Computer Vision-AI on Raspberry Pi

Members: Nataniel Kisten, Nicholas Calabrese, Andrew Heckler, Rachel Brooks

Hardware Architecture

- Raspberry Pi 4 Model B
  - 8GB RAM
- Raspberry Pi Camera
- Pi Foundation Display Touchscreen
- SmartiPi Touch 2

Software Architecture

- Raspberry Pi OS
- Python 3
- Bash
- PyQt5/Qt Designer
- Figma
- Azure Custom Vision
- Docker

Raspberry Pi 4: Single board computer that will contain the entire program

PyQt5/Qt Designer – Python library and tool used to develop the main GUI

Raspberry Pi Camera: Used to capture pictures for object detection on Raspberry Pi

Azure Custom Vision - Takes pictures from camera to train object recognition AI model

Raspberry Pi Computer Vision Programming

Rachel S Tattersall

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 FeaturesExplore the potential of computer vision with Raspberry Pi and Python programmingPerform computer vision tasks

such as image processing and manipulation using OpenCV and Raspberry PiDiscover easy to follow examples and screenshots to implement popular computer vision techniques and applicationsBook 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 learnSet up a Raspberry Pi for computer vision applicationsPerform basic image processing with libraries such as NumPy Matplotlib and OpenCVDemonstrate arithmetical logical and other operations on imagesWork with a USB webcam and the Raspberry Pi Camera ModuleImplement low pass and high pass filters and understand their applications in image processingCover advanced techniques such as histogram equalization and morphological transformationsCreate GUI apps with Python 3 and OpenCVPerform machine learning with K means clustering and image quantizationWho 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** Mohaideen A, Dr. Kadhar,G. Anand,2024-03-12 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 ll 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 ll 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 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 Shrirang Ambaji Kulkarni,Varadraj P. Gurupur,Steven L. Fernandes,2020-08-16 Machine Learning a branch of Artificial Intelligence is influencing the society industry and academia at large The adaptability of Python programming language to Machine Learning has increased its popularity further Another technology on the horizon is Internet of Things IoT The present book tries to address IoT Python and Machine Learning along with a small introduction to Image Processing If you are a novice programmer or have just started exploring IoT or Machine Learning with Python then this book is for you Features Raspberry Pi as IoT is described along with the procedure for installation and configuration A simple introduction to Python Programming Language along with its popular library packages like NumPy Pandas SciPy and Matplotlib are dealt in an exhaustive manner along with relevant examples Machine Learning along with Python Scikit Learn library is explained to audience with an emphasis on supervised learning and classification Image processing on IoT is introduced to the audience who love to apply Machine Learning algorithms to Images The book follows hands on approach and provide a huge collection of Python programs   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 with Maker Tech** Fabio Manganiello,2021 Harness the untapped potential of combining a decentralized Internet of

Things IoT with the ability to make predictions on real world fuzzy data This book covers the theory behind machine learning models and shows you how to program and assemble a voice controlled security You ll learn the differences between supervised and unsupervised learning and how the nuts and bolts of a neural network actually work You ll also learn to identify and measure the metrics that tell how well your classifier is doing An overview of other types of machine learning techniques such as genetic algorithms reinforcement learning support vector machines and anomaly detectors will get you up and running with a familiarity of basic machine learning concepts Chapters focus on the best practices to build models that can actually scale and are flexible enough to be embedded in multiple applications and easily reusable With those concepts covered you ll dive into the tools for setting up a network to collect and process the data points to be fed to our models by using some of the ubiquitous and cheap pieces of hardware that make up today s home automation and IoT industry such as the RaspberryPi Arduino ESP8266 etc Finally you ll put things together and work through a couple of practical examples You ll deploy models for detecting the presence of people in your house and anomaly detectors that inform you if some sensors have measured something unusual And you ll add a voice assistant that uses your own model to recognize your voice You will Develop a voice assistant to control your IoT devices Implement Computer Vision to detect changes in an environment Go beyond simple projects to also gain a grounding machine learning in general See how IoT can become smarter with the inception of machine learning techniques Build machine learning models using TensorFlow and OpenCV   Practical OpenCV Samarth Brahmbhatt,2013-11-30 Practical OpenCV is a hands on project book that shows you how to get the best results from OpenCV the open source computer vision library Computer vision is key to technologies like object recognition shape detection and depth estimation OpenCV is an open source library with over 2500 algorithms that you can use to do all of these as well as track moving objects extract 3D models and overlay augmented reality It s used by major companies like Google in its autonomous car Intel and Sony and it is the backbone of the Robot Operating System s computer vision capability In short if you re working with computer vision at all you need to know OpenCV With Practical OpenCV you ll be able to Get OpenCV up and running on Windows or Linux Use OpenCV to control the camera board and run vision algorithms on Raspberry Pi Understand what goes on behind the scenes in computer vision applications like object detection image stitching filtering stereo vision and more Code complex computer vision projects for your class hobby robot job many of which can execute in real time on off the shelf processors Combine different modules that you develop to create your own interactive computer vision app   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 **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 **Raspberry Pi Robotics** Barrett Williams,ChatGPT,2024-08-17 Raspberry Pi Robotics Unleash Your Inner Innovator Dive into the thrilling world of robotics with Raspberry Pi Robotics the ultimate guide for beginners and enthusiasts alike Whether you re a hobbyist student or tinkering tech lover this eBook is your gateway to creating intelligent and functional robots from the ground up Discover the Power of Raspberry Pi Start your journey with an introduction to the versatile Raspberry Pi and why it s the perfect platform for your robotic projects Learn which components you need to get started alongside step by step instructions for setting up and configuring your Raspberry Pi Master Python Programming Nothing makes a robot more interactive than custom software Learn the essentials of Python programming install it on your Raspberry Pi and write your first programs Unlock the

