

The Developer Advocates present

# SAP CodeJam

2024



Getting Started with  
Machine Learning using SAP HANA



's-Hertogenbosch, Netherlands  
Jun 21, 2024



# Witalij Rudnicki

aka @Sygymundovych  
aka Vitaliy Rudnytskiy  
aka Віталій Рудницький

- 15 years **tech consultant** in SAP BI/BW
- SAP **Developer Advocate**  
in **SAP Community & Developer Relations**
- All things Data  
<http://bit.ly/SAPDevsData>
- Based in Wrocław, Poland
- Organizer of local SAP Community meetups and **SAP Inside Track**



# SAP Inside Track Wrocław 2024 on July 6

<https://www.linkedin.com/events/sapinsidetrackwroclaw20247199703869621223425/>



## SAP Inside Track

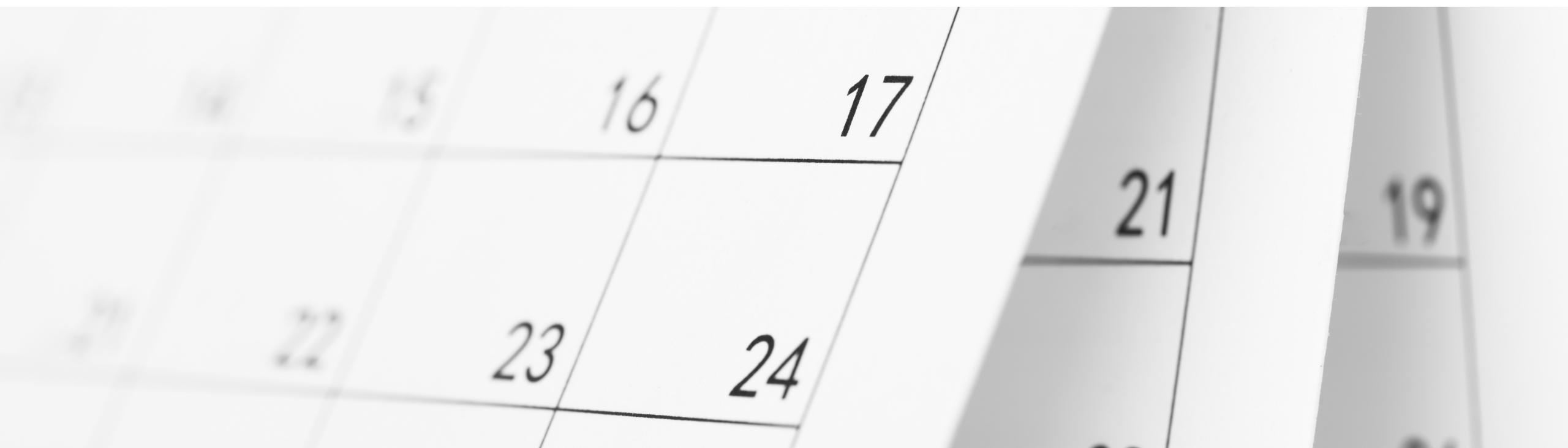
6.07.2024

Fabryczna 14G, Wrocław

Capgemini

M UNIWERSYTET  
WSB MERITO

# **Events not be missed**



**Devtoberfest:** <https://community.sap.com/t5/devtoberfest/gh-p/Devtoberfest>

1. ABAP & CAP
2. Low-code/No-code
3. Data, Analytics, & AI
4. User Interface
5. Integration Suite

# SAP TechEd

Where ideas get real

The SAP TechEd event brings together developers, practitioners, enterprise architects, and global IT leaders. Joined by SAP experts and partners, they'll unite to explore innovations in app development tools, generative AI, clean core for cloud ERP, and much more.



<https://news.sap.com/2024/01/sap-teched-in-2024-expanded-global-program>:

**SAP TechEd Virtual:** October 8-9, 2024

**SAP TechEd On Tour:**

- North America,
- Europe, the Middle East and Africa (EMEA),
- Latin America and the Caribbean (LAC), and
- Asian-Pacific and Japan (APJ)

**ASUG Tech Connect with SAP TechEd, West Palm Beach, Florida: November 12-14, 2024**

# June Developer Challenge: SAP HANA multi-model, incl. Vector Engine

## The Timeline

Just check the challenges each Wednesday during the following four weeks to get the new one.

Mark your calendars! Here's the game plan:

June 5th	Start of the Challenge	Setup exercise	Submissions
June 12th	Week 2	<a href="#">Words as Vectors</a>	<a href="#">Submissions</a>
June 19th	Week 3		
June 26th	Week 4		
July 3rd	Final deadline		

## Ready, Set, Code!

*Have fun, experiment boldly, and good luck!*

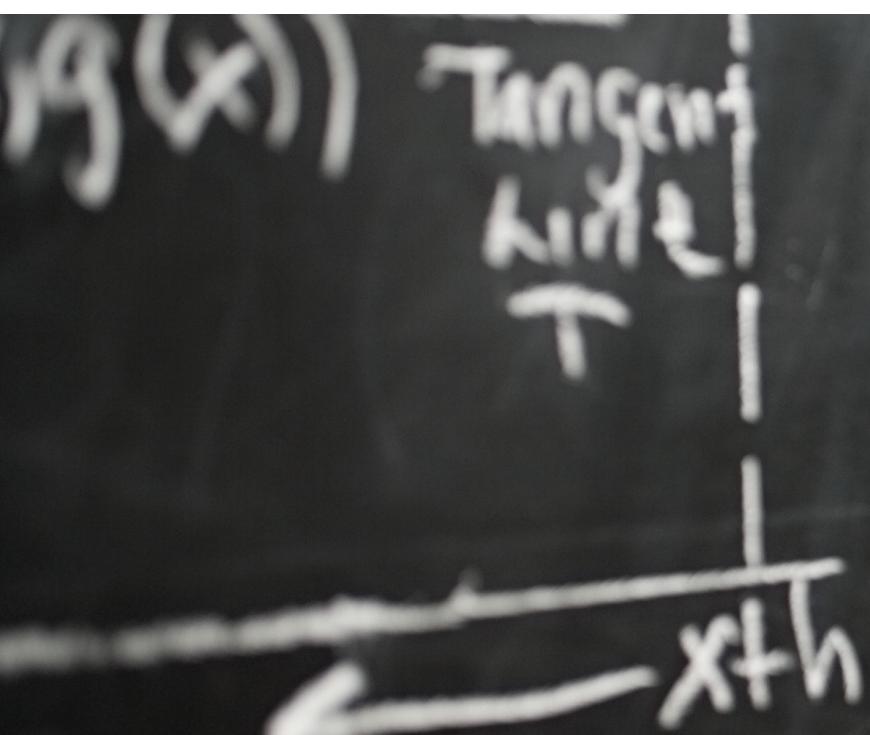


source: <https://community.sap.com/t5/application-development-blog-posts/developer-challenge-sap-hana-multi-model-using-python-in-sap-business/ba-p/13722560>

SAP Developers channel: <https://www.youtube.com/@sapdevs>

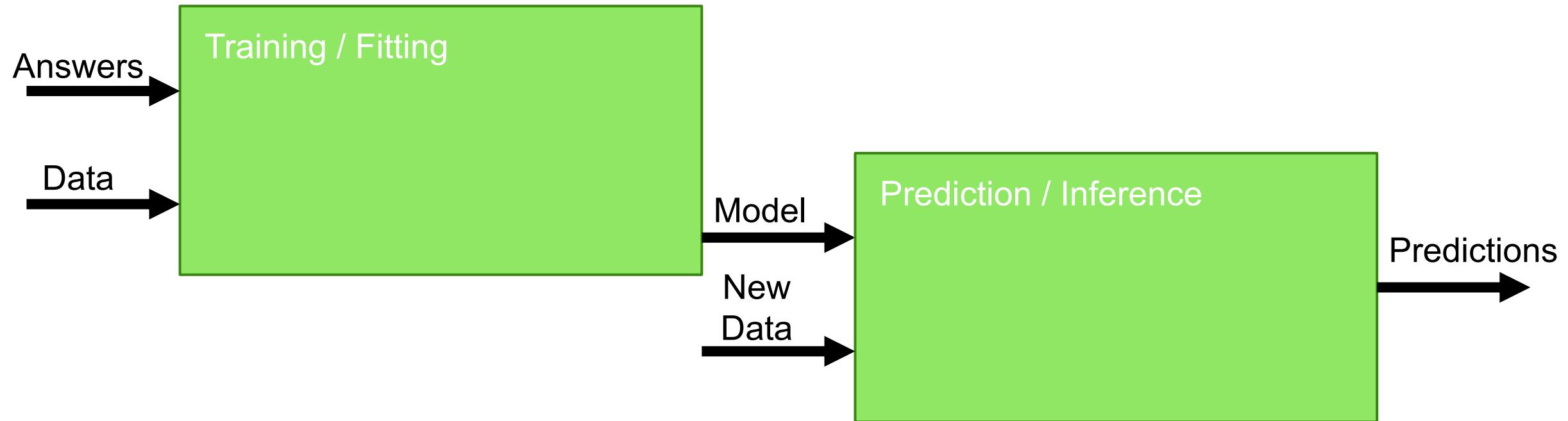
The screenshot shows a YouTube video player interface. At the top, the YouTube logo and search bar are visible. The main video frame displays two men in a video conference. On the left, Thomas Jung, a Developer Advocate, is shown with a blue radial background and the SAP logo. On the right, DJ Adams is shown in a room with wooden cabinets and blinds. The video player includes a progress bar at 0:45 / 1:01:20, control buttons (play, pause, volume), and a SAP logo indicating it's powered by Zoom. Below the video, a caption reads "Let's test drive Joule's generative AI features in SAP Build Code together! 1 of 2 (EMEA / APJ)". The video has 34.4K subscribers and 49 likes. A banner at the bottom right promotes "GENERATIVE UI" with the text "Anyone can build GENERATIVE UI with AI SDK 3.0".

