Mineral Potential in Hutti-Maski Greenstone Belt, India using Airborne Visible/Infrared Imaging Spectrometer-Next Generation (AVIRIS-NG) Data

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Outline

- Goal and Scope of the research

- Research objectives

- Study area and data sources

- Methods

- Preliminary results

- Summary and future work

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Goal and Scope of Research

- Mineral exploration using AVIRIS-NG data

- Classification of rock types, and developing the potential mineral maps

- The mineral potential at the Hutti-Maski greenstone belt regions in India by using AVIRIS-NG data

- Evaluate uncertainty of the mineralization potential for better guidance for future detailed mineral exploration in this area.

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Research Objectives

- Evaluate the potentials of AVIRIS-NG data for classifying the surface minerals/rock types

- Mapping of minerals associated with alteration zone to locate areas of probable mineralization.

- Utilization of hyperspectral and other data sources for identifying guides of gold mineralization

- Generate the uncertainty maps of mineral potential as guiding tools for future detailed exploration
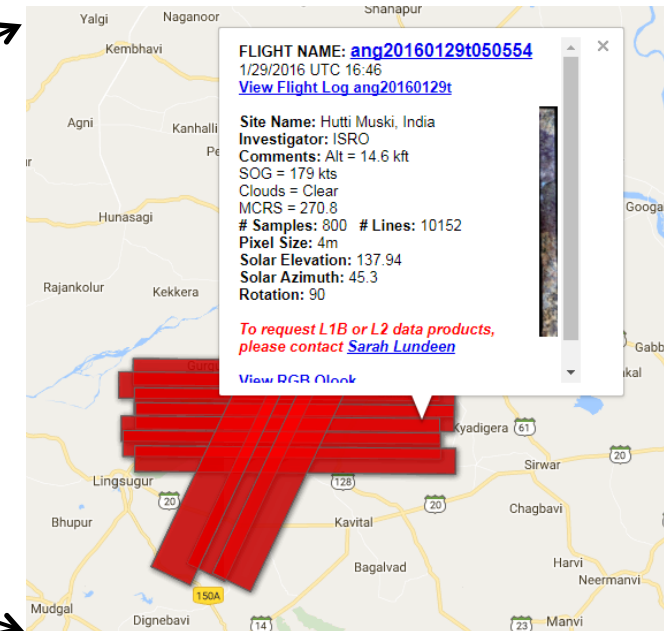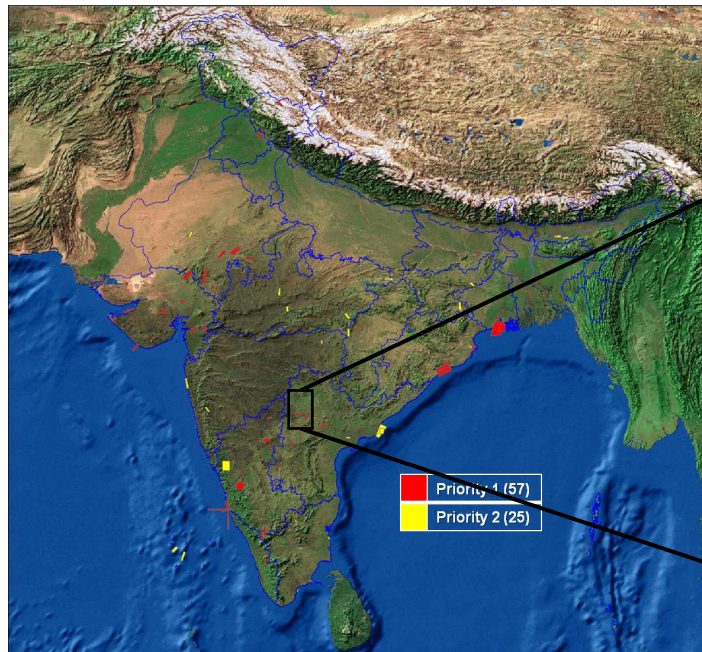
Study area and data sources

- The Hutti-Maski belt, located in Southern India
- The Hutti mine comprises a series of parallel steeply dipping shear zones
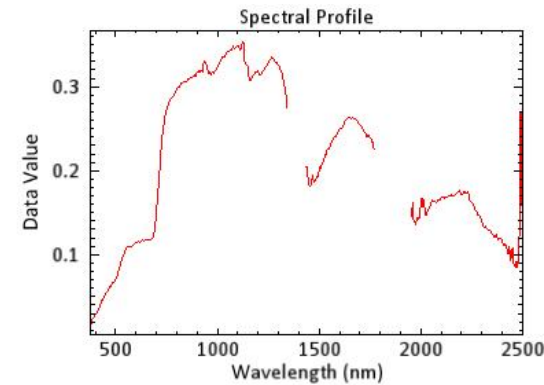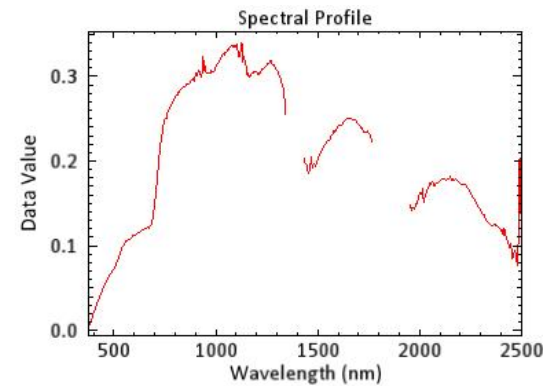- Gold lodes are associated with shear zones

