<table>
<thead>
<tr>
<th><strong>Module Code</strong></th>
<th>CS7DS2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Module Name</strong></td>
<td>Optimisation Algorithms for Data Analysis</td>
</tr>
<tr>
<td><strong>ECTS weighting</strong></td>
<td>5</td>
</tr>
<tr>
<td><strong>Term</strong></td>
<td>Hilary Term</td>
</tr>
<tr>
<td><strong>Contact Hours</strong></td>
<td>2 lecture hours per week</td>
</tr>
<tr>
<td><strong>Module Personnel</strong></td>
<td>Professor Douglas Leith</td>
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**Learning Outcomes**

Students who complete this module should be able to:
- DS2LO1 Describe the principle types of algorithm that form the basis of data science methods;
- DS2LO2 Explain the properties of these algorithms that will or will not permit scalability;
- DS2LO3 Choose the appropriate software and hardware tools to implement these algorithms in any specific case.

**Module Learning Aims**

The aims of this module are to give the student skills to address the principal computational challenges that are encountered when trying to scale statistical algorithms:
- Convex optimization: convexity, subgradient methods, duality.
- Co-ordinate descent methods, asynchronous updating.
- Introduction to non-convex optimisation: convex-concave approach
- Linear programming
- Matrix factorisation and decomposition,
- Large-dimension simulation: Gibbs sampling, annealing methods
- Overview of Programming: Python, R for big data, Map-reduce/Hadoop, Scala.

**Assessment Details**

- Coursework: 20%
- Exam: 80%

The coursework is a project.