

1st Workshop on Context Representation in User Modelling

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Context, a critical aspect of personalisation and human-computer interaction, is becoming increasingly significant with the proliferation of user-centric applications. The First ACM Workshop on Context Representation in User Modelling (CRUM 2023), organised in conjunction with the 31st ACM Conference on User Modeling, Adaptation and Personalization (UMAP 2023), provided a venue for research in the representation and utilisation of contextual information in intelligent systems. The workshop aimed to bring together researchers from various disciplines, including natural language processing, user modelling, explainable systems, and human-robot interaction and to facilitate conversation about the role of context in adaptive applications. The prospective authors were invited to submit papers of up to seven pages, four of which were accepted for publication and are introduced in this summary.

CCS Concepts: • **Human-centered computing** → **User studies; HCI theory, concepts and models**; • **Information systems** → **Personalization; Users and interactive retrieval; Music retrieval**.

Additional Key Words and Phrases: adaptation, context, data representation, personalisation, control, scrutability

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1 INTRODUCTION AND MOTIVATION

Context is a broad term in computer science research, whose most all-encompassing description is: any information that can be used to characterise the situation of any person, place, or object deemed relevant to the interaction between a user and a computer system. Research on context representation generally involves multidisciplinary interactive systems focusing on user-centred design. The application areas include recommender systems, human-robot interactive interfaces, personalised intelligent agents, and adaptive hypermedia applications. Modelling and representing context is becoming even more significant with the proliferation of user-centric applications that necessitate identifying and accounting for relevant information and explicit requests. The success in fulfilling this requirement may determine the appropriateness of the system's behaviour.

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Frequent discussion of the concept in the user modelling and adaptive systems community, as well as within the recommender system community, led us to recognise the need to organise the First Workshop on Context Representation¹. The workshop provided researchers and practitioners with a venue to discuss, present, and promote research pertaining to the modelling and representation of contextual information and its impact on adaptive systems, ubiquitous computing, virtual personal assistants, social robots, and human-computer interaction in general. The workshop's long-term goal is to catalyse advance of the integration of contextual information in intelligent system behaviour that would increase the appropriateness of system response and user satisfaction.

The workshop invited prospective authors to submit papers up to seven pages introducing ideas, positions, and novel research about the identification, realisation, utilisation, and explainability of context. Specifically, the topics of the first edition of CRUM welcomed papers on the topics that included (but were not limited to): Capturing and storing contextual information; Situation-aware user modelling and adaptive system; Algorithmic relevance of situational, temporal, location, and hypermedia context; Context representation for personalisation; Adaptation of user models based on spatial, temporal, or situational context; Capturing and ranking application-specific context in hypermedia user applications; Context as the relevance of static and dynamic external characteristics within recommendation systems; Contextualising proactive behaviour; Context-aware personalised pervasive computing; The role of context for user modelling in recommender systems; Evaluation frameworks for capturing, representing, and using contextual information in agent decision-making; Role of context and context representation within explainable adaptation; Scrutability of contextual representation in personalised systems; and Evaluating the impact of context on user modelling.

2 WORKSHOP PROGRAMME

The First Workshop on Context Representation in User Modelling took place in person at Limassol, Cyprus on 26 June 2023. The workshop was a half-day event co-located with The 31st ACM Conference On User Modeling, Adaptation and Personalization. The programme comprised four main parts: an opening talk on scrutability and context, the presentation of accepted publications, a panel discussion on the role of context in personalisation, and a collaborative brainstorming activity.

2.1 Opening Talk

Workshop co-chair Judy Kay opened the workshop with a talk on context, personalisation and scrutability. Judy Kay is a Professor of Computer Science. She leads the Human Centred Technology Research Cluster, in the Faculty of Engineering at the University of Sydney. A core focus of her research has been to create infrastructures and interfaces for personalisation so that people can scrutinise and control them. She has created such systems to support people in lifelong, life-wide learning. This ranges from formal education settings to support people in using their long-term ubicomp data to support self-monitoring, reflection and planning and includes medical contexts such as learning communication skills in medical settings. She has integrated this into new forms of interaction, including virtual reality, surface computing, wearables and ambient displays.

Abstract of the talk: There has been a huge amount of research on personalisation. It has also moved well beyond the research lab and is widely used in real-world applications, websites, and much more. A model of the user and their context drives that personalisation. This, like many other forms of AI, has typically been *inscrutable*. This is because

¹Website: crum-workshop.github.io

system builders have failed to prioritise the design of their systems so that the user can scrutinise the key elements of the personalisation process: the data used, the time and context of that data, the user modelling process and the personalisation. As the broad public increasingly calls for better understanding and control of smart systems, we need to establish ways for system builders to focus on scrutability from the design foundations, right through to system building and deployment. This talk outlined a vision for ways to do this, drawing on my team’s previous work across diverse areas, ranging from learning, recommenders and smart buildings.

2.2 Accepted Papers

There were five submissions for the workshop, and each of the submissions was peer-reviewed by two to four members of the programme committee and meta-reviewed by workshop organisers. This section summarises the four papers accepted for in-person presentation and publication.

Doumbia et al. [1] presents a novel dataset on the effects of gait initiation in the context of emotion by music. The paper presents an experimental protocol which uses Spotify’s recommendation lists to generate different lists of music according to user preference for each participant as data was collected on the effect of the music choice in gait initiation with well-defined protocols for control studies and biomechanical variations. Music was used to showcase the importance of emotional context and its role in predicting anticipatory postural adjustments.

