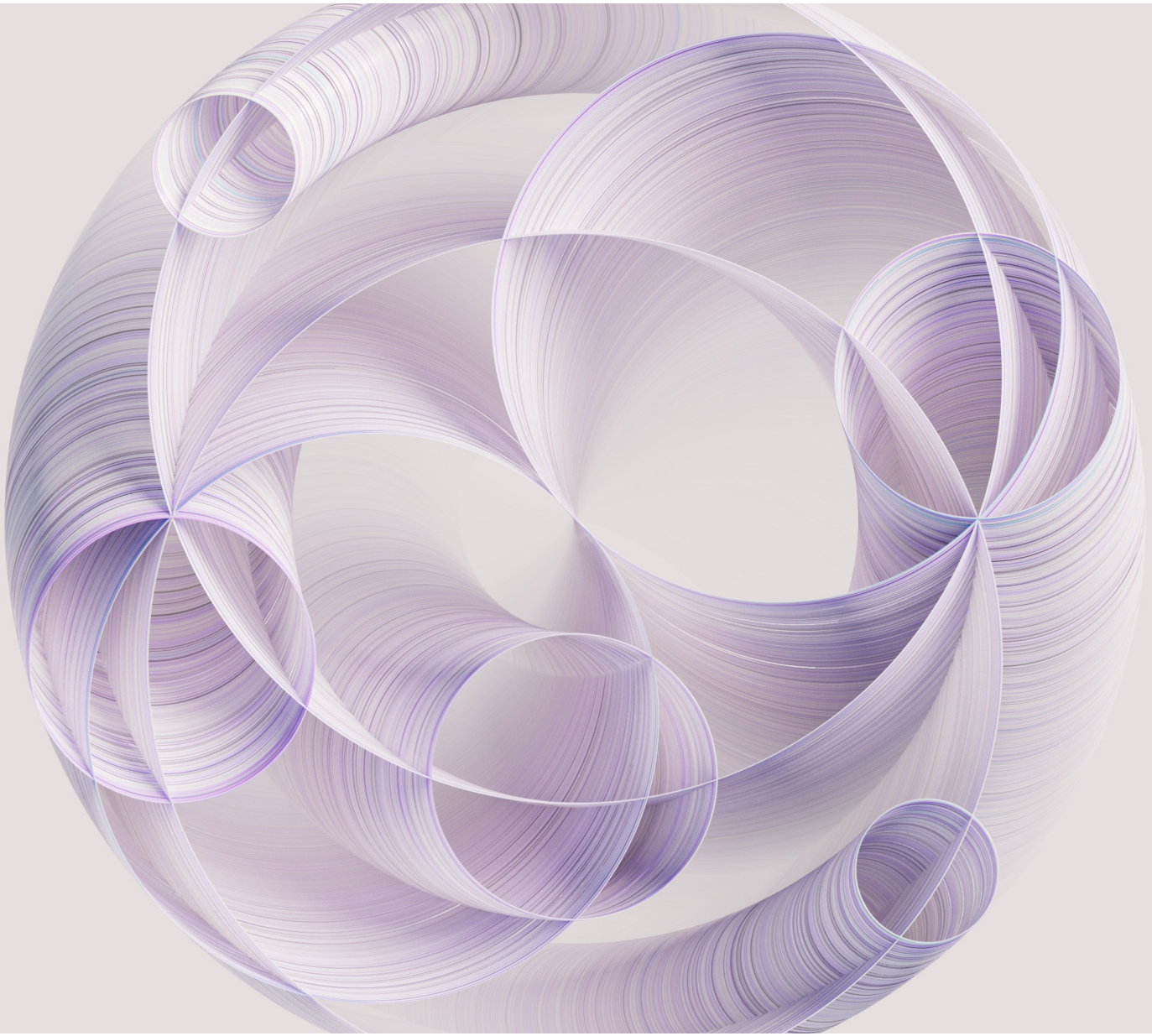
watsonx.ai

Train, validate, tune and deploy AI models



Contents

AI adoption more than doubled since 2017

2017

20%

2.5X

2022

50%

Source: McKinsey – The State of AI in 2022 – and a half decade in review

Foundation Models and Generative AI are bringing an inflection point in AI...

...but how enterprises adopt and execute will define whether they unlock, create value, unleash innovation at scale and with speed

Enterprise leaders are faced with unprecedented challenges to scale AI

1 in 5
Leaders cite difficulties integrating data across any cloud

25%
of organizations lack the tools or platforms to develop models

34%
of businesses lack the necessary AI skills, expertise or knowledge to keep up with AI innovation

74%
of leaders haven't taken the necessary steps to reduce bias in the organization's AI

Source: 2022 AI Adoption Index https://www.ibm.com/downloads/cas/GVAGA3JP

Impact of generative AI

The speed, scope, and scale of generative AI impact is unprecedented

Massive early adoption

80%

of enterprises are working with or planning to leverage foundation models and adopt generative AI

Broad-reaching and deep impact

Generative AI could raise global GDP by

7%

within 10 years

Critical focus of AI activity and investment

Generative AI expected to represent

30%

of overall market by 2025

Sources: Statista; Reuters; Goldman Sachs; IBM Institute for Business Value; Gartner. Scale Zeitgeist: AI Readiness Report, a survey of more than 1,600 executives and ML practitioners

Generative AI and traditional AI

Both traditional AI and generative AI are useful for enterprises.
Neither replaces the other, generative AI opens new possibilities

Generative AI

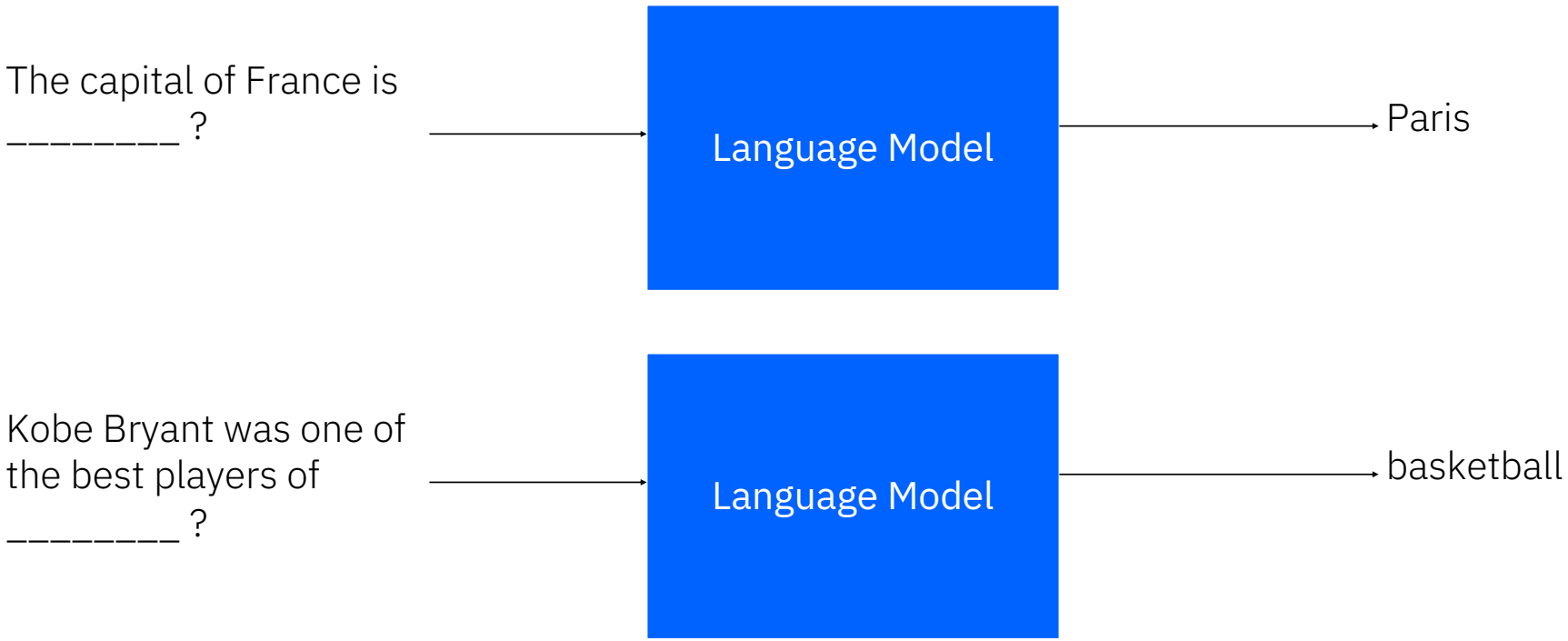
- Foundation models trained with unlabeled data
- Unsupervised
- Trained on very big data sets
- No specific task
- Transferable
- Works well for general tasks and can improve for specific tasks with less training
- Need to monitor bias and drift

Traditional AI

- Traditional Machine learning (ML/AI) model trained with “labeled” data
- Training is supervised
- Trained on proper, large data sets
- Trained for a specific task
- Does not transfer well to other tasks
- A tuned model can be very efficient for the specific task it was designed for
- Need to monitor bias and drift

