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SNOWFLAKE FOR AI & ML

EASY TO USE. SECURE.

Nov 2023

Forward Looking Statement

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Generative AI

Machine Learning



Snowflake Copilot



Document AI



Universal Search



Snowflake Notebooks



Feature Store



Streamlit in Snowflake



Snowpark ML



Snowpark Model Registry



Snowpark Container Services



Snowflake Cortex



Snowflake Data



Security & Governance



Snowflake for AI / ML: Platform Objectives

Democratize access to enterprise data and AI

Expand adoption beyond the AI experts. Capture value at scale with innovation that's a click or query away.

Alleviate operational burden, so you focus on development

Deliver custom applications faster by keeping data where it's secure and keeping developers focused on building.

Protect your data and models

Your data is your most valuable asset—and so are the models you fine-tune with it.



Snowflake for AI / ML: Platform Overview

Use AI in everyday analytics within seconds

No AI expertise or integrations needed. Access via Snowsight using pre-built UIs or SQL / Python functions.

Build and deploy AI apps in as little as minutes

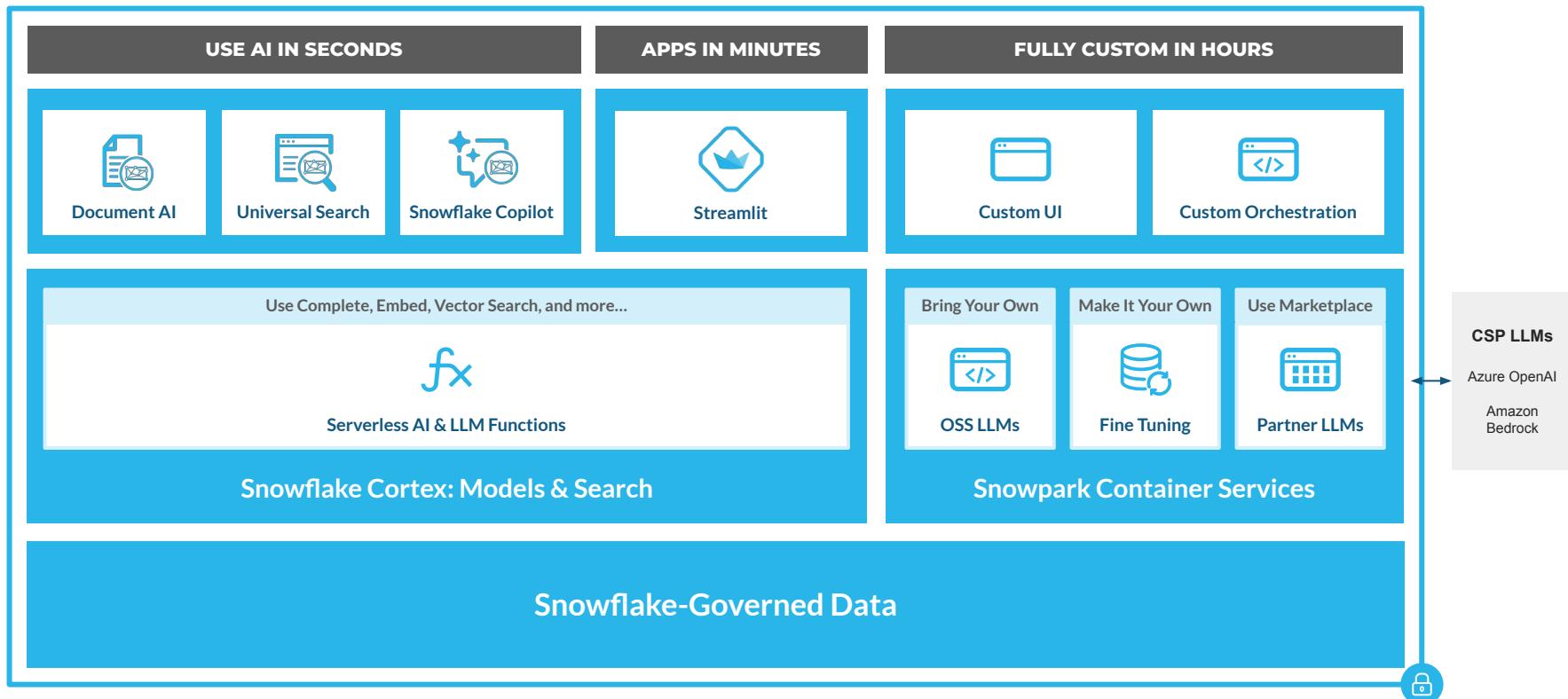
Accelerate delivery of innovation with scalable infrastructure and app stack primitives. Build apps in minutes or go fully custom in hours.

Keep data and models secure and governed

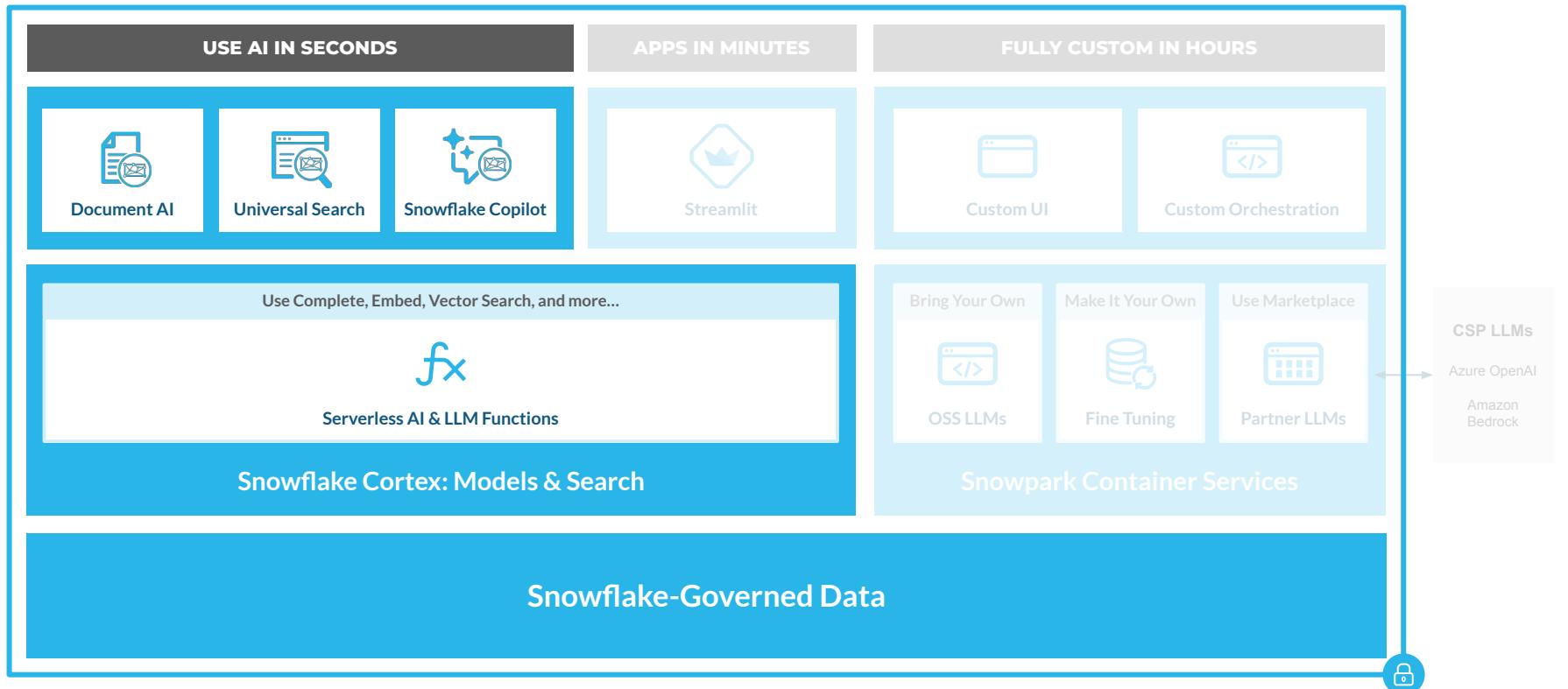
Robust foundation to safeguard your IP from unintended use with role-based access definitions on data, models and apps in Snowflake.



