

# Geospatial AI at Scale

Melda Salhab



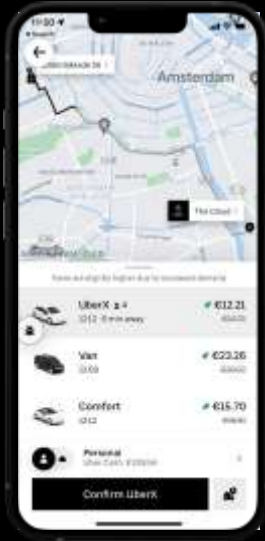
# Melda Salhab

Sr Technical Program Manager

- **TPM / Data Scientist** | Uber AI, Maps, Operations
- **PhD** | Spatial Data Science
- **Consultant** | Monitor Deloitte, World Bank, UNDP
- **Co-founder** | Open Map Lebanon

# Why do we need a map?

Search & Marketplace




Order tracking



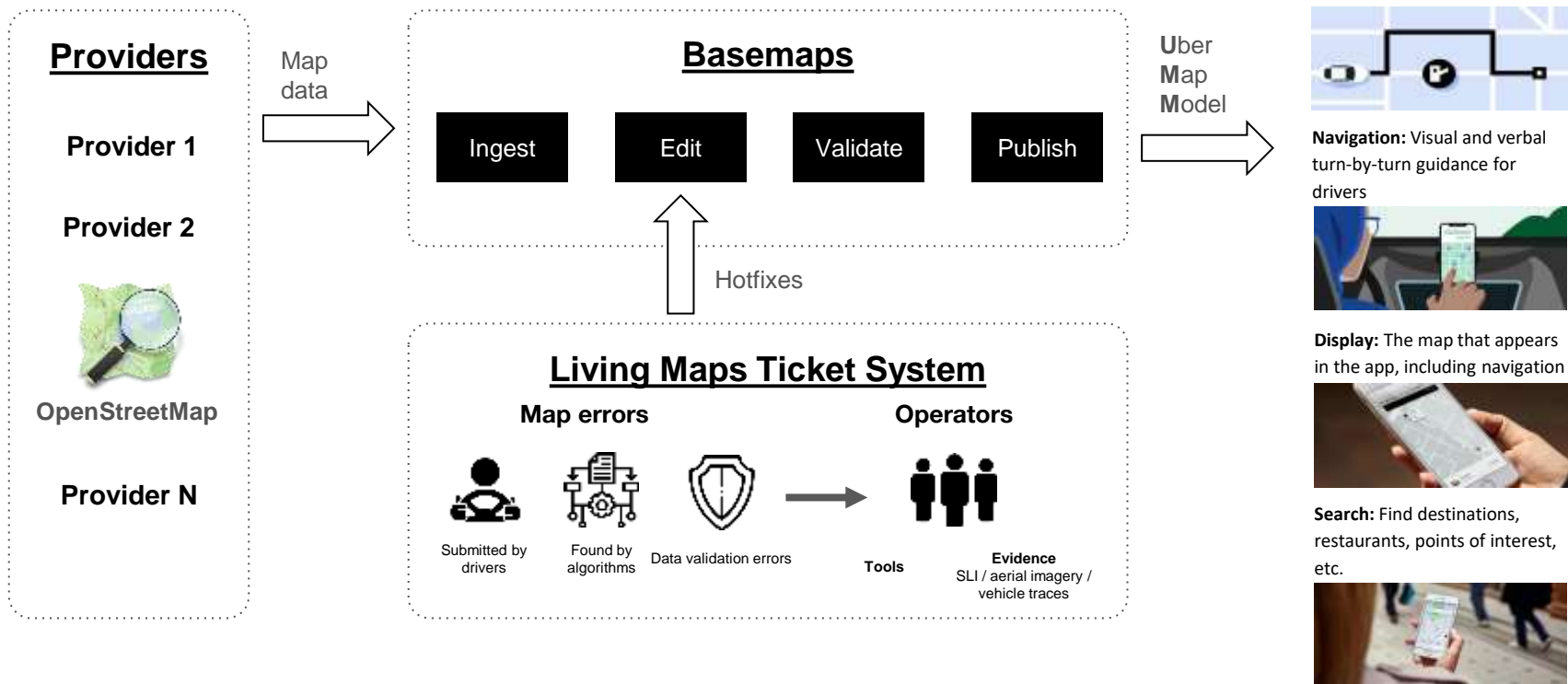
On-trip navigation



# What data do we use?

		Layer	Services
<b>Real-time</b>		Traffic, events, weather Road closures	→ Turn-by-turn navigation → ETAs and routing
<b>Places</b>		POIs Addresses and parcels	→ Search → Geocoding
<b>Basemaps</b>		Road network Land use and water bodies Admin boundaries	→ Turn-by-turn navigation → ETAs and routing → Display Map tiles

# How's the map built?



70+

Countries

15,000+

Cities

36M

Total Trips per Day

>15%

Year to Year Growth

over 100,000 since I started talking!

