

The Developer Advocates present

# SAP CodeJam

2024

> Getting Started with  
Machine Learning using SAP HANA



Isernhagen, Germany



Sep 11, 2024



Stuttgart, Germany



Sep 13, 2024



# Witalij Rudnicki

aka @Sygymundovych  
aka Vitaliy Rudnytskiy  
aka Віталій Рудницький

- 11 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**

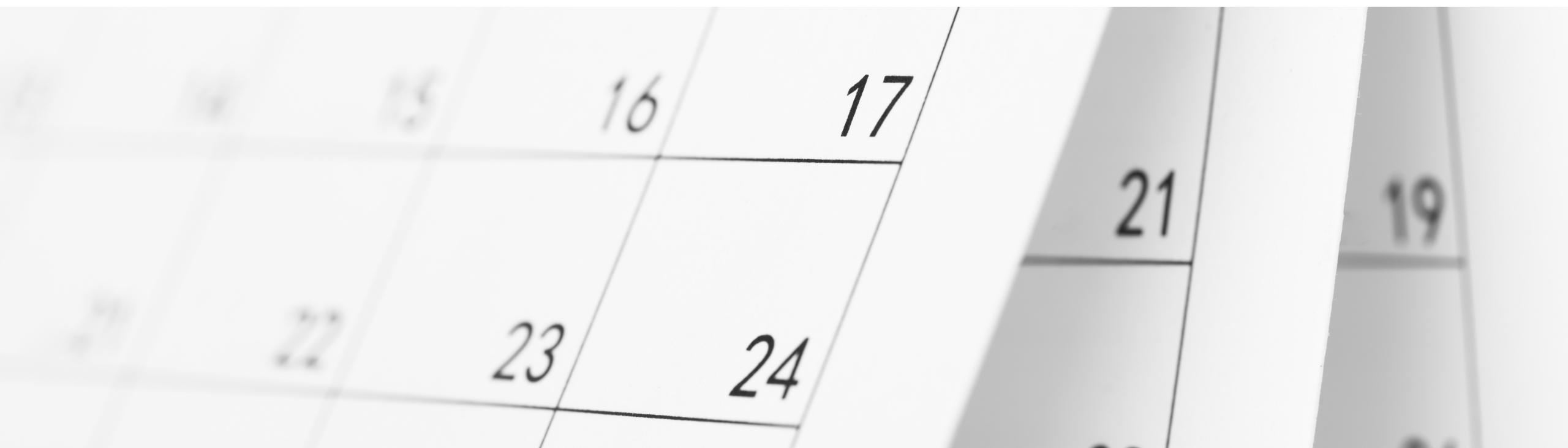


# Stuttgart Stammtisch 🍺

<https://www.meetup.com/de-DE/SAP-Community-Stammtisch-Meetup/>



# **Events not be missed**



# 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/2024/08/sap-teched-in-2024-registration-now-live/>:

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

**SAP TechEd On Tour:**

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

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

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

1. ABAP and SAP Cloud Application Programming Model
2. Tooling
3. Integration
4. MAD  
(Machine Learning, AI, and Data)
5. Frontend



Devtoberfest

SAP TechEd

# 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 | <a href="#">Setup exercise</a>   | <a href="#">Submissions</a> |
| 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, the caption reads: "Let's test drive Joule's generative AI features in SAP Build Code together! 1 of 2 (EMEA / APJ)". The video has 49 likes and 34.4K subscribers. The SAP Developers channel page is shown below the video.

THOMAS JUNG  
Developer Advocate

SAP

Thomas Jung

DJ Adams

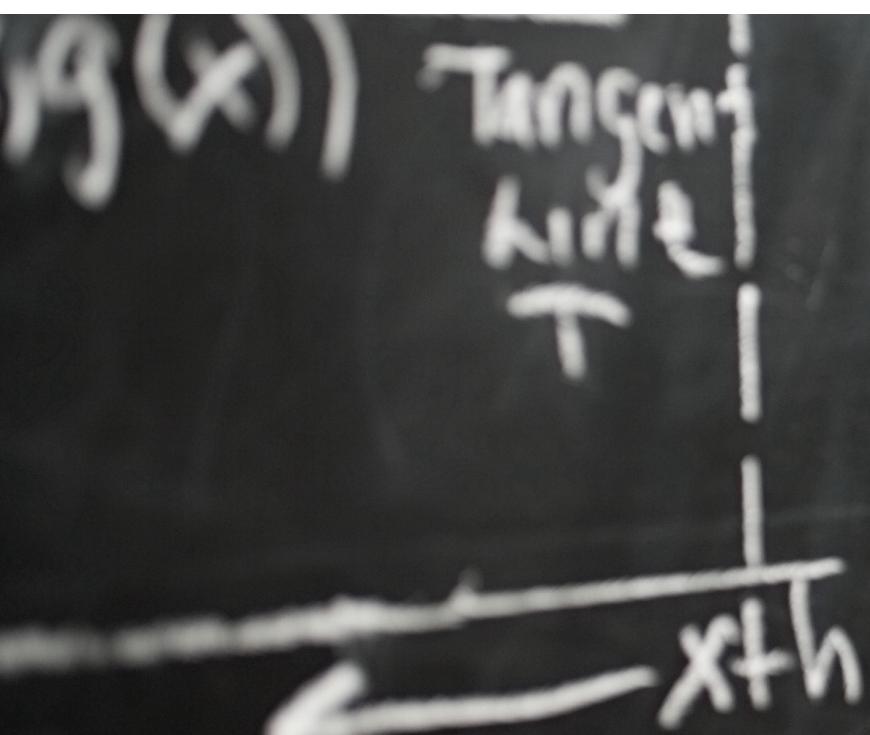
Let's test drive Joule's generative AI features in SAP Build Code together! 1 of 2 (EMEA / APJ)

All From SAP Developers SAP AI Re >

SAP Developers 34.4K subscribers Subscribed 49 Share ...

