WASALATHILAKA.N.S.

E/20/425

URBAN_6 DATASET

LOAD THE DATA SET

```
from google.colab import files
uploaded = files.upload()
```

```
import scipy.io

# Load the .mat file
mat = scipy.io.loadmat('urban_6.mat')

# structure
print(mat.keys())
```

```
dict_keys(['__header__', '__version__', '__globals__', 'A', 'M', 'Y',
'HW'])
```

SHAPE OF THE DATASET

```
import numpy as np

Y = mat['Y']      # (bands, num_pixels)
M = mat['M']      # Endmembers: (bands, num_endmembers)
A = mat['A']      # Abundances: (num_endmembers, num_pixels)
HW = mat['HW']    # (height, width)

bands, num_pixels = Y.shape
_, num_endmembers = M.shape
height, width = HW[0][0], HW[0][1]

print("Number of spectral channels (bands):", bands)
print("Number of pixels:", num_pixels)
print("Image dimensions (HxW):", height, "x", width)
print("Number of endmembers:", num_endmembers)
```

```
Number of spectral channels (bands): 162
Number of pixels: 94249
Image dimensions (HxW): 307 x 307
Number of endmembers: 6
```

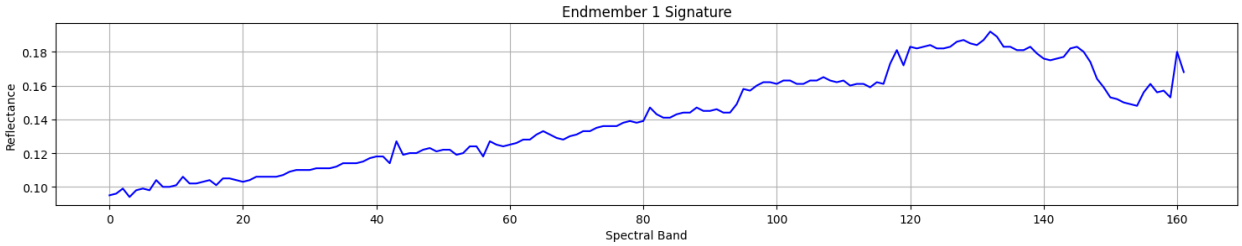
PLOTS OF ABUNDANCE MAPS

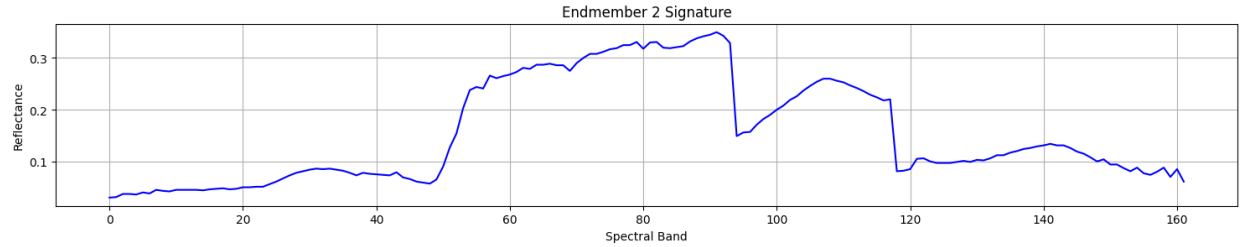
```
import matplotlib.pyplot as plt
import numpy as np
```

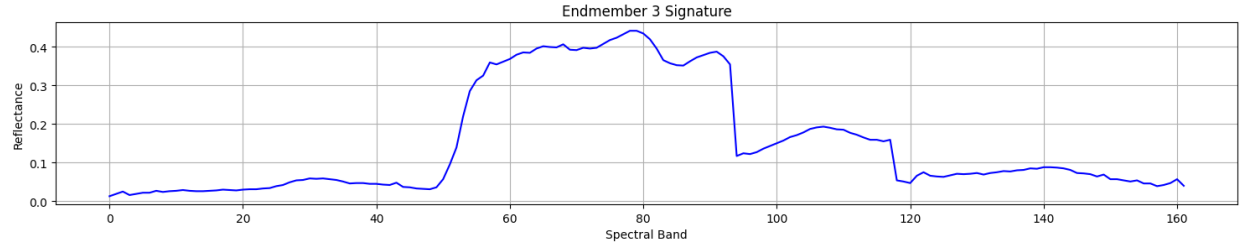
```
A = mat['A']
HW = mat['HW']
height, width = HW[0][0], HW[0][1]

num_endmembers = A.shape[0]

abundance_maps = A.reshape((num_endmembers, height, width))

plt.figure(figsize=(15, 3))
for i in range(num_endmembers):
    plt.subplot(1, num_endmembers, i+1)
    plt.imshow(abundance_maps[i], cmap='viridis')
    plt.title(f'Endmember {i+1}')
    plt.axis('off')
plt.tight_layout()
plt.show()
```

