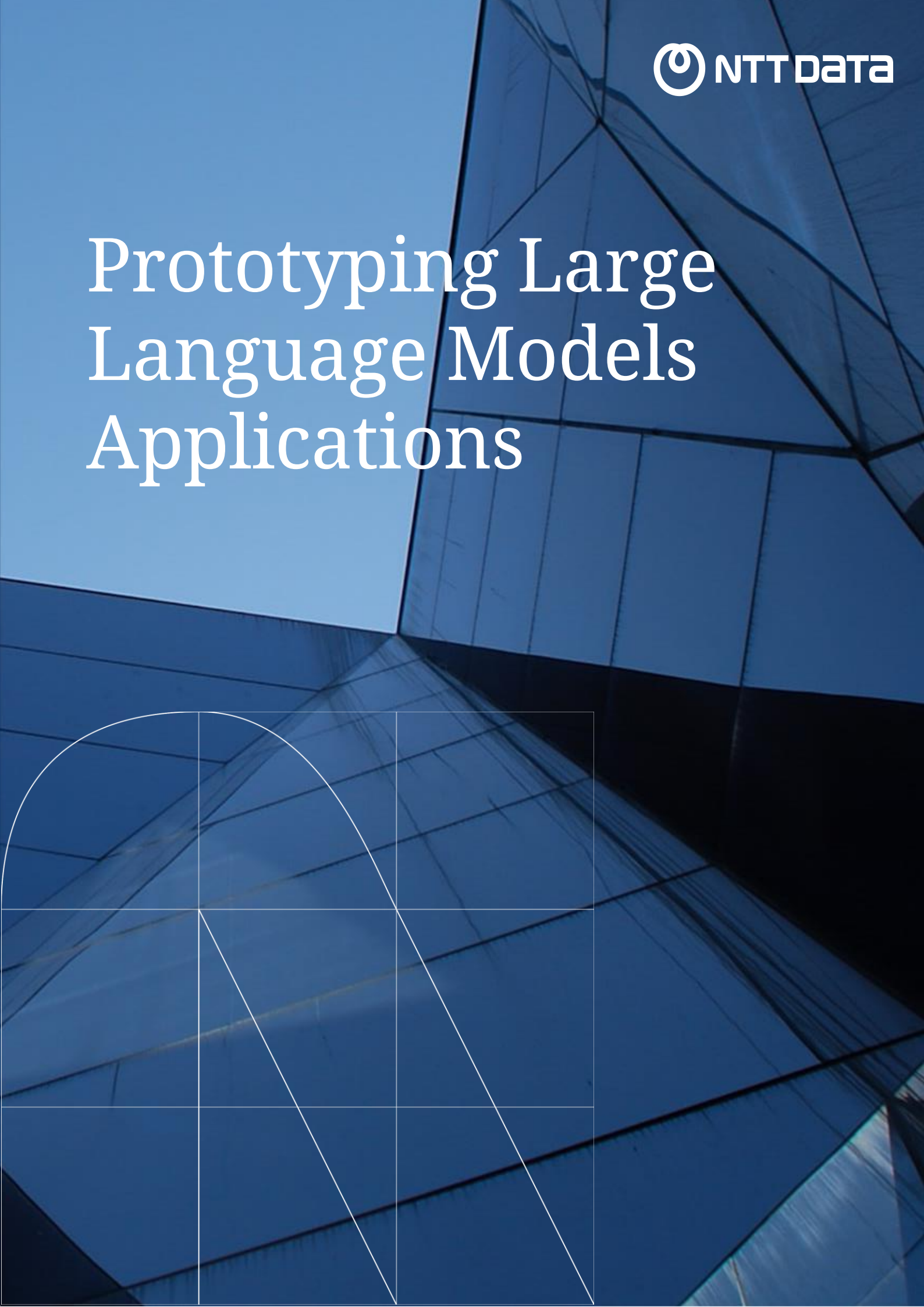
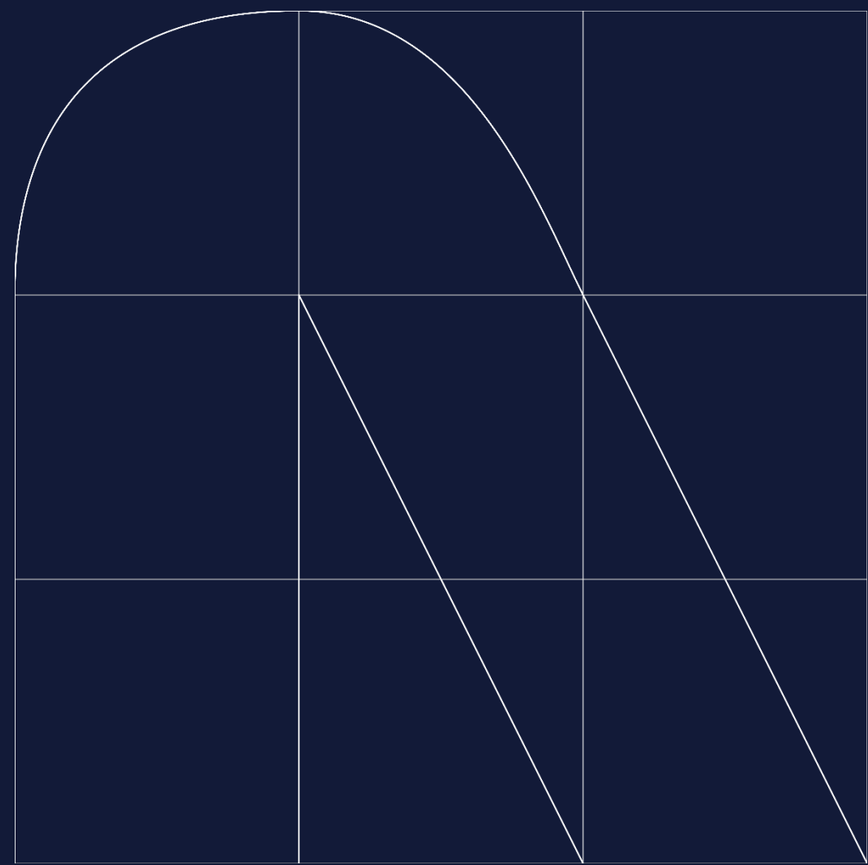


