DATASTAX

Please Join our WiFi Network
WeWork Guest

Real-time AI

Out of the Lab, Into Prod

Introduction

Hilton Rosenfeld

- Developer / Architect
- Application Modernization
- Digital Transformation
- IT Operations Management
- CI / CD

Build your own NLP text classifier and expose it as an API

FastAPI

DATASTAX ASTRA DB

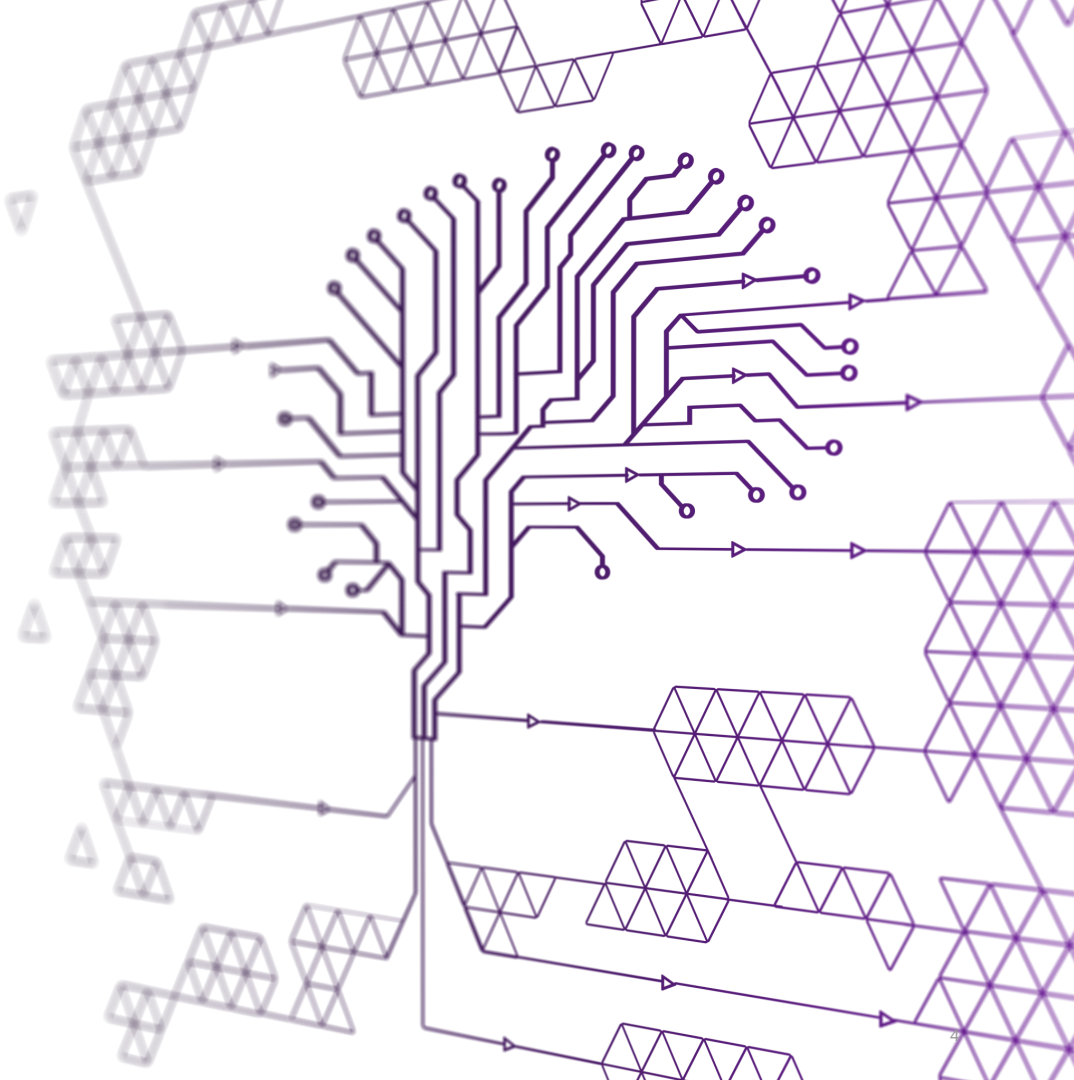
Housekeeping

- Break(s) will be provided.
- Refreshments will be served.

- Ask Questions !
- Scroll through exercises at your own pace.

