

Research Topics & Ideas: Computer Science

About this document

This PDF contains 50 **computer science research topics** for dissertations and theses, organized into 10 areas of computer science, from algorithmic fairness, ethics and accountability to software engineering and developer tools. Each topic is written as a researchable question and linked to a completed dissertation (2022–2026, 22 universities), so you can see how it was studied in practice. Use it to shortlist computer science dissertation topics and thesis ideas, then narrow one down to your own population, setting and timeframe.

By [Derek Jansen](#) (MBA) · Reviewed by [Eunice Rautenbach](#) (DTech) · Grad Coach · October 2026

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Algorithmic fairness, ethics and accountability

1. Who is left carrying the cost when an algorithmic system is judged on efficiency alone?

See it in a real dissertation: [Byproducts of Algorithmic Systems: Fairness, Usability, and Transparency Challenges](#) · Kevin Bryson · University of Chicago · 2026

2. What would it take to show that a predictive policing system is fair?

See it in a real dissertation: [A mixed methods exploration of fairness issues in algorithmic policing systems](#) · Emmanuel Udoh · University at Albany, State University of New York · 2022

3. How does a person turn an automated benefits decision into a legal claim?

See it in a real dissertation: [Naming And Blaming Automated Decision-Making Systems: Analysis Of Contesting Algorithmic Injustice](#) · Esra Gules-Guctas · University at Albany, State University of New York · 2023

4. Should a model be able to say it does not know, and what would that take?

See it in a real dissertation: [A Holistic Framework for Enhancing Machine Learning Reliability: From Model Architecture and Algorithm Design to Human Interpretability](#) · Kyle Naddeo · Rowan University · 2026

5. What rhetorical moves does a video make to persuade an algorithm as well as a viewer?

See it in a real dissertation: ["But that's just a theory": The radicalizing rhetoric of the YouTube algorithm](#) · Jessica Erin Berchtold · Purdue University · 2026

Algorithms, complexity and optimization

6. What does graph theory give an algorithm designer that a purely algorithmic view misses?

See it in a real dissertation: [From Graph Theory to Graph Algorithms, and Back](#) · Zihan Tan · University of Chicago · 2022

7. Why is constructing a pseudorandom object so much harder than proving one exists?

See it in a real dissertation: [The complexity of explicit construction problems](#) · Hanlin Ren · University of Oxford · 2025

8. What does a quantum relaxation buy you on a constraint satisfaction problem?

See it in a real dissertation: [Composing classical and quantum relaxations of CSP and structure isomorphism](#) · Mohammad Karamlou · University of Oxford · 2025

9. Which traveling salesperson approximation wins on real instances rather than in the worst case?

See it in a real dissertation: [Empirical Comparison of Traveling Salesperson Approximation Algorithms](#) · Shayan Daijavad · California Polytechnic State University · 2026

10. How much does knowing a graph's structure speed up a shortest path query?

See it in a real dissertation: [Graph Structures in Clustering and Fast Shortest Path Algorithms](#) · Yufan Huang · Purdue University · 2026

Cloud, distributed and parallel systems

11. How does one slow node turn into an outage, and where should the propagation be cut?

See it in a real dissertation: [Understanding, Detecting, and Controlling Failure Propagation in Distributed Systems](#) · Shangshu Qian · Purdue University · 2026

12. When do retries and timeouts stop protecting a system and start harming it?

See it in a real dissertation: [Improving Task-Resilience Mechanisms in Software Systems](#) · Utsav Sethi · University of Chicago · 2024

13. What consistency can a distributed store actually promise once the network splits?

See it in a real dissertation: [Coordination Protocols for Verifiable Consistency in Distributed Storage Systems](#) · Ashwin Ramaswamy · San Jose State University · 2022

14. Where does the time go in a large accelerator cluster, and how much of it is communication?

See it in a real dissertation: [Characterizing and Mitigating Communication Overheads in Large-Scale Accelerator-Based Systems](#) · Amel Fatima · University of Virginia · 2026

15. Could a data center find its own bad configuration before a customer notices?

See it in a real dissertation: [Domain knowledge assisted configuration management and diagnosis in data centers](#) · Negar Mohammadi Koushki · Temple University · 2026

Computer science education

16. Who is studying computer science at a community college, and what do they make of it?

See it in a real dissertation: [Computer Science at Community Colleges: Attitudes and Trends](#) · Trenton J. Dawson · Louisiana State University · 2022