Gupta and Bansal [2] propose a lightweight and straightforward neural bag-of-words-based model to predict a user’s return time on an e-commerce platform. This model is compared with the current state-of-the-art models, which are based on recurrent neural networks and temporal point process formulations. The proposed model treats the user activity trail as a bag-of-words embedding model and uses a simple aggregation operation for prediction. The proposed bag-of-words model was tested on interaction log data from a major e-commerce company and found that the proposed model outperforms the complex recurrence-based neural network.

Makhneva et al. [3] contribute a method of integrating time awareness in next-item recommender algorithms. The authors showcase how adding information about the time of predictions can improve the quality of sequential recommender system models. GRU4Rec and TiSASRec were then used on several datasets to test the effectiveness of the proposed method. The preliminary results demonstrate an improvement in some cases.

The work of van Kasteren and Vredenburg [4] is a position paper on context representation in context-aware public transport information systems. The authors argue that human-centred approaches for context modelling are required in addition to data-driven approaches. To that end, the authors argue that “experienced context”, which is shaped by how users perceive a situation, is equally important as the “observed context”, which is based on different contextual signals such as weather or location. The authors conduct a focus group study to support their argument on the importance of incorporating users’ experience in context representation, namely the “experienced context”.

2.3 Panel Discussion

An expert panel on the role of context in personalised systems took place. The panel was moderated by Dipto Barman and Jovan Jeromela. The panellists included Prof. Owen Conlan, Prof. Judith Masthoff, Dr David Massimo, and Dr Bereket Abera Yilma. The panel delved into the intricacies and advancements of capturing and utilising contextual information in various domains. They explored topics ranging from NLP, machine learning, and information retrieval and discussed the latest techniques and models for context representation. The panellists also discussed the challenges associated with context modelling, including temporal, spatial, and semantic dimensions, and explored the potential applications of context-aware systems in fields such as dialogue systems and recommendation engines.

2.4 Workshop Activity: Brainstorming Context

Finally, a workshop activity was conducted in order to distil the learnings from the paper presentations and panel discussions that took place at the workshop. Given that this was the first edition of CRUM, we included a brainstorming activity with the intent of introducing a nuanced perspective on the themes presented in the workshop. The discussion facilitated a deeper understanding of contextual information within intelligent systems, the incorporation of context representation into agent behaviour and its impact in terms of system design with a view towards scrutability. This brainstorming session was guided by Prof. Owen Conlan and the workshop organisers.

Workshop participants were divided into groups of three to four researchers. Each group was asked to first individually identify the role context played in their research and how accounting for context would impact the behaviour of their target system or agent. This was followed by a discussion within the group determining the underlying similarities in how context is represented within their individual domains and examining tractable representations of contextual information so as to be able to determine how it influences the decisions taken by an intelligent system. Finally, each group presented their idea of such a tractable representation and identified potential improvements to existing state-of-the-art based on an externalised representation of contextual phenomena.

3 ORGANISATION

The workshop was chaired by Owen Conlan (ADAPT Centre, Trinity College Dublin) and Judy Kay (University of Sydney). In addition to the co-chairs, the workshop was organised by five PhD candidates: Jovan Jeromela (jeromelj@tcd.ie), Dipto Barman (barmand@tcd.ie), Hassan Zaal (zaalh@tcd.ie), Alok Debnath (debnatha@tcd.ie), and Awais Akbar (aakbar@tcd.ie), all of ADAPT Centre, Trinity College Dublin.

The workshop would not be possible without the generous help of our program committee members, who agreed to volunteer their time to review submitted papers. CRUM 2023 had 24 programme committee members. Ordered alphabetically, they are Rachid Alami (LAAS-CNRS), Thomas Baier (Vrije Universiteit Amsterdam), Robin Burke (University of Colorado Boulder), Gabriele Civitares (University of Milan), Amra Delić (University of Sarajevo), Ivana Dusparic (Trinity College Dublin), Justin Edwards (University College Dublin), Kieran Fraser (Trinity College Dublin), Jasmina Gajcin (Trinity College Dublin), Hanna J. Hauptmann (Utrecht University), Eelco Herder (Utrecht University), Zhongli Filippo Hu (University of Torino), Gerry Lacey (Maynooth University), David Millard (University of Southampton), Julia Neidhardt (TU Wien), Declan O’Sullivan (Trinity College Dublin), Selene Baez Santamaria (Vrije Universiteit Amsterdam), Jeffrey Sardina (Trinity College Dublin), Mete Sertkan (TU Wien), Giovanni Stilo (University of L’Aquila), Peter Knees (TU Wien), Moshe Unger (Tel Aviv University), Piek Th.J.M. Vossen (Vrije Universiteit Amsterdam), and Marko Tkalčić (FAMNIT, University of Primorska). We thank them all wholeheartedly for their valuable contribution.

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4 CONCLUSION

The inaugural workshop, CRUM 2023, marks the initiation of a prospective series of workshops aiming to address contemporary challenges and research avenues pertaining to context representation and user modelling. By fostering the generation of novel ideas, facilitating methodological discussions, and proposing effective solutions, these workshops aspire to enhance the effective utilisation of context in user-centric applications.

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