Anyone can build GENERATIVE UI with AI SDK 3.0

# A bit of theory before we start

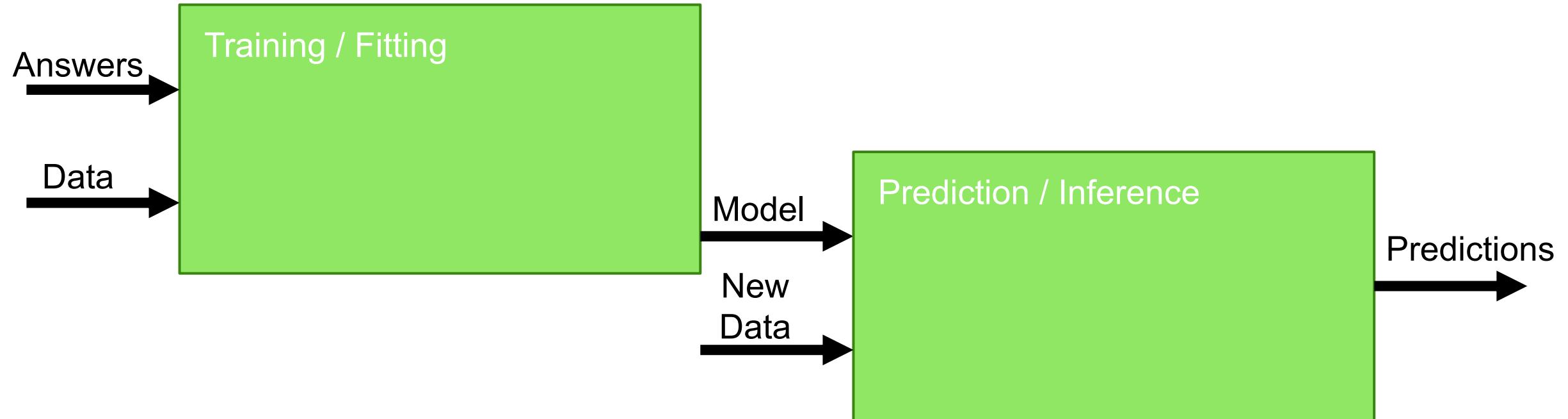


$$f'(x) = \lim_{h \rightarrow 0} \frac{(x+h)^2 - x^2}{h}$$

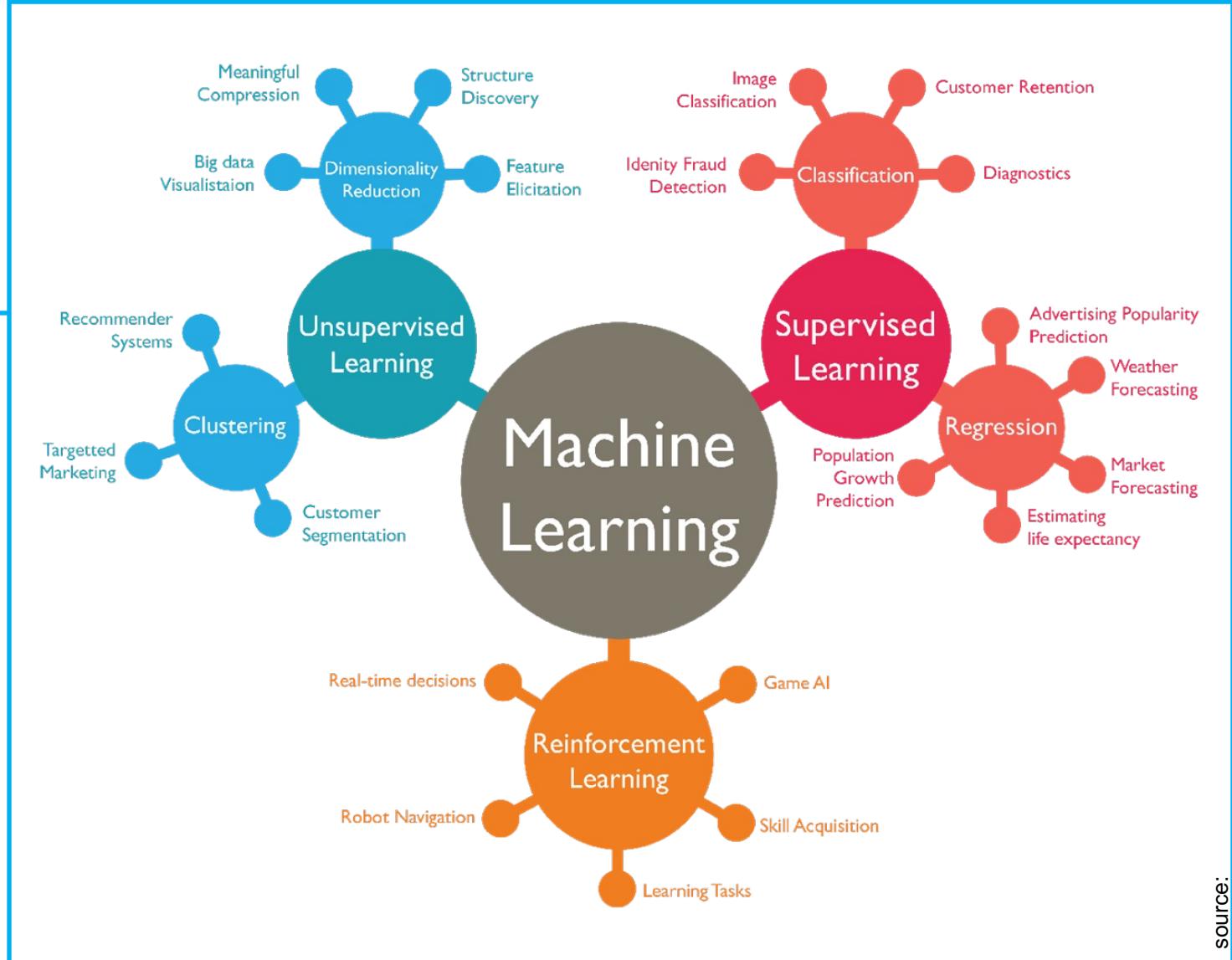
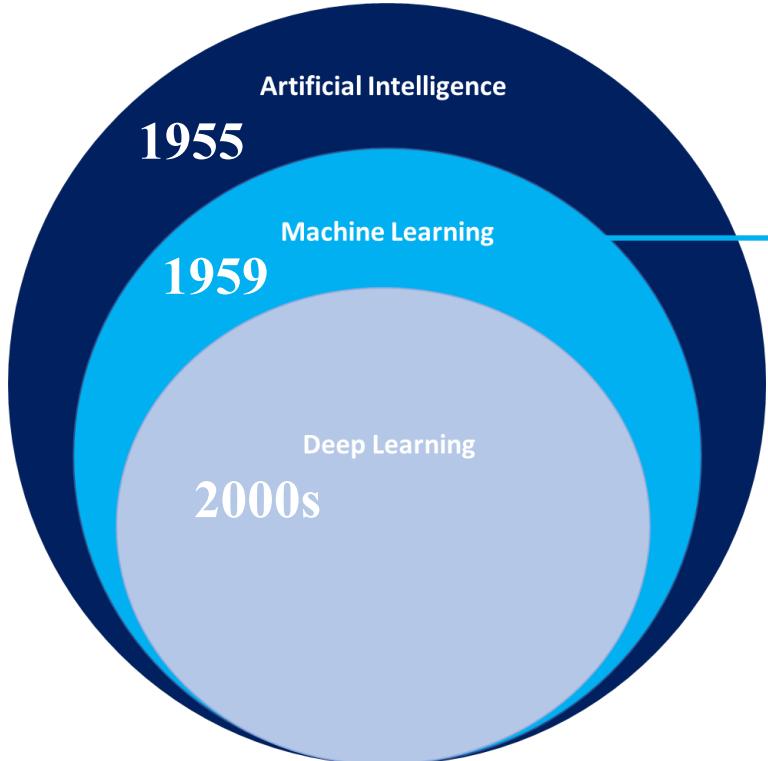
$$= \lim_{h \rightarrow 0} \frac{x^2 + 2xh + h^2 - x^2}{h}$$

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

# Machine Learning



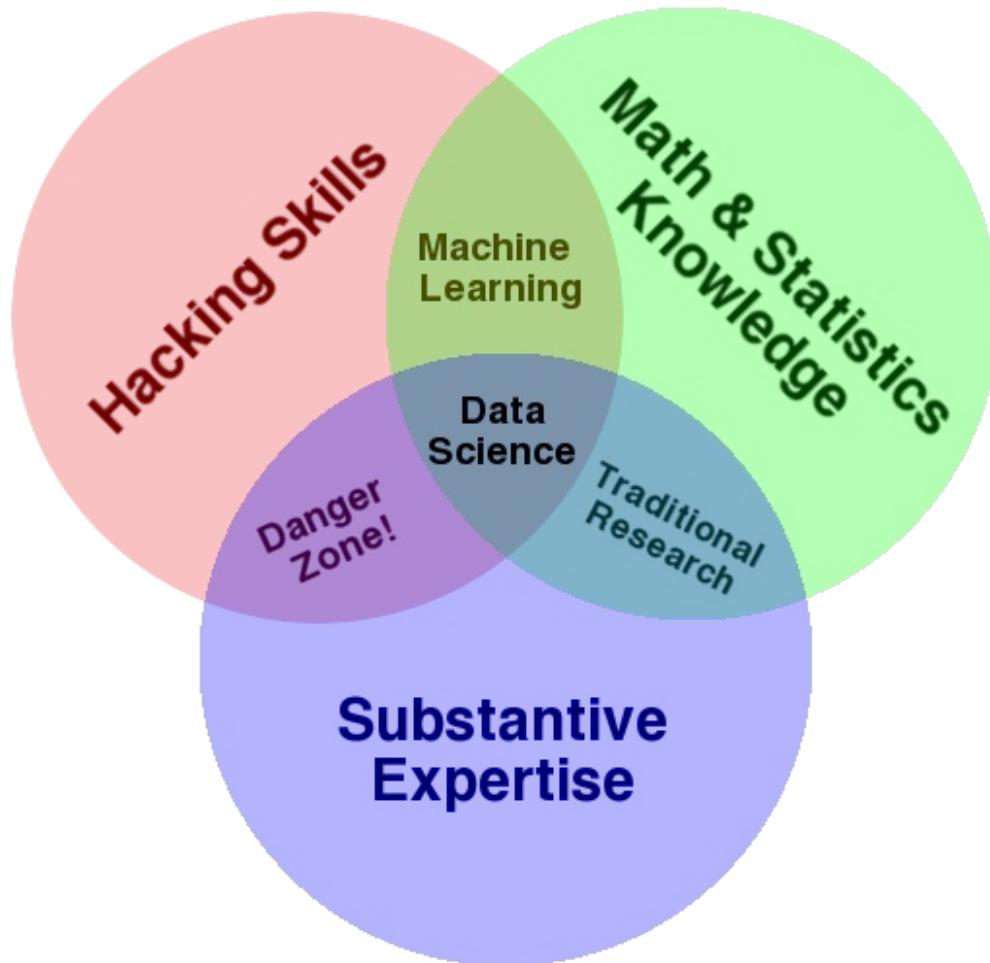
# Machine Learning Terminology



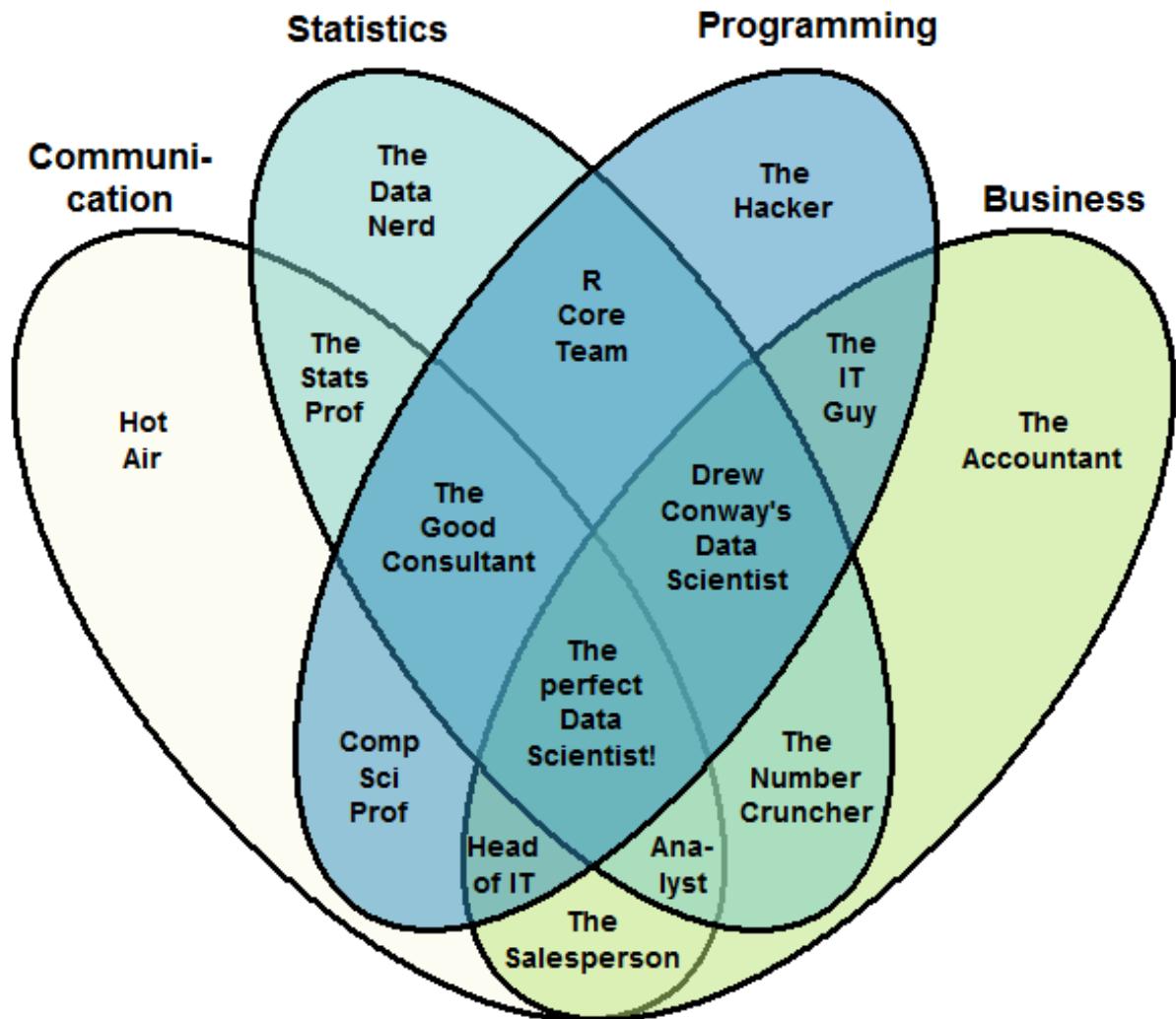
source:

[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?

