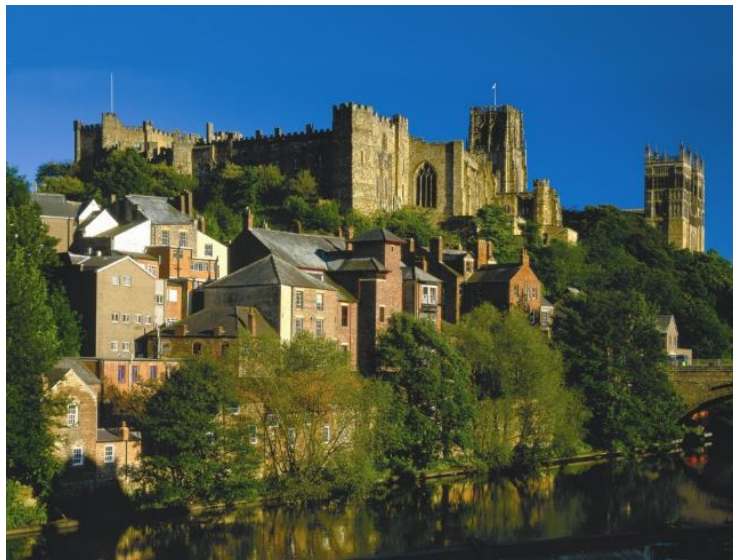


apts.ac.uk

Academy for PhD Training in Statistics



Week 4: Durham University
7 – 11 September 2026



Welcome to Durham!

CONFERENCE VENUE

The conference will take place in CG93 on the University Science site. This room is located on the ground floor of the Chemistry building, entering through the main Chemistry entrance in the Atrium-type building close to the barrier controls. It is a 10-15 minute walk from the college accommodation. Please see the Durham campus map below.

APTS REGISTRATION

Registration will take place in the Chemistry Café on Monday 9th September from 11:00am. You will receive your badge from the registration desk. Please wear your badge at all times. This will help with security and also help participants to identify one another. There are no facilities to store luggage on the Science Site.

Please note that most of Durham is on a slope. Let us know at registration if you have mobility difficulties, and we will try to accommodate these. There is no parking available on the University Science site.

IT

You are strongly encouraged, if possible, to bring a laptop with R installed for taking part in the practical sessions.

