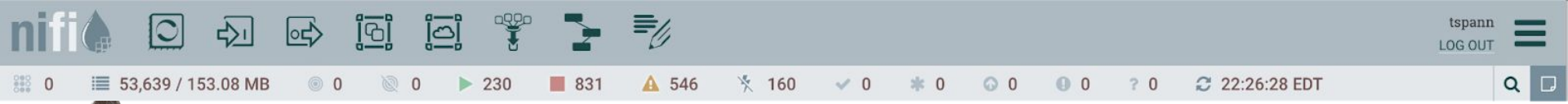
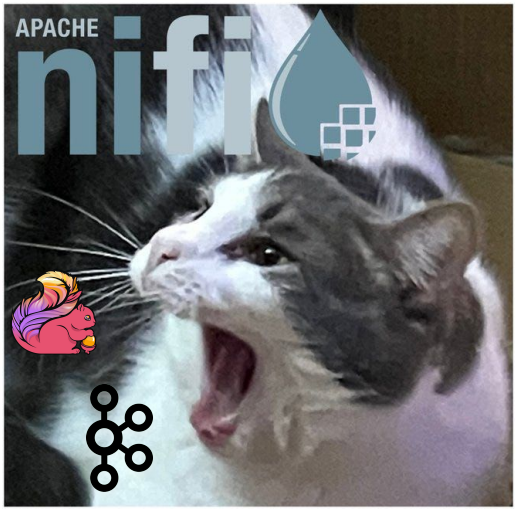


Building IoT Applications with Open Source

Tim Spann, Senior Sales Engineer

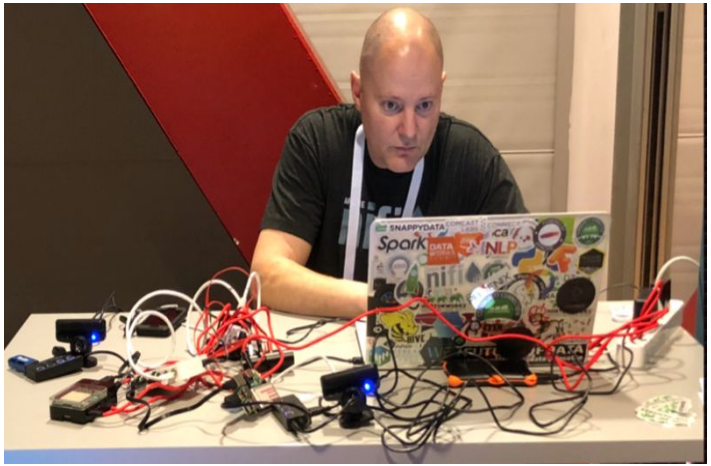
AI + Streaming Weekly by Tim Spann



https://bit.ly/32dAJft

This week in Apache NiFi, Apache Polaris, Apache Flink, Apache Kafka, ML, AI, Streamlit, Jupyter, Apache Iceberg, Python, Java, LLM, GenAI, Vector DB and Open Source friends.

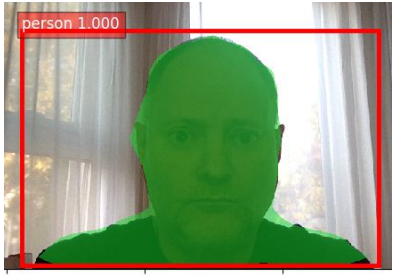
Tim Spann

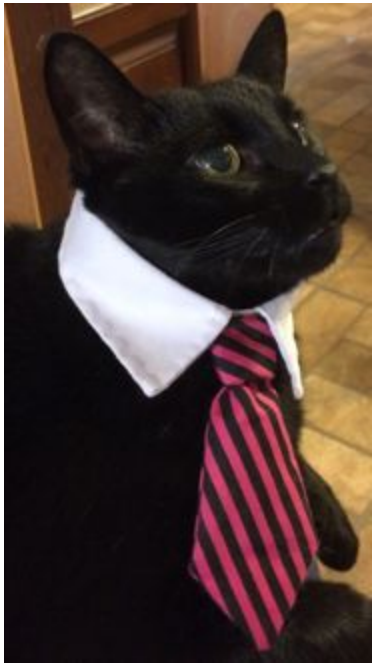


Twitter: @**PaasDev** // Blog: **datainmotion.dev**
Senior Sales Engineer, Snowflake
NY/NJ/Philly - Cloud Data + AI Meetups
ex-Zilliz, ex-Pivotal, ex-Cloudera,
ex-StreamNative, ex-Hortonworks.

