Information Frames

Milton A. Garces
University of Hawaii, Manoa

5 November 2019

Consortium for
ENABLING TECHNOLOGIES & INNOVATION

Georgia Tech

Colorado School of Mines

Duke University

University of Hawai'i

MIT

University of Michigan

The University of North Carolina at Chapel Hill

The Ohio State University

Texas A&M University

The University of Texas at Austin

Washington State University

Argonne National Laboratory

Berkeley Lab

Brookhaven National Laboratory

INL Idaho National Laboratory

70 Years of Science & Innovation

Lawrence Livermore National Laboratory

Los Alamos National Laboratory EST. 1943

Oak Ridge National Laboratory

Pacific Northwest National Laboratory

PPPL Princeton Plasma Physics Laboratory

Sandia National Laboratories

Consortium for Enabling Technologies & Innovation

Ubiquitous sensor data exploitation and platform optimization

The project will enable global nuclear proliferation detection through the use of ubiquitous mobile sensor systems (such as smartphones) connected to a cloud computing architecture.

Continuing National Lab Collaborations

- MINOS: Brian Quiter (LBNL), David Chichester (INL), Tom Reichardt (SNL), Jessie Gaylord (LLNL), Steven Magana-Zook (LLNL)

Possible Future National Lab Collaborations

- ADAPD. Interest to collaborate with ETI during Schubert Review. Good fit.
- Data Collection at Nevada National Security Site: Cleat Zeiler (NNSS).

UH Task Overlap with other PIs

- Anna Erickson (GT) – ETI Lead, sensors and integration.
- Paul Wilson (U Wisc) – Computer and Engineering Sciences for Nonproliferation.
- Steven Biegalski (GT) – Advanced Manufacturing for Nonproliferation, maker communities.
- Raymond Cao (OSU) – Novel Instrumentation for nuclear fuel cycle monitoring, SWAP, light.
- John Fisher (MIT), Al Hero (U Mich) – Machine learning.

ETI

Interest Statements

Multi-Informatics for Nuclear Operations Scenarios (MINOS)

"MINOS aims to characterize a isotope production reactor and material processing facility at ORNL using multimodal analyses, and welcomes ETI collaboration"