- Connectivity Issues:
  - disable VPN and/or Firewall

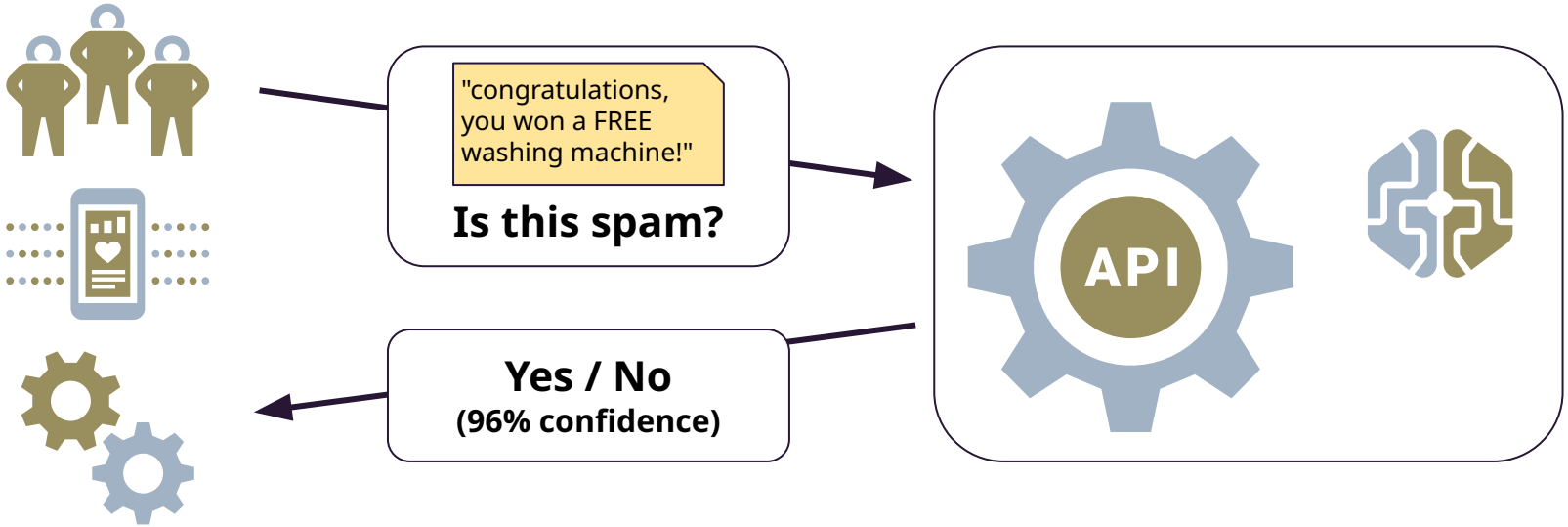
What we are building today



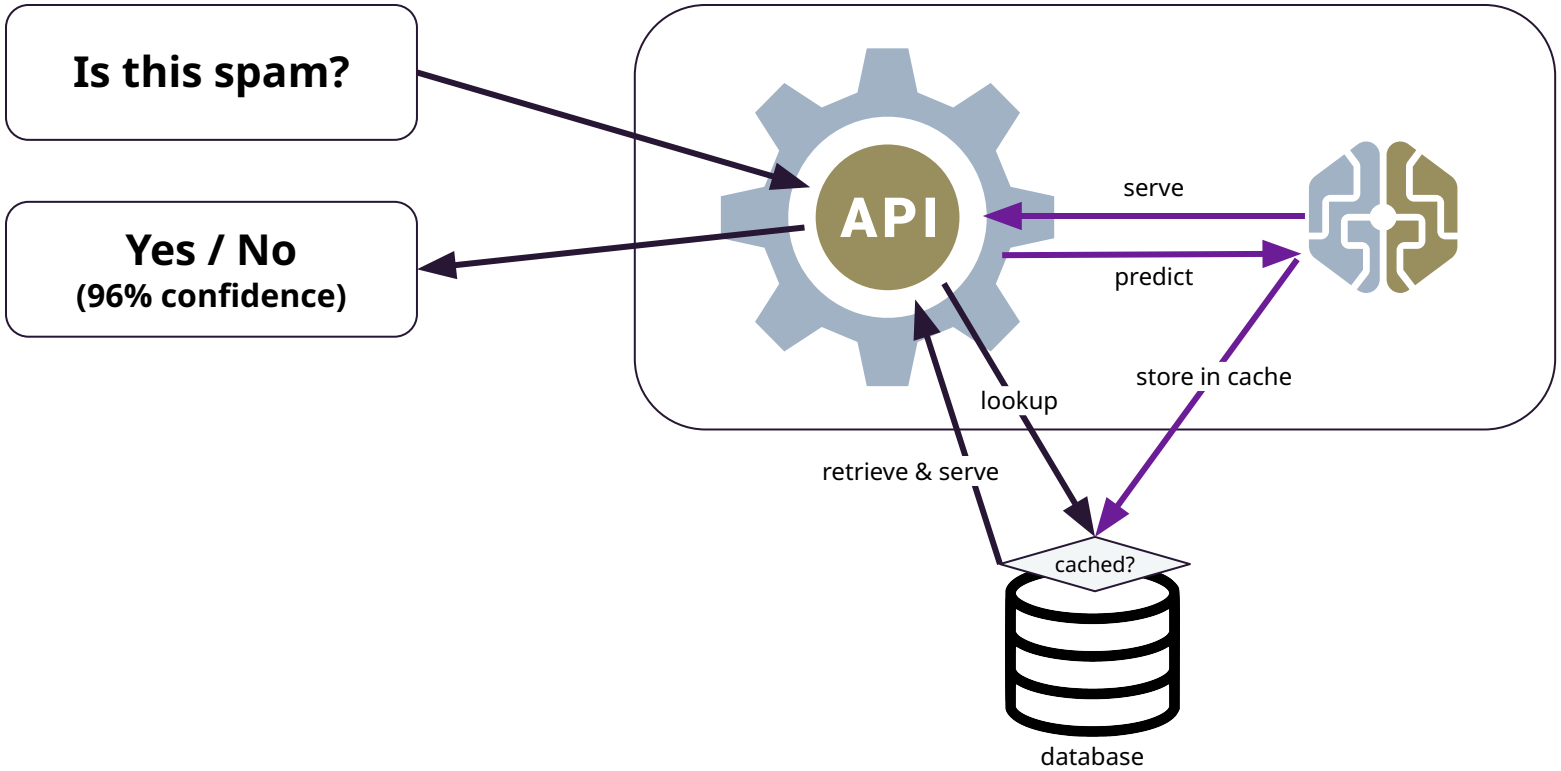
Spam

- 85% of emails are spam:
  122, 330, 000, 000 daily
  - Advertising - 36%
  - Adult-related content - 31.7%
  - Financial matters - 26.5%
  - Scams and fraud - 2.5%
- For every 12,500,000 emails sent, spammers receive one reply.
- Email spam costs businesses **$20.5 billion** annually.

