

# LEVERHULME INTERDISCIPLINARY NETWORK ON CYBERSECURITY AND SOCIETY (LINCS)

## DOCTORAL SCHOLARSHIPS 2019

LEVERHULME INTERDISCIPLINARY  
NETWORK ON CYBERSECURITY  
AND SOCIETY (LINCS)



THE SENATOR  
GEORGE J. MITCHELL  
INSTITUTE FOR GLOBAL PEACE,  
SECURITY AND JUSTICE

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# LEVERHULME INTERDISCIPLINARY NETWORK ON CYBERSECURITY AND SOCIETY (LINCS)



## Guidance for Applicants, September 2019 entry

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## ABOUT THE PROGRAMME

The Leverhulme Interdisciplinary Network on Cybersecurity and Society (LINCS) at Queen's University Belfast was established in 2015, to support pioneering research at the interface between the social sciences and electronic engineering & computer science.

LINCS brings together the [Senator George J. Mitchell Institute for Global Peace, Security and Justice](#) (Mitchell Institute) and the [Centre for Secure Information Technologies](#) (CSIT) to develop a distinctive cohort of doctoral students working across the boundaries of their disciplines who will open up new avenues of enquiry centred initially on the priority themes and specific PhD projects.

LINCS opens up new avenues of enquiry on Cybersecurity through 4 priority research areas:

1. **Cybersecurity: Technology and Ethics**
2. **Cyberspace, Privacy and Data Protection**
3. **Debordering and Rebordering in Cyberspace: Technological, Legal and Political Aspects**
4. **Borders, Security Technologies, Data Gathering and Data Sharing**

Projects are welcome from within these themes or other related areas of interest to the applicant. Please contact a relevant academic member of the team to discuss your idea. Professor Cathal McCall ([c.mccall@qub.ac.uk](mailto:c.mccall@qub.ac.uk)) is the coordinator of the programme and can assist in directing inquiries.

The LINCS project runs from 2015 to 2021, funding a total of 30 Doctoral Scholarships.

## LEVERHULME DOCTORAL SCHOLARSHIPS

There are 5 Leverhulme LINCS Doctoral Scholarships available in 2019, to outstanding eligible candidates, for full-time study over 3 years. Full details on the research projects are provided in the next section - Available Scholarships.

The Scholarship covers

- Full tuition fees at Standard UK Rates (£4,260 per annum) for three years (based on 2018/19 rate – 2019/20 rate to be confirmed)
- A maintenance award at the Research Councils UK Rates
- Research Training and Expenses £1,000 per annum for three years.

## ELIGIBILITY CRITERIA

- Applicants must hold a minimum 2nd Class Upper Degree (2:1) or equivalent qualification in a relevant Technology, Social Science or Humanities Based subject.
- Applicants must be a UK or EU citizen.
- Applications from non-UK or non-EU citizens may be accepted on an exceptional basis but additional funding to cover International student fees is not available and must be secured by the applicant prior to starting.
- Applicants must be proficient in both writing and speaking in English.
- Successful applicants must be prepared to live and work in Northern Ireland for the duration of their studies.

- Interested candidates must consult the main topic contact at the earliest possible opportunity to discuss their research plans and application, or [Professor Cathal McCall](#) in relation to an Open Proposal.

## AVAILABLE SCHOLARSHIPS

### 1. THEME - Cybersecurity: Technology and Ethics

#### PROJECT: Robot Judges?

Lead Supervisor: [Prof John Morison](#)

Supervisory Team: [Prof John Morison](#), [Dr Niall McLaughlin](#)

Primary Location: Mitchell Institute

The legal system has long been a favourite subject for AI researchers, based largely upon an imperfect understanding of law as a logical process where fixed rules can be applied to known facts. In reality law is of course a complex, socially determined interaction where legal rules are largely indeterminate and facts are constructed in an essentially social process. The practice of law, and the role of judges, is fundamentally socially produced and acted on by dynamic processes within the wider legal system which are complex, and contingent on a social context in ways that it is difficult to imagine ICT capturing in full or accurately. Nevertheless recent algorithmic approaches have rediscovered the legal system as a subject where there is interest from both government seeking economies and the wider legal market where “technology solutions” have a \$16 billion market in the USA alone.

This can be witnessed in recent attempts to algorithmically predict case outcomes, of which there are two prime examples. First is the attempt (by Aletras et al.) to predict decisions of the European Court of Human Rights (ECtHR), and secondly, there is work by Katz et al. to predict decisions of the United States Supreme Court. The former’s model predicted 584 decisions with an average of 79% accuracy (as high as 84% for violations of Article 6 of the European Convention on Human Rights), and the latter predicted 28,000 case outcomes with 70.2% accuracy, and 240,000 judicial votes with 71.9% accuracy. Both studies used the available databases of judgments for each court to construct their model, applying natural language processing and machine learning algorithms to text-based material. The sheer scale of cases involved demonstrates the significant computing power of big data that was previously unavailable with other forms of analysis.

Such approaches, and others developing semi-autonomous decision-making systems, have introduced particular difficulties about trust, neutrality and bias in view of the opacity of the machine process and the closed nature of the training data that can be employed. This project is intended to unpack some of the issues about the differences between human and machine decision-making and, in particular, consider if there are technological obstacles to reproducing the judicial function.

We specifically ask:

- Can automated justice become a *system* rather than simply a *tool* within a wider process?
- How can bias be “programmed out” of automated or semi-automated justice

systems?