# A bit of theory before we start

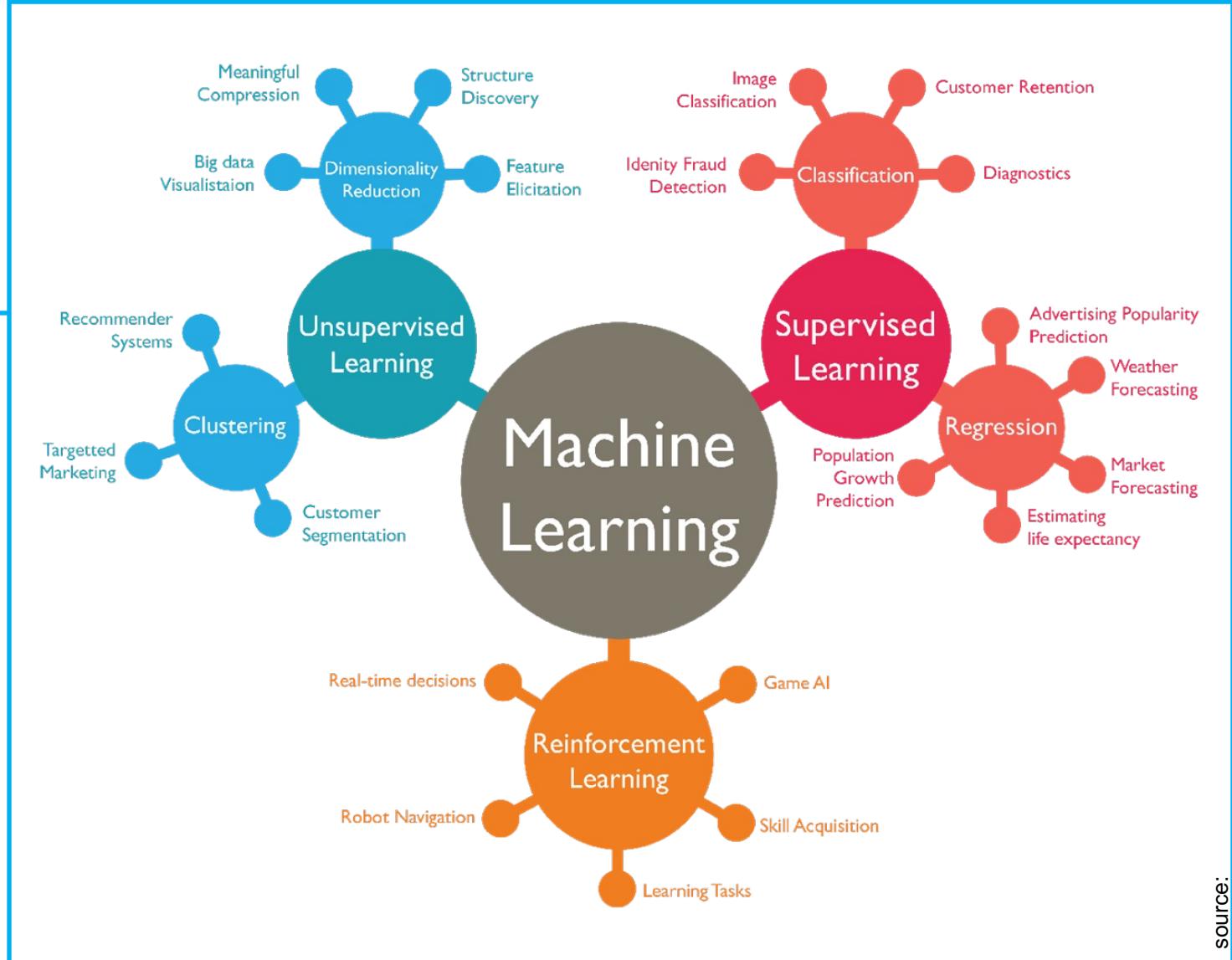
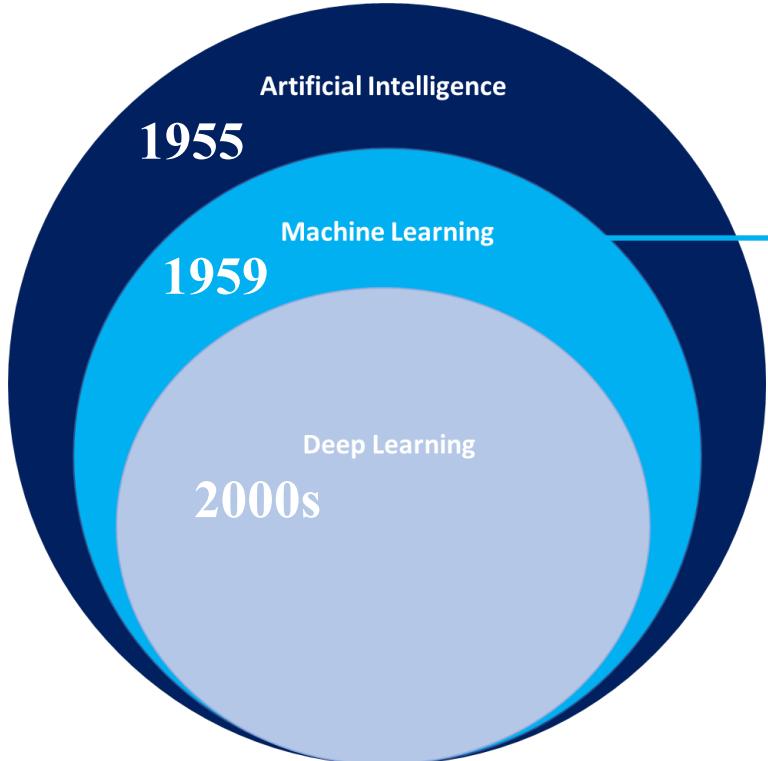


$$f'(x) = \lim_{h \rightarrow 0} \frac{(x+h)^2 - x^2}{h}$$
$$= \lim_{h \rightarrow 0} \frac{x^2 + 2xh + h^2 - x^2}{h}$$
$$= \lim_{h \rightarrow 0} \frac{2xh + h^2}{h}$$
$$= \lim_{h \rightarrow 0} (2x + h)$$
$$= 2x$$
$$f'(x) = \lim_{\Delta x \rightarrow 0} \frac{f(x+\Delta x) - f(x)}{\Delta x}$$

