Software Requirements Specification

for

Satellite Image Processing

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Revision History

Name	Date	Reason of Changes	Version

1. Introduction

1.1 Purpose

The purpose of this document is to specify the software requirements for the Satellite Image Processing using Deep Learning Techniques project. This document outlines the functional and non-functional requirements, constraints, and assumptions of the system to be developed.

1.2 Scope

The Satellite Image Processing using Deep Learning Techniques project aims to develop a software system that can process satellite images using deep learning techniques. The system will be able to perform various image processing tasks such as image classification, object detection, and semantic segmentation.

The system will be developed to run on a computer with the necessary hardware and software requirements. The system will be designed to be user-friendly and easy to use, with a graphical user interface (GUI) that allows users to interact with the system.

1.3 Definitions, Acronyms, and Abbreviations

- SRS: Software Requirements Specification
- GUI: Graphical User Interface

2. Overall Description

2.1 Product Perspective

The Satellite Image Processing using Deep Learning Techniques system will be a standalone software application that will be developed to process satellite images using deep learning techniques. The system will be developed to run on a computer with the necessary hardware and software requirements.

2.2 Product Functions

The system will be capable of performing the following functions:

1. Image Classification: The system will be able to classify satellite images into different categories based on their content.

2. Object Detection: The system will be able to detect and localize objects within satellite images.
3. Semantic Segmentation: The system will be able to segment satellite images into different regions based on their semantic meaning.
4. Image Enhancement: The system will be able to enhance satellite images to improve their quality and visibility.

2.3 User Characteristics

The system will be designed for users with a basic understanding of satellite image processing and deep learning techniques. The users will be able to interact with the system using a GUI.

2.4 Constraints

The following constraints apply to the system:

1. The system will require a computer with the necessary hardware and software requirements.
2. The system will be developed using the Python programming language and various libraries such as TensorFlow, Keras, and OpenCV.

2.5 Assumptions and Dependencies

The following assumptions and dependencies apply to the system:

1. The system assumes that the input images are in a compatible format and have been pre-processed.
2. The system depends on the availability and compatibility of the required software libraries and tools.

3. Specific Requirements

3.1 External Interfaces

The system will have the following external interfaces:

1. GUI: The system will have a GUI that allows users to interact with the system.
2. Input Interface: The system will accept input images in a compatible format.
3. Output Interface: The system will produce output images in a compatible format.

3.2 Functional Requirements

The following functional requirements apply to the system:

1. The system shall be able to classify satellite images into different categories based on their content.
2. The system shall be able to detect and localize objects within satellite images.
3. The system shall be able to segment satellite images into different regions based on their semantic meaning.
4. The system shall be able to enhance satellite images to improve their quality and visibility.

3.3 Non-Functional Requirements

The following non-functional requirements must be met by the system:

1. Performance:
   - The system shall be able to process large volumes of satellite imagery data in real-time.
   - The system shall provide accurate and reliable analysis of the satellite images.

2. Usability:
   - The system shall be easy to use for non-technical users, with an intuitive user interface.
   - The system shall provide clear visualizations and reports of the analysis of the satellite images.

3. Security:
   - The system shall provide secure access to the satellite imagery data and analysis results.
   - The system shall protect the confidentiality and integrity of the satellite imagery data and analysis results.

4. Reliability:
   - The system shall provide accurate and reliable analysis of the satellite images under varying weather and lighting conditions.

- The system shall be able to handle errors and failures gracefully, with minimal impact on system performance and data integrity.

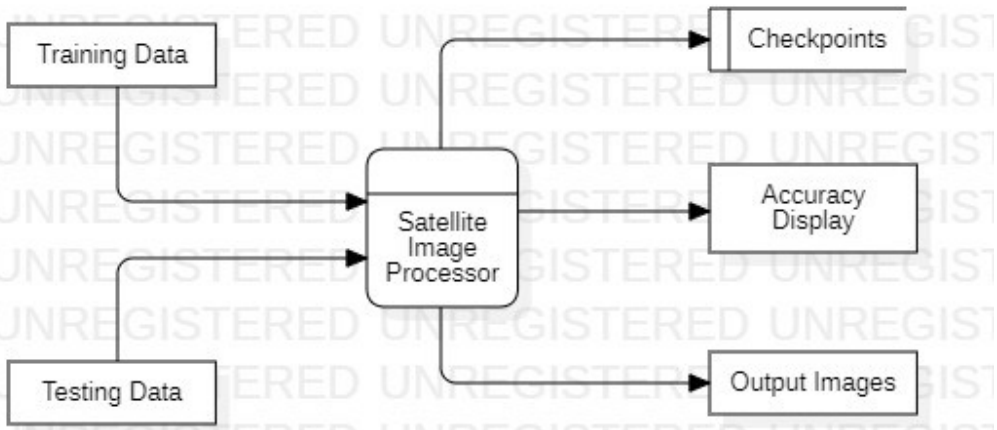
5. Scalability:
   - The system shall be able to handle increasing volumes of satellite imagery data and user requests.
   - The system shall be able to scale horizontally or vertically to accommodate changes in system requirements.

