

# Module Interface Specification for Image Feature Correspondences for Camera Calibration

Kiran Singh

March 14, 2025

# 1 Revision History

Date	Version	Notes
2025-03-19	1.0	Initial Release

## 2 Symbols, Abbreviations and Acronyms

See SRS Documentation at <https://github.com/KiranSingh15/CAS-741-Image-Correspondences/blob/main/docs/SRS/SRS.pdf>.

[Also add any additional symbols, abbreviations or acronyms —SS]

# Contents

<b>1</b>	<b>Revision History</b>	<b>i</b>
<b>2</b>	<b>Symbols, Abbreviations and Acronyms</b>	<b>ii</b>
<b>3</b>	<b>Introduction</b>	<b>1</b>
<b>4</b>	<b>Notation</b>	<b>1</b>
<b>5</b>	<b>Module Decomposition</b>	<b>1</b>
<b>6</b>	<b>MIS of Input Format Module</b>	<b>3</b>
6.1	Module . . . . .	3
6.2	Uses . . . . .	3
6.3	Syntax . . . . .	3
6.3.1	Exported Constants . . . . .	3
6.3.2	Exported Access Programs . . . . .	3
6.4	Semantics . . . . .	3
6.4.1	State Variables . . . . .	3
6.4.2	Environment Variables . . . . .	3
6.4.3	Assumptions . . . . .	4
6.4.4	Access Routine Semantics . . . . .	4
6.4.5	Local Functions . . . . .	4
<b>7</b>	<b>MIS of Specification Parameters Module</b>	<b>4</b>
7.1	Module . . . . .	5
7.2	Uses . . . . .	5
7.3	Syntax . . . . .	5
7.3.1	Exported Constants . . . . .	5
7.3.2	Exported Access Programs . . . . .	5
7.4	Semantics . . . . .	6
7.4.1	State Variables . . . . .	6
7.4.2	Environment Variables . . . . .	6
7.4.3	Assumptions . . . . .	7
7.4.4	Access Routine Semantics . . . . .	7
7.4.5	Local Functions . . . . .	8
<b>8</b>	<b>MIS of Output Format Module</b>	<b>8</b>
8.1	Module . . . . .	8
8.2	Uses . . . . .	8
8.3	Syntax . . . . .	8
8.3.1	Exported Constants . . . . .	8
8.3.2	Exported Access Programs . . . . .	8

8.4	Semantics . . . . .	8
8.4.1	State Variables . . . . .	8
8.4.2	Environment Variables . . . . .	8
8.4.3	Assumptions . . . . .	8
8.4.4	Access Routine Semantics . . . . .	9
8.4.5	Local Functions . . . . .	9
<b>9</b>	<b>MIS of Output Verification Module</b>	<b>9</b>
9.1	Module . . . . .	9
9.2	Uses . . . . .	9
9.3	Syntax . . . . .	9
9.3.1	Exported Constants . . . . .	9
9.3.2	Exported Access Programs . . . . .	9
9.4	Semantics . . . . .	10
9.4.1	State Variables . . . . .	10
9.4.2	Environment Variables . . . . .	10
9.4.3	Assumptions . . . . .	10
9.4.4	Access Routine Semantics . . . . .	10
9.4.5	Local Functions . . . . .	10
<b>10</b>	<b>MIS of Control Module</b>	<b>10</b>
10.1	Module . . . . .	11
10.2	Uses . . . . .	11
10.3	Syntax . . . . .	11
10.3.1	Exported Constants . . . . .	11
10.3.2	Exported Access Programs . . . . .	11
10.4	Semantics . . . . .	11
10.4.1	State Variables . . . . .	11
10.4.2	Environment Variables . . . . .	11
10.4.3	Assumptions . . . . .	11
10.4.4	Access Routine Semantics . . . . .	11
10.4.5	Local Functions . . . . .	12
<b>11</b>	<b>MIS of Image Smoothing Module</b>	<b>12</b>
11.1	Module . . . . .	12
11.2	Uses . . . . .	12
11.3	Syntax . . . . .	12
11.3.1	Exported Constants . . . . .	12
11.3.2	Exported Access Programs . . . . .	12
11.4	Semantics . . . . .	13
11.4.1	State Variables . . . . .	13
11.4.2	Environment Variables . . . . .	13
11.4.3	Assumptions . . . . .	13

