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Ivan Idris has an MSc in experimental physics. His thesis was made with a strong emphasis on applied computer science. After graduating, he worked for several companies as a Java developer, Datawarehouse developer, and quality analyst. His core professional interests are business intelligence, big data, and cloud computing. Ivan Idris likes to write clean test code and interesting technical articles. Ivan Idris is the author of the NumPy 1.5 Beginners Guide. You can find more information and a blog with a few examples of NumPy ivanidris.net. Over 70 interesting recipes to study Python's open source mathematical library, NumPy Review Lee high-performance calculations with pure and effective NumPy code Analysis of large data sets with statistical functions Perform complex linear algebra and mathematical calculations in the details of today's world of science and technology all about speed and flexibility. When it comes to scientific computing, NumPy is at the top of the list. NumPy will give you both speed and high performance. NumPy Cookbook will teach you all about NumPy, the leading science computing library. NumPy replaces a lot of the functionality of Matlab and Mathematica, but unlike these products, it's free and open source. Numpy Cookbook will teach you to write readable, efficient and fast code that is as close to the math language as possible with the cutting edge of the open source NumPy software library. You'll learn about the installation and use of NumPy and related concepts. At the end of the book we explore the relevant scientific computational projects. This book will give you a solid foundation in the NumPy arrays and universal features. You'll also learn about the Matplotlib conspiracy and the associated SciPy project from the examples. NumPy Cookbook will help you be productive with NumPy and write clean and fast code. What you'll learn from this book is Learn Advanced Indexing and Linear Algebra Know Changes automatically immersion in the broadcasting and histogram profile NumPy code and visualize your profiling results to speed up your code with Cython Using the Interface Array to expose foreign memory NumPy Using universal features and compatibility features Learn about Matplotlib and Scipy, which is often used in conjunction with the Numpy approach Examples of code taking your Numpy skills to the next level. Who this book is written for this book will take Python developers with basic Numpy skills to the next level through some practical recipes. NumPy has the ability to give you speed and high performance. High performance calculations can be easily done with clean and efficient code, and this allows you to perform complex and mathematical calculations on time. This book will give you a solid foundation in the NumPy arrays and universal features. Starting with the installation IPython configuration, you'll learn about advanced indexing concepts and array along with widely used but effective features. You will then cover practical concepts such as image processing, special arrays and universal features. You'll also learn about the Matplotlib conspiracy and the associated SciPy project with the help of examples. At the end of the book, you'll learn how to investigate atmospheric pressure and related methods. By the time you finish this book, you'll be able to write a clean and fast code with NumPy. Copyright Credits About Reviewers www.PacktPub.com Table Content Table Foreword Chapter 1: Windings Along with IPython Introduction Installation IPython Using IPython As Shell Reading Manual Pages Installation matplotlib Launch IPython Laptop Export IPython Laptop Import Web Laptop Setting Laptop Server Learning Profile SymPy Chapter 2 : Advanced Indexing and Array Concepts Introduction Installation SciPy Installation PIL Resources Image Creation views and copies flipping Lena Fancy Indexing with a list of places Indexing with Booleans Step tricks for Sudoku Broadcasting Arrays Chapter 3 : Getting to Grips with widely used features Introduction Summing Up Fibonacci Numbers Search for the main factors Finding palindrome numbers Sustainable Vector State Opening Power Law Trade periodically on dips Imitation Trade on Random Sieving Whole Numbers with sieve Eratosthenes Chapter 4 : NumPy Connection with the Rest of the World Introduction Use Buffer Protocol Using an Array Data Exchange Interface with MATLAB and Octave Installation RPy2 Interaction with R Installation JPyPe Sending Array NumPy JPyPe Installation Google App Engine Deployment Code NumPy on Google Cloud Launch of NumPy Code in PythonAnywhere Web Console Chapter 5 : Audio and Image Processing Introduction Image Loading in Memory Cards Combination images Blurring Images Repeating Audio Snippets Generation Audio Sound Filter Edge Detection with Sobel Filter Chapter 6 : Special Arrays and Universal Features Introduction Creating a Universal Search Function Pythagorean Triple Execution Line Operations with Chararray Creating Masking : Profiling and Debugging Introduction Profiling with Taik Profiling with IPython Installation line_profiler Profile Code with line_profiler Code Profiling with cProfile Debugging extension with IPython Debague with PuDB Chapter 8 : Providing quality Introduction Installation PyIakes Performing static analysis with PyIakes Code Analysis with PyLint Performing Static Analysis with Pycheck Pyer Testing Code with doctstrings Writing Unit Tests Test Code Testing With Mock-ups Testing BDD Way Chapter 9 : Speeding up the code has a Vi (m) editor, which if you like vi is obviously great. You can save and edit files from IPython sessions. IPython can be installed in different ways, depending on your operating system. There is a reliance on the readline for the terminal-based shell. The web laptop requires tornadoes and zmq, in addition to installing IPython, we will install a setup that gives you easy_install command. The easy_install team is a popular package manager for Python. The pips can be installed as soon as you easy_install. The pips team is similar to easy_install options, such as non-installation. This section describes how IPython can be installed on Windows, Mac OS X and Linux. It also describes how to install IPython and its dependencies with easy_install and