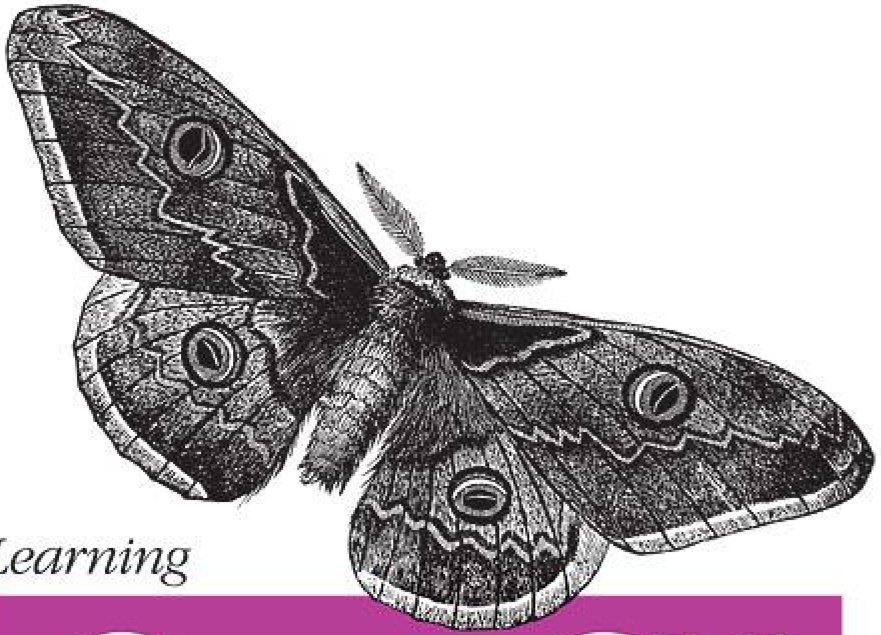
OpenCV API

A Quick Introduction to the C Interface
By David Johnston

Software that Sees



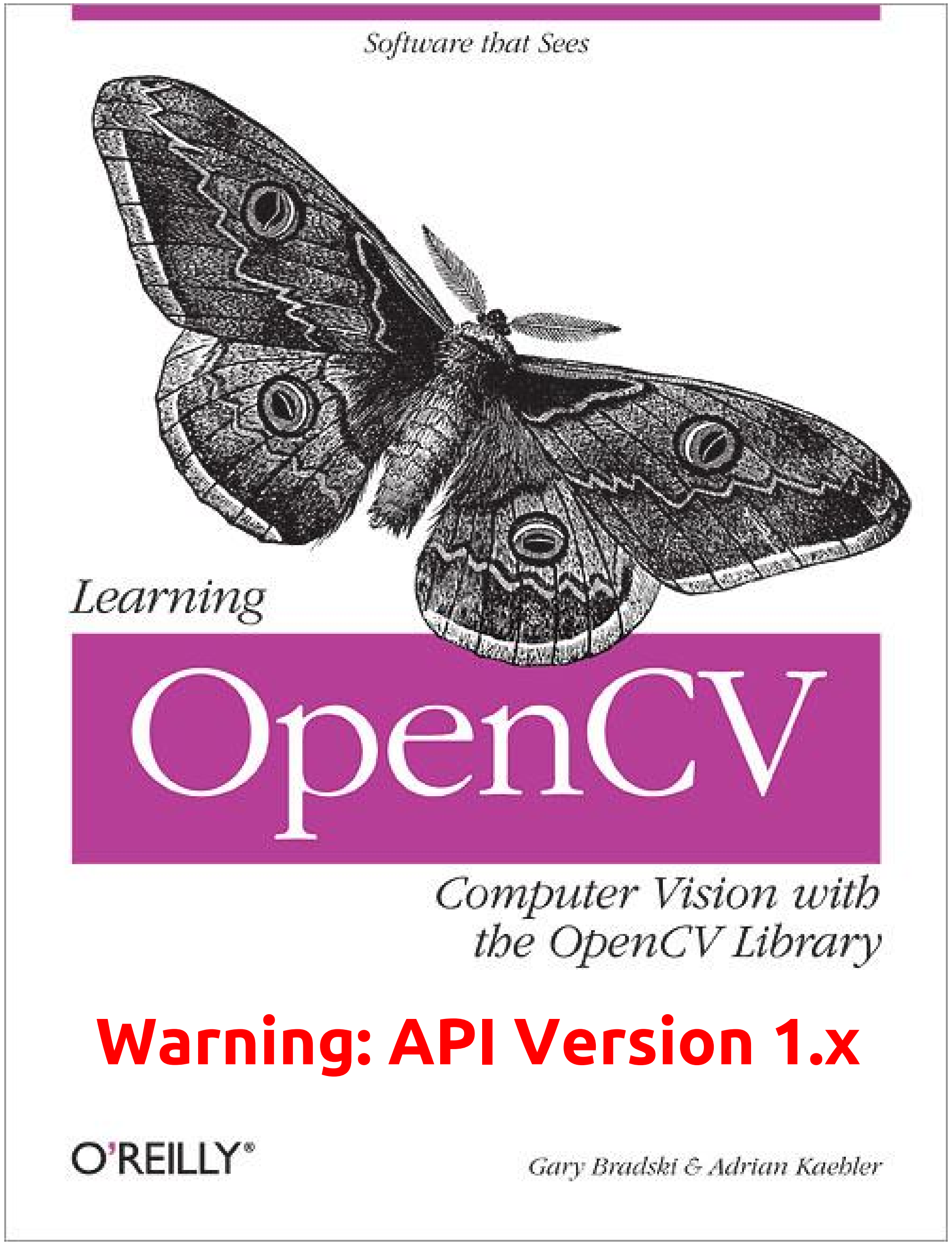
Learning

OpenCV

Computer Vision with the OpenCV Library

O'REILLY®

Gary Bradski & Adrian Kaehler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Warning: API Version 1.x

Primary OpenCV Interfaces

The 1.x API is based on C.

The 2.x API is based on C++.

Goals

Very briefly outline the OpenCV installation process on Windows, OS X, and Linux.

Walk through 4 example programs which should relevant to solving homework 2.

Point out some common API patterns and idioms.

Installing OpenCV

Windows 7 64-bit and Visual C++ 2010 Express

- Install Visual C++ 2010 Express Edition (or some other modern Visual Studio product).
- Download prebuilt binaries and extract them to some desired location.
- Set the OPENCV_DIR environment variable:

```
> setx -m OPENCV_DIR C:\opencv\build\x64\vc10
```

Windows 7 64-bit and Visual C++ 10.0 Express

- Add `%OPENCV_DIR%\bin` to your system path.
- Modify Visual Studio properties to find necessary files. The following describes this process in great detail:

docs.opencv.org/doc/tutorials/introduction/windows_visual_studio_Opencv/windows_visual_studio_Opencv.html

Install on Mac OS X

- Install XCode or the Apple Command Line Tools. Both are available with a (free) Apple ID.
- Install a package manager such as macports or homebrew.
- Install OpenCV.

Install on Linux

- Install via native package manager (ie. apt-get, yum, etc.)

