

INTERNATIONAL JOURNAL FOR ADVANCE RESEARCH IN ENGINEERING AND TECHNOLOGY

WINGS TO YOUR THOUGHTS.....

Study of Various Computer Vision Libraries and Tools

Solanki Chetan R.¹, Dr. R. C. Thool²

¹M. Tech. (I.T.), ²Professor

^{1,2}Shri Guru Gobind Singhji Institute of Engineering and Technology
Vishnupuri, Nanded - 431606.

¹chetansolanki.89@gmail.com, ²rcthool@yahoo.com

Abstract: -Now-a-days the engineers and researchers are more interested in building real-time applications/products. For real-time application development the researches should have a deep knowledge of computer vision. For the application of the concepts of computer vision into a product/application, there are various tools and libraries present which can be used for development. All these tools and libraries are written in different languages like C, C++, python, etc. In this paper we are going to precisely study about different tools and libraries used for development in the field of computer vision.

Keywords: Open CV, Blep0, Embed CV, QCV, Simple CV, VXL.

1. INTRODUCTION

Computer vision includes methods for acquiring, processing, analyzing, and understanding images; in short the high-dimensional data from the real world produces numerical or symbolic information which is helpful for making decisions. There is no specific programming language or software/tool or library used to study computer vision. In the following section we are going to study about various tools and libraries used in the field of computer vision.

2. LIBRARIES USED

Following are some of the well-known libraries used in the development of computer vision algorithms/applications:

a) **OpenCV:** OpenCV is an extensive open-source image processing library, built on the Intel Image Processing Library (IPL). OpenCV aids commercial uses of computer vision in human-computer interface, robotics, monitoring, biometrics and security by providing a free and open infrastructure where the distributed efforts of the vision community can be consolidated and performance optimized[1].

b) **VXL:** VXL (the Vision-something-Libraries) is a collection of C++ libraries designed for computer vision research and implementation. It was created from Target Jr and the IUE with the aim of making a light, fast and consistent system. VXL is written in ANSI/ISO C++ and is designed to be portable over many platforms. There are libraries covering numerical algorithms, image processing, co-ordinate systems, camera geometry, stereo, video manipulation,

structure recovery from motion, probability modeling, GUI design, classification, robust estimation, feature tracking, topology, structure manipulation, 3d imaging, and much more[3].

c) **GPUCV:** GPUCV is a free GPU-accelerated library for image processing and computer vision. It offers an Intel OPENCV-like programming interface for easily porting existing applications [3].

d) **Torch3vision:** It's a machine vision library, written in simple C++ and based on the Torch machine-learning library. This package contains Basic image processing and feature extraction algorithms such as rotation, flip, photometric normalizations (Histogram Equalization, Multi scale Retinex, Self-Quotient Image or Gross-Brajovic), edge detection, 2D DCT, 2D FFT, 2D Gabor, PCA to do Eigen-Faces, LDA to do Fisher-Faces[2].

e) **Tlib:** TLIB is an image processing library written specifically for real-time object tracking. It is meant for people with basic C/C++ programming and image processing skills. TLIB aims at fulfilling several goals: Efficiency, Ease-of-use, Portability, Educational, and Use of multiple sources [3].

f) **Simple CV:** Simple CV is a Python interface to several powerful open source computer vision libraries in a single convenient package. With it, your software can have access to high level algorithms in feature detection, filtering, and pattern recognition in a unified framework. Forget about bit depths, file formats, color spaces, buffer management, eigen values, and matrix vs bitmap storage [4].

g) **QCV:** QCV is a Qt-based computer vision framework library that provides an easy to use interface

INTERNATIONAL JOURNAL FOR ADVANCE RESEARCH IN ENGINEERING AND TECHNOLOGY

WINGS TO YOUR THOUGHTS.....

