# Kai-Cheng Yang

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CONTACT
INFORMATION

Luddy School of Informatics, Computing, and Engineering
Indiana University Bloomington
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EDUCATION

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|---|---|
| Ph.D., Informatics, Indiana University | Jun. 2023 |
| M.S., Theoretical Physics, Lanzhou University (China) | Jun. 2017 |
| B.S., Theoretical Physics, Lanzhou University (China) | Jun. 2014 |

RESEARCH
INTERESTS

**Current focuses**

- **Generative AI in social contexts**: combating misinformation [R2], enhancing social bots [R1]
- **Social media bot**: detection (Botometer®) [J3, C2, C3, J18]; characterization [J5, W6]; human perception [R4, J13];
- **Online misinformation**: prevalence [J1, J9, W4]; dissemination [J21]; real-world implications [J7];

**Past projects**

- **U.S. opioid epidemic**: intervention policy evaluation [J11]; high-risk patients [J2, J6, J19]; impact of COVID-19 [J10];
- **Network science**: embedding [J14–J16]; spreading phenomenon [R3, J20, J22]

HONORS &
AWARDS

| | |
|---|---|
| IU Informatics Luddy Graduate Research Award ($500) | 2023 |
| IU Luddy Dean's Office Conference Travel Award ($1,000) | 2023 |
| Affiliate, Center for Information, Technology, and Public Life, UNC-Chapel Hill | 2022 |
| IU GISA Conference Travel Award ($300) | 2022 |
| Best Reviewer Award at AAAI ICWSM 2022 | 2022 |
| Selected for Future Leaders Summit 2022, University of Michigan | 2022 |
| IU Luddy Outstanding Research Award ($500) | 2021 |
| IU School of Public Health Big Idea Challenge ($250) | 2020 |
| IU Informatics Ph.D. Student Conference Travel Award ($1,000) | 2020 |
| IU GISA Conference Travel Award ($700) | 2019 |
| IU Informatics Ph.D. Student Conference Travel Award ($1,000) | 2019 |
| NSF Research Trainee scholarship in Complex Networks and Systems ($5,000) | 2018 |

PUBLICATIONS
GOOGLE SCHOLAR

†as corresponding author

**Journal Articles**

J1. Pierri, F., DeVerna, M. R., **Yang, K.-C.**, Axelrod, D., Bryden, J. & Menczer, F. One Year of COVID-19 Vaccine Misinformation on Twitter: Longitudinal Study. *Journal of Medical Internet Research* **25,** e42227 (2023).

J2. **Yang, K.-C.**, Aronson, B., Odabas, M., Ahn, Y.-Y. & Perry, B. L. Comparing measures of centrality in bipartite patient-prescriber networks: A study of drug seeking for opioid analgesics. *PLoS ONE* **17,** e0273569 (2022).

J3. **Yang, K.-C.**†, Ferrara, E. & Menczer, F. Botometer 101: Social bot practicum for computational social scientists. *Journal of Computational Social Science* **5,** 1511–1528 (2022).

J4. **Yang, K.-C.**[†], 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.**[†], 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.**[†], 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.**[†]. *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.**[†], 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.**[†], 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.**[†] & Menczer, F. Anatomy of an AI-powered malicious social botnet. *Preprint arXiv:2307.16336* (2023).

R2. **Yang, K.-C.**[†] & 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.**[†]. *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® [J3, C3, J18], BotometerLite [C2]: bot detection tools handling $\sim 250,000$ 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®: 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
  *$IC^2S^2$ 2020 (Virtual)*    Jul. 2020
- Introduction to Botometer®
  *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 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
  *$IC^2S^2$ 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]
  *$IC^2S^2$ 2020 (Virtual)*     Jul. 2020
- Prevalence of Low-Credibility Information on Twitter During the COVID-19 Outbreak [W4]
  *CySoc 2020 (Virtual)*     Jun. 2020
- BotometerLite [C2]
  *$IC^2S^2$ 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 Prac-

tice (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 bots and other inauthentic actors on social media
  *The Verge (May 2023)*; *TechCrunch (Feb. 2023)*; *CNN (Feb. 2023)*; *Tech Policy Press (Feb. 2023)*; *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)*;
- Social media in general
  *Reuters (Jul. 2023)*;

**Selected Media Coverage of My Works**

- Botometer® [C3, J18] & BotAmp
  *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®
  *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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