Globally connected through Big Data
Overview of 
Big Data

The science of Big Data uses algorithms to ‘mine’ datasets in order to extract practical knowledge. There is more stored data in the world than ever before, and, organisations are increasingly utilising Big Data techniques. Consequently, there is a greater need than ever for advancements in Data Science.

Companies are increasingly looking to employ Data Scientists who are multi-skilled experts possessing a variety of skills such as programming, mathematics, statistics and business knowledge. There is a big gap in the number of scientists available.

Big Data skills are in high demand, currently attracting well-paid salaries.

Data Science research at the University of Stirling is conducted by world-class scientists exploring, developing and applying brain-inspired computational techniques and search and optimisation methodologies to a range of real-world data-driven problems.

Analysing data allows organisations to utilise insights and make informed decisions.

Our research makes a difference.

Professor Maggie Cusack
Dean of the Faculty of Natural Sciences
Global connections

The University of Stirling is a prestigious university with a reputation for high-quality teaching and research. We are an international authority in the field of Cognitive Computation and Big Data, and have forged relationships with collaborators from all over the world.

Overview of partnerships

The University of Stirling is part of the Scottish Informatics and Computer Science Alliance and the Data Lab. We conduct funded research totalling over £1.4Million in partnership with the UK Engineering and Physical Sciences Research Council (EPSRC), UK Research Councils - Economic and Social Research Council (ESRC), Medical Research Council (MRC), Biological and Basic Sciences Research Council (BBSRC), Natural Environmental Research Council (NERC) - the European Union FP7 Programme and a wide range of other funding agencies.

The Data Lab

The Data Lab enables industry, public sector and researchers to innovate and develop new data science capabilities in a collaborative environment. Its core mission is to generate significant economic, social and scientific value from Big Data.

Established with an £11.3 million grant from the Scottish Funding Council, investment surrounding the Data Lab is projected to bring a minimum of 248 jobs and an additional £104.5 million worth of value to the Scottish economy. The investment is projected to bring a minimum of 248 new jobs and an additional £104.5 million worth of value to the Scottish economy.

Our collaboration with the Data Lab has been very successful over the last three years that we have been working together.

"The University of Stirling has been part of The Data Lab Masters Programme since its inception, and we are delighted to have them as partners. Stirling students have consistently performed highly not only in their courses, but also in the cross-university course’s activities and challenges, as well as being highly regarded by their host work-placement organisations. This is testament to Stirling’s commitment towards the development of highly skilled data talent, and we look forward to continuing working with them in years to come”.

Gillian Docherty CEO, the Data Lab

The Scottish Informatics and Computer Science Alliance

The University of Stirling is part of the Scottish Informatics and Computer Science Alliance (SICSA) Scotland. SICSA promotes international excellence in University-led research, education and knowledge exchange for Scottish Informatics and Computer Science.
Research opportunities

The University of Stirling is an institution delivering research that has an impact on society.

Our research targets in the area of Big Data are to:

- Adopt a general definition of Big Data that we are able to adapt in order to meet the expectations of our multidisciplinary audience
- Establish algorithmic, theoretical and computational approaches - including online incremental and domain independent learning, nature and brain inspired multimodal cognitive learning, visualisation and informatics
- Develop cognitive Big Data implementations - including neuromorphic GPUs, smart clusters and clouds and open source software
- Create cognitive Big Data applications in domains as diverse as genomics, medicine, natural robotics, language processing, meteorology, geoscience, multimedia, e-learning, business intelligence, HCI, social media, network analysis, opinion mining, smart cities, transportation, energy management and biology

Cognitive Computation and Big Data Analytics

Cognitive Computation and Big Data Analytics (CogBID) is the world’s first multidisciplinary research Lab that aims to bring together the emerging areas of Cognitive Computation and Big Data Analytics.

Founded in 2010 by Professor Amir Hussain, CogBID aims to address the growing needs of industry, commerce, robotics, medical healthcare and a range of real-world application areas that call for the creation of next-generation cognitive machines and systems possessing truly brain-like, ‘multimodal’ cognitive Big Data analytic capabilities.

In a 2016 survey carried out by a leading Elsevier journal (Information Processing and Management), CogBID Lab researchers came out as the world’s two most productive authors in Big Data sentiment analysis over the past 15 years*.