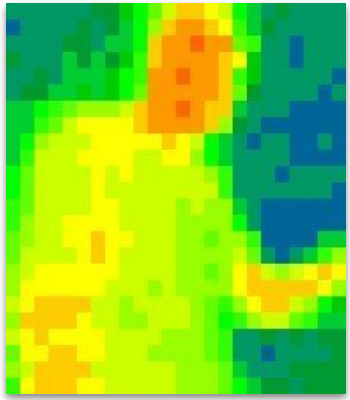
https://medium.com/@tspann
https://github.com/tspannhw

snowflake

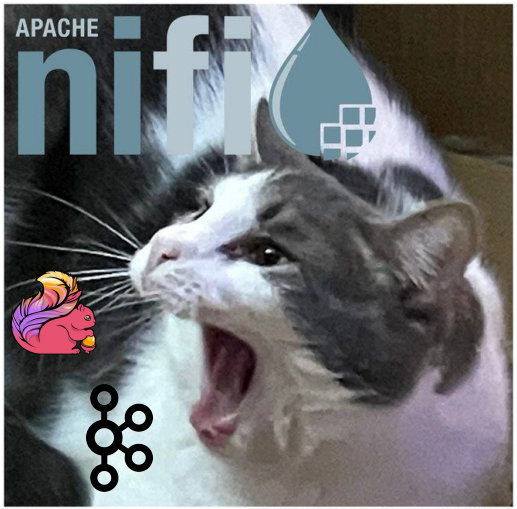




- Introduction
- Devices
- Iot Apps
- Messaging
- Edge AI
- Demos



AI + All Data Weekly by Tim Spann



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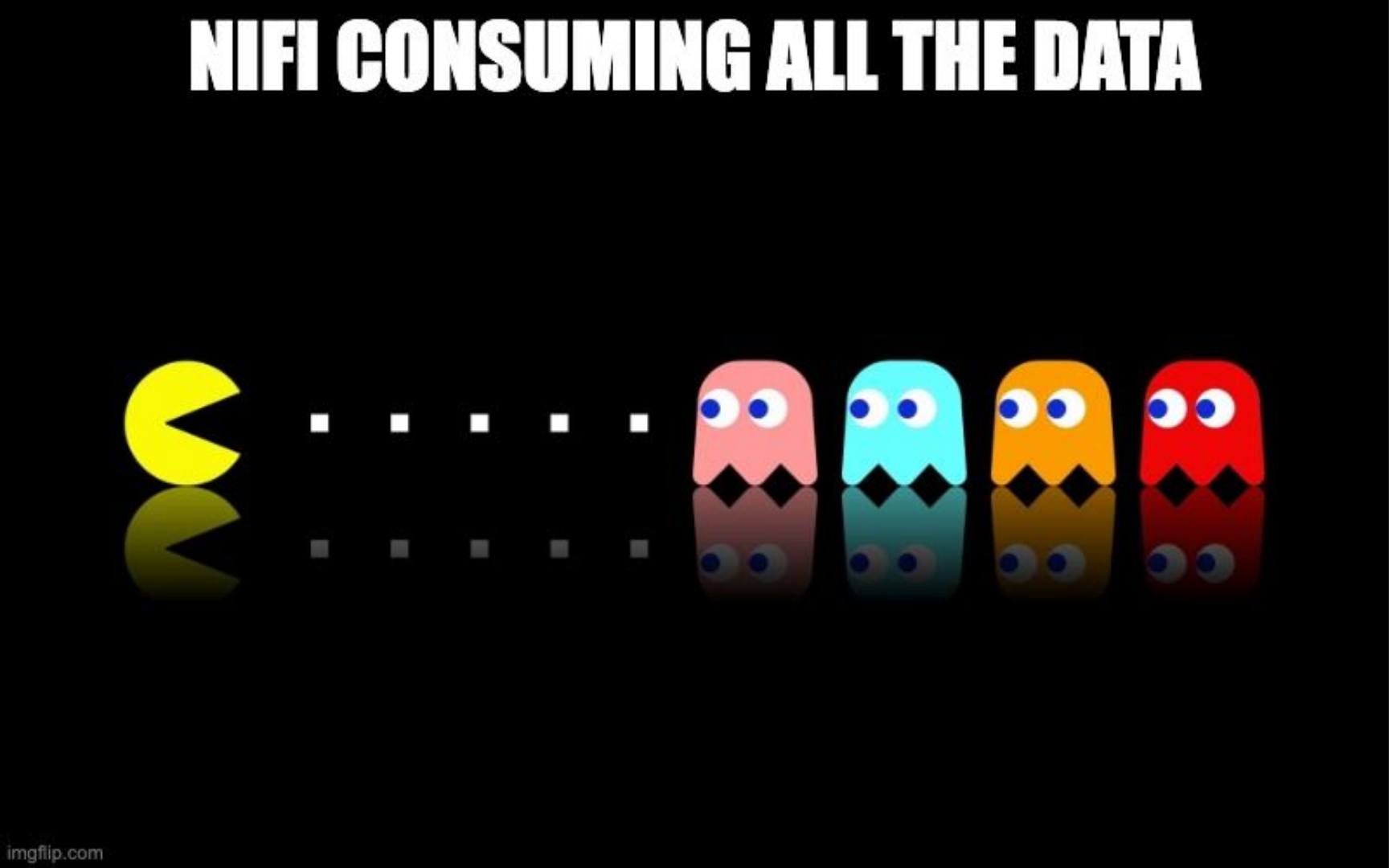
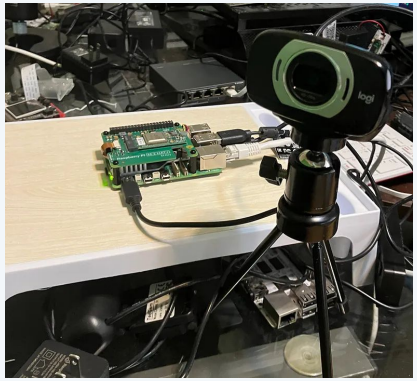