Snowflake for Gen AI & LLMs: Platform Overview



Snowflake for Gen AI & LLMs: Platform Details



Snowflake Cortex

What Is It

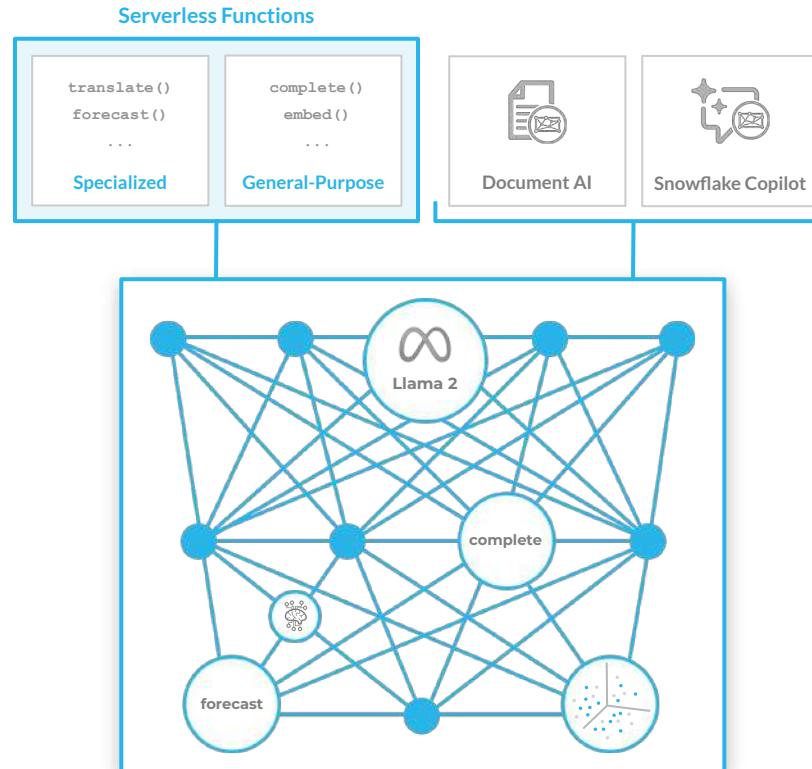
An intelligent, fully managed service that hosts and serves industry-leading AI models, LLMs and vector functions

Why Use It

Quickly and securely analyze your data and build AI applications contextualized with your enterprise data

How To Use It

Access the power of Snowflake Cortex via serverless SQL / Python functions or as part of LLM-powered experiences such as Document AI and Snowflake Copilot



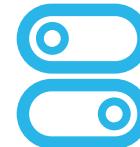
Snowflake Cortex

Puts LLMs and AI models in the hand of every user to get value securely from enterprise data



Easy To Use

Use AI in everyday analytics or build LLM applications without infrastructure management



Flexible

Access industry-leading AI models, LLMs and vector search functionality via SQL / Python functions



Cost Effective

Compute optimized for inference and search to run where your data is secure and governed



Built On Snowflake Cortex



Document AI

Easily extract
structured data from
your PDFs documents



Snowflake Copilot

An LLM-powered
coding assistant
tailored to your data



Universal Search

Quickly search to
discover everything in
the Data Cloud

Document AI

What Is It

New workflow to easily extract content from PDF documents using a built-in LLM developed by Snowflake

Why Use It

Extract analytical value from documents without requiring AI expertise

How To Use It

Ask questions in natural language, automatically get answers, optionally fine-tune results, all in a no-code UI

The screenshot shows the Document AI interface with the following details:

- Project List:** Paystubs 2022
- Model Quality:** 0.8
- Published:** Yes
- Start Training:** Button
- Questions and Answers:**
 - employeeName: What is the employee name? score: 0.97 Maryl Greenhome
 - employeeAddress: What is the employee address? score: 0.83 3109 SE 33rd Terrace
 - employeeID: What is the employee ID? score: 0.91 12380
- PDF Preview:** Shows a preview of a paystub document with fields like Name: Maryl Greenhome, Address: 3109 SE 33rd Terrace, City: Jacksonville, FL, Zip: 32204, and Payroll Period: 02-01-2023 - 02-28-2023.
- Table Data:**

Employee Identifier	Start Date	Employee ID	Open Date	End Date	Close Date
Maryl Greenhome	2023-02-01	12380	2023-02-01	2023-02-28	2023-03-01

arnings	Rate	Hours	OverTime	Year-to-Date	Reductions	Current	Total-to-Date
Regular Pay	\$12.00	30.00	0.00	\$120.00	Health Tax \$10.00 Med Tax \$5.00 Soc Sec / UnEMP \$7.50 State Insurance Tax \$1.00	\$102.50	\$120.00
Overtime Pay							
Other Pay							
Net Pay							

Credit No.	#
Her Pay	\$102.50
HIS Net Pay	\$102.50



Universal Search

What Is It

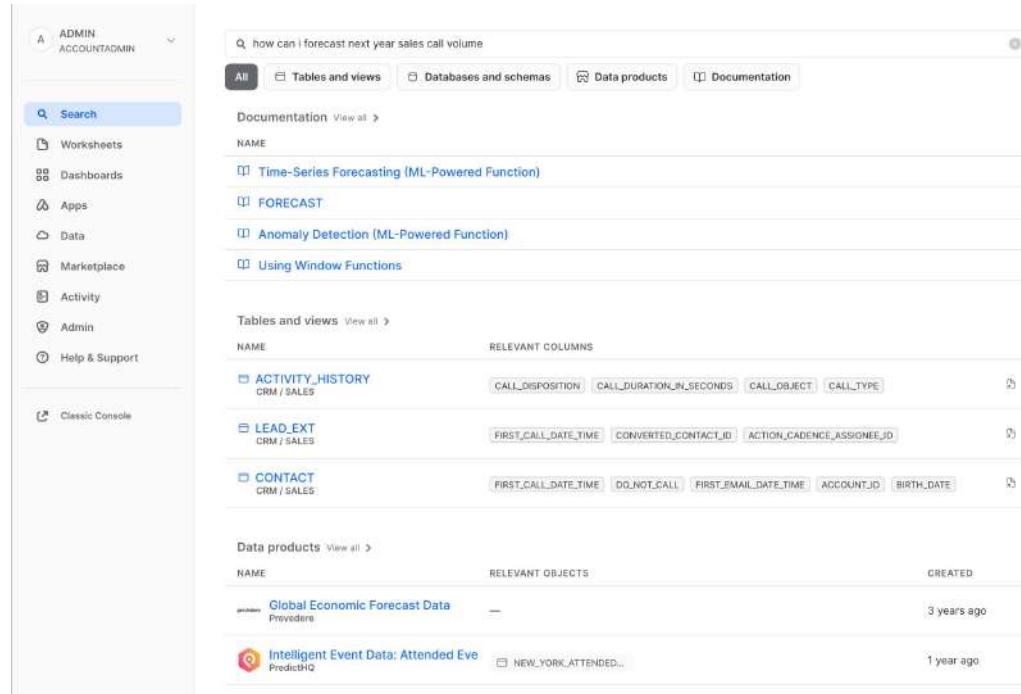
Search and discover tables, views, databases, schemas and available Marketplace listings

Why Use It

Find the data and apps you're looking for faster, across both your Snowflake account and the Marketplace, in one search

How To Use It

Available in the Snowsight UI, allowing you to search across your Snowflake objects



The screenshot shows the Snowsight UI with the "Search" tab selected in the sidebar. A search bar at the top contains the query "how can i forecast next year sales call volume". Below the search bar, there are tabs for "All", "Tables and views", "Databases and schemas", "Data products", and "Documentation". The "Documentation" tab is currently active, displaying results for "Time-Series Forecasting (ML-Powered Function)", "FORECAST", "Anomaly Detection (ML-Powered Function)", and "Using Window Functions". The "Tables and views" section lists three tables: "ACTIVITY_HISTORY" (CRM / SALES), "LEAD_EXT" (CRM / SALES), and "CONTACT" (CRM / SALES). Each table entry includes its name, relevant columns (e.g., CALL_DISPOSITION, CALL_DURATION_IN_SECONDS, CALL_OBJECT, CALL_TYPE for ACTIVITY_HISTORY), and a preview icon. The "Data products" section lists two entries: "Global Economic Forecast Data" (Provider: Preveders) and "Intelligent Event Data: Attended Eve" (Provider: PredictHQ). Each product entry includes its name, relevant objects (e.g., FIRST_CALL_DATE_TIME, DO_NOT_CALL, FIRST_EMAIL_DATE_TIME, ACCOUNT_ID, BIRTH_DATE for CONTACT), and a creation timestamp (e.g., 3 years ago for Global Economic Forecast Data, 1 year ago for Intelligent Event Data).