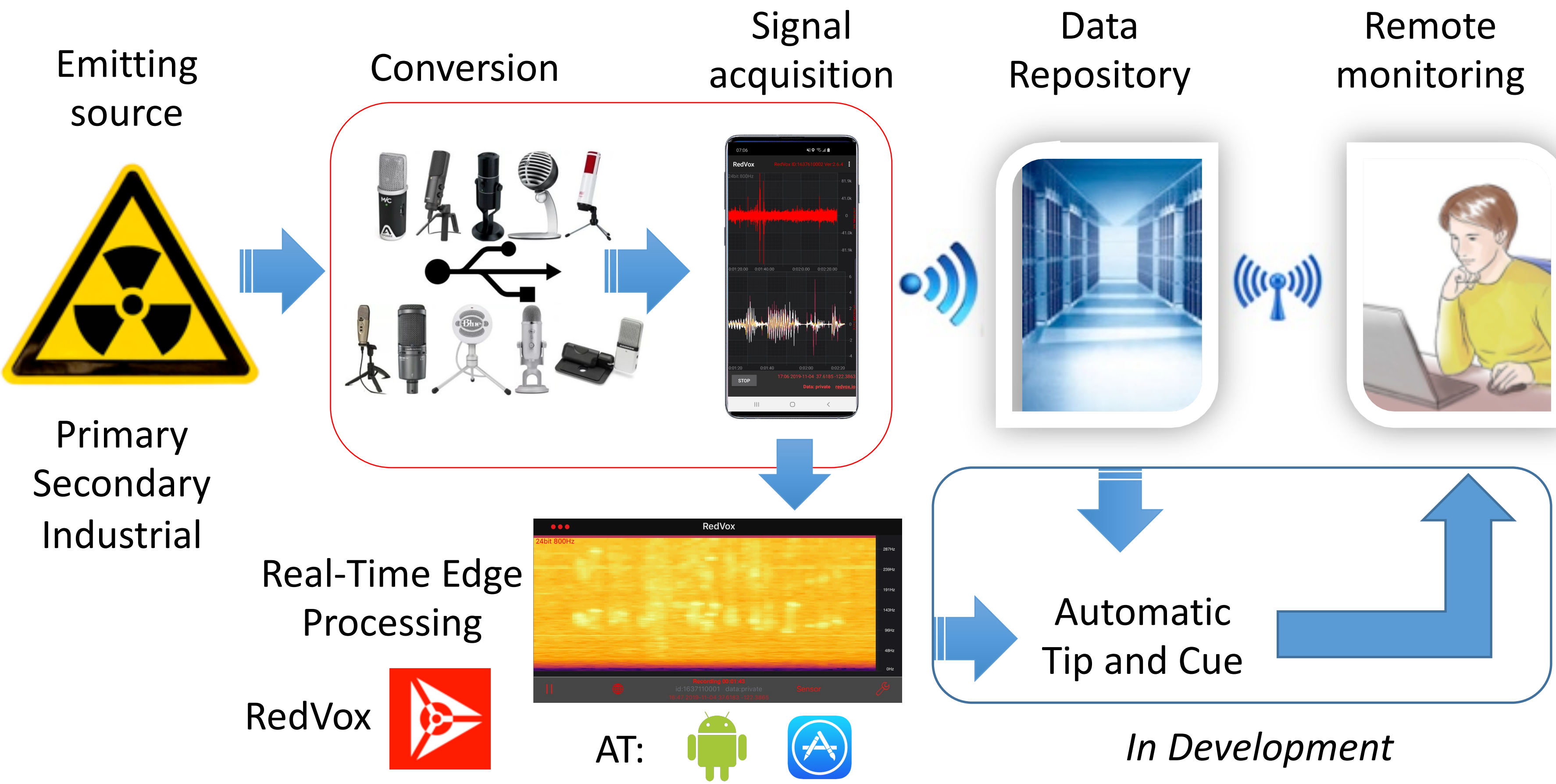
J. Johnson, ORNL

Advanced Data Analytics for Proliferation Detection (ADAPD)

"ADAPD is eager to engage ETI researchers in collaborative work, host students and post-docs at the national labs, and participate on dissertation committees where appropriate."