NIFI CONSUMING ALL THE DATA
imgflip.com

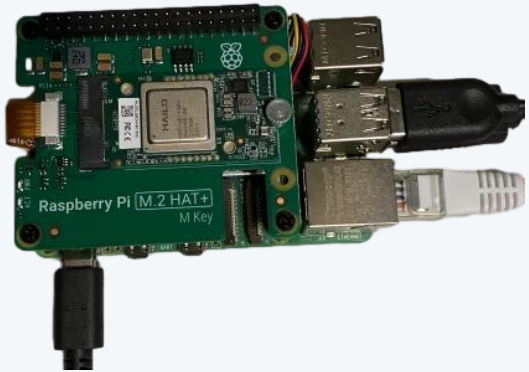
DEVICES

Raspberry Pi 5 + AI Kit

Raspberry Pi 5 with 8GB of RAM

The AI Kit adds a neural network inference accelerator capable of **13 tera-operations per second (TOPS),** which is pretty good for $70 US. Attached to this M.2 Hat is the Hailo-8L M.2 Entry-Level Acceleration Module which will give us our AI powers.





What is it?

https://paperswithcode.com/task/pose-estimation

1,431 papers with code

Human Pose Estimation is a computer vision technique that locates and estimates things like eyes, ears, shoulders, joints in motion.

It looks pretty cool and has some interesting applications for medical purposes and robotics. For me, it was one of the cool examples that runs on the AI Kit.

Pose Estimation by Hailo 8L

Each person is identified and represented by 17 keypoints

Examples

nose, eyes, ears, shoulders, elbows, wrists, hips, knees, and ankles.

We are tracking eyes and more (updated today)

https://github.com/tensorboy/centerpose
https://softwaremill.com/human-pose-estimation-2023-guide/

https://github.com/hailo-ai/hailo_model_zoo/blob/master/docs/public_models/HAILO8/HAILO8_pose_estimation.rst

