Kai-Cheng Yang

CONTACT
INFORMATION

Luddy School of Informatics, Computing, and Engineering
Indiana University Bloomington
1015 E. 11th Street
Bloomington, IN 47408

(812) 955-8786
yangkc@iu.edu
kaichengyang.me
Google Scholar

EDUCATION

Ph.D., Informatics, Complex Systems track, Indiana University   June 2023 (expected)
   Committee: Filippo Menczer, Yong-Yeol Ahn, Brea Perry, Alessandro Flammini
M.S., Theoretical Physics, Lanzhou University (China)   Jun. 2017
B.S., Theoretical Physics, Lanzhou University (China)   Jun. 2014

RESEARCH
INTERESTS

Social Media | Mining social media data to:

- Reveal the prevalence [J1, J9, W4], dissemination [J21], and real-world implications of online misinformation [J7];
- Detect social bots with machine learning (Botometer®) [J3, C2, C3, J18]; study their role [J5, W6] and human perception [R3, J13];
- Probe platform bias [J4, J12];

Public Health | Analyzing large-scale medical claims datasets to:

- Evaluate the effectiveness of intervention policies targeting the US opioid epidemic [J11];
- Identify patients likely to experience opioid overdose [J2, J6, J19]
- Reveal the impact of COVID-19 on medical care system [J8, J10];

Network Science

- Propose and evaluate network embedding methods [J14–J16]
- Model spreading phenomenon on networks [R2, J20, J22]

HONORS &
AWARDS

IU Informatics Luddy Graduate Research Award	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

†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. DeVerna, M. R., Aiyappa, R., Zhao, W., Pote, M., Truong, B. T., Axelrod, D., Pessianzadeh, A., Kachwala, Z., Kim, M., Seckin, O. C., 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. *Forthcoming in Proceedings of the International AAAI Conference on Web and Social Media (ICWSM) - arXiv:2301.06287* (2023).

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. Large language models can rate news outlet credibility. *arXiv:2304.00228* (2023).

R2. Xue, L., **Yang, K.-C.**, Cui, P.-B. & Di, Z. Network localization strength regulates innovation diffusion with macro-level social influence. *arXiv: 2301.00151* (2023).

R3. 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

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PRESENTATIONS   **Tutorials and Demos**

- Identifying Social Media Manipulation with OSoMe Tools
  Computation + Journalism Conference – C+J 2022 (Virtual)   Jun. 2022
  IC^{2}S^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

- Fantastic bots and how to find them [J3, R3, J12, J13, W4, C2, C3, J18]
  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^{2}S^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^{2}S^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^{2}S^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

Journal Reviewer: ACM Digital Threats: Research and Practice (21); Big Data & Society (21); BMC Digital Health (23); Computers & Security (21); Decision Support Systems (22); Frontiers in Public Health (22); Humanities & Social Sciences Communications (21-23); IEEE Internet Computing (21); IEEE Transactions on Knowledge and Data Engineering (21); 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); Online Social Networks and Media (21, 22); PeerJ Computer Science (20, 22); PLoS ONE (21, 22); Political Research Exchange (21); Progress in Artificial Intelligence (23); Royal Society Open Science (22); Scientific Reports (22); Social Network Analysis and Mining (21, 22); Socius (22);

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

(22);
Workshop Organizer: International Workshop on Cyber Social Threats 2022 (CySoc); International Workshop on Cyber Social Threats 2023 (CySoc);

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IN THE PRESS

Selected Quotations and Interviews

- Social bots and other inauthentic actors on social media
  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)*;

Selected Media Coverage of My Works

- Botometer® [C3, J18] & BotAmp
  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)*; *Reuters (Nov. 2018)*;
- Midterm 2022 dashboard
  Indiana Public Media (Nov. 2022);
- CoVaxxy [W2]
  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)*; *Mother Jones (Feb. 2020)*; *NBC News (Jan. 2020)*; *Vice News (Jan. 2020)*; *NBC News (Nov. 2019)*; *Reuters (Nov. 2018)*;

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