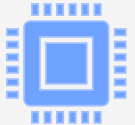
SQL Data Insights … new feature of Db2 13

An industry-leading relational database with embedded AI capabilities

Infuses AI directly into your database on existing data to **discover hidden information**

Minimizes complexity of deploying AI into your applications

Single model used for a range of inferencing tasks over multiple fields

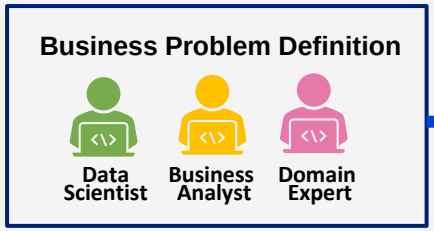


Exploits IBM **zIIP**

Typical AI development and deployment personas

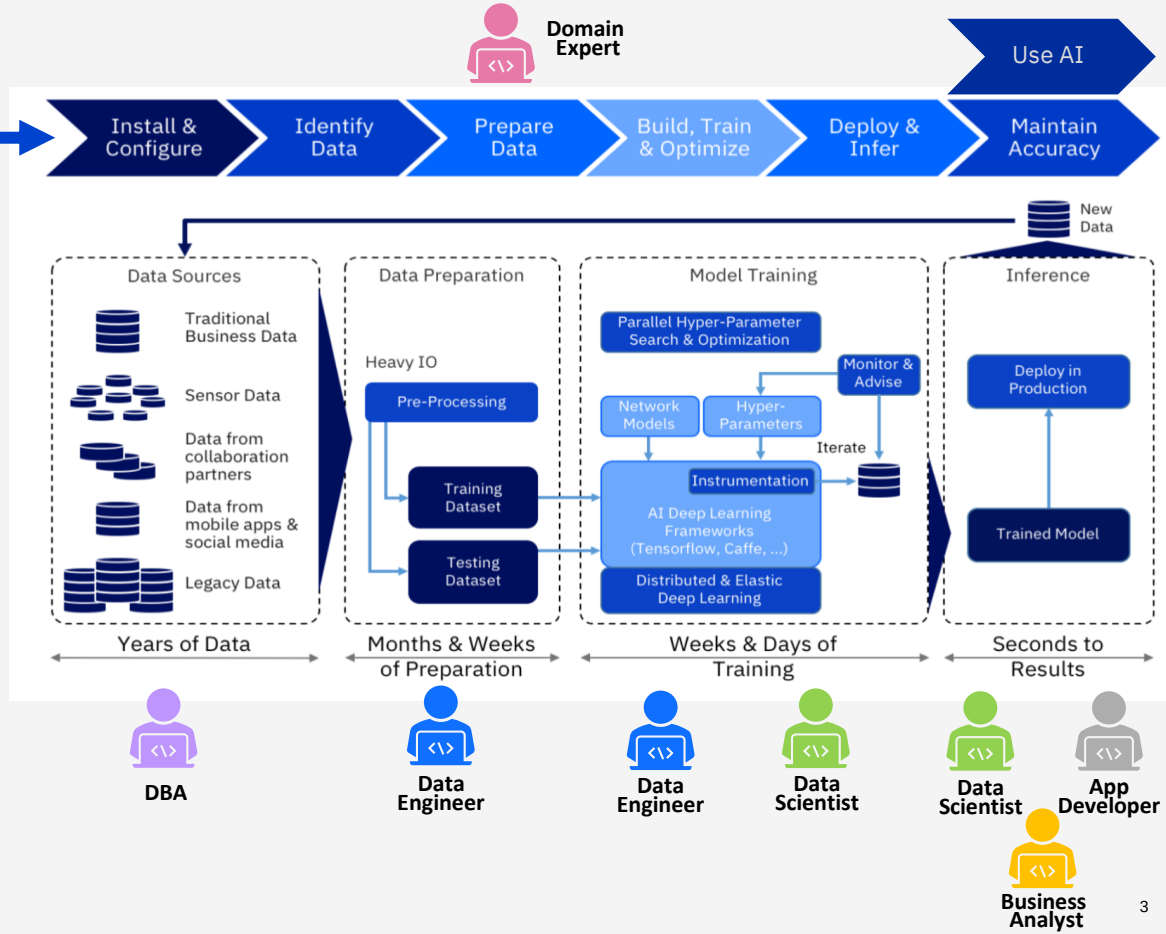
Domain Expert Responsibilities: • Owns business results for a LOB • Deep knowledge of business domain • Owns supporting applications	**Business Analyst** Responsibilities: • Identify business issues • Collects, records, and analyzes data • Evaluates and present data solutions	**Data Scientist** Responsibilities: • Initial data investigation and exploratory data analysis • Identify potential models & algorithms • Measure and tune models • Select models for deployment
Data Engineer Responsibilities: • Locates and identify relevant data sources • Prepares and cleanse datasets for use by data scientist	**Application Developer** Responsibilities: • Develops and maintains applications programs and interfaces • Interacts with data using SQL • Invokes AI services via API interfaces	**DBA** Responsibilities: • Owns and manages physical data structures • Provides user/application access to data • Optimize and tune SQL access

