Kai-Cheng Yang

CONTACT
INFORMATION

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EDUCATION

Ph.D., Informatics, Complex Systems track, Indiana University   2022 (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
PROJECTS

Social Media

Mining social media data to:

- Reveal the prevalence [R1, J8, W3], dissemination [J20], and real-world implications of online misinformation [J6];
- Detect social bots with machine learning [J2, C2, C3, J17]; study their role [J4] and human perception [J12];
- Probe platform bias [J3, J11];

Public Health

Analyzing large-scale medical claims datasets to:

- Study the opioid epidemic in the US [J9]; estimate the effectiveness of intervention policies [J10]; identify at-risk patients [J1, J5, J18]

Network Science

- Propose and evaluate network embedding methods [J13–J15]
- Model spreading phenomenon [J19, J21]

HONORS &
AWARDS

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 ($1000)	2020
IU GISA Conference Travel Award ($700)	2019
IU Informatics Ph.D. Student Conference Travel Award ($1000)	2019
NSF Research Trainee scholarship in Complex Networks and Systems ($5000)	2018

PUBLICATIONS
GOOGLE SCHOLAR
CITATIONS: 2,373
H-INDEX: 15
I10-INDEX: 17

Journal Articles

J1. **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).

J2. **Yang, K.-C.**, Ferrara, E. & Menczer, F. Botometer 101: Social bot practicum for computational social scientists. *Journal of Computational Social Science* (2022).

J3. **Yang, K.-C.**, Hui, P.-M. & Menczer, F. How Twitter data sampling biases U.S. voter behavior characterizations. *PeerJ Computer Science* **8,** e1025 (2022).

J4. 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).

J5. 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).

J6. 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).

J7. **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).

J8. **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).

J9. 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).

J10. 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).

J11. Wen, C., Pacheco, D., **Yang, K.-C.** & Menczer, F. Neutral bots probe political bias on social media. *Nature Communications* **12,** 5580 (2021).

J12. Yan, H., **Yang, K.-C.**, Menczer, F. & Shanahan, J. Asymmetrical Perceptions of Partisan Political Bots. *New Media & Society* **23,** 3016–3037 (2021).

J13. 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).

J14. Zhang, Y.-J., **Yang, K.-C.** & Radicchi, F. Model-free hidden geometry of complex networks. *Physical Reviews E* **103,** 012305 (2021).

J15. Zhang, Y.-J., **Yang, K.-C.** & Radicchi, F. Systematic comparison of graph embedding methods in practical tasks. *Physical Reviews E* **104,** 044315 (2021).

J16. 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).

J17. **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).

J18. 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).

J19. 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).

J20. 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).

J21. **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** (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., 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.

W2. **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).

W3. **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).

W4. 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.

W5. **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.

W6. 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. Pierri, F., DeVerna, M. R., **Yang, K.-C.**, Axelrod, D., Bryden, J. & Menczer, F. One year of COVID-19 vaccine misinformation on Twitter. *arXiv: 2209.01675* (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® [J2, C3, J17], BotometerLite [C2]: popular 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 [J2]: bot amplification level comparison
- BotSlayer [W4, W6], Hoaxy®: bot amplification detection & visualization tools with thousands of users
- OSoMeTweet (GitHub, PyPI): Python library for accessing Twitter's V2 API
- CoVaxxy [W1]: dashboard for COVID-19 vaccine Twitter discussion

Network Science

- Persona2vec (GitHub) [J13]: multi-role representations embedding for networks
- BiRank (GitHub, PyPI, CRAN) [W2]: bipartite network PageRank

PRESENTATIONS

Tutorials and Demos

- Identifying Social Media Manipulation with OSoMe Tools
  Computation + Journalism Conference – C+J 2022 (Virtual) — Jun. 2022
  IC²S² 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

- The COVID-19 Infodemic: prevalence, adverse actors, and real-world impact [J6, J8, W3]
  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 [J8]
  Social Media Lab Guest Speaker Series (Virtual) — Oct. 2021
  IC²S² 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 [J1]
  IC²S² 2020 (Virtual) — Jul. 2020
- Prevalence of Low-Credibility Information on Twitter During the COVID-19 Outbreak [W3]
  CySoc 2020 (Virtual) — Jun. 2020

- BotometerLite [C2]
  IC²S² 2020 (Virtual) Jul. 2020
  AAAI 2020 (New York, USA) Feb. 2020
- Bot Electioneering Volume [W5]
  CyberSafety 2019 (San Francisco, USA) May 2019

WORKING EXPERIENCE

TikTok Inc. (ByteDance), CA, USA

    Security engineering intern   Summer 2021

Indiana University, IN, USA

    Research assistant, doctor shopping project   2018 – 2022

TEACHING EXPERIENCE

Indiana University, IN, USA

    Mentor, Undergraduate Research Opportunities in Computing   2021 – 2022
    Associate instructor, I590 Applied Data Science   Fall 2017, Spring 2018

SERVICE

Journal Reviewer: Decision Support Systems (22); Scientific Reports (22); JMIR Public Health and Surveillance (22); Royal Society Open Science (22); Journal of Medical Internet Research (22); Online Social Networks and Media (21, 22); PeerJ Computer Science (20, 22); JMIR Infodemiology (22); Journal of Computational Social Science (22); Social Network Analysis and Mining (21, 22); Frontiers in Public Health (22); Journal of the Royal Society Interface (22); International Journal of Human-Computer Interaction (22); PLoS ONE (21, 22); Political Research Exchange (21); International Journal of Information Technology & Decision Making (21); Computers & Security (21); International Journal of Data Science and Analytics (21); International Communication Gazette (21); Big Data & Society (21); Information, Communication and Society (21); Information Processing & Management (21); IEEE Transactions on Knowledge and Data Engineering (21); Humanities & Social Sciences Communications (21); IEEE Internet Computing (21); ACM Digital Threats: Research and Practice (21);
Conference Reviewer: CSCW (22); ICWSM (20-22); CIKM (21,22);
Workshop Organizer: International Workshop on Cyber Social Threats 2022 (CySoc)

IN THE PRESS

Selected Quotations and Interviews

- Social bots and other inauthentic actors on social media
  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
  IEEE Spectrum (Jul. 2020);

Selected Media Coverage of My Works

- Botometer® [C3, J17] & BotAmp
  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)*;
- CoVaxxy [W1]
  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 [J6]
  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 [J11]
  NBC News (Apr. 2022); *Metro (Apr. 2022)*; *Rolling Stone (Apr. 2022)*;
- COVID-19 Infodemic on Twitter and Facebook [J8]
  News 5 (Jan. 2022); *The Conversation (Jul. 2021)*;
- Substitution of Nonpharmacologic Therapy With Opioid Prescribing for Pain During the COVID-19 Pandemic [J9]
  Clinical Pain Advisor (Jan. 2022); *Everyday Health (Dec. 2021)*; *Health Day (Dec. 2021)*;
- Systematic evaluation of state policy interventions targeting the US opioid epidemic [J10]
  MedPage Today (Jan. 2022); *U.S. Pharmacist (Mar. 2021)*; *News-Medical (Feb. 2021)*;
- Hoaxy®
  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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