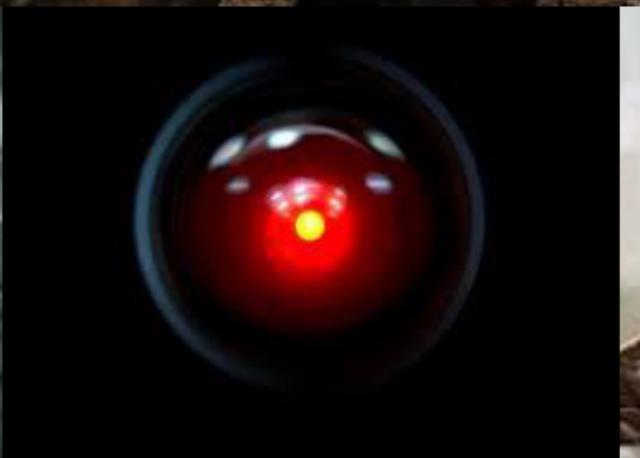


# Artificial Intelligence

## *Fundamentals*



# IBM Research definition of Artificial Intelligence

« Artificial Intelligence (AI) has a long history at IBM Research, dating back to the 1950s. By AI we mean **anything that makes machines act more intelligently**.

Our work includes basic and applied research in machine learning, deep question answering, search and planning, knowledge representation and cognitive architectures. »

# Famous applications of AI



## Deep Blue

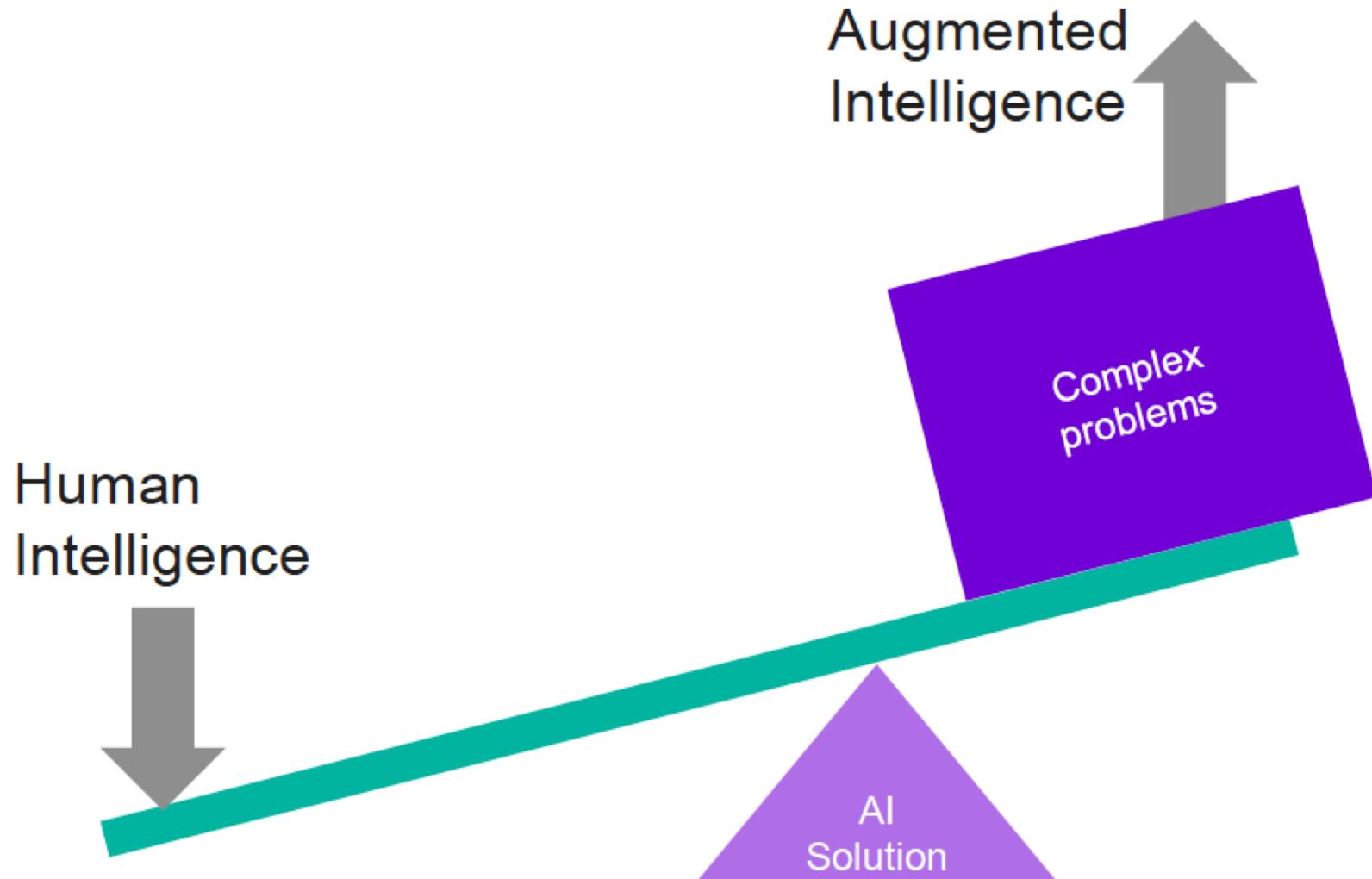
In 1997, the IBM chess-playing computer named Deep Blue beat World Chess Champion Garry Kasparov in a six-game match.

## Watson

In 2011, the IBM Jeopardy!-playing computer named Watson beat Ken Jennings and Brad Rutter in a grand champion challenge.