11.4.4	Access Routine Semantics . . . . .	13
11.4.5	Local Functions . . . . .	13
<b>12</b>	<b>MIS of Keypoint Detection Module</b>	<b>13</b>
12.1	Module . . . . .	13
12.2	Uses . . . . .	14
12.3	Syntax . . . . .	14
12.3.1	Exported Constants . . . . .	14
12.3.2	Exported Access Programs . . . . .	14
12.4	Semantics . . . . .	14
12.4.1	State Variables . . . . .	14
12.4.2	Environment Variables . . . . .	14
12.4.3	Assumptions . . . . .	14
12.4.4	Access Routine Semantics . . . . .	14
12.4.5	Local Functions . . . . .	15
<b>13</b>	<b>MIS of Feature Descriptor Module</b>	<b>15</b>
13.1	Module . . . . .	15
13.2	Uses . . . . .	15
13.3	Syntax . . . . .	15
13.3.1	Exported Constants . . . . .	15
13.3.2	Exported Access Programs . . . . .	15
13.4	Semantics . . . . .	15
13.4.1	State Variables . . . . .	15
13.4.2	Environment Variables . . . . .	16
13.4.3	Assumptions . . . . .	16
13.4.4	Access Routine Semantics . . . . .	16
13.4.5	Local Functions . . . . .	16
<b>14</b>	<b>MIS of Feature Matching Module</b>	<b>16</b>
14.1	Module . . . . .	16
14.2	Uses . . . . .	16
14.3	Syntax . . . . .	17
14.3.1	Exported Constants . . . . .	17
14.3.2	Exported Access Programs . . . . .	17
14.4	Semantics . . . . .	17
14.4.1	State Variables . . . . .	17
14.4.2	Environment Variables . . . . .	17
14.4.3	Assumptions . . . . .	17
14.4.4	Access Routine Semantics . . . . .	17
14.4.5	Local Functions . . . . .	17

<b>15 MIS of Image Data Structure Module</b>	<b>18</b>
15.1 Module . . . . .	18
15.2 Uses . . . . .	18
15.3 Syntax . . . . .	18
15.3.1 Exported Constants . . . . .	18
15.3.2 Exported Access Programs . . . . .	18
15.4 Semantics . . . . .	18
15.4.1 State Variables . . . . .	18
15.4.2 Environment Variables . . . . .	18
15.4.3 Assumptions . . . . .	18
15.4.4 Access Routine Semantics . . . . .	18
15.4.5 Local Functions . . . . .	19
<b>16 MIS of Image Plot Module</b>	<b>19</b>
16.1 Module . . . . .	19
16.2 Uses . . . . .	19
16.3 Syntax . . . . .	19
16.3.1 Exported Constants . . . . .	19
16.3.2 Exported Access Programs . . . . .	19
16.4 Semantics . . . . .	19
16.4.1 State Variables . . . . .	19
16.4.2 Environment Variables . . . . .	20
16.4.3 Assumptions . . . . .	20
16.4.4 Access Routine Semantics . . . . .	20
16.4.5 Local Functions . . . . .	20
<b>17 MIS of Feature Match Data Module</b>	<b>20</b>
17.1 Module . . . . .	20
17.2 Uses . . . . .	20
17.3 Syntax . . . . .	21
17.3.1 Exported Constants . . . . .	21
17.3.2 Exported Access Programs . . . . .	21
17.4 Semantics . . . . .	21
17.4.1 State Variables . . . . .	21
17.4.2 Environment Variables . . . . .	21
17.4.3 Assumptions . . . . .	21
17.4.4 Access Routine Semantics . . . . .	21
17.4.5 Local Functions . . . . .	21
<b>18 MIS of Dataframe Structure Module</b>	<b>22</b>
18.1 Module . . . . .	22
18.2 Uses . . . . .	22
18.3 Syntax . . . . .	22

18.3.1	Exported Constants . . . . .	22
18.3.2	Exported Access Programs . . . . .	22
18.4	Semantics . . . . .	22
18.4.1	State Variables . . . . .	22
18.4.2	Environment Variables . . . . .	22
18.4.3	Assumptions . . . . .	22
18.4.4	Access Routine Semantics . . . . .	22
18.4.5	Local Functions . . . . .	23
<b>19</b>	<b>MIS of ORB Data Structure Module</b>	<b>23</b>
19.1	Module . . . . .	23
19.2	Uses . . . . .	23
19.3	Syntax . . . . .	23
19.3.1	Exported Constants . . . . .	23
19.3.2	Exported Access Programs . . . . .	23
19.4	Semantics . . . . .	23
19.4.1	State Variables . . . . .	23
19.4.2	Environment Variables . . . . .	24
19.4.3	Assumptions . . . . .	24
19.4.4	Access Routine Semantics . . . . .	24
19.4.5	Local Functions . . . . .	24
<b>20</b>	<b>MIS of [Module Name —SS]</b>	<b>24</b>
20.1	Module . . . . .	24
20.2	Uses . . . . .	25
20.3	Syntax . . . . .	25
20.3.1	Exported Constants . . . . .	25
20.3.2	Exported Access Programs . . . . .	25
20.4	Semantics . . . . .	25
20.4.1	State Variables . . . . .	25
20.4.2	Environment Variables . . . . .	25
20.4.3	Assumptions . . . . .	25
20.4.4	Access Routine Semantics . . . . .	25
20.4.5	Local Functions . . . . .	26
<b>21</b>	<b>Appendix</b>	<b>27</b>



