

# Learning Opencv Computer Vision With The Library Gary Bradski

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Computer Vision with Python Cookbook  
A Practical Introduction to Computer Vision with OpenCV

## Mastering OpenCV with Practical Computer Vision Projects

Expand your OpenCV knowledge and master key concepts of machine learning using this practical, hands-on guide. About This Book Load, store, edit, and visualize data using OpenCV and Python Grasp the fundamental concepts of classification, regression, and clustering Understand, perform, and experiment with machine learning techniques using this easy-to-follow guide Evaluate, compare, and choose the right algorithm for any task Who This Book Is For This book targets Python programmers who are already familiar with OpenCV; this book will give you the tools and understanding required to build your own machine learning systems, tailored to practical real-world tasks. What You Will Learn Explore and make effective use of OpenCV's machine learning module Learn deep learning for computer vision with Python Master linear regression and regularization techniques Classify objects such as flower species, handwritten digits, and pedestrians Explore the effective use of support vector machines, boosted decision trees, and random forests Get acquainted with neural networks and Deep Learning to address real-world problems Discover hidden structures in your data using k-means clustering Get to grips with data pre-processing and feature engineering In Detail Machine learning is no longer just a buzzword, it is all around us: from protecting your email, to automatically tagging friends in pictures, to predicting what movies you like. Computer vision is one of today's most exciting application fields of machine learning, with Deep Learning driving innovative systems such as self-driving cars and Google's DeepMind. OpenCV lies at the intersection of these topics, providing a comprehensive open-source library for classic as well as state-of-the-art computer vision and machine learning algorithms. In combination with Python

Anaconda, you will have access to all the open-source computing libraries you could possibly ask for. Machine learning for OpenCV begins by introducing you to the essential concepts of statistical learning, such as classification and regression. Once all the basics are covered, you will start exploring various algorithms such as decision trees, support vector machines, and Bayesian networks, and learn how to combine them with other OpenCV functionality. As the book progresses, so will your machine learning skills, until you are ready to take on today's hottest topic in the field: Deep Learning. By the end of this book, you will be ready to take on your own machine learning problems, either by building on the existing source code or developing your own algorithm from scratch! Style and approach OpenCV machine learning connects the fundamental theoretical principles behind machine learning to their practical applications in a way that focuses on asking and answering the right questions. This book walks you through the key elements of OpenCV and its powerful machine learning classes, while demonstrating how to get to grips with a range of models.

## **Learning OpenCV 3 Computer Vision with Python**

If you are a competent C++ programmer and want to learn the tricks of image processing with OpenCV, then this book is for you. A basic understanding of image processing is required.

## **Mastering OpenCV 4**

Work on practical computer vision projects covering advanced object detector techniques and modern deep learning and machine learning algorithms  
Key Features  
Learn about the new features that help unlock the full potential of OpenCV 4  
Build face detection applications with a cascade classifier using face landmarks  
Create an optical character recognition (OCR) model using deep learning and convolutional neural networks  
Book Description  
Mastering OpenCV, now in its third edition, targets computer vision engineers taking their first steps toward mastering OpenCV. Keeping the mathematical formulations to a solid but bare minimum, the book delivers complete projects from ideation to running code, targeting current hot topics in computer vision such as face recognition, landmark detection and pose estimation, and number recognition with deep convolutional networks. You'll learn from experienced OpenCV experts how to implement computer vision products and projects both in academia and industry in a comfortable package. You'll get acquainted with API functionality and gain insights into design choices in a complete computer vision project. You'll also go beyond the basics of computer vision to implement solutions for complex image processing projects. By the end of the book, you will have created various working prototypes with the help of projects in the book and be well versed with the new features of OpenCV4. What you will learn  
Build real-world computer vision problems with working OpenCV code samples  
Uncover best practices in engineering and maintaining OpenCV projects  
Explore algorithmic design approaches for complex computer vision tasks  
Work with OpenCV's most updated API (v4.0.0) through projects  
Understand 3D scene reconstruction and Structure from Motion (SfM)  
Study camera calibration and overlay AR using the ArUco Module  
Who this book is for  
This book is for those who have a basic knowledge of OpenCV and are competent C++ programmers. You need to have an understanding of some of the

more theoretical/mathematical concepts, as we move quite quickly throughout the book.

## **Machine Learning for OpenCV 4**

Each chapter in the book is an individual project and each project is constructed with step-by-step instructions, clearly explained code, and includes the necessary screenshots. You should have basic OpenCV and C/C++ programming experience before reading this book, as it is aimed at Computer Science graduates, researchers, and computer vision experts widening their expertise.

## **Computer Vision with OpenCV 3 and Qt5**

Unleash the power of computer vision with Python using OpenCV About This Book Create impressive applications with OpenCV and Python Familiarize yourself with advanced machine learning concepts Harness the power of computer vision with this easy-to-follow guide Who This Book Is For Intended for novices to the world of OpenCV and computer vision, as well as OpenCV veterans that want to learn about what's new in OpenCV 3, this book is useful as a reference for experts and a training manual for beginners, or for anybody who wants to familiarize themselves with the concepts of object classification and detection in simple and understandable terms. Basic knowledge about Python and programming concepts is required, although the book has an easy learning curve both from a theoretical and coding point of view. What You Will Learn Install and familiarize yourself with OpenCV 3's Python API Grasp the basics of image processing and video analysis Identify and recognize objects in images and videos Detect and recognize faces using OpenCV Train and use your own object classifiers Learn about machine learning concepts in a computer vision context Work with artificial neural networks using OpenCV Develop your own computer vision real-life application In Detail OpenCV 3 is a state-of-the-art computer vision library that allows a great variety of image and video processing operations. Some of the more spectacular and futuristic features such as face recognition or object tracking are easily achievable with OpenCV 3. Learning the basic concepts behind computer vision algorithms, models, and OpenCV's API will enable the development of all sorts of real-world applications, including security and surveillance. Starting with basic image processing operations, the book will take you through to advanced computer vision concepts. Computer vision is a rapidly evolving science whose applications in the real world are exploding, so this book will appeal to computer vision novices as well as experts of the subject wanting to learn the brand new OpenCV 3.0.0. You will build a theoretical foundation of image processing and video analysis, and progress to the concepts of classification through machine learning, acquiring the technical know-how that will allow you to create and use object detectors and classifiers, and even track objects in movies or video camera feeds. Finally, the journey will end in the world of artificial neural networks, along with the development of a hand-written digits recognition application. Style and approach This book is a comprehensive guide to the brand new OpenCV 3 with Python to develop real-life computer vision applications.

## **Learning Image Processing with OpenCV**

Computer Vision: Algorithms and Applications explores the variety of techniques commonly used to analyze and interpret images. It also describes challenging real-world applications where vision is being successfully used, both for specialized applications such as medical imaging, and for fun, consumer-level tasks such as image editing and stitching, which students can apply to their own personal photos and videos. More than just a source of “recipes,” this exceptionally authoritative and comprehensive textbook/reference also takes a scientific approach to basic vision problems, formulating physical models of the imaging process before inverting them to produce descriptions of a scene. These problems are also analyzed using statistical models and solved using rigorous engineering techniques. Topics and features: structured to support active curricula and project-oriented courses, with tips in the Introduction for using the book in a variety of customized courses; presents exercises at the end of each chapter with a heavy emphasis on testing algorithms and containing numerous suggestions for small mid-term projects; provides additional material and more detailed mathematical topics in the Appendices, which cover linear algebra, numerical techniques, and Bayesian estimation theory; suggests additional reading at the end of each chapter, including the latest research in each sub-field, in addition to a full Bibliography at the end of the book; supplies supplementary course material for students at the associated website, <http://szeliski.org/Book/>. Suitable for an upper-level undergraduate or graduate-level course in computer science or engineering, this textbook focuses on basic techniques that work under real-world conditions and encourages students to push their creative boundaries. Its design and exposition also make it eminently suitable as a unique reference to the fundamental techniques and current research literature in computer vision.