**Primary Academic Discipline:** Law

**PROJECT: Building Interpretable and De-biased AI for use in the legal system**

**Lead Supervisor:** [Dr Niall McLaughlin](#)

**Supervisory Team:** [Dr Niall McLaughlin](#), [Prof John Morison](#), [Dr Jesús Martínez-del-Rincón](#)

**Primary Location:** CSIT

AI and machine learning are increasingly used to aid human decision making, or in some cases to almost entirely replace human decision makers in the legal context. If AI systems are to be tasked with making important decisions, we need to understand those decision-making processes better and develop better tools to enable us to reproduce where possible the behaviour of such systems and understand the circumstances under which they can be trusted.

The most common way to create an AI system today is through a process called supervised learning, where a large corpus of data is used by an algorithm to learn associations between input-output pairs. There are several problems with this approach to AI:

Firstly, the decision-making process is often opaque to the end-user. From the end-user's perspective the system simply produces a decision, but it is not capable of explaining the reasoning process used to reach that decision. Such ideas are inimical to any judicial process and ways of making the decision-making more visible need to be explored.

Secondly, due to inadequacies in the training dataset, combined with the ability of AI algorithms to find correlations, the decisions made by an AI system may take into account factors that should not be used in the legal decision-making process. This may be reflected in biased decisions made by the system or it at the very least it will be a closed system where new problems can only be addressed on the basis of previous solutions. This can lead to a feedback loop where the AI system reproduces and reinforces biases societal, historical and judicial biases.

In order to use AI in the context of legal decision making both these challenges should be addressed.

This PhD will have two key stages:

- Develop novel methods for explaining the decisions made by a modern AI system based on Deep-Learning neural networks. We will examine the links between interpretable AI and adversarial examples in order to generate human-understandable explanations of the AI's behaviour.
- Examine ways to produce more dynamic legal datasets. This will lead to the development of a novel method for representing data, such that AI systems can use the data for decision making in ways that replicate socially grounded systems with any biases removed, so that a more impartial decision making can be reproduced.

**Primary Academic Discipline:** Computer Science/Machine Learning

**PROJECT: Privacy-preserving functional cryptography**

**Lead Supervisor:** [Dr Ciara Rafferty](#)

**Supervisory Team:** [Dr Ciara Rafferty](#), [Dr Fabian Schuppert](#)

**Primary Location:** CSIT

This PhD will investigate the technological development of functional cryptography from a privacy perspective, taking into account legal and ethical concerns. Functional cryptography is a term describing advanced cryptographic primitives that offer extended functionalities in comparison to traditional encryption schemes and other cryptosystems. Cryptographers are developing a series of techniques that offer fine-grained access control and/or secure computation or communication within groups. These advanced methods are still being improved upon, and further research is necessary. Moreover, any such technologies often claim to be *privacy-preserving* solutions. Can we harness technology to provide privacy by default, to aid user privacy, and enable secure communications?

Despite recent advances, the impact on user privacy, secure communications and computations is yet to be fully explored. Furthermore, what ethical, legal and commercial considerations need to be made to ensure and increase online security and privacy, whilst enabling communication and computation services?

This PhD has the following core objectives:

- Investigate the state of the art in advanced cryptographic primitives and privacy-preserving technologies, particularly functional cryptography
- Analysis of privacy provisions made by promising functional and other advanced cryptographic techniques
- Consideration of practical, legal and ethical considerations, and evaluation against current privacy-preserving approaches
- Analysis of the most suitable technological solutions, and proposal for improvements to user privacy and performance.

**Primary Academic Discipline:** Data Security

**PROJECT: Protecting the states against all enemies, foreign and domestic: the ethics of policing social media sites in monitoring domestic extremists**

**Lead Supervisor:** [Dr Fabian Schuppert](#)

**Supervisory Team:** [Dr Fabian Schuppert](#), [Dr Niall McLaughlin](#)

**Primary Location:** Mitchell Institute

Police forces spend considerable time and resources nowadays on monitoring social media traffic, in particular for keeping a close eye on the activities of so-called extremist groups, whether that is left-wing radicals, environmental activists, neo-Nazi groups or terror suspects.

Even several years after the Snowden revelations and the uncovering of social media mass surveillance, this is still a huge issue. Take for instance the policy that people applying for a US visa can nowadays be asked about their social media account names and recent reports that the UK and US government invest substantial funds in trying to predict activist behaviour

by infiltrating and surveying social media groups. However, the kind of 'threats' that police and governments try to keep in check through social media surveillance can vary significantly: the Tanzanian president ordered the establishment of an anti-gay social media police task force, with the explicit aim of identifying homosexuals on social media in order to arrest them.

No matter what the ultimate rationale, the effectiveness of social media surveillance is another bone of contention. Law enforcement circles, policy-makers, lawyers and social scientists widely disagree whether targeted cyber surveillance generates enough key insights in terms of security in order to justify the mass infringement of privacy. This ethical debate over the trade-offs of social media surveillance is one key concern of the proposed PhD project.

Another relevant normative concern is whether surveillance of standard social media merely leads to extremist groups moving their communication elsewhere, possibly going digitally dark, making the general (less invasive) monitoring and prevention of extremist outbursts much more difficult.

