

**Image content based classification of  
Vacation/ tourism related images**

Software Requirements Specification

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**Image spatial representation and segmentation  
function**

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## **Declaration**

I hereby declare that the Software Requirements Specification entitled “Image content based classification of vacation/ tourism related images”, submitted to the Sri Lanka Institute of Information Technology is a record of an original work done by me, under the guidance of our supervisor Dr.Rohana Thilakumara. This project work is submitted in the partial fulfillment of the requirement for the award of the degree of Bachelor of Science in Information Technology. The results embodied in this report have not been submitted to any other university or Institution for the award of any degree or diploma. Information derived from the published or unpublished work of others has been acknowledged in the text and a complete list of references is given.

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# **1 Introduction**

## **1.1 Purpose**

The purpose of this document is to provide a detailed overview idea of that come up to define the image spatial representation and segmentation function. This document includes what are the goals and implementation process of this function. It also includes the procedure of the function and hope to give a better understanding of this function. This document's target audience is users and developers. It helps any designer and developer to assist in SDLC.

## **1.2 Scope**

This document contains all the requirements for developing image spatial representation and segmentation function of this algorithm. The purpose of this is to guide developers in selecting a design that will be able to accommodate the full-scale of proposed algorithm. This SRS aims to describe the procedure of image spatial representation and segmentation component. Limitation of this document is explaining only the function. It is not going to explain the implementation in detail. In this document we mainly focus on aspects of segmenting the image into same regions. We want every image to be segment more accurately therefore we use random forest algorithm to improve the segmentation process.

### 1.3 Definitions, Acronyms, and Abbreviations

#### Acronyms

SRS	Software Requirement Specification
ANN	Artificial Neural Network
RNN	Recursive Neural Network
CNN	Convolutional Neural Network
SDLC	Software development Life Cycle

#### Definitions

SRS	A document that completely describes all the functions of a proposed system and the constraints under which it must operate.
Database	Collection of data stored in the system
Stakeholder	Any person who can affect the project in development.

#### Abbreviation

The System	The project “Image content based classification of vacation/ tourism related images” will hereafter be simply referred as “The System”
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## **1.5 Overview**

Overview section of the document provides a description that includes characteristics of the functional and data requirements of the developing image spatial representation and segmentation function. This algorithm is used to allow user to upload an image to the system and then the system will segment the image into same regions.

### **Section 1**

In section 1 we give a brief introduction about the purpose, scope, definitions, Acronyms, and Abbreviations.

### **Section 2**

In section 2 we discussed overall description of the function and product perspective of our system comparing to other related products. In product perspective we discuss system interfaces, user interfaces, hardware interfaces, software interfaces, communication interfaces, memory constraints and the operations. Then we discuss about the product function, user characteristics and the constraints.

### **Section 3**

This section we discuss the external interface requirements, Classes/Object, performance requirement, design constraint and the software system attributes. Under software system attributes we discuss the non-functional requirements such as availability, reliability, security and maintainability.

## **2 Overall Descriptions**

Image content based classification of vacation/ tourism is an algorithm which is used to classify the content of the image. Usage of the image classification is increasing as there is increase in number of web users.

Image spatial representation and segmentation is the first step of our algorithm which separate the pixels of the image initially and then check the pixels whether they are in same region or not. Same region pixels are merged together and iteratively search for same region pixels until the process is done. To do this process more accurately, we use random forest algorithm which has many decision trees. What random forest does is, take every pixel randomly and send through random decision trees. The leaf nodes of each tree are labeled by estimates of the posterior distribution over the image classes. An image is segmented by sending each pixel down every tree and aggregating the reached leaf distributions.

### **2.1 Product perspective**

Image spatial representation and segmentation can be mainly done in two ways. Those are edge based segmentation and region based segmentation. Under these two categories there are lots of methods available like K-means clustering, Histogram based methods etc...

[1] Has used “splitting and merging” method for image segmentation which has pyramidal structure. But there is a problem that any two regions may be merged if adjacent and if the larger region satisfies the homogeneity criteria. [2] Has used histogram based method which is efficient compared to others. But the problem is its very difficult to identify the peaks and the valleys in the image.



