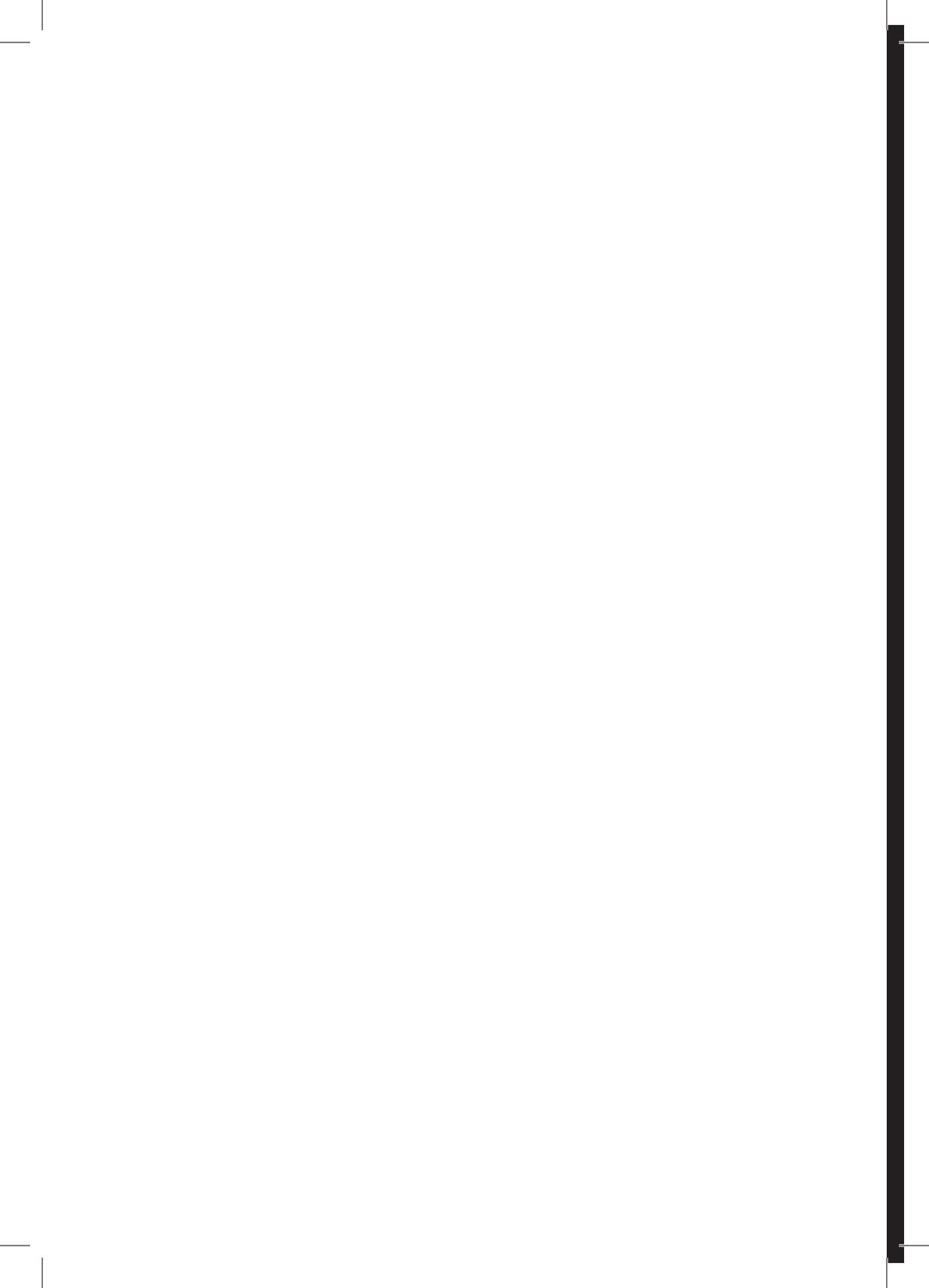


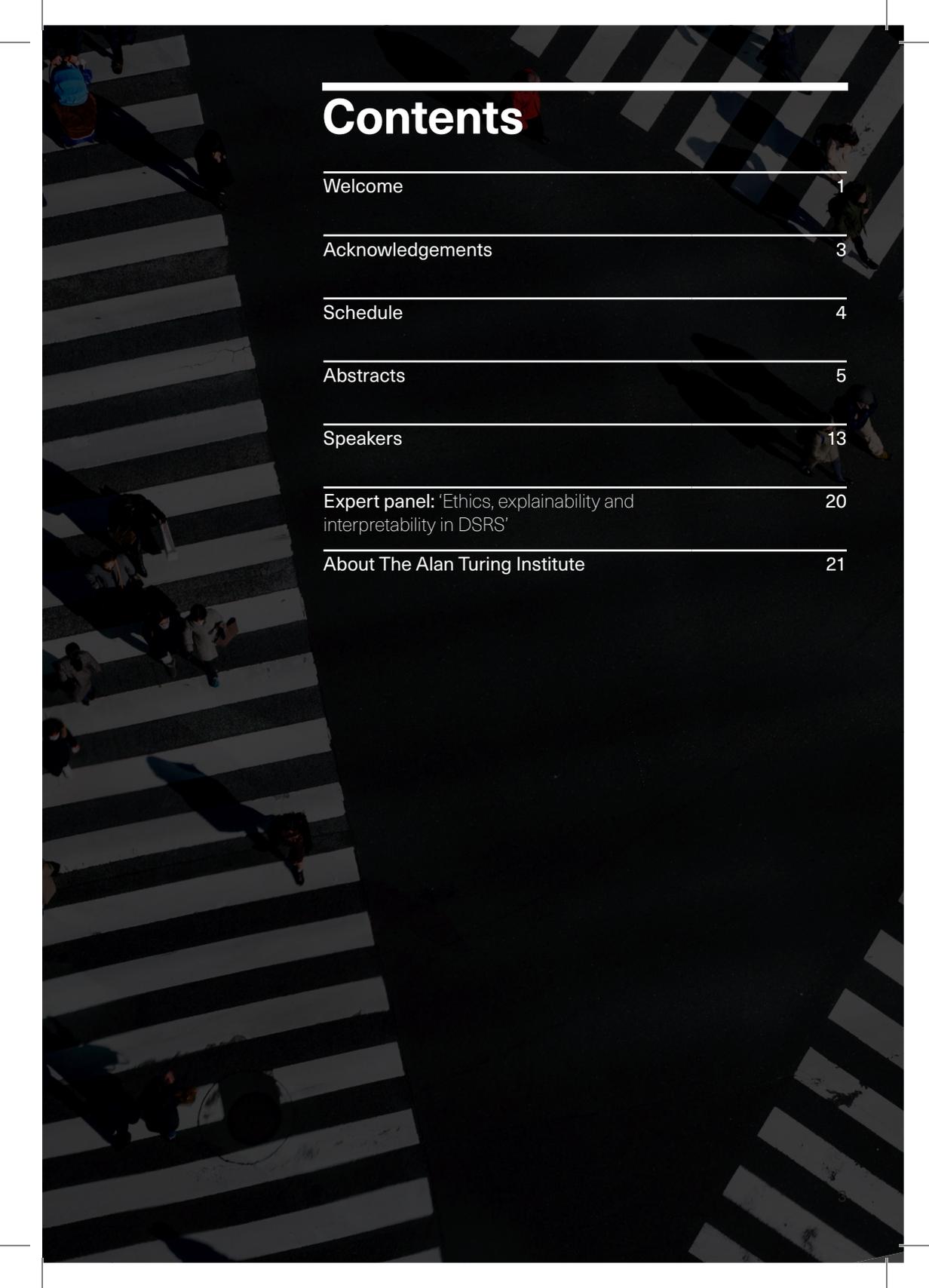
An aerial, high-angle photograph of a city street featuring a prominent zebra crossing with white stripes on a dark asphalt surface. Several pedestrians are captured in motion, crossing the street. The scene is brightly lit, casting distinct shadows of the people and the stripes onto the pavement. The overall composition is dynamic and urban.

