Gabriele Rigon, JC Martel

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Definition:

Multilingual models are transformer-based neural machine learning models trained over large, multilingual corpora. Such ML models allow the NLUs and other language applications to operate more efficiently in multiple language outputs via the common underlying multilingual model.

Why This Is Important

Multilingual models can significantly reduce costs and increase the effectiveness of multilingual NLP initiatives. Thanks to their transfer-learning capabilities, they are especially recommended for use cases covering low-resource languages or multilingual datasets. Their general applicability to multilingual scenarios, usually handled via individual monolingual models, seems promising with anecdotal evidence of successful deployments or customer stories.

Business Impact

Multilingual models mostly found in the following domains:

- Neural machine translation (NMT), in particular when low-resource languages and dialects are involved.
- Natural language understanding (in the context of multilingual conversational AI (CAI) solutions, for example).

- Text analytics (for example, in the definition of multilingual sentiment analysis and content moderation tools).
- Voice technology (where, for example, they are core to multilingual automatic speech recognition models).

Drivers

- Soon after the introduction of transformer architectures and, in particular, BERT in the NLT landscape in 2018, multilingual models have been applied to a wide variety of use cases, starting from translation-related ones.
- The entry barrier is low, so this has resulted in a significant amount of academic interest and enterprise R&D investment on multilingual models. Tech heavyweights (such as Google, Microsoft, Oracle, Amazon and IBM) have been advancing research on the subject, and smaller vendors operating in specific NLT subfields (like NMT and CAI) are also starting to include them within their standard offering.
- There is an increasing demand for language-automation solutions (such as chatbots and AI-enabled translation services) to address use cases involving low-resource languages, to which it is more difficult to apply NLP techniques due to lack of data, and code-switching scenarios. At the same time, low-resource dialects in regions like Asia are often not supported by the standard toolkit of vendors in this space.
- Content-moderation use cases, like offensive-language detection tasks, are especially relevant these days and they appear to be particularly interesting as a field of application for these models, since social-media datasets tend to present stressed multilingual traits.

Obstacles

- They are not straightforward to implement and deploy, so require a higher level of technical skills than monolingual ones to use effectively.
- They are better suited for use cases involving low-resource languages or multilingual data sources. It is not trivial to benchmark their accuracy even in these scenarios, and their general effectiveness is currently difficult to estimate.
- They appear to perform differently depending on the NLP task. Compared to classification-focused ones (like NLU), generation-oriented multilingual models (like NMT) have yet to catch up with monolingual approaches.
- They work better when the data they are trained with comes from “typologically similar” languages. For example, the quality of translations produced via multilingual NMT models degrades if the languages are too different.
- They are relatively new to the market. For example, in the CAI space they may be found as alternative NLU components to handle multilingual chatbot initiatives, but with many caveats.

User Recommendations

- Ensure you have the required skills to handle multilingual models in-house, or that the vendor is providing you with the expected support to deploy and maintain them.
- Set the correct expectation with stakeholders, remembering this technology is to some extent emerging and difficult to benchmark.
- Use multilingual models when the use case requires them, typically in low-resource-language or multilingual-dataset scenarios, and there is low risk and/or exposure.
- Ensure the data you are training such models with is from “typologically similar” language varieties.

Sample Vendors

AppTek; Cognigy; Kore.ai; NeuralSpace; Salesforce

Gartner Recommended Reading

[Cool Vendors in Conversational and NLT Widen Use Cases, Domain Knowledge and Dialect Support](#)

Best Practices for Localizing Your Chatbot Initiative

Market Guide for AI-Enabled Translation Services

Text Summarization

Analysis By: Shubhangi Vashisth, Stephen Emmott

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Definition:

Text summarization is a range of techniques that automatically produce short textual summaries representing longer or multiple texts. The principal purpose of this technology is to reduce human time and effort required to acquire insight from content, either by signaling the value of reading the source(s) or by delivering value directly in the form of the summary.

Why This Is Important

The principal beneficiary of text summarization is a human rather than a machine. Appropriate use of the technology can reduce task time and effort, improving access to insight for all employees of an organization, thus reducing the orientation required for decisions and actions, and stimulating ideation.

Business Impact

Text summarization is increasingly valuable across many use cases:

- The principal use of this technology is and will continue to be in real-time, reader-led summarization of found/shared documents.
- Across all vertical industries, the functional domains that are likely to benefit most from text summarization are legal, finance, HR, supply chain and research. The government and education sectors could also benefit from the technology.
- Integration with applications like insight engines, knowledge graphs and content management systems.

Drivers

Technology to summarize text dates back to the 1950s. Key drivers include:

- Reducing employee time and effort required to acquire insight from content.
- Recent advances in AI-herald-abstraction-based approach, including transformers, as a viable way to apply text summarization at the domain and foundation, as well as situation levels of the application portfolio.

Below are the approaches taken for text summarization. Among the two options, extraction remains the dominant form:

- **Extraction** — This is where statistically significant words, phrases and sentences are extracted, leaving the rest. It is comparable to, but falls short of, skim reading the source.
- **Abstraction** — This is where supervised learning is used to map salient words and phrases from the source into novel sentences in the target.

Obstacles

Though the technology continues to improve in performance, it falls short when compared to having a human summarize the content.

This stems from the approaches taken and their inherent limitations:

- **Quality** — The extraction approach is well-established but produces summaries that are further removed from the quality of human-generated summaries.
- **Contextualization** — The abstraction approach has emerged in recent years and produces summaries that are closer to human-generated summaries, but requires training in context and is therefore more challenging and costly to apply.
- **Omission of key information** — Missing vital information from a summary reduces the quality of insight needed from the source document, which can adversely impact analysis, decision and action. Such risks are intolerable in many vertical industries and functional domains, such as compliance within banking or research within life sciences and healthcare products. HITL process and incorporating user feedback to improve subsequent summaries.

User Recommendations

- List the business functions and use cases that require text summarization capabilities and check if these capabilities are embedded within existing applications. Text summarization is often deployed as a component part of the applications that are specific to, or customized for, these situational uses.
- Explore the use of open-source capabilities for text summarization.
- Approach the technology as a prepackaged business capability that can be reused across the application portfolio. This will help application leaders looking for an abstraction-based approach.

Sample Vendors

Amazon Web Services (AWS); Datamatics; Expert.ai; Google; IBM; iManage; Lexalytics; Microsoft; Salesforce (Narrative Science)

Gartner Recommended Reading

[Market Guide for Text Analytics](#)

[Vendor ID Tool: Natural Language Technologies](#)

[Emerging Use Cases for Natural Language Technology](#)

[How to Benefit From Creative AI — Assisted and Generative Content Creation](#)

At the Peak

Emotion AI

Analysis By: Annette Zimmermann

Benefit Rating: Transformational

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Definition:

Emotion artificial intelligence (AI) technologies (also called affective computing) use AI techniques to analyze the emotional state of a user (via computer vision, audio/voice input, sensors and/or software logic). Emotion AI can initiate responses by performing specific, personalized actions to fit the mood of the customer.

Why This Is Important

Emotion AI is considered transformational as it turns human behavioral attributes into data that will have a large impact on human-machine interface (HMI). Machines will become more “humanized” as they can detect sentiments in many different contexts. Furthermore, applying deep learning to computer vision or audio-based systems to analyze emotions in real time has spawned new use cases for customer experience enhancements, employee wellness and many other areas.

Business Impact

Contact centers use voice analysis and natural language processing (NLP)-based algorithms to detect emotions in voice conversations, in personal chat conversations and chatbots. Computer vision (CV) based emotion AI has already been used for more than a decade in market research with neuromarketing platforms that test users’ reactions toward products. In addition, we see the technology expanding to other verticals, such as medical research, healthcare (diagnostic) and retail (customer experience).

Drivers

The increasing number of use cases we have identified indicates an increase in commercialization as emotion AI finds applicability in new domains.

- One of the drivers for detecting emotions/states is the need for a system to act more sympathetically. For instance, it creates anthropomorphic qualities for personal assistant robots (PARs) and virtual beings, making them appear more “human.” This “emotional capability” is an important element in enhancing the communication and interaction between users and a PAR. This can be an empathic avatar or an emotion-detection-enabled chatbot. A person’s daily behavior, communication and decisions are based on emotions — our nonverbal responses in a one-to-one communication are an inseparable element from our dialogues and need to be considered in the human-machine interface (HMI) concept.
- Combinatorial technology solutions such as computer vision-based and audio analytics or language-based and computer vision enable customer experience enhancements.
- Strongest adoption is currently happening in the context of contact centers where voice-based emotion analysis supports multiple use cases such as real-time analysis on voice conversations, emotion detection in chat conversations, emotional chatbots and more.
- Market research and neuromarketing tools are continuously leveraging emotion detection in various user scenarios including focus groups and product testing. Vendors have been extending their offerings toward remote/online interviews during 2020 — due to the pandemic.
- In the creation of virtual beings in customer service or other consumer-facing scenarios, emotional responses are a critical element.
- As the metaverse unfolds, virtual beings will play an important role as business models evolve and the entire ecosystem of this new digital world emerges.

Obstacles

- Privacy concerns are the main obstacle to rapid adoption in the enterprise. This is especially a concern in real-live situations (vs. lab/research environments) for both consumer-facing (e.g., monitoring emotions in a retail environment via cameras) and employee-facing situations. Research environments like product testing have the advantage that the Emotion AI is used for this specific purpose and the user (product tester) is fully aware that their emotions are being captured to improve usability or other features.

- Bias: when using facial expression analysis, models are likely to be retrained in different geographies to get the system to detect the different nuances present due to different cultural backgrounds.
- Variation across modalities. Certain emotions can be better detected with one technology mode than with another. For instance, “irony” can be detected using voice-based analysis while this is close to impossible to detect with facial expression analysis.

User Recommendations

- Review vendors’ capabilities and reference cases carefully. As the market is currently very immature, most vendors are focused on two or three use cases in two or three industries. At the same time, identifying and processing human emotion is currently a gray area, especially in the EU. The EU Commission has started an initiative to review the ethical aspects of AI technologies, and emotion AI will certainly be part of this debate.
- Enhance your customer analytics and behavioral profiling by applying emotion AI technologies bringing your customer experience strategy to the next level.
- Be use-case-driven. The use case will determine the emotion AI technology to be used and vendor selection.
- Appoint responsibility for data privacy in your organization — a chief data privacy officer or equivalent.
- Work with your vendor on change management in order to avoid user backlash due to sensitive data being collected.

Sample Vendors

Behavioral Signals; Cogito; DAVI; Intelligent Voice; kama.ai; MorphCast; Soul Machines; Superceed; Symanto; Uniphore

Gartner Recommended Reading

[Competitive Landscape: Emotion AI Technologies, Worldwide](#)

[Emerging Technologies: Emotion AI in the Workplace](#)

[Competitive Landscape: Customer Analytics](#)

Tool: Vendor Identification for Natural Language Technologies

Multistructured Analytics

Analysis By: David Pidsley, Tim Nelms, Stephen Emmott

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Definition:

Multistructured analytics is an umbrella term for all techniques applied to unlocking the value of wide data — the spectrum of multistructured information (structured, semi-structured, and unstructured) of any format e.g., language (text/audio) and vision (image/video), sourced internally or externally. Multistructured analytics (sometimes called 'X Analytics') decomposes meaningful features of human-generated wide data for DSML, and composes machine-generated wide data into context-enriched analysis for expert decision making.

Why This Is Important

D&A leaders must bridge the gap between the analytics of today and the context-enriched analysis for decision makers to uncover unique insights. Exponential growth in the spectrum of multistructured information sources/formats needs techniques beyond the traditional, highly structured, transactional, relational data. To get a grip on business complexity they must harness multistructured analytics to support expert decision making with richer situational awareness, augment business workflows and automate decisions.

