

# Numba High Performance Python With Cuda Acceleration

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## HICKS HERRERA

*Python for Finance* "O'Reilly Media, Inc."

Much has changed in technology over the past decade. Data is hot, the cloud is ubiquitous, and many organizations need some form of automation. Throughout these transformations, Python has become one of the most popular languages in the world. This practical resource shows you how to use Python for everyday Linux systems administration tasks with today's most useful DevOps tools, including Docker, Kubernetes, and Terraform. Learning how to interact and automate with Linux is essential for millions of professionals. Python makes it much easier. With this book, you'll learn how to develop software and solve problems using containers, as well as how to monitor, instrument, load-test, and operationalize your software. Looking for effective ways to "get stuff done" in Python? This is your guide. Python foundations, including a brief introduction to the language How to automate text, write command-line tools, and automate the filesystem Linux utilities, package management, build systems, monitoring and instrumentation, and automated testing Cloud computing, infrastructure as code, Kubernetes, and serverless Machine learning operations and data engineering from a DevOps perspective Building, deploying, and operationalizing a machine learning project

[Guide to NumPy](#) Packt Publishing Ltd

This book constitutes the revised selected papers of the 11th International Conference on Cloud Computing, Big Data & Emerging Topics, JCC-BD&ET 2023, held in La Plata, Argentina\*, in June 2023. The 14 full papers were carefully reviewed and selected from a total of 38 submissions. The papers are organized in topical sections on: Parallel and Distributed Computing, Big Data, Machine and Deep Learning, Smart Cities and E-Government, Visualization.

[Cloud Computing, Big Data & Emerging Topics](#) Packt Publishing Ltd

Much has changed in technology over the past decade. Data is hot, the cloud is ubiquitous, and many organizations need some form of automation. Throughout these transformations, Python has become one of the most popular languages in the world. This practical resource shows you how to use Python for everyday Linux systems administration tasks with today's most useful DevOps tools, including Docker, Kubernetes, and Terraform. Learning how to interact and automate with Linux is essential for millions of professionals. Python makes it much easier. With this book, you'll learn how to develop software and solve problems using containers, as well as how to monitor, instrument, load-test,

and operationalize your software. Looking for effective ways to "get stuff done" in Python? This is your guide. Python foundations, including a brief introduction to the language How to automate text, write command-line tools, and automate the filesystem Linux utilities, package management, build systems, monitoring and instrumentation, and automated testing Cloud computing, infrastructure as code, Kubernetes, and serverless Machine learning operations and data engineering from a DevOps perspective Building, deploying, and operationalizing a machine learning project

**Speed Up Your Python with Rust** Apress

Effective Data Science Infrastructure: How to make data scientists more productive is a hands-on guide to assembling infrastructure for data science and machine learning applications. It reveals the processes used at Netflix and other data-driven companies to manage their cutting edge data infrastructure. In it, you'll master scalable techniques for data storage, computation, experiment tracking, and orchestration that are relevant to companies of all shapes and sizes. You'll learn how you can make data scientists more productive with your existing cloud infrastructure, a stack of open source software, and idiomatic Python.

**Mastering Python** CreateSpace

Explore GPU-enabled programmable environment for machine learning, scientific applications, and gaming using PuCUDA, PyOpenGL, and Anaconda Accelerate Key Features Understand effective synchronization strategies for faster processing using GPUs Write parallel processing scripts with PyCuda and PyOpenCL Learn to use the CUDA libraries like CuDNN for deep learning on GPUs Book Description GPUs are proving to be excellent general purpose-parallel computing solutions for high performance tasks such as deep learning and scientific computing. This book will be your guide to getting started with GPU computing. It will start with introducing GPU computing and explain the architecture and programming models for GPUs. You will learn, by example, how to perform GPU programming with Python, and you'll look at using integrations such as PyCUDA, PyOpenCL, CuPy and Numba with Anaconda for various tasks such as machine learning and data mining. Going further, you will get to grips with GPU work flows, management, and deployment using modern containerization solutions. Toward the end of the book, you will get familiar with the principles of distributed computing for training machine learning models and enhancing efficiency and performance. By the end of this book, you will be able to set up a GPU ecosystem for running complex applications and data models that demand great processing capabilities, and be able to efficiently manage memory to compute your application effectively and quickly. What you will learn Utilize Python libraries and frameworks for GPU acceleration Set up a

GPU-enabled programmable machine learning environment on your system with Anaconda Deploy your machine learning system on cloud containers with illustrated examples Explore PyCUDA and PyOpenCL and compare them with platforms such as CUDA, OpenCL and ROCm. Perform data mining tasks with machine learning models on GPUs Extend your knowledge of GPU computing in scientific applications Who this book is for Data Scientist, Machine Learning enthusiasts and professionals who wants to get started with GPU computation and perform the complex tasks with low-latency. Intermediate knowledge of Python programming is assumed.