Name	Relevant Columns	Created
ACTIVITY_HISTORY CRM / SALES	CALL_DISPOSITION, CALL_DURATION_IN_SECONDS, CALL_OBJECT, CALL_TYPE	3 years ago
LEAD_EXT CRM / SALES	FIRST_CALL_DATE_TIME, CONVERTED_CONTACT_ID, ACTION_CADEENCE_ASSIGNEE_ID	3 years ago
CONTACT CRM / SALES	FIRST_CALL_DATE_TIME, DO_NOT_CALL, FIRST_EMAIL_DATE_TIME, ACCOUNT_ID, BIRTH_DATE	3 years ago

Name	Relevant Objects	Created
Global Economic Forecast Data Preveders	—	3 years ago
Intelligent Event Data: Attended Eve PredictHQ	NEW_YORK_ATTENDED..	1 year ago

Snowflake Copilot

What Is It

An LLM-powered assistant that brings the power of Generative AI to everyday Snowday coding tasks

Why Use It

Generates SQL from natural language, refines queries through conversation, improving user productivity

How To Use It

Available in the Snowsight UI, as a side panel where you can ask your questions in natural language

The screenshot shows the Snowsight UI interface. On the left, there's a sidebar titled "Copilot" with a "PREVIEW" button. A message bubble in the sidebar says "Show me this for each month of 2021". Below it, the sidebar displays a generated SQL query:

```

SELECT
    city,
    date_trunc('month', DATE) as MONTH,
    SUM(VALUE) as TOTAL_CRIME
FROM
    urban_crime_timeseries
WHERE
    EXTRACT(
        YEAR
        FROM
        DATE
    ) = 2021
GROUP BY
    city,
    MONTH
ORDER BY
    TOTAL_CRIME DESC;
  
```

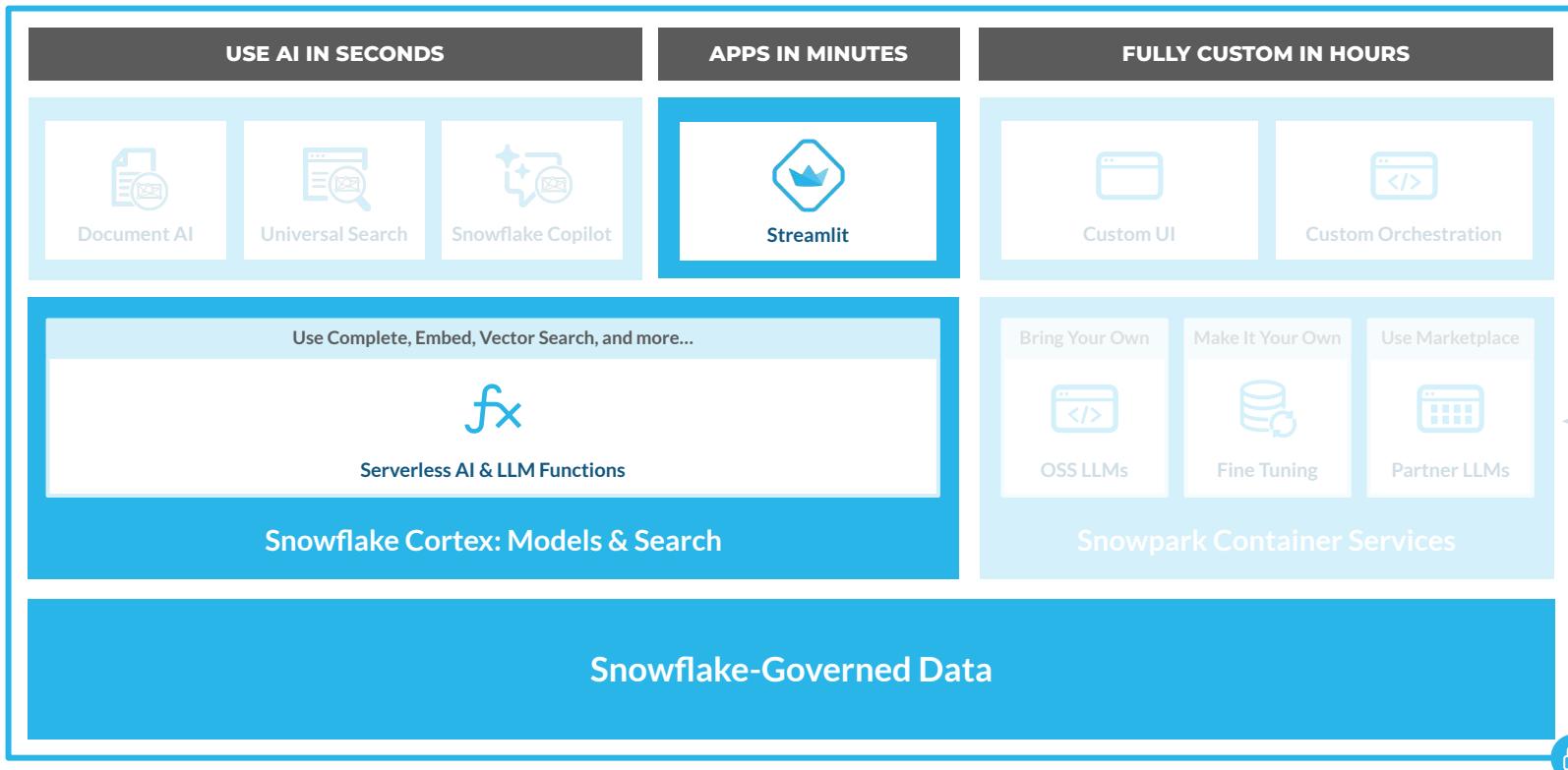
The main workspace shows a worksheet titled "CYBERSYN_URBAN_CRIME.CYBERSYN" with the following code:

```

/*
Generated by Snowflake Copilot based on:
"Which city has the most crime?"
*/
SELECT
    city,
    SUM(VALUE) as TOTAL_CRIME
FROM
    urban_crime_timeseries
GROUP BY
    city
ORDER BY
    TOTAL_CRIME DESC
LIMIT
    1;
  
```

At the bottom right of the workspace, there's a message box that says "Ask a question about your data. Use @ to find tables and columns." and a "CYBERSYN_URBAN_CRIME.CYBERSYN" link.

Snowflake for Gen AI & LLMs: Platform Details



Snowflake Cortex: Specialized Functions

What Is It

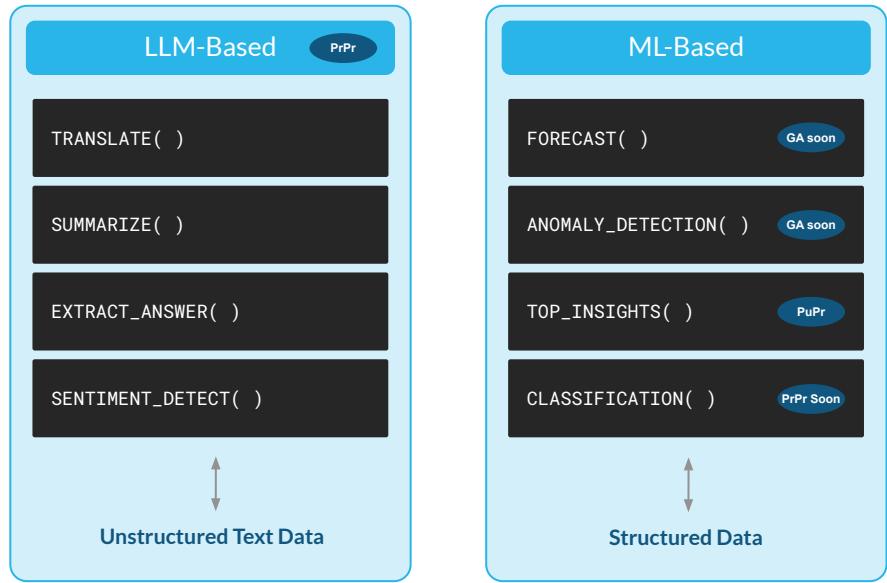
Serverless SQL / Python functions that are well-suited for unstructured text analysis and predictive analytics

Why Use It

Receive specific outputs from unstructured text data in a cost-effective way using smaller, task-tuned language models, or generate predictions and insights on your structured data