The random forest algorithm, which we use to segment an image, is a better algorithm compared to others because of the efficiency and the reliability.

### 2.1.1 System interfaces

Since this proposed system is based on some algorithms, there is no any external interface involved with. It only needs a proper Internet connection and a computer running on windows 7 or above to operate the system.

### 2.1.2 User interfaces

Form1

Images classified: 14

Images failed to classify: 2

Images Categories Identified: 6

Image Categories	Percentage
Beach	20%
Urban Areas	20%
Forests	20%
Gardens	20%
Mountains	18%
Waterfalls	1%

Image Category

Image Category

Image Category

Image Category

Image Category

Image Category

Image Category

Image Category

Image Category

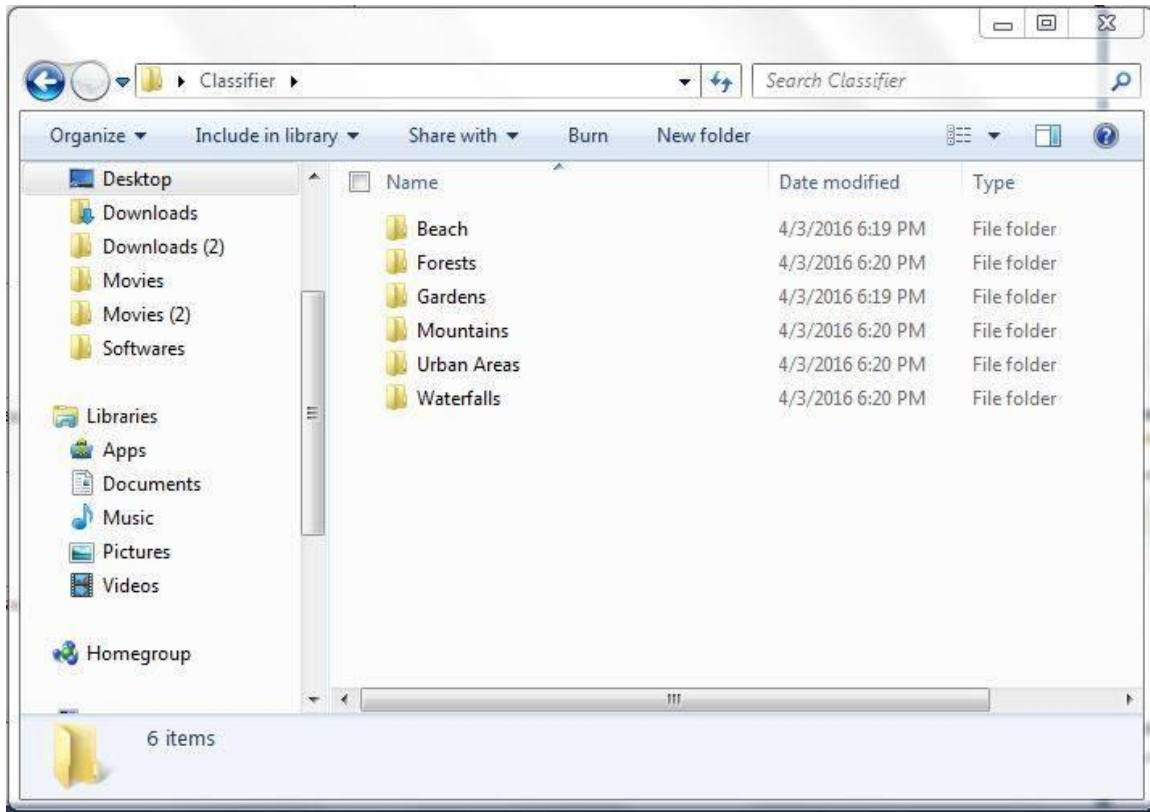
Image Category

Image Category

Image Category

Upload Images

Figure 2.1.2.1 Upload Image Interface



*Figure 2.1.2.2 Categorized Images Interface*

### **2.1.3 Hardware interfaces**

Since our project is based on an algorithm, there is no need for any hardware device. So there is no any hardware interface.

### **2.1.4 Software interfaces**

- Python 2.7 -  
Main environment for building the algorithms
- MySQL -  
To storing the sample images in the database
- MATLAB -  
To check the algorithms are working properly or not.