pip, or from a source: installing IPython and installation devices on Windows: a Windows Binary Installer for Python 2 or Python 3 is available on the IPython website. Also installations with an installer from the . Then set the pip like this: Installing IPython on Mac OS X: Install Apple Developer Tools (Xcode) if necessary. Xcode can be found in . Follow the instructions easy_install/pips or installation instructions from the source later in this section. Installing IPython on Linux: Since there are so many Linux distributions, this section will not be exhaustive: On Debian, bring the following command: On Fedora, the magic command is this: The next team will install IPython on Gentoo: For Ubuntu, the installation team is as follows: Install IPython with easy_install or pip; Install IPython and all dependency, necessary for recipes in this chapter with easy_install using the following command: Alternatively, you can first install pips with easy_install by entering this command in the terminal: After that install IPython using pip: Installation from the source: If you want to use the bleeding version of the development, then install from the source for you: Download the last archive of the source from the source code from the archive: Instead, if you have a Git installed, you can clone the Git repository: Go to the root directory in the downloadable source: Start the customization script. This may require you to run a team with a sudo, as follows: We have installed IPython using several methods. Most of these methods set the last stable release, except when you install from a source that will install a version of the development. Scientists and engineers are used to experimenting. IPython was created by scientists with experiments in mind. The interactive environment IPython provides is reviewed as a direct response to MATLAB, Mathematica, Maple and R. The following: IPython Shell Features: Tab completion History mechanism inline editing The ability to call external Python scripts with %run ability to call magical features that interact with the shell of the operating system Access to system commands including Switch Access to Python debugger and profiler This section describes how to use the IPython shell: pylab: the switch is automatically imported. Without this switch, we would have to import these packages ourselves. All we have to do is enter the following instruction on the command line: Save the session: We might be able to go back to our experiments. In IPython, it's easy to save a session for longer use. This is done with the following command: Registration can be turned off with this command: Performing the shell system command: You can command the shell system in the default IPython profile by locking the command with ! Symbol. For example, the next entry will get the current date: In fact, any line is prefixed with ! sent to the system shell. We can also store team output, as shown here: Displaying history: We can show the history of teams with a team like this: It's a common feature in the team-line interface environments (CLI). We can also view the story with a -g switch: Download an example of code that you can upload to the example of the code files for all the Packt Publishing books you purchased from your account in . If you purchased this book elsewhere, you can and register to get the files emailed directly to you. We saw a number of so-called magical features in action. These functions start with a % of the symbol. If the magic function is used in a line by itself, the prefix % is optional. We can open documentation for NumPy features with the help of a team. You don't have to know the name of the function. We can enter multiple characters and then let the tab complete to do your job. For example, let's view the available information for the arange function. We can view the information available in one of the following ways: Call the Help feature: Call the help team. Enter a few character features, and then press the Tab key (see the following screenshot); Request with a question mark: Another option is to put a question mark over the name of the feature. Then of course you need to know the name of the feature, but you don't need to print the help command: The completion of the tab depends on the readline, so you need to make sure it's installed. The question mark gives you information from doctstrings. matplotlib (all lower register by convention) is a very useful Python building library and we will need it for the following recipes as well Later. It depends on NumPy, but in all likelihood you already have NumPy installed. We Are We See how matplotlib can be installed on Windows, Linux and Mac OS X, as well as how to install it from the source: Installing matplotlib on Windows: You can install this with enthought distribution, also known as Canopy (. You may need to put msxcp7L.dll in the C:\Windows-system32 catalog. You can get it from . Installing matplotlib on Linux: Let's see how matplotlib can be installed in various Linux distributions: Here's a team setup on Debian and Ubuntu: The installation team at Fedora/Redhat is this: Installation from source: You can download the latest source from the release of tar.gz in Sourceforge (. or from the reposition, Git Using the following command: Once it has been downloaded, build and install the matplotlib as usual with the following commands: Install matplotlib on Mac OS X: Get the latest DMG file and install it. You can also use Mac Ports, Fink or Homebrew package managers. IPython has an exciting laptop feature. The so-called laptop server can serve laptops over the Internet. Now we can start a laptop server and get a web IPython environment. This environment has most of the features that the regular environment IPython has. The features of the IPython laptop include the following: Displaying images and in-line plots Using HTML and Markdown (this simplified HTML-like language see in text cell importation and export laptops) The before we start, we need to make sure that all the necessary software is installed. There is a reliance on tornadoes and zmq. You can find out more about this in the recipe for the IPython installation in this chapter. Running the laptop: We can start the laptop with the following command: As you can see, we use the