## **Building Computer Vision Projects with OpenCV 4 and C++**

Build practical applications of computer vision using the OpenCV library with Python. This book discusses different facets of computer vision such as image and object detection, tracking and motion analysis and their applications with examples. The author starts with an introduction to computer vision followed by setting up OpenCV from scratch using Python. The next section discusses specialized image processing and segmentation and how images are stored and processed by a computer. This involves pattern recognition and image tagging using the OpenCV library. Next, you'll work with object detection, video storage and interpretation, and human detection using OpenCV. Tracking and motion is also discussed in detail. The book also discusses creating complex deep learning models with CNN and RNN. The author finally concludes with recent applications and trends in computer vision. After reading this book, you will be able to understand and implement computer vision and its applications with OpenCV using Python. You will also be able to create deep learning models with CNN and RNN and understand how these cutting-edge deep learning architectures work. What You Will Learn Understand what computer vision is, and its overall application in intelligent automation systems Discover the deep learning techniques required to build computer vision applications Build complex computer vision applications using the latest techniques in OpenCV, Python, and NumPy Create practical applications and implementations such as face detection and recognition, handwriting recognition, object detection, and tracking and motion analysis Who This Book Is For Those who have a basic understanding of machine learning and

Python and are looking to learn computer vision and its applications.

## Learning OpenCV 3

Design and develop advanced computer vision projects using OpenCV with Python  
About This Book Program advanced computer vision applications in Python using  
different features of the OpenCV library Practical end-to-end project covering an  
important computer vision problem All projects in the book include a step-by-step  
guide to create computer vision applications Who This Book Is For This book is for  
intermediate users of OpenCV who aim to master their skills by developing  
advanced practical applications. Readers are expected to be familiar with  
OpenCV's concepts and Python libraries. Basic knowledge of Python programming  
is expected and assumed. What You Will Learn Generate real-time visual effects  
using different filters and image manipulation techniques such as dodging and  
burning Recognize hand gestures in real time and perform hand-shape analysis  
based on the output of a Microsoft Kinect sensor Learn feature extraction and  
feature matching for tracking arbitrary objects of interest Reconstruct a 3D real-  
world scene from 2D camera motion and common camera reprojection techniques  
Track visually salient objects by searching for and focusing on important regions of  
an image Detect faces using a cascade classifier and recognize emotional  
expressions in human faces using multi-layer perceptrons (MLPs) Recognize street  
signs using a multi-class adaptation of support vector machines (SVMs) Strengthen  
your OpenCV2 skills and learn how to use new OpenCV3 features In Detail OpenCV  
is a native cross platform C++ Library for computer vision, machine learning, and  
image processing. It is increasingly being adopted in Python for development.  
OpenCV has C++/C, Python, and Java interfaces with support for Windows, Linux,  
Mac, iOS, and Android. Developers using OpenCV build applications to process  
visual data; this can include live streaming data from a device like a camera, such  
as photographs or videos. OpenCV offers extensive libraries with over 500  
functions This book demonstrates how to develop a series of intermediate to  
advanced projects using OpenCV and Python, rather than teaching the core  
concepts of OpenCV in theoretical lessons. Instead, the working projects developed  
in this book teach the reader how to apply their theoretical knowledge to topics  
such as image manipulation, augmented reality, object tracking, 3D scene  
reconstruction, statistical learning, and object categorization. By the end of this  
book, readers will be OpenCV experts whose newly gained experience allows them  
to develop their own advanced computer vision applications. Style and approach  
This book covers independent hands-on projects that teach important computer  
vision concepts like image processing and machine learning for OpenCV with  
multiple examples.

## Hands-On Algorithms for Computer Vision

Delve into practical computer vision and image processing projects and get up to  
speed with advanced object detection techniques and machine learning algorithms  
Key Features Discover best practices for engineering and maintaining OpenCV  
projects Explore important deep learning tools for image classification Understand  
basic image matrix formats and filters Book Description OpenCV is one of the best  
open source libraries available and can help you focus on constructing complete  
projects on image processing, motion detection, and image segmentation. This

Learning Path is your guide to understanding OpenCV concepts and algorithms through real-world examples and activities. Through various projects, you'll also discover how to use complex computer vision and machine learning algorithms and face detection to extract the maximum amount of information from images and videos. In later chapters, you'll learn to enhance your videos and images with optical flow analysis and background subtraction. Sections in the Learning Path will help you get to grips with text segmentation and recognition, in addition to guiding you through the basics of the new and improved deep learning modules. By the end of this Learning Path, you will have mastered commonly used computer vision techniques to build OpenCV projects from scratch. This Learning Path includes content from the following Packt books: Mastering OpenCV 4 - Third Edition by Roy Shilkrot and David Millán Escrivá Learn OpenCV 4 By Building Projects - Second Edition by David Millán Escrivá, Vinícius G. Mendonça, and Prateek Joshi What you will learn Stay up-to-date with algorithmic design approaches for complex computer vision tasks Work with OpenCV's most up-to-date API through various projects Understand 3D scene reconstruction and Structure from Motion (SfM) Study camera calibration and overlay augmented reality (AR) using the ArUco module Create CMake scripts to compile your C++ application Explore segmentation and feature extraction techniques Remove backgrounds from static scenes to identify moving objects for surveillance Work with new OpenCV functions to detect and recognize text with Tesseract Who this book is for If you are a software developer with a basic understanding of computer vision and image processing and want to develop interesting computer vision applications with OpenCV, this Learning Path is for you. Prior knowledge of C++ and familiarity with mathematical concepts will help you better understand the concepts in this Learning Path.

### **Qt 5 and OpenCV 4 Computer Vision Projects**

A practical, project-based tutorial for Python developers and hobbyists who want to get started with computer vision with OpenCV and Python. OpenCV Computer Vision with Python is written for Python developers who are new to computer vision and want a practical guide to teach them the essentials. Some understanding of image data (for example, pixels and color channels) would be beneficial. At a minimum you will need access to at least one webcam. Certain exercises require additional hardware like a second webcam, a Microsoft Kinect or an OpenNI-compliant depth sensor such as the Asus Xtion PRO.

### **Learning OpenCV**

Learning OpenCV 3.0 puts you in the middle of the expanding field of computer vision. Written by the creators of the free open source OpenCV library, this book introduces you to computer vision and demonstrates how you can quickly build applications that enable computers to “see” and make decisions based on that data. It’s thoroughly updated to cover new features and changes in OpenCV 3.0. Computer vision is everywhere—in security systems, manufacturing inspection systems, medical image analysis, Unmanned Aerial Vehicles, and more. It stitches Google maps and Google Earth together, checks the pixels on LCD screens, and makes sure the stitches in your shirt are sewn properly. OpenCV provides an easy-to-use computer vision framework and a comprehensive library with more than

500 functions that can run vision code in real time.

## Mastering OpenCV 4 with Python

If you want a basic understanding of computer vision's underlying theory and algorithms, this hands-on introduction is the ideal place to start. You'll learn techniques for object recognition, 3D reconstruction, stereo imaging, augmented reality, and other computer vision applications as you follow clear examples written in Python. Programming Computer Vision with Python explains computer vision in broad terms that won't bog you down in theory. You get complete code samples with explanations on how to reproduce and build upon each example, along with exercises to help you apply what you've learned. This book is ideal for students, researchers, and enthusiasts with basic programming and standard mathematical skills. Learn techniques used in robot navigation, medical image analysis, and other computer vision applications Work with image mappings and transforms, such as texture warping and panorama creation Compute 3D reconstructions from several images of the same scene Organize images based on similarity or content, using clustering methods Build efficient image retrieval techniques to search for images based on visual content Use algorithms to classify image content and recognize objects Access the popular OpenCV library through a Python interface

