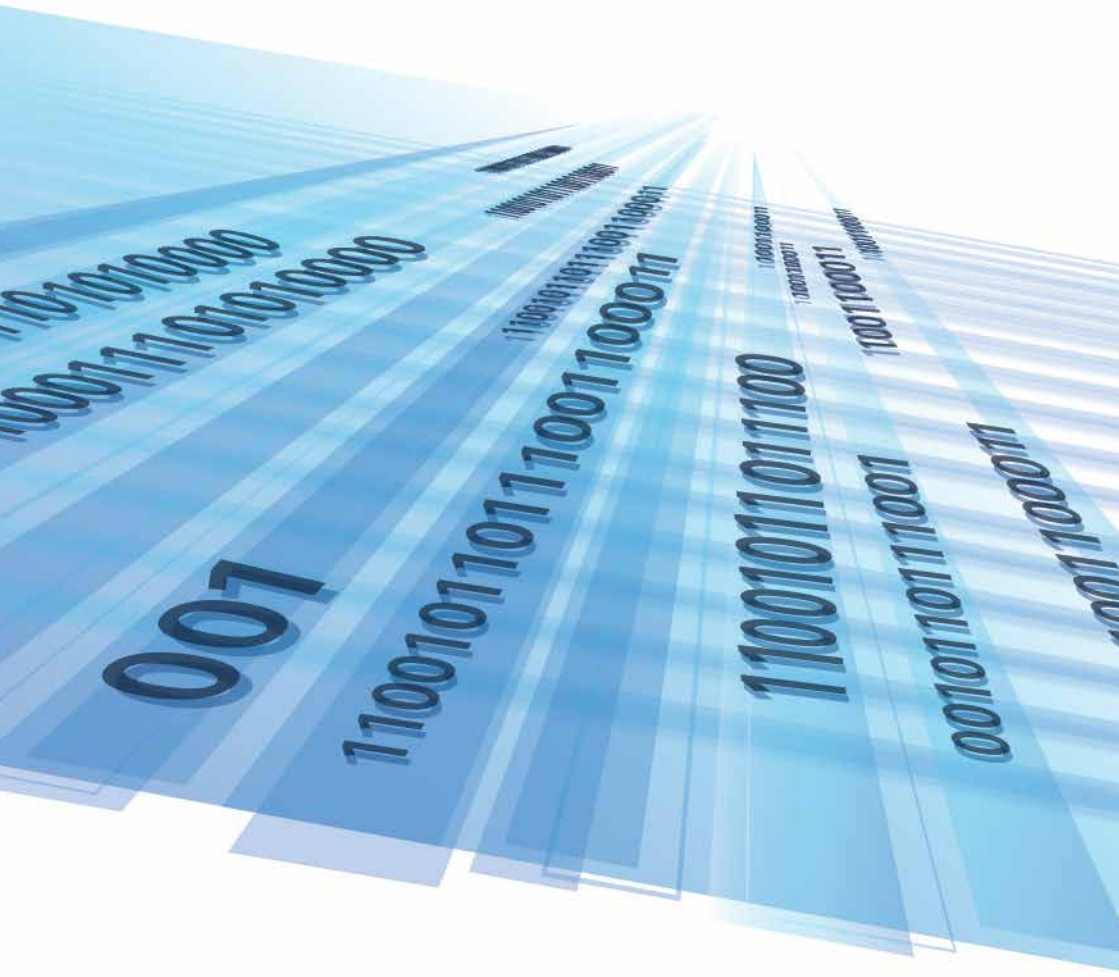
THE UNIVERSITY OF
WARWICK

Data Science

BSc Hons



Warwick
Statistics

Department of
COMPUTER SCIENCE

"By 2018, the United States alone could face a shortage of 140,000 to 190,000 people with deep analytical skills."

McKinsey,
Management Consultancy, 2011

"Data scientists are the magicians of the Big Data era."

New York Times, 2013

Data Science (BSc Hons)

Single Honours Degrees in Data Science

What is Data Science?

The revolution in the development of computers and automated systems in the 20th Century has created a fundamental problem: how to make sense of the unprecedented volumes of data generated on a daily basis. In every facet of modern life, from online shopping and social networks to scientific research and finance, we collect immensely detailed data on actions taking place throughout the world. However, without interpretation, this data is just noise. Data Science is fundamentally concerned with how data can be turned into intelligence.

Suppose, for instance, you run an e-commerce site selling music. How would you recommend new artists to a customer? You might use everything you know about that customer, such as the music they have bought before, the songs they have previewed, and what news articles they have read on your site. You might also use the information you have about other customers. How can you combine all this to produce recommendations that lead to sales? Is there other information you could bring in from other sources? How could you redesign your site to convert more previews to sales? When you see new sales figures, how confident can you be that they are due to your changes, and not random variations? Data Science is concerned with all of these questions, and many more!