WI-FI

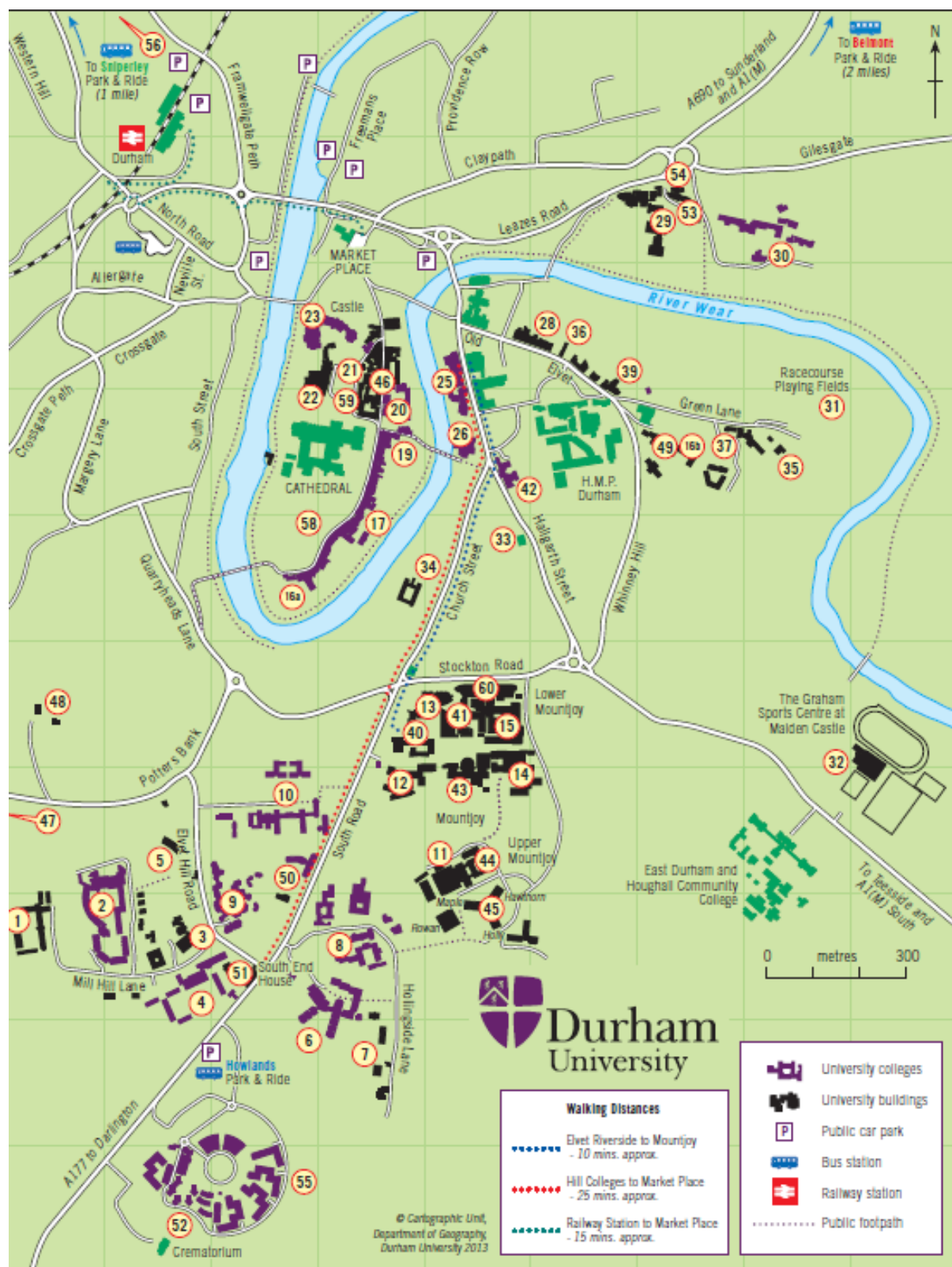
We strongly advise that you set up Eduroam beforehand via <https://cat.eduroam.org/>. Alternatively, the internet can be accessed via the cloud wi-fi; details on how to do this are available at www.durham.ac.uk/about-us/professional-services/computing-information-services/support/wireless-service/.

LECTURE THEATRES AND LABS

All lectures will take place in lecture room CG93 (Chemistry building; see item 15 on the map below). The following 'breakout' rooms are suitable for lab work and are also available at any time during the week, including breaks and free time: PCL050, PLC051, PCL053, PCL054, PCL056, PCL057, PCL058, PCL059. The breakout rooms are located in the Palatine Centre; this is a one-minute-walk from CG93 which will be signposted.

MEALS

All meals, with the exception of lunch and the Academy dinner will take place in the main Dining Hall of Collingwood College (item 6 on the campus map). Breakfast will be served from 8:00-9:00 and dinner from 18:00-19:00. Lunch will be from 12:30-13:30 in the Scarborough Café and Chemistry Atrium. There will be a wine reception on Monday from 19:00 in the Collingwood college penthouse. The Academy Dinner will be held at St Aidan's College (item 2 on the campus map) at 19:00 on Thursday. Dress code for the Academy Dinner: Smart/casual.



Accommodation

YOUR ROOM

All residential delegates have been booked en-suite accommodation at Collingwood College (item 6 on the Campus map) for 4 nights from Monday 7 September until Friday 11 September. Rooms are guaranteed to be ready by 2pm and keys can be collected from Collingwood College respectively. The reception will be open from 8am-4pm. Outside these times, a porter will be available to show you to your room. Please use the internal telephone near to Reception to call the porter if he is away from his post. **For all delegates, breakfast will be served in the Dining Hall of Collingwood College from 8:00-9:00.** You will have the option of a full English breakfast. Check out is on Friday by 10am.

Smoking is prohibited in all enclosed public places in the UK. A designated outdoor smoking area is provided at both colleges.