Business Impact

Across industries/business functions, organizations accelerate their application of multistructured analytics to wide data sources/formats to reduce costs, address new uncertainties/risks, drive growth and enable innovation in the use cases for analytics. Multistructured analytics of audio/video streams in sales and marketing can identify behaviors and sentiment of customers and influencers across channels for new deal insight, customer experience optimization, real-time dynamic pricing and deeper competitive intelligence.

Drivers

- Decisions are more complex — with more stakeholders and choices than two years ago. Scenarios need evaluating in a context-sensitive manner, beyond individual events/transactions, using multidimensional models of real-world uncertainties and context. Lacking the right variety of data stifles this.
- By 2025, 70% of organizations will shift their focus from big to wide data, providing more context for analytics. Internal (digital workplace) and external (business ecosystem) data sources increase the “dark data” locked in silos, leaving untapped business potential and hidden intelligence for competitive advantage. Data marketplaces and exchanges make larger, pretrained and more diverse data assets widely available.
- Organizations are adopting multistructured analytics to move beyond storing content, to extract meaningful features and insights from multistructured information sources. By 2023, over 80% of organizations will use some form of computer vision to analyze images and videos.
- All forms of wide data can now be processed. Document topics can be tagged, speech transcribed, imaged environments annotated, emotions predicted from video, gauges digitized, opening new doors for analytics, DSML and AI.
- Transformer models (via BERT and GPT techniques), advanced text analytics and deep learning have been a catalyst of multistructured analytics for linguistic and visual analysis. By 2025, AI for video, audio, vibration, text, emotion and other content analytics will trigger major innovations and transformations in most global enterprises.
- Improved price/performance ratio of cloud AI developer services made experimenting with multistructured analytics accessible and scalable.
- Multistructured analytics enriches structured data with categorization and tagging. Analytics and BI and multipersona DSML platforms are adding multistructured analytics and graph capabilities so that by 2025, context-driven analytics and AI models will replace 60% of existing models built from traditional data sources, consolidating a hotchpotch of analytics solutions.

Obstacles

- Although different forms of (text) content analytics have been deployed for years, many organizations avoid leveraging multistructured information due to limited competencies, specialized tools and their perceived difficulty fueled by confusion around terminology.
- While the tools now exist to deploy multistructured analytics uniting the spectrum of multistructured information to model complex context, it's a shift in the way D&A teams undertake data modeling especially in natural language processing.
- The difficulty of combining techniques (composite AI) to handle specific formats/sources — like deep learning for videos, symbolic algorithms for text analytics, and knowledge graphs — is a challenge.
- Data sourcing, quality and privacy are common challenges that can be cost prohibitive for large datasets. Finding suitable data for a specific use case can be difficult and require governance.
- The market for multistructured analytics tools is fragmented and will likely require leveraging multiple vendors, increasing costs.

User Recommendations

- Leverage multistructured analytics for richer situation awareness and expert decision support.
- Conduct proof of value/pilots and understand the data, technical and organizational gaps.
- Apply text analytics for supply chain optimization, image analytics for diagnostic maintenance, video analytics for conferences, and audio analytics for fraud prevention.
- Provide context-enriched analysis for decision makers by applying multistructured analytics to wide data multistructured information.
- Explore multistructured analytics capabilities and roadmaps of vendors, including insight engines for text content and cloud AI developer services for image, video and audio analytics.
- Engage startups and hyperscale cloud providers for innovation.
- Estimate your compute and storage needs to train/run effective ML models that leverage multistructured information.
- Invest in taxonomy/ontology skills to accelerate the refinement and automation of information tagging/classification.
- Revise data collection, management and integration practices to take advantage of multistructured analytics.

Sample Vendors

Alibaba Group; Amazon Web Services; Coveo; Elastic; Google; IBM; iOmniscient; Lucidworks; Microsoft; OpenAI

Gartner Recommended Reading

[Magic Quadrant for Insight Engines](#)

[Magic Quadrant for Cloud AI Developer Services](#)

[Hype Cycle for Natural Language Technologies, 2021](#)

[Emerging Technologies: Emergence Cycle of Video Analytics](#)

Top Trends in Data and Analytics for 2021: From Big to Small and Wide Data

Foundation Models

Analysis By: Arun Chandrasekaran, JC Martel

Benefit Rating: Transformational

Market Penetration: 1% to 5% of target audience

Maturity: Adolescent

Definition:

Foundation models (previously called transformers) are transformer architecture-based models, such as large language models, which embody a type of deep neural network architecture that computes a numerical representation of text in the context of surrounding words, emphasizing sequences of words. They are called Foundation models because of their critical importance and applicability for a wide variety of downstream use cases due to the pretraining of the models.

Why This Is Important

Foundation models represent an important step forward in the field of AI due to their massive pretrained datasets and wide use-case applicability. They are capable of delivering more state-of-the-art natural language processing capabilities with higher efficacy than their predecessors. Foundation models have become the go-to architecture in NLP and the model architecture has also been applied to computer vision, audio processing, software engineering, biochemistry, finance and legal use cases.

Business Impact

Foundation models:

- Have the potential to enhance applications across a wide variety of natural language use cases, such as creating well-formed blocks of text from keywords and generating human-like conversational responses.
- Will have a wide impact across vertical industries (i.e., financial services, healthcare, law, government, education, etc.). Their capabilities are extending to domains such as translating natural language to code with Codex from OpenAI and AlphaCode from Google DeepMind.

Drivers

Foundation models:

- **Require only limited model customization to deliver effective results:** Clients report to Gartner that they are able to use Google's open-source BERT implementation without training the entire network. Rather, they retrain only the top few layers to customize for their language domain.
- **Deliver superior text classifications:** The difference between these models and prior neural network solutions is stark. Transformer architecture model patterns are in relatively large blocks of text, as opposed to predicting the next word based on the preceding words. These improvements have materially advanced speech, language and text applications. A notable example is the improvement in Google Translate.
- **Can create well-formed text passages from minimal inputs:** GPT-3 is a foundational model developed by OpenAI and licensed by Microsoft. This transformer model, which incorporates 175 billion parameters, is designed to create paragraphs or pages of text from small excerpts. GPT-3 does this based on predicting the most likely next word in a sentence, based on its absorbed accumulated training.
- **Have accelerated the innovation in the space of AI** with massive model sizes. Examples include OpenAI's GPT-3, with 175 billion parameters; DeepMind's Gopher and Chinchilla, with 280 billion and 70 billion parameters; Meta (Facebook), with OPT model of 175B parameters; Google's PaLM, with 540 billion parameters; Microsoft – Nvidia's Megatron – Turing NLG, with 530 billion; and Alibaba's M6 with 10 trillion parameters. In addition, both Meta and Google have also open sourced their models.

Obstacles

Foundation models:

- **Do not deliver perfect results:** Although a significant advance, foundation models still require careful training, and can deliver unacceptable results due to their black box nature. They can propagate downstream any bias in the datasets.
- **Require appropriate skills and talent:** As with all AI solutions, the end result is dependent on the skills, knowledge and talent of the trainers.

- **Expand to impractical sizes:** Large models are up to billions, or even trillions, of parameters. These models are impractically large to train for most organizations because of the necessary compute resources, which can make them expensive and ecologically unfriendly.
- **Concentration power:** These models have been mostly built by the largest technology companies with huge R&D investments and significant AI talent. This has resulted in concentration of power with a few large, deep-pocketed entities, which may create a significant imbalance in the future.

User Recommendations

- **Create a strategy document** that outlines the benefits, risks, opportunities and execution plans for these models in a collaborative effort.
- **Plan to introduce foundation models into existing speech or text programs:** If you have any older language processing systems, moving to a transformer-based model could significantly improve performance. One example might be a voice interface, where transformers can interpret multiple ideas in a single utterance. This shift in approach can significantly advance language interfaces by reducing the number of interactions.
- **Start with established, open source-based models,** which have superior ecosystem support across DSML platforms and are more widely deployed.
- **Explore new use cases,** such as natural language inference or sentiment analysis, where the models can significantly improve both accuracy and time to market.

Sample Vendors

Alibaba; Amazon; Baidu; Google; IBM; Microsoft; Nvidia; OpenAI; Tencent

Adaptive PEMT

Analysis By: Bern Elliot

Benefit Rating: Moderate

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Definition:

Adaptive post-edit machine translation (PEMT) solutions allow a human translator to edit a document that has already been machine translated. Typically, this is done sentence-by-sentence using a specialized computer-assisted-translation application. The solutions are considered adaptive because human translator corrections may be incorporated into the machine translation model in real-time, allowing the translation accuracy to improve during the editing process.

Why This Is Important

Adaptive PEMT has the potential to reduce costs and speed the translation process. PEMT is typically incorporated into a computer assisted translation (CAT) tool. As machine translation technology itself becomes adaptable, the effectiveness of PEMT will improve. However, it is likely that enterprises will continue to find that some translation use cases are best left entirely to human translation. In those cases, the benefits of PEMT would not be realized.

Business Impact

PEMT augments the human translation process. It transforms the translation task from writer to reviewer or editor. The edits that a translator makes to the post-edited machine translation (MT) output can also be used to improve the MT model. This is sometimes called human-in-the-loop (HITL) AI model training. If adaptive PEMT is as effective as early deployments indicate, enterprises may realize significant measurable productivity and operational improvements.

Drivers

- **The primary driver for adoption is cost savings.** A human translation may cost \$0.08 to \$0.25 per word, depending on the skill required. An adaptive PEMT approach is currently estimated to cost \$0.02 to \$0.04 per word. This represents an opportunity for significant savings, even if only 20% of the enterprise documents can be translated with this method. Note that MT-only translation costs approximately \$20 per 1 million characters, and so will remain significantly cheaper. As PEMT tools may also increase the speed of translations, reduction of costs should be expected also in per-hour pricing frameworks.
- **The adoption of adaptive PEMT may also be facilitated by the adoption of interrelated AI-enabled translation solutions.** Multiple translation workflows are available that use a variety of translation solutions, one of which is PEMT. Transparency of the translation workflow can alert users to understand specific service charges, as well as to identify what translation task is needed. This transparency will also enable better classification of translation tasks.
- **Many organizations push to expand their markets into new geographic regions.** These globalization strategies result in increased demand for translation services, including for low resource languages and specialist knowledge areas.

Obstacles

- **New technology.** Updating models in real time and allowing the training to immediately influence subsequent MT predictions is new functionality. As a result, this method's effectiveness needs to be proven across a range of use cases.
- **Technology adoption and disruption.** The success of adaptive PEMT requires that human translators accept and adopt new technology and methods. Human translators may perceive machine translation and thus, PEMT, as a threat to their job security and value.
- **Not a panacea for all translation.** Most enterprises will most likely still require a combination of translation approaches, even if they use adaptive PEMT. The applicability of PEMT tools should be assessed case by case, depending on the complexity and type of the source documents.
- **Enterprise readiness.** Organizational inertia often inhibits adoption of new methods. This may result in lagging adoption by enterprises.

User Recommendations

- Use an adaptive PEMT approach if your organization is supporting initiatives that require a high volume of translations. This can help you achieve significant savings.
- Use change management programs when introducing the solution. Some human translators may perceive this method as a threat, so these programs will assist in making the transition.
- Products in this sector are new. Market leaders and best practices have not yet emerged. As a result, enterprise leaders should anticipate the need to use early adopter methods.