Traditional AI model development and deployment



Traditional AI models are complex to build and deploy and serve a single narrow purpose

- Needs deep data science skills
- Adds complexity when AI and business systems are siloed
- Requires specialized architecture
- Can miss valuable insights hidden in data
- Typically built using dated historical data (not real time)
- Costly to retrain and redeploy
- Elongated time frames



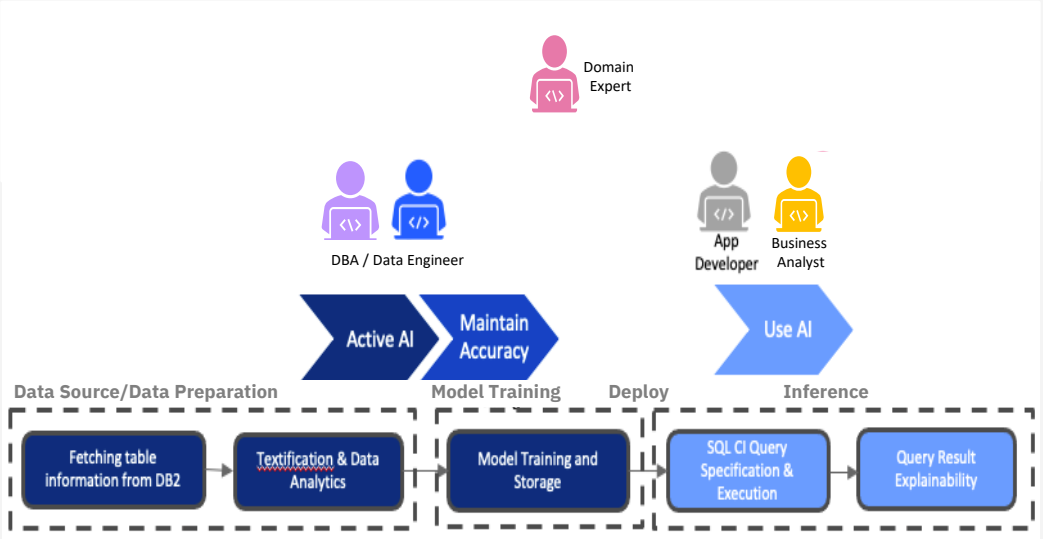
SQL Data Insights … extract greater value from Db2 data

Ease of Use

- Build Neural Network powered relationship maps using unsupervised training over (unlabeled) structured data
- Simply select data, enable training and Db2 for z/OS builds a data relationship model
- Apply relationship maps and built-in AI-related functions within any SQL statement
- Readily interpret underlying reasons for insight

Major Benefits

- No deep data scientist skills required
- Rapid time to develop and deploy AI
- No specialized architecture
- Efficient AI scoring (elapsed time, CPU, throughput)
- Highly efficient retraining and redeployment
- No data latency
- Model can address multiple questions



Applicable to a broad range of enterprise critical domains: Finance, Insurance, Retail, Security, HR, IT Management, Data Integration, etc.
(Entity Resolution; Data Cleansing)

SQL Data Insights ... use cases

Uncover hidden relationships by using complex interactions between AI and critical business systems

