Advances in Generative AI for SAR to EO Translation

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An innovation collaboration between Users-Industry-Academia

INDO-PACIFIC GEOINTELLIGENCE

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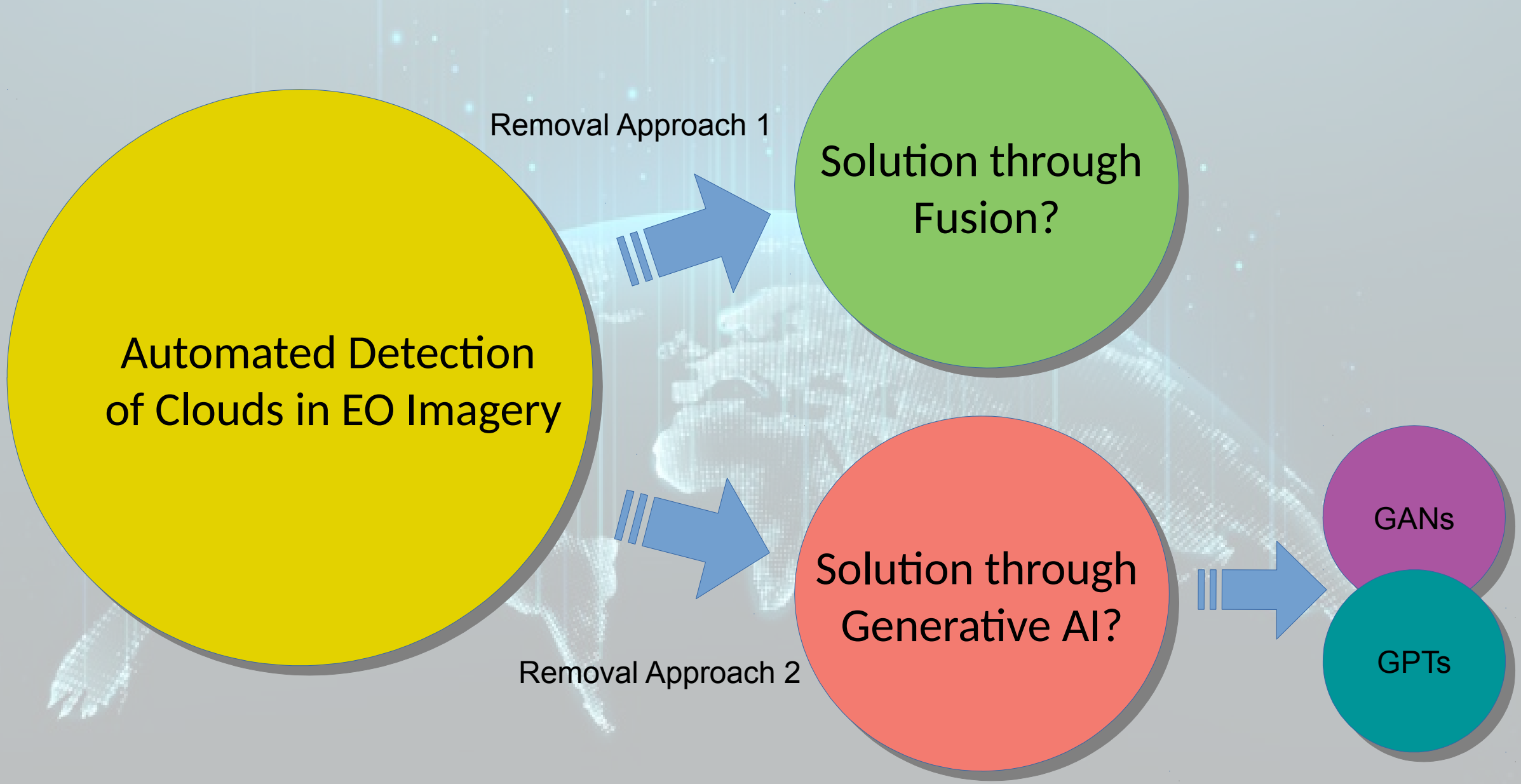
Motivation & Field Situation