**The  
Alan Turing  
Institute**

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**International Alan  
Turing Conference on  
Decision Support and  
Recommender Systems  
(DSRS-Turing'19)**



An aerial, high-angle photograph of a zebra crossing on a city street. The crossing consists of wide, parallel white stripes on a dark asphalt surface. Several people are seen walking across the crossing, their shadows cast long and dark on the pavement. The overall scene is captured in a dark, monochromatic style, with the white stripes providing the primary contrast.

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# Welcome

On behalf of the organising committee, I am delighted to welcome you to the 1st Edition of the International 'Alan Turing' Conference on Decision Support and Recommender Systems (DSRS-Turing, 2019) at The Alan Turing Institute, London, UK, on 21-22 November 2019.

This conference is being organised for the first time at The Alan Turing Institute in central London. The event aims to provide a discussion forum, both UK-wide and internationally, on the latest research advances and challenges involving complex decision-making in real life scenarios. It focuses on cutting-edge decision support approaches based on AI and data science techniques, to help alleviate the complexity in such (sometimes arduous and highly uncertain) decision-making processes.

Our goal is to bring together international researchers, industry professionals and domain experts in data science and AI, alongside leaders in the field at the Turing.

We will discuss the latest trends and ongoing challenges in the aforesaid areas of research involving decision aid, reaching out to diverse disciplines and current societal challenges.

These challenges include health and wellbeing, sustainability, finance, urban analytics and planning, e-government and, with a particular emphasis, personalisation via recommender systems.

Six renowned speakers based across Europe have accepted to give plenary talks not only on decision-making predicated on AI and machine learning, but also on human decision-making in domains such as tourism, decision support systems for surveillance and security, and recommender systems for music listeners, nutrition and wellbeing.

We also introduced a side activity for young researchers, consisting of a call for extended abstracts led by students and early stage researchers. This initiative was successful and 14 papers have been accepted for oral presentations, posters and demos at The Alan Turing Institute, thereby providing a unique opportunity for these young researchers to discuss their ideas and network with leading experts in DSRS, AI and data science.

We really hope that these authors and presenters can benefit from this activity and wish them every success with your research.

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## Welcome (cont.)

In addition, there is a growing importance of protecting and making fair and transparent use of citizens' data in a world where both human and machine-led decisions are increasingly data driven, as well as "explaining why the decisions made have been made". We have therefore introduced a panel with experts on ethics, explainability and interpretability in decision support and recommender systems to give the perfect wrap-up to the conference.

I am very grateful to The Alan Turing Institute, with a special mention to the Events and Communications teams, for supporting this project, and no less grateful to the conference co-organisers and members of our research team at the University of Bristol, for their generous and altruistic help in organising this event. This has been the very first experience of this kind for all of us and without your valuable help, it would not have been possible to make this event a success. So thank you **James Neve, Hugo Alcaraz-Herrera** and **Benjamin Arana**.

I would also like to thank the six phenomenal speakers from various international institutions – Prof. Peter Flach, Prof. Francisco Herrera, Prof. Mounia Lalmas, Dr Julia Neidhardt, Dr Christoph

Trattner and Dr Matthijs Spaan – who agreed to join us and share their expertise and latest research ideas at the conference.

Special thanks also to Christina Hitrova, Digital Ethics Researcher at the Turing, for proposing and coordinating an exciting expert panel on 'Ethics, Explainability and Interpretability in DSRS'. Thanks to panellists Dr David Leslie, Dr Ewa Luger, Prof Francesca Toni and Dr Florian Ostmann.

Last but not least, many thanks to all the authors and presenters of the accepted contributions at the conference which greatly enriched our technical programme, and thanks to you, conference attendee, for your genuine interest in this conference and for contributing to make it possible.

Wishing you a great time at the conference and in London!

**Ivan Palomares Carrascosa**,  
General Chair of DSRS-Turing 2019,  
University of Bristol



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# Acknowledgments to the DSRS-Turing Programme Committee

We would like to give our most sincere thanks to those experts and colleagues in decision-making, decision support systems and recommender systems, who kindly helped peer-reviewing the young researchers' contributions submitted to the conference, providing them with valuable and constructive comments to improve their research contributions.