default profile. The server is launched on a local machine in port 8888. You'll learn how to set up these settings later in this chapter. The laptop is open in the default browser; It's customizable as well (see next screenshot): IPython lists all the laptops in the catalog where you started your laptop. No notebooks were found in this example. The server can be stopped by tapping Ctrl and C. Running your laptop in pill mode: Run the web laptop in pill mode with the following command: It loads the modules of SciPy, NumPy and matplotlib. Running a laptop with inline numbers: We can display inline matplotlib stories using the inline directive, using the following command: The next steps demonstrate the functionality of the IPython laptop: Click on the New Notebook button to create a new laptop. Create an array with arange function. Join the team shown in the screenshot and click on Cell/Run: Next type in the next command and click Enter. You'll see an out exit, as shown in the following screenshot: Apply sinc () function to the array and build the result, as shown in this screenshot: Inline option allows you to display inline matplotlib plots. Combined with pylab, you don't need to import NumPy, SciPy, and matplotlib packages. Sometimes you want to exchange notebooks with friends or colleagues. A web laptop provides several methods for exporting data. A web laptop can be exported using the following options: Print Option: The print button doesn't actually print a laptop, but allows you to export your laptop as a PDF or HTML document. Laptop Download: Load your laptop to your chosen location with the Download button. We can specify whether we want to download the laptop as a .py file, which is a regular Python program, or in JSON format as a .ipynb file. The notebook we created in the previous recipe looks like this after export: Some texts have been omitted for brevity. This file is not intended to be edited or even read, but it is quite readable if you ignore part of the view of the image. More information about JSON can be found at . Saving your laptop: Save your laptop with the Save button. This will automatically export the laptop in JSON's native format, .ipynb. The file will be stored in the catalog where you started IPython originally. Python scripts can be imported as a web laptop. Obviously, we can also import previously exported laptops. This recipe shows how the Python script can be imported as a web laptop. Download the Python script with this command: The following screenshot shows an example of what we see after downloading vectorsum.py from NumPy Beginner's Guide to the laptop page: a public laptop server should be secure. You have to set a password and use an SSL certificate to connect to it. We need a certificate to ensure secure communication through HTTPS (for more information, see . HTTPS adds a safe layer on top of the standard HTTP protocol widely used on the internet. HTTPS also encrypts data sent from the client to and from the server. A certificate body is often a commercial organization that issues certificates for websites. Web browsers have knowledge of certificates and can recognize certificates. The website administrator must create a certificate and sign it to the certificate authority. The following steps describe how to set up a secure laptop server: We can create a password from IPython. Start the new IPython session and bring in the following commands: on the second entry line you will be asked Password. You have to remember this. A long line is generated. Copy this line because you'll need it later. To create an SSL certificate, you'll need an openssl team on your way. Setting up the openssl team is not rocket science, but it can be tricky. Unfortunately, this goes beyond this book. On the bright side, there are many tutorials available online to help you move on. Follow the following command to create a certificate with mycert.pem as a name: Openssl utility encourages you to fill some fields. For more information, check the relevant person page (short for a manual page) as follows: Create a special profile for the server using the following command: Edit the configuration file. In this example, it can be found in q/.ipython/profile_nbserver/ipython_notebook_config.py. The configuration file is quite large, so we lower most of the lines in it. We set the password and changed the port to 9999. Using the next command, start the server to check if the changes are working: The server is running on port 9999 and you need to connect to it via https. If all goes well, you should see the login page. Also, you may have to take exception to the security in your browser. We created a special profile for our public server. There are some profile samples that are already present, such as the default profile. Creating a profile adds profile_ to the .ipython catalog with a configuration file, among others. The profile can be downloaded with a command line option profile_name-profile. We can list profiles with the following team: IPython has a sample of the SymPy profile. SymPy is a mathematics library that symbolizes Python. We can simplify algebraic expressions or differentiate functions like Mathematica and Maple. SymPy is obviously a fun piece of software, but not necessary for our journey through the NumPy landscape. Consider this as an additional or bonus recipe. As a dessert, feel free to miss it, although you may miss out on the sweetest piece of this chapter. Install SymPy with easy_install or pip: Next steps will help you explore the SymPy profile: Look at the configuration file that can be found on q/.ipython/profile_sympy/ipython_config.py. Content as follows: This code performs the following: Loads default ProfileImerages SymPy Defines SymPyfines characters Start IPython with SymPy profile with this command: Expand algebraic expression with the help of the command shown in the following screenshot: Page SymPy on More Unlock this book with FREE 10-day trial build effectively, high-speed programs with The high-performance NumPy Mathematical Library Ivan Idris Applied Machine Learning with a solid.it/profile_name/profilename in theory. Revised and expanded for TensorFlow 2, GANs, and strengthening training. Sebastian Raschka and 1 more

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