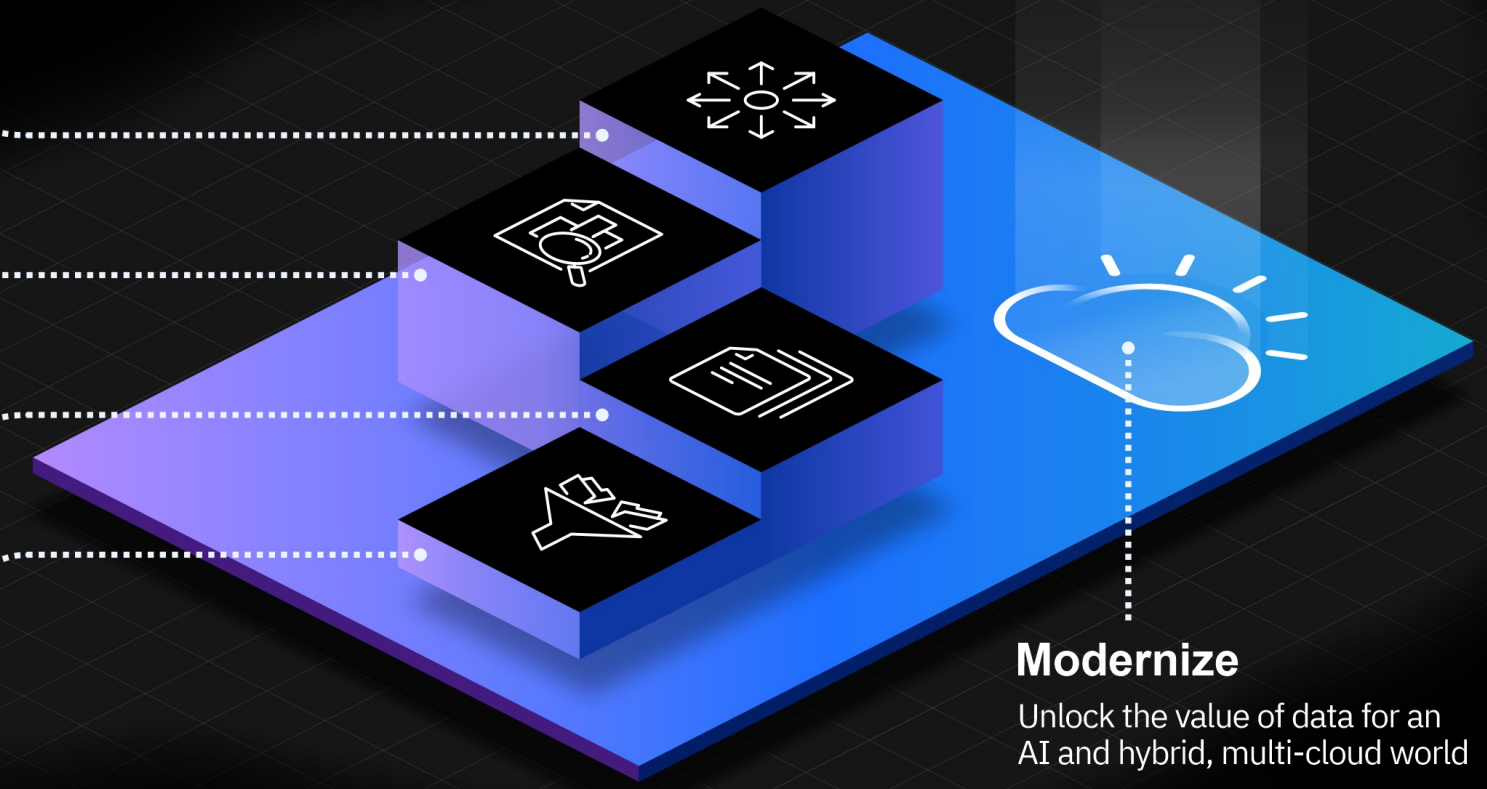
What is a *Language Model?*

Language models predict the next word in a sequence given the words have appeared before.



The AI Ladder

IBM’s prescriptive approach to the journey to AI



Infuse
Operationalize AI throughout the enterprise

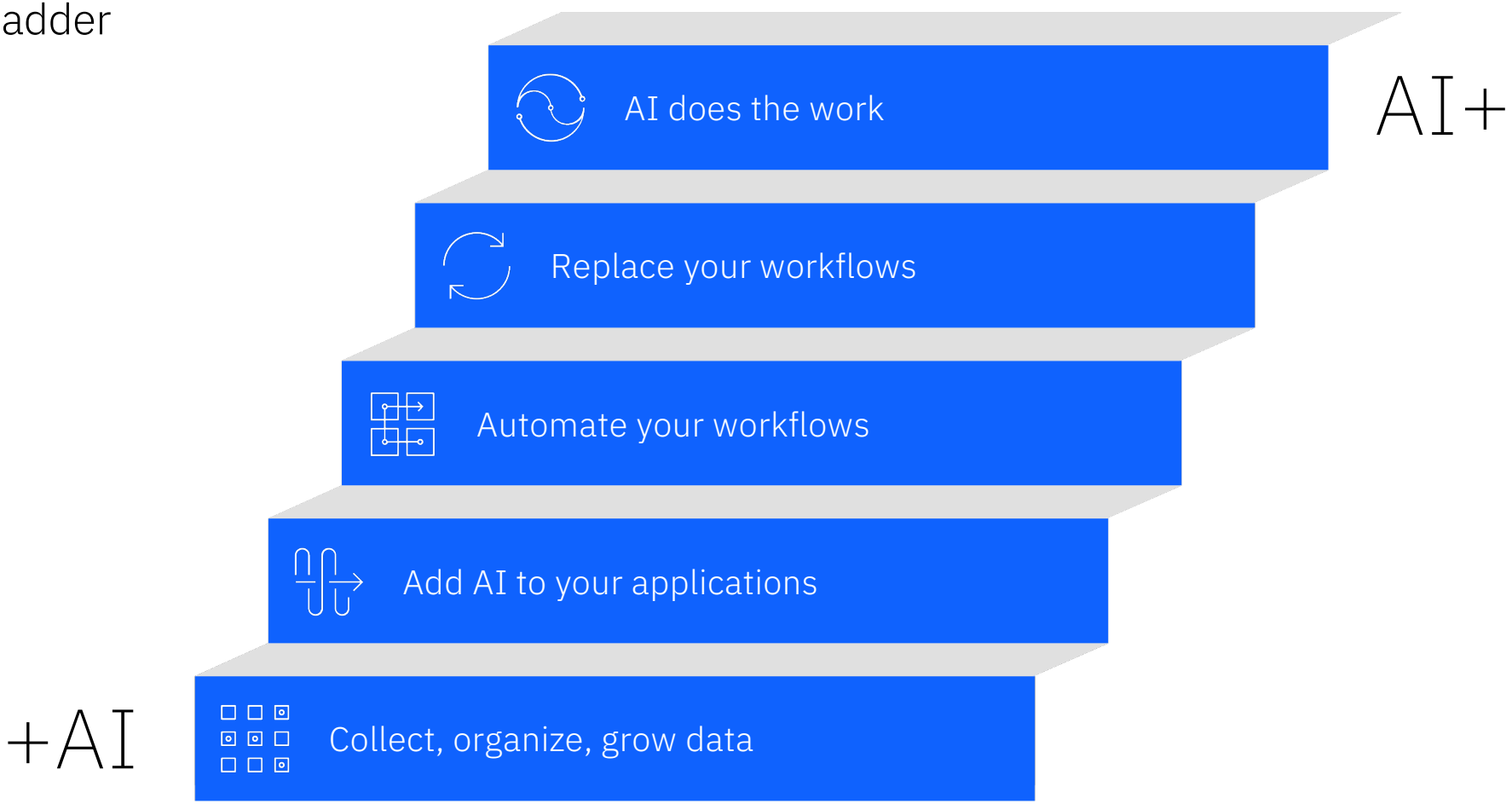
Analyze
Build and scale AI with trust and transparency

Organize
Create a business-ready analytics foundation

Collect
Make all data simple and accessible

Modernize
Unlock the value of data for an AI and hybrid, multi-cloud world

The modern-day
AI ladder



Introducing...

watsonx

Models available in **watsonx.ai**

granite.13b	flan-ul2-20b	gpt-neox-20b	mt0-xxl-13b	flan-t5-xxl-11b	mpt-instruct2-7b	llama2	starcoder
13 billion params	*20 billion params*	*20 billion params*	*13 billion params*	*11 billion params*	*7 billion params*	*70 billion params*	*15.5 billion params*
decoder only	encoder/decoder	decoder only	encoder/decoder	encoder/decoder	decoder only	decoder only	decoder only
Q&A	Q&A	Q&A	Q&A	Q&A	Q&A	Q&A	CodeGen
Generate	Generate	Generate	Generate	Generate	Generate	Generate	
Extract	Extract		Extract	Summarize		Extract	
Summarize	Summarize		Summarize	Classify		Summarize	
Classify	Classify		Classify			Classify	
Class 3	Class 3	Class 3	Class 2	Class 2	Class 1	Class 3	Class 2
8k	4k	8k	4k	4k	2k	4k	8k
IBM Model	*Open Source*	*Open Source*	*Open Source*	*Open Source*	*Open Source*	*3rd Party*	*3rd Party*
Instruct	Instruct		Instruct	Instruct	Instruct	Instruct	
Why Me: *Built on enterprise-relevant datasets; IP protections*	**Why Me:** *Flexibility*	**Why Me:** *Special Characters Context Length*	**Why Me:** *Multi-Lingual Model 100+ languages*	**Why Me:** *Medium Instruct*	**Why Me:** *Small Instruct*	**Why Me:** *Personality*	**Why Me:** *Code*

Note: Llama 2 and StarCoder have non-standard open-source terms with additional Acceptable Use Policies

watsonx

and its 3 components

The platform for AI and data

Scale and accelerate the impact of AI with trusted data.

watsonx.ai

Train, validate, tune and deploy AI models

A next generation enterprise studio for AI builders to train, validate, tune, and deploy both traditional machine learning and new generative AI capabilities powered by foundation models. It enables you to build AI applications in a fraction of the time with a fraction of the data.

watsonx.data

Scale AI workloads, for all your data, anywhere

Fit-for-purpose data store, built on an open lakehouse architecture, supported by querying, governance and open data formats to access and share data.

watsonx.governance

Enable responsible, transparent and explainable AI workflows

End-to-end toolkit encompassing both data and AI governance to enable responsible, transparent, and explainable AI workflows.