Appendix A: Glossary

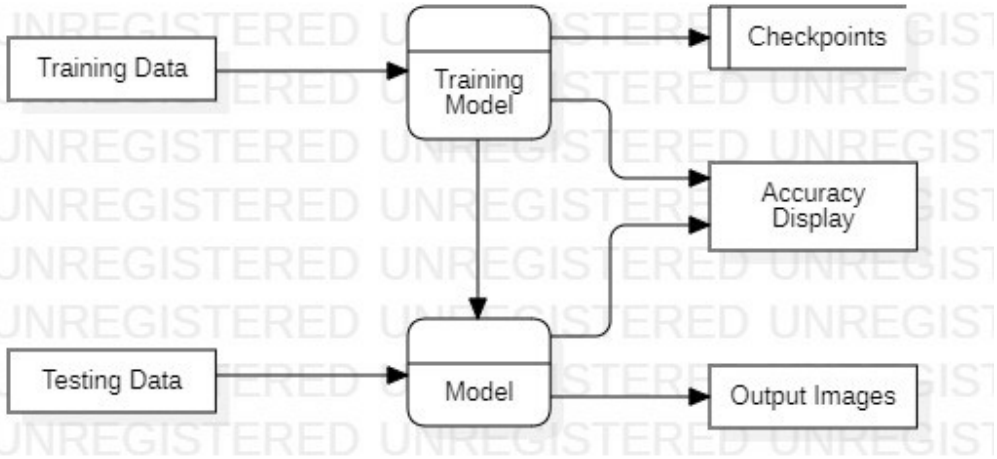
- Landsat: A series of Earth observation satellites launched by NASA and USGS, with multispectral sensors for monitoring land cover and land use change.
- Sentinel: A series of Earth observation satellites launched by the European Space Agency, with multispectral and radar sensors for various applications, such as land cover, oceanography, and climate change.
- MODIS: A multispectral instrument onboard two NASA Earth observation satellites, with global coverage and high temporal resolution, for monitoring land, ocean, and atmosphere.
- Supervised classification: A method of image classification that uses training samples of known classes to classify the rest of the image pixels based on spectral similarity.
- Unsupervised classification: A method of image classification that groups pixels into clusters based on spectral similarity, without prior knowledge of the classes.
- Object-based analysis: A method of image analysis that uses image segmentation to group pixels into meaningful objects, and then analyzes the objects based on their spectral, spatial, and contextual features.
- Raster: A data format that represents data as a grid of cells, each with a value or a set of values, such as pixel values in an image.
- Vector: A data format that represents data as points, lines, and polygons, with attributes attached to them, such as spatial data in a GIS.
- Tabular: A data format that represents data as rows and columns, with each cell containing a value, such as statistics in a spreadsheet.

