

DATASHEET



ALEX IoT ANALYTICS

RAPID AI ENABLEMENT FOR YOUR IoT SOLUTION

In order to build the Industry 4.0 world, the IoT revolution requires much more than just Machine Learning models maintained by humans. In often changing context, machines evolving models for machines is the way forward where a human is a spectator or a regulator.

ALEX IoT Analytics is a high-speed component for streaming IoT and IIoT solutions that **rapidly** enables self-learning and self-correcting AI models right at the Edge or in the Cloud.

ONLY 1% OF IoT DATA IS USED FOR
INTELLIGENT DECISION MAKING

KEY FEATURES

- ML model training and inference at the Edge with zero Cloud.
- AutoML technology with fast hyper-parameters optimization and pipeline selection.
- Model self-retraining without a human.
- Proprietary fault-tolerant distributed hierarchical In-Memory Database optimized for real-time feature extraction and IoT.
- No expert data science skills required in 80% cases.
- Real-time decision making based on inference.
- Convergence of IT, OT and AI.
- Scalability and fault-tolerance.

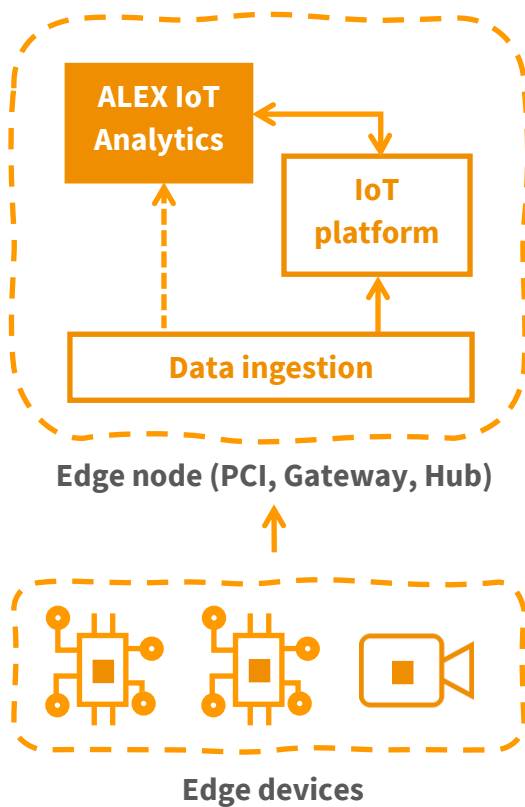


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ARCHITECTURE

ALEX IoT Analytics runs at the Edge or in the Cloud. It comes in conjunction with an IoT platform that provides IoT middleware and generic IoT applications.



- Rapid integration to IoT platforms via open protocols.
- Rapid model development with zero coding efforts.
- Autonomous Machine Learning models training and retraining as new streaming data arrives to the Edge nodes or to the Cloud.
- Deployment a model to a device.
- Distributed training over multiple nodes.
- Real-time inference and actionable insights at Edge devices, Edge nodes and in the Cloud.
- Rich system integration capabilities.
- MLOps.



IoT USE CASES

Machine Learning models automatically created by ALEX IoT Analytics significantly reduce the Total Cost of Ownership of IOT solutions. It also enables additional use cases and adds **value**, not just technology. Gallery of models will be available in later releases.

Predictive Maintenance

Predict equipment Remaining Useful Life, alert when it is likely to fail and maintenance is due.

- Smart Manufacturing.
- Smart Buildings.
- Vending.
- Agriculture.

Prioritizing Human Attention (Cognitive Insights)

Manual data analysis cannot digest huge amount of streaming data. AI helps to discover cognitive insights as occupant comfort and set priorities to improve.

- Smart Manufacturing.
- Smart Buildings.
- Feedback Culture.
- Networks.

Supply Optimization

Forecast demand and build best schedule to re-supply for the sake of cost efficiency.

- Transportation and Logistic.
- Vending.
- Smart Energy.

Consumer Intelligent Real-time Health Monitoring

Real-time 360° users view through wide range of wearable devices. Cognitive insights, real-time rules and actions contributing to wellness.

- Healthcare.
- Fitness.

Object Detection And Recognition

Computer vision deep learning models with inference at the Edge devices enable embedding visual data into IoT Edge infrastructure.

- Smart Manufacturing.
- Smart Buildings.
- Security.

“DATASTREAMS AI” PROVIDES SERVICES TO ENABLE AND SUPPORT THE USE CASES



WHY IoT EDGE

Training and using AI models at the Edge with zero or limited Cloud is becoming a trend for a niche of IoT use cases where sending data to the Cloud is not business efficient or not feasible.

Data Quality

Edge keeps data of higher quality since there are no data loss and data downsampling as when sending data to the Cloud.

Model Accuracy

As a result of having clearer and complete data the accuracy of AI models built right at the Edge is higher.

Security Risks

There are security risks when sending and receiving data from the Cloud related to network, processing and storage.

Real-time Inference

Real-time inference is de facto an expectation from IoT and IIoT technologies where reaction time matters. Cloud cannot provide this in a reliable way.

