

Scilab Computer Vision Toolbox

Ekalavya, 2016

Asmita Bhar Deepshikha Diwakar Bhardwaj Kevin
George Rohit Suri Shashank Shekhar Sridhar
Reddy Suraj Prakash Choubey Tanmay Chaudhari
Umang Agrawal

Summer Internship, 2016

Scilab Computer Vision Toolbox

Asmita Bhar,
Deepshikha,
Diwakar Bhardwaj,
Kevin George,
Rohit Suri,
Shashank Shekhar,
Sridhar Reddy,
Suraj Prakash
Choubey, Tanmay
Chaudhari, Umang
Agrawal

Introduction

Aim
Scilab
OpenCV

Interface

Design of Interface
Important parts of the
Interface
OpenCV Modules

Summary

Team Members

1. Asmita Bhar CSE, NIT Durgapur
2. Deepshikha CSE, NIT Agartala
3. Diwakar Bhardwaj CSE, NIT Agartala
4. Kevin George IT, NITK Surathkal
5. Rohit Suri CSE, NIT Rourkela
6. Shashank Shekhar CSE, NIT Durgapur
7. Sridhar Reddy CSE, RGUKT Basar, Telangana
8. Suraj Prakash Choubey CSE, NIT Agartala
9. Tanmay Chaudhari ECE, IIIT Hyderabad
10. Umang Agrawal ECE, MNNIT Allahabad

Scilab Computer Vision Toolbox

Asmita Bhar,
Deepshikha,
Diwakar Bhardwaj,
Kevin George,
Rohit Suri,
Shashank Shekhar,
Sridhar Reddy,
Suraj Prakash
Choubey, Tanmay
Chaudhari, Umang
Agrawal

Introduction

Aim
Scilab
OpenCV

Interface

Design of Interface
Important parts of the
Interface
OpenCV Modules

Summary

Table of Contents

Introduction

Aim

Scilab

OpenCV

Interface

Design of Interface

Important parts of the Interface

OpenCV Modules

Scilab Computer
Vision Toolbox

Asmita Bhar,
Deepshikha,
Diwakar Bhardwaj,
Kevin George,
Rohit Suri,
Shashank Shekhar,
Sridhar Reddy,
Suraj Prakash
Choubey, Tanmay
Chaudhari, Umang
Agrawal

Introduction

Aim
Scilab
OpenCV

Interface

Design of Interface
Important parts of the
Interface
OpenCV Modules

Summary

Outline

Introduction

Aim

Scilab

OpenCV

Interface

Design of Interface

Important parts of the Interface

OpenCV Modules

Scilab Computer
Vision Toolbox

Asmita Bhar,
Deepshikha,
Diwakar Bhardwaj,
Kevin George,
Rohit Suri,
Shashank Shekhar,
Sridhar Reddy,
Suraj Prakash
Choubey, Tanmay
Chaudhari, Umang
Agrawal

Introduction

Aim

Scilab

OpenCV

Interface

Design of Interface

Important parts of the
Interface

OpenCV Modules

Summary

Aim

We aim to build a comprehensive computer vision toolbox in Scilab that is at par to its proprietary software counterpart. A computer vision toolbox provides functions, algorithms and various machine learning algorithms to train and to perform

- ▶ Feature Detection, Extraction and Matching
- ▶ Object Detection and Tracking
- ▶ Motion Estimation and Video Analysis
- ▶ Camera Calibration and Stereo Vision

Scilab Computer Vision Toolbox

Asmita Bhar,
Deepshikha,
Diwakar Bhardwaj,
Kevin George,
Rohit Suri,
Shashank Shekhar,
Sridhar Reddy,
Suraj Prakash
Choubey, Tanmay
Chaudhari, Umang
Agrawal