FACILITIES

All bedrooms have the following facilities:

- Tea and coffee making facilities refreshed daily
- Free internet connection Wi-Fi available in the bedrooms
- Bathrooms with shaver socket outlets
- Toiletry pack containing shower gel/shampoo, soap, body lotion and a vanity kit, one per person per stay
- One hand towel and one bath towel per person
- Hairdryers, irons and ironing boards available from Reception

PARKING

Car parking is limited at the college and strictly on a first come first serve basis. No spaces can be reserved. Car details will need to be registered on arrival at the College Reception.

LUGGAGE STORAGE

Collingwood College has limited luggage storage and will operate on a first come first serve basis.

DIRECTIONS (Public Transport)

Durham Railway station is 2 miles away. From the city bus station - a short walk from the railway station – take the Arriva No 6 Bishop Auckland service which runs every 15 minutes past the Colleges on South Road.

DIRECTIONS (Car)

Take the A690 from the A1(M), turn left across Elvet Bridge at the traffic lights. Follow the road up to the New Inn crossroads and go straight over. Continue along South Road past the turning for Grey College. Collingwood College is the next major left turn, directly opposite the main entrance of the University's Hill Colleges complex.

Further details regarding travel information can be found below.

Emergency details

FIRE PROCEDURES

If the fire alarm sounds for more than five seconds and there has been no warning of a prolonged test, you must leave the building by the nearest emergency exit. All exits are well signposted. Do not stop to collect personal belongings. Make your way to the nearest evacuation point, standing well clear of the building. Do not re-enter the building until told to do so by the Fire Services or the University security staff.

EMERGENCY AND MEDICAL ASSISTANCE NUMBERS

Collingwood College – Reception 0191 334 5000 (8am – 4pm)

After these hours: Porters – 0191 334 5000

Palatine – Reception 0191 334 6111

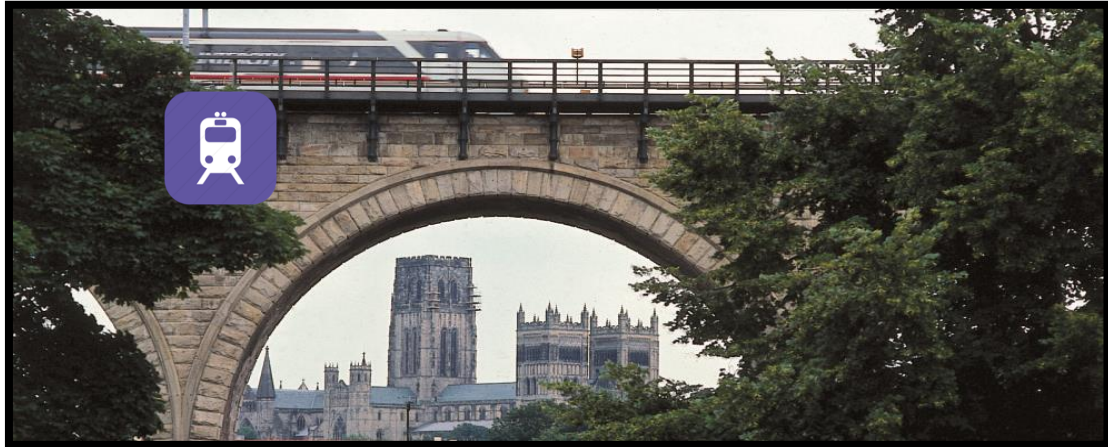
First Aiders – Please call the reception number above and they will transfer to a First Aider

Chemistry – Security – 0191 334 2222

MEDICAL ASSISTANCE

Please contact a local member of staff who will alert the appropriate services. Please note if you need to dial 999 from a mobile, please also call security on 0191 3342222 to inform them your location as the campus is complex and escorts by the security team are required for emergency service vehicles arriving onto campus to prevent any delays reaching you.

Travel Information



DURHAM STATION

Over 60 trains call at Durham daily from most major centres in the country, including 14 trains from London. The high speed LNER service takes under 3 hours from London Kings Cross on the main East Coast line. First Transpennine Express offers frequent links from North West England, Yorkshire and Scotland. Cross Country trains link Durham with Yorkshire, Manchester, Nottingham, Bristol, Cardiff, Southampton and Edinburgh.

