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# AI Driven Online Advertising: Market Design, Generative AI, and Ethics

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## ABSTRACT

Online advertising contributes a considerable part of the tech sector's revenue, and has been remarkably influencing the public agenda. With evolving developments, AI is playing an increasingly significant role in online advertising. We propose to create a forum for researchers, developers, users, ventures, policymakers, and other stakeholders to exchange ideas, research, innovations, etc. with emphasis on (1) AI driven mechanism design for distributing advertisements, (2) generative AI for creating content in advertisements, such as the promotion images/videos, and (3) ethics issues, especially in political advertisements, such as user privacy, fairness, hating speech, misinformation, etc. Relevant but not mentioned areas are also much encouraged. We plan to organize a half-day workshop.

## CCS CONCEPTS

• **Information systems** → **Online advertising**; • **Theory of computation** → **Algorithmic game theory and mechanism design**; • **Computing methodologies** → **Computer vision**; **Natural language processing**; **Computer graphics**; • **Social and professional topics** → **Computing / technology policy**.

## KEYWORDS

Online Advertising, E-Commerce, Economics, Algorithmic Game Theory, Mechanism Design, Auction, Generative AI, Ethics

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## 1 INTRODUCTION

Online advertising has contributed a considerable part of the revenue of the tech sector. In 2022, Google reported US \$224 billion in advertising revenues [1], while Meta gained US \$113 billion [3]. PwC estimated that the entire sector will see revenues of US \$723.6 billion in 2026 [4]. Political online advertisements have also been remarkable in influencing the public agenda. AI has been an evolving game changer in online advertising, from advertisement distribution to content generation, and deserves serious discussion.

The objectives of this workshop are to create an inclusive, interdisciplinary forum that brings together researchers, developers, users, industry partners, ventures, policymakers and other stakeholders to discuss the responsible, ethical use of AI for online advertising. The workshop aims to facilitate the exchange of cutting-edge ideas, innovations, research, etc. at the intersection of ethical AI and AI-driven advertising. It will cover the full spectrum of interactions between responsible and ethical AI [2], economics, algorithmic game theory, mechanism design, auctions, generative AI, e-commerce, ethics, law, etc. We seek to empower vibrant, robust discussion, and collaboration around advancing responsible AI in online advertising.

## 2 FORMAT

This workshop will be a half-day event consisting of 4 keynote talks (30 min each), 3 contributed talks (30 min each), and 2 networking sessions with light refreshments provided.

## 3 TOPICS AND THEMES

The workshop welcomes contributions on any subject related to AI in digital advertising, particularly focusing on the following non-exhaustive list of topics. We strongly support proposals that extend beyond these topics, provided they are in line with our goals.

**Market Design:**

- Economics theory
- Algorithmic game theory
- Mechanism design
- Auction
- Matching market
- Automated bidding strategies and bid optimization
- Advertising exchanges and advertisement allocation platforms
- Competition, cooperation, and stability in advertisement markets
- Incentive alignment in online advertising ecosystems
- Fraud and trust in advertising networks

**Generative AI:**

- AI-generated content for advertisements
- Generative models for images, video, audio, text, etc.
- Image and video editing using generative networks
- Evaluating quality, diversity, and bias in AI-generated content
- Controllable generation and personalisation
- Impact on creativity and media professionals

**Ethics:**

- Transparency, explainability, and accountability
- Privacy preserving in targeted advertising
- Algorithmic fairness in advertisement delivery and pricing
- Mitigating harmful content - toxic, violent, hateful
- Combating misinformation in online advertising
- Political advertising and ethical regulation
- Broader societal impacts of AI in online advertising

**4 TENTATIVE PROGRAM COMMITTEE**

Three organizers will chair the review in the three areas respectively:

**Chair in Market Design:** Aris Filos-Ratsikas

**Chair in Generative AI:** Mengnan Du

**Chair in Ethics:** Lu Cheng

We have a fairly large Program Committee with diverse backgrounds (more are expected, depending upon the number of submissions received). Over half of them have confirmed. We have taken due diligent steps for inclusion and diversity, in terms of demography, geography, seniority, and research areas. We are proud that over 30% of the committee are women.