Introduction

Aim
Scilab
OpenCV

Interface

Design of Interface
Important parts of the
Interface
OpenCV Modules

Summary

Outline

Introduction

Aim

Scilab

OpenCV

Interface

Design of Interface

Important parts of the Interface

OpenCV Modules

Scilab Computer Vision Toolbox

Asmita Bhar,
Deepshikha,
Diwakar Bhardwaj,
Kevin George,
Rohit Suri,
Shashank Shekhar,
Sridhar Reddy,
Suraj Prakash
Choubey, Tanmay
Chaudhari, Umang
Agrawal

Introduction

Aim

Scilab

OpenCV

Interface

Design of Interface

Important parts of the
Interface

OpenCV Modules

Summary

Scilab

- Open-source cross-platform numerical computational package and a high-level, numerically oriented programming language.

Scilab Computer Vision Toolbox

Asmita Bhar,
Deepshikha,
Diwakar Bhardwaj,
Kevin George,
Rohit Suri,
Shashank Shekhar,
Sridhar Reddy,
Suraj Prakash
Choubey, Tanmay
Chaudhari, Umang
Agrawal

Introduction

Aim

Scilab

OpenCV

Interface

Design of Interface

Important parts of the
Interface

OpenCV Modules

Summary

Scilab

- ▶ Open-source cross-platform numerical computational package and a high-level, numerically oriented programming language.
- ▶ A major open-source alternative to MATLAB.

Scilab Computer Vision Toolbox

Asmita Bhar,
Deepshikha,
Diwakar Bhardwaj,
Kevin George,
Rohit Suri,
Shashank Shekhar,
Sridhar Reddy,
Suraj Prakash
Choubey, Tanmay
Chaudhari, Umang
Agrawal

Introduction

Aim

Scilab

OpenCV

Interface

Design of Interface

Important parts of the
Interface

OpenCV Modules

Summary

Scilab

- ▶ Open-source cross-platform numerical computational package and a high-level, numerically oriented programming language.
- ▶ A major open-source alternative to MATLAB.
- ▶ The base functionality of Scilab can be extended through toolboxes.

Scilab Computer Vision Toolbox

Asmita Bhar,
Deepshikha,
Diwakar Bhardwaj,
Kevin George,
Rohit Suri,
Shashank Shekhar,
Sridhar Reddy,
Suraj Prakash
Choubey, Tanmay
Chaudhari, Umang
Agrawal

Introduction

Aim
Scilab
OpenCV

Interface

Design of Interface
Important parts of the
Interface
OpenCV Modules

Summary

Scilab

- ▶ Open-source cross-platform numerical computational package and a high-level, numerically oriented programming language.
- ▶ A major open-source alternative to MATLAB.
- ▶ The base functionality of Scilab can be extended through toolboxes.
- ▶ Toolbox functions can be interfaced with C, C++, Java or Fortran using Scilab API.

Scilab Computer Vision Toolbox

Asmita Bhar,
Deepshikha,
Diwakar Bhardwaj,
Kevin George,
Rohit Suri,
Shashank Shekhar,
Sridhar Reddy,
Suraj Prakash
Choubey, Tanmay
Chaudhari, Umang
Agrawal

Introduction

Aim
Scilab
OpenCV

Interface

Design of Interface
Important parts of the
Interface
OpenCV Modules

Summary

Outline

Introduction

Aim

Scilab

OpenCV

Interface

Design of Interface

Important parts of the Interface

OpenCV Modules

Scilab Computer Vision Toolbox

Asmita Bhar,
Deepshikha,
Diwakar Bhardwaj,
Kevin George,
Rohit Suri,
Shashank Shekhar,
Sridhar Reddy,
Suraj Prakash
Choubey, Tanmay
Chaudhari, Umang
Agrawal

Introduction

Aim

Scilab

OpenCV

Interface

Design of Interface

Important parts of the
Interface

OpenCV Modules

Summary

OpenCV

- Open-source cross-platform library of programming functions aimed at real-time computer vision.