# Famous applications of AI

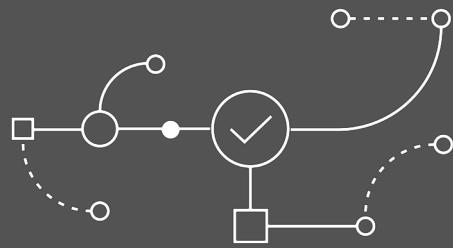


# A cognitive business has systems that can enhance digital intelligence exponentially

## UNDERSTAND



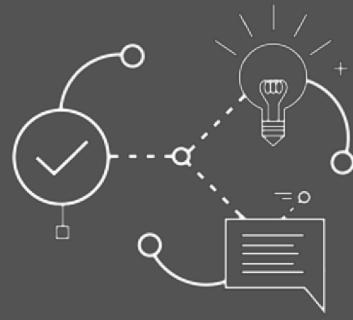
## REASON



## LEARN



## INTERACT



Cognitive systems understand imagery, language and other unstructured data **like humans do**.

They can reason, grasp underlying concepts, form hypotheses, and **infer and extract ideas**.

With each data point, interaction and outcome, they develop and sharpen expertise, **so they never stop learning**.

With abilities to see, talk and hear, cognitive systems **interact with humans in a natural way**.

# Ethical Challenges

« AI, like most other technology tools, is most effective when it is used to extend the natural capabilities of humans instead of replacing them.  
That means that AI and humans are best when they work together and can trust each other. » **Rob High, CTO IBM Watson**

**Among the many ethical issues are:**

- Trust
- Privacy

# AI is probabilistic

Until now, computing has been deterministic.

Watson sees...

```
if (x==5) then  
    print ("just right")  
  
else if (x>5) then  
    print ("too high")  
  
else  
    print ("too low")
```



Classes	Score
Chihuahua dog	0.94
small dog	0.96
dog	0.96
domestic animal	0.96
animal	0.96
ivory color	0.71
light brown color	0.60

# Learning

One critical component of any kind of intelligence is the ability to learn.

- Supervised
- Unsupervised
- Reinforcement Learning
- Deep Learning



# Learning

**One critical component of  
any kind of intelligence is  
the ability to learn.**

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# Learning

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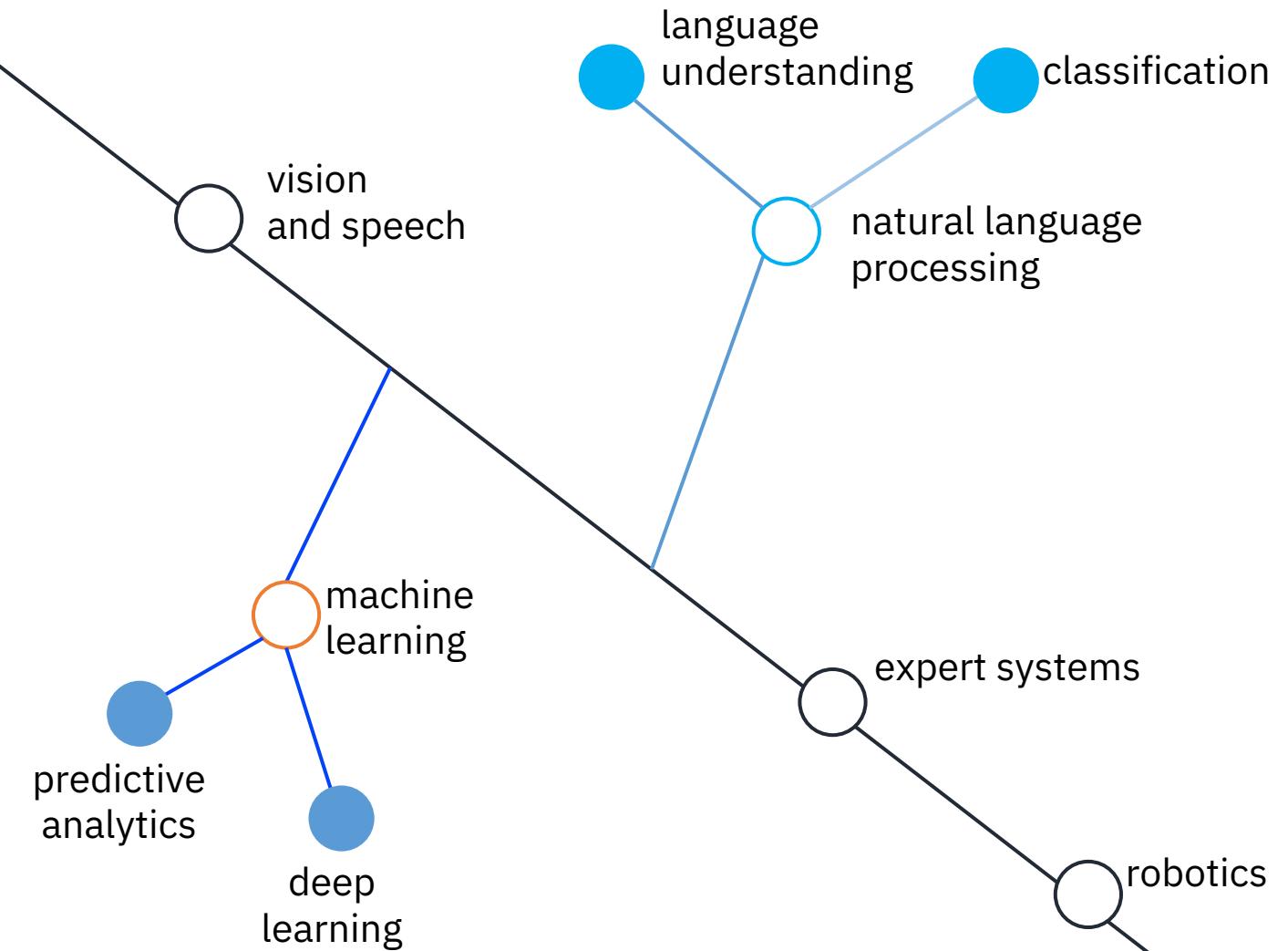
- Supervised
- Unsupervised
- Reinforcement Learning
- Deep Learning

# Watson AI Platform

# Artificial Intelligence

AI is the theory and development of computer systems to perform tasks that normally require human intelligence.