**High Performance Python** O'Reilly Media

Master the art of writing beautiful and powerful Python by using all of the features that Python 3.5 offers About This Book Become familiar with the most important and advanced parts of the Python code style Learn the trickier aspects of Python and put it in a structured context for deeper understanding of the language Offers an expert's-eye overview of how these advanced tasks fit together in Python as a whole along with practical examples Who This Book Is For Almost anyone can learn to write working script and create high quality code but they might lack a structured understanding of what it means to be 'Pythonic'. If you are a Python programmer who wants to code efficiently by getting the syntax and usage of a few intricate Python techniques exactly right, this book is for you. What You Will Learn Create a virtualenv and start a new project Understand how and when to use the functional programming paradigm Get familiar with the different ways the decorators can be written in Understand the power of generators and coroutines without digressing into lambda calculus Create metaclasses and how it makes working with Python far easier Generate HTML documentation out of documents and code using Sphinx Learn how to track and optimize application performance, both memory and cpu Use the multiprocessing library, not just locally but also across multiple machines Get a basic understanding of packaging and creating your own libraries/applications In Detail Python is a dynamic programming language. It is known for its high readability and hence it is often the first language learned by new programmers. Python being multi-paradigm, it can be used to achieve the same thing in different ways and it is compatible across different platforms. Even if you find writing Python code easy, writing code that is efficient, easy to maintain, and reuse is not so straightforward. This book is an authoritative guide that will help you learn new advanced methods in a clear and contextualised way. It starts off by creating a project-specific environment using venv, introducing you to different Pythonic syntax and common pitfalls before moving on to cover the functional features in Python. It covers how to create different decorators, generators,

and metaclasses. It also introduces you to `functools.wraps` and `coroutines` and how they work. Later on you will learn to use `asyncio` module for asynchronous clients and servers. You will also get familiar with different testing systems such as `py.test`, `doctest`, and `unittest`, and debugging tools such as Python debugger and `faulthandler`. You will learn to optimize application performance so that it works efficiently across multiple machines and Python versions. Finally, it will teach you how to access C functions with a simple Python call. By the end of the book, you will be able to write more advanced scripts and take on bigger challenges. **Style and Approach** This book is a comprehensive guide that covers advanced features of the Python language, and communicate them with an authoritative understanding of the underlying rationale for how, when, and why to use them.

**Python Parallel Programming Cookbook** Packt Publishing Ltd Build real-world applications with Python 2.7, CUDA 9, and CUDA 10. We suggest the use of Python 2.7 over Python 3.x, since Python 2.7 has stable support across all the libraries we use in this book. **Key Features** Expand your background in GPU programming—PyCUDA, `scikit-cuda`, and `Nsight` Effectively use CUDA libraries such as `cuBLAS`, `cuFFT`, and `cuSolver` Apply GPU programming to modern data science applications **Book Description** Hands-On GPU Programming with Python and CUDA hits the ground running: you'll start by learning how to apply Amdahl's Law, use a code profiler to identify bottlenecks in your Python code, and set up an appropriate GPU programming environment. You'll then see how to "query" the GPU's features and copy arrays of data to and from the GPU's own memory. As you make your way through the book, you'll launch code directly onto the GPU and write full blown GPU kernels and device functions in CUDA C. You'll get to grips with profiling GPU code effectively and fully test and debug your code using `Nsight` IDE. Next, you'll explore some of the more well-known NVIDIA libraries, such as `cuFFT` and `cuBLAS`. With a solid background in place, you will now apply your new-found knowledge to develop your very own GPU-based deep neural network from scratch. You'll then explore advanced topics, such as warp shuffling, dynamic parallelism, and PTX assembly. In the final chapter, you'll see some topics and applications related to GPU programming that you may wish to pursue, including AI, graphics, and blockchain. By the end of this book, you will be able to apply GPU programming to problems related to data science and high-performance computing. What you will learn **Launch GPU code directly from Python** Write effective and efficient GPU kernels and device functions **Use libraries such as** `cuFFT`, `cuBLAS`, and `cuSolver` **Debug and profile your code with** `Nsight` and `Visual Profiler` **Apply GPU programming to datascience problems** Build a GPU-based deep neural network from scratch **Explore advanced GPU hardware features, such as warp shuffling** Who this book is for **Hands-On GPU Programming with Python and CUDA** is for developers and data scientists who want to learn the basics of effective GPU programming to improve performance using Python code. You should have an understanding of first-year college or university-level engineering mathematics and physics, and have some experience with Python as well as in any C-based programming language such as C, C++, Go, or Java.

