

# **OpenGL Data Visualization Cookbook**

Over 35 hands-on recipes to create impressive, stunning  
visuals for a wide range of real-time, interactive  
applications using OpenGL

**Raymond C. H. Lo**

**William C. Y. Lo**



# OpenGl Data Visualization Cookbook

**Raymond Lo, William Lo**

## Opengl Data Visualization Cookbook:

**OpenGL Data Visualization Cookbook** Raymond Lo, William Lo, 2015-08-30 Over 35 hands on recipes to create impressive stunning visuals for a wide range of real time interactive applications using OpenGL About This Book Get acquainted with a set of fundamental OpenGL primitives and concepts that enable users to create stunning visuals of arbitrarily complex 2D and 3D datasets for many common applications Explore interactive real time visualization of large 2D and 3D datasets or models including the use of more advanced techniques such as stereoscopic 3D rendering Create stunning visuals on the latest platforms including mobile phones and state of the art wearable computing devices Who This Book Is For This book is aimed at anyone interested in creating impressive data visualization tools using modern graphics hardware Whether you are a developer engineer or scientist if you are interested in exploring the power of OpenGL for data visualization this book is for you While familiarity with C/C++ is recommended no previous experience with OpenGL is assumed What You Will Learn Install, compile and integrate the OpenGL pipeline into your own project Create interactive applications using GLFW to handle user inputs and the Android Sensor framework to detect gestures and motions on mobile devices Use OpenGL primitives to plot 2D datasets such as time series, dynamically Render complex 3D volumetric datasets with techniques such as data slicers and multiple viewpoint projection Render images, videos and point cloud data from 3D range sensing cameras using the OpenGL Shading Language (GLSL) Develop video see-through augmented reality applications on mobile devices with OpenGL ES 3.0 and OpenCV Visualize 3D models with meshes and surfaces using stereoscopic 3D technology In Detail OpenGL is a great multi-platform cross-language and hardware accelerated graphics interface for visualizing large 2D and 3D datasets Data visualization has become increasingly challenging using conventional approaches as datasets become larger and larger especially with the Big Data evolution From a mobile device to a sophisticated high-performance computing cluster OpenGL libraries provide developers with an easy to use interface to create stunning visuals in 3D in real time for a wide range of interactive applications This book provides a series of easy to follow hands-on tutorials to create appealing OpenGL based visualization tools with minimal development time We will first illustrate how to quickly set up the development environment in Windows, Mac OS X and Linux Next we will demonstrate how to visualize data for a wide range of applications using OpenGL starting from simple 2D datasets to increasingly complex 3D datasets with more advanced techniques Each chapter addresses different visualization problems encountered in real life and introduces the relevant OpenGL features and libraries in a modular fashion By the end of this book you will be equipped with the essential skills to develop a wide range of impressive OpenGL based applications for your unique data visualization needs on platforms ranging from conventional computers to the latest mobile wearable devices Style and approach This is an easy to follow comprehensive Cookbook showing readers how to create a variety of real time interactive data visualization tools Each topic is explained in a step by step format A range of hot topics is included including stereoscopic 3D rendering and data

