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Convolutional Autoencoder for the unsupervised extraction of fire footprints from Sentinel-1 time-series

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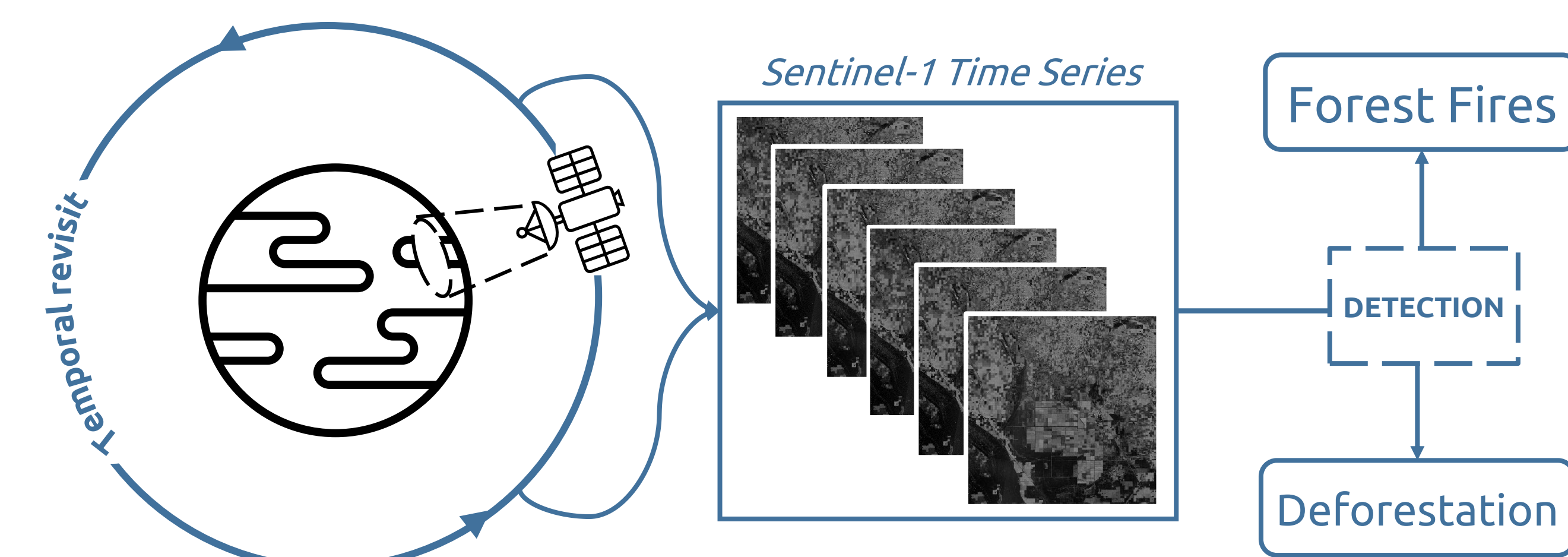
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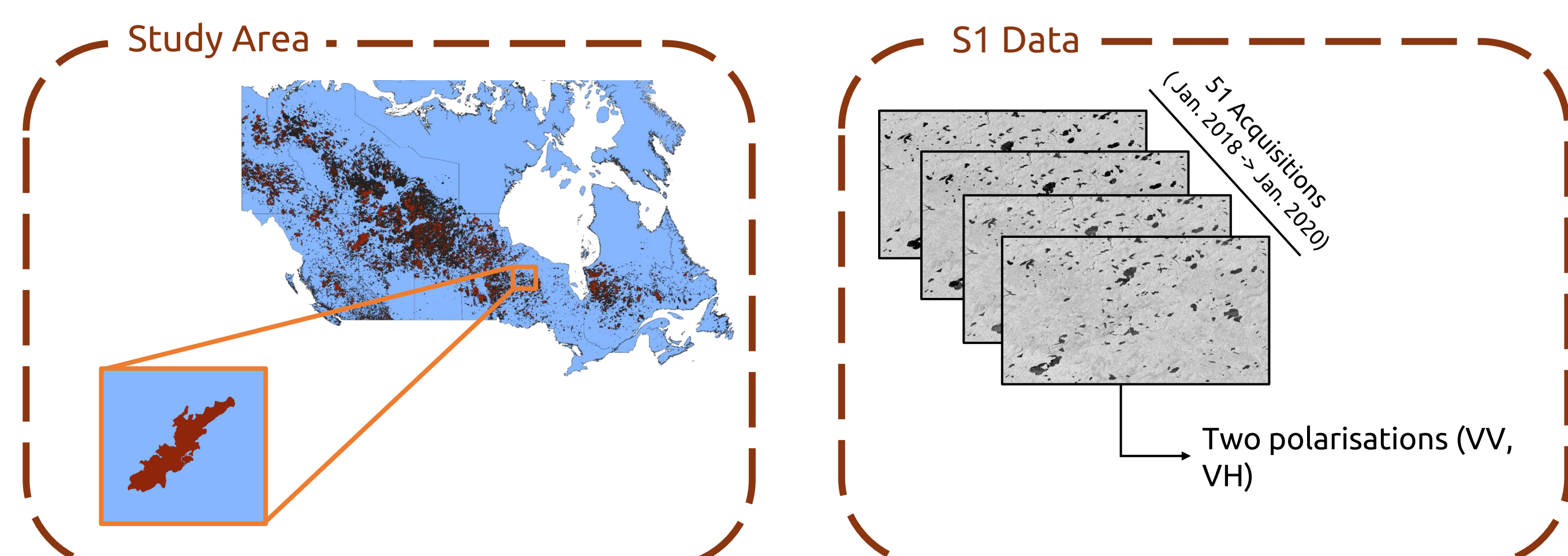
INTRODUCTION