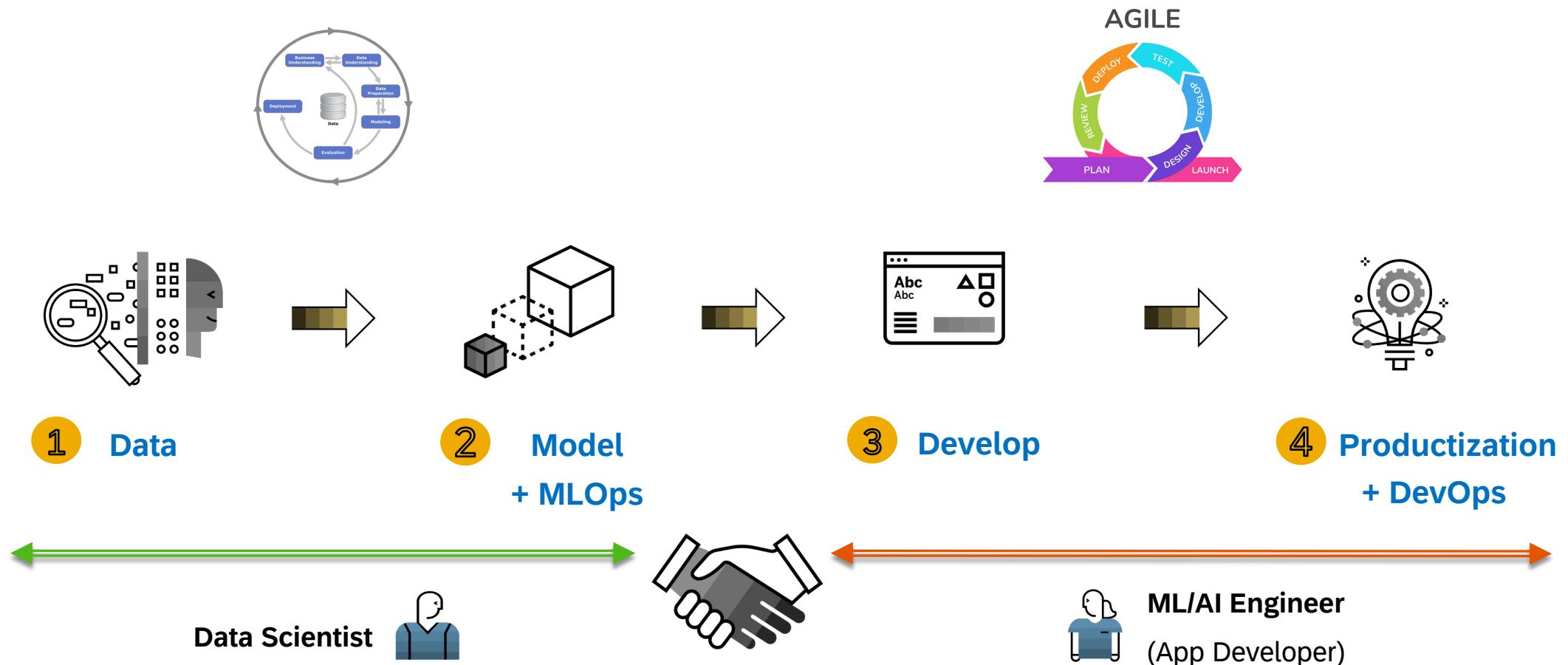


Drew Conway's Data Scientist Venn Diagram

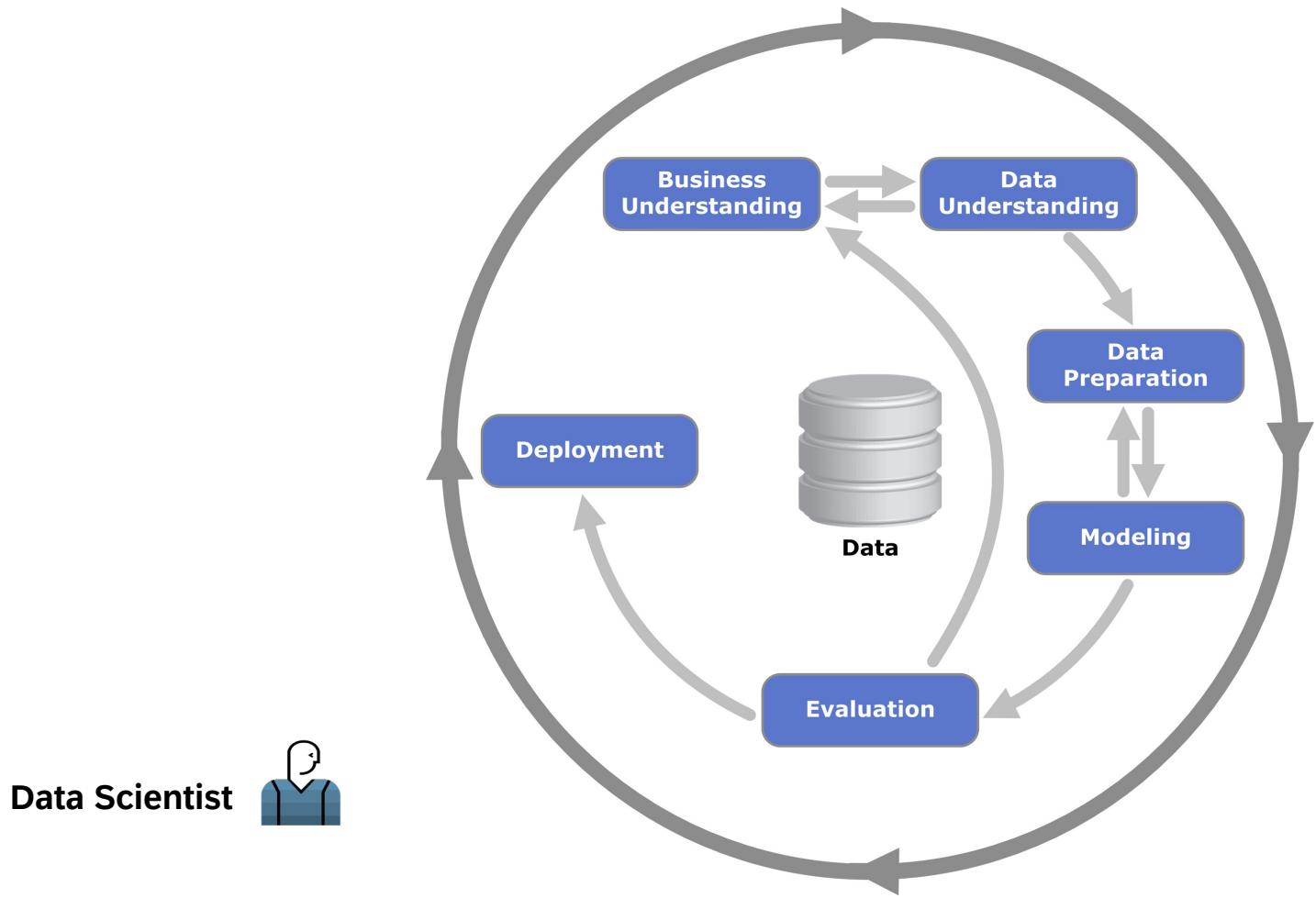


Stephan Kolassa's Data Scientist Venn Diagram

# Development Approach | Building an Intelligent Data Application



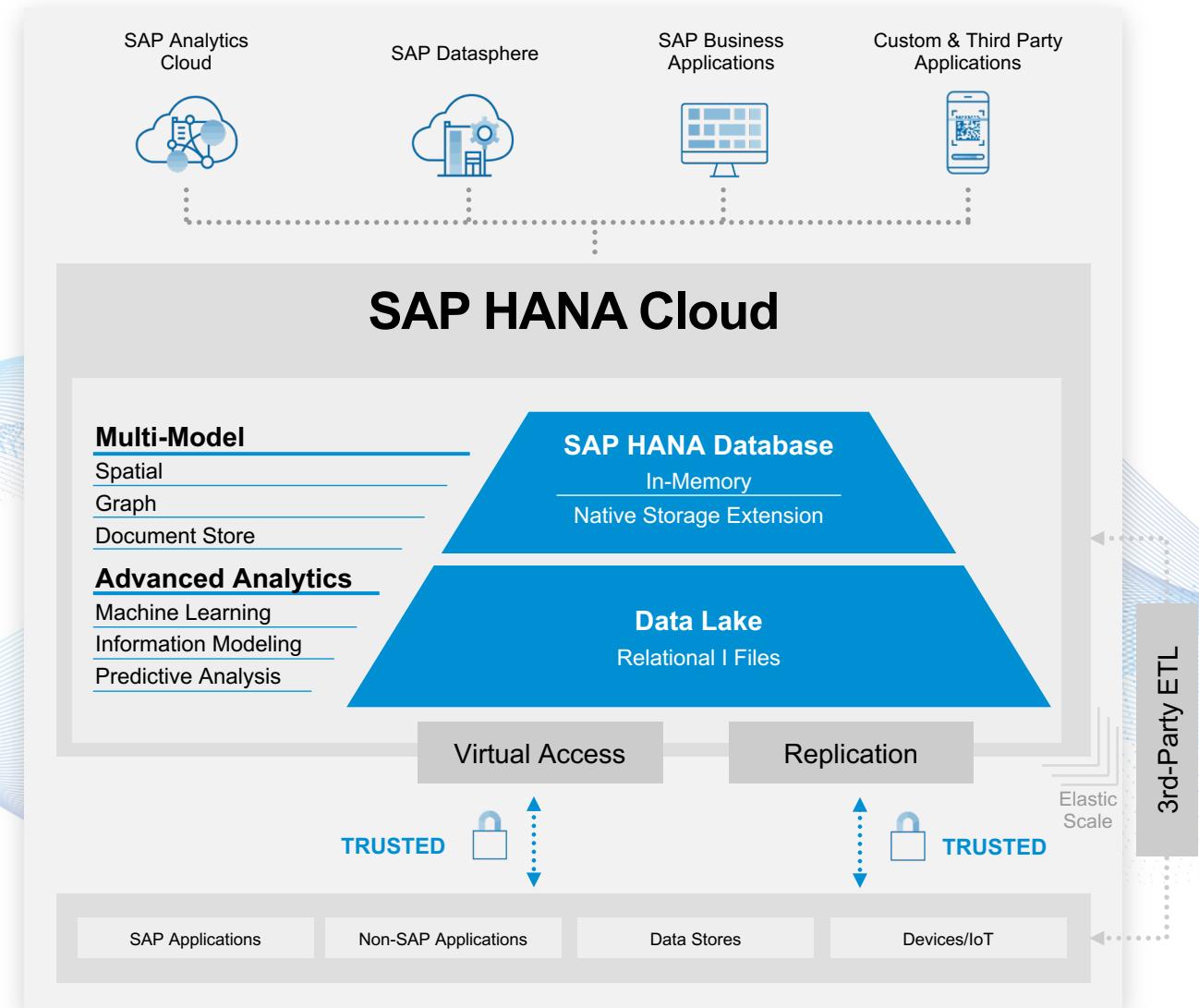
# Development Approach | Training a Model



