Best Practices :
Drone Imagery Acquisition & GeoAi Applications

Luvo Qumba, Snobani Dweku, Riona Parumasur

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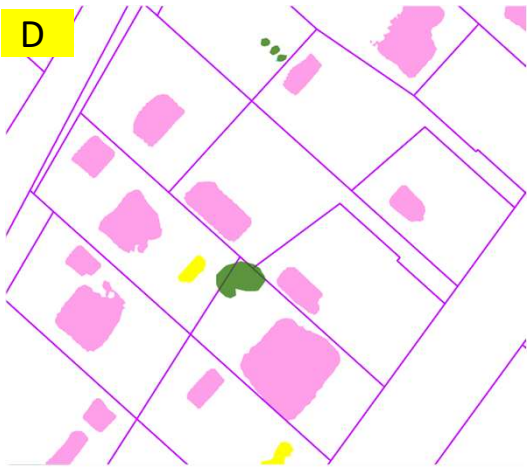
02 | GeoAI Applications

What is GeoAI

- Geospatial data- location attributes.
- Artificial Intelligence - machines mimic human behaviour.
- *Geospatial Artificial Intelligence* – fusion of both.
- Enhances GIS capabilities



Why Drone Imagery?

- **High Resolution**: inspect individual objects or structures

A

B

C

D

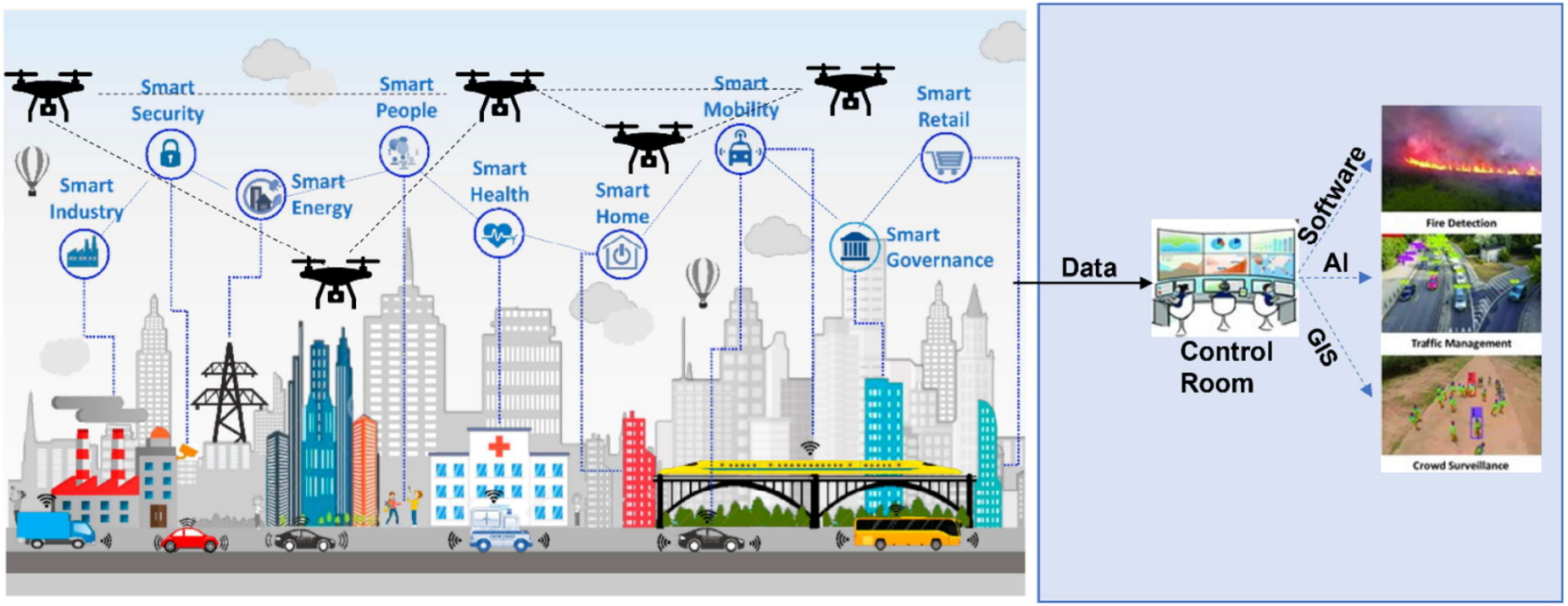
E

Why Drone Imagery?