- Hugo Alcaraz-Herrera (University of Bristol, UK)
- Benjamin Arana (University of Bristol, UK)
- Alejandro Bellogin (Universidad Autonoma de Madrid, Spain)
- Katharina Burger (University of Bristol, UK)
- Ivan Cantador (Universidad Autonoma de Madrid, Spain)
- Cristobal J. Carmona-del Jesus (Universidad de Jaen, Spain)
- Macarena Espinilla (Universidad de Jaen, Spain)
- Frank Hopfgartner (University of Sheffield, UK)
- Anna Jurek-Loughrey (Queen's University Belfast, UK)
- Mesut Kaya (Technological University (TU) Delft, Netherlands)
- Daniel Kershaw (Elsevier, UK)
- Sergey Kovalchuk (ITMO University, Russia)
- Zhiwei Lin (Ulster University, UK)
- Victoria Lopez (Universidad Complutense de Madrid, Spain)
- Eugenio Martinez-Camara (Universidad de Granada, Spain)
- Javier Medina (Universidad de Jaen, Spain)
- Rosana Montes (Universidad de Granada, Spain)
- Julia Neidhardt (Technological University (TU) of Wien, Austria)
- James Neve (University of Bristol, UK)
- Ivan Palomares (University of Bristol & The Alan Turing Institute, UK)
- Massimo Quadrana (Pandora Media, Italy)
- Oscar Gabriel Reyes-Pupo (Universidad de Córdoba, Spain)
- Raul Santos-Rodriguez (University of Bristol, UK)
- Hanna Schäfer (Technical University of Munich, Germany)
- Marko Tkalcic (Free University of Bolzano, Italy)
- Zhen Zhang (Dalian University of Technology, China)

On behalf of the organising committee, thank you!

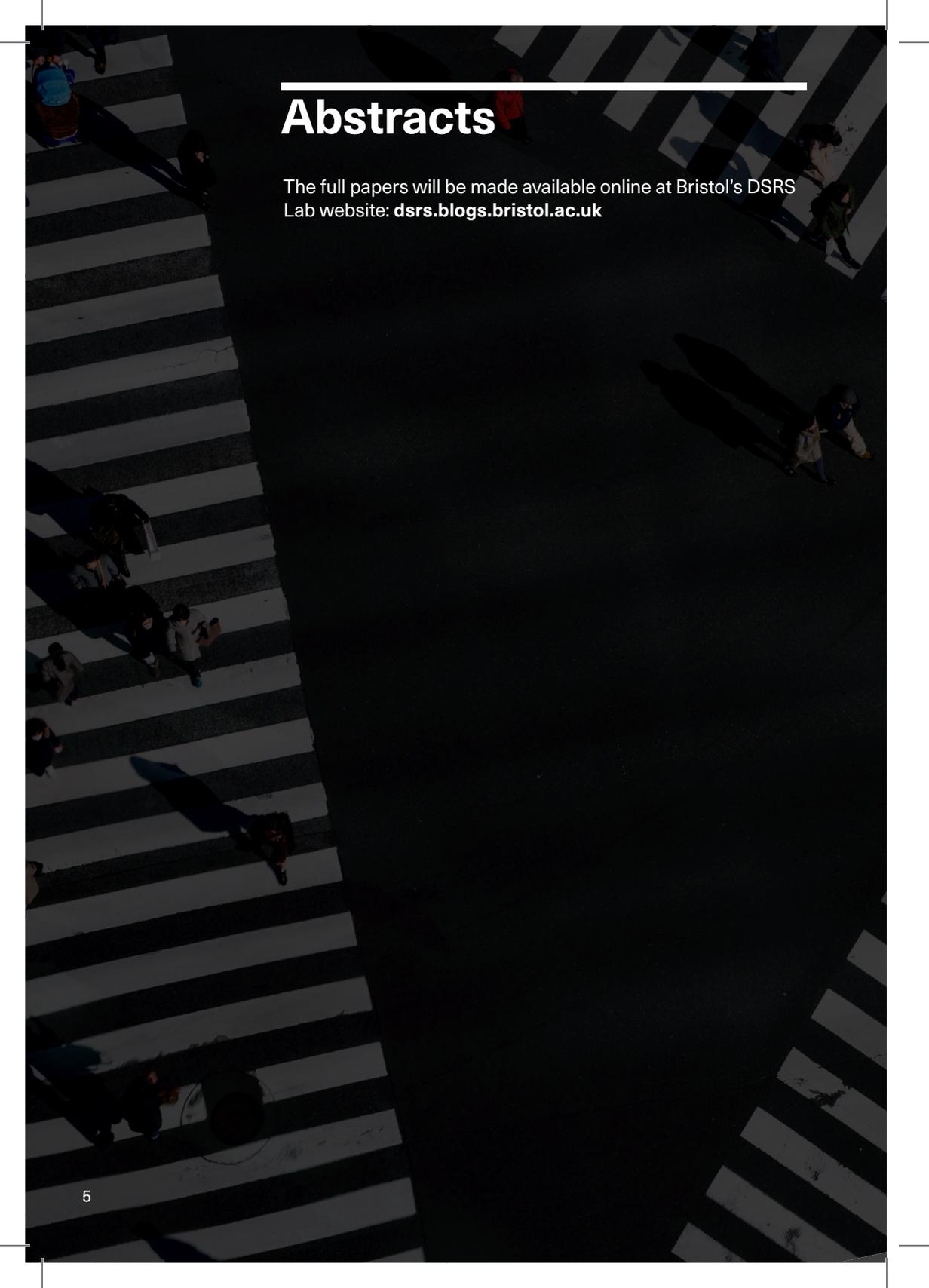
# Schedule

Thursday 21 November

Time	Event
9:30–10:15	Registration
10:15–10:30	Welcome: Ivan Palomares-Carrascosa
10:30–11:30	Talk 1: Francisco Herrera
11:30–12:00	Coffee break
12:00–13:00	Oral paper presentations I
13:00–14:00	Lunch break
14:00–15:00	Talk 2: Matthijs Spaan
15:00–15:30	Poster demo and coffee break
15:30–16:00	Oral paper presentations II
16:00–17:00	Talk 3: Julia Neidhardt
17:00	Social event