to display, analyze and run computer vision algorithms. The library is provided with practical examples to show what you can do with just a few lines of code. OpenCV is used as the supporting computer vision library. QCV offers a 2D visualization tool, an on-line on-the-fly parameter editor, a clock tool to evaluate computation times, and a control tool to manipulate input video and sequences of images [5].

h) Machine Perception Toolbox: The MPT is a cross-platform collection of libraries for real-time perception primitives, including face detection, eye detection, blink detection, and color tracking [3].

i) IPL: Intel® Integrated Performance Primitives (Intel® IPP) is a software library of highly optimized functions for multimedia, audio, video, speech, computer vision, image and signal processing [3].

j) ImLib3D: ImLib3D is an open source C++ library for 3D (volumetric) image processing. Focus has been put on simplicity for the developer. It contains most basic image processing algorithms, and some more sophisticated ones. It comes with an optional viewer that features multi planar views, animations, vector field views and 3D (OpenGL) multi planar. All image processing operators can be interactively called from the viewer as well as from the UNIX command-line. ImLib3D's goal is to provide a standard and easy to use platform for volumetric image processing research. ImLib3D has been carefully designed, using modern, standards conforming C++. It intensively uses the Standard C++ Library, including strings, containers, and iterators. [6].

k) Free Image Algorithms: Free Image Algorithms is an image processing library built on top of Free Image. Although originally created for images involving cells it could be used for a large range of tasks. Some of the features include Arithmetic operations, Statistical operations, Convolution and related filters, Predefined Palettes, FFT, Binary Morphology, Particle finding - Ie Labelling of binary images, HBITMAP conversions (Win32), Drawing - Basic Shapes / Convex Hull, Distance Transform, Flood Fill, Linear Scaling, Many utility functions including min max finding in an image, Get Pixels values along a line, Create images from arrays of data [3].

l) Gamera: Gamera is a cross platform python library for the creation of document recognition systems. It combines a programming library with GUI tools for symbol training and interactive image processing. Apart from providing a set of commonly needed functionality for document image analysis, Gamera additionally allows for custom plugins as Python or C++ Plug-ins and as Toolkits [7].

m) Camellia: The Camellia Library is an open source Image Processing & Computer Vision library. Written in plain C, it is cross-platform (Unix / Linux, Windows) and robust. It already includes a lot of functions for image processing (filtering, morphological mathematics, labelling, warping, drawing, project/back project, color conversion, loading/saving images, etc.), most of them being highly speed-optimized. It is also doxygen-documented and examples of use are provided [8].

n) Blob Detection: The library is aimed at doing computer vision by finding 'blobs' on an image, that is to say areas whose brightness is above or below a particular value. It allows computing blobs' edges as well as blobs' bounding box. However, the library does not perform blob tracking; it only tries to find all blobs each frame it was fed with. It was primarily developed for Processing (Beta) but can be used in any java programs [10].

o) Yayi: Yayi is an open-source image processing framework, which particularly focuses on Mathematical Morphology operators. It is released under the very permissive Boost license. The core of Yayi is entirely written in C++, mainly using templated code and meta programming, which enables a high level of genericity. It implements some of the main concepts of Mathematical Morphology into an efficient and proven design. Yayi aims at providing robust, efficient and flexible algorithms for image analysis, but also reference algorithms for Mathematical Morphology [9].

p) BoofCV: BoofCV is an open source Java library for real-time computer vision and robotics applications. Written from scratch for ease of use and high performance, it often outperforms even native libraries. Functionality includes optimized low-level image processing routines, feature tracking, and geometric computer vision. BoofCV has been released under an Apache license for both academic and commercial use[11].