### 3 Introduction

The following document details the Module Interface Specifications for [Fill in your project name and description —SS]

Complementary documents include the System Requirement Specifications and Module Guide. The full documentation and implementation can be found at .... [provide the url for your repo —SS]

### 4 Notation

[You should describe your notation. You can use what is below as a starting point. —SS]

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

The following table summarizes the primitive data types used by the Image Feature Correspondences for Camera Calibration software.

Data Type	Notation	Description
character	char	a single symbol or digit
boolean	$\mathbb{F}_2$	a number in the binary field, where all elements are $\{0,1\}$
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 Image Feature Correspondences for Camera Calibration 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, Image Feature Correspondences for Camera Calibration 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	
Behaviour-Hiding	Input Parameters Input Format Module Specification Parameters Output Format Module Output Verification Module Control Module Image Smoothing Module Keypoint Detection Module Feature Descriptor Module Feature Matching Module
Software Decision	Sequence Data Structure Image Data Structure Module Image Plot Module Feature Match Data Module Dataframe Structure Module ORB Data Structure Module

Table 1: Module Hierarchy

## 6 MIS of Input Format Module

[You can reference SRS labels, such as R??. —SS]

[It is also possible to use  $\LaTeX$  for hyperlinks to external documents. —SS]

### 6.1 Module

config

### 6.2 Uses

- specParams (Section 7)

### 6.3 Syntax

#### 6.3.1 Exported Constants

#### 6.3.2 Exported Access Programs

Name	In	Out	Exceptions
get_head_directory	-	string	noHeadFound
get_active_functions	-	tuple (user-methods)	-
get_chosen_parameters	-	tuple (user-params)	-
check_limits	tuple (user-params)	-	badKernelSize, badStdDeviation, badFASTThreshold, badBinSize, badPatchSize, badDistThreshold

### 6.4 Semantics

#### 6.4.1 State Variables

[Not all modules will have state variables. State variables give the module a memory. —SS]

#### 6.4.2 Environment Variables

[This section is not necessary for all modules. Its purpose is to capture when the module has external interaction with the environment, such as for a device driver, screen interface, keyboard, file, etc. —SS]

### 6.4.3 Assumptions

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

### 6.4.4 Access Routine Semantics

[accessProg —SS]():

- transition: [if appropriate —SS]
- output: [if appropriate —SS]
- exception: none

check\_limits():

- output: none
- exception: exc:=

$\neg(kernel\_sz < 1)$	$\Rightarrow$ badKernelSize
$\neg(kernel\_sz > 15)$	$\Rightarrow$ badKernelSize
$\neg(kernel\_sz \% 2 \neq 0)$	$\Rightarrow$ badKernelSize
$\neg(0 < std\_deviation < 10)$	$\Rightarrow$ badStdDeviation
$\neg(2 \leq FAST\_threshold \leq 255)$	$\Rightarrow$ badFASTThreshold
$\neg(1 \leq FAST\_threshold \leq 2048)$	$\Rightarrow$ badBinSize
$\neg(5 \leq FAST\_threshold \leq 100)$	$\Rightarrow$ badPatchSize

[A module without environment variables or state variables is unlikely to have a state transition. In this case a state transition can only occur if the module is changing the state of another module. —SS]

[Modules rarely have both a transition and an output. In most cases you will have one or the other. —SS]

### 6.4.5 Local Functions

[As appropriate —SS] [These functions are for the purpose of specification. They are not necessarily something that is going to be implemented explicitly. Even if they are implemented, they are not exported; they only have local scope. —SS]

## 7 MIS of Specification Parameters Module

[You can reference SRS labels, such as R??. —SS]

[It is also possible to use  $\LaTeX$  for hyperlinks to external documents. —SS]

## 7.1 Module

specParams (Section 6)

## 7.2 Uses

None.