Credit Card

Determine if credit card rewards participants are gaming the system

Government

Discover tax cheats by finding similarity to known cheaters

Retail

Find customers based upon similar buying patterns

Customer churn analysis

Predict sales of new products to existing customers

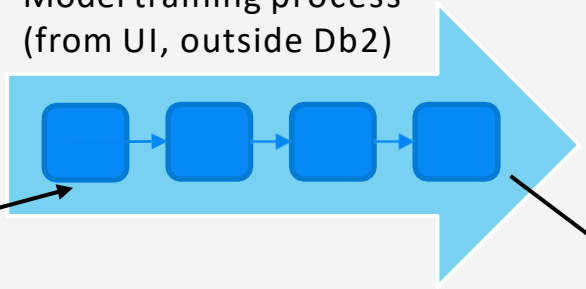
Health Care

Identify appropriate physicians based on patient treatment successes with similar disease states

Identify potential treatments based on similar patients, conditions and positive outcomes (avoid unsuccessful treatments)

SQL Data Insights … model representation

Model training process
(from UI, outside Db2)

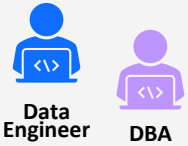


A model is a Db2 table containing encoded vectors for each distinct entity in the source table

SQL semantic functions retrieve the vectors to calculate their results

USER.DATA_TABLE

CUSTOMER_ID	GENDER	BILLING	…
3668-QPYBK	F	auto	…
…	…	…	…



DSNAIDB.<generated vector table name>

Column	Value	vector
CUSTOMER_ID	3668-QPYBK	<1280 byte vector>
GENDER	F	<1280 byte vector>
…	…	…

SQL:

```
SELECT CustomerID,
AI_SIMILARITY(CUSTOMER_ID, '3668-QPYBK')
FROM USER.DATA_TABLE
WHERE ...
```

SQL Data Insights … semantic SQL Functions

FL 500

First set of AI built-in functions (BIFs) available in Db2 13

Cognitive Intelligence Query	Functional Classification	Functional Description	Db2 Functions
Semantic **similarity and dissimilarities**	**Entity Matching Recommendation**	• **Matching** rows/entities based on overall meaning (similarity/dissimilarity) • **Suggest** choices for incorrect or missing entities	**AI_SIMILARITY**
Semantic **clustering**	**Recommendation**	• **Find** entities/rows based on relationships between attributes in a given set • Example: Find animals similar to (lion, tiger, panther)	**AI_SEMANTIC_CLUSTER**
Reasoning **analogy**	**Recommendation**	• **Find** entities/rows based on relationships between attributes • Example: Cat : Mammals :: Turtle : ?	**AI_ANALOGY**

SQL Data Insights … examples of functions

AI_SIMILARITY:

```
SELECT V.VENDOR_NAME,

   AI_SIMILARIY(VENDOR_NAME, 'IBM CORPORATION')
FROM VENDORS V ORDER BY 2 DESC
FETCH FIRST 10 ROWS ONLY;
```

Find top 10 vendors most similar to “IBM CORPORATION”

AI_SEMANTIC_CLUSTER:

```
SELECT V.VENDOR_NAME,
      AI_SEMANTIC_CLUSTER(VENDOR_NAME,'IBM CORPORATION',
                          'AMAZON’,’MICROSOFT')
FROM VENDORS V
ORDER BY 2 DESC
FETCH FIRST 10 ROWS ONLY;
```

Find the top 10 vendors that belong in a cluster formed by “IBM CORPORATION”, “AMAZON” and “MICROSOFT”

AI_ANALOGY:

```
SELECT V.SERVICE_COUNTRY,

   AI_ANALOGY('IBM CORPORATION' USING MODEL COLUMN
   VENDOR_NAME, 'USA' USING MODEL COLUMN
   SERVICE_COUNTRY,’SAMSUNG' USING MODEL COLUMN
   VENDOR_NAME,SERVICE_COUNTRY)
FROM VENDORS V  ORDER BY 2 DESC
FETCH FIRST 10 ROWS ONLY;
```

Find top 10 “service countries” that have the same relationship to SAMSUNG, as USA is related to IBM CORPORATION

Function improvement and new vector prefetch

APAR PH51892

AI_SEMANTIC_CLUSTER

- New column in vector table for normalizing vectors
  - Improves scoring accuracy of AI_SEMANTIC_CLUSTER and overall SQL DI scoring performance

New vector prefetch

- Previously, query functions were limited to submitting one row at a time for processing
- Now, prefetch enables functions to submit a batch of multiple vectors at a time for processing
  - Significantly accelerates SQL DI query processing

SQL Data Insights … software & hardware requirements

Software:

- Db2 for z/OS
  - Db2 13 as built-in AI functions
  - Db2 12 technical preview provided as UDF AI functions
- SQL Data Insight UI and training services
  - separately orderable, no-charge feature of Db2 13 (FMID HDBDD18)
- z/OS maintenance
  - z/OS 2.4 and above and
  - Install 3 IBM neural network libraries

Separate install steps needed to enable SQL Data Insights – refer to IBM Documentation and IBM Redbooks

Hardware:

- zEC12 and above
- Z14 + leverages OpenBLAS library exploitation for AI with SIMD
- Both training and SQL execution is ZIIP eligible

Finding hidden information

I want to find other customers like this one

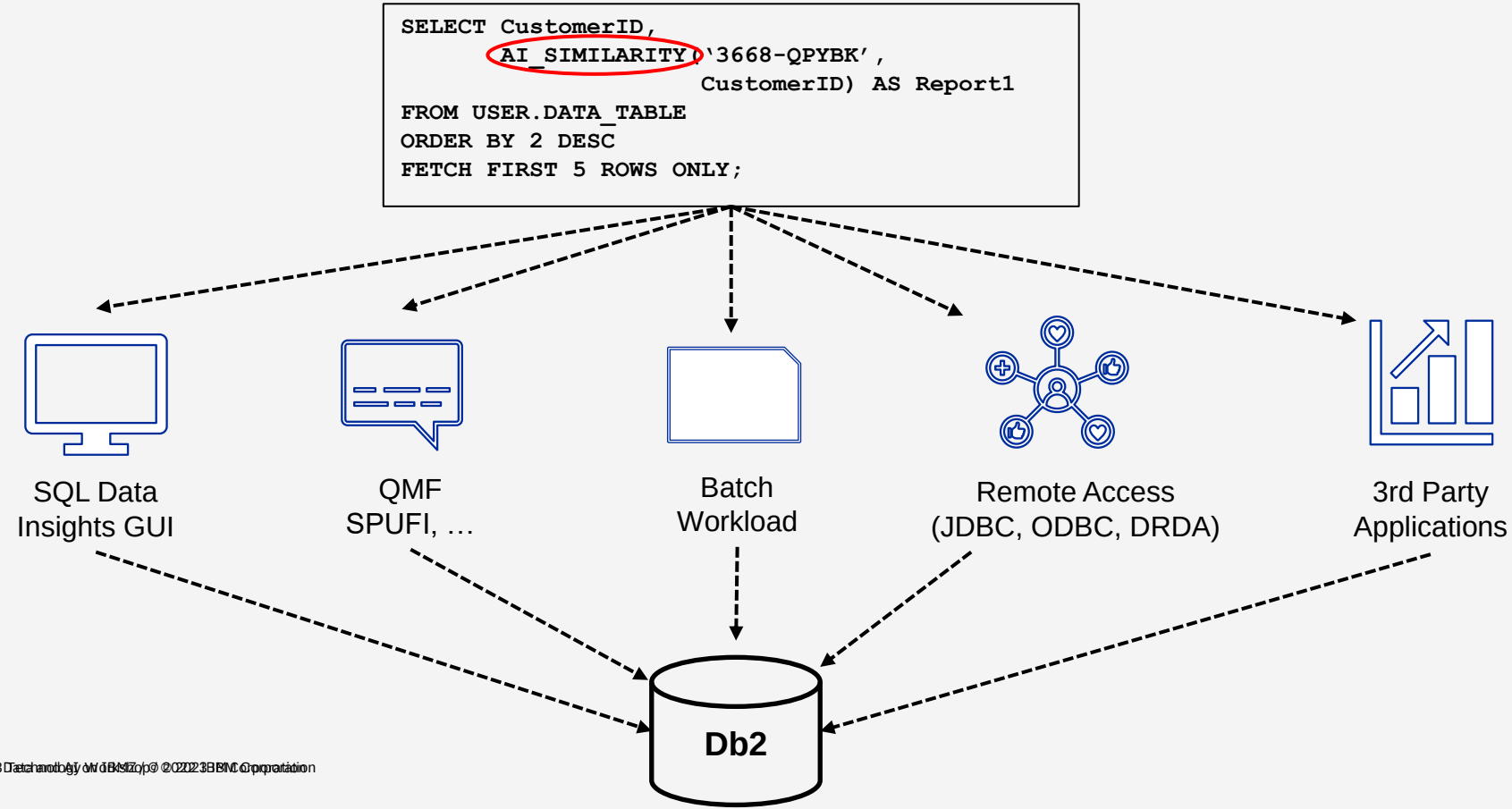
Customer ID	Gender	Senior Citizen	Dependents	Tenure	Phone Service	Multiple Lines	Internet service	Contract	Paperless billing	Payment method	Charges	Churn
001	**Male**	**0**	**NO**	**2**	**YES**	**NO**	**DSL**	**Month-to-Month**	**YES**	**Mailed Check**	**120.22**	**YES**

```
SELECT * ,
AI_SIMILARITY (Customer_ID, '001' )
AS SimScore
FROM TABLE WHERE ….
ORDER BY SimScore DESC
```