NTT DATA

Prototyping Large Language Models Applications

Content



Executive summary

In the rapidly evolving world of Artificial Intelligence (AI) and Large Language Models (LLMs), businesses face both opportunities and challenges in harnessing their immense potential. This whitepaper explains the key role of prototyping in transforming AI concepts into actionable solutions.

Central to our methodology is a carefully curated technology stack for LLMs applications prototyping. This toolkit, developed from rigorous evaluations and trials, not only adheres to industry best practices but is also fine-tuned to leverage the expertise of data scientists.

We've laid out distinct engagement models to cater to diverse business needs. Whether it's crafting tailored prototypes or assisting organizations in setting up their in-house AI Labs, our methodologies are designed for adaptability and efficiency. Through specific project types, we navigate from the initial ideation phase, pinpointing AI opportunities in specified business domains, to bringing those ideas to fruition.

In conclusion, AI's potential can only be unlocked with a clear strategy, keen foresight, and the right partners. As your trusted ally, we're committed to simplifying complexities and ensuring your seamless journey towards effective AI adoption.

key takeaways

The AI Frontier with Large Language Models

Large Language Models are game-changers in the tech landscape. They have the power to automate tasks, enhance productivity, and usher in innovative products that redefine industries. As these models evolve, businesses stand on the brink of transformative change.

The Power of Prototyping

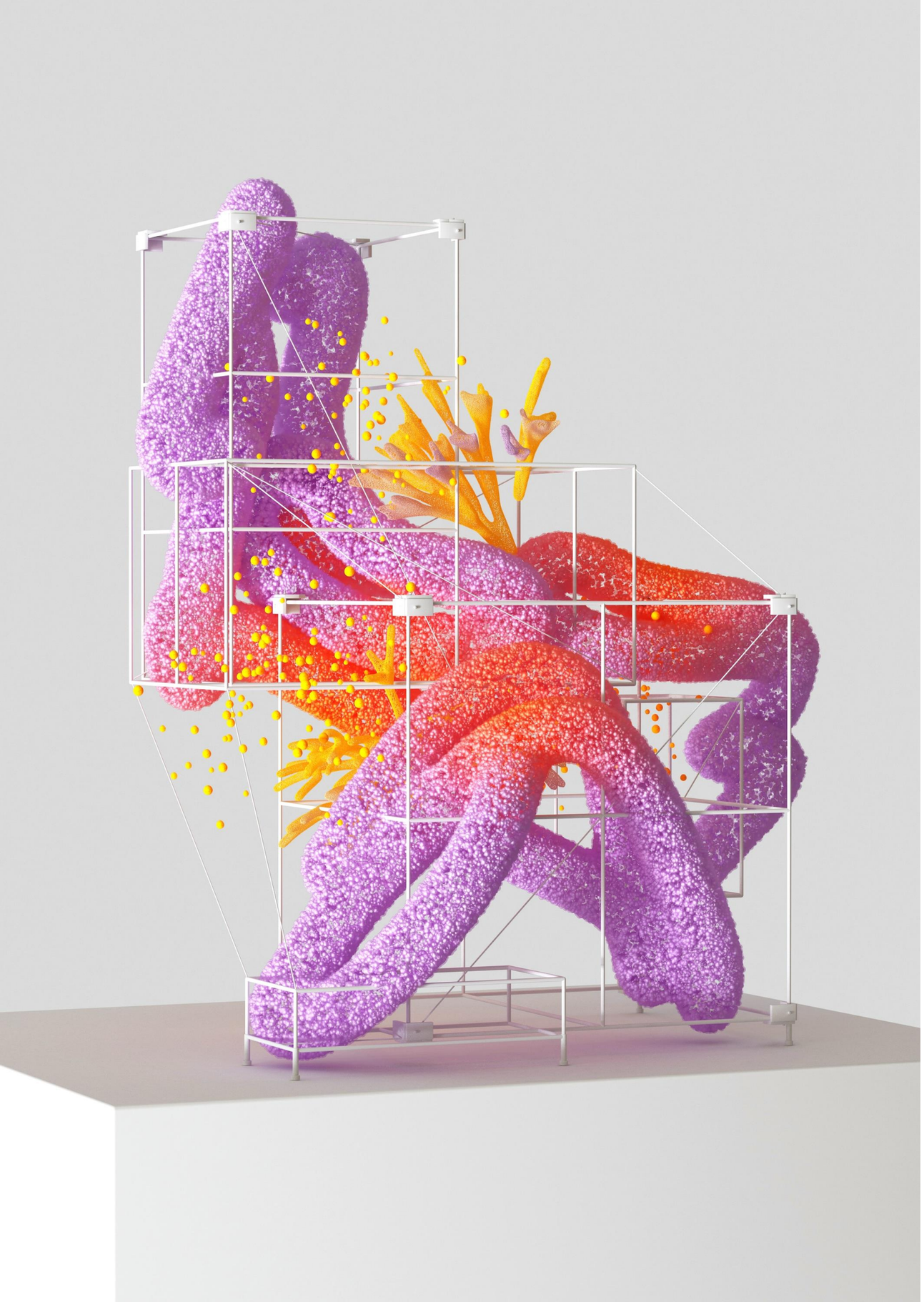
Prototyping is not just a process but the bridge that links AI potential to real-world solutions. By transforming abstract concepts into actionable models, prototyping demystifies the AI journey and makes innovation accessible.