## 7.3 Syntax

### 7.3.1 Exported Constants

- *kernel\_sz* := 5
- *std\_deviation* := 1
- *FAST\_threshold* := 15
- *bin\_sz* := 2000
- *patch\_sz* := 31
- *mthd\_img\_smoothing* := 1
- *mthd\_kp\_detection* := 1
- *mthd\_kp\_description* := 1
- *mthd\_ft\_match* := 1

### 7.3.2 Exported Access Programs

Name	In	Out	Exceptions
set_default_parameters	-	$kernel\_sz : \mathbb{Z}$ $std\_deviation : \mathbb{R}$ $FAST\_threshold : \mathbb{Z}$ $bin\_sz : \mathbb{Z}$ $patch\_sz : \mathbb{Z}$	-
set_default_methods	-	$mthd\_img\_smoothing : \mathbb{Z}$ $mthd\_kp\_detection : \mathbb{Z}$ $mthd\_kp\_description : \mathbb{Z}$ $mthd\_ft\_match : \mathbb{Z}$	-
check_limits	$kernel\_sz : \mathbb{Z}$ $std\_deviation : \mathbb{R}$ $FAST\_threshold : \mathbb{Z}$ $bin\_sz : \mathbb{Z}$ $patch\_sz : \mathbb{Z}$	-	badKernelSize, badStdDeviation, badFASTThreshold, badBinSize, badPatchSize, badDistThreshold

## 7.4 Semantics

### 7.4.1 State Variables

$kernel\_sz : \mathbb{Z}$   
 $std\_deviation : \mathbb{R}$   
 $FAST\_threshold : \mathbb{R}$   
 $bin\_sz : \mathbb{Z}$   
 $patch\_sz : \mathbb{Z}$   
 $mthd\_img\_smoothing : \mathbb{Z}$   
 $mthd\_kp\_detection : \mathbb{Z}$   
 $mthd\_kp\_description : \mathbb{Z}$   
 $mthd\_ft\_match : \mathbb{Z}$

### 7.4.2 Environment Variables

[This section is not necessary for all modules. Its purpose is to capture when the module has external interaction with the environment, such as for a device driver, screen interface, keyboard, file, etc. —SS]

### 7.4.3 Assumptions

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

### 7.4.4 Access Routine Semantics

set\_default\_parameters():

- output:
  - $kernel\_sz : \mathbb{Z}$
  - $std\_deviation : \mathbb{R}$
  - $FAST\_threshold : \mathbb{Z}$
  - $bin\_sz : \mathbb{Z}$
  - $patch\_sz : \mathbb{Z}$

- exception: none

set\_default\_methods():

- output:
  - $mthd\_img\_smoothing : \mathbb{Z}$
  - $mthd\_kp\_detection : \mathbb{Z}$
  - $mthd\_kp\_description : \mathbb{Z}$
  - $mthd\_ft\_match : \mathbb{Z}$

- exception: none

check\_limits():

- output: none
- exception: exc:=

$\neg(kernel\_sz < 1)$	$\Rightarrow$ badKernelSize
$\neg(kernel\_sz > 15)$	$\Rightarrow$ badKernelSize
$\neg(kernel\_sz \% 2 \neq 0)$	$\Rightarrow$ badKernelSize
$\neg(0 < std\_deviation < 10)$	$\Rightarrow$ badStdDeviation
$\neg(2 \leq FAST\_threshold \leq 255)$	$\Rightarrow$ badFASTThreshold
$\neg(1 \leq FAST\_threshold \leq 2048)$	$\Rightarrow$ badBinSize
$\neg(5 \leq FAST\_threshold \leq 100)$	$\Rightarrow$ badPatchSize

### 7.4.5 Local Functions

None.

## 8 MIS of Output Format Module

[You can reference SRS labels, such as R??. —SS]

[It is also possible to use  $\LaTeX$  for hyperlinks to external documents. —SS]

### 8.1 Module

formatOutput

### 8.2 Uses

- matchStruct (Section 10)
- dataframeStruct (Section 18)

### 8.3 Syntax

#### 8.3.1 Exported Constants

Not applicable.

#### 8.3.2 Exported Access Programs

Name	In	Out	Exceptions
main	-	-	-

### 8.4 Semantics

#### 8.4.1 State Variables

[Not all modules will have state variables. State variables give the module a memory. —SS]

#### 8.4.2 Environment Variables

[This section is not necessary for all modules. Its purpose is to capture when the module has external interaction with the environment, such as for a device driver, screen interface, keyboard, file, etc. —SS]

#### 8.4.3 Assumptions

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



#### 8.4.4 Access Routine Semantics

[accessProg —SS]():

- transition: Modify the state of the Specification Parameters Module and the environment variables for the Image Plot Module and Dataframe Structure modules through the following steps.
- output: [if appropriate —SS]
- exception: [if appropriate —SS]

[A module without environment variables or state variables is unlikely to have a state transition. In this case a state transition can only occur if the module is changing the state of another module. —SS]

[Modules rarely have both a transition and an output. In most cases you will have one or the other. —SS]

#### 8.4.5 Local Functions

[As appropriate —SS] [These functions are for the purpose of specification. They are not necessarily something that is going to be implemented explicitly. Even if they are implemented, they are not exported; they only have local scope. —SS]

## 9 MIS of Output Verification Module

[You can reference SRS labels, such as R??. —SS]

[It is also possible to use L<sup>A</sup>T<sub>E</sub>X for hyperlinks to external documents. —SS]

### 9.1 Module

verifyOutput

### 9.2 Uses

None.