AI systems continuously learn using such techniques as machine learning and deep learning to solve problems in machine vision, speech and natural language.



# Every Business and Enterprise is Embracing AI

Leaders everywhere  
are monetizing data  
and developing  
strategies to embed  
AI in business



## Sales

Market basket analysis,  
next-best offer,  
customer churn,  
propensity to buy, and  
smart engagement.



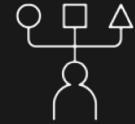
## Marketing

Discount targeting, email  
optimization, and lifetime  
client value, basket  
recommendation  
systems.



## Human Resources

Medicare fraud, AI-  
assisted diagnosis, and  
drug demand  
forecasting.



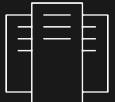
## Supply Chain

Predictive maintenance,  
process optimization,  
and demand forecasting.



## Energy & Utilities

Power usage prediction,  
maintenance, and smart  
grid management.



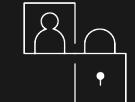
## Finance

Customer segmentation,  
credit risk, and credit  
card fraud detection.



## Security

Activity monitoring,  
intrusion detection, and  
log analysis.



## Data & Technology

Dynamic pricing, call  
center assistance,  
tourism forecasting, and  
self-driving cars.

**Machine Learning** is algorithm selection

**Deep learning** is neural network design

**AI** is systems architecture

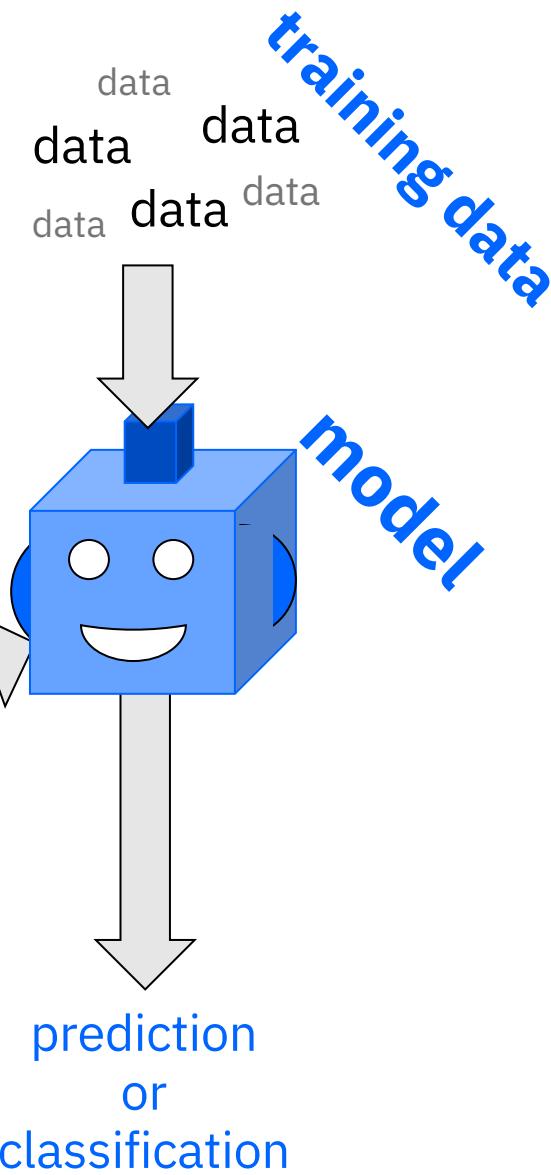
# How does machine learning work?

Machine learning requires  
TONS OF DATA

- ① A machine learning model is trained to recognize patterns in historical data

- ② The model is then shown new data and asked to predict or classify it.

- ③ If patterns in the new data match the training data then the model makes accurate predictions



# AI Products & Services

## AI Assistant

Integrate diverse conversation technology into your application.

## Knowledge

Get insights through accelerated data optimization capabilities.

## Vision

Identify and tag content then analyze and extract detailed information found in an image.

## Speech

Convert text and speech with the ability to customize models.

## Language

Analyze text and extract meta-data from unstructured content.

## Empathy

Understand tone, personality, and emotional state.

 <b>Watson Assistant (formerly Conversation)</b> Lite • IBM	 <b>AI OpenScale</b> Lite • IBM	 <b>Compare Comply</b> IBM • Beta
 <b>Discovery</b> Lite • IBM	 <b>Knowledge Catalog</b> Lite • IBM	 <b>Knowledge Studio</b> Lite • IBM
 <b>Language Translator</b> Lite • IBM	 <b>Machine Learning</b> Lite • IBM	 <b>Natural Language Classifier</b> IBM
 <b>Natural Language Understanding</b> Lite • IBM	 <b>Personality Insights</b> Lite • IBM	 <b>Speech to Text</b> Lite • IBM
 <b>Text to Speech</b> Lite • IBM	 <b>Tone Analyzer</b> Lite • IBM	 <b>Visual Recognition</b> Lite • IBM
 <b>Watson Studio</b> Lite • IBM	 <b>PowerAI</b> Third Party	

# Why are enterprises struggling to capture the value of AI?

## Data

- Data resides in silos & difficult to access
- Unstructured and external data wasn't considered

## Governance

- If the data isn't secure, self-service isn't a reality
- Challenge understanding data lineage and getting to a system of truth