Crafting Success with the Right Tools

To harness the full potential of AI, two things are paramount: selecting the most promising use cases and having the right technology stack. Our expertise ensures that businesses not only choose the right paths to tread but also have the perfect tools to navigate them.

Tailored Engagement for Every Business Needs

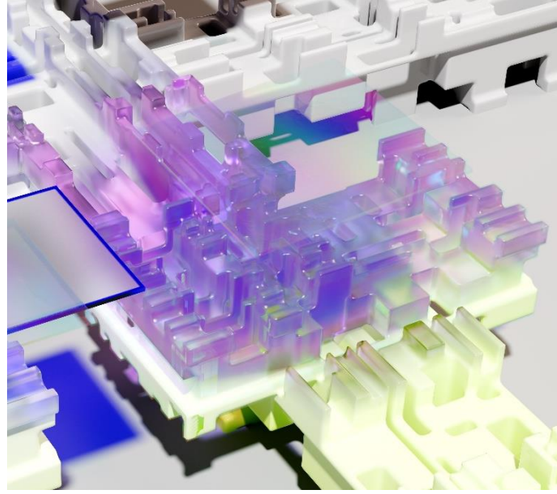
Businesses are unique, and so are their AI aspirations. Recognizing this, we offer varied engagement models. Whether it's bespoke prototype development or empowering businesses to set up their own AI Labs, our approaches are all about flexibility, efficiency, and alignment with your vision.