## Computer Vision

Discover interesting recipes to help you understand the concepts of object detection, image processing, and facial detection Key Features Explore the latest features and APIs in OpenCV 4 and build computer vision algorithms Develop effective, robust, and fail-safe vision for your applications Build computer vision algorithms with machine learning capabilities Book Description OpenCV is an image and video processing library used for all types of image and video analysis. Throughout the book, you'll work through recipes that implement a variety of tasks, such as facial recognition and detection. With 70 self-contained tutorials, this book examines common pain points and best practices for computer vision (CV) developers. Each recipe addresses a specific problem and offers a proven, best-practice solution with insights into how it works, so that you can copy the code and configuration files and modify them to suit your needs. This book begins by setting up OpenCV, and explains how to manipulate pixels. You'll understand how you can process images with classes and count pixels with histograms. You'll also learn detecting, describing, and matching interest points. As you advance through the chapters, you'll get to grips with estimating projective relations in images, reconstructing 3D scenes, processing video sequences, and tracking visual motion. In the final chapters, you'll cover deep learning concepts such as face and object detection. By the end of the book, you'll be able to confidently implement a range to computer vision algorithms to meet the technical requirements of your complex CV projects What you will learn Install and create a program using the OpenCV library Segment images into homogenous regions and extract meaningful objects Apply image filters to enhance image content Exploit image geometry to relay different views of a pictured scene Calibrate the camera from different image observations Detect people and objects in images using machine learning techniques Reconstruct a 3D scene from images Explore face detection using deep

learning Who this book is for If you're a CV developer or professional who already uses or would like to use OpenCV for building computer vision software, this book is for you. You'll also find this book useful if you're a C++ programmer looking to extend your computer vision skillset by learning OpenCV.

## **Pro Processing for Images and Computer Vision with OpenCV**

Unleash the power of computer vision with Python to carry out image processing and computer vision techniques About This Book Learn how to build a full-fledged image processing application using free tools and libraries Perform basic to advanced image and video stream processing with OpenCV's Python APIs Understand and optimize various features of OpenCV with the help of easy-to-grasp examples Who This Book Is For This book is for Python developers who want to perform image processing. It's ideal for those who want to explore the field of computer vision, and design and develop computer vision applications using Python. The reader is expected to have basic knowledge of Python. What You Will Learn Working with open source libraries such Pillow, Scikit-image, and OpenCV Writing programs such as edge detection, color processing, image feature extraction, and more Implementing feature detection algorithms like LBP and ORB Tracking objects using an external camera or a video file Optical Character Recognition using Machine Learning. Understanding Convolutional Neural Networks to learn patterns in images Leveraging Cloud Infrastructure to provide Computer Vision as a Service In Detail This book is a thorough guide for developers who want to get started with building computer vision applications using Python 3. The book is divided into five sections: The Fundamentals of Image Processing, Applied Computer Vision, Making Applications Smarter, Extending your Capabilities using OpenCV, and Getting Hands on. Throughout this book, three image processing libraries Pillow, Scikit-Image, and OpenCV will be used to implement different computer vision algorithms. The book aims to equip readers to build Computer Vision applications that are capable of working in real-world scenarios effectively. Some of the applications that we will look at in the book are Optical Character Recognition, Object Tracking and building a Computer Vision as a Service platform that works over the internet. Style and approach Each stage of the book elaborates on various concepts and algorithms in image processing/computer vision using Python. This step-by-step guide can be used both as a tutorial and as a reference.

## **Deep Learning for Computer Vision**

Recipe-based approach to tackle the most common problems in Computer Vision by leveraging the functionality of OpenCV using Python APIs Key Features ●Build computer vision applications with OpenCV functionality via Python API ●Get to grips with image processing, multiple view geometry, and machine learning ●Learn to use deep learning models for image classification, object detection, and face recognition Book Description OpenCV 3 is a native cross-platform library for computer vision, machine learning, and image processing. OpenCV's convenient high-level APIs hide very powerful internals designed for computational efficiency that can take advantage of multicore and GPU processing. This book will help you tackle increasingly challenging computer vision problems by providing a number of recipes that you can use to improve your applications. In this book, you will learn how to process an image by manipulating pixels and analyze an image using

histograms. Then, we'll show you how to apply image filters to enhance image content and exploit the image geometry in order to relay different views of a pictured scene. We'll explore techniques to achieve camera calibration and perform a multiple-view analysis. Later, you'll work on reconstructing a 3D scene from images, converting low-level pixel information to high-level concepts for applications such as object detection and recognition. You'll also discover how to process video from files or cameras and how to detect and track moving objects. Finally, you'll get acquainted with recent approaches in deep learning and neural networks. By the end of the book, you'll be able to apply your skills in OpenCV to create computer vision applications in various domains. What you will learn

- Get familiar with low-level image processing methods
- See the common linear algebra tools needed in computer vision
- Work with different camera models and epipolar geometry
- Find out how to detect interesting points in images and compare them
- Binarize images and mask out regions of interest
- Detect objects and track them in videos

Who this book is for This book is for developers who have a basic knowledge of Python. If you are aware of the basics of OpenCV and are ready to build computer vision systems that are smarter, faster, more complex, and more practical than the competition, then this book is for you.

## Learning OpenCV 3

A practical guide to understanding the core machine learning and deep learning algorithms, and implementing them to create intelligent image processing systems using OpenCV 4

Key Features Gain insights into machine learning algorithms, and implement them using OpenCV 4 and scikit-learn Get up to speed with Intel OpenVINO and its integration with OpenCV 4 Implement high-performance machine learning models with helpful tips and best practices

Book Description OpenCV is an opensource library for building computer vision apps. The latest release, OpenCV 4, offers a plethora of features and platform improvements that are covered comprehensively in this up-to-date second edition. You'll start by understanding the new features and setting up OpenCV 4 to build your computer vision applications. You will explore the fundamentals of machine learning and even learn to design different algorithms that can be used for image processing. Gradually, the book will take you through supervised and unsupervised machine learning. You will gain hands-on experience using scikit-learn in Python for a variety of machine learning applications. Later chapters will focus on different machine learning algorithms, such as a decision tree, support vector machines (SVM), and Bayesian learning, and how they can be used for object detection computer vision operations. You will then delve into deep learning and ensemble learning, and discover their real-world applications, such as handwritten digit classification and gesture recognition. Finally, you'll get to grips with the latest Intel OpenVINO for building an image processing system. By the end of this book, you will have developed the skills you need to use machine learning for building intelligent computer vision applications with OpenCV 4. What you will learn

- Understand the core machine learning concepts for image processing
- Explore the theory behind machine learning and deep learning algorithm design
- Discover effective techniques to train your deep learning models
- Evaluate machine learning models to improve the performance of your models
- Integrate algorithms such as support vector machines and Bayes classifier in your computer vision applications
- Use OpenVINO with OpenCV 4 to speed up model inference

Who this book is for

This book is for Computer Vision professionals, machine learning developers, or anyone who wants to learn machine learning algorithms and implement them using OpenCV 4. If you want to build real-world Computer Vision and image processing applications powered by machine learning, then this book is for you. Working knowledge of Python programming is required to get the most out of this book.

## **Machine Learning for OpenCV**

Step-by-step tutorials on deep learning neural networks for computer vision in python with Keras.

## **Learning OpenCV 3 Application Development**

Blend the power of Qt with OpenCV to build cross-platform computer vision applications

**Key Features**

- Start creating robust applications with the power of OpenCV and Qt combined
- Learn from scratch how to develop cross-platform computer vision applications
- Accentuate your OpenCV applications by developing them with Qt

**Book Description** Developers have been using OpenCV library to develop computer vision applications for a long time. However, they now need a more effective tool to get the job done and in a much better and modern way. Qt is one of the major frameworks available for this task at the moment. This book will teach you to develop applications with the combination of OpenCV 3 and Qt5, and how to create cross-platform computer vision applications. We'll begin by introducing Qt, its IDE, and its SDK. Next you'll learn how to use the OpenCV API to integrate both tools, and see how to configure Qt to use OpenCV. You'll go on to build a full-fledged computer vision application throughout the book. Later, you'll create a stunning UI application using the Qt widgets technology, where you'll display the images after they are processed in an efficient way. At the end of the book, you'll learn how to convert OpenCV Mat to Qt QImage. You'll also see how to efficiently process images to filter them, transform them, detect or track objects as well as analyze video. You'll become better at developing OpenCV applications.

