

# Kai-Cheng Yang

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CONTACT INFORMATION	Luddy School of Informatics, Computing, and Engineering Indiana University Bloomington 1015 E. 11th Street Bloomington, IN 47408	yang3kc@gmail.com kaichengyang.me Google Scholar
EDUCATION	Ph.D., Informatics, Indiana University M.S., Theoretical Physics, Lanzhou University (China) B.S., Theoretical Physics, Lanzhou University (China)	Jun. 2023 Jun. 2017 Jun. 2014
RESEARCH INTERESTS	<b>Current focuses</b> <ul style="list-style-type: none"><li>• <b>Generative AI in social contexts:</b> combating misinformation [R2], enhancing social bots [R1]</li><li>• <b>Social media bot:</b> detection (<b>Botometer</b><sup>®</sup>) [J3, C2, C3, J18]; characterization [J5, W6]; human perception [R4, J13];</li><li>• <b>Online misinformation:</b> prevalence [J1, J9, W4]; dissemination [J21]; real-world implications [J7];</li></ul> <b>Past projects</b> <ul style="list-style-type: none"><li>• <b>U.S. opioid epidemic:</b> intervention policy evaluation [J11]; high-risk patients [J2, J6, J19]; impact of COVID-19 [J10];</li><li>• <b>Network science:</b> embedding [J14–J16]; spreading phenomenon [R3, J20, J22]</li></ul>	
HONORS & AWARDS	IU Informatics Luddy Graduate Research Award (\$500) IU Luddy Dean’s Office Conference Travel Award (\$1,000) Affiliate, <b>Center for Information, Technology, and Public Life</b> , UNC-Chapel Hill IU GISA Conference Travel Award (\$300) Best Reviewer Award at AAAI ICWSM 2022 Selected for <b>Future Leaders Summit 2022</b> , University of Michigan IU Luddy Outstanding Research Award (\$500) IU School of Public Health Big Idea Challenge (\$250) IU Informatics Ph.D. Student Conference Travel Award (\$1,000) IU GISA Conference Travel Award (\$700) IU Informatics Ph.D. Student Conference Travel Award (\$1,000) <b>NSF Research Trainee scholarship</b> in Complex Networks and Systems (\$5,000)	2023 2023 2022 2022 2022 2022 2021 2020 2020 2019 2019 2018
PUBLICATIONS	<sup>†</sup> as corresponding author	
GOOGLE SCHOLAR	<b>Journal Articles</b> <ol style="list-style-type: none"><li>J1. Pierri, F., DeVerna, M. R., <b>Yang, K.-C.</b>, Axelrod, D., Bryden, J. &amp; Menczer, F. One Year of COVID-19 Vaccine Misinformation on Twitter: Longitudinal Study. <i>Journal of Medical Internet Research</i> <b>25</b>, e42227 (2023).</li><li>J2. <b>Yang, K.-C.</b>, Aronson, B., Odabas, M., Ahn, Y.-Y. &amp; Perry, B. L. Comparing measures of centrality in bipartite patient-prescriber networks: A study of drug seeking for opioid analgesics. <i>PLoS ONE</i> <b>17</b>, e0273569 (2022).</li><li>J3. <b>Yang, K.-C.</b><sup>†</sup>, Ferrara, E. &amp; Menczer, F. Botometer 101: Social bot practicum for computational social scientists. <i>Journal of Computational Social Science</i> <b>5</b>, 1511–1528 (2022).</li></ol>	