Sample Vendors

Baidu; GTCOM; Lilt; Memsource; RWS; SYSTRAN; Translated; TransPerfect; XTM International

Gartner Recommended Reading

[Market Guide for AI-Enabled Translation Services](#)

[AI-Enabled Translation Services - Vendor Profiles for Market Guide](#)

Sliding into the Trough

Natural Language Generation

Analysis By: Bern Elliot

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Definition:

Natural language generation (NLG) solutions automatically convert structured data (such as that found in a database) and in some cases, unstructured data (such as that found in text documents, a live video feed or images) into text-based narratives. This makes the data easier for users to access by reading or listening, and therefore easier to comprehend.

Why This Is Important

NLG solutions can improve understanding and operational efficiencies by making it easier to appraise, via summary, large or complex material and data. Most solutions currently in the market are based on an older “slot-filling” and rule-based methodologies. However, emerging solutions are evaluating how to use transformer artificial intelligence (AI) techniques to generate novel narratives without human intervention, and evaluating other AI techniques to enable more complex use cases and increased automation.

Business Impact

NLG supports a number of productivity-enhancing use cases that can reduce the need for human editors and writers. It can support interpretation of complex information such as analytic reports. It can also increase the speed at which textual information can be produced and shared, and can allow applications to communicate with users and audiences in a more fluid and natural manner. The emerging translator solutions hold the promise of expanding the scope and quality of what can be generated, and the breadth and complexity of the use cases that can be supported.

Drivers

The most common uses cases for NLG driving adoption fall into several categories:

- **Enhance understanding of business analytics:** For instance, integrating NLG functionality with existing analytics and business intelligence (BI) and data science initiatives.
- **Article-type short summaries:** For instance, writing summaries or analysis of business data, financial data, wealth management information, personalized marketing copy or sports — perhaps in conjunction with abstractive text summarization technology.
- **Conversation responses:** For instance, writing personalized communications to customers via email or text.
- **Easing data access:** For instance, writing short, prose-based product descriptions based on database product information. These might then be posted as a reply to website information requests.
- **Generating variants of outbound messaging and marketing copy:** The last four years have seen growth in the number of short-form NLG specialist vendors.

Emerging, more complex, use cases include:

- **The combination of NLG with automated pattern/insight detection and self-service data preparation:** This can drive the user experience of next-generation augmented analytics platforms. Users have varying degrees of analytics skill to correctly interpret and act on statistically significant relationships in visualization. This use case could also expand the benefits of advanced analytics to a wider audience of business users, as well as making existing analysts and data scientists more efficient.
- **Tighter integration with BI workflows and experiences:** Context-based narration will reinforce mobile BI use cases, where a lack of screen space is a major impediment to information consumption. It will also expand the use of conversational analytics that combine natural language query (NLQ), chatbots and NLG via virtual personal assistants.
- **Complementing conversational experiences:** Conversational solutions, including virtual assistants, will be able to use NLG methods to enable more complex and natural-sounding interactions.

Obstacles

- Most current NLG solutions are based on slot-filling and rule-based approaches to generating text. While these approaches are mature, they are limited in the range of language and complexity of article types that they can generate. More advanced approaches face barriers.
- There are technical barriers. Advanced AI techniques for NLG, such as transformer-based language generation and case-based learning, are complex applications to build. The optimal algorithms and parameter settings must be explored. Often, these also have significant compute and memory requirements. A second technical barrier is that these AI-based solutions will need advanced tools that enable customization of solutions.
- There are also market barriers. As AI and machine learning (ML) methods advance, they will offer disruptive delivery and go-to-market approaches. NLG may be increasingly bundled within established application portfolios and within broad AI solution sets from large-scale cloud AI providers. This will change the way that enterprises source their options.

User Recommendations

- Be aware of a solution's maturity, particularly in terms of data integration and preparation requirements, the platform's self-learning capabilities, and upfront set-up and configuration required. Also consider the range of languages supported, the extent of narration for a single chart or across a dashboard, the degree of story automation and control supported, and the accuracy of the findings and narration.
- Investigate and understand potential drawbacks relating to multilingual user scenarios, as NLG requires specific libraries for each language in use. Additionally, industry-specific use cases need to be considered carefully with respect to jargon, tone and specialized ontologies.
- Identify how NLG could be attractive to organizations that are wishing to have their analytics, BI solutions and other classes of visual information accessible to those audiences that are visually impaired (for instance, to comply with the Americans with Disabilities Act [in the U.S.] and similar mandates in other countries).

Sample Vendors

Arria; Automated Insights; AX Semantics; Marlabs; Narrative Science; Retresco; ThoughtSpot; Yseop

Gartner Recommended Reading

Intelligent Document Processing

Analysis By: Shubhangi Vashisth, Stephen Emmott, Anthony Mullen

Benefit Rating: High

Market Penetration: 20% to 50% of target audience

Maturity: Adolescent

Definition:

Intelligent document processing (IDP) solutions extract data to support automation of high-volume, repetitive document processing tasks and for analysis and insight. IDP uses natural language technologies and computer vision to extract data from structured and unstructured content, especially from documents, to support automation and augmentation.

Why This Is Important

Intelligent document processing is increasingly important to create operational efficiencies in business processes that need to extract information from semistructured and unstructured data for further analysis. These processes currently are majorly human centric. IDP caters to a wide variety of use cases — from digitization initiatives to supporting more complex processes such as document-centric taxation processing and pension fund management. IDP is one of the technologies within a spectrum of technologies that enable hyperautomation.

Business Impact

- Reducing human labor to process documents and the improvement of document-based workflows.
- Extracting relevant data from different input formats for further analysis, validation and/or automation.
- Preprocessing unstructured data for analysis.
- Automated document and email classification and extraction.
- Discovery and insight.
- Creating workflows to support process automation or integrate with existing automation solutions.

Drivers

Key drivers include:

- Consolidating document processing across multiple applications into one component.
- The need to ingest data from a wide variety of sources and in different formats (e.g., pdfs, images) and extract information from the same.
- Achieve high accuracy and efficiency in the extraction and automation processes for operational efficiencies.
- Enhanced capabilities to denoise and preprocess semi and unstructured data.
- Support for additional capabilities such as document classification, metadata extraction, knowledge graphs, search, natural language query and answer.
- Increased leveraging of HITL training methods to simplify adoption and deployment-to continuously improve automation accuracy.

Examples of use cases span many enterprise departments and vertical industries, including:

- **Accounts payable/receivable:** Processing of invoices, POs, payments, expense reports and receipts.

- **Healthcare:** Processing of medical forms.
- **Banking and financial services:** Processing of loan applications, drivers licenses and other collateral; customer onboarding; ESG; and compliance.
- **Government:** Processing of forms, drivers licenses, passports and other IDs.
- **Manufacturing:** Processing of equipment maintenance records, RFPs, business contracts and operating agreements.
- **HR:** Employee onboarding, travel and expenses.

Obstacles

- **Complex, consolidating markets.** The market has a competitive vendor landscape with dedicated solutions and offerings from adjacent technology markets such as insight engines, OCR, RPA vendors, cloud providers, and, increasingly, service providers. Selecting the right solution gets tricky, as vendors offer overlapping capabilities and differentiation is low.
- **Integration challenges:** Many organizations already have either a homegrown solution or an existing IDP tool but are looking for enhanced features to cater to wider use cases and growing business needs. However, integration complexity makes it challenging.
- **Category bleed confuses buyers.** With semantic platforms, insight engines, RPA and conversational AI vendors all offering IDP-like solutions to interpret and mine document form factors, buyers may not feel compelled to purchase an additional format-specific (document) solution.

User Recommendations

- Evaluate the entire business process to understand where and how IDP solutions can be integrated. Treat IDP as a component that integrates with other platforms/applications.
- Adopt industry- and or business-domain-focused solutions for a quick time to start.
- Align with stakeholders on accuracy and efficiency baselines for the process.
- Investigate the difference between placed-framed extraction and semantic-framed extraction – the former is not IDP, and only the latter can scale to unstructured content.
- Design the HITL validation process either by leveraging internal sources or through outsourcing the same to the IDP solution provider.
- Discuss specialized requirements such as ability to process documents in entirely new formats, data preprocessing needs and SLAs around processing time.
- Compare the ease of integration of new tools if looking to complement capabilities of an existing solution.

Sample Vendors

Alkymi; Altilia; Applica; DocDigitizer; Eigen Technologies; Ephesoft; IBM; Indico; Infrd; Opentext

Gartner Recommended Reading

[Infographic: Understand Intelligent Document Processing](#)

[Market Guide for Intelligent Document Processing Solutions](#)

[Quick Answer: How to Prioritize Requirements in the RFP for Intelligent Document Processing](#)

[Tool: RFP for Intelligent Document Processing](#)

[Competitive Landscape: Intelligent Document Processing Platform Providers](#)

Speech Analytics

Analysis By: Steve Blood

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Definition:

Speech analytics is a combination of phrase-matching, phonetic indexing and transcription technologies used to extract contextual insights from recorded and real-time voice streams. Speech analytics surfaces insights such as topics, categories and emotional engagement in conversations. Artificial intelligence (AI) and machine learning improve categorization and accuracy of analysis. Use cases range from customer service to workplace analytics and compliance across multiple industry verticals.

Why This Is Important

Rapid advancements in speech-to-text technologies and natural language technology in recent years, including the use of AI techniques such as machine learning, have improved categorization and analysis accuracy. This is enabling organizations to be more accurate and confident when using the insights surfaced from analyzing voice conversations for compliance, training, analytics and collaboration initiatives.

Business Impact

Speech analytics can be used to provide insights into:

- Employee performance and compliance by analyzing conversations for keywords, acoustics and talkover to highlight areas where further training could be required.
- The content of internal meetings and work sessions to identify subject matter experts and manage compliance.
- Emotional analysis to provide feedback on customer and employee sentiment, individually or in aggregate.
- Behavioral analytics to understand more about people's personalities, authentication and credibility.
- Insights on conversational dynamics, topics and flows.

Drivers

- A common use case for speech analytics is found in the customer service department. These use cases focus on mining of recorded calls to surface insights into quality of customer interactions, customer satisfaction and sentiment, opportunities for employee training as well as real-time analysis for compliance and next best action.
- Just as sentiment analysis is used in determining customer satisfaction in the front office, it could also be used to determine employee sentiment as part of a broader voice of the employee initiative. Analysis of conversations in the enterprise will greatly increase the ability to monitor compliance and risk, identify areas of improvements, and streamline automation of processes.
- There is an emerging set of use cases for speech analytics in the digital workplace for meetings and content management platforms. Transcription is already available with providers such as GoToMeeting, Cisco Webex, Microsoft Teams and Zoom.
- Analysis of the conversational track to surface insights from collaboration is an important step in understanding and cataloging content. The opportunity to use real-time speech analytics to support meetings with real-time content and actions is the next possible step for speech analytics in the digital workplace but needs to respect ethics and privacy scenarios by geography (see [Predicts 2022: Artificial Intelligence and Its Impact on Consumers and Workers](#)).

Obstacles

- Speech analytics ownership and procurement is fragmented across multiple operations in organizations, with little coordination for selecting a primary vendor to meet multiple business use cases. This will hamper broader scale and adoption of speech analytics as they remain discrete projects.
- Speech-to-text capabilities are progressing rapidly, but understanding intent and surfacing useful insights from analysis require investment in people and time. A continual update of the speech library with relevant data (new products, competitors, campaigns) is essential to uncover useful insights across the organization. Without this maintenance, the insights will become less accurate and of less use to the organization.
- Monitoring and analysis of conversations in the enterprise can have a positive impact on operational performance. But, if not used positively, the perception of “big brother” listening to and analyzing what people say can lead to disengagement of associates and distrust of employers.