visualization on mobile wearable platforms

**OpenGL Data Visualization Cookbook** Raymond C. H. Lo, William C. Y.

Lo, 2015-08-24 Over 35 hands on recipes to create impressive stunning visuals for a wide range of real time interactive applications using OpenGL. **About This Book** Get acquainted with a set of fundamental OpenGL primitives and concepts that enable users to create stunning visuals of arbitrarily complex 2D and 3D datasets for many common applications. Explore interactive real time visualization of large 2D and 3D datasets or models including the use of more advanced techniques such as stereoscopic 3D rendering. Create stunning visuals on the latest platforms including mobile phones and state of the art wearable computing devices. **Who This Book Is For** This book is aimed at anyone interested in creating impressive data visualization tools using modern graphics hardware. Whether you are a developer, engineer or scientist if you are interested in exploring the power of OpenGL for data visualization this book is for you. While familiarity with C/C++ is recommended no previous experience with OpenGL is assumed. **What You Will Learn** Install, compile and integrate the OpenGL pipeline into your own project. Create interactive applications using GLFW to handle user inputs and the Android Sensor framework to detect gestures and motions on mobile devices. Use OpenGL primitives to plot 2D datasets such as time series dynamically. Render complex 3D volumetric datasets with techniques such as data slicers and multiple viewpoint projection. Render images, videos and point cloud data from 3D range sensing cameras using the OpenGL Shading Language (GLSL). Develop video see-through augmented reality applications on mobile devices with OpenGL ES 3.0 and OpenCV. Visualize 3D models with meshes and surfaces using stereoscopic 3D technology. **In Detail** OpenGL is a great multi-platform, cross-language and hardware accelerated graphics interface for visualizing large 2D and 3D datasets. Data visualization has become increasingly challenging using conventional approaches as datasets become larger and larger especially with the Big Data evolution. From a mobile device to a sophisticated high performance computing cluster OpenGL libraries provide developers with an easy to use interface to create stunning visuals in 3D in real time for a wide range of interactive applications. This book provides a series of easy to follow hands on tutorials to create appealing OpenGL based visualization tools with minimal development time. We will first illustrate how to quickly set up the development environment in Windows, Mac OS X and Linux. Next we will demonstrate how to visualize data for a wide range of applications using OpenGL starting from simple 2D datasets to increasingly complex 3D datasets with more advanced techniques. Each chapter addresses different visualization problems encountered in real life and introduces the relevant OpenGL features and libraries in a modular fashion. By the end of this book you will be equipped with the essential skills to develop a wide range of impressive OpenGL based applications for your unique data visualization needs on platforms ranging from conventional computers to the latest mobile wearable devices. **Style and approach** This is an easy to follow comprehensive Cookbook showing readers how to create an application with real time interactive data visualization in stereoscopic 3D. Each topic is explained in a step by step format. A range of hot topics is included including data visualization on mobile and wearable platforms.

[Open Gl Data Visualization Cookbook](#) John

MacLane,2017-06-04 OpenGL is a great multi platform cross language and hardware accelerated graphics interface for visualizing large 2D and 3D datasets Data visualization has become increasingly challenging using conventional approaches as datasets become larger and larger especially with the Big Data evolution From a mobile device to a sophisticated high performance computing cluster OpenGL libraries provide developers with an easy to use interface to create stunning visuals in 3D in real time for a wide range of interactive applications This book provides a series of easy to follow hands on tutorials to create appealing OpenGL based visualization tools with minimal development time We will first illustrate how to quickly set up the development environment in Windows Mac OS X and Linux Next we will demonstrate how to visualize data for a wide range of applications using OpenGL starting from simple 2D datasets to increasingly complex 3D datasets with more advanced techniques Each chapter addresses different visualization problems encountered in real life and introduces the relevant OpenGL features and libraries in a modular fashion By the end of this book you will be equipped with the essential skills to develop a wide range of impressive OpenGL based applications for your unique data visualization needs on platforms ranging from conventional computers to the latest mobile wearable devices

*Python Data Visualization Cookbook* Igor Milovanovic, Dimitry Foures, Giuseppe Vettigli, 2015-11-30 Over 70 recipes to get you started with popular Python libraries based on the principal concepts of data visualization About This Book Learn how to set up an optimal Python environment for data visualization Understand how to import clean and organize your data Determine different approaches to data visualization and how to choose the most appropriate for your needs Who This Book Is For If you already know about Python programming and want to understand data data formats data visualization and how to use Python to visualize data then this book is for you What You Will Learn Introduce yourself to the essential tooling to set up your working environment Explore your data using the capabilities of standard Python Data Library and Panda Library Draw your first chart and customize it Use the most popular data visualization Python libraries Make 3D visualizations mainly using mplot3d Create charts with images and maps Understand the most appropriate charts to describe your data Know the matplotlib hidden gems Use plotly to share your visualization online In Detail Python Data Visualization Cookbook will progress the reader from the point of installing and setting up a Python environment for data manipulation and visualization all the way to 3D animations using Python libraries Readers will benefit from over 60 precise and reproducible recipes that will guide the reader towards a better understanding of data concepts and the building blocks for subsequent and sometimes more advanced concepts Python Data Visualization Cookbook starts by showing how to set up matplotlib and the related libraries that are required for most parts of the book before moving on to discuss some of the lesser used diagrams and charts such as Gantt Charts or Sankey diagrams Initially it uses simple plots and charts to more advanced ones to make it easy to understand for readers As the readers will go through the book they will get to know about the 3D diagrams and animations Maps are irreplaceable for displaying geo spatial data so this book will also show how to build them In the last chapter it includes explanation on how to

