# NMF-based Inpainting

Group 6: 楊逸泉(E24096823)、周學浩(E24096815)、顏鈺蓁(E24096857)

01

# Division of Work

Evenly distributed

# 02

# Performance Report

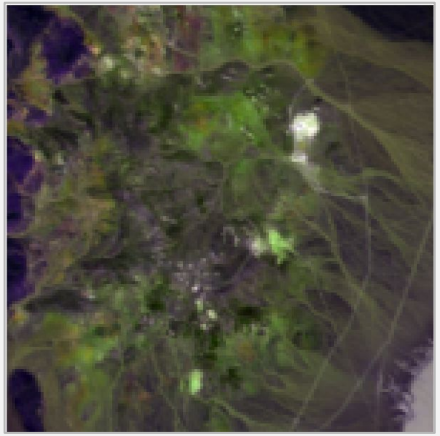
# Performance Report

| Computational Time | Missing Rate |
| --- | --- |
| 1.06s | 45.90% |

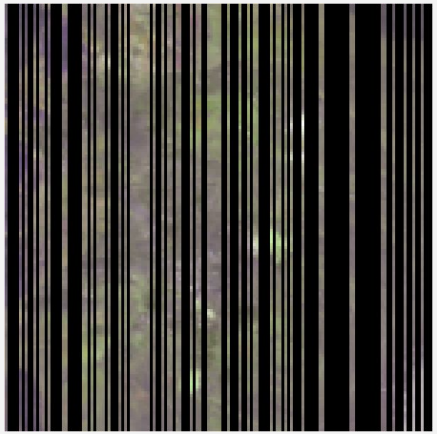
| RMSE | Frobenius Norm |
| --- | --- |
| 0.003708 | 7.5249 |

# Visual Inspection

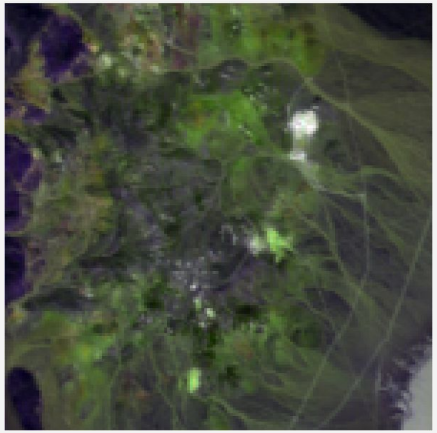
Original



Corrupted



Reconstructed



140 bands, 60% corruption → 46% missing rate

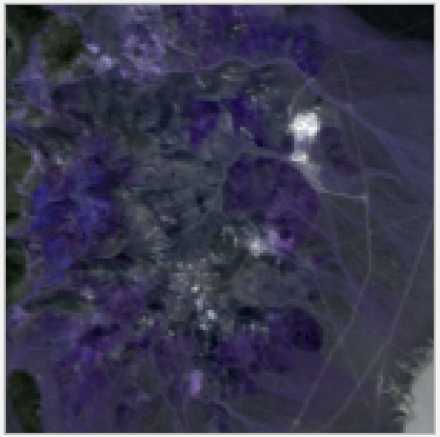
RMSE: 0.0037

# Performance Report (case 2)

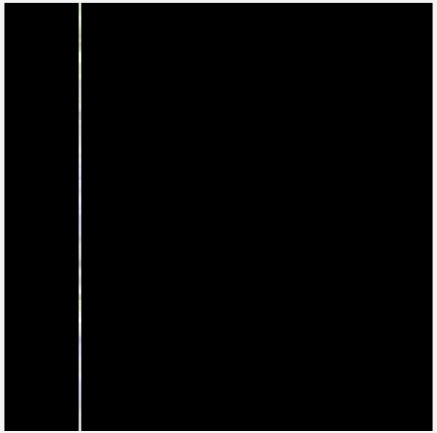
| Computational Time | Missing Rate |
| --- | --- |
| 0.6s | 97.87% |
| **RMSE** | **Frobenius Norm** |
| 0.020278 | 41.1464 |