**5 AUDIENCE AND PAPER SUBMISSIONS**

We expect to hold a **medium-size** event.

**Audience:** We expect around **100** researchers and developers with backgrounds in AI, Economics, Algorithmic Game Theory, Mechanism Design, Auction, Online Advertising, Generated AI, E-Commerce, and other related areas. We also expect the event to attract web users, developers, ventures, policymakers, and so on.

**Paper Submission:** Submission can be in the form of long papers of **8** pages and shorter papers of **4** pages (excluding references & appendix). **1** additional content page is allowed for the camera-ready version. Supplementary material such as appendices, proofs,

and derivations may be attached to the paper. However, reviewers are not required to review these materials.

**Archival & Non-Archival Options:** Both Archival or Non-Archival submissions are accepted. Archival papers will be included in the workshop proceedings, while only the title and abstract of non-archival papers will be recorded. Non-archival submissions can include ongoing work and can be subsequently or concurrently submitted to other venues. The archival status will only need to be determined after a paper has been accepted.

**6 ORGANISERS**

We have a strong organisation team with diverse backgrounds. Our bios are as follows.

**Fengxiang He** is a Lecturer at Artificial Intelligence and its Application Institute, School of Informatics, University of Edinburgh, and also an Affiliate of Edinburgh's Institute for Adaptive and Neural Computation, Edinburgh Future Institute, and Edinburgh Centre for Financial Innovations. His research interest is in trustworthy AI, particularly, deep learning theory, theory of decentralised learning, symmetry in learning theory, learning theory in game-theoretical problems, and their applications in economics and finance. He is a member of IEEE's Global Initiative on XR Ethics, Ethical Assurance of Data-Driven Technologies for Mental Healthcare, AI/ML Terminology and Data Formats Working Group, and Decentralized Metaverse Initiative. He is an Organiser and the Finance Chair of the AAAI 2023 Workshop on Responsible Language Models, an invited speaker of SIAM Conference on Optimization 2023, and an Area Chair of ICML, UAI, AISTATS, and ACML.

**Mengnan Du** is an Assistant Professor of Data Science at New Jersey Institute of Technology. He earned his Ph.D. in Computer Science from Texas A&M University. He has previously worked with Microsoft Research, Adobe Research, Intel, etc. His research interests lie within the extensive domain of trustworthy machine learning, with a particular emphasis on explainability, fairness, robustness, privacy, and security. Additionally, he is particularly intrigued by the intersection of trustworthy machine learning with large language models (LLMs). He has had more than 50 papers published in prestigious venues such as NeurIPS, AAAI, KDD, WWW, ICLR, and ICML. He received over 3,400 citations with an H-index of 18. He was the WSDM 2022 Registration Chair, and he has served on the senior program committees of IJCAI 2023, the program committees of conferences such as NeurIPS, ICML, and ICLR, as well as as the reviewer for journals such as Nature Machine Intelligence and Nature Communications. He is the co-organizer for the AAAI-24 Workshop on Responsible Language Models (ReLM 2024). Mengnan Du's profile as an organizer brings significant expertise in AI ethics and social good, ensuring an impactful and inclusive event. His research excellence and active engagement in the community make him an ideal facilitator for the proposed workshop.

**Aris Filos-Ratsikas** is a Lecturer in Algorithms and Complexity and Deputy Director of the Laboratory for Foundations of Computer Science at the University of Edinburgh. His research lies in the intersection of theoretical computer science and AI, with an emphasis on algorithms and computational complexity. In particular, he is interested in problems related to social choice theory, fair division, competitive markets, game theory and mechanism design.

