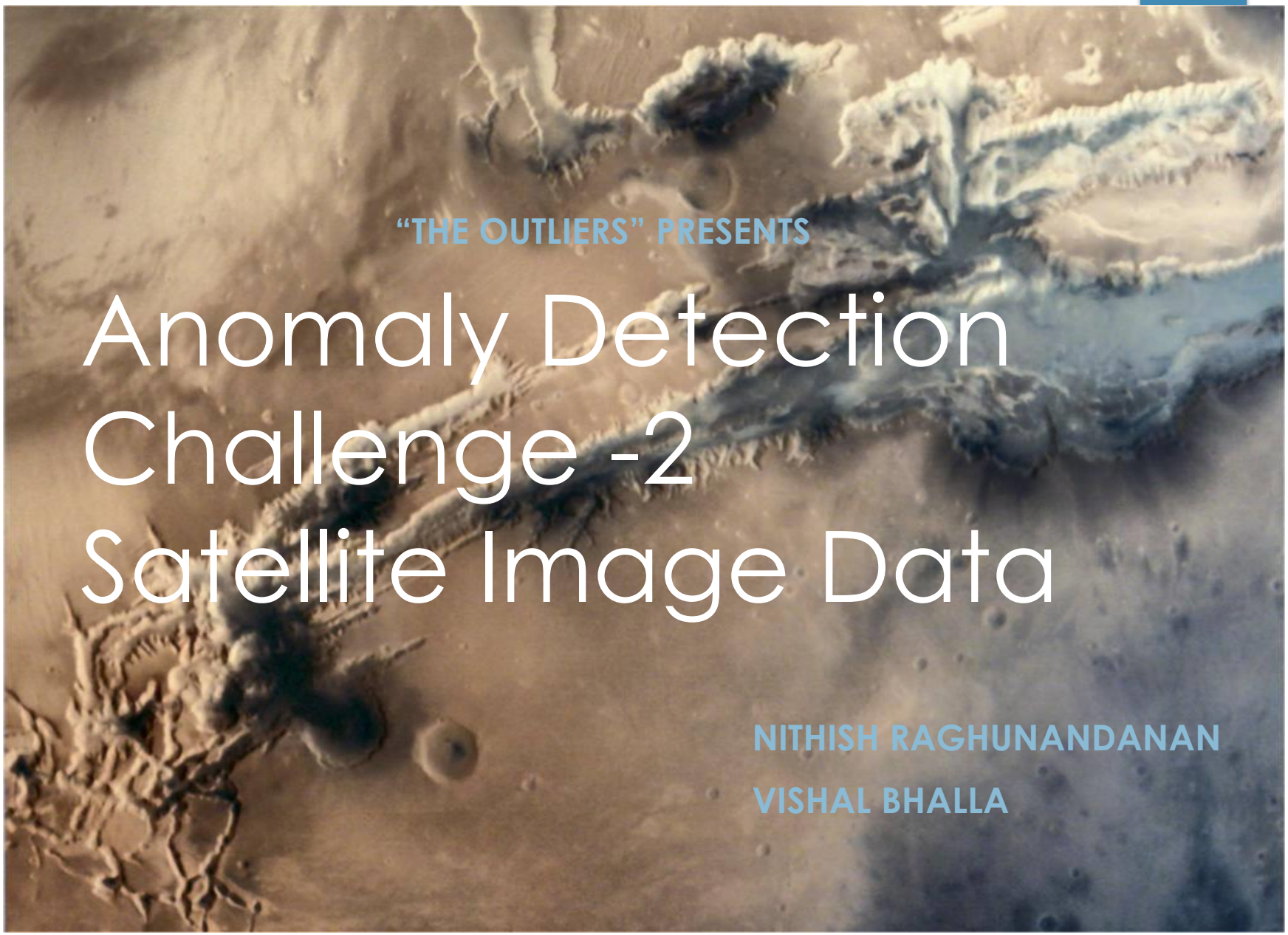


Picture: Close-up of grandest canyon of all: Valles Marineris from ISRO's Mars Orbiter

Agenda

- Introduction
- Data Pre-processing
  - Rearrangement of the Data
  - Replacement of Missing Values
- System Pipeline
- Data Model
- Evaluation of the Models
- Results
- Conclusion

Introduction

- Aim: Classify the central pixel in 3x3 neighbourhoods of a multi-spectral satellite image.
- Problem Type: Multi-class Classification
- Samples
  - Training Set: 4435
  - Test Set: 2000
- Number of Attributes: 36 (4 spectral bands x 9 pixels in neighbourhood)
- Attributes: The attributes are numerical, in the range 0 to 255.
- Classification
  - There are 6 decision classes: 1,2,3,4,5 and 7.

Data Pre-processing

- Rearrangement of the Data
  - Given data set had the Spectral Data combined together.
  - Grouped all the data pertaining to a Spectrum together.
- Example

S1.1	S2.1	S3.1	S4.1	S1.2	S2.2	S3.2	S4.2
S1.1	S1.2	S2.1	S2.2	S3.1	S3.2	S4.1	S4.2

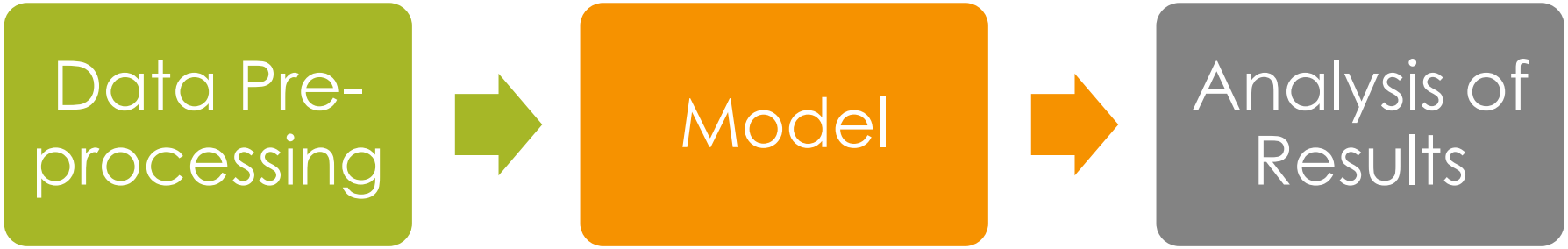
Data Pre-processing(2)