# Machine Learning



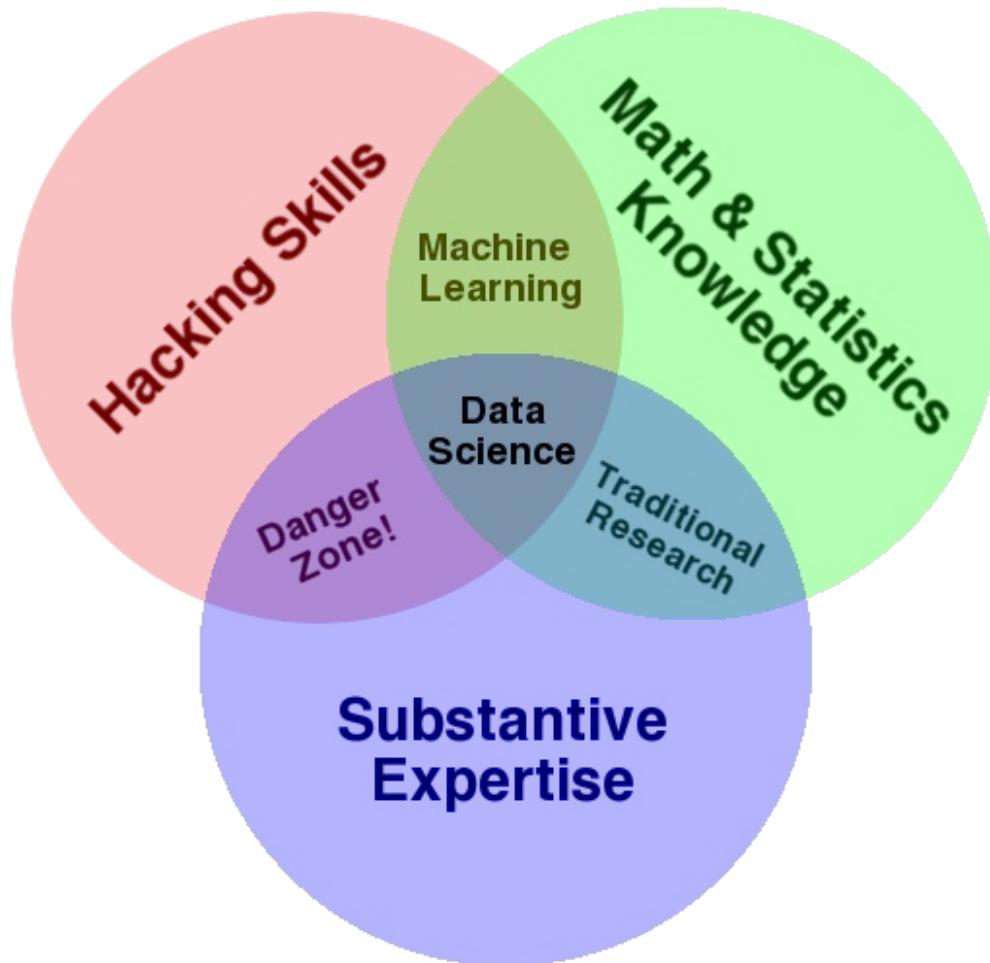
# Machine Learning Terminology



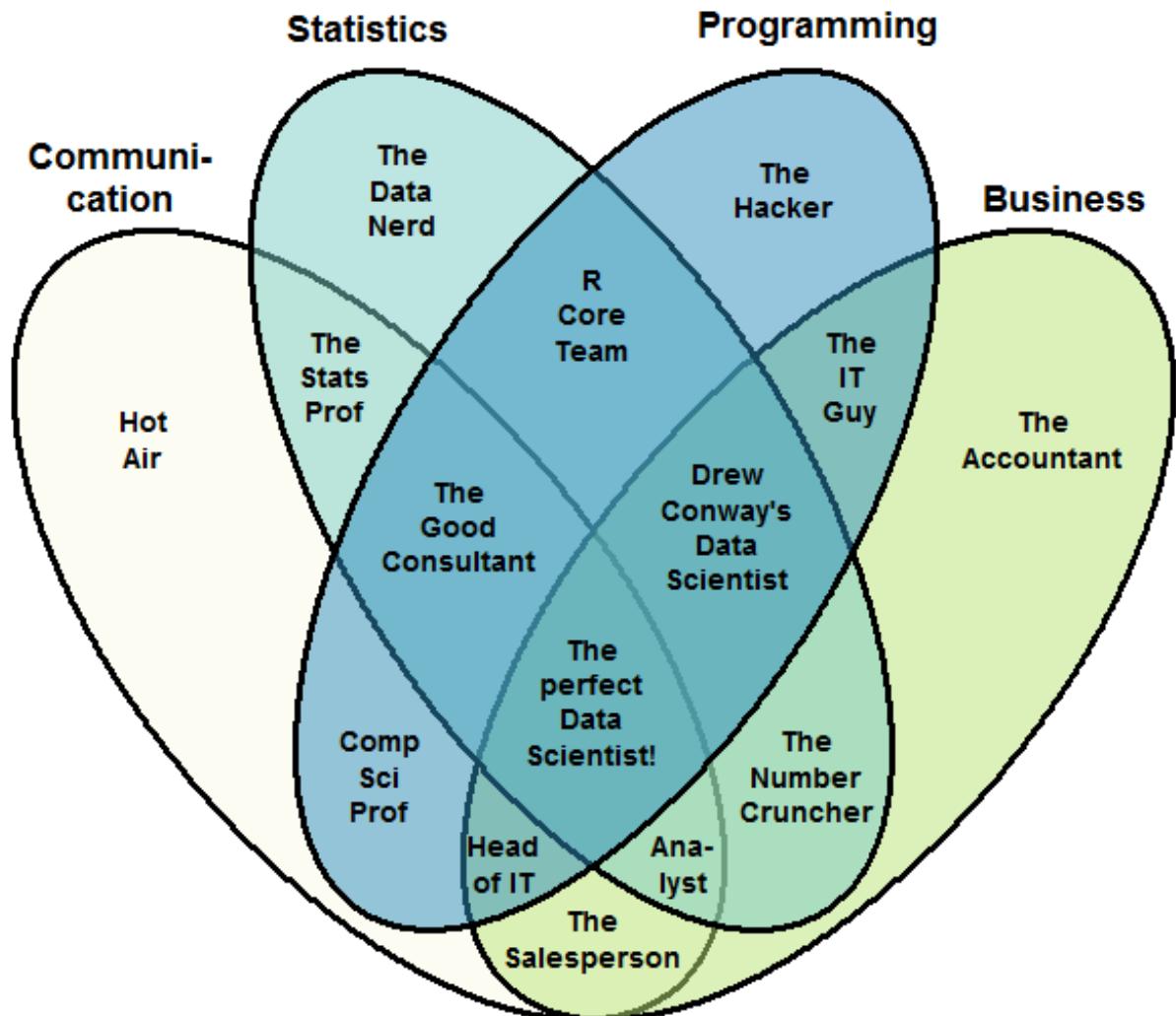
source:

[https://www.researchgate.net/publication/337958773 A Novel Approach for Improving Breast Cancer Risk Prediction using Machine Learning Algorithms A Survey](https://www.researchgate.net/publication/337958773_A_Novel_Approach_for_Improving_Breast_Cancer_Risk_Prediction_using_Machine_Learning_Algorithms_A_Survey)