For train times and fare information visit www.nationalrail.co.uk or call National Rail Enquiries on +44(0)3457 48 49 50.

A taxi from Durham Station to the majority of the University venues in Durham would cost in the region of £5.00 to £8.00. There is a taxi rank at the station. You will also find a list of Durham taxis in our taxi section.



NEWCASTLE AIRPORT (NCL)

Newcastle Airport is approximately 20 miles north of Durham. There are connecting flights from many European hubs including London Heathrow and London Gatwick, Amsterdam, Paris and Brussels. The airport is served by a number of budget airlines. See www.newcastleairport.com for full details.

The Metro (underground) is available from the airport to Newcastle Central Station, which takes around 20 minutes, and Metro trains run every 7 minutes. From Newcastle Central Station you can catch a train (overground) to Durham which takes around 15 minutes. If you are arriving in the evening, we recommend taking a taxi from the airport to avoid the risk of missing the last trains south. The cost would be approximately £45.00 to £70.00 depending on the taxi company (see taxi section).

DURHAM TEES VALLEY AIRPORT (DTV)

Durham Tees Valley is approximately 25 miles south of Durham. Although it has fewer flights than Newcastle, there are connecting flights with Amsterdam and other cities, and it is served by budget airlines. See www.durhamteesvalleyairport.com for full details. We would recommend a taxi from this airport to Durham.



DRIVING

Durham is only 2 miles from the A1(M) motorway. Leave the motorway at Junction 62 on the A690 heading towards Durham and follow the signs to the city centre.

The city is served by three Park & Ride sites on the main routes into Durham: Belmont, Sniperley, and Howlands. These sites are open 7am to 7pm daily. A direct bus service runs from each site to the city centre.

Parking at all sites is free for Park & Ride users, and the cost of unlimited daily travel into the city centre and back is £2.00 per person. Park & Ride users can also travel to Durham Cathedral at no additional cost.

Further information can be found at www.durham.gov.uk/parkandride.

UNIVERSITY VENUES

Durham is a relatively small city, and most of our venues are situated not far from the city centre. More detailed information on the venues being used for your event is given on separate pages in this document.



There are many taxi companies in Durham. Please note that taxis are busy in the morning and afternoon when schools are opening/closing. If travelling at these times, we would recommend pre-booking in advance.

USEFUL TAXI NUMBERS

Airport Express: +44 (0)191 371 2352 (9am–8pm)

Airport Cars Durham: +44 (0)191 386 5796

Mac's Taxis: +44 (0)191 384 1329 or +44 (0)191 372 3786

Polly's Taxis: +44 (0)7910 179397

Pratt's Taxis: +44 (0)191 386 4040 or +44 (0)191 386 0700

Sherburn Taxis: +44 (0)191 372 3388

Local Attractions



Few venues in the world can rival the splendour, prestige and heritage of the City of Durham. Located on a dramatic peninsula overlooking the River Wear, Durham's unique Norman Cathedral and Castle not only dominate the skyline, but are also part of a designated World Heritage Site.

Durham is a small and compact city and everything is within easy walking distance. Just minutes from the bustling city centre, you can enjoy the tranquillity of leafy riverside footpaths along the banks of the River Wear, or the changing seasonal displays at Durham University Botanic Garden. Palace Green Library, the Oriental Museum and the World Heritage Site Visitor Centre hold fascinating collections of international significance, as well as offering key insights into local history.

Museums, libraries and places of interest

Durham Cathedral is only a short (10 minute) walk from Grey college and is a must see! Further details can be found at:

www.durhamcathedral.co.uk/

Why not combine a trip to the cathedral with a visit to Palace Green Library:

www.durham.ac.uk/things-to-do/venues/historic-libraries-at-palace-green/

The Botanic Gardens are very close to Grey College (and directly opposite the Mathematical Sciences building). Entry is £4.50. Further details can be found at:

www.durham.ac.uk/things-to-do/venues/botanic-garden/

The Oriental Museum is close by (turn left on to South Road and then right on to Elvet Hill Road) and has free entry:

www.durham.ac.uk/things-to-do/venues/oriental-museum/

Sports facilities

The Graham Sports Centre, Maiden Castle, is a 15 minute walk from Grey College. Facilities include a fitness centre (£5 per session www.durham.ac.uk/colleges-and-student-experience/team-durham/community/fitness-centre-and-classes/) and a

range of indoor and outdoor facilities (www.durham.ac.uk/colleges-and-student-experience/team-durham/services/facilities/).