### 9.3 Syntax

#### 9.3.1 Exported Constants

#### 9.3.2 Exported Access Programs

Name	In	Out	Exceptions
[accessProg —SS]	-	-	-

## 9.4 Semantics

### 9.4.1 State Variables

[Not all modules will have state variables. State variables give the module a memory. —SS]

### 9.4.2 Environment Variables

[This section is not necessary for all modules. Its purpose is to capture when the module has external interaction with the environment, such as for a device driver, screen interface, keyboard, file, etc. —SS]

### 9.4.3 Assumptions

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

### 9.4.4 Access Routine Semantics

[accessProg —SS]():

- transition: [if appropriate —SS]
- output: [if appropriate —SS]
- exception: [if appropriate —SS]

[A module without environment variables or state variables is unlikely to have a state transition. In this case a state transition can only occur if the module is changing the state of another module. —SS]

[Modules rarely have both a transition and an output. In most cases you will have one or the other. —SS]

### 9.4.5 Local Functions

[As appropriate —SS] [These functions are for the purpose of specification. They are not necessarily something that is going to be implemented explicitly. Even if they are implemented, they are not exported; they only have local scope. —SS]

## 10 MIS of Control Module

[You can reference SRS labels, such as R??. —SS]

[It is also possible to use  $\LaTeX$  for hyperlinks to external documents. —SS]

## 10.1 Module

main

## 10.2 Uses

- matchFeatures (Section 14)
- plotImage (Section 16)
- formatOutput (Section 8)
- verifyOutput (Section 9)

## 10.3 Syntax

### 10.3.1 Exported Constants

### 10.3.2 Exported Access Programs

Name	In	Out	Exceptions
main	-	-	-

## 10.4 Semantics

### 10.4.1 State Variables

[Not all modules will have state variables. State variables give the module a memory. —SS]

### 10.4.2 Environment Variables

[This section is not necessary for all modules. Its purpose is to capture when the module has external interaction with the environment, such as for a device driver, screen interface, keyboard, file, etc. —SS]

### 10.4.3 Assumptions

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

### 10.4.4 Access Routine Semantics

[accessProg —SS]():

- transition: [if appropriate —SS]
- output: [if appropriate —SS]

- exception: [if appropriate —SS]

[A module without environment variables or state variables is unlikely to have a state transition. In this case a state transition can only occur if the module is changing the state of another module. —SS]

[Modules rarely have both a transition and an output. In most cases you will have one or the other. —SS]

### 10.4.5 Local Functions

[As appropriate —SS] [These functions are for the purpose of specification. They are not necessarily something that is going to be implemented explicitly. Even if they are implemented, they are not exported; they only have local scope. —SS]

## 11 MIS of Image Smoothing Module

[You can reference SRS labels, such as R??. —SS]

[It is also possible to use  $\LaTeX$  for hyperlinks to external documents. —SS]

### 11.1 Module

smoothImage

### 11.2 Uses

- config (Section 10)
- imageStruct (Section 15)

### 11.3 Syntax

#### 11.3.1 Exported Constants

None.

#### 11.3.2 Exported Access Programs

Name	In	Out	Exceptions
smooth_image	noisy_img: $\mathbb{Z}^{H \times W}$ , kernel_sz: $\mathbb{Z}$ std_deviation: $\mathbb{R}$	smoothed_img: $\mathbb{Z}^{H \times W}$	-

## 11.4 Semantics

### 11.4.1 State Variables

- `smoothed_img`:  $\mathbb{Z}^{H \times W}$

### 11.4.2 Environment Variables

[This section is not necessary for all modules. Its purpose is to capture when the module has external interaction with the environment, such as for a device driver, screen interface, keyboard, file, etc. —SS]

### 11.4.3 Assumptions

- Exceptions on input limits are handled in `specParams` module.