# 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

**House Prices - Advanced Regression Techniques**

Predict sales prices and practice feature ...  
Getting Started  
4328 Teams

**Spaceship Titanic**

Predict which passengers are transported...  
Getting Started  
2506 Teams

Knowledge Ongoing

Knowledge Ongoing

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>

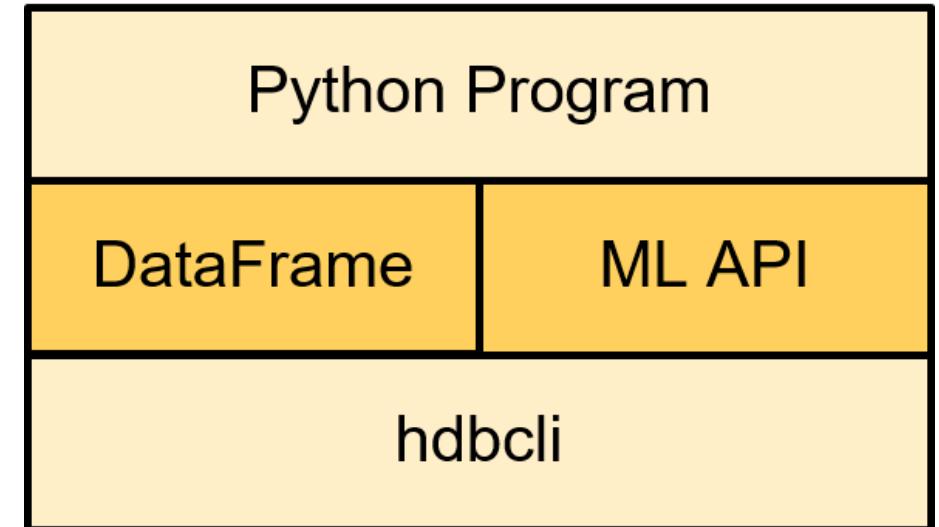
## **4. Try at home in your SAP BTP Trial:**

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

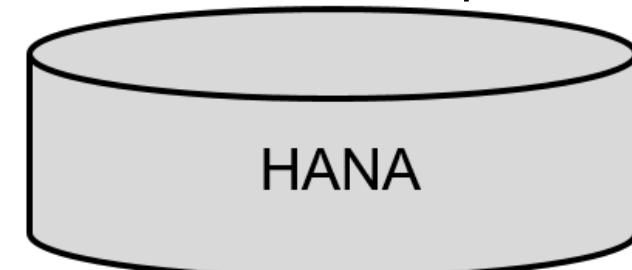
# Understand DataFrame(s)

# Data Scientist using Python

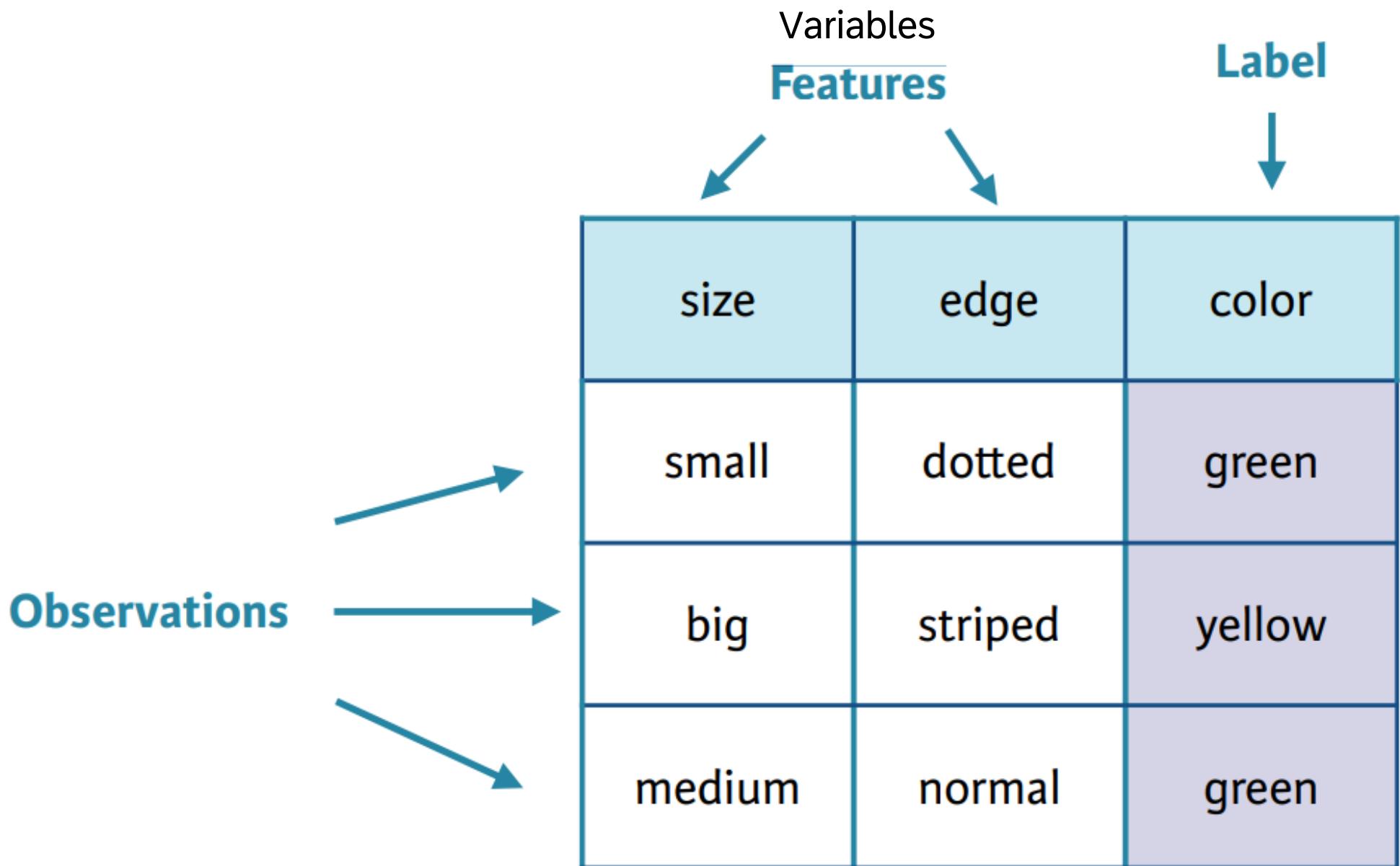
Pandas DataFrame <-> HANA DataFrame



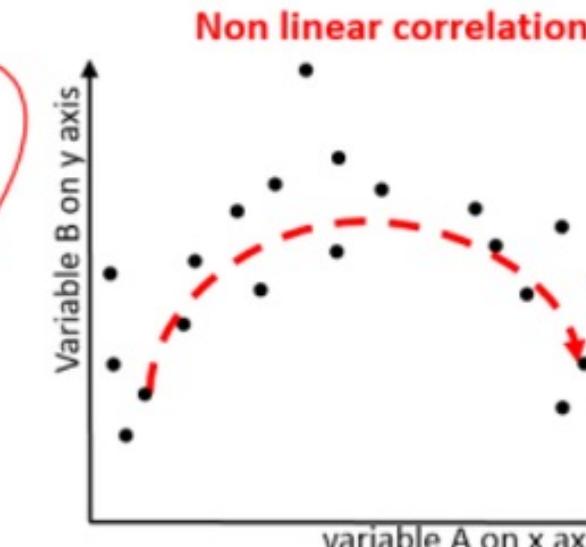
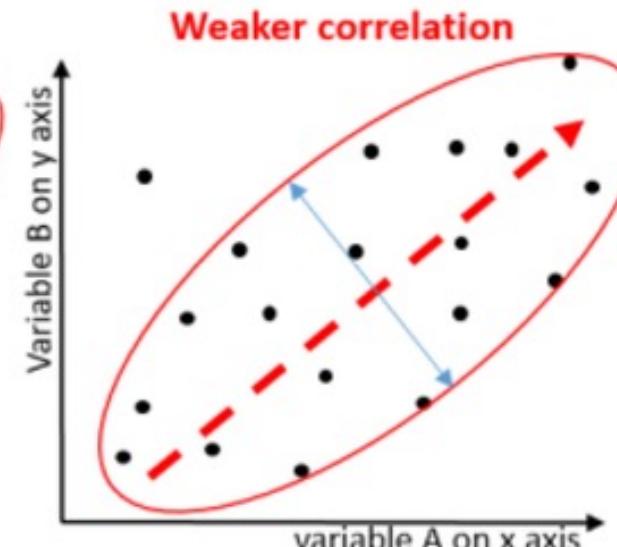
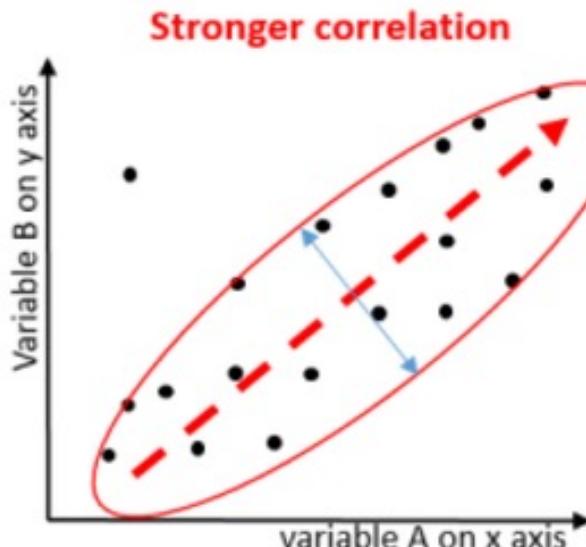
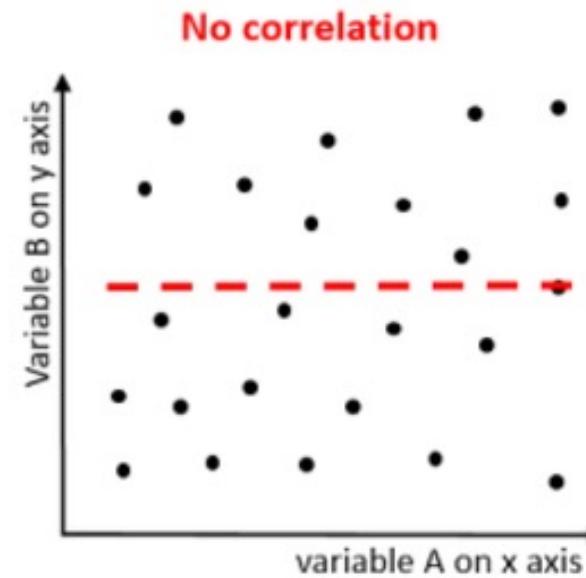
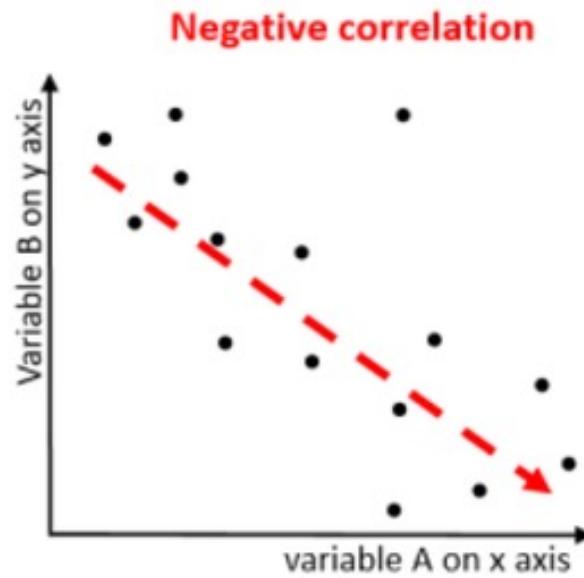
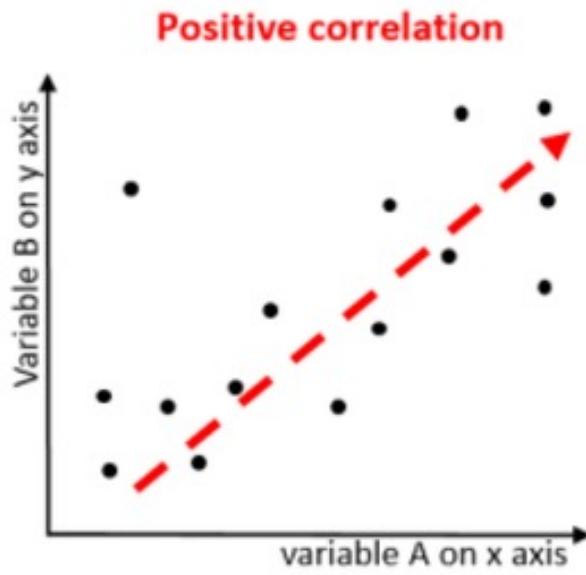
SQL / SQLScript



