

Raspberry Pi Computer Vision Programming

Second Edition

Design and implement computer vision applications with Raspberry Pi,
OpenCV, and Python 3



Adrian Pyzdek

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Raspberry Pi Computer Vision Programming

Joseph Howse



Raspberry Pi Computer Vision Programming:

Raspberry Pi Computer Vision Programming - Second Edition Ashwin Pajankar, 2020 Perform a wide variety of computer vision tasks such as image processing and manipulation feature and object detection and image restoration to build real life computer vision applications Key Features Explore the potential of computer vision with Raspberry Pi and Python programming Perform computer vision tasks such as image processing and manipulation using OpenCV and Raspberry Pi Discover easy to follow examples and screenshots to implement popular computer vision techniques and applications Book Description Raspberry Pi is one of the popular single board computers of our generation All the major image processing and computer vision algorithms and operations can be implemented easily with OpenCV on Raspberry Pi This updated second edition is packed with cutting edge examples and new topics and covers the latest versions of key technologies such as Python 3 Raspberry Pi and OpenCV This book will equip you with the skills required to successfully design and implement your own OpenCV Raspberry Pi and Python based computer vision projects At the start you ll learn the basics of Python 3 and the fundamentals of single board computers and NumPy Next you ll discover how to install OpenCV 4 for Python 3 on Raspberry Pi before covering major techniques and algorithms in image processing manipulation and computer vision By working through the steps in each chapter you ll understand essential OpenCV features Later sections will take you through creating graphical user interface GUI apps with GPIO and OpenCV You ll also learn to use the new computer vision library Mahotas to perform various image processing operations Finally you ll explore the Jupyter Notebook and how to set up a Windows computer and Ubuntu for computer vision By the end of this book you ll be able to confidently build and deploy computer vision apps What you will learn Set up a Raspberry Pi for computer vision applications Perform basic image processing with libraries such as NumPy Matplotlib and OpenCV Demonstrate arithmetical logical and other operations on images Work with a USB webcam and the Raspberry Pi Camera Module Implement low pass and high pass filters and understand their applications in image processing Cover advanced techniques such as histogram equalization and morphological transformations Create GUI apps with Python 3 and OpenCV Perform machine learning with K means clustering and image quantization Who this book is for This book is *Raspberry Pi Computer Vision Programming -Second Edition* Ashwin Pajankar, 2020-06-29 Raspberry Pi Computer Vision Programming Ashwin Pajankar, 2015-05-28 This book is intended for novices as well as seasoned Raspberry Pi and Python enthusiasts who would like to explore the area of computer vision Readers with very little programming or coding scripting experience can create wonderful image processing and computer vision applications with relatively fewer lines of code in Python *Raspberry Pi Computer Vision Programming* Ashwin Pajankar, 2020-06-29 Perform a wide variety of computer vision tasks such as image processing and manipulation feature and object detection and image restoration to build real life computer vision applications Key Features Explore the potential of computer vision with Raspberry Pi and Python programming Perform computer vision tasks

such as image processing and manipulation using OpenCV and Raspberry Pi. Discover easy to follow examples and screenshots to implement popular computer vision techniques and applications.

Book Description Raspberry Pi is one of the popular single board computers of our generation. All the major image processing and computer vision algorithms and operations can be implemented easily with OpenCV on Raspberry Pi. This updated second edition is packed with cutting edge examples and new topics and covers the latest versions of key technologies such as Python 3, Raspberry Pi and OpenCV. This book will equip you with the skills required to successfully design and implement your own OpenCV, Raspberry Pi and Python based computer vision projects. At the start you will learn the basics of Python 3 and the fundamentals of single board computers and NumPy. Next you will discover how to install OpenCV 4 for Python 3 on Raspberry Pi before covering major techniques and algorithms in image processing, manipulation and computer vision. By working through the steps in each chapter you will understand essential OpenCV features. Later sections will take you through creating graphical user interface GUI apps with GPIO and OpenCV. You will also learn to use the new computer vision library Mahotas to perform various image processing operations. Finally you will explore the Jupyter Notebook and how to set up a Windows computer and Ubuntu for computer vision. By the end of this book you will be able to confidently build and deploy computer vision apps. What you will learn:

- Set up a Raspberry Pi for computer vision applications
- Perform basic image processing with libraries such as NumPy, Matplotlib and OpenCV
- Demonstrate arithmetical, logical and other operations on images
- Work with a USB webcam and the Raspberry Pi Camera Module
- Implement low pass and high pass filters and understand their applications in image processing
- Cover advanced techniques such as histogram equalization and morphological transformations
- Create GUI apps with Python 3 and OpenCV
- Perform machine learning with K means clustering and image quantization

Who this book is for: This book is for beginners as well as experienced Raspberry Pi and Python 3 enthusiasts who are looking to explore the amazing world of computer vision. Working knowledge of the Python 3 programming language is assumed.

Industrial Vision Systems with Raspberry Pi K. Mohaideen Abdul Kadhar, G. Anand, 2024-08-10

Today's industries are faced with a growing demand for vision systems due to their non-invasive characteristics in inspecting product quality. These systems identify surface defects and faults and verify components orientation and their measurements etc. This book explores the vision techniques needed to design and develop your own industrial vision system with the help of Raspberry Pi. You will start by reviewing basic concepts and applications of machine vision systems followed by the preliminaries of Python, OpenCV, required libraries and installing OpenCV for Python on Raspberry Pi. These are used when implementing image processing for the system applications. You will then look at interfacing techniques and some of the challenges industrial vision systems encounter such as lighting and camera angles. Algorithms and image processing techniques are also discussed along with machine learning and deep learning techniques. Later chapters explain the use of GUI apps and real time applications of Industrial vision systems. Each chapter concludes with examples and demo implementations to facilitate your knowledge of

the concepts By the end of the book you ll be able to build and deploy computer vision applications with Python OpenCV and Raspberry Pi What You ll Learn Build and deploy industrial vision system using Raspberry Pi and Python programming Explore computer vision techniques using Raspberry Pi and OpenCV Implement popular vision techniques for industrial applications in real time Review modern image processing techniques such as image segmentation thresholding and contours Who This Book Is For Raspberry Pi and Python enthusiasts interested in computer vision applications educators industrialists and industrial solution providers who want to design vision based testing products with the help of Raspberry Pi

Raspberry Pi by Example Ashwin Pajankar,Arush Kakkar,2016-04-20 Start building amazing projects with the Raspberry Pi right out of the boxAbout This Book Explore the vast range of opportunities provided by Raspberry Pi and other hardware components such as a webcam the Pi camera and sensors Get hands on experience with coding networking and hardware with the Raspberry Pi platform Learn through ample screenshots that offer a play by play account of how to implement Raspberry Pi based real life projectsWho This Book Is ForWhat s the best way to learn how to use your Raspberry Pi By example If you want something exciting to do whilst getting to grips with what your Pi can offer this is the book for you With both simple and complex projects you ll create a wide variety of cool toys and functions with your Raspberry Pi all with minimal coding experience necessary What You Will Learn Set up your Raspberry Pi and get it ready for some interesting real life projects Work with images videos webcams and the Pi camera and create amazing time lapse videos Explore the amazing world of Minecraft Pi Get to know how to use PiGlow for GPIO programming Interface your Pi with Grove Sensors and implement IoT applications Build your own cluster with Raspberry Pi Understand the networking and network programming fundamentalsIn DetailWant to put your Raspberry Pi through its paces right out of the box This tutorial guide is designed to get you learning all the tricks of the Raspberry Pi through building complete hands on hardware projects Speed through the basics and then dive right in to development Discover that you can do almost anything with your Raspberry Pi with a taste of almost everything Get started with Pi Gaming as you learn how to set up Minecraft and then program your own game with the help of Pygame Turn the Pi into your own home security system with complete guidance on setting up a webcam spy camera and OpenCV computer vision for image recognition capabilities Get to grips with GPIO programming to make a Pi based glowing LED system build a complete functioning motion tracker and more Finally get ready to tackle projects that push your Pi to its limits Construct a complete Internet of Things home automation system with the Raspberry Pi to control your house via Twitter turn your Pi into a super computer through linking multiple boards into a cluster and then add in advanced network capabilities for super speedy processing Style and approachThis step by step guide to building Raspberry Pi based projects is explained in a conversational and easy to follow style Each topic is explained sequentially in the process of creating real life projects and detailed explanations of the basic and advanced features of various Python libraries are also included **Learn Raspberry Pi Programming with Python** Wolfram Donat,2014-05-08