Scilab Computer Vision Toolbox

Asmita Bhar,
Deepshikha,
Diwakar Bhardwaj,
Kevin George,
Rohit Suri,
Shashank Shekhar,
Sridhar Reddy,
Suraj Prakash
Choubey, Tanmay
Chaudhari, Umang
Agrawal

Introduction

Aim

Scilab

OpenCV

Interface

Design of Interface

Important parts of the
Interface

OpenCV Modules

Summary

OpenCV

- ▶ Open-source cross-platform library of programming functions aimed at real-time computer vision.
- ▶ Officially launched by Intel in 1999 and now supported by Itseez.

Scilab Computer
Vision Toolbox

Asmita Bhar,
Deepshikha,
Diwakar Bhardwaj,
Kevin George,
Rohit Suri,
Shashank Shekhar,
Sridhar Reddy,
Suraj Prakash
Choubey, Tanmay
Chaudhari, Umang
Agrawal

Introduction

Aim

Scilab

OpenCV

Interface

Design of Interface

Important parts of the
Interface

OpenCV Modules

Summary

OpenCV

- ▶ Open-source cross-platform library of programming functions aimed at real-time computer vision.
- ▶ Officially launched by Intel in 1999 and now supported by Itseez.
- ▶ Written in C++ and has its primary interface in C++.

Scilab Computer Vision Toolbox

Asmita Bhar,
Deepshikha,
Diwakar Bhardwaj,
Kevin George,
Rohit Suri,
Shashank Shekhar,
Sridhar Reddy,
Suraj Prakash
Choubey, Tanmay
Chaudhari, Umang
Agrawal

Introduction

Aim
Scilab
OpenCV

Interface

Design of Interface
Important parts of the
Interface
OpenCV Modules

Summary

OpenCV

- ▶ Open-source cross-platform library of programming functions aimed at real-time computer vision.
- ▶ Officially launched by Intel in 1999 and now supported by Itseez.
- ▶ Written in C++ and has its primary interface in C++.
- ▶ Has bindings in Python, Java and MATLAB/OCTAVE.

Scilab Computer Vision Toolbox

Asmita Bhar,
Deepshikha,
Diwakar Bhardwaj,
Kevin George,
Rohit Suri,
Shashank Shekhar,
Sridhar Reddy,
Suraj Prakash
Choubey, Tanmay
Chaudhari, Umang
Agrawal

Introduction

Aim
Scilab
OpenCV

Interface

Design of Interface
Important parts of the
Interface
OpenCV Modules

Summary

OpenCV

- ▶ Open-source cross-platform library of programming functions aimed at real-time computer vision.
- ▶ Officially launched by Intel in 1999 and now supported by Itseez.
- ▶ Written in C++ and has its primary interface in C++.
- ▶ Has bindings in Python, Java and MATLAB/OCTAVE.
- ▶ Provides : Human-computer interaction, Object Identification, Face Recognition, Motion Tracking, Stereo and Multi-Camera Calibration.

Scilab Computer Vision Toolbox

Asmita Bhar,
Deepshikha,
Diwakar Bhardwaj,
Kevin George,
Rohit Suri,
Shashank Shekhar,
Sridhar Reddy,
Suraj Prakash
Choubey, Tanmay
Chaudhari, Umang
Agrawal

Introduction

Aim
Scilab
OpenCV

Interface

Design of Interface
Important parts of the
Interface
OpenCV Modules

Summary

Outline

Introduction

Aim

Scilab

OpenCV

Interface

Design of Interface

Important parts of the Interface

OpenCV Modules

Scilab Computer
Vision Toolbox

Asmita Bhar,
Deepshikha,
Diwakar Bhardwaj,
Kevin George,
Rohit Suri,
Shashank Shekhar,
Sridhar Reddy,
Suraj Prakash
Choubey, Tanmay
Chaudhari, Umang
Agrawal

Introduction

Aim

Scilab

OpenCV

Interface

Design of Interface

Important parts of the
Interface

OpenCV Modules

Summary

Design of Interface

The basic procedure for interfacing Scilab and OpenCV is as follows:

- Get data like videos, images etc from Scilab

Scilab Computer
Vision Toolbox

Asmita Bhar,
Deepshikha,
Diwakar Bhardwaj,
Kevin George,
Rohit Suri,
Shashank Shekhar,
Sridhar Reddy,
Suraj Prakash
Choubey, Tanmay
Chaudhari, Umang
Agrawal

Introduction

Aim
Scilab
OpenCV

Interface

Design of Interface

Important parts of the
Interface
OpenCV Modules

Summary

Design of Interface

The basic procedure for interfacing Scilab and OpenCV is as follows:

- ▶ Get data like videos, images etc from Scilab
- ▶ Convert data to the format required by OpenCV

Scilab Computer
Vision Toolbox

Asmita Bhar,
Deepshikha,
Diwakar Bhardwaj,
Kevin George,
Rohit Suri,
Shashank Shekhar,
Sridhar Reddy,
Suraj Prakash
Choubey, Tanmay
Chaudhari, Umang
Agrawal

Introduction

Aim
Scilab
OpenCV

Interface

Design of Interface

Important parts of the
Interface
OpenCV Modules

Summary

Design of Interface

The basic procedure for interfacing Scilab and OpenCV is as follows:

- ▶ Get data like videos, images etc from Scilab
- ▶ Convert data to the format required by OpenCV
- ▶ Give the data to OpenCV

Scilab Computer
Vision Toolbox

Asmita Bhar,
Deepshikha,
Diwakar Bhardwaj,
Kevin George,
Rohit Suri,
Shashank Shekhar,
Sridhar Reddy,
Suraj Prakash
Choubey, Tanmay
Chaudhari, Umang
Agrawal

Introduction

Aim

Scilab

OpenCV

Interface

Design of Interface

Important parts of the
Interface

OpenCV Modules

Summary

Design of Interface

The basic procedure for interfacing Scilab and OpenCV is as follows:

- ▶ Get data like videos, images etc from Scilab
- ▶ Convert data to the format required by OpenCV
- ▶ Give the data to OpenCV
- ▶ Get the return value(s), if any, from OpenCV

Scilab Computer
Vision Toolbox

Asmita Bhar,
Deepshikha,
Diwakar Bhardwaj,
Kevin George,
Rohit Suri,
Shashank Shekhar,
Sridhar Reddy,
Suraj Prakash
Choubey, Tanmay
Chaudhari, Umang
Agrawal

Introduction

Aim
Scilab
OpenCV

Interface

Design of Interface
Important parts of the
Interface
OpenCV Modules

Summary

Design of Interface

The basic procedure for interfacing Scilab and OpenCV is as follows:

- ▶ Get data like videos, images etc from Scilab
- ▶ Convert data to the format required by OpenCV
- ▶ Give the data to OpenCV
- ▶ Get the return value(s), if any, from OpenCV
- ▶ Return data to Scilab

Scilab Computer
Vision Toolbox

Asmita Bhar,
Deepshikha,
Diwakar Bhardwaj,
Kevin George,
Rohit Suri,
Shashank Shekhar,
Sridhar Reddy,
Suraj Prakash
Choubey, Tanmay
Chaudhari, Umang
Agrawal

Introduction

Aim
Scilab
OpenCV

Interface

Design of Interface
Important parts of the
Interface
OpenCV Modules

Summary

Outline

Introduction

Aim

Scilab

OpenCV

Interface

Design of Interface

Important parts of the Interface

OpenCV Modules

Scilab Computer Vision Toolbox

Asmita Bhar,
Deepshikha,
Diwakar Bhardwaj,
Kevin George,
Rohit Suri,
Shashank Shekhar,
Sridhar Reddy,
Suraj Prakash
Choubey, Tanmay
Chaudhari, Umang
Agrawal