# Who is the Data Scientist?

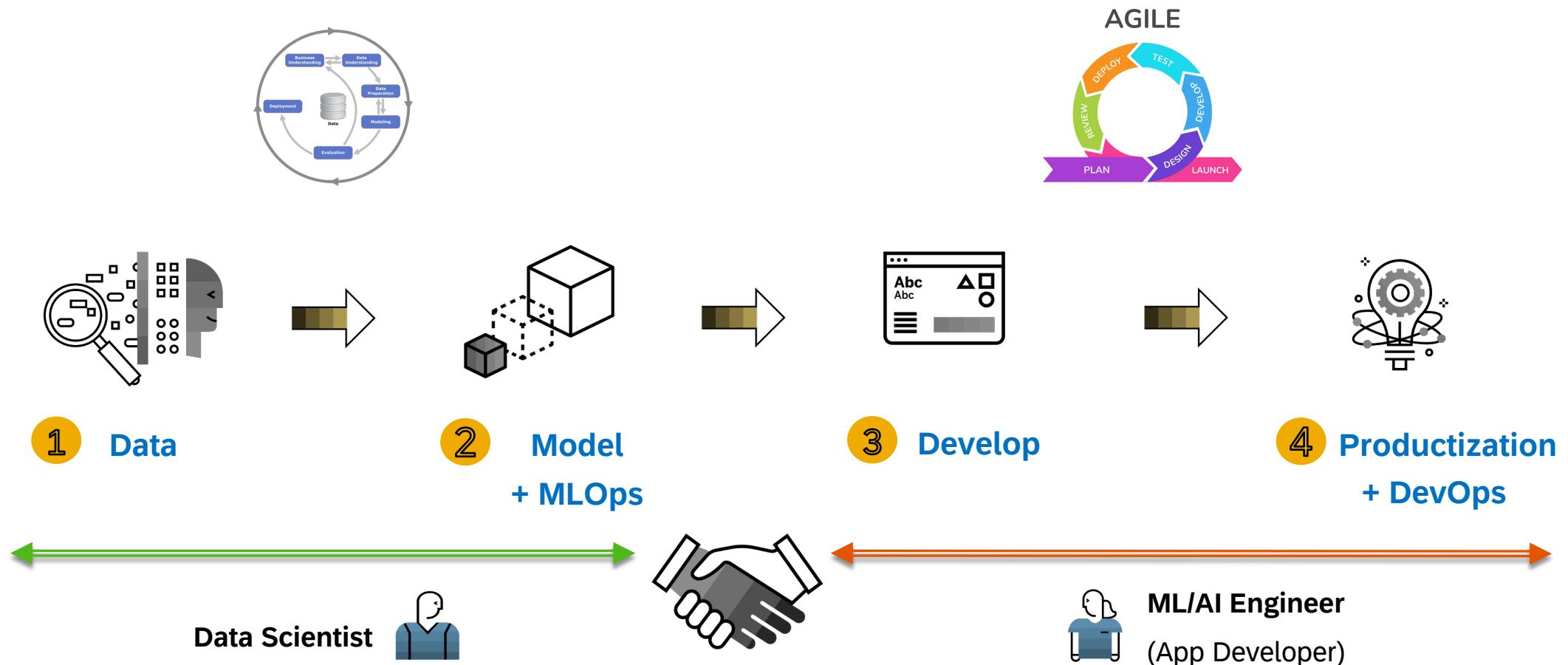


Drew Conway's Data Scientist Venn Diagram

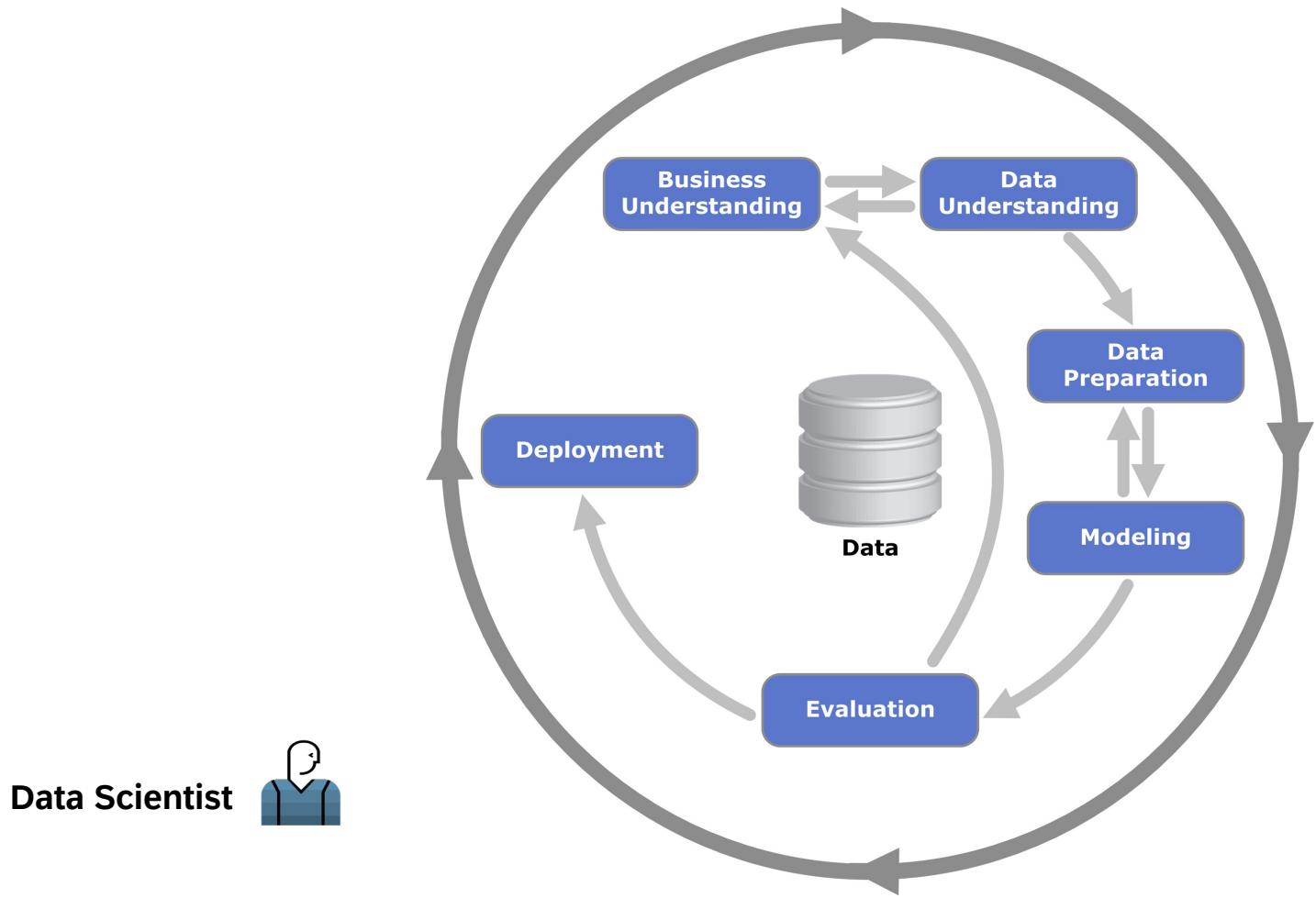


Stephan Kolassa's Data Scientist Venn Diagram

# Development Approach | Building an Intelligent Data Application



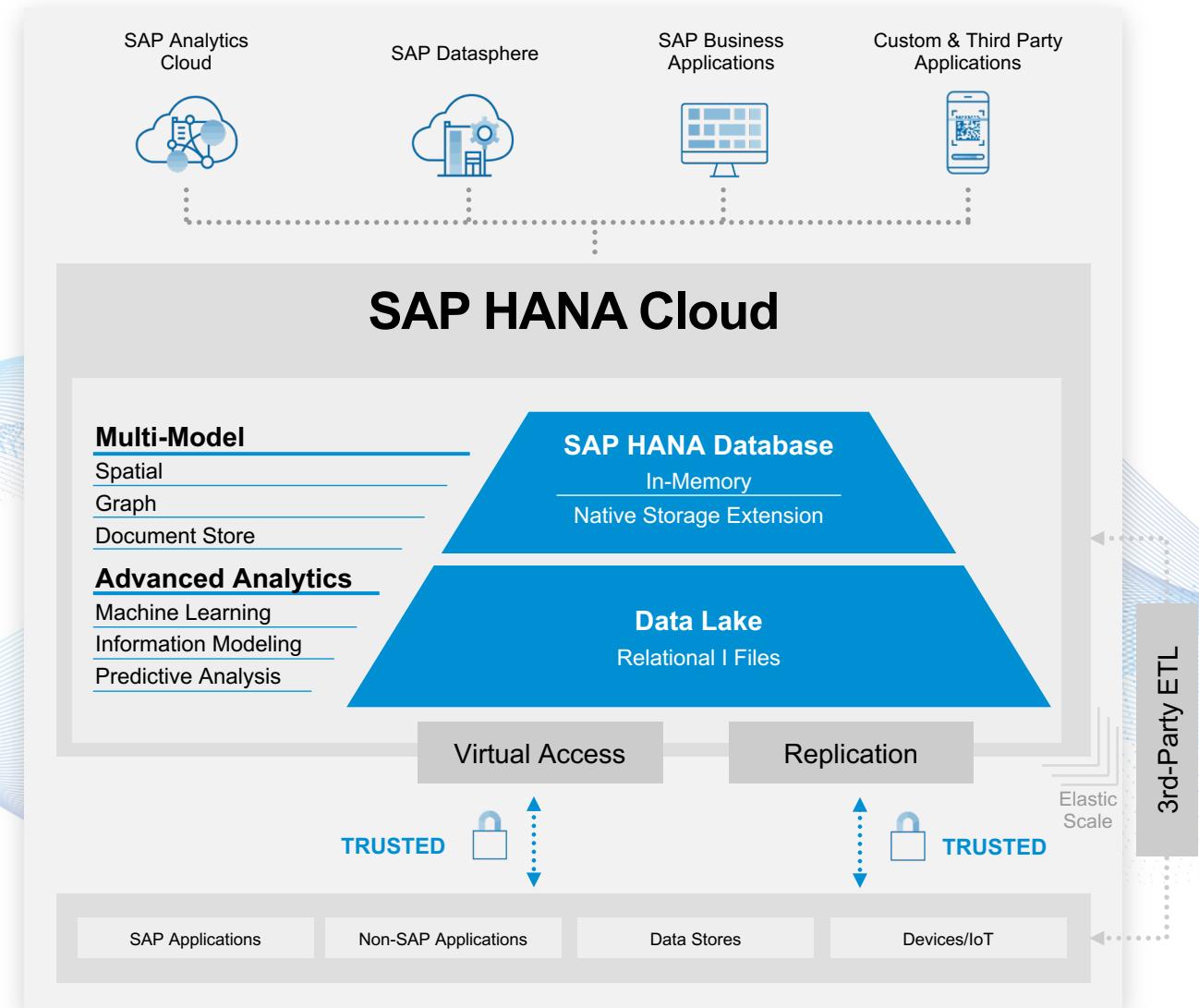
# Development Approach | Training a Model



# SAP HANA Cloud | Foundation for Intelligent Data Applications on SAP BTP

## Power Intelligent Data Applications with SAP HANA Cloud

- Running mission-critical applications and analytics with **one solution**
- Seamlessly blend **multi-model data** to enhance business processes
- Federate data **across hybrid systems** and multiple clouds
- Provide **proven in-memory performance** for all data needs



# Let's get busy



# Your ML Challenge today:

The screenshot shows the Kaggle website's 'Competitions' page. On the left is a sidebar with navigation links: kaggle, Create, Home, Competitions (which is selected), Datasets, Models, Code, Discussions, Learn, and More. The main content area has a title 'Competitions' and a sub-section 'Host a Competition'. Below this is a search bar with 'Search competitions' and a 'Filters' button. A row of category cards includes 'All Competitions' (Everything, past & present), 'Featured' (Premier challenges with prizes), 'Getting Started' (Approachable ML fundamentals), 'Research' (Scientific and scholarly challenges), 'Community' (Created by fellow Kagglers), and 'Playground' (Fun practice problems). A 'Get Started' section follows, featuring three competitions: 'Titanic - Machine Learning from Disaster' (highlighted with a red box), 'House Prices - Advanced Regression Techniques', and 'Spaceship Titanic'. Each card shows the competition name, a thumbnail image, a brief description, the number of teams, and status (Knowledge, Ongoing).

**Competitions**

Grow your data science skills by competing in our exciting competitions. Find help in the [documentation](#) or learn about [Community Competitions](#).

[Host a Competition](#)

Search competitions

Filters

All Competitions Everything, past & present

Featured Premier challenges with prizes

Getting Started Approachable ML fundamentals

Research Scientific and scholarly challenges

Community Created by fellow Kagglers

Playground Fun practice problems

Get Started

New to Kaggle?

These competitions are perfect for newcomers.

Titanic - Machine Learning from Disaster

Start here! Predict survival on the Titanic ...

Getting Started

16184 Teams

Knowledge Ongoing

House Prices - Advanced Regression Techniques

Predict sales prices and practice feature ...

Getting Started

4328 Teams

Knowledge Ongoing

Spaceship Titanic

Predict which passengers are transported...

Getting Started

2506 Teams

Knowledge Ongoing

# Exercises



**Repo:** <https://github.com/SAP-samples/hana-ml-py-codejam/>

(→ [https://bit.ly/CJ\\_HANAML](https://bit.ly/CJ_HANAML))

## **1. Pre-requisites:**

<https://github.com/SAP-samples/hana-ml-py-codejam/blob/main/prerequisites.md>

## **2. Exercises:**

<https://github.com/SAP-samples/hana-ml-py-codejam#the-exercises>

## **3. Worth watching:**

<https://github.com/SAP-samples/hana-ml-py-codejam#additional-learning-material>

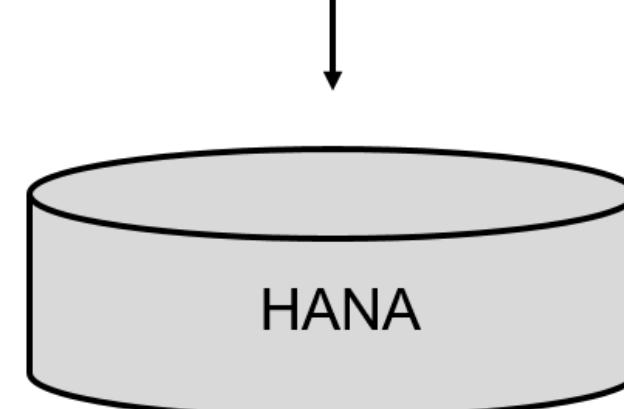
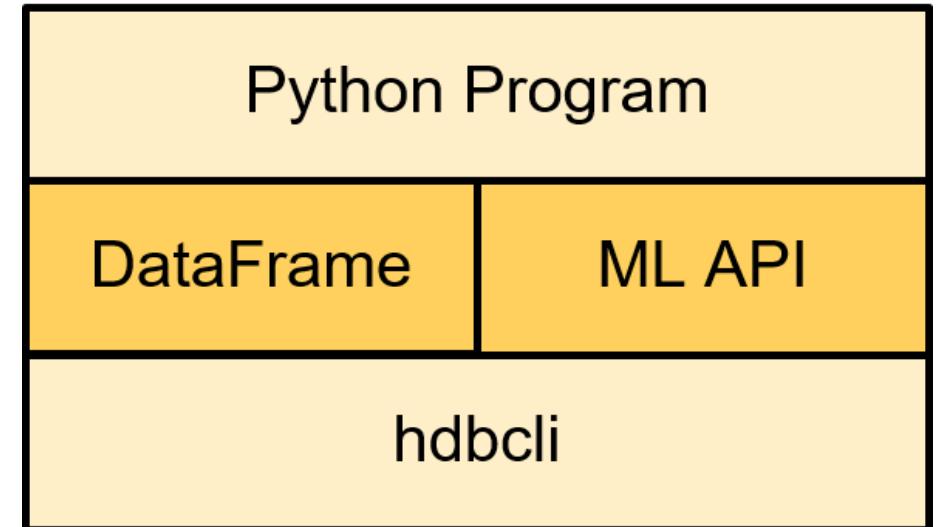
## **4. Try at home in your SAP BTP Trial:**