A key aspect of Data Science that distinguishes it from more traditional statistics is the need to extract information from very large data sets: currently "big data" may be of the order of petabytes. These data sets are made difficult to analyse by their sheer size and variety, yet they occur in many different areas of industry and society. Advances in technology have led to the creation of large data sets in many areas, including genetics, e.g. decoding the human genome; personalised healthcare; the internet; social networks; and physics, e.g. the search for the Higgs boson. Processing this deluge of data requires the use of sophisticated computing techniques. As a consequence, it is now imperative for "information workers" to have a combination of highly developed mathematical, statistical and computing skills, which Data Science provides.

- Data Science is an emerging discipline at the interface of Statistics and Computer Science.
- The University of Warwick is the first in the UK to offer an undergraduate degree in Data Science.
- A three year course leading to a BSc Honours degree, offered jointly by the Departments of Statistics and Computer Science.

If you would like more information on the Data Science degree, please write to:

Undergraduate Admissions
Department of Statistics
The University of Warwick
Coventry CV4 7AL

or email: **datsci@warwick.ac.uk**

Is Data Science for you?

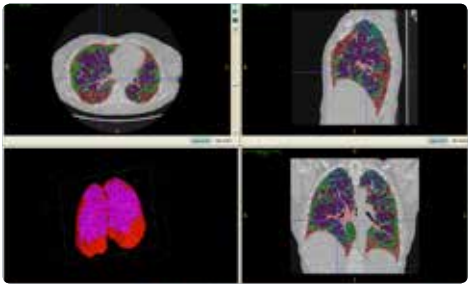
Data Science is designed for talented mathematicians who are interested in pursuing sophisticated theory relevant to modern application domains requiring large-scale data analysis.

Admission to Data Science requires a top grade in A-level Mathematics and Further Mathematics. No previous knowledge of Statistics or Computer Science is expected or required, but applicants should want to apply theory to answer real world problems. UCAS personal statements need not explicitly discuss Data Science, but an emphasis on mathematical interests and achievements will be viewed positively.

Data Science is one of a comprehensive range of mathematically-oriented single honours degrees at the University of Warwick, including:

- **MORSE (Mathematics, Operational Research, Statistics and Economics)**
- **Mathematics and Statistics**
- **Mathematics (Pure)**
- **Mathematics and Physics**
- **Computer Science**
- **Discrete Mathematics**

The Data Science degree concentrates in particular on those modern and developing areas of mathematics, statistics and computer science needed to help understand the vast amounts of data arising across the the physical and social sciences, commerce, finance, the internet, etc.



High Resolution Computed Tomography (HRCT) data of patients with lung diseases for computer-aided diagnosis, developed as part of an ongoing collaboration between the Statistics and Computer Science Departments at Warwick, and Coventry and Warwickshire University Hospitals.

Data Science Course Structure

The degree course begins with a year of structured study which builds a strong foundation in areas that are important for all data scientists. It teaches rigorous mathematical reasoning through introductory modules in probability, statistics, software and data structures. In later years, students apply these skills in more substantial projects, concentrating their studies on areas that excite them most.

First year

The first year of the course provides the background knowledge and fundamental skills required to develop expertise in Data Science. Students cover topics in university-level mathematics and statistics, such as formal proof, mathematical reasoning and probability theory, and also take a range of modules in computer programming, algorithms and the design of information structures. In particular, students encounter programming in both Java and R. The core modules are taught by Mathematics (approximately 40% of total load), Statistics (30%), Computer Science (20%) and Warwick Business School (10%).

Second year

In the second year, students further integrate the skills gained in their first year, developing their expertise in statistical inference, algorithm design and software engineering, whilst also building their communication

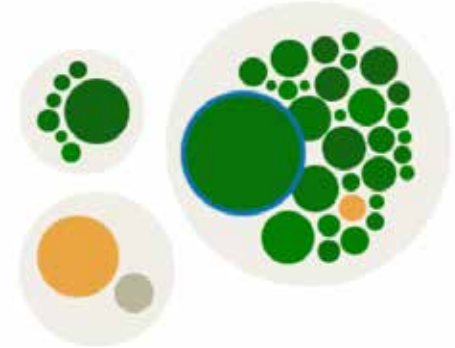
and team working skills – thereby allowing them to operate effectively as data scientists. Core modules from Statistics and Computer Science account for approximately two thirds of the credit for the year, with students selecting options to make up the remaining third. A group project gives students practical experience of industrial software engineering.

Third year

In their final year of study, students focus on applying the skills gained in a variety of problem domains, including in an individual project involving an extended analysis of a substantial data set. They also develop a greater understanding of cutting-edge topics and issues in Data Science. For example, students may study topics in multivariate statistics, Bayesian forecasting, machine learning, data mining and algorithmic complexity.

Flexible study

The options permitted by Data Science degree course allow great flexibility. In addition to the diverse range of mathematical, statistical and computing modules available, there are opportunities for students to study topics such as robotics, business studies, finance and stars/galaxies, and even take modules on teaching, a language or music.