3. TOOLS USED

a) eLynx: eLynx Image Processing SDK and Lab. Windows & Linux image processing tools. Supports multi-core, 8 to 64-bit resolutions for grey, RGB, HLS, CIE Lab and Bayer images. Handles dng, tiff, fits, jpg, j2k, png and raw file formats. eLynx lab is a GUI application based on wxWidgets & eLynx SDK[3].

b) CImg: The CImg Library is an open source C++ toolkit for image processing. It provides simple classes and functions to load, save, process and display images in your own C++ code. CImg stands for "Cool Image": It is simple to use and efficient. It's like a STL

INTERNATIONAL JOURNAL FOR ADVANCE RESEARCH IN ENGINEERING AND TECHNOLOGY

WINGS TO YOUR THOUGHTS.....

for image processing. CImg can use functionalities of external tools/libraries such as Board, FFMPEG, FFTW3, Graphics Magick, Image Magick, Lapack, libjpeg, libpng, libtiff, Magick++, OpenEXR OpenCV, OpenMP or XMedCon. Moreover, a simple plug-in mechanism allows any user to directly enhance the library capabilities according to his needs. [12].

c) Cell Profiler: Cell Profiler is free open-source software designed to enable biologists without training in computer vision or programming to quantitatively measure phenotypes from thousands of images automatically. See their papers on analyzing cell images and non-cell images [13].

d) ADISL (Advanced Digital Imaging Solutions Laboratory): Image Apprentice is a C/C++ based Image Processing Learner's Toolkit. Students use it as a companion to their favorite Image Processing Textbook. It allows one to use self-written image processing algorithms as plugins. It comes with a Plugin Development Kit (PDK) that has a skeleton code having a simple coding style. A student who has attended a 101-level course in C/C++ programming is well-equipped to write an Image Processing plugin for Image Apprentice using Visual C++ [14].

e) XVision: XVision provides an application independent set of tools for visual feature tracking optimized to be simple to configure at the user level, yet extremely fast to execute [3].

f) VIP Base: VIP Base is free software with unique features that are useful for image and video processing. These include Canny edge detection, Split / Merge videos, Affine, Perspective transformation, Radial distortion removal, Background subtraction, Camera calibration, and AdaBoost face detection and feature training [3].

g) UTHSCSA Image Tool: UTHSCSA Image Tool (IT) is a free image processing and analysis program for Microsoft Windows 9x, Windows ME or Windows NT. IT can acquire, display, edit, analyze, process, compress, save and print gray scale and color images. IT can read and write over 22 common file formats including BMP, PCX, TIF, GIF and JPEG[3].

h) QVision: Built upon the Qt library, it offers a set of computer vision and image processing algorithms, matrix, vector and tensor algebra functions, under an homogeneous object oriented API. It also provides a comprehensive set of wrapper functions for the Intel's image processing IPP library and a GUI based designer application that makes creating new programs a snap [15].

i) Projective Vision Toolkit: PVT is a series of utilities that allows one to take an image sequence and compute the fundamental matrix and tri-linear tensor.

This can be used for such problems as camera self-calibration, structure from motion, camera motion annotation, image stabilization, 3D tracking and recognition, etc. [3].

4. CONCLUSIONS

In this paper, we have studied about some of the well-known tools and libraries used in the field of computer vision. These are not the only tools and libraries used, there are many more tools and libraries developed by various research groups and institutes. The main aim behind this paper was to make the researchers aware of these different tools and libraries, so there may be increment in the real-time application development.

REFERENCES

- [1] <http://opencv.org/>
- [2] <http://torch3vision.idiap.ch/>
- [3] http://www.roborealm.com/links/vision_software.php
- [4] <http://www.simplecv.org/>
- [5] <http://sourceforge.net/projects/qcv/>
- [6] <http://imlib3d.sourceforge.net/>
- [7] <http://gamera.informatik.hsnr.de/>
- [8] <http://camellia.sourceforge.net/>
- [9] <http://raffi.enficiaud.free.fr/>
- [10] <http://www.v3ga.net/processing/BlobDetection>
- [11] <http://boofcv.org>
- [12] <http://cimg.sourceforge.net/>
- [13] <http://www.cellprofiler.org/>
- [14] <http://home.iitk.ac.in/~rksr/adisl.html>
- [15] <http://qvision.sourceforge.net/>