## Skills

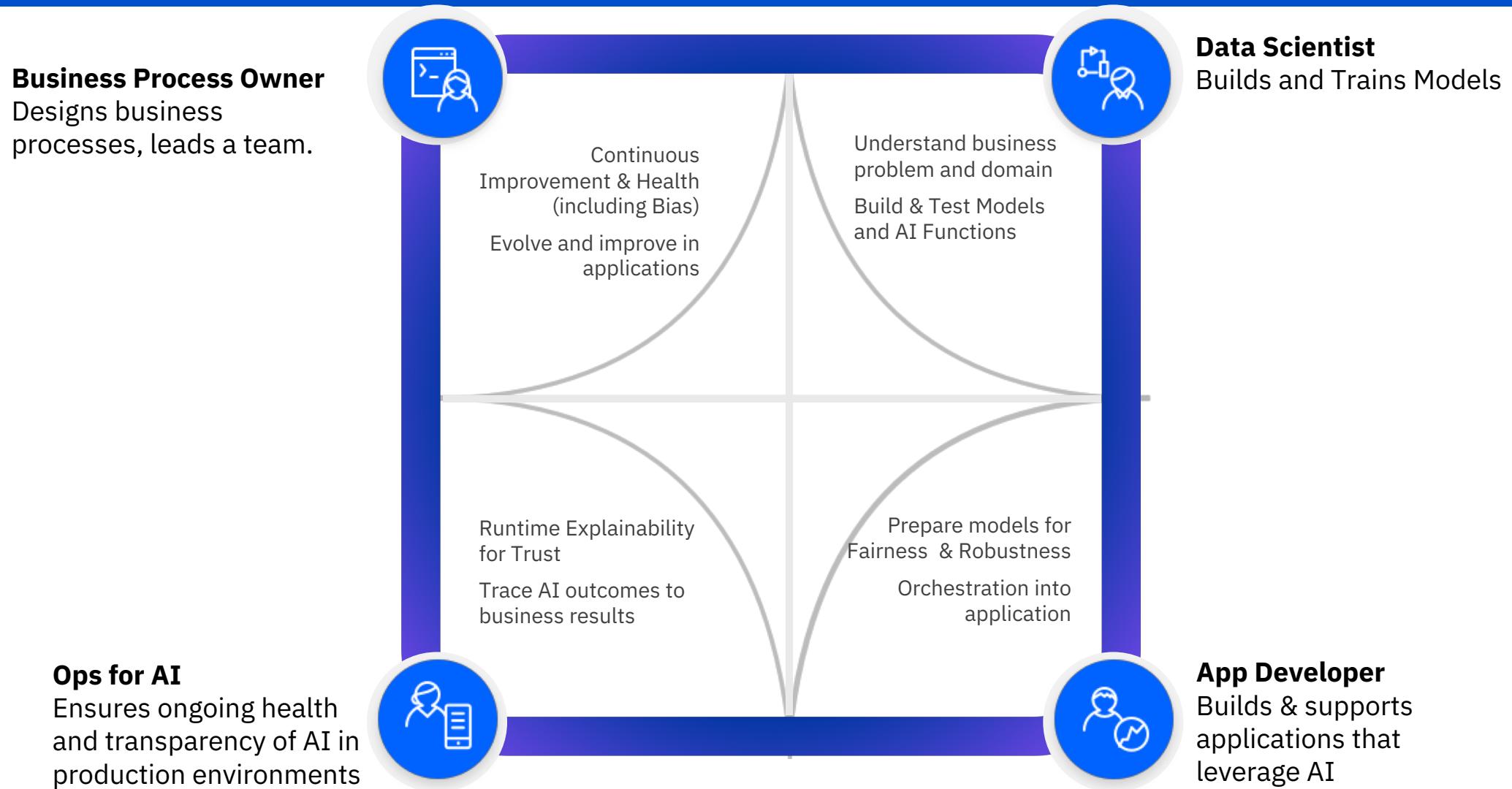
- Data Science skills are in low supply and high demand
- Nurturing new data professionals is challenging

## Tools & Infrastructure

- Need an environment that enables a “fail fast” approach
- Discrete tools present barriers to productivity

# Watson AI Platform

Built for AI teams – enabling team productivity and collaboration



# Watson Studio

Watson Studio accelerates the machine and deep learning workflows required to infuse AI into your business to drive innovation. It provides a suite of tools for data scientists, application developers and subject matter experts to collaboratively and easily work with data and use that data to build, train and deploy models at scale.

## AI Requires Teamwork

- AI is not magic
- AI is algorithms + data + team

# Watson Studio

## Supporting the end-to-end AI workflow

### Connect & Access Data

### Search and Find Relevant Data

### Prepare Data for Analysis

### Build and Train ML/DL Models

### Deploy Models

### Monitor, Analyze and Manage

Connect and discover content from multiple data sources in the cloud or on premises. Bring **structured** and **unstructured** data to one toolkit.

**Find** data (structured, unstructured) and AI assets (e.g., ML/DL models, notebooks, Watson Data Kits) in the **Knowledge Catalog** with intelligent search and giving the right access to the right users.

Clean and prepare your data with **Data Refinery**, a tool to create data preparation pipelines visually. Use popular open source libraries to prepare unstructured data.

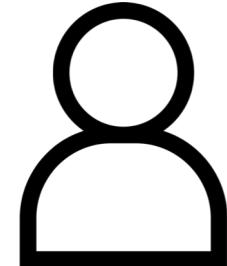
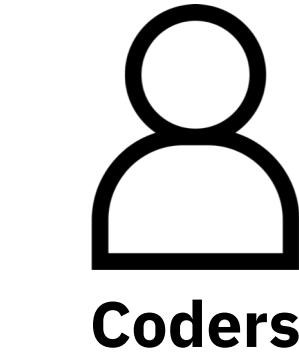
**Democratize** the creation of ML and DL models. Design your AI models **programmatically** or **visually** with the most popular **open source** and IBM ML/DL frameworks or leverage transfer learning on **pre-trained** models using **Watson tools** to adapt to your business domain. Train at scale on **GPUs** and **distributed** compute

Deploy your models easily and have them **scale automatically** for online, batch or streaming use cases

Monitor the performance of the models in production and trigger automatic retraining and redeployment of models. Build **Enterprise Trust** with Bias Detection, Mitigation Model **Robustness** and Testing Service Model **Security**.