**What you will learn**

- Get an introduction to Qt IDE and SDK
- Be introduced to OpenCV and see how to communicate between OpenCV and Qt
- Understand how to create UI using Qt Widgets
- Learn to develop cross-platform applications using OpenCV 3 and Qt 5
- Explore the multithreaded application development features of Qt5
- Improve OpenCV 3 application development using Qt5
- Build, test, and deploy Qt and OpenCV apps, either dynamically or statically
- See Computer Vision technologies such as filtering and transformation of images, detecting and matching objects, template matching, object tracking, video and motion analysis, and much more
- Be introduced to QML and Qt Quick for iOS and Android application development

**Who this book is for** This book is for readers interested in building computer vision applications. Intermediate knowledge of C++ programming is expected. Even though no knowledge of Qt5 and OpenCV 3 is assumed, if you're familiar with these frameworks, you'll benefit.

## **Learn Computer Vision Using OpenCV**

How does the computer learn to understand what it sees? Deep Learning for Vision

Systems answers that by applying deep learning to computer vision. Using only high school algebra, this book illuminates the concepts behind visual intuition. You'll understand how to use deep learning architectures to build vision system applications for image generation and facial recognition. Summary Computer vision is central to many leading-edge innovations, including self-driving cars, drones, augmented reality, facial recognition, and much, much more. Amazing new computer vision applications are developed every day, thanks to rapid advances in AI and deep learning (DL). Deep Learning for Vision Systems teaches you the concepts and tools for building intelligent, scalable computer vision systems that can identify and react to objects in images, videos, and real life. With author Mohamed Elgendy's expert instruction and illustration of real-world projects, you'll finally grok state-of-the-art deep learning techniques, so you can build, contribute to, and lead in the exciting realm of computer vision! Purchase of the print book includes a free eBook in PDF, Kindle, and ePub formats from Manning Publications.

About the technology How much has computer vision advanced? One ride in a Tesla is the only answer you'll need. Deep learning techniques have led to exciting breakthroughs in facial recognition, interactive simulations, and medical imaging, but nothing beats seeing a car respond to real-world stimuli while speeding down the highway. About the book How does the computer learn to understand what it sees? Deep Learning for Vision Systems answers that by applying deep learning to computer vision. Using only high school algebra, this book illuminates the concepts behind visual intuition. You'll understand how to use deep learning architectures to build vision system applications for image generation and facial recognition.

What's inside Image classification and object detection Advanced deep learning architectures Transfer learning and generative adversarial networks DeepDream and neural style transfer Visual embeddings and image search About the reader For intermediate Python programmers. About the author Mohamed Elgendy is the VP of Engineering at Rakuten. A seasoned AI expert, he has previously built and managed AI products at Amazon and Twilio. Table of Contents PART 1 - DEEP LEARNING FOUNDATION 1 Welcome to computer vision 2 Deep learning and neural networks 3 Convolutional neural networks 4 Structuring DL projects and hyperparameter tuning PART 2 - IMAGE CLASSIFICATION AND DETECTION 5 Advanced CNN architectures 6 Transfer learning 7 Object detection with R-CNN, SSD, and YOLO PART 3 - GENERATIVE MODELS AND VISUAL EMBEDDINGS 8 Generative adversarial networks (GANs) 9 DeepDream and neural style transfer 10 Visual embeddings

## **Learning OpenCV 4 Computer Vision with Python 3**

Explains the theory behind basic computer vision and provides a bridge from the theory to practical implementation using the industry standard OpenCV libraries. Computer Vision is a rapidly expanding area and it is becoming progressively easier for developers to make use of this field due to the ready availability of high quality libraries (such as OpenCV2). This text is intended to facilitate the practical use of computer vision with the goal being to bridge the gap between the theory and the practical implementation of computer vision. The book will explain how to use the relevant OpenCV library routines and will be accompanied by a full working program including the code snippets from the text. This textbook is a heavily illustrated, practical introduction to an exciting field, the applications of which are becoming almost ubiquitous. We are now surrounded by cameras, for

example cameras on computers & tablets/ cameras built into our mobile phones/ cameras in games consoles; cameras imaging difficult modalities (such as ultrasound, X-ray, MRI) in hospitals, and surveillance cameras. This book is concerned with helping the next generation of computer developers to make use of all these images in order to develop systems which are more intuitive and interact with us in more intelligent ways. Explains the theory behind basic computer vision and provides a bridge from the theory to practical implementation using the industry standard OpenCV libraries. Offers an introduction to computer vision, with enough theory to make clear how the various algorithms work but with an emphasis on practical programming issues. Provides enough material for a one semester course in computer vision at senior undergraduate and Masters levels. Includes the basics of cameras and images and image processing to remove noise, before moving on to topics such as image histogramming; binary imaging; video processing to detect and model moving objects; geometric operations & camera models; edge detection; features detection; recognition in images. Contains a large number of vision application problems to provide students with the opportunity to solve real problems. Images or videos for these problems are provided in the resources associated with this book which include an enhanced eBook.

## **Programming Computer Vision with Python**

Get started in the rapidly expanding field of computer vision with this practical guide. Written by Adrian Kaehler and Gary Bradski, creator of the open source OpenCV library, this book provides a thorough introduction for developers, academics, roboticists, and hobbyists. You'll learn what it takes to build applications that enable computers to "see" and make decisions based on that data. With over 500 functions that span many areas in vision, OpenCV is used for commercial applications such as security, medical imaging, pattern and face recognition, robotics, and factory product inspection. This book gives you a firm grounding in computer vision and OpenCV for building simple or sophisticated vision applications. Hands-on exercises in each chapter help you apply what you've learned. This volume covers the entire library, in its modern C++ implementation, including machine learning tools for computer vision. Learn OpenCV data types, array types, and array operations. Capture and store still and video images with HighGUI. Transform images to stretch, shrink, warp, remap, and repair. Explore pattern recognition, including face detection. Track objects and motion through the visual field. Reconstruct 3D images from stereo vision. Discover basic and advanced machine learning techniques in OpenCV.

## **Computer Vision Projects with OpenCV and Python 3**

Gain a working knowledge of advanced machine learning and explore Python's powerful tools for extracting data from images and videos. Key Features: Implement image classification and object detection using machine learning and deep learning. Perform image classification, object detection, image segmentation, and other Computer Vision tasks. Crisp content with a practical approach to solving real-world problems in Computer Vision. Book Description: Python is the ideal programming language for rapidly prototyping and developing production-grade codes for image processing and Computer Vision with its robust syntax and wealth of powerful libraries. This book will help you design and develop production-grade Computer

Vision projects tackling real-world problems. With the help of this book, you will learn how to set up Anaconda and Python for the major OSes with cutting-edge third-party libraries for Computer Vision. You'll learn state-of-the-art techniques for classifying images, finding and identifying human postures, and detecting faces within videos. You will use powerful machine learning tools such as OpenCV, Dlib, and TensorFlow to build exciting projects such as classifying handwritten digits, detecting facial features, and much more. The book also covers some advanced projects, such as reading text from license plates from real-world images using Google's Tesseract software, and tracking human body poses using DeeperCut within TensorFlow. By the end of this book, you will have the expertise required to build your own Computer Vision projects using Python and its associated libraries. What you will learn Install and run major Computer Vision packages within Python Apply powerful support vector machines for simple digit classification Understand deep learning with TensorFlow Build a deep learning classifier for general images Use LSTMs for automated image captioning Read text from real-world images Extract human pose data from images Who this book is for Python programmers and machine learning developers who wish to build exciting Computer Vision projects using the power of machine learning and OpenCV will find this book useful. The only prerequisite for this book is that you should have a sound knowledge of Python programming.

