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Test Plan, Test Design Specifications and Test Cases

Version 1

CENG 408

Innovative System Design and Development II

DETECTION OF OBSTRUCTIONS IN THE VESSELS IN FUNDUS IMAGES

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1. INTRODUCTION

1.1 Version Control

Table 1 Version Control

Version No	Description of Changes	Date
1.0	First Version	Mar 13, 2018

1.2 Overview

The use case of Detection of Obstructions in the Vessels in Fundus Images system users namely participant and admin which had been determined in SRS document will be tested.

1.3 Scope

This document encapsulates the test plan of the use cases, test design specifications and the test cases correspond to test plan.

1.4 Terminology

Table 2 Terminology

Acronym	Definition
GUI	Graphical User Interface (GUI)
SP	Segmentation Process
EDP	Emboli Detection Process

2. FEATURES TO BE TESTED

This section lists and gives a brief description of all the major features to be tested. For each major feature there will be a Test Design Specification added at the end of this document.

2.1 Graphical User Interface (GUI)

In project, graphical user interface components are used. The GUI has only one major part which is the Main Menu and its divided into sub parts. Those sub parts include three buttons which consist of Find Emboli Button (Congestion), Upload Image Button, Change Markings Button and finally Save Results Button and one image display area where end user (ophthalmologist) can analysis operation results.

2.2 Segmentation Process (SP)

The segmentation process is a helper process for the main operation, emboli detection. This process is used for extracting the vessel locations and therefore increasing the main operation's accuracy. Testing of the stated requirements will occur in this document.

2.3 Emboli Detection Process (EDP)

The emboli detection process is the main operation of our software. After the segmentation process is done, emboli detection process uses the extracted vessel skeleton to identify whether the detected emboli is inside one of the vessels or not and marks congestion spots according to the desired marking shape and color. Testing of the stated requirements will occur in this document.

3. ITEM PASS/FAIL CRITERIA

3.1 Exit Criteria

- 100% of the test cases are executed
- 100% of the test cases passed
- All High and Medium Priority test cases passed

4. REFERENCES

[1] GroupP201709_SRS_V2.0, March 13, 2018
[2] GroupP201709_SDD_V2.0, March 13, 2018

5. TEST DESIGN SPECIFICATIONS

5.1 Graphical User Interface (GUI)

5.1.1 Upload Image Button (GUI.UPLIMG_BTN)

Participant can upload image with a DICOM format by selecting the “Upload Image” button.

5.1.2 Find Emboli (Congestion) Button (GUI.FIND_BTN)

Participant can detect occurrences of retinal emboli by selecting the “Find Emboli” button.

5.1.3 Customize Markings Button (GUI.MARK_BTN)

Participant can display marking customization options by selecting the “Customize Markings” button.

5.1.3.1 Change Shape Button (GUI.MARKSHP_BTN)

Participant can change shape of the markings by selecting the “Change Shape” button.

5.1.3.2 Change Color Button (GUI.MARKCLR_BTN)

Participant can change color of the markings by selecting the “Change Color” button.

5.1.4 Save Results Button (GUI.SAVE_BTN)

Participant can save the results by selecting the “Save Results” button.

5.1.5 Image Display Area (GUI.IMDISP)

System displays initial and modified image here.

5.1.6 Results Display Area Button (GUI.RESDISP)

System displays results of the image processing operations and various warning messages here.

5.1.7 Test Cases

Here list all the related test cases for this feature

Table 3 Test Cases

TC ID	Requirements	Priority	Scenario Description
GUI.UPLIMG_BTN.01	3.3.5	M	Select “Upload Image” button, after selecting system browser will be displayed.

Table 4 Test Cases

TC ID	Requirements	Priority	Scenario Description
GUI.FIND_BTN.01	3.1.1	M	Select “Fınd Congestion” button, after selecting main image processin operation will start.

Table 5 Test Cases

TC ID	Requirements	Priority	Scenario Description
GUI.MARK_BTN.01	3.2	M	Select “Change Shape” button, after selecting system displays various geometric shapes for the selection.
GUI.MARK_BTN.02	3.2	M	Select “Change Color” button, after selecting system displays various colors for the selection.

Table 6 Test Cases

TC ID	Requirements	Priority	Scenario Description
GUI.SAVE_BTN.01	3.1.1	M	Select “Save Results” button, after selecting system displays system browser for the save location selection.

Table 7 Test Cases

TC ID	Requirements	Priority	Scenario Description
GUI.IMDISP.01	3.1.1	L	Image is uploaded.