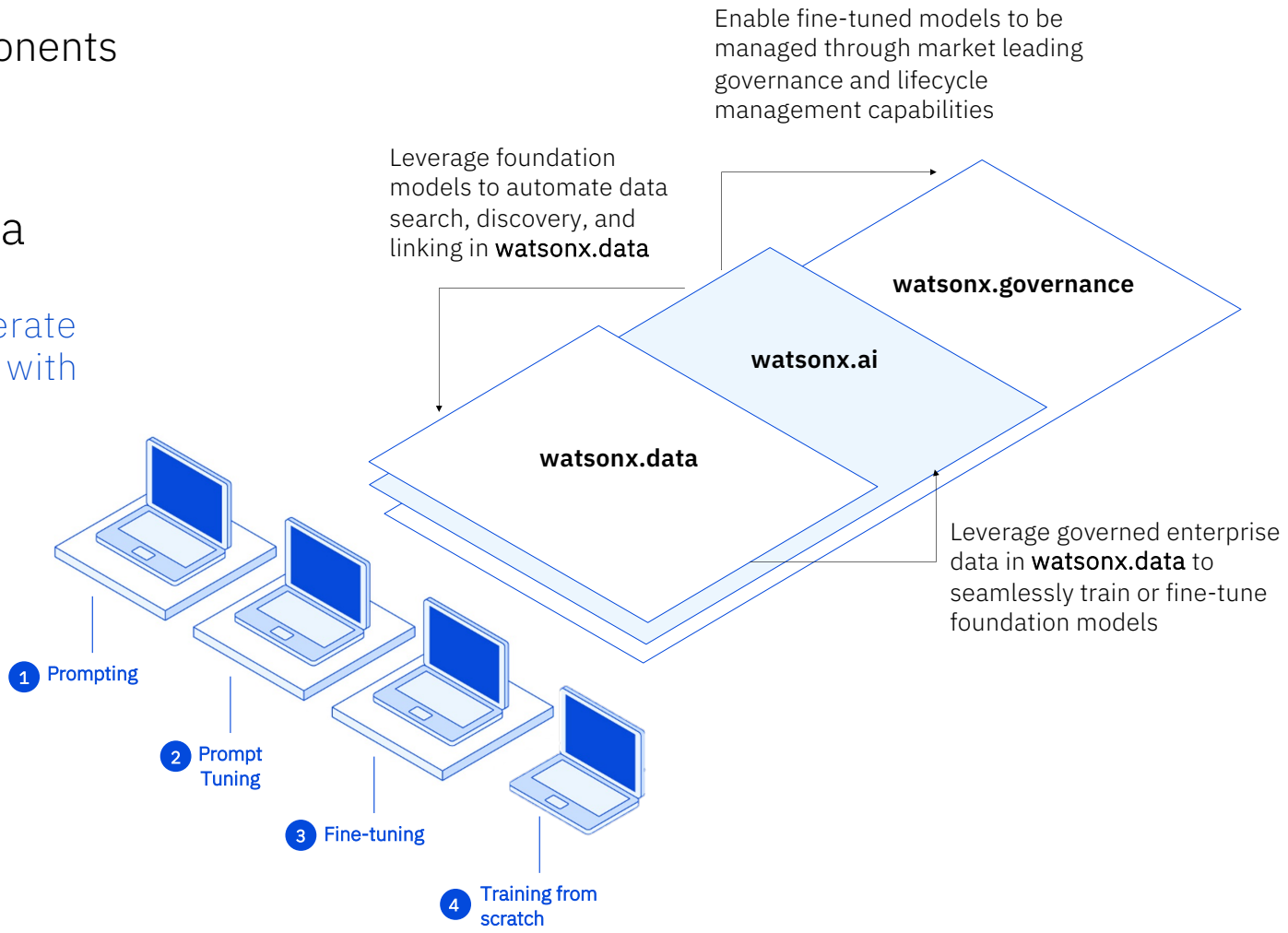
Unleash the intelligence in your business with IBM Software

watsonx

and its 3 components

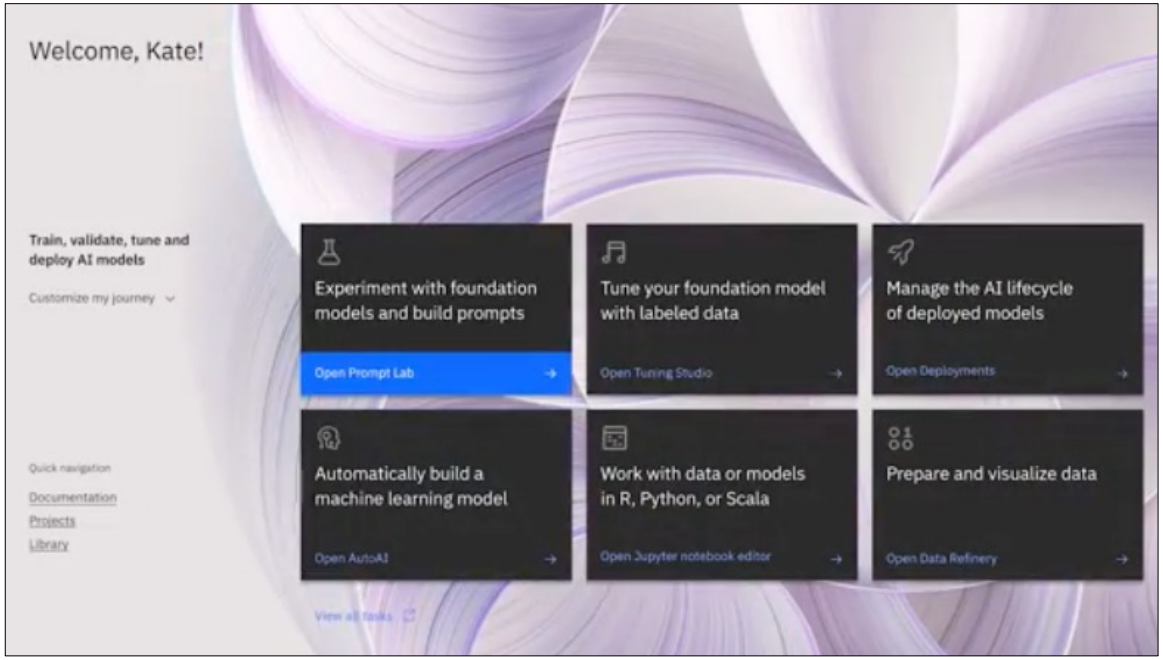
The platform for AI and data

Scale and accelerate the impact of AI with trusted data.



watsonx.ai

Build, train, validate, tune and deploy AI models



A next generation enterprise studio for AI builders to build, train, validate, tune and deploy generative AI, foundation models, and machine learning capabilities

- **Foundation Model Library** with IBM and open-source models
- **Prompt Lab** to experiment with foundation models and build prompts for various use cases and tasks
- **Tuning Studio** to tune your foundation models with labeled data
- **Data Science and MLOps** to build machine learning models automatically with model training, development and visual modeling, and synthetic data generation

watsonx.ai and its own foundation models

Model architectures	Architecture name	Use case
Encoder-only	Slate (use through a Watson Studio notebook)	Best cost performance trade-off for non-generative use cases but require task-specific labeled data for fine tuning.
Decoder-only	Granite	Designed explicitly for generative AI use cases; represents the architectures used in GPT-3 and other popular LLMs.
Encoder-decoder	Sandstone To be released...	Support both generative and non-generative use cases. Best cost performance trade-off for generative use cases when input is large but generated output is small.