### **2.1.5 Communication interfaces**

Initially we develop this algorithm for the desktop application. So that Internet connection is not required at that moment. When we use this algorithm in a web application then user must have a proper Internet connection.

### **2.1.6 Memory constraints**

User's computer machine is expected to use at least 4GB of Ram and 1GB of external storage.

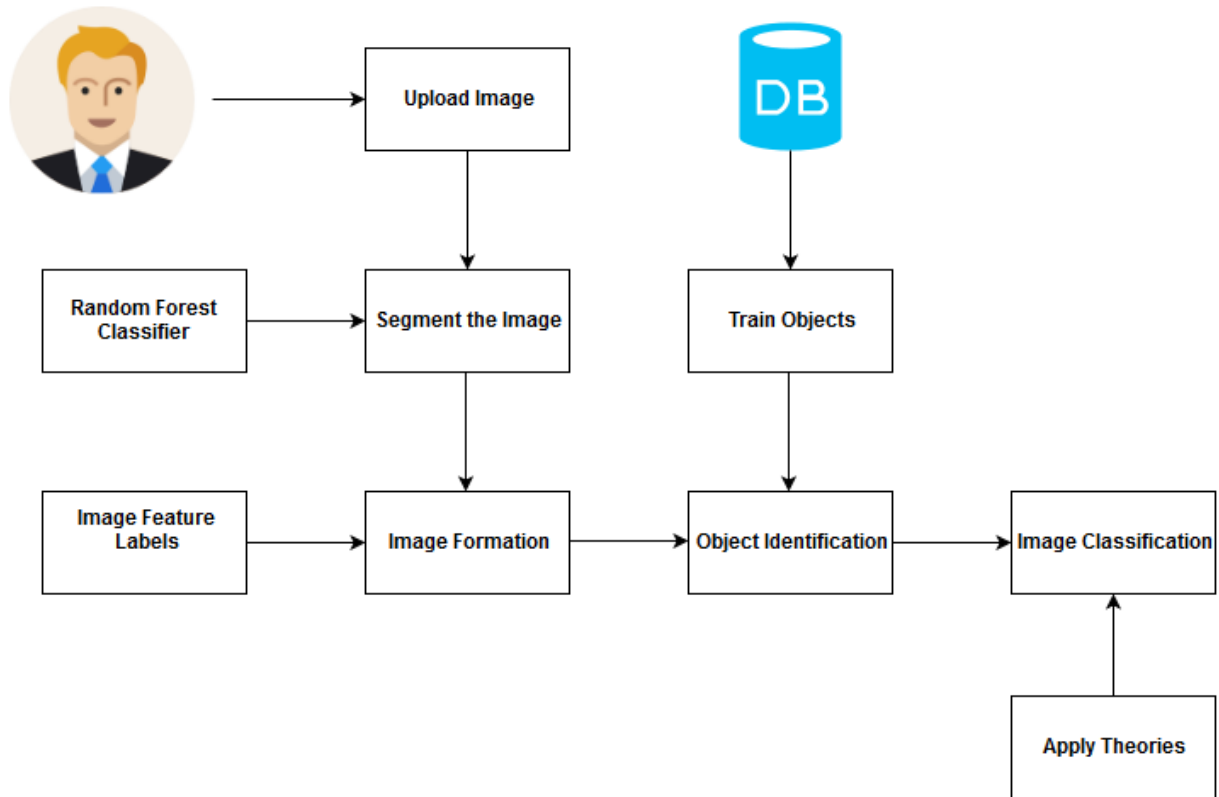
### **2.1.7 Operations.**

- User must enable the web access of the computer
- User should upload images for segmentation

### **2.1.8 Site adaptation requirements**

Since the system will be initially developed to be as a desktop application it should be run on a computer with windows 7 or above. User interface must be in English language because the user can be any nationality.

