FOURTH INDUSTRIAL REVOLUTION:
FROM ARTIFICIAL INTELLIGENCE TO ACTIONABLE INTELLIGENCE

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Enabling Indonesia 4.0

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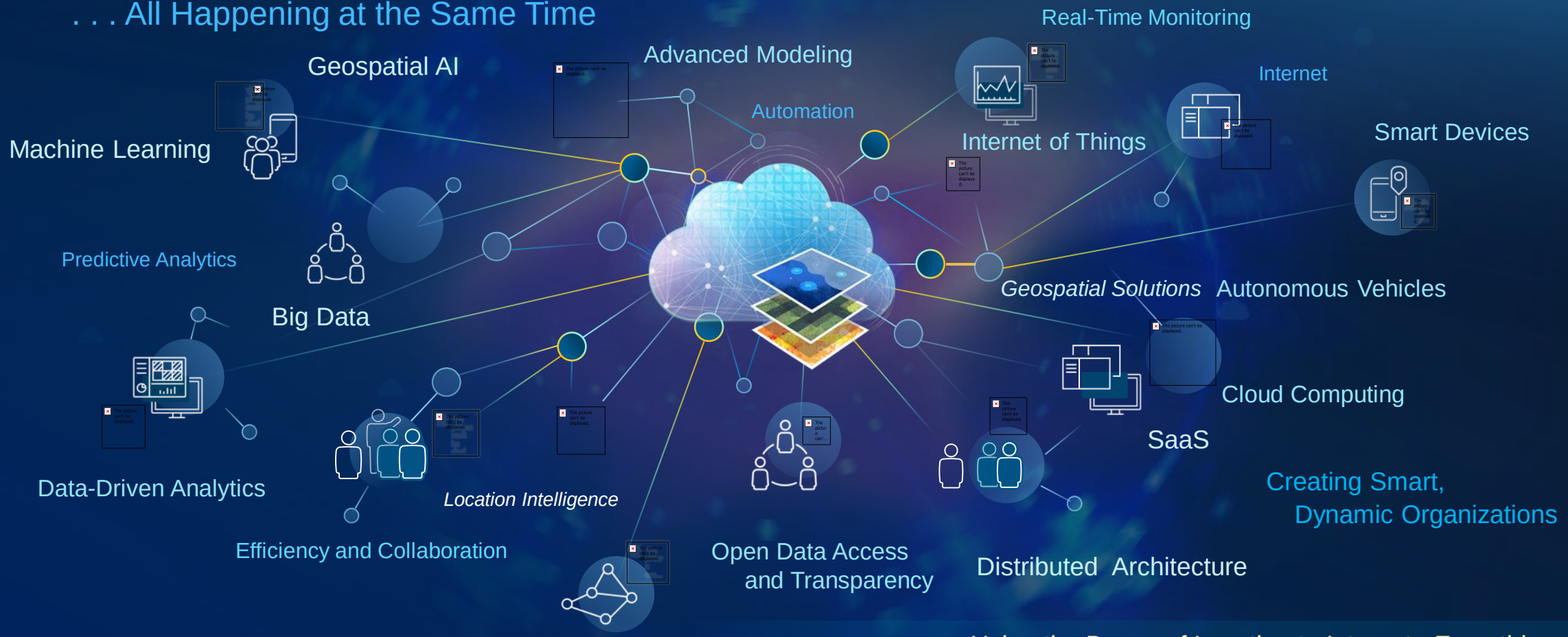
Geo-enable the 4th Industrial Revolution

Interconnected Information, Processes, and Workflows . . .
. . . All Happening at the Same Time