<https://github.com/SAP-samples/sap-community-developer-challenge-eda-hana>

# Understand DataFrame(s)

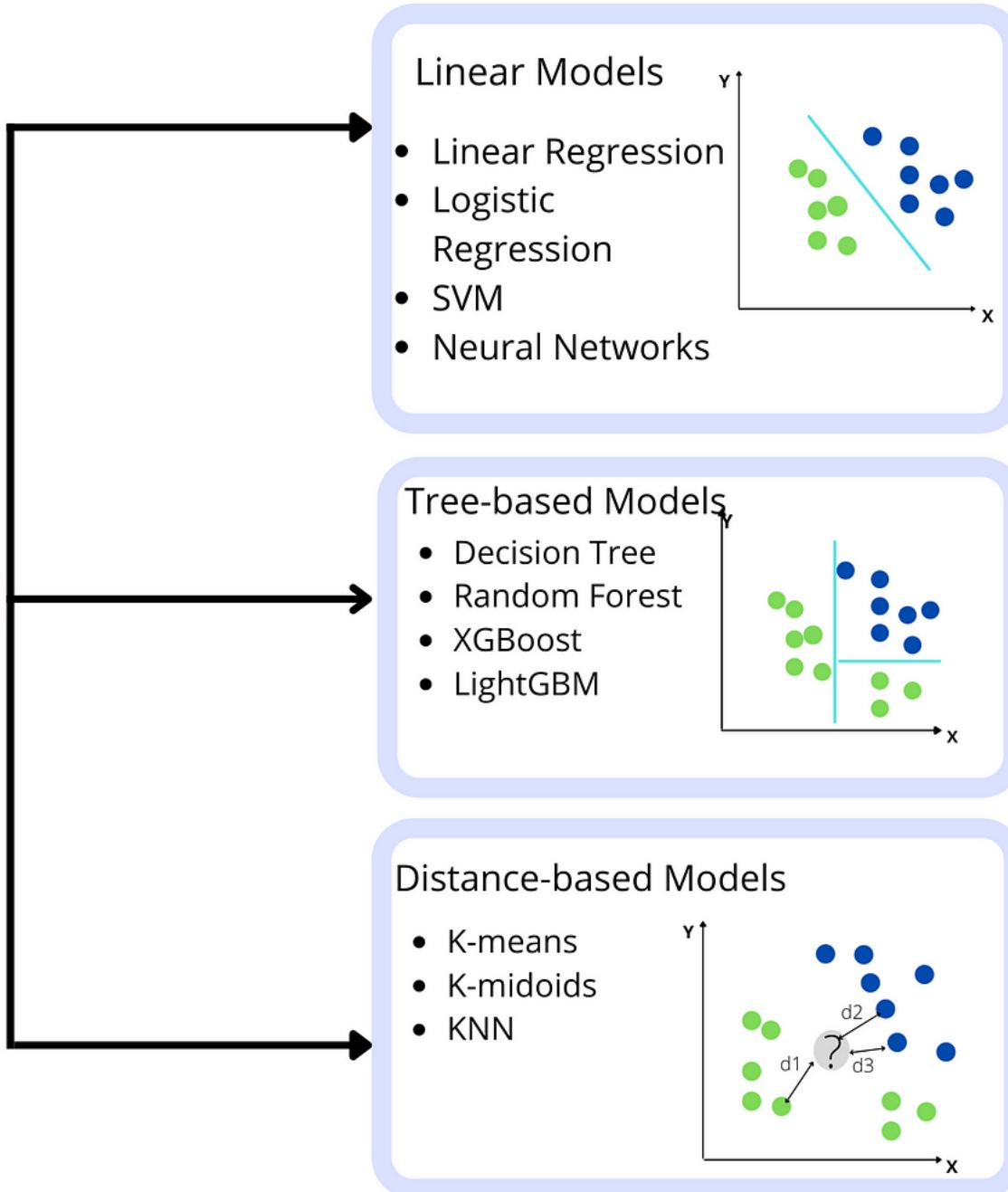
# Data Scientist using Python

Pandas DataFrame <-> HANA DataFrame

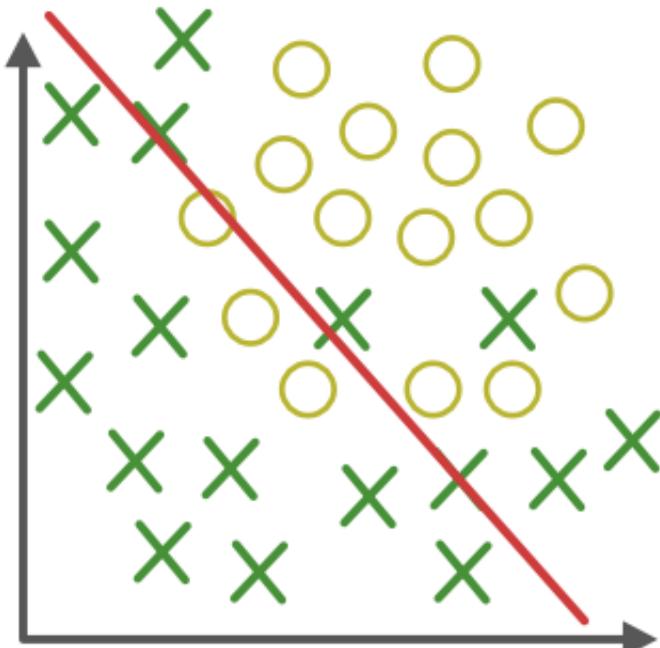


# Decision Boundary

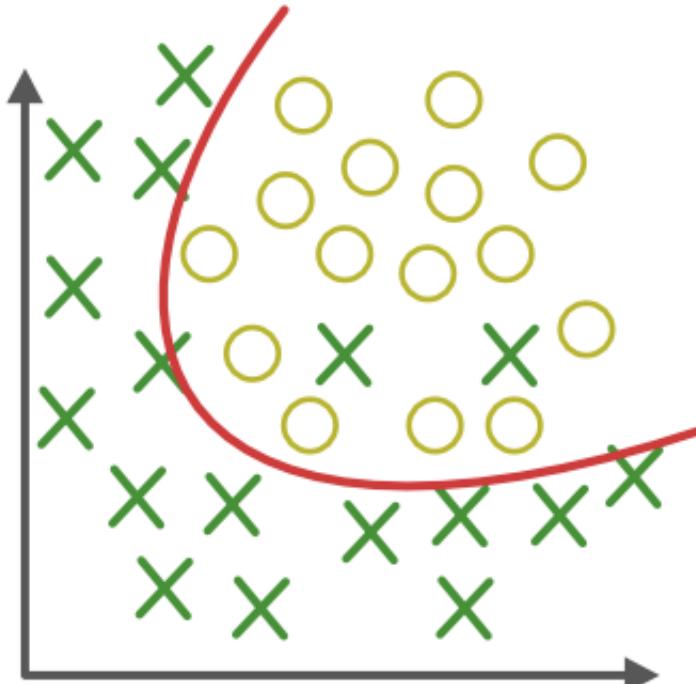
Decision  
Boundary



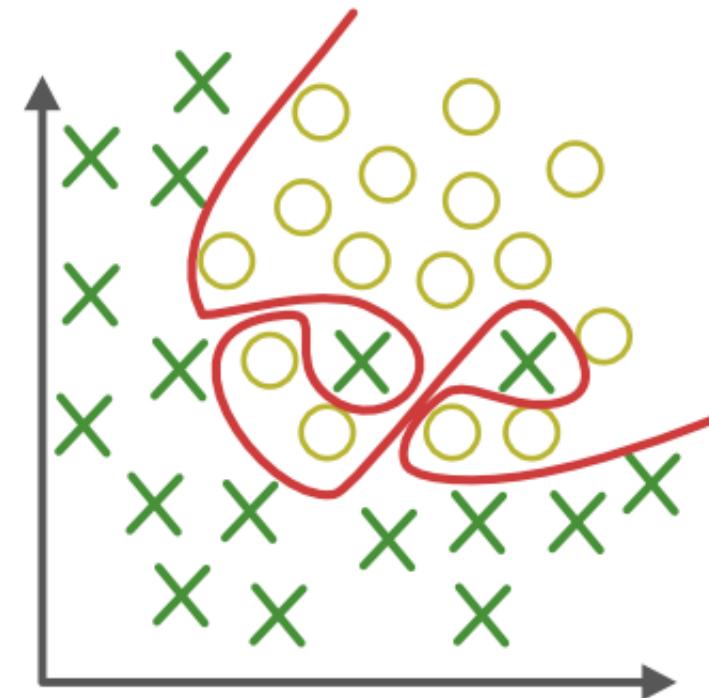
# Underfitting and Overfitting



**Under-fitting**  
(too simple to  
explain the variance)



**Appropriate-fitting**

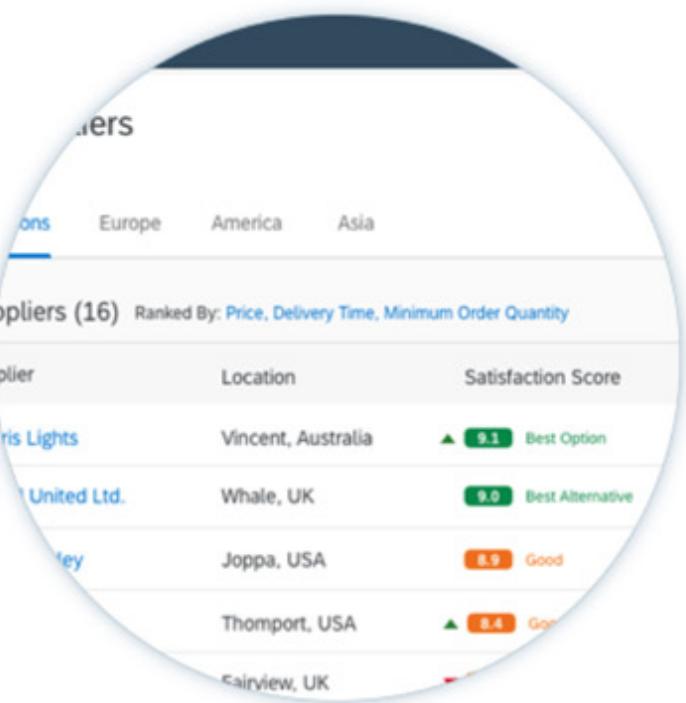


**Over-fitting**  
(forcefitting--too  
good to be true)

<https://experience.sap.com/fiori-design-web/explainable-ai/>

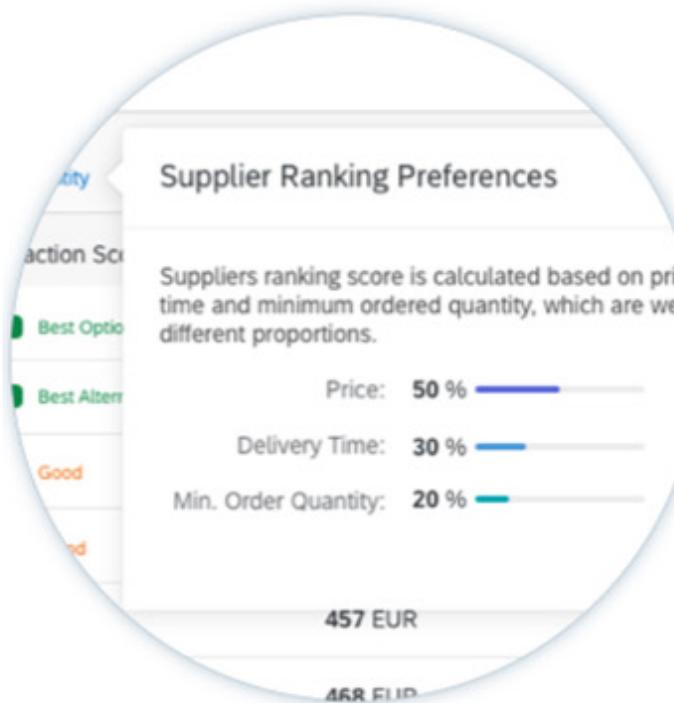
### Level 1

WHAT



### Level 2

WHY



### Level 3

HOW



**Minimum**

**Simple**

**Expert**

## Confusion matrix

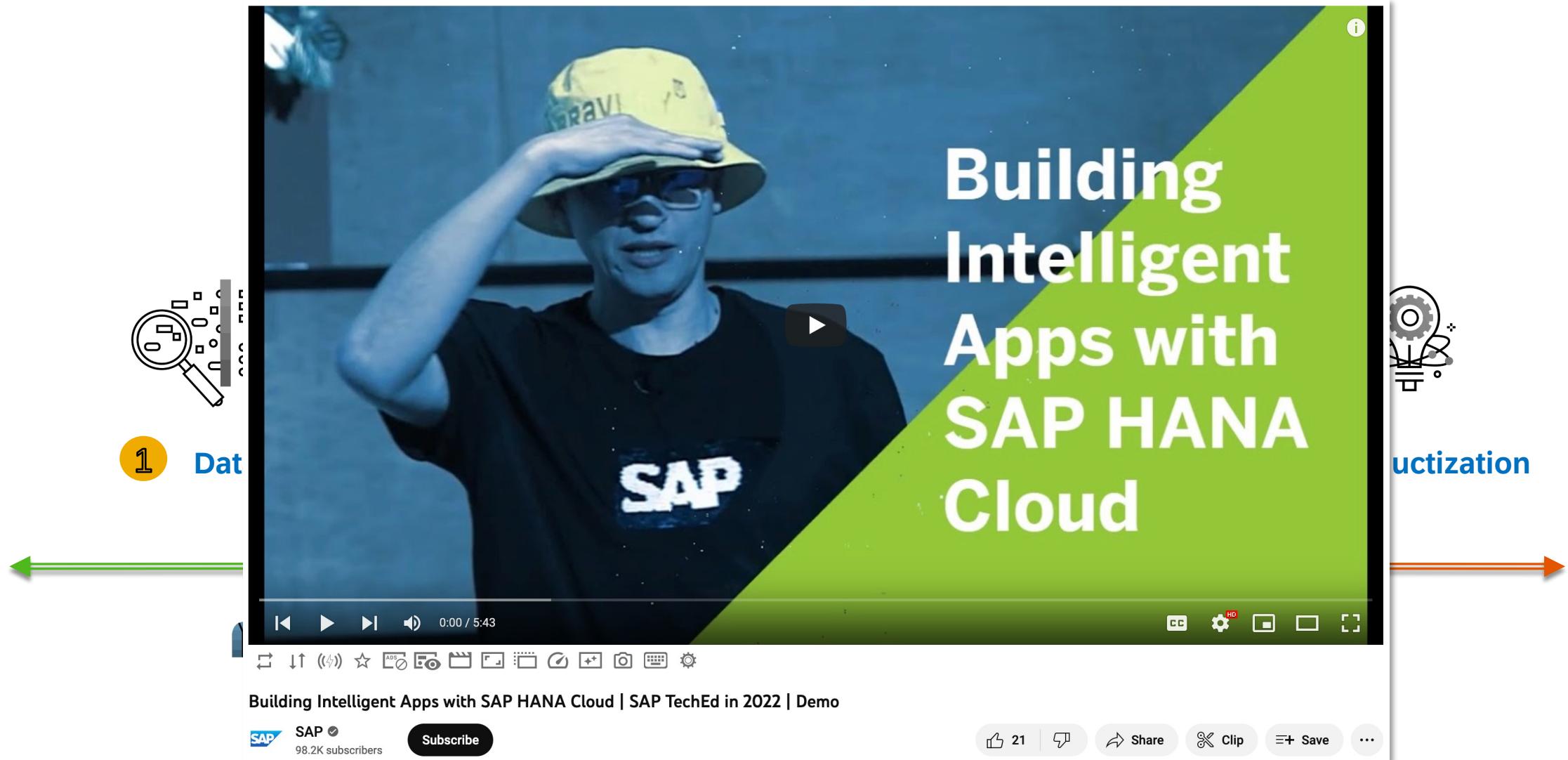
In predictive analytics, a **table of confusion** (sometimes also called a **confusion matrix**) is a table that reports the number of true positives, false negatives, false positives, and true negatives.

		Predicted class
		$P$
		$N$
Actual class	$P$	True positives (TP)
	$N$	False negatives (FN)
$N$	$P$	False positives (FP)
	$N$	True negatives (TN)

source: <https://subscription.packtpub.com/book/data/9781787125933/6/ch06lvl1sec41/looking-at-different-performance-evaluation-metrics>

# **Additional content**

## Development Approach | Building an Intelligent Data Application (demo)

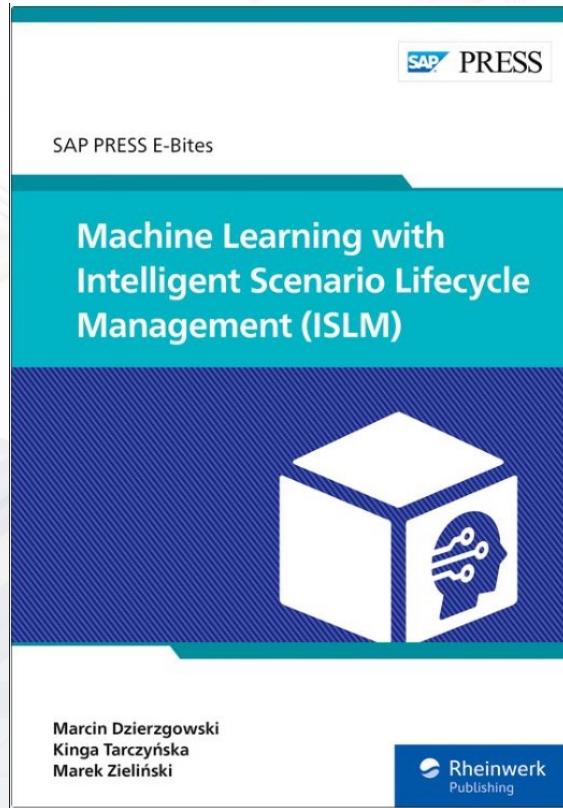


# Code samples: <https://github.com/SAP-samples/hana-ml-samples>

Screenshot of a GitHub repository page for "hana-ml-samples / Python-API / usecase-examples /". The page shows a list of code samples with their names, last commit messages, and dates.