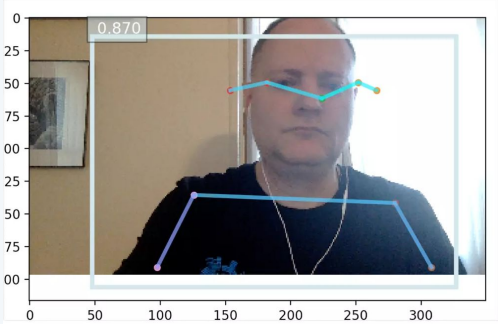
Pose Estimation on Hailo 8L

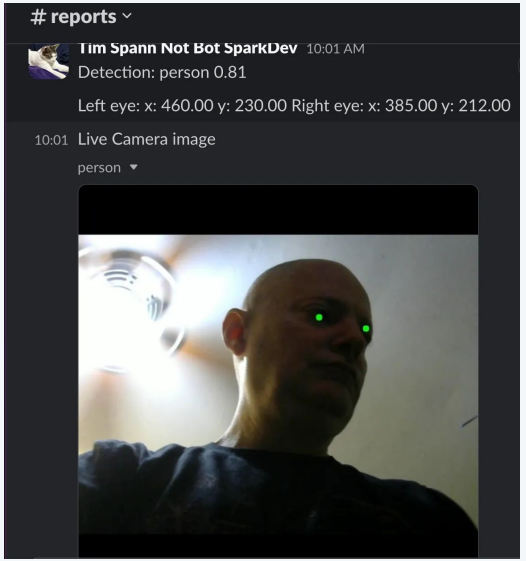
Pose Estimation COCO

Yolov8s_pose

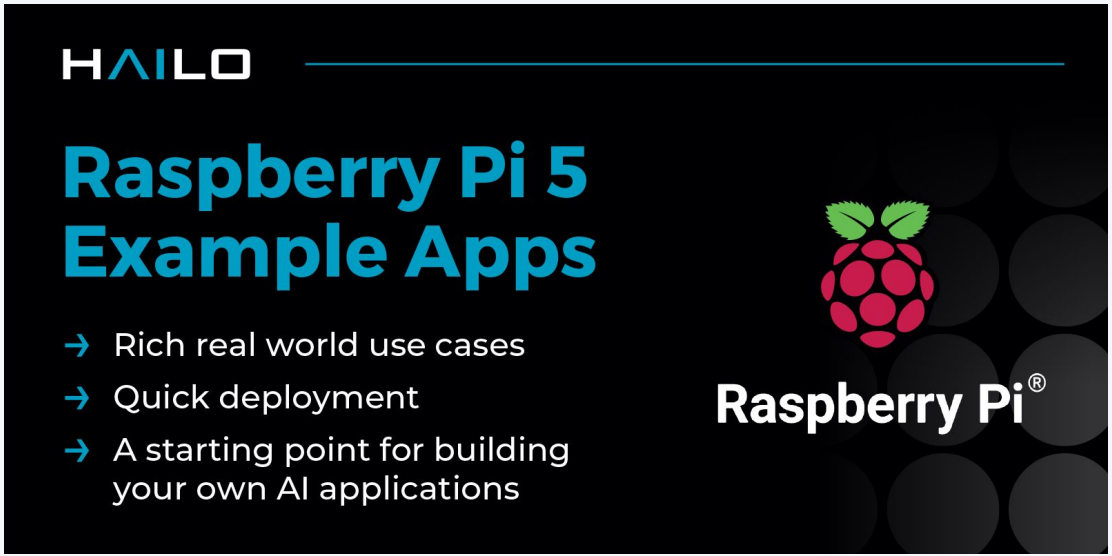
Hailo-8L

https://github.com/ultralytics/ultralytics





HAILO Raspberry Pi 5 Example Apps



https://github.com/hailo-ai/hailo-rpi5-examples

New: CLIP Zero Shot Inference Application

Alternatives

- Just Released AI Kit+ with 26 Tops
- NVIDIA Jetson Series
- Smart Cameras like OAK-D
- Specialized Devices

Edge Vector Olympics

Gold - NVIDIA Jetson AGX Orin - 275 TOPS, 2048-core, 64 GB RAM

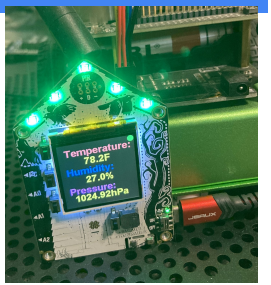
Silver - NVIDIA Jetson Xavier NX, 21 TOPS, 384-core, 8 GB RAM

Bronze - Raspberry Pi 5, 13 TOPS, 4-core, 8 GB RAM

Edge Computing Power - Edge Server

- Containers
- 64 bit processors and operating systems
- 8-64 GB Modern RAM
- Fast WiFi / Bluetooth
- 300+ Core GPUs
- eMMC Fast Storage
- TBs of SSD
- Examples: NVIDIA JETSON XAVIER NX, NVIDIA JETSON ORIN AGX

Device 1 - AdaFruit Funhouse



- https://github.com/tspannhw/pulsar-adafruit-funhouse

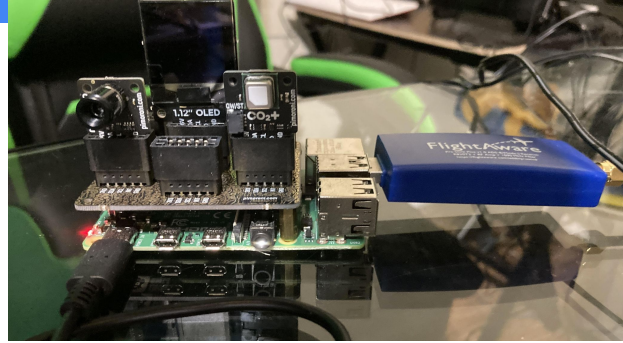
(**MQTT**)

Raw **JSON**:


```
{"pressure": 1009.08,
"button_sel": "off",
"pir_sensor": "off",
"humidity": 36.0422, "temperature": 80.9526,
"button_down": "off", "captouch6": "off",
"captouch7": "off", "button_up": "off", "captouch8": "off",
"light": 6990}
```