(source: Srikantia, 1995)
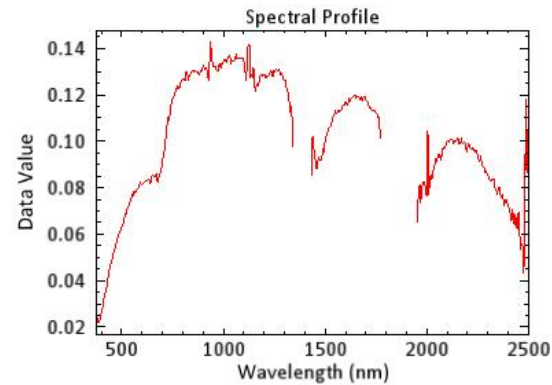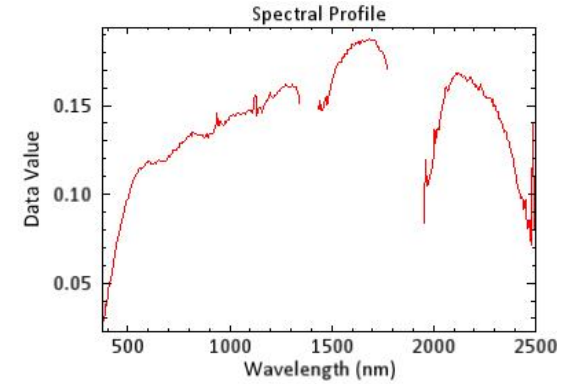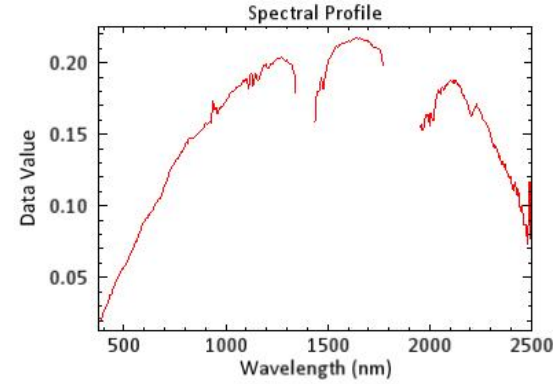
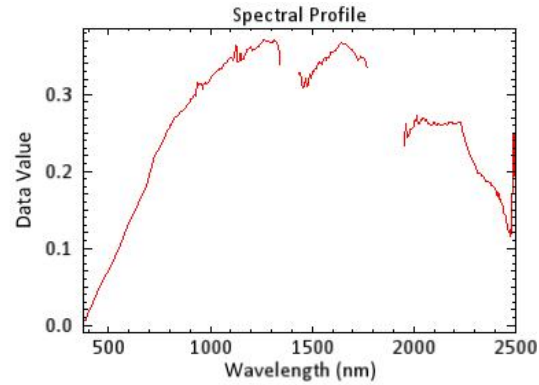*Geological and Mining Engineering and Sciences*
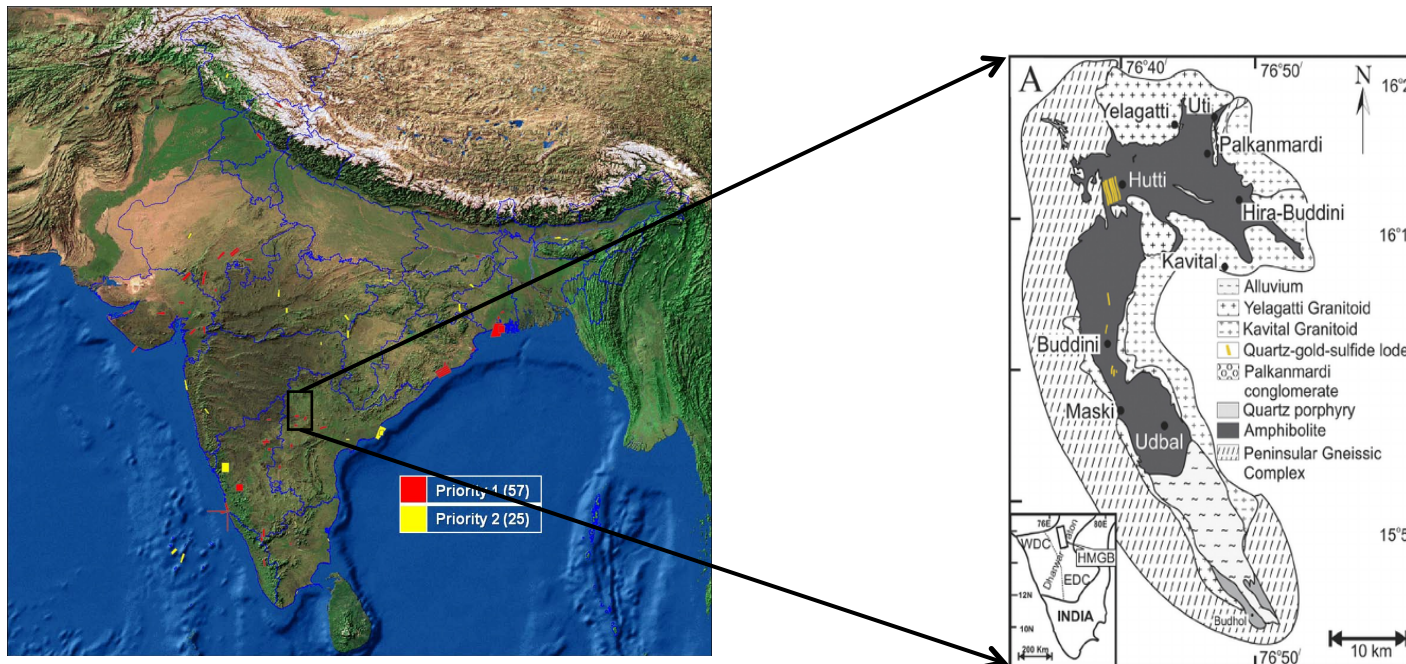
Study area and data sources

- The Hutti-MThe Level 1 (at sensor radiance) and Level 2 (surface reflectance) data are available through the NASA-ISRO campaign

FLIGHT NAME: ang20160129t050554
1/29/2016 UTC 16:46
View Flight Log ang20160129t

Site Name: Hutti Muski, India
Investigator: ISRO
Comments: Alt = 14.6 kft
SOG = 179 kts
Clouds = Clear
MCRS = 270.8
# Samples: 800   # Lines: 10152
Pixel Size: 4m
Solar Elevation: 137.94
Solar Azimuth: 45.3
Rotation: 90

To request L1B or L2 data products,
please contact Sarah Lundeen

View RGB Qlook

Priority 1 (57)
Priority 2 (25)

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Study area and data sources

Methods

- Dimensional Reduction
  - PCA and Kernel PCA

- Classification:
  - Unsupervised
    - K-means algorithm
  - Semi Supervise
    - MOGA SVM
  - Supervise
    - Bayesian SVM