## **OpenCV 4 Computer Vision Application Programming Cookbook**

Create powerful, accurate, and real-time Computer Vision applications using a perfect blend of algorithms and filters. Also learn about object tracking and foreground extractions with a variety of new filters and algorithms. Key Features Filter, transform, and manipulate images using MAT class and OpenCV Framework Explore motion detection and object tracking with filters and algorithms Build object detectors using deep learning and machine learning algorithms Book Description An arena that has been positively impacted by the advancements in processing power and performance is the field of computer vision. It's only natural that over time, more and more algorithms are introduced to perform computer vision tasks more efficiently. Hands-On Algorithms for Computer Vision is a starting point for anyone who is interested in the field of computer vision and wants to explore the most practical algorithms used by professional computer vision developers. The book starts with the basics and builds up over the course of the chapters with hands-on examples for each algorithm. Right from the start, you will learn about the required tools for computer vision development, and how to install and configure them. You'll explore the OpenCV framework and its powerful collection of libraries and functions. Starting from the most simple image modifications, filtering, and transformations, you will gradually build up your knowledge of various algorithms until you are able to perform much more sophisticated tasks, such as real-time object detection using deep learning algorithms. What you will learn Get to grips with machine learning and artificial intelligence algorithms Read, write, and process images and videos Perform mathematical, matrix, and other types of image data operations Create and use histograms from back-projection images Detect motion, extract foregrounds, and track objects Extract key points with a collection of feature detector algorithms Develop cascade classifiers and use them, and train and test classifiers Employ TensorFlow object detection to detect multiple objects Who this book is for Hands-

On Algorithms for Computer Vision helps those who want to learn algorithms in Computer Vision to create and customize their applications. This book will also help existing Computer Vision developers customize their applications. A basic understanding of computer vision and programming experience is needed.

## **Deep Learning for Vision Systems**

Apply neural network architectures to build state-of-the-art computer vision applications using the Python programming language  
Key Features Gain a fundamental understanding of advanced computer vision and neural network models in use today  
Cover tasks such as low-level vision, image classification, and object detection  
Develop deep learning models on cloud platforms and optimize them using TensorFlow Lite and the OpenVINO toolkit  
Book Description Computer vision allows machines to gain human-level understanding to visualize, process, and analyze images and videos. This book focuses on using TensorFlow to help you learn advanced computer vision tasks such as image acquisition, processing, and analysis. You'll start with the key principles of computer vision and deep learning to build a solid foundation, before covering neural network architectures and understanding how they work rather than using them as a black box. Next, you'll explore architectures such as VGG, ResNet, Inception, R-CNN, SSD, YOLO, and MobileNet. As you advance, you'll learn to use visual search methods using transfer learning. You'll also cover advanced computer vision concepts such as semantic segmentation, image inpainting with GAN's, object tracking, video segmentation, and action recognition. Later, the book focuses on how machine learning and deep learning concepts can be used to perform tasks such as edge detection and face recognition. You'll then discover how to develop powerful neural network models on your PC and on various cloud platforms. Finally, you'll learn to perform model optimization methods to deploy models on edge devices for real-time inference. By the end of this book, you'll have a solid understanding of computer vision and be able to confidently develop models to automate tasks.  
What you will learn Explore methods of feature extraction and image retrieval and visualize different layers of the neural network model  
Use TensorFlow for various visual search methods for real-world scenarios  
Build neural networks or adjust parameters to optimize the performance of models  
Understand TensorFlow DeepLab to perform semantic segmentation on images and DCGAN for image inpainting  
Evaluate your model and optimize and integrate it into your application to operate at scale  
Get up to speed with techniques for performing manual and automated image annotation  
Who this book is for This book is for computer vision professionals, image processing professionals, machine learning engineers and AI developers who have some knowledge of machine learning and deep learning and want to build expert-level computer vision applications. In addition to familiarity with TensorFlow, Python knowledge will be required to get started with this book.

## **Computer Vision with Python 3**

Learn the techniques for object recognition, 3D reconstruction, stereo imaging, and other computer vision applications using examples on different functions of OpenCV. Key Features Learn how to apply complex visual effects to images with OpenCV 3.x and Python Extract features from an image and use them to develop advanced applications Build algorithms to help you understand image content and

perform visual searches Get to grips with advanced techniques in OpenCV such as machine learning, artificial neural network, 3D reconstruction, and augmented reality Book Description Computer vision is found everywhere in modern technology. OpenCV for Python enables us to run computer vision algorithms in real time. With the advent of powerful machines, we have more processing power to work with. Using this technology, we can seamlessly integrate our computer vision applications into the cloud. Focusing on OpenCV 3.x and Python 3.6, this book will walk you through all the building blocks needed to build amazing computer vision applications with ease. We start off by manipulating images using simple filtering and geometric transformations. We then discuss affine and projective transformations and see how we can use them to apply cool advanced manipulations to your photos like resizing them while keeping the content intact or smoothly removing undesired elements. We will then cover techniques of object tracking, body part recognition, and object recognition using advanced techniques of machine learning such as artificial neural network. 3D reconstruction and augmented reality techniques are also included. The book covers popular OpenCV libraries with the help of examples. This book is a practical tutorial that covers various examples at different levels, teaching you about the different functions of OpenCV and their actual implementation. By the end of this book, you will have acquired the skills to use OpenCV and Python to develop real-world computer vision applications. What you will learn Detect shapes and edges from images and videos How to apply filters on images and videos Use different techniques to manipulate and improve images Extract and manipulate particular parts of images and videos Track objects or colors from videos Recognize specific object or faces from images and videos How to create Augmented Reality applications Apply artificial neural networks and machine learning to improve object recognition Who this book is for This book is intended for Python developers who are new to OpenCV and want to develop computer vision applications with OpenCV and Python. This book is also useful for generic software developers who want to deploy computer vision applications on the cloud. It would be helpful to have some familiarity with basic mathematical concepts such as vectors, matrices, and so on.

## **Mastering Computer Vision with TensorFlow 2.x**

"This library is useful for practitioners, and is an excellent tool for those entering the field: it is a set of computer vision algorithms that work as advertised." -William T. Freeman, Computer Science and Artificial Intelligence Laboratory, Massachusetts Institute of Technology Learning OpenCV puts you in the middle of the rapidly expanding field of computer vision. Written by the creators of the free open source OpenCV library, this book introduces you to computer vision and demonstrates how you can quickly build applications that enable computers to "see" and make decisions based on that data. Computer vision is everywhere-in security systems, manufacturing inspection systems, medical image analysis, Unmanned Aerial Vehicles, and more. It stitches Google maps and Google Earth together, checks the pixels on LCD screens, and makes sure the stitches in your shirt are sewn properly. OpenCV provides an easy-to-use computer vision framework and a comprehensive library with more than 500 functions that can run vision code in real time. Learning OpenCV will teach any developer or hobbyist to use the framework quickly with the help of hands-on exercises in each chapter. This book includes: A thorough introduction to OpenCV Getting input from cameras Transforming images

Segmenting images and shape matching Pattern recognition, including face detection Tracking and motion in 2 and 3 dimensions 3D reconstruction from stereo vision Machine learning algorithms Getting machines to see is a challenging but entertaining goal. Whether you want to build simple or sophisticated vision applications, Learning OpenCV is the book you need to get started.