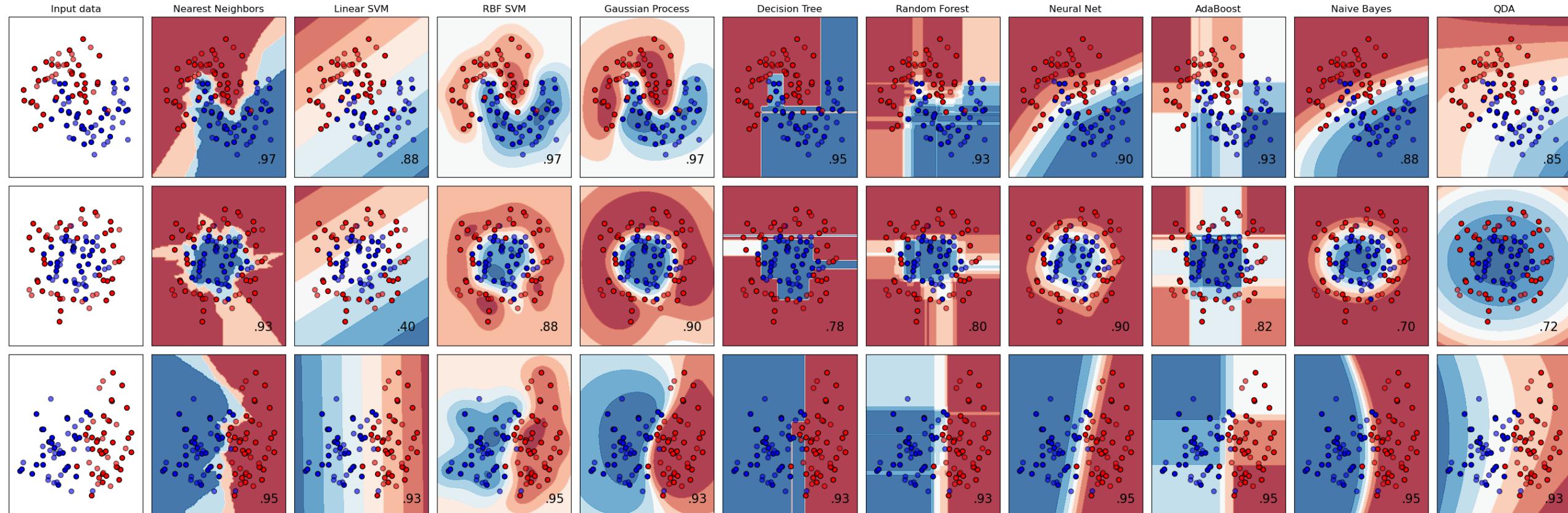
# Train datasets in Supervised Machine Learning



# Correlation based on direction, form, and dispersion strength

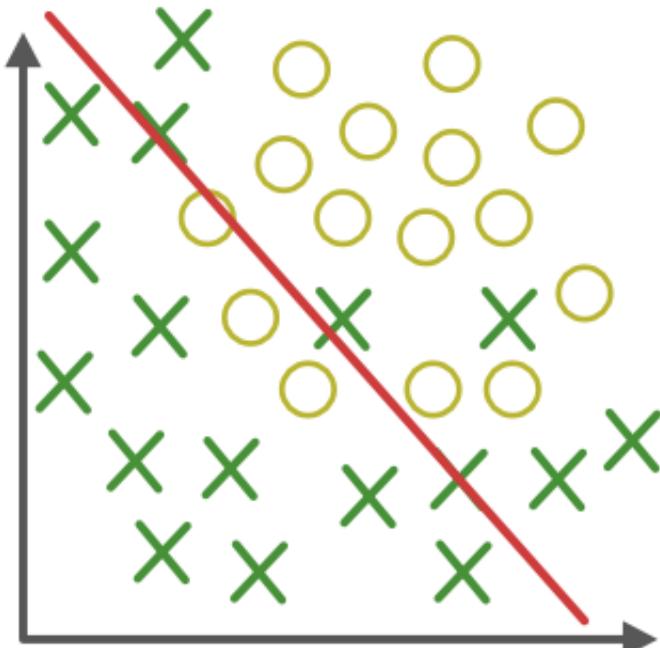


# Decision Boundary (different classification algorithms)

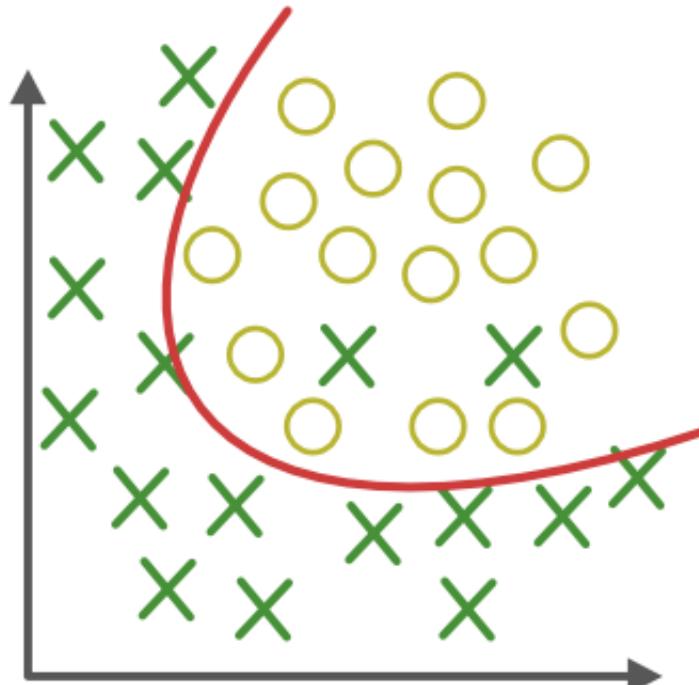


source: [https://scikit-learn.org/stable/auto\\_examples/classification/plot\\_classifier\\_comparison.html](https://scikit-learn.org/stable/auto_examples/classification/plot_classifier_comparison.html)