Table 8 Test Cases

TC ID	Requirements	Priority	Scenario Description
GUI.RESDISP.01	3.1.1	L	Image processing operations result and warning messages are displayed.

5.2 Segmentation Process (SP)

5.2.1 Performance Evaluation (True Positive Fraction) (SP.PE_TPF)

System tests true-positive fraction (TPF) value for the segmentation process with the equation: TPF = TP/TP+FN where TP denotes true positive and FN denotes false negative.

5.2.2 Performance Evaluation (False Positive Fraction) (SP.PE_FPF)

System tests false-positive fraction (FPF) value for the segmentation process with the equation: FPF = FP/FP+TN where FP denotes false positive and TN denotes true negative.

5.2.3 Performance Evaluation (Accuracy) (SP.PE_ACC)

System tests the accuracy value for the segmentation operation with dividing the TPF value to total number of pixels in the image.

5.2.4 Performance Evaluation (Time) (SP.PE_TIME)

System tests the process time taken for each of the image inside the DRIVE dataset and calculates an average computational time.

5.2.5 Test Cases

Here list all the related test cases for this feature

Table 9 Test Cases

TC ID	Requirements	Priority	Scenario Description
SP.PE_TPF.01	3.3.1	H	After the segmentation process TPF value must indicate %85 of the total pixels.

Table 10 Test Cases

TC ID	Requirements	Priority	Scenario Description
SP.PE_FPF.01	3.3.1	H	After the segmentation process FPF value must indicate %10 of the total pixels

Table 11 Test Cases

TC ID	Requirements	Priority	Scenario Description
SP.PE_ACC.01	3.3.1	H	After the segmentation process accuracy value must be at least 85%.

Table 12 Test Cases

TC ID	Requirements	Priority	Scenario Description
SP.PE_TIME.01	3.3.1	H	After the each segmentation process average time spent must be under a second.

5.3 Emboli Detection Process (EDP)

5.3.1 Performance Evaluation (EDP.PE)

System compares detected emboli occurrences with the ground truth to check whether the detected congestions are actually congestion spots or not.

5.3.2 Test Cases

Here list all the related test cases for this feature

Table 13 Test Cases

TC ID	Requirements	Priority	Scenario Description
EDP.PE.01	3.3.1	H	All congestion spots must be detected less than 3 minutes.

6. Detailed Test Cases

6.1 GUI.UPLIMG_BTN.01

Table 14 GUI.UPLIMG_BTN.01

TC_ID	GUI.UPLIMG_BTN.01
Purpose	Upload a DICOM image.
Requirements	3.3.5
Priority	Medium.
Estimated Time Needed	< 1 Minutes.
Dependency	None.
Setup	A DICOM image should exist in host computer.
Procedure	[A01] Click “Upload Image” button.
	[V01] System displays system browser panel.
	[A02] User selects an image.
	[A03] Click on the “Select” button.
	[V02] System displays selected image.
Cleanup	New image.

6.2 GUI.FIND_BTN.01

Table 15 GUI.FIND_BTN.01

TC_ID	GUI.FIND_BTN.01
Purpose	Start the main process.
Requirements	3.1.1
Priority	Medium.
Estimated Time Needed	< 1 minutes.
Dependency	None.
Setup	DICOM image should be loaded to the software.
Procedure	[A01] Click on the “Find Congestion” button.
	[V01] Observe that the operation is successful and the results displayed.
Cleanup	New image.

6.3 GUI.MARK_BTN.01

Table 16 GUI.MARK_BTN.01

TC_ID	GUI.MARK_BTN.01
Purpose	Selecting shape of the mark.
Requirements	3.2
Priority	Medium.
Estimated Time Needed	< 1 minutes.
Dependency	None.
Setup	None.
Procedure	[A01] Click on the “Change Shape” button.
	[V01] Geometrical shape list appears.
	[A02] Select a shape.
	[V02] Observe that the selection applied and confirmation message appears.
Cleanup	Close Customize Markings menu.

6.4 GUI.MARK_BTN.02

Table 17 GUI.MARK_BTN.02

TC_ID	GUI.MARK_BTN.02
Purpose	Selecting color of the mark.
Requirements	3.2
Priority	Medium.
Estimated Time Needed	< 1 minutes.
Dependency	None.
Setup	None.
Procedure	[A01] Click on the “Change Color” button.
	[V01] Color list appears.
	[A02] Select a color.
	[V02] Observe that the selection applied and confirmation message appears.
Cleanup	Close Customize Markings menu.