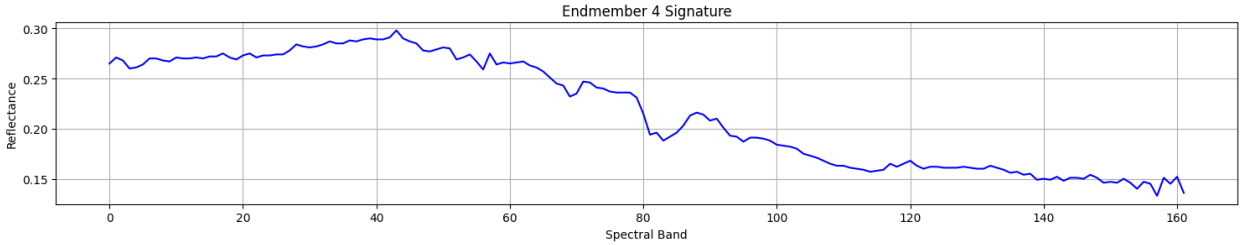
ENDMEMBER SIGNATURES

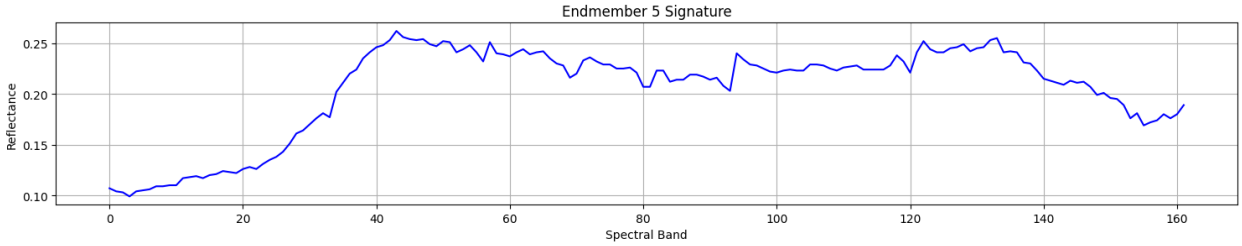
```
import matplotlib.pyplot as plt
import numpy as np

M = mat['M']  # shape: (bands, num_endmembers)
bands, num_endmembers = M.shape

plt.figure(figsize=(15, 3 * num_endmembers))
for i in range(num_endmembers):
    plt.subplot(num_endmembers, 1, i + 1)
    plt.plot(M[:, i], color='blue')
    plt.title(f'Endmember {i+1} Signature')
    plt.xlabel('Spectral Band')
    plt.ylabel('Reflectance')
    plt.grid(True)

plt.tight_layout()
plt.show()
```