Friday 22 November

Time	Event
10:00–11:00	Talk 4: Peter Flach
11:00–11:30	Coffee break
11:30–12:30	Talk 5: Christoph Trattner
12:30–13:00	Oral paper presentations III
13:00–14:00	Lunch break
14:00–15:00	Talk 6: Mounia Lalmas
15:00–15:30	Poster demo and coffee break
15:30–16:30	Expert panel: Ethics, Explainability and Interpretability in DSRS
16:30	Closing



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# Abstracts

The full papers will be made available online at Bristol's DSRS  
Lab website: [dsrs.blogs.bristol.ac.uk](https://dsrs.blogs.bristol.ac.uk)

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A group decision-making procedure where agents with different expertise evaluate alternatives through qualitative assessments

**Authors**

José Luis García-Lapresta, Raquel González del Pozo (University of Valladolid, Spain)

**Abstract**

Some decision-making problems use ordered qualitative scales formed by linguistic terms to evaluate alternatives or the knowledge of experts. Sometimes these scales can be considered as non-uniform, in the sense that agents may perceive different proximities between the terms of the scale. In this contribution, we propose a group decision-making procedure for ranking alternatives evaluated by a group of experts through a non-necessarily uniform ordered qualitative scale. To assign a weight to each expert according to their expertise, a decision-maker assesses the experts' expertise by means of another ordered qualitative scale. In the procedure, each of the two ordered qualitative scales is equipped with an ordinal proximity measure that collects the ordinal proximities between the linguistic terms of the scale. The procedure assigns scores to the linguistic terms of the scales taking into account the ordinal proximity measures of the scales. Afterwards, the scores are normalized and aggregated for generating the ranking of the alternatives.

---

Bip4Cast: Some advances in mood disorders data analysis

**Authors**

Pavel Llamocca (Complutense University of Madrid, Spain), Diego Urgelés (Hospital Ntra Sra de la Paz, Spain), Milena Cukic (3EGA, Netherlands), Victoria Lopez (Complutense University of Madrid, Spain)

**Abstract**

Mood disorders have been a relevant topic for the last decade. According to the World Health Organization, the cost of mood disorders and anxiety in the EU is about €170 billion per year. Bip4Cast is a project aiming at crisis prediction for patients with bipolar disorder. Traditional indicators like Hamilton and Yang are insufficient to predict and avoid crises. This study adds up to 149 new variables from data gathered from different sources as wearable devices and smartphones. The analytics include correlation between all the accelerometer variables and linear regression between variables that come from different sources. The results show the existence of a relationship between biological, psychological, physical indicators with the appearance of a crisis of depression or mania. These relations are the base of the predictive analytics that clinicians need in order to make better decisions on the future treatment plans.

---

## Content-based recommender systems for heritage: Developing a personalised museum tour

### **Authors**

Olga Loboda, Julianne Nyhan, Simon Mahony and Daniela M. Romano (University College London, UK), Melissa Terras (University of Edinburgh, UK)

### **Abstract**

How will a content-based recommender system be perceived by museum visitors? How will it transform visitor experience, and how can we adapt recommender systems to meet the needs of users in the museum domain? In this paper, we demonstrate the implementation of a content-based recommender system to generate personalised museum tours within the UCL Grant Museum of Zoology, London, UK. We also outline pilot usability tests that were carried out to collect initial feedback on the system performance in the wild. The findings help detect critical issues before the system is tested with museum visitors to explore the potential transformation in visitor experience that occurs with content-based recommender systems in physical museums.

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## Modeling a decision-maker in goal programming by means of computational rationality

### **Authors**

Maura E Hunt, Manuel López-Ibáñez (University of Manchester, UK)

### **Abstract**

This paper extends a simulation of cognitive mechanisms in the context of multi-criteria decision-making by using ideas from computational rationality. Specifically, this paper improves the simulation of a human decision-maker (DM) by considering how resource constraints impact their evaluation process in an interactive Goal Programming problem. Our analysis confirms and emphasizes a previous simulation study by showing key areas that could be effected by cognitive mechanisms. While the results are promising, the effects should be validated by future experiments with human DMs.

---

## Learning sparse changes in time-varying Markov networks with density ratio estimation and its application to fMRI

### **Authors**

Yulong Zhang (University of Bristol, UK), Christelle Langley (University of Cambridge, UK), Jade Thai and Song Liu (University of Bristol, UK)

### **Abstract**

This paper proposes a method for estimating sparse changes in time-varying Markov networks. Rather than estimating two network structures separately and then obtaining the differences, we adopt a previously proposed method which directly estimates the ratio of the two Markov network densities. The sparse changes are tackled easily with a sparse inducing regularizer. Specifically, to consider the temporality of the networks, an importance weighting scheme is introduced. Moreover, an application to fMRI data demonstrates the potential of the proposed method

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## Extracting emerging patterns with change detection in time for data streams

### **Authors**

Cristobal J. Carmona, Angel M. Garcia-Vico, Pedro Gonzalez, Maria J. del Jesus (University of Jaen & Andalusian Research Institute on Data Science and Computational Intelligence, Spain)

### **Abstract**

Currently, many sources such as the Internet, sensor networks, the Internet of Things and others, generate information on a continuous basis, in a big data context. The processing of these data is well-known as data stream analysis, where data is processed as soon as it arrives in the system, not being stored. There is a large number of techniques for processing these data throughout the literature. In particular, emerging pattern mining attempts the search for discriminative relationships in data in order to describe differentiating properties between classes. Its main objective is the description of interesting knowledge in data with respect to a target variable. In this contribution, we raised the possibility to modify the extraction of emerging patterns in data streaming through the use of the time as target variable. This is well-known into the community as change mining. The benefits of extracting a precise and interpretable knowledge in data streaming could be very relevant for the community, because emerging patterns with change detection can support recommender systems by means of the extraction of alarms based on interpretable and precise patterns.

