



AI based Change Detection for Defence Lands

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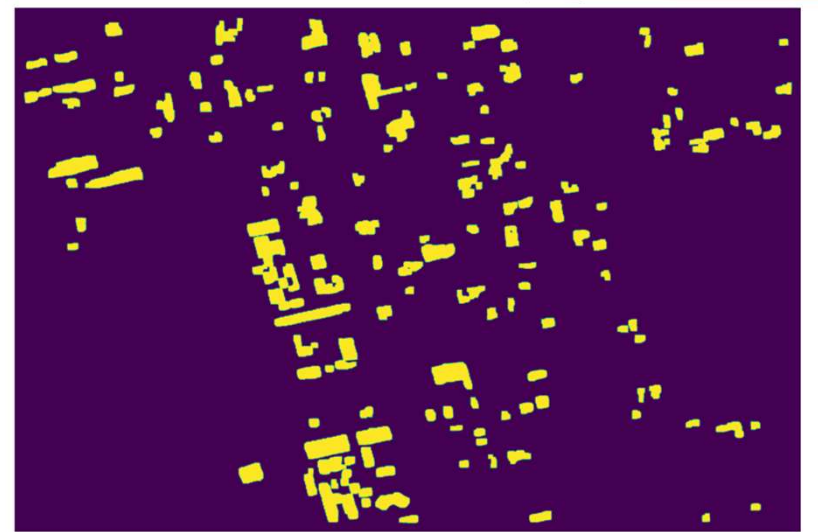
Summary in 5 seconds



Amritsar - 2018



Amritsar - 2022



Predicted Change Map by the tool
Amritsar - (2018 - 2022)



BACKGROUND



**CURRENT
SCENARIO**



APPROACH



**ISSUES &
EXAMPLES**



CONCLUSION

Flow of Presentation



- ▶ **Significant Landholding of Government.**
 - ▶ **As per the GLIS website.**
 - ▶ **38 lakh acres.**
 - ▶ **95,742 land parcels.**
 - ▶ **51 Ministries and 116 CPSEs**
- ▶ **Difficult to guard / fence / boundary wall.**
- ▶ **Spread across the country.**

Background



- ▶ **Increasing urbanization – creating pressure on the land.**
- ▶ **Government Lands – Have become Prime lands.**
- ▶ **Increasing realization in Government of India to put these land lying idle to use.**
- ▶ **Infrastructure creation – requires land.**

Background



Current Scenario



Increasing Threat of Encroachment.



Human Intervention.



Lack of Reporting.



Once encroached -
Loss of precious
government land.



Difficult to Measure



Approach

**High resolution
Satellite imagery.**

Cartosat 3, 2 and
open-source
imagery.

**AI / ML / Deep
learning Model.**

Open-source
models fared
poorly.

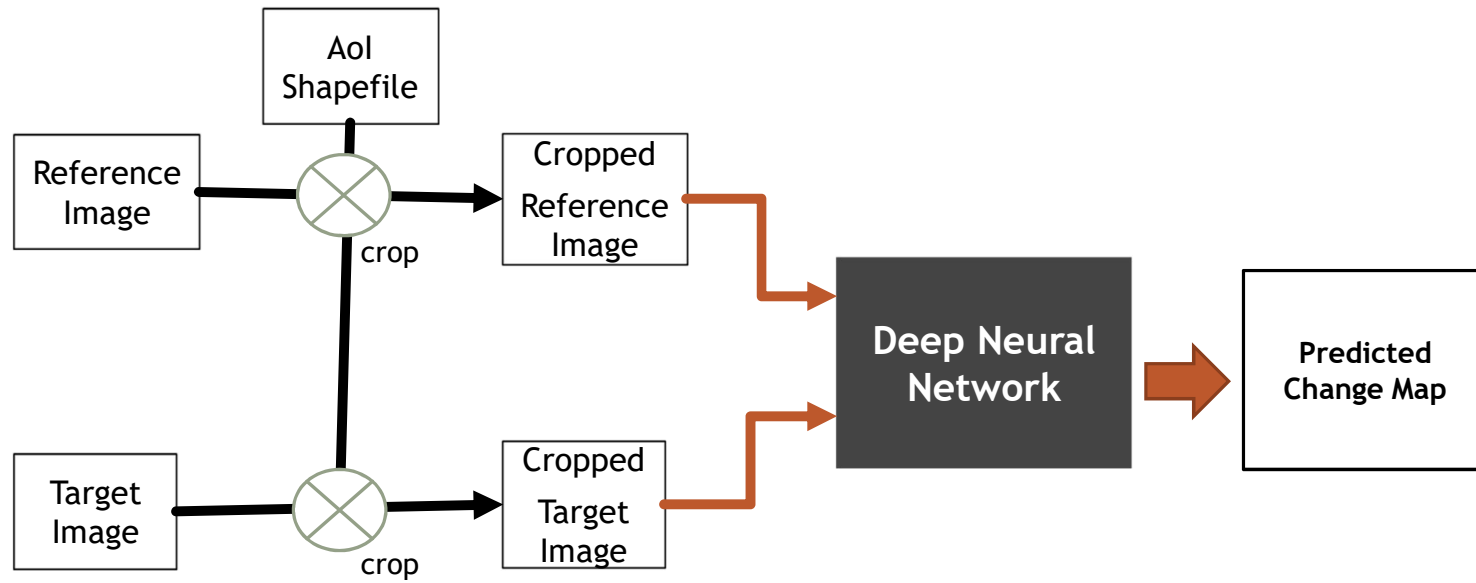
**Training the model
with varied sets of
data.**