# Watson Studio

Two types of custom model builders



**Non-Coders  
(Clickers)**



SPSS Modeler



Model Builder

Deep Learning



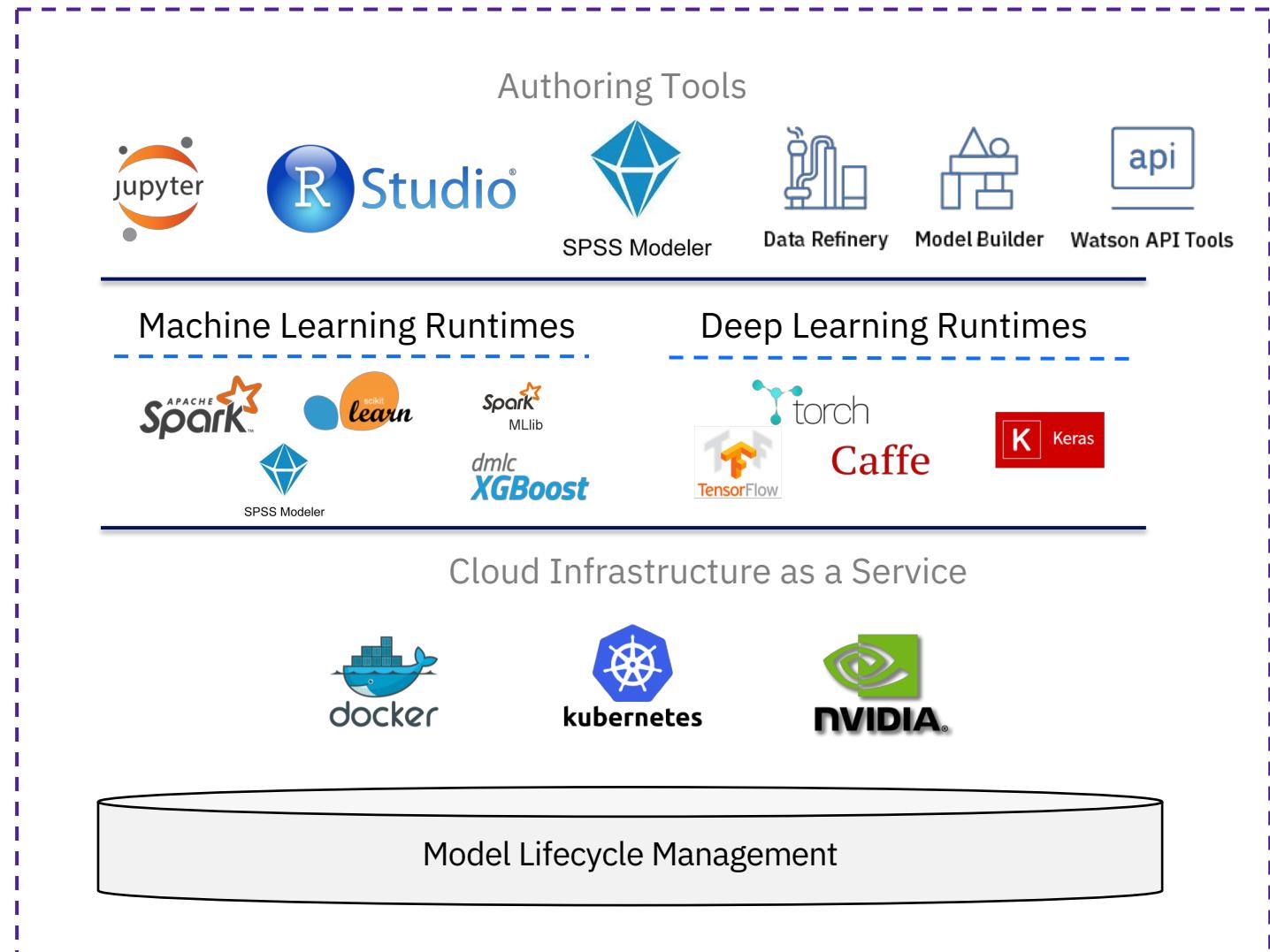
Caffe



# Watson Studio

## Tools for supporting the end-to-end AI workflow

- Create, collaborate, deploy, and monitor
- Best of breed open source & IBM tools
- Code (R, Python or Scala) and no-code/visual modeling tools
- Most popular open source frameworks
- IBM best-in-class frameworks
- Fully managed service
- Container-based resource management
- Elastic pay as you go cpu/gpu power



# Data Refinery

## *Making data fit for use*

The screenshot shows the IBM Watson Data Preparation interface. At the top, there are navigation links for 'IBM Watson', 'Projects', 'Tools', 'Community', 'Services', and 'US South'. Below the header, the breadcrumb trail reads 'My Projects / Data Preparation / Customer\_Orders\_flow / Data Refinery'. On the left, a sidebar has a '+ Operation' button and a 'Data Profile' section. The main area is titled 'Code an operation to cleanse and shape your data' and contains a table of operations. The table has columns for 'TRANSACTION String', 'arrange', 'PRODUCT\_TYPE String', 'CUST\_ORDER\_NUMB... String', 'COUNTRY String', 'STATE String', 'CITY String', 'GEN String', and 'Count'. Rows show various operations like 'count', 'distinct', 'filter', 'group\_by', 'mutate', 'mutate\_all', and 'mutate\_at'. To the right of the table, a '4 STEPS' panel shows the following steps:

- Data Source : Great Outdor...**
- Remove duplicates**  
Removed rows with duplicate values in STATE
- Sort ascending**  
Sorted rows by CITY
- Sort descending**  
Sorted rows by CUST\_ORDER\_NUMBER

A large blue box at the bottom contains the text: "Self-service data refinement and cleaning".