- Endmember Selection
  - Sparsity Promoting Iterated Constrained Endmember (SPICE) algorithm

- Uncertainty analysis
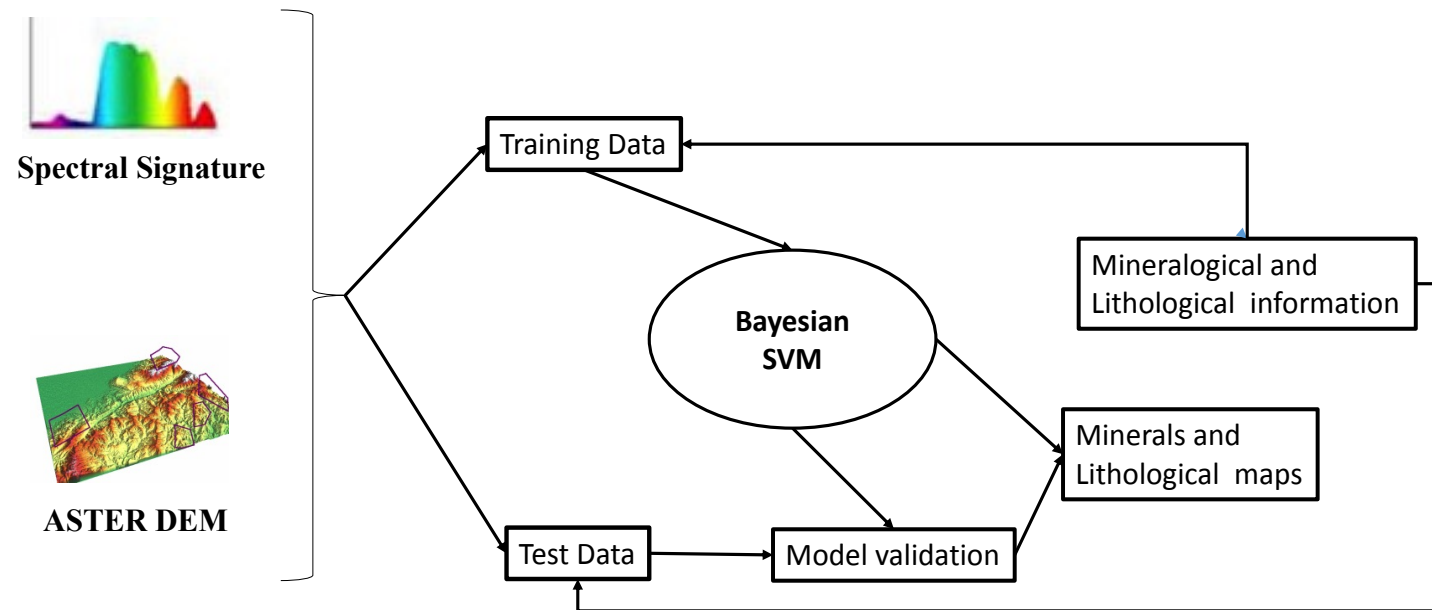
Method: Semi-supervise classification

- Step 1: Training patterns are selected using multi-objective genetic algorithm (MOGA) fuzzy clustering algorithm for non-stationary classification.
- Step 2: the support vector machine (SVM) model is developed using the selected number of clusters and selected patterns to classify the remaining patterns.

Two objectives:
**Xie-Beni (XB) index**
fuzzy C-means (FCM)
measure
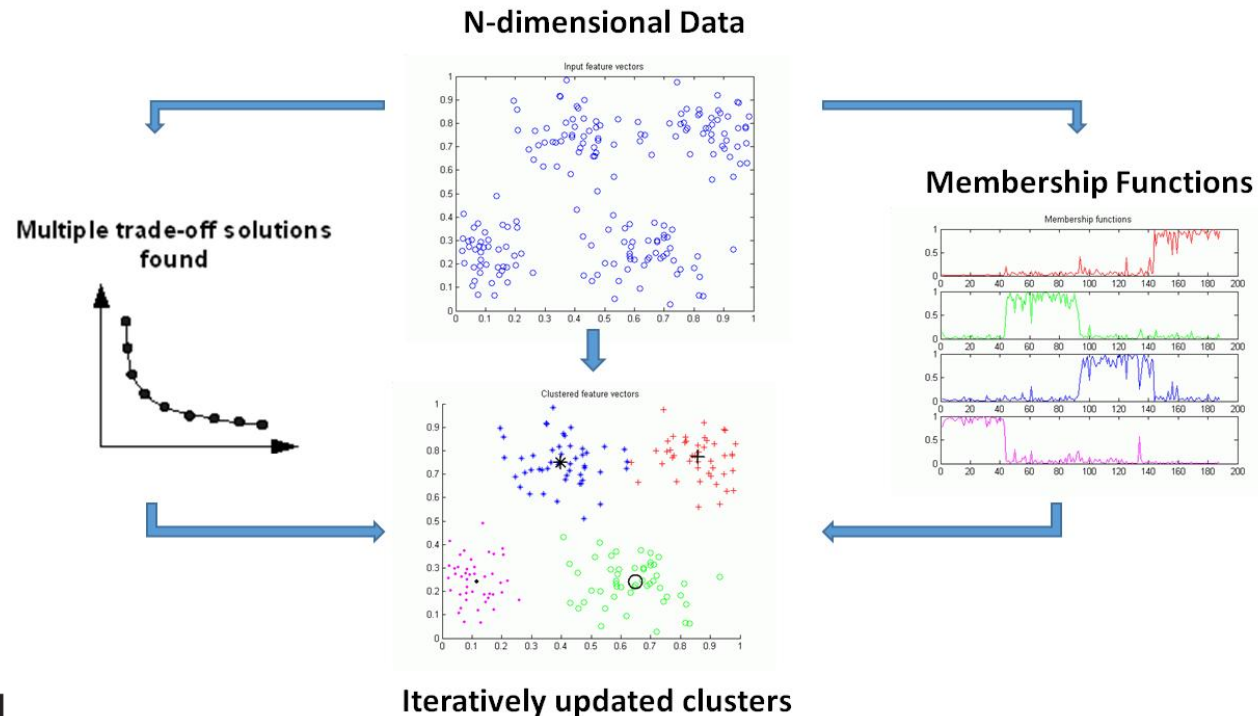
Method: Supervise classification