## 2.2 Product functions

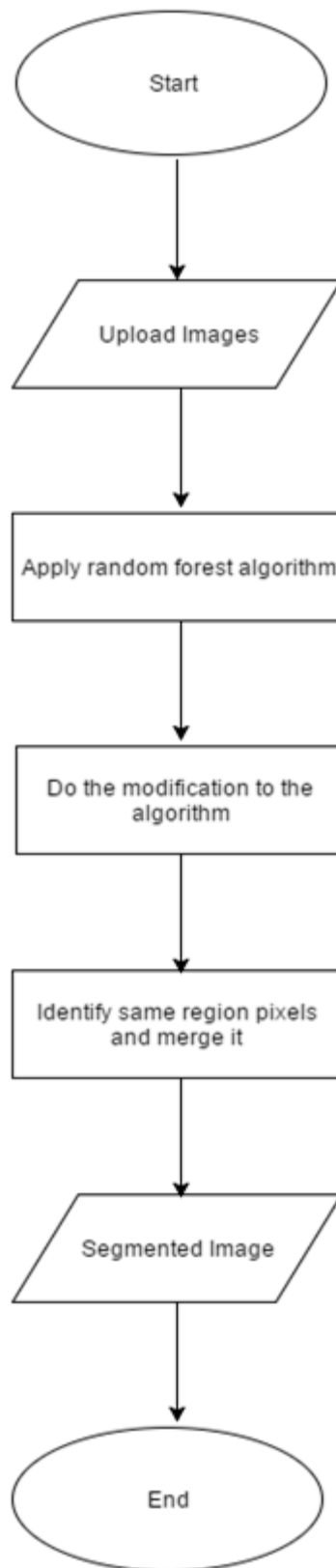


*Figure 2.2.1 High level diagram for the system*

The system consists of mainly four functions named image spatial representation and segmentation, object formation from segmented images parts, object classification and identification, Image context identification and classification. This SRS document mainly covers the requirements for the “Image spatial representation and segmentation” component of the application.

Image spatial representation and segmentation is a process of dividing an image into multiple parts or multiple regions. First we need to remove the noise from the image and make the image more quality one.

Then start the segmentation process. This algorithm will take pixels randomly and send it through random trees. Each decision tree process the pixels and assign labels to them. So same region pixels are merged and finally the segmented image is created.



