AI meets IOT: Sensor+Spatial+Contextual computing for Situational Awareness

Milind Naphade, Chief Technology Officer, Metropolis/AI Cities
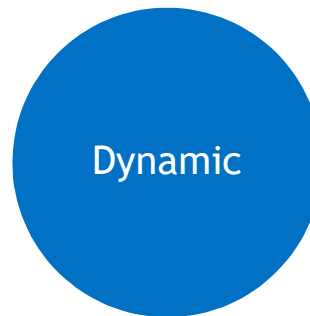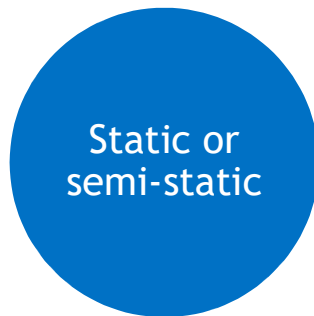
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SPATIAL Intelligence/Situational Awareness

Multiple domain problems need joint analysis of both static & dynamic data

x,y,z, layer attributes   t,x,y,z, sensed attributes

Static or semi-static   **+**   **Dynamic**   **=**   **Geospatial Intelligence Situational Awareness**

Environment Models
such as Maps, BIM
Models w. layers of
semi-static info such
as roads, buildings,
waterways, etc.

Sensor Data
generated by Video
Cameras, LIDAR,
GPS, Wi-Fi, LiFi,
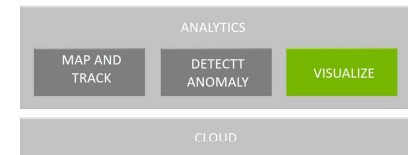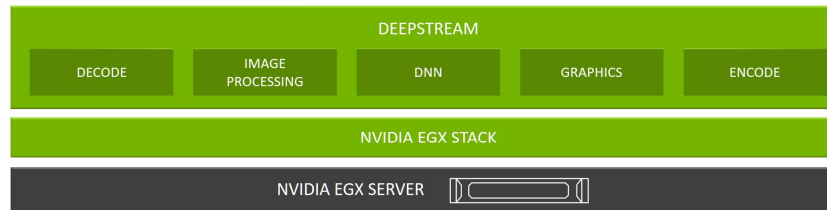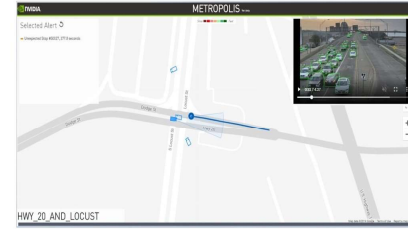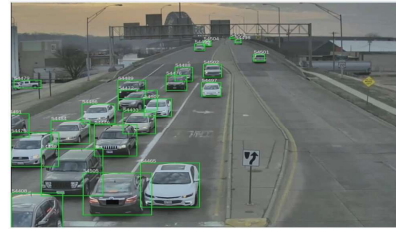Blue-tooth beacons,
Smart meters etc.

Domains
Retail
Smart Cities
Traffic
Placemaking
Safety & Security
Navigation
Disaster Recovery

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NVIDIA Metropolis
Platform for fusing sensor, spatial, contextual info for situational awareness

NVIDIA METROPOLIS
IOT APPLICATION FRAMEWORK
DETECT ANOMALY

DEEPSTREAM				
DECODE	IMAGE PROCESSING	DNN	GRAPHICS	ENCODE

NVIDIA EGX STACK

NVIDIA EGX SERVER

ANALYTICS		
MAP AND TRACK	DETECTT ANOMALY	VISUALIZE

CLOUD
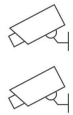
cuSpatial

GPU Acceleration of common spatial processing functions

Layer	0.10/0.11 Functionality	Functionality Roadmap (2020)
High-level Analytics	C++ Library w. Python bindings enabling distance, speed, trajectory similarity, trajectory clustering	C++ Library w. Python bindings for additional spatio-temporal trajectory clustering, acceleration, dwell-time, salient locations, trajectory anomaly detection, origin destination, etc.
Graph layer	cuGraph	Map matching, Djikstra algorithm, Routing
Query layer	Nearest Neighbor, Range Search	KNN, Spatiotemporal range search and joins
Index layer	Grid, Quad Tree	R-Tree, Geohash, Voronoi Tessellation
Geo-operations	Point in polygon (PIP), Haversine distance, Hausdorff distance, lat-lon to xy transformation	Line intersecting polygon, Other distance functions, Polygon intersection, union
Geo-representation	Shape primitives, points, polylines, polygons	Additional shape primitives

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Resources

NVIDIA Metropolis

https://www.nvidia.com/en-us/autonomous-machines/intelligent-video-analytics-platform/

NVIDIA cuSpatial Medium Blog

https://medium.com/rapids-ai/releasing-cuspatial-to-accelerate-geospatial-and-spatiotemporal-processing-b686d8b32a9