Learn Raspberry Pi Programming with Python will show you how to program your nifty new 35 computer to make a web spider a weather station a media server and more You ll learn how to program in Python on your Raspberry Pi with hands on examples and fun projects Even if you re completely new to programming in general you ll figure out how to create a home security system an underwater photography system an RC plane with a camera and even a near space weather balloon with a camera You ll learn how to make a variety of fun and even useful projects from a web bot to search and download files to a toy to drive your pets insane You ll even learn how to use Pi with Arduino as well as Pi with Gertboard an expansion board with an onboard ATmega microcontroller

Computer Vision for the Web Foat Akhmadeev, 2015-10-14 Unleash the power of the Computer Vision algorithms in JavaScript to develop vision enabled web content About This Book Explore the exciting world of image processing and face and gesture recognition and implement them in your website Develop wonderful web projects to implement Computer Vision algorithms in an effective way A fast paced guide to help you deal with real world Computer Vision applications using JavaScript libraries Who This Book Is For If you have an interest in Computer Vision or wish to apply Computer Vision algorithms such as face custom object and gesture recognition for an online application then this book is ideal for you Prior understanding of the JavaScript language and core mathematical concepts is recommended What You Will Learn Apply complex Computer Vision algorithms in your applications using JavaScript Put together different JavaScript libraries to discover objects in photos Get to grips with developing simple computer vision applications on your own Understand when and why you should use different computer vision methods Apply various image filters to images and videos Recognize and track many different objects including face and face particles using powerful face recognition algorithms Explore ways to control your browser without touching the mouse or keyboard In Detail JavaScript is a dynamic and prototype based programming language supported by every browser today JavaScript libraries boast outstanding functionalities that enable you to furnish your own Computer Vision projects making it easier to develop JavaScript based applications especially for web centric technologies It makes the implementation of Computer Vision algorithms easier as it supports scheme based functional programming This book will give you an insight into controlling your applications with gestures and head motion and readying them for the web Packed with real world tasks it begins with a walkthrough of the basic concepts of Computer Vision that the JavaScript world offers us and you ll implement various powerful algorithms in your own online application Then we move on to a comprehensive analysis of JavaScript functions and their applications Furthermore the book will show you how to implement filters and image segmentation and use tracking js and jsfeat libraries to convert your browser into Photoshop Subjects such as object and custom detection feature extraction and object matching are covered to help you find an object in a photo You will see how a complex object such as a face can be recognized by a browser as you move toward the end of the book Finally you will focus on algorithms to create a human interface By the end of this book you will be familiarized with the application of complex Computer Vision algorithms to