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## Personalised playlist prediction

### Authors

Lewis Bell (University of Bristol, UK), Carlos Del Rey (University Carlos III Madrid, Spain), Eimear Cosgrave (Trinity College Dublin, Ireland)

### Abstract

In recent years, the class of recommendation problems have been increasingly solved using Collaborative Filtering (CF) methods due to the increased viability of artificial neural networks in practical applications. We present a new novel method for Item-Based-CF recommendation using unsupervised clustering in Embedding Spaces of abstract song objects such as those produced by the Word2Vec methods detailed in Mikolov et al.'s seminal papers on the topic [1][2], abstracted away from the original use of finding natural language semantics to build embeddings of generalised items (So called 'Item2Vec' methods). We give an application of this concept in the form of recommending playlists to a user who has built playlists that they enjoy, based upon a dataset of 1.4 million unique songs contained within 11,000 playlists from other users to perform collaborative filtering, and detail the various other models and techniques we attempted on the way to our final solution. The results of these methods are successful by both empirical and subjective metrics, with our solution being suited to performing prediction on arbitrarily sized inputs, and being able to predict arbitrarily sized outputs.

---

## User-centric design of a clinical decision support system for critical care treatment optimisation

### Authors

Christopher McWilliams, Iain Gilchrist and Raul Santos-Rodriguez (University of Bristol, UK), Matt J Thomas, Timothy Gould and Christopher Bourdeaux (University Hospitals Bristol NHS Foundation Trust, UK)

### Abstract

In this paper we present the concept for an interactive clinical decision support system that will replace the intensive care unit dashboards currently deployed at the Bristol Royal Infirmary. The proposed system is intended to promote compliance with treatment guidelines and will improve on the pre-existing dashboards by introducing predictive modelling, capturing usage data for algorithm development and providing an enhanced user interface that is co-created by our interdisciplinary research team and the clinical users of the system. The intention is to design both the software and the algorithms such that the system could be deployed across multiple NHS trusts in the future.

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## A hybrid decision making system using image analysis by deep learning and IoT sensor data to detect human falls

### **Authors**

Pingfan Wang (Northumbria University, UK), Sean McGrath (University of Limerick, Ireland), Nanlin Jin (Northumbria University, UK)

### **Abstract**

Falling is the leading cause of injury and accidental death for those who are older or reduced disability. In recent years, both the problem of population aging and the number of disabled people are growing. There is evidence that people with disabilities are at higher risk of injury from falls than a person without a disability. Therefore, high-efficiency and accurate fall detection are highly demanded, to protect the health and safety of the elderly, at the same time, it helps to reduce the burden on individuals and society. This paper proposes a method that combines image processing and IoT to analyze to predict the possible physical state of the people, as the basis for subsequent decision making of health care. In this method, image data is processed and analyzed by deep learning network and feature matching algorithm, the sensor data is collected and processed by multiple sensors and cloud platform. The result of the experiment has shown the hybrid decision method based on data fusion has higher accuracy and low latency.

---

## Decision making model based on expert evaluations extracted with sentiment analysis

### **Authors**

Cristina Zuheros, Eugenio Martínez-Cámara, Enrique Herrera-Viedma, Francisco Herrera (University of Granada & Andalusian Research Institute in Data Science and Computational Intelligence, Spain)

### **Abstract**

Decision making requires the evaluation of a set of alternatives by a group of experts. Those alternatives are usually assessed with a set of pre-defined linguistic terms. However, the evaluation and the experts are constrained by those linguistic terms. Hence, we propose that experts express their views in natural language, extract the aspects of interest of the problem and inferring the opinion meaning about them using Aspect-based Sentiment Analysis methods. We will apply our model to a real case of study for evaluating restaurants.

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## On tour: Harnessing social tourism data for city and point of interest recommendation

### **Authors**

Tom Bewley, Ivan Palomares (University of Bristol & The Alan Turing Institute, UK)

### **Abstract**

In this work, we introduce a variety of data-driven models for recommending both city destinations and within-city points of interest to tourists. The models are implemented with a novel dataset of travel histories, derived from social media data, which is larger by size and scope than in prior work. All proposed models outperform simple baselines in cross-validation experiments, with the strongest variants reliably including tourists' true movements among their top recommendations.

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## Realising the potential for ML from electronic health records

### **Authors**

Haoyuan Zhang (University College London, UK), D. William R. Marsh, Norman Fenton and Martin Neil (Queen Mary University London, UK)

### **Abstract**

The potential for applying Machine Learning (ML) to Electronic Health Records (EHRs) has been widely agreed but practical progress has been slow. One reason why EHR data are not immediately usable for ML is lack of information about the meaning of the data. An improved description of the data would help to close this gap. However, the description needed is of the data journey from the original data capture, not just of data in the final form needed for ML. We use a simplified example to show how typical EHR data has to be transformed in a series of steps to prepare data for analysis or modelling building. We outline some of the typical transformations and argue that the data transformation needs to be visible to the users of the data. Finally, we suggest that synthetic data could be used to accelerate the interaction between medical practitioners and the ML community.

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## Vectology – Exploring biomedical variable relationships using sentence embedding and vectors

### Authors

Benjamin Elsworth, Yi Liu, Tom R Gaunt (University of Bristol, UK)

### Abstract

Many biomedical data sets contain variables that are identified by simple, and often short, descriptions. Traditionally these would either be manually annotated and/or assigned to ontologies using expert knowledge, facilitating interactions with other data sets and gaining an understanding of where these variables lie in the biomedical knowledge space. An alternative approach is to utilise sentence embedding methods and convert these variables into vectors, calculated from precomputed models derived from biomedical literature. This provides a data-driven alternative to manual expert annotation, automatically harnessing the expert knowledge captured in the existing literature. These vectors, representing the biomedical space embodied by each specific piece of text, enable us to apply methods for exploring relationships between variables in vector space, notably comparing distances between vectors. From here, it is possible to recommend a set of variables as the most conceptually similar to a given piece of text or existing vector, whilst also gaining insight into how a group of variables are related. Vectology is made available via an API (<http://vectology-api.mrcieu.ac.uk/>) and basic usage can be explored via a web application (<http://vectology.mrcieu.ac.uk>).