J. Smith, LANL

Ubiquitous sensor data exploitation and platform optimization

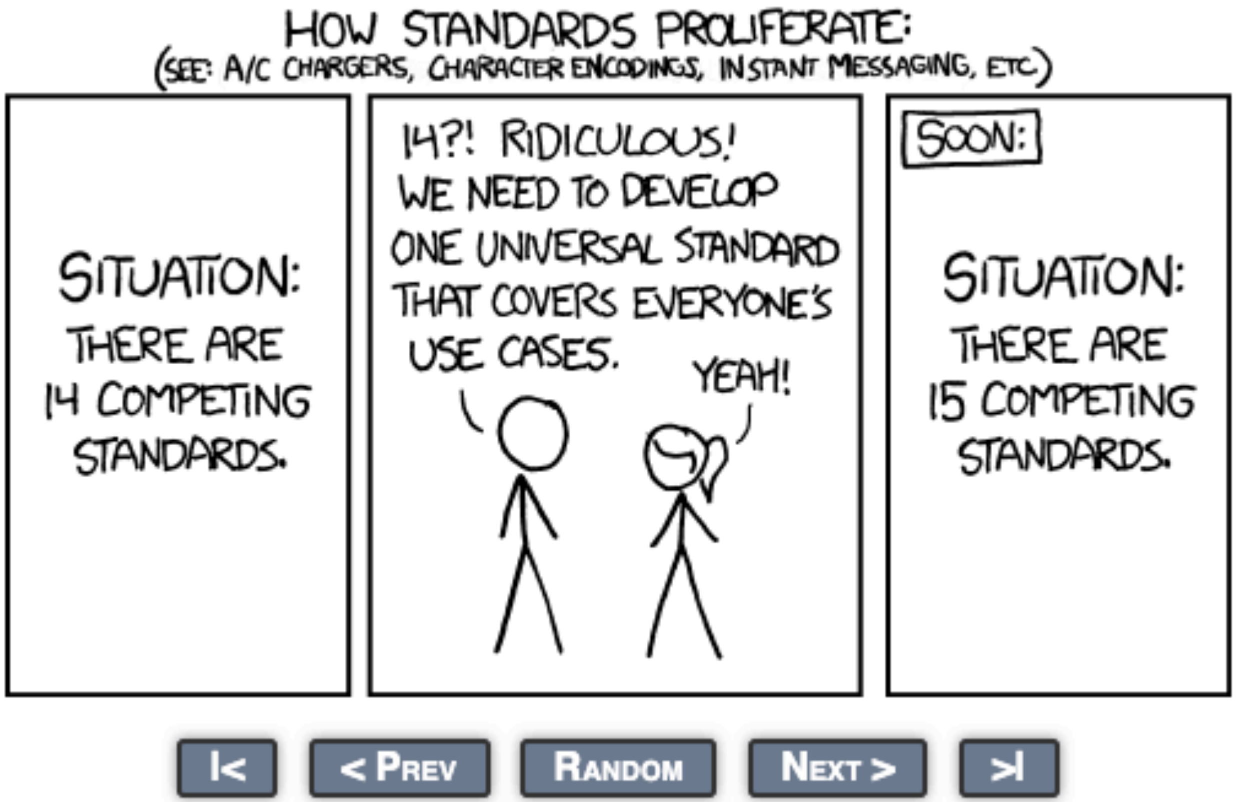


Addendum to Bernard Kippelen, Next Gen Light Collection and Materials, ETI Kickoff Meeting, May 2019

Ubiquitous sensor data exploitation and platform optimization

- **Primary Task:** TA1.5. Commercial Ad Hoc Networks
- UH proposes to build a bridge between the raw ubiquitous (smartphone) digital data and the input requirements for ML training by building standardized, modular data quality metrics and signal processing methods that can be used for diverse sensor modalities.
- Evaluate and/or construct standardized, transportable frameworks (APIs, SDKs) and pipelines for detection, feature extraction, and ML.
- Construct expandable data structures and pipelines.
- Consider versioning, provenance and traceability.
- Consider class hierarchy and feature annotation.