Our ambitious aim is being realised through the group’s complementary vision of developing a deeper and more comprehensive understanding of the brain’s cognitive Big Data analytic capabilities, such as:

- Perception
- Action and Attention Learning
- Reasoning
- Language Processing
- Communication
- Problem Solving
- Synthetic Self Awareness
- Reinforcement Learning

Our research falls under three research themes:

- Cognitively-inspired multimodal hearing aids: Using visual cues to enhance speech intelligibility
- Sentiment mining of natural language: "This car is expensive but nice", versus "This car is nice but expensive" Which statement is more positive?
- Automating the heuristic design process: Optimising in complex fitness landscapes

World’s most productive authors in Big Data*

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Our projects

Melanoma diagnosis and detection using deep learning
Melanoma is the third most frequent type of skin cancer, and one of the most malignant tumours - accounting for 79% of skin cancer deaths. Despite its aggressive infiltration of other body parts, it is highly curable if diagnosed early and treated properly. The ultimate goal of applying machine learning to medical images is to recognise patterns in a better and quicker way than humans can, thereby increasing the productivity of doctors and the patient healthcare outcomes. Deep Learning (a form of machine learning) is able to provide improved predictions from the large amount of data it is trained on due to the higher levels of abstractions it provides. We believe Deep Learning could effectively contribute to the early detection of melanoma, and facilitate in distinguishing between benign and malignant moles.

Cognitively inspired, emotion-sensitive, human-computer interaction for Big Data
Opinion mining and sentiment analysis offer huge, unrealised potential to advertisers, companies and the public. Current text-based sentiment analysis techniques only recognise certain keywords – far from the goal of true natural language understanding. Next-level sentiment analysis associates emotions or attitudes with text, and is of greater commercial value. Our researchers have pioneered commercially relevant, cognitively inspired computing techniques for Big Data analysis. In partnership with industry supervisors, sentiment and predictive analytics will be researched, developed, tested and integrated in at least one existing commercial application. One example would be the development of a company’s online wedding services management system in order to provide a more natural, emotion-sensitive human-computer interaction. The next-generation engine will be adaptable to other commercial real-world applications, including online travel management services. Skyscanner (UK) Ltd, a global, web-based travel search company based in Edinburgh, has already expressed an interest in piloting the innovative multimodal analytics engine in their commercial Big Data system.

Customer churn prediction in telecommunication sector
Customer churn occurs when customers or subscribers stop doing business with a company or service. It is a critical and challenging problem affecting business and industry – in particular, the rapidly growing, highly competitive telecommunication sector. It is of substantial interest to both academic researchers and businesses that forecast the behaviour of customers in order to differentiate the churn from non-churn customers. The primary motivation is businesses’ need to retain customers, coupled with the high cost associated with acquiring new ones. A review of the sector has revealed a lack of efficient, rule-based Customer Churn Prediction (CCP) approaches in the telecommunication sector. This study proposes an intelligent, rule-based decision-making technique based on rough set theory (RST) to extract important decision rules related to customer churn and non-churn. The proposed approach effectively distinguishes churn from non-churn customers, and predicts customers who will or may churn in the near future.

Emotion recognition from speech, face and electroencephalograph
Automatic recognition of human emotions has been a hot research topic, with published papers exploiting several modalities, including: face; physiological signals, such as electrocardiogram (ECG) and electroencephalography (EEG); gesture; posture; pupillary dilation; and speech. Engineers are keen to develop systems capable of recognising human emotions from speech, as these could be used in applications in many fields - such as robotics, telecommunications services and e-learning. The research aims to propose a system capable of recognising humans’ emotional state with a high degree of reliability, in real conditions and in real-time. The research will also examine differences between features from each modality, depending on the age, gender and cultural background of subjects.

Explore the work of our Big Data experts online:
http://stir.ac.uk/1g2
Teaching Big Data

How do you help Masters students to develop employability skills?
The Big Data course is designed to teach students the skills they need to work as Data Scientists. The skills we teach are the skills employers are seeking. In addition, we run Curriculum Vitae and interview skills workshops during the course. In recent years, these have been delivered by a recruitment agency that specialises in recruiting for jobs in data and analytics.

Big Data in the classroom: what does this mean?
Classes are a mixture of lectures, practical sessions at the computer and small group tutorials. Each module has a single assignment and an exam, both worth 50% of the marks. Where possible, assignments are inspired by real-world examples.