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## From pictures to touristic profiles: A deep learning based approach

### Authors

Mete Sertkan, Julia Neidhardt, Hannes Werthner (TU Wien, Austria)

### Abstract

Tourism products are typically very complex and strongly tied to emotional experiences. Thus, for many people it is hard to state their preferences and needs explicitly. To overcome such difficulties, we follow the idiom “A Picture is worth a thousand words”. Thus, in this work tourists as well as tourism destinations are profiled within the Seven-Factor Model of travel behavioural patterns by using picture collections. Pre-labelled pictures are used in order to train convolutional neural networks (CNNs) with the goal to determine the Seven-Factor representation of a given picture. We demonstrate that touristic characteristics can be extracted out of the pictures. Furthermore, we show that those characteristics can be aggregated for a collection of pictures such that a Seven-Factor representation of a tourist or tourism destination respectively can be determined.

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# Speakers



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**Prof Francisco Herrera**

University of Granada (Spain)

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**Bio**

Francisco Herrera (SM'15) received his M.Sc. in Mathematics in 1988 and Ph.D. in Mathematics in 1991, both from the University of Granada, Spain. He is currently a Professor in the Department of Computer Science and Artificial Intelligence at the University of Granada and Director of DaSCI Institute (Andalusian Research Institute in Data Science and Computational Intelligence).

He's an academician at the Spanish Royal Academy of Engineering. He has been the supervisor of 46 Ph.D. students. He has published more than 400 journal papers that have received more than 75,000 citations (Scholar Google, H-index 135). He also currently acts as Editor in Chief of the international journal 'Information Fusion' (Elsevier).

His current research interests include among others, soft computing (including fuzzy modeling, evolutionary algorithms and deep learning), computing with words, information fusion and decision making, and data science (including data preprocessing, prediction and big data).

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**Video surveillance and weapon detection with deep learning**

In the last years, deep learning methods and particularly Convolutional Neural Networks (CNNs) have exhibited excellent accuracies in many image detection and pattern classification problems, among others. To analyze surveillance videos is an important problem. It requires to develop deep learning approaches for automatically detection of objects or actions. In this talk we will focus the attention on the real time weapon detection for surveillance videos, paying attention to pistols and cold steel weapon detection.

We will discuss the preprocessing and postprocesses process approaches to reduce the false positives and to improve the overall performance of the detection model. We will pay attention to the database creation, the illumination conditions preprocessing, the use of binocular images fusion, the similarity among objects, among others. We analyze the connection between deep learning and data quality preprocessing. In short, we discuss about the quality data preprocessing under the premise of "more quality data for better knowledge on the problem and the extraction" and better detection model.



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**Prof Peter Flach**

University of  
Bristol; The Alan  
Turing Institute  
(UK)

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**Bio**

Peter Flach has been Professor of Artificial Intelligence at the University of Bristol since 2003. An internationally leading researcher in the areas of mining highly structured data and the evaluation and improvement of machine learning models using ROC analysis, he has also published on the logic and philosophy of machine learning, and on the combination of logic and probability.

He is author of *Simply Logical: Intelligent Reasoning by Example* (John Wiley, 1994) and *Machine Learning: the Art and Science of Algorithms that Make Sense of Data* (Cambridge University Press, 2012). Prof Flach is the Editor-in-Chief of the *Machine Learning* journal, one of the two top journals in the field that has been published for over 25 years by Kluwer and now Springer.

He was Programme Co-Chair of the 1999 International Conference on Inductive Logic Programming, the 2001 European Conference on Machine Learning, the 2009 ACM Conference on Knowledge Discovery and Data Mining, and the 2012 European Conference on Machine Learning and Knowledge Discovery in Databases in Bristol.

---

**Better decisions with machine learning**

Machine learning, broadly defined as data-driven technology to enhance human decision making, is already in widespread use and will soon be ubiquitous and indispensable. The quality of algorithmic decisions depends crucially on whether the scores of a machine learning classifier are calibrated: for example, if the classifier's scores approximate the posterior probability over the classes, then the optimal decision rule is to predict the class that minimises expected cost averaged over all possible classes.

An alternative view of calibration holds that a well-calibrated classifier calculates the cost parameters under which the expected cost for the instance under consideration is the same regardless of the predicted class; the main advantage of this more general view is that it can be adapted to different loss measures. In this talk I will review recent work in classifier calibration, including the use of precision-recall-gain curves to obtain scores calibrated for the F-score, and Beta-calibration which is suited for classifiers scoring on a bounded scale.



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**Prof Mounia  
Lalmas**

Spotify (UK)

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## Bio

Mounia Lalmas is a Director of Research at Spotify, and the Head of Tech Research in Personalization. Mounia also holds an honorary professorship at University College London. Before that, she was a Director of Research at Yahoo, where she led a team of researchers working on advertising quality for Gemini, Yahoo's native advertising platform. She also worked with various teams at Yahoo on topics related to user engagement in the context of news, search, and user generated content.

Prior to this, she held a Microsoft Research/RAEng Research Chair at the School of Computing Science, University of Glasgow. Before that, she was Professor of Information Retrieval at the Department of Computer Science at Queen Mary, University of London. Her work focuses on studying user engagement in areas such as native advertising, digital media, social media, search, and now audio. She has given numerous talks and tutorials on these and related topics, including recently a WWW 2019 tutorial on 'Online User Engagement: Metrics and Optimization'. She is regularly a senior programme committee member at conferences such as WSDM, KDD, WWW and SIGIR.

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## Personalising the listening experience

When users interact with the recommendations served to them, they leave behind fine-grained traces of interaction patterns, which can be leveraged to predict how satisfying their experience was. This talk will present various works and personal thoughts on how to measure user engagement. It will discuss the definition and development of metrics of user satisfaction that can be used as proxy of user engagement, and will include cases of good and bad scenarios.