### 11.4.4 Access Routine Semantics

[`accessProg` —SS]():

- transition: [if appropriate —SS]
- output: [if appropriate —SS]
- exception: [if appropriate —SS]

[A module without environment variables or state variables is unlikely to have a state transition. In this case a state transition can only occur if the module is changing the state of another module. —SS]

[Modules rarely have both a transition and an output. In most cases you will have one or the other. —SS]

### 11.4.5 Local Functions

[As appropriate —SS] [These functions are for the purpose of specification. They are not necessarily something that is going to be implemented explicitly. Even if they are implemented, they are not exported; they only have local scope. —SS]

## 12 MIS of Keypoint Detection Module

[You can reference SRS labels, such as R??. —SS]

[It is also possible to use `\LaTeX` for hyperlinks to external documents. —SS]

### 12.1 Module

`detectKeypoints`

## 12.2 Uses

- config (Section 6)
- smoothImage (Section 11)
- imageStruct (Section 15)
- orbStruct (Section 19)

## 12.3 Syntax

### 12.3.1 Exported Constants

### 12.3.2 Exported Access Programs

Name	In	Out	Exceptions
[accessProg —SS]	-	-	-

## 12.4 Semantics

### 12.4.1 State Variables

[Not all modules will have state variables. State variables give the module a memory. —SS]

### 12.4.2 Environment Variables

[This section is not necessary for all modules. Its purpose is to capture when the module has external interaction with the environment, such as for a device driver, screen interface, keyboard, file, etc. —SS]

### 12.4.3 Assumptions

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

### 12.4.4 Access Routine Semantics

[accessProg —SS]():

- transition: [if appropriate —SS]
- output: [if appropriate —SS]
- exception: [if appropriate —SS]

## HOW DO WE HANDLE IF-ELSE CASES?

[A module without environment variables or state variables is unlikely to have a state transition. In this case a state transition can only occur if the module is changing the state of another module. —SS]

[Modules rarely have both a transition and an output. In most cases you will have one or the other. —SS]

### 12.4.5 Local Functions

[As appropriate —SS] [These functions are for the purpose of specification. They are not necessarily something that is going to be implemented explicitly. Even if they are implemented, they are not exported; they only have local scope. —SS]

## 13 MIS of Feature Descriptor Module

[You can reference SRS labels, such as R??. —SS]

[It is also possible to use L<sup>A</sup>T<sub>E</sub>X for hyperlinks to external documents. —SS]

### 13.1 Module

assignDescriptors

### 13.2 Uses

- detectKeypoints (Section 12)

### 13.3 Syntax

#### 13.3.1 Exported Constants

#### 13.3.2 Exported Access Programs

Name	In	Out	Exceptions
[accessProg —SS]	-	-	-

### 13.4 Semantics

#### 13.4.1 State Variables

[Not all modules will have state variables. State variables give the module a memory. —SS]

### 13.4.2 Environment Variables

[This section is not necessary for all modules. Its purpose is to capture when the module has external interaction with the environment, such as for a device driver, screen interface, keyboard, file, etc. —SS]

### 13.4.3 Assumptions

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

### 13.4.4 Access Routine Semantics

[accessProg —SS]():

- transition: [if appropriate —SS]
- output: [if appropriate —SS]
- exception: [if appropriate —SS]

[A module without environment variables or state variables is unlikely to have a state transition. In this case a state transition can only occur if the module is changing the state of another module. —SS]

[Modules rarely have both a transition and an output. In most cases you will have one or the other. —SS]

### 13.4.5 Local Functions

[As appropriate —SS] [These functions are for the purpose of specification. They are not necessarily something that is going to be implemented explicitly. Even if they are implemented, they are not exported; they only have local scope. —SS]

## 14 MIS of Feature Matching Module

[You can reference SRS labels, such as R??. —SS]

[It is also possible to use  $\LaTeX$  for hyperlinks to external documents. —SS]

### 14.1 Module

matchFeatures

### 14.2 Uses

- assignDescriptors (Section 13)



## 14.3 Syntax

### 14.3.1 Exported Constants

### 14.3.2 Exported Access Programs

Name	In	Out	Exceptions
[accessProg —SS]	-	-	-

## 14.4 Semantics

### 14.4.1 State Variables

[Not all modules will have state variables. State variables give the module a memory. —SS]

### 14.4.2 Environment Variables

[This section is not necessary for all modules. Its purpose is to capture when the module has external interaction with the environment, such as for a device driver, screen interface, keyboard, file, etc. —SS]

### 14.4.3 Assumptions

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

### 14.4.4 Access Routine Semantics

[accessProg —SS]():

- transition: [if appropriate —SS]
- output: [if appropriate —SS]
- exception: [if appropriate —SS]

[A module without environment variables or state variables is unlikely to have a state transition. In this case a state transition can only occur if the module is changing the state of another module. —SS]

[Modules rarely have both a transition and an output. In most cases you will have one or the other. —SS]

### 14.4.5 Local Functions

[As appropriate —SS] [These functions are for the purpose of specification. They are not necessarily something that is going to be implemented explicitly. Even if they are implemented, they are not exported; they only have local scope. —SS]

## 15 MIS of Image Data Structure Module

[You can reference SRS labels, such as R??. —SS]

[It is also possible to use L<sup>A</sup>T<sub>E</sub>X for hypperlinks to external documents. —SS]

### 15.1 Module

imageStruct

### 15.2 Uses

None.