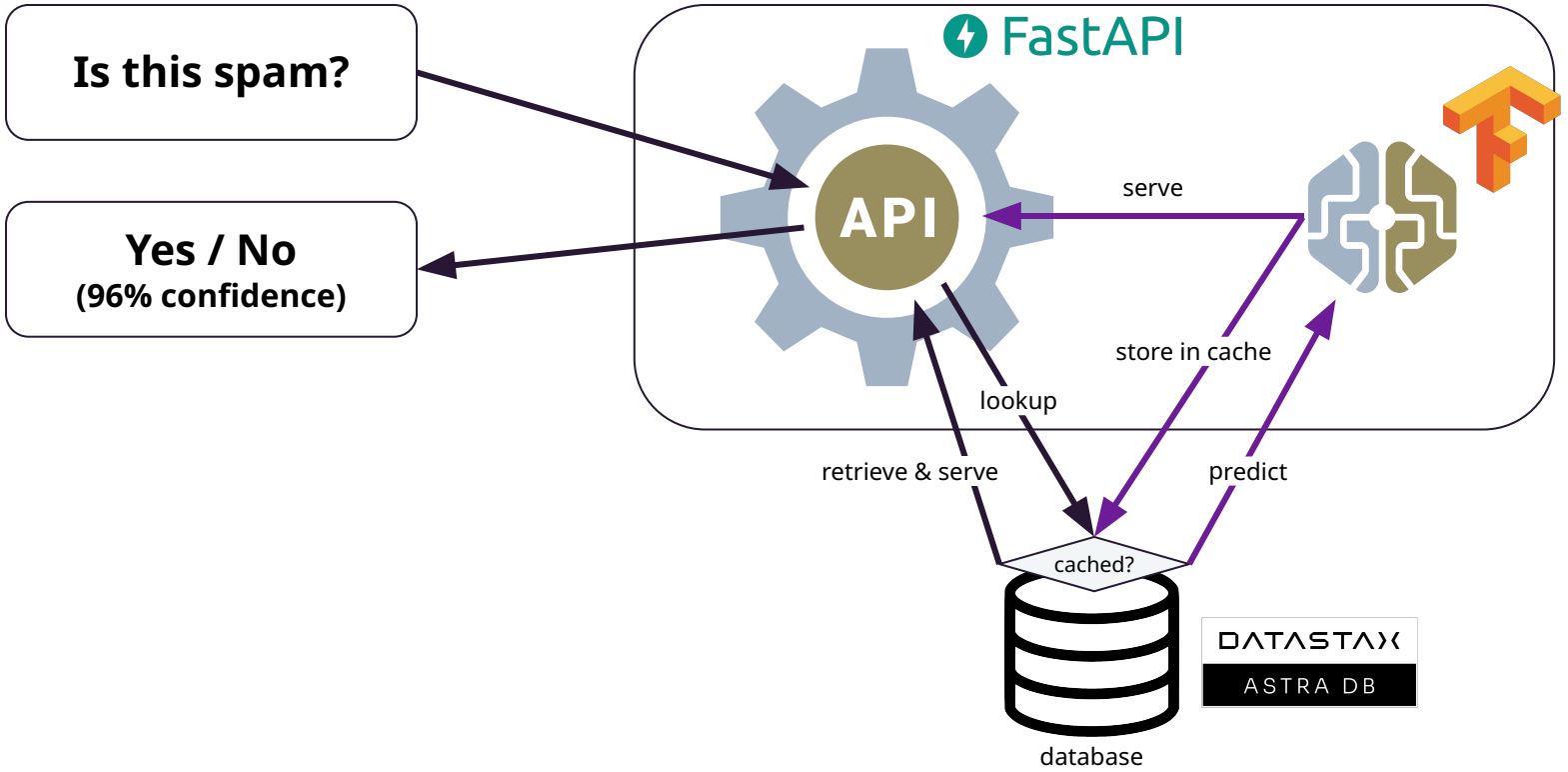
What we want



Architecture sketch



Tech stack

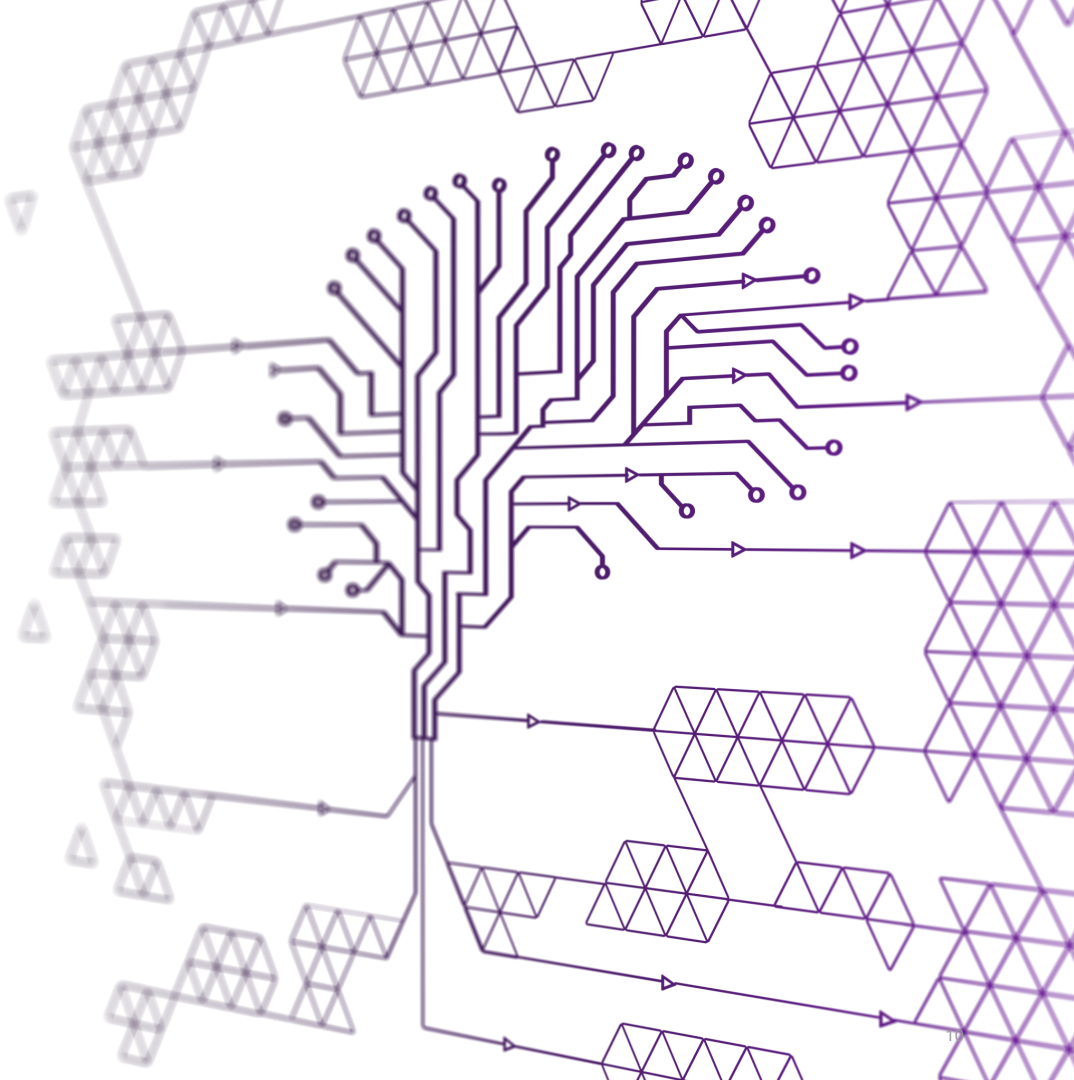


Applying Machine Learning to the problem of Spam filtering

1. Create a deep learning model from multiple spam datasets
2. Make that available as a REST API using Jupyter, TensorFlow, FastAPI and DataStax Astra DB.

- Combining 2 open source spam datasets curated by The University of California, Irvine (UCI).
- Preparing a new dataset to be fully ready for training a model.
- Building and training an LSTM model leveraging Keras and TensorFLow.