Creating Smart, Dynamic Organizations

Using the Power of Location to Integrate Everything

Industry 4.0: Key Challenges for Government

Integration

Interoperability

Data QC

Time Consuming

Analytics

Dissemination

Creating Smart,
Dynamic Organizations

Industry 4.0 Enabler:
Real-Time, IoT, AI/Machine Learning

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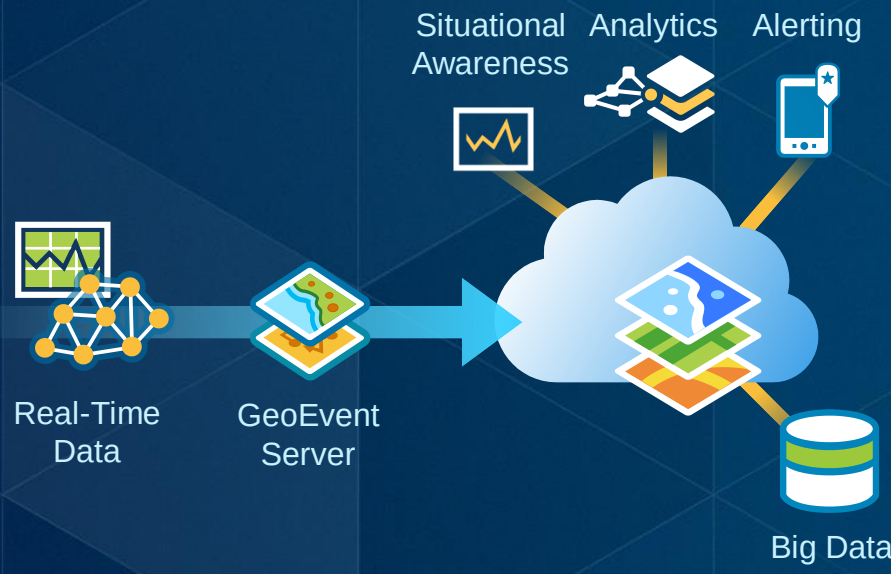
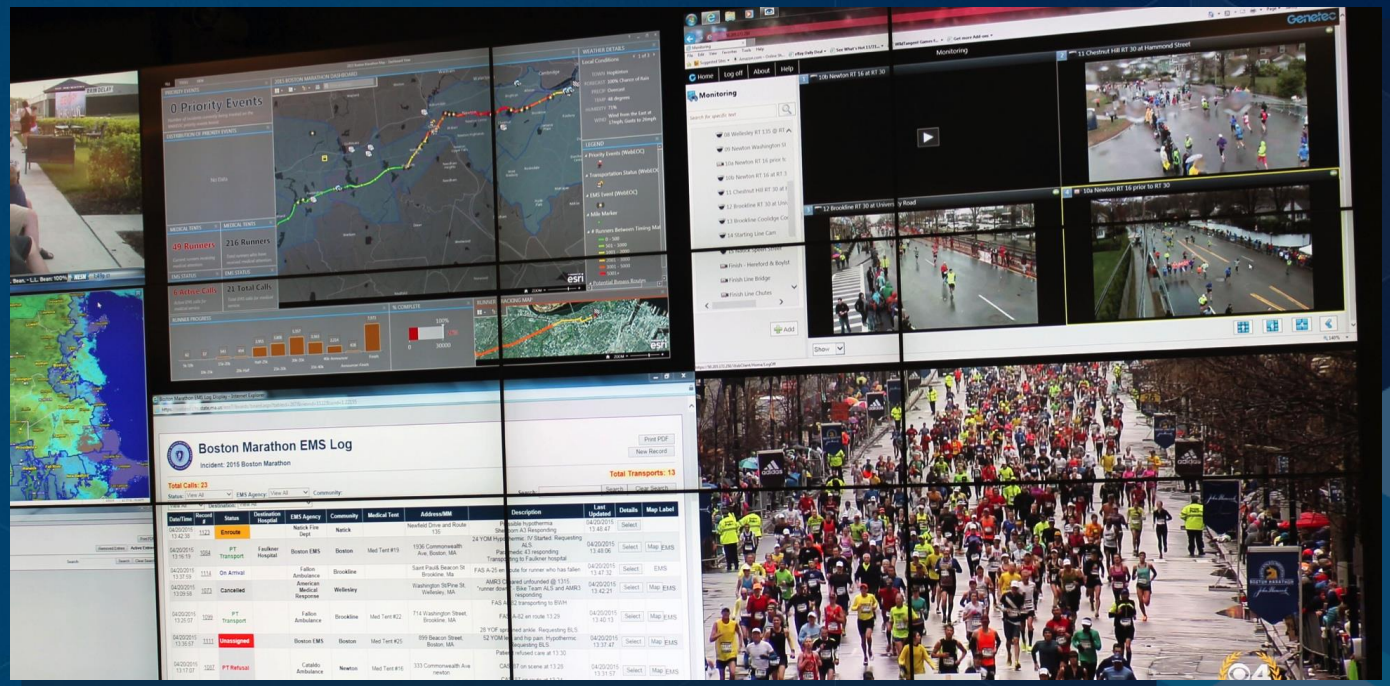
Real-Time Analytics | Integrating Sensor Networks and the IoT

- High-Velocity Data Streams
- Monitoring and Alerting
- Dynamic and Big Data Analytics