develop your own applications without spending much time learning sophisticated theory Style and approach This book is an easy to follow project based guide that throws you directly into the excitement of the Computer Vision theme A more in less approach is followed by important concepts explained in a to the point easy to understand manner **Recent Advances in Computer Vision Applications Using Parallel Processing** Khalid M. Hosny,Ahmad Salah,2023-01-23 This comprehensive book is primarily intended for researchers computer vision specialists and high performance computing specialists who are interested in parallelizing computer vision techniques for the sake of accelerating the run time of computer vision methods This book covers different penalization methods on different parallel architectures such as multi core CPUs and GPUs It is also a valuable reference resource for researchers at all levels e g undergraduate and postgraduate who are seeking real life examples of speeding up the computer vision methods run time **Machine Learning with the Raspberry Pi** Donald J. Norris,2019-11-29 Using the Pi Camera and a Raspberry Pi board expand and replicate interesting machine learning ML experiments This book provides a solid overview of ML and a myriad of underlying topics to further explore Non technical discussions temper complex technical explanations to make the hottest and most complex topic in the hobbyist world of computing understandable and approachable Machine learning also commonly referred to as deep learning DL is currently being integrated into a multitude of commercial products as well as widely being used in industrial medical and military applications It is hard to find any modern human activity which has not been touched by artificial intelligence AI applications Building on the concepts first presented in Beginning Artificial Intelligence with the Raspberry Pi you ll go beyond simply understanding the concepts of AI into working with real machine learning experiments and applying practical deep learning concepts to experiments with the Pi board and computer vision What you learn with Machine Learning with the Raspberry Pi can then be moved on to other platforms to go even further in the world of AI and ML to better your hobbyist or commercial projects What You ll Learn Acquire a working knowledge of current ML Use the Raspberry Pi to implement ML techniques and algorithms Apply AI and ML tools and techniques to your own work projects and studies Who This Book Is For Engineers and scientists but also experienced makers and hobbyists Motivated high school students who desire to learn about ML can benefit from this material with determination **Learn Robotics with Raspberry Pi** Matt Timmons-Brown,2019-01-22 In Learn Robotics with Raspberry Pi you ll learn how to build and code your own robot projects with just the Raspberry Pi microcomputer and a few easy to get components no prior experience necessary Learn Robotics with Raspberry Pi will take you from inexperienced maker to robot builder You ll start off building a two wheeled robot powered by a Raspberry Pi minicomputer and then program it using Python the world s most popular programming language Gradually you ll improve your robot by adding increasingly advanced functionality until it can follow lines avoid obstacles and even recognize objects of a certain size and color using computer vision Learn how to Control your robot remotely using only a Wii remote Teach your robot to use sensors to avoid obstacles Program your robot to follow a line autonomously Customize your robot with

LEDs and speakers to make it light up and play sounds See what your robot sees with a Pi Camera As you work through the book you ll learn fundamental electronics skills like how to wire up parts use resistors and regulators and determine how much power your robot needs By the end you ll have learned the basics of coding in Python and know enough about working with hardware like LEDs motors and sensors to expand your creations beyond simple robots

Introduction to IoT with Machine Learning and Image Processing Using Raspberry Pi Shirang Ambaji Kulkarni,Varadraj P. Gurupur,Steven L. Fernandes,2022-03 This book introduces Raspberry Pi using real world applications in computer vision machine learning and deep learning It provides a detailed step by step approach to application development for users without any prior programming knowledge

Proceedings of the 11th National Technical Seminar on Unmanned System Technology 2019 Zainah Md Zain,Hamzah Ahmad,Dwi Pebrianti,Mahfuzah Mustafa,Nor Rul Hasma Abdullah,Rosdiyana Samad,Maziyah Mat Noh,2020-07-07 This book includes research papers from the 11th National Technical Symposium on Unmanned System Technology Covering a number of topics including intelligent robotics novel sensor technology control algorithms acoustics signal processing imaging techniques biomimetic robots green energy sources and underwater communication backbones and protocols it will appeal to researchers developing marine technology solutions and policy makers interested in technologies to facilitate the exploration of coastal and oceanic regions

The Official Raspberry Pi Projects Book Volume 2 The Makers of The MagPi magazine,2016-11-01 The Official Raspberry Pi projects book returns with inspirational projects detailed step by step guides and product reviews based around the phenomenon that is the Raspberry Pi See why educators and makers adore the credit card sized computer that can be used to make robots retro games consoles and even art In this volume of The Official Raspberry Pi Projects Book you ll Get involved with the amazing and very active Raspberry Pi community Be inspired by incredible projects made by other people Learn how to make with your Raspberry Pi with our tutorials Find out about the top kits and accessories for your Pi projects And much much more If this is your first time using a Raspberry Pi you ll also find some very helpful guides to get you started with your Raspberry Pi journey With millions of Raspberry Pi boards out in the wild that s millions more people getting into digital making and turning their dreams into a Pi powered reality Being so spoilt for choice though means that we ve managed to compile an incredible list of projects guides and reviews for you This book was written using an earlier version of Raspberry Pi OS Please use Raspberry Pi OS Legacy for full compatibility See magpi cc legacy for more information