- Creating an API to expose the model for use leveraging FastAPI
- Caching predictions and inference data

The AI



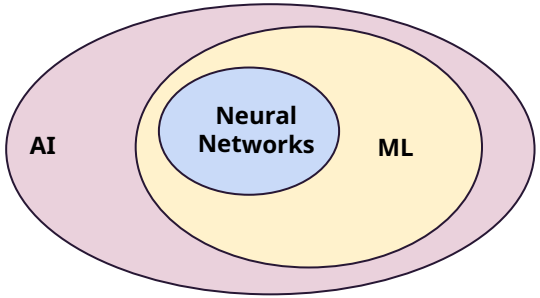
AI and ML

"ML: LSTM RNN for NLP"

Machine Learning = *algorithms that improve by being fed data, without explicit instructions what to do.*

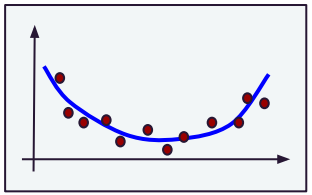
It's essentially statistical inference *(with superpowers)*.

Lots of math involved (*linear algebra, calculus, probability/statistics*).
Nowadays accessible as neatly-packaged tools (good for us!)

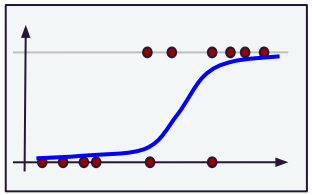


Simple examples of ML:

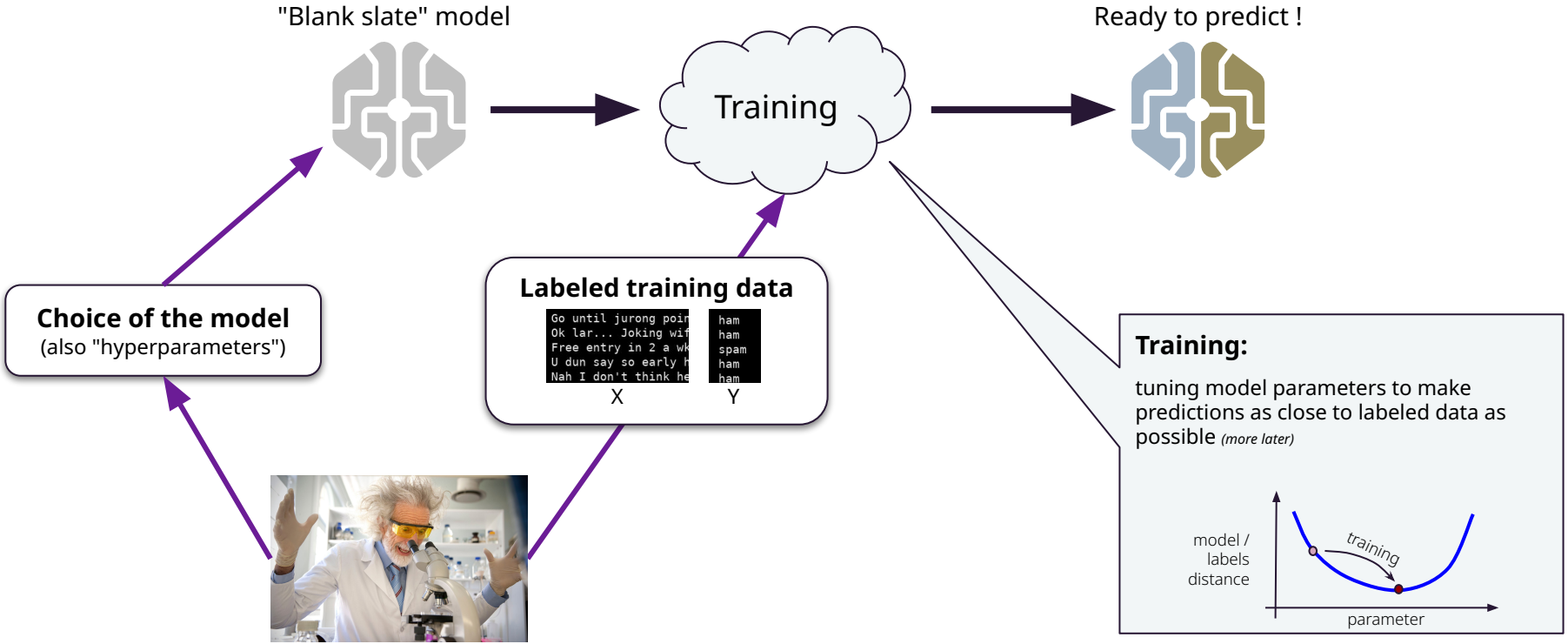
Least-Squares Fits



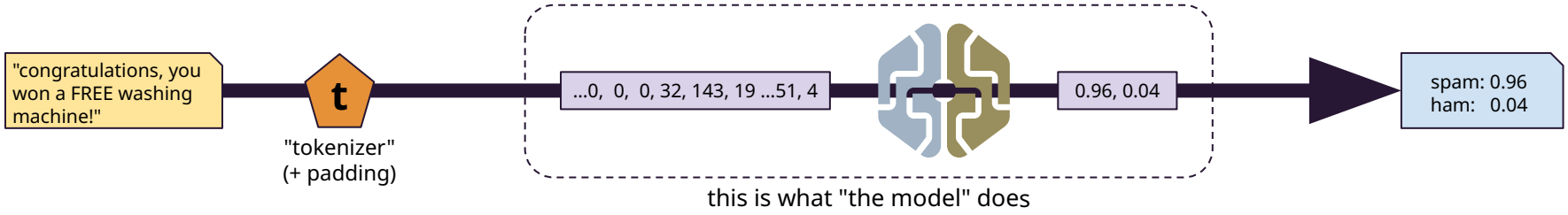
Logistic Regressions



Supervised learning



A closer look: numeric encoding



Prepare the dataset before training

Labeled training data

X	Y
Go until jurong poi	ham
Ok lar... Joking wif	ham
Free entry in 2 a wk	spam
U dun say so early h	ham
Nah I don't think he	ham
FreeMsg Hey there da	spam

...0, 0, 0, 32, 143, 19 ... 51, 4
...0, 0, 0, 0, 41, 4 ... 65, 10
...0, 0, 0, 0, 0, 21 ... 84, 5
...0, 0, 0, 0, 81, 205 ... 3, 51
...0, 0, 0, 7, 56, 4 ... 15, 75
...0, 0, 0, 0, 0, 194 ... 2, 65

t

1, 0
1, 0
0, 1
1, 0
1, 0
0, 1

Split "train" / "test"

train

...0, 0, 0, 32, 143, 19 ... 51, 4
...0, 0, 0, 0, 41, 4 ... 65, 10
...0, 0, 0, 0, 0, 21 ... 84, 5
...0, 0, 0, 0, 81, 205 ... 3, 51
...0, 0, 0, 7, 56, 4 ... 15, 75

test

...0, 0, 0, 0, 0, 194 ... 2, 65
... ...

