arm AI

AI Virtual Tech Talks Series

Automate tinyML Development & Deployment with Qeexo AutoML

Qeexo

Tina Shyuan

March 9th, 2021

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Thank you!

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Attendees: don’t forget to fill out the survey to be in with a chance of winning an Arduino Nano 33 BLE board (also supported on Qeexo AutoML)

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AI Virtual Tech Talks Series

Date	Title	Host
March 9th	Automate tinyML Development & Deployment with Qeexo AutoML	Qeexo
March 30th	Thermal Vision AI – Creating TensorFlow Models for Thermal Image Classification	OpenMV
April 13th	The First No-Code Voice AI Platform for Arm Cortex-M-based Microcontrollers	Picovoice
April 27th	Build smarter, Real World IoT Products with Production Quality Tools	SensiML

Visit: developer.arm.com/solutions/machine-learning-on-arm/ai-virtual-tech-talks

Presenter

Tina Shyuan, Director of Product Marketing

Tina helps businesses apply Qeexo AutoML to build innovative solutions using sensor data. She has a passion for building and launching cutting-edge machine learning technologies and has launched many successful ML products during her six years at Qeexo. Tina is an advocate for running machine learning at the Edge, and actively contributes to the tinyML community.

Tina holds an MBA from Columbia University and a BS degree in EECS from UC Berkeley. Before Qeexo, she was a software consultant and facilitated the end-to-end integration of enterprise processes.

Agenda

- Qeexo introduction
- Why machine learning at the Edge & challenges
- Qeexo AutoML to the rescue!
- Demo video: single-class anomaly detection using STWIN
- Live workshop: gesture detection (ST SensorTile.box giveaway!)
- Resources
- Q&A

Who We Are

- **Founded:** Spun out of Carnegie Mellon University in 2012
- **Headquarters:** Mountain View, CA
  - Additional key locations: Pittsburgh, PA; Shanghai and Beijing, China
- **Key Products**:
  - AutoML – Intuitive machine learning platform enabling efficient development of ML applications; delivers intelligence wherever sensor data is generated
  - Qeexo-developed ML applications using Qeexo AutoML that provide strong proof points:
    - FingerSense – Input-type classification for touchscreens
    - TouchTools – Understands user intention from gestures
    - EarSense – Software-only proximity sensing solution
- **Select Partners & Collaborators:**

Rising Market Demand for Edge Intelligence

DRIVERS FOR EMBEDDED MACHINE LEARNING

Embedded ML utilizes Microcontroller Units (MCUs) or other hardware embedded in devices for advanced data processing.

BENEFITS

- Processes time-sensitive data at the point of origin, eliminating dependency on the cloud or a centralized server
- Reduces latency, bandwidth and power usage by eliminating data transfers
- Enables smarter, more agile applications that provide better insights and faster outcomes
- Addresses privacy & security concerns

SOURCES: REALITY.AI, 2019; FRAUNHOFER, 2019; Sources: Gartner, 2019; McKinsey, 2019; Statista, 2019

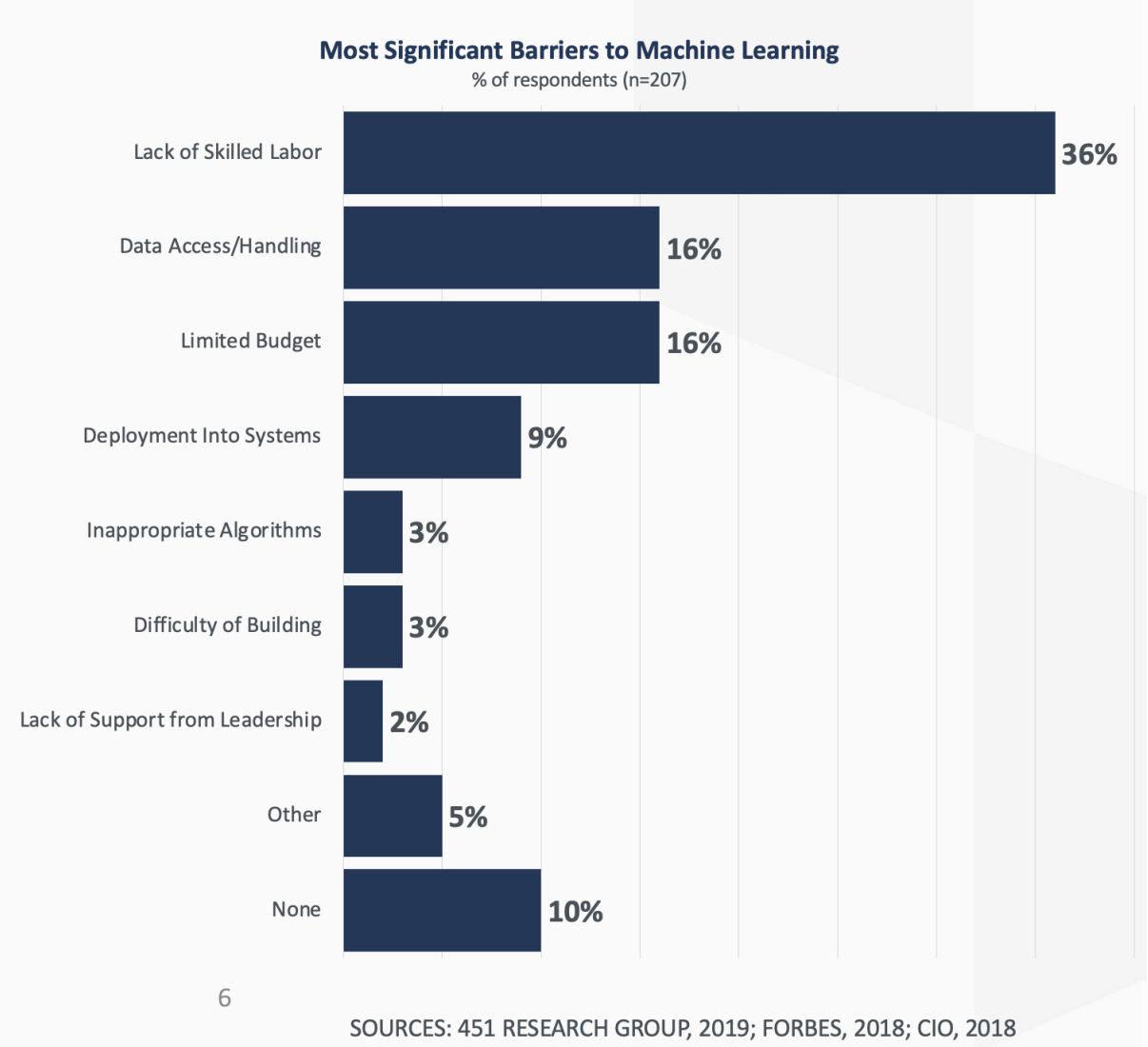
Qeexo Addresses Barriers Hindering tinyML Adoption