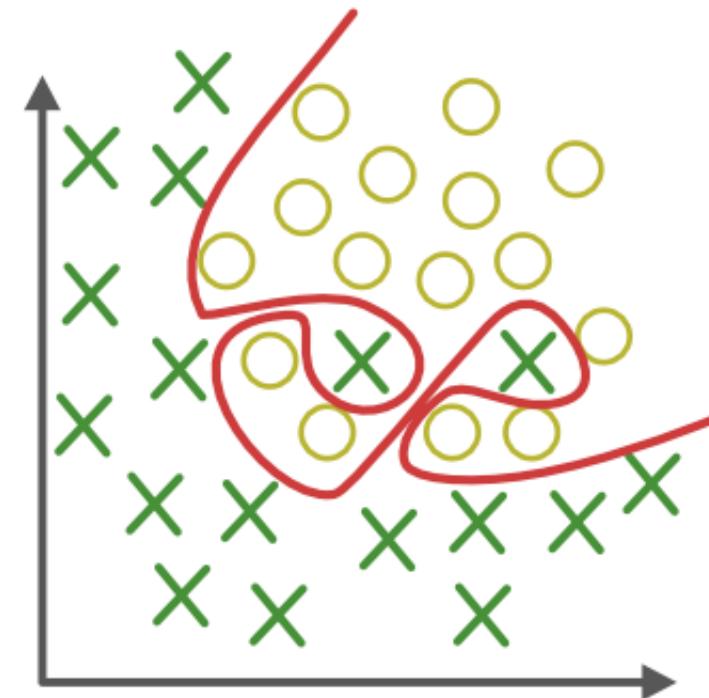
# Underfitting and Overfitting



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



**Appropriate-fitting**



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

DG

# From “black box”...



Predicted: **wolf**  
True: **wolf**



Predicted: **husky**  
True: **husky**



Predicted: **wolf**  
True: **wolf**



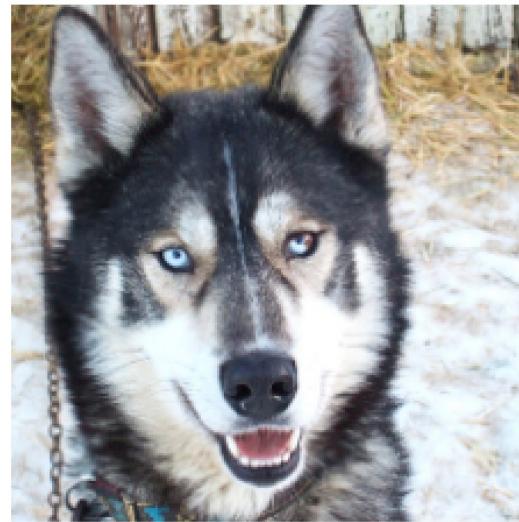
Predicted: **wolf**  
True: **husky**



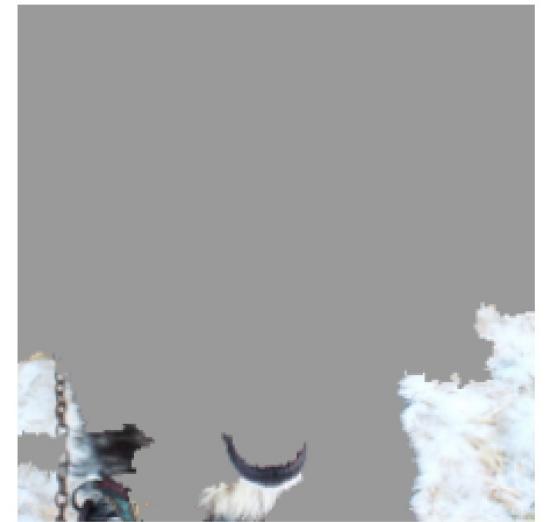
Predicted: **husky**  
True: **husky**



Predicted: **wolf**  
True: **wolf**



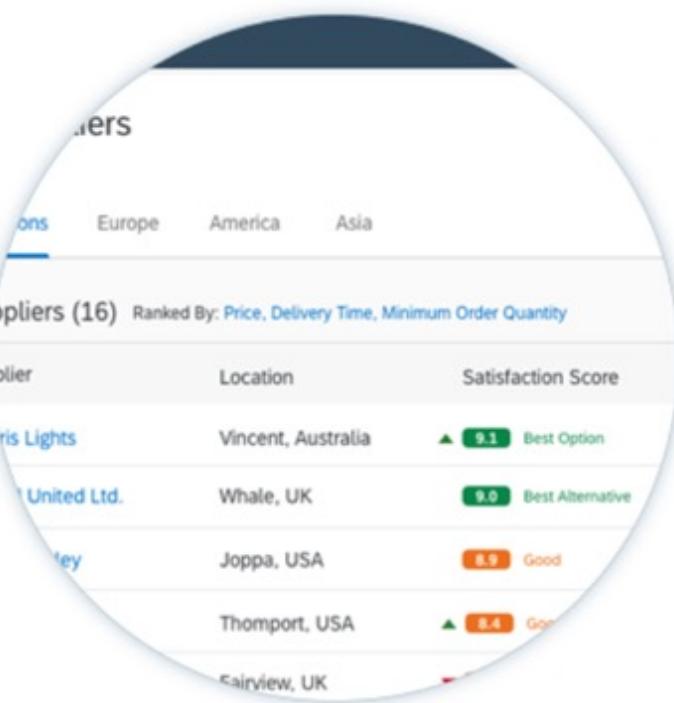
...to **Explainable AI (XAI)**



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

### Level 1

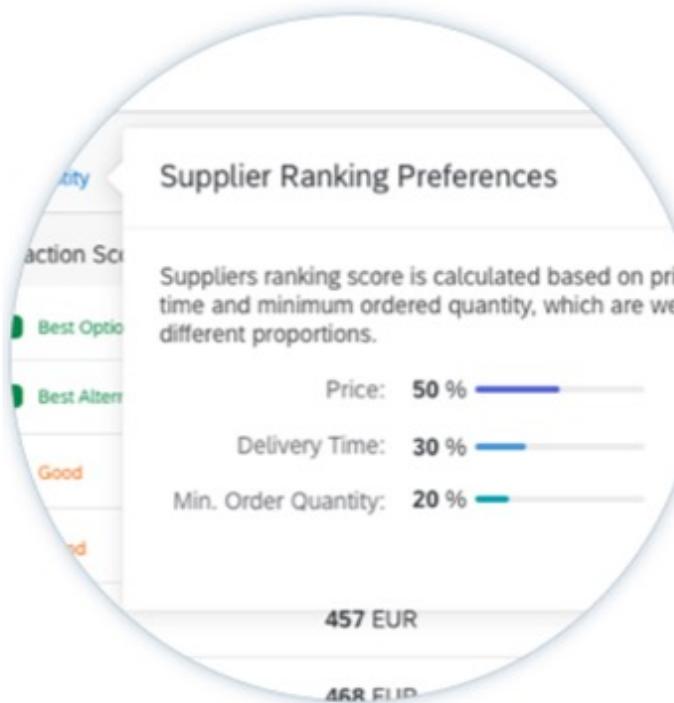
WHAT



Minimum

### Level 2

WHY



Simple

### Level 3

HOW



Expert

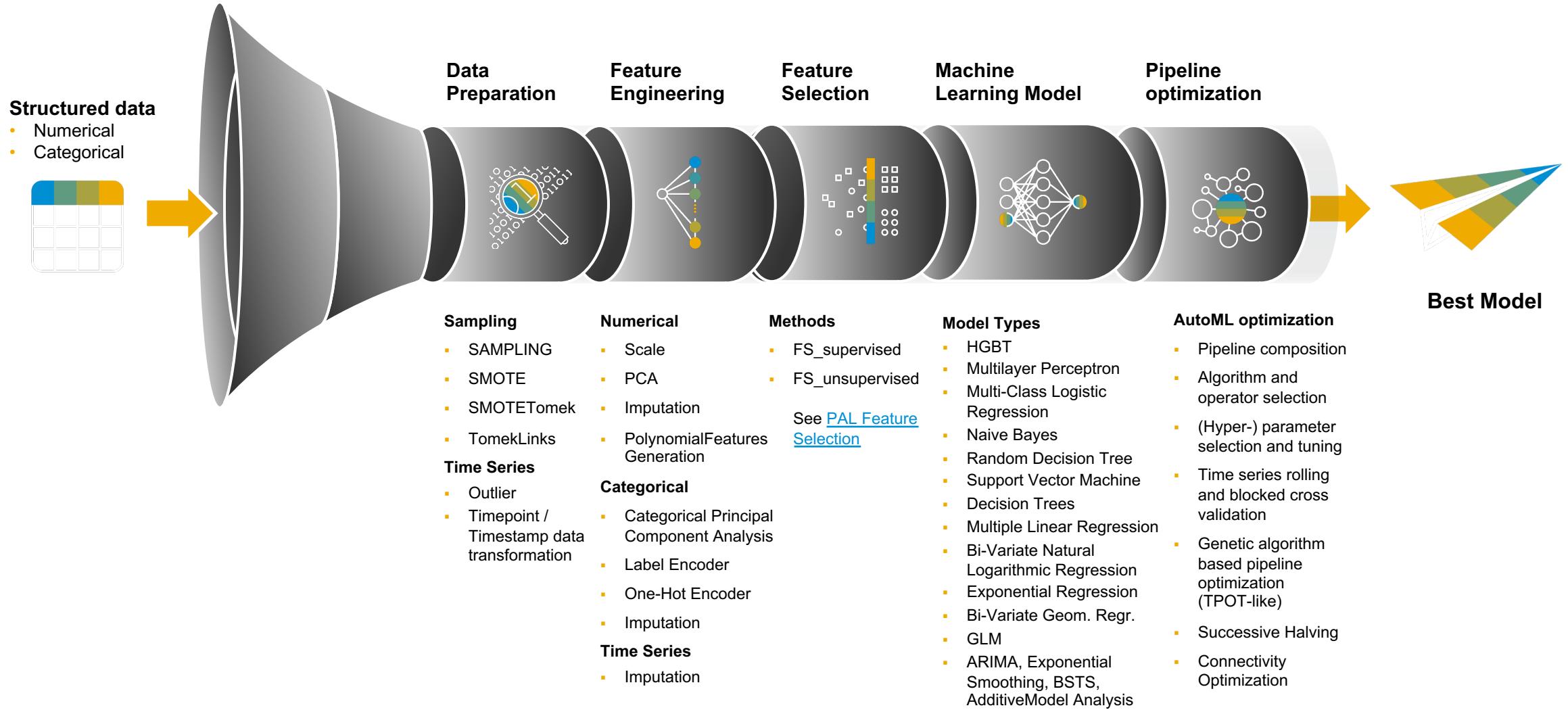
## Confusion matrix

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) |
|              | $N$ | False positives (FP) |
|              |     | True negatives (TN)  |

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

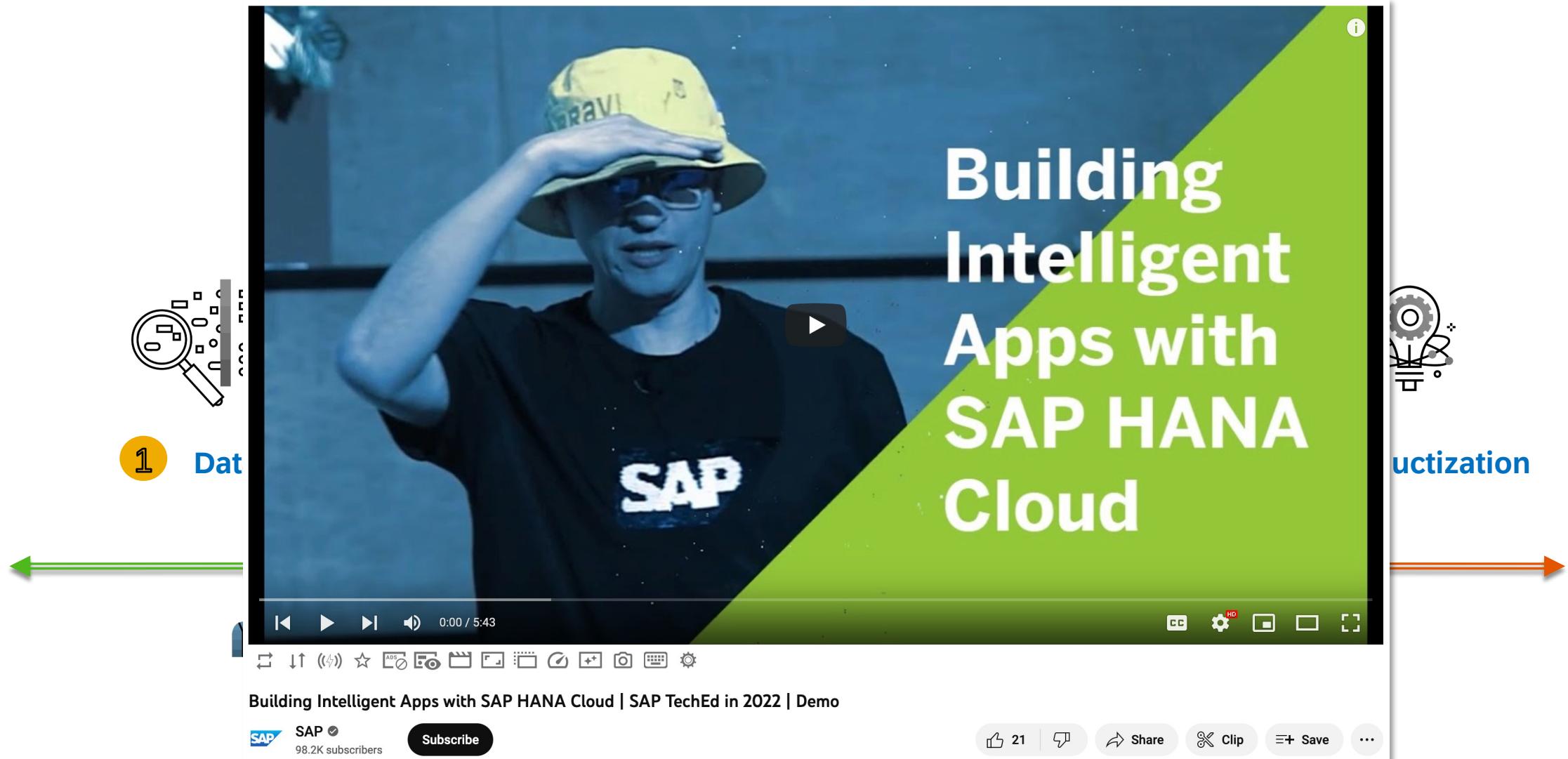
# Predictive Analysis Library | Automated Machine Learning – Supported Operators