The repository was created by cmog (FairML - Fair Recruiting Model) on f009115 · 3 weeks ago. There is a History link available.

Name	Last commit message	Last commit date
..		
diabetes-classification	Create OpenSAP-SAPHANA-HANA Machine Learning Demo (2...	2 years ago
estimate-car-price	update estimate car price	3 years ago
fairml-examples	FairML - Fair Recruiting Model	3 weeks ago
fraud-detection	fraud-detection use case	2 years ago
melbourne-housing-price	Add files via upload	4 years ago
ml-anonymized-data	Tutorial example - ML with HANA-ML Python ML client on HAN...	4 years ago
multimodel-analysis-airroutes	Update README.md	4 years ago
sapcommunity-automl-examples	update community call examples	2 years ago
sapcommunity-hanaml-challenge	Create SAP HANA Cloud Machine Learning Demo - Employee C...	7 months ago



## Machine Learning with Intelligent Scenario Lifecycle Management (ISLM)

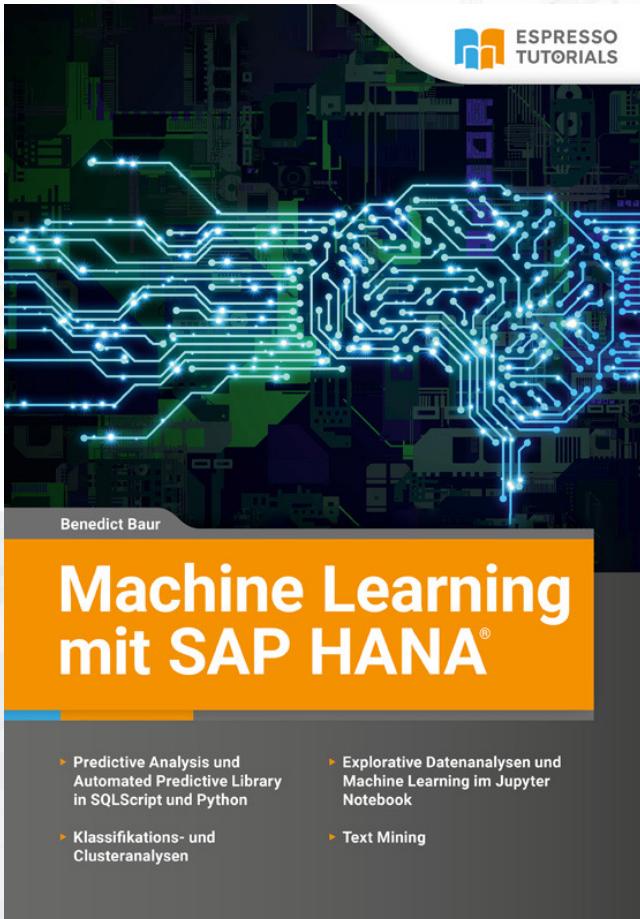
115 pages, 2023, E-Book  
ISBN 978-1-4932-2395-4

[www.sap-press.de/5668](http://www.sap-press.de/5668)

## Update your machine learning skills with Intelligent Scenario Lifecycle Management (ISLM)!

In this E-Bite, you'll develop a complete machine learning application for SAP S/4HANA using SAP HANA PAL, from data preparation and model building to training and prediction generation. You'll learn to use the ISLM framework to simplify machine learning implementation with standard apps for managing intelligent scenarios. Learn the ins and outs of machine learning with ISLM in this how-to guide!