### **Practical Computer Vision**

Create advanced applications with Python and OpenCV, exploring the potential of facial recognition, machine learning, deep learning, web computing and augmented reality. Key Features Develop your computer vision skills by mastering algorithms in Open Source Computer Vision 4 (OpenCV 4) and Python Apply machine learning and deep learning techniques with TensorFlow, Keras, and PyTorch Discover the modern design patterns you should avoid when developing efficient computer vision applications Book Description OpenCV is considered to be one of the best open source computer vision and machine learning software libraries. It helps developers build complete projects in relation to image processing, motion detection, or image segmentation, among many others. OpenCV for Python enables you to run computer vision algorithms smoothly in real time, combining the best of the OpenCV C++ API and the Python language. In this book, you'll get started by setting up OpenCV and delving into the key concepts of computer vision. You'll then proceed to study more advanced concepts and discover the full potential of OpenCV. The book will also introduce you to the creation of advanced applications using Python and OpenCV, enabling you to develop applications that include facial recognition, target tracking, or augmented reality. Next, you'll learn machine learning techniques and concepts, understand how to apply them in real-world examples, and also explore their benefits, including real-time data production and faster data processing. You'll also discover how to translate the functionality provided by OpenCV into optimized application code projects using Python bindings. Toward the concluding chapters, you'll explore the application of artificial intelligence and deep learning techniques using the popular Python libraries TensorFlow, and Keras. By the end of this book, you'll be able to develop advanced computer vision applications to meet your customers' demands. What you will learn Handle files and images, and explore various image processing techniques Explore image transformations, including translation, resizing, and cropping Gain insights into building histograms Brush up on contour detection, filtering, and drawing Work with Augmented Reality to build marker-based and markerless applications Work with the main machine learning algorithms in OpenCV Explore the deep learning Python libraries and OpenCV deep learning capabilities Create computer vision and deep learning web applications Who this book is for This book is designed for computer vision developers, engineers, and researchers who want to develop modern computer vision applications. Basic experience of OpenCV and Python programming is a must.

### **OpenCV with Python Blueprints**

A practical guide designed to get you from basics to current state of art in computer vision systems. Key Features Master the different tasks associated with Computer Vision and develop your own Computer Vision applications with ease Leverage the power of Python, Tensorflow, Keras, and OpenCV to perform image

processing, object detection, feature detection and more With real-world datasets and fully functional code, this book is your one-stop guide to understanding Computer Vision Book Description In this book, you will find several recently proposed methods in various domains of computer vision. You will start by setting up the proper Python environment to work on practical applications. This includes setting up libraries such as OpenCV, TensorFlow, and Keras using Anaconda. Using these libraries, you'll start to understand the concepts of image transformation and filtering. You will find a detailed explanation of feature detectors such as FAST and ORB; you'll use them to find similar-looking objects. With an introduction to convolutional neural nets, you will learn how to build a deep neural net using Keras and how to use it to classify the Fashion-MNIST dataset. With regard to object detection, you will learn the implementation of a simple face detector as well as the workings of complex deep-learning-based object detectors such as Faster R-CNN and SSD using TensorFlow. You'll get started with semantic segmentation using FCN models and track objects with Deep SORT. Not only this, you will also use Visual SLAM techniques such as ORB-SLAM on a standard dataset. By the end of this book, you will have a firm understanding of the different computer vision techniques and how to apply them in your applications. What you will learn Learn the basics of image manipulation with OpenCV Implement and visualize image filters such as smoothing, dilation, histogram equalization, and more Set up various libraries and platforms, such as OpenCV, Keras, and Tensorflow, in order to start using computer vision, along with appropriate datasets for each chapter, such as MSCOCO, MOT, and Fashion-MNIST Understand image transformation and downsampling with practical implementations. Explore neural networks for computer vision and convolutional neural networks using Keras Understand working on deep-learning-based object detection such as Faster-R-CNN, SSD, and more Explore deep-learning-based object tracking in action Understand Visual SLAM techniques such as ORB-SLAM Who this book is for This book is for machine learning practitioners and deep learning enthusiasts who want to understand and implement various tasks associated with Computer Vision and image processing in the most practical manner possible. Some programming experience would be beneficial while knowing Python would be an added bonus.

## **OpenCV 3.0 Computer Vision with Java**

Updated for OpenCV 4 and Python 3, this book covers the latest on depth cameras, 3D tracking, augmented reality, and deep neural networks, helping you solve real-world computer vision problems with practical code Key Features Build powerful computer vision applications in concise code with OpenCV 4 and Python 3 Learn the fundamental concepts of image processing, object classification, and 2D and 3D tracking Train, use, and understand machine learning models such as Support Vector Machines (SVMs) and neural networks Book Description Computer vision is a rapidly evolving science, encompassing diverse applications and techniques. This book will not only help those who are getting started with computer vision but also experts in the domain. You'll be able to put theory into practice by building apps with OpenCV 4 and Python 3. You'll start by understanding OpenCV 4 and how to set it up with Python 3 on various platforms. Next, you'll learn how to perform basic operations such as reading, writing, manipulating, and displaying still images, videos, and camera feeds. From taking you through image processing, video analysis, and depth estimation and segmentation, to helping you gain

practice by building a GUI app, this book ensures you'll have opportunities for hands-on activities. Next, you'll tackle two popular challenges: face detection and face recognition. You'll also learn about object classification and machine learning concepts, which will enable you to create and use object detectors and classifiers, and even track objects in movies or video camera feed. Later, you'll develop your skills in 3D tracking and augmented reality. Finally, you'll cover ANNs and DNNs, learning how to develop apps for recognizing handwritten digits and classifying a person's gender and age. By the end of this book, you'll have the skills you need to execute real-world computer vision projects. What you will learn

- Install and familiarize yourself with OpenCV 4's Python 3 bindings
- Understand image processing and video analysis basics
- Use a depth camera to distinguish foreground and background regions
- Detect and identify objects, and track their motion in videos
- Train and use your own models to match images and classify objects
- Detect and recognize faces, and classify their gender and age
- Build an augmented reality application to track an image in 3D
- Work with machine learning models, including SVMs, artificial neural networks (ANNs), and deep neural networks (DNNs)

Who this book is for If you are interested in learning computer vision, machine learning, and OpenCV in the context of practical real-world applications, then this book is for you. This OpenCV book will also be useful for anyone getting started with computer vision as well as experts who want to stay up-to-date with OpenCV 4 and Python 3. Although no prior knowledge of image processing, computer vision or machine learning is required, familiarity with basic Python programming is a must.

## **OpenCV 3 Computer Vision Application Programming Cookbook**

Create image processing, object detection and face recognition apps by leveraging the power of machine learning and deep learning with OpenCV 4 and Qt 5

- Key Features** Gain practical insights into code for all projects covered in this book
- Understand modern computer vision concepts** such as character recognition, image processing and modification
- Learn to use a graphics processing unit (GPU)** and its parallel processing power for filtering images quickly

**Book Description** OpenCV and Qt have proven to be a winning combination for developing cross-platform computer vision applications. By leveraging their power, you can create robust applications with both an intuitive graphical user interface (GUI) and high-performance capabilities. This book will help you learn through a variety of real-world projects on image processing, face and text recognition, object detection, and high-performance computing. You'll be able to progressively build on your skills by working on projects of increasing complexity. You'll begin by creating an image viewer application, building a user interface from scratch by adding menus, performing actions based on key-presses, and applying other functions. As you progress, the book will guide you through using OpenCV image processing and modification functions to edit an image with filters and transformation features. In addition to this, you'll explore the complex motion analysis and facial landmark detection algorithms, which you can use to build security and face detection applications. Finally, you'll learn to use pretrained deep learning models in OpenCV and GPUs to filter images quickly. By the end of this book, you will have learned how to effectively develop full-fledged computer vision applications with OpenCV and Qt. What you will learn

- Create an image viewer with all the basic requirements
- Construct an image editor to filter or transform images
- Develop a security app to detect movement and secure homes
- Build an app to detect facial landmarks and

apply masks to faces Create an app to extract text from scanned documents and photos Train and use cascade classifiers and DL models for object detection Build an app to measure the distance between detected objects Implement high-speed image filters on GPU with Open Graphics Library (OpenGL) Who this book is for This book is for engineers and developers who are familiar with both Qt and OpenCV frameworks and are capable of creating simple projects using them, but want to build their skills to create professional-level projects using them. Familiarity with the C++ language is a must to follow the example source codes in this book.

## **OpenCV 3.x with Python By Example**

OpenCV 3.0 Computer Vision with Java is a practical tutorial guide that explains fundamental tasks from computer vision while focusing on Java development. This book will teach you how to set up OpenCV for Java and handle matrices using the basic operations of image processing such as filtering and image transforms. It will also help you learn how to use Haar cascades for tracking faces and to detect foreground and background regions with the help of a Kinect device. It will even give you insights into server-side OpenCV. Each chapter is presented with several projects that are ready to use. The functionality of these projects is found in many classes that allow developers to understand computer vision principles and rapidly extend or customize the projects for their needs.