incorporate matplotlib into different environments such as a writing system LaTeX or how to create Gantt charts using Python Style and approach A step by step recipe based approach to data visualization The topics are explained sequentially as cookbook recipes consisting of a code snippet and the resulting visualization [Geographical Information Systems Theory, Applications and Management](#) Lemonia Ragia, Robert Laurini, Jorge Gustavo Rocha, 2018-12-29 This book constitutes the thoroughly refereed proceedings of the Third International Conference on Geographical Information Theory Application and Management GISTAM 2017 held in Porto Portugal in April 2017 The 11 full papers presented were carefully reviewed and selected from 70 submissions The papers are centered around photogrammetry spatio temporal data acquisition spectroscopy and spectroradiometry hyperspectral imaging Earth observation and satellite data computational geometry web applications geographic information retrieval urban and regional planning

**OpenGL - Build high performance graphics** Muhammad Mobeen Movania, David Wolff, Raymond C. H. Lo, William C. Y. Lo, 2017-05-29 Gain proficiency with OpenGL and build compelling graphics for your games and applications About This Book Get to grips with a wide range of techniques for implementing shadows using shadow maps shadow volumes and more Explore interactive real time visualizations of large 2D and 3D datasets or models including the use of more advanced techniques such as stereoscopic 3D rendering Create stunning visuals on the latest platforms including mobile phones and state of the art wearable computing devices Who This Book Is For The course is appropriate for anyone who wants to develop the skills and techniques essential for working with OpenGL to develop compelling 2D and 3D graphics What You Will Learn Off screen rendering and environment mapping techniques to render mirrors Shadow mapping techniques including variance shadow mapping Implement a particle system using shaders Utilize noise in shaders Make use of compute shaders for physics animation and general computing Create interactive applications using GLFW to handle user inputs and the Android Sensor framework to detect gestures and motions on mobile devices Use OpenGL primitives to plot 2 D datasets such as time series dynamically Render complex 3D volumetric datasets with techniques such as data slicers and multiple viewpoint projection In Detail OpenGL is a fully functional cross platform API widely adopted across the industry for 2D and 3D graphics development It is mainly used for game development and applications but is equally popular in a vast variety of additional sectors This practical course will help you gain proficiency with OpenGL and build compelling graphics for your games and applications OpenGL Development Cookbook This is your go to guide to learn graphical programming techniques and implement 3D animations with OpenGL This straight talking Cookbook is perfect for intermediate C programmers who want to exploit the full potential of OpenGL Full of practical techniques for implementing amazing computer graphics and visualizations using OpenGL OpenGL 4.0 Shading Language Cookbook Second Edition With Version 4 the language has been further refined to provide programmers with greater power and flexibility with new stages such as tessellation and compute OpenGL Shading Language 4 Cookbook is a practical guide that takes you from the fundamentals of programming with modern GLSL and

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**OpenGL Es 3.0 Cookbook** Parminder Singh,2015-05-30 If you are new to OpenGL ES or have some experience in 3D graphics then this book will be extremely helpful in raising your expertise level from a novice to professional The book implements more than 90 recipes to solve everyday challenges helping you transition from a beginner to a professional

**OpenGL ? Build High Performance Graphics** Muhammad Mobeen Movania,2017 *OpenGL Development Cookbook* Muhammad Mobeen Movania,2013-01-01 The book is written in a Cookbook format with practical recipes aimed at helping you exploit OpenGL to its full potential This book is targeted towards intermediate OpenGL programmers However those who are new to OpenGL and know an alternate API like DirectX might also find these recipes useful to create OpenGL animations

**Tableau Data Visualization Cookbook** Ashutosh Nandeshwar,2013 This Cookbook contains step by step instructions for Tableau users to create effective graphics The book is designed in such a way that you can refer to it chapter by chapter you can look at the list of recipes and read them in no particular order You ll gain the most from this book if you have basic understanding of various chart types and of their importance Knowing when to employ a certain graphic will be equally useful This book will get you up to speed if you just started using Tableau You ll find this book useful if you spend a lot of time conducting data analysis and creating reports

**Estuarine and Coastal Modeling** Malcolm L. Spaulding,2002 This collection contains 66 papers on marine environmental modeling presented at the Seventh International Conference on Estuarine and Coastal Modeling held in St Petersburg Florida November 5 7 2001

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*Data Visualization with D3.js Cookbook* Nick Qi Zhu,2013-10-24 Packed with practical recipes this is a step by step guide to learning data visualization with D3 with the help of detailed illustrations and code samples If you are a developer familiar with HTML CSS and JavaScript and you wish to get the most out of D3 then this book is for you This book can also serve as a desktop quick reference guide for experienced data visualization developers