The initial focus is on two categories for each model: language and code. A model's name will identify its characteristics

Model naming convention: **<category>/<architecture><opt sub arc>.<size>.<opt info>** where the 2 initial categories are fm.code and fm.language or fm.code/<architecture> where fm is the name of the foundation model

Examples:

- **fm.language/sandstone.3b** is the Encoder-decoder model on language-related tasks with 3b parameters.
- **fm.code/granite.350m.ansible** is the Decoder model on code-related tasks with 350m parameter for ansible

watsonx.ai: Prompt Lab

Experiment with foundation models and build prompts

Interactive prompt builder

Includes prompt examples for various use cases and tasks

Experiment with different prompts, save and reuse older prompts, use different models and vary different parameters

Experiment with zero-shot, one-shot, or few-shot prompting to get the best results

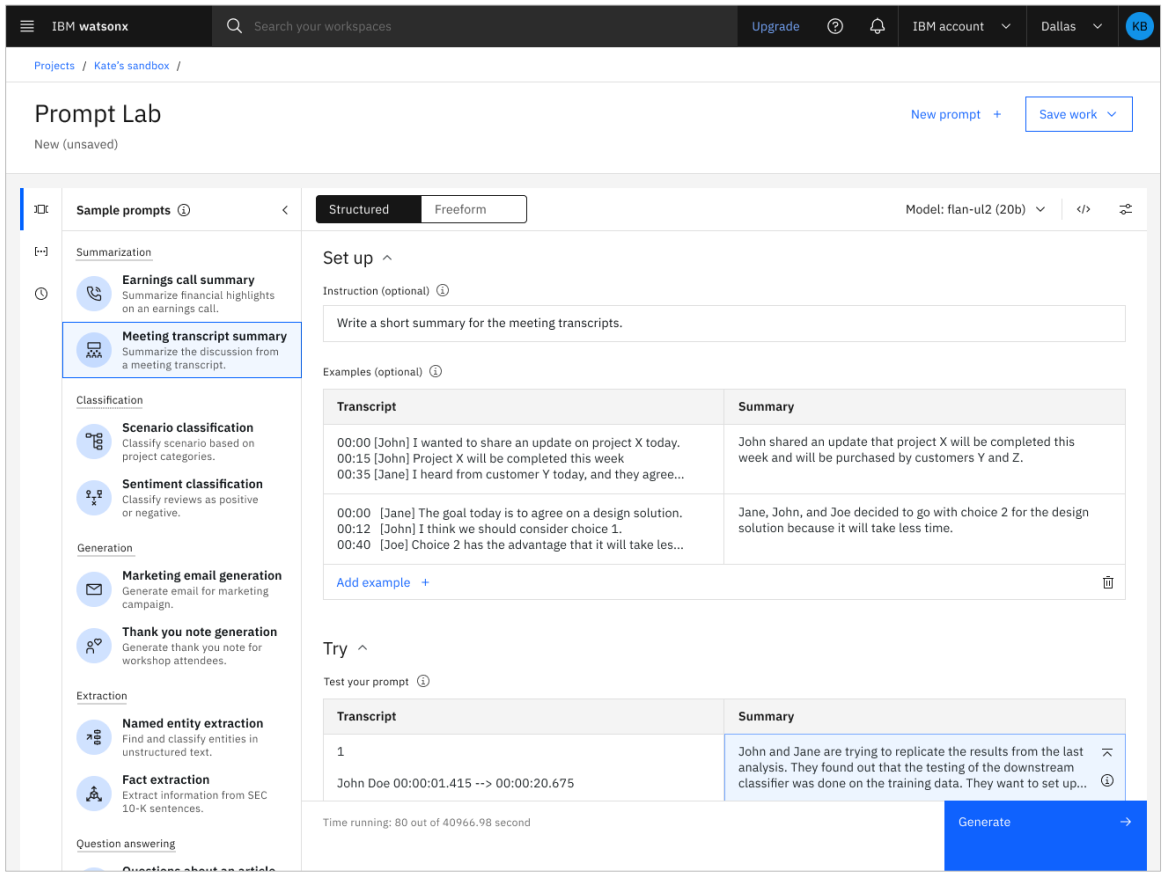
Experiment with prompt engineering

Choice of foundation models to use based on task requirements

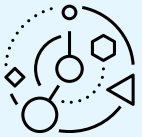
Prevent the model from generating repeating phrases

Number of min and max new tokens in the response

Stop sequences – specifies sequences whose appearances should stop the model



watsonx.ai



Prompt Engineering

Prompt engineering is an art – and watsonx.ai Prompt Lab provides a rich and guided learning experience.

Foundation models are adaptable. One way to adapt the model is using prompt engineering.

What is prompt engineering?

- Prompt engineering is a new discipline for finding the optimal prompt to use with a foundation model for the best performance.

Why is it important?

- For most generative AI, it is not so much "answering" a question than simply appending the most likely text
- Simply asking a straightforward question may not yield the best result

- A prompt is a way to communicate with the foundation model to:
  - Pass additional instructions on how the model should respond
  - Feed task-specific context to the model
- IBM watsonx.ai provides a Prompt Lab with an interactive prompt builder:
  - Includes prompt examples for various use cases
  - Clients can experiment with different prompts, save and reuse older prompts, use different models and vary different parameters

Zero/One/Few Shot learning / Prompt Engineering

Foundation models are adaptable. One way to adapt the model is using prompt engineering.

What is prompt engineering?

- Prompt engineering is a new discipline for finding the optimal prompt to use with a foundation model for the best performance

- A prompt is a way to communicate with the foundation model to:

  Pass additional instructions on how the model should respond

  Feed task-specific context to the model

Zero-shot

```
Translate English to French:
cheese =>
```

One-shot

```
Translate English to French:
sea otter => loutre de mer
cheese =>
```

Few-shot

```
Translate English to French:
sea otter => loutre de mer
peppermint => menthe poivrée
plush girafe => girafe peluche
cheese =>
```

Effective Prompts

Effective prompts usually have one or more of the following components:

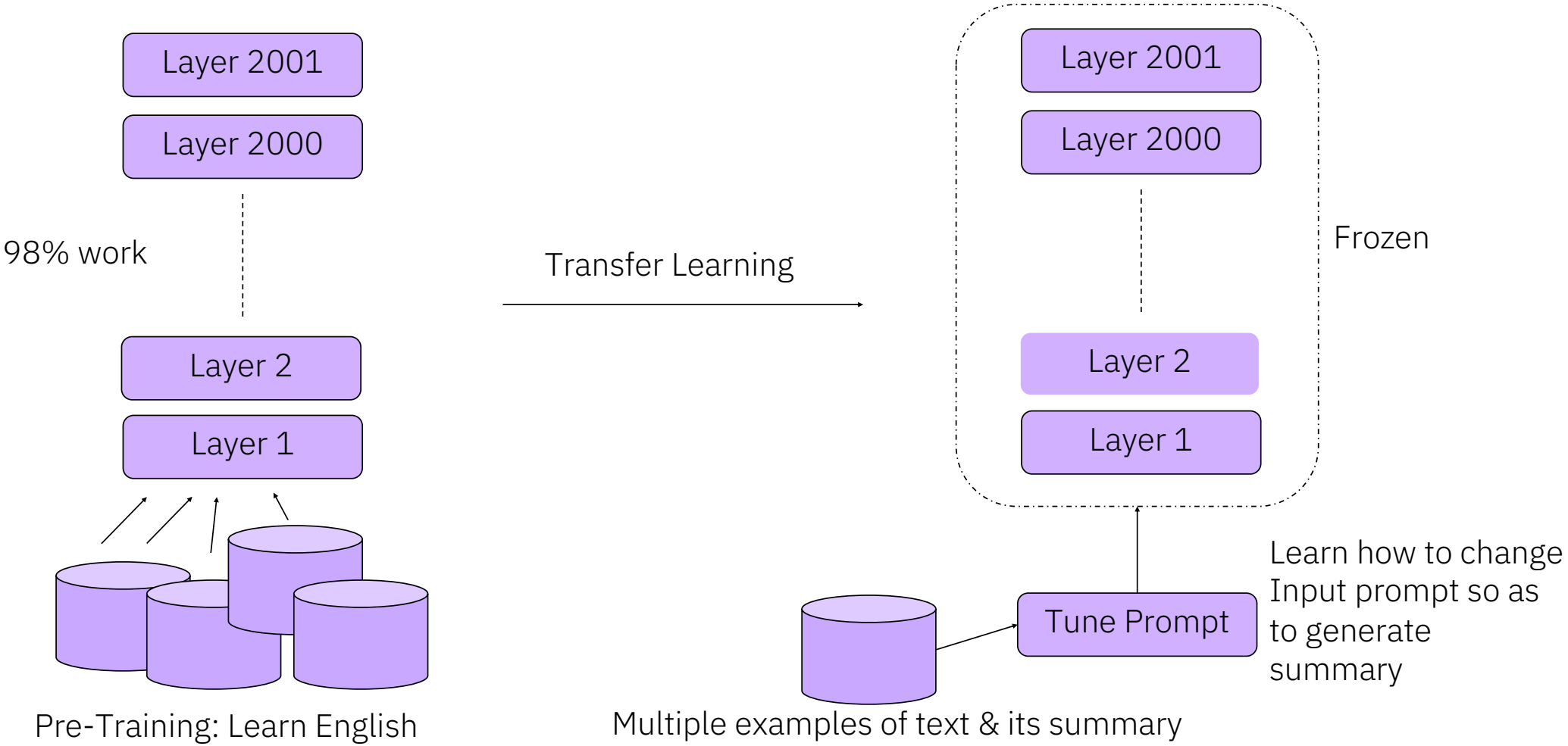
Instruction - an imperative statement that tells the model what to do.

Context - contextual information in your prompt can nudge the model to the desired output.