- Ground truth data from Indian collaborators
- Multi-class Support vector machine
- Bayesian methods for parameter selections
- Secondary data (ASTER DEM) to be incorporated

Spectral Signature

ASTER DEM

Training Data

Bayesian SVM

Mineralogical and Lithological information

Minerals and Lithological maps

Test Data

Model validation

Method: Endmember selection and spatial mapping

- SPICE endmember selection method
- Number of enemembers can be selected automatically
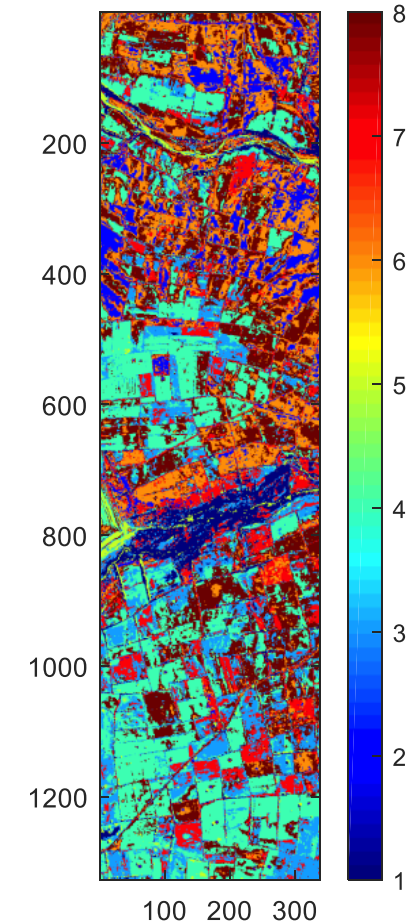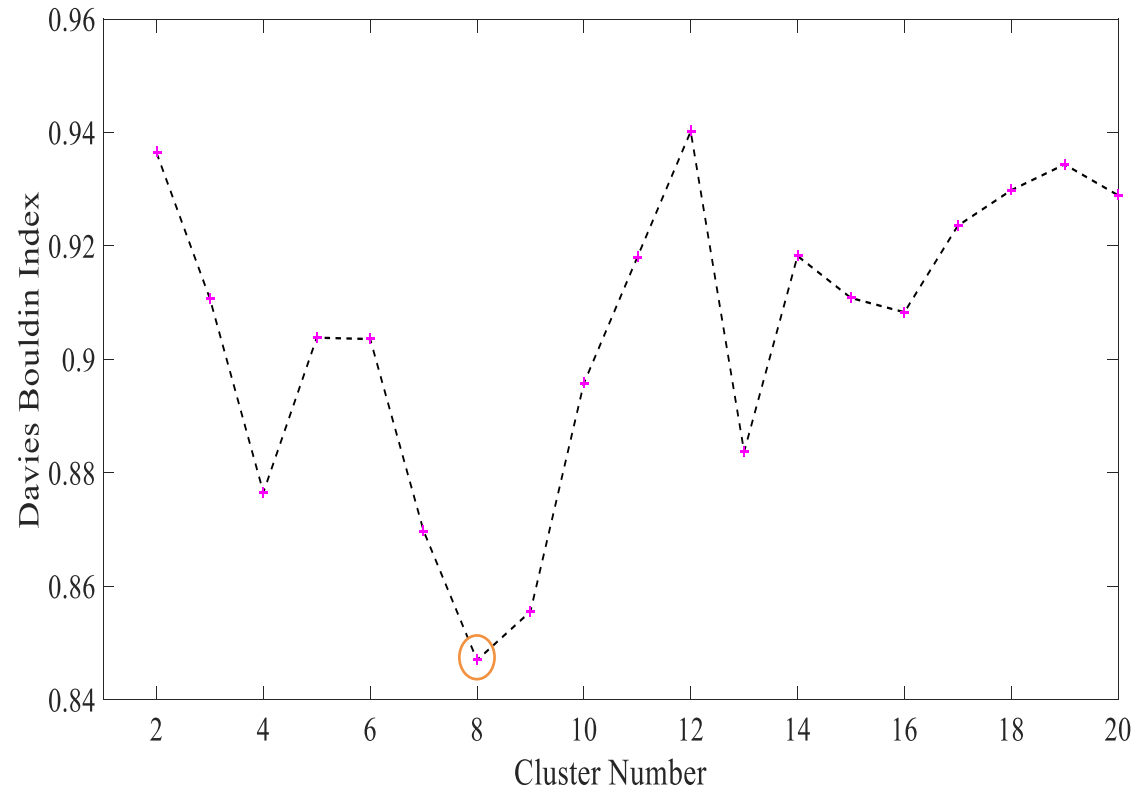- Genetic algorithm will be used for select the parameters for SPICE method
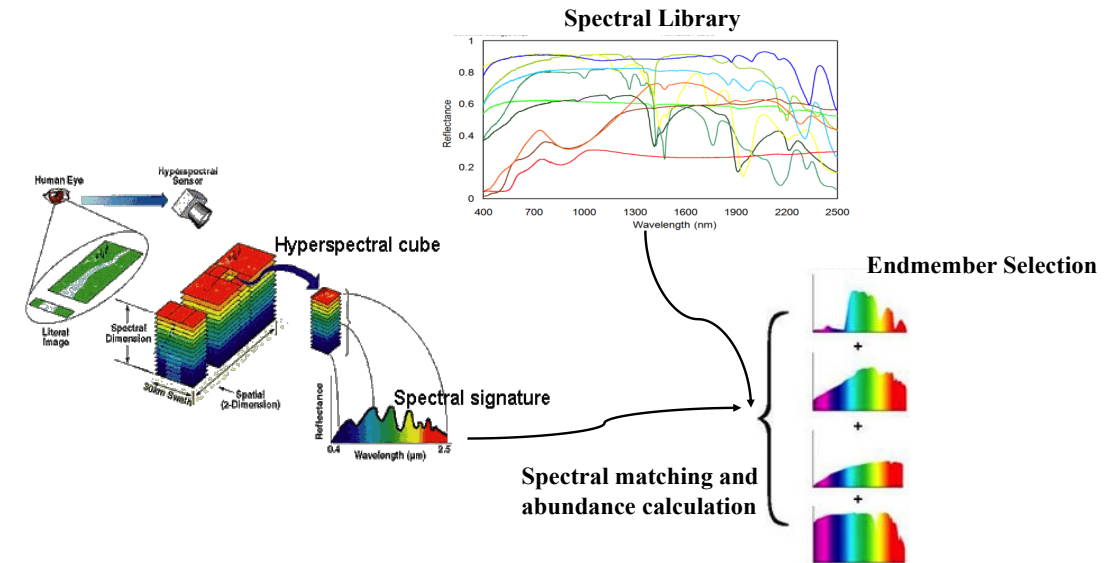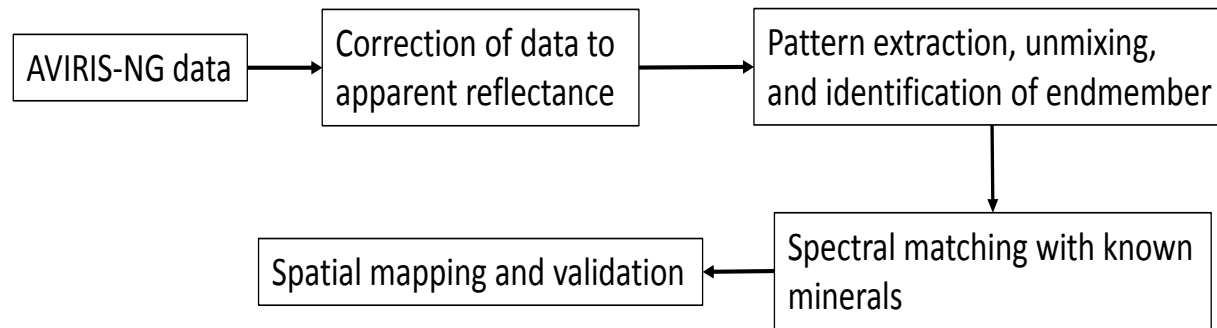
Preliminary results: Dimensional Reduction