# Visual Inspection(case 2)

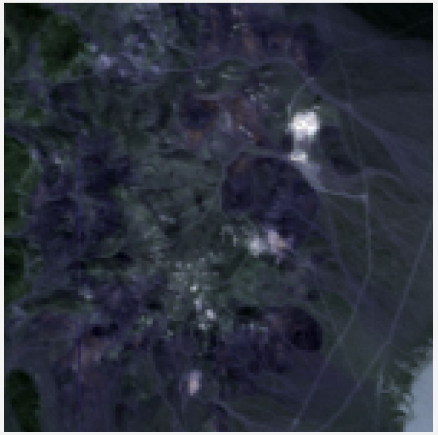
Original



Corrupted



Reconstructed



180 bands, 99.5% corruption ➡ 97.87% missing rate

RMSE: 0.0203

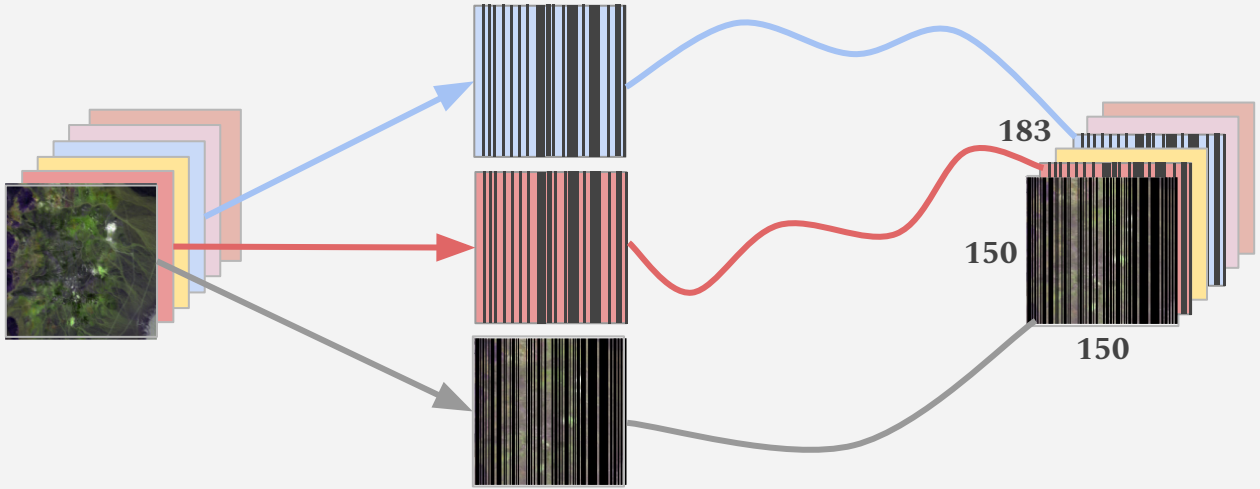
# 03

# Detailed Discussion

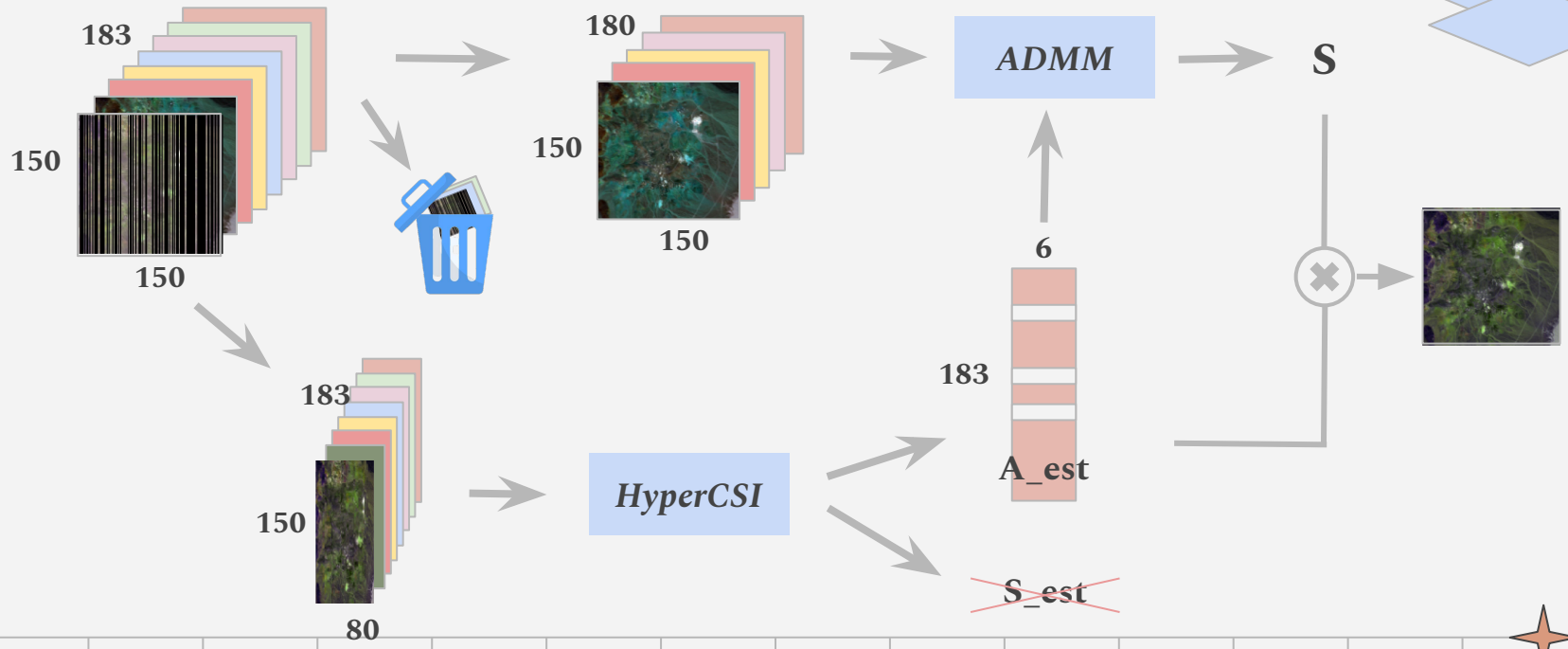
# Data Preprocessing

## How we create corrupted data

- Randomly select bands, then remove columns from those bands



# Flow Diagram



# Difficulties Encountered & Solutions

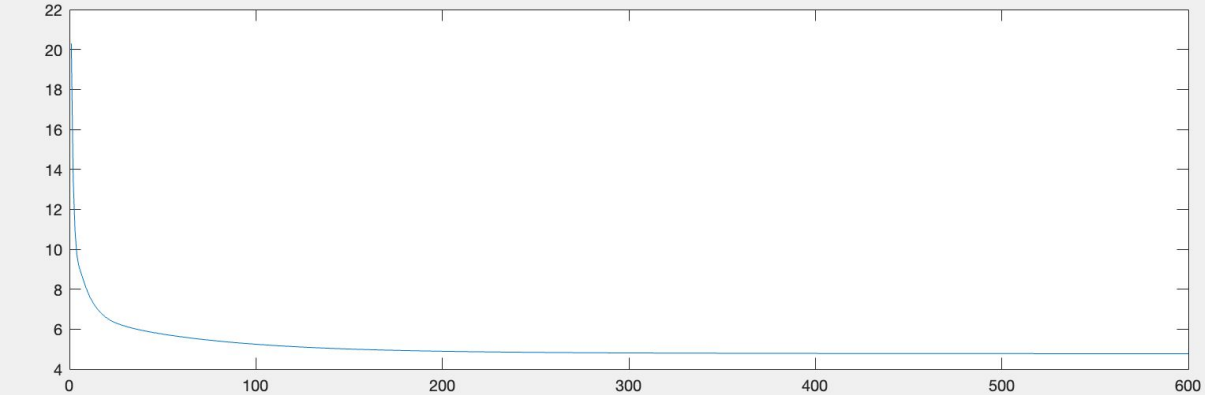
There exists **negative entries** in the calculated S

Sol: Set those negative numbers to **0**

```
>> S(S<0) = 0;
```

# Difficulties Encountered & Solutions

- **Finding Optimal iterations for ADMM**




  - **Sol: Set Max iterations to 600 for stability**

# ADMM

# ADMM

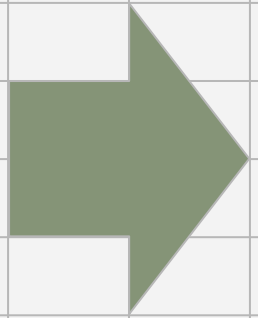
Minimize $||img\_complete\_2d - tempA*S||_F^2$

Subject to $S>=0$

# ADMM

Constrained optimization problem

Lagrange multipliers



Unconstrained optimization problem

# ADMM

Expand objective function and take derivative with respect to S:

$$S = (tempA'*tempA + rho*eye(num\_components)) \setminus (tempA'*img\_complete\_2d + rho*(Z-U))$$

$$(tempA'*tempA + rho*eye(num\_components)) *S = (tempA'*img\_complete\_2d + rho*(Z-U))$$