How To Use It

Use SQL / Python function in Snowsight or expose as a custom app via Streamlit



PR Private Preview

PU Public Preview

GA General Availability



Snowflake Cortex: General-Purpose Functions

What Is It

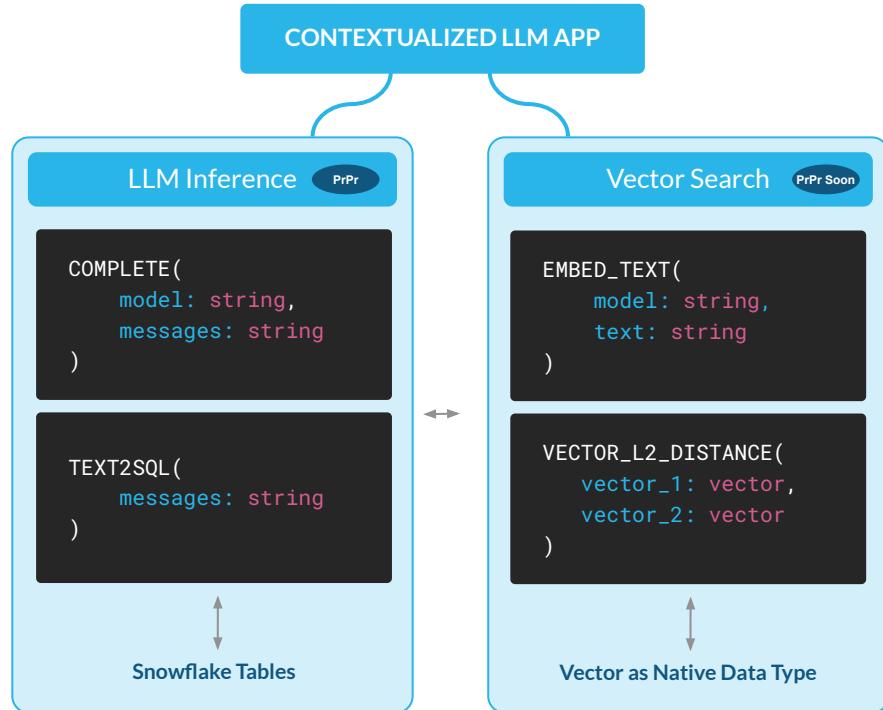
Serverless SQL / Python functions that run inference on conversational LLMs and execute vector search functionality

Why Use It

Quickly build contextually enriched applications using RAG by combining cutting-edge LLMs such as text2SQL and Llama 2 with vector embedding and similarity functions

How To Use It

Use SQL / Python function in Snowsight or expose as a custom app via Streamlit



Root cause analysis, summarization, sentiment analysis

Accelerate development on natural language with Snowflake Native functions.

```
select "Review" , SNOWFLAKE.ML.SENTIMENT("Review")
from HOTEL REVIEW.PUBLIC.HOTEL_REVIEWS
where "Language" = 'en'
limit 10
```



Review

Nice place. The stay was one night but everything was in good order, no issues. The room was nice and clean and the breakfast buffet was plentiful. Would recommend for couples on short stays. They also have free shuttle to Nana Sky Train.

SNOWFLAKE.ML.SENTIMENT("REVIEW")

0.8333

```
prompt = \
"""##"
Summarize this transcript in less than 200 words.
Put the product name, defect and summary in JSON format.
##"
"""
sql = f"select snowflake.ml.complete('llama2-70b-chat', \
(select concat('[INST]', '{prompt}', transcript, '[INST]') from call_transcripts \
where language = 'English' limit 1)) as response"
summary = session.sql(sql).to_pandas()
st.write(summary)
st.json(summary.iloc[0][0])
```



```
{ "product" : "XtremeX helmets",
  "defect" : "broken buckles",
  "summary" :
    "Mountain Ski Adventures received a batch of XtremeX helmets with broken
    buckles. The agent apologized and offered a replacement or refund. The
    customer preferred a replacement, and the agent expedited a new shipment of
    ten helmets with functioning buckles to arrive within 3-5 business days."}
```

Streamlit in Snowflake

What Is It

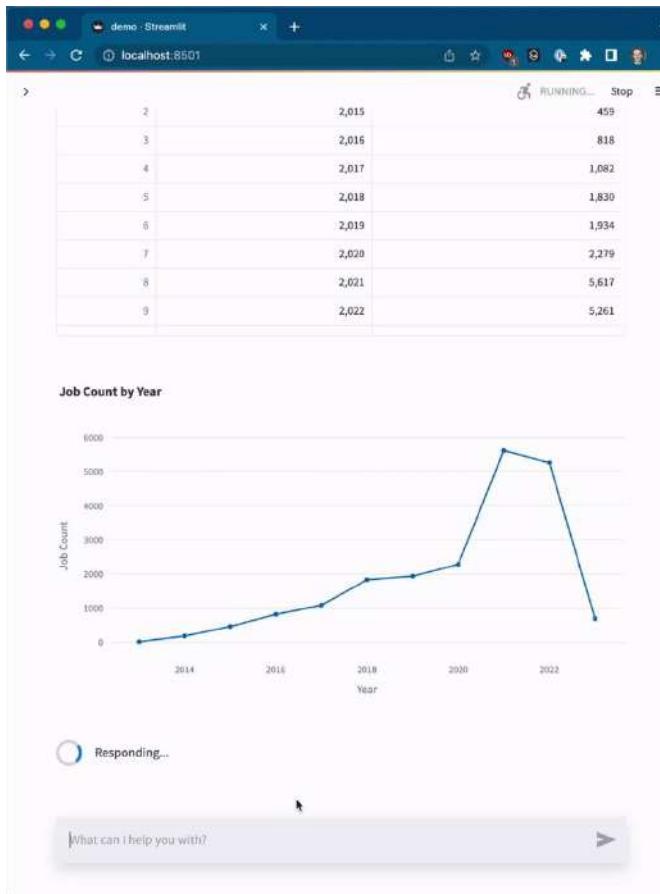
OSS Python library for app development, natively integrated in Snowflake for scalable, reliable and secure deployment

Why Use It

Turn data and AI / ML models into interactive applications that empower stakeholders to self-serve insights and gain trust in results

How To Use It

Use side-by-side code editor and preview pane to add and remove components, then share app URL with coworkers in one click



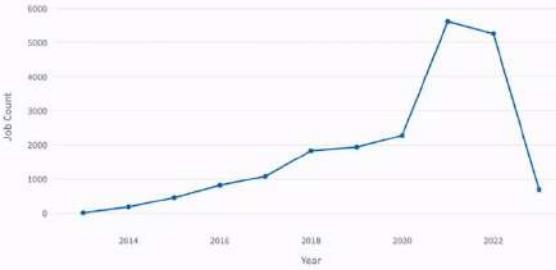
The screenshot shows a Streamlit application running in a browser window titled "demo : Streamlit" at "localhost:8501". The application displays two main components: a table and a line chart.

Table:

2	2,015	459
3	2,016	818
4	2,017	1,082
5	2,018	1,830
6	2,019	1,934
7	2,020	2,279
8	2,021	5,617
9	2,022	5,261

Line Chart:

Job Count by Year



A line chart titled "Job Count by Year" showing the number of jobs over time. The x-axis represents the year from 2014 to 2022. The y-axis represents the job count from 0 to 6000. The data shows a steady increase from 2014 to 2019, followed by a sharp peak in 2020 (approx. 2200 jobs), a slight dip in 2021 (approx. 5500 jobs), and a significant drop in 2022 (approx. 1000 jobs).

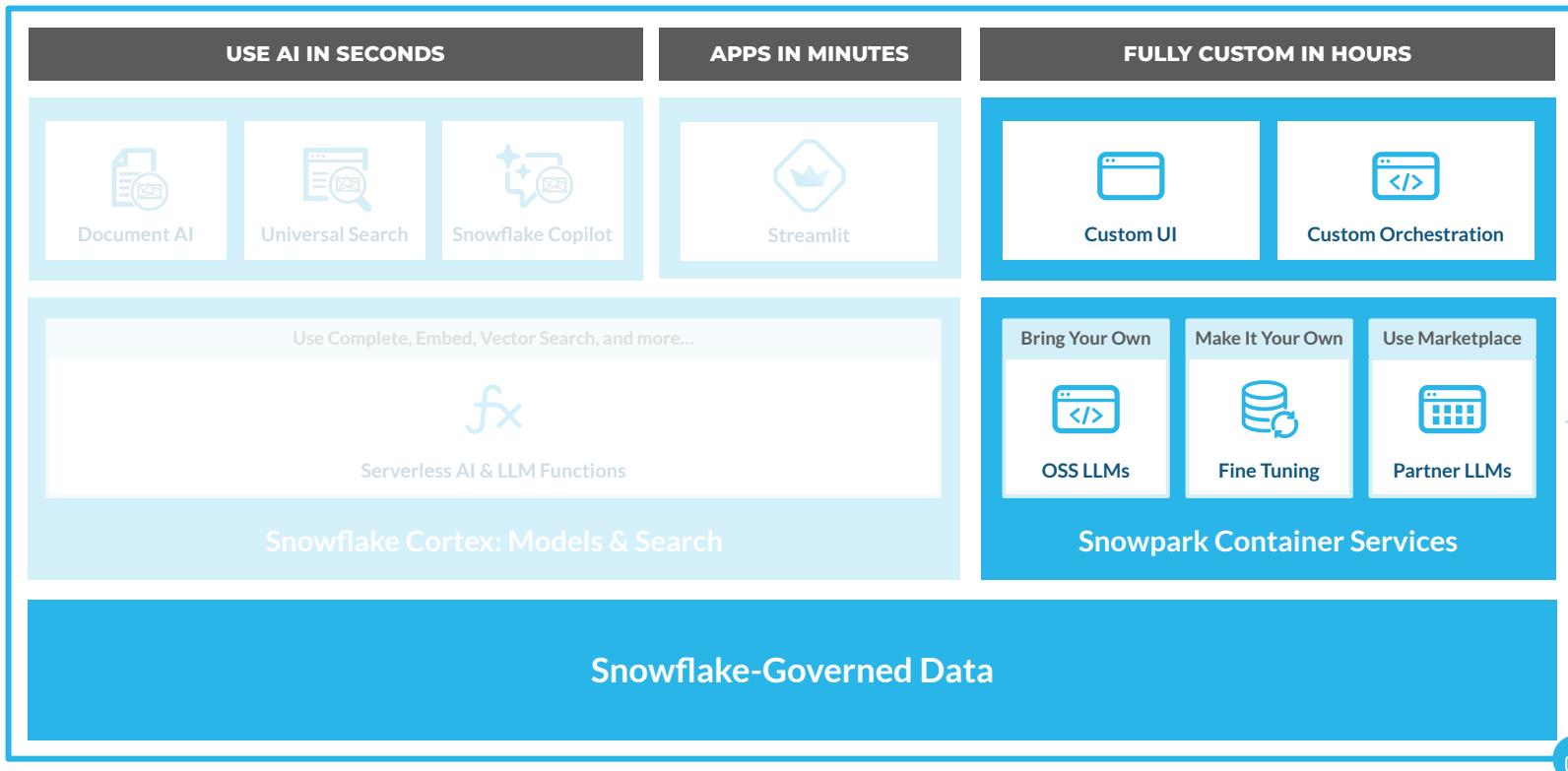
Year	Job Count
2014	~100
2015	~200
2016	~400
2017	~600
2018	~1800
2019	~2000
2020	~2200
2021	~5500
2022	~1000