17. What should a department's policy on AI code generators actually say?

See it in a real dissertation: [Responsible and Equitable Use of AI Code Generators in Computer Science Education](#) · Nicholas Gardella · University of Virginia · 2026

18. Which problem-solving strategies separate students who can design an algorithm from those who cannot?

See it in a real dissertation: [Investigating Student Usage of Metacognitive Problem-Solving Strategies in Algorithm Design Problems](#) · Jonathan Liu · University of Chicago · 2026

19. Does an early intervention still show up in retention three years later?

See it in a real dissertation: [Analysis of Early Interventions to Retain Underrepresented Students in Computer Science](#) · Michael Conti · University of Rhode Island · 2025

20. What is lost when high school programming is taught as correctness rather than as making?

See it in a real dissertation: [Three Perspectives on the Pedagogy of Creative Work in High School Computer Programming](#) · Kang, Jane M · Harvard University · 2023

Data management and scientific computing

21. What share of a research data swamp can be made searchable automatically?

See it in a real dissertation: [Automated Metadata Extraction Can Make Data Swamps More Navigable](#) · Tyler J. Skluzacek · University of Chicago · 2022

22. Is a scientific workflow reproducible if nobody recorded where its data came from?

See it in a real dissertation: [Verifying Data Provenance During Workflow Execution for Scientific Reproducibility](#) · Rizbanul Hasan · Boise State University · 2023

23. Who actually writes research software, and does the academy count it as research?

See it in a real dissertation: [“I really don’t like Gaussian processes. I wanna write Python libraries.” — A mixed methods investigation of Research Software Engineering in the U.K.](#) · Lee, Graham · University of Oxford · 2024

24. Does natural language search beat a field query on a specialist literature database?

See it in a real dissertation: [Natural Language Search for NASA ADS](#) · Marsh, Tanner · Harvard University · 2024

25. How do you crawl the content that only appears once a search form has been filled in?

See it in a real dissertation: [A Distributed Approach to Crawl Domain Specific Hidden Web](#) · Lovekeshkumar Desai · Georgia State University · 2022

Machine learning systems and applications

26. What breaks first when a language model is served to thousands of users at once?

See it in a real dissertation: [A Scalable Approach to Distributed Large Language Model Inference](#) · Yihua Cheng · University of Chicago · 2025

27. How should a serving system absorb a bursty workload without overprovisioning for it?

See it in a real dissertation: [Designing Efficient, Elastic, and High-Throughput LLM Serving Systems](#) · Zhaoyuan Su · University of Virginia · 2026

28. Which implementation choices actually make an attention kernel fast?

See it in a real dissertation: [What Makes a Modern Attention Implementation?](#) · Brian H Slonim · California Polytechnic State University · 2026

29. Does motion add anything to facial expression recognition beyond a single frame?

See it in a real dissertation: [Using Neural Networks to Understand Static and Dynamic Cues in Facial Expression Recognition](#) · Yifan Li · Purdue University · 2026

30. Which signals beyond the face improve emotion recognition on spontaneous data?

See it in a real dissertation: [Emotions Recognition Using Multimodal Spontaneous Emotion Database and Deep Learning Technology](#) · Shruthi Hassan Sathish · San Jose State University · 2023

Privacy, trust and secure computing

31. When is federated learning worth it, and when should each participant train alone?

See it in a real dissertation: [From Federation to Personalization: Trust, Topology, and Heterogeneity in Collaborative Machine Learning](#) · Atul Sharma · Purdue University · 2026

32. What is the cheapest communication that still makes federated learning work?

See it in a real dissertation: [Towards Practical Federated Learning: Communication-Efficient Design Under System Constraint](#) · Mu, Yujia · University of Virginia · 2025

33. Can a model be reverse engineered from nothing but how long its arithmetic takes?

See it in a real dissertation: [Using floating-point timing side-channels to reverse engineer deep neural networks](#) · Cheng Gongye · Northeastern University · 2023

34. How much of its training data does a model memorize, and can that be bounded?

See it in a real dissertation: [Memorization in Private and Secure Machine Learning](#) · Kaiyuan Zhang · Purdue University · 2026

35. Could a smart grid verify a device without learning who owns it?

See it in a real dissertation: [A Privacy-Preserving Strategy for the Trust Layer of the Energy Grid of Things Distributed Energy Resource Management System](#) · Mohammed Alsaid · Portland State University · 2022

