Pennsylvania 5-day Hands-on Workshop on:

Python for Scientific Computing
and
TensorFlow for Artificial Intelligence

By Dr Stephen Lynch FIMA SFHEA

Author of Two Patents
Author of PYTHON™, MATLAB®, MAPLE™ AND MATHEMATICA® BOOKS
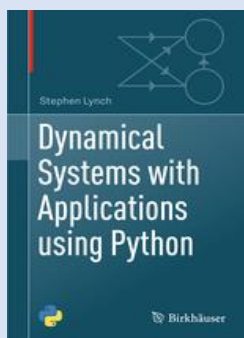STEM Ambassador, Public Engagement Champion and Speaker for Schools

Python for Scientific Computing
Dates: Mon 11th July – Wed 13th July

TensorFlow for Artificial Intelligence
Dates: Thu 14th July – Fri 15th July

Part of the workshop is based on Dr Lynch's latest book, "*Dynamical Systems with Applications using Python*", Springer International Publishing, 2018.

A copy of this 665-page reference e-book will be available during the workshop

- This workshop is designed for anyone in the engineering, computing and scientific community who wants to learn how to use Python for Scientific Computing and TensorFlow for Artificial Intelligence (AI) programming.
- No prior knowledge of Python or programming is required to benefit from this workshop.
- The emphasis of the workshop is on practical applications by means of hands-on tutorials using Python and TensorFlow. The emphasis is **not** on the mathematical theory.

Attend this workshop and learn:

- how to program Python using IDLE, SPYDER and JUPYTER/GOOGLE COLAB NOTEBOOKS
- how to model both CONTINUOUS and DISCRETE DYNAMICAL SYSTEMS
- about models in engineering, computing, biology, chemistry, physics and mathematics
- how the brain works and about ARTIFICIAL INTELLIGENCE
- how to program deep neural networks In GOOGLE COLAB with TENSORFLOW

The workshop participants need no knowledge of any programming language.

The methods used in this workshop have been successfully tested on undergraduates and postgraduates for over 25 years. The workshop is highly interdisciplinary.

This is a practical workshop using Python and TensorFlow.

Manchester Metropolitan University

python Programming

INTRODUCTION/ OBJECTIVES

The main objective of this workshop is to introduce delegates to Scientific Computing using Python and Artificial Intelligence using TensorFlow.

Participants will be introduced to Python and Scientific Computing before moving on to Artificial Intelligence. The workshop will focus on the Python and TensorFlow programs and **NOT** on the mathematical theory.

WORKSHOP OUTLINE

Day 1: INTRODUCTION TO PYTHON

Topic 1
An Introduction to Python using IDLE

- Using Python as a powerful calculator
- Simple programming techniques including, defining functions, loops and if, then, else statements
- Simple plots using Turtle
- A tutorial introduction to NumPy and Matplotlib with Spyder

Day 2: PYTHON PROGRAMMING

Topic 2
Anaconda, Spyder and SymPy

- Tutorial introduction to SymPy
- Jupyter notebooks and Google Colab
- Simple programming
- Scientific computing: Biological models

Delegates can view the Python programs online via a Jupyter notebook:

http://www.doc.mmu.ac.uk/STAFF/S.Lynch/DSAP_Jupyter_Notebook.html

DAY 3: SCIENTIFIC COMPUTING in PYTHON

Topic 3
Scientific Computing

- Scientific computing: Chemical kinetics
- Scientific computing: Fractals and multifractals
- Scientific computing: Engineering
- Scientific computing: Physics

DAY 4: ARTIFICIAL INTELLIGENCE (AI)

Topic 4
An Introduction to Artificial Intelligence

- Image processing
- Binary oscillator computing
- Artificial Intelligence
- The backpropagation algorithm

DAY 5: AN INTRODUCTION to TENSORFLOW

Topic 5
An Introduction to TensorFlow in Google Colab

- Simple examples
- KERAS and TensorFlow
- Convolutional neural networks
- Recurrent neural networks
- Introduction to TensorBoard
- The future of AI

The workshop includes practical, hands-on sessions where participants are given the opportunity to apply in practice the theory they have learnt. All Python and TensorFlow program files can be downloaded through GitHub:

https://github.com/proflynch/Tekbac

Similar courses in industry can cost over $7000 per delegate:

https://www.nobleprog.co.uk/cc/pythonprog

WHO WILL BENEFIT FROM THIS WORKSHOP

This workshop is aimed at a large professional audience: from academics and technicians, advanced undergraduate and graduate students to applied mathematicians, engineers, and researchers in a broad range of disciplines such as biology, chemistry, computing, economics, nonlinear optics, neural networks, population dynamics and physics.

The workshop will help to develop a practical understanding of how Python can be used to solve real-world problems and provide scientists with a means of presenting their results.