Detection of forest perturbations is possible with Sentinel-1 time series, through temporal processing:

- Detection of deforestation [1,2]
- Detection of wildfires [3]



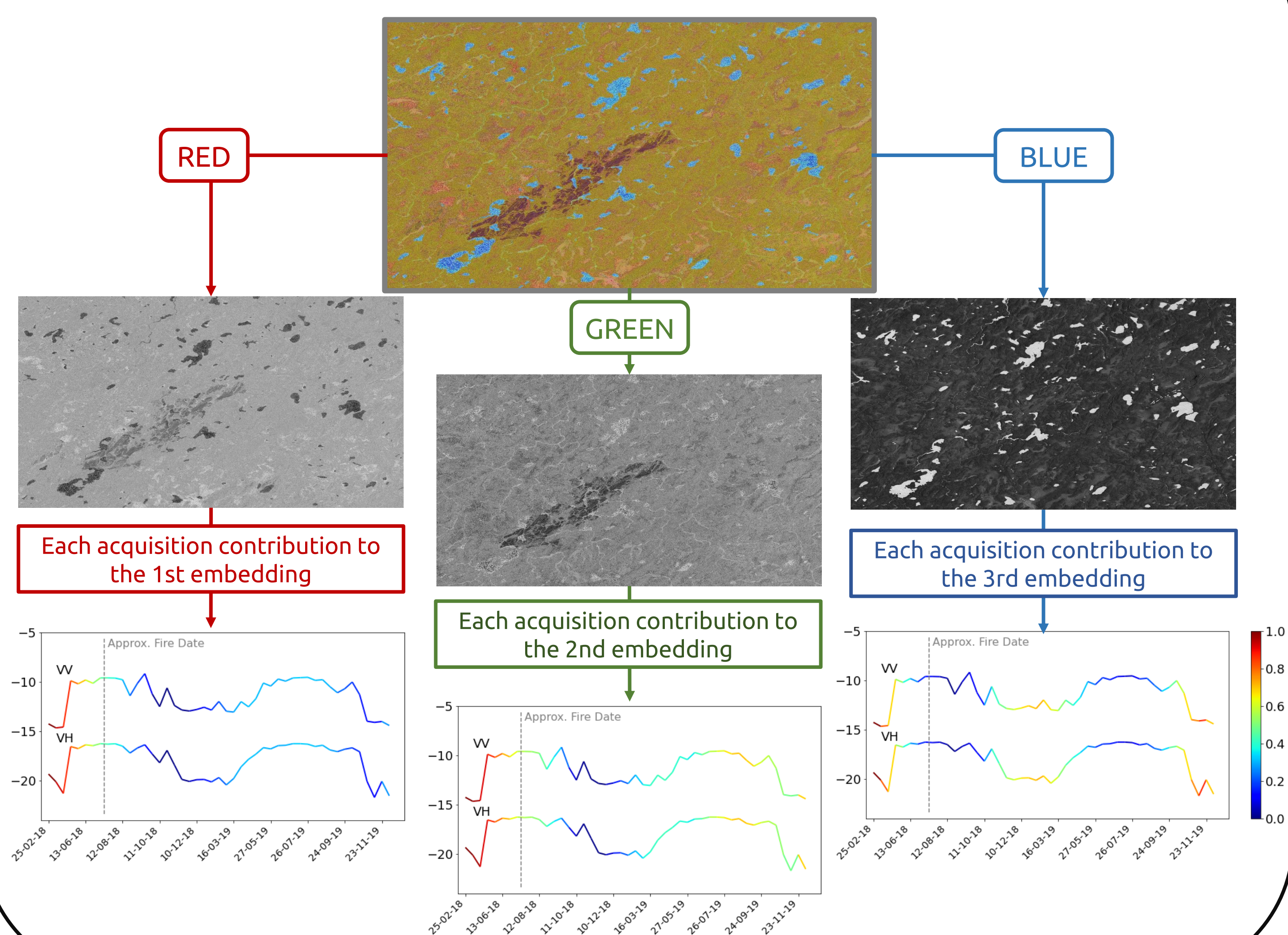
STUDY DATASET



- Ontario Fire, starting date: 21st of June 2018.
