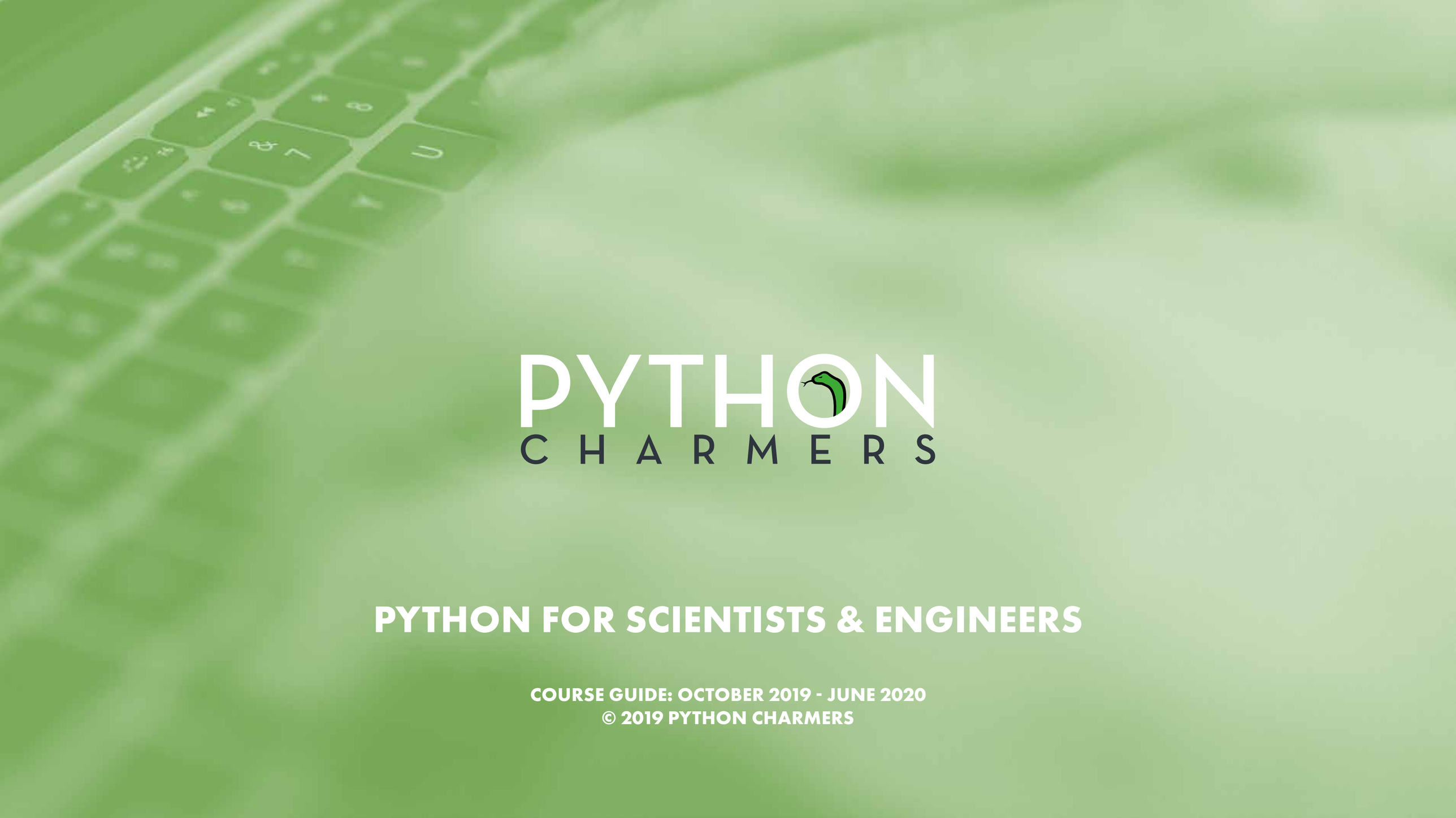

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PYTHON FOR SCIENTISTS & ENGINEERS

COURSE GUIDE: OCTOBER 2019 - JUNE 2020

Python for Scientists & Engineers

A specialist course

Audience: This is a course for scientists and engineers interested in using Python for solving computational problems that arise in daily work, modelling, and automatically processing different kinds of scientific data.

Context: In the last 15 years Python has become the go-to language for scientific and engineering computing, with a powerful ecosystem of high-level libraries for easily solving a wide range of problems.

Overview: By the end of the course, you will have all the knowledge you need to start programming competently in Python for scientific and engineering applications.