Processor 240MHz / **RAM** 2+4MB

Device 2 - Raspberry Pi



- https://github.com/tspannhw/FLiP-Pi-DeltaLake-Thermal

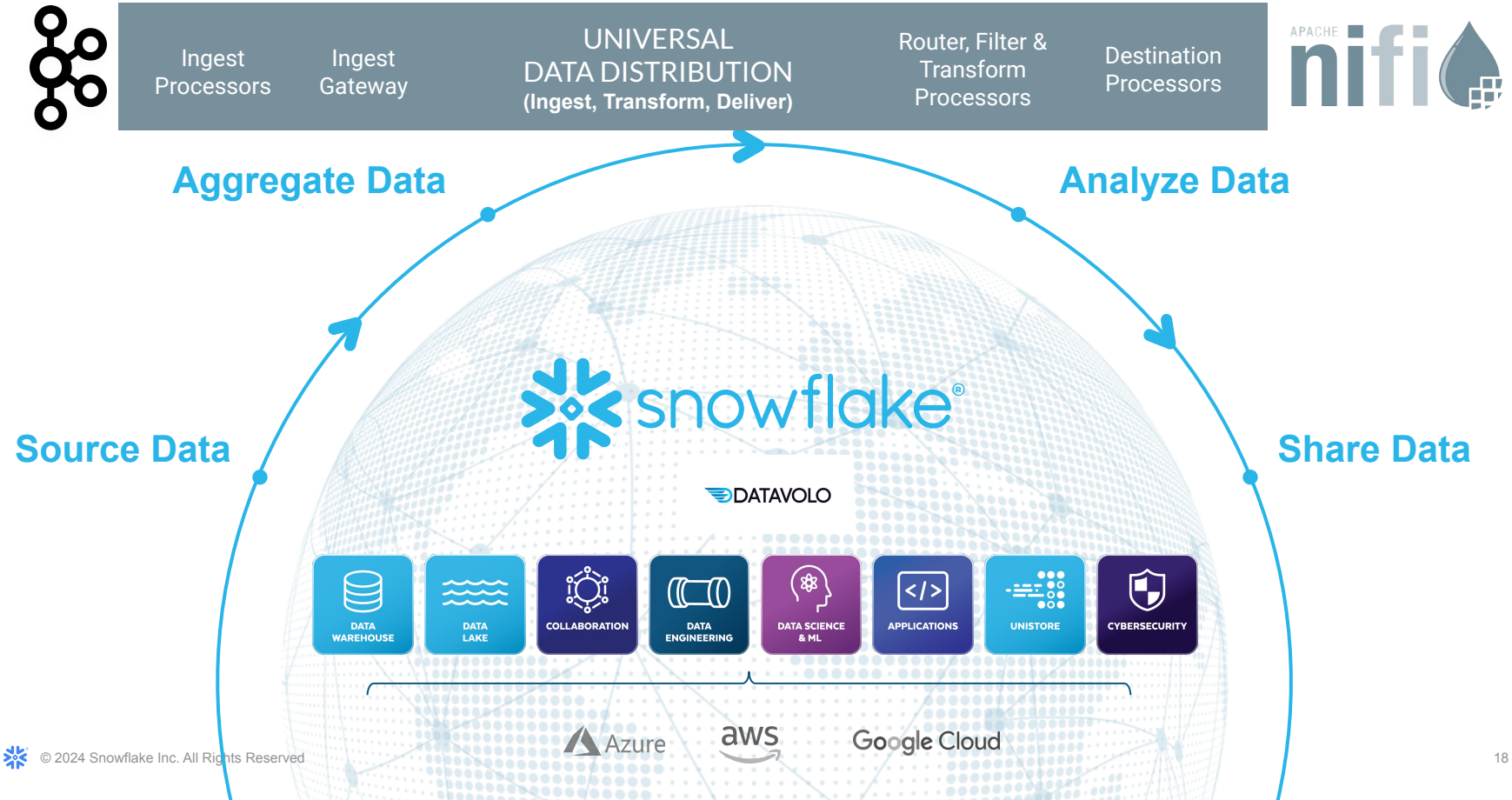
Pulsar Protocol Raw JSON:


```
{"uuid": "thrml_zda_20220715182748", "ipaddress": "192.168.1.204",
 "cputempf": 108, "runtime": 0, "host": "thermal", "hostname": "thermal",
 "macaddress": "e4:5f:01:7c:3f:34", "endtime": "1657909668.7279365",
 "te": "0.00073981285095214 84", "cpu": 1.8,
"diskusage": "105078.0 MB",
 "memory": 9.0, "rowid": "20220715182748_fc4cbbb1-79da-4c1a-8991-78bd23c9f221",
 "systemtime": "07/15/2022 14:27:53", "ts": 1657909673,
"starttime": "07/15/2022 14:27:48",
 "datetimestamp": "2022-07-15 18:27:52.492469+00:00", "temperature": 28.238,
"humidity": 29.61, "co2": 992.0}
```