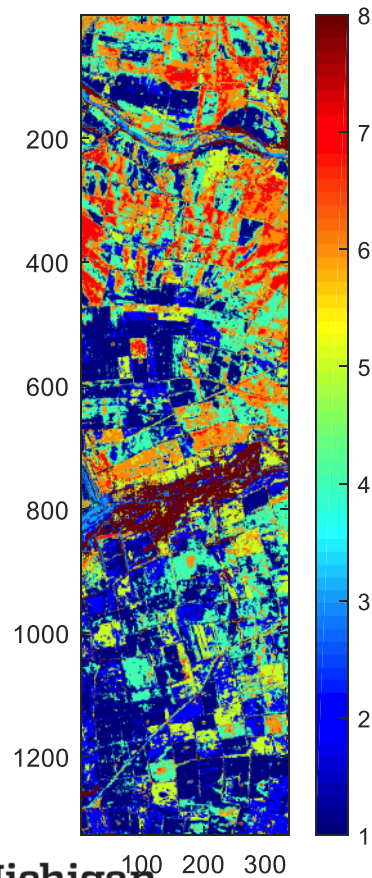- First 7 PCA can explain 99.5% of the spectral variability
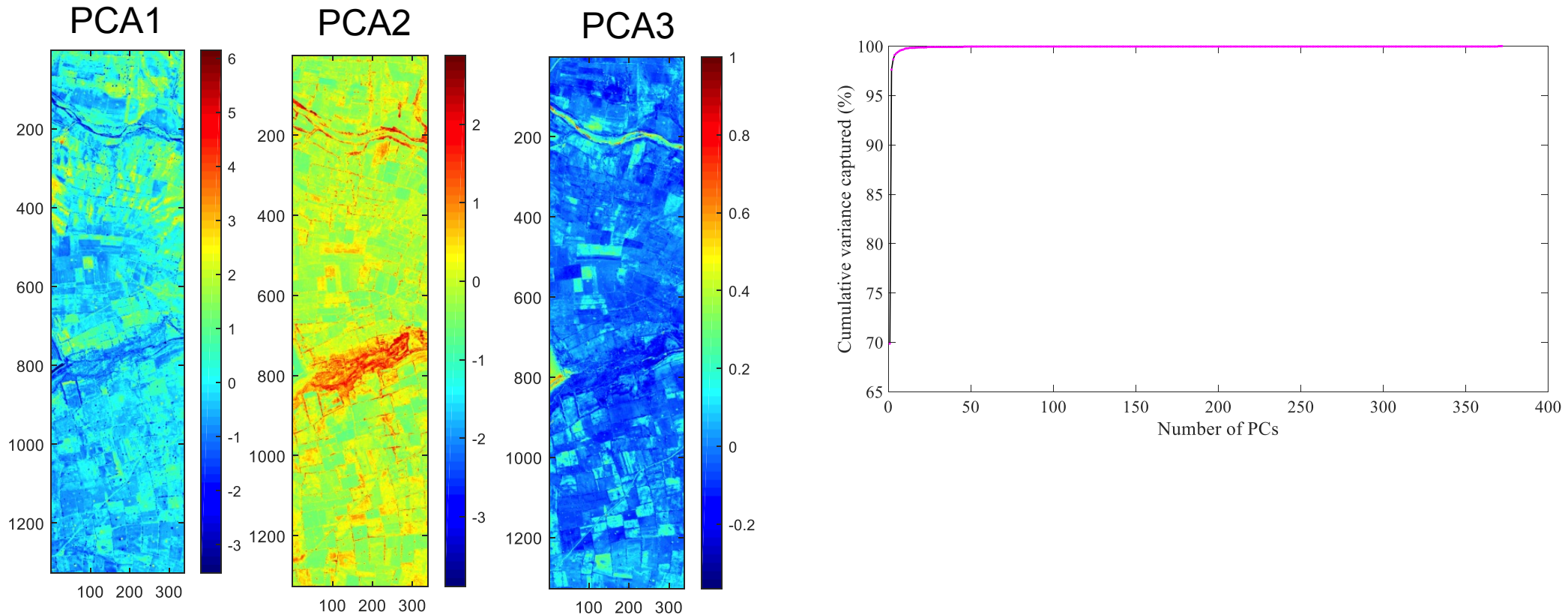
Preliminary results: k-means clustering

