Programming Foundations for Medical Image Analysis (MPHY0030)

**Description**

MPHY0030 Programming Foundations for Medical Image Analysis

Good computer programming skills are fundamental to modern medical image analysis methods. The aim of this module is to introduce programming techniques required for the analysis of medical images in a research or industrial setting. Students completing the course will understand key concepts of programming in MATLAB, C/C++, and other high-level languages, and be able to apply these to store, display, manipulate and process medical images using standard techniques, as well as combine these techniques to implement more complex image analysis algorithms. The module has a practical rather than theoretical bias, with the emphasis on implementing and thoroughly testing computer programs to perform tasks that are common to many image analysis techniques, such as image blurring and computing image gradients. However, many of the techniques covered require an understanding of the underlying computational and mathematical principles and therefore this module is not recommended for students who are new to programming, or those who not comfortable with linear algebra, including vector and matrix operations, matrix transformations, and coordinate systems.

Topics covered include data structures, pointers, and referencing; performing core mathematical and data operations in different programming languages; comparing the roles of different programming languages; common compilers, libraries, and toolkits; storing and displaying binary, greyscale and colour images; medical image file formats (including DICOM); minimising and handling numerical errors; debugging tools and strategies; good programming practice; the Fourier transform; implementing linear filters in the spatial and frequency domain; and computing first and second-order image gradients using Gaussian derivatives.

The module is assessed by 100% coursework, comprising a mixture of programming exercises set through the term.

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**Key information**

**Year** 2020/21  
**Credit value** 15 (150 study hours)  
**Delivery** PGT L7, Campus-based  
**Reading List** [View on UCL website]  
**Tutor** Dr Yipeng Hu  
**Term** Term 1  
**Timetable** [View on UCL website]

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**Assessment**

- Coursework: 50.0%
- Coursework: 50.0%

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**Find out more**

For more information about the department, programmes, relevant open days and to browse other modules, visit [ucl.ac.uk](http://ucl.ac.uk)

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**Disclaimer:** All information correct as of March 2020. Please note that aspects of the module may be subject to change. UCL will make best efforts to inform applicants of major changes.
and more substantial assignments in different programming languages in which algorithms are implemented to analyse patient image data and solve real-world medical image computing problems.

**Prerequisites:**

a) Completion of an introductory course on programming using MATLAB, C++, or another high-level, object-oriented language, such as Python or C#, at undergraduate or postgraduate level (e.g. MPH0020 Computing in Medicine)

b) Good mathematical ability, especially proficiency in linear algebra (vector and matrix representations, common vector-matrix operations, matrix and spatial co-ordinate transformations).

**Module organiser:** Professor Dean Barratt

**Lecturers:** Dr. Yipeng Hu

A video description can be found at the UCL Media Central.
Medical Physics and Biomedical Engineering

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