**High Performance Python** Packt Publishing Ltd **Interfacing with C** is about interfacing personal computers using C. Anyone who is interested in ports, transducer interfacing, analog to digital conversion, convolution, filters or digital/analog conversion will benefit from reading **Interfacing with C**. Students will also find this a practical introduction to real-time programming with a generous collection of tried and tested programs. The pace of the book is such that the reader is encouraged to run the programs and experiment with C. The principles precede the applications in most cases in an attempt to provide genuine understanding and encourage further development. Readers will gain much from the hands-on experience the authors' approach provides, an approach designed to enable readers to climb steep learning curves with the minimum amount of assistance. The many programs included in the text provide the essential hands-on experience. Some of the programs inevitably become rather lengthy, so the source code used is available as a free download from the Newnes website. The aim of the book, however, is to give the reader enough confidence to rewrite and improve these programs. In the second edition Mike James has thoroughly updated all aspects relating to software, operating systems and graphical interfaces. He has also increased the scope of the book to include current forms of C++. Material on data acquisition has been thoroughly updated and the section on peripherals increased. - A practical and painless way of becoming an expert C programmer - New edition also covers C++ and the Windows environment - Get up to speed with the essential maths needed for C without having to buy a university maths text!

**Hands-On GPU Programming with Python and CUDA** "O'Reilly Media, Inc." Master these effective techniques to reduce costs and run times, handle huge datasets, and implement complex machine learning applications efficiently in Python. **Fast Python** is a hands-on guide to writing Python code that can process more data, faster, and with less resources. It takes a holistic approach to Python

performance, showing you how your code, libraries, and computing architecture interact and can be optimized together. Written for experienced practitioners, **Fast Python** dives right into practical solutions for improving computation and storage efficiency. You'll experiment with fun and interesting examples such as rewriting games in lower-level Cython and implementing a MapReduce framework from scratch. Finally, you'll go deep into Python GPU computing and learn how modern hardware has rehabilitated some former antipatterns and made counterintuitive ideas the most efficient way of working. Purchase of the print book includes a free eBook in PDF, Kindle, and ePub formats from Manning Publications.

**Mastering Python High Performance** O'Reilly Media

This is the second edition of Travis Oliphant's **A Guide to NumPy** originally published electronically in 2006. It is designed to be a reference that can be used by practitioners who are familiar with Python but want to learn more about NumPy and related tools. In this updated edition, new perspectives are shared as well as descriptions of new distributed processing tools in the ecosystem, and how Numba can be used to compile code using NumPy arrays. Travis Oliphant is the co-founder and CEO of Continuum Analytics. Continuum Analytics develops Anaconda, the leading modern open source analytics platform powered by Python. Travis, who is a passionate advocate of open source technology, has a Ph.D. from Mayo Clinic and B.S. and M.S. degrees in Mathematics and Electrical Engineering from Brigham Young University. Since 1997, he has worked extensively with Python for computational and data science. He was the primary creator of the NumPy package and founding contributor to the SciPy package. He was also a co-founder and past board member of NumFOCUS, a non-profit for reproducible and accessible science that supports the PyData stack. He also served on the board of the Python Software Foundation.

**Python Interactive Computing and Visualization Cookbook** Packt Publishing Ltd

Effective Python will help students harness the full power of Python to write exceptionally robust, efficient, maintainable, and well-performing code. Utilizing the concise, scenario-driven style pioneered in Scott Meyers's best-selling **Effective C++**, Brett Slatkin brings together 53 Python best practices, tips, shortcuts, and realistic code examples from expert programmers. Each section contains specific, actionable guidelines organized into items, each with carefully worded advice supported by detailed technical arguments and illuminating examples.