# **Additional content**



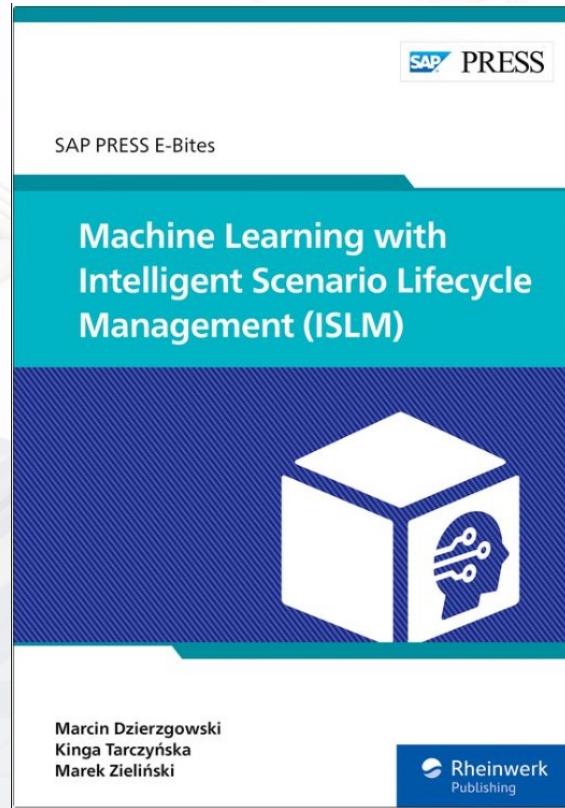
# Development Approach | Building an Intelligent Data Application (demo)



# 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 repository was created by cmog (FairML - Fair Recruiting Model) on f009115 · 3 weeks ago. The page shows a list of code samples with their names, last commit messages, and dates.

| 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)

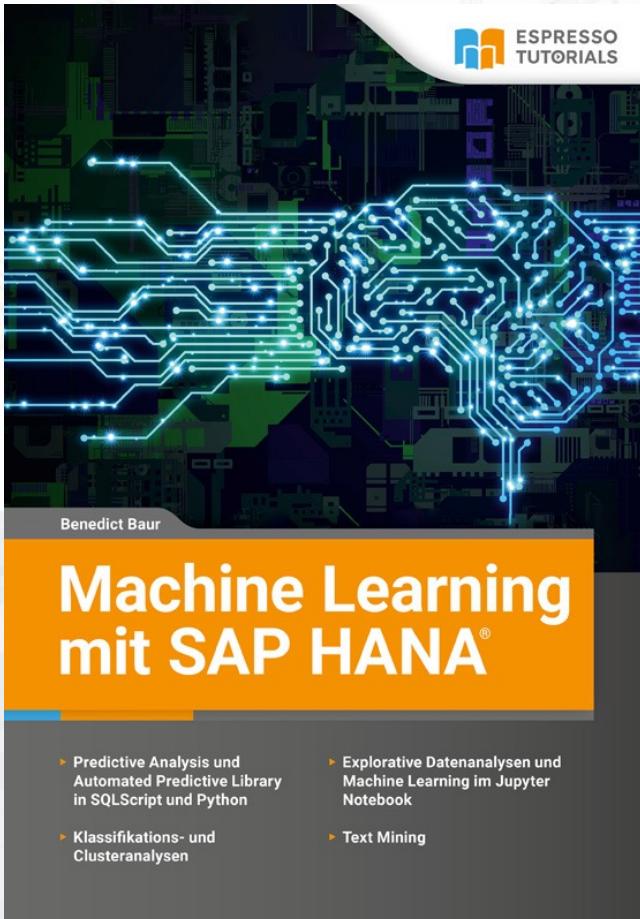
115 pages, 2023, E-Book  
ISBN 978-1-4932-2395-4

[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



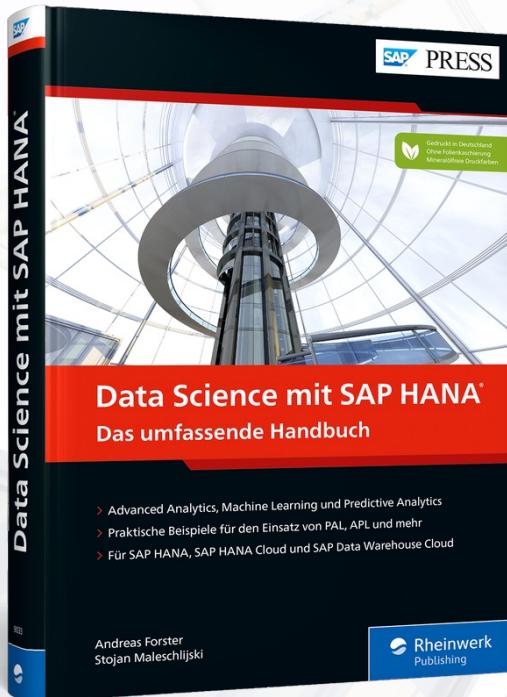
## Machine Learning mit SAP HANA

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

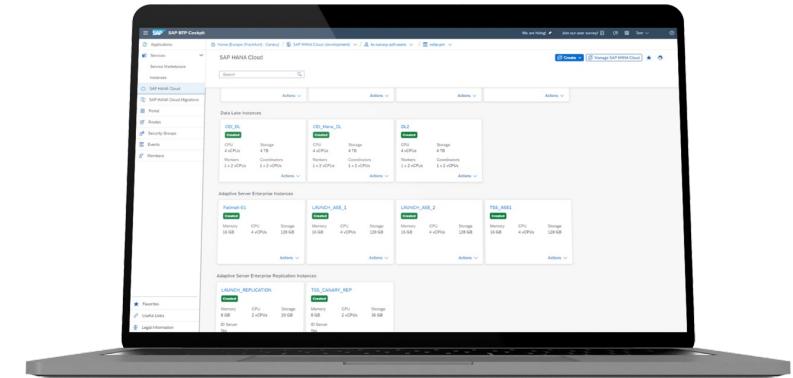
- 3x30-days own-instance in SAP BTP Trial
- 16GB RAM, 1 vCPU
- <https://developers.sap.com/tutorials/hana-trial-advanced-analytics.html>

## SAP HANA Cloud Free Tier

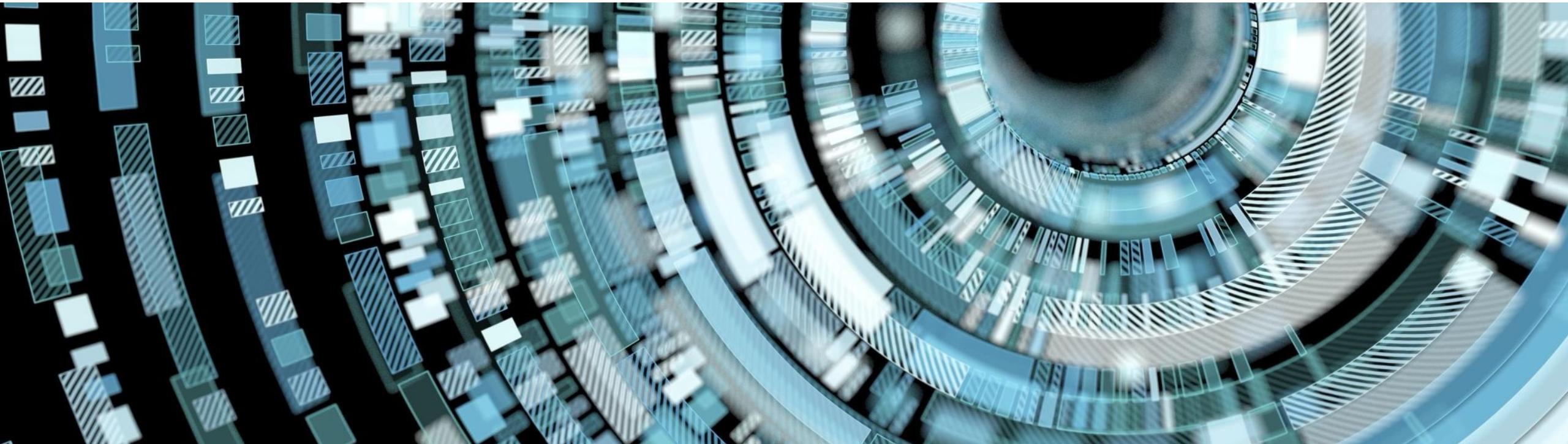
- 30 GB RAM, 2 vCPUs
- <https://developers.sap.com/mission.hana-cloud-database-get-started.html>