Bottom Panel:

Responding... 

What can I help you with? 

Snowflake for Gen AI & LLMs: Platform Details



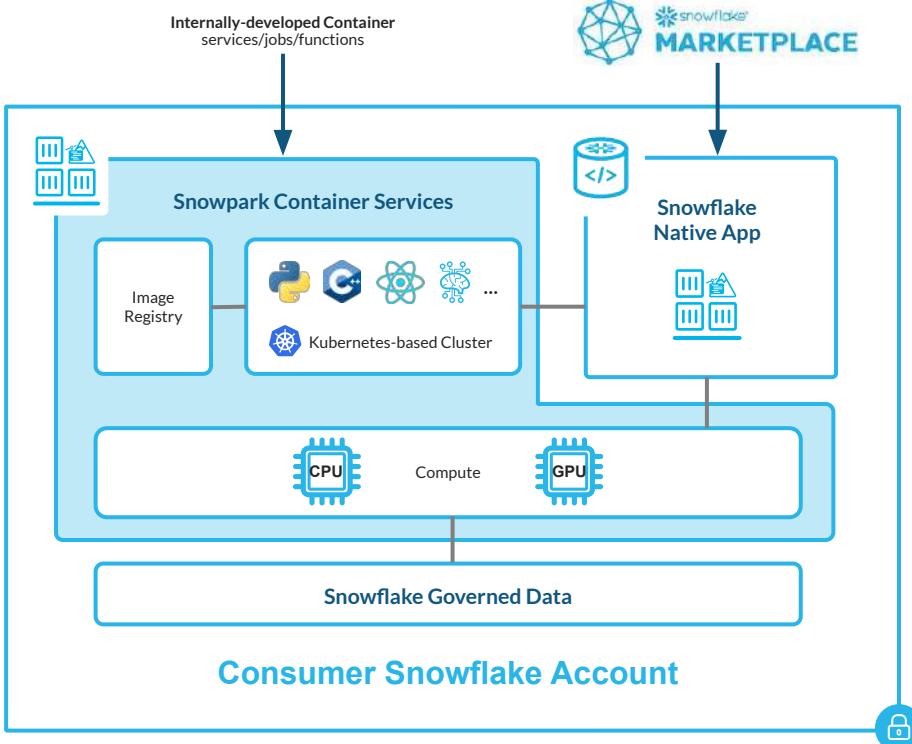
Snowpark Container Services

What is it

Additional Snowpark runtime that helps developers register and deploy container images in Snowflake

Why use it

- Language & hardware flexibility:** Build in any programming language, package as a container image and deploy in configurable CPUs & GPUs
- Unified services experience:** Effortlessly deploy with integrated image registry, elastic compute infrastructure and managed Kubernetes-based cluster
- Bring sophisticated apps to the data:** Run entire containerized applications from third-party developers in your account as Snowflake Native Apps via Snowflake Marketplace



What are the use cases ?

Data Exploration

Text to SQL, universal search, business chatbot

Customer Experience & Marketing

Customer / sales assistant chatbot, basket recommendation, sentiment analysis, identity reconciliation online news scrapping
Targeting, Segmentation, Content creation

Operational Efficiency

Description generation / translation, support tickets classification, Automatic RFP response

Unstructured data extraction & Search engine / Smart EDM

Internal search engine for all documents (pdf, mail, docx, html, png, jpeg, etc.)
Quality incident detection, business process monitoring, legal & regulatory compliance , product information retrieval