1. Large amount of all weather data

2. Op-critical AoI covered with cloud

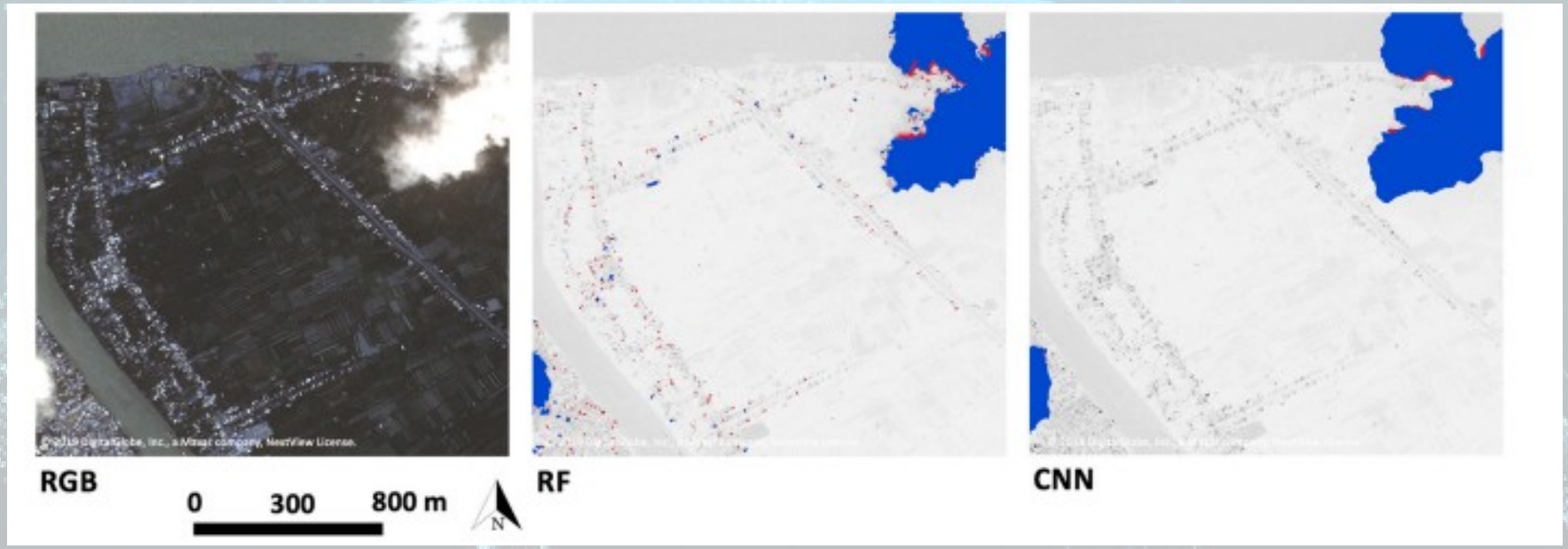
Technical Approach & Points to Consider



AI Based Cloud Detection/Segmentation

1. First step for generating the cloud free insight is the automated detection

2. Multiple SOTA techniques exist in literature – image processing, CNNs, Classifiers



Ref: Caraballo-Vega, J. A., Carroll, M. L., Neigh, C. S. R., Wooten, M., Lee, B., Weis, A., ... & Williams, Z. (2023). Optimizing WorldView-2,-3 cloud masking using machine learning approaches. Remote Sensing of Environment, 284, 113332.