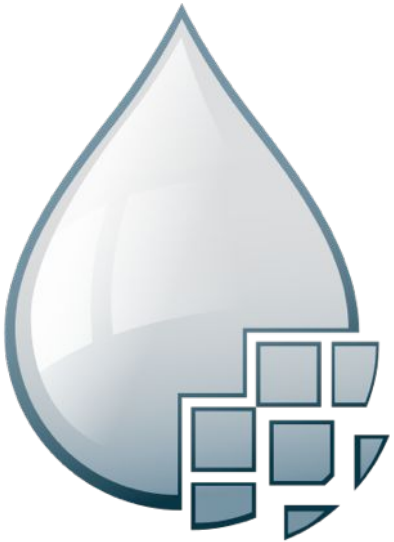

Processor 1.5 GHz, 64-bit quad-core / **RAM** 2-8 GB LPDDR4-3200 SDRAM

STREAMING

IoT to Cloud Data Platform



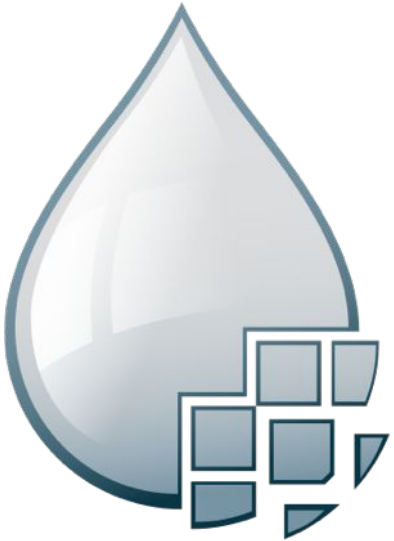
DataFlows for Data Ingest, Movement and Routing



- Guaranteed delivery
- Data buffering
  - Backpressure
  - Pressure release
- Prioritized queuing
- Flow specific QoS
  - Latency vs. throughput
  - Loss tolerance
- Data provenance
- Supports push and pull models

- Hundreds of processors
- Visual command and control
- Over a 200 sources
- Flow templates
- Pluggable/multi-role security
- Designed for extension
- Clustering
- Version Control

The Power of Apache NiFi



- Moving Binary, Unstructured, Image and Tabular Data
- Enrichment
- Universal Visual Processor
- Simple Event Processor
- Routing
- Feeding data to Central Messaging
- Support for modern protocols
- Kafka Protocol Source/Sink
- Pulsar Protocol Source/Sink

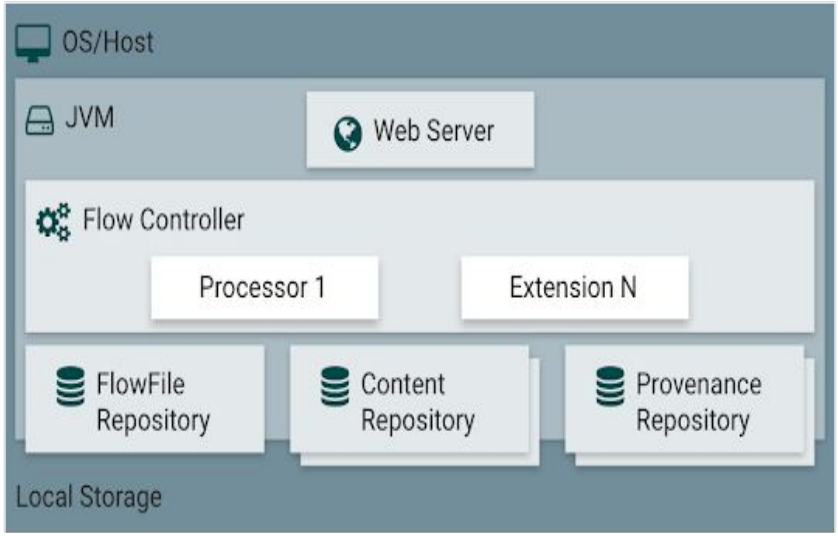
NIFI 2.0 FEATURES

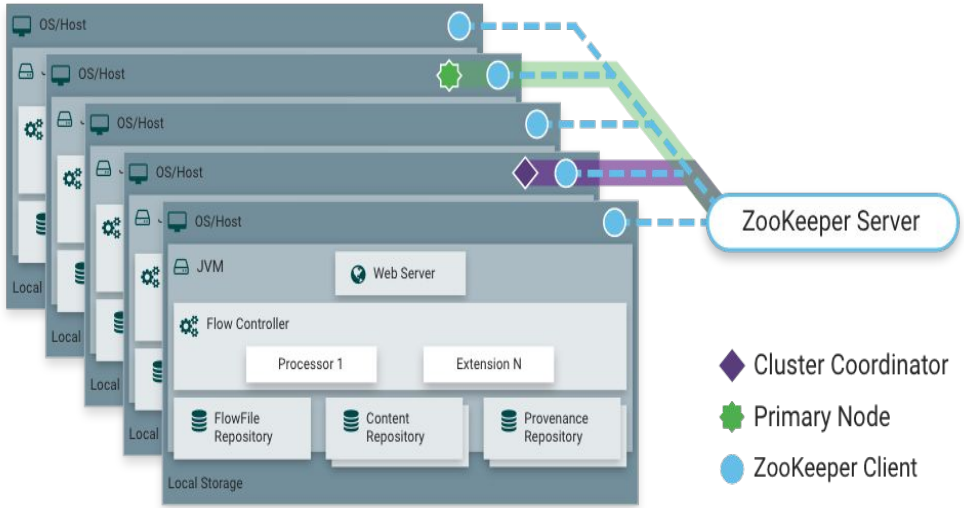
DataFlow is built for Real-Time Integration and AI

Major Updates:

- Python Integration
- ParameterIZATION
- JDK 21+
- Provenance / Data Lineage
- Rules Engine for Development Assistance
- Additional Azure Processors
- Integration with Zendesk, Slack,
- Database Tables as Schemas
- Amazon Glue Schema Registry
- OpenTelemetry Support

Architecture

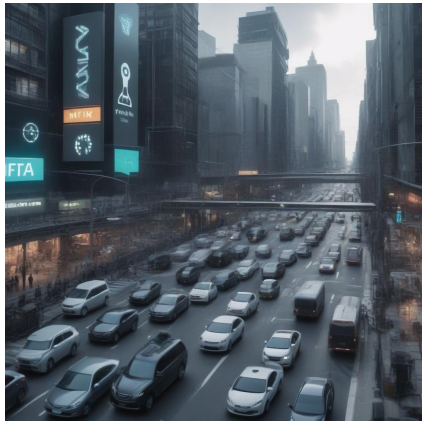




https://nifi.apache.org/docs/nifi-docs/html/overview.html

What is Apache NiFi?

Apache NiFi is a scalable, real-time streaming data platform that collects, curates, and analyzes data so customers gain key insights for immediate actionable intelligence.



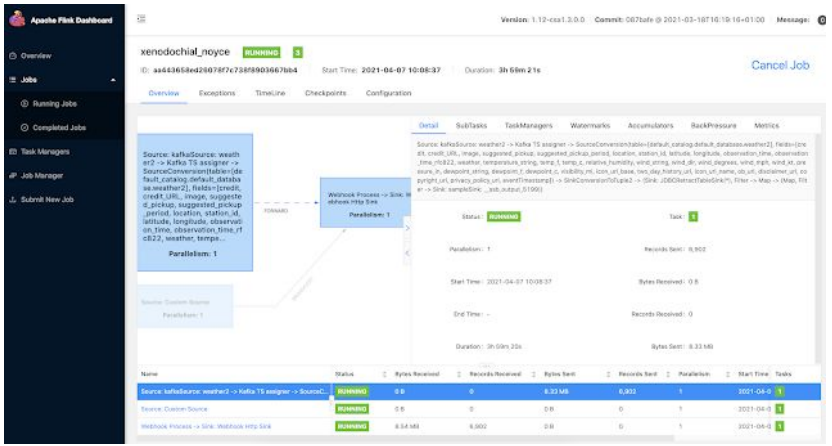
Address To Lat/Long

- Python 3.10+
- geopy Library
- Nominatim
- OpenStreetMaps (OSM)
- openstreetmap.org/copyright
- Returns as attributes and JSON file
- Works with partial addresses
- Categorizes location
- Bounding Box

https://github.com/tspannhw/FLaNKAI-Boston

Flink SQL

- Streaming Analytics
- Continuous SQL
- Continuous ETL
- Complex Event Processing
- Standard SQL Powered by Apache Calcite



Edge Models

HuggingFaceTB/SmolLM2-1.7B-Instruct

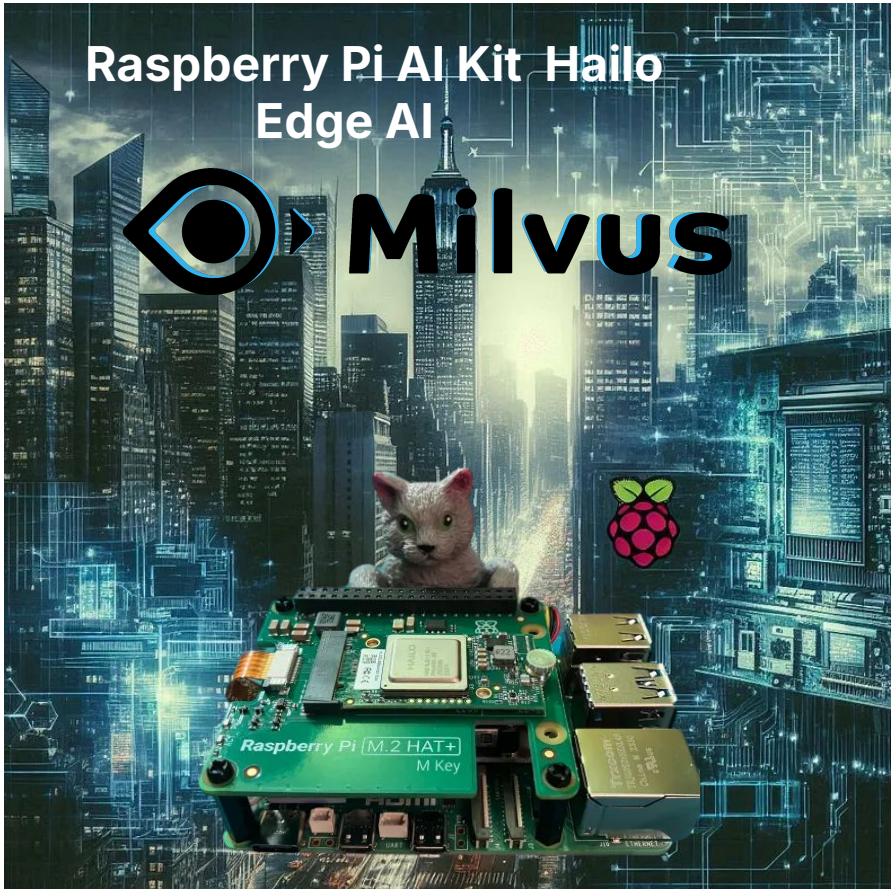
Small language models (SLMs)