This PhD will have 4 key stages:

- At the outset, the research will chart the development and management of social media surveillance in the UK;
- It will then examine the key ethical issues in terms of the assumed trade-off between security and freedom;
- The PhD will also look at empirical data concerning surveillance efficiency and effectiveness in order to support its normative arguments with empirical insights;
- Finally, it will critically question the very assumption that security forces and law enforcement should be able to determine without judicial oversight what kind of activities threaten national security, as currently is the case under the UK Investigatory Powers Act.

**Primary Academic Discipline:** Philosophy / Ethics

**PROJECT: Robotics, Autonomous Learning and the Algorithm: Delineating Criminal Responsibility and Legal Liability in the New Machine Age**

**Lead Supervisor:** [Prof John Morison](#)

**Supervisory Team:** [Dr Paul Miller](#), [Dr Muiris MacCarthaigh](#),

[Dr Mike Bourne](#), [Dr Kieran McLaughlin](#)

**Primary Location:** CSIT/Mitchell Institute

Rapid developments in robotics and machine learning, which will be only accelerated by the development of big data from the internet of things, have already transformed human society. This revolution in how we live everyday will increase in reach and scope as sophisticated algorithms develop autonomously, and are deployed through robotic technology with hugely improving cognitive abilities. This raises interesting (and familiar) philosophical issues as to whether these autonomous learning machines have consciousness or other attributes of personhood. An important and practical way of



unpacking such questions, and exploring others, involves focusing on the criminal responsibility and legal liability for such technologies.

As technologies of this kind advance from driverless cars to smart medical devices, from digital personal assistants to advanced autonomous advice systems, and from delivery drones to self-governing policing and weapons systems, the legal implications become increasingly complex. The applications that make up a “smart” home or office may fail. As things stand now the supplier is probably liable for any damage caused. But we are on the threshold of a more complex world where existing understandings provided by product liability law, legal notions of consent and criminal responsibility may be tested to destruction. What is the position in routine, real-world use if a driverless car or a drone is programmed (or has programmed itself) to cause minimum damage between two humans when faced with an inescapable collision? Where should tortious liability (in the sense of compensation) lie or criminal responsibility be attributed?

As applications become more complex and more embedded within our social and economic systems the potential for negative interactions multiply. What if a malfunction in the sense of a “fault” or inappropriate application (as we might understand it from within our complex social and economic context) develops as a result of a device’s autonomous learning? Software used in financial markets to buy and sell in response to complex, self-generated algorithms can make decisions with major implications but these may be blind to non-technical factors such as their impact in relation to gender, class or ethnicity. Or they may contain or produce misstatements which, if they were from a human source, might be regarded as negligent, reckless or deliberate. Similar concerns and others manifest themselves immediately in relation to policing and defence applications. What is the initial programmer’s responsibility? When, within the development of a self-learning machine, should the designer “pull the plug” in relation to the potential harms that it may cause? What is to be done about applications that are already in market?

**Primary Academic Discipline:** This would suit EITHER

1. a law (or possibly social science) graduate who wishes to apply existing legal background to new technical area OR EQUALLY
2. A computer science graduate student with background in machine learning who wishes to explore the legal and other implications of the technology

**PROJECT: Robotics, Autonomous Learning and the Algorithm: Delineating Criminal Responsibility and Legal Liability in the New Machine Age**

**Lead Supervisor:** [Dr Paul Miller](#)

**Supervisory Team:** [Dr Paul Miller](#), [Dr Graham Ellison](#)

**Primary Location:** CSIT

The domestic market for overt use of police Body-Worn Video (BWV) is potentially very large. Public Order deployments of police generally include both Forward Intelligence Teams and Evidence Gathering Teams, who are overtly collecting video footage of subjects using BWV (this is also known as second person video). One of the issues is how to exploit the data in order to provide enhanced situation awareness, both to officers on the ground and back at command and control centres. The research question addressed by this work is: Can data analytics for BWV networks be used to recognise and track persons of interest during a public order incident? Specifically, given a third person video from a CCTV camera,

the system will retrieve all second person video of those individuals in the third person video, acquired by police officers during the public order incident. Conversely, given a second person video containing an individual's signature, the system, will retrieve third person video containing that individual. This will build on previous work that we have performed in this area for static mounted CCTV sensor networks. Specifically, we will address the novel challenges posed by BWV such as camera jitter, moving background and reduced resolution. In this work, we will employ a 3-D multi-target tracking algorithm developed for tracking subjects in conventional CCTV systems where the camera angle is acute. We will develop a technique for matching a set of egocentric videos with an acute-view video. Following this, we will then associate each egocentric video with a viewer in the acute-view. In the second stage, we propose the use of bipartite graph matching between each egocentric video and each viewer in the acute-view. In the third and final stage, those viewers not associated with an egocentric video, will be associated by performing person re-identification between their signatures in the ego-centric video and the acute video.

The Security Innovation and Demonstration Centre (SIDC) recently hosted a workshop on Body-Worn Video and the Digital Criminal Justice System. Dr Chris Rampton who is Director SIDC, is a member of the CSIT advisory board and has expressed an interest in this work. This project will partner another LINC project supervised by Dr Graham Ellison, entitled "The Use and Potential of Body-Worn Cameras for Policing Purposes", which will focus on examining and evaluating practice to date in a range of jurisdictions and making an assessment in particular of the technical as well as the human rights challenges which the use of such technology entails.