- Superficies: ~760 Ha.
- Fire outline data source: 2021 Canadian National Fire Database product

EXPLAINABILITY

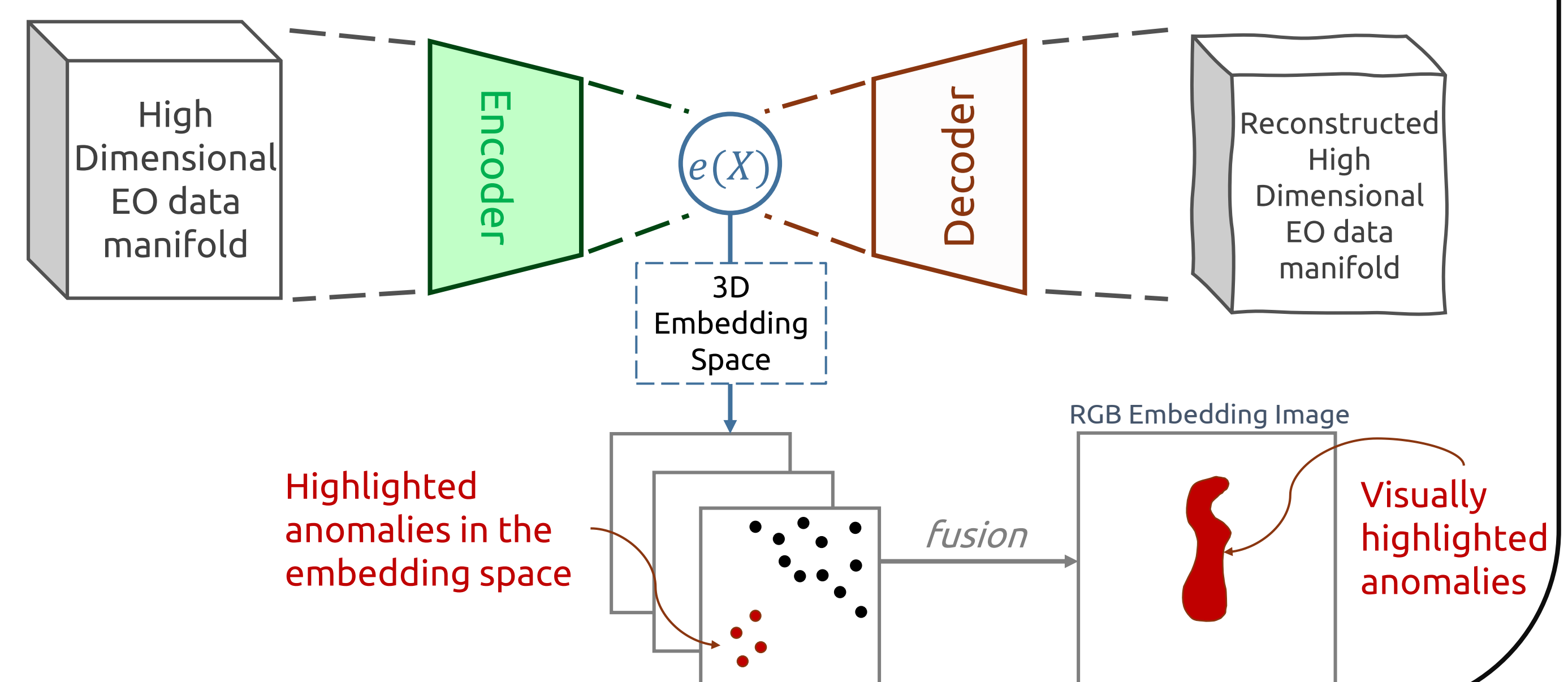
Custom Grad-CAM methodology [5] → temporal localization of the fire outline