User Recommendations

- Conduct pilot projects to evaluate whether speech analytics can provide demonstrably valuable insights into customer sentiment, employee quality and operational excellence. Align speech analytics with other customer service analytics initiatives such as text analytics, which is inherently more mature.
- Experiment with meeting transcription and analytics to tease out the value of surfacing insights from a series of internal meetings.
- Favor the SaaS deployment model with short-term licensing commitments or consumption-based billing to limit financial exposure as part of a trial. Ensure your data privacy and security requirements are maintained through trial into production.
- Create policies and an ethics board with employee representation for fair use of conversational data.
- Engage HR councils and workers’ representatives to ensure the thin line of monitoring and analysis is not overstepped. Look for positive use-case examples of analytics already in use in the organization.

Sample Vendors

Amazon Connect; CallMiner; Chorus.ai; Convin; Gong; MeetRecord; NICE; Uniphore

Gartner Recommended Reading

[How to Harness Voice of the Employee Insights for Continuous Employee Experience Improvement](#)

[Infographic: Artificial Intelligence Use-Case Prism for Customer Service](#)

[Vendor ID Tool: Natural Language Technologies](#)

[Accelerate Identification of Actionable VoC Insights With Speech Analytics](#)

[Use Analytics to Improve Customer Service Experience and Productivity](#)

Virtual Assistants

Analysis By: Van Baker

Benefit Rating: Transformational

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Definition:

Virtual assistants help users with tasks previously handled by humans. VAs use natural language processing, prediction models, recommendations and personalization to interact with people via voice or text. Increasingly, they automate processes and workflows. VAs learn from user behaviors, build data models, and recommend and complete actions to support VA users. VAs are primarily deployed in more complex use cases as chatbot interfaces are increasingly embedded in analytics solutions.

Why This Is Important

Conversational interactions are inherently appealing. The ability to converse with applications to retrieve information or accomplish transactions is a natural extension of human-to-human interactions to human-to-machine interactions. A well-implemented VA is always available and can efficiently assist humans in accomplishing tasks and, increasingly, may also proactively initiate interactions with human users of the technology.

Business Impact

VAs, RPA, machine learning models, event brokers and other technologies automate the enterprise. VAs use contextual multiturn conversations to drive workflows. Integration with enterprise applications enhances the handling of complex tasks. Consumer VAs led to enterprise VAs in SaaS platforms. Business channels like websites, mobile apps and messaging are common. Voice-based VAs are emerging as voice technologies improve. Use of VAs can expand hours of operation and improve customer response.

Drivers

- Customer expectations for access to customer service anytime, anywhere. This is especially true for online e-commerce businesses that have seen extreme growth in response to the pandemic.
- E-commerce is a 24/7 business and consumers expect to get their answers whenever they engage.
- Employee access to information on a real-time basis via conversational queries, resulting in enhanced productivity because of increased use of business-critical information. There is an increasing demand for technology that is easy to understand and interact with. While this is true for all workers, it is especially needed by remote workers in the enterprise.
- A strong desire by businesses to automate business workflows and processes wherever automation via conversational interactions can deliver value to the business.
- The ability to initiate communication with your workforce in response to event-triggered conditions or transactions. This facilitates more timely responses to changing business conditions by removing the need for workers to initiate transactions.
- Improved access to the business across multiple channels addressing the preferences of particular customer segments. This allows customers and employees to select their channel and modality of choice.
- Improving capability for conversational AI platforms to use natural language generation. This allows VAs to initiate interactions with customers and employees rather than just reacting to user requests.
- Enabling technologies. VA tools are becoming available that enable the automatic ingestion of unstructured and structured data to enhance and improve the language models. Additionally, low-code tools, automated identification of intents and entities, and the use of APIs for complex integrations make creation of sophisticated VAs easier.

Obstacles

- Poor or inadequate language models for the use case that is deployed. VAs need to be able to respond to an extraordinary variety of user questions. They should also be able to handle off-topic questions to some degree.
- Inadequate conversational AI platforms that do not have the capabilities needed to deliver VAs. Many platforms lack the ability to handle complex transactions, context switching, multi-intent utterances, strong integration, process automation and other functionality needed for virtual-assistance-level capabilities.
- A design approach that oversimplifies use cases for VAs. Many dialogue designs assume consistency in the way that people ask questions or conduct transactions that does not exist. This often leads to successful pilot development efforts that fail upon deployment.
- The need for ongoing continual retraining of the language models is often overlooked or ignored, leading to poor performance over time.

User Recommendations

- Assess the continual rapid evolution of the technologies that support the creation and deployment of VAs. These technologies are evolving at a very rapid pace that is not expected to slow in the near term.
- Deliver significant levels of integration and business process automation, in conjunction with VA conversational capability, as the platforms in the market are becoming increasingly sophisticated. Many conversational AI platforms include workflow automation capabilities as part of their offering.
- Include voice capabilities when evaluating VAs as voice is emerging as a dominant modality in addition to text.
- Define a conversational AI strategy. Establish enterprise scenarios for chat and VA technologies, and approach the technical decisions to support the full range of use cases.
- Favor approaches that allow for selection of discrete core service combinations that enable modular technical solutions that can optimize use cases.

Gartner Recommended Reading

[Magic Quadrant for Enterprise Conversational AI Platforms](#)

[Choosing the Right Conversational AI Platform](#)

[Roles and Responsibilities for Scaling Chatbot Initiatives](#)

[Solution Criteria for Enterprise Conversational AI Platforms](#)

[Critical Capabilities for Enterprise Conversational AI Platforms](#)

Natural Language Query

Analysis By: David Pidsley, Rita Sallam

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Definition:

Natural language query allows business users to query information using business terms typed into a search box or chatbot, or via voice. Vendors' techniques differ in analytical complexity of queries, data volumes and types supported. Some use keyword search, others translate terms into natural language questions using natural language processing technologies, and some combine both. Some use cases support querying structured data, and others enable semantic search of multistructured information.

Why This Is Important

- Business users need to make faster data-driven decisions, and get context-enriched analysis that includes reasoning about location and time-sensitive situations.
- Despite significant advances in the usability of the point-and-click visual-based ABI platforms and other knowledge bases, traditional access paradigms are still too hard for most business users.
- Flattening the learning curve for ABI platform users enables adoption by the remaining two-thirds of employees in organizations that do not use them.

Business Impact

Natural language query (NLQ) is an increasingly important interface for analytic content creation and consumption, making data-driven decision making accessible to business users unfamiliar with SQL and other formal query languages. NLQ drives adoption by nontechnical personas, offering them the ability to ask questions to gain insights, overcoming resistance to visual-based self-service analytics interfaces. Where data pipelines enable NLQ across multistructured information, it can unify the search experience across a spectrum of structured data and unstructured content.

Drivers

- The hype around generative AI is accelerating. Foundation models (via Bidirectional Encoder Representations from Transformers [BERT] and Generative Pre-trained Transformer [GPT] techniques), advanced text analytics and deep learning have been catalysts of natural language technologies, including natural language generation (NLG) and NLQ. NLQ and NLG are two sides of the same coin, in that they enable two-way communication between the human questioner and the machine-generated answer based on the data.
- Adoption of NLQ continues to grow as the availability and sophistication improves, with new entrants and new features within existing platforms addressing many challenges.
- As demand for pervasive analytics increases, ABI platform vendors have responded by improving their support for and innovation around NLQ. NLQ is rapidly becoming a standard and is a critical capability of ABI platforms rather than a specialty point solution.
- NLQ is also becoming central to new consumer-oriented user experiences that combine augmented analytics or autogenerated insights, narratives and anomaly detection into dynamic data stories and conversational analytics.
- Augmented analytics capabilities, such as automated insights, NLG, NLQ and data storytelling, make the analytics consumer of tomorrow a power user by today's standards. The majority of analytics consumers enter the data story workflow when viewing content that has already been created from prepared components and existing data visualizations. Their interaction is typically followed by NLQ or conversational analytics.
- Increasingly mobile workforces using handheld devices and voice interfaces need NLQ that can interpret geospatial questions and immediately deliver location-based answers and business insights as a best-fit map visualization. Advances in geospatial analytics and algorithms enable NLQ to deliver geospatial reasoning of distance, route calculations, and analytics about entities near, farther than or within a certain proximity or boundary, based on business defined regions or geocoded reference data.

Obstacles

- NLQ must support how business people ask questions. Limitations in real-time “type ahead” search-bar suggestions can frustrate users, reduce usefulness and hinder adoption. Similarly, many business users may not understand the implicit structure of underlying data, rendering their queries uninterpretable by the NLQ parser.
- Unindexed datasets often hindered bringing search and/or NLQ into the ABI context. The effort/costs to map and model data were too high.
- Substantial variety between vendors in how analytically complex queries can be, such as in their ability to provide rankings, comparisons, trend analyses, forecasts or predictions.
- Support varies among vendors for data sizes, formats, integration with NLG tools to explain findings, and automated insights to show the user related findings.
- Capabilities also vary among vendors in terms of support for suggestions for the next questions to ask, spoken languages beyond English, domain and industry ontologies, ease of configuration, and how much needs to be predefined in advance versus dynamically generated.
- Optimizing NLQ often requires customizing the platform and curating synonyms.

User Recommendations

Data and analytics leaders and other IT leaders looking to make analytics more pervasive should:

- Help business users adopt NLQ to find the decision making insights and information they need.
- Promote data literacy training for those not adopting visual self-service analytics or SQL.
- Assess the NLQ roadmaps of vendors and innovative startups.
- Prioritize vendors based on how and what a platform learns via usage during a proof of concept with real data and users.
- Evaluate how NLQ fits into your analytics solution architecture. Involve IT in evaluation, data preparation, and deployment of ABI platforms and augmented analytics tools.

- If supporting multiple use cases, modalities or operationalization needs, evaluate enterprise conversational AI platforms.
- Invest in design thinking about dialogue flows and in competencies to connect conversational analytics to the ecosystem of APIs; for example, ABI platforms and insight engines that enable semantic search and analyzing results sets of multistructured information.

Sample Vendors

AnswerRocket; Elastic; iGenius; Mindbreeze; Qlik; Quaeris; Tableau; ThoughtSpot; Unscrambl; WhizAI

Gartner Recommended Reading

[Magic Quadrant for Analytics and Business Intelligence Platforms](#)

[Critical Capabilities for Analytics and Business Intelligence Platforms](#)

[Quick Answer: What Are Key Considerations for an RFP in the Analytics and BI Platform Market?](#)

[Magic Quadrant for Insight Engines](#)

[Magic Quadrant for Enterprise Conversational AI Platforms](#)

Natural Language Understanding

Analysis By: Bern Elliot

Benefit Rating: Transformational

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Definition:

Natural language understanding (NLU) is a subtopic of the natural language processing (NLP) field of artificial intelligence. NLU focuses primarily on interpreting or understanding the text, and it is typically based on matching the parsed input to an underlying knowledge model or structured ontology.

Why This Is Important

NLU encompasses a broad range of applications, from simple understanding tasks, such as interpreting short direct commands, to complex understanding tasks, such as comprehending newspaper articles or maintaining a humanlike conversation. NLU functionality, even the basic ones, offers enterprises useful ways of directing the actions of a business application, appliance or device based on the natural language inputs received from users and the intent they entail.

Business Impact

There is significant and widespread demand for systems that can understand or interpret natural language, and that can interact with people in a conversational style. Applications that leverage NLU include chatbots, virtual assistants, text summarization and text content analysis. Other uses include smart vehicles, machinery, and consumer “intelligent” devices and appliances. In many cases, the effectiveness of NLU will determine the overall satisfaction with the application or appliance.