Advanced Research in Technologies, Information, Innovation and Sustainability Teresa Guarda,Filipe Portela,Maria Fernanda Augusto,2022-11-24 The two volume Proceedings set CCIS 1675 and 1676 constitutes the refereed proceedings of the Second International Conference ARTIIS 2022 held in Santiago de Compostela Spain during September 12 15 2022 The 72 papers included in these proceedings were carefully reviewed and selected from 191 submissions These papers were categorized into 2 technical tracks i e Computing Solutions and Data Intelligence

Proceedings of the International Conference on Paradigms of Computing,

Communication and Data Sciences Rajendra Prasad Yadav, Satyasai Jagannath Nanda, Prashant Singh Rana, Meng-Hiot Lim, 2023-02-23 This book gathers selected high quality research papers presented at International Conference on Paradigms of Communication Computing and Data Sciences PCCDS 2022 held at Malaviya National Institute of Technology Jaipur India during 05-07 July 2022. It discusses high quality and cutting edge research in the areas of advanced computing communications and data science techniques. The book is a collection of latest research articles in computation, algorithm, communication and data sciences intertwined with each other for efficiency.

Computer Vision Using the Raspberry Pi for the Evil Genius Donald Norris, 2019-11-22 Publisher's Note: Products purchased from Third Party sellers are not guaranteed by the publisher for quality, authenticity, or access to any online entitlements included with the product. This fun DIY project book teaches computer vision technology using Raspberry Pi and Raspi Cam. Written by dedicated hobbyist and bestselling author Donald Norris, this guide provides an introduction to the emerging field of computer vision technology and features interesting projects that use cutting edge real time imaging triggers. You will explore the basics of computer vision and get complete explanations of how to employ open source software and inexpensive hardware including Raspberry Pi, OpenCV, and the Raspberry Pi Camera Module. Computer Vision Using the Raspberry Pi for the Evil Genius discusses many different types of real time visual triggers including facial and low light recognition with easy to follow explanations of the systems that control them. The book then presents step by step DIY home projects from a pet gate that opens for your pet but can keep out all unwanted critters to an outdoor bird feeder that can count the number of bird visitors and record information on their species. There is also a project that shows how to conduct crowd size estimations. Teaches the basics of computer vision technology using Raspberry Pi, OpenCV, and the Raspberry Pi Camera Module. Each project includes a parts list, illustrations, and easy to follow assembly instructions. Introduces computer vision using Keras, an open source Python framework.

Python 3 Image Processing Ashwin Pajankar, 2019-09-19 Gain a working knowledge of practical image processing and with scikit image. DESCRIPTION The book has been written in such a way that the concepts are explained in detail giving adequate emphasis on code examples. To make the topics more comprehensive, screenshots and code samples are furnished extensively throughout the book. The book is conceptualized and written in such a way that the beginner readers will find it very easy to understand the concepts and implement the programs. The book also features the most current version of Raspberry Pi and associated software with it. This book teaches novice beginners how to write interesting image processing programs with scientific Python ecosystem. The book will also be helpful to experienced professionals to make transition to rewarding careers in scientific Python and computer vision.