Introduction

Aim
Scilab
OpenCV

Interface

Design of Interface
Important parts of the
Interface
OpenCV Modules

Summary

Important parts of the Interface

- builder.sce
 - 1. Serves as a make file for the toolbox

Scilab Computer
Vision Toolbox

Asmita Bhar,
Deepshikha,
Diwakar Bhardwaj,
Kevin George,
Rohit Suri,
Shashank Shekhar,
Sridhar Reddy,
Suraj Prakash
Choubey, Tanmay
Chaudhari, Umang
Agrawal

Introduction

Aim
Scilab
OpenCV

Interface

Design of Interface
Important parts of the
Interface
OpenCV Modules

Summary

Important parts of the Interface

► builder.sce

1. Serves as a make file for the toolbox
2. Used to build the Scilab Computer Vision Toolbox

Scilab Computer
Vision Toolbox

Asmita Bhar,
Deepshikha,
Diwakar Bhardwaj,
Kevin George,
Rohit Suri,
Shashank Shekhar,
Sridhar Reddy,
Suraj Prakash
Choubey, Tanmay
Chaudhari, Umang
Agrawal

Introduction

Aim
Scilab
OpenCV

Interface

Design of Interface
Important parts of the
Interface
OpenCV Modules

Summary

1. Serves as a make file for the toolbox
2. Used to build the Scilab Computer Vision Toolbox
3. Contains name of the macros which it is to be called in the scilab

- ▶ `builder.sce`
 1. Serves as a make file for the toolbox
 2. Used to build the Scilab Computer Vision Toolbox
 3. Contains name of the macros which it is to be called in the scilab
- ▶ `builder_gateway_cpp.sce`

Important parts of the Interface

- ▶ `builder.sce`
 1. Serves as a make file for the toolbox
 2. Used to build the Scilab Computer Vision Toolbox
 3. Contains name of the macros which it is to be called in the scilab
- ▶ `builder_gateway_cpp.sce`
 1. Contains name of the function with which it is to be called in the scilab

Scilab Computer
Vision Toolbox

Asmita Bhar,
Deepshikha,
Diwakar Bhardwaj,
Kevin George,
Rohit Suri,
Shashank Shekhar,
Sridhar Reddy,
Suraj Prakash
Choubey, Tanmay
Chaudhari, Umang
Agrawal

Introduction

Aim
Scilab
OpenCV

Interface

Design of Interface
Important parts of the
Interface
OpenCV Modules

Summary

Important parts of the Interface

► builder.sce

1. Serves as a make file for the toolbox
2. Used to build the Scilab Computer Vision Toolbox
3. Contains name of the macros which it is to be called in the scilab

► builder_gateway_cpp.sce

1. Contains name of the function with which it is to be called in the scilab
2. Contains the list of source file of the function

Scilab Computer
Vision Toolbox

Asmita Bhar,
Deepshikha,
Diwakar Bhardwaj,
Kevin George,
Rohit Suri,
Shashank Shekhar,
Sridhar Reddy,
Suraj Prakash
Choubey, Tanmay
Chaudhari, Umang
Agrawal

Introduction

Aim
Scilab
OpenCV

Interface

Design of Interface
Important parts of the
Interface
OpenCV Modules

Summary

Important parts of the Interface

► builder.sce

1. Serves as a make file for the toolbox
2. Used to build the Scilab Computer Vision Toolbox
3. Contains name of the macros which it is to be called in the scilab

► builder_gateway_cpp.sce

1. Contains name of the function with which it is to be called in the scilab
2. Contains the list of source file of the function

Scilab Computer
Vision Toolbox

Asmita Bhar,
Deepshikha,
Diwakar Bhardwaj,
Kevin George,
Rohit Suri,
Shashank Shekhar,
Sridhar Reddy,
Suraj Prakash
Choubey, Tanmay
Chaudhari, Umang
Agrawal