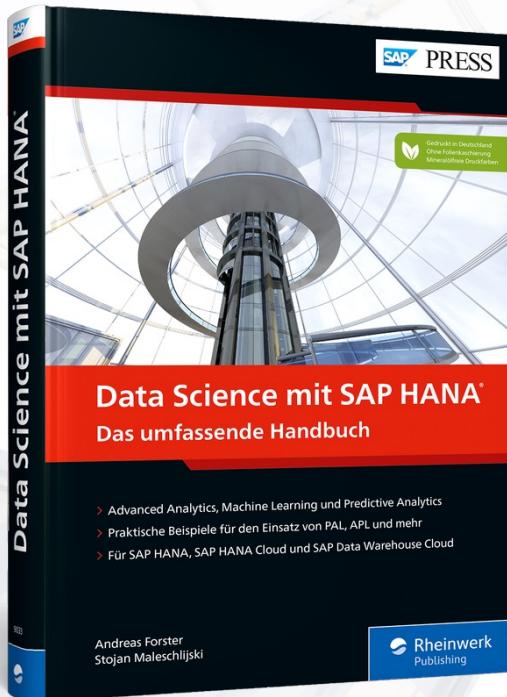
- Learn to use the ISLM framework in SAP S/4HANA
- Develop an end-to-end machine learning scenario with SAP HANA PAL
- Prepare data, train models, and implement predictions with ISLM



**Machine Learning mit SAP HANA**  
von Benedict Baur  
320 Seiten, 1. Auflage, ISBN: 9783960121237

**Seit einigen Jahren preist die SAP das intelligente Unternehmen als Wettbewerbsvorteil an.** Mit diesem Buch springen Sie mitten hinein in die Welt der künstlichen Intelligenz (KI). Erfahren Sie, welche Algorithmen die leistungsstarke In-Memory-Datenbank SAP HANA für das Machine Learning (ML) bereithält. Auf deren Basis lassen sich Muster und Gesetzmäßigkeiten in Datenbeständen erkennen und Vorhersagen treffen, die helfen, Geschäftsprozesse zu verbessern.

- Predictive Analysis und Automated Predictive Library in SQLScript und Python
- Klassifikations- und Cluster-Analysen
- Explorative Datenanalysen und Machine Learning im Jupyter Notebook
- Text Mining



## Mit SAP HANA, SAP HANA Cloud und SAP Data Warehouse Cloud ist viel mehr möglich als das Speichern großer Datenmengen.

In diesem Buch erfahren Sie, wie Sie die Automated Predictive Library (APL) und die Predictive Analysis Library (PAL) einsetzen können, um komplexe Auswertungen vorzunehmen und Vorhersagen zu treffen. Praktische Beispiele zu Klassifizierung, Textanalyse, Clustering, Regression u.v.m. zeigen Ihnen die vielfältigen Möglichkeiten auf und lassen sich direkt auf Ihre Anwendungsfälle übertragen.

- Advanced Analytics, Machine Learning und Predictive Analytics
- Praktische Beispiele für den Einsatz von PAL, APL und mehr
- Für SAP HANA, SAP HANA Cloud und SAP Data Warehouse Cloud

### Data Science mit SAP HANA

Das umfassende Handbuch

von [Andreas Forster, Stojan Maleschlijski](#)

<https://www.rheinwerk-verlag.de/data-science-mit-sap-hana/>

# SAP HANA Cloud Multi-model Further Learning

## SAP HANA Cloud Basic Trial

- 30-days own-schema shared-instance
- <https://www.sap.com/products/technology-platform/hana/guided-experience.html>

## SAP HANA Cloud Trial

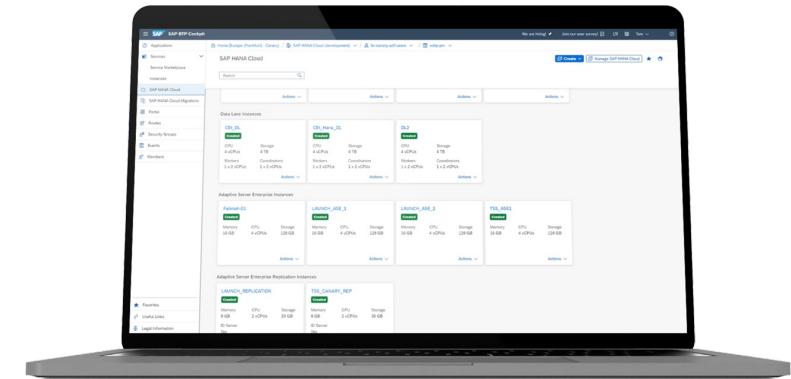
- 3x30-days own-instance in SAP BTP Trial
- 16GB RAM, 1 vCPU
- <https://developers.sap.com/tutorials/hana-trial-advanced-analytics.html>

## SAP HANA Cloud Free Tier

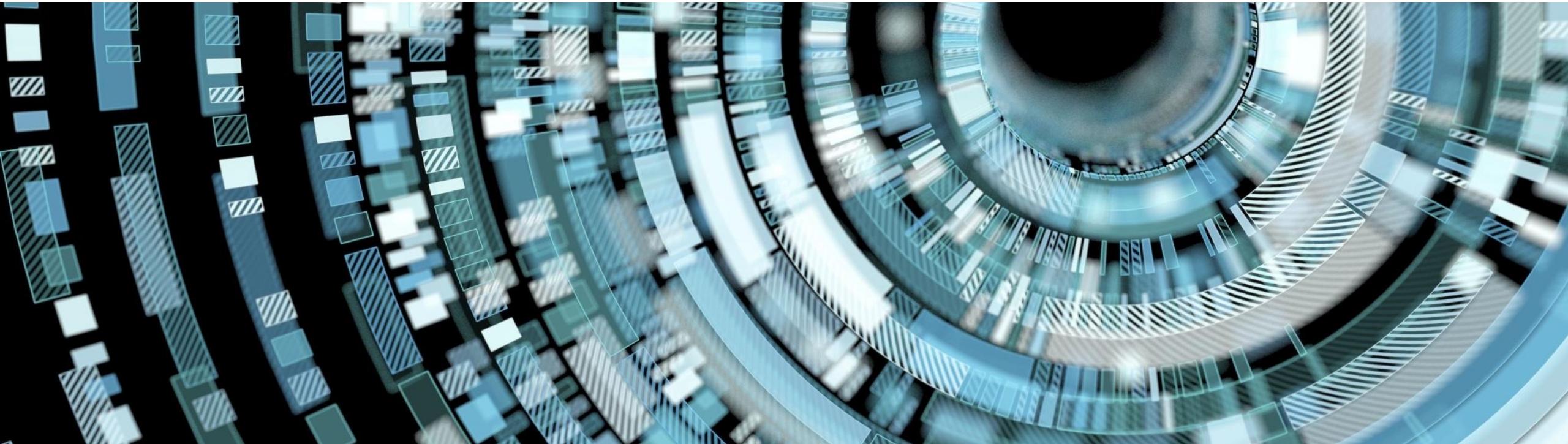
- 30 GB RAM, 2 vCPUs
- <https://developers.sap.com/mission.hana-cloud-database-get-started.html>

## SAP TechEd 2023 exercises

- DAT285v - Building Intelligent Data Applications with SAP HANA Cloud: <https://github.com/SAP-samples/teched2023-DA285v>
- DA263 - Build Innovative Business Applications with Database Services: <https://github.com/SAP-samples/teched2023-DA263>



# SAP Business AI portfolio



# SAP Business AI approach

Relevant. Reliable. Responsible.

Finance | Supply Chain | HR | Procurement | Marketing and Commerce | Sales and Services | IT