Is there any industry involvement related to setting up the curriculum?
Yes. When the course was designed, I spoke to many companies and recruitment agencies and asked: “what is the ideal data CV?” Those answers informed the skills and technologies we teach on the course.

Dr Kevin Swingler
Programme Director, MSc Big Data

Big Data research

How are academia and the industry working together around Big Data?
Data Science connects academics and industry experts by co-creating new market opportunities, and boosting productivity to spur global economic growth. Innovative, cross-disciplinary partnerships of the kind Stirling is pioneering are expected to revolutionise the data-driven industry of tomorrow.

What are the research topics emerging in Big Data at the moment?
Cognitive Computing, also known as machine learning, is the hottest area of research in Big Data. This aims to equip future cognitive machines, robots and computing systems with optimal, human-like learning, reasoning and decision-making capabilities without the need for human intervention. Stirling is at the forefront to identify and address emerging research challenges in Big Data and Cognitive Computing.

What makes Big Data at the University of Stirling different?
What makes research at Stirling different is its unique model for scientific discovery based on ‘cross-disciplinary and multi-stakeholder collaborations’. This enables industry, public sector and world-class University researchers to innovate and develop new data science capabilities in a collaborative environment.

Professor Amir Hussain, Head of Data Science Research Group and CogBID Lab

Big Data in practice

How would you summarise the trends in Big Data?
The amount of data that’s being created and stored is almost inconceivable, and you will often hear statistics indicating 90% of all the data in the world today has been created in the last couple of years. It’s not just volume, but an increasing variety of data such as audio and video. But data alone is of no significance – only when data is analysed to unlock insights does it deliver business value. Yet only a small percentage of data is actually analysed. Despite this, research SAS carried out with the Centre for Economic and Business Research revealed that, in the UK alone, Big Data analytics will contribute an average £40 billion per year to the economy from 2015 to 2020.

What’s the impact of Big Data on business?
Analysing Big Data allows businesses to extract insights to make evidence-based decisions rather than rely purely on instinct. It means smarter decisions are made. Computer power also ensures that data can be analysed in just a couple of minutes. Streaming analytics allows real-time insights to be extracted from data as it is generated. It is not just a case of smarter decisions - but also much quicker decisions and a greater understanding of ‘what-if’ scenarios.

What has driven the growth of Big Data?
With so much of our lives conducted over the Internet, we have much more readily available data to analyse and make sense of the world. Much lower costs of storage and the rise in computer power have also meant there is greater capability to analyse all this information. Businesses use data to make better decisions, but it can also help with many other challenges facing the world - including the discovery of new medicines and treatments for diseases, and developing a better understanding of multiple and related environmental factors that can aid conservation etc.

Mr Laurie Miles, Director of Analytics, SAS UK & Ireland

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Professor Amir Hussain, Head of Data Science Research Group and CogBID Lab

Globally connected through Big Data
At Stirling, our courses are designed to develop forward-thinking graduates and help students from around the world to redefine their potential. We are ranked 1st in Scotland for welcoming international students (International Student Barometer 2016).

Undergraduate opportunities

BSc (Hons) Business Computing
You’ll examine just how critical computers are to business. The emphasis is on organisations and how computers are used within them. You’ll study the basic skills of designing and building software systems, and gain a broad range of skills by combining theory and practice. This is a skillset that resonates well with employers, both in the software industry as well as in a wider and more strategic context developing the use of IT in any business.

http://stir.ac.uk/1fy

BSc (Hons) Computing Science
Our Computing Science course teaches you how to design, build and analyse such systems – in both theory and practice. Your training will help you to understand how computers work, how to programme them to make them do what we want and how they fit into their environment. Our graduates are highly sought after within the industry. The course’s large practical element ensures you are well prepared for an IT career.

http://stir.ac.uk/1fz

BSc (Hons) Software Engineering
You will study practice and techniques for real-world software design and associated programming technologies – putting the theory in practice with software development and teamwork. You will learn how to reason logically, analyse problems and resolve them by building effective computer systems. The course’s large practical element ensures you are well prepared for an IT career.

http://stir.ac.uk/1g0

BSc (Hons) Computing Science
The MSc in Big Data has been developed in partnership with global and local companies who employ Data Scientists. The course features a three-months summer project, generally in partnership with a company or technology partner, that provides students with the opportunity to develop their employability skills. This course covers Big Data technology, advanced analytics and industrial and scientific applications. The syllabus includes a variety of subjects, including: mathematics for Big Data; Python scripting; business and scientific applications of Big Data; Big Databases and NoSQL, including MongoDB, Cassandra and Neo4j; analytics; machine learning and data visualisation using Weka, R and ScikitLearn; and cluster computing with Hadoop, Spark, Hive and MapReduce.