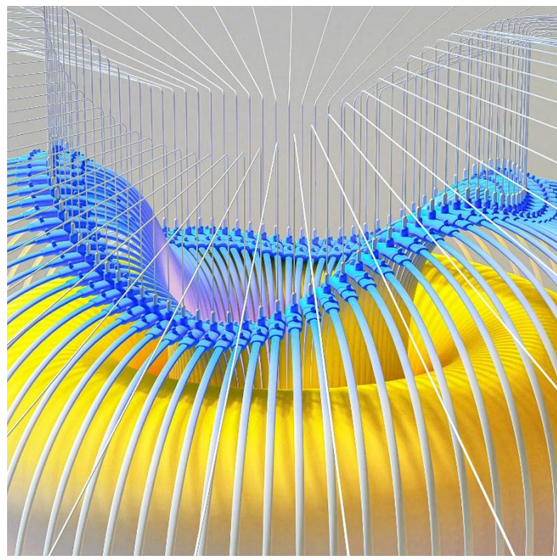


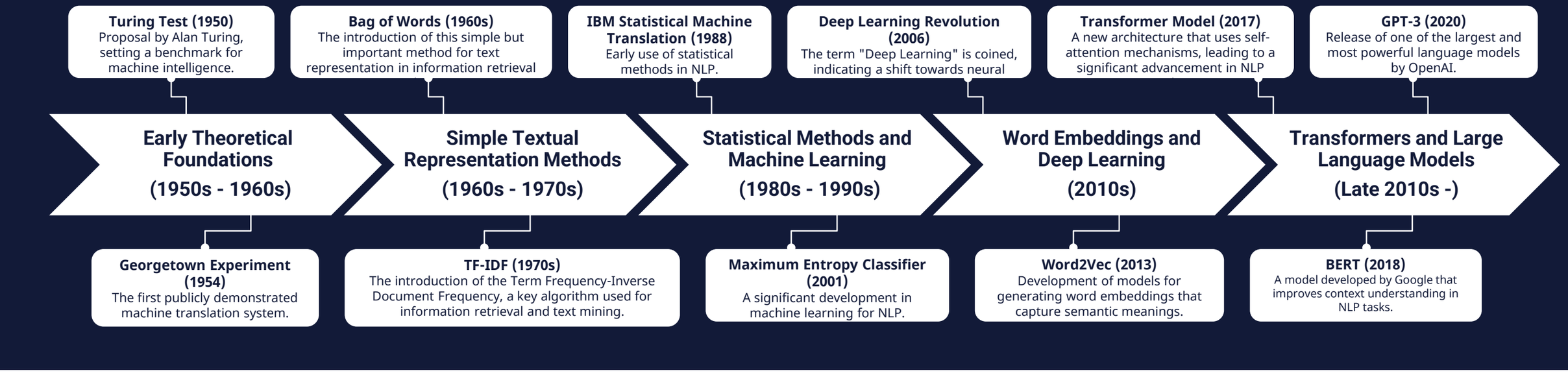
Introduction

The emergence of Large Language Models (LLMs) and their applications, such as ChatGPT, signals a dynamic progression in the field of artificial intelligence (AI). These models promise a future of expert-level precision, high-speed information processing, and unprecedented productivity. At NTT DATA, we view LLMs as instrumental in reshaping industries, from automating complex tasks to inspiring revolutionary products and services. Their integration into business models and customer interactions is a necessity, especially in a world where customers expect personalization and relevance.

However, AI adoption is not without its challenges. Given the novelty and experimental nature of LLM technology, many organizations prefer to validate AI use cases through Proof of Concepts (PoCs) before committing resources to larger initiatives. This is where prototyping becomes invaluable, providing a low-risk environment to assess AI applications and benefits. NTT DATA has embraced this approach, developing an AI Prototyping framework and technology stack to expedite the end-to-end AI prototyping process, allowing our clients to test, validate, and adopt AI innovations swiftly and confidently.







Chapter 1

The Potential of Large Language Models

The history of Natural Language Processing (NLP) reflects a captivating progression from relatively basic text manipulation to complex language understanding. Earlier models, driven primarily by statistical methods, provided rudimentary text analysis but fell short when discerning deeper semantic connections and understanding context. This landscape changed dramatically with the emergence of word embeddings and transformer models, which introduced a nuanced approach to linguistic patterns and contexts. This set the groundwork for the rise of Large Language Models (LLMs).

These advanced models, trained on vast arrays of text data, mark a significant shift in our engagement with AI, transitioning from basic processing to genuine understanding and creation of human-like language.

Delving into the capabilities of LLMs, it becomes evident that their reach extends far beyond what was once imagined. Their adeptness in understanding, predicting, and even generating text paves the way for a broad spectrum of applications across countless industries.

For instance, in the realm of customer service, LLMs enable AI chatbots to provide not just generic answers but insightful, timely solutions, mirroring the evolving expectations of today's consumers. But their influence doesn't stop there. LLMs, with their prowess in crafting coherent, context-aware content, are set to transform fields such as content generation, language translation, and even coding.

As LLMs continue their trajectory, their potential to redefine entire sectors and alter our very interface with technology becomes more palpable. They stand as a testament to the ongoing, transformative chapter of AI evolution.

Large Language Models are reshaping the AI landscape. Their unmatched ability to understand and generate text opens doors to groundbreaking applications set to redefine numerous sectors and industries.

Chapter 2

The Importance of Prototyping

In the dynamic landscape of AI, prototyping plays a pivotal role, aligning innovation with practical applications. When it comes to Large Language Models (LLMs), the value of prototyping is further accentuated and can be broadly categorized into the following:

1. Business Value: Prototyping unveils the potential in textual data, facilitating a clear understanding of how LLMs can align with and drive business strategies. It inspires confidence in the approach and helps in decision-making.

2. Culture of Experimentation: Creating a prototyping environment fosters an experimental culture, allowing stakeholders to explore, iterate, and refine the use of LLMs within business processes. It promotes innovation and reduces the risk associated with new initiatives.

3. Cost: By validating use cases before deployment, prototyping serves as a safeguard against costly mistakes, ensuring that project success is more achievable.

