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CENG 407

SOFTWARE REQUIREMENTS SPECIFICATION (SRS)

BLOOD VESSEL SEGMENTATION IN EYE ANGIOGRAM IMAGE

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1. INTRODUCTION

1.1 Purpose

This document provides detailed information about the requirements of blood vessel segmentation software. It will explain the purpose and features of the proposed method, the working principles of this method and the general information about the difference of the proposed method from previous studies. This document is intended for both stakeholders and developers who are working on such work.

1.2 Scope of the Project

This project's main purpose is to segment blood vessels in eye angiographic images therefore, primary objective is to reduce the effort spent by the doctor to detect eye diseases. However, the area of use is not limited to medical field alone instead; proposed method can also be used to detect rivers in satellite images for military purposes or geologic analyses. Another application for this method is the crack detection in images including tunnels or concrete walls.

1.2.1 Benefits

The developed method provides the segmentation of the blood vessels in these images by looking at eye angiogram images to help the medical science. The purpose of this method is to prevent the occurrence of any problems in the vessels by determining the blood vessels that cannot be seen by the human eye through computer technology.

1.3 Glossary

Term	Definition
Angiogram Image	The film or image of the blood vessels
Segmentation	Division into separate parts or sections
Feature Extraction	Transformation of input data into a set of features. Features are distinctive properties of input patterns that help in differentiating between the categories of input patterns.

1.4 References

[1] IEEE. "*IEEE Std 830-1998 IEEE Recommended Practice for Software Requirements Specifications".* IEEE Computer Society. October 20, 1998.

1.5 Overview of the Document

In the remainder of this document, the specifications of actors and stakeholders and their interaction with the developed method are presented. It describes the definition and properties of the method and its application. The constraints and risks of this method are mentioned. Details of the requirements for developing this method are described.

2. OVERALL DESCRIPTION

2.1 Product Perspective

The software described in this SRS allows the exact location of the blood vessels in these images by looking at the angiogram images of the eye. If the system is generally software based, a hardware tool is needed to determine eye angiogram images. But the segmentation process is software based. The purpose of the proposed segmentation method is to increase the segmentation success rate obtained in previous studies. This system allows all blood vessels in the eye to be identified, including blood vessels not visible to the human eye. In this case, an expert of this topic about the vessels in the eye can easily interpret or treat. In addition, in future levels, looking at these segmented vessels, eye disease may be detected according to certain criteria.

2.2 User Characteristics

Expectation from the participants should have knowledge about the topics and concepts related to computer science and medical science, and have information about previous work on segmentation.

2.3 Constraints

There are no constraints. // To be thought later.

2.4 Risks

In this project, low quality images or the images that belongs to the patients whose have advanced macular degeneration or diabetic retinopathy will be hard to perform segmentation since vast majority of the vessel view will be blocked by either leaked blood or noise. Therefore, output images will have poor accuracy thus it'll be much harder for the doctor to diagnose the disease.

2.5 Assumptions

Images segmented by this project will have decently higher accuracy compared to other amateur methods and method used in this project can also be used to crack detection.

3. REQUIREMENTS

3.1 Specific Requirements

3.1.1 System Interfaces

To do

3.1.2 Hardware Interfaces

To do

3.1.3 Software Interfaces

To do

3.1.4 Communications Interfaces

To do

3.2 Functional Requirements

Requirements	Descriptions
FR01	User shall be able to upload angiographic images to the software.
FR02	User shall be able to change color scheme of the segmented vessel structure.
FR03	User shall be able to save segmented image to specific location under the same computer.

3.3 Non-Functional Requirements

3.3.1 Performance

Requirements	Descriptions
P01	Segmentation process shall take no more than 5 minutes.
P02	Accuracy percentage of the output image shall be higher than %60.

3.3.2 Usability

Requirements	Descriptions
U01	Software shall accept image formats of .jpg and .png
U02	Software shall be able to maintain any size of image.

4. UML ANALYSIS MODEL

4.1 Use Cases

4.1.1 Actor(s)

User: User is a person who uploads the images in the form necessary for segmentation of the system developed for blood vessel segmentation. User can perform any necessary operations according to the function of the button by selecting any of the accessible features or buttons in the system, such as segmenting the image or showing results obtained and recording these results.

4.1.2 Stakeholder(s)

Project Advisor: The project advisor is responsible for delivering the project on time and on a given budget. They usually work together and guide the team that develops the project so that the goals in the project can be fulfilled correctly.

The Project Manager's goals are;

- To follow the project and check if it is done as requested.
- To ensure that the risks and problems are properly handled.
- Working with the group to motivate them and give the necessary support.

Project Development Team: It is a team of people who design the project given by the project advisor according to the desired characteristics and who play an active role in the project by working together within the project.

The Project Development Team's goals are;

- To make the project timely and correctly.
- To be able to complete the project in accordance with the quality and rules as much as possible.
- To obtain high accuracy and low computational time as segmentation results.