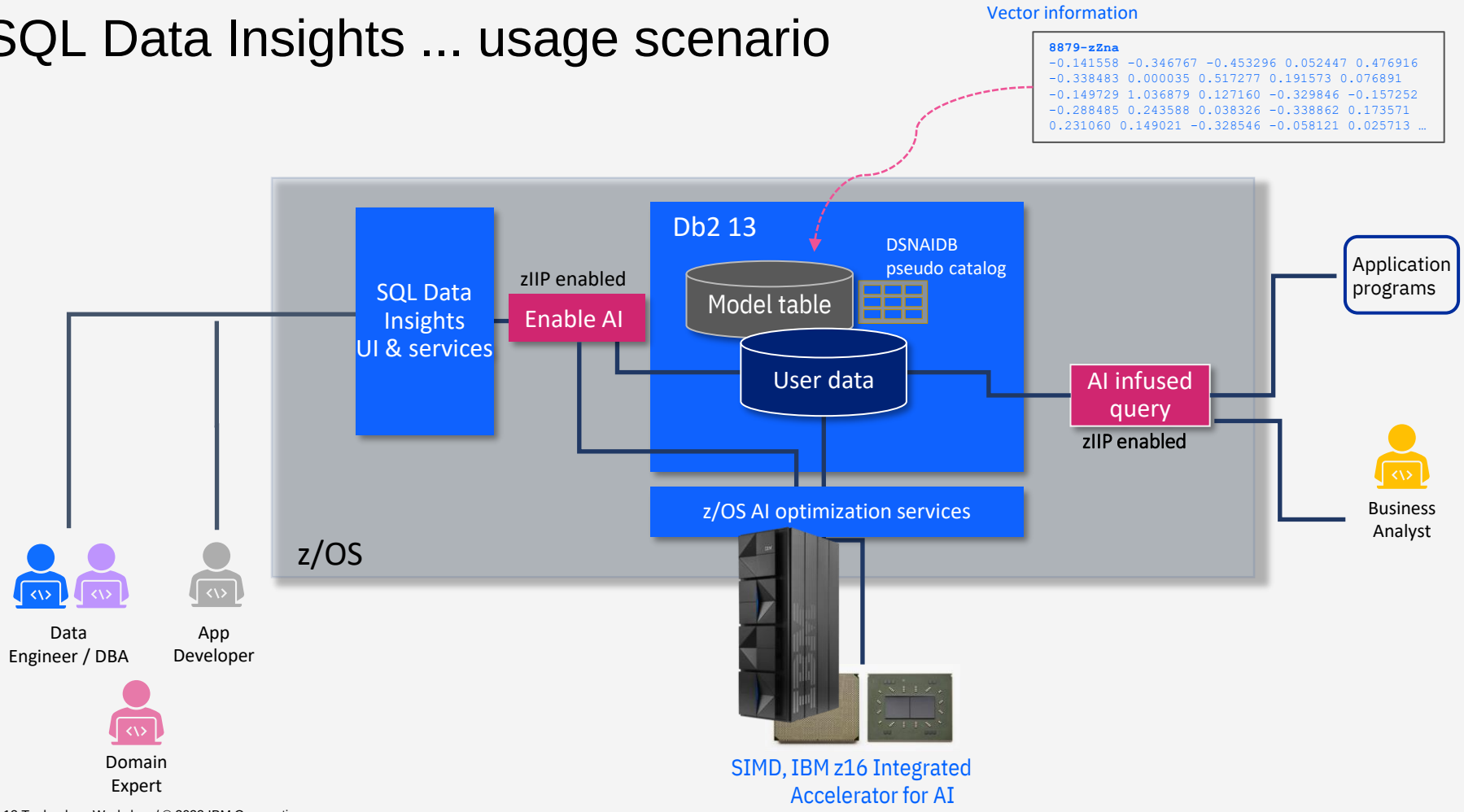
Ranked Similarity Results (most to least similar)