Build on UNIX-Like System

```
cc `pkg-config --cflags --libs\
    opencv` -o foo foo.c
```

Four Code Demos

Some Constructors for Important Data Structures

`CvMat`	`cvMat(...)`
`CvMat*`	`cvCreateMat(...)`
`CvMat*`	`cvCreateMatHeader(...)`
`IplImage*`	`cvCreateImage(...)`
`CvSeq*`	`cvCreateSeq(...)`

Ex 1: Image Workflow

Loading, modifying, saving, and closing an image file.

See **`filter.c`**.

Macros

OpenCV defines a lot of macros.

- Most are prefixed with CV_*
- Many are function-specific
- The online documentation is usually pretty clear

In-Place Matrix Operations

```
cvNot(img, img);
```

Manual Memory Management

```
IplImage* img = cvLoadImage(...);

/* do something worthwhile */

cvReleaseImage(&img);
```

Ex 2: Basic Morphology and Color

Creating basic structuring elements and calling **`cvErode()`** and **`cvDilate()`**.

Using binary images (bit masks) and **`cvSet()`** to color regions of an image.

See **`noteSeg.c`**.

Constructors of Helper Data Structures

Simple ideas wrapped inside a data type:

```
CvPoint  cvPoint(int x, int y)
CvSize   cvSize(int width, int height)
CvScalar cvScalar(double d0, double d1, double d2, double
d3)
CvScalar cvScalarAll(double d)
CvScalar cvRealScalar(double d)
CvRect   cvRect(int x, int y, int width, int height)
```

Ex 3: Horizontal and Vertical Projections

Use **`cvGetRow()`**, **`cvGetCol()`**, and **`cvSum()`** to perform very simple projections.

Sort of Object Oriented

The most important data structure is arguably **`IplImage`**.

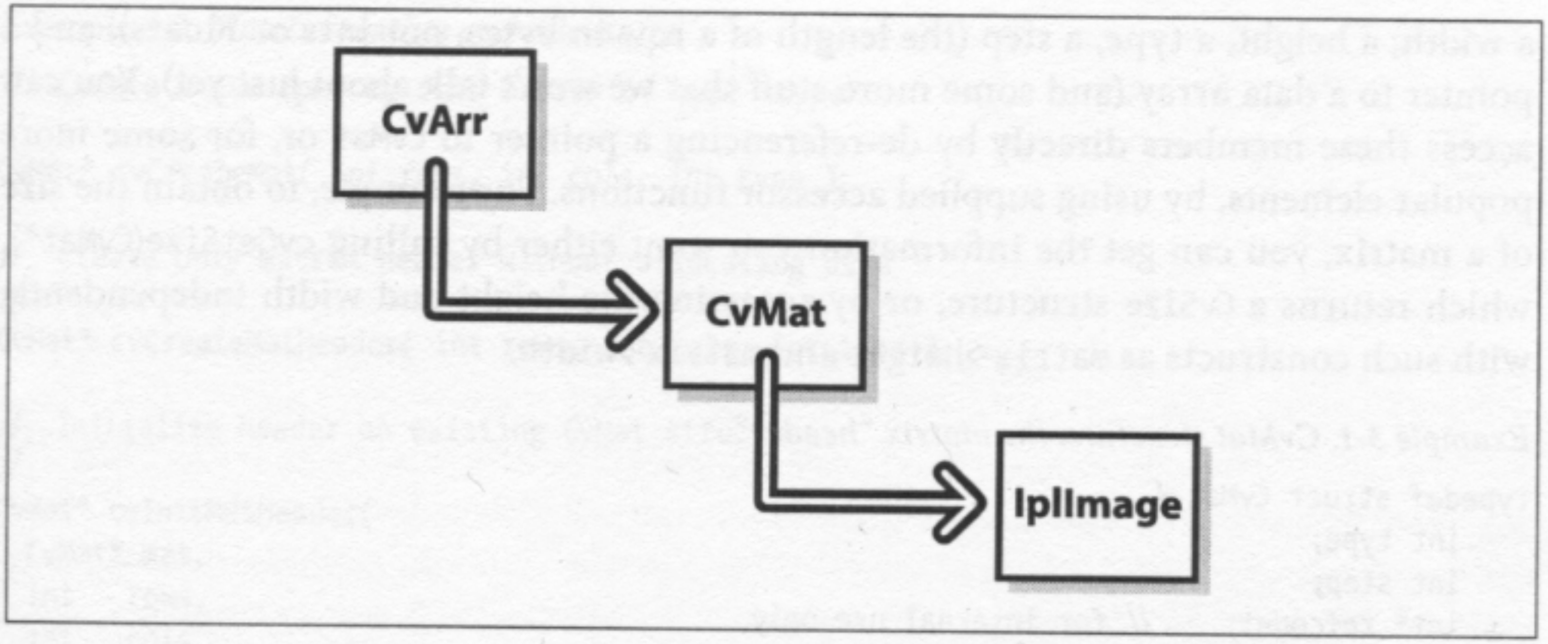

Figure 3-1. Even though OpenCV is implemented in C, the structures used in OpenCV have an object-oriented design; in effect, IplImage is derived from CvMat, which is derived from CvArr

- Page 33 of *Learning OpenCV* by Bradski and Kaehler

Sort of Object Oriented

The `IplImage` and `CvMat` data structures are just metadata which provide interfaces to the underlying image data.

See `projections.c`.

Ex 4: Custom Morphology

Creating custom structuring elements using **`cvCreateStructuringElementEx()`** and an **`int[]`**.

Warning: Pointer Arithmetic is Imminent!

Examples and discussion can be found in the text (highly recommended reading):

- **`cvMat`** and **`IplImage`**: pp. 31 - 47
- **`cvSeq`**: pp. 222 - 234

See **`customStructElem.c`**.

Questions?

Example

```
CvSize size = cvSize(600, 400);
IplImage* img = cvCreateImage(
   size, IPL_DEPTH_8U, 3
);
cvSet(img, cvScalarAll(0), NULL);
```

Why isn't every call to these helper functions a memory leak?

Esoteric C99 Feature of the Day: *Inline Functions*

"The keyword `inline` is a request to the compiler to insert a function's machine code wherever the function is called in the program."

- Page 106 of *C in a Nutshell*, by Prinz and Crawford

Automatic variables declared in an inline function become automatic variables in the calling function.