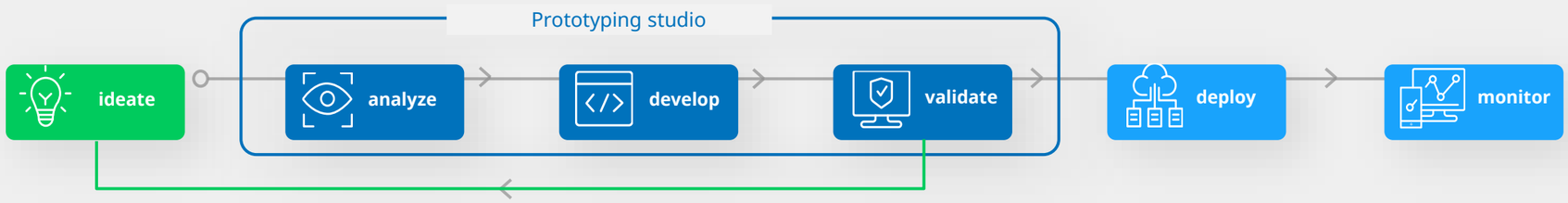
4. Organizational Impact: Prototyping plays a crucial role in demonstrating the value of AI initiatives to diverse areas within the company. This approach not only brings alignment but also opens doors to new opportunities for leveraging language models across different functions within the organization.

5. Quality: Embracing an Agile approach, prototyping leads to regular iterations and feedback, culminating in a refined and high-quality final product.

6. Delivery Time: Prototyping identifies and halts non-valuable use cases quickly, boosting the speed to market for valuable ones, thus enabling faster innovation.

What is Prototyping?

Prototyping is an experimental process where teams implement ideas into tangible products, capturing design concepts and testing on users. With prototypes, designs and products can be refined and validated so that only the right products are released.



Chapter 3

Selecting Use Cases for Prototyping

Before initiating the prototyping process, it's crucial to select the right use cases for prototyping. Rather than chasing market trends or the fear of missing out, it's essential to prioritize use cases that genuinely benefit your business. This selection requires a clear understanding of:

- The primary business goals, urgent needs, and critical challenges that this technology aims to address.
- The present readiness across technological, data, and organizational domains for prototype testing, and their adaptability should a solution be operationalized.

AT NTT DATA, we use a four-step process that allows us to go from the highest corporate level to the detailed definition of the prototyping roadmap.

Step 1: Comprehend the corporate strategic objectives

Starting with the big picture, it is important to understand the organization´s strategic goals and current lines of action where LLMs solutions can be a lever of change. To cover all the possibilities a good practice is to identify external lines of action: new business models, new products and services, client relationships; and the internal ones: operational competitiveness, organizational change, etc.

This exercise helps companies pinpoint the appropriate business domain for initiating the prototyping process. While this step is typically at the forefront of any initiative, some companies already have clarity on which domain to begin with.

Step 2: Perform a throughput scan of the business domain

Evaluate the chosen business domains: Understand their goals, objectives, and maturity in terms of data culture. Consider if they handle significant volumes of textual information, the nature of that data (structured, unstructured, tabular, etc.), their unique terminologies, and tasks that involve extensive documentation. This critical step ensures the feasibility and potential success of the use cases ; and it should precede the ideation phase for prototypes.

Step 3: Identify use cases

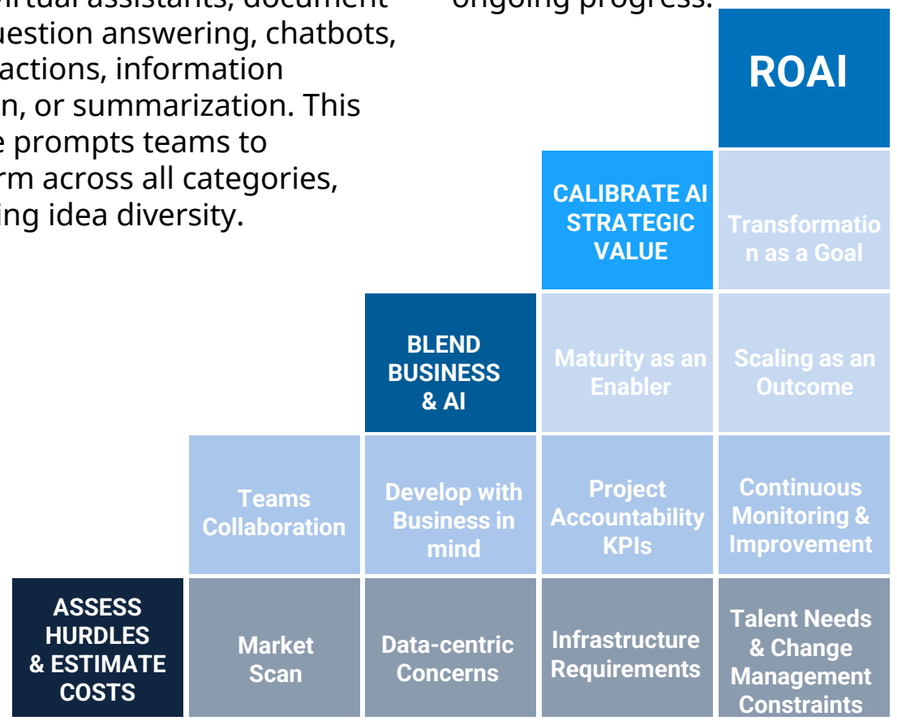
After pinpointing the needs, challenges, and status of business domains, the next step is the ideation of potential use cases. To foster comprehensive ideation, a workshop should be organized, bringing together AI specialists with knowledge in LLM-based solutions, business experts familiar with existing processes and data, and IT professionals knowledgeable about current tool functionalities.