KEY FEATURES Comprehensive coverage of various aspects of scientific Python and concepts in image processing. Covers various additional topics such as Raspberry Pi, conda package manager, and Anaconda distribution of Python. Simple language, crystal clear approach, and straight forward comprehensible presentation of concepts followed by code examples and output screenshots. Adopting user friendly style for

explanation of code examples WHAT WILL YOU LEARN Raspberry Pi Python 3 Basics Scientific Python Ecosystem NumPy and Matplotlib Visualization with Matplotlib Basic NumPy Advanced Image Processing with NumPy and Matplotlib Getting started with scikit image Thresholding Histogram Equalization and Transformations Kernels Convolution and Filters Morphological Operations and Image Restoration Noise Removal and Edge Detection Advanced Image Processing Operations WHO THIS BOOK IS FOR Students pursuing BE BSc ME MSc BTech MTech in Computer Science Electronics Electrical and Mathematics Python enthusiasts Computer Vision and Image Processing professionals Anyone fond of tinkering with Raspberry Pi Researchers in Computer Vision Table of Contents 1 Concepts in Image Processing 2 Installing Python 3 on Windows 3 Introduction to Raspberry Pi 4 Python 3 Basics 5 Introduction to the Scientific Python Ecosystem 6 Introduction to NumPy and Matplotlib 7 Visualization with Matplotlib 8 Basic Image Processing with NumPy and Matplotlib 9 Advanced Image Processing with NumPy and Matplotlib 10 Getting Started with Scikit Image 11 Thresholding Histogram Equalization and Transformations 12 Kernels Convolution and Filters 13 Morphological Operations and Image Restoration 14 Noise Removal and Edge Detection 15 Advanced Image Processing Operations 16 Wrapping Up OpenCV 4 for Secret Agents Joseph Howse, 2019-04-30 Turn futuristic ideas about computer vision and machine learning into demonstrations that are both functional and entertaining Key Features Build OpenCV 4 apps with Python 2 and 3 on desktops and Raspberry Pi Java on Android and C in Unity Detect classify recognize and measure real world objects in real time Work with images from diverse sources including the web research datasets and various cameras Book Description OpenCV 4 is a collection of image processing functions and computer vision algorithms It is open source supports many programming languages and platforms and is fast enough for many real time applications With this handy library you ll be able to build a variety of impressive gadgets OpenCV 4 for Secret Agents features a broad selection of projects based on computer vision machine learning and several application frameworks To enable you to build apps for diverse desktop systems and Raspberry Pi the book supports multiple Python versions from 2.7 to 3.7 For Android app development the book also supports Java in Android Studio and C in the Unity game engine Taking inspiration from the world of James Bond this book will add a touch of adventure and computer vision to your daily routine You ll be able to protect your home and car with intelligent camera systems that analyze obstacles people and even cats In addition to this you ll also learn how to train a search engine to praise or criticize the images that it finds and build a mobile app that speaks to you and responds to your body language By the end of this book you will be equipped with the knowledge you need to advance your skills as an app developer and a computer vision specialist What you will learn Detect motion and recognize gestures to control a smartphone game Detect car headlights and estimate their distance Detect and recognize human and cat faces to trigger an alarm Amplify motion in a real time video to show heartbeats and breaths Make a physics simulation that detects shapes in a real world drawing Build OpenCV 4 projects in Python 3 for desktops and Raspberry Pi Develop OpenCV 4 Android applications in Android Studio and Unity Who this book

is for If you are an experienced software developer who is new to computer vision or machine learning and wants to study these topics through creative projects then this book is for you The book will also help existing OpenCV users who want upgrade their projects to OpenCV 4 and new versions of other libraries languages tools and operating systems General familiarity with object oriented programming application development and usage of operating systems OS developer tools and the command line is required Hybrid Intelligent Systems Ajith Abraham,Thomas Hanne,Oscar Castillo,Niketa Gandhi,Tatiane Nogueira Rios,Tzung-Pei Hong,2021-04-16 This book highlights the recent research on hybrid intelligent systems and their various practical applications It presents 58 selected papers from the 20th International Conference on Hybrid Intelligent Systems HIS 2020 and 20 papers from the 12th World Congress on Nature and Biologically Inspired Computing NaBIC 2020 which was held online from December 14 to 16 2020 A premier conference in the field of artificial intelligence HIS NaBIC 2020 brought together researchers engineers and practitioners whose work involves intelligent systems network security and their applications in industry Including contributions by authors from 25 countries the book offers a valuable reference guide for all researchers students and practitioners in the fields of science and engineering

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Raspberry Pi Computer Vision Programming Introduction

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