Drivers

The fundamental driver for NLU improvements is a more accurate identification of a user’s intent. As a subfield of NLP, which also includes natural language generation (NLG), NLU has a narrower scope and exclusively aims to comprehend what users meant to say. People have multiple ways of expressing the same thing. Conversely, people may use the same words to express different meanings. The NLU functionality will examine the parsed elements of the text and allow an application to interpret what was meant or intended based on its underlying model. NLU plays a significant role in key functions and applications, including:

- **Chatbots and virtual assistants:** NLU enables the chatbot to identify the intent of the user’s input, and, as needed, to extract key entities from that. For example, in the request, “I’d like to order a large mushroom pizza.” Ordering pizza is the intent, and mushroom and large are entities needed to properly complete the order.
- **Text categorization and classification:** NLU enables systems to analyze and assign text input into predefined categories. Examples include spam filters, document classification and script compliance.
- **Automatic text summarization:** NLU can play a role in creating summaries of longer text sections.
- **Question answering and semantic parsing:** QA systems leverage several of the above outlined functions to create a natural language interaction.

- **Content moderation:** While user-generated content keeps increasing on social media platforms, solutions to monitor it, detect offensive/inappropriate/harmful content and moderate interactions are increasingly needed. Content that may be subject to moderation can be identified by means of NLU techniques.
- **Sentiment analysis:** NLU helps to identify and measure the sentiment behind an opinion or context.

Obstacles

- **Complexity:** While some NLU objectives are simple, many are complex, which becomes an obstacle to successful usage of NLU. Factors driving complexity include the use of large-scale vocabularies, grammar, ontologies and models. Significant progress is needed on each of these factors before complex applications of NLU are ready for mainstream adoption.
- **Customization:** Many NLU implementations require customization in terms of the factors mentioned above, as well as custom training datasets.
- **Evolving technology:** The optimal techniques for implementing NLU continue to evolve. While methods such as tree graph analysis are well-established, newer methods based on transformer algorithms are just starting to emerge. The tooling and level of complexity required by each application significantly vary for each use case.
- **Bundling:** NLUs are often bundled within a chatbot platform and are managed via an integrated developer environment. As a result, they are often not separately reviewed.

User Recommendations

- **Examine the architecture of the NLU module.** Each NLU solution is intimately tied to its NLP environment, as well as to the application it supports, the model(s) it supports and the data that is in the model. It is critical that enterprise technical teams understand how these interrelated areas come together within the NLU module.
- **Determine the types of NLU modules that best fit your models.** In some cases, it may be useful to have NLU modules that can be interchanged, support multiple underlying models or offer preexisting data for the models.
- **Select based on language and use case.** Evaluate the NLU options based on the specific types of language and types of use cases that enterprise technical teams will need to support.

Sample Vendors

Amazon Web Services; IBM; NLTK; Rasa

Gartner Recommended Reading

[Magic Quadrant for Enterprise Conversational AI Platforms](#)

[Tool: Vendor Identification for Natural Language Technologies](#)

[2021 Strategic Roadmap for Enterprise AI: Natural Language Architecture](#)

[Quick Answer: How to Prioritize Requirements in the RFP for Conversational AI](#)

[Best Practices for Localizing Your Chatbot Initiative](#)

Climbing the Slope

Enterprise Conversational AI Platforms

Analysis By: Magnus Revang

Benefit Rating: Transformational

Market Penetration: More than 50% of target audience

Maturity: Early mainstream

Definition:

Enterprise conversational AI platforms are a strategic product for enterprises that need multiple, scalable and sophisticated chatbots and virtual assistants. These platforms typically provide a variety of capabilities with a no-code toolset for business users to themselves build and maintain chatbots and virtual assistants. There is an incredibly wide array of use cases, including use cases for customer service, call center automation, ITSM and HR.

Why This Is Important

Chatbots, virtual agents (VAs) and other conversational user interfaces are becoming the face of artificial intelligence (AI). Enterprises adopt this technology for a variety of use cases, spanning customer service, call center automation, IT service desk and human resources — for tasks like recruitment, debt collection, appointment booking and more. Conversational AI platforms are the underlying collections of technologies that enable centralized implementation and operations across multiple chatbots or VAs.

Business Impact

Automating interactions in the enterprise has tremendous business impact that cannot be understated. The cost and number of employees in customer call centers, IT service desk and HR operations present a compelling business case. Mature organizations are looking even further, toward using this technology for proactive conversations that would not previously have been possible without a strong reliance on human labor.

Drivers

- Enterprise conversational AI platforms have emerged from the pandemic period as strategic choices to automate customer and employee services.

- The emergence of sophisticated voice capabilities have made large-scale call center automation viable, with huge potential for savings and great customer experience.
- The number of vendors is still staggeringly large at more than 2,000 worldwide. Although Gartner estimates that only about 150 of these vendors can be considered to be possible strategic choices for the major use cases.
- There is still value in specialist offerings — vendors that specialize in industry, domain or even tasks. However, long term, the market will be dominated by larger horizontal platforms that offer industry, domain and task components on top of a versatile platform core.

Obstacles

- **Immature buyers** — The majority of buyers today remain immature. Most have little experience and rely on outdated advice and practices.
- **Diversity of approaches** — Vendors and customers alike are frustrated by the number of offerings, the diversity of deployment approaches, the different pricing models, unclear scopes of work, and the inability to measure the quality of a platform and implementations. This creates a rationale for the category being squarely in the Trough of Disillusionment. However, Gartner expects the category to mature quickly, with a fairly short time frame before reaching the Plateau of Productivity.
- **Scaling** — The major challenge to implementation is scaling the implementations from proofs of concept or initial deployments to strategic and operationalized deployments that bring tangible business value. Over the past year, Gartner has observed a focus among major offerings on operationalization, and on enabling nondevelopers and non-data-scientists not only to build, but also to maintain, improve and evolve the solution implementation over time.

User Recommendations

- Choose enterprise-ready platforms that support no-code options that allow nondevelopers and non-data-scientists to do build, maintenance and evolution tasks.
- Choose platforms that support multiple use cases, multiple bots, and multiple roles within the enterprise, and that have strong orchestration and synergies between these integrations.

- Choose platforms with flexibility in deployment and integration, so they can fit into your existing architecture and processes.

Sample Vendors

Amelia; Cognigy; Google; IBM; KORE; Omilia; OneReach.ai; Openstream.ai; Oracle

Gartner Recommended Reading

[Magic Quadrant for Enterprise Conversational AI Platforms](#)

[Critical Capabilities for Enterprise Conversational AI Platforms](#)

[Craft a Chatbot Initiative Based on Your Business Requirements and Solution Complexity](#)

[2021 Strategic Roadmap for Enterprise AI: Natural Language Architecture](#)

Ontologies and Knowledge Graphs for NLT

Analysis By: Anthony Mullen

Benefit Rating: High

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Definition:

Ontologies and knowledge graphs enable users to model a set of concepts, categories, properties and relationships in a particular domain. They support the development of a consistent terminology and allow complex relationships to be represented. They are often used to abstract away from underlying relational schemas, and can be seen as a flexible knowledge network with broad applicability across many NLT use cases. OWL and RDF are popular standards for ontology definitions.

Why This Is Important

As artificial intelligence (AI) and language automation projects proliferate data, content and architecture can become chaotic, with metadata scattered across business units, implementations and vendors. Domain ontologies and knowledge graphs (KGs) are major AI methods to represent knowledge that is human-readable, standardized and easily shareable, and abstracted from the underlying storage mechanism.

Business Impact

As investment and dependence on natural language technology (NLT) increases, ontologies and graphs will become a foundational approach for concept and relationship modeling, allowing:

- Better integration between disparate information systems and heterogeneous infrastructures.
- Consistent labeling for AI projects where ontologies act as a canonical reference.
- Broad application to use cases.
- Support of multiagent systems.
- Approaches to model context.
- More performant AI systems using composite AI.

Drivers

- **Language automation drives usage** — Conversational AI, insight engines, speech solutions and intelligent document processing (IDP) systems are just some of the submarkets driving the broader language automation market. While some vendor solutions may weight structural roles (for example, ontologies and KGs) and computational roles (for example, deep neural networks [DNNs]) differently in their solution architecture, we see aggregate growth of ontologies and KGs both by vendors and clients. Major drivers, like conversational AI, have given ontologies and KGs renewed prominence as an alternative to traditional intent-based approaches.
- **Better user experience in creating and managing ontologies and graphs** — Today, the heavy burden of humans alone managing ontologies and knowledge graphs is reduced by using machine learning (ML) to support their creation, maintenance and tuning.
- **Accelerated and broader use in data management** — Ontologies and knowledge graphs offer a flexible knowledge network, enabling broader use in both metadata management and data fabrics.
- **New approaches to composite AI in NLT** — Many semantic platforms, the torchbearers for this approach to concept modeling, have pivoted to integrate symbolic approaches (such as ontologies and KGs) and subsymbolic approaches (such as DNNs) over recent years. This has improved NLT performance.
- **Improvement in ModelOps and AI orchestration techniques for graphs** — New techniques for distributed architecture and federated learning provide greater capacity to manage billions of triples, and allow for secure data collaboration.

Obstacles

- **Ontologies and graphs are often a hidden mechanic** — Vendors using ontologies often don't make the information architecture directly available to buyers. Vendors should seek to make their ontologies available as an asset, in a marketplace, rather than a hidden mechanic for the end users they serve. Vendors should use their ontologies to expand data and service partnerships in the NLT space.
- **Their value is not clear to novice buyers** — A major trigger for evolving to ontologies and graphs is when bottom-up approaches proliferate and create technical debt in information architecture. In the AI space, most buyers have really just begun to develop their AI data pipeline, and therefore don't realize the benefits of ontologies and graphs.
- **Knowledge graphs are time-consuming to develop** — Even with support from other AI tools like neural networks, there is still human effort needed to shape and calibrate the knowledge graph asset. As domains expand, the complexity of the graph increases, and without a good UI they become too unwieldy to manage.

User Recommendations

- Check what already exists. See if any large-scale ontologies are available for the industry or within existing applications.
- Ensure easy read/write access to data for software engineers and data scientists.
- Reduce technical debt. Master key metadata and classifications for all projects with an ontology, supporting reuse and simpler networking of information.
- Represent product catalogs and services as ontologies and graphs to enable richer analytics and support collaborations with partners.
- Counter employee churn and retiring experts by developing ontologies and knowledge graphs to model tacit and implicit knowledge of employees. Connect human-in-the-loop enrichment of semantic assets to knowledge workers across business units.
- Hire librarians to complement the data science team by managing ontological models.
- Examine ontology vendors and their wider offerings — specifically how they relate ontologies (or definitions) to graphs (or expressions of ontologies as data).

Sample Vendors

Expert.ai; Ontotext; PoolParty; SciBite; semantha; Smartlogic; Synaptica; TAIGER; Talkmap

Gartner Recommended Reading

[2021 Strategic Roadmap for Enterprise AI: Natural Language Architecture](#)

[Vendor ID Tool: Natural Language Technologies](#)

[Magic Quadrant for Insight Engines](#)

[Magic Quadrant for Enterprise Conversational AI](#)

Text Autoclassification

Analysis By: Stephen Emmott

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Definition:

Text autoclassification encompasses a range of techniques that automatically associate metadata with text to enrich the text's content. The target text can be of any length, from messages (such as tweets and emails) to whole documents. The metadata — typically in the form of keywords drawn from a taxonomy or ontology — facilitates the selection, analysis and automated processing of the text it represents.

Why This Is Important

Autoclassification facilitates automated processing of content at scale, to augment or automate work. Relying on employees to classify results in variable quality and consistency of classification, or none at all, and, therefore, an inability to scale/adapt. This obstructs the use or flow of content. Advances in the application of machine learning, knowledge graphs and natural language processing have enabled automated attribution that diminishes the need for manual, human classification, but still requires oversight.

Business Impact

A primary use case of autotclassification is to facilitate automation as a preparatory step for use by other applications such as content services, insight engines, enterprise information archiving and e-discovery, surveillance, and hyperautomation. Other uses center around locating text using the labels associated with it (e.g., enterprise search or recommendations) or data analytics. This innovation applies across all languages, industries and business functions where use cases and their fulfillment are dependent upon content and content services technologies.

