



Community Experience Distilled

# OpenCV Android Programming By Example

Develop vision-aware and intelligent Android applications with the robust OpenCV library

Amgad Muhammad

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BIRMINGHAM - MUMBAI

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First, I would like to thank my lovely wife, Noha, and my beautiful kids, Zain, Hla, and Darine, for their continuous care so that I could finish this book. The book is the fruit of my family's support and understanding, in spite of all the time it took me away from them, and all the weekends I spent in front of my computer. It was really a challenging and long journey, having a full-time job and my graduate studies while writing this book, but, as a loving and caring family, we were able to pull through.

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---

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- Treasure Hunting Robot, a brainwave-controlled robot that he developed in February 2012 (<http://www.siprop.org/en/2.0/index.php?product%2FTreasureHuntingRobot>).
- OpenCV for the Android NDK, which has been included since Android 4.0.1 ([http://tools.oesf.biz/android-4.0.1\\_r1.0/search?q=SIProp](http://tools.oesf.biz/android-4.0.1_r1.0/search?q=SIProp)).
- Auto Chasing Turtle, a human face recognition robot with Kinect, which he developed in February 2011 (<http://www.siprop.org/ja/2.0/index.php?product%2FAutoChasingTurtle>).
- Feel Sketch, an AR authoring tool and AR browser as an Android application, which he developed in December 2009 (<http://code.google.com/p/feelstetch/>).

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*To my wife, Noha, and my children, Zain, Hla, and Darine*



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# Preface

Learn how to use OpenCV to develop vision-aware, intelligent Android applications in a step-by-step tutorial and join the interesting and rapidly expanding field of computer vision to enable your Android phone to make sense of the world.

Starting from the basics of computer vision and OpenCV, we'll take you through all the ways to create exciting applications. You will discover that although computer vision is a challenging subject, the ideas and algorithms used are simple and intuitive, and you will appreciate the abstraction layer that OpenCV offers in order to do the heavy lifting for you.

Packed with many examples, the book will help you understand the main data structures used in OpenCV, and how you can use them to gain performance boosts. Next, we will discuss and use several image processing algorithms, such as histogram equalization, filters, and color space conversion. You then will learn about image gradients and how they are used in many shape analysis techniques, such as edge detection, Hough line transform, and Hough circle transform. In addition to using shape analysis to find things in images, you will learn how to describe objects in images in a more robust way using different feature detectors and descriptors. Finally, you will be able to make intelligent decisions using machine learning, specifically, the famous adaptive boosting learning algorithm and cascade classifiers.

## What this book covers

*Chapter 1, Getting Yourself Ready*, explains how to start using OpenCV to develop vision-aware Android applications in a step-by-step fashion.

*Chapter 2, App 1 - Building Your Own Darkroom*, shows you how images are stored and represented in OpenCV, and how to utilize this representation to implement interesting algorithms that will enhance the way your images look.

*Chapter 3, App 2 - Software Scanner*, explains how to implement your next application, a software scanner. It allows people to take a photo of, let's say, a receipt, and apply some transformations to make it look as if it was scanned. In this chapter, we will introduce two important topics that will help us to reach our final goal.

The first topic will be about spatial filtering and its definition and applications. The second topic will be about a famous shape analysis technique called the Hough transform. You will learn about the basic idea behind this technique that has made it very popular and widely used, and we will use the OpenCV implementation to start fitting lines and circles to a set of edge pixels.

*Chapter 4, App 2 - Applying Perspective Correction*, continues to build on the application that we started in Chapter 3. We will use the concepts that you've learned, namely, the edge detection and Hough line transform, to do perspective correction to a quadrilateral object. Applying perspective transformation to an object will change the way that we see it; this idea will come in handy when you take pictures of documents, receipts, and so on, and you want to have a better view of the captured image or a scan-like copy.

*Chapter 5, App 3 - Panoramic Viewer*, starts working on a new application. The goal of the application is to stitch two images together in order to form a panoramic view, and in this chapter, we will introduce the concept of image features and why they are important, and we will see them in action.

*Chapter 6, App 4 - Automatic Selfie*, introduces a new application. The goal of the application is to be able to take a selfie without touching your phone's screen. Your application will be able to detect a certain hand gesture that will trigger the process of saving the current camera frame.

## What you need for this book

- Tegra Android Development Pack
- An IDE of your choice (Eclipse or Android Studio)
- Android SDK
- Android NDK
- OpenCV4Android SDK

## Who this book is for

If you are an Android developer and want to know how to implement vision-aware applications using OpenCV, then this book is definitely for you.

It would be very helpful if you understand the basics of image processing and computer vision, but no prior experience is required.

## Conventions

In this book, you will find a number of text styles that distinguish between different kinds of information. Here are some examples of these styles and an explanation of their meaning.

Code words in text, database table names, folder names, filenames, file extensions, pathnames, dummy URLs, user input, and Twitter handles are shown as follows: "To uninstall the previous installation, go to the previous installation directory and run `tadp_uninstall.exe`."

A block of code is set as follows:

```
LOCAL_PATH := $(call my-dir)
include $(CLEAR_VARS)
LOCAL_MODULE := hello-jni
LOCAL_SRC_FILES := hello-jni.c
```

When we wish to draw your attention to a particular part of a code block, the relevant lines or items are set in bold:

```
Mat rgbImage=new Mat();

Imgproc.cvtColor(originalImage, rgbImage, Imgproc.COLOR_BGR2RGB);
```

**New terms** and **important words** are shown in bold. Words that you see on the screen, for example, in menus or dialog boxes, appear in the text like this: "You will need to choose the type of the installation. Select a custom installation and click **Next**."

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