Modules Description

Artificial Intelligence

This module aims to introduce symbolic and agent-based approaches to Artificial Intelligence. You will understand the historical development of symbolic and sub symbolic approaches to Artificial Intelligence including search, vision and planning. You will be familiar with the agent-based and multi-agent-based approach to software design and understand its significance especially with respect to trends in computing such as human-computer interaction, ubiquity and interconnectedness.

Big data analysis

This module covers the topic of big data, which is a key element of contemporary applications of data science. It also provides practical skills related to working with big data computing resources.

By taking this module, you will gain an in-depth understanding of the technology and methods used for big data analysis. The technologies you will study include distributed file systems, SQL and NoSQL databases, parallel computing and cluster computing. You will learn what the key challenges are in big data analysis, and how they are met with current technologies. You will work in a modern scripting language which is appropriate for big data work. You will use querying to extract data, then design data processing and analysis pipelines to carry out studies using the data. You will learn how to apply these big data analysis techniques to business and scientific problems.

Blockchain programming

Blockchain is the technology that underpins Bitcoin and other cryptocurrencies. Blockchain promises to become a dominant technology in financial and other transactions, whether cryptocurrencies thrive or die. This module will give you a practical and theoretical knowledge of: how blockchains work, security issues with blockchains, where blockchains come from, how to analyse competing notions for blockchains (i.e. proof of stake vs proof of work; and bitcoin vs ethereum), and what applications there are on the horizon.

Data programming in python

This module aims to provide you with the programming skills you will need to carry out the programming tasks you will encounter in the other modules in this programme. You will learn about general programming techniques such as variables, functions and control flow. You will learn how to work with different types of data structures such as arrays and dictionaries. You will develop data processing pipelines, which allow you to convert raw data into data that you can analyse. You will apply mathematical and statistical procedures to data. You will learn how to plot graphs of various types. You will also familiarise yourself

with an industry standard data science programming environment which you can use throughout the course.

Data science research topics

The module introduces you to research topics related to Data Science, such as Modern applications of Machine Learning, Data Mining, Computational Statistics; Cybersecurity, Financial Informatics, Business analytics and its applications and many more.

The module will guide your work in exploring a research theme of interest, as a preliminary phase preparing you for the Final Project. The module will also expose you to learning techniques of conducting research work and of writing scientific reports. You will be taught approaches for devising and optimising your strategies adapted to your skills in seeking and securing an employment.

Data visualisation

This module aims to equip you with a data visualisation skillset. By taking this module, you will be able to gain access to a wide range of data sources, and then to transform this data into compelling visualisations and plots. You will learn how to convert a data source into a visual story, where you will reveal and present the structure of the data. You will also learn how to publish your data visualisations on the web, such that your work is available to others. You will use a range of data visualisation tools, including interactive and animated graphing libraries.

Financial data modelling

This module aims to provide you with the ability to analyse financial, time series data using machine learning techniques. Analysis of financial data is an exciting application area for data science. You will study linear, non-linear and density models of sequential data, using neural networks. You will use gradient descent techniques and apply Kalman filters to enable proper dynamic treatments. You will investigate the concepts of overfitting, generalisation and performance evaluation. You will see several practical applications of neural networks and extended Kalman filters from the FinTech area of financial data analytics. These include value-at- risk estimation, option pricing, portfolio estimation and automated, algorithmic trading.

Financial markets

This module will give you the mathematical and qualitative tools to analyse modern financial markets, helping you develop strategies for market participants. It will introduce you to a range of derivatives and market behaviour. We take a distinctly mathematical and computational approach, leading you to understand how financial markets work well

enough to analyse, evaluate and implement investment decisions involving financial instruments.

Machine learning

This module provides a broad view of machine learning and statistical pattern recognition. You will learn several techniques, including supervised learning (e.g. generative and discriminative learning, parametric and non-parametric learning), unsupervised learning (e.g. clustering), and theoretical aspects of machine learning (e.g. bias, variance). The module will also discuss recent applications of machine learning to areas of interest to data scientists.

Social media and network science

By taking this module, you will have an opportunity to master the theory and practice of graph analysis and social media data analysis. You will be shown how to gather datasets from public social networking platforms. You will learn how to gather social network data, into graph representations and then apply typical algorithms to analyse the structure of the graph. You will visualise graphs and assess data flow and influence between nodes in the graph.

Statistics and Statistical Data Mining

This module aims to cover the key statistical concepts and techniques you will need to interpret the results you might generate through data analysis. The areas covered include probability theory, likelihood, common distributions, confidence intervals, hypothesis tests, parametric and nonparametric tests.

Mathematics for Data Science

This module aims to cover the key mathematical concepts and techniques you will need to interpret the results you might generate through data analysis. The areas covered include probability theory, likelihood, common distributions, confidence intervals, hypothesis tests, parametric and nonparametric tests.

Natural language processing

This module provides you with a grounding in both rule-based and statistical approaches to Natural Language Processing, and combines theoretical study with hands-on work employing widely used software packages. The module focusses on text processing, and does not deal with speech or multi-modal communication.

Neural networks

This module introduces the theory and practice of neural computation. It offers the principles of neuro-computing with neural networks widely used for addressing real world problems such as regression, pattern recognition and time-series prediction.

R for data science

This module will provide you with a wide range of applied data analysis techniques in R. With its strong focus on practical application of the techniques, and learning by doing, you will gain confidence in your ability to select appropriate techniques for attacking a wide variety of data sources.

Final Project - Overview

In this module you will undertake a substantial independent research project that will allow you to demonstrate a wide range of skills: project planning, management, research, and written presentation. You will integrate the knowledge gained throughout the programme and use skills acquired in other modules in the implementation of your Final Project. The work will consist of a combination of research and highly applicative elements in various proportions.

For your project work, you can make use of methodologies from various components of Data Science as instruments of research.