Drivers

Progress is driven by:

- **Demand due to growth in the quantity of content across many modes**, e.g., audio and visual as well as textual, both internally in terms of what organizations manage, and externally in terms of what organizations consume.
- **Expansion of the use cases** content can serve, both in terms of employees working within the digital workplace, and automation.
- **Advances in machine learning and knowledge graphs**, and particularly their application to natural language processing e.g., transformers (foundational models).
- **Leveraging composite AI to blend approaches** — machine learning, rules, etc. — for the best overall result.
- **Availability both within applications** (e.g., content services platforms and insight engines) and as separate point solutions.
- **Use of metadata to drive classification**, search, retention and security in employee-centric content services.

For these reasons and more, text autotclassification has reached 5% to 20% of its target audience as it continues its journey up the Slope of Enlightenment.

Obstacles

Progress is obstructed by:

- **Benefits of metadata are indirect**, meaning the business case can be difficult to articulate and support.

- **Ownership by IT as a tool rather than by subject matter experts as a solution,** integrated into the tools where work takes place.
- **Performance often falls short of expectations** meaning augmentation rather than automation is where expectations should be sent.
- **Limited or no expertise in house,** and few providers externally, to develop metadata standards and ensure these are both maintained and adhered to.
- **The range of solutions available for selection and use,** and their presence in multiple and often differing markets. Few tools are dedicated to autotclassification.
- **Multiple solutions in use throughout organizations** without coordination, especially in terms of their configuration, which hampers a joined-up approach to metadata management.
- **There is a need for continuous training and rule creation to ensure performance,** as the content to be classified grows and changes.

User Recommendations

- **Identify ownership for metadata** and identify an external partner to provide support at critical stages e.g., getting started.
- **Start small and narrow** in terms of metadata labels and permitted values, and grow values while constraining labels.
- **Prepare a training set of representative content assets** for both rule-based and machine-learning-based approaches.
- **Identify existing capability to autotclassify** and coordinate configuration and management, or use a separate point solution where no capability exists at present.
- **Establish metadata schemas** and manually pilot this on a subset of your content to ensure proof of concept and refine the schema.
- **Test performance regularly** using a carefully selected set of representative content assets, and use these to guide revision of your training set.
- **Engage subject matter experts outside IT** to own and lead deployment and maintenance.
- **Frame it strategically** to ensure autotclassification is considered part of your natural language technology strategies.

Sample Vendors

Access Innovations; BA Insight; Ontotext; Semantic Web Company; ZERO

Gartner Recommended Reading

[Leverage Semantics to Drive Business Value From Data](#)

[Checklist for Ensuring Hybrid Workers Can Always Find the Information They Need](#)

[Magic Quadrant for Insight Engines](#)

[Magic Quadrant for Enterprise Information Archiving](#)

[2022 Strategic Roadmap for Storage](#)

Semantic Search

Analysis By: Stephen Emmott

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Definition:

Semantic search uses natural language technologies to improve the value of search for users. It does this by processing the relationship between words — as a proxy for meaning — in addition to the words themselves. By identifying “things, not strings,” entities such as people and organizations are revealed along with their attributes and relationships. This serves to better mediate between intent and outcome, improving relevance and accuracy.

Why This Is Important

Performant search is essential for improved employee and customer experience within the digital workplace and within digital commerce. Semantic search amplifies performance by indexing words, and also their relationships to one another. This enables understanding of what content and data represents, and the meaning of data queries — delivering productivity gains and reducing risks. Semantic search can be used to apply domain-specific semantics to text analysis. This makes search a powerful tool for domain specialists and knowledge workers.

Business Impact

Use-case scenarios include:

- Facilitating employee experience by connecting employees to one another, or to information, based on their expertise, activities or need for knowledge.
- Facilitating customer experience by supporting purchasing decisions or improving self-help pre- or post-sale.
- Extending automation and analytics to processes currently restricted to employees receiving and processing documents manually.

Drivers

Progress is driven by:

- The continued need for more relevant experiences in the context of the digital workplace.
- Improving customer experience to increase the quality and quantity of transactions as well as self-help. This helps organizations stay ahead of expectations while increasing value and reducing costs.
- The pursuit of both augmentation and automation to create new ways of working for both employees and machines. Semantic search improves accuracy in identifying and extracting data for processing and analysis, and the use of that data in training machine learning models.
- The capability to extract textual data from audio and visual sources, thereby extending the reach of search to all content.
- Advances in transformers (that is, machine learning) as a natural language processing technique to enable meaning to be processed reliably in the workplace.
- Advances in knowledge graphs, enabling explicit representation of the entities and concepts words represent, their attributes and relationships.
- The emergence of Composite AI and the ability to marshall multiple AI approaches such as rules and machine learning to optimize capabilities.
- The need to analyze semantics across languages and harmonize search results for multilingual datasets.

- The availability of data exchanges and marketplaces for ontologies and other semantic assets.
- The extraction of semantics through text analytics enables natural language query in analytics and business intelligence platforms.

For these reasons and more, semantic search has reached 5% to 20% of its target audience as it continues its ascent up the Slope of Enlightenment.

Obstacles

- Domain-specific use where there are fewer customers leads to models and rules that are at lower levels of maturity.
- Use typically relates to private, confidential or commercial sources. This results in learning and adaptation that cannot be shared beyond individual customers.
- There is a need for professional services from vendors or partners to get started and continue.
- There is a need for semantic models to be developed, as they are not purchasable.
- There is a requirement for continuous commitment to the development and optimization of models, rules and data structures to support natural language processing.
- While transformers are flexible, rule-based approaches require further development — meaning those products that utilize a composite approach tend to be limited to specific languages.
- Significant compute resources are required for analyzing text and creating performant search experiences across large datasets.

User Recommendations

- Use insight engines as the platform for developing semantic search.
- Review your insight engine's capabilities to ensure they support semantic search, and factor it in as a requirement during selection of new products.
- Link your search and insight activities with your other natural language technologies initiatives and in the context of the organization's wider data fabric. Seek rationalization and consolidation where appropriate.
- Coordinate the development and maintenance of search and insight services to ensure common methodology and policies for configuration and training.
- Test the performance of semantic search in the business context. The performance of semantic search is highly dependent on its "semantic fabric," which requires testing before deployment.
- Engage subject matter experts to contribute — ideally independently and proactively — to the maintenance of semantic search capabilities.

Sample Vendors

EPAM; Expert.ai; IBM; Ontotext; Openstream.ai; Semantic Web Company

Gartner Recommended Reading

[Magic Quadrant for Insight Engines](#)

[Critical Capabilities for Insight Engines](#)

Neural Machine Translation

Analysis By: Bern Elliot

Benefit Rating: Transformational

Market Penetration: Less than 1% of target audience

Maturity: Adolescent

Definition:

Neural machine translation (NMT) is the application of deep neural nets to automate the machine translation of text from one language to another.

Why This Is Important

Neural machine translation algorithms are enabling significantly higher quality translations than previous approaches. In turn, this is enabling new use cases for content translation that were previously too expensive or complex, or not readily available. NMT is also being used to augment current human translation methods, allowing the translator to focus on the more difficult translation tasks.

Business Impact

Human translation typically costs \$0.08 to \$0.25 per word, depending on the knowledge and skill required. NMT costs approximately \$20 per million characters. A typical page is about 500 words or 3,000 characters. The most significant business impact has been to enable new applications due to the lower costs by creating access to a greater audience for digital content. Other impacted areas are areas where speed is critical in real-time synchronous scenarios (such as virtual meetings or live streams), or where NMT augments human translator tasks.

Drivers

- Core drivers for usage of NMT are significantly reduced costs over human translation, and the speed of translation if needed.
- There are also significant quality improvements that NMT offers over previous techniques. This in turn enables a broad set of use cases across many business areas. Areas include text translation for documents, blogs, emails, memos, e-commerce and web content, and online customer sales and support for customer problem tickets, chat forums and real-time queries. There are also use cases such as multimedia translation for training seminars, entertainment, audio and video clips, and real-time multimedia translation for video and phone meetings, one-to-ones and many-to-many.
- As NMT matures, secondary effects of the NMT technology are also driving new markets. NMT is being integrated with computer assisted translation tools (CAT) in a process called adaptive post-edit of machine translation (PEMT). Quality evaluation solutions are being developed to measure the accuracy of NMT translations. NMT hub services are being offered to arbitrage and route translation requests to the best fit NMT provider. Translation management systems (TMS) and the language services provider (LSP) market are shifting to adapt to NMT innovation. Website localization methods are using NMT for novel, proxy-based dynamic approaches. There are markets for data for customization of NMT models for verticals, languages and dialects.
- As a result of the above, enterprises are rethinking their approaches to localization and globalization.

Obstacles

- NMT still has limitations on quality and so requires careful fitting of the use cases.
- NMT will not fit the requirements for use cases where specialized knowledge and high accuracy are critical requirements, such as medical and legal translation.
- Availability and quality of NMT models varies significantly between language pairs, and there's still a deficit for low resource languages.
- The processes and best practices associated with effectively using NMT are still nascent both in products and in enterprise preparedness.
- Some enterprises worry about privacy and confidentiality of data sent to cloud-based NMT models.

User Recommendations

- Review where enterprise processes could be improved with NMT. This may involve modifying existing processes that require a high degree of human intervention.
- Assess where and how translation service providers are using NMT to improve their current service offerings.
- Collect translation data as this may be useful for customization of language models. This includes determining the format of the data so that it is usable for NMT model training.
- Evaluate NMT solutions based on your target language pairs and on text samples related to your actual documents and use cases. Not all NMTs are equally effective in all languages.
- Evaluate the benefits of using different NMT vendors for different language pairs in order to deliver the optimal NMT translation.

Sample Vendors

Amazon; AppTek; Google; Microsoft; RWS; SYSTRAN; Tarjama; Translated; TransPerfect; XTMInternational

Gartner Recommended Reading

[Market Guide for AI-Enabled Translation Services](#)

[Toolkit for AI-Enabled Translation Services — Vendor Profiles for Market Guide](#)

[Tool: Vendor Identification for Natural Language Technologies](#)

Chatbots

Analysis By: Magnus Revang

Benefit Rating: High

Market Penetration: More than 50% of target audience

Maturity: Early mainstream

Definition:

Chatbots are domain-specific or task-specific conversational interfaces that use an app, messaging platform, social network or chat solution for conversations. Chatbots range in use-case sophistication from simple, decision-tree-based solutions, to implementations built on feature-rich enterprise conversational AI platforms. Unlike virtual assistants, chatbots are always narrow in scope. A chatbot can be text-based or voice-based (commonly referred to as a voice bot), or a combination of both.

Why This Is Important

Chatbots represent one of the primary use cases of artificial intelligence (AI) in enterprises. While most commonly applied to customer service, IT service management (ITSM) or human resources, chatbot uses are incredibly diverse. Offerings in the market include developer self-service platforms, managed products, middleware offerings, integrated offerings, best-of-breed approaches and enterprise conversational AI platforms.

Business Impact

Chatbots are the face of AI and will impact all areas with communication between machines and humans. Customer service is an area where chatbots are already very influential — they have a great impact on the number of service agents employed by an enterprise and how customer service is conducted. The change from “the user learns the interface” to “the chatbot learns what the user wants” has implications for onboarding, training, productivity and efficiency inside the workplace.

Drivers

- The sophistication of the enterprise conversational AI platform market has led to enhanced tooling for enterprises to build and maintain chatbots using non-IT resources. Operationalization outside of IT, in the business units, is making chatbot production a more productive activity.
- Predefined intents, entities and dialogue templates for common use cases, domains and industries are accelerating time to market and increasing quality.
- While we can still claim that there are more emerging practices than established best practices, the experience of building high quality chatbots is increasingly being codified into educational resources.