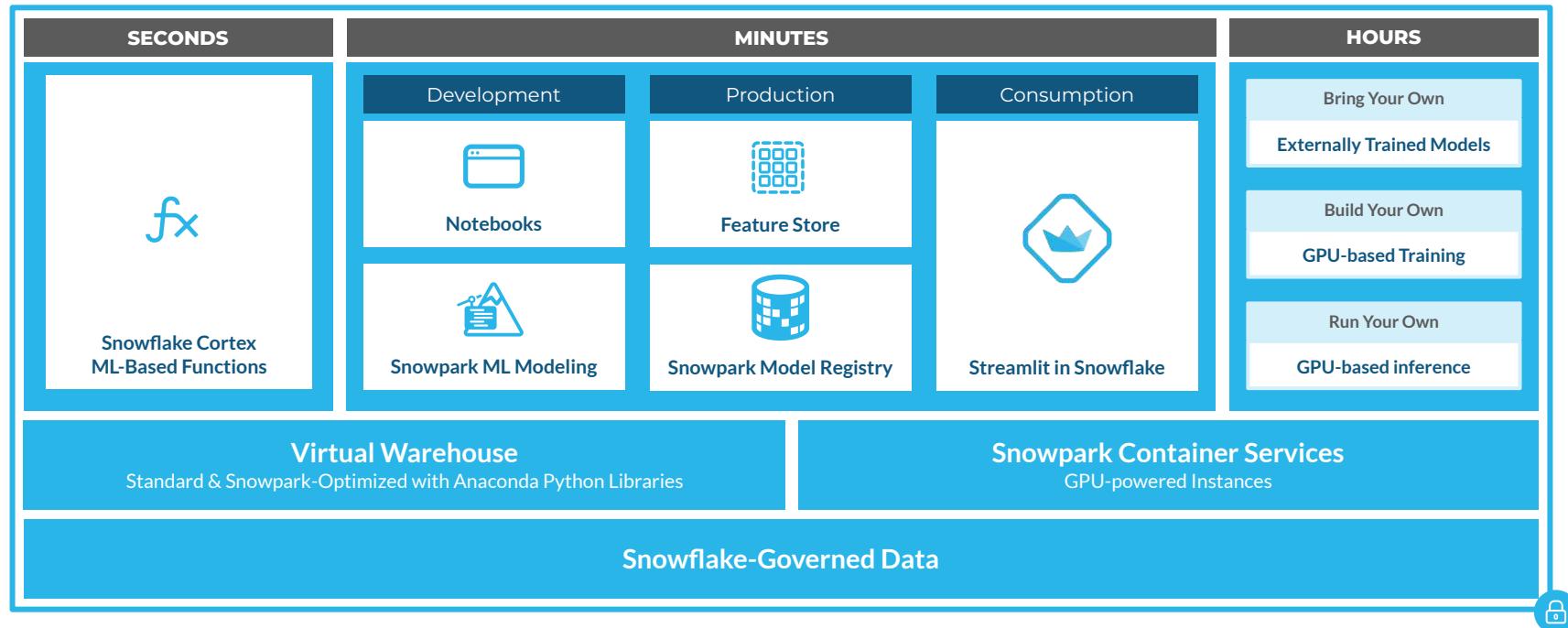
Risk mitigation

Anomaly detection, Fraud, bot detection , transaction anomaly



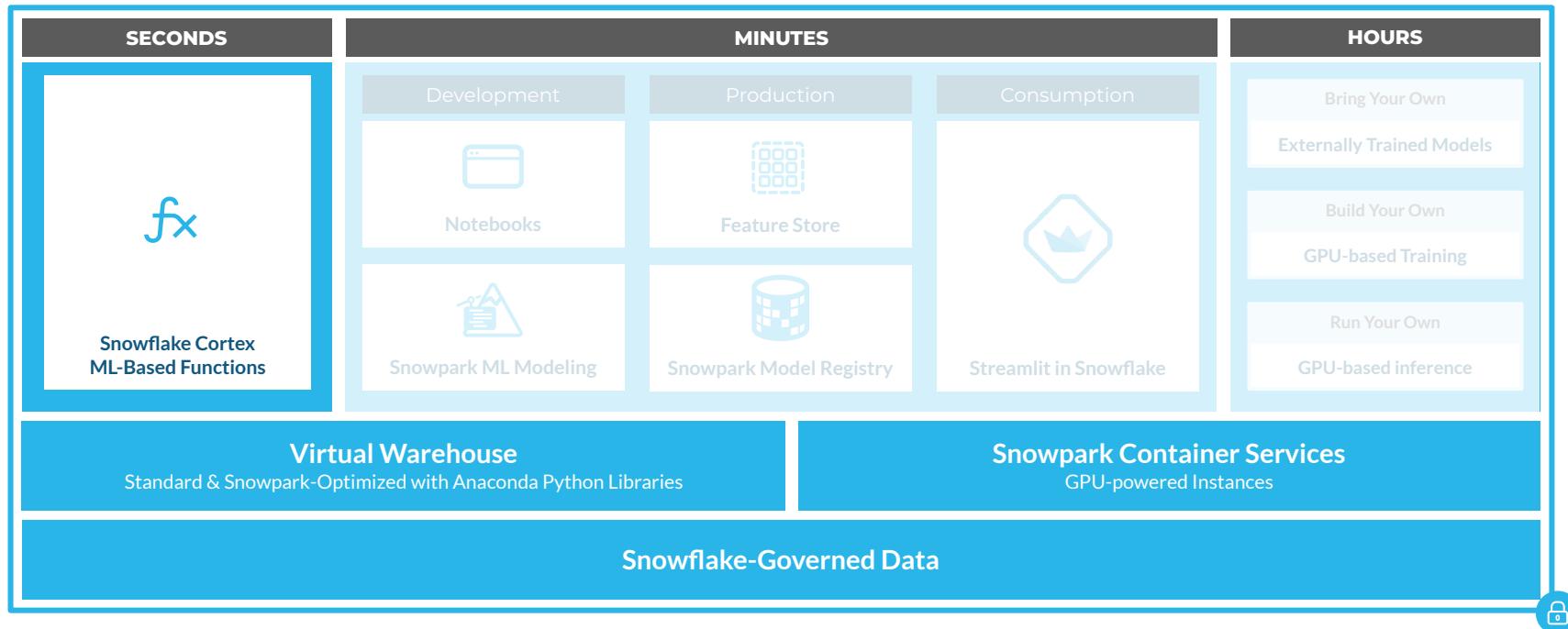
Snowflake for Machine Learning

Securely and collaboratively build and deploy features, models and apps



Snowflake for Machine Learning

Securely and collaboratively build and deploy features, models and apps



SNOWFLAKE CORTEX: ML-BASED FUNCTIONS

ML accessible via SQL

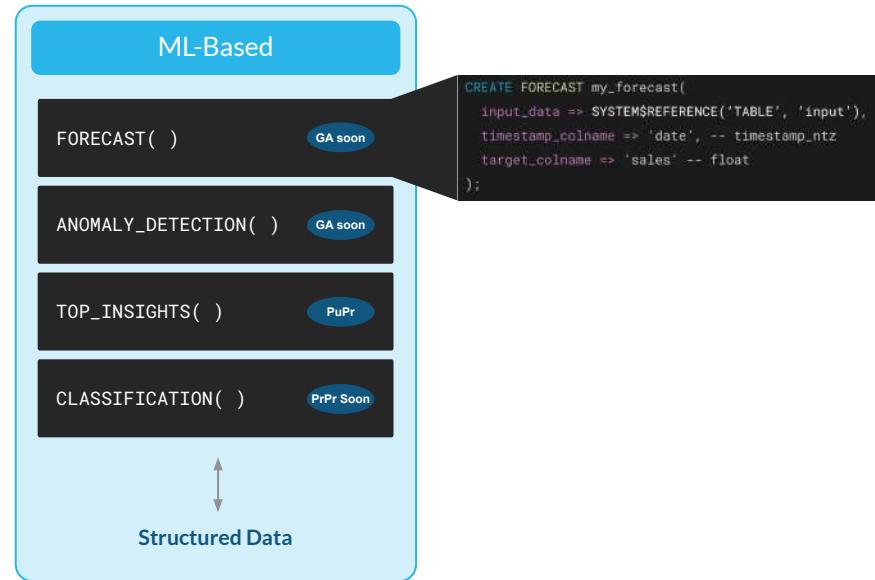
Abstract complexity of ML frameworks and algorithms for forecasting, anomaly detection & more with SQL functions

No complex infrastructure

Scale from one to millions of ML-powered insights with the elasticity and near-zero operations of Snowflake's virtual warehouse compute

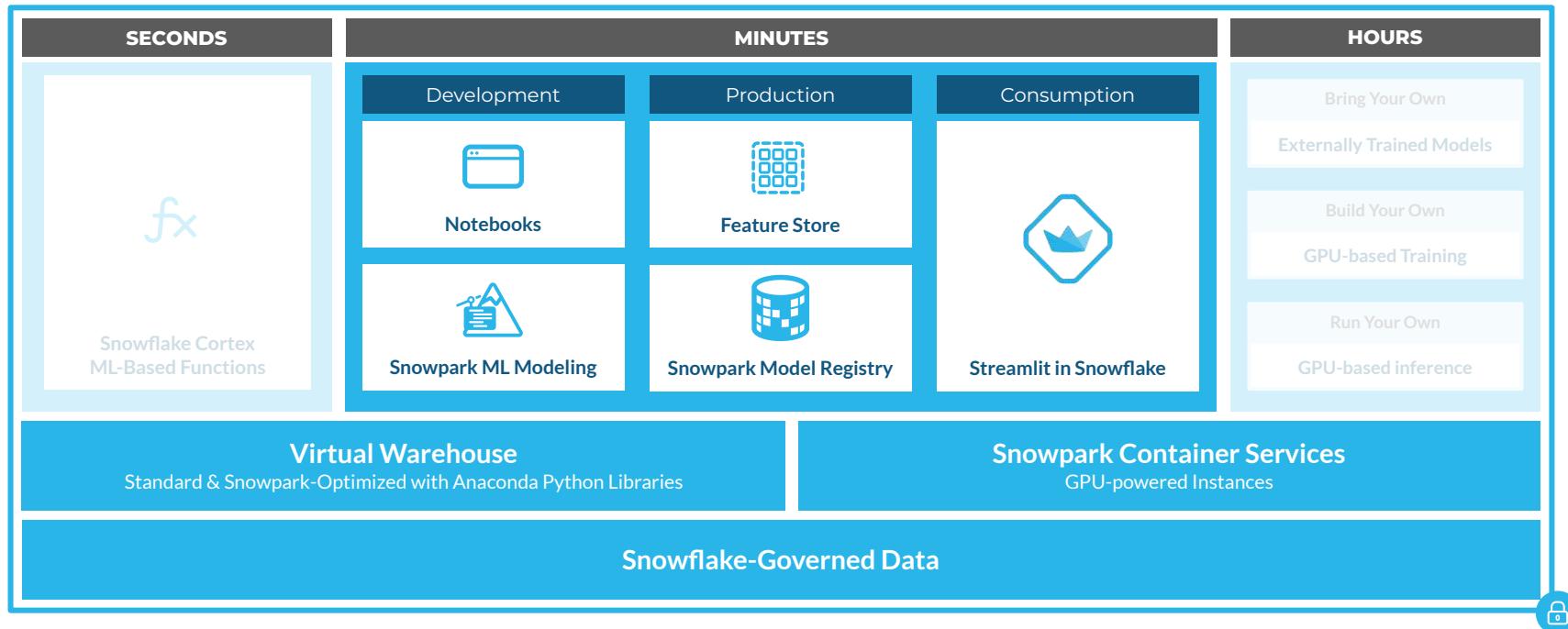
Quick insights delivery

Share insights in analytics / BI tools integrated with Snowflake's consistent data governance across model inputs and outputs



Snowflake for Machine Learning

Securely and collaboratively build and deploy features, models and apps



Snowflake Notebooks

What Is It

SQL, Python, and Markdown cell-based development interface in Snowsight

Why Use It

Quickly explore data with language of choice and visualize results using popular Python libraries. Leverage role-based controls to securely share work with others.