Dashboard

Supporting Real-Time GIS Applications . . .
. . . Enabling Smarter Organizations

Internet of Things (IoT)

enabling geospatial insights with your IoT

Environment
noise co2 nitrates
gases temperature humidity
atmospheric pressure radiation
pesticides electromagnetic feedback
rain gauges water level gauges
water quality air quality

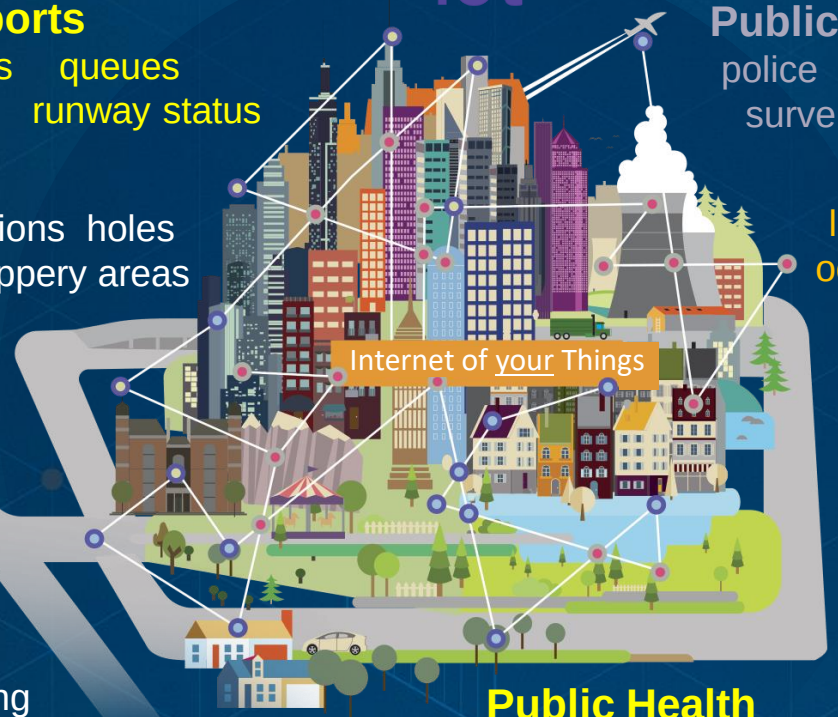
Weather
warnings earthquakes
precipitation

Airports
flight status queues
plane location runway status

Public Safety
police fire
surveillance

Connected Cars
autonomous driving traffic conditions holes
parking meters road conditions slippery areas
network improvements

Buildings
lighting hvac
occupancy counts



Web Device Desktop

Enterprise GIS

with real-time & big data capabilities

ingest, store, analyze, visualize

Transit
buses taxis rail
trains crowds

Energy Usage
electricity gas smart meters

City Workers
sanitation snow plows

People
health monitoring
social activity

Public Health
hospitals ambulances

Telecommunications
cell phone signals dropped calls

Predictive Analysis – Accident Probability

Training machines to derive predictions from big data

Temperature
Sun, Mon, Fri..

Wind Speed
Fast, Slow..

Visibility
High/Low

Snow Depth
High/Low

Day of the Week
Sun, Mon, Fri..

Time of the Day
12:45, 23:00

Month
Feb, Dec..

Road Width
20-30 M

Road Alignment
Straight / Curved

Proximity to
Intersections

Speed Limit
120 km/h

Sun Direction
East, West

Daily Traffic
AADT

Proximity to
Billboards

...

10s of Variables

7 Years of Data
400,000 Accidents
500,000 Segments

Impossible to Manually Analyze

Train a Machine to do?

What is Machine Learning?

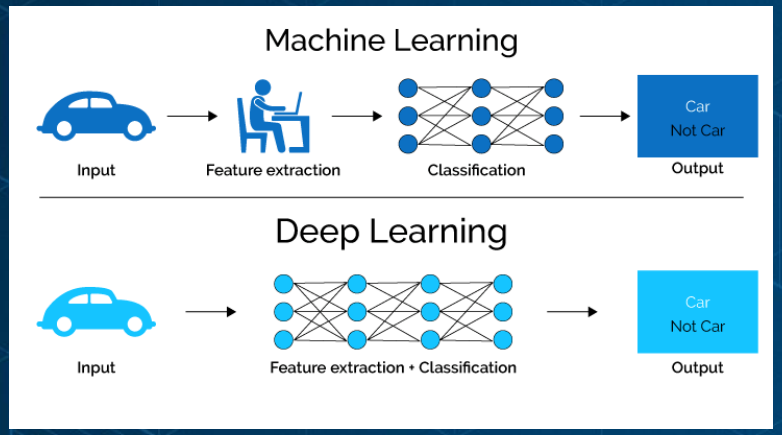
Data-driven algorithms and techniques that automate **prediction, classification** and **clustering** of data