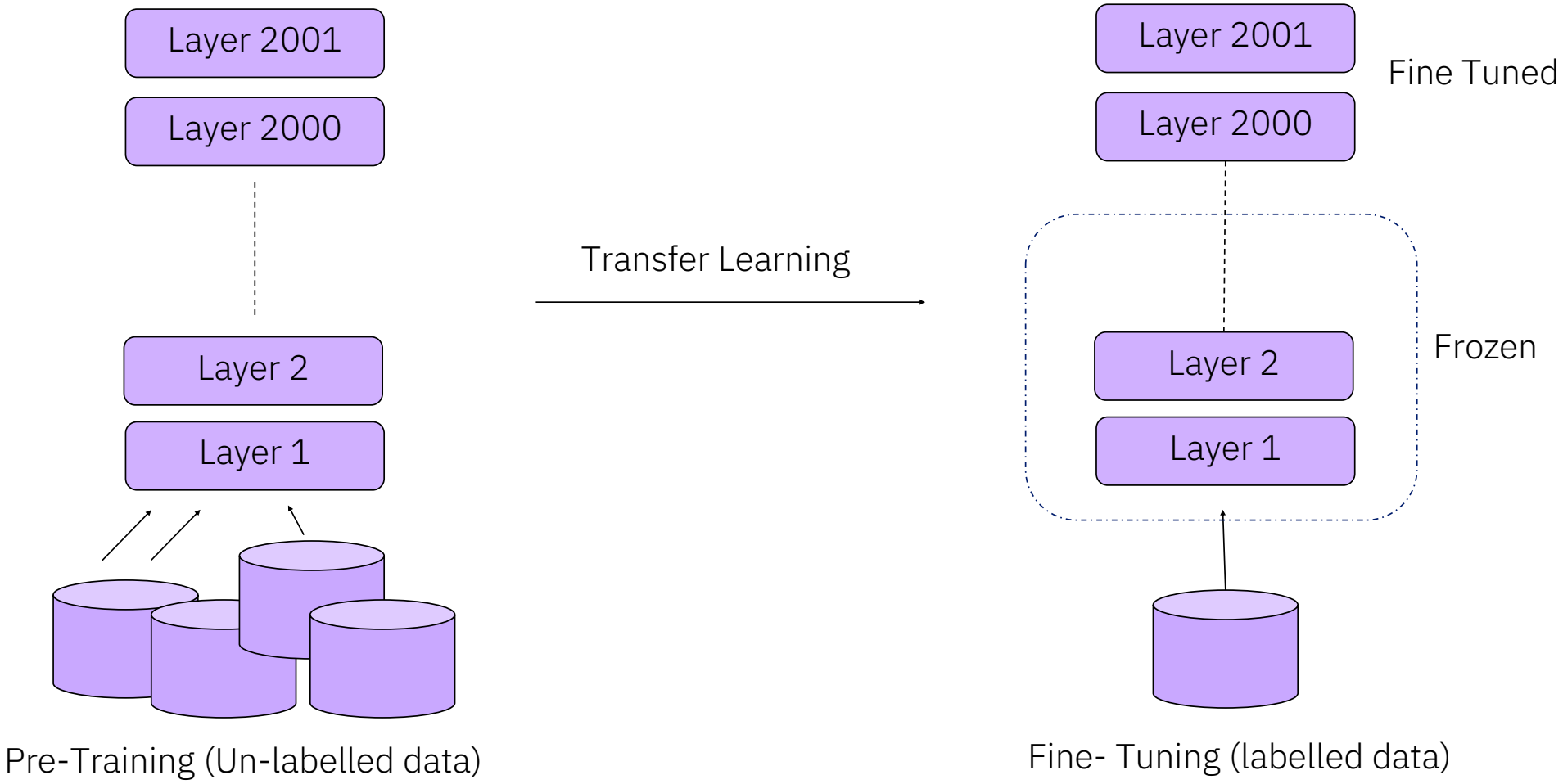
Examples - one or more pairs of example input and corresponding output showing the pattern you want the generated text to look like.

Cue - text at the end of the prompt that is likely to start the generated output on a wanted path.

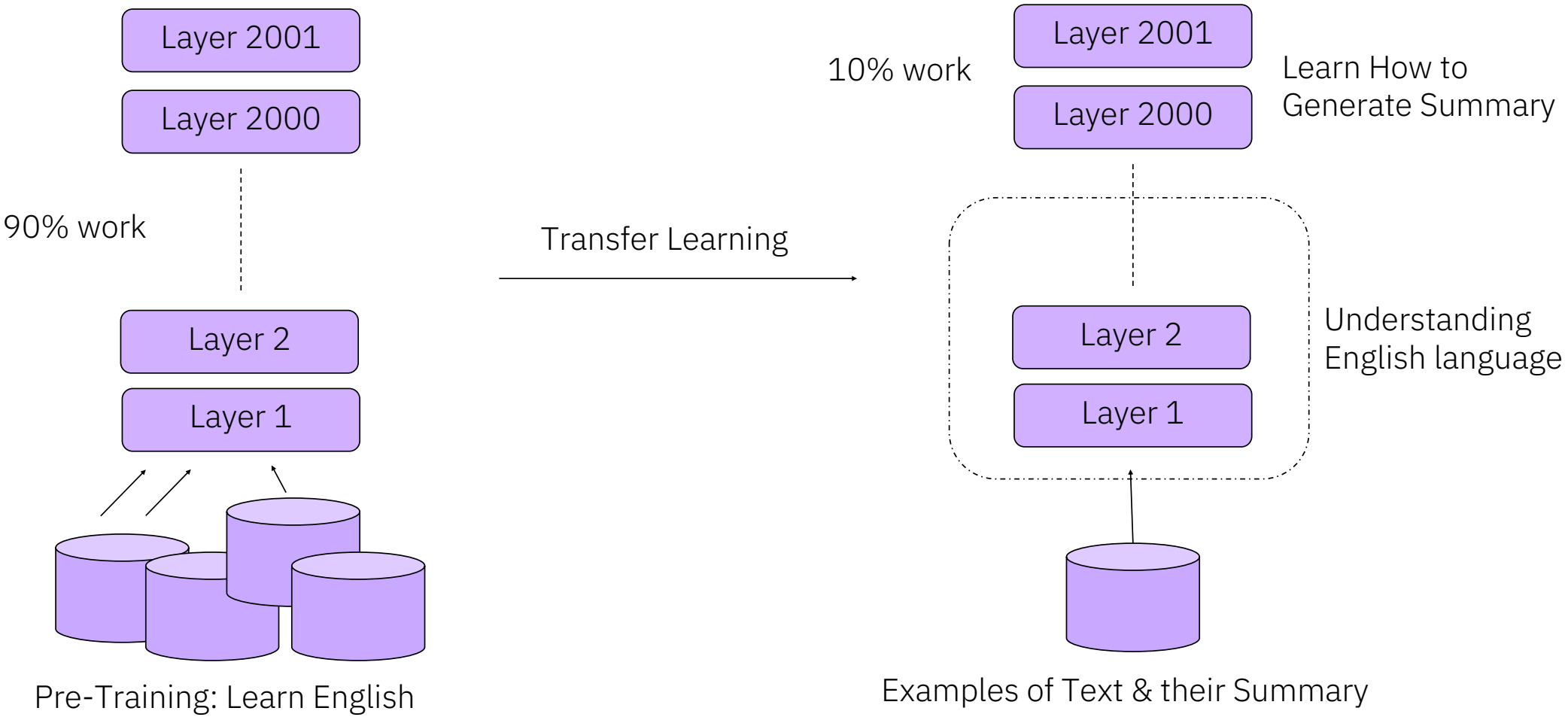
Prompt Tuning: Find summary of a text



Fine Tuning


Layer 2001
Layer 2000
Layer 2
Layer 1
Pre-Training (Un-labelled data)
Transfer Learning
Layer 2001
Layer 2000
Fine Tuned
Layer 2
Layer 1
Frozen
Fine- Tuning (labelled data)

