

# **Software Requirements Specification**

**for**

## **Layer Analyzing**

**Version 2.0 approved**

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## Revision History

Name	Date	Reason For Changes	Version
First Draft	11/14/17	Original Version	1.0
Final Draft	4/14/18	Final Version	2.0

# **1. Introduction**

## **1.1 Purpose**

The purpose of this document is to present a detailed description of the Layer Analyzing Software. It will explain the purpose, requirements, features, and constraints of the software. This document is intended for developers of the system, researchers, faculty, and any Computer Science student.

## **1.2 Intended Audience and Reading Suggestions**

The intended audience is developers, project managers, researchers, scientists, and students majoring in Computer Science and maybe even students majoring in Geology/Astrology. The suggested reading sequence is in order, unless referencing a section of interest.

## **1.3 Product Scope**

The software will be a cluster of functions used to analyze data files/arrays. This system is designed to help educate the public about the moon through the use of analysis of the data gathered from the moon. The software will assist researchers in the analysis of large data files gathered from sensors used when exploring distant celestial bodies.

## **1.4 Definitions, Acronyms, and Abbreviations**

SRS - Software Requirements Specification

JPL - Jet Propulsion Laboratory

CLI – Command Line Interface

## **1.5 References**

Moon Trek (<https://moontrek.jpl.nasa.gov/>)

GDAL ver. 2.2.1 (<http://www.gdal.org/>)

Python ver. 3.5.2 (<https://www.python.org/download/releases/3.0/>)

NumPy ver. 1.13.1 (<http://www.numpy.org/>)

Matplotlib ver. 2.0.2 (<https://matplotlib.org/>)

Pandas ver. 0.20.3 (<http://pandas.pydata.org/>)

Georasters ver. 0.5.11 (<https://github.com/ozak/georasters>)

Inquirer ver. 2.2.0 (<https://pypi.python.org/pypi/inquirer>)

Scikit-learn ver. 0.19.1 (<http://scikit-learn.org>)

Visualizing Distributions of Covariance Matrices

(<http://www.stat.columbia.edu/~gelman/research/unpublished/Visualization.pdf>)

## **2. Overall Description**

The Layer Analyzing Software has a cluster of functions useful for statistical calculations. The software will receive input (the “layer(s)” to be analyzed), compute data based on the chosen defined functions, and return data or visual representation of data.

### **2.1 Product Perspective**

The software makes specific calculations available through various Python modules and unites them into one software. It is dependent on Python and its various modules to run the functions.

### **2.2 Product Functions**

The product receives information from the selected layer(s) and will use it to calculate and return max, min, average, median, and standard deviation. If multiple layers are selected, the calculated data will be plotted and a visual representation depicting correlations shall be outputted.

### **2.3 User Classes and Characteristics**

All functions will be available and JPL will decide what data would be meaningful to call the functions on to retrieve useful data.

### **2.4 Operating Environment**

The operating environment can be any OS that supports Python 3, GDAL, and all libraries listed under reference.

### **2.6 User Documentation**

There will be a documentation regarding the functions detailing their input and output formats.

### **2.7 Assumptions and Dependencies**

GDAL  
Python  
NumPy  
Matplotlib  
Pandas  
Georasters  
Inquirer  
Scikit Learn

## 3. External Interface Requirements

### 3.1 User Interfaces

The system will execute in command line. The user will be provided with a prompt once the system begins.

#### 3.1.1 Layer Selection

3.1.1.1 A selection of layers will initially be presented.

#### 3.1.2 Functions

3.1.2.1 A specific list of functions will appear.

3.1.2.2 Another prompt may appear depending on which function is chosen (i.e. Ask if the user would want to normalize the values before the function executes).

#### 3.1.3 Results

3.1.3.1 Statistical calculations of selected layer(s) will be returned

3.1.3.2 A graph will appear depicting the statistical calculations depending on which function is selected.

### 3.2 Hardware Interfaces

This is not covered within the software.