How To Use It

Create, edit and share your analyses and models in Snowsight

```
< Notebooks SNOWDAY_ML_DEMO >
```

Markdown • in Intro_to_correlation

Feature Correlation

Let's also calculate correlation between the feature columns.

```
Python • as correlation
```

```
1 from snowflake.ml.modeling.matrix.correlation import correlation
2 corr_df = correlation(df=input_df,
3                      st.dataframe(corr_df, use_container_width=True)
```

	ISFraud	TX_UTILIZATION_NORM	TX_DAILY_COUNT_NORM	PREF_CUSTOMER	HOUR_OF_DAY
ISFraud	1	0.0265	0.1461	-0.006	-0.3493
TX_UTILIZATION_NORM	0.0265	1	-0.0717	-0.0256	-0.3083
TX_DAILY_COUNT_NORM	0.1461	-0.0717	1	0.0029	-0.0015
PREF_CUSTOMER	-0.006	-0.0256	0.0029	1	0.0085
HOUR_OF_DAY	-0.3493	-0.3083	-0.0015	0.0085	1


```
Python • as plot_correlation
```

```
1 import plotly.express as px
2 fig = px.imshow(corr_df, text_auto=True, aspect="auto")
3 # you can choose "streamlit" theme if preferred
4 st.plotly_chart(fig, theme="streamlit")
```



The heatmap shows the correlation coefficients between five features: ISFraud, TX_UTILIZATION_NORM, TX_DAILY_COUNT_NORM, PREF_CUSTOMER, and HOUR_OF_DAY. The color scale ranges from -1 (dark blue) to 1 (dark red). The diagonal elements are all 1.0. The correlation values are as follows:

	ISFraud	TX_UTILIZATION_NORM	TX_DAILY_COUNT_NORM	PREF_CUSTOMER	HOUR_OF_DAY
ISFraud	1	0.0265	0.1461	-0.006	-0.3493
TX_UTILIZATION_NORM	0.0265	1	-0.0717	-0.0256	-0.3083
TX_DAILY_COUNT_NORM	0.1461	-0.0717	1	0.0029	-0.0015
PREF_CUSTOMER	-0.006	-0.0256	0.0029	1	0.0085
HOUR_OF_DAY	-0.3493	-0.3083	-0.0015	0.0085	1

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Snowpark ML Modeling API

What Is It

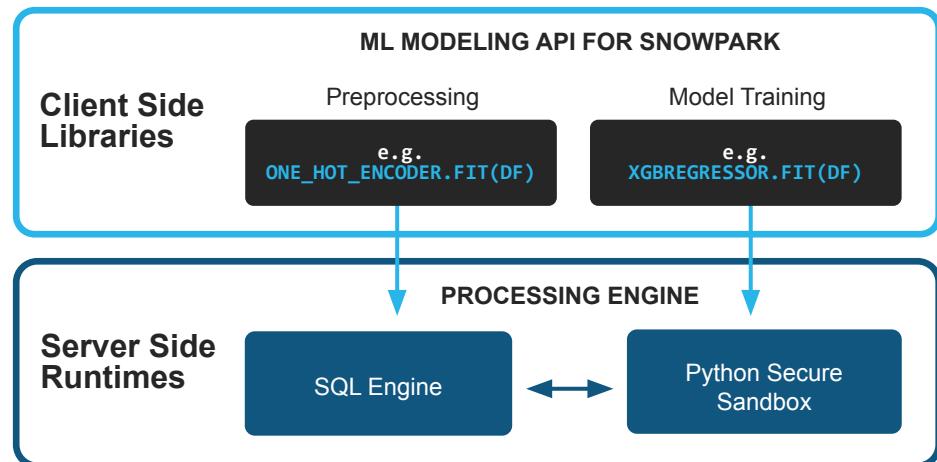
Popular frameworks for feature engineering and ML training directly in Snowpark

Why Use It

- Preprocessing:** Improve performance and scalability with distributed execution for common scikit-learn preprocessing functions
- Model Training:** Simplify model training for scikit-learn and xgboost models

How To Use It

Use in Snowflake Notebooks (PrPr) or work from your tool of choice by installing the Snowpark ML library from the Snowflake Conda Channel or PyPI



Snowpark Model Registry

What Is It

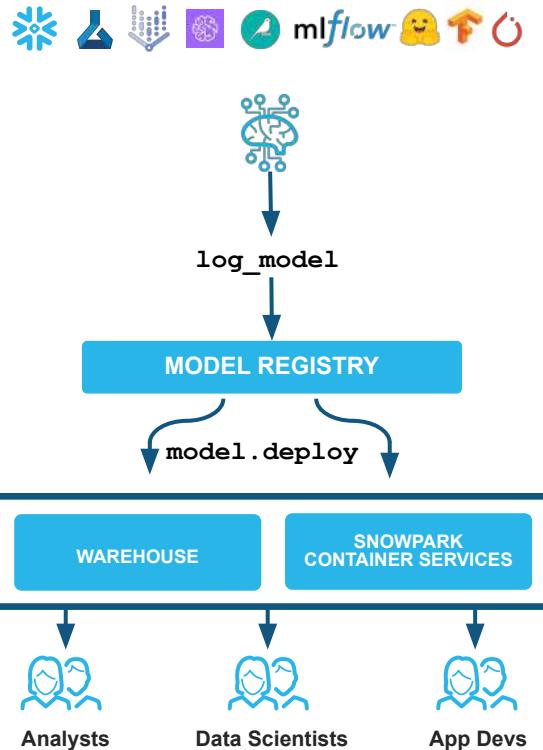
Integrated solution to manage and deploy models and their metadata natively in Snowflake

Why Use It

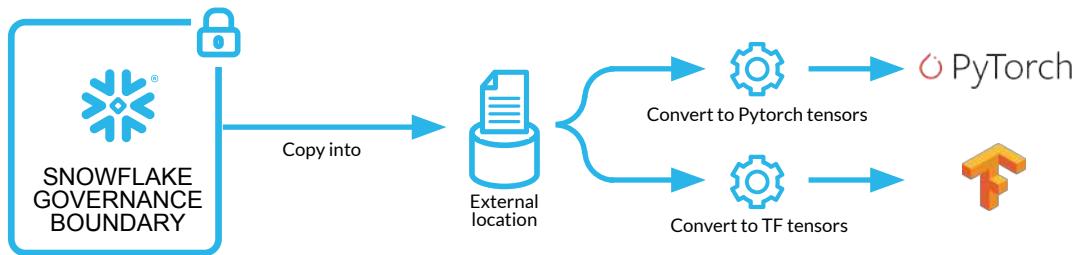
Scalable and secure deployment, management, and inference of ML models in Snowflake compute, including warehouses and Snowpark Container Services

How To Use It

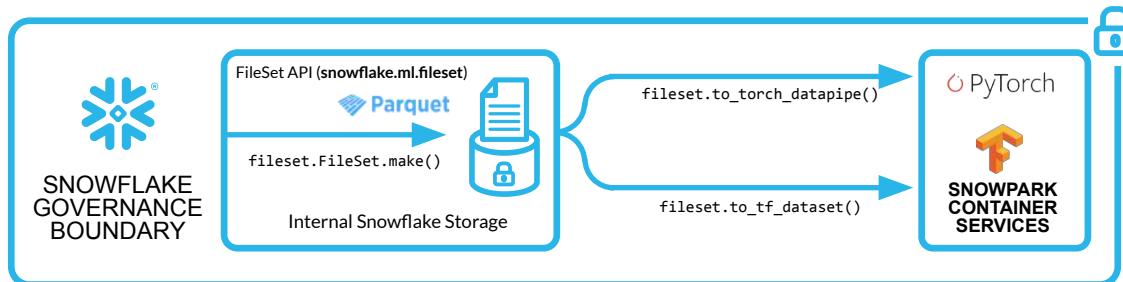
Use in Snowflake Notebooks (PrPr) or work from your tool of choice by installing the Snowpark ML library from the Snowflake Conda Channel or PyPI



Snowpark ML FileSet



- ✗ Unmanaged data egress
- ✗ Additional post-processing needed
- ✗ Need external compute for GPU training/inference



- ✓ Full governance over extracted data
- ✓ No post-processing needed
- ✓ Train/deploy Pytorch/TF models on Snowpark Container Services w/GPUs.