- **Flexibility**: various terrain

Why Drone Imagery?

- **Real Time Data**:



Types of Drone Data

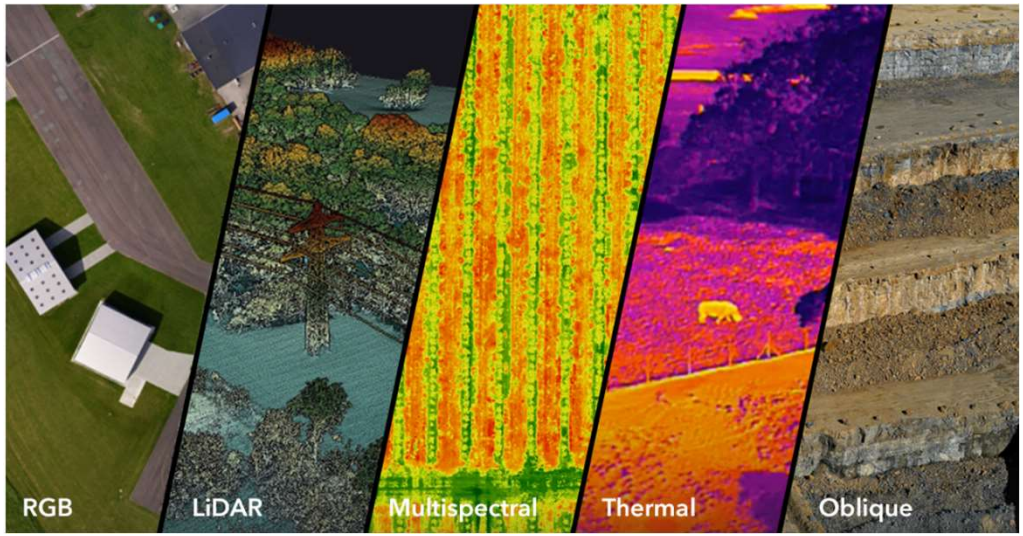
- **RGB**: Building footprints, roof inspections

- **LiDAR**: High-accuracy DEM/DSM creation, especially under vegetation.

- **Multispectral:** Vegetation mapping and classification**,**
- Wetland delineation.

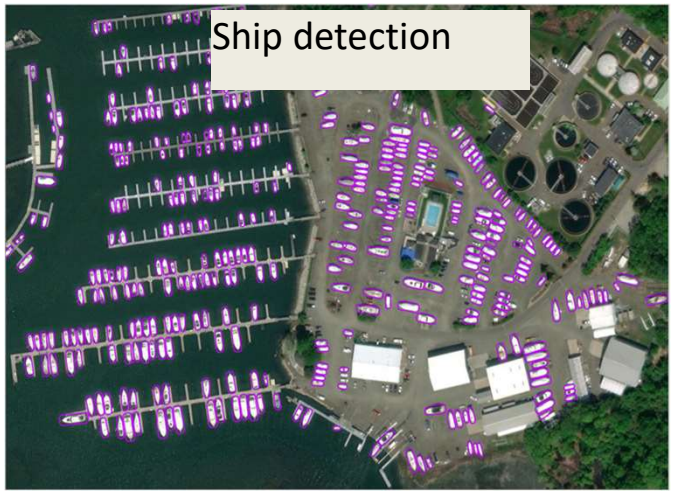
- **Thermal;** Crop water stress analysis and irrigation management,
- Electrical and mechanical inspections (e.g., substations, solar panels).

- **Oblique:** Side-view damage assessments for collapsed structures.

