

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 Committee: Filippo Menczer , Yong-Yeol Ahn , Brea Perry , Alessandro Flammini M.S., Theoretical Physics, Lanzhou University (China) B.S., Theoretical Physics, Lanzhou University (China)	2022 (expected) Jun. 2017 Jun. 2014
RESEARCH PROJECTS	Social Media Mining social media data to: <ul style="list-style-type: none">• Reveal the prevalence [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 [J11];• Probe platform bias [J3, J16]; Public Health Analyzing large-scale medical claims datasets to: <ul style="list-style-type: none">• Study the opioid epidemic in the US [J9]; estimate the effectiveness of intervention policies [J10]; identify at-risk patients [J1, J5, J18] and high-risk providers [R2]; Network Science <ul style="list-style-type: none">• Propose and evaluate network embedding methods [J12–J14]• Model spreading phenomenon [J19, J21]	
HONORS & AWARDS	Affiliate, Center for Information, Technology, and Public Life , UNC-Chapel Hill IU GISA Conference Travel Award (\$300) Best Reviewer Award at AAAI ICWSM 2022 Selected for Future Leaders Summit 2022 , 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 (\$1000) IU GISA Conference Travel Award (\$700) IU Informatics Ph.D. Student Conference Travel Award (\$1000) NSF Research Trainee scholarship in Complex Networks and Systems (\$5000)	2022 2022 2022 2022 2021 2020 2020 2019 2019 2018
PUBLICATIONS	Journal Articles GOOGLE SCHOLAR CITATIONS: 2,255 H-INDEX: 14 I10-INDEX: 16	<p>J1. Yang, K.-C., Aronson, B., Odabas, M., Ahn, Y. Y. & Perry, B. L. Comparing Measures of Centrality in Bipartite Social Networks: A Study of Drug Seeking for Opioid Analgesics. <i>Forthcoming in PLoS ONE</i> (2022).</p> <p>J2. Yang, K.-C., Ferrara, E. & Menczer, F. Botometer 101: Social bot practicum for computational social scientists. <i>Forthcoming in Journal of Computational Social Science; arXiv:2201.01608</i> (2022).</p>

- 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. Yan, H., **Yang, K.-C.**, Menczer, F. & Shanahan, J. Asymmetrical Perceptions of Partisan Political Bots. *New Media & Society* **23**, 3016–3037 (2021).
- J12. 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).
- J13. Zhang, Y.-J., **Yang, K.-C.** & Radicchi, F. Model-free hidden geometry of complex networks. *Physical Reviews E* **103**, 012305 (2021).
- J14. Zhang, Y.-J., **Yang, K.-C.** & Radicchi, F. Systematic comparison of graph embedding methods in practical tasks. *Physical Reviews E* **104**, 044315 (2021).
- J15. 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).
- J16. Wen, C., Pacheco, D., **Yang, K.-C.** & Menczer, F. Neutral bots probe political bias on social media. *Nature Communications* **12**, 5580 (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. Yan, H. & **Yang, K.-C.** The landscape of social bot research: a critical appraisal. *OSF Preprint*. <https://doi.org/10.31219/osf.io/3cf4j> (2022).
- R2. **Yang, K.-C.**, Lee, B., Kaminski, P., Odabas, M., Ahn, Y.-Y. & Perry, B. L. Association between receiving prescription opioids through high-volume opioid prescribers and adverse outcomes in a commercially insured population, 2015-2019. *In submission* (2021).

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[®] [C3, J17], BotometerLite [C2]: popular bot detection tools handling 250,000 daily requests from researchers, journalists, and social media users
- 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) [J12]: 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 Associate instructor, I590 Applied Data Science	2021 – 2022 Fall 2017, Spring 2018
SERVICE	<p>Journal Reviewer: 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);</p> <p>Conference Reviewer: CSCW (22); ICWSM (20-22); CIKM (21,22);</p> <p>Workshop Organizer: <i>International Workshop on Cyber Social Threats 2022 (CySoc)</i></p>	
IN THE PRESS	<p>Selected Quotations and Interviews</p> <ul style="list-style-type: none"> Social bots and other inauthentic actors on social media <i>BBC (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);</i> Online misinformation <i>IEEE Spectrum (Jul. 2020);</i> <p>Selected Media Coverage of My Works</p> <ul style="list-style-type: none"> Botometer[®] [C3, J17] & BotAmp <i>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);</i> CoVaxxy [W1] <i>The New York Times (May 2022); AP News (Dec. 2021); USA Today (Mar. 2021);</i> Online misinformation is linked to early COVID-19 vaccination hesitancy and refusal [J6] <i>Time (May 2022); News-Medical (May 2022); Tech Policy Press (Apr. 2022); Slate (Apr. 2022);</i> Neutral bots probe political bias on social media [J16] 	

- *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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