NVIDIA Edge AI / Physical AI Edge Models

Raspberry Pi Edge AI

DEMO

RESOURCES AND WRAP-UP



https://medium.com/@tspann/unstructured-data-processing-with-a-raspberry-pi-ai-kit-c959dd7fff47

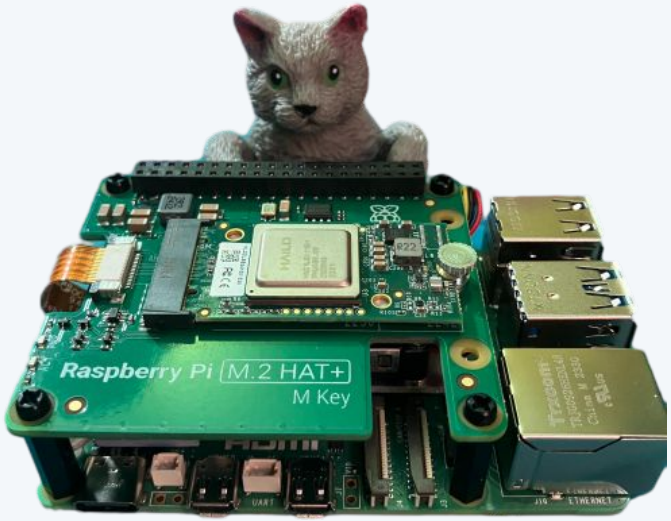
Raspberry Pi AI Kit Hailo
Edge AI Pose Estimation

Milvus

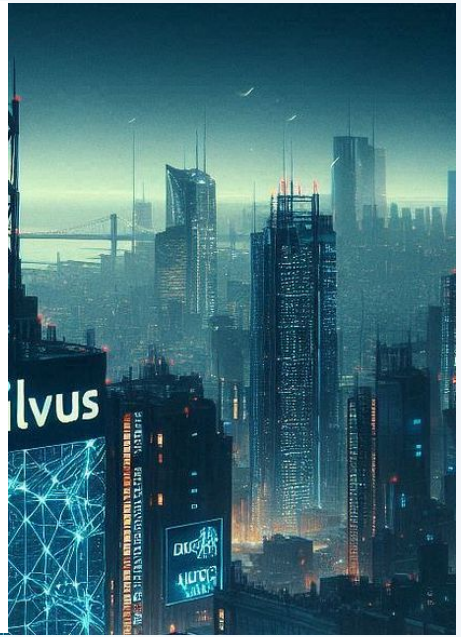
https://medium.com/@tspann/from-the-edge-to-the-cloud-and-back-again-01095e95a783

Spann

Code -

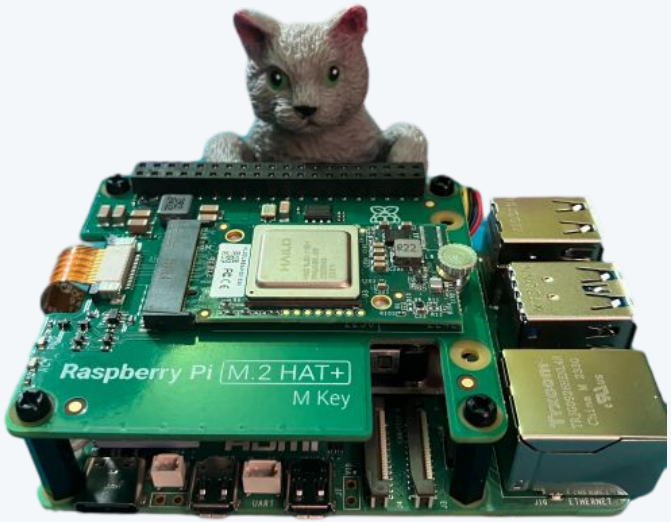


bitly



https://bit.ly/4ftn04t

Code - Pose Estimation



https://bit.ly/4ebEPUJ

Walk Through Article

https://bit.ly/4hxjvvF

/tspannhw/AIM-BecomingAnAIEngineer: AIM - Becoming An AI Engineer

https://bit.ly/3BV4IKX

What’s in the Air Tonight Mr. Milvus?

https://bit.ly/4fQhBog

Street Cameras

https://medium.com/cloudera-inc/streaming-street-cams-to-yolo-v8-with-python-and-nifi-to-minio-s3-3277e73723ce

Tim SPANN

https://github.com/tspannhw

https://www.datainmotion.dev/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