KEY BARRIERS TO ADOPTION OF ML/AI

- Severe shortage of skilled resources with AI/ML skillsets, and inability for academia to catch up
- End-to-end process of ML modeling to develop applications is labor-intensive, time-consuming, and costly
- ML is particularly challenging in resource-constrained environments

NO END-TO-END TOOL AVAILABLE

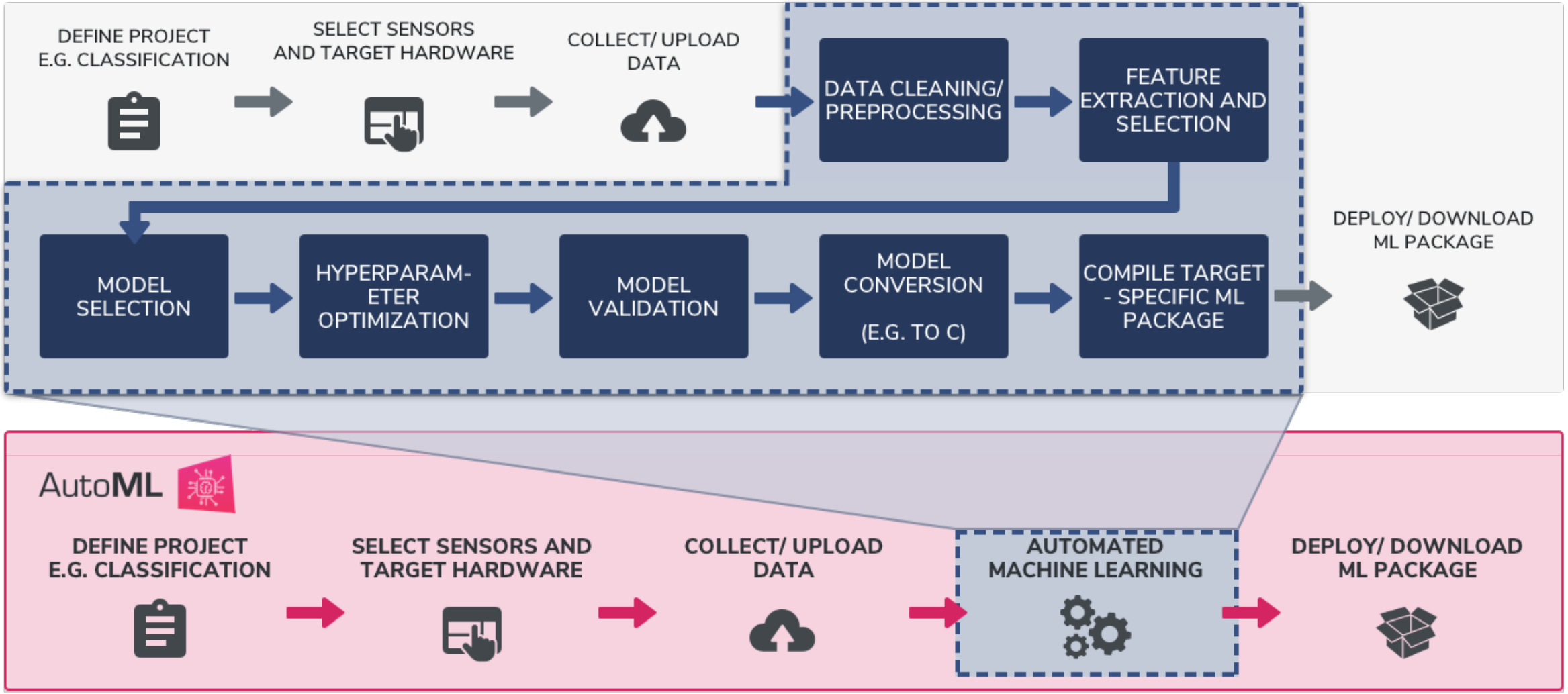
TensorFlow Lite™ PyTorch™ aws
Caffe™ Caffe2™ Microsoft Azure
TensorFlow™ ONNX™ CMSIS
mxnet™ Android™ NNAPI arm NN