*Figure 2.2.2 Flow Chart*

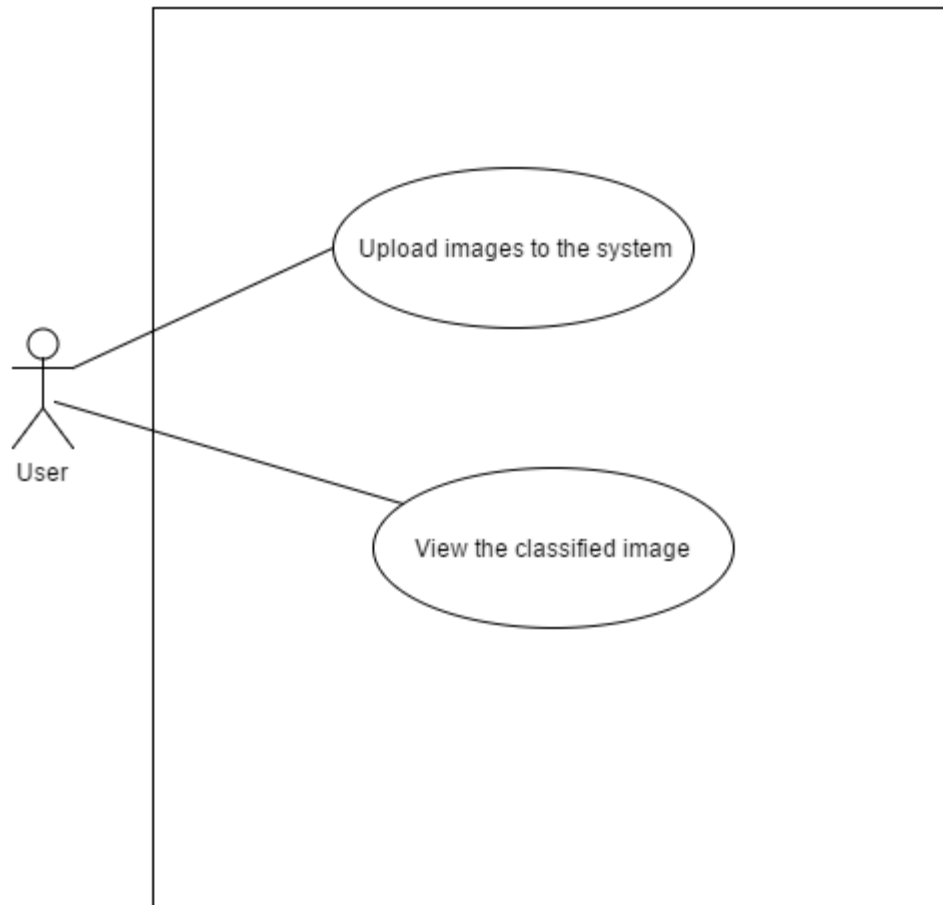


Figure 2.2.3 Use case scenario

### Use case scenario

Use case 01	Upload images to the system
Primary Actor(s)	User
Pre-Condition	Images should be related to vacation/tourism related images
Post-Condition	Uploaded image should be display in the interface.
Main Scenario	1. Start with opening the application

	<ol style="list-style-type: none"> <li>2. User click on the browse image button</li> <li>3. Select image and click OK button.</li> </ol>
Extensions	If user input a different file to the system, system will display an error message

*Table 2.2.1 Use case scenario1*

Use case 02	View the classified image
Primary Actor(s)	User
Pre-Condition	Images should be related to vacation/tourism related images
Post-Condition	Uploaded image should be display in the interface
Main Scenario	<ol style="list-style-type: none"> <li>1. Start with opening the application</li> <li>2. User click on the browse image button</li> <li>3. Select image and click OK button.</li> <li>4. User click “Apply Classification” button</li> </ol>
Extensions	If user input a different file to the system, system will display an error message

*Table 2.2.2 Use case scenario2*

## **2.3 User characteristics**

1. Computer users
2. Software professionals

## **2.4 Constraints**

- User must have an Internet connection.
- This algorithm is only considered about the images related to travel and tourism.
- This algorithm will operate on PCs running on Windows 7 or later at a minimum speed of 2.2GHZ

## **2.5 Assumptions and dependencies**

- User has an average speed of computer and good Internet connection.
- User inputs are only vacation/ tourism related images.

## **2.6 Apportioning of requirements**

### Essential Requirement

1. Allow user to upload images to be classified
2. User upload images should be segmented.

### Desirable Requirements

1. Use this algorithm as a web service for the travelling/tourism related applications for get the user preferences and suggest the places where user wish to visit.

### Optional Requirements

1. Connect with social profiles, check the contents and suggest the places according to their desires.



### 3 Specific requirements

#### 3.1 External interface requirements

##### 3.1.1 User interfaces

Figure 2.1.2.1 Interface1

Name of the item	“Upload images” button
Description of purpose	Pop up a new window to browse images from the computer
Source of input or destination of output	Mouse point
Valid range, accuracy and/or tolerance	N/A
Units of measure	No
Timing	No
Relationships to other inputs/outputs	No
Screen formats/organization	Bottom left
Window formats/organization	Left of screen
Data formats	N/A

Table 3.1.1.1 User interface details for figure 2.1.2.1

##### **3.1.2 Hardware interfaces**

- Core i3 processor required in order to process the large amount of images.

##### **3.1.3 Software interfaces**

- Python 2.7 -  
Main environment for building the algorithms
- MySQL -  
To storing the sample images in the database

- MATLAB -

To check the algorithms are working properly or not.

### 3.1.4 Communication interfaces

Users must have good Internet connection. Therefore a modem or wifi router is required.