- J4. **Yang, K.-C.<sup>†</sup>**, Hui, P.-M. & Menczer, F. How Twitter data sampling biases U.S. voter behavior characterizations. *PeerJ Computer Science* **8**, e1025 (2022).
- J5. Duan, Z., Li, J., Lukito, J., **Yang, K.-C.**, Chen, F., Shah, D. V. & Yang, S. Algorithmic Agents in the Hybrid Media System: Social Bots, Selective Amplification, and Partisan News about COVID-19. *Human Communication Research* **48**, 516–542 (2022).
- J6. Perry, B. L., Odabas, M., **Yang, K.-C.**, Lee, B., Kaminski, P., Aronson, B., Ahn, Y.-Y., Oser, C. B., Freeman, P. R. & Talbert, J. C. New means, new measures: Assessing prescription drug seeking indicators over ten years of the opioid epidemic. *Addiction* **117**, 195–204 (2022).
- J7. Pierri, F., Perry, B. L., DeVerna, M., **Yang, K.-C.**, Flammini, A., Menczer, F. & Bryden, J. Online misinformation is linked to early COVID-19 vaccination hesitancy and refusal. *Scientific Reports* **12**, 5966 (2022).
- J8. **Yang, K.-C.**, Lee, B., Ahn, Y.-Y. & Perry, B. L. Use of and Comorbidities Associated With Diagnostic Codes for COVID-19 in US Health Insurance Claims. *JAMA Network Open* **4**, e2124643 (2021).
- J9. **Yang, K.-C.<sup>†</sup>**, Pierri, F., Hui, P.-M., Axelrod, D., Torres-Lugo, C., Bryden, J. & Menczer, F. The COVID-19 Infodemic: Twitter versus Facebook. *Big Data & Society* **8**, 20539517211013861 (2021).
- J10. Lee, B., **Yang, K.-C.**, Kaminski, P., Ahn, Y.-Y., Peng, S., Odabas, M., Gupta, S., Green, H. & Perry, B. L. Substitution of Nonpharmacologic Therapy With Opioid Prescribing for Pain During the COVID-19 Pandemic. *JAMA Network Open* **4**, e2138453 (2021).
- J11. Lee, B., Zhao, W., **Yang, K.-C.**, Ahn, Y.-Y. & Perry, B. L. Systematic Evaluation of State Policy Interventions Targeting the US Opioid Epidemic, 2007-2018. *JAMA Network Open* **4**, e2036687 (2021).
- J12. Wen, C., Pacheco, D., **Yang, K.-C.** & Menczer, F. Neutral bots probe political bias on social media. *Nature Communications* **12**, 5580 (2021).
- J13. Yan, H., **Yang, K.-C.**, Menczer, F. & Shanahan, J. Asymmetrical Perceptions of Partisan Political Bots. *New Media & Society* **23**, 3016–3037 (2021).
- J14. Yoon, J., **Yang, K.-C.**, Jung, W.-S. & Ahn, Y.-Y. Persona2vec: A Flexible Multi-role Representations Learning Framework for Graphs. *PeerJ Computer Science* **7**, e174 (2021).
- J15. Zhang, Y.-J., **Yang, K.-C.** & Radicchi, F. Model-free hidden geometry of complex networks. *Physical Reviews E* **103**, 012305 (2021).
- J16. Zhang, Y.-J., **Yang, K.-C.** & Radicchi, F. Systematic comparison of graph embedding methods in practical tasks. *Physical Reviews E* **104**, 044315 (2021).
- J17. Pasquetto, I. V., Swire-Thompson, B., Amazeen, M. A., Benevenuto, F., Brashier, N., Bond, R. M., Bozarth, L. C., Budak, C., Ecker, U. K., ... & **Yang, K.-C.** Tackling misinformation: What researchers could do with social media data. *The Harvard Kennedy School (HKS) Misinformation Review* **1** (2020).
- J18. **Yang, K.-C.**, Varol, O., Davis, C. A., Ferrara, E., Flammini, A. & Menczer, F. Arming the public with artificial intelligence to counter social bots. *Human Behavior and Emerging Technologies*, e115 (2019).
- J19. Perry, B. L., **Yang, K.-C.**, Kaminski, P., Odabas, M., Park, J., Martel, M., Oser, C. B., Freeman, P. R., Ahn, Y.-Y. & Talbert, J. Co-prescription network reveals social dynamics of opioid doctor shopping. *PLoS ONE* **14**, e0223849 (2019).