Obstacles

- Scaling and operationalizing still remains a challenge in some cases due to a lack of dedicated internal teams to work on continuous improvements.
- Figuring out the composition of teams and the methodologies to iterate effectively is difficult. These are still emerging practices with strong vendor dependency.
- Technology is improving at an astounding pace, but best practices for adoption and use of these technological advancements are still being developed, resulting in a lot of trial and error for enterprises.
- Selected vendors are sometimes unable to keep pace with the technology and the market dynamics.
- The vendor landscape still comprises a large selection of vendors — by Gartner's estimate, it is somewhere in the thousands. Although consolidation is happening, newcomers are currently entering the market at a pace equal to that of mergers and acquisitions.

User Recommendations

- Select an enterprise-grade platform to develop multiple use cases with orchestration of the assets needed.
- Focus on operationalization of chatbots as a product — with the necessary organization and roles in place — to evolve and maintain chatbots over time.
- Identify capabilities where integration within a heterogeneous environment is possible, especially where networking of chatbots is required.

Sample Vendors

Amazon; Amelia; Avaamo; Cognigy; Google; IBM; Kore.ai; Microsoft; OneReach.ai; Yellow.ai

Gartner Recommended Reading

[The 3 Decisions You Must Make Before You Begin a Chatbot Project](#)

[Magic Quadrant for Enterprise Conversational AI Platforms](#)

[Critical Capabilities for Enterprise Conversational AI Platforms](#)

Insight Engines

Analysis By: Stephen Emmott

Benefit Rating: High

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Definition:

Insight engines apply relevancy methods to discover, analyze, describe, and organize content and data. They enable the interactive or proactive delivery or synthesis of information to people, and data to machines, in the context of their respective business moments.

Why This Is Important

The growth of content and data — both internal and external to organizations — makes it challenging for employees and customers to gain the insight they need for purposeful decision and action. Insight engines solve this by using composite AI (blending machine learning and rules) to reinvent enterprise search. Applications built on insight engines' capabilities (including semantic search) can deliver information (that is, content and data in context) required for insight.

Business Impact

Insight engines support both employee and customer experience in terms of digital workplace, data analytics, and automation. Insight engines are platforms, marshaling natural language technologies for a range of applications. They apply across all domains (that is, business functions and industry verticals), but especially domain and situational scenarios. Insight is delivered in the form of separate touchpoints, or embedded in third-party applications.

Drivers

As the technology continues its ascent up the Slope of Enlightenment toward the Plateau of Productivity (insight engines are reaching 20% to 50% of the target audience), progress is driven by:

- The bundling of insight engines within the digital workplace services provided by Microsoft (Microsoft 365) and Google (Google Workspace), thereby providing a foundational service by default.
- The need to support better customer experiences that help drive revenue growth, for e-commerce customer journeys in particular.
- The increase in both content (that is, unstructured data) and structured data within organizing, thus giving rise to “wide data.”
- The need for custom-made applications serving domain and situational use cases, thereby providing deeper context and amplifying relevance.
- The need to provide better user experiences with less friction, by including information in the applications where it is needed — bringing orientation, decision and action into one place or tool.
- Developments in semantic search, which drive the capability of insight engines, enabling wide data to be synthesized as information throughout the digital workplace.
- Programmatic access to content (and other data sources) for various applications to support digital transformation (for example, automation).
- The need for a natural language technology platform upon which multiple insight applications can be developed and delivered cohesively and according to aspiration.
- SaaS deployment models and packaged capabilities (that is, e-commerce) that are speeding up the time to value for insight engines in certain market segments.
- The fact that relevance varies across vendors, and client deployments, making it challenging to measure and optimize.

Obstacles

Progress is obstructed by the following:

- Although the impact of insight engines is high, the benefits can be difficult to articulate and quantify as impact is often nuanced and indirect.
- Custom development is required, expanding the time, skills and cost needed to attain higher aspirations for the technology. This is often provided by the vendor and their partners.

- The range of connectors to data sources is constrained and varies across vendors.
- Similarly, the range of prebuilt integrations into third-party applications is often limited, driving customers to further custom development.
- The complexity of insight engines means they can be challenging for proof-of-concept initiatives, and usually entail a long-term (typically three-year) commitment once selected and deployed.
- Shifting to semantic search entails a commitment to natural language technologies, necessitating the continuous development of language models and rules and the resources needed to enable this.

User Recommendations

- Establish whether insight engines included in cloud office are sufficient for all employees and use cases. It is unlikely that you will need just one insight engine.
- Review and shape your portfolio to ensure you can address use cases across the foundational, domain and situational levels.
- Place the beneficiaries — e.g., employees — at the center to focus the purpose of insight engines.
- Personify the beneficiaries of insight engines using personas. Identify their use cases and the applications they use to conduct work, and the sources of content and data from which the information is retrieved or synthesized.
- Align expectations. At the highest level of maturity, insight engines synthesize information proactively in the context of work, but more typically, they offer enhanced search.
- Ensure that there is a link to your wider natural language initiatives.
- Choose an implementation partner with the skills and best practice necessary to help accelerate your deployment and reap value from the investment.

Sample Vendors

Coveo; Elastic; Expert.ai; Lucidworks; Sinequa; Squirro

Gartner Recommended Reading

[Magic Quadrant for Insight Engines](#)

Critical Capabilities for Insight Engines

Open-Source NLP Toolkits

Analysis By: Adrian Lee

Benefit Rating: High

Market Penetration: More than 50% of target audience

Maturity: Mature mainstream

Definition:

Open-source natural language processing (NLP) toolkits enable end users and commercial companies to review, modify or design the source code for their own purposes, mostly free of charge. Open-source NLP toolkits address the foundational problems of analyzing and processing large, unstructured natural language corpora into structured data so as to facilitate the support for applications such as text analytics or virtual assistants.

Why This Is Important

Open-source NLP toolkits have been available for over two decades. Current releases incorporate a new generation of natural language technologies that provide value by optimizing business processes and operations. Applicable use cases are in business intelligence (text analytics), customer service (improving customer satisfaction, increasing engagement) and employee support (productivity applications, knowledge base management).

Business Impact

Open-source NLP toolkits enable:

- Rapid prototyping of conversational agents or applications with VAs as front-ends or leveraging NLP.
- A test bed environment for enterprises to internally build/test their NLP requirements.
- NLP capabilities for some conversational AI platform vendors.
- Enterprises to gain control over the application to develop customized solutions.

- Application vendors with conversational elements to develop their solutions for resale without costly machine learning investments.

Drivers

- Growing adoption of text analytics and other natural language-based solutions (such as virtual assistants) is lowering the barrier to entry for enterprises-building solutions with open-source NLP toolkits to integrate into their digital products.
- Some enterprises need to customize their integrations of NLT with their applications and domain-specific use cases.
- There is a lack of availability of customization of custom-made and packaged NLT IDE solutions without high professional services fees.
- NLP toolkits are mature, have broad user communities, and are an NLP foundation widely accepted by enterprises and some conversational AI providers to enable the most common modes of linguistic analysis to help machines understand text.
- Core features of open-source NLP toolkits position them to be suitable, lower-cost platforms for prototyping and piloting conversational agents or natural language applications and appeals to new or smaller organizations.
- An increased proportion of open-source NLP toolkits will come with some pretrained intent models, languages and test suites to accelerate the project delivery for end users.

Obstacles

- NLP toolkits are often focused toward experimental research and projects combining commercial solutions. Prototypes may not make it into production or be scaled up for commercial use.
- NLP toolkits require enterprises to provide their own custom data and develop their own advanced in-house AI and ML skills that require mid-to-long-term funding.
- To realize near-term business objectives, IT leaders typically consider managed service providers that can fulfill domain-specific needs and have prebuilt intent models to accelerate deployment.
- Limitations can exist where end users do not augment toolkits with suitable ML algorithms to improve the performance of the NLP output.
- Using NLP toolkits is iterative and requires customization and integrations with enterprise applications to deliver business benefits.
- Differences exist between self-service, managed service providers and open-source platforms in ontologies, taxonomies and domain specificity to drive contextual natural language understanding.

User Recommendations

- Implement open-source NLP toolkits if you want to build their own natural language technology stack by starting with a suitable toolkit to match their existing IT infrastructure or to incorporate into a sellable product.
- Possess skilled in-house resources of data scientists and artificial intelligence (AI) technology engineers for NLP.
- Evaluate a longer and more costly initial IT investment by using open-source NLP toolkits in order to benefit subsequently from lower total costs of ownership.

Sample Vendors

AllenNLP; Apache OpenNLP; Baidu; Intel; NLTK Project; PyTorch; Rasa; spaCy; Stanford NLP Group

Gartner Recommended Reading

[Architecture of Conversational AI Platforms](#)

Cool Vendors in Conversational AI Platforms

Selecting Conversational AI Solutions for Chatbot and Virtual Assistant Initiatives

Emerging Technologies: Tech Innovators in Conversational AI and Virtual Assistants

Speech Synthesis

Analysis By: Bern Elliot

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Definition:

Speech synthesis is the artificial production of human speech. Earlier generations concatenated stored words or sounds (phones and diaphones). Current methods synthesize the voice using a variety of modeling approaches (e.g., vocal tract and other voice characteristics) to produce entirely synthetic speech. Enhancements allow models to mimic specific speech patterns of individuals by tuning the synthesis model based on recordings.

Why This Is Important

High-quality speech synthesis allows vastly improved user experiences at a fraction of the cost of a human-recorded alternative. The current deep-learning-based approach uses acoustic models to produce waveforms and generate speech that is highly accurate. This approach was only developed in 2016. The rapid advancement of this technique promises to enable many new and useful applications.

Business Impact

Speech synthesis will have the most impact on the following business areas and applications:

- High volumes of generated speech
- Speech content that changes frequently
- Speech where imitation of certain characteristics is desirable

- Ability to translate speech to other languages
- Hands-free environments

Drivers

- **Reading and communication aids for the blind and visually impaired**
- **Improved user experiences with speech-enabled virtual assistants, chatbots and personal assistants;** modernization of contact center IVRs; clearer and more engaging narration of news or information drawn from data, such as sports or business events
- **Better-quality and less expensive audio narratives,** including audio books, such as read-aloud children's stories with fun voices, with interesting possible applications to e-learning activities
- **Match voice personas to audiences.** Target audiences based on both content and voice characteristics in website and other commercial audio information
- **Hands free.** Improved usability of hands-free voice controls and interaction with voice assistants
- **Markup expressivity.** Voice controls and markup to more effectively draw listener's attention to specific details
- **Gaming immersion.** More engaging characters and dialogues offered in computer games

Obstacles

- **Ethical issues.** Recent models can mimic a specific individual's speech to the point that it is very difficult to identify it as a fake (aka deepfake). While there are legitimate uses for mimicry, it also poses ethical issues where it may be used to manipulate or deceive listeners.
- **Risk of taking digital recordings out of context.** While this is a risk, the introduction of "digital watermarks" makes it possible to better identify when generated speech has been taken out of context and/or used without proper licensing.
- **Uncanny valley experience.** Users may find overly realistic virtual assistants "creepy."
- **Cost and time for custom-made voices.** Custom speech synthesis models take expertise and time to develop and tune.

User Recommendations

- Business leaders should review their current applications that use speech and consider how this low-cost approach to speech generation, which combines low cost with high quality, can be best leveraged. However, planners should evaluate solutions before committing, because quality and latency issues may make some solutions less desirable than others.
- Leaders and those responsible for risk and security should determine where there may be exposures to voice mimicking. This can include situations where significant actions are taken solely based on verbal commands via phone. Personnel, clients and employees should be warned of the risk and enlisted in identifying situations at risk for this sort of fraud.
- Leaders should loosely couple their applications to vendors generating voice. To be able to choose between different providers of voice and to reduce technical debt of NLT solutions, ensure that either you or your vendor allow voice generation services to be easily interchanged.