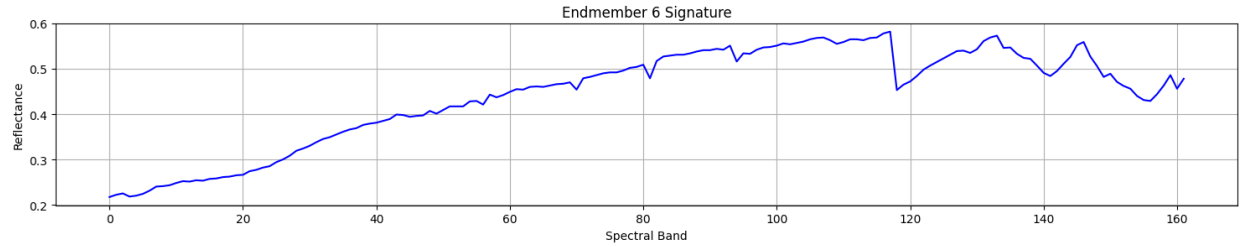

Endmember 1 Signature
Reflectance
Spectral Band


Endmember 2 Signature
Reflectance
Spectral Band


Endmember 3 Signature
Reflectance
Spectral Band

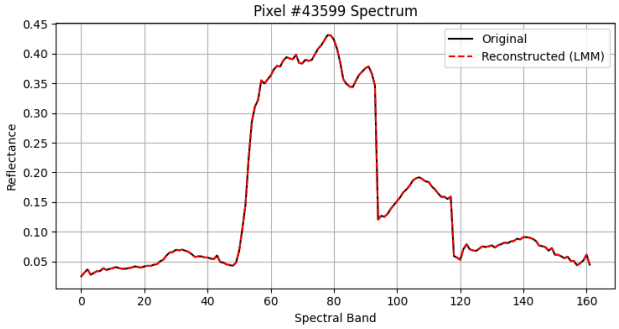

Endmember 4 Signature
Reflectance
Spectral Band

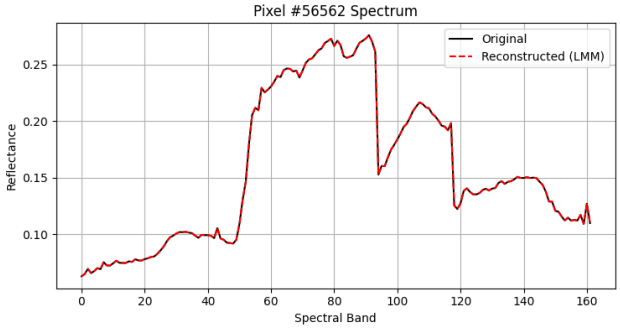

Endmember 5 Signature
Reflectance
Spectral Band

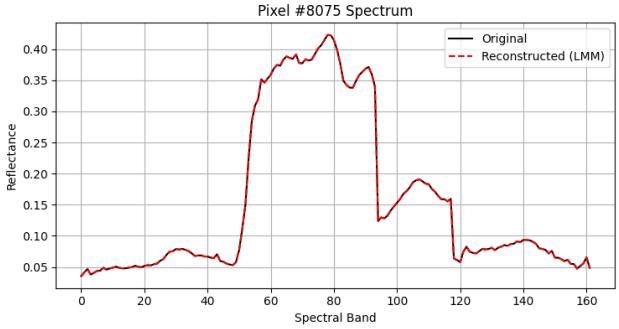

Endmember 6 Signature
Reflectance
Spectral Band

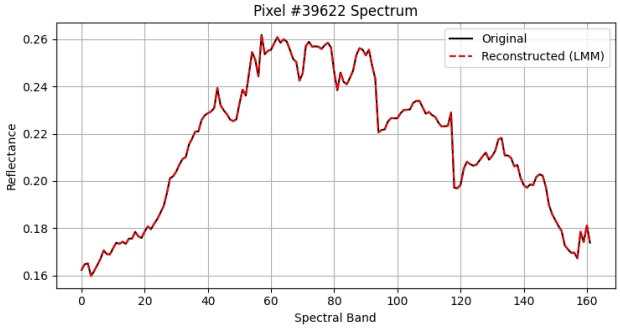
LINEAR MIXTURE MODEL

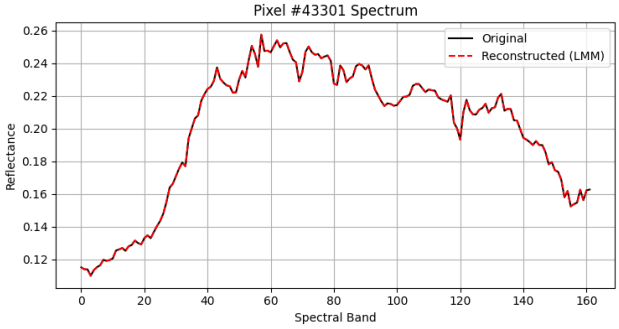
```
import matplotlib.pyplot as plt
import numpy as np

Y = mat['Y']
A = mat['A']
M = mat['M']

# Pick 10 random pixel
np.random.seed(42)
pixel_indices = np.random.choice(Y.shape[1], size=10, replace=False)

plt.figure(figsize=(15, 20))
for i, idx in enumerate(pixel_indices):
    original = Y[:, idx]                  # Actual pixel spectrum
    abundance = A[:, idx]                 # Abundance values for this pixel
    reconstructed = M @ abundance         # LMM: M * a = predicted spectrum

    plt.subplot(5, 2, i+1)
    plt.plot(original, label='Original', color='black')
    plt.plot(reconstructed, label='Reconstructed (LMM)', linestyle='--',
color='red')
    plt.title(f'Pixel #{idx} Spectrum')
    plt.xlabel('Spectral Band')
    plt.ylabel('Reflectance')
    plt.legend()
    plt.grid(True)

plt.tight_layout()
plt.show()
```