- J20. Zhang, Y.-J., Wu, Z.-X., Holme, P. & **Yang, K.-C.** Advantage of Being Multicomponent and Spatial: Multipartite Viruses Colonize Structured Populations with Lower Thresholds. *Physical Reviews Letters* **123**. (Editors' Suggestion), 138101 (2019).
- J21. Shao, C., Ciampaglia, G. L., Varol, O., **Yang, K.-C.**, Flammini, A. & Menczer, F. The spread of low-credibility content by social bots. *Nature Communications* **9**, 4787 (2018).
- J22. **Yang, K.-C.**, Wu, Z.-X., Holme, P. & Nonaka, E. Expansion of cooperatively growing populations: Optimal migration rates and habitat network structures. *Physical Reviews E* **95**, 012306 (2017).

#### Peer-reviewed Conference Proceedings

- C1. Torres-Lugo, C., **Yang, K.-C.** & Menczer, F. *The Manufacture of Partisan Echo Chambers by Follow Train Abuse on Twitter* in *Proceedings of the International AAAI Conference on Web and Social Media (ICWSM)* **16** (Atlanta, GA, USA, 2022), 1017–1028.
- C2. **Yang, K.-C.**<sup>†</sup>, Varol, O., Hui, P.-M. & Menczer, F. *Scalable and Generalizable Social Bot Detection through Data Selection* in *Proceedings of the AAAI Conference on Artificial Intelligence (AAAI)* **34** (New York, NY, USA, 2020), 1096–1103.
- C3. Sayyadiharikandeh, M., Varol, O., **Yang, K.-C.**, Flammini, A. & Menczer, F. *Detection of Novel Social Bots by Ensembles of Specialized Classifiers* in *Proceedings of the 29th ACM International Conference on Information & Knowledge Management (CIKM)* (Virtual, 2020), 2725–2732.

#### Peer-reviewed Workshop/Demo/Dataset/Software Papers

- W1. Aiyappa, R., DeVerna, M. R., Pote, M., Tran Truong, B., Zhao, W., Axelrod, D., Pessianzadeh, A., Kachwala, Z., Kim, M., Can Seckin, O., Kim, M., Gandhi, S., Manikonda, A., Pierri, F., Menczer, F. & **Yang, K.-C.**<sup>†</sup>. *A Multi-Platform Collection of Social Media Posts about the 2022 U.S. Midterm Elections* in *Proceedings of the International AAAI Conference on Web and Social Media (ICWSM)* **17** (Limassol, Cyprus, 2023), 981–989.
- W2. DeVerna, M. R., Pierri, F., Truong, B. T., Bollenbacher, J., Axelrod, D., Loynes, N., Torres-Lugo, C., **Yang, K.-C.**, Menczer, F. & Bryden, J. *CoVaxxy: A Collection of English-Language Twitter Posts About COVID-19 Vaccines* in *Proceedings of the International AAAI Conference on Web and Social Media (ICWSM)* **15** (Virtual, 2021), 992–999.
- W3. **Yang, K.-C.**, Aronson, B. & Ahn, Y.-Y. BiRank: Fast and Flexible Ranking on Bipartite Networks with R and Python. *Journal of Open Source Software* **5**, 2315 (2020).
- W4. **Yang, K.-C.**<sup>†</sup>, Torres-Lugo, C. & Menczer, F. *Prevalence of Low-Credibility Information on Twitter During the COVID-19 Outbreak* in *Proceedings of the ICWSM International Workshop on Cyber Social Threats (CySoc)* (Virtual, 2020).
- W5. Hui, P.-M., **Yang, K.-C.**, Torres-Lugo, C. & Menczer, F. *BotSlayer: DIY Real-Time Influence Campaign Detection* in *Proceedings of the International AAAI Conference on Web and Social Media (ICWSM)* **14** (Virtual, 2020), 980–982.
- W6. **Yang, K.-C.**<sup>†</sup>, Hui, P.-M. & Menczer, F. *Bot Electioneering Volume: Visualizing Social Bot Activity During Elections* in *Companion Proceedings of The 2019 World Wide Web Conference (WWW)* (San Francisco, CA, USA, 2019), 214–217.
- W7. Hui, P.-M., **Yang, K.-C.**, Torres-Lugo, C., Monroe, Z., McCarty, M., Serrette, B., Pentchev, V. & Menczer, F. BotSlayer: real-time detection of bot amplification on Twitter. *Journal of Open Source Software* **4**, 1706 (2019).