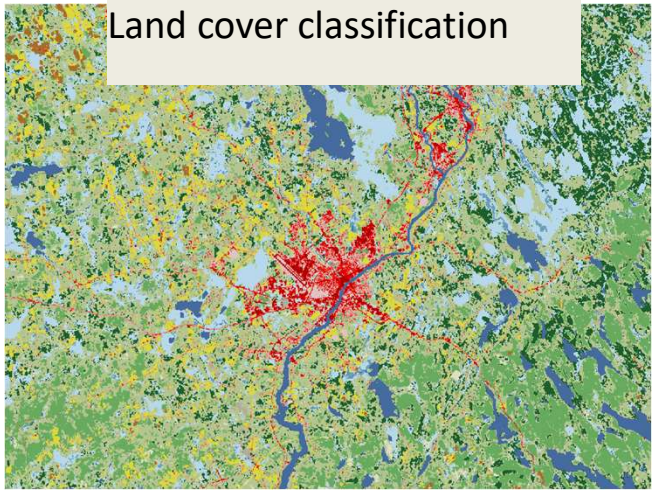


Deep Learning In Action

Feature detection & extraction



Pixel classification



Point cloud classification

ArcGIS Living Atlas of the World

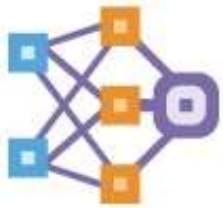
Solar Panel Detection

Input

Deep Learning Model

Output

Analysis



Registered Parcels (owner information)

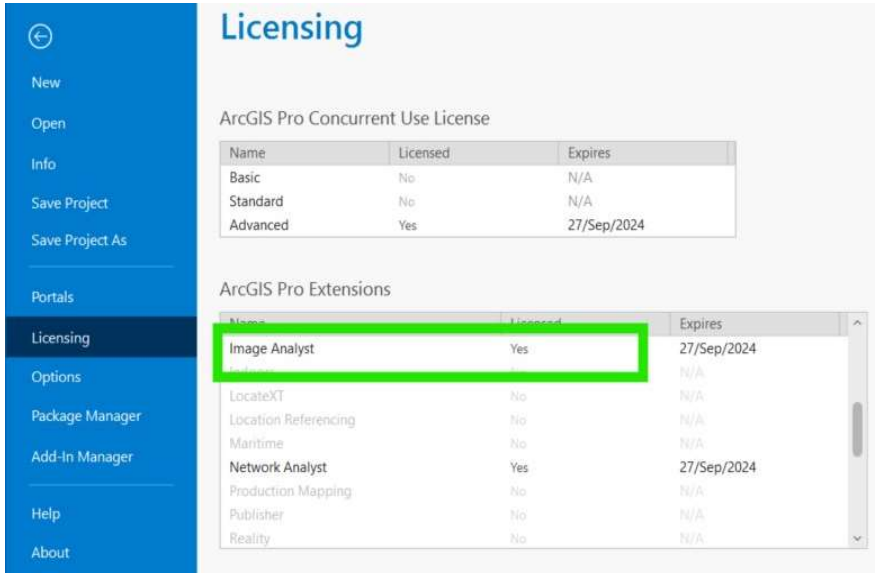
Deep learning package from Esri
Managed by esri_analytics