Text Summarization: Find summary of a given text



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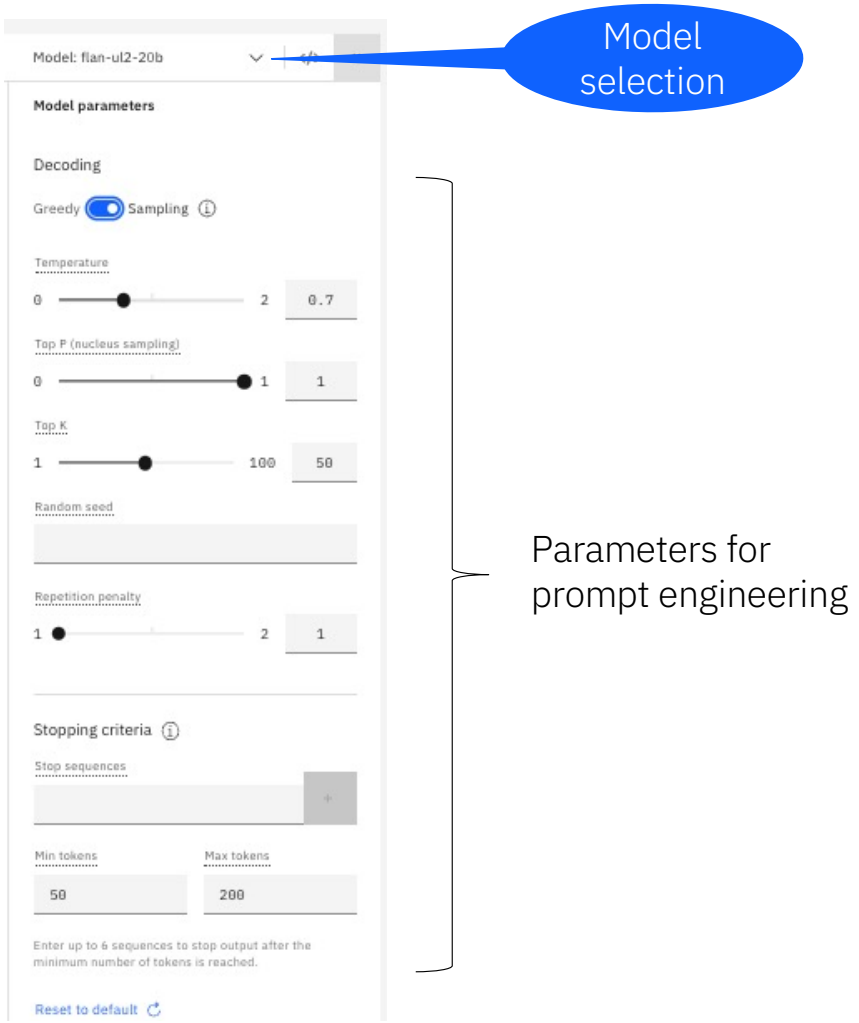
Prompt Lab

The Prompt Lab allows other modifications on various parameters such as:

- **Choice of foundation models to use** – some are better at certain tasks than others
- **Types of decoding used** – the process the model uses to generate the output
- **Repetition penalty** – prevent the model from generating repeating phrases
- **Stop sequences** – specifies sequences whose appearances should stop the model
- **Number of min and max new tokens** – specifies boundaries of the number of tokens in the response



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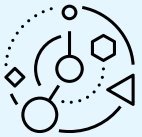

Prompt Lab: email generation

Prompt: Write a thank you note for attending a workshop.
Attendees: Enterprise clients
Topic: Introduction to IBM watsonx
Tone: Appreciative

Output:
We would like to thank all the attendees that came out and participated in today's introduction to watsonx workshop. It was a great turnout, and you are making an impact by engaging your enterprise with Watson. Thank you for taking the time, spending the day, and sharing your experience with it. We hope that you enjoyed the workshop and learned something new. If you have any questions about watsonx, just let me know!

Append prompt with additional context

Prompt: Write a thank you note for attending a workshop.
Attendees: Enterprise clients
Topic: Introduction to IBM watsonx
Tone: Appreciative
Expectation: discuss business opportunities

Output:
We would like to thank you for taking the time to attend our workshop today. It was a great day, and we are pleased that you were able to participate. This is an exciting time for Watson Health as we continue to expand our capabilities in clinical care, cognitive computing, analytics and mobile technology. As IBM watsonx continues to expand, we hope that you will reach out to us with questions or concerns regarding the product. In addition, we welcome feedback on how we can improve your experience with watsonx. Thank you again

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Prompt Lab: client complaint

The following paragraph is a consumer complaint.
The complaint is about one of these options: credit cards, credit reporting, mortgages and loans, retail banking, or debt collection.
Read the following paragraph and list all the issues.

I called your helpdesk multiple times and every time I waited 10-15 minutes before I gave up. The first time I got through, the line got cut suddenly and I had to call back. This is just ridiculous. When I finally got through like after 3 days (yes, 3 days) your agent kept going over a long checklist of trivial things and asking me to verify, after I repeatedly told the agent that I am an experienced user and I know what I am doing. It was a complete waste of time. After like an eternity of this pointless conversation, I was told that an SME will contact me. That – was 2 days ago. What is the problem with your support system?

Retail banking

In this example, a modified prompt with an example is provided to the model to teach it what is expected.

I bought a GPS from your store and the instructions included are in Spanish, not English. I have to use Google Translate to figure out. The mounting bracket was broken, and so I need information on how to get a replacement. Moreover, the information seems to be outdated because I cannot see the new roads put in around my house within the last 12 months.

The list of issues is as follows:
1) The instructions are in Spanish, not English.
2) The mounting bracket is broken.
3) The information is outdated.

The next page shows the new output with this additional “one shot” input.

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Prompt Lab:
client complaint continue

The following paragraph is a consumer complaint.
The complaint is about one of these options: credit cards, credit reporting, mortgages and loans, retail banking, or debt collection. Read the following paragraph and list all the issues.

I called your helpdesk multiple times and every time I waited 10-15 minutes before I gave up. The first time I got through, the line got cut suddenly and I had to call back. This is just ridiculous. When I finally got through like after 3 days (yes, 3 days) your agent kept going over a long checklist of trivial things and asking me to verify, after I repeatedly told the agent that I am an experienced user and I know what I am doing. It was a complete waste of time. After like an eternity of this pointless conversation, I was told that an SME will contact me. That – was 2 days ago. What is the problem with your support system?

With the added instructions from the previous slide, this is the new output:

The list of issues are as follows;
1) Waited 10-15 minutes every time I called
2) The line got cut suddenly
3) The agent kept going over a long checklist of trivial things
4) I was told that an SME will contact me
5) No one called

This is the expected results.
With the added instructions, the model further understands that the task is to extract a list of issues raised by the customer.

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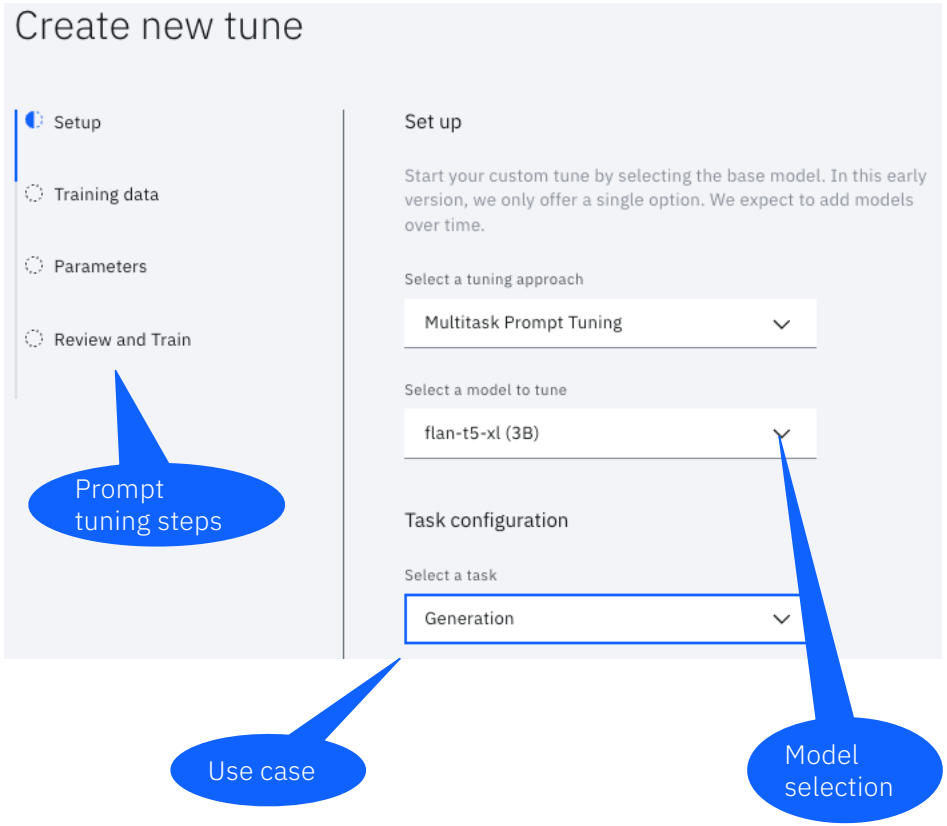
Prompt tuning

Another useful feature of **watsonx.ai** is the prompt tuning in the tuning studio.

- **Watsonx.ai** allows clients to further tune the prompts
- Unlike prompt engineering, prompt tuning allows clients to further train a model with focused, business data.
- In prompt tuning, the underlying model is not changed.
- The input prompt is changed via augmenting input with examples.

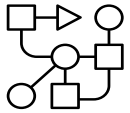


watsonx.ai

Prompt engineering

Benefits to clients:

- There is no change to the model (no need for an expensive rebuild)
- No need to pass in labeled data
- Much faster way of training the prompt to properly respond to requests
- Can be passed in via APIs once a prompt has been properly engineered
- Can be used by anyone to guide the model to respond in a desirable way



Prompt tuning

Benefits to clients

- There is no change to the model (no need for an expensive rebuild)
- Requires labeled data but can achieve better performance even with using a smaller size model.
- Can achieve close to fine-tuning results without model modification
- Can be passed in via API
- Can be used by anyone to work with the model

IBM partnership with open-source models provider

HUGGING FACE

- IBM **watsonx.ai** clients have access to the latest and greatest open-source foundation models from Hugging Face.