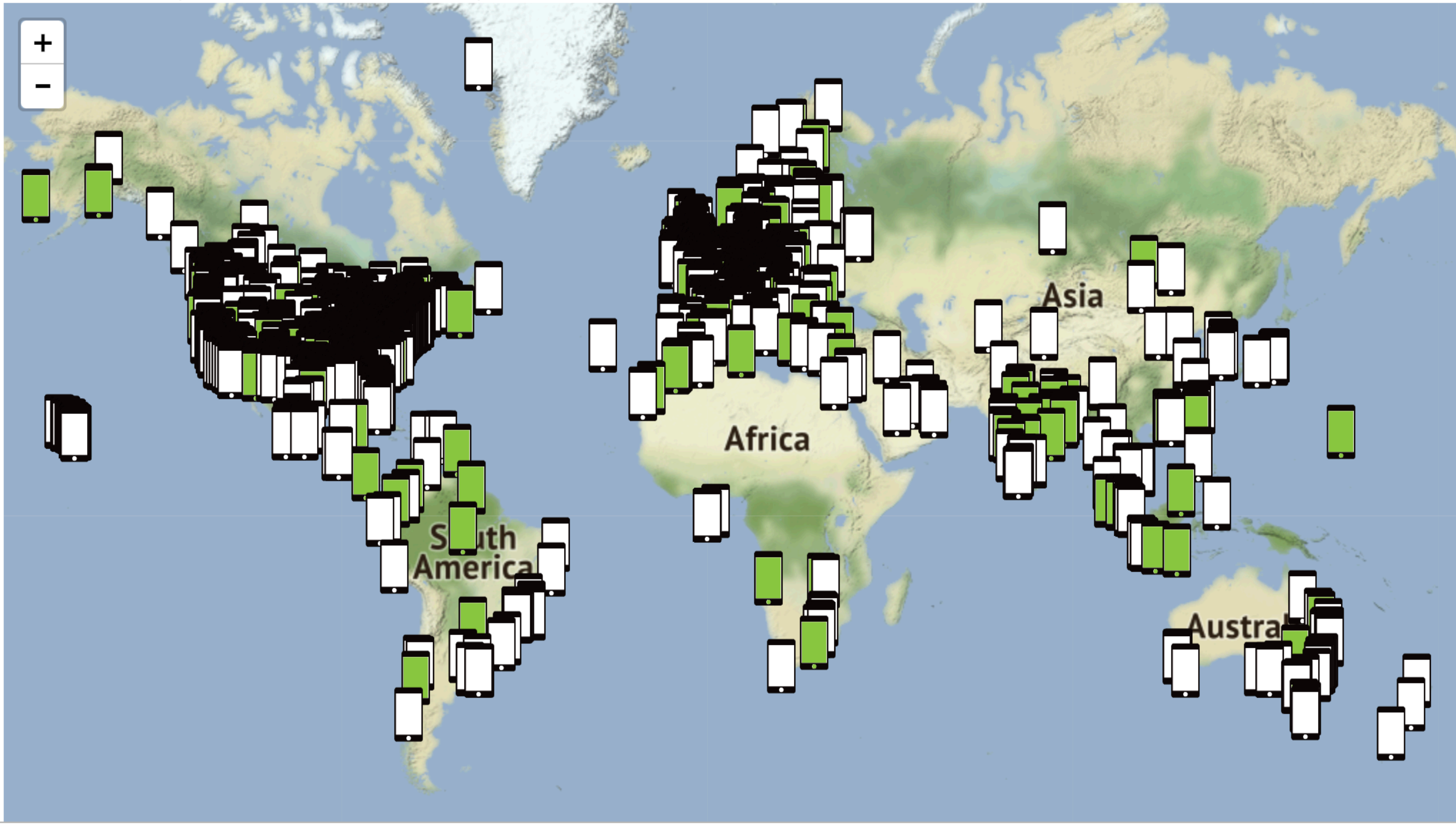
ML Application Programming Interface?



PERMANENT LINK TO THIS COMIC: HTTPS://XKCD.COM/927/
IMAGE URL (FOR HOTLINKING/EMBEDDING): HTTPS://IMGS.XKCD.COM/COMICS/STANDARDS.PNG