The antispam model architecture

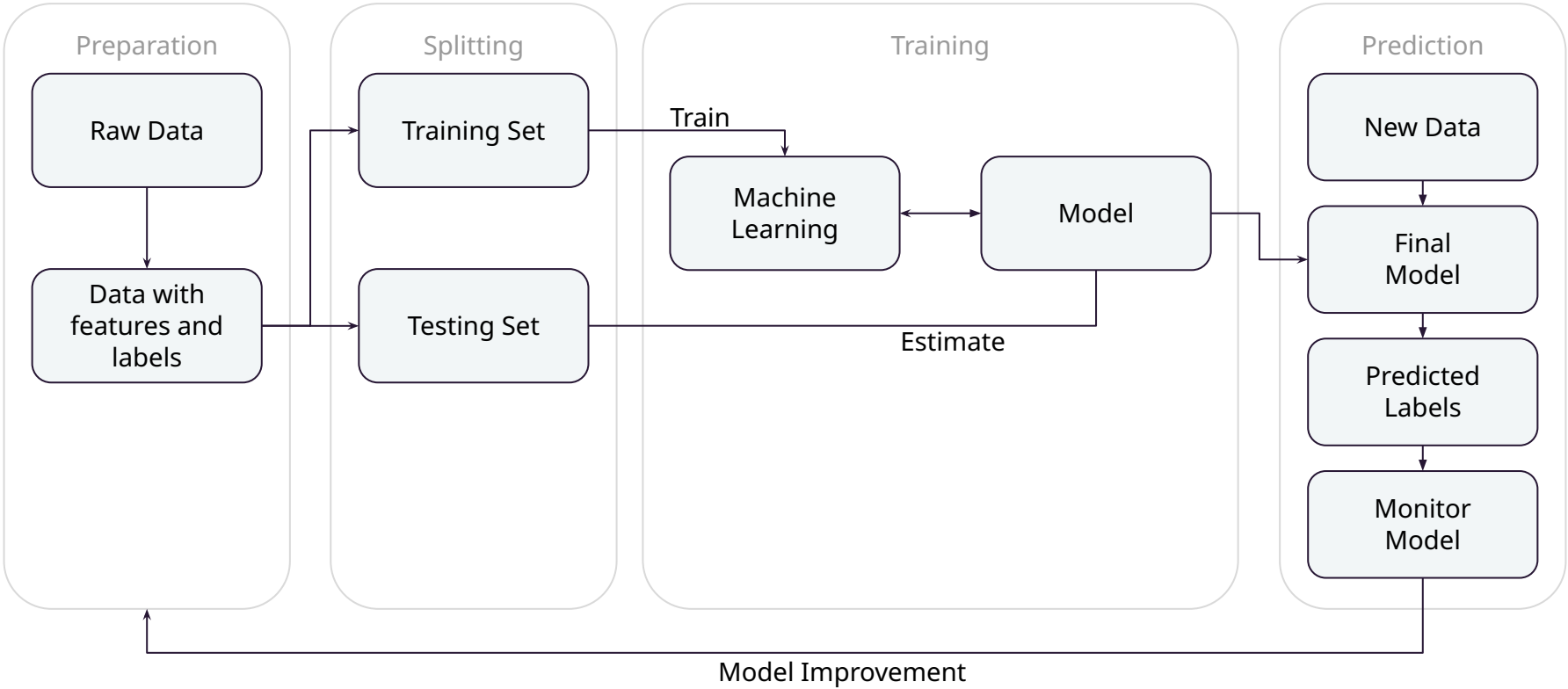
```
model = Sequential()
model.add(Embedding(MaxNumWords, embedDim, i
model.add(SpatialDropout1D(0.4))
model.add(LSTM(LstmOut, dropout=0.3, recurre
model.add(Dense(2, activation='softmax'))
model.compile(loss='categorical_crossentropy
```

A stack of layers:

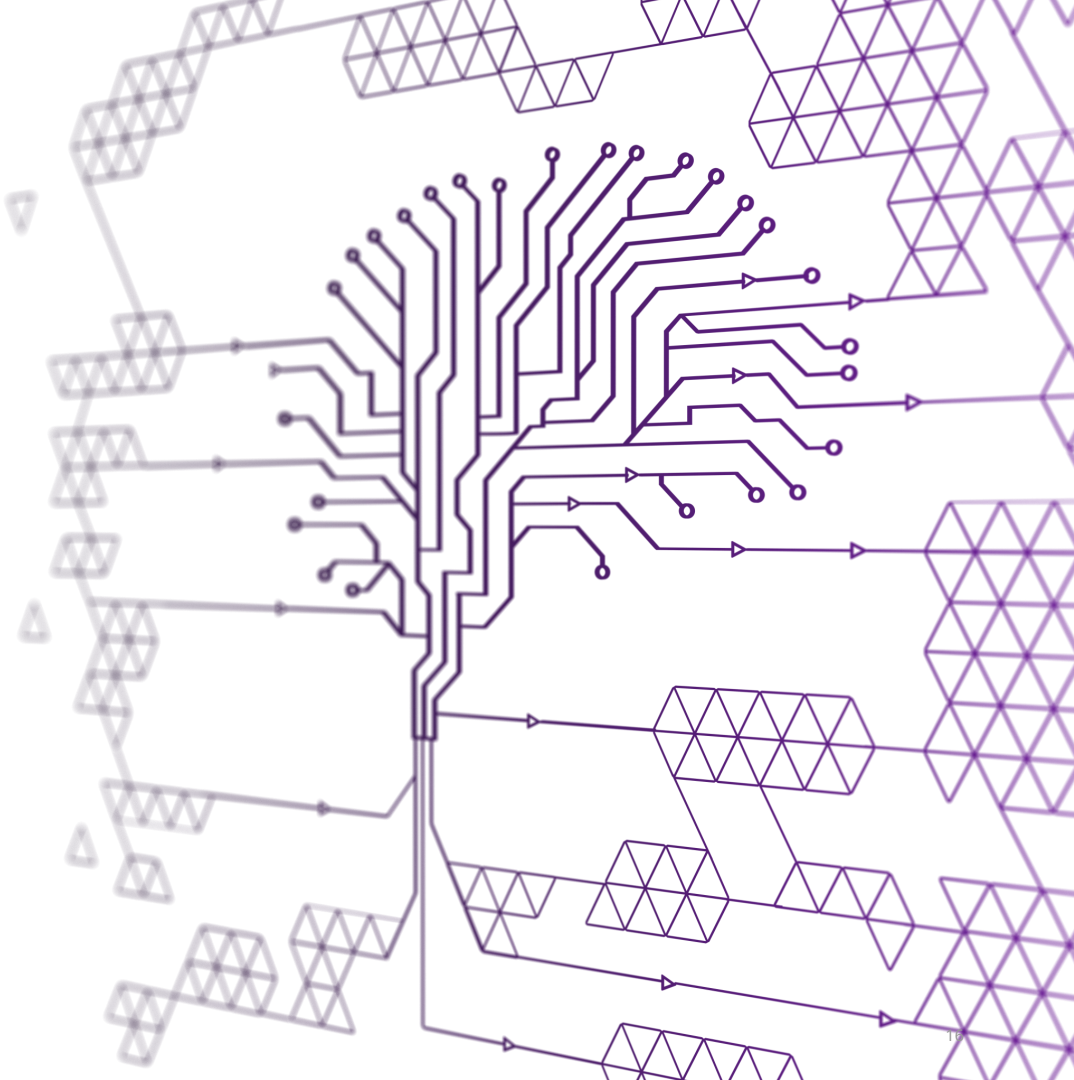
- translate an input number into a vector
- randomly disables pieces of network to enhance training ("dropout")
- the LSTM (recurrent within the layer)
- reducing to a 2-option output (spam/ham)