# ADMM


**Z**

**make sure that S remains positive**

---

**U=S-Z**

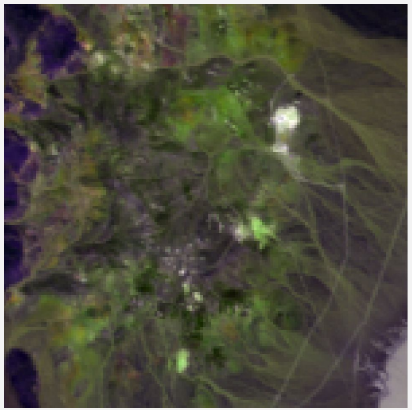
**(Lagrange multiplier is applied)**

# Other Ideas

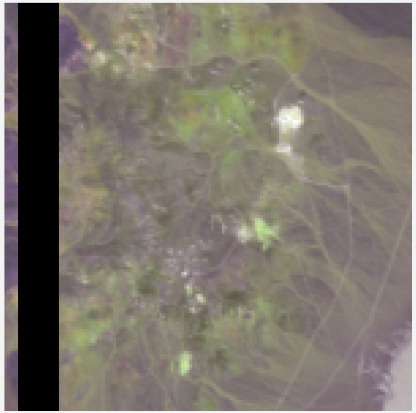
# Other Ideas

## Diffusion based inpainting

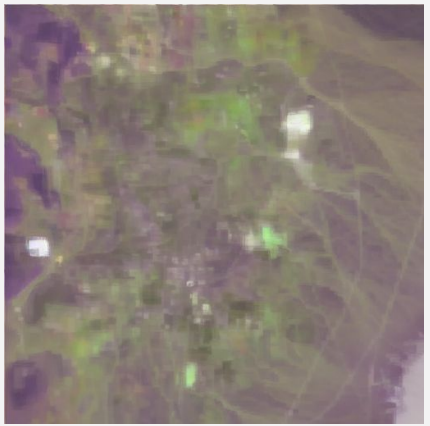
### Original



### Corrupted



### Reconstructed

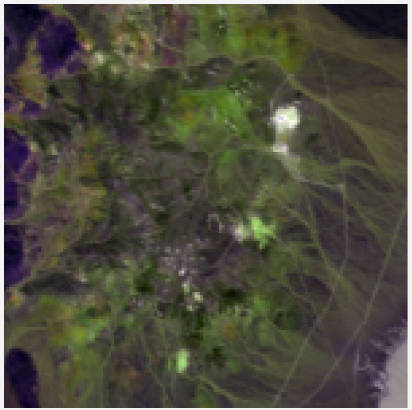
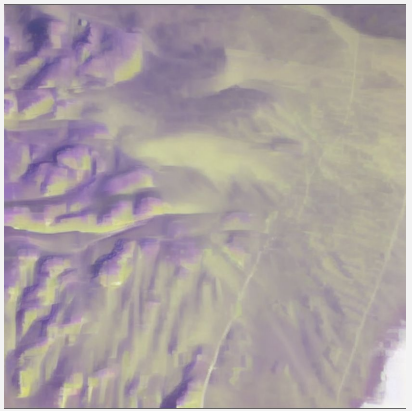


**prompt**: satellite image, hyperspectral image, nmf based inpainting, landscape, aerial view, mountains

**Pros**: Image inpainting with only 3 bands, beautiful
**Cons**: Inaccurate recovery

# Other Ideas

## Diffusion based inpainting

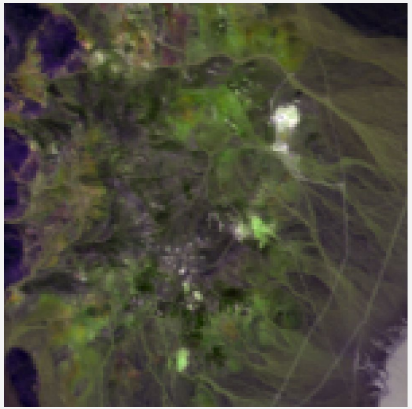
| Original | Corrupted | Reconstructed |
| --- | --- | --- |
|  |  |  |

**Pros**: Image inpainting with only 3 bands, beautiful
**Cons**: Inaccurate recovery

# Other Ideas

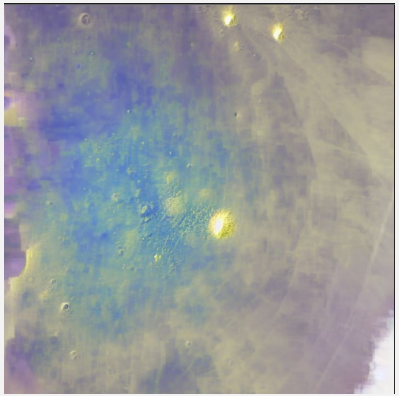
## Diffusion based inpainting

### Original



### Corrupted

### Reconstructed



Prompt: hyperspectral image, moon surface, satellite image

**Pros**: Image inpainting with only 3 bands, beautiful
**Cons**: Inaccurate recovery

# Resources

## Icons & Vectors

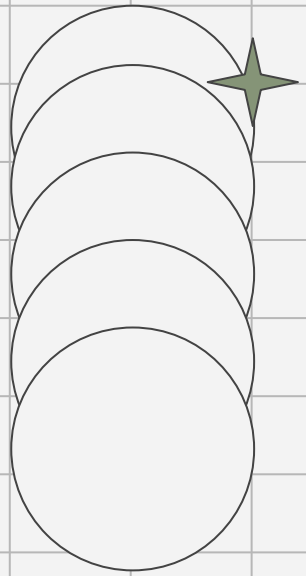
- Flaticon

## Google Slide Template:

- Slidesgo

## Open-source Tools

- StableDiffusion



Google Slide