An important message will be to show that, when aiming to personalise the recommendations, it is important to consider the heterogeneity of both user and content to formalise the notion of satisfaction, and in turn design the appropriate satisfaction metrics to capture these. One way to do this is to consider the following angles when developing machine learning solutions for personalization: (1) Understanding intents; (2) Optimizing for the right metric; (3) Acting on segmentation; and (4) Thinking about diversity.



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**Dr Christoph  
Trattner**

University  
of Bergen  
(Norway)

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**Bio**

Christoph Trattner is an Associate Professor at the University of Bergen in the Information Science & Media Studies Department. Previously, he was an Asst. Prof. at MODUL University Vienna in the New Media Technology Department. He also founded and led the Social Computing department at the Know-Center, Austria's research competence for data-driven business and big data analytics.

He holds a Ph.D. in Computer Science and Telematics from Graz University of Technology (Austria). Christoph's research background includes Applied Machine Learning, Predictive Modeling, Recommender Systems, Social Networks Analysis, Human Computer Interaction and Data Science in particular. He is leading an international research effort that tries to understand, predict and change online food preferences to tackle health-related food issues such as diabetes or obesity.

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**Computational analytics on the web for better food  
decision-making**

According to the World Health Organization around 80% of cases of heart disease, strokes and type 2 diabetes could be avoided if people were to implement a healthier diet. Computational data analytics approaches have been touted as a valuable asset in achieving the ambitious goal of understanding user behavior and being able to develop intelligent online systems, which can positively influence people's food choices.

In this talk, I will present our latest research on computational data analytics approaches to understand, predict and potentially change food decision making in an online context. First, I will show to what extent online food interactions can be linked to real-world health issues such as obesity on a large-scale. After that, I will show how people upload, bookmark or rate online recipes in large online food communities and how contextual factors and biases such as seasonality, temporality, social context or presentation of recipes have an impact on popularity and how they are perceived.

Furthermore, I will reveal to what extent these factors and biases can be exploited to model and predict the users' online food choices. To conclude, I will present some preliminary work aiming to nudge people towards food choices and recent work on learning to recommend similar items from human judgments in that domain employing crowdsourcing.



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**Dr Julia  
Neidhardt**

TU Wien  
(Austria)

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## Bio

Julia Neidhardt is a researcher at the E-Commerce Research Unit at TU Wien, Austria. She holds a Master's degree in mathematics from the University of Vienna and a PhD in Computer Science from TU Wien. Her research focuses on modeling and predicting complex human behavior, user opinions, preferences and social relations as well as their dynamics in digital-enabled environments.

In recent projects, she studied social influence mechanism in online communities, the diffusion of topics, opinions and sentiments, social media-based event prediction, team performance, news recommender systems as well as picture-based travel recommender systems.

Since 2013, she has been a regular visiting researcher at the Science of Networks in Communities (SONIC) research group at Northwestern University, USA. Her work is published in internationally highly renowned conferences and journals including Nature Human Behaviour.

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## Recommender systems and decision-making in the tourism domain

Recommender systems face specific challenges in the travel domain, as the tourism product is typically very complex. In addition, travelling can be seen as an emotional experience. Particularly in the early phases of a travel decision process, users are not able to explicitly express their preferences. Therefore, comprehensive user models are required.

In this talk, I present a picture-based approach as an effective and joyful method to implicitly elicit user preferences for tourism products. In this approach, a user's travel profile is composed of seven basic factors. The scores of these factors are determined by asking the user to select a number of pictures that are appealing to him or her. In addition, I will discuss automated ways for determining the seven-factor scores of tourism products to enable matchmaking for recommender systems.

Finally, since travelling is typically a social activity, I will talk about group decision making and show that in order to understand the outcome of a group decision making process new strategies that go beyond the simple aggregation of the initial preferences of the group members have to be applied.



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**Dr Matthijs Spaan**

TU Delft (The Netherlands)

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**Bio**

Matthijs Spaan is an Associate Professor of Computer Science at Delft University of Technology, the Netherlands. He received his PhD degree in Computer Science from the University of Amsterdam in 2006. After graduating, he was a research scientist at Instituto Superior Técnico in Lisbon, Portugal.

His research focuses on designing algorithms for planning under uncertainty and applying them in domains such as smart energy systems, robotics and transportation. Matthijs co-chaired ICAPS-2018 and serves on the AAAI Executive Council and on the IFAAMAS Board of Directors.

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**Sequential decision-making under shared resource constraints**

The rapidly increasing impact of cooperative intelligent systems creates a need for algorithms to optimize their joint behavior. In particular, agents often have to optimize their decision making under shared resource constraints, such as limits on infrastructural capacity. Examples are load balancing of electric vehicle charging in smart energy grids or recommending points of interests to tourists in overcrowded cities.

However, the effect of personalized recommendations on a collective of users can overload infrastructural capacity. Without coordination, individual optimization leads to overexploitation of the shared resources. To address these issues, I discuss recent work on constrained multiagent sequential decision making.

First, I focus on scenarios in which agents need to satisfy resource constraints in expectation but cannot coordinate during execution. I bound the probability of actual constraint violations and present algorithms that maximize value subject to a user-defined tolerance of resource violations.

Second, I present algorithms that compute capacity-aware personalized recommendations for points of interests in city while considering a large number of users and capacity limits (e.g., maximum attendance of a museum). I show how constraint satisfaction can be decoupled from sequential recommendation policies, resulting in algorithms that provide recommendations for thousands of users while respecting capacity limits.

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# Expert panel on ‘Ethics, explainability and interpretability in DSRS’

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## Chair

Dr David Leslie, The Alan Turing Institute

## Panel Organisers

Christina Hitrova (Research Assistant in Digital Ethics) and Dr Ivan Palomares (Turing Fellow), The Alan Turing Institute

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## Overview

As decision-support (DS) and recommendation systems (RS) become deployed more widely across society, their impact on individuals grows. They are now involved in personalising the interest rate on loans or insurance, in shaping our political views by tailoring content, or in helping diagnose medical conditions and make treatment decisions. Whether automatically or by informing human decision-making, such tools have an irrefutably large impact on our life and work.