**Primary Academic Discipline:** Computer Science

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## 2. THEME: Cyberspace, Privacy and Data Protection

**PROJECT:** Future Citizens and Future Governance in the Smart City

**Lead Supervisor:** [Professor John Morison](#)

**Supervisory Team:** [Professor John Morison](#); [Dr Sandra Scott-Hayward](#)

**Primary Location:** Mitchell Institute

This project seeks to develop a series of protections and opportunities – both technical and legal – for young people as they grow up in the increasingly information-based governance systems that are coming into being through the development of the so-called "smart city".

The contemporary city is perhaps exceptionally data rich, and a smart city is uniquely placed to harvest this resource, and put it to work within a wider governing project. Within the city, citizens are moving about, buying, communicating, browsing the web, engaging with public services and more, and, as they do so, they leave a wealth of data trails. This is particularly so with young people as the Children's Commissioner Report published in November 2018 highlights. (See <https://www.childrenscommissioner.gov.uk/2018/11/08/childrens-commissioners-report-calls-on-internet-giants-and-toy-manufacturers-to-be-transparent-about-collection-of-childrens-data/>) As the Report finds, children's data is routinely collected online through social media updates on parents' profiles, through children's smartphone and tablets and through web-browsing and search engines and at home through smart speakers,

connected toys and connected baby cameras. Data is also collected outside the home through location tracking watches, school databases, classroom apps, biometric data in schools, retail loyalty schemes, travel passes, and medical records such as the Personal Child Health Record and GP records. The Smart Cities in which many of these young people will grow up involve a further set of multiple, complex, integrated, and interacting algorithmic regulation systems, amounting to a new form of 'algorithmic governance'. Essentially, (following Yeung 2007) this involves decision-making systems that regulate a domain of activity in order to manage risk or alter behaviour through continual computational generation of knowledge from data emitted and directly collected (in real time on a continuous basis) from numerous dynamic components pertaining to the regulated environment in order to identify and, if necessary, automatically refine (or prompt refinement of) the system's operations to attain a pre-specified goal. Due to their complexity, the level of technical capability required, and the capital costs of development, many of these smart city algorithmic regulation systems are provided by private sector corporations. This blurs further the traditional boundaries between public and private and dilutes some of the legal protections that currently exist.

All of this means that future citizens when they reach the age of 18 will have unimaginably larger, deeper and more nuanced digital footprint than in the past and this will be available to a wider range of actors across both the state and private sector. Future citizens will find themselves more visible and less protected than ever before. The so-called right to be forgotten, along with a range of other protections provided by the GDPR require citizens to actively manage their digital lives in ways that are unlikely to be used. The various technologies are designed to harvest, process and monetise data, and technical opt-outs are problematic.

This project will provide a technically literate and legally informed account of how young people can manage their digital life and develop forms of citizenship that are more than simply a reflection of their patterns of consumption. While the project will develop a full, critical understanding of algorithmic governance, it will also offer the opportunity to design engineering solutions to protect young people while enhancing opportunities for meaningful civic engagement.

This PhD will include the possibility of a placement with Belfast City Councils' Smart City initiative.

This proposal builds upon a developing relationship with Belfast City Council and the Smart Belfast Framework and would seek to develop further a nascent connection with the Northern Ireland Children's Commissioner (NICCY).

**Primary Academic Discipline:** Law

**PROJECT: The Ethics of Data Use and Data Ownership in the Digital Information Society**

**Lead Supervisor:** [Dr Fabian Schuppert](#)

**Supervisory Team:** [Dr Fabian Schuppert](#), [Dr Ciara Rafferty](#)

**Primary Location:** Mitchell Institute

This PhD will critically investigate potential blind spots of the General Data Protection Regulation (GDPR) when it comes to worrying about what happens to anonymous user data 'downstream', that is after initial data collection consent has been granted.

The GDPR is, at least according to its defenders, an important bulwark against the appropriation of personal data and the unwarranted storing of personal data beyond its immediate required use. While these are important concerns, the GDPR has, according to prominent critics, a major blind spot when it comes to the long-term cumulative use of anonymised user data within the digital information society. Recent research studying anonymous credit card data found that as little as three separate data points allowed smart technology to identify individual shoppers (de Montjoye, Y., Radaelli, L. & Pentland, A.'. 2015, "Unique in the shopping mall: On the reidentifiability of credit card metadata", Science, vol. 347, no. 6221, pp. 536). It is here that the real problem of data use, data exchange and data ownership lies. The GDPR does not and cannot protect anonymous downstream data.

This PhD project will look at the ethical issues that advances in data technology creates with regard to the cumulative use of separate data points, arguing for the basic tenets of a data use regulation in light of the research findings

This PhD will have 3 key stages:

- At the outset, the research will chart the development of new data analysis technology and how separate, anonymous data points can generate significant insights for the knowledgeable technology user;
- It will then examine the ethics of anonymous data use, exchange and ownership downstream, once the original data owner has lost control over the data points in question;
- Finally, it will propose some basic principles which should inform the development of what could be called a 'Data traffic law'

**Primary Academic Discipline:** Philosophy / Ethics; needs input from Law

**PROJECT: The Regulation of risk and security in crypto-currency transactions: how is a 'good transaction' detected and separated from a 'bad one' in a context in which complex and novel legal, economic and moral logics are involved?**

**Lead Supervisor:** [Dr Teresa Degenhardt](#)

**Supervisory Team:** [Dr Teresa Degenhardt](#), [Dr Sandra Scott-Hayward](#)

**Primary Location:** Mitchell Institute

This PhD involves research on the sociological aspects of implementing cryptocurrency transaction analysis techniques for the purpose of cybercrime detection.