IBM Watson Projects Tools Community Services US South

My Projects / Data Preparation / Customer\_Orders\_flow / Data Refinery

+ Operation Code an operation to cleanse and shape your data

Data Profile Visualizations Steps

CUST_ORDER_NUMBER	COUNTRY	STATE	CITY
String	String	String	String

FREQUENCY	FREQUENCY	FREQUENCY	FREQUENCY
171930	United States	PA	Singapore
172495	China	CA	Chengdu
176806	Germany	CA	Brisbane
105131	Spain	Singapore	Adelaide
102146	Brazil	PR-RJ	Beijing
101997	United Kingdom	NY	Sydney
102304	France	FL	Melbourne
104853	Canada	ON	Toronto
107726	Australia	PR-SP	Pune
170420	Italy	SA	Guangzhou

STATISTICS	STATISTICS	STATISTICS	STATISTICS
Maximum length	6	Maximum length	9
Minimum length	1	Mean length	2.3778
Unique	100	Length	100
Maximum length	25	Minimum length	3
Mean length	8.1706	Length	768
Unique	768	Length	100

Comprehensive profiling

The screenshot shows the IBM Watson Data Refinery interface. On the left, there's a sidebar with tabs for 'Input' (selected), 'Data', 'Profile', and 'Visualizations'. The 'Input' tab shows 'Columns: COUNTRY, PRODUCT\_LINE' and 'Chart types: Treemap'. Below that is a 'Brunel syntax' box containing code: 

```
tree x#PRODUCT_LINE size(#count) label(COUNTRY)  
tooltip(#all)
```

. The main area displays a treemap visualization where three categories—'Camping Equipment', 'Golf Equipment', and 'Mountaineering Equipment'—are represented as large blue rectangles. Each rectangle is further subdivided into smaller blue rectangles representing countries: Australia, Canada, Italy, Spain, and United Kingdom. A large blue callout box at the bottom contains the text 'Interactive visualization'.

The screenshot shows the IBM Watson Data Prep interface. At the top, there's a navigation bar with links for Home, Projects, Tools, Community, Services, and a user icon. To the right of the navigation is a location bar showing "US South" and some icons. Below the navigation, the breadcrumb path reads "My Projects / Data Preparation / Customer Orders\_flow". On the right side of the header are buttons for "Refine", "Run", "Preview", "Edit", "Logs", and "Metrics".

The main area is titled "Summary". It shows a data flow from a source file "Great Outdoor Customer Orders.csv" to an output file "Customer Orders\_shaped.csv". The flow consists of 3 steps. Below this, the "Runs" section is visible, showing a history of runs from March 6, 2018, to March 11, 2018, with each run taking 9:58 pm. The "Schedule" tab is also present.

DATE	DAY	TIME	Summary
6 Mar 2018	Tue	9:58 pm	
7 Mar 2018	Wed	9:58 pm	
8 Mar 2018	Thu	9:58 pm	
9 Mar 2018	Fri	9:58 pm	
10 Mar 2018	Sat	9:58 pm	
11 Mar 2018	Sun	9:58 pm	

# Watson Studio

This screenshot shows the Watson Studio interface with a Jupyter notebook open. The code cell contains Python code to generate a bar chart titled 'Tweets Country Distribution based on the User Profile'. The chart displays tweet counts for various countries. A comment from 'ARMAND RUIZ G...' is visible, saying 'Great work!'. The interface includes standard Jupyter notebook controls like Run, Cell, Kernel, and Help.

Not Trusted | Python 3.5

```
colors = ['gray'] + colors
lt.figure(figsize=(10,8))
lt.barh(y_pos, num_tweets, align='center', color=colors)
lt.yticks(y_pos, countries)
lt.xlabel('Number of Tweets')
lt.title('Tweets Country Distribution based on the User Profile')
lt.ylim(-1, len(y_pos))
lt.show()
```

Tweets Country Distribution based on the User Profile

GERMANY  
MEXICO  
CANADA  
INDIA  
JAPAN  
SPAIN

Add a comment

ARMAND RUIZ G... 7:49 AM  
Great work!

Open Source tools – Jupyter and RStudio

This screenshot shows the 'Environments' tab in Watson Studio. It provides a overview of active environment runtimes and allows users to define new environments. A search bar at the top asks 'Which environment are you looking for?'. Below, a table lists environment definitions, including 'Default SPSS Modeler XS' which uses 'Wml\_flow' and '2 vCPU and 8 GB RAM'. A note says 'you currently have no active environment runtimes'.

+ Add to project

Overview Assets Environments Bookmarks Deployments Collaborators Settings

Environments

Define the hardware size and software configuration for the runtime associated with DSX tools such as notebooks.

In this release you can use default environments or you can create custom environments with different hardware and software configurations. [Learn more](#).

Which environment are you looking for?