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Kenwright,2025    **OpenGL 4 Shading Language Cookbook** David Wolff,2018    *3D Graphics Rendering Cookbook*  
Sergey Kosarevsky,Viktor Latypov,2021-08-25 Build a 3D rendering engine from scratch while solving problems in a step by step way with the help of useful recipes Key Features Learn to integrate modern rendering techniques into a single performant 3D rendering engine Leverage Vulkan to render 3D content use AZDO in OpenGL applications and understand modern real time rendering methods Implement a physically based rendering pipeline from scratch in Vulkan and OpenGL Book DescriptionOpenGL is a popular cross language cross platform application programming interface API used for rendering 2D and 3D graphics while Vulkan is a low overhead cross platform 3D graphics API that targets high performance applications 3D Graphics Rendering Cookbook helps you learn about modern graphics rendering algorithms and techniques using C programming along with OpenGL and Vulkan APIs The book begins by setting up a development environment and takes you through the steps involved in building a 3D rendering engine with the help of basic yet self contained recipes Each recipe will enable you to incrementally add features to your codebase and show you how to integrate different 3D rendering techniques and algorithms into one large project You ll also get to grips with core techniques such as physically based rendering image based rendering and CPU GPU geometry culling to name a few As you advance you ll explore common techniques and solutions that will help you to work with large datasets for 2D and 3D rendering Finally you ll discover how to apply optimization techniques to build performant and feature rich graphics applications By the end of this 3D rendering book you ll have gained an improved understanding of best practices used in modern graphics APIs and be able to create fast and versatile 3D rendering frameworks What you will learn Improve the performance of legacy OpenGL applications Manage a substantial amount of content in real time 3D rendering engines Discover how to debug and profile graphics applications Understand how to use the Approaching Zero Driver Overhead AZDO philosophy in OpenGL Integrate various rendering techniques into a single application Find out how to develop Vulkan applications Implement a physically based rendering pipeline from scratch Integrate a physics library with your rendering engine Who this book is for This book is for 3D graphics developers who are familiar with the mathematical fundamentals of 3D rendering and want to gain expertise in writing fast rendering engines with advanced techniques using C libraries and APIs A solid understanding of C and basic linear algebra as well as experience in creating custom 3D applications without using premade rendering engines is required    **Oceans '96 MTS/IEEE** ,1996    OpenGL 4 Shading Language Cookbook David Wolff,2018-09-28 Over 70 recipes that cover advanced techniques for 3D programming such as lighting shading textures particle systems and image processing with OpenGL 4 6 Key Features Explore techniques for implementing shadows using shadow maps and shadow volumes Learn to use GLSL features such as compute geometry and tessellation shaders Use GLSL to create a wide variety of modern realistic visual effects Book Description OpenGL 4 Shading Language Cookbook Third Edition provides easy to follow recipes that first walk you through the theory and background behind each technique and then proceed to showcase and explain the GLSL and

OpenGL code needed to implement them. The book begins by familiarizing you with beginner level topics such as compiling and linking shader programs saving and loading shader binaries including SPIR V and using an OpenGL function loader library. We then proceed to cover basic lighting and shading effects. After that you'll learn to use textures produce shadows and use geometry and tessellation shaders. Topics such as particle systems screen space ambient occlusion deferred rendering depth based tessellation and physically based rendering will help you tackle advanced topics. OpenGL 4 Shading Language Cookbook Third Edition also covers advanced topics such as shadow techniques including the two of the most common techniques shadow maps and shadow volumes. You will learn how to use noise in shaders and how to use compute shaders. The book provides examples of modern shading techniques that can be used as a starting point for programmers to expand upon to produce modern interactive 3D computer graphics applications. What you will learn: Compile, debug and communicate with shader programs. Use compute shaders for physics, animation and general computing. Learn about features such as shader storage buffer objects and image load store. Utilize noise in shaders and learn how to use shaders in animations. Use textures for various effects including cube maps for reflection or refraction. Understand physically based reflection models and the SPIR V Shader binary. Learn how to create shadows using shadow maps or shadow volumes. Create particle systems that simulate smoke, fire and other effects. Who this book is for: If you are a graphics programmer looking to learn the GLSL shading language this book is for you. A basic understanding of 3D graphics and programming experience with C are required.

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