DiffCR - A Fast Conditional Diffusion Framework for Cloud Removal from Optical Satellite Images

Problem they are trying to solve / Purpose of method

- 66-67% of Earth's surface is covered by clouds
- Cloud cover obstructs satellite imagery
- Reduces usability of optical satellite images

How does it differ from other methods?

Other methods use GANs(Generative Adverserial Networks) for cloud removal. DiffCR uses diffusion models for stable and high-quality results.

How the method works

DiffCR is a conditional diffusion model for removing clouds from satellite images. It takes a cloudy image as input and learns to generate a cloud-free version through a two-step process:

1. **Forward Process**: Adds noise to clean images during training to learn the noise distribution.
2. **Reverse Process**: During inference, denoises a random image step-by-step, conditioned on the cloudy input, to reconstruct the clean scene.

Key components include:

- **Condition Encoder**: Extracts features from the cloudy image.
- **Time Encoder**: Encodes diffusion timestep info.
- **Denoising Autoencoder**: Removes noise using spatial and temporal features.
- **Fusion Block**: Enhances reconstruction by merging time and condition features.

Limitations

Struggles with water bodies and is computationally expensive.