### 15.3 Syntax

#### 15.3.1 Exported Constants

#### 15.3.2 Exported Access Programs

Name	In	Out	Exceptions
[accessProg —SS]	-	-	-

### 15.4 Semantics

#### 15.4.1 State Variables

[Not all modules will have state variables. State variables give the module a memory. —SS]

#### 15.4.2 Environment Variables

[This section is not necessary for all modules. Its purpose is to capture when the module has external interaction with the environment, such as for a device driver, screen interface, keyboard, file, etc. —SS]

#### 15.4.3 Assumptions

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

#### 15.4.4 Access Routine Semantics

[accessProg —SS]():

- transition: [if appropriate —SS]

- output: [if appropriate —SS]
- exception: [if appropriate —SS]

[A module without environment variables or state variables is unlikely to have a state transition. In this case a state transition can only occur if the module is changing the state of another module. —SS]

[Modules rarely have both a transition and an output. In most cases you will have one or the other. —SS]

#### 15.4.5 Local Functions

[As appropriate —SS] [These functions are for the purpose of specification. They are not necessarily something that is going to be implemented explicitly. Even if they are implemented, they are not exported; they only have local scope. —SS]

## 16 MIS of Image Plot Module

[You can reference SRS labels, such as R??. —SS]

[It is also possible to use L<sup>A</sup>T<sub>E</sub>X for hypperlinks to external documents. —SS]

### 16.1 Module

plotImage

### 16.2 Uses

- imageStruct (Section 16)

### 16.3 Syntax

#### 16.3.1 Exported Constants

#### 16.3.2 Exported Access Programs

Name	In	Out	Exceptions
[accessProg —SS]	-	-	-

### 16.4 Semantics

#### 16.4.1 State Variables

[Not all modules will have state variables. State variables give the module a memory. —SS]

### 16.4.2 Environment Variables

[This section is not necessary for all modules. Its purpose is to capture when the module has external interaction with the environment, such as for a device driver, screen interface, keyboard, file, etc. —SS]

### 16.4.3 Assumptions

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

### 16.4.4 Access Routine Semantics

[accessProg —SS]():

- transition: [if appropriate —SS]
- output: [if appropriate —SS]
- exception: [if appropriate —SS]

[A module without environment variables or state variables is unlikely to have a state transition. In this case a state transition can only occur if the module is changing the state of another module. —SS]

[Modules rarely have both a transition and an output. In most cases you will have one or the other. —SS]

### 16.4.5 Local Functions

[As appropriate —SS] [These functions are for the purpose of specification. They are not necessarily something that is going to be implemented explicitly. Even if they are implemented, they are not exported; they only have local scope. —SS]

## 17 MIS of Feature Match Data Module

[You can reference SRS labels, such as R??. —SS]

[It is also possible to use  $\LaTeX$  for hyperlinks to external documents. —SS]

### 17.1 Module

matchStruct

### 17.2 Uses

None.

## 17.3 Syntax

### 17.3.1 Exported Constants

### 17.3.2 Exported Access Programs

Name	In	Out	Exceptions
[accessProg —SS]	-	-	-

## 17.4 Semantics

### 17.4.1 State Variables

[Not all modules will have state variables. State variables give the module a memory. —SS]

### 17.4.2 Environment Variables

[This section is not necessary for all modules. Its purpose is to capture when the module has external interaction with the environment, such as for a device driver, screen interface, keyboard, file, etc. —SS]

### 17.4.3 Assumptions

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

### 17.4.4 Access Routine Semantics

[accessProg —SS]():

- transition: [if appropriate —SS]
- output: [if appropriate —SS]
- exception: [if appropriate —SS]

[A module without environment variables or state variables is unlikely to have a state transition. In this case a state transition can only occur if the module is changing the state of another module. —SS]

[Modules rarely have both a transition and an output. In most cases you will have one or the other. —SS]

### 17.4.5 Local Functions

[As appropriate —SS] [These functions are for the purpose of specification. They are not necessarily something that is going to be implemented explicitly. Even if they are implemented, they are not exported; they only have local scope. —SS]

## 18 MIS of Dataframe Structure Module

[Use labels for cross-referencing —SS]

[You can reference SRS labels, such as R??. —SS]

[It is also possible to use L<sup>A</sup>T<sub>E</sub>X for hyperlinks to external documents. —SS]

### 18.1 Module

dataframeStruct

### 18.2 Uses

None.