A copilot that truly understands your business

## Embedded AI capabilities

Cloud ERP

Human capital management

Spend management  
and business network

Customer relationship  
management

Business Technology  
Platform

## AI Foundation

on Business Technology Platform

## AI ecosystem partnerships and investments



ANTHROPIC



cohere

databricks

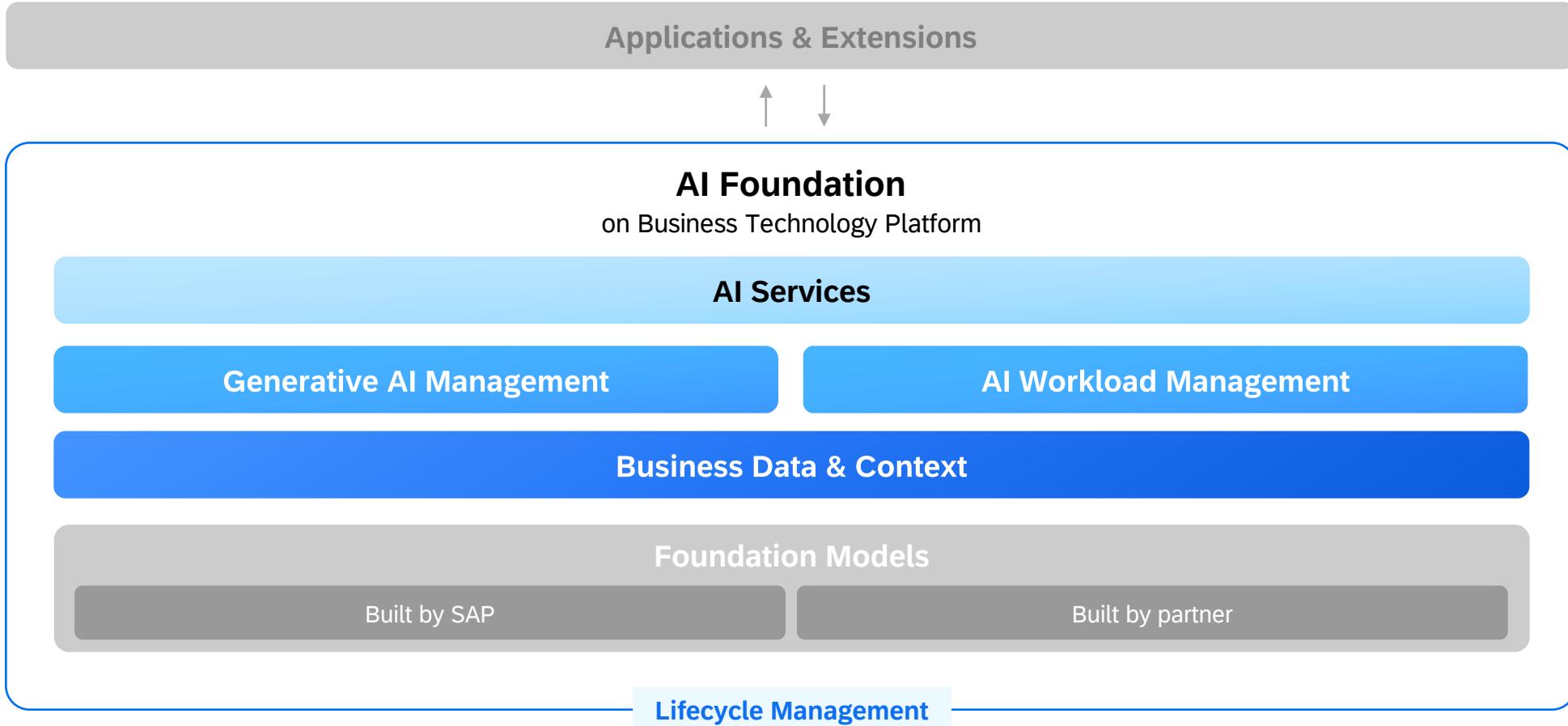
DataRobot

Google Cloud

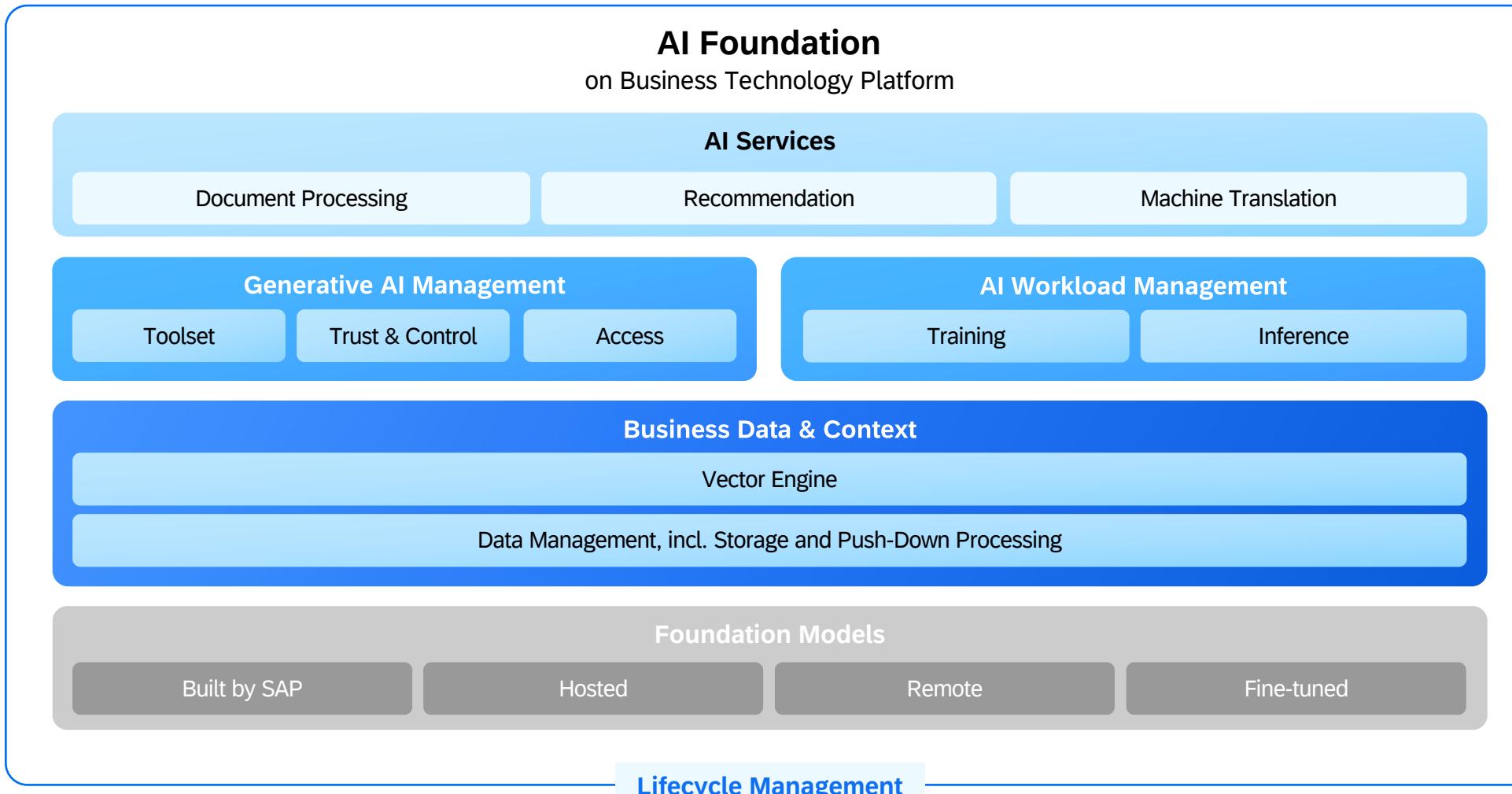
IBM

Microsoft

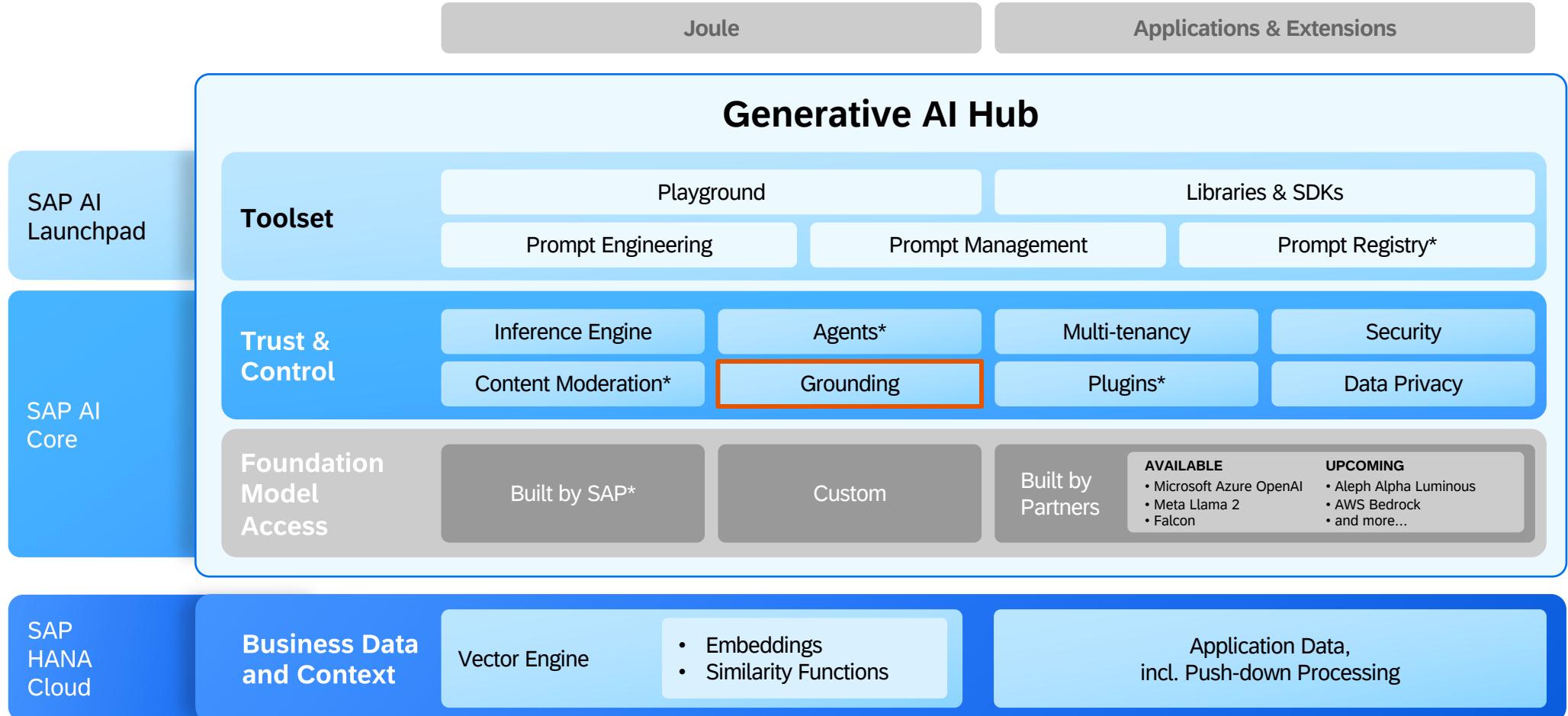
# A complete set of services for AI developers on SAP BTP



# A complete set of services for AI developers on SAP BTP



# Generative AI Hub: integrate AI into applications, seamlessly



Please, support Ukrainian business 💙💛 eg. Ugears Mechanical Models

<https://ugearsmodels.com/>

Free shipping on all orders of €60 or more!

UGEARs  
Mechanical Models

CATALOG ▾ BEST DEALS CUSTOMER SERVICE ▾ UGEARs WORLDWIDE GIFT IDEAS ❤️

English ▾

SEARCH

Facebook Twitter Instagram Pinterest YouTube LinkedIn TikTok

NEW RELEASE

SERENITY'S DREAM YACHT

NASA SPACE SHUTTLE DISCOVERY

RESCUE HOVERCRAFT

STEGOSAURUS

LEARN MORE

SELF ASSEMBLY

Details are already cut and ready to assemble

MECHANICAL

The models produce motion

EDUCATIONAL

Perfect for family projects through hands-on STEM learning

<https://ugearsmodels.com/catalogue/preorder5/>



**Thank you // Дякую // Hartelijk dank!**

Contact information:

Witalij Rudnicki, **SAP Developer Advocacy**