In this panel, we will take a closer look at the ethical questions arising from using DSRS. In addition, the panel will look at the ethical challenges that emerge in designing and implementing DSRS and will explore practical ways of thinking about ethics when building such tools. This panel discussion will focus on the role of interpretability and explainability of models and their outputs in ensuring accountable and ethical design of DSRS tools.



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**Dr David Leslie**

The Alan Turing  
Institute

Philosophical  
perspective



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**Dr Ewa Luger**

University of  
Edinburgh

HCI perspective



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**Prof Francesca  
Toni**

Imperial College  
London

Technical  
perspective



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**Dr Florian  
Ostmann**

The Alan Turing  
Institute

Policy  
perspective

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## About the Turing

The Alan Turing Institute is the national institute for data science and artificial intelligence.

Founded in 2015, the Turing now has thirteen university partners and works with an extensive and thriving network of industry, public and third sector partners and collaborators.

The Turing has convened a world-class research community and has a crucial role advising policymakers and shaping the public conversation around data science and AI.

Through its strategic research programmes and projects the Turing works in partnership to apply data science and AI research to real-world problems, supporting the creation of new products, services and jobs.

We are here to help to make the UK the best place in the world for data science and AI research, collaboration, and business.

# The Alan Turing Institute



# The Knowledge Quarter

The Turing is part of the Knowledge Quarter, the focal point for one of the greatest knowledge clusters anywhere in the world, located in a small area around King's Cross, the Euston Road and Bloomsbury.

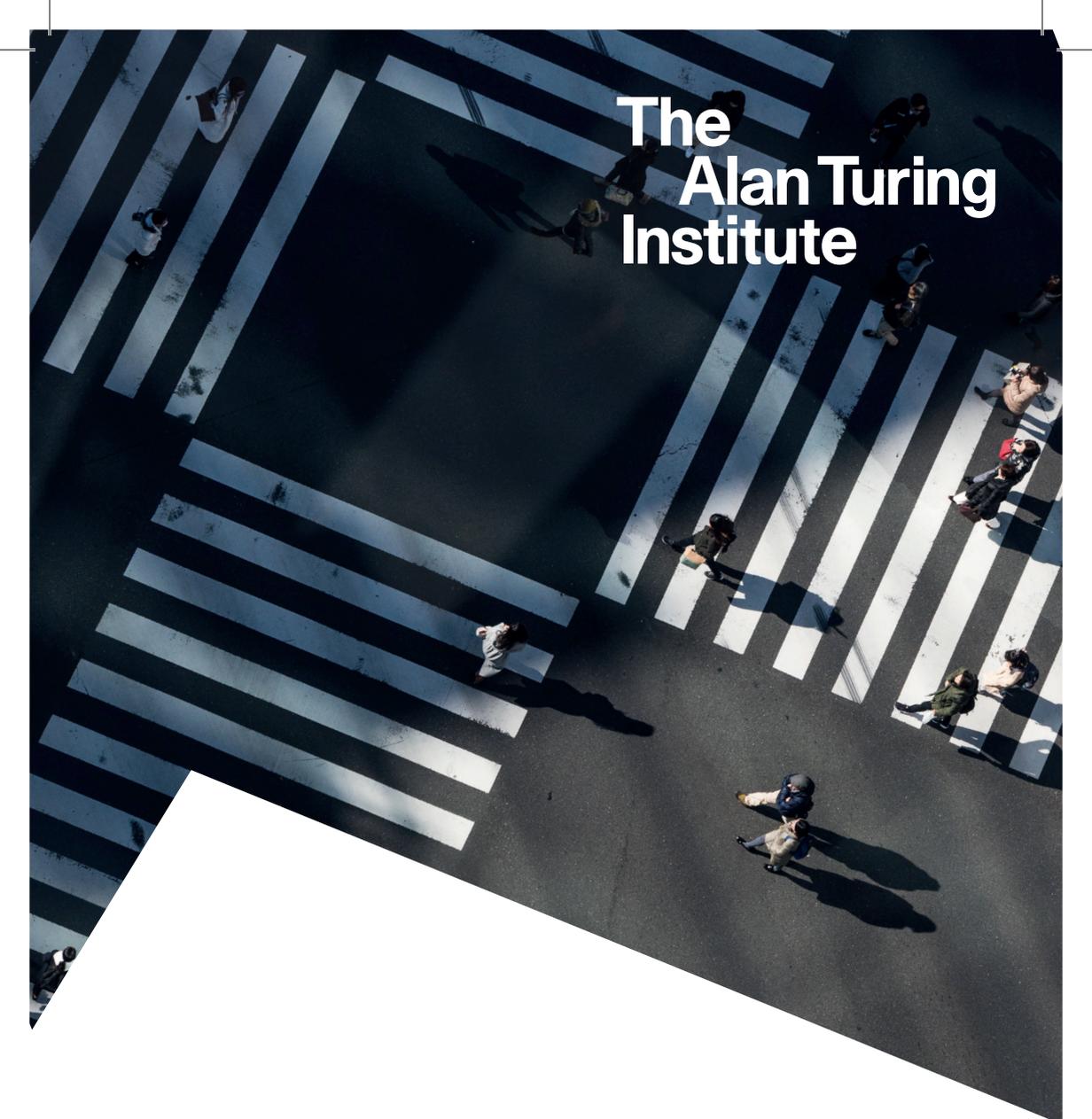
Within a few hundred metres you can find knowledge resources ranging from the world's earliest books and manuscripts to the latest fashion and creative designs and cutting-edge medical research.



Image credit: Knowledge Quarter





An aerial, high-angle photograph of a zebra crossing on a dark asphalt road. The crossing is marked with thick, parallel white stripes. Several people are captured in motion, walking across the crossing. Their shadows are cast long and dark on the pavement, indicating a low sun position. The overall scene is captured in a high-contrast, almost black and white style, with the white stripes of the crossing providing the primary source of light and detail.

# The Alan Turing Institute

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[turing.ac.uk](https://turing.ac.uk)

[dsrs.blogs.bristol.ac.uk](https://dsrs.blogs.bristol.ac.uk)