Skills: Manipulating vector/matrix data, performing Monte Carlo simulations, constructing statistical models; analyzing images and time-series; creating beautiful statistical graphics; and fitting and evaluating machine learning models for regression, classification, and clustering.

You will learn to work with and analyze data in many useful formats, including CSV, Excel, SQL, time-series, NetCDF, and others.

You will also learn about how to achieve huge speedups for slow numerical code and how to parallelise computationally intensive tasks with large datasets across several cores/processors or distribute them across a cluster of machines.

Duration: 4 days

Format: Each topic is a mixture of hands-on exercises, expert instruction, and demos.

Venues: modern, light-filled computer-based training facilities (CBD)

Dates and locations:
Melbourne: 21-24 October 2019, 1-5 June 2020
Brisbane: 24-27 February 2020
Canberra: 2-5 December 2019, 22-26 June 2020

Expert instructors: See bios below.

Price: $3,000 (excl GST)

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Topic outline

Day 1: Python basics

Day 1 covers how to use Python for basic scripting and automation tasks, including tips and tricks for making this easy:

- Why Python? What's possible?
- The *Jupyter* notebook for rapid prototyping
- Modules and packages
- Python concepts: an introduction through examples
- Essential data types: strings, tuples, lists, dicts
- Worked example: fetching and ranking real-time data from a web API
- Raising and handling exceptions

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Topic outline

Day 2: Handling, analyzing, and presenting data in Python

Python offers amazingly productive tools like Pandas for working with different kinds of data. Day 2 gives a thorough introduction to analyzing and visualizing data easily:

- Reading and writing common tabular data formats:
  CSV, Excel, SQL, time-series (others on request)
- Indexing and selecting data in Pandas
- Data fusion: joining & merging datasets
- Summarization with “group by” operations; pivot tables
- Time-series data: indexing, resampling, parsing custom date formats
- Visualization and statistical graphics with *Seaborn*

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Topic outline

Day 3: Essentials of scientific computing with Python

Day 3 teaches you how to use Python for numerical and scientific computing. It covers array and matrix manipulation and an overview of available scientific routines, including an introduction to statistical modelling:

- Introduction to manipulating vectors and matrices with *NumPy*

- Tour of *SciPy* and related packages, with fancy demos:
  - unit conversions
  - interpolation
  - dense & sparse linear algebra
  - image processing
  - signal processing

- Statistics in Python, with scientific applications:
  - modelling (density estimation)
  - confidence intervals and hypothesis testing
  - linear regression
  - Monte Carlo simulation

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Topic outline

Day 4: Machine learning; scaling up

Day 4 gives you a practical introduction to machine learning for powerfully inferring complex models from data. Examples focus on applications of classification, regression, and clustering to time-series and spatial datasets. Day 4 also teaches you how to scale up from small datasets to large ones that are too big for memory or too slow for one computer to process:

Morning: machine learning

- Overview and intuition behind ML
- Classification and non-linear regression using *scikit-learn*
- Clustering, with applications
- Validation and model selection; diagnostic tools: *yellowbrick*
- Feature engineering and selection

Afternoon: scaling up

- Speeding up code by 4x to 10,000x:
    - profiling, vectorization, JIT compilation
    - parallel and distributed computing with *dask*

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Supplemental materials

We will provide you with printed course notes, cheat sheets, and a USB stick containing kitchen-sink Python installers for multiple platforms, solutions to the programming exercises, several written tutorials, and reference documentation on Python and the third-party packages covered in the course.

Instructor bio

Dr Edward Schofield

Ed has consulted to or trained over 2000 people from dozens of organisations in data analytics using Python, including Atlassian, Barclays, Cisco, CSIRO, Dolby, Harvard University, IMC, Singtel Optus, Oracle, Shell, Telstra, Toyota, Verizon, and Westpac. He is well-known in the Python community as a former release manager of *SciPy* and the author of the widely used *future* package. He regularly presents at conferences in data science and Python in Australia and internationally.

Ed holds a PhD in machine learning from Imperial College London. He also holds BA and MA (Hons) degrees in mathematics and computer science from Trinity College, University of Cambridge. He has 20+ years of experience in programming, teaching, and public speaking.

Instructor bio

Dr Juan Nunez-Iglesias

Juan Nunez-Iglesias is co-author of the book *Elegant SciPy*, published by O'Reilly Media. Juan is a core developer of the *scikit-image* Python library, and has contributed to many others in the scientific Python ecosystem, including *SciPy*, *NetworkX*, and *Matplotlib*. He has taught and presented at the SciPy conference in Austin, EuroSciPy, PyCon Australia, the Advanced Scientific Programming in Python summer school, and Software Carpentry workshops.