Only to identify
changes in
building /
construction
activity / shed.

Manual
annotation.

**Validating the
results.**

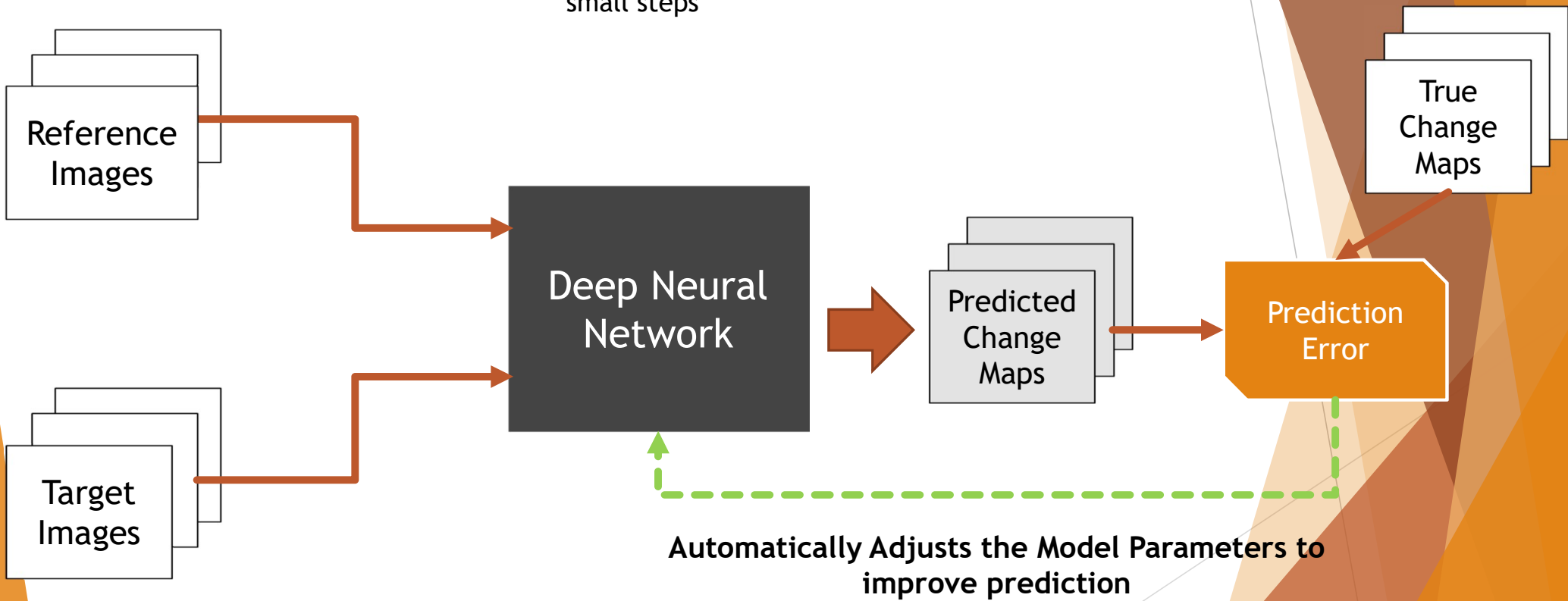
Providing Feedback



AI Model


Training

Thousands of Image triplets (reference, target & change-map) are fed into the Deep Neural Network for it to learn to detect relevant changes. Learning happens iteratively, in Crores of small steps





Training the Model

- ▶ Datasets from Open Source and Manually Hand Annotated data.
 - ▶ Approx 16000 sq km of data.
 - ▶ Multiple approaches were adopted.
 - ▶ Numerous iterations were made to the model to tune it to our requirements.
- 