According to the Internet Organised Crime Threat Assessment (IOCTA) 2017 report, Bitcoin is still the currency of choice in criminal markets and as payment for cyber-related extortion attempts, such as from ransomware or a Distributed Denial-of-Service (DDoS) attack. Bitcoin is a public blockchain; everyone on the network knows about a transaction, and the history of a transaction can be traced back to the point where the bitcoins were produced.

So if bitcoin is traceable, why is it so popular for cybercrime? Although anyone can view the flow of bitcoins between addresses in the blockchain (or between bitcoin wallets), these addresses are just random numbers. In order to be able to identify an individual, it is necessary to trace the address to a real identity. A number of methods for the analysis of bitcoin user identities have already been proposed. Given the technologies available and the potential for accelerated analysis in software-defined networks, the challenge lies in maintaining privacy and anonymity for the general public while bringing the cybercriminal to account.

Sociologically, we are interested in investigating the ways in which the defender in the software-defined world may follow specific ideas of risk and threats to proceed to the identification of the user, to ascertain whether or not this is implicated in criminal activities or indeed whether the transaction at play is the result of criminal activities. Relatedly, how are the 'good' from 'bad' transactions sorted — how are the lines of legality- morality- economic- imagined within these networks, by different private, public, informal and formal actors and institutions?

We specifically ask:

- How is detection of threat and risk within the transaction system identified?
- What sort of knowledge is used as part of the process of detection and suspicion of the threat?
- What techniques are used to suspect transactions and related actors? What are the ways in which the threat is then ascertained or how is a 'red alert' materialised, by whom, and to who is the risk information passed on, if to any formal organization or elsewhere? Is there some sort of censure or stop then activated in the transaction?
- How is the reaction to the 'suspicious interaction' and the 'control activity' devised? How are they impacting on the source of the threat, and, further, on the network's ability to perform its economic transaction safely?
- How is the logic of economic profit-seeking and security articulated within this software and imagined by the scientists enrolled in its production? How are these competing or indeed combining in the process?
- How is the instance of control encroaching on the economic and political logic of these networks?
- What represents order in this world? What sort of economic mobility is considered adequate to perform the service? In what way is that mobility regulated so as to guarantee safety and/or control of the actions of the consumers/actors involved?
- What kind of investigation or control is considered morally valid and legitimate? How does that relate to our current understanding of privacy? How does it modify it?

**Primary Academic Discipline:** Criminology

**PROJECT: Breaking barriers to criminal justice communication; a secure information system approach**

**Lead Supervisor:** [Dr Sandra Scott-Hayward](#)

**Supervisory Team:** [Dr Sandra Scott-Hayward](#), [Professor Sakir Sezer](#), [Dr Michelle Butler](#)

**Primary Location:** CSIT

This PhD will combine research on the technological development of secure distributed information systems with efforts by governments to develop a more effective and efficient criminal justice system.

There has been a growing diversification of providers working with offenders in the criminal justice system. However, contracts are often awarded to providers without information sharing protocols being agreed or established. Each provider tends to have their own secure information system which is not accessible to others or designed to share information. These barriers to information-sharing have hindered efforts to reduce reoffending and improve outcomes, sometimes placing individuals lives at risk as information about risks, needs and suicidal intention are not shared with relevant professionals. Frustrations are also evident among offenders, victims and their families as they must re-tell their stories multiple times with different providers, increasing the likelihood of disenfranchisement, disengagement and their needs not being met in a timely fashion.

This project will seek to pilot the development of a distributed information system which can overcome these barriers to information-sharing, while seeking to ensure data is held and shared securely and in a manner which addresses the privacy concerns of both the individuals involved and the respective providers.

This PhD will consist of 4 key stages:

- Stage 1: Interviews will be conducted with relevant criminal justice stakeholders to identify the main obstacles to effective information-sharing, as well as the cybersecurity, privacy and system design issues involved;
- Stage 2: The findings emerging from stage 1 will be used to inform the development of a new distributed system which will facilitate the sharing of information between providers in a quick, efficient and timely manner, while nonetheless ensuring data is shared securely and respecting privacy concerns;
- Stage 3: The developed system will be piloted with two different providers. Interviews conducted to obtain their feedback regarding the usability and appropriateness of this system, as well as its ability to enhance efforts to reduce re-offending and improve criminal justice outcomes.
- Stage 4: Based on the feedback from stage 3, the system will be amended to address any issues that may emerge during stage 3.

It is proposed to draw on Dr Butler's existing links with criminal justice agencies to recruit participants to take part in the proposed interviews, as well as recruit two different providers working within the criminal justice sector to pilot the proposed software.

**Primary Academic Discipline:** Network Security

**PROJECT: Regulating the Use of Big Data: The challenge for government**

**Lead Supervisor:** [Dr Muiris MacCarthaigh](#)

**Supervisory Team:** [Professor John Morison](#)

**Primary Location:** Mitchell Institute

Big data constitutes 'information that can't be processed or analysed using traditional processes or tools' (Eaton et al. 2015: 3). It can be characterized in a number of ways, for example by 5Vs: Volume, Velocity, Variety, Veracity, and Value (Kune 2011: 1). In general, big data is information that is not structured or easily interpreted by traditional databases or data models, and the majority of it is text-heavy (Arthur 2013). Conversely, multi/semi-structured data constitutes a wide variety of data which can be derived from interactions between people and machines, such as web applications or social networks. Current estimates are that 80 percent of the world's information is unstructured data, and the volume of this is growing at 15 times the rate of structured data.