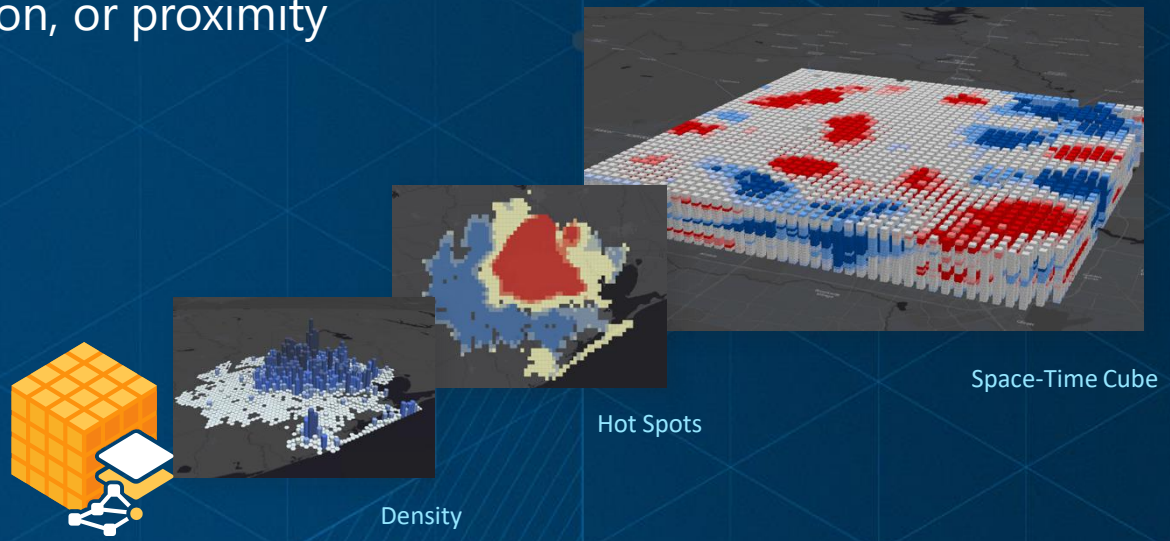
Traditional Machine Learning

- Useful to solve a wide range of spatial problems
- Geography often acts as the ‘key’ for disparate data

Spatial Machine Learning

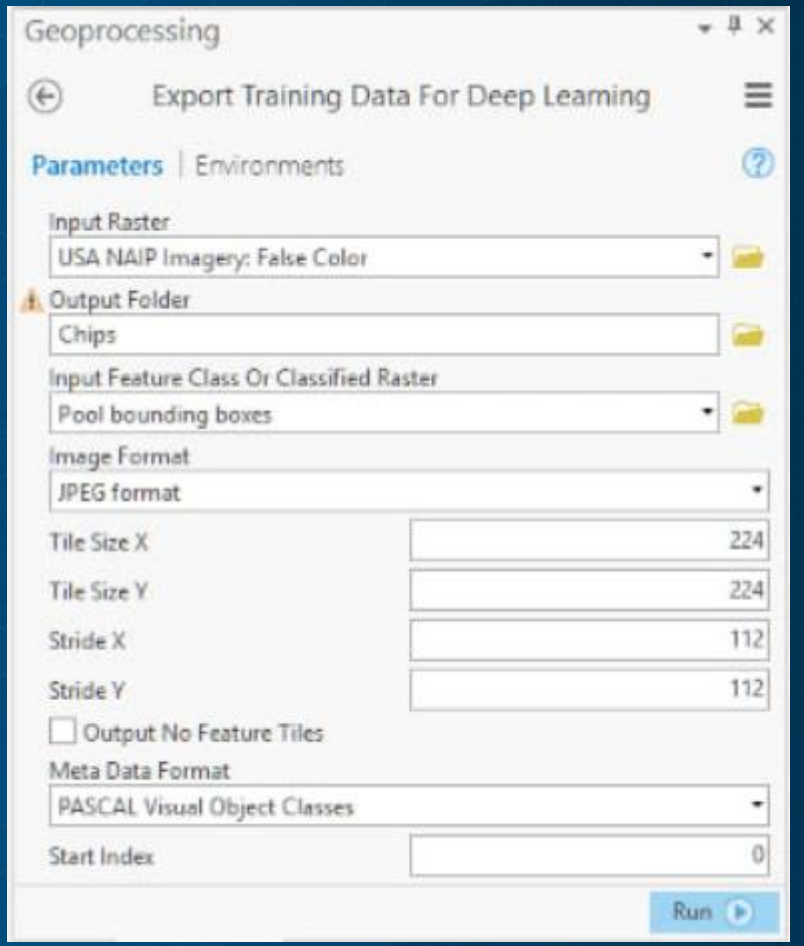
- Incorporate geography in their computation
- Shape, density, contiguity, spatial distribution, or proximity