Doctor: Doctor is the person who wants the project and will use it after the project is done. It is the person who guides to the project development team with project advisor about the necessary progresses of the project and how the project should be.

The Doctor’s goals are;

- To use provided method and software for better and faster disease diagnosis.

4.1.3 Use Case Diagram

Figure 1 presents a use case diagram for the subject blood vessel segmentation system. The system shows the operations that end users can perform.

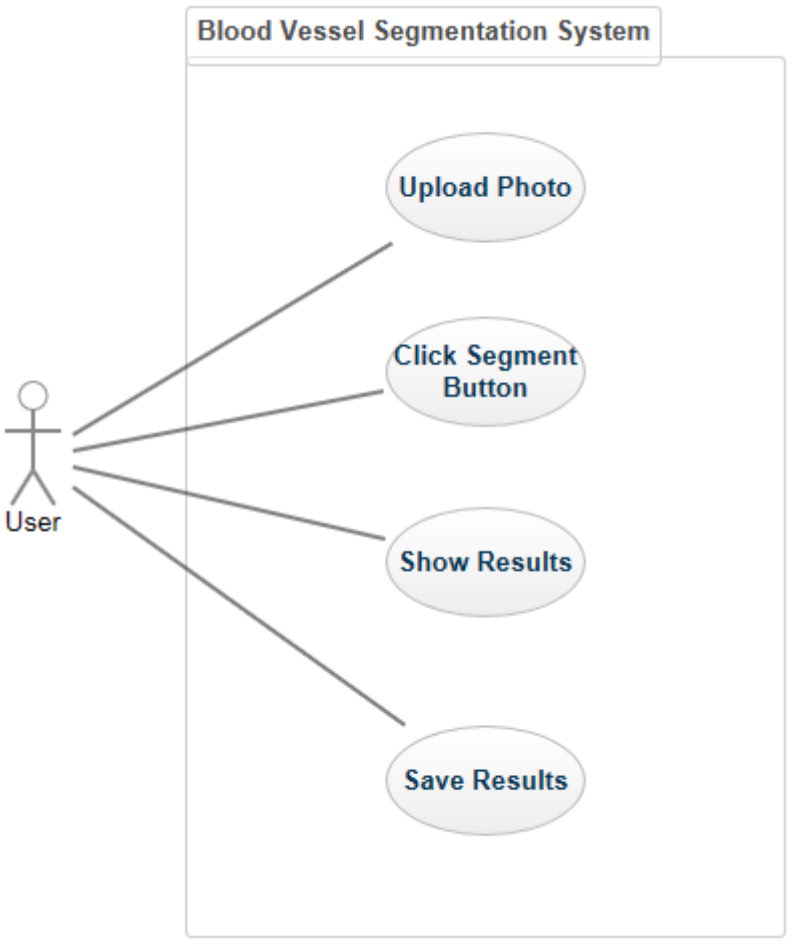

Figure 1 Blood Vessel Segmentation System Use Case Diagram

4.1.3.1 Brief Description of Use Case Diagram

After opening the software, the process begins with the "Upload Photo" use case. This is the step where user uploads the image into the software to start segmentation process. After the image is loaded, user will start the segmentation process. Clicking the "Segment" button will trigger the segmentation method to start and generate couple of detailed images which are either binarized or normalized. The use case "Show Results" will now allow the user to see segmented image and its accuracy or specificity results. With the results the user can decide if the segmented image is useful for his/her diagnosis or not. "Save Results" use case allows user to save the output image to specific location.

4.1.4 Use Case Descriptions

Use Case	Upload Photo
Primary Actor	User
Goal In Context	Loading the image into the software to be processed.
Preconditions	None

Trigger	None
Scenario	User selects an angiographic image that belongs to a patient and loads it into the software to be processed.
Exceptions	Wrong format or poor quality image is selected to load.

Table 1 Upload Photo Use Case Description

Use Case	Click Segment Button
Primary Actor	User
Goal In Context	Start segmentation process.
Preconditions	An angiographic image shall be loaded into the software.
Trigger	User clicking the "Segment" button.
Scenario	User wants to see segmentation results.
Exceptions	None

Table 2 Click Segment Button Use Case Description

Use Case	Show Results
Primary Actor	User
Goal In Context	Viewing the segmentation results such as accuracy and specificity.
Preconditions	None
Trigger	User clicking the "Show Results" button.
Scenario	User wants to view results and diagnose the state of the patient.
Exceptions	Process failure due to poor quality of the image.

Table 3 Show Results Use Case Description

Use Case	Save Results
Primary Actor	User
Goal In Context	Saving the output image.
Preconditions	Success of the segmentation process.
Trigger	User clicking the "Save" button.

Scenario	User wants to save output image to diagnose later or for any achieving purpose.
Exceptions	Low memory to save output image on host computer.

Table 4 Save Results Use Case Description

4.2 Activity Diagrams

4.2.1 Class Descriptions

//To do

4.3 State Chart Diagrams

//To do