The big data 'revolution' presents a number of unique challenges for government. These range from practical issues concerning the toll placed on a government's administrative hardware and software infrastructure by an ever-expanding data footprint, to the need for data management skills within government, to the economic challenge of ensuring markets based on big data work well for citizens and businesses. We may summarise the many challenges presented by big data for government as twofold: firstly, ensuring the state is in a position to make effective and meaningful use of data (primarily a technological and administrative challenge) and, secondly, discovering how best to balance the opportunities afforded by big data against the social and ethical questions its use raises.

The purpose of this PhD study will therefore be to initially explore the range of regulatory challenges faced by governments arising from big data use across economic, social and political domains, and from this develop a regulatory taxonomy. Next, the study will involve the development of a conceptual model that addresses these multiple regulatory challenges. This model will then be tested through the use of a limited number of case studies involving big data usage by citizens and firms, and in respect of both historical and real-time data use contexts.

Combined, these case studies will provide new insights as to how big data use can be regulated and in so doing the studentship will make a major contribution to both academic public administration and data analytics research. The ideal candidate will have some technological awareness including the use of big data for decision-making. A candidate with basic legal training will also be at an advantage for the project, though this is not essential.

The thesis will be supervised draw upon the disciplines of public administration, data analytics, political science and law.

**Primary Academic Discipline:** Public Administration

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### 3. THEME: Debordering and Rebordering in Cyberspace: Technological, Legal and Political Aspects

**PROJECT: Algorithmic Ethics and ‘Pattern-of-Life’ Analysis: The Automation of Everyday Life**

**Lead Supervisor:** [Professor Debbie Lisle](#)

**Supervisory Team:** [Dr Kieran McLaughlin](#), [Dr Mike Bourne](#)

**Primary Location:** Mitchell Institute

Much has been written about how security technologies and algorithms govern by gathering information about the isolated characteristics of people’s lives (gender, age, citizenship, religion, purchase history etc.) so as to better understand the characteristics of a whole population. This project engages with more recent arguments about how algorithms and security technologies observe distinct ‘patterns-of-life’ (POL) behaviours and habits which are then used as the basis for new techniques of governance and intervention. POL analysis is a form of surveillance that constructs a pattern of statistically normal behaviours against which instances of statistical deviance can be identified, tracked, and acted upon. Central to this production of norm / deviance is a pre-emptive frame: the future is made *actionable* so that (a) populations can be encouraged to avoid pre-determined deviant behaviour; and (b) suspect individuals can be identified by their ‘pattern-of-life’ behaviour and marked as risky *before* they have committed a crime. This project contributes to critical accounts of how the norm/deviant logics underscoring POL analysis map onto more familiar social cleavages to do with race, gender, sexuality, socio-economic position, citizenship status and difference. This PhD project focuses on two areas:

**From the Battlefield to Everyday life:** Much critical work on POL analysis examines its use in drone warfare: how data points from drone footage produce generalized norms of behaviour against which deviations can be identified. However, the way ‘foreign’ individuals and populations become suspect through POL analysis is not neutral, but instead maps norm/deviance logics onto prevailing geopolitical asymmetries. In other words, patterns of ‘normal’ behaviour assume particular Western liberal subjectivities, behaviours and habits, whereas deviations from that norm are attached to bodies that are culturally, ethnically and racially ‘different’ (Franz, 2017; Pötzsch, 2015; Shaw, 2016). Drawing on those insights, this project explores how POL analysis is now being used to shape, manage and intervene in the everyday lives of subjects, citizens and non-citizens. Certainly law enforcement agencies have been early adopters of predictive systems that can help them mobilize, direct and focus their resources to pre-emptively identified ‘hotspots’ of crime, and retailers have long used POL analysis to predict consumer demand, behaviour and habits (Bell, 2013; Wall, 2016). This project analyses how POL analysis is being rolled out into the sectors of society that govern our everyday lives such as education, public health and transport, and asks how its central norm / deviant logics are making themselves felt differently in different populations (e.g. citizens, non-citizens).

**The Automation of Judgement:** The central selling point of POL analysis is its supposed ‘neutrality’: by allowing algorithms to trawl the data and produce statistically proven norms, governing authorities can avoid charges of discrimination (e.g. ‘We are not racist! The data



told us to arrest this individual!') In this sense, POL analysis has to be understood as part of a broader shift into algorithmic governance. However, what remains unclear in the expansion of POL analysis is the transformation in who is enacting political judgement and making decisions. Drawing on recent work in critical security studies, this project puts debates about pre-emption and POL analysis into productive conversation with debates over the ethics of automation and algorithmic governance (Amoore & Piotukh, 2016; Hall, 2018; Lisle & Bourne, 2018). Of particular concern here is the way automation claims to be objective, neutral and impartial while it simultaneously disaggregates populations through familiar categories of race, difference, gender, class and sexuality.