Trips per second

600+

Combined Mobility and Delivery

# Uber ML Scale

over 10,000,000,000  
since I started talking!

**45M++**

Predictions per second

**1M++**

CPU&GPU cores

# Michelangelo provides unique value for Uber's ML needs

Uber's business requires **large scale, low latency, and high quality** real-time ML

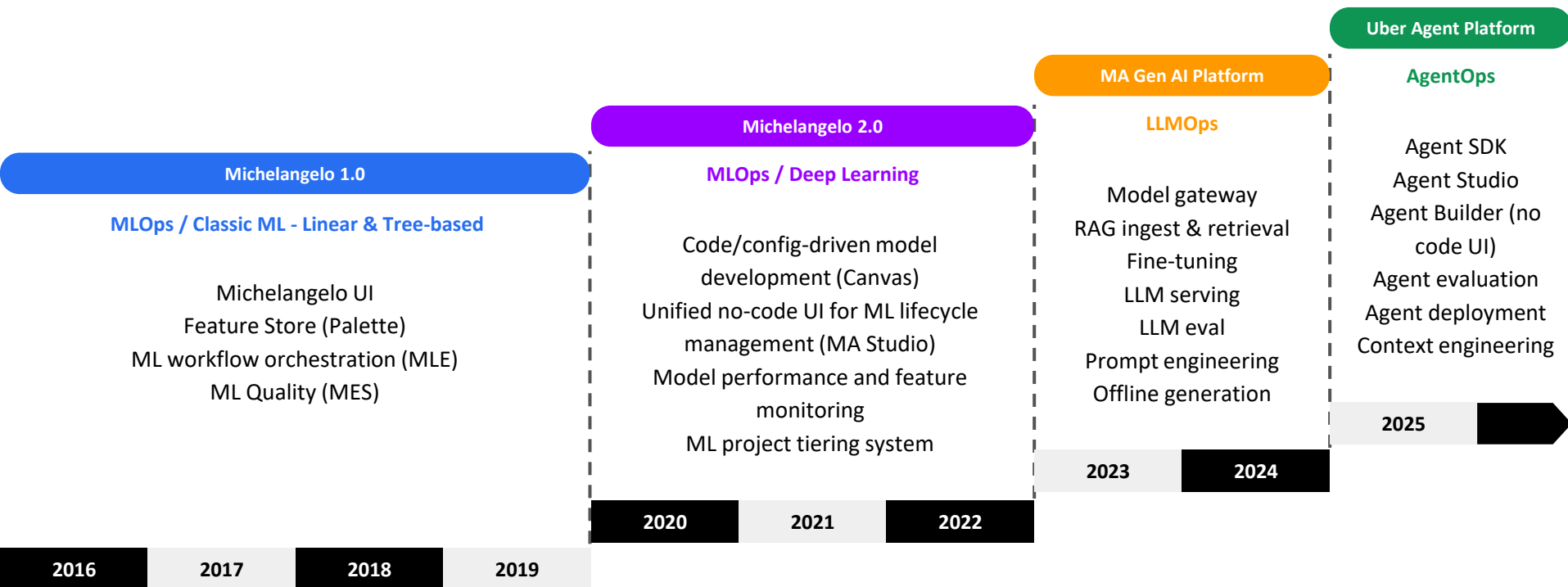
## Prior to Michelangelo

- ✗ Ad-hoc pipelines and workflows
- ✗ Hard to productionize; impossible to scale
- ✗ Inconsistency, no code reuse, and duplicated effort across teams
- ✗ Monitoring was non-existent
- ✗ No governance or transparency of how ML was utilized at Uber

## Michelangelo

- **A centralized ML platform** to manage the whole ML lifecycle to improve ML dev productivity
- **ML best practices** are natively built-in and enforced via platform features to improve ML quality
- **AI governance, regulation, and accountability** with end-to-end traceability and auditing
- **Lead and drive company-wide ML initiatives:** e.g. DL adoption in 2021 and Gen AI adoption starting 2023

# Evolution of Michelangelo - Uber's AI Platform



# Michelangelo system overview

**ML Development Experience**

**UI tools**

MA Studio - Model Studio	MA Studio - Agent Studio	Assistant Builder	Responsible AI - Model card
--------------------------	--------------------------	-------------------	-----------------------------

**Frameworks/SDKs**

Canvas	Canvas Flex	Uniflow (orchestration)	LangFx (agent builder)	Responsible AI - Explainability	Responsible AI - Bias Detection
--------	-------------	-------------------------	------------------------	---------------------------------	---------------------------------

**Platform Core Functions**

**Core ML**

<b>Feature engineering</b> Feature Store Feature compute	<b>Train &amp; Eval</b> Trainer, HP tuning, Model registry, Evaluator, Orchestration engine
<b>Deploy &amp; Serve</b> Safe deployment, Batch prediction, Online prediction, ML on Mobile	<b>Monitoring</b> Model Excellence Score, Model performance, Feature monitoring

