Bachelor of Data Analytics in Data Science

Unit Description

Applied Statistics

This unit considers select topics from experimental design and survey methods, descriptive statistics, hypothesis testing and modelling for continuous and categorical variables. Throughout the unit, advanced statistical software will play an important role in data visualisation and analysis. Students will consider topics through the presentation of real research problems from a number of disciplines, gaining valuable experience in the application of statistics in a variety of contexts, including a project simulating statistical problems commonly encountered in the workplace.

Big Data and Data Science

The objectives of this unit are to introduce students to an understanding of data, uncover patterns within data, and develop models whose prediction accuracy on future unknown data can be quantified. Major topics include: concepts of statistical learning; machine learning algorithms; over-fitting and model tuning; regression models; classification models; recommendation engines and social networks; assessing model performance; and extracting meaning from data. The R programming language and software environment will be introduced to students and will be used to demonstrate implementations.

Data Visualisation and Simulation

This unit aims to give students: the background for data visualisation, data storytelling, data visualisation techniques in non-immersive and immersive environments, data visualisation for artificial intelligence, innovative data exploration and discovery of hidden patterns, interactive techniques and user interactions with data, interactive analytics, non-real-time and real-time simulation of live-steaming and offline data, and the design and development of interactive and collaborative/multi-user data visualisation tools using Python, JavaScript D3.js, Unity3D, Unreal, WebGL, and XR technologies and devices

Databases

This unit focuses on database design, implementation and management. Topics include data modelling, database administration, logical and physical database design, non-relational databases, recovery, relational model, security, standard query language (SQL) and transaction management. The theory material is complemented by practical work using common database management systems.

Introductory Calculus with Applications

This unit provides an introduction to differential and integral calculus, and basic ordinary differential equations. The concepts and techniques will be motivated and illustrated using mathematical models in engineering, the physical and biological sciences, commerce, economics and the social sciences. Other topics include complex numbers and their applications. The unit builds an awareness of the use of mathematical software to visualise functions.

Introduction to ICT Research Methods

This unit provides an introduction to research in the information and communications technology (ICT) discipline. It explores the kinds of research questions addressed in ICT research and provides an opportunity for students to understand the broad range of research approaches used in ICT research including action research, case study research, design research, experimental research and survey research.

Students will develop both research and project management skills, and gain the knowledge and skills needed to critically evaluate the ICT research literature.

Mathematical Modelling and Differential Equations

This unit considers mathematical models, their uses, and limitations. Case studies involving relatively simple mathematical ideas will demonstrate that models range from simple tools for answering 'what if' questions to quite accurate descriptions that allow useful predictions to be made. Topics include: modelling of chemical, biological and physical systems (using first order ordinary differential equations); modelling of steady state systems (using matrix algebra); dynamical models (using ordinary differential equations); and modelling of diffusive processes (using partial differential equations).

Optimisation and Graph Theory

This unit covers topics in discrete mathematics that have relevance to computer science, including theory of graphs and trees, algorithms for graph problems (eg. shortest paths and spanning trees) and coding theory (for information transfer). The unit also covers topics in management science (also called operations research) that are important in industry and government, including formulation of linear programming problems, simplex method, sensitivity analysis, transportation problems, networks and project scheduling. Computer packages are used to aid understanding of various methods.

Principles of Computer Science

This unit is designed to develop problem-solving and programme design skills by using an object-oriented programming language. Major topics include algorithm design, procedural abstractions, use of libraries as collection of black-box code modules, the concepts of pre- and post-conditions, strings, arrays, an introduction to object-oriented concepts including data abstraction, encapsulation, classes and object references, inheritance, introduction to recursion, streams and file input and output, and the definition and use of common classes — lists, stack and queues.

Probability and Statistical Inference

This unit examines relevant topics in probability and statistics theory, including distribution theory, mathematical expectation and variance, and likelihood inference. It derives common probability distributions and illustrates their uses, provides insight into the forms of expected values and variances for various distributions, and introduces likelihood inference, which provides a unified framework that underpins much of statistical inference.

Statistical Data Analysis

This unit introduces students to data collection methods and statistical analyses common in the life and health sciences. Topics include analysing relationships between variables, comparing measurements or proportions between groups, describing and comparing data distributions, nonparametric methods, probability and sampling distributions, sampling methods, statistical inference foundations (estimation and hypothesis testing), and summarising data with numbers and graphs. Throughout the unit, students will use statistical software, interpret its output and report their conclusion.

The Search for Everything: Data Analytics and Storytelling in the 21st Century

Data analytics is present in every moment of our lives. Data flows through smart phones, smart cars, smart fridges, streaming services, social media, loyalty programs, business operations, logistics, leisure, and entertainment like a current shaping everything.

At the heart of comprehensive data collection and analysis is a quest to understand ‘everything’, and this unit invites students into the multi-layered data-driven world where the real and the digital meet.

This unit teaches you how to clean, manipulate, interpret, and transform data into creative visualisations using Microsoft Excel, to tell data-driven stories for invested stakeholders. You will examine the impact of data analytics in the context of public and private life; professional, political, and societal domains; and the reach of data across local, national, and global contexts.

In hand with foundational data skills, this unit explores ethical issues relating to data surveillance, the implications of data mining on human behaviour, and the analytics machines central to the functioning of big tech platforms such as Google, Amazon, and Facebook.