Introduction

Aim
Scilab
OpenCV

Interface

Design of Interface
Important parts of the
Interface
OpenCV Modules

Summary

Outline

Introduction

Aim

Scilab

OpenCV

Interface

Design of Interface

Important parts of the Interface

OpenCV Modules

Scilab Computer Vision Toolbox

Asmita Bhar,
Deepshikha,
Diwakar Bhardwaj,
Kevin George,
Rohit Suri,
Shashank Shekhar,
Sridhar Reddy,
Suraj Prakash
Choubey, Tanmay
Chaudhari, Umang
Agrawal

Introduction

Aim
Scilab
OpenCV

Interface

Design of Interface
Important parts of the
Interface
OpenCV Modules

Summary

OpenCV Modules

- ▶ core :- It includes basic data structures (e.g. Mat data structure) and basic image processing functions
- ▶ highgui :- This module provides simple user interface capabilities, several image and video codecs
- ▶ imgproc :- This module includes basic image processing algorithms including image filtering, image transformations, color space conversions and etc
- ▶ video :- This is a video analysis module which includes object tracking algorithms, background subtraction algorithms, etc

Scilab Computer
Vision Toolbox

Asmita Bhar,
Deepshikha,
Diwakar Bhardwaj,
Kevin George,
Rohit Suri,
Shashank Shekhar,
Sridhar Reddy,
Suraj Prakash
Choubey, Tanmay
Chaudhari, Umang
Agrawal

Introduction

Aim
Scilab
OpenCV

Interface

Design of Interface
Important parts of the
Interface
OpenCV Modules

Summary

- ▶ objdetect:- This includes object detection and recognition algorithms for standard objects
- ▶ calib3d:- This includes camera calibrations algorithm
- ▶ features2d:- This is used for features point detection
- ▶ tesseract:- This includes optical character recognition library

Scilab Computer
Vision Toolbox

Asmita Bhar,
Deepshikha,
Diwakar Bhardwaj,
Kevin George,
Rohit Suri,
Shashank Shekhar,
Sridhar Reddy,
Suraj Prakash
Choubey, Tanmay
Chaudhari, Umang
Agrawal

Introduction

Aim
Scilab
OpenCV

Interface

Design of Interface
Important parts of the
Interface
OpenCV Modules

Summary

Summary

- ▶ Functions have been implemented using OpenCV and produce accurate results, considerably close to MATLAB results.
- ▶ Structures have been used to implement the wide use of Objects in Scilab Functions, to be at par with MATLAB. If Object Oriented Programming is included in future versions of Scilab, it would be easier to use OpenCV with API Scilab.
- ▶ The Tesseract Library has been used to implement Optical Character Recognition.
- ▶ Video Player has to be implemented.

Scilab Computer Vision Toolbox

Asmita Bhar,
Deepshikha,
Diwakar Bhardwaj,
Kevin George,
Rohit Suri,
Shashank Shekhar,
Sridhar Reddy,
Suraj Prakash
Choubey, Tanmay
Chaudhari, Umang
Agrawal

Introduction

Aim
Scilab
OpenCV

Interface

Design of Interface
Important parts of the
Interface
OpenCV Modules

Summary

QUESTIONS

Scilab Computer Vision Toolbox

Asmita Bhar,
Deepshikha,
Diwakar Bhardwaj,
Kevin George,
Rohit Suri,
Shashank Shekhar,
Sridhar Reddy,
Suraj Prakash
Choubey, Tanmay
Chaudhari, Umang
Agrawal

Introduction

Aim
Scilab
OpenCV

Interface

Design of Interface
Important parts of the
Interface
OpenCV Modules

Summary

THANK YOU

Scilab Computer Vision Toolbox

Asmita Bhar,
Deepshikha,
Diwakar Bhardwaj,
Kevin George,
Rohit Suri,
Shashank Shekhar,
Sridhar Reddy,
Suraj Prakash
Choubey, Tanmay
Chaudhari, Umang
Agrawal

Introduction

Aim
Scilab
OpenCV

Interface

Design of Interface
Important parts of the
Interface
OpenCV Modules

Summary