Juan is a research fellow at Monash University, with interests in neuroscience and biological image analysis. He also has a particular interest in renewable energy and the environment.

Juan has Bachelor's degree in Biomedical Science from the University of Melbourne and both an MSc in Statistics and PhD in Computational Biology and Bioinformatics from the University of Southern California.

Instructor bio

Henry Walshaw

Henry has almost 15 years of experience in Python application development and has trained hundreds of people in how to use Python from organisations including AGL, the Bureau of Meteorology, ESRI, the NSW Department of Finance, National Australia Bank, and Telstra.

Henry's core technical expertise relates to the development and analysis of large scale spatial datasets (primarily using Python), and communicating this understanding to both subject matter experts and the general public.

Before joining Python Charmers, Henry worked in both government and industry — at Geoscience Australia, the Victorian Department of Sustainability and Environment, and the Environmental Protection Agency (EPA); as a consultant with Sinclair Knight Merz (SKM), a manager at we-do-IT, and as CTO of a startup. He holds a Bachelors in Computational Science.

Instructor bio

Dr Clare Sloggett

Clare conducts research into algorithms and in the application of machine learning to genomics, primarily using Python. She co-organised the Python in Science and Data Miniconf for PyCon AU from 2015–2017 and regularly gives talks at conferences and community events in genomics and data analytics with Python and other open source tools.

Clare holds a BSc and PhD in computational physics from the University of NSW, Australia. Her thesis was on the properties of quantum dots and quantum point contacts using analytical and computational techniques.

Instructor bio

Dr Robert Layton

Robert is the author of the book "Data Mining in Python", published by O'Reilly. He provides analysis, consultancy, research and development work to businesses, primarily using Python. Robert has worked with government, financial and security sectors, in both a consultancy and academic role. He is also a Research Fellow at the Internet Commerce Security Laboratory, investigating cybercrime analytics and data-mining algorithms for attribution and profiling.

Robert is a contributor to the Python-based *scikit-learn* open source project for machine learning and writes regularly on data mining for a number of outlets. He is also the author of the website "LearningTensorflow.com". He has presented regularly at a number of international conferences in Python, data analysis, and its applications.

Instructor bio

Janis Lesinskis

Janis is a software developer who has been using Python since 2005. He has worked on several high-end Python projects across a variety of software industry sub-sectors, including: mathematical optimization engines for logistics, a game theory solver, a variety of backend web apps with *Django* and *Flask*, and as a scalability consultant improving Python performance.

Janis loves open source and is the author of several open source Python projects on GitHub. He is involved in education in several ways: in an in-house capacity as a Python consultant, as a regular blogger, as a volunteer for events like Django Girls and Python community workshops, and as a frequent presenter about Python at local meetup events.

Janis is a co-founder of the Custom Programming Solutions consulting group and joined Python Charmers as a trainer in 2018.

Other information

Computer: An computer and internet connection will be provided for you during the course.

Exercises: There will be practical programming exercises throughout the course. These will be challenging and fun, and the solutions will be discussed after each exercise and provided as source code. During the exercises, the trainer(s) will offer individual help and suggestions.

Timing: The course will run from 9:00 to roughly 17:00 each day, with breaks of 50 minutes for lunch and 20 minutes each for morning and afternoon tea.

Personal help: Your trainer(s) will be available after each day for you to ask any one-on-one questions you like — whether about the course content and exercises or about specific problems you face in your work and how to use Python to solve them. We encourage you to have your own data sets ready to discuss if you wish.

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About Python Charmers

Python Charmers is the leading provider of Python training in the Asia-Pacific region, based in Australia and Singapore. Since 2010, Python Charmers has given over 250 training courses and bootcamps to over 3000 delighted people from organizations such as AGL, Atlassian, Barclays, CSIRO, Cisco, Deloitte, Dolby, IMC, pwc, Singtel Optus, Shell, Sportsbet, Telstra, Toyota, Verizon, Westpac, and Woolworths. Python Charmers specializes in teaching programming and data science to scientists, engineers, data analysts, quants, and computer scientists in the Python language.

Python Charmers' trainers boast years of Python experience and deep roots in the open source community, as both speakers at events and contributors to well-known open source projects, including *NumPy*, *SciPy*, *Scikit-Learn*, *Pandas*, and *Python-Future*.

Testimonials: Testimonials from past participants of similar bootcamps and training courses are available at

https://pythoncharmers.com/testimonials/

Questions: We are happy to customise this program further on request. Please let us know if you would like to discuss this or have any other questions.

Contact:

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