Integrating Deep Learning with GIS

Object Detection Using Drone Imagery



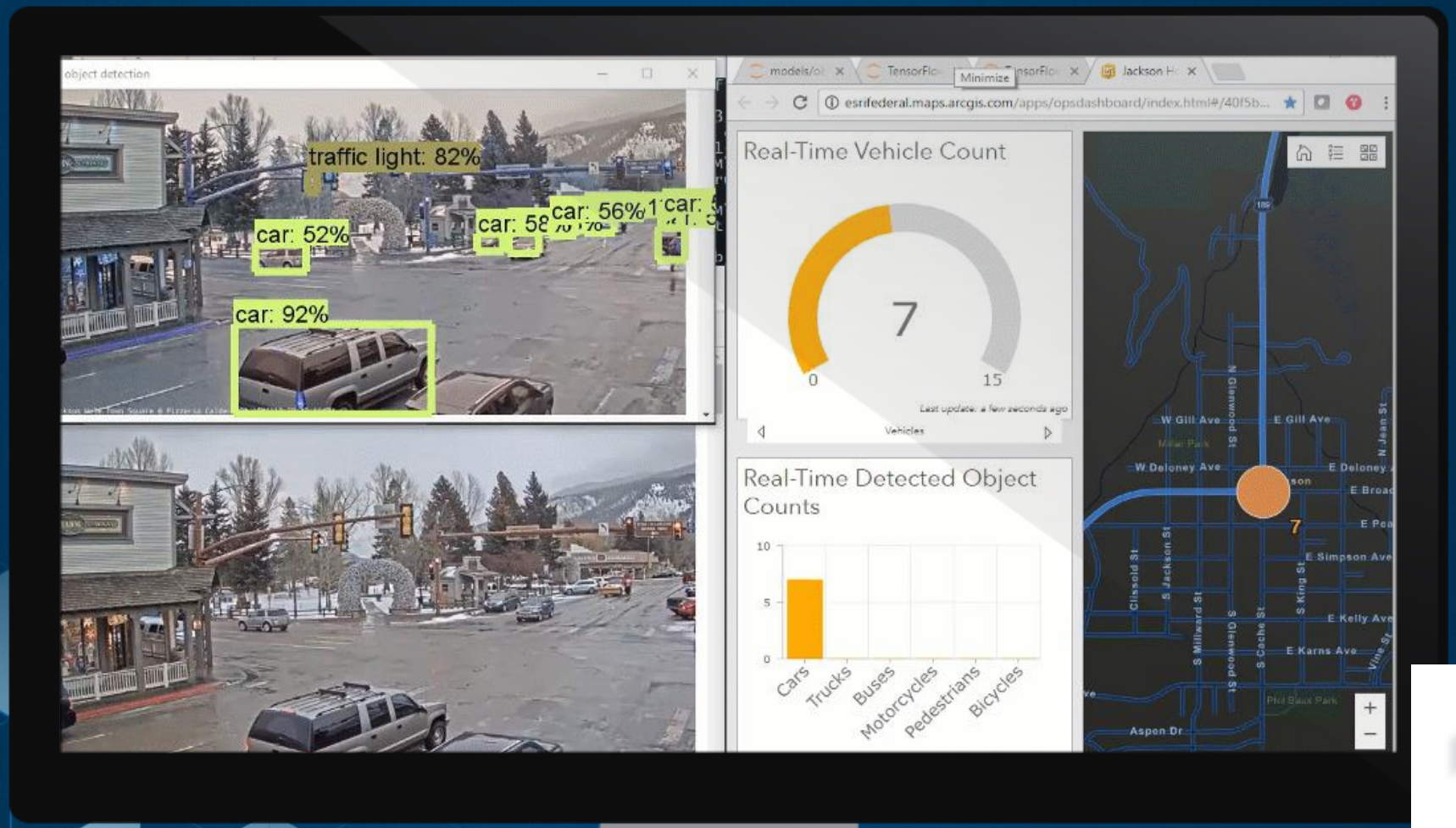
TensorFlow

scikit learn

IBM Watson

Working with External AI Engines - TensorFlow

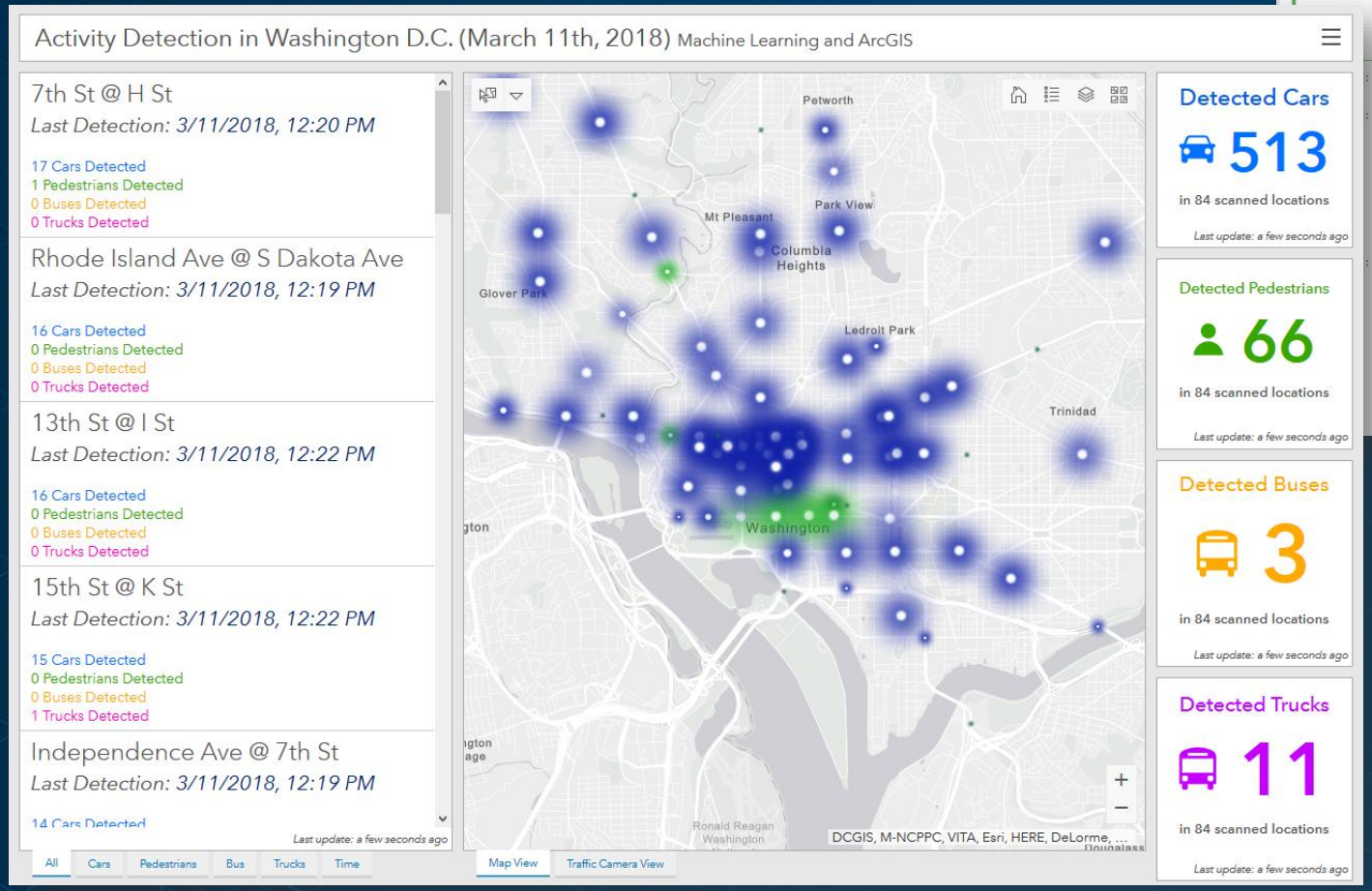
Real-Time Object Recognition from Video