To guide this workshop effectively, it's beneficial to establish categories based on insights from the previous assessments. These categories ensure a thorough exploration of topics and stimulate a wealth of ideas. Participants can be grouped into teams, with each team focusing on a distinct category. These categories might also be framed around prevalent LLM use cases, such as virtual assistants, document-based question answering, chatbots, API interactions, information extraction, or summarization. This structure prompts teams to brainstorm across all categories, maximizing idea diversity.

Step 4: Use case prioritization

During the workshop outlined in step 3, after brainstorming ideas, the next phase is their evaluation. The initial assessment can focus on the potential business value and technical feasibility of each idea. At this point, a deep dive isn't necessary; instead, the aim is to discard technically implausible use cases or those that don't align with the business domain's objectives.

After narrowing down to a set of promising use cases that could be prototyped, a more detailed analysis is warranted. The goal is to pinpoint the most feasible prototypes. Key to this selection is understanding the potential Return on Investment (ROI) each use case might yield. To aid this assessment, NTT DATA presents ROAI (Return of AI Investment), a comprehensive framework designed not only for evaluating use cases but also for monitoring the initiative's ongoing progress.



Chapter 4

Technology Stack for Prototyping LLMs Applications

The rapid advancement of AI, particularly LLMs, requires a swift prototyping approach. Drawing from our vast AI project experience, we've optimized our prototyping methods, focusing on effective technologies. Our aim is to streamline the AI prototype development and boost experimentation rates.

Our technology stack for LLMs Apps prototyping, crafted from rigorous evaluations, aligns with industry standards and is customized to our data scientists' expertise, resting on four foundational pillars:

1. Python Ecosystem

Renowned for its versatility and expansive library support, Python remains the cornerstone of our AI applications. Its comprehensive ecosystem provides numerous tools, libraries, and frameworks essential for LLMs Apps prototyping.

Within its vast ecosystem, we find an array of libraries, from web scraping tools like Beautifulsoup, to established machine learning frameworks like Scikit-learn and TensorFlow, and even application creation libraries such as Streamlit and Gradio. The Langchain library, in particular, is instrumental for crafting LLM applications.

With its clear syntax, Python caters to a spectrum of programming needs, spanning from simple scripts to sophisticated applications.

2. Cloud Providers ML Capabilities

Leading cloud providers offer expansive capabilities that ensure our prototypes are scalable, flexible, and robust. These cloud solutions, equipped with specialized infrastructure like CPUs and GPUs, streamline the deployment and testing of LLMs applications. Platforms such as AWS SageMaker facilitate quick machine learning model building, training, and deployment, while Azure offers integration with OpenAI's LLM APIs.

Additionally, they offer easily customizable pre-trained models, allowing even those with limited AI know-how to develop tailored models. Together, these cloud tools and LLM APIs enable the creation of advanced use cases, boosting innovation and increasing business value.

3. Azure OpenAI APIs

OpenAI, the creator of GPT-4 and ChatGPT, provides user-friendly APIs that allow for easy integration of their advanced language models into applications. Microsoft Azure offers direct access to these APIs. Azure OpenAI APIs is our top choice for prototyping given its ease of use and enterprise readiness. To further optimize the development process, we suggest using LangChain, a specialized Python library that simplifies the API interaction, making the creation of LLMs applications straightforward.

4. Streamlit

Born as an open-source library, Streamlit was designed specifically for ML engineers and data scientists, enabling them to create applications using Python with ease. After its acquisition by Snowflake, the company continues to provide the original Python library for free, despite their cloud offerings. This version of Streamlit perfectly serves our prototyping needs. A standout feature of Streamlit is its approach to interactive layouts, treating Python widgets as simple variables. This, combined with its capabilities to reuse data, perform quick computations, allows developers build responsive applications with just a few lines of Python code. For those exploring other tools, Gradio offers a viable alternative for swift prototyping.