## 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



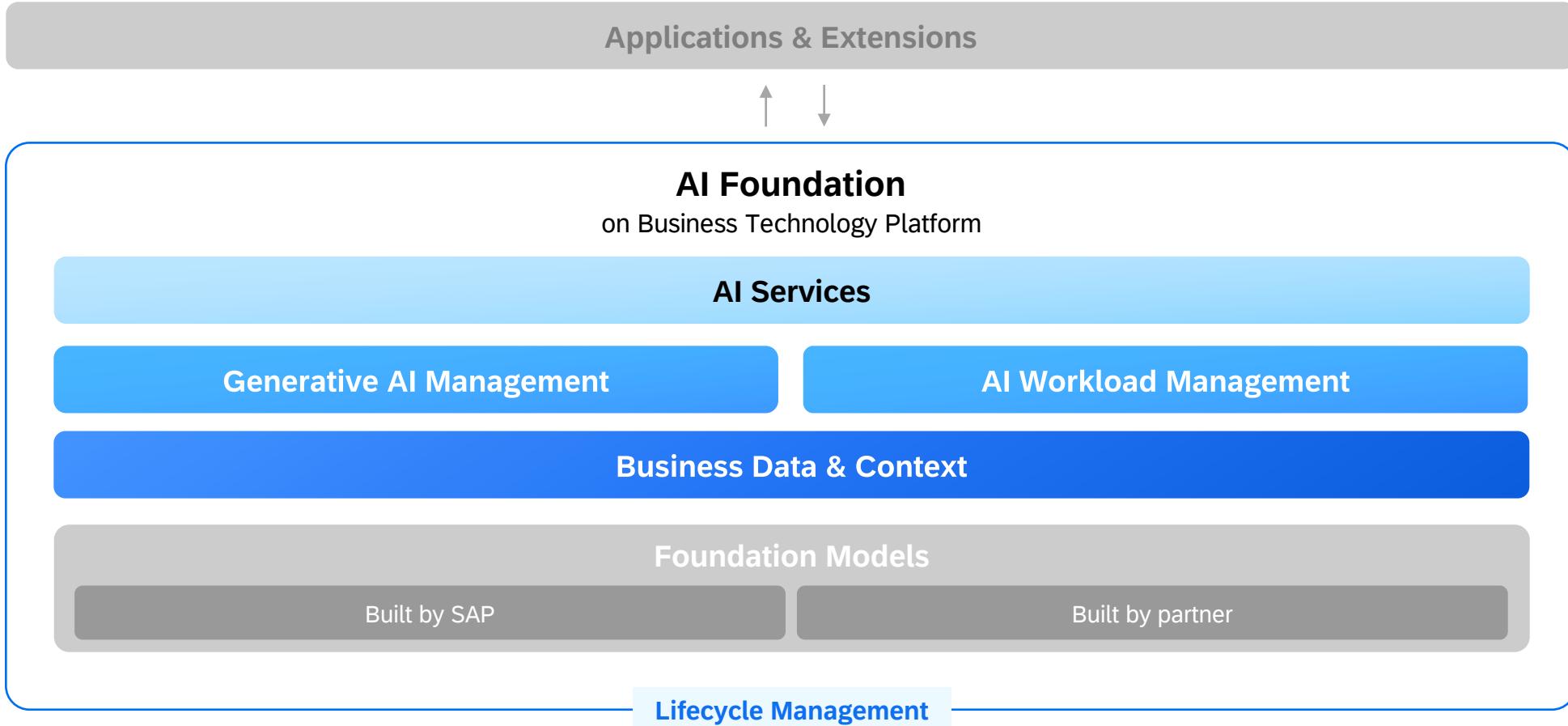
ANTHROPIC



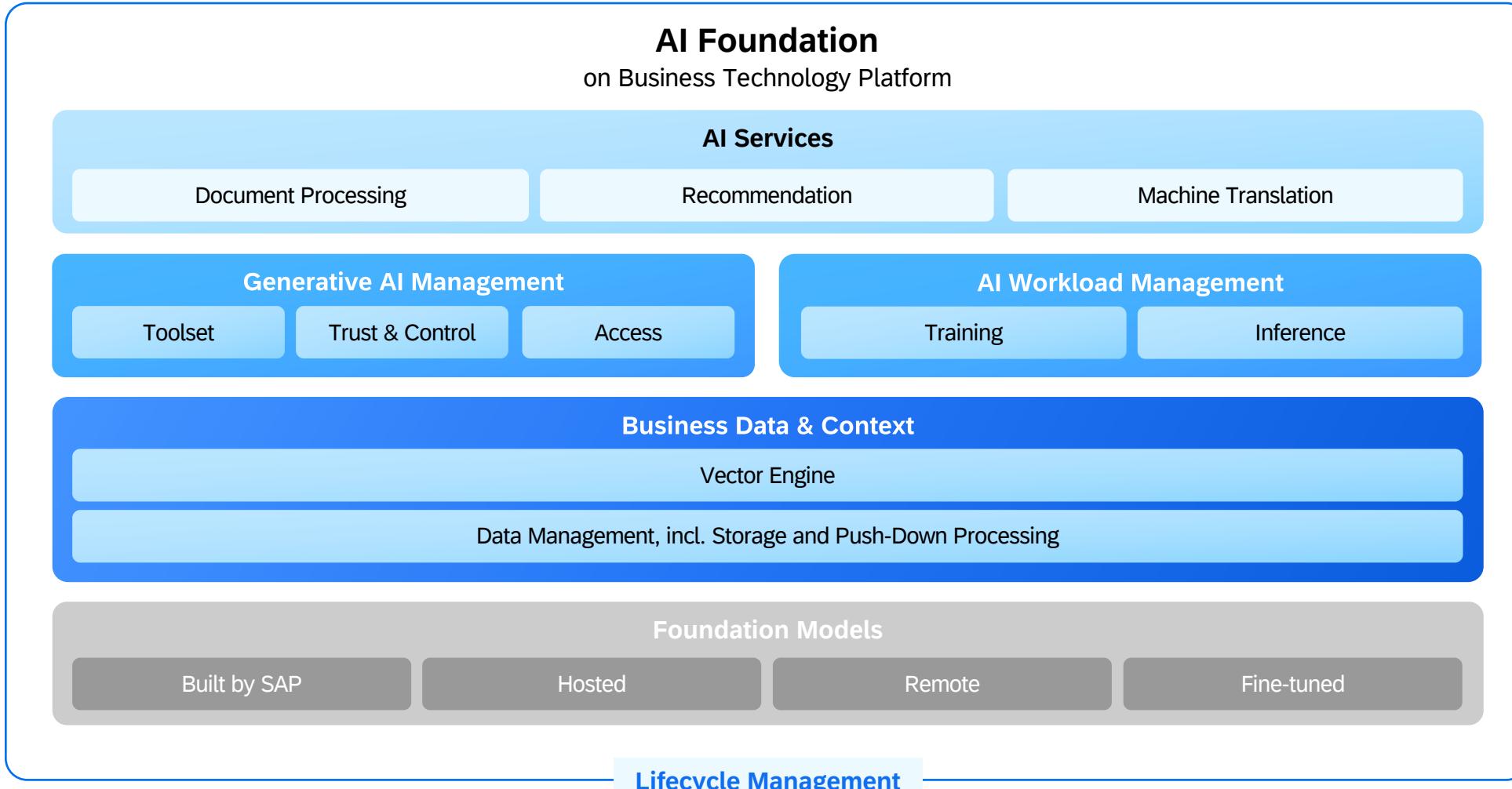
Google Cloud



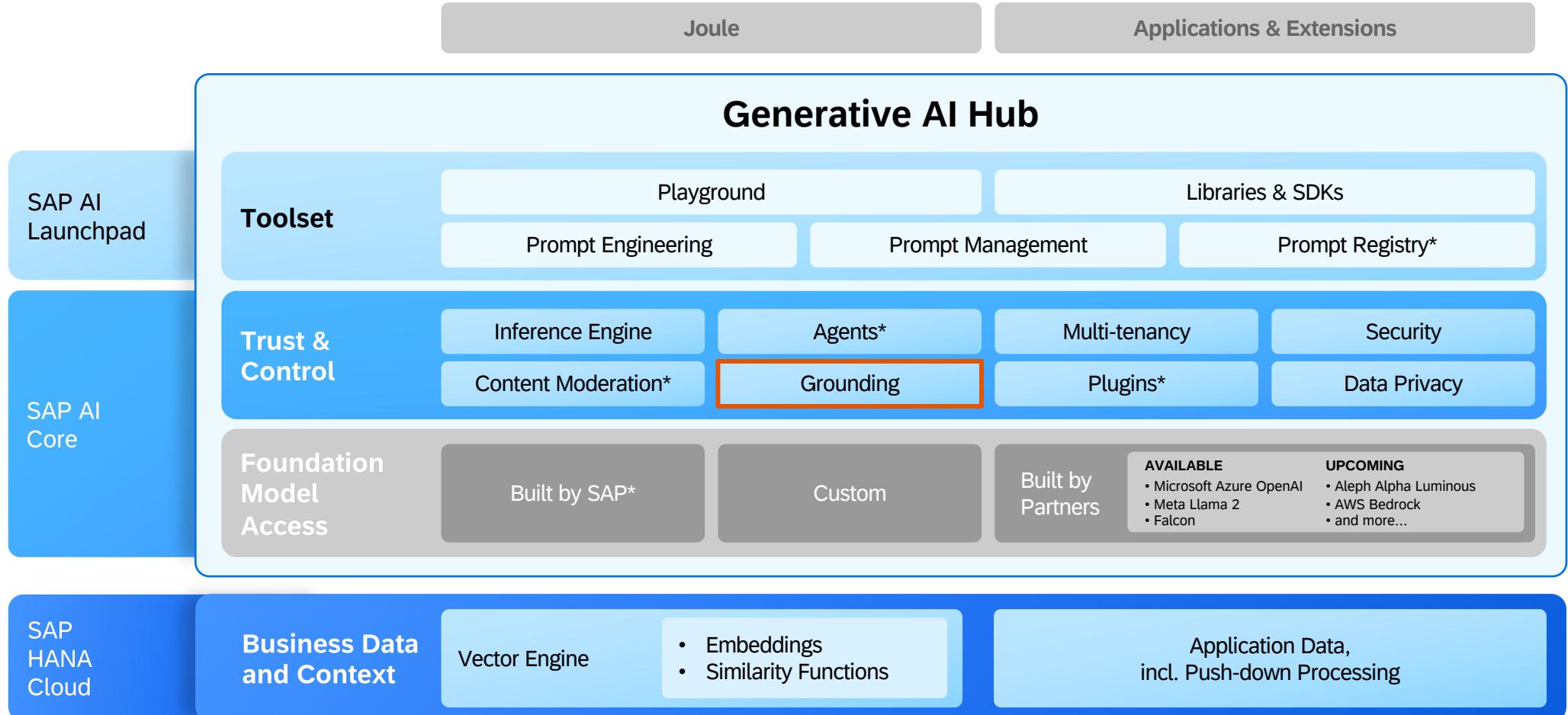
# A complete set of services for AI developers on SAP BTP



# 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

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## 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 // Vielen Dank!**

Contact information:

Witalij Rudnicki, **SAP Developer Advocacy**