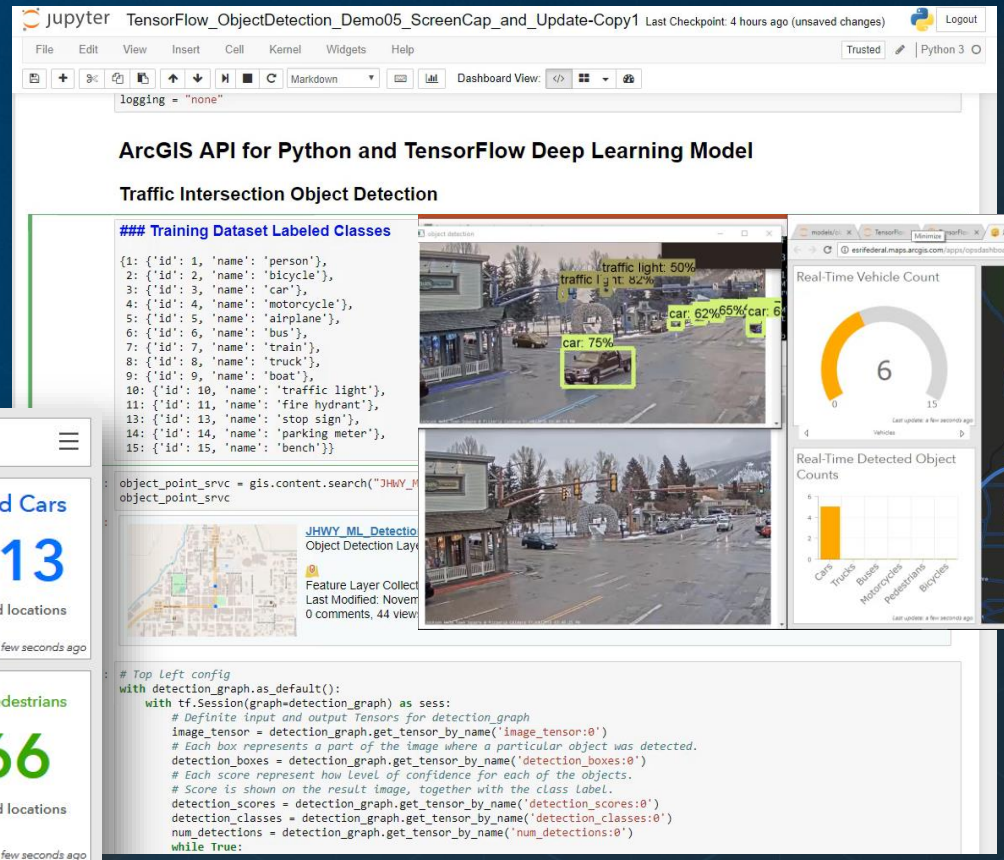


TensorFlow

Working at Scale - TensorFlow

Multiple Cameras – Analysis at machine speed





TensorFlow

Augmented Reality

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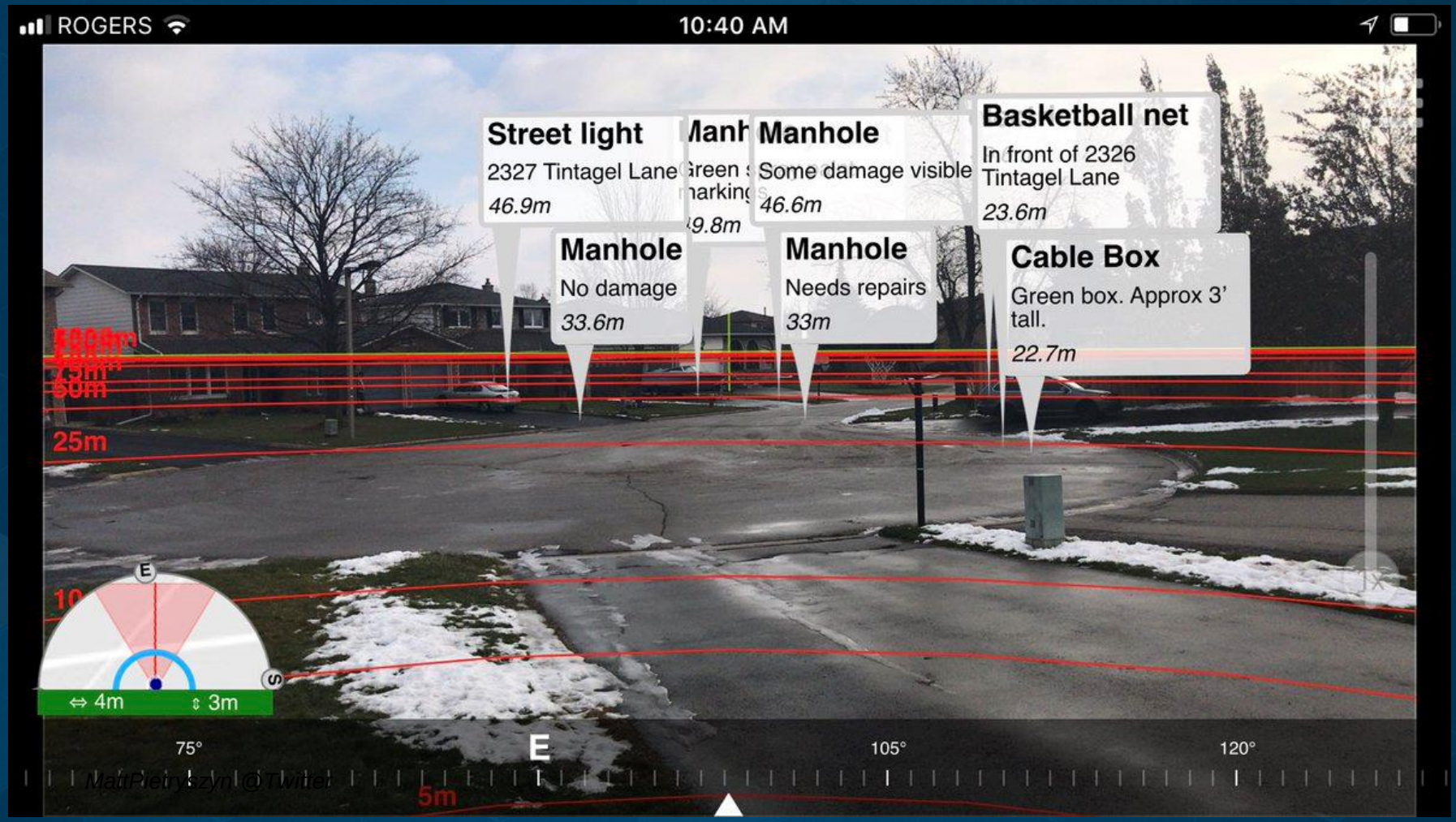