Active environment runtimes

NAME	CAPACITY UNIT HOURS	OWNER	TOOL	HARDWARE CONFIGURATION	STARTED AT	ACTIONS
you currently have no active environment runtimes						

New environment definition

Environment definitions

NAME	TOOL	HARDWARE CONFIGURATION	LAST MODIFIED	ACTIONS
Default SPSS Modeler XS	Wml_flow	2 vCPU and 8 GB RAM	2 Mar 2018	⋮
Default				⋮
Default				⋮

Elastic and customizable compute environments

This screenshot shows the 'Car recognition' tool in Watson Studio. It allows users to upload image datasets and train machine learning models. The interface includes a sidebar for 'My Classes' and 'All Images', and a main area for uploading files. A list of uploaded datasets is shown on the right, including 'BentleyMulsanneSedan2...', 'BugattiVeyron16.4Coupe...', 'BuickRegalGS2012.zip', 'BuickRainierSUV2007.zip', 'BuickEnclaveSUV2012.zip', 'BuickVeranoSedan2012.zip', 'CadillacCTS-VSedan2012.zip', 'ChevroletAvalancheCrew...', and 'CadillacSRXSVU2012.zip'. A note at the top says 'Drop a .zip file of images here to add them to your project or browse to select a .zip file.'

Unclassified images: 0 Incomplete classes: 0

Train Model

Drop a .zip file of images here to add them to your project or browse to select a .zip file.

Car recognition

My Classes All Images

Add a zipped file from your project.

Search classes

49 classes

Create a class

AMGeneralHummerS... 89 images

AcuraTSX Sedan2012 81 images

AcuraIntegraTypeR... 89 images

AcuraTL Sedan2012 86 images

AstonMartinV8 Vanta... 82 images

Audi100Sedan1994 81 images

AstonMartinV8 Vanta... 90 images

BentleyMulsanneSedan2... 6 Mar 2018, 3:44:19 pm

BugattiVeyron16.4Coupe... 6 Mar 2018, 3:44:16 pm

BuickRegalGS2012.zip 6 Mar 2018, 3:44:14 pm

BuickRainierSUV2007.zip 6 Mar 2018, 3:44:13 pm

BuickEnclaveSUV2012.zip 6 Mar 2018, 3:44:13 pm

BuickVeranoSedan2012.zip 6 Mar 2018, 3:44:11 pm

CadillacCTS-VSedan2012.zip 6 Mar 2018, 3:44:11 pm

ChevroletAvalancheCrew... 6 Mar 2018, 3:44:10 pm

CadillacSRXSVU2012.zip 6 Mar 2018, 3:44:09 pm

Watson Visual Recognition – retrain Watson

This screenshot shows the 'ML flows' interface in Watson Studio. It allows users to design and visualize machine learning pipelines. A complex flow diagram is shown, starting with 'Image Data' input, followed by 'Conv 2d', 'ReLU', 'Pooling 2d', 'Flatten', 'Dense', 'Softmax', and finally 'Accuracy' and 'Sigmoid Cross-E...'. The diagram also includes an 'SGD' node. The interface has a toolbar with various icons for managing the flow.

Single Convolution layer on M

Image Data → Conv 2d → ReLU → Pooling 2d

Flatten → Dense → Softmax → Accuracy → Sigmoid Cross-E... → SGD

Watson Visual Recognition – retrain Watson

Create ML flows and design Neural Networks visually

# Watson Knowledge Catalog

*Unlock tribal knowledge and unleash your knowledge workers*

Browse Assets Usage Statistics Access control Settings

What assets are you looking for?

Recently Added

US Airlines Owner: Jay Limburn Added: 1 Mar 2018 13:04 Airline	Harry Rosen example Owner: Michael Tucker Added: 28 Feb 2018 17:30 Sales Forecast	Machine Learning using R Owner: Jay Limburn Added: 20 Feb 2018 14:55 notebooks... dax	FDIC Failed Bank List Owner: Jay Limburn Added: 19 Feb 2018 14:25 banking	2017 Small Business Banking Loans Owner: Jay Limburn Added: 19 Feb 2018 13:36 banking loan	All US Banks Owner: Jay Limburn Added: 19 Feb 2018 13:36 fss banking
---	--	--	--	---	---

Filter

Asset types

- Data Asset (56)
- Notebook (4)
- Connection (2)
- dashboard (2)

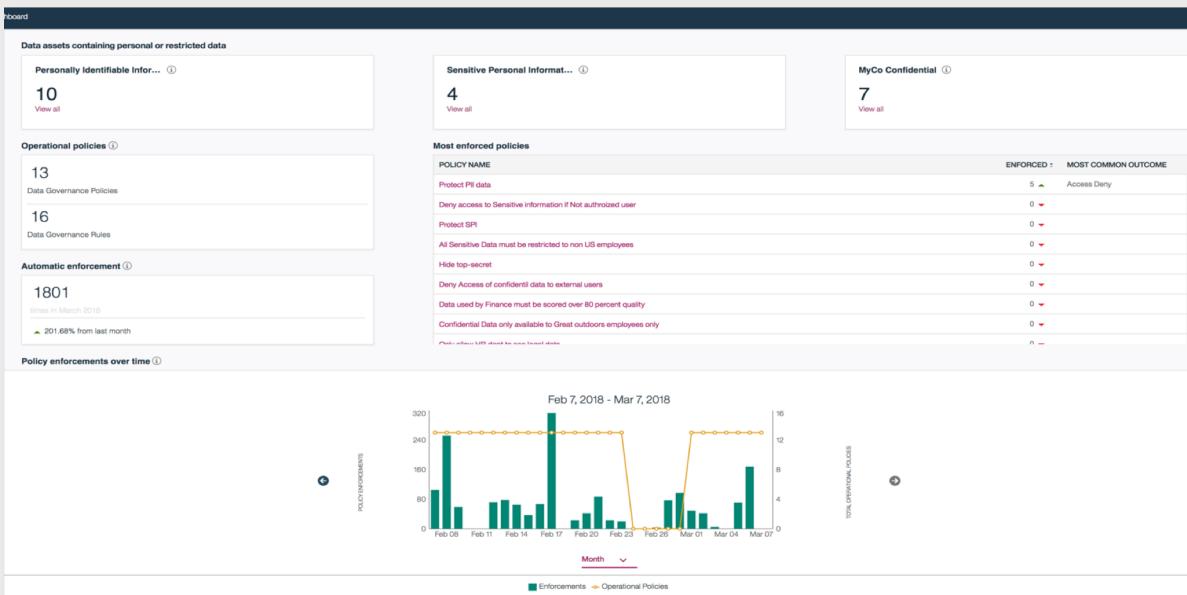
Tags

- discovered (24)
- SAMPLES (1)
- untagged (6)
- GOSALES (6)
- sales (5)
- banking (4)
- dax (4)
- notebook (4)
- GOSALESDW (3)

