Computational Modelling for Biomedical Imaging (COMP0118)

Description

Aims:
To expose students to the challenges and potential of computational modelling in a key application area. To explain how to use models to learn about the world. To teach parameter estimation techniques through practical examples. To familiarize students with handling real data sets.

Learning outcomes:
On successful completion of the module, a student will be able to:
1. understand the aims of biomedical imaging;
2. understand the advantages and limitations of model-based approaches and data-driven approaches;
3. have knowledge of standard techniques in modelling, experimental design and parameter estimation;
4. understand the challenges of data modelling, experiment design and parameter estimation in practical situations;
5. gain knowledge of handling real-world data in computer programs;

Content:
- The module introduces the basics of mathematical modelling: the distinction between models and the real world; when and how models are useful; advantages and disadvantages of explicit model-based approaches;
- The module covers a range of model based approaches to biomedical imaging and basic computer science techniques that underpin them. The intention is to introduce the students to standard techniques of parameter estimation in a hands-on practical way within the context of model-based imaging. The module also gives exposure to common applications and challenges in biomedical imaging;
- The content draws from examples at a range of length scales from molecular imaging, cellular scales in microscopy, regional scales, whole organ and whole population scales. The module uses each example to introduce both new kinds of model and, more

Key information

Year 2019/20
Credit value 15 (150 study hours)
Delivery PGT L7, Campus-based
Reading List View on UCL website
Tutor Prof Daniel Alexander
Term Term 2
Timetable View on UCL website

Assessment

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Report</td>
<td>45%</td>
</tr>
<tr>
<td>Coursework 1</td>
<td>35%</td>
</tr>
<tr>
<td>Coursework 2</td>
<td>15%</td>
</tr>
<tr>
<td>Oral Presentation</td>
<td>5%</td>
</tr>
</tbody>
</table>

Find out more

For more information about the department, programmes, relevant open days and to browse other modules, visit ucl.ac.uk

Disclaimer: All information correct as of August 2019. Please note that aspects of the module may be subject to change. UCL will make best efforts to inform applicants of major changes.
fundamentally, new algorithms and techniques for parameter estimation, optimization, sampling and validation;

**Requisites:**
In order to be eligible to select this module, a student must be registered on a programme for which it is a formally-approved option or elective choice.

The module makes heavy use of Matlab programming for courseworks, although a strong programmer in other languages will pick up the necessary Matlab during the course. It also assumes a strong grasp of general engineering mathematical concepts, in particular linear algebra, probability and statistics, geometry, and calculus.
Computer Science

Computational Modelling for Biomedical Imaging (COMP0118)

Description

Aims:
To expose students to the challenges and potential of computational modelling in a key application area. To explain how to use models to learn about the world. To teach parameter estimation techniques through practical examples. To familiarize students with handling real data sets.

Learning outcomes:
On successful completion of the module, a student will be able to:
1. understand the aims of biomedical imaging;
2. understand the advantages and limitations of model-based approaches and data-driven approaches;
3. have knowledge of standard techniques in modelling, experimental design and parameter estimation;
4. understand the challenges of data modelling, experiment design and parameter estimation in practical situations;
5. gain knowledge of handling real-world data in computer programs;

Content:
- The module introduces the basics of mathematical modelling: the distinction between models and the real world; when and how models are useful; advantages and disadvantages of explicit model-based approaches;
- The module covers a range of model based approaches to biomedical imaging and basic computer science techniques that underpin them. The intention is to introduce the students to standard techniques of parameter estimation in a hands-on practical way within the context of model-based imaging. The module also gives exposure to common applications and challenges in biomedical imaging;
- The content draws from examples at a range of length scales from molecular imaging, cellular scales in microscopy, regional scales, whole organ and whole population scales. The module uses each example to introduce both new kinds of model and, more
fundamentally, new algorithms and techniques for parameter estimation, optimization, sampling and validation;

**Requisites:**
In order to be eligible to select this module, a student must be registered on a programme for which it is a formally-approved option or elective choice.

The module makes heavy use of Matlab programming for courseworks, although a strong programmer in other languages will pick up the necessary Matlab during the course. It also assumes a strong grasp of general engineering mathematical concepts, in particular linear algebra, probability and statistics, geometry, and calculus.