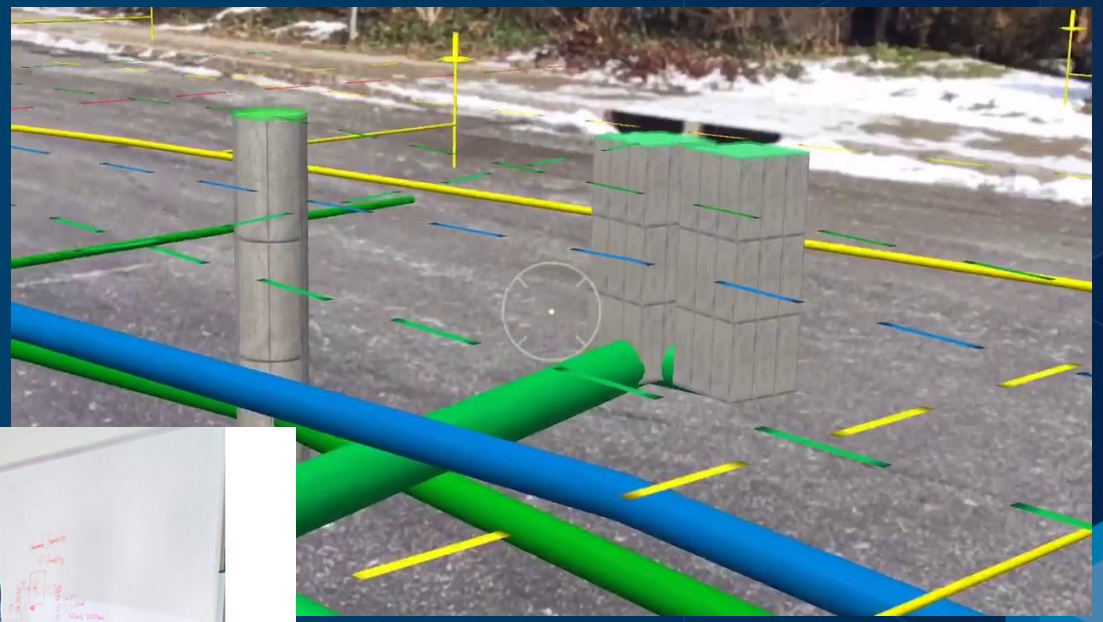
“See” your asset where you cannot see



Underground assets: pipes, valves, holes ...

Inspect your asset better

Increase Safety, Easy Maintenance



Conclusions

Successful Large Enterprise Implementation

Requires More Than Technology

- Vision and Leadership
- Executive Support
- Developing Sustainable Value
- Change Management
- Planning and Implementation
- Technical Enablement

The application of GIS is limited only by the imagination of those who use it.

Jack Dangermond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