

Research Topics & Ideas: AI and Machine Learning

About this document

This PDF contains 50 **AI and machine learning research topics** for dissertations and theses, organized into 10 areas of AI and machine learning, from AI for science and engineering to time series, forecasting and anomaly detection. Each topic is written as a researchable question and linked to a completed dissertation (2022–2026, 26 universities), so you can see how it was studied in practice. Use it to shortlist AI and machine learning dissertation topics and thesis ideas, then narrow one down to your own population, setting and timeframe.

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AI for science and engineering

1. Can a surrogate replace a power system simulation without losing the physics?

See it in a real dissertation: [Scientific Machine Learning for Power System Dynamic Simulation](#) · Matthew A. Bossart · Dartmouth College · 2024

2. How far can deep learning stretch the scales a molecular simulation reaches?

See it in a real dissertation: [Deep Learning Approaches to Extend Time and Length Scales of Molecular Simulations](#) · Michael S. Jones · University of Chicago · 2024

3. Can a physics-informed model predict how printed concrete will flow?

See it in a real dissertation: [3D Concrete Printing Material Prediction and Flow Simulation Using Physics-Informed Neural Network](#) · Tianjie Zhang · Boise State University · 2024

4. Where in drug discovery does machine learning genuinely shorten the path?

See it in a real dissertation: [Machine learning for molecular modelling and drug discovery](#) · L Vost · University of Oxford · 2025

5. Can machine learning predict a molecule's properties faster than the physics can?

See it in a real dissertation: [Efficient and Accurate Machine Learning Methods for Molecular Property Prediction](#) · Caitlin A Whitter · Purdue University · 2026

AI in healthcare and biomedicine

6. How much faster is a stroke diagnosis when the imaging is read by a model?

See it in a real dissertation: [Deep Learning in AI Medical Imaging for Stroke Diagnosis](#) · James Mario Guzman · San Jose State University · 2023

7. Can a model find a rare cardiac condition hiding inside a common one?

See it in a real dissertation: [A Machine Learning Approach for Early Diagnosis of Transthyretin Amyloid Cardiomyopathy Among Heart Failure Patients](#) · Tanjim Ahmed · West Virginia University · 2023

8. How early can machine learning catch kidney disease, and at what false-positive cost?

See it in a real dissertation: [Role of machine learning in early diagnosis of kidney diseases](#) · Mohamed Shehata · University of Louisville · 2022

9. Does multimodal learning predict disease progression better than any single source?

See it in a real dissertation: [Multimodal Learning for Disease Diagnosis and Progression Modeling](#) · Tiffany Le · Chapman University · 2026

10. Can plain language be the interface to a medical imaging model?

See it in a real dissertation: [Language as interface to medical image representation learning](#) · Maxime Kayser · University of Oxford · 2025

Computer vision and image analysis

11. Can image segmentation count coral reliably enough to replace a diver?

See it in a real dissertation: [Image Segmentation by Convolutional Neural Networks in Coral Resilience Research](#) · Jennifer Benbow · San Jose State University · 2024

12. How do you train a detector when almost none of the underwater imagery is labeled?

See it in a real dissertation: [Enhancing Bay Scallop Monitoring Using Machine Learning and Semantic Segmentation with Benthic Visual Imagery](#) · Waheed Odubayo · University of Rhode Island · 2026

13. How little supervision does object recognition actually need?

See it in a real dissertation: [Object Recognition and Visual Question Answering with Limited Supervision: From Episodic Learning to Foundational Models](#) · Mohammad Reza Zarei · Carleton University · 2026

14. What does it take to synthesize video that holds together over time?