No Stable Connection

Connectivity to the Cloud can be unstable. It leads to inability to send data to the Cloud or much higher latency. 5G is aiming to close this gap, but may not resolve it completely.

Cost Of Ownership

Cost of Edge + Cloud computing is higher than Edge only since it requires more expensive infrastructure and extended team for building and supporting.

Time To Market

Initial deployment of an AI model to the Edge can take months. Maintenance of existing models may take around 50% of data scientists time. Building a model right at the Edge using self-learning techniques is a fundamental shift towards more rapid evolution.



AUTONOMOUS MACHINE LEARNING

ALEX IoT Analytics comes with capabilities to build and deploy Machine Learning models automatically without data science expertise. Real-time actions can be bound to models in the same UI. It makes intelligent IoT simple to use.

Model types

- Classification analysis.
- Regression analysis.
- Time-aware classification analysis.
- Time-aware regression analysis.
- Deep learning.

AutoML

- Auto pipeline selection.
- Auto hyperparameters optimization.
 - Random strategy.
 - Bayesian Optimization with Hyper Band strategy.
- Auto model creation per new IoT object.

Feature extraction

- Auto feature generation.
- Auto features selection.
- Real-time feature extraction from streaming data.
- Manual feature configuration via Excel-like formulas.
- Reconciliation of features.

Concept Drift

- Auto model retraining as new data arrives (continuous learning).
- Alerting about metrics degradation.

Insights

- Feature importance.
- Model explanation.
- Decision threshold context.
- Full set of metrics, confusion matrices, curves.

MLOps

- Model versioning.
- Model leader board.
- Model deployment.
- Model monitoring.
- Model upgrade.
- Deployment of a model via a Docker container.

Deep learning

- Real-time object detection and classification running on a device.



TECHNOLOGY

ALEX IoT Analytics uses both open source and proprietary components that differentiate Datastreams AI. The components are designed for high performance, high availability and security. All together are assembled in a way to provide excellent Time To Market.

AutoML Engine

- Auto model selection with two generations of hypotheses L0 and L1 (proprietary, C++).
- BOHB fast hyperparameters optimization (open source and proprietary, Python).
- ML pipelines framework (proprietary, C++).
- Continuous learning engine (proprietary, C++).

In-Memory Database

- Fault-tolerant distributed hierarchical IMDB optimized for real-time feature extraction upon an event arrival from IoT data streams. Keeps real-time 360° IoT device view (proprietary, C++).

ML Algorithms

- XGBoost (open source, C++).
- Very Fast Decision Trees continuous (incremental learning, proprietary, C++).
- Incremental Tree Induction (incremental learning, proprietary, C++).
- Random Bagger (proprietary, C++).
- Linear regression (open source, C++).
- PCA, imputation, categorical encoding, transformation, feature selection and other algorithms for pipelines (proprietary, C++).
- Permutation importance (proprietary, C++).
- Local Interpretable Model-Agnostic Explanations (open source, Python).

Auto Feature Generator

- Feature generation (proprietary, C++).
- Correlation analysis (open source, Python).
- RFECV (open source, Python).
- Collinear Features Elimination with Graph approach (proprietary, C++).

Rule Engine

- Real-time rule engine (proprietary, C++).
- High-performance workflow engine (proprietary, C++).

Deep Learning

- TensorFlow, PyTorch deep learning (open source).
- OpenVINO Toolkit for deployment (open source, C++, Python).

Common Framework

- Highly efficient framework providing scalability, redundancy, message bus, message queue, fault and performance management (proprietary, C++).
- Docker (open source).

Cold storage

- Clickhouse fast column-oriented DBMS (open source, C++).



CONNECTIVITY

Inbound and outbound data connectors for wide range of protocols and formats are supported. Sophisticated data transformation and system integration routines can be configured using ALEX Connect.

Inbound data streams from IoT platform and integration layer

- Custom REST API.
- Custom HTTPS.
- Apache Kafka.
- MQTT.
- SOAP.
- DBs.
- SMPP.
- CSV files.
- JSON files.
- XML files.
- BER files (ASN.1).
- SmartCare Network Probe.
- Custom formats.

ALEX Connect

The bus that enables reliable system integration with following characteristics:

- High performance.
- Linear scalability.
- High availability.
- In-service upgrade.
- Well-tested and reliable.
- Edge ready.
- Cloud ready.
- No programming skills required.

Outbound connectors to IoT platform and 3PP

- Custom REST API.
- Custom HTTPS.
- Apache Kafka.
- MQTT.
- SOAP.
- SMPP.
- SMTP.
- XML files.
- Custom.

“DATASTREAMS AI” ADDS
OUT-OF-THE-BOX CONNECTORS
TO ECOSYSTEM PARTNERS



SECURITY AND DATA PRIVACY

Running both at the Edge or in the Cloud requires strong policies about security and data privacy.

Access control

Authentication and Authorization allow users and engineers to access parts of their interest and to run operations according to their roles only.

Secure protocols

Secure protocols as SSL, HTTPS and SFTP guarantee encrypted data being sent from both the server and the client.

Data protection

- Data encryption.
- Anonymization.
- GDPR.
- Proprietary data formats in IMDB.

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