**Generative AI**

<b>LLM access</b> Gen AI Gateway PII redactor Safety guardrails	<b>Data &amp; Tools</b> RAG ingestion RAG retrieval MCP registry
<b>Train &amp; Eval</b> LLM Trainer LLM evaluator Agent registry Agent evaluator	<b>Deploy &amp; Generate</b> Prompt engineering Offline generation LLM serving Agent deployment

**Infrastructure Interface**

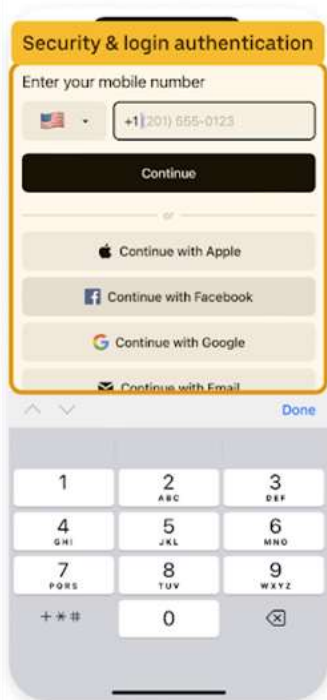
Job Controller (Ray, Spark)	Artifact Store	Model Registry	Resource Mgmt	Access Control
-----------------------------	----------------	----------------	---------------	----------------

**Uber Infrastructure**

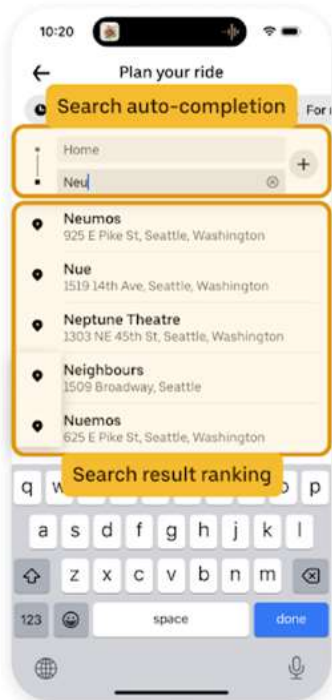
Compute (CPU, GPU) & K8S	Storage (Vector DB, Hive, Redis, Terrablob, S3 ...)	Network
--------------------------	-----------------------------------------------------	---------

Michelangelo Unified API

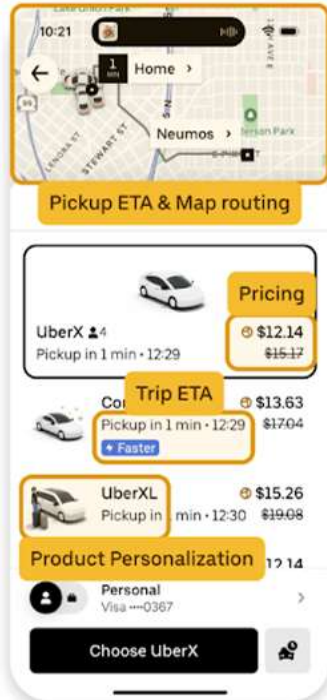
# AI/ML powers Uber's magical user experience



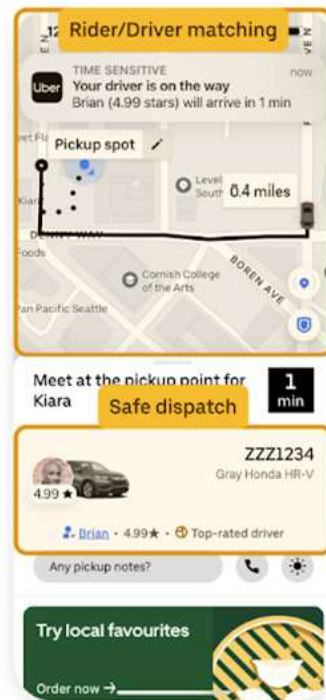
Login



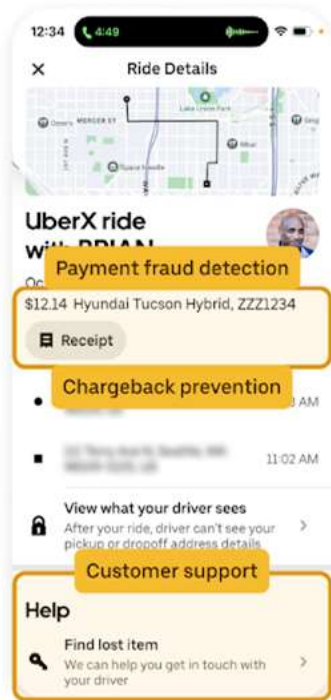
Search



Booking



Trip



Post-trip

Q&A