DSC6027: TOPICS OF AI FOR COMPUTATIONAL SOCIAL SCIENCES

Effective Term
Semester A 2026/27

Part I Course Overview

Course Title
Topics of AI for Computational Social Sciences

Subject Code
DSC - Data Science
Course Number
6027

Academic Unit
Data Science (DS)

College/School
College of Computing (CC)

Course Duration
One Semester

Credit Units
3

Level
P5, P6 - Postgraduate Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Nil

Precursors
Nil

Equivalent Courses
SDSC6027 Topics of Artificial Intelligence for Computational Sciences

Exclusive Courses
Nil

Part II Course Details

Abstract

This course introduces causal inference and AI-enabled computational methods for studying social phenomena, institutional behaviour and policy problems. It begins with philosophical and scientific accounts of causation, then connects them to causal reasoning in experiments, economics, public policy and legal evidence. The main body of the course examines two influential traditions: Rubin's potential-outcomes framework, including randomised controlled trials, propensity scores, matching, instrumental variables, regression discontinuity, difference-in-differences and causal machine learning; and Pearl's causal-graph framework, including Bayesian networks, directed acyclic graphs, structural causal models, d-separation, do-calculus and counterfactual reasoning. The course then introduces selected AI and computational approaches, including Double Machine Learning, heterogeneous treatment effects, computational text analysis, agent-based modelling, adaptive experiments and responsible AI. Through interdisciplinary examples and Python-based tutorials, students learn to formulate causal questions, evaluate identification assumptions, implement selected methods and assess the interpretability, ethical limits and policy relevance of computational evidence.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Explain clearly fundamental frameworks and methods in causal inference	20	x		
2	Comprehend conceptually and in technical specifics various causal inference methods	20	x	x	
3	Evaluate existing practices in causal modelling of social data and seek ways to improve the existing practices	30	x	x	x
4	Apply appropriate identification and estimation methods to solve given practical causal modeling problems	30	x	x	x

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Learning and Teaching Activities (LTAs)

	LTAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lecture	Students will engage in formal lectures to gain knowledge about various computational methods for causal inference.	1, 2, 3, 4	2
2	Tutorial	Students will participate in hands-on tutorials to apply learned computational methods and code to real-world cases.	2, 3, 4	1

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("-" for nil entry)	Allow Use of GenAI?
1	Hands-in assignments	2, 3, 4	15	These are skills-based assessment to enable students to demonstrate the basic concepts and methods in causal inference, and applications of the methods in some applications.	Yes
2	Test	1, 2, 3, 4	15	Questions are designed for basic techniques of causal inference to see how well the students have learned fundamental concepts and methods, and applications of causal modeling	No
3	Project	1, 2, 3, 4	35	-	Yes

Continuous Assessment (%)

65

Examination (%)

35

Examination Duration (Hours)

2

Minimum Examination Passing Requirement (%)

30

Assessment Rubrics (AR)

Assessment Task

Hands-in assignments (for students admitted in Semester A 2026/27 & thereafter)

Criterion

Ability to learn the basic concepts, apply methods and algorithms for causal modelling.

Excellent

(A+, A, A-) High

Good

(B+, B, B-) Significant

Fair

(C+, C, C-) Moderate

Marginal
(D) Basic

Failure
(F) Not even reaching marginal levels

Assessment Task
Test (for students admitted in Semester A 2026/27 & thereafter)

Criterion
Ability to understand and apply fundamental concepts and technical specifics of causal inference.

Excellent
(A+, A, A-) High

Good
(B+, B, B-) Significant

Fair
(C+, C, C-) Moderate

Marginal
(D) Basic

Failure
(F) Not even reaching marginal levels

Assessment Task
Project (for students admitted in Semester A 2026/27 & thereafter)

Criterion
Ability to apply appropriate causal inference methods in practical applications.

Excellent
(A+, A, A-) High

Good
(B+, B, B-) Significant

Fair
(C+, C, C-) Moderate

Marginal
(D) Basic

Failure
(F) Not even reaching marginal levels

Assessment Task

Examination (for students admitted in Semester A 2026/27 & thereafter)

Criterion
Ability to solve learning tasks using causal inference methods.

Excellent
(A+, A, A-) High

Good
(B+, B, B-) Significant

Fair
(C+, C, C-) Moderate

Marginal
(D) Basic

Failure
(F) Not even reaching marginal levels

Part III Other Information

Keyword Syllabus
Causal inference; potential outcomes; randomised controlled trials; propensity scores; matching; instrumental variables; regression discontinuity; difference-in-differences; directed acyclic graphs; structural causal models; do-calculus; Double Machine Learning; heterogeneous treatment effects; computational text analysis; agent-based modelling; adaptive experiments; policy simulation; responsible AI.

Reading List

Compulsory Readings

	Title
1	Taha Yasseri, ed. (2025), Handbook of Computational Social Science. Edward Elgar Publishing.
2	Pearl, J. (2000). Causality#: Models, Reasoning, and Inference. Cambridge University Press.
3	Guido W. Imbens & Donald B. Rubin (2015). Causal Inference for Statistics, Social, and Biomedical Sciences. Cambridge University Press.

Additional Readings

	Title
1	Victor Chernozhukov, Christian Hansen, Nathan Kallus, Martin Spindler and Vasilis Syrgkanis (2026), Applied Causal Inference Powered by ML and AI. Online book.
2	Stefan Wager (2025), Causal Inference: A Statistical Learning Approach. Draft textbook, Stanford University.
3	Giovanni Dosi and Andrea Roventini (2025), Agent-Based Macroeconomics: The Schumpeter Meeting Keynes Models. Cambridge Elements in Evolutionary Economics, Cambridge University Press.