Sample Vendors

Acapela Group; Amazon; CereProc; DeepZen, Descript; Google; IBM; Microsoft; rSpeak

Gartner Recommended Reading

[Critical Capabilities for Cloud AI Developer Services](#)

[Top 10 Strategic Technology Trends for 2020: Human Augmentation](#)

Text Analytics

Analysis By: Shubhangi Vashisth, Stephen Emmott

Benefit Rating: Moderate

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Definition:

Text analytics is the process of deriving business insight from structured and unstructured textual data. This process can include determining and classifying the subjects of texts, summarizing texts, extracting key entities from texts, and identifying the tone or sentiment of texts.

Why This Is Important

Text analytics addresses a diverse range of use cases, from general capabilities of extracting data from textual content, to industry-specific and line of business (LOB) use cases. Solutions in this market provide products that extract meaning and context from vast volumes of textual content that cannot be processed by humans. This can then be used to derive insights and action, either within the context of the product or by other products to which the data is made available.

Business Impact

Text analytics, when combined with other analytics capabilities, such as IDP and search, can benefit the organization in the following areas:

- Preprocessing, identifying and analyzing unstructured data for compliance, risk and fraud detection.
- Automated document matching and classification.
- Discovery and insight from vast amounts of data that can't be analyzed manually.
- Sentiment, VOC/VOE, emotion detection.

Drivers

Key drivers include:

- A surge in the volume of textual data, especially from sources other than traditional "documents" (such as instant messages, emails and automatically extracted metadata), has fueled the evolution of text analytics.
- The desire to complement insights gleaned from analysis of structured numerical data with text-based facts and hidden intents and insights for more robust predictive modeling.
- Advancements in nonsymbolic (ML-based) techniques.

Text analytics uses different combinations of technologies for different business use cases:

- Healthcare: Analyzing medical records by mapping key medical terms into a graph
- Insurance: Identifying fraudulent claims by analyzing the narratives and identifying common individuals across claims
- Finance: Gaining insights on investments by monitoring public information sources and social media
- Legal: Supporting contract review by extracting key terms and obligations from complex contracts
- Retail: Monitoring product pricing across markets
- Marketing: Monitoring brand loyalty and sentiment by analyzing social media feeds and customer feedback
- Law enforcement: Performing forensic analysis of a body of documents by identifying key subjects and dates and developing a chain of events
- Digital publishing: Identifying related articles and developing a summary relevant to an article in progress

Obstacles

Several factors hinder the emergence of more pervasive, easy-to-use business solutions for text analytics:

- The differentiation between the many overlapping vendors is too nuanced for those organizations without in-house expertise. The capabilities also overlap with adjacent technology areas such as insight engines.
- Embedded text analytics is a challenge for stand-alone text analytics.
- Although easier to use, it is still challenging to incorporate solutions into an organization's wider digital platform, given the diversity of use cases and specialist skills needed to utilize and gain benefit.
- Most organizations lack a strategy to deal with unstructured data. The approach to select tools for point solutions adds to the problem of tool sprawl.
- Training the solutions for specialized use cases is also a barrier in adoption.

User Recommendations

- **Position text analytics as an NLT** in the context of internal discussions to correctly frame its role in augmentation and automation.
- **Identify and prioritize use cases** that text analytics can address. Create an enterprise text analytics strategy. Tie these initiatives with master metadata management projects for enterprisewide standardization.
- **Review the text analytics market** to acquaint yourself with its vendors, products and capabilities.
- **Start with prepackaged products designed for business users** to administer for well-established use cases, such as the voice of the customer (VoC). Cloud-based text analytics packages are another good way to experiment and enable easy adoption.
- **Select products based on how well they suit specific business scenarios** and their ability to integrate with other applications that work with unstructured data.
- **Allow a realistic lead time to recruit text analytics talent.** Consider working with a third-party analytics service provider for text analytics initiatives.

Sample Vendors

Amazon Web Services; Amenity Analytics; Bitext; Qualtrics (Clarabridge); Google; IBM; Lexalytics; Megaputer; Microsoft; SavantX

Gartner Recommended Reading

[Artificial Intelligence Primer for 2022](#)

[Market Guide for Text Analytics](#)

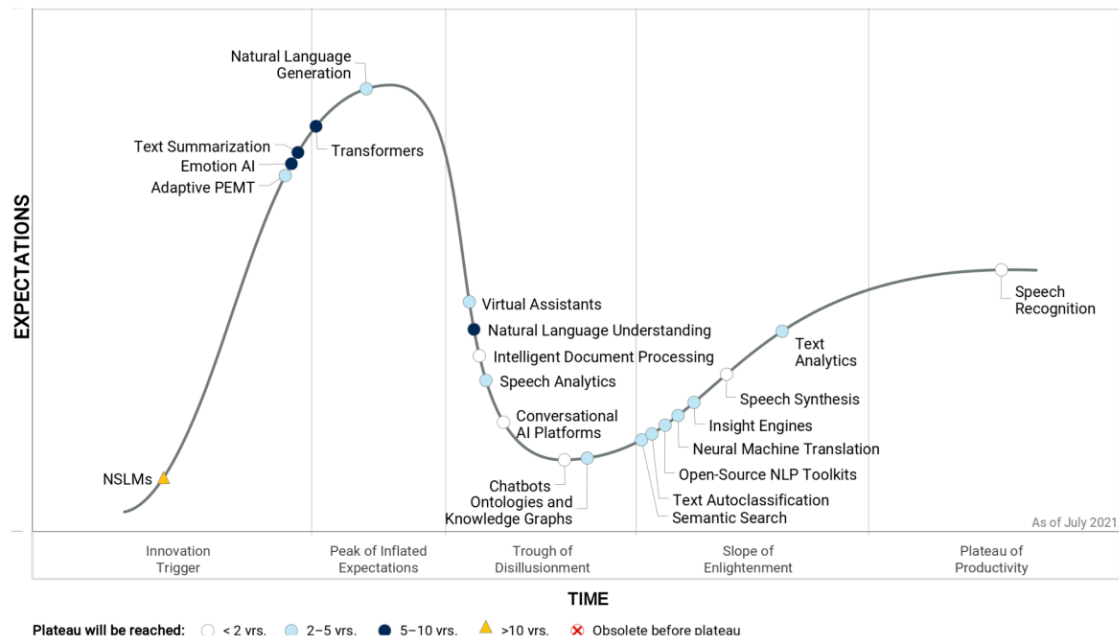
[Vendor ID Tool: Natural Language Technologies](#)

[Emerging Use Cases for Natural Language Technology](#)

Appendixes

Figure 2: Hype Cycle for Natural Language Technologies, 2021

Hype Cycle for Natural Language Technologies, 2021



Source: Gartner (July 2021)

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Hype Cycle Phases, Benefit Ratings and Maturity Levels

Table 2: Hype Cycle Phases

(Enlarged table in Appendix)

<i>Phase</i> ↓	<i>Definition</i> ↓
<i>Innovation Trigger</i>	A breakthrough, public demonstration, product launch or other event generates significant media and industry interest.
<i>Peak of Inflated Expectations</i>	During this phase of overenthusiasm and unrealistic projections, a flurry of well-publicized activity by technology leaders results in some successes, but more failures, as the innovation is pushed to its limits. The only enterprises making money are conference organizers and content publishers.
<i>Trough of Disillusionment</i>	Because the innovation does not live up to its overinflated expectations, it rapidly becomes unfashionable. Media interest wanes, except for a few cautionary tales.
<i>Slope of Enlightenment</i>	Focused experimentation and solid hard work by an increasingly diverse range of organizations lead to a true understanding of the innovation's applicability, risks and benefits. Commercial off-the-shelf methodologies and tools ease the development process.
<i>Plateau of Productivity</i>	The real-world benefits of the innovation are demonstrated and accepted. Tools and methodologies are increasingly stable as they enter their second and third generations. Growing numbers of organizations feel comfortable with the reduced level of risk; the rapid growth phase of adoption begins. Approximately 20% of the technology's target audience has adopted or is adopting the technology as it enters this phase.
<i>Years to Mainstream Adoption</i>	The time required for the innovation to reach the Plateau of Productivity.

Source: Gartner (July 2022)

Table 3: Benefit Ratings

<i>Benefit Rating</i> ↓	<i>Definition</i> ↓
<i>Transformational</i>	Enables new ways of doing business across industries that will result in major shifts in industry dynamics
<i>High</i>	Enables new ways of performing horizontal or vertical processes that will result in significantly increased revenue or cost savings for an enterprise
<i>Moderate</i>	Provides incremental improvements to established processes that will result in increased revenue or cost savings for an enterprise
<i>Low</i>	Slightly improves processes (for example, improved user experience) that will be difficult to translate into increased revenue or cost savings

Source: Gartner (July 2022)

Table 4: Maturity Levels

(Enlarged table in Appendix)

<i>Maturity Levels</i> ↓	<i>Status</i> ↓	<i>Products/Vendors</i> ↓
<i>Embryonic</i>	In labs	None
<i>Emerging</i>	Commercialization by vendors Pilots and deployments by industry leaders	First generation High price Much customization
<i>Adolescent</i>	Maturing technology capabilities and process understanding Uptake beyond early adopters	Second generation Less customization
<i>Early mainstream</i>	Proven technology Vendors, technology and adoption rapidly evolving	Third generation More out-of-box methodologies
<i>Mature mainstream</i>	Robust technology Not much evolution in vendors or technology	Several dominant vendors
<i>Legacy</i>	Not appropriate for new developments Cost of migration constrains replacement	Maintenance revenue focus
<i>Obsolete</i>	Rarely used	Used/resale market only

Source: Gartner (July 2022)

Document Revision History[Hype Cycle for Natural Language Technologies, 2021 - 21 July 2021](#)[Hype Cycle for Natural Language Technologies, 2020 - 6 July 2020](#)**Recommended by the Authors**

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[Understanding Gartner's Hype Cycles](#)[Create Your Own Hype Cycle With Gartner's Hype Cycle Builder 2021](#)[Magic Quadrant for Enterprise Conversational AI Platforms](#)[Market Guide for Text Analytics](#)[Market Guide for AI-Enabled Translation Services](#)[Magic Quadrant for Insight Engines](#)[Magic Quadrant for Cloud AI Developer Services](#)

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Table 1: Priority Matrix for Natural Language Technologies, 2022

Benefit ↓	Years to Mainstream Adoption			
	Less Than 2 Years ↓	2 - 5 Years ↓	5 - 10 Years ↓	More Than 10 Years ↓
Transformational	Enterprise Conversational AI Platforms	Natural Language Understanding Neural Machine Translation Virtual Assistants	Emotion AI Foundation Models	NSLMs
High	Chatbots Intelligent Document Processing Open-Source NLP Toolkits	Insight Engines Natural Language Generation Ontologies and Knowledge Graphs for NLT	LangOps Multistructured Analytics	
Moderate	Speech Synthesis	Adaptive PEMT Multilingual Models Natural Language Query Semantic Search Speech Analytics Text Analytics Text Autoclassification	Text Summarization	
Low				

Source: Gartner (July 2022)

Table 2: Hype Cycle Phases

Phase ↓	Definition ↓
<i>Innovation Trigger</i>	A breakthrough, public demonstration, product launch or other event generates significant media and industry interest.
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<i>Years to Mainstream Adoption</i>	The time required for the innovation to reach the Plateau of Productivity.

Phase ↓

Definition ↓

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