- Feature Analysis
  - ✓ Data is in the range of [0,255]
  - ✓ Normalisation not required
- Strategies for Replacement of Missing Values
  - ✓ Row Wise
  - ✓ Column Wise
  - ✓ Spectrum Wise

Data Pre-processing (3)

- Replacement Techniques
  - ✓ Zeros & Mid Values
  - ✓ Mean
  - ✓ Median
  - ✓ Mode
  - ✓ Minimum
  - ✓ Maximum
  - ✓ Interpolated Values

System Pipeline



- We iteratively used the above pipeline to arrive at the best model

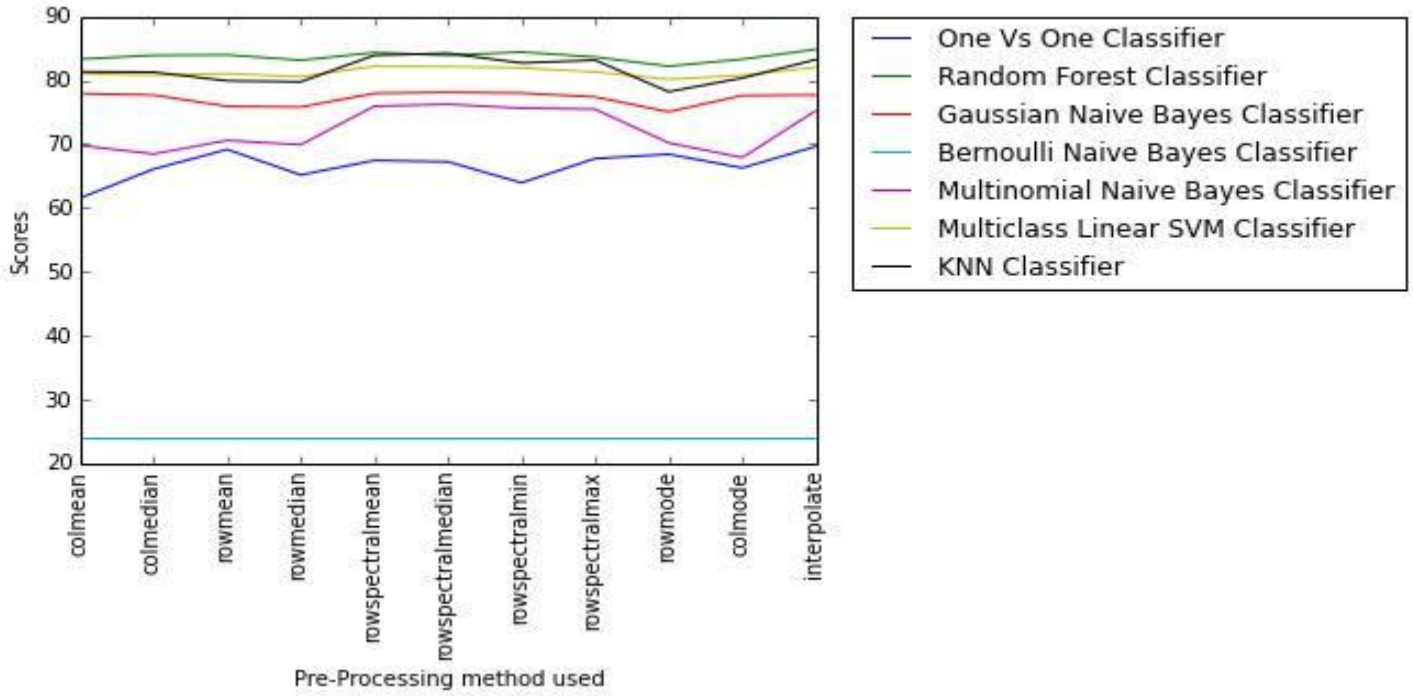
Model

- We tried different types of Multi Class Classification Models to fit our data
  - One Versus One and One Versus Rest Multiclass Classification
  - Random Forests
  - Gaussian , Bernoulli and Multinomial Naïve Bayes Classifier
  - Multi Class SVM with Linear Kernel
  - K Nearest Neighbours

Evaluation of the Models

Criteria

Classification Accuracy on Stratified K-Fold Cross Validation with a split of 4:1.



Results

Model	Replacement Technique	Classification Accuracy (Public Score)	Classification Accuracy (Private Score)
Random Forest (50 trees with Entropy)	Row Spectral Median	**0.89800**	
Random Forest (50 trees with Gini)	Row Spectral Median	0.89300	
KNN with 3 neighbours	Row Spectral Median	**0.89200**	
Random Forest(Gini)	Interpolation	0.89000	
KNN with 3 neighbours	Row Spectral Median	0.89000	
KNN with 3 neighbours	Column Mean	0.87800	
Multi-class Linear SVM	Row Spectral Median	0.84000	

Conclusion

- The best results were observed for Random Forest (50 trees with Entropy as a criterion) on rearranged data and using row spectral median values for missing values.

- Replacement of missing values by Row Spectral Median values gave consistently better results across all of our models.

Questions?

Thank You !