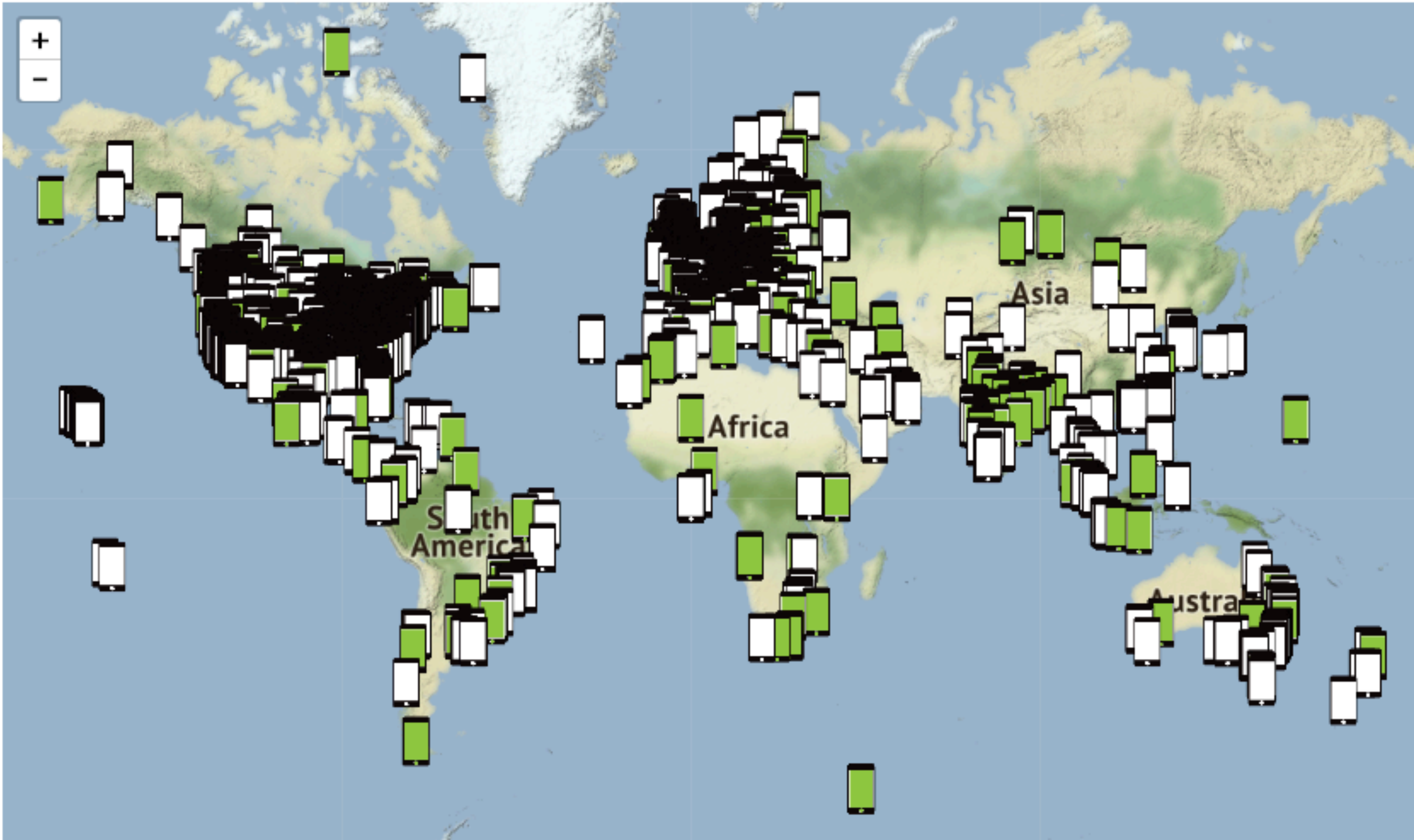
ETI Kickoff, May 2019

iOS June 2015 to April 2019 **Android** June 2017 to April 2019



ETI Workshop, November 2019

iOS June 2015 to October 2019 **Android** June 2017 to October 2019



Other ETI Tasks

- TA1.1. Machine learning. Train, test, and evaluate for selected signals of interests.
- TA1.2. Data Fusion. Integrate smartphone multisensory data at unit and collective scales. Integrate with traditional data streams (IMS and other regional networks).
- TA2.3. Maker communities. Side channel reconstruction of manufacturing processes.
- TA3.2. SWAP(C), Explore optimal smartphone configurations for mission-specific data collection. Consider USB and analogue specifications and interfaces for external sensors.
- ETI Laboratory Outreach Director for Technology
    - Facilitate cross-cutting research between the labs and universities
    - Ensure the practicality and transferability of the work at the universities

Information Framing

- Process lifecycle: Boundary value problem, initial and final states
- Measurements and signals within process
- Data preprocessing: DQ, annotation, and hierarchy
- Hierarchy and taxonomy tailored to use case
- Classes of signals, noise, and SNR thresholds
- Domain-specific (physics?) transfer learning
- Collaborate with machine learning engineer
- Uncertainty quantification
- Explainability/interpretability

ETI