**Fast Python** Cambridge University Press

Your Python code may run correctly, but you need it to run faster. Updated for Python 3, this expanded edition shows you how to locate performance bottlenecks and significantly speed up your code in high-data-volume programs. By exploring the fundamental theory behind design choices, **High Performance Python** helps you gain a deeper understanding of Python's implementation. How do you take advantage of multicore architectures or clusters? Or build a system that scales up and down without losing reliability? Experienced Python programmers will learn concrete solutions to many issues, along with war stories from companies that use high-performance Python for social media analytics, productionized machine learning, and more. Get a better grasp of NumPy, Cython, and profilers Learn how Python abstracts the underlying computer architecture Use profiling to find bottlenecks in CPU time and memory usage Write efficient programs by choosing appropriate data structures Speed up matrix and vector computations Use tools to compile Python down to machine code Manage multiple I/O and computational operations concurrently Convert multiprocessing code to run on local or remote clusters Deploy code faster using tools like Docker

**The Hitchhiker's Guide to Python** Packt Publishing Ltd **Fast Python** aggressively refreshes the basics of Python programming in order to dispel myths and misconceptions about how to write fast code. Readers equipped with the lessons from this book will be able to test, diagnose, and optimize out performance bottlenecks in their own work. For each algorithm discussed, readers will walk through numerous progressively faster methods of programming it, all while picking up bits of fundamental knowledge about time complexity, memory efficiency, data structures, multi-threading, and vectorization. As such, this book is relevant to veterans looking refresh their methods and to computer science students navigating **Algorithms 101**. This book maintains a high standard of reproducibility. All of the graphics, tables, and code profiles contained in this book are fully reproducible and available to anyone in a public GitHub repository.

**An Introduction to Computational Physics** Addison-Wesley Professional

Build software that combines Python's expressivity with the performance and control of C (and C++). It's possible with Cython, the compiler and hybrid programming language used by foundational packages such as NumPy, and prominent in projects including Pandas, h5py, and scikits-learn. In this practical guide, you'll learn how to use Cython to improve Python's performance—up to 3000x—and to wrap C and C++ libraries in Python with ease. Author Kurt Smith takes you through Cython's capabilities, with sample code and in-depth practice exercises. If

you're just starting with Cython, or want to go deeper, you'll learn how this language is an essential part of any performance-oriented Python programmer's arsenal. Use Cython's static typing to speed up Python code Gain hands-on experience using Cython features to boost your numeric-heavy Python Create new types with Cython—and see how fast object-oriented programming in Python can be Effectively organize Cython code into separate modules and packages without sacrificing performance Use Cython to give Pythonic interfaces to C and C++ libraries Optimize code with Cython's runtime and compile-time profiling tools Use Cython's `prange` function to parallelize loops transparently with OpenMP

**Learning Concurrency in Python** Simon and Schuster

Discover how to inject your code with highly performant Rust features to develop fast and memory-safe applications **Key Features** Learn to implement Rust in a Python system without altering the entire system Write safe and efficient Rust code as a Python developer by understanding the essential features of Rust Build Python extensions in Rust by using Python NumPy modules in your Rust code **Book Description** Python has made software development easier, but it falls short in several areas including memory management that lead to poor performance and security. Rust, on the other hand, provides memory safety without using a garbage collector, which means that with its low memory footprint, you can build high-performant and secure apps relatively easily. However, rewriting everything in Rust can be expensive and risky as there might not be package support in Rust for the problem being solved. This is where Python bindings and pip come in. This book will help you, as a Python developer, to start using Rust in your Python projects without having to manage a separate Rust server or application. Seeing as you'll already understand concepts like functions and loops, this book covers the quirks of Rust such as memory management to code Rust in a productive and structured manner. You'll explore the PyO3 crate to fuse Rust code with Python, learn how to package your fused Rust code in a pip package, and then deploy a Python Flask application in Docker that uses a private Rust pip module. Finally, you'll get to grips with advanced Rust binding topics such as inspecting Python objects and modules in Rust. By the end of this Rust book, you'll be able to develop safe and high-performant applications with better concurrency support. What you will learn **Explore the quirks of the Rust programming language** that a Python developer needs to understand to code in Rust **Understand the trade-offs for multiprocessing and thread safety** to write concurrent code **Build and manage a software project** with cargo and crates **Fuse Rust code with Python** so that Python can import and run Rust code **Deploy a Python Flask application** in Docker that utilizes a private Rust pip module **Inspect and create your own Python objects** in Rust **Who this book is for** This book is for Python developers who want to speed up their Python code with Rust and implement Rust in a Python system without altering the entire system. You'll be able to learn about all topics relating to Rust programming. Basic knowledge of Python is required to get the most out of this book.

**Using Asyncio in Python** Springer

Understanding the atomic structure of complex and time disordered materials relies upon computer simulations of these structures. This cook book provides a unique mixture of simulation know-how and hands on examples. All related files and the program DISCUS are included on a CDROM with the book.