Programming languages, verification and formal methods

36. Can a distributed protocol be verified once and hold for any number of processes?

See it in a real dissertation: [Automating Formal Verification of Distributed Systems via Property-Driven Reductions](#) · Christopher Wagner · Purdue University · 2025

37. How do you analyze a safety-critical system whose state space is effectively infinite?

See it in a real dissertation: [Efficient Methods and Algorithms for Analyzing Stochastic Systems](#) · Ahmadi, Mohammad · University of South Florida · 2025

38. When does a Reed-Muller form beat a conventional one for logic synthesis?

See it in a real dissertation: [Logic synthesis and optimisation using Reed-Muller expansions](#) · L. McKenzie · Edinburgh Napier University · 2026

39. What can formal language theory contribute to a reinforcement learning objective?

See it in a real dissertation: [Regular Transformations In Sequential Optimization & Reinforcement Learning](#) · Dohmen, Taylor · University of Colorado Boulder · 2024

40. Is there a principled way to merge two UML class diagrams that disagree?

See it in a real dissertation: [Composition of UML class diagrams using category theory and external constraints](#) · Alexey Tazin · Northeastern University · 2022

Quantum computing

41. What does fault tolerance cost, in qubits, before a quantum machine is useful?

See it in a real dissertation: [Software/Hardware Co-Design of Fault-Tolerant Quantum Systems](#) · Joshua Viszlai · University of Chicago · 2026

42. Can graph rewriting keep a quantum compiler fast as the programs get larger?

See it in a real dissertation: [Scaling quantum compilation with graph rewriting](#) · Luca Matteo Mondada · University of Oxford · 2025

43. Which compiler choices make a program survive a transient hardware fault?

See it in a real dissertation: [Compilation Optimizations to Enhance Resilience of Big Data Programs and Quantum Processors](#) · Travis LeCompte · Louisiana State University · 2022

44. Why does Grover's algorithm return wrong answers for some Boolean oracles?

See it in a real dissertation: [Layout-Aware Quantum Circuitry and Algorithmic Extensions to Grover's Algorithm](#) · Ali Al-Bayat · Portland State University · 2025

45. What can an emulator tell you about a quantum algorithm before the hardware exists?

See it in a real dissertation: [Quantum Algorithm Emulation Using FPGAs](#) · Samuel Petruescu · San Jose State University · 2025

Software engineering and developer tools**46. What separates a code review comment that changes the code from one that does not?**

See it in a real dissertation: [Art of Code Review](#) · Sharif Ahmed · Boise State University · 2025

47. How often does a coding model invent an API, and what makes it stop?

See it in a real dissertation: [Understanding and Mitigating Hallucination of Language Models in Software Engineering](#) · Bonan Kou · Purdue University · 2026

48. Can a model match compiled binaries back to the source they came from, across languages?

See it in a real dissertation: [Cross-language binary-to-source code matching approach using graph neural networks](#) · Hanze Chen · Iowa State University · 2023

49. Does classical program analysis make a language model better at changing real code?

See it in a real dissertation: [Integrating Program Analysis with Language Models for Software Evolution](#) · Aidan Yang · Carnegie Mellon University · 2026

50. How much does a trainer need to see while people work through a computer-based task?

See it in a real dissertation: [Towards a Testbed for Improving Awareness of Computer-based Training Tasks](#) · Samuel David George · University of North Carolina at Chapel Hill · 2026

How to turn a topic into your research question

A topic is a starting point, not something you can research yet. These four steps take you from a topic on this list to a focused question you can actually answer.

- 1. Shortlist three, not one.** Pick three topics from this list that genuinely interest you and fit the access you have to people and data.

Recommended reading: [How to find and choose a dissertation topic](#)

- 2. Read the dissertation behind each one.** Its literature review and its "recommendations for future research" section show you what is already known and what is still open.

Recommended reading: [How to find a research gap](#)

- 3. Narrow it to your setting.** Name one population, one setting and one thing you will measure or explore. That turns a broad topic into a question you can finish.

Recommended reading: [How to write a research question](#)

- 4. Line up your aims, objectives and questions.** Your committee will check that they agree.

Recommended reading: [Research aims, objectives and questions](#)

Work through these once and you will have a focused question rather than a broad topic, which is what the rest of your proposal is built on.