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Raspberry Pi Projects For Dummies Mike Cook,Jonathan Evans,Brock Craft,2015-07-13 Join the Raspberry revolution with these fun and easy Pi projects The Raspberry Pi has opened up a whole new world of innovation for everyone from hardware hackers and programmers to students hobbyists engineers and beyond Featuring a variety of hands on projects this easy to understand guide walks you through every step of the design process and will have you creating like a Raspberry Pi pro in no time You ll learn how to prepare your workspace assemble the necessary tools work with test equipment and find your way around the Raspberry Pi before moving on to a series of fun lively projects that brings some power to your plain ol Pi Introduces Raspberry Pi basics and gives you a solid understanding of all the essentials you ll need to take on your first project Includes an array of fun and useful projects that show you how to do everything from creating a magic light wand to enhancing your designs with Lego sensors installing and writing games for the RISC OS building a transistor tester and more Provides an easy hands on approach to learning more about electronics programming and interaction design for Makers and innovators of all ages Bring the power of Pi to your next cool creation with Raspberry Pi Projects For Dummies *Raspberry Pi Cookbook* Simon Monk,2022-12-08 If you ve started to work with Raspberry Pi you know that Raspberry Pi s capabilities are continually expanding The fourth edition of this popular cookbook provides more than 200 hands on recipes complete with code that show you how to run this tiny low cost computer with Linux program it with Python hook it up to sensors and motors and use it with the internet of things IoT This new edition includes new chapters on the Raspberry Pi Pico and machine learning with the Raspberry Pi These easy to use recipes will show you step by step how to Set up your Raspberry Pi and connect to a network Work with its Linux based operating system Program your Raspberry Pi with Python Give your Pi eyes with computer vision Recognize objects from video and sounds using machine learning Control hardware through the GPIO connector Use your Raspberry Pi to run different types of motors Work with switches keypads and other digital inputs Use sensors to measure temperature light and distance Connect to IoT devices in various ways and automate your home Use the Raspberry Pi Pico microcontroller board with your Raspberry Pi **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   Learn Raspberry Pi Programming with Python Wolfram Donat,2018-07-19 Learn how to program your nifty new 35 computer to make a web spider a weather station a media server and more This book explores 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 Even if you re completely new to programming in general you ll see how easy it is 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 use Pi with Arduino as well as Pi with Gertboard an expansion board with an onboard ATmega microcontroller Learn Raspberry Pi Programming with Python has been fully updated in this new edition to cover the features of the new boards You ll learn how to program in Python on your Raspberry Pi with hands on examples and fun projects What You ll Learn Set up your new Raspberry Pi Build unique projects across a range of interests Program basic functions and processes using Python Who This Book Is For Readers who want to learn Python on a fun platform like the Pi and pick up some electronics skills along the way No programming or Linux skill required but a little experience with Linux will be helpful Readers familiar with the 1st edition will enjoy the updated information in this new edition   Learning Raspberry Pi Samarth Shah,2015-04-24 If you have a passion for technology and want to explore the world of Raspberry Pi then this book provides you with all the tools and information you are looking for Although being familiar with basic programming concepts is useful you can still learn a lot from this book as a wide variety of topics are covered

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Raspberry Pi Computer Vision Programming Introduction

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