http://stir.ac.uk/je

MSc Big Data
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http://stir.ac.uk/je

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http://stir.ac.uk/1g0

Work placement
Most students complete applied dissertation projects - either on internships, company sponsored projects or based on ideas of their own. Work placements provide students with the opportunity to develop their experience using data in a work environment, often leading to job offers at the end of the projects.

http://stir.ac.uk/i1d

MSc Financial Technology (Fintech)
The MSc Financial Technology has been developed in partnership with global organisations specifically to provide the skills that employers in the fintech industry need. Companies such as HSBC, Sainsbury’s Bank, JP Morgan and MBN helped shape the course with employability firmly in mind. This advanced taught postgraduate course combines the technology from big data and analytics, mobile computing and modern financial services. The course provides a solid foundation in computing technology, financial theory, business skills and ethical and regulatory constraints for students looking to enter a career in the fintech industry. This course covers manipulating data and scripting in Python, Blockchain, cyber security and data protection, NoSQL databases, corporate finance, behavioural finance, business start-up planning and managing disruptive technology.

http://stir.ac.uk/1i4

MSc Data Science for Business
According to Harvard Business Review, being a Data Scientist is considered the sexiest job of the 21st Century. Our new MSc Data Science for Business has been developed in close collaboration with leading financial services organisation HSBC and the Data Lab to produce graduates with the skills that industry needs. This course gives you the opportunity to develop specialist skills by choosing elective modules from finance, computing science and management. You’ll work on a three-month work placement covering out consultancy-style projects alongside industry leaders in data analytics. Our extensive network of external organisations across all sectors provides opportunities to build your knowledge, skills and experience for a successful career in business analytics roles.

http://stir.ac.uk/17r

“...We have been impressed by the MSc Data Science for Business course at the University of Stirling, as well as the quality of students. Being able to analyse and interpret data to give it relevance and meaning is a must-have in modern business. Having worked with two recent Masters graduates, it is clear that the course delivers a strong blend of analytics, commercial acumen and excellent management skills.”

Bill Percy, Customer Experience Director at Virgin Money
What our staff and students say about us

“The MSc Big Data at the University of Stirling has been a great experience, helping me to get a good understanding of machine learning and Big Data. I have already been offered a job in the industry as a Data Scientist. The work placement was a good professional experience, and helped me to settle comfortably into my current job without any pressure.”

Maniteja Jaggavarapu | MSc Big Data 2017 | Hyderabad | India

“Having completed my undergraduate studies at India’s top BITS Pilani University (2016), I was awarded a prestigious Stirling IMPACT PhD scholarship. I have just completed my first year, and it has been a truly inspirational experience. Working as part of the world-leading interdisciplinary CogBID Lab has led to seven research papers, published to-date.”

Mandar Gogate | 1st year PhD student | Maharashtra | India

“My inspiration as a Data Scientist is to design and embed intelligent, human-like computing in real-world, cognitive decision-making engines in order to solve a wide-range of real-world problems. I am part of multidisciplinary projects, and published research in world-leading journals. I am also interested in the impact of data science in cutting-edge areas, ranging from education, culture and heritage, early dementia and cancer diagnosis, to smart cities, journalism, media, policy making, and smart governance.”

Dr Ahsan Adeel | Technical Head/R&D Lead Cognitive Big Data Informatics (CogBID) | Islamabad | Pakistan

“The course was challenging, and a big career change from architecture. I enjoyed the course, and I got to meet many professionals and students around Scotland who were passionate about Data Science through the University’s partnership with the Data Lab. My work placement with the NHS was extremely valuable, as it led to an offer of a full-time job. I also won Best Project Award at the Data Lab Project Awards, which was a fantastic experience and a dream come true.”

Anita George | MSc Data Science for Business 2017 | Kerala | India

“It is fantastic news and great to hear that Anita’s hard work on her Masters project has been recognised and rewarded. We are also delighted that Anita will be working with NHS National Services Scotland in her career, and look forward to seeing her skills and knowledge from the MSc Data Science for Business course being used in our organisation.”

Jonathan Cameron | Head of Service for Strategic Development Public Health and Intelligence at NHS Scotland