Table of Contents

Preface	V
Chapter 1: Introduction to Computer Vision and Raspberry Pi	1
Computer vision	1
OpenCV	2
Single-board computers and the Raspberry Pi	4
Raspberry Pi	4
Operating systems	5
Raspbian	6
Setting up your Raspberry Pi B+	7
Preparing your microSD card manually	9
Booting up your Raspberry Pi for the first time	11
Shutting down and rebooting your Pi safely	12
Preparing your Pi for computer vision	13
Testing OpenCV installation with Python	15
NumPy	16
Array creation	16
Basic operations on arrays	17
Linear algebra	17
Summary	18
Chapter 2: Working with Images, Webcams, and GUI	19
Running Python programs with Raspberry Pi	19
Working with images	22
Using matplotlib	24
Drawing geometric shapes	26
Working with trackbar and named window	28
Working with a webcam	30
Creating a timelapse sequence using fswebcam	32
Webcam video recording and playback	34

Working with a webcam using Open	CV	34
Saving a video and playback of a vid	eo using OpenCV	36
Working with the Pi camera module		37
Using raspistill and raspivid		37
Using picamera in Python with the Pi	i camera module	38
picamera and OpenCV		39
Summary		39
Chapter 3: Basic Image Processing	g	41
Retrieving image properties		41
Arithmetic operations on images		42
Blending and transitioning images		45
Splitting and merging image colour	channels	47
Creating a negative of an image		48
Logical operations on images		50
Exercise		51
Summary		52
Chapter 4: Colorspaces, Transform	nations, and Thresholds	53
Colorspaces and conversions		53
Tracking in real time based on color		56
Image transformations		58
Scaling		58
Translation, rotation, and affine trans	formation	59
Perspective transformation		64
Thresholding image		66
Otsu's method	t to the state of	68
Exercise		69
Summary		70
Chapter 5: Let's Make Some Noise		71
Noise		71
Introducing noise to an image		72
Kernels		74
2D convolution filtering		74
Low-pass filtering		76
Exercise		79
Summary		79

Chapter 6: Edges, Circles, and Lines' Detection	81
High-pass filters	81
Canny Edge detector	85
Hough circle and line transforms	86
Exercise	90
Summary	90
Chapter 7: Image Restoration, Quantization, and Depth Map	91
Restoring images using inpainting	91
Image segmentation	93
Mean shift algorithm based segmentation	94
K-means clustering and image quantization	95
Comparison of mean shift and k-means	98
Disparity map and depth estimation	98
Summary	99
Chapter 8: Histograms, Contours, Morphological	
Transformations, and Performance Measurement	101
Image histograms	101
Image contours	104
Morphological transformations on image	106
OpenCV performance measurement and improvement	107
Summary	108
Chapter 9: Real-life Computer Vision Applications	109
Barcode detection	109
Motion detection and tracking	117
Hand gesture recognition	121
Chroma key with green screen	126
Summary	132
Chapter 10: Introduction to SimpleCV	133
SimpleCV and its installation on Raspberry Pi	133
Getting started with the camera, display, and images	135
Binary thresholding and color distances	137
The blur effect on a live web camera feed	140
Histogram calculation	141
Greyscale conversion	142

Table of Contents

Detecting corners and lines in an image	143
Blob detection in images	144
Sending Raspberry Pi on a boating vacation	145
Exercise	149
Summary	150
ndex	151