Visualisation of rumour spreading on twitter during the London riots, taken from a study of Rob Proctor, Professor of Social Informatics, University of Warwick. For more details see: www.guardian.co.uk/news/datablog/2011/dec/08/twitter-riots-interactive

Career Opportunities

Even in difficult times for recruitment, students graduating from the Departments of Statistics and Computer Science are in high demand. Data Science graduates in particular will be well prepared to embark on a wide variety of careers, for example:

Industry - Global demand for combined statistical and computing expertise already outstrips supply, which means industry is consistently short of people equipped to take on the deep analyses of data. Data Science graduates will clearly be well placed to fill this gap! Many data scientists are already employed in companies working in a range of areas, including:

- Information technology
- Manufacturing
- Pharmaceuticals
- Finance
- Telecoms
- Market Research

Research - Many students from the Departments of Statistics and Computer Science go on to take up postgraduate degrees and research posts in Biostatistics, Econometrics, Engineering, Computer Science and Physics, as well as in medical schools and government agencies.

Teaching - Schools are desperately short of mathematics teachers, and people who can teach an additional subject are especially welcome. After further study, a university career is also possible.

Management / Professional Roles - Modern managers need to understand mathematical methods such as statistics and decision theory. Familiarity with computing is important too, and communication skills are vital. Project work enables Data Science students to develop these skills. Data Science graduates may also obtain exemptions for some actuarial or accountancy exams.

Mathematically - Oriented Degrees at Warwick

Since its formation as one of the new universities in 1965, Warwick has become one of the strongest universities for the mathematical sciences in the country, and is building on this position of strength to take the lead in the UK in the provision of a Data Science degree. Indeed, students on this degree course benefit from significant contact with a range of the departments that have contributed to Warwick's excellent reputation in relevant areas: Mathematics, Statistics and Computer Science. Moreover, Warwick is already a leader in Data Science, as the only European partner in the New York Centre for Urban Science and Progress, which focuses on Data Science for cities.

Mathematics

Warwick's thriving and internationally renowned Mathematics Department has staff with interests in many areas of pure and applied mathematics, and links with other departments concerned with applicable mathematics. Several lecturers, for example Ian Stewart, are also well-known authors.

Statistics

The Statistics Department was formed in 1972, has expanded considerably since then and has established an enviable international reputation in teaching and research – being placed at 30th in the world in the 2013 QS University Rankings, for example. The Centre for Research in Statistical Methodology (CRiSM) is a multi-million pound government initiative which further strengthens the department. The excellence of the department research output directly impacts teaching: our lecturing staff are active researchers in a broad range of areas in probability and statistics, from statistical theory and probability to applications in biology, economics, finance and medicine.

Computer Science

Established in 1969, the Department of Computer Science was one of the first on the campus, and it has steadily grown in size with the increasing demand for undergraduate and postgraduate places. As well as obtaining an excellent level of teaching, the Department has achieved grade 5 or above in every research selectivity exercise. It is consistently ranked in the top ten UK Computer Science departments in the Times Good University Guide. Its friendly academic community creates a caring and supportive environment for students.

The Data Science degree is administered by the Department of Statistics, which has a long track record of running the interdisciplinary MORSE degree. Students are assigned personal tutors in the Department of Statistics, who give pastoral support and academic guidance. The course is represented on both the Statistics and Computer Science department Student-Staff Liaison Committees.

With regards to teaching, each subject is delivered by specialists from the relevant department. In addition to those introduced above, these include academic staff from the highly regarded Warwick Business School. Small-group tutorials provide an important supplement to lecture classes in the first two years, helping students adjust to the demands of degree-level material. Students also benefit from exposure to other world leading departments at the University of Warwick

While Data Science represents a new degree course, it is taught by established departments, and incorporates a number of existing modules. Further details of these modules and the course structure are available on the course website. The majority of admitted students will complete their degree in Data Science, though transfers to the Mathematics and Statistics degree, or to the Computer Science degree, are possible at the end of the first year. However, it is not possible to transfer into Data Science from other subjects, because the full range of Data Science core material will not have been covered.

About the University

Granted a charter in the 1960s, Warwick quickly established itself as a dynamic university and has become known for the quality of its teaching and research. The Government's Teaching Quality Assessment has rated as excellent each of the Mathematics, Statistics and Computer Science Departments.

We want students to enjoy life at Warwick. The beautifully landscaped campus acts as a backdrop for its excellent student accommodation and provides a lively and vibrant base for the more than 13,000 undergraduate students who comprise 55% of the student population.

The Warwick Arts Centre is the focus for student and community entertainment, housing a concert hall, theatres, cinema, art gallery and a bookshop. The University also provides on-campus facilities for many sports and activities. A wide range of shops, restaurants and banks are on hand to add to the quality of student life.

warwick.ac.uk/datsci

For further information contact:

Undergraduate Admissions
Department of Statistics
University of Warwick
Coventry CV4 7AL UK

Tel: +44 (0)24 7652 3066

Fax: +44 (0)24 7652 4532

Email: datsci@warwick.ac.uk

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