Removal Approach 1: Fusion

- Synchronization of both SAR & EO sensors over area of interest
- Revisit frequency of both sensors
- Ground resolution of both sensors
- Inter-sensor data compatibility
- Tools to integrate and fuse

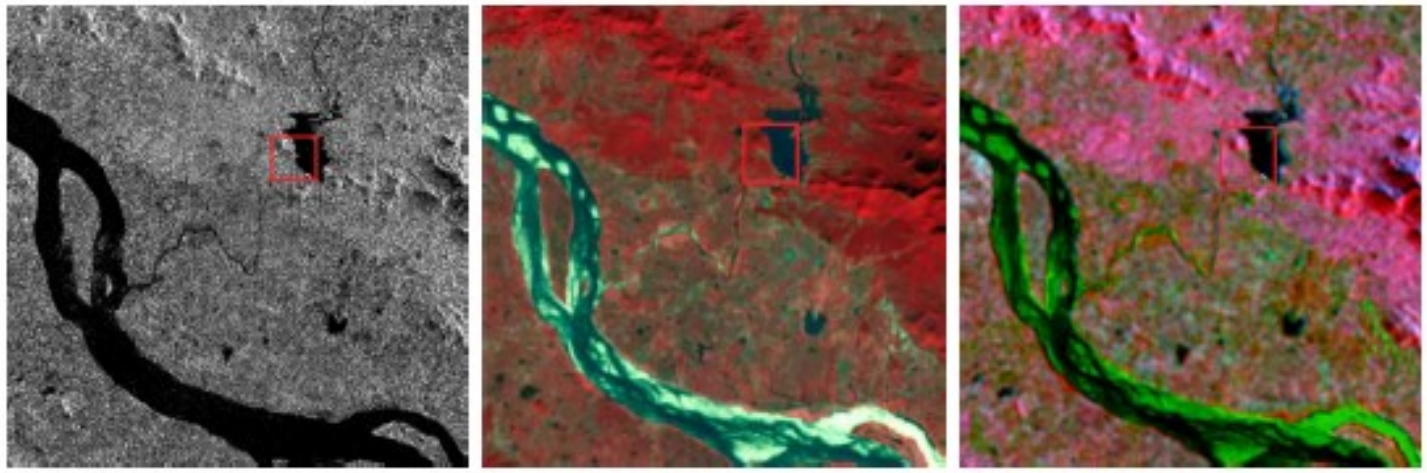
Removal Approach 2: Generative AI

Synchronization of both SAR & EO sensors over area of interest

1. Training data of SAR-EO Pairs and Dataset availability
2. Sense of authenticity for generated EO Scene
3. Tools availability

(a) Image with thin cloud (b) Cloud free image

Fig. 17: Hazing image and clear image.



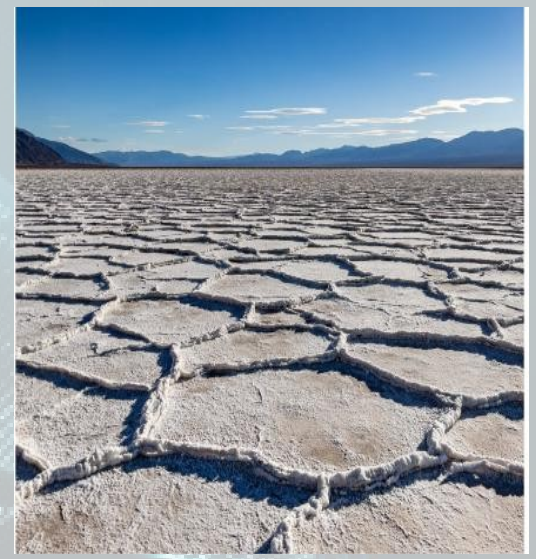
(a) SAR image (b) MS image (c) Fusion image

P. Liu, J. Li, L. Wang and G. He, "Remote Sensing Data Fusion With Generative Adversarial Networks: State-of-the-art methods and future research directions," in *IEEE Geoscience and Remote Sensing Magazine*, vol. 10, no. 2, pp. 295-328, June 2022, doi: 10.1109/MGRS.2022.3165967.

Does it Solve the Problem ?

Techniques used for cloud removal (generative AI based) do not maintain Temporal Features

1. Loss of Intelligence
2. Temporary establishments in existing data
3. Solution:
   - Effective SAR to EO for maintaining intelligence value.
   - Generative approaches for fine grain corrections (GANs) to include analyst inputs (GPTs)



Thanks