- Davies Bouldin Index was used for cluster number selection
- Optimum cluster number is 8

Preliminary results: MOGA SVM clustering

- We have used fuzzy membership function value as 0.9
- A total number of 1276 training sample and 632 test samples are selected
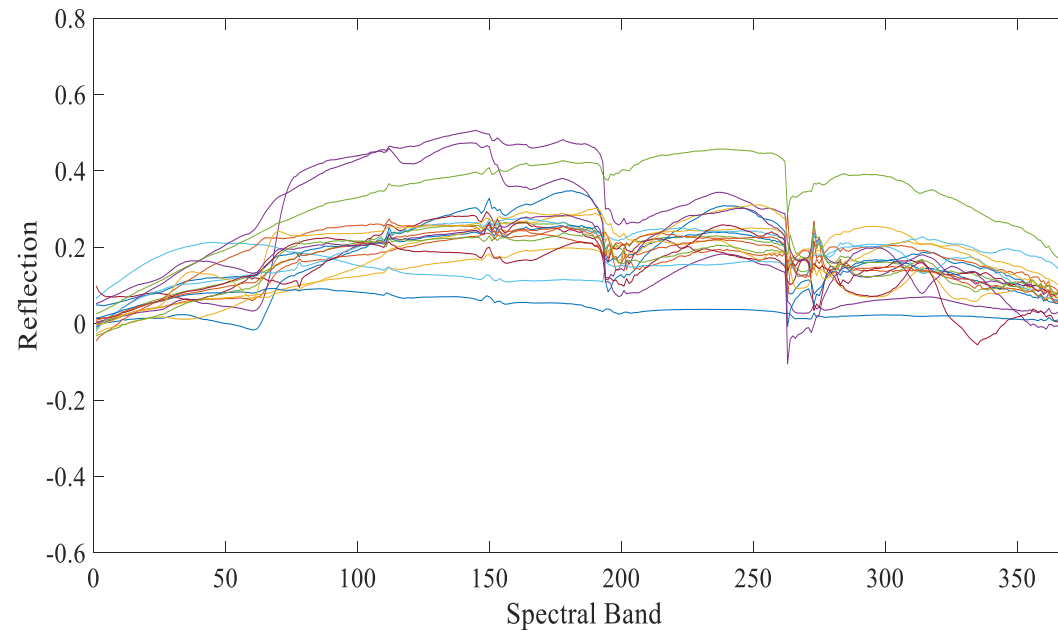