- The IBM and Hugging Face partnership demonstrates a joint commitment to deliver an open ecosystem to clients, allowing them to find the best foundation models for their business needs.

watsonx.ai: Data Science and MLOps

Build machine learning models automatically in the studio

Model training and development

Build experiments quickly and enhance training by optimizing pipelines and identifying the right combination of data

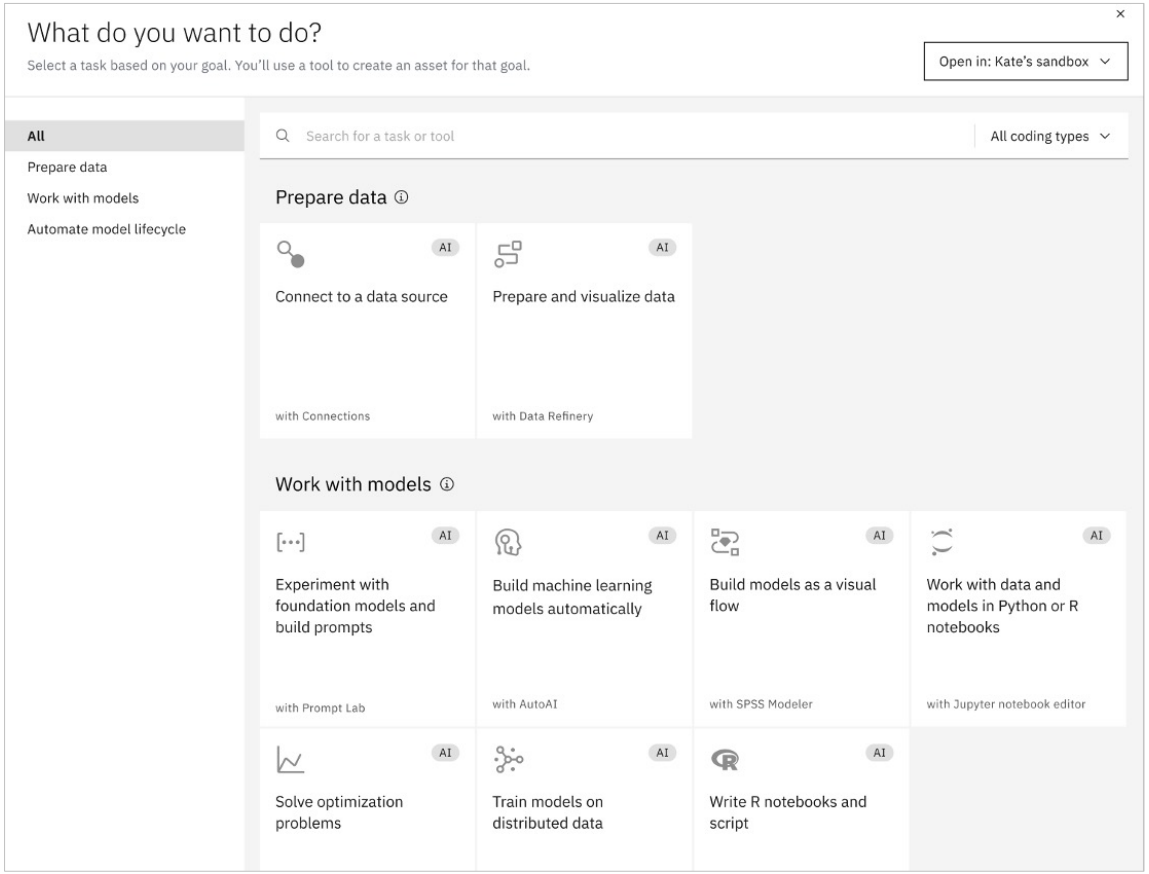
AutoAI, including preparing data for machine learning and generating and ranking candidate model pipelines

Use predictions to optimize decisions, create and edit models in Python, in OPL or with natural language

Integrated visual modeling

Prepare data quickly and develop models visually to help visualize and analyze enterprise data to identify patterns and trends, explore opportunities, and make informed, insightful business decisions

- Uncover correlations
- Insight for hypotheses
- Find relationships and connections within the data



watsonx.ai Use cases

1 **Retrieval-Augmented Generation (RAG)**
Based on a set of documents or dynamic content, create a chatbot or a question-answering feature grounded on specific content. E.g., building a Q&A resource from a broad knowledge base, providing customer service assistance
**note: only possible with watsonx.ai and Watson discovery*

2 **Summarization**
Transform text with domain-specific content into personalized overviews, capturing key points
E.g., sales conversation summaries, insurance coverage, meeting transcripts, and contract information

3 **Content Generation**
Generate text content for a specific purpose.
E.g., content creation for marketing campaigns, job descriptions, blog posts and articles, and email drafting support

4 **Named Entity Recognition**
Identify and extract essential information from unstructured text
E.g., audit acceleration, SEC 10K fact extraction

5 **Insight Extraction**
Analyze existing unstructured text content to surface insights in specialized domain areas.
E.g., medical diagnosis support, user research findings

6 **Classification**
Read and classify written input with as few as zero examples
E.g., sorting of customer complaints, threat & vulnerability classification, sentiment analysis, and customer segmentation

watsonx.ai differentiators

Open

- **Built on open technologies**
  - IBM's hybrid cloud-native stack based on Red Hat OpenShift enables a flexible and secure deployment of **watsonx.ai.**
  - Hugging Face partnership provides access to the best open-source model collection.

Trusted

- IBM's suite of foundation models is designed to **ensure model trust** and efficiency in business applications.
- Models trained with scrutinized and copyright-free data
- Tight integration with **watsonx.governance** provides clients with a **trusted pathway** to operationalize AI confidently and at scale.

Targeted

- Designed for **targeted business use cases**, that unlock new value.
  - On-prem, hybrid cloud and IBM Cloud
  - Designed for scalability
  - Right model for the right task
- **Industry-leading support** for use case implementations.

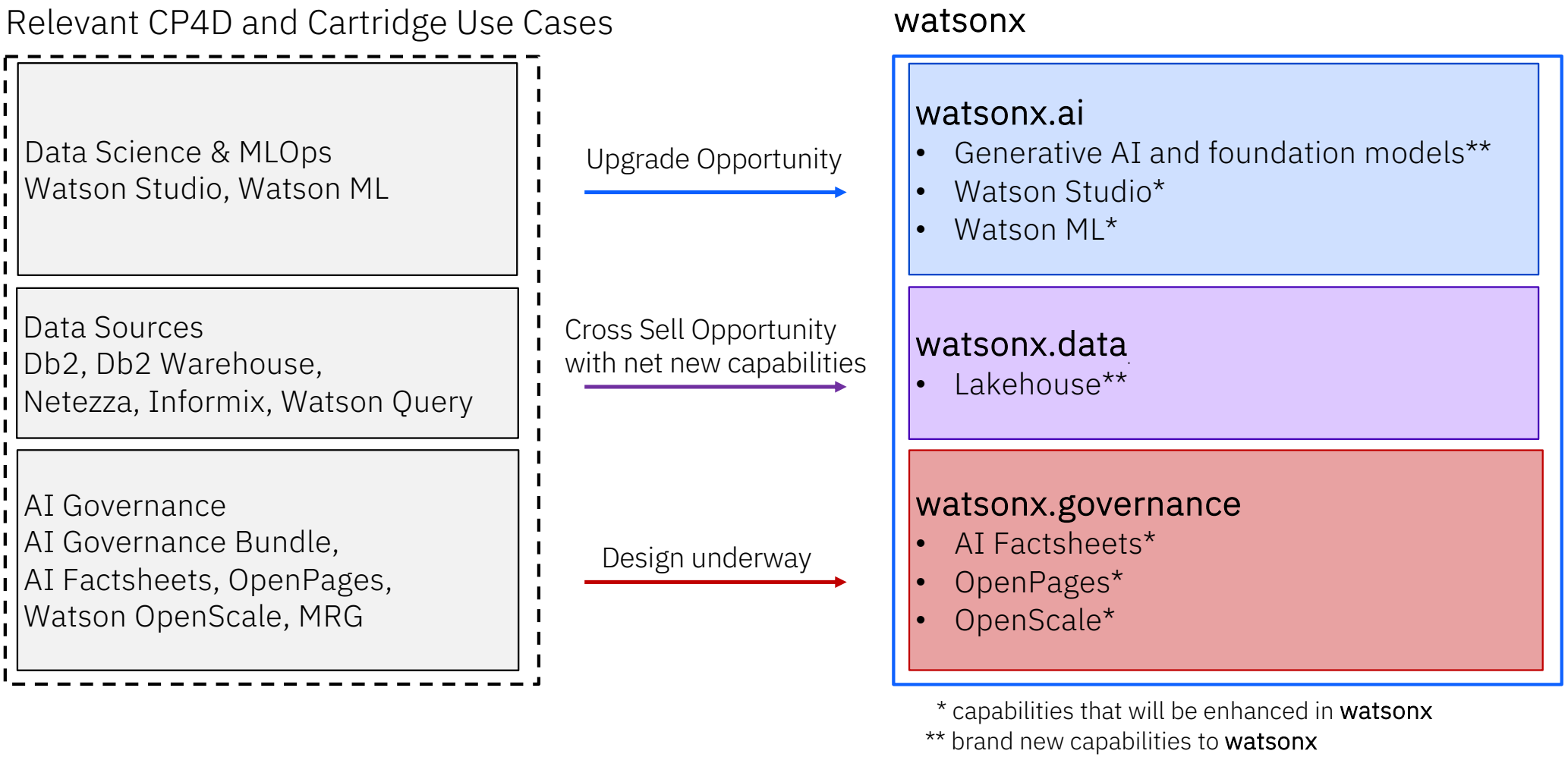
Empowering

- For **value creators**, not just users
  - Tunable models at a fraction of the cost & time
  - Deploy anywhere
- An enterprise studio that allows clients build their own differentiated AI assets with their own proprietary data, creating a competitive edge.