#### Under Review

- R1. **Yang, K.-C.<sup>†</sup>** & Menczer, F. Anatomy of an AI-powered malicious social botnet. *Preprint arXiv:2307.16336* (2023).
- R2. **Yang, K.-C.<sup>†</sup>** & Menczer, F. Large language models can rate news outlet credibility. *Preprint arXiv:2304.00228* (2023).
- R3. Xue, L., **Yang, K.-C.**, Cui, P.-B. & Di, Z. Network localization strength regulates innovation diffusion with macro-level social influence. *Preprint arXiv: 2301.00151* (2023).
- R4. Yan, H., **Yang, K.-C.**, Shanahan, J. & Menczer, F. Exposure to social bots amplifies perceptual biases and regulation propensity. *OSF preprint*. <https://doi.org/10.31219/osf.io/ap2qf> (2022).

### Book chapters

- B1. Yan, H. & **Yang, K.-C.<sup>†</sup>**. *Handbook of Critical Studies of Artificial Intelligence* (ed Lindgren, S.) chap. The landscape of social bot research: a critical appraisal. <https://doi.org/10.31219/osf.io/3cf4j> (Edward Elgar, 2023).

### Other Works

- O1. **Yang, K.-C.** & Menczer, F. *How many bots are on Twitter? The question is difficult to answer and misses the point*. The Conversation (<https://theconversation.com/how-many-bots-are-on-twitter-the-question-is-difficult-to-answer-and-misses-the-point-183425>). 2022.

## TOOLS

### Observatory on Social Media (OSoMe)

- **Botometer<sup>®</sup>** [J3, C3, J18], **BotometerLite** [C2]: bot detection tools handling ~ 250,000 daily requests from researchers, journalists, and social media users; used by Elon Musk's team in his dispute with Twitter (via **CNN**, **BBC**, and **Yahoo! Finance**)
- **BotAmp** [J3]: bot amplification level comparison
- **Midterm 2022 dashboard**: dashboard for US 2022 midterm elections Twitter discussion
- **Hoaxy<sup>®</sup>**: visualization of information spreading online with tens of thousands of users
- **CoVaxxy** [W2]: dashboard for COVID-19 vaccine Twitter discussion

### Network Science

- **Persona2vec** (**GitHub**) [J14]: multi-role representations embedding for networks
- **BiRank** (**GitHub**, **PyPI**, **CRAN**) [W3]: bipartite network PageRank

## PRESENTATIONS Tutorials and Demos

- Identifying Social Media Manipulation with OSoMe Tools  
*Computation + Journalism Conference – C+J 2022 (Virtual)* Jun. 2022  
*IC<sup>2</sup>S<sup>2</sup> 2020 (Virtual)* Jul. 2020
- Introduction to **Botometer<sup>®</sup>**  
*Visit by former Dominican Republic president Leonel Fernández (Bloomington, USA)* Apr. 2022  
*Invited demo at the Learning Informatics Lab, University of Minnesota (Virtual)* Mar. 2022  
*Knight Research Network Tool Demonstration Day (Virtual)* Oct. 2021
- Fast and Flexible Ranking on Bipartite Networks with Python and R  
*Indiana University Network Institute workshop series (Bloomington, USA)* Nov. 2021

### Talks

- LLMs and cyber social threats: Good, bad, and ugly [R1, R2]  
*Invited talk at Workshop on Applications of LLMs in Media (Beijing, China)* Jul. 2023  
*Invited talk at School of Journalism, Fudan University (Shanghai, China)* Jun. 2023

