Module Interface Specification for IFDS

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1 Revision History

Date	Version	Notes
Mar.24, 2024	1.0	Initial Version
April.12, 2024	2.0	Second revision

2 Symbols, Abbreviations and Acronyms

symbol	description
AC	Anticipated Change
DAG	Directed Acyclic Graph
DoG	Differential of Gaussian Transform of
G(x)	Gaussian Transform or Guassian Filtering of Image x
GoI	Gradients of Image
GUI	Graphical User Interface
I(x)	Image x
IFDS	Image Features Detection System
L(x)	Laplacian Transform
LoG	Laplacian Transform of Gaussian Transform of
Mat	Matrix
M	Module
MG	Module Guide
MIS	Module Interface Specification
OS	Operating System
R	Requirement
SC	Scientific Computing
SIFT	Scale Invariant Feature Transform
SRS	Software Requirements Specification
UC	Unlikely Change

Contents

3 Introduction

The following document details the Module Interface Specifications for Image Features Detection System(IFDS)

Complementary documents include the System Requirement Specifications and Module Guide. The full documentation and implementation can be found at ,https://github.com/Zhou4truth/imageFeatureDetection.

4 Notation

The structure of the MIS for modules comes from Hoffman and Strooper (1995), with the addition that template modules have been adapted from Ghezzi et al. (2003). The mathematical notation comes from Chapter 3 of Hoffman and Strooper (1995). For instance, the symbol := is used for a multiple assignment statement and conditional rules follow the form $(c_1 \Rightarrow r_1 | c_2 \Rightarrow r_2 | ... | c_n \Rightarrow r_n)$.

The following table summarizes the primitive data types used by .

Data Type	Notation	Description
character	char	a single symbol or digit
integer	$\mathbb{Z}$	a number without a fractional component in $(-\infty, \infty)$
natural number	$\mathbb{N}$	a number without a fractional component in $[1, \infty)$
real	$\mathbb{R}$	any number in $(-\infty, \infty)$

The specification of uses some derived data types: sequences, strings, and tuples. Sequences are lists filled with elements of the same data type. Strings are sequences of characters. Tuples contain a list of values, potentially of different types. In addition, uses functions, which are defined by the data types of their inputs and outputs. Local functions are described by giving their type signature followed by their specification.

5 Module Decomposition

The following table is taken directly from the Module Guide document for this project.

Level 1	Level 2
Hardware-Hiding Module	
Behaviour-Hiding Module	Input Module Output Module Control Module
Software Decision Module	Feature Detection Module

Table 1: Module Hierarchy

6   MIS of Control Module

6.1   Module

GUI

6.2   Uses

Control the input and output and different operations.

6.3   Syntax

6.3.1   Exported Access Programs

IFDS software installable format.

Name	In	Out	Exceptions
.msi	-	For windows	-
MFC-Dialog	-	-	-

6.4   Semantics

6.4.1   State Variables

m_OriginalImage: the original image imported by users.
m_GrayImage: the grayscale image transformed from original image.
m_ModifiedImage: the image modified for displaying.

6.4.2   Assumptions

Try to minimize assumptions and anticipate programmer errors via exceptions, but for practical purposes assumptions are sometimes appropriate.

6.4.3   Access Routine Semantics

OnClickedButtonImport();
OnClickedButtonCorner();
OnClickedButtonEdge();
OnClickedButtonBrisk();
OnClickedButtonExport();
OnClickedButtonClose()

7 MIS of Input Module

7.1 Module

Input

7.2 Uses

To process the input images and judge if these inputs are available to be processed within this system.

7.3 Syntax

7.3.1 Exported Access Programs

Preprocessed images that will be continued to the feature detection algorithm module.

Name	In	Out	Exceptions
cv::imread()	RGB image	m_GrayImage	-
DisplayImage()	m_OriginalImage	m_OriginalImage, m_GrayImage	-

7.4 Semantics

7.4.1 State Variables

m_OriginalImage: the original image imported by users.
m_GrayImage: the grayscale image transformed from original image.
m_ModifiedImage: the image modified for displaying.

7.4.2 Assumptions

Here, After the image was imported, the system will tranform it into grayscale image automatically.
DisplayImage() will display both the original and the grayscale image on the GUI.

7.4.3 Access Routine Semantics

cv::imread(filename:stdStr)

8 MIS of Output module

8.1 Module

Output

8.2 Uses

Display the feature points on the grayscale image and export the feature points image according to user's opinion.

8.3 Syntax

8.3.1 Exported Access Programs

Name	In	Out	Exceptions
onClickedButtonImport()	m_OriginalImage	m_GrayImage	-
OnClickedButtonCorner()	m_GrayImage	DisplayImage(corner points)	-
OnClickedButtonEdge()	m_GrayImage	DisplayImage(edge points)	-
OnClickedButtonBrisk()	m_GrayImage	DisplayImage(BRISK points)	-
OnClickedButtonExport	m_GrayImage	corner points	
		edge points	-
		BRISK points	-

8.4 Semantics

8.4.1 State Variables

m_OriginalImage: the original image imported by users.
m_GrayImage: the grayscale image transformed from original image.
m_ModifiedImage: the image modified for displaying.

8.4.2 Environment Variables

The MFC framwork.

8.4.3 Access Routine Semantics

OnClickedButtonImport();
OnClickedButtonCorner();
OnClickedButtonEdge();
OnClickedButtonBrisk();
OnClickedButtonExport();

OnClickedButtonClose()

9 MIS of Feature Detection Module

9.1 Module

Detection Algorithms.

9.2 Uses

To do feature detection as the user asked.

9.3 Syntax

9.3.1 Exported Access Programs

Name	In	Out	Exceptions
OnClickedButtonImport()	m_OriginalImage	DisplayImage()	-
OnClickedButtonCorner()	m_GrayImage	DisplayImage()	-
OnClickedButtonEdge()	m_GrayImage	DisplayImage()	-
OnClickedButtonBrisk();	m_GrayImage	DisplayImage()	-

9.4 Semantics

9.4.1 State Variables

m_OriginalImage: the original image imported by users.
m_GrayImage: the grayscale image transformed from original image.
m_ModifiedImage: the image modified for displaying.

9.4.2 Assumptions

Only selected features can be displayed.

9.4.3 Access Routine Semantics

OnClickedButtonImport();
OnClickedButtonCorner();
OnClickedButtonEdge();
OnClickedButtonBrisk();

OnClickedButtonExport();
OnClickedButtonClose()

References

Carlo Ghezzi, Mehdi Jazayeri, and Dino Mandrioli. *Fundamentals of Software Engineering.* Prentice Hall, Upper Saddle River, NJ, USA, 2nd edition, 2003.

Daniel M. Hoffman and Paul A. Strooper. *Software Design, Automated Testing, and Maintenance: A Practical Approach.* International Thomson Computer Press, New York, NY, USA, 1995. URL http://citeseer.ist.psu.edu/428727.html.