"finalize" the model: ready to train!

The AI



Database



Database-as-a-Service powered by Apache Cassandra

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ASTRA DB

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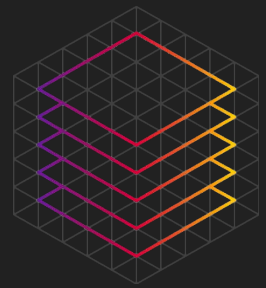
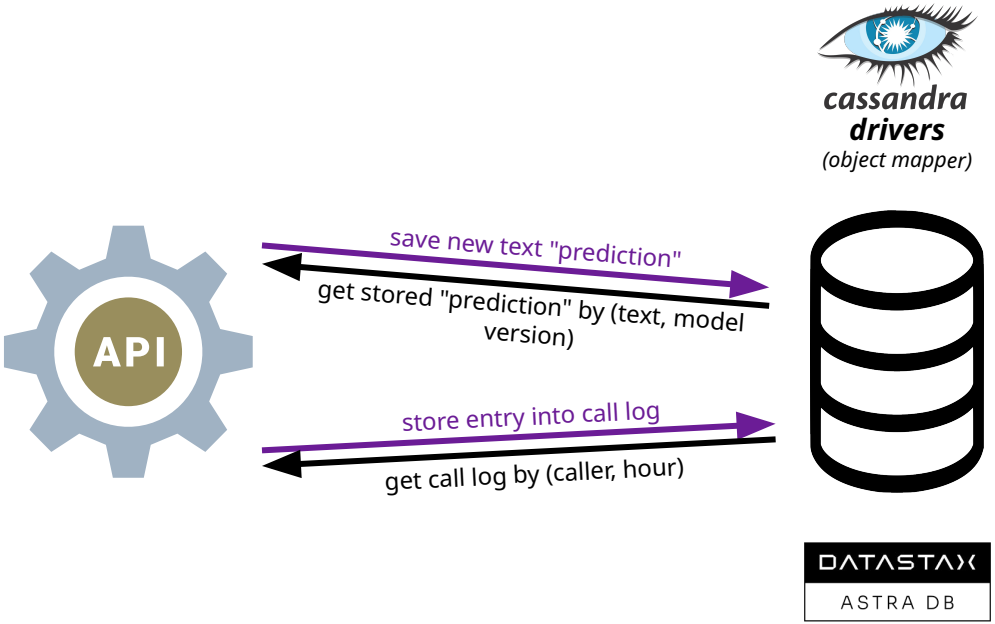


- Build in any language
- Global Scale
- Zero Operations
- Zero lock-in
- Enterprise security
- Extensibility