Why IBM?

- **Open - Hybrid and Multicloud capabilities -** Can work on cloud platform of choice for client as well as on-prem (in future). No cloud vendor lock-in
- **Trusted - Market leader Governance** - Provides tooling and capabilities for end-to-end Data and AI governance.
- **Trusted - IBM Foundation models** are trained on data which is checked and curated by legal and ethical teams and uses HAP filters, so that you can completely trust the data on which they are build.
- **Empowering - Integrated** capabilities for **generative AI** and **traditional AI**
- **Empowering** - Complete and Integrated capabilities for AI, Data and Governance.
- **Targeted - IBM's Prompt Tuning** uses Multitask Prompt Tuning, developed by **MIT IBM Watson AI Labs** which is efficient, low-cost way, of adapting an AI foundation model to your custom tasks, using lesser training data and much lesser cost compared to fine tuning approach and still able to provide at par results with fine tuning models.
- **Targeted** - IBM is creating smaller foundation models which can be effective for specific tasks. Idea is to use diff models for diff tasks at much lower cost instead of using one large model for all the use cases.

Connecting current software portfolio with **watsonx**



* capabilities that will be enhanced in **watsonx**

** brand new capabilities to **watsonx**

watsonx.ai is helping companies custom-build AI solutions to suit their specific needs.

Leveraged **watsonx.ai** foundation models to train their AI to create tennis commentary. Generated informative and engaging video clip narrations for fans with varied sentence structures and vocabulary.

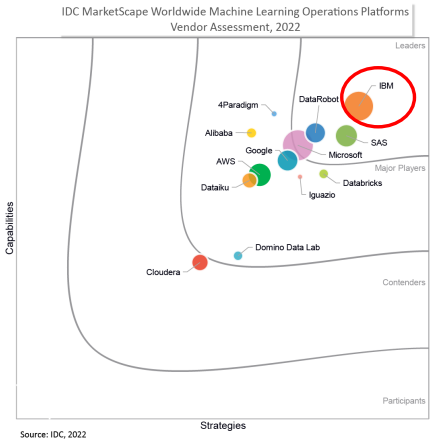
SAMSUNG SDS

Exploring **watsonx.ai** generative AI capabilities for new solutions such as SDS's Zero Touch Mobility to deliver unprecedented product innovations to improve client experience.

Using **watsonx.ai** to slash delivery time from 3-4 months down to 3-4 weeks for many customer care use cases.

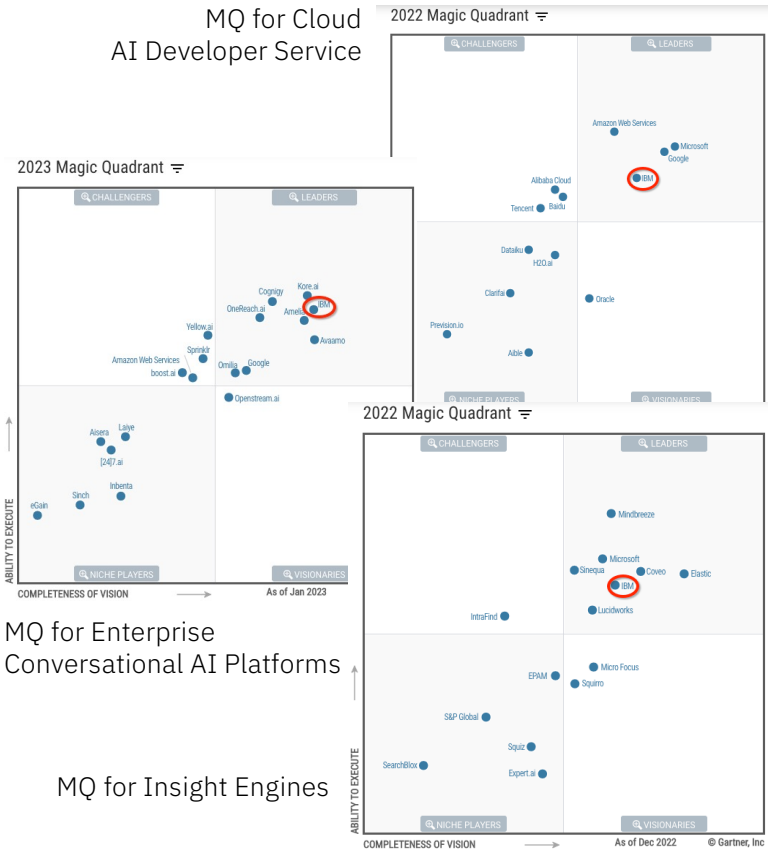
An early adopter of generative AI, has been exploring **watsonx.ai** to improve content discoverability, summarization and classification of data to enhance productivity.

IBM is a leader in AI



IDC Marketscape:
Leader in Worldwide
Machine Learning
Operations Platforms
2022 Vendor Assessment

MQ for Cloud
AI Developer Service



MQ for Enterprise
Conversational AI Platforms

MQ for Insight Engines

Multiple Gartner Magic Quadrants
for AI-related capabilities

Forrester Wave:
Multimodal Predictive
Analytics and
Machine Learning

Call to action

1. Challenge yourself to deliver a watsonx briefing for each of your clients
   - Leverage the watsonx.ai Sales Kit, generative AI whitepaper and watsonx.ai video on seismic
   - Engage clients in **watsonx.ai** pilot: https://ibm.biz/watsonx-pilot

2. Get Prepared - Complete required learning & earn your **watsonx.ai** sales foundation badge
   - AI Fundamentals
   - AI for Business
   - **watsonx.ai** Level 2
   - **watsonx.data** Level 2

3. Participate in the **watsonx** challenge
   – Coming Soon...

Backup

Supervised and Self Supervised Learning ↷ What's the difference?

Supervised learning

Human powered

Requires intense labeling

Long, hard, expensive

Self-supervised learning

Computer powered

Requires little labeling

Quick, automated, and efficient

Leveraging foundation model capabilities across various domains

	Customer Care Watson Assistant, Cloud Pak for Data	Digital Labor Watson Orchestrate, Cloud Pak for Integration/Automation, Wisdom in Ansible	IT Operations Turbonomic, Instana, Cloud Pak for Watson AIPOs	Cybersecurity QRadar, Cloud Pak for Security
Summarization Summarizing large documents, conversations, and recordings to key takeaways	• Call center transcripts • Omnichannel journey summary • Summarizing search snippets to augment chatbots • Summarize events, analyst reports, financial info etc. for advisor • Sentiment analysis	• Summarize documents, contracts, technical manuals, reports, etc. • Transcribe videos to text and summarize • Summarizing reports on Form 10K	• Summarize alerts, technical logs, tickets, incident reports, etc. • Summarize policy, procedure, meeting notes, etc. • Vendor report QBR summarization	• Summarize security event logs • Summarize steps to recap security incident • Summarize security specs
Extraction Extract structured insights from unstructured data	• Extracting interaction history with clients • Extract information from specific types/categories of incidents	• Extract answers and data from complex unstructured documents • Extract information from media files such as meeting records, audio, and video	• Extract key information from various sources for report automation • Extract relevant system/network information for administration, maintenance, and support purpose	• Extract information from incidents, content for security awareness • Extract key security markers and attributes from new threat reports.
Generate Generate AI to create text	• User stories, personas • Create personalized UX code from experience design • Training, and testing data for chatbots • Automate responses to emails and reviews	• Automate the creation of marketing material and language translation • Automate image, text, and video creation for articles, blogs, etc. • Create automation scripts for various workflows across applications	• Create technical document from code • Automate scripts to configure, deploy, and manage hybrid cloud • Co-pilot to create code across multiple programming languages	• Automate report generation • Social engineering simulation • Security documentation creation • Automate threat detection by looking for anomaly patterns
Classify For sentiment or topics	• Classify customer sentiments from feedback or chatbot interaction • Classify typical issues raised by clients for focused improvements	• Classify documents by different criteria – types, contents, keywords • Sort digital contents in storage into pre-defined categories	• Classify incident reports • Automate workflow based on analysis of items/status/reports	• Classify flagged items properly as threats or other categories • Classify the type of security risks and find the best response • Classify log and other monitoring output to determine the next action
Question answering Knowledge base search across the company's proprietary data.	• Knowledgebase articles • Augment chatbot w/search • Agent assist • Contract intelligence • mart search in technical manuals, HR documents, ethics codes, product documentation, etc.	• Analyze emails, attachments, documents, invoices, reports, etc. • Knowledge search for company information to provide in-house day-to-day assistance and automation	• Knowledge search for IT helpdesk • Ticket resolution by suggesting solutions from resolved tickets • Error log and root cause analysis • Compliance monitoring	• Knowledge search across security spec documents • External threat intelligence • Error log and root cause analysis • Security incident search @ forensics