

# Kai-Cheng Yang

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EDUCATION    Ph.D., Informatics, Complex Systems track, Indiana University    Aug. 2022 (expected)  
                         M.S., Theoretical Physics, Lanzhou University (China)    Jun. 2017  
                         B.S., Theoretical Physics, Lanzhou University (China)    Jun. 2014

## HONORS &

AWARDS    

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

## RESEARCH PROJECTS

### Social Media

Mining social media data to:

- Reveal the prevalence [J5, W3], dissemination [J17], and real-world implications of online misinformation [J3];
- Detect social bots with machine learning [R1, C2, C3, J14]; study their role [J1] and human perception [J8];
- Probe platform bias [R4, J13];

### Public Health

Analyzing large-scale medical claims datasets to:

- Study the opioid epidemic in the US [J6]; estimate the effectiveness of intervention policies [J7]; identify at-risk patients [J2, R2, J15] and high-risk providers [R3];

### Network Science

- Propose and evaluate network embedding methods [J9–J11]
- Model spreading phenomenon [J16, J18]

## PUBLICATIONS

GOOGLE SCHOLAR

CITATIONS: 1,991

H-INDEX: 14

I10-INDEX: 15

### Journal Articles

- J1. 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* (2022).
- J2. 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).

- J3. 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).
- J4. **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).
- J5. **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).
- J6. 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).
- J7. 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).
- J8. Yan, H., **Yang, K.-C.**, Menczer, F. & Shanahan, J. Asymmetrical Perceptions of Partisan Political Bots. *New Media & Society* **23**, 3016–3037 (2021).
- J9. 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).
- J10. Zhang, Y.-J., **Yang, K.-C.** & Radicchi, F. Model-free hidden geometry of complex networks. *Physical Reviews E* **103**, 012305 (2021).
- J11. Zhang, Y.-J., **Yang, K.-C.** & Radicchi, F. Systematic comparison of graph embedding methods in practical tasks. *Physical Reviews E* **104**, 044315 (2021).
- J12. 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).
- J13. Wen, C., Pacheco, D., **Yang, K.-C.** & Menczer, F. Neutral bots probe political bias on social media. *Nature Communications* **12**, 5580 (2020).
- J14. **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).
- J15. 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).
- J16. 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).
- J17. 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).
- J18. **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 (Forthcoming) *Proceedings of the International AAAI Conference on Web and Social Media (ICWSM)* (2022).
- 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. **Yang, K.-C.**, Ferrara, E. & Menczer, F. Botometer 101: Social bot practicum for computational social scientists. *arXiv:2201.01608* (2022).
- R2. **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. *In submission* (2021).
- R3. **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).
- R4. **Yang, K.-C.**, Hui, P.-M. & Menczer, F. How Twitter Data Sampling Biases U.S. Voter Behavior Characterizations. *arXiv:2006.01447* (2020).

#### TOOLS

##### Observatory on Social Media (OSoMe)

- **Botometer**<sup>®</sup> [C3, J14], **BotometerLite** [C2]: popular bot detection tools handling 250,000 daily requests from researchers, journalists, and social media users

- **BotAmp** [R1]: bot amplification level comparison
- **BotSlayer** [W4, W6], **BEV** [W5], **Hoaxy**<sup>®</sup>: 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) [J9]: multi-role representations embedding for networks
- **BiRank** (GitHub, PyPI, CRAN) [W2]: bipartite network PageRank

#### PRESENTATIONS Tutorials and Demos

- 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* Nov. 2021
- Identifying Social Media Manipulation with OSoMe Tools (video)  
*IC<sup>2</sup>S<sup>2</sup> 2020* (Virtual) Jul. 2020

#### Talks

- The COVID-19 Infodemic: prevalence, adverse actors, and real-world impact [J3, J5, W3]  
*Future Leaders Summit 2022* (Ann Arbor, USA) Apr. 2022
- The COVID-19 Infodemic: Twitter versus Facebook [J5]  
*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 [R2]  
*IC<sup>2</sup>S<sup>2</sup> 2020* (Virtual) Jul. 2020
- Prevalence of Low-Credibility Information on Twitter During the COVID-19 Outbreak [W3]  
*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 [W5]  
*CyberSafety 2019* (San Francisco, USA) May 2019
- Expansion of Cooperatively Growing Populations on Networks [J18]  
*Chinese Physical Society Fall Meeting 2016* (Beijing, China) Sep. 2016