## **OpenCV: Computer Vision Projects with Python**

"This library is useful for practitioners, and is an excellent tool for those entering the field: it is a set of computer vision algorithms that work as advertised."-William T. Freeman, Computer Science and Artificial Intelligence Laboratory, Massachusetts Institute of Technology Learning OpenCV puts you in the middle of the rapidly expanding field of computer vision. Written by the creators of the free open source OpenCV library, this book introduces you to computer vision and demonstrates how you can quickly build applications that enable computers to "see" and make decisions based on that data. Computer vision is everywhere-in security systems, manufacturing inspection systems, medical image analysis, Unmanned Aerial Vehicles, and more. It stitches Google maps and Google Earth together, checks the pixels on LCD screens, and makes sure the stitches in your shirt are sewn properly. OpenCV provides an easy-to-use computer vision framework and a comprehensive library with more than 500 functions that can run vision code in real time. Learning OpenCV will teach any developer or hobbyist to use the framework quickly with the help of hands-on exercises in each chapter. This book includes: A thorough introduction to OpenCV Getting input from cameras Transforming images Segmenting images and shape matching Pattern recognition, including face detection Tracking and motion in 2 and 3 dimensions 3D reconstruction from stereo vision Machine learning algorithms Getting machines to see is a challenging but entertaining goal. Whether you want to build simple or sophisticated vision applications, Learning OpenCV is the book you need to get started.

## **OpenCV Computer Vision with Python**

Get started in the rapidly expanding field of computer vision with this practical

guide. Written by Adrian Kaehler and Gary Bradski, creator of the open source OpenCV library, this book provides a thorough introduction for developers, academics, roboticists, and hobbyists. You'll learn what it takes to build applications that enable computers to "see" and make decisions based on that data. With over 500 functions that span many areas in vision, OpenCV is used for commercial applications such as security, medical imaging, pattern and face recognition, robotics, and factory product inspection. This book gives you a firm grounding in computer vision and OpenCV for building simple or sophisticated vision applications. Hands-on exercises in each chapter help you apply what you've learned. This volume covers the entire library, in its modern C++ implementation, including machine learning tools for computer vision. Learn OpenCV data types, array types, and array operations Capture and store still and video images with HighGUI Transform images to stretch, shrink, warp, remap, and repair Explore pattern recognition, including face detection Track objects and motion through the visual field Reconstruct 3D images from stereo vision Discover basic and advanced machine learning techniques in OpenCV

## **Learn OpenCV 4 by Building Projects**

Explore OpenCV 4 to create visually appealing cross-platform computer vision applications Key Features Understand basic OpenCV 4 concepts and algorithms Grasp advanced OpenCV techniques such as 3D reconstruction, machine learning, and artificial neural networks Work with Tesseract OCR, an open-source library to recognize text in images Book Description OpenCV is one of the best open source libraries available, and can help you focus on constructing complete projects on image processing, motion detection, and image segmentation. Whether you're completely new to computer vision, or have a basic understanding of its concepts, Learn OpenCV 4 by Building Projects - Second edition will be your guide to understanding OpenCV concepts and algorithms through real-world examples and projects. You'll begin with the installation of OpenCV and the basics of image processing. Then, you'll cover user interfaces and get deeper into image processing. As you progress through the book, you'll learn complex computer vision algorithms and explore machine learning and face detection. The book then guides you in creating optical flow video analysis and background subtraction in complex scenes. In the concluding chapters, you'll also learn about text segmentation and recognition and understand the basics of the new and improved deep learning module. By the end of this book, you'll be familiar with the basics of Open CV, such as matrix operations, filters, and histograms, and you'll have mastered commonly used computer vision techniques to build OpenCV projects from scratch. What you will learn Install OpenCV 4 on your operating system Create CMake scripts to compile your C++ application Understand basic image matrix formats and filters Explore segmentation and feature extraction techniques Remove backgrounds from static scenes to identify moving objects for surveillance Employ various techniques to track objects in a live video Work with new OpenCV functions for text detection and recognition with Tesseract Get acquainted with important deep learning tools for image classification Who this book is for If you are a software developer with a basic understanding of computer vision and image processing and want to develop interesting computer vision applications with OpenCV, Learn OpenCV 4 by Building Projects for you. Prior knowledge of C++ will help you understand the concepts covered in this book.

## OpenCV By Example

Apply the Processing language to tasks involved in computer vision--tasks such as edge and corner detection, recognition of motion between frames in a video, recognition of objects, matching of feature points and shapes in different frames for tracking purposes, and more. You will manipulate images through creative effects, geometric transformation, blending of multiple images, and so forth. Examples are provided. Pro Processing for Images and Computer Vision with OpenCV is a step-by-step training tool that guides you through a series of worked examples in linear order. Each chapter begins with a basic demonstration, including the code to recreate it on your own system. Then comes a creative challenge by which to engage and develop mastery of the chapter's topic. The book also includes hints and tips relating to visual arts, interaction design, and industrial best practices. This book is intended for any developer of artistic and otherwise visual applications, such as in augmented reality and digital effects, with a need to manipulate images, and to recognize and manipulate objects within those images. The book is specifically targeted at those making use of the Processing language that is common in artistic fields, and to Java programmers because of Processing's easy integration into the Java programming environment. What You'll Learn Make use of OpenCV, the open source library for computer vision in the Processing environment Capture live video streams and examine them frame-by-frame for objects in motion Recognize shapes and objects through techniques of detecting lines, edges, corners, and more Transform images by scaling, translating, rotating, and additionally through various distortion effects Apply techniques such as background subtraction to isolate motion of objects in live video streams Detect and track human faces and other objects by matching feature points in different images or video frames Who This Book Is For Media artists, designers, and creative coders

## Learning OpenCV

Learn how to build your own computer vision (CV) applications quickly and easily with SimpleCV, an open source framework written in Python. Through examples of real-world applications, this hands-on guide introduces you to basic CV techniques for collecting, processing, and analyzing streaming digital images. You'll then learn how to apply these methods with SimpleCV, using sample Python code. All you need to get started is a Windows, Mac, or Linux system, and a willingness to put CV to work in a variety of ways. Programming experience is optional. Capture images from several sources, including webcams, smartphones, and Kinect Filter image input so your application processes only necessary information Manipulate images by performing basic arithmetic on pixel values Use feature detection techniques to focus on interesting parts of an image Work with several features in a single image, using the NumPy and SciPy Python libraries Learn about optical flow to identify objects that change between two image frames Use SimpleCV's command line and code editor to run examples and test techniques

## Learning OpenCV 3

Build, create, and deploy your own computer vision applications with the power of

**OpenCV About This Book** This book provides hands-on examples that cover the major features that are part of any important Computer Vision application. It explores important algorithms that allow you to recognize faces, identify objects, extract features from images, help your system make meaningful predictions from visual data, and much more. All the code examples in the book are based on OpenCV 3.1 – the latest version.

**Who This Book Is For** This is the perfect book for anyone who wants to dive into the exciting world of image processing and computer vision. This book is aimed at programmers with a working knowledge of C++. Prior knowledge of OpenCV or Computer Vision/Machine Learning is not required.

**What You Will Learn**

- Explore the steps involved in building a typical computer vision/machine learning application.
- Understand the relevance of OpenCV at every stage of building an application.
- Harness the vast amount of information that lies hidden in images into the apps you build.
- Incorporate visual information in your apps to create more appealing software.
- Get acquainted with how large-scale and popular image editing apps such as Instagram work behind the scenes by getting a glimpse of how the image filters in apps can be recreated using simple operations in OpenCV.
- Appreciate how difficult it is for a computer program to perform tasks that are trivial for human beings.
- Get to know how to develop applications that perform face detection, gender detection from facial images, and handwritten character (digit) recognition.