### 3.3 Software Interfaces

3.3.1 GDAL ver. 2.2.1 (<http://www.gdal.org/>)

3.3.2 Python ver. 3.5.2 (<https://www.python.org/download/releases/3.0/>)

3.3.3 NumPy ver. 1.13.1 (<http://www.numpy.org/>)

3.3.4 Matplotlib ver. 2.0.2 (<https://matplotlib.org/>)

3.3.5 Pandas ver. 0.20.3 (<http://pandas.pydata.org/>)

3.3.6 Georasters ver. 0.5.11 (<https://github.com/ozak/georasters>)

3.3.7 Inquirer ver. 2.2.0 (<https://pypi.python.org/pypi/inquirer>)

3.3.8 Scikit-learn ver. 0.19.1 (<http://scikit-learn.org>)

There are no plans to implement a new interface as it will be provided by Moon Trek. This is completely a backend program.

### 3.4 Communications Interfaces

Prompts will be displayed to the user within the CLI as the system executes which will lead the user to the information that he or she would want to examine.

## 4. Requirements Specification

### 4.1 Functional Requirements

- 4.1.1 The system shall be written in Python.
  - 4.1.1.1 The system shall integrate the following Python libraries and modules: GDAL, NumPY, Matplotlib, Pandas, Georasters, Inquirer, Scikit-learn, and Seaborn.
- 4.1.2 The system shall take in GeoTIFF and .xyz files.
- 4.1.3 The system shall output statistical data from the GeoTIFF or .xyz file.
  - 4.1.3.1 The system shall output average, standard deviation, minimum value, maximum value, and median.
- 4.1.4 The system shall read raster bands from the GeoTIFF files and translate them into a data format to be used for analysis.
  - 4.1.4.1 The system shall return coordinates from a pixel coordinate system to a latitude-longitude coordinate system.
- 4.1.5 When provided with more than 1 layer, the system shall calculate any correlation between them.
- 4.1.6 The system shall represent the data in graphical formats such as a histogram and/or scatter graph.

### 4.2 External Interface Requirements

- 4.1.1 GeoTIFF file
  - 4.1.2 A file for the layer to be analyzed
  - 4.1.3 File received from database server
  - 4.1.4 Range and accuracy varies per file, specific range and accuracy given per file.
  - 4.1.5 Unit of measure varies per file, specific measure given per file.
  - 4.1.6 The GeoTIFF file contains all the data to be used in the software's functions
  - 4.1.7 GDALinfo will return metadata about the file in a list format.
  - 4.1.8 The data from the GeoTIFF file shall be converted into a dataframe to be fed into the functions of the system as input
- 4.2.1 xyz file
  - 4.2.2 xyz file contains data for a period of time at specific intervals (ex data recorded every hour).
  - 4.2.3 File is given to the local system.
  - 4.2.4 Range is given in a 24 hour range, with data recorded once per hour.
  - 4.2.5 Unit of measure is in Kelvin for given file.
  - 4.2.6 The xyz file contains the data in a three column format.
  - 4.2.7 The xyz file can be viewed and opened in a text editor, and is presented in three columns

### **4.3 Logical Database Requirements**

4.3.1 The GeoTIFF files to be used as inputs for the software's functions are stored on a database used by a website that updates regularly.

### **4.4 Design Constraints**

4.4.1 The functions are to be run on a web server hardware.



## **5. Other Nonfunctional Requirements**

### **5.1 Performance Requirements**

The system shall output a specified result within 15 seconds.

### **5.2 Safety Requirements**

There are no safety requirements.

### **5.3 Security Requirements**

There are no security requirements since this software shall retrieve data from the inputted files.

### **5.4 Software Quality Attributes**

The system shall be capable of supporting the multiple layers from JPL's Moon Trek API.

### **5.5 Business Rules**

The system shall only be available to JPL to be integrated into the Moon Trek API.

## **Appendix A: Glossary**

- SRS - Software Requirements Specification
- JPL - Jet Propulsion Laboratory
- CLI – Command Line Interface

## **Appendix B: Analysis Models**

## **Appendix C: To Be Determined List**

- May implement Spark to speed up the data processing time.
- May use Seaborn to visually display the data retrieved from the .xyz files.