He obtained his PhD degree from the Computer Science Department of Aarhus University, Denmark in 2015. He was a Lecturer at the University of Liverpool, a postdoctoral researcher at École polytechnique fédérale de Lausanne, and a postdoctoral research assistant at the University of Oxford. He is a Program (co-)Chair of SAGT, an Area Chair of EC, a Senior Program Committee Member of WINE, AAMAS, and AAAI, and an Organiser of Frontiers in Economics and Computation - UK (ECUK) Seminar Series, ICALP 2022 Workshop on Recent Advances on Total Search Problems, EC 2021 Workshop on Fair Resource Allocation: Concepts, Algorithms and Complexity, EC 2020 Workshop on the Distortion and Information-Efficiency Tradeoffs, ICALP 2019 Workshop on Theoretical Aspects of Fairness, and Indoor Games: 1st UK Workshop on Algorithmic Game Theory and Mechanism Design.

**Lu Cheng** is an assistant professor in the Department of Computer Science at the University of Illinois Chicago (UIC). Her research lies in socially responsible AI and AI for social good. Lu's work has appeared in and been invited to top venues for AI, data mining, and NLP. She is the web chair of WSDM'22 and a senior program committee member of AAAI'22-24. Lu was the recipient of the 2022 International Neural Network Society Doctoral Dissertation Award Runnerup, 2022 CS Outstanding Doctoral Student, 2021 ASU Engineering Dean's Dissertation Award, 2020 ASU Graduate Outstanding Research Award, 2021-22 ASU CIDSE Doctoral Fellowship, IBM Ph.D. Social Good Fellowship, and Visa Research Scholarship. With Lu's experience, the workshop can expect meticulous planning, thoughtful curation of topics and speakers, and a supportive environment for all participants, especially those from minority groups such as females, ensuring a successful and impactful event.

**Qingquan Song** is a machine learning and relevance engineer in the AI Optimization team at LinkedIn. He received his PhD in computer science from Texas A&M University. His research interests are large model acceleration and compression, automated machine learning, dynamic data analysis, tensor decomposition, and their applications in recommender systems and social networks. These build foundations of developing AI for online advertisement distribution in the evolving cyber space. He is one of the authors of books *AutoKeras* and *Automated Machine Learning in Action* with Manning Publication. His papers have been published at major data mining and machine learning venues, including KDD, the Web conference, NeurIPS, Transactions on Knowledge Discovery from Data (TKDD).

**Min Lin** is a Principal Research Scientist at Sea AI Lab, Sea Ltd, Singapore. He is also an Adjunct Assistant Professor in School of Computing, National University of Singapore. He received PhD from School of Integrative Science and Engineering, National University of Singapore in 2015. He worked in Qihoo 360 on search engine and recommendation systems from 2015 to 2017. After that he joined Quebec Institute of Artificial Intelligence (Mila) from 2017 to 2021, where he worked as a postdoc researcher on continual and online learning. The machine learning topics he is interested in include online learning, generative models and non-parametric models. He also works on machine learning systems covering topics of differentiable programming, distributed machine learning and reinforcement learning etc. He recently started working on quantum chemistry where he aims to transform density functional theory with recent tools developed in the AI field. His research and development experiences provide unique insights into how AI technologies would drive the distribution of advertisements and the generation of content wherein in the online environments.

**John Vines** is a Professor and Chair of Design Informatics in the School of Informatics at the University of Edinburgh. He (co-)directs UKRI AI Centre for Doctoral Training in Responsible and Trustworthy in-the-world NLP, the Institute for Design Informatics (the University's interdisciplinary centre for expertise on designing data-driven technologies), the Centre for Investing Innovation (a partnership between abrdn and the University of Edinburgh), and the MSc in Design Informatics programme. His research is in the fields of human-computer interaction and interaction design, and focuses on how people experience and use digital and data-driven technologies in their everyday lives. His projects often take a participatory and research through design approach, involving designing prototypes with people, users and stakeholders and studying the use of new technologies in real world contexts. He works on projects across a wide-range of subjects, but has specific expertise in technology design in relation to: ageing and the lifecourse; personal and community health and wellbeing; personal finance and socially inclusive economies; and civic engagement and civil society.

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