- Fantastic bots and how to find them [J3, R4, J12, J13, W4, C2, C3, J18]  
*Invited talk at Yangtze Delta Region Institute (Huzhou), University of Electronic Science and Technology of China (Huzhou, China)* Aug. 2023  
*Invited talk at International Academic Center of Complex Systems, Beijing Normal University – Zhuhai (Zhuhai, China)* Jul. 2023  
*Invited talk at Summer Institutes in Computational Social Science 2023 – Beijing (Beijing, China)* Jul. 2023  
*Invited talk at New Media Research Center, Beijing Normal University (Beijing, China)* Jul. 2023  
*Invited talk at Social Computing Group, University of Zurich (Virtual)* Feb. 2023  
*Invited talk at Computational Methods Research Group, UW-Madison (Virtual)* Feb. 2023
- The COVID-19 Infodemic: prevalence, adverse actors, and real-world impact [J7, J9, W4]  
*2022 INFORMS Annual Meeting (Indianapolis, USA)* Oct. 2022  
*Invited talk at Computational Social Science Lab at Penn (Virtual)* Jun. 2022  
*Future Leaders Summit 2022 (Ann Arbor, USA)* Apr. 2022
- The COVID-19 Infodemic: Twitter versus Facebook [J9]  
*Social Media Lab Guest Speaker Series (Virtual)* Oct. 2021  
*IC<sup>2</sup>S<sup>2</sup> 2021 (Virtual)* Jul. 2021  
*NetSci 2021 (Virtual)* Jul. 2021  
*Computation + Journalism Symposium – C+J 2021 (Virtual)* Feb. 2021  
*The 3rd North American Social Networks Conference – NASN 2021 (Virtual)* Jan. 2021
- Bipartite Network Centrality Comparison: A Study of Opioid Doctor Shopping [J2]  
*IC<sup>2</sup>S<sup>2</sup> 2020 (Virtual)* Jul. 2020
- Prevalence of Low-Credibility Information on Twitter During the COVID-19 Outbreak [W4]  
*CySoc 2020 (Virtual)* Jun. 2020
- BotometerLite [C2]  
*IC<sup>2</sup>S<sup>2</sup> 2020 (Virtual)* Jul. 2020  
*AAAI 2020 (New York, USA)* Feb. 2020
- Bot Electioneering Volume [W6]  
*CyberSafety 2019 (San Francisco, USA)* May 2019

WORKING  
EXPERIENCE

**Analysis Group, MA, USA**  
 Consultant for the trial of Elon Musk vs. Twitter Fall 2022

**Indiana University, IN, USA**  
 Research assistant, Botometer project Fall 2022, Spring 2023  
 Research assistant, doctor shopping project Fall 2018 – Spring 2022

**TikTok Inc. (ByteDance), CA, USA**  
 Security engineering intern Summer 2021

TEACHING

**Indiana University, IN, USA**  
 Guest lecturer, INFO-T100 Social Media Manipulation 101 Fall 2022

**Indiana University, IN, USA**  
 Associate instructor, INFO-I590 Applied Data Science Fall 2017, Spring 2018

SERVICE

**Guest Editor:** EPJ Data Science: Special Issue on Computational Approaches for Cyber Social Threats;  
**Workshop Organizer:** International Workshop on Cyber Social Threats 2022 (CySoc) @

ICWSM22; International Workshop on Cyber Social Threats 2023 (CySoc) @ WebConf23;

**Journal Reviewer:** ACM Computing Surveys (23); ACM Digital Threats: Research and Practice (21); Behaviour & Information Technology (23); Big Data & Society (21); BMC Digital Health (23); Computers & Security (21); Decision Support Systems (22); EPJ Data Science (23); Frontiers in Public Health (22); HKS Misinformation Review (23); Humanities & Social Sciences Communications (21-23); IEEE Internet Computing (21); IEEE Transactions on Knowledge and Data Engineering (21); IEEE Transactions on Network Science and Engineering (23); Information, Communication and Society (21); Information Processing & Management (21); International Communication Gazette (21); International Journal of Data Science and Analytics (21); International Journal of Human-Computer Interaction (22); International Journal of Information Technology & Decision Making (21); JMIR Infodemiology (22, 23); JMIR Public Health and Surveillance (22); Journal of Computational Social Science (22); Journal of Medical Internet Research (22, 23); Journal of the Royal Society Interface (22); New Media and Society (23); Online Social Networks and Media (21, 22); PeerJ Computer Science (20, 22); PLoS ONE (21, 22, 23); PNAS (23); Political Research Exchange (21); Progress in Artificial Intelligence (23); Royal Society Open Science (22); Scientific Reports (22, 23); Social Network Analysis and Mining (21, 22); Socius (22); Telematics and Informatics (23);