This project emerges from our ESRC grant 'Treating People as Objects' (2014-2016) and helps to develop our current thinking about automation, ethics, materialism and politics. The student selected for this project will become part of our reading group on 'Materiality, Objects, Politics and Space'

**Primary Academic Discipline:** International Relations (Critical Security Studies / Critical Border Studies)

**PROJECT: Emerging Cyber Bordering Technologies**

**Lead Supervisor:** [Professor Sakir Sezer](#)

**Supervisory Team:** [Professor Sakir Sezer](#), [Professor Cathal McCall](#)

**Primary Location:** CSIT

Securing cyberspace borders is a rapidly evolving and crucial area of interest for governments, private sector interests, and individual citizens. Defending cyberspace borders for the protection of critical infrastructure, key resources and sensitive information is a key concern for governments. Yet, as the Edward Snowden case revealed, governments are also deeply implicated in penetrating cyberspace borders for the purpose of information-gathering on friend and foe alike. Similarly, international corporations have a vital interest in securing internal networks, as well as a research and development compulsion to penetrate the cyberspace borders of competitors in the name of innovation.

Firewalls, network-based application and user detection technologies and URL black and white lists present essential technological tools for building borders in cyberspace and preventing cross-border access to web-content. For example, large scale filtering of URLs in China restricts the access of its citizens to many US and European websites. On the other hand, service providers of streamed content (e.g. live football matches, movies, shows etc.) restrict international cross-border access due to broadcast restrictions of licensed content. For example, except BBC News, all Internet-based access to UK TV programmes are restricted by a firewall, ensuring that access is permitted to users within UK jurisdictions only. However, new technologies, based on well-established Virtual Private Networks (VPNs), and new VPN service providers (CyberGhost, Spotflux, Private Internet Access, Hotspot Shield, ProXPN, etc.) have evolved, providing encrypted anonymous tunnels, capable of penetrating virtual borders and providing anonymous access and hosting of unrestricted content via a country specific proxy server. The majority of these services are used for accessing terrorist or organised-crime related, copyright protected or illegal (offensive, abusive, sexual) content, stored or hosted in states with limited data protection and copyright laws.

The aim of this project is to explore various security, firewall and access control technologies that can be effectively used for policing and enforcing of cyber border policies. Many IT security technologies are developed for the Enterprise market and impose privacy and ethical concerns when they are used for bordering public cyber space. Scalability and global deployment pose technological challenges and potential misuse of intercepted and/or logged information as part of the policing process.

Project Objectives:

- Investigate and evaluate various security technologies that are suitable for cyber bordering and cyber border enforcements.
- In collaboration with AHSS, derive feature specification for cyber bordering technology for national cyber space and national cyber border protection.
- Explore technologies for policing encrypted VPN tunnels without violating user privacy or exposing intellectual property or trade secrets.
- Develop traffic analytics algorithms for cyber border policy enforcement.
- Prototype and validate traffic analytics algorithms and assess their suitability for cyber bordering.

Assess the proposed analytics algorithms and developed bordering technology in terms of potential misuse for user privacy violation and ethical concerns.

**Primary Academic Discipline:** Computer Science (Social Science)

**PROJECT: Cyberborder Development, Defence and Penetration: Technological and Governmental Aspects**

**Lead Supervisor:** [Professor Cathal McCall](#)

**Supervisory Team:** , [Professor Cathal McCall](#), [Professor Sakir Sezer](#), [Professor Hastings Donnan](#)

**Primary Location:** Mitchell Institute

This PhD will combine research on the technological development of cyberborders with the efforts of state governments to defend and penetrate them.

Firewalls, network-based application and user detection technologies, as well as URL black and white lists present essential technological tools for building borders in cyberspace and preventing cross-border access to web-content. However, new technologies, based on well-established Virtual Private Networks (VPNs), and new VPN service providers (CyberGhost, Spotflux, Private Internet Access, Hotspot Shield, ProXPN, etc.) have evolved, providing encrypted anonymous tunnels, capable of penetrating virtual borders and providing anonymous access and hosting of unrestricted content via a country specific proxy server.

Defending cyberspace borders for the protection of critical infrastructure, key resources and sensitive information is a key concern for governments. Yet, as the Edward Snowden case revealed, state governments are also deeply implicated in acts of penetrating cyberspace borders for the purpose of information-gathering on friend and foe alike. Similarly, international corporations have a vital interest in securing internal networks, as well as a research and development compulsion to penetrate the cyberborders of competitors in the name of innovation.

This PhD will have 4 key stages:

- At the outset, the research will chart the development and management of cyberspace borders by selected states in the contexts of technology and government policy;
- It will then examine the evolution of VPNs and service providers in the context of the provision of encrypted anonymous tunnels that penetrate cyberborders;
- It will consider the political implications of a policy of cyberborder penetration by governments for the purposes of espionage.
- Finally, it will assess the prospects for integrated cyberborder management systems between 'friendly' states.

The PhD will include a 3 month research internship with GCHQ or I-BOC.

**Primary Academic Discipline:** Border Studies

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## 4. Borders, Security Technologies, Data Gathering and Data Sharing

**PROJECT: Enhancing Human Rights and Ethical Applications of the Law: Stop & Search**

**Lead Supervisor:** [Dr John Topping](#)

**Supervisory Team:** TBC

**Primary Location:** Mitchell Institute

This PhD proposal seeks to combine the latest technological advance in point-of-contact data capture between police officers and the public in the application of stop and search powers.

The use of stop and search powers across the U.K. have attracted voluminous attention over the past 40 years. Yet focus on use of the powers generally, and specifically 'everyday' powers of stop and search have, until recently, remained marked by their lack of academic or policy attention.

The most recent research indicates PSNI are using stop and search at much higher rates than all other UK police forces (Topping & Bradford, 2018; Topping & Schbotz, 2018). But beyond the general application of the power, this emerging body of research also points to the power as a disciplinary tool, demarcating the boundaries between, and flagging up, young, urban, socio-economic deprived males for special attention relative to the rest of the population. In essence, virtual geographic and socio-economic boundaries exist to influence the use of stop and search above and beyond any crime considerations.