Other attractions in Durham

For more information of what to see and do, and to make your visit unforgettable, please visit:

www.thisisdurham.com

www.dur.ac.uk/attractions

Further afield

If you wish to travel a little further afield, within a short distance of Durham visitors can experience dynamic cities, an unforgettable stretch of coastline, and a wealth of historical and natural wonders.

The world famous Beamish open air museum is approximately 9 miles from Durham and allows visitors to experience the history of the North East England. Visitors travelling by Go North East bus can save 25% on their ticket. For further details, see www.gonortheast.co.uk/beamish/ and www.beamish.org.uk/.

The sights and sounds of Newcastle are only 15 minutes north of Durham by train.

For more ideas please visit:

www.newcastlegateshead.com/explore

APTS Schedule

	Monday	Tuesday	Wednesday	Thursday	Friday
8:00-9:00		Breakfast	Breakfast	Breakfast	Breakfast
9:00-10:30		Causal Inference (Lecture)	Statistical Machine Learning (Lecture)	Causal Inference (Lecture)	Statistical Machine Learning (Lecture)
10:30-11:00		Coffee (Scarborough café / atrium)			
11:00-12:30	Registration (Chemistry atrium)	Causal Inference (Lab)	Causal Inference (Lecture)	Causal Inference (Lab)	Statistical Machine Learning (Lab)
12:30-13:30	Lunch (Scarborough café / atrium)				
13:30-15:00	Causal Inference (Lecture)	Statistical Machine Learning (Lecture)	Free afternoon	Statistical Machine Learning (Lab)	
15:00-15:30	Coffee (Scarborough café / atrium)			Coffee (Scarborough café / atrium)	
15:30-17:00	Causal Inference (Lecture)	Statistical Machine Learning (Lecture)		Statistical Machine Learning (Lecture)	
18:00-19:00	Dinner (Collingwood College - Dining Hall)			Pre-dinner drinks (St Aidan's College - College Bar)	
19:00-	APTS welcome reception (Collingwood College - Penthouse)	Free evening	Free evening	Academy dinner (St Aidan's College - Dining Hall)	

LOCAL ORGANISERS

Georgios Karagiannis (Email: georgios.karagiannis@durham.ac.uk)

Cuong V. Nguyen (Email: viet.c.nguyen@durham.ac.uk)

Statistical Machine Learning

Module leader: Louis Aslett

Aim:

This module introduces students to modern supervised machine learning methodology and practice, with an emphasis on statistical and probabilistic approaches in the field. The course seeks to balance theory, methods and application, providing an introduction with firm foundations that is accessible to those working on applications and seeking to employ best practice. There will be exploration of some key software tools which have facilitated the growth in the use of these methods across a broad spectrum of applications and an emphasis on how to carefully assess machine learning models.

Learning outcomes:

Students following this module will gain a broad view of the supervised statistical machine learning landscape, including some of the main theoretical and methodological foundations. They will be able to appraise different machine learning methods and reason about their use. In particular, students completing the course will gain an understanding of how to practically apply these techniques, with an ability to critically evaluate the performance of their models. Students will also have an insight into the extensive software libraries available today and their use to construct a full machine learning pipeline.

Prerequisites:

To undertake this module, students should have:

- at least one undergraduate level course in probability and in statistics
- standard undergraduate level knowledge of linear algebra and calculus;
- solid grasp of statistical computing in R;
- knowledge of statistical modelling, including regression modelling (eg. APTS Statistical Modelling course);
- some basic understanding of optimisation methods is beneficial, but not essential.

As preparatory reading, the enthusiastic student may choose to browse An Introduction to Statistical Learning (James et al., 2013) (freely and legally available online), which covers some of the topics of the course at a more elementary and descriptive level.