Sim Score	Customer ID	Gender	Senior Citizen	Dependents	Tenure	Phone Service	Multiple Lines	Internet service	Contract	Paperless billing	Payment method	Charges	Churn
0.80	004	Male	0	NO	1	YES	NO	DSL	Month-to-Month	YES	Mailed Check	48.55	YES
0.75	002	Male	0	NO	7	NO	NO	DSL	Month-to-Month	YES	Mailed Check	51.00	YES
0.70	006	Male	0	NO	3	NO	NO	DSL	Month-to-Month	YES	Mailed Check	49.80	YES
0.55	003	Female	0	NO	4	NO	NO	DSL	Month-to-Month	YES	Mailed Check	60.40	YES
0.35	005	Female	1	NO	1	NO	NO	DSL	Month-to-Month	YES	Credit Card	55.10	YES

Power any Db2 for z/OS application with AI enhanced SQL



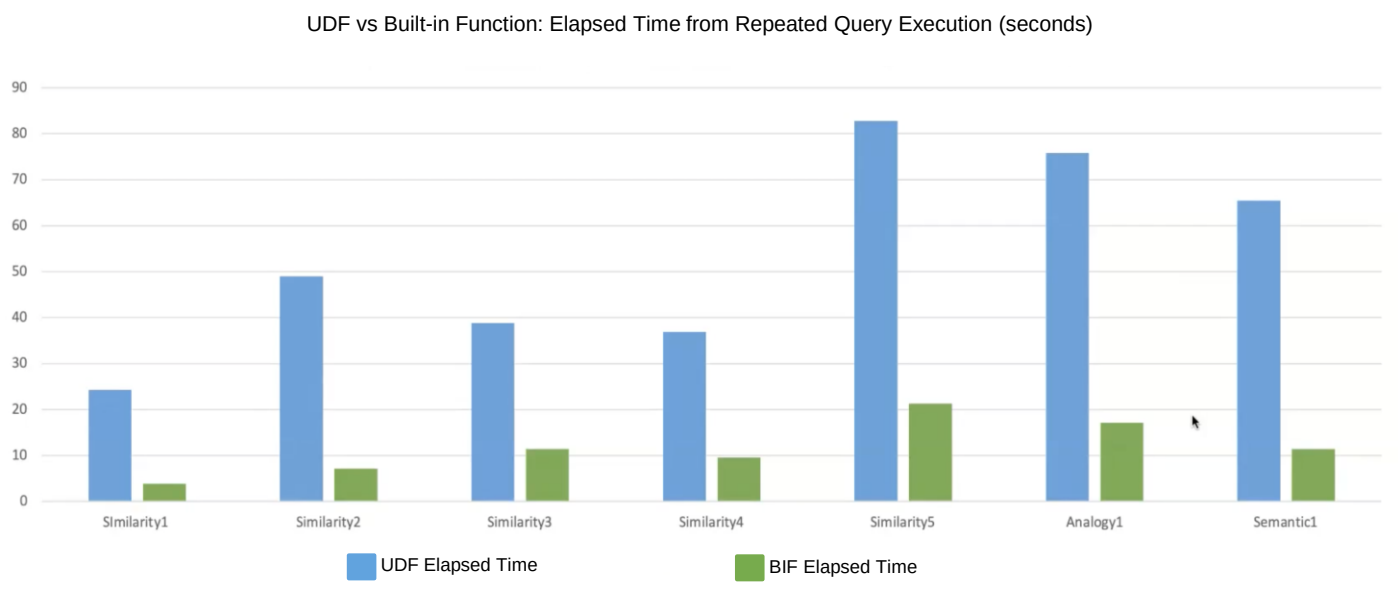
SQL Data Insights ... usage scenario



SQL Data Insights ... performance

The built-in scalar functions outperforms similar UDFs by 3 to 7 times faster and CPU time 2 to 5 times less

– When AI semantic functions (AI_SIMILARITY, AI_ANALOGY, and AI_SEMANTIC_CLUSTER) are used the query becomes zIIP eligible



*development of performance benchmark is continuous