At present, public data around PSNI stop and search remains limited; while organisational recording practices and internal management of stop and search remains siloed, and contributes to little meaningful understanding of how it is repetitively concentrated on certain

populations and within certain geographic areas.

Drawing on the lessons from existing consultancy work with PSNI by Topping; and those derived from recent technological reform around stop and search by Police Scotland, this PhD will attempt to combine a range of ethical, human rights and accountability frameworks into user-friendly technology for both point of contact and subsequent monitoring / analysis related to use of the power. It is anticipated that once developed, such a system could be modified to include dynamics and variables unique to particular policing jurisdictions.

This PhD will have 3 key stages:

1. Exploring the stop and search landscape in Northern Ireland / PSNI;
2. Examining existing police technologies around recording of stop and search from other jurisdictions;
3. Develop a computer system (including mobile app for police) which actively monitors and flags up stop and search practice, which in turn will provide new data attuned to existing human rights and accountability frameworks unique to NI

In view of Topping's existing work with the PSNI / NIPB, and current consultancy work with PSNI, significant organisational interest from both organisations in terms of 'buy in' could be expected.

Topping is also involved in an EU COST network grant on stop and search across Europe, providing further opportunities for international interest and contacts for the prospective PhD student

**Primary Academic Discipline:** Criminology

**PROJECT: The Vigilant Image: Documentary Technologies in the Age of Global (In)Security**

**Lead Supervisor:** [Dr Des O'Rawe](#)

**Supervisory Team:** [Dr Des O'Rawe](#), [Dr Niall McLaughlin](#), [Professor Cathal McCall](#)

**Primary Location:** Mitchell Institute

The discourse of catastrophe has become particularly influential in contemporary global societies. In addition to environmental disasters and the spectre of economic collapse, there is now the emergence of complex, mutable, unpredictable forms of terrorism, forms that have in recent times become more effective in *terrorizing* by being simultaneously here and elsewhere, familiar and alien. The socio-psychological consequences of 'new terrorism' are significant in relation to how communities and citizens – especially, in the major global cities – are becoming habituated to a culture of normalised trauma and excessive vigilance. The role of contemporary liberal democracies – equipped with increasingly sophisticated surveillance and security technologies – and the mass media, remains similarly problematic in this context. Guy Debord's adage that 'the story of terrorism is written by the state' is still relevant to any understanding how responses to (and representations of) contemporary forms of political violence and the 'terrorist threat' undermine democratic power-relations and affect the sociology of everyday life in the West.

This PhD project explores how new and emergent documentary technologies contribute to cultures of excessive vigilance, and their influence on political and social behaviour in modern democracies. New digital technologies have transformed traditional modes and ontologies of documentary practice, with filmmakers increasingly experimenting with animated, VR/AR, 360, and interactive multimedia platforms. These developments have the capacity to both shape and critique perceptions of reality, especially within the political sphere where states and corporate interests compete with creative practitioners and activists to control the content and dissemination of these technologies. What is the role of these technologies in negotiating between modes of vigilance and technologies of surveillance? How might new documentary technologies be employed to critique the over-vigilant society, disrupting the legitimizing processes integral to 'states of exception', with its and direct and indirect forms of repressive legislation, censorship and regulation, and more generalised suspicion of the 'other'?

A PhD in this area would pivot the participation of the Mitchell Institute and CSIT in the £13m Future Screens NI, the collaboration between Queen's, Ulster University and local industry partners for creative industries in Northern Ireland. Future Screens NI aims to provide opportunity and growth across film and broadcast, animation, games and emerging technologies and industries. This PhD proposal speaks directly to its film and emerging technologies foci.

**Primary Academic Discipline:** Film Studies

## HOW TO APPLY

**The deadline for applications is 5:00pm, Monday 21 January 2019.**

### ONLINE APPLICATION FORM

If you meet the eligibility criteria and wish to apply for any of these posts, you will need to complete an on-line application via the [Queen's University Applications Portal](#).

You must include the code **LINCS19** on your application form to indicate that you wish to be considered for a LINCS award.

Applicants should choose the option “**I wish to be considered for external funding**” and then enter **LINCS19** in the free text box which follows.

### COMPLETING YOUR APPLICATION

- All applicants must provide an up-to-date CV; this should be uploaded to the Admissions Portal as a separate document.<sup>1</sup>
- All applicants are required to provide a **400 - 800** word statement detailing how their PhD will address the interdisciplinary aspects of the LINCS programme.
- Applicants wishing to propose an interdisciplinary PhD topic of their own, that aligns with one or more of the LINCS priority themes, **must upload a 400 - 800 word research proposal** that describes the topic as a separate document.<sup>2</sup> This research proposal must **clearly identify** a potential supervisory team and which of the themes it relates to.
- Applicants must provide the name of an Academic Referee in support. **Failure to provide a referee will result in the application being rejected.**
- **Please note, failure to include the reference **LINCS19** in the free text box may result in your application not being allocated or considered for funding.**

**The deadline for applications is 5:00pm, Monday 21 January 2019**

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<sup>1</sup> Please note that **only one document can be uploaded**, you must combine your CV and Research Proposal into one document (word or PDF).

<sup>2</sup> As above note.

## PROGRAMME CONTACTS

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