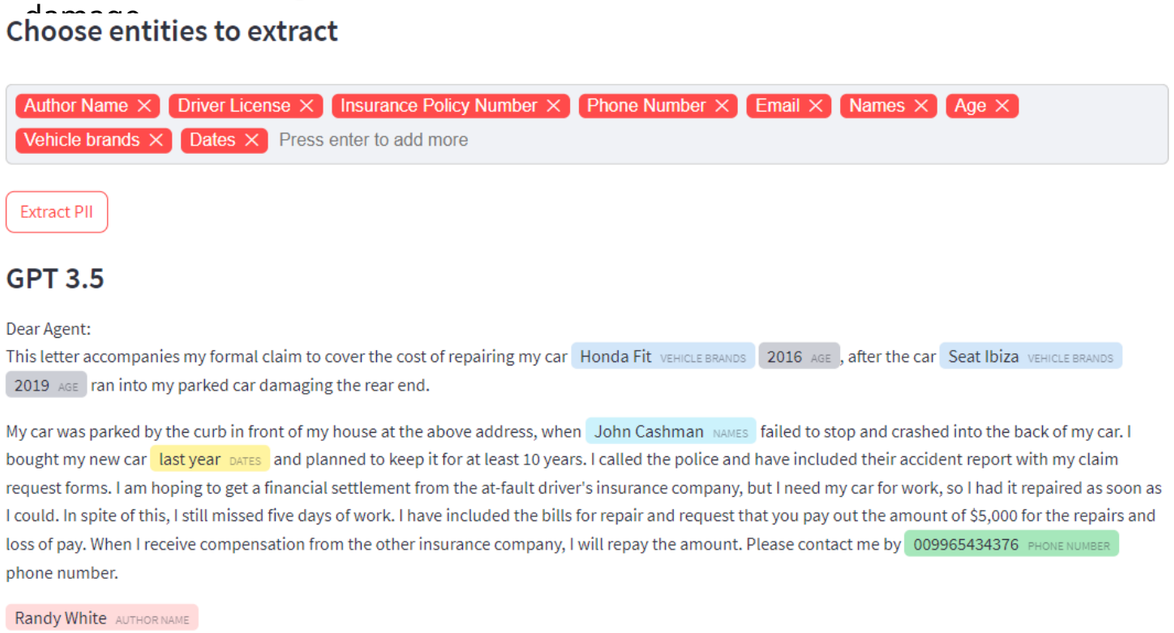
Chapter 5

Prototyping Example

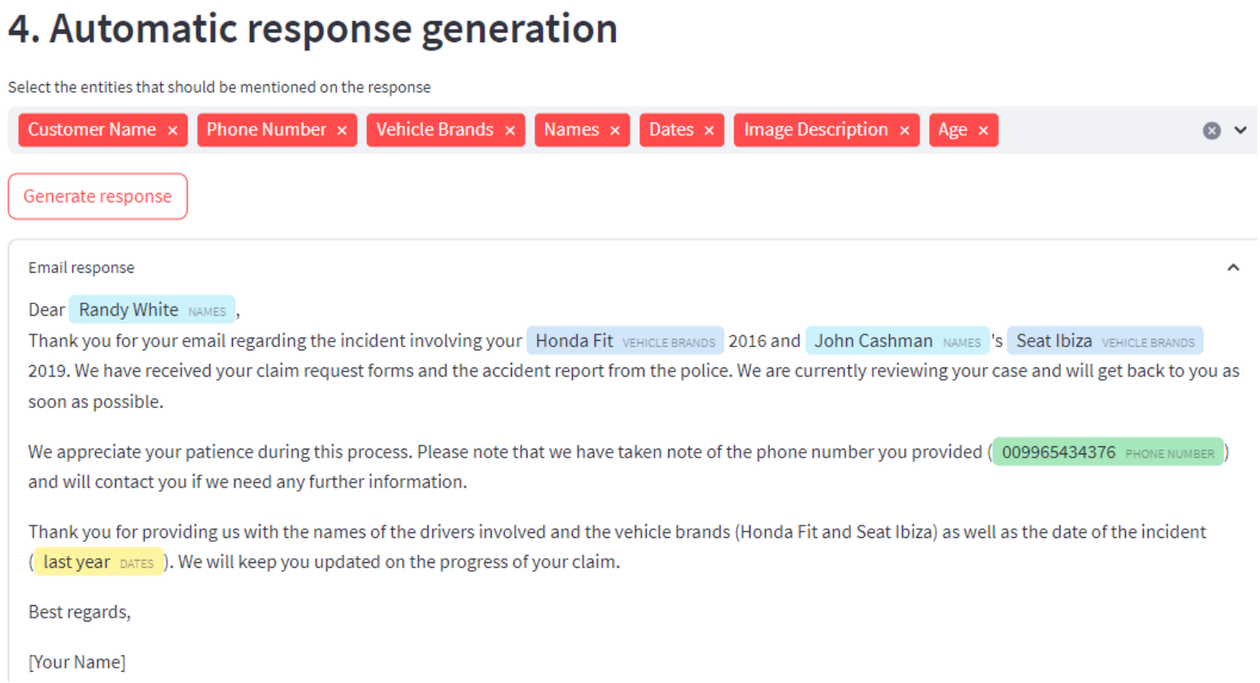
Prototyping a use case offers several advantages since it can provide valuable information about the technical feasibility of a product and at the same time it can be shown to all stakeholders, including C-level executives, to demonstrate in an easy and visual way the business impact of the selected use case.