Sample Training Data



Issues and Examples



**Moving
Objects**



**Angle of
Image.**



Tree Cover



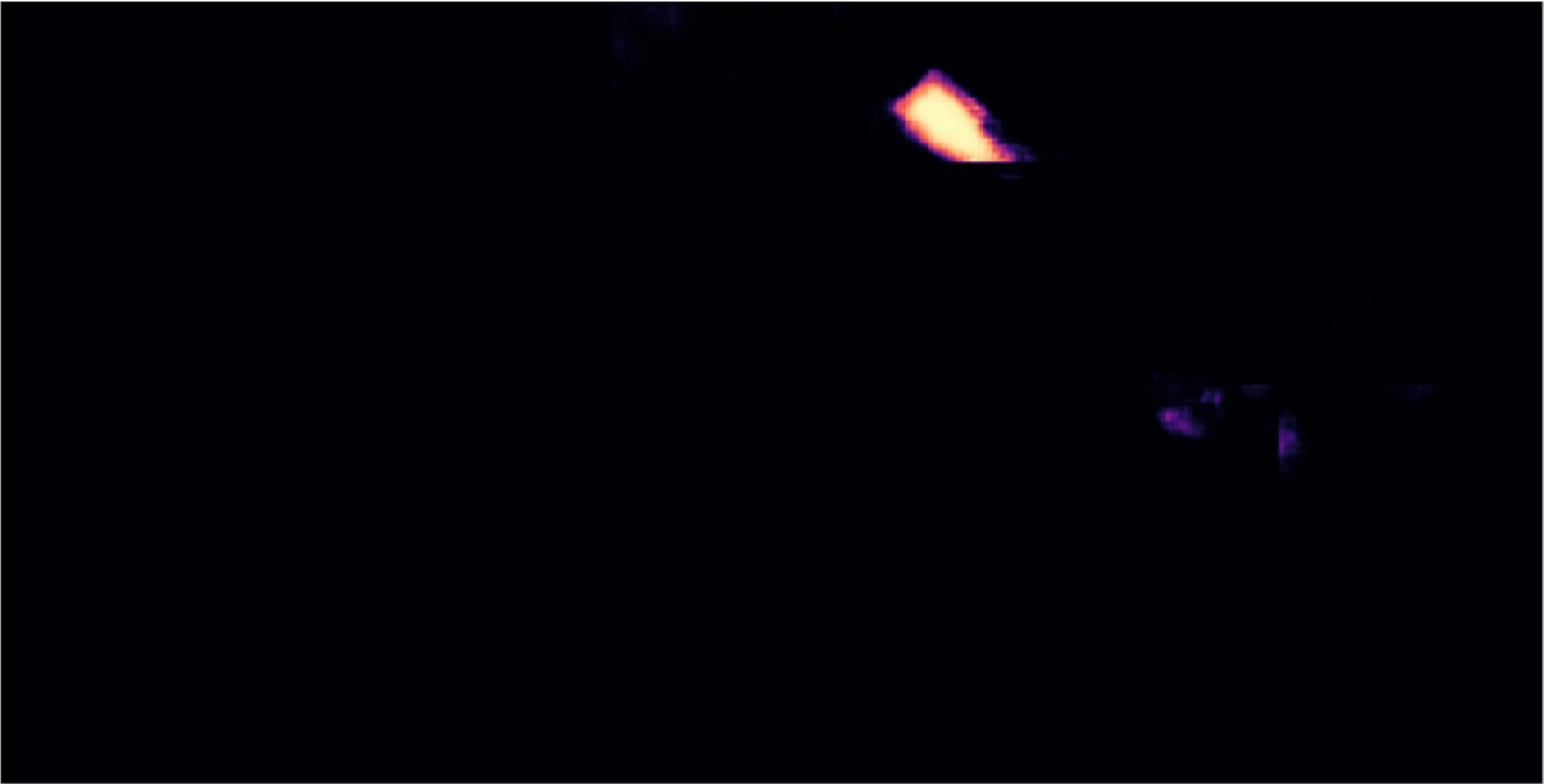
**Colour of
Roof**



Zoomed-In Ahmedabad 2017
Open Source Imagery



Zoomed-In Ahmedabad 2021
Open Source Imagery



Zoomed-In Output Change Heat Map

Issues and Examples



**Moving
Objects**



**Angle of
Image.**



Tree Cover



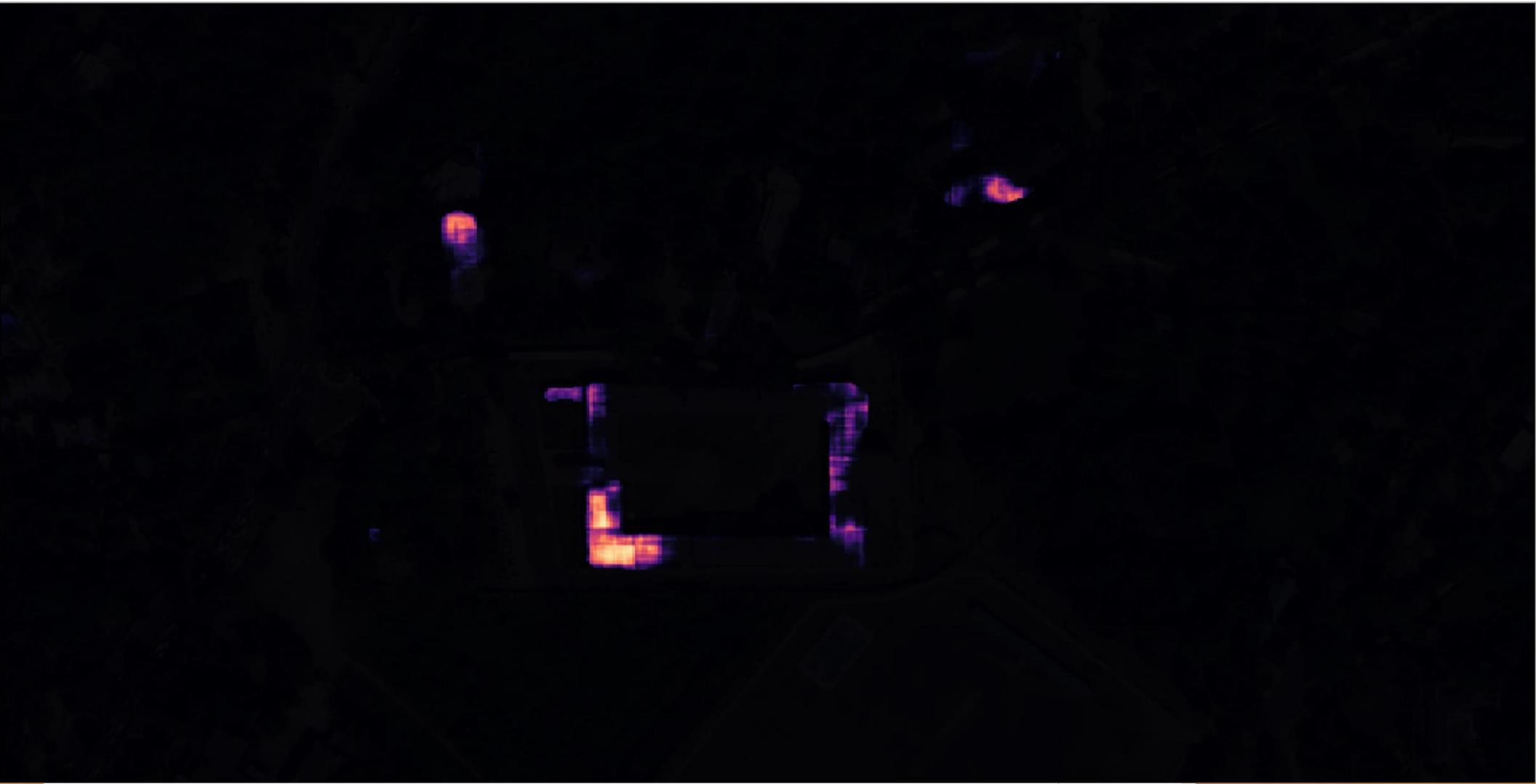
**Colour of
Roof**



Zoomed-In Ahmedabad 2017
Open Source Imagery



Zoomed-In Ahmedabad 2021
Open Source Imagery



Zoomed-In Output Change Heat Map

Limitations

- ▶ **Mispredictions.**

- ▶ False Positives.

- ▶ Vegetation
 - ▶ Elevation of Building
 - ▶ Large Vehicles

- ▶ Missed Changes

- ▶ Small changes
 - ▶ Changes along height

- ▶ Reasons for mispredictions.

- ▶ Poor Image Quality
 - ▶ Atmospheric interference
 - ▶ Improper Orthorectification
 - ▶ Model Inaccuracy



Way Forward

- ▶ Version 3.2.3 - Currently being used.
- ▶ As per Indian Space Policy 2023, NRSC has agreed to provide Cartosat submeter level data free of cost.
- ▶ We are getting ortho-rectified & registered images from NRSC.
- ▶ **National Remote Sensing Centre (NRSC) has agreed for data acquisition of data every 6 months for our Aol.**
- ▶ Bhoonidhi Team & NRSC team at Data Center is extending all possible help.



Way Forward

- ▶ Being scaled up to monitor all defence land across the country.
- ▶ Has the potential to be used across the country for all government lands.
- ▶ We are in touch with other ministries so that this model can be adopted for all government lands across the country.



Thank You

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