Appendix B: Analysis Models

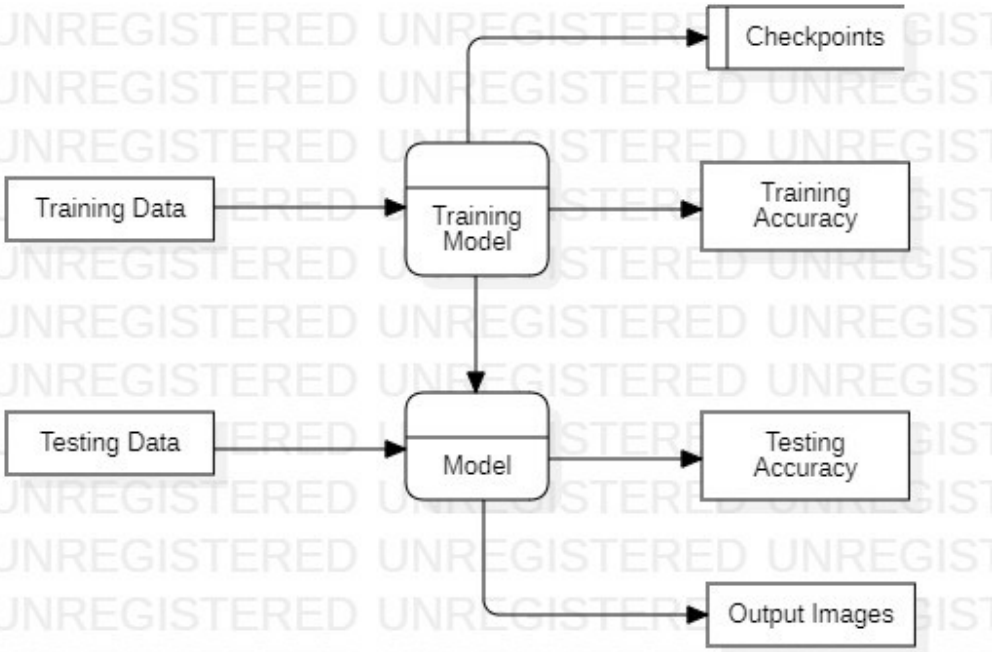
- **Data Flow Diagram**
  - Level-0



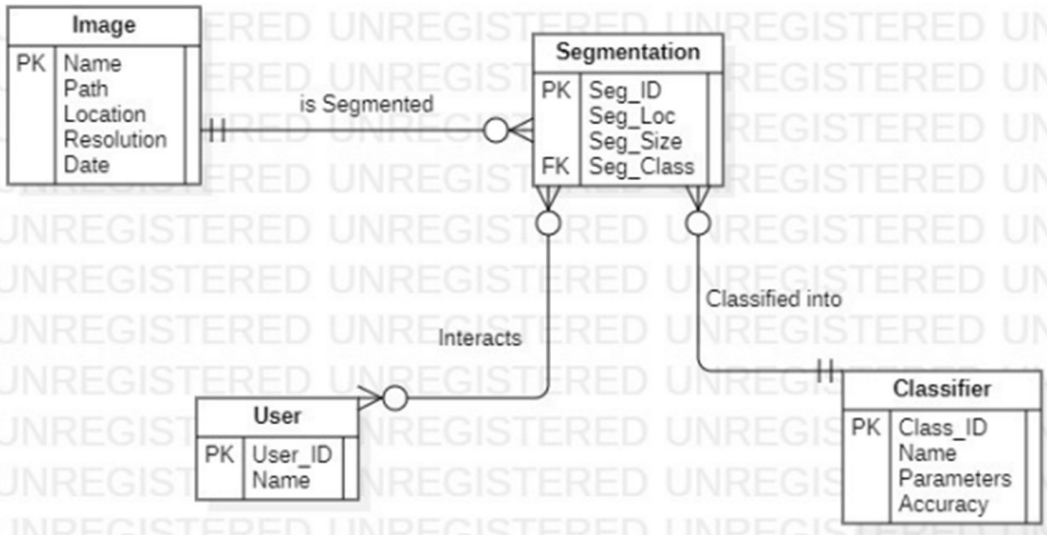
  - Level-1



- Level-2



- **Entity-Relationship Diagram**



Appendix C: To Be Determined List

[1] Campbell, J. B., & Wynne, R. H. (2011). Introduction to remote sensing. Guilford Press.

[2] Lu, D., & Weng, Q. (2007). A survey of image classification methods and techniques for improving classification performance. International Journal of Remote Sensing, 28(5), 823-870.

[3] Gao, J., Liu, Y., & Du, S. (2017). Image segmentation: progress and prospects. Machine Vision and Applications, 28(7-8), 905-922.

[4] Zhang, Y., & Ling, F. (2018). A review of satellite image processing techniques for urban vegetation mapping. International Journal of Remote Sensing, 39(14), 4535-4559.

[5] ISO 19115-1:2014, Geographic information -- Metadata -- Part 1: Fundamentals

[6] ISO 19139:2007, Geographic information -- Metadata -- XML schema implementation.