Imagine we are an insurance company that wants to explore how LLMs can streamline and automate the processing of emails from customers about car damage claims. These emails may contain information about the vehicle, the user as well as images of the damage.

An LLM in this case may help in several ways. First, it can extract the relevant information (such as username, email address, driver ID) and add it to a database. In case the LLM is multimodal (that is, it can process not only text but also images), it can be used to detect the type of damage the car has suffered. If not, another AI model specifically trained for that can complete the task. Finally, the LLM can draft a reply email, specifically crafted for the customer who claimed the damage and that includes all the information extracted from the customer claim and from the images provided.



The LLM automatically extract from the email the information required by the insurance company



Automatic generation of the reply email, which can be customized to include all the required information

Since LLMs have been trained with huge text corpora, they are very flexible and can adapt to different user requests. In the example shown on the left, the user can specify what kind of information he wants to extract from the email while, on top, he can customize the reply email by selecting which information to add and, if he wants to, even modify the writing style according to that of the claim.

Given their ability to work with both natural languages as well as programming languages, LLMs could also be used to generate code. In this example, the LLM may be used to generate the SQL call to add a new entry into a table or write the call to the API which is used to update the database containing customer claims.

Chapter 6

How can we help?

Navigating the complex world of AI and Large Language Models can be daunting, but our expertise makes the journey smoother. Here's how we can assist:

Engagement Models:

Selecting the right collaboration model is crucial to ensure alignment with your strategic goals.

1. **Project-Based Engagement:** Using our AI Prototyping methodology and tools, we craft tailored prototypes that align with client's specific needs.
2. **AI-Lab Engagement:** For businesses aiming to build their own in-house capabilities, we offer the resources and tools necessary to set up an AI Lab for prototyping and experimentation.

Project Types:

Every organization's AI journey is unique. Our diverse project offerings cater to specific needs.

- **Prototyping Compass**: Give us a business area, and we pinpoint AI opportunities, subsequently suggesting a curated list of prototype ideas.
- **Prototyping Blueprint**: For clients with a specific concept in mind, we bring it to life, transforming their idea into a functional prototype.
- **End-to-end AI Driven Services Design**: Work with us to develop AI-powered services and business models tailored for your industry.

Comprehensive Services for AI-Lab Setup:

We offer a suite of services that support clients building their own AI-Lab for prototyping and experimentation.

- **Team Building**: We assist in defining team roles and ensure effective collaboration between the AI Lab and business units.
- **Architecture Blueprint**: Setting up a cloud environment for experimentation can be complex. We simplify this by creating a structured environment with essential tools.
- **Empowerment Workshops:** We offer training for data scientists to apply our AI Prototyping methodology and understand our tech stack.
- **AI Market Observatory**: AI advancements happen rapidly. We help you keep up by analyzing learnings from various prototypes, giving an integrated perspective of the broader AI market.

project-based engagement

Using our AI Prototyping methodology and tools, we craft tailored prototypes that align with client's specific needs.

Prototyping Compass

Prototyping Blueprint

End-to-end AI Driven Services Design

AI-LAB engagement

For businesses aiming to build their own in-house capabilities, we offer the resources and tools necessary to set up an AI Lab for prototyping and experimentation.

Team Building

Empowerment Workshops

Architecture Blueprint

AI Market Observatory

Conclusion

Embarking on an AI journey requires a combination of vision, strategy, and execution. Central to this transformative path is the practice of prototyping, an essential step that not only tests and refines concepts but also aligns them with real-world business objectives. As the AI landscape continues to evolve, challenges of adoption may arise. Yet, we stand firm in our mission: to provide our expertise and support, making the process simpler and turning ideas into tangible AI solutions. We are more than just consultants; we are your dedicated partners in ensuring a seamless AI adoption for your enterprise.

why NTT DATA?

NTT DATA’s Data & Intelligence practice consists of over 8,000 professionals providing services to Fortune 500 clients in all geographies.

NTT DATA provides end-to-end Data & Intelligence services covering the whole cycle of value generation from strategy to the execution of Data & Intelligence projects with a strong focus on innovation, data and AI governance, and AI ethics.

With delivery centers in 70+ locations across 25+ countries and 10+ innovation centers worldwide, NTT DATA offers a flexible delivery model that combines near-shore and offshore capabilities. These enable clients to get the best of NTT DATA’s skills and resources for project-based or long-term managed services engagements.

About NTT DATA

NTT DATA – part of NTT Group – is a trusted global innovator of IT and business services headquartered in Tokyo and serving clients over the world operating in more than 50 countries.

NTT DATA enables clients, as well as society, to move confidently into the digital future, supporting their transformation through consulting, industry solutions, business process services, IT modernization, and managed services.

As a trusted global innovator, our values come from our commitment to our clients' long-term success, combining global reach with local client attention.

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