The misclassification error in training data is 7.3%

The misclassification error in test data is 11.6%
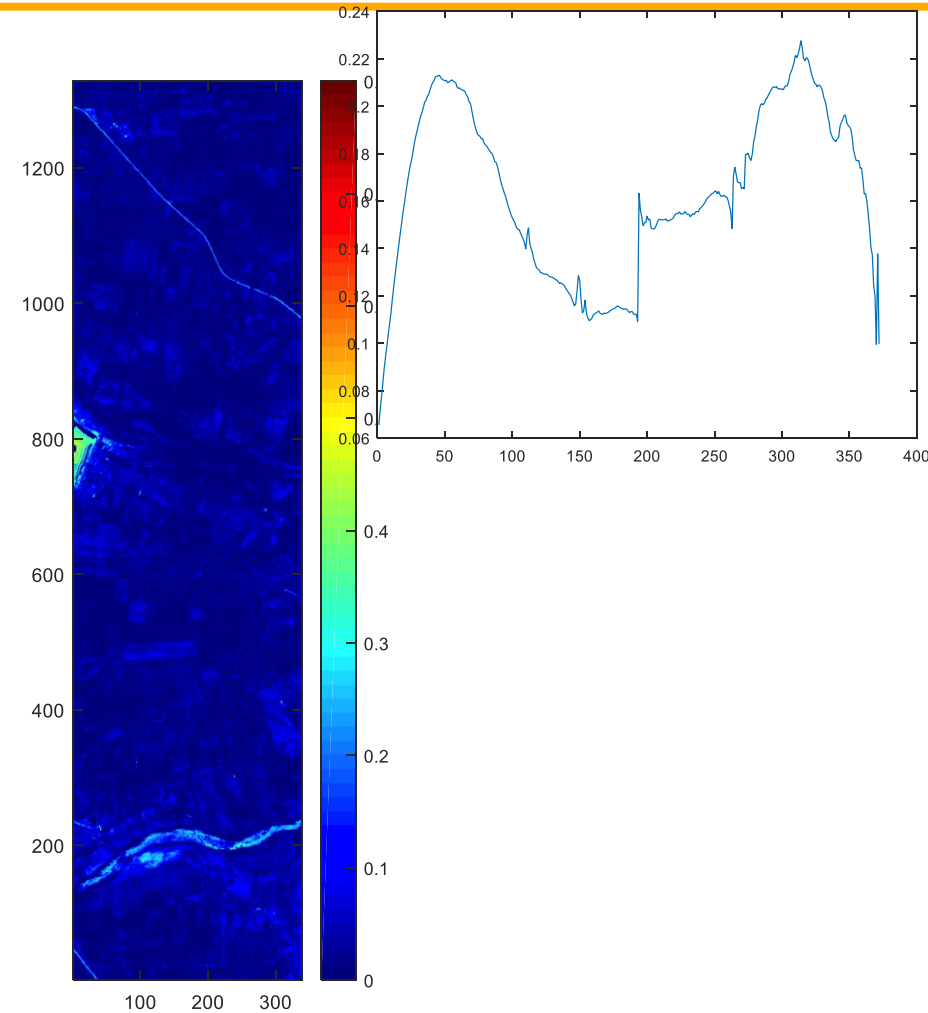
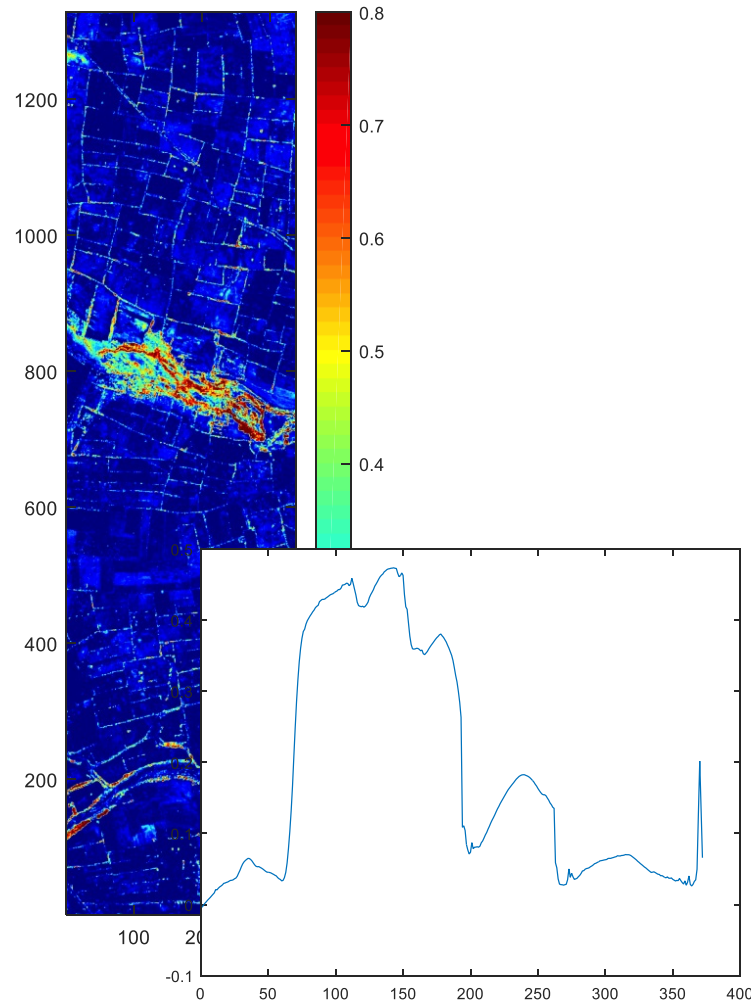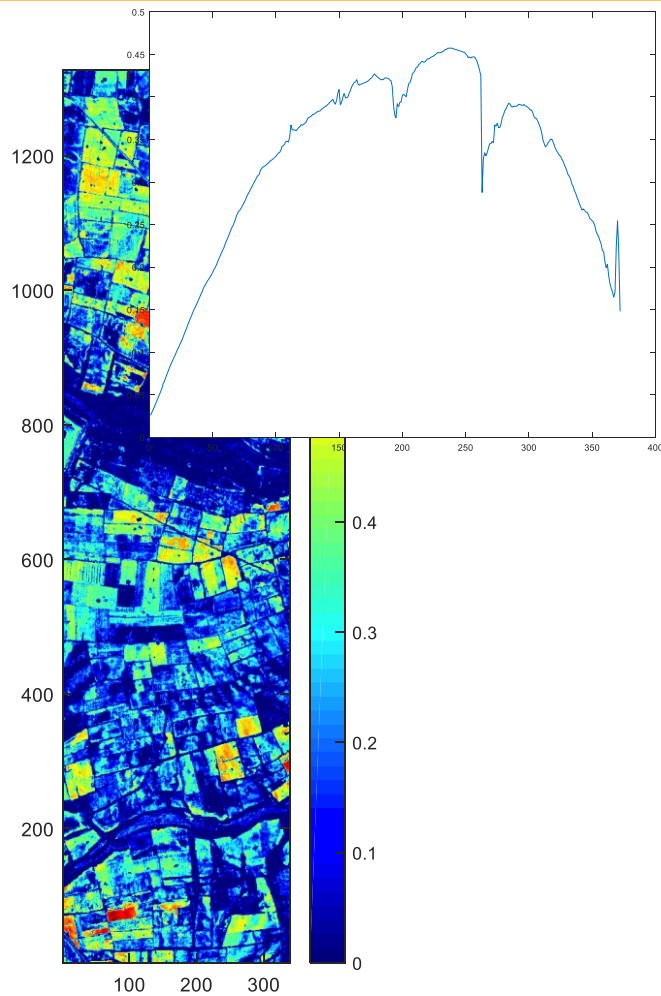*Geological and Mining Engineering and Sciences*