Solar Panel Detection

ArcGIS Pro

ArcGIS Image Analyst extension

Python deep learning libraries

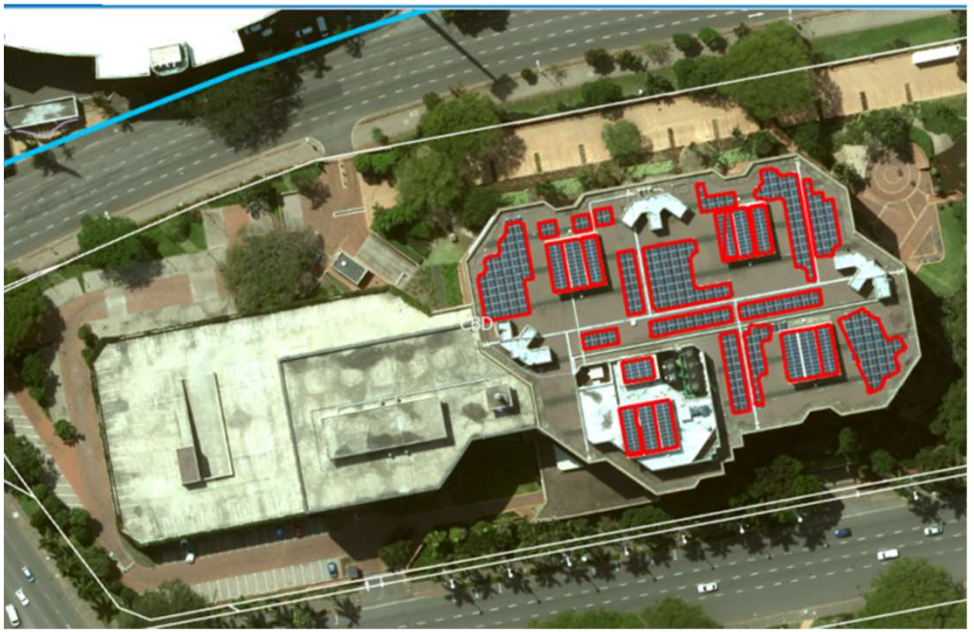


GPU: with compute capability of 6.0 or higher
Input : Raster- (5–15 cm spatial resolution)
Output: Polygon Feature class
Architecture: **Mask RCNN** model architecture
Accuracy metrics: Average precision score of 0.76

Model options

NO	MODELS	INPUT/IMAGERY REQUIREMENT- (AERIAL, SATELLITE, DRONE)	APPLICATIONS	DEPARTMENT/UNIT
	OBJECT DETECTION			
1	**Building Footprint Extraction - USA**	8-bit, 3-band high-resolution (10–40 cm) imagery	Exctracts building footprints from high-resolution (10–40 cm) imagery for urban planning and development, insurance, taxation, change detection, infrastructure planning,	CGIS/PHOTOGRAMMETRY/REAL ESTATE/DEVELOPMENT PLANNING
3	**Car Detection - USA**	High resolution RGB imagery (5 - 20 centimeter spatial resolution)/	Detect cars in high resolution drone or aerial imagery for traffic management and analysis, parking lot utilization, urban planning	ETA/DEVELOPMENT PLANNING
4	**Land Cover Classification (Aerial Imagery)**	8-bit, 3-band very high-resolution (10 cm) imagery	Useful in urban planning, resource management, change detection, agriculture	REAL ESTATE/DEVELOPMENT PLANNING
5	**Parcel Extraction - USA**	3-band high-resolution (40–50 cm) imagery	Useful for basemap creation and for land management.	REAL ESTATE/DEVELOPMENT PLANNING/CGIS
6	**Pool Detection - USA**	8-bit, 3-band high resolution (5-30 centimeters) imagery	Automates the task of finding pools from high resolution satellite imagery	REAL ESTATE/PARKS/SAFER CITIES
8	**Road Extraction - Global**	8-bit, 3-band high resolution (1 meter) aerial/satellite imagery.	Used to extract roads from high resolution (1 meter) aerial/satellite imagery.	DEVELOPMENT PLANNING/ENGINEERING
9	**Solar Panel Detection - USA**	High resolution (5-15 cm) RGB imagery	Automates the task of solar panel detection,	ELECTRICITY/DEVELOPMENT PLANNING
10	**Tree Detection**	8 bit, 3-band high-resolution (10-25 cm) imagery	Detects trees in high resolution drone or aerial imagery for vegetation management, forestry, urban planning applications,	PARKS/ DEVELOPMENT PLANNING & ENVIRONMENTAL MANAGEMENT UNIT
11	**Tree Segmentation**	8 bit, 3-band high-resolution (10-25 cm) imagery	Detects and segments trees in high resolution drone or aerial imagery for vegetation management, forestry, urban planning applications	PARKS/ DEVELOPMENT PLANNING & ENVIRONMENTAL MANAGEMENT UNIT