**In Detail** Computer vision and machine learning concepts are frequently used in practical computer vision based projects. If you're a novice, this book provides the steps to build and deploy an end-to-end application in the domain of computer vision using OpenCV/C++. At the outset, we explain how to install OpenCV and demonstrate how to run some simple programs. You will start with images (the building blocks of image processing applications), and see how they are stored and processed by OpenCV. You'll get comfortable with OpenCV-specific jargon (Mat, Point, Scalar, and more), and get to know how to traverse images and perform basic pixel-wise operations. Building upon this, we introduce slightly more advanced image processing concepts such as filtering, thresholding, and edge detection. In the latter parts, the book touches upon more complex and ubiquitous concepts such as face detection (using Haar cascade classifiers), interest point detection algorithms, and feature descriptors. You will now begin to appreciate the true power of the library in how it reduces mathematically non-trivial algorithms to a single line of code! The concluding sections touch upon OpenCV's Machine Learning module. You will witness not only how OpenCV helps you pre-process and extract features from images that are relevant to the problems you are trying to solve, but also how to use Machine Learning algorithms that work on these features to make intelligent predictions from visual data!

**Style and approach** This book takes a very hands-on approach to developing an end-to-end application with OpenCV. To avoid being too theoretical, the description of concepts are accompanied simultaneously by the development of applications. Throughout the course of the book, the projects and practical, real-life examples are explained and developed step by step in sync with the theory.

### **Practical Computer Vision with SimpleCV**

Recipes to help you build computer vision applications that make the most of the popular C++ library OpenCV 3.

**About This Book** Written to the latest, gold-standard specification of OpenCV 3.

**Master OpenCV**, the open source library of the computer vision community.

**Master fundamental concepts** in computer vision and image

processing Learn about the important classes and functions of OpenCV with complete working examples applied to real images Who This Book Is For OpenCV 3 Computer Vision Application Programming Cookbook Third Edition is appropriate for novice C++ programmers who want to learn how to use the OpenCV library to build computer vision applications. It is also suitable for professional software developers who wish to be introduced to the concepts of computer vision programming. It can also be used as a companion book for university-level computer vision courses. It constitutes an excellent reference for graduate students and researchers in image processing and computer vision. What You Will Learn Install and create a program using the OpenCV library Process an image by manipulating its pixels Analyze an image using histograms Segment images into homogenous regions and extract meaningful objects Apply image filters to enhance image content Exploit the image geometry in order to relay different views of a pictured scene Calibrate the camera from different image observations Detect people and objects in images using machine learning techniques Reconstruct a 3D scene from images In Detail Making your applications see has never been easier with OpenCV. With it, you can teach your robot how to follow your cat, write a program to correctly identify the members of One Direction, or even help you find the right colors for your redecoration. OpenCV 3 Computer Vision Application Programming Cookbook Third Edition provides a complete introduction to the OpenCV library and explains how to build your first computer vision program. You will be presented with a variety of computer vision algorithms and exposed to important concepts in image and video analysis that will enable you to build your own computer vision applications. This book helps you to get started with the library, and shows you how to install and deploy the OpenCV library to write effective computer vision applications following good programming practices. You will learn how to read and write images and manipulate their pixels. Different techniques for image enhancement and shape analysis will be presented. You will learn how to detect specific image features such as lines, circles or corners. You will be introduced to the concepts of mathematical morphology and image filtering. The most recent methods for image matching and object recognition are described, and you'll discover how to process video from files or cameras, as well as how to detect and track moving objects. Techniques to achieve camera calibration and perform multiple-view analysis will also be explained. Finally, you'll also get acquainted with recent approaches in machine learning and object classification. Style and approach This book will arm you with the basics you need to start writing world-aware applications right from a pixel level all the way through to processing video sequences.

## **OpenCV 3 Computer Vision with Python Cookbook**

Enhance your understanding of Computer Vision and image processing by developing real-world projects in OpenCV 3 About This Book Get to grips with the basics of Computer Vision and image processing This is a step-by-step guide to developing several real-world Computer Vision projects using OpenCV 3 This book takes a special focus on working with Tesseract OCR, a free, open-source library to recognize text in images Who This Book Is For If you are a software developer with a basic understanding of Computer Vision and image processing and want to develop interesting Computer Vision applications with Open CV, this is the book for you. Knowledge of C++ is required. What You Will Learn Install OpenCV 3 on your

operating system Create the required CMake scripts to compile the C++ application and manage its dependencies Get to grips with the Computer Vision workflows and understand the basic image matrix format and filters Understand the segmentation and feature extraction techniques Remove backgrounds from a static scene to identify moving objects for video surveillance Track different objects in a live video using various techniques Use the new OpenCV functions for text detection and recognition with Tesseract In Detail Open CV is a cross-platform, free-for-use library that is primarily used for real-time Computer Vision and image processing. It is considered to be one of the best open source libraries that helps developers focus on constructing complete projects on image processing, motion detection, and image segmentation. Whether you are completely new to the concept of Computer Vision or have a basic understanding of it, this book will be your guide to understanding the basic OpenCV concepts and algorithms through amazing real-world examples and projects. Starting from the installation of OpenCV on your system and understanding the basics of image processing, we swiftly move on to creating optical flow video analysis or text recognition in complex scenes, and will take you through the commonly used Computer Vision techniques to build your own Open CV projects from scratch. By the end of this book, you will be familiar with the basics of Open CV such as matrix operations, filters, and histograms, as well as more advanced concepts such as segmentation, machine learning, complex video analysis, and text recognition. Style and approach This book is a practical guide with lots of tips, and is closely focused on developing Computer vision applications with OpenCV. Beginning with the fundamentals, the complexity increases with each chapter. Sample applications are developed throughout the book that you can execute and use in your own projects.

## **A Practical Introduction to Computer Vision with OpenCV**

Get savvy with OpenCV and actualize cool computer vision applications About This Book Use OpenCV's Python bindings to capture video, manipulate images, and track objects Learn about the different functions of OpenCV and their actual implementations. Develop a series of intermediate to advanced projects using OpenCV and Python Who This Book Is For This learning path is for someone who has a working knowledge of Python and wants to try out OpenCV. This Learning Path will take you from a beginner to an expert in computer vision applications using OpenCV. OpenCV's application are humongous and this Learning Path is the best resource to get yourself acquainted thoroughly with OpenCV. What You Will Learn Install OpenCV and related software such as Python, NumPy, SciPy, OpenNI, and SensorKinect - all on Windows, Mac or Ubuntu Apply "curves" and other color transformations to simulate the look of old photos, movies, or video games Apply geometric transformations to images, perform image filtering, and convert an image into a cartoon-like image Recognize hand gestures in real time and perform hand-shape analysis based on the output of a Microsoft Kinect sensor Reconstruct a 3D real-world scene from 2D camera motion and common camera reprojection techniques Detect and recognize street signs using a cascade classifier and support vector machines (SVMs) Identify emotional expressions in human faces using convolutional neural networks (CNNs) and SVMs Strengthen your OpenCV2 skills and learn how to use new OpenCV3 features In Detail OpenCV is a state-of-art computer vision library that allows a great variety of image and video

processing operations. OpenCV for Python enables us to run computer vision algorithms in real time. This learning path proposes to teach the following topics. First, we will learn how to get started with OpenCV and OpenCV3's Python API, and develop a computer vision application that tracks body parts. Then, we will build amazing intermediate-level computer vision applications such as making an object disappear from an image, identifying different shapes, reconstructing a 3D map from images , and building an augmented reality application, Finally, we'll move to more advanced projects such as hand gesture recognition, tracking visually salient objects, as well as recognizing traffic signs and emotions on faces using support vector machines and multi-layer perceptrons respectively. This Learning Path combines some of the best that Packt has to offer in one complete, curated package. It includes content from the following Packt products: OpenCV Computer Vision with Python by Joseph Howse OpenCV with Python By Example by Prateek Joshi OpenCV with Python Blueprints by Michael Beyeler Style and approach This course aims to create a smooth learning path that will teach you how to get started with will learn how to get started with OpenCV and OpenCV 3's Python API, and develop superb computer vision applications. Through this comprehensive course, you'll learn to create computer vision applications from scratch to finish and more!.

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