DB Query patterns

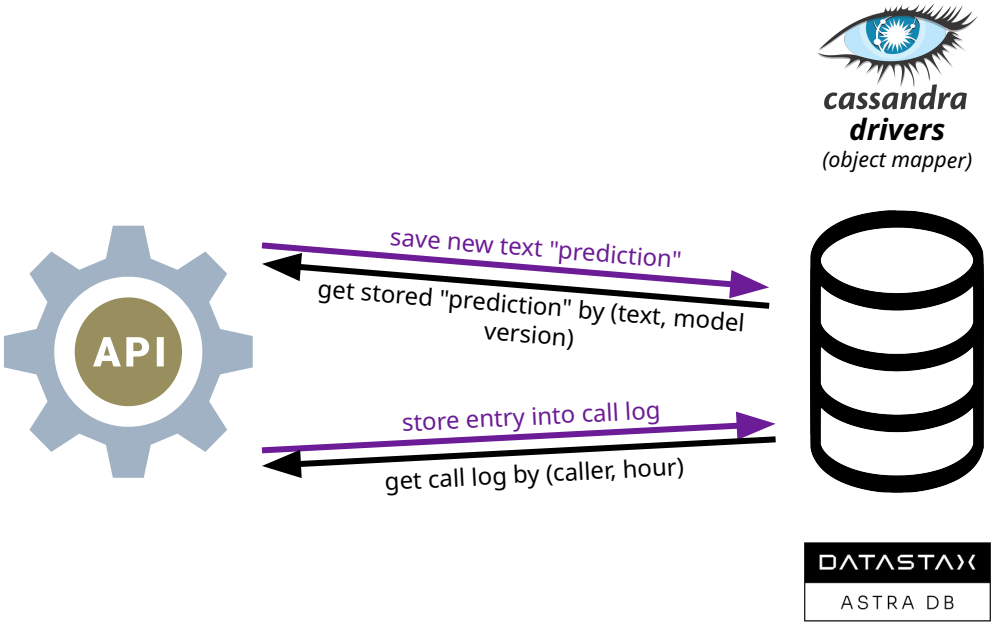


Data modeling, the Astra way:

"design the table after the query"

(also: tables are partitioned!)

DB Query patterns



spam_cache_items		
model_version	**text**	**K**
input	**text**	**K**
confidence	float	
prediction_map	map<text,float>	
result	text	
stored_at	timeuuid	

spam_calls_per_caller		
caller_id	**text**	**K**
called_hour	**timestamp**	**K**
called_at	**timeuuid**	**C↑**
input_text	text	

"partition key" (rows stored together)

"primary key" (row uniqueness)

"Chebotko diagrams"

Real-Time Data Processing (Feature Engineering)

Table Row Examples

version	input	confidence	prediction_map	result	stored_at
v1	Combing the white hair of the waves blown back	0.955171	{'ham': 0.955171, 'spam': 0.044829}	ham	08f849b6-f92a-
v1	We have lingered in the chambers of the sea	0.992575	{'ham': 0.992575, 'spam': 0.007425}	ham	090de000-f92a-
v1	Till human voices wake us, and we drown.	0.988767	{'ham': 0.988767, 'spam': 0.011233}	ham	092371b8-f92a-
v1	Click TO WIN a FREE CAR	0.739895	{'ham': 0.260105, 'spam': 0.739895}	spam	5d957634-f929-
v1	By sea-girls wreathed with seaweed red and brown	0.912248	{'ham': 0.912248, 'spam': 0.087752}	ham	e9424acc-f929-
v1	When the wind blows the water white and black.	0.979708	{'ham': 0.979708, 'spam': 0.020292}	ham	d4647bca-f929-
v1	I have seen them riding seaward on the waves	0.977917	{'ham': 0.977917, 'spam': 0.022083}	ham	d44dafda-f929-

spam_cache_items

model_version	**text**	**K**
input	**text**	**K**
confidence	float	
prediction_map	map<text,float>	
result	text	
stored_at	timeuuid	

caller_id	called_hour	called_at	input
127.0.0.1	2023-05-25 12:00:00.000000+0000	77049492-fafa-11ed-8a10-a2ab11a8d5af	Click TO WIN
192.168.150.76	2023-05-23 05:00:00.000000+0000	d42292e6-f929-11ed-a192-1a3838142467	I have seen them riding seaward o
192.168.150.76	2023-05-23 05:00:00.000000+0000	d438241c-f929-11ed-a192-1a3838142467	When the wind blows the water white
192.168.150.76	2023-05-23 05:00:00.000000+0000	e901c97a-f929-11ed-a192-1a3838142467	I have seen them riding seaward o
192.168.150.76	2023-05-23 05:00:00.000000+0000	e9174da4-f929-11ed-a192-1a3838142467	When the wind blows the water white
192.168.150.76	2023-05-23 05:00:00.000000+0000	e92cc8dc-f929-11ed-a192-1a3838142467	By sea-girls wreathed with seaweed re
192.168.150.76	2023-05-23 05:00:00.000000+0000	08771a08-f92a-11ed-a192-1a3838142467	I have seen them riding seaward o

spam_calls_per_caller

caller_id	**text**	**K**
called_hour	**timestamp**	**K**
called_at	**timeuuid**	**C↑**
input_text	text	

"partition key" (rows stored together)

"primary key" (row uniqueness)

Hands On Time

Tools

- Nothing to Install!
- GitHub repository: [bit.ly/irt-ai-as-an-api](bit.ly/irt-ai-as-an-api)

GitHub — Source code + Exercises + Slides

Gitpod — Cloud Development Environment

DATASTAX ASTRA DB — Database

FastAPI — API

Know your tools

- Python
- Jupyter
- TensorFlow
- Keras
- FastAPI
- Astra DB

Lab Steps

1. Initialise GitPod
2. Create a database in Astra DB
3. Inspect the Dataset
4. Train the Model in Jupyter
5. Expose the Model as an API
6. Use the API
7. Inspect the database

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ASTRA DB

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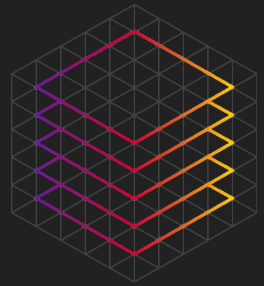

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Available from aws marketplace

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HANDS-ON WORKSHOP | MELBOURNE, AU

IRT AI/ML – Out of the Lab, Into Production

20 July, Thursday | 5pm - 7pm | WeWork Office, Level 22, 120 Spencer St

Hilton Rosenfeld
Data Architect, DataStax

REGISTER NOW

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Thank You


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