Snowflake Feature Store

What Is It

Integrated solution to create, store, manage, and serve ML features for model training and inference in Snowflake

Why Use It

Maintains a single source of truth and automates feature updates continuously for consistent downstream pipelines

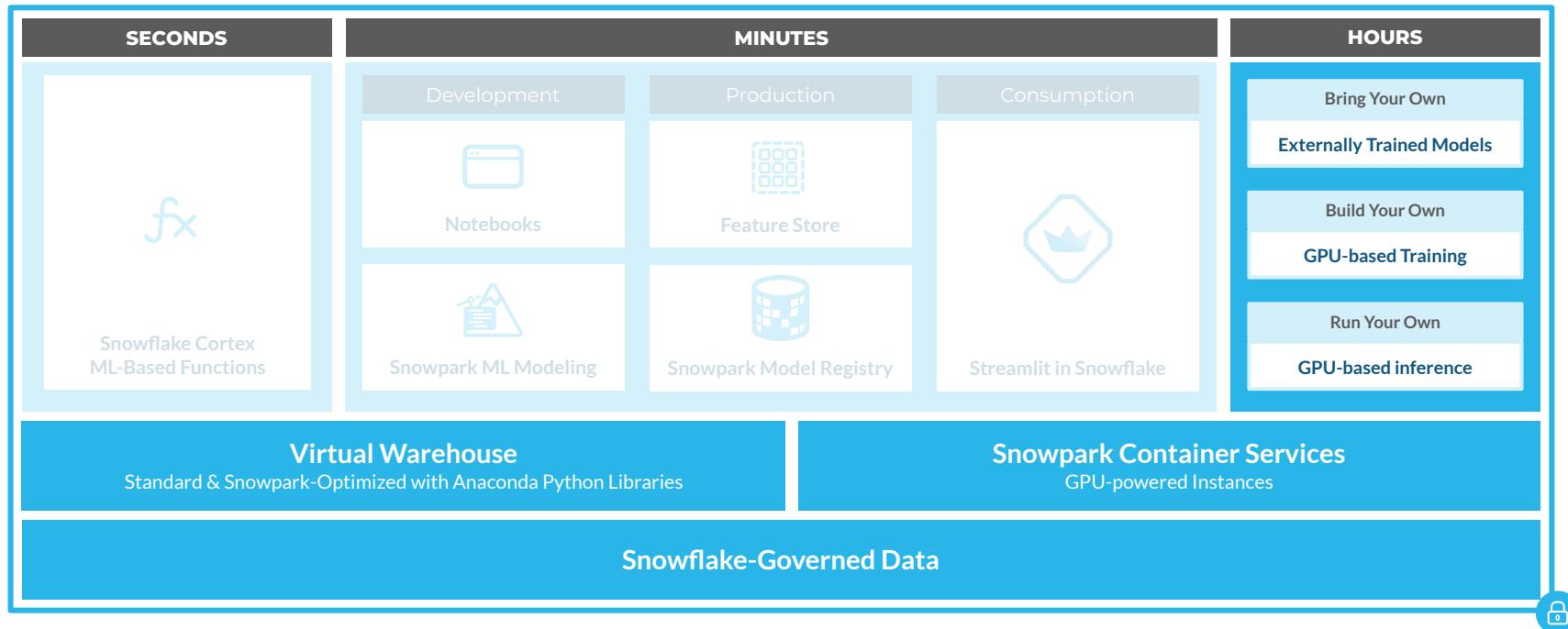
How To Use It

Python APIs accessible via Snowpark ML library, and SQL interfaces for defining, managing and retrieving features



Snowflake for Machine Learning

Securely and collaboratively build and deploy features, models and apps



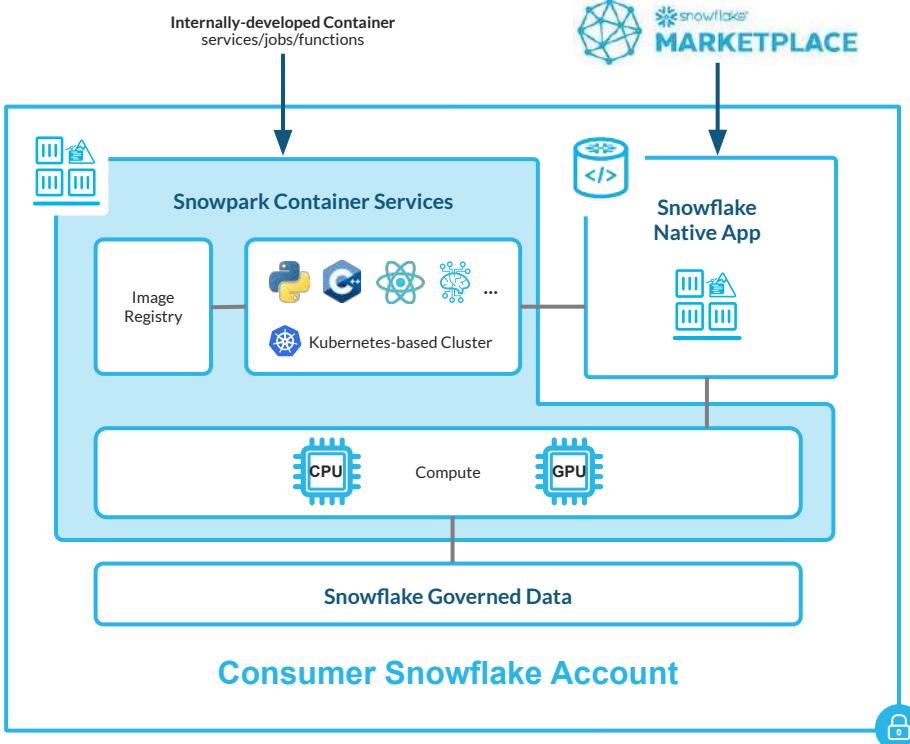
Snowpark Container Services

What is it

Additional Snowpark runtime that helps developers register and deploy container images in Snowflake

Why use it

- Language & hardware flexibility:** Build in any programming language, package as a container image and deploy in configurable CPUs & GPUs
- Unified services experience:** Effortlessly deploy with integrated image registry, elastic compute infrastructure and managed Kubernetes-based cluster
- Bring sophisticated apps to the data:** Run entire containerized applications from third-party developers in your account as Snowflake Native Apps via Snowflake Marketplace



Workloads Supported



AI/ML WORKLOADS

Train and execute inference for large scale models using GPUs with any language including Python and R



LLMs

Run open source LLMs, and third-party LLMs tuned to your data.



OPTIMIZED PROCESSING

Run C/C++ workloads and web APIs that process large amounts of data



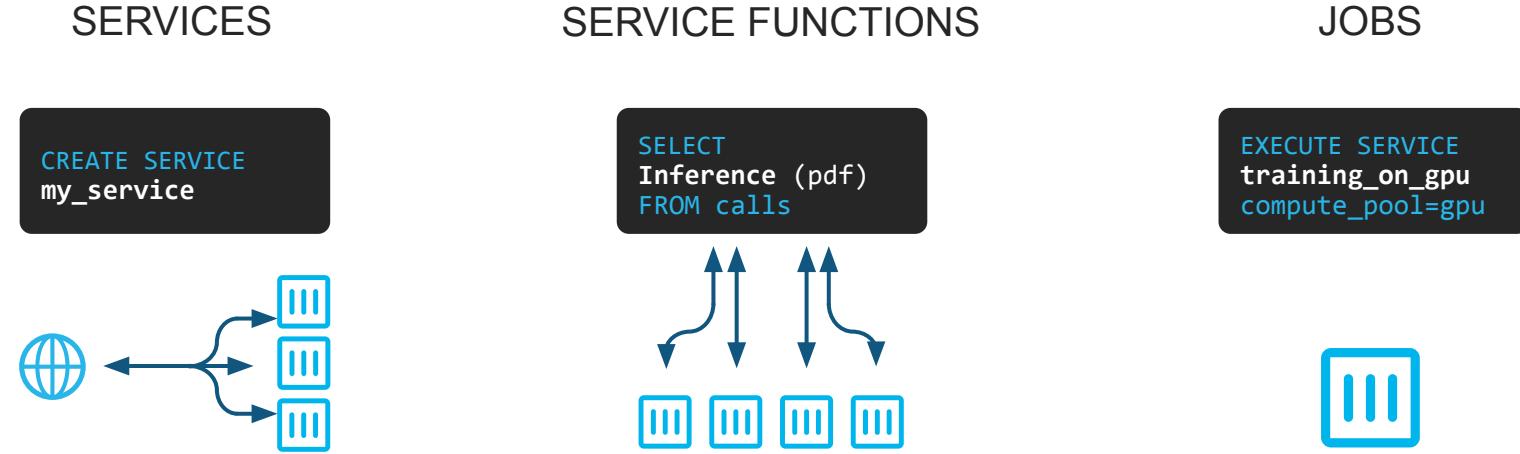
APPLICATIONS

Run any component of an app from APIs to UIs

& more



Usage Options



Creating Services, Jobs, and Service Functions with Snowpark Container Services

```
CREATE COMPUTE POOL my_cpl  
    MIN_NODES = 1  
    MAX_NODES = 3  
    INSTANCE_FAMILY = GPU
```

```
CREATE SERVICE [ IF NOT EXISTS ] inference_point  
    MIN_INSTANCES = 1  
    MAX_INSTANCES = 3  
    COMPUTE_POOL = my_cpl  
    SPEC = @my_service_stage/path/to/inference_point.yaml
```

Define compute pool size and instance type

Choose and define execution as service, function or job

Point to spec file with service definition