## 3.2 Classes/Objects

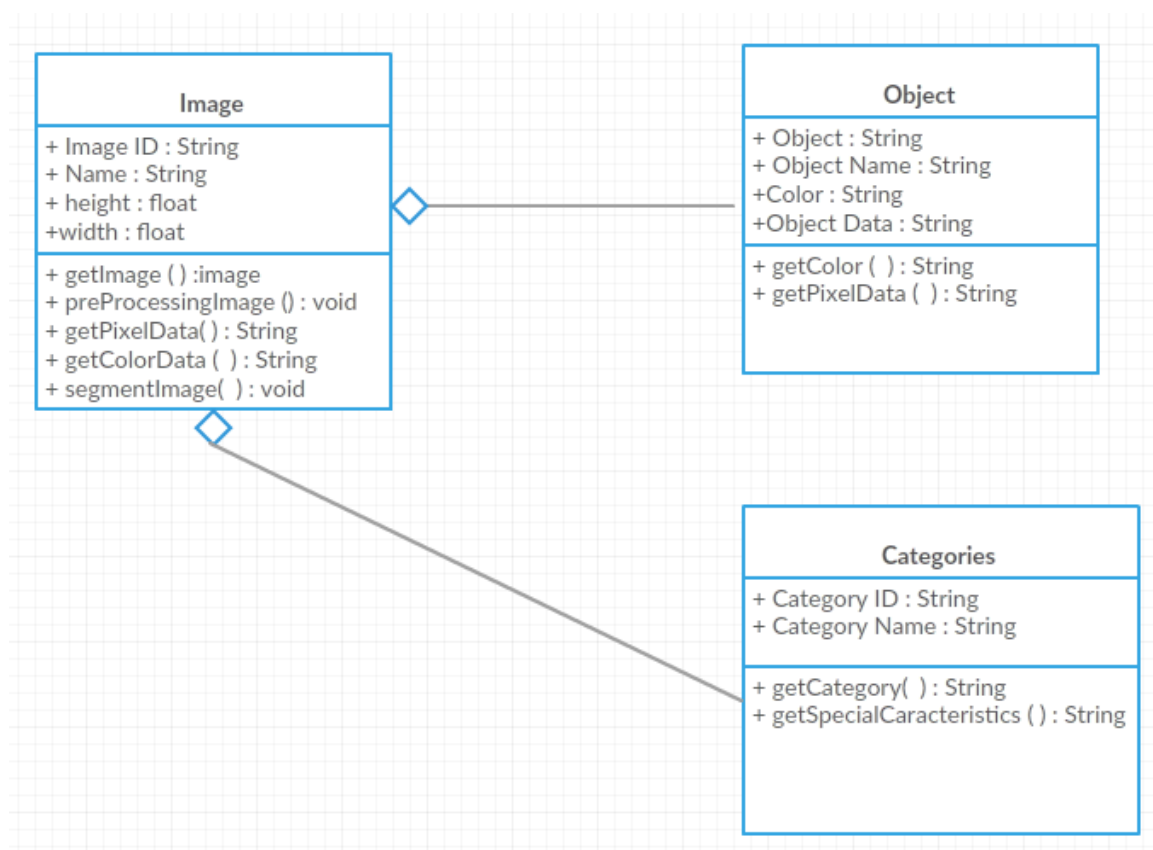


Figure 3.2.1 Class Diagram

## 3.3 Performance requirements

- Since this algorithm needs more processing power, the system will require at least 2GB RAM
- The processor speed should be at least 2.2 GHZ.

### **3.4 Design constraints**

Since we are developing an algorithm for image segmentation, we do not want design interfaces for now. After developed this algorithm we could use it for various applications.

### **3.5 Software system attributes**

#### **3.5.1 Reliability**

This algorithm should be able to segment images accurately.

#### **3.5.2 Availability**

This system should be available for any web user and they must have a proper Internet connection for maintaining availability.

#### **3.5.3 Security**

When user closed the application, uploaded images must be removed from the system. Because it is not ethical to keep users images and when they uploaded an image to the system that image must be secured from external people.

#### **3.5.4 Maintainability**

The system should be able to classify the images properly after the maintenance has done and updated categories and need to be classified and give correct output.

### **3.6 Other requirements**

- User friendly -

User can easily upload images to the system and the predicted results should be displayed in well formed.

- Modifiability-

The proposed system should be able to accept modifications.

## **4 Supporting information**

### **4.1 References**

- [1] Toru Tamaki, Tsuyoshi Yamamura and Noboru Ohnishi: “Image segmentation and object extraction based on geometric features of regions”, Part of IS&T/SPIE Conf. on VCIP'99, SPIE Vol.3653, Part Two, pp.937{945 (1999 1)
- [2] Linda G. Shapiro and George C. Stockman (2001): “Computer Vision”, pp 279-325, New Jersey, Prentice-Hall, ISBN 0-13-030796-3