Textbooks at roughly the level of the course include:

- The Elements of Statistical Learning (Friedman, Tibshirani, and Hastie)
- Pattern Recognition and Machine Learning (Bishop)
- Machine Learning: A Probabilistic Perspective (Murphy)
- Deep Learning (Goodfellow, Bengio and Courville)

Topics:

- Formulation of supervised learning for regression and classification (scoring/probabilistic, decision boundaries, generative/discriminative), loss functions and basic decision theory.
- Theory of model capacity, complexity and bias-variance decomposition.
- Curse of dimensionality.
- Overview of some key modelling methodologies (e.g., logistic regression, local methods, kernel smoothing, trees, boosting, bagging, forests).
- Model selection, ensembles, tuning and super-learning.
- Evaluation of model performance, validation and calibration and their reporting in applications.
- Reproducibility.
- Coverage of some key software frameworks for applying machine learning in the real world.

Assessment:

An exercise set by the module leader involving practical use of some of the machine learning methods covered and critical evaluation of their performance.

Causal Inference

Module leader: Vanessa Didelez and Karla Diaz-Ordaz

Aim:

Causal inference deals with investigating the effect(s) of (typically hypothetical) interventions from (typically ‘imperfect’) data; often the data is observational, i.e., not obtained from a ‘perfect’ randomised experiment. The aim of the course is to introduce the fundamental principles, concepts and basic methods of causal inference, including an outlook on current challenges and recent developments.

Learning outcomes:

The participants will be able to distinguish research questions that are causal, as opposed to descriptive or predictive, in nature. They will be able to formalise research questions as causal estimands, state and evaluate the required assumptions in a variety of common settings. They will further be able to use causal diagrams to identify potential sources of bias and how to mitigate these. Finally, they will be able to carry out a basic causal analysis with standard software.

Prerequisites:

Familiarity with regression models, multivariate distributions and their properties. It will be helpful to revisit, prior to the course, the general notions of conditional distributions and conditional (in)dependence. Some knowledge of methods of estimation beyond maximum likelihood, such as estimating equations will be useful.

Preliminary reading:

- Didelez. Causal Reasoning and Inference in Epidemiology. In: Handbook of Epidemiology, 3rd edition, eds. Wolfgang Ahrens and Iris Pigeot, Springer, 2024.
- Richardson and Robins. Single World Intervention Graphs: a primer. In Second UAI workshop on causal structure learning, Bellevue, Washington. 2013.
- Daniel, Cousens, De Stavola, Kenward and Sterne. Methods for dealing with time dependent confounding. Statistics in Medicine, 32(9), pp.1584-1618, 2013.

Further reading:

- Didelez. Causal concepts and graphical models. In: Handbook of Graphical Models (eds. Maathuis, Drton, Lauritzen, Wainwright), Chapman Hall/CRC, 2018.
- Hernán and Robins. Causal Inference: What If, Chapman Hall/CRC, 2020 - online.
- Lauritzen. Causal inference from graphical models. In: Complex Stochastic Systems (eds. Barndorff-Nielsen, Cox, Klüppelberg), Chapman Hall/CRC, 2001.

- Peters, Janzing and Schölkopf. Elements of Causal Inference, Cambridge, 2017.
- Pearl. Causality: Models, Reasoning, and Inference, (3rd ed.) Cambridge, 2013.

Topics:

- Basic concepts: causation vs association, randomisation, do-interventions, potential outcomes, causal estimands, identifiability (key assumptions), confounding and selection bias, target trial emulation.
- Causal diagrams: conditional independence, directed acyclic graphs (DAGs), d-separation, causal Markov condition, backdoor criterion, confounding and selection bias revisited, SWIGs.
- Estimating the causal effect of a point treatment: g-methods (propensity scores, inverse probability weighting, g-formula, g-estimation), optimal adjustment, checking assumptions (positivity, negative controls), double-robustness and double-machine learning, survival outcomes.
- Multiple or sequential treatments: causal interpretation (and misconceptions) of multiple regression, time-dependent confounding, marginal structural models.
- Outlook on further topics: causal discovery. If there is time, we will discuss mediation, direct and indirect effects, and instrumental variables.

Assessment:

A worksheet with questions based on the core topics above.