#### WORKING EXPERIENCE

**TikTok Inc. (ByteDance), CA, USA**

Security engineering intern

Summer 2021

**Indiana University, IN, USA**

Research assistant, doctor shopping project

Fall 2018 – Spring 2022

#### TEACHING EXPERIENCE

**Indiana University, IN, USA**

Mentor, Undergraduate Research Opportunities in Computing

Indiana University, IN, USA

Associate instructor, I590 Applied Data Science

Fall 2017, Spring 2018

SERVICE

**Journal Reviewer:** Journal of Computational Social Science (2022); Social Network Analysis and Mining (2022, 2020); Frontiers in Public Health (2022); Journal of the Royal Society Interface (2022); International Journal of Human-Computer Interaction (2022); PLoS ONE (2022, 2021); Political Research Exchange (2021); International Journal of Information Technology & Decision Making (2021); Computers & Security (2021); International Journal of Data Science and Analytics (2021); International Communication Gazette (2021); Big Data & Society (2021); Information, Communication and Society (2021); Online Social Networks and Media (2021); Information Processing & Management (2021); IEEE Transactions on Knowledge and Data Engineering (2020); Humanities & Social Sciences Communications (2020); PeerJ Computer Science (2020); IEEE Internet Computing (2020); ACM Digital Threats: Research and Practice (2020);

**Conference Reviewer:** CSCW ('22); ICWSM ('20,'21,'22); CIKM ('21);

**Workshop Organizer:** *International Workshop on Cyber Social Threats 2022 (CySoc)*

IN THE PRESS

**Quotations and Interviews**

- Social bots and other inauthentic actors on social media  
*The Washington Post* (May 2022); *Spectrum News* (Apr. 2022);
- Online misinformation  
*IEEE Spectrum* (Jul. 2020);

**Media Coverage of My Work**

- Using *OSoMe* tools to track inauthentic actors and spread of misinformation online  
*Protocol* (May 2022); *Los Angeles Times* (Apr. 2022); *Sky News* (Jan. 2022); *AXIOS* (May 2021); *USA Today* (Mar. 2021); *IndyStar* (Mar. 2021); *AXIOS* (Feb. 2021); *Scientific American* (Jan. 2021); *Bloomberg News* (Nov. 2020); *The New York Times* (Oct. 2020); *Newsweek* (Oct. 2020); *Bloomberg News* (Mar. 2020); *The Conversation* (Jan. 2020); *The National Interest* (Nov. 2019); *The Conversation* (Nov. 2019); *IU news* (Sep. 2019); *IDS news* (Sep. 2019); *Science Node* (Sep. 2019); *Reuters* (Nov. 2018);
- Online misinformation is linked to early COVID-19 vaccination hesitancy and refusal [J3]  
*Time* (May 2022); *News-Medical* (May 2022); *Tech Policy Press* (Apr. 2022); *Slate* (Apr. 2022);
- Neutral bots probe political bias on social media [J13]  
*NBC News* (Apr. 2022); *The Conversation* (Apr. 2022); *Metro* (Apr. 2022); *Rolling Stone* (Apr. 2022); *Futurity* (Oct. 2021);
- COVID-19 Infodemic on Twitter and Facebook [J5]  
*News 5* (Jan. 2022); *The Conversation* (Jul. 2021);
- Substitution of Nonpharmacologic Therapy With Opioid Prescribing for Pain During the COVID-19 Pandemic [J6]  
*Clinical Pain Advisor* (Jan. 2022); *Everyday Health* (Dec. 2021); *Health Day* (Dec. 2021);
- Systematic evaluation of state policy interventions targeting the US opioid epidemic [J7]  
*MedPage Today* (Jan. 2022); *U.S. Pharmacist* (Mar. 2021); *News-Medical* (Feb. 2021);
- Asymmetrical perceptions of partisan political bots [J8]  
*IU the Media School Report* (Jul. 2020);
- The spread of low-credibility content by social bots [J17]  
*Salon* (Sep. 2020); *IU news* (Nov. 2018); *ScienceNews* (Nov. 2018);

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