### 18.3 Syntax

#### 18.3.1 Exported Constants

#### 18.3.2 Exported Access Programs

Name	In	Out	Exceptions
[accessProg —SS]	-	-	-

### 18.4 Semantics

#### 18.4.1 State Variables

[Not all modules will have state variables. State variables give the module a memory. —SS]

#### 18.4.2 Environment Variables

[This section is not necessary for all modules. Its purpose is to capture when the module has external interaction with the environment, such as for a device driver, screen interface, keyboard, file, etc. —SS]

#### 18.4.3 Assumptions

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

#### 18.4.4 Access Routine Semantics

[accessProg —SS]():

- transition: [if appropriate —SS]

- output: [if appropriate —SS]
- exception: [if appropriate —SS]

[A module without environment variables or state variables is unlikely to have a state transition. In this case a state transition can only occur if the module is changing the state of another module. —SS]

[Modules rarely have both a transition and an output. In most cases you will have one or the other. —SS]

#### 18.4.5 Local Functions

[As appropriate —SS] [These functions are for the purpose of specification. They are not necessarily something that is going to be implemented explicitly. Even if they are implemented, they are not exported; they only have local scope. —SS]

## 19 MIS of ORB Data Structure Module

[Use labels for cross-referencing —SS]

[You can reference SRS labels, such as R??. —SS]

[It is also possible to use L<sup>A</sup>T<sub>E</sub>X for hypperlinks to external documents. —SS]

### 19.1 Module

orbStruct

### 19.2 Uses

None.

### 19.3 Syntax

#### 19.3.1 Exported Constants

#### 19.3.2 Exported Access Programs

Name	In	Out	Exceptions
[accessProg —SS]	-	-	-

### 19.4 Semantics

#### 19.4.1 State Variables

[Not all modules will have state variables. State variables give the module a memory. —SS]

### 19.4.2 Environment Variables

[This section is not necessary for all modules. Its purpose is to capture when the module has external interaction with the environment, such as for a device driver, screen interface, keyboard, file, etc. —SS]

### 19.4.3 Assumptions

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

### 19.4.4 Access Routine Semantics

[accessProg —SS]():

- transition: [if appropriate —SS]
- output: [if appropriate —SS]
- exception: [if appropriate —SS]

[A module without environment variables or state variables is unlikely to have a state transition. In this case a state transition can only occur if the module is changing the state of another module. —SS]

[Modules rarely have both a transition and an output. In most cases you will have one or the other. —SS]

### 19.4.5 Local Functions

[As appropriate —SS] [These functions are for the purpose of specification. They are not necessarily something that is going to be implemented explicitly. Even if they are implemented, they are not exported; they only have local scope. —SS]

## 20 MIS of [Module Name —SS]

[Use labels for cross-referencing —SS]

[You can reference SRS labels, such as R??. —SS]

[It is also possible to use  $\LaTeX$  for hyperlinks to external documents. —SS]

### 20.1 Module

[Short name for the module —SS]



## 20.2 Uses

## 20.3 Syntax

### 20.3.1 Exported Constants

### 20.3.2 Exported Access Programs

Name	In	Out	Exceptions
[accessProg —SS]	-	-	-

## 20.4 Semantics

### 20.4.1 State Variables

[Not all modules will have state variables. State variables give the module a memory. —SS]

### 20.4.2 Environment Variables

[This section is not necessary for all modules. Its purpose is to capture when the module has external interaction with the environment, such as for a device driver, screen interface, keyboard, file, etc. —SS]

### 20.4.3 Assumptions

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

### 20.4.4 Access Routine Semantics

[accessProg —SS]():

- transition: [if appropriate —SS]
- output: [if appropriate —SS]
- exception: [if appropriate —SS]

[A module without environment variables or state variables is unlikely to have a state transition. In this case a state transition can only occur if the module is changing the state of another module. —SS]

[Modules rarely have both a transition and an output. In most cases you will have one or the other. —SS]

#### 20.4.5 Local Functions

[As appropriate —SS] [These functions are for the purpose of specification. They are not necessarily something that is going to be implemented explicitly. Even if they are implemented, they are not exported; they only have local scope. —SS]

## 21 Appendix

[Extra information if required —SS]