THOUGHTS ON EDGE INTELLIGENCE

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CREATING THE NEXT®

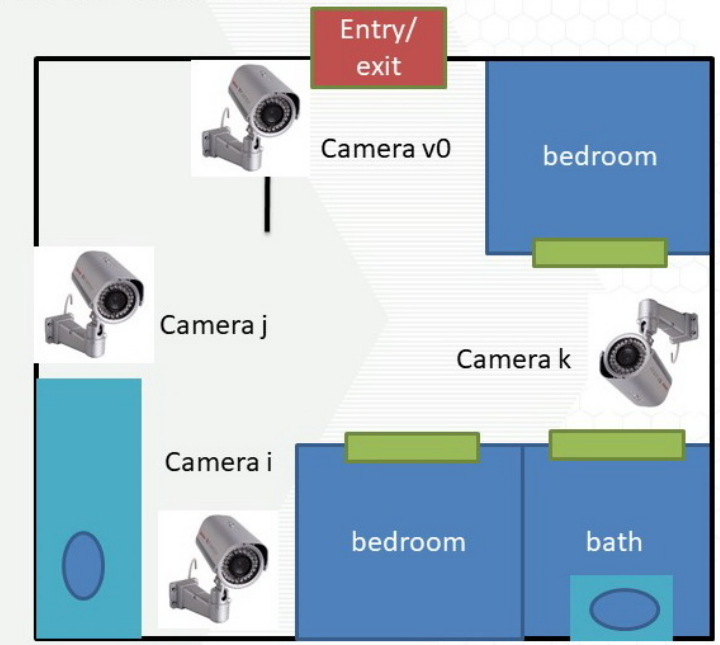
EDGE INTELLIGENCE

Machine learning at the edge:

- Smart devices.
- Smart networks.

A wide range of applications:

- Manufacturing and logistics.
- Smart health.
- Smart grids and smart cities.



IMPERATIVES

Technological:

- Rich set of cheap sensors.
- Highly integrated computation and communication.

Application:

- More complex requirements.
- Customization of generic systems:
  - Engnieering varitions.
  - Human user adaptation.

TRILLION SENSOR WORLD

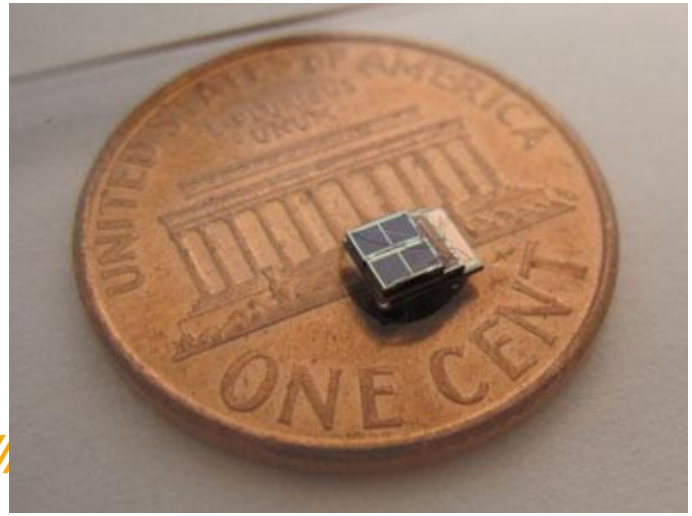
Semiconductor industry is capable of building huge numbers of sensors:

- Accelerometer.
- Temperature.
- Chemical composition.

- 4 petabytes/day:
  - Total Facebook data rate.
  - Data rate from 1,000 cars.

On-board processing, networking, storage allows us to analyze data efficiently.

Low-power systems allow us to deploy widely.



CONTINUOUS SENSING AND MACHINE LEARNING

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Manual data capture:

- Limited duration.
- Limited number of measurement points.

Sensor-driven management:

- 24/7/365.
- Many measurement points.

What does the data mean?

WHY EDGE INTELLIGENCE?

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Not all machine learning will occur in the cloud:

- Local inference.
- Local training.

Why edge/fog:

- Limited bandwidth to cloud.
- Low-power sensing (wireless, energy scavenging).
- Privacy (personal, corporate).

Each device may require localized training.

- Personalized training strains cloud, network resources.

CHALLENGES

Algorithmic:

Non-standard statistics: non-Gaussian, non-IID.

Training based on limited amounts of labeled data.

Classification explanation.

Distributed algorithms for classification, training.

Matching application to algorithms.

Architectural:

Streaming classification.

Limited bandwidth.

Low power.

Safety, security, privacy.

PAPER MILL OPTIMIZATION

Georgia-Pacific operates about 230 paper mills.

- Most slightly different.
- Many types of products.

Maintenance prediction and planning.

Experienced personnel may retire.

Plenty of bandwidth within plant, limited bandwidth to cloud.