Preliminary results: Endmember selection

- SPICE method selects endmembers as 19
- Two inputs (regularization term and constant that control the sparsity among endmembers) of SPICE method were optimized using Genetic Algorithm (GA)
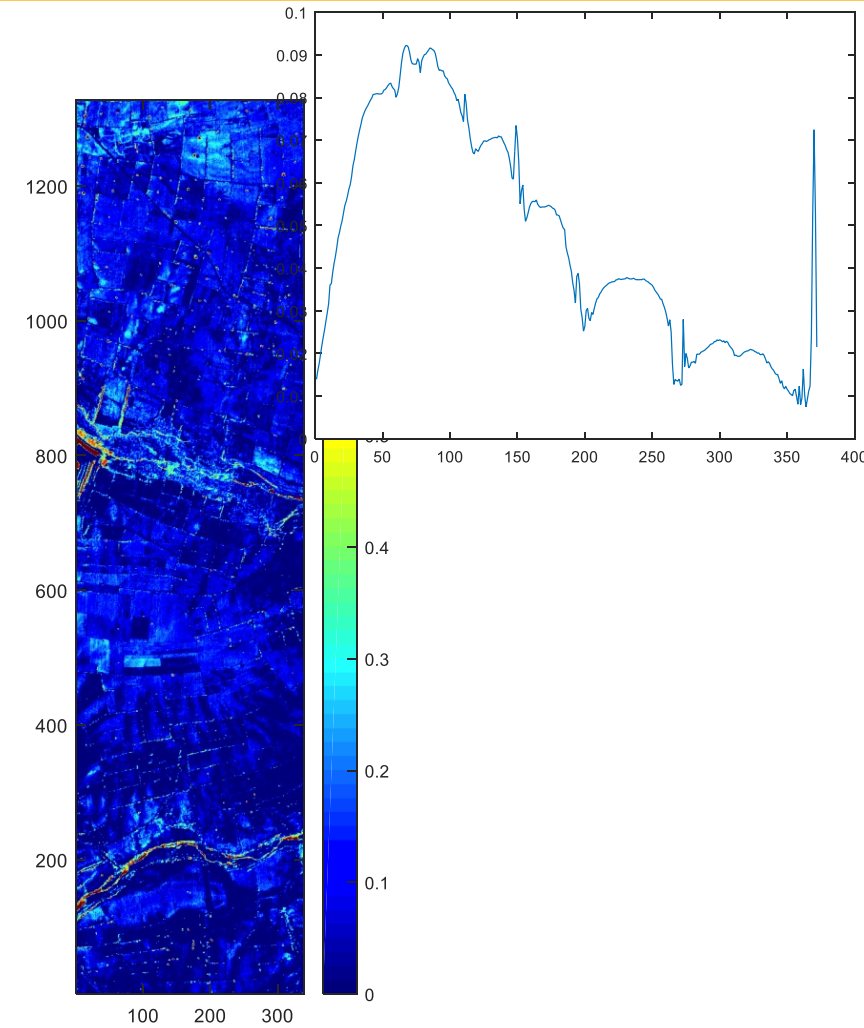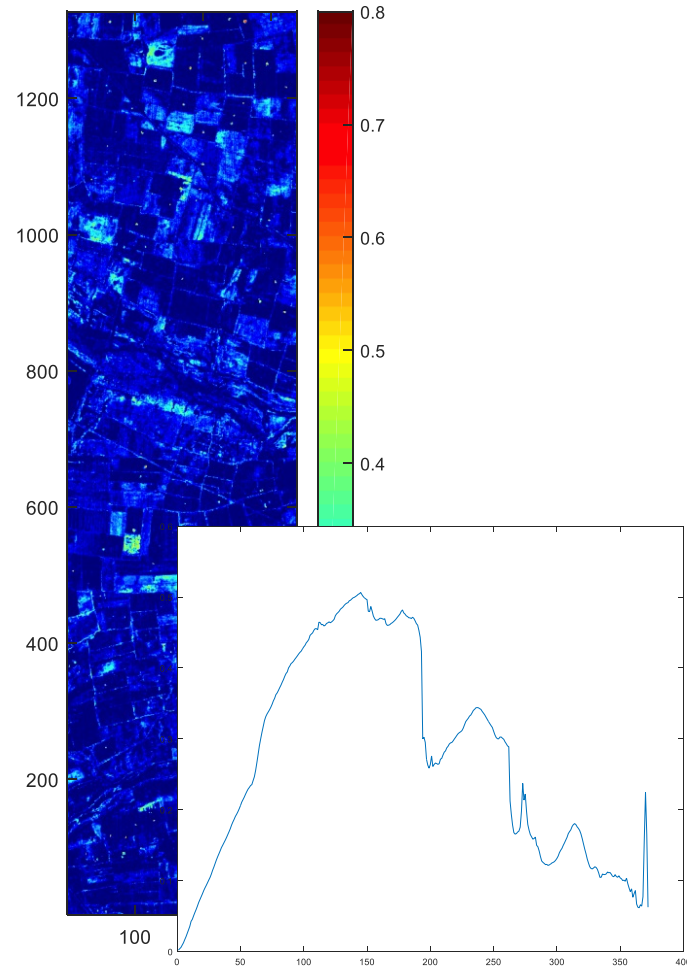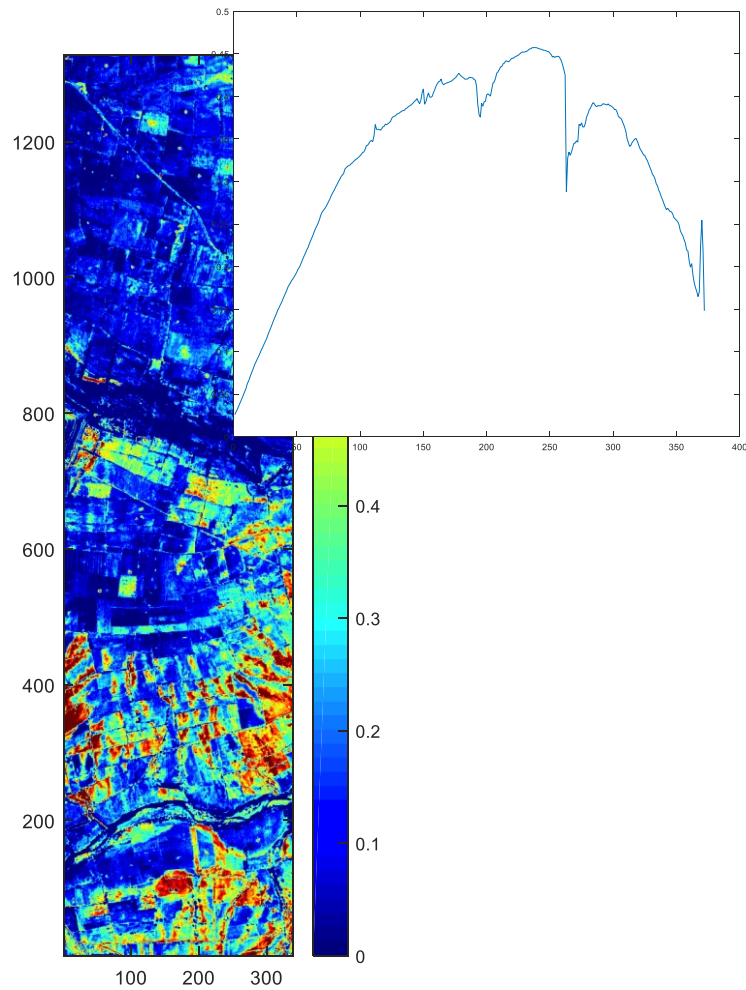- GA was implemented with crossover rate of 0.9 and mutation rate is 0.1

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Preliminary results: Endmember selection

Preliminary results: Endmember selection

Summary and Future work

- Minerals and Rock types mapping of Hutti Maski Greenstone

- Endmembers and purity index of pixels

- Validations of methods

- Uncertainty analysis of classification methods

- Validation of models with ground truth data

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Thank You

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