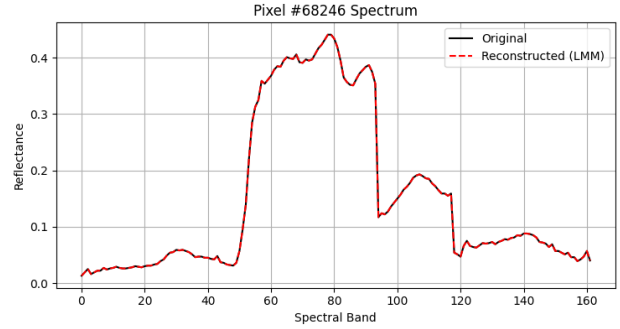

Pixel #43599 Spectrum
Original
Reconstructed (LMM)
Reflectance
Spectral Band

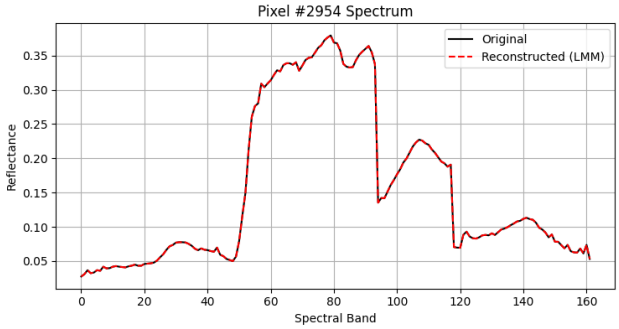

Pixel #56562 Spectrum
Original
Reconstructed (LMM)
Reflectance
Spectral Band

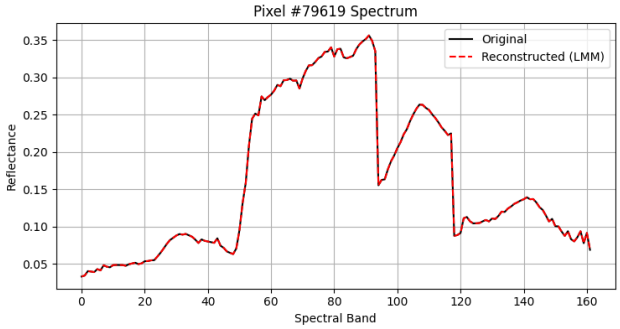

Pixel #8075 Spectrum
Original
Reconstructed (LMM)
Reflectance
Spectral Band

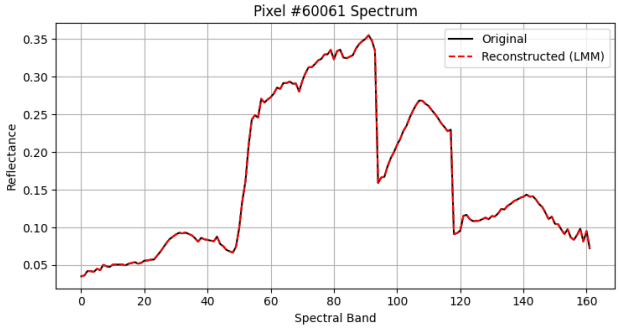

Pixel #39622 Spectrum
Original
Reconstructed (LMM)
Reflectance
Spectral Band

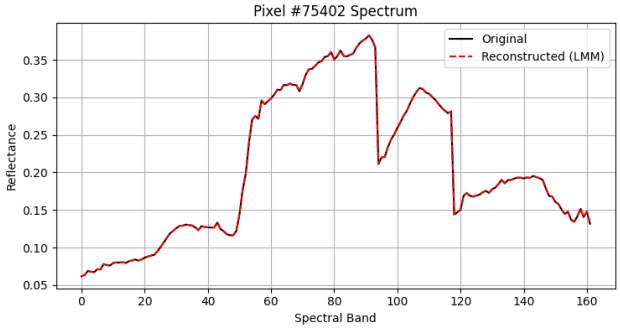

Pixel #43301 Spectrum
Original
Reconstructed (LMM)
Reflectance
Spectral Band


Pixel #68246 Spectrum
Original
Reconstructed (LMM)
Reflectance
Spectral Band


Pixel #2954 Spectrum
Original
Reconstructed (LMM)
Reflectance
Spectral Band


Pixel #79619 Spectrum
Original
Reconstructed (LMM)
Reflectance
Spectral Band


Pixel #60061 Spectrum
Original
Reconstructed (LMM)
Reflectance
Spectral Band


Pixel #75402 Spectrum
Original
Reconstructed (LMM)
Reflectance
Spectral Band