Available Assets

Showing 64 of 64 assets

<input type="checkbox"/> NAME	OWNER	TAGS	TYPE	DATE ADDED	...
2017 Small Business Banking Loans	Jay Limburn	banking loan	Data Asset	19 Feb 2018	...
ANCESTRY	Jay Limburn	discovered SAMPLES	Data Asset	13 Dec 2017	...
AWS Data Warehouse	Jay Limburn		Connection	13 Dec 2017	...
All US Banking Branches	Jay Limburn	fss banking branches	Data Asset	19 Feb 2018	...
Banking Demographic Data	Jay Limburn	banking client customer	Data Asset	19 Feb 2018	...
BlodPower_Tcav	paul taylor		Data Asset	22 Jan 2018	...
CONVERSION_RATE	Jay Limburn	discovered GOSALES	Data Asset	13 Dec 2017	...
COUNTRY	Jay Limburn	discovered GOSALES	Data Asset	13 Dec 2017	...
CUST_WIN_BACK	Jay Limburn	discovered SAMPLES	Data Asset	13 Dec 2017	...
Customer Orders Q3	Jay Limburn	sales Warehouse	Data Asset	11 Jan 2018	...



Browse Assets Usage Statistics Access control Settings

Total assets ①



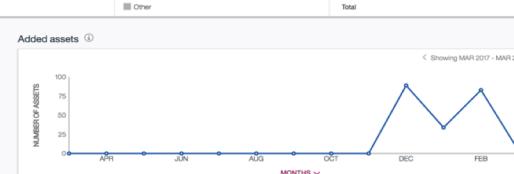
Deleted assets ①

< Showing MAR 2017 - MAR 2018 >



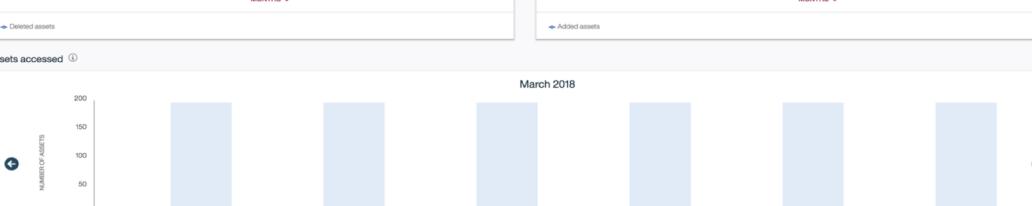
Added assets ①

< Showing MAR 2017 - MAR 2018 >



Assets accessed ①

March 2018



NUMBER OF ASSETS

MONTHS ▾

Deleted assets

NUMBER OF ASSETS

MONTHS ▾

Added assets

NUMBER OF ASSETS

MONTHS ▾

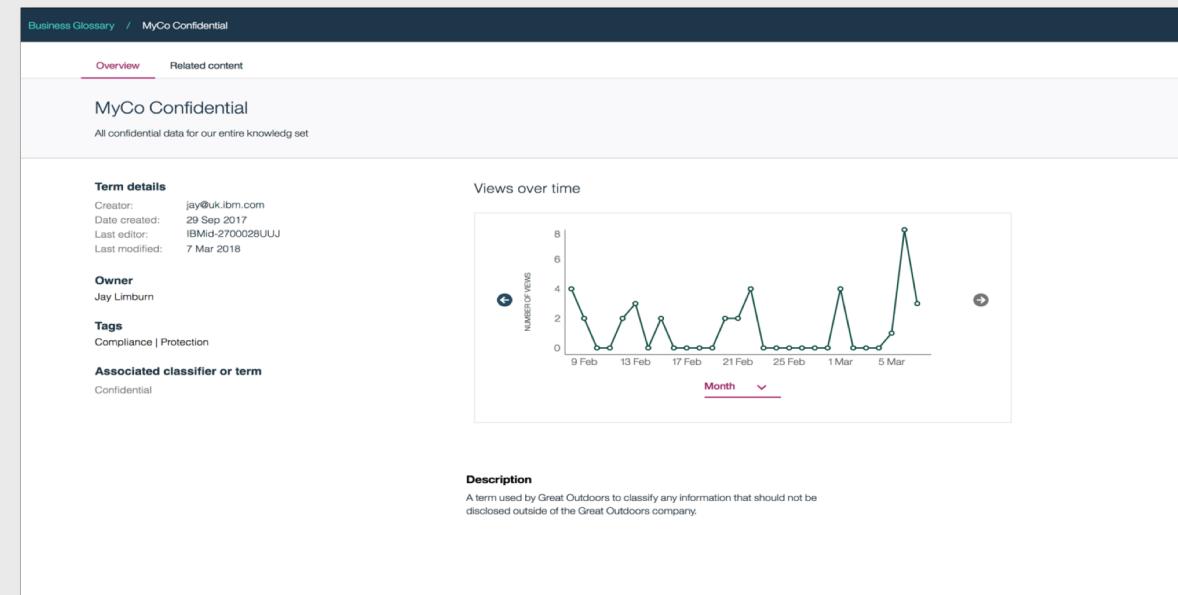
Assets accessed

NUMBER OF ASSETS

1 2 3 4 5 6

1 2 3 4 5 6

Assets accessed Total assets



# Thank You