Solar Panel Detection

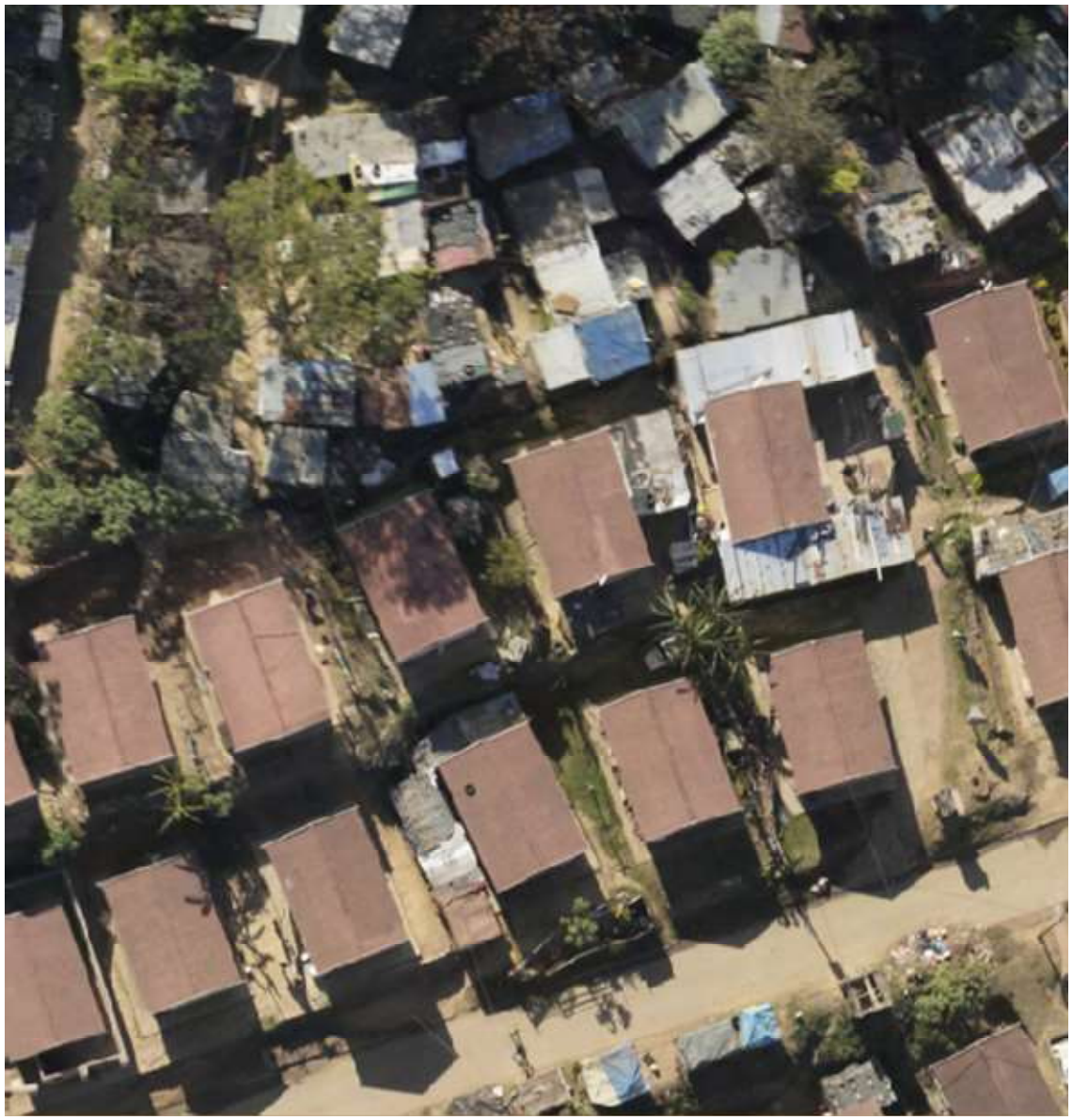


Solar Panel Detection

2022

2023

Drone imagery 5cm



Challenges, Limitations and Way Forward

Category	Limitation
Technical	Limited battery life, sensor quality, weather dependence
Operational	Line-of-sight, small area coverage, complex planning
Legal/Regulatory	Airspace laws, licenses, privacy concerns
Data	Accuracy issues, heavy processing requirements, lighting problems
Environmental/Physical	Obstacles, wildlife impact, GPS or signal interference

- Lack of Policy within council
- Departments working in silos
- Drones are highly sensitive to weather conditions


THANK YOU