**Conference Reviewer:** CSCW (22, 23); CIKM (21-23); ICWSM (20-22); WebSci (22); WWW (22);

#### IN THE PRESS

#### Selected Quotations and Interviews

- Social media in general  
*Reuters (Jul. 2023); The Verge (May 2023); TechCrunch (Feb. 2023); CNN (Feb. 2023); Tech Policy Press (Feb. 2023);*
- Social bots and other inauthentic actors on social media  
*WIRED (Sep. 2022); WIRED (Sep. 2022); BBC (Aug. 2022); Ars Technica (Aug. 2022); Yahoo! Finance (Aug. 2022); CNN (Aug. 2022); Yahoo! Finance (Aug. 2022); CNN (Jun. 2022); The Wall Street Journal (Jun. 2022); The Washington Post (May 2022); Politico (May 2022); Business Insider (May 2022); Yahoo! News (May 2022); Spectrum News (Apr. 2022);*
- Online misinformation  
*WISH-TV (Sep. 2022); IEEE Spectrum (Jul. 2020);*

#### Selected Media Coverage of My Works

- AI-powered social bots [R1]  
*Tech Policy Press (Aug. 2023);*
- Botometer® [C3, J18] & BotAmp  
*Forbes (Aug. 2023); The Washington Post (Jun. 2023); Business Insider (May 2023); i (May 2023); The Hill (May 2023); Vice (Apr. 2023); PEN America Mar. 2023; ABC Action News (Jan. 2023); Poder360 (Jan. 2023); Newsweek (Dec. 2022); Business Insider (Nov. 2022); The Daily Star (Nov. 2022); USA Today (Oct. 2022); Daily Maverick (Oct. 2022); CNN (Oct. 2022); The Washington Times (Sep. 2022); The Economic Times (Sep. 2022); CNN (Sep. 2022); Quotidiano Nazionale (Aug. 2022); The Guardian (Aug. 2022); The National Interest (Aug. 2022); The Verge (Aug. 2022); Yahoo! Finance (Aug. 2022); CNN (Aug. 2022); CNBC (Aug. 2022); Washington Examiner (Aug. 2022); Engadget (Aug. 2022); The Washington Post (Aug. 2022); The New York Times (Aug. 2022); Inc. Magazine (Aug. 2022); Newsweek (Aug. 2022); Snopes (Jul. 2022); USA Today (Jun. 2022); Slate (Jun. 2022); Forbes (Jun. 2022); Wired (May 2022); The Washington Post (May 2022); Los Angeles Times (Apr. 2022);*
- CoVaxxy [W2]  
*Washington Examiner (Jun. 2023); The New York Times (May 2022); AP News (Dec. 2021); USA Today (Mar. 2021);*

- Online misinformation is linked to early COVID-19 vaccination hesitancy and refusal [J7]  
*The Hill* (Feb. 2023); *Global Citizen* (Aug. 2022); *Medical News Today* (Aug. 2022); *Time* (May 2022); *News-Medical* (May 2022); *Tech Policy Press* (Apr. 2022); *Slate* (Apr. 2022);
- Neutral bots probe political bias on social media [J12]  
*The Hill* (Feb. 2023); *NBC News* (Apr. 2022); *Metro* (Apr. 2022); *Rolling Stone* (Apr. 2022);
- COVID-19 Infodemic on Twitter and Facebook [J9]  
*News 5* (Jan. 2022); *The Conversation* (Jul. 2021);
- Substitution of Nonpharmacologic Therapy With Opioid Prescribing for Pain During the COVID-19 Pandemic [J10]  
*Clinical Pain Advisor* (Jan. 2022); *Everyday Health* (Dec. 2021); *Health Day* (Dec. 2021);
- Systematic evaluation of state policy interventions targeting the US opioid epidemic [J11]  
*MedPage Today* (Jan. 2022); *U.S. Pharmacist* (Mar. 2021); *News-Medical* (Feb. 2021);
- Hoaxy<sup>®</sup>  
*MakeUseOf* (Jan. 2023); *MIT Technology Review* (Dec. 2022); *Media Matters for America* (Dec. 2022); *The Conversation* (Oct. 2022); *Bloomberg* (Nov. 2020); *NBC News* (Feb. 2020);

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