6.5 GUI.SAVE.01

Table 18 GUI.SAVE.01

TC_ID	GUI.SAVE.01
Purpose	Saving operation results.
Requirements	3.1.1
Priority	Medium.
Estimated Time Needed	< 2 minutes.
Dependency	Find congestion and Segmentation process test cases should pass.
Setup	Find congestion operation should be finished.
Procedure	[A01] Click on the “Save Results” button.
	[V01] System browser appears.
	[A02] Select a save location.
	[V02] Observe that the save operation is successful and system browser disappears.
Cleanup	Close system browser.

6.6 GUI.IMDISP.01

Table 19 GUI.IMDISP.01

TC_ID	GUI.IMDISP.01
Purpose	Display the uploaded image.
Requirements	3.1.1
Priority	Low.
Estimated Time Needed	< 1 minutes.
Dependency	None.
Setup	An image should be uploaded.
Procedure	[A01] Go to upload image menu.
	[A02] Select an image.
	[A03] Click upload button.
	[V01] Observe that the image is displayed properly.
Cleanup	None.

6.7 GUI.RESDISP.01

Table 20 GUI.RESDISP.01

TC_ID	GUI.RESDISP.01
Purpose	Display the results.
Requirements	3.1.1
Priority	Low.
Estimated Time Needed	< 1 minutes.
Dependency	Find congestion and Segmentation process test cases should pass
Setup	Find Congestion operation should be started.
Procedure	[A01] Start Find Congestion Process.
	[V01] Observe that the results are displayed properly.
Cleanup	None.

6.8 SP.PE_TPF.01

Table 21 SP.PE_TPF.01

TC_ID	SP.PE_TPF.01
Purpose	Extracting the vessel skeleton.
Requirements	3.3.1
Priority	High.
Estimated Time Needed	< 1 Minutes.
Dependency	None.
Setup	An image should be uploaded and the “Find Congestion” button is pressed.
Procedure	[A01] Click on “Find Congestion” button.
	[V01] System starts segmentation.
	[V02] Vessel skeleton is extracted.
	[V03] Observe that the segmentation operation is successful and the performance values are adequate.
Cleanup	None.

6.9 SP.PE_FPF.01

Table 22 SP.PE_FPF.01

TC_ID	SP.PE_FPF.01
Purpose	Extracting the vessel skeleton.
Requirements	3.3.1
Priority	High.
Estimated Time Needed	< 1 Minutes.
Dependency	None.
Setup	An image should be uploaded and the “Find Congestion” button is pressed.
Procedure	[A01] Click on “Find Congestion” button.
	[V01] System starts segmentation.
	[V02] Vessel skeleton is extracted.
	[V03] Observe that the segmentation operation is successful and the performance values are adequate.
Cleanup	None.

6.10 SP.PE_ACC.01

Table 23 SP.PE_ACC.01

TC_ID	SP.PE_ACC.01
Purpose	Extracting the vessel skeleton.
Requirements	3.3.1
Priority	High.
Estimated Time Needed	< 1 Minutes.
Dependency	None.
Setup	An image should be uploaded and the “Find Congestion” button is pressed.
Procedure	[A01] Click on “Find Congestion” button.
	[V01] System starts segmentation.
	[V02] Vessel skeleton is extracted.
	[V03] Observe that the segmentation operation is successful and the performance values are adequate.
Cleanup	None.

6.11 SP.PE_TIME.01

Table 24 SP.PE_TIME.01

TC_ID	SP.PE_TIME.01
Purpose	Extracting the vessel skeleton.
Requirements	3.3.1
Priority	High.
Estimated Time Needed	< 1 Minutes.
Dependency	None.
Setup	An image should be uploaded and the “Find Congestion” button is pressed.
Procedure	[A01] Click on “Find Congestion” button.
	[V01] System starts segmentation.
	[V02] Vessel skeleton is extracted.
	[V03] Observe that the segmentation operation is successful and the performance values are adequate.
Cleanup	None.

6.12 EDP.PE.01

Table 25 EDP.PE.01

TC_ID	EDP.PE.01
Purpose	Finding retinal emboli occurrences.
Requirements	3.3.1
Priority	High.
Estimated Time Needed	3 Minutes.
Dependency	Segmentation process test case should pass
Setup	Segmentation process should be finished.
Procedure	[V01] Segmentation process finishes.
	[V02] System starts congestion detection process.
	[V03] System evaluates performance results.
	[V04] Observe that the performance values are adequate.
Cleanup	None.