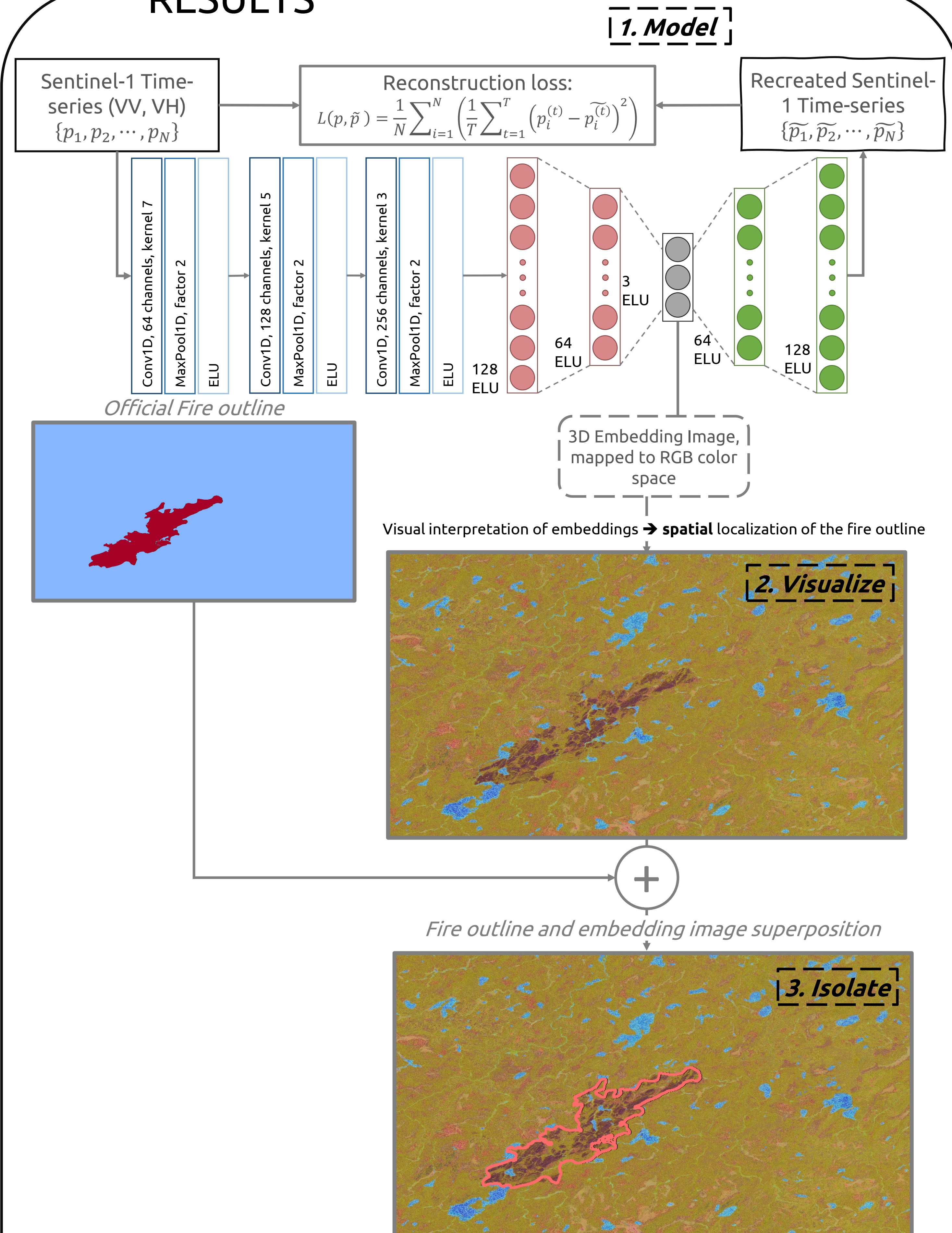
METHOD

Unsupervised temporal anomaly detection method:

1. **Model** radiometric temporal profile of forests using Convolutional Autoencoders [4].
2. **Visualize** variations in the profiles of forest using the generated embedding space.
3. **Isolate** profiles deviating from a norm as being fire.



RESULTS



CONCLUSION

Thanks to the modeling of SAR time series of forested environments with Convolutional Autoencoders, we can:

- **Extract** and **visualize** the main temporal profiles within a forested scene.

- **Adopt** an **anomaly detection** viewpoint to **model** “normal” forest temporal signatures, and the **extraction** of “abnormal” forest temporal signatures.

- Leverage this viewpoint to **retrieve fire outlines** as “abnormal” profiles **without supervision**.

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