Python for employability:

https://www.mathscareers.org.uk/python-for-a-level-maths-undergraduate-maths-and-employability/

WORKSHOP LEADER: DR Stephen Lynch FIMA SFHEA

Stephen is a **world leader** in the use of mathematics packages in teaching, learning, assessment, research and employability. He started using packages in the mid 1980's whilst studying for his PhD in Pure Mathematics. Upon completion of his PhD, he started his lecturing career at Southampton University at the age of 24.

This MMU workshop has developed from a series of mathematics lectures to undergraduates and from both national and international Python and TensorFlow workshops.

Although educated as a pure mathematician, Stephen's many interests now include applied mathematics, cell biology, electrical engineering, computing, neural networks, nonlinear optics and binary oscillator computing, which he co-invented with a colleague.

He has authored 2 international patents for inventions, 7 books, 4 book chapters, over 40 journal articles and a few conference proceedings.

Stephen is a Fellow of the Institute of Mathematics and Its Applications (FIMA) and a Senior Fellow of the Higher Education Academy (SFHEA). He is currently a Reader with MMU and was an Associate Lecturer with the Open University from 2008-2012. In 2010, Stephen volunteered as a **STEM Ambassador**, in 2012, he was awarded MMU **Public Engagement Champion** status and in 2014 he became a **Speaker for Schools**.

Stephen runs national workshops with the IMA on **Python for A-Level Mathematics and Beyond**, for pupils and teachers:

https://ima.org.uk/events/conferences/

Stephen is also the author of **MATLAB®, Maple™** and **Mathematica®** books – all published by Springer International Publishing. According to **Springer**, there have been nearly **600,000** chapter downloads for all of his books up to January 2022. The chapters from the Python book alone have been downloaded over **130,000** times since late 2018.

The Mathematics degrees offered at MMU (student population over 38,000) are heavily technology-based and loved by our students. In 2020, 2018 and 2012, Mathematics was voted **Course of the Year** at the Students' Union Teaching Awards.

In 2022, Stephen was nominated by MMU for a **National Teaching Fellowship** for his work in Widening Participation, programming in the Maths curriculum and interdisciplinary research feeding in to teaching.

PYTHON for SCIENTIFIC COMPUTING
and
TENSORFLOW for ARTIFICIAL INTELLIGENCE

Workshop Itinerary
Dr Stephen Lynch FIMA SFHEA
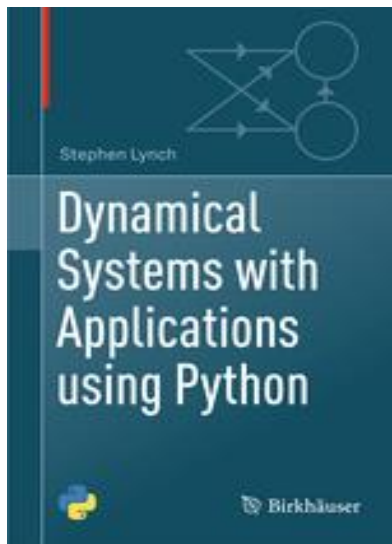
Day 1			
Topics	**Hours**	**Topics**	**Hours**
Introduction and using Python as a Powerful Calculator	10am-11am	Simple Plots using Turtle	1pm-2pm
Simple Programming Techniques	11am-12pm	A Tutorial Introduction to Numpy/Matplotlib	2pm-3pm
Day 2			
Topics	**Hours**	**Topics**	**Hours**
A Tutorial Introduction to Sympy	10am-11am	Simple Programming	1pm-2pm
An Introduction to Jupyter/Colab Notebooks	11am-12pm	Scientific Computing: Biological Models	2pm-3pm
Day 3			
Topics	**Hours**	**Topics**	**Hours**
Scientific Computing: Chemical Kinetics	10am-11am	Scientific Computing: Engineering	1pm-2pm
Scientific Computing: Fractals and Multifractals	11am-12pm	Scientific Computing: Physics	2pm-3pm
Day 4			
Topics	**Hours**	**Topics**	**Hours**
AI: Introduction to Image Processing	10am-11am	AI: Artificial Intelligence	1pm-2pm
AI: Binary Oscillator Computing	11am-12pm	AI: The Backpropagation Algorithm	2pm-3pm
Day 5			
Topics	**Hours**	**Topics**	**Hours**
AI: KERAS and TensorFlow	10am-11am	AI: Recurrent Neural Networks	1pm-2pm
AI: Convolutional Neural Networks	11am-12pm	AI: Introduction to TensorBoard	2pm-3pm

New Book: Lynch S (2023) *Python for Scientific Computing and TensorFlow for Artificial Intelligence*, CRC Press (in press).