**Fast Python** Pearson Education

Get complete instructions for manipulating, processing, cleaning, and crunching datasets in Python. Updated for Python 3.6, the second edition of this hands-on guide is packed with practical case studies that show you how to solve a broad set of data analysis problems effectively. You'll learn the latest versions of pandas, NumPy, IPython, and Jupyter in the process. Written by Wes McKinney, the creator of the Python pandas project, this book is a practical, modern introduction to data science tools in Python. It's ideal for analysts new to Python and for Python programmers new to data science and scientific computing. Data files and related material are available on GitHub. Use the IPython shell and Jupyter notebook for exploratory computing Learn basic and advanced features in NumPy (Numerical Python) Get started with data analysis tools in the pandas library Use flexible tools to load, clean, transform, merge, and reshape data Create informative visualizations with matplotlib Apply the pandas groupby facility to slice, dice, and summarize datasets Analyze and manipulate regular and irregular time series data Learn how to solve real-world data analysis problems with thorough, detailed examples

**Modern Fortran** Elsevier

Write fast, robust, and highly reusable applications using Python's internal optimization, state-of-the-art performance-benchmarking tools, and cutting-edge libraries **Key Features** Benchmark, profile, and accelerate Python programs using optimization tools Scale applications to multiple processors with concurrent programming Make applications robust and reusable using effective design patterns **Book Description** Python's powerful capabilities for implementing robust and efficient programs make it one of the most sought-after programming languages. In this book, you'll explore the tools that allow you to improve

performance and take your Python programs to the next level. This book starts by examining the built-in as well as external libraries that streamline tasks in the development cycle, such as benchmarking, profiling, and optimizing. You'll then get to grips with using specialized tools such as dedicated libraries and compilers to increase your performance at number-crunching tasks, including training machine learning models. The book covers concurrency, a major solution to making programs more efficient and scalable, and various concurrent programming techniques such as multithreading, multiprocessing, and asynchronous programming. You'll also understand the common problems that cause undesirable behavior in concurrent programs. Finally, you'll work with a wide range of design patterns, including creational, structural, and behavioral patterns that enable you to tackle complex design and architecture challenges, making your programs more robust and maintainable. By the end of the book, you'll be exposed to a wide range of advanced functionalities in Python and be equipped with the practical knowledge needed to apply them to your use cases. What you will learn Write efficient numerical code with NumPy, pandas, and Xarray Use Cython and Numba to achieve native performance Find bottlenecks in your Python code using profilers Optimize your machine learning models with JAX Implement multithreaded, multiprocessing, and asynchronous programs Solve common problems in concurrent programming, such as deadlocks Tackle architecture challenges with design

patterns Who this book is for This book is for intermediate to experienced Python programmers who are looking to scale up their applications in a systematic and robust manner. Programmers from a range of backgrounds will find this book useful, including software engineers, scientific programmers, and software architects. Numerical Methods for Scientific Computing Simon and Schuster Measure, optimize, and improve the performance of your Python code with this easy-to-follow guide About This Book Master the do's and don'ts of Python performance programming Learn how to use exiting new tools that will help you improve your scripts A step-by-step, conceptual guide to teach you how to optimize and fine-tune your critical pieces of code Who This Book Is For If you're a Python developer looking to improve the speed of your scripts or simply wanting to take your skills to the next level, then this book is perfect for you. What You Will Learn Master code optimization step-by-step and learn how to use different tools Understand what a profiler is and how to read its output Interpret visual output from profiling tools and improve the performance of your script Use Cython to create fast applications using Python and C Take advantage of PyPy to improve performance of Python code Optimize number-crunching code with NumPy, Numba, Parakeet, and Pandas In Detail Simply knowing how to code is not enough; on mission-critical pieces of code, every bit of memory and every CPU cycle counts, and knowing how to squish every bit

of processing power out of your code is a crucial and sought-after skill. Nowadays, Python is used for many scientific projects, and sometimes the calculations done in those projects require some serious fine-tuning. Profilers are tools designed to help you measure the performance of your code and help you during the optimization process, so knowing how to use them and read their output is very handy. This book starts from the basics and progressively moves on to more advanced topics. You'll learn everything from profiling all the way up to writing a real-life application and applying a full set of tools designed to improve it in different ways. In the middle, you'll stop to learn about the major profilers used in Python and about some graphic tools to help you make sense of their output. You'll then move from generic optimization techniques onto Python-specific ones, going over the main constructs of the language that will help you improve your speed without much of a change. Finally, the book covers some number-crunching-specific libraries and how to use them properly to get the best speed out of them. After reading this book, you will know how to take any Python code, profile it, find out where the bottlenecks are, and apply different techniques to remove them. Style and approach This easy-to-follow, practical guide will help you enhance your optimization skills by improving real-world code. Effective Python Apress This advanced textbook provides an introduction to the basic methods of computational physics.

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