SOURCES: 451 RESEARCH GROUP, 2019; FORBES, 2018; CIO, 2018

Fully Automated Machine Learning

Without AutoML



Supported Sensors

Motion Sensors:
accelerometer, gyroscope & magnetometer, radar, etc.

Acoustic Sensors:
microphone, ultrasonic, geophone, vibrometers

Environmental Sensors:
temperature, humidity, air pressure, illumination, IR, etc.

Touchscreen Sensors:
capacitive & IR touchscreens

Biometric Sensors*:
SpO2, heart rate, etc.

* Sensors currently under research

Demo Video: Fault Simulator with STWIN

- **Hardware platform:** STWIN SensorTile Wireless Industrial Node (STWIN)
- **Sensors:** accelerometer & gyroscope
- **Sampling rate:** 6.6 kHertz
- **Machine learning type:** single-class classification (only NORMAL data is collected)
- **Anomalies detected:** imbalanced rotor, eccentric rotor, bent rotor shaft

Single-Class Anomaly Detection for Predictive Maintenance Using STWINKT1

AutoML

Qeexo AutoML Live Workshop

- Qeexo AutoML Registration: https://automl.qeexo.com/signup
- Data CSV files: https://qeexo-my.sharepoint.com/:u:/p/tina/EfYB3XB5V9REnPU89KcsQMwBlwQ145Q3vXYrR8u9IXseaQ?e=hIV7Ef
- Qeexo AutoML Web Application: https://automl.qeexo.com/
- Qeexo AutoML Installer & Installation Guide: https://automl.qeexo.com/resources

- Receive ML/AI updates from ST & Qeexo (plus the giveaway!): https://qeexo.com/armtechtalk2021/

Qeexo AutoML Highlights

- **Automates** complex and labor-intensive processes of a typical ML workflow – no coding or ML expertise required!
- **Wide range** of ML methods - 17 different ML algorithms
  - Multi-class algorithms: GBM, XGBoost, Random Forest, Logistic Regression, Gaussian Naive Bayes, Decision Tree, Polynomial SVM, RBF SVM, SVM, CNN, RNN, CRNN, ANN
  - Single-class algorithms: Local Outlier Factor, One Class SVM, One Class Random Forest, Isolation Forest
- **Easy-to-use** interface for labeling, recording, validating, visualizing time-series sensor data
- **Optimized** for low latency, low power consumption, and a small memory footprint
- **On-device inference** - Supports Arm® **Cortex™- M0** to Cortex™- M4 class MCUs

Qeexo AutoML for Enterprise Customers

- **Phase 1: Machine Learning Solution Development & Deployment**
  - Client provides ML solution requirements (e.g. detecting/predicting machine failures) and historic data (if any)
  - Qeexo provides sensor modules to attach to client machines OR integrate and use client's preferred/existing hardware
  - Qeexo builds custom ML solution using our proprietary platform and tools (we can do this much faster than competitors because of our automated tools)
  - Qeexo implements the machine learning solution in the field (and see results!)
- **Phase 2: Qeexo AutoML Customization**
  - Qeexo customizes our existing Qeexo AutoML platform for client's specific use case
- **Phase 3: Qeexo AutoML Hand-Off & Training**
  - Qeexo delivers custom Qeexo AutoML platform to client
  - Qeexo provides knowledge transfer and training to client so client can continue to operate Qeexo AutoML
  - Client uses Qeexo AutoML to generate new machine learning models for current and future projects (does not require previous ML knowledge)

Qeexo AutoML Resources

- Qeexo website: www.qeexo.com
- Qeexo AutoML Web Application: https://automl.qeexo.com/
- Qeexo partners page on ST website: Qeexo on ST Website
- Qeexo AutoML YouTube Channel
- Email inquiries: tina@qeexo.com
- Demo video links:
  - Qeexo AutoML Intro Video
  - Anomaly Detection Demo
  - Activity Tracking Demo
  - Intelligent Shipping
  - Fan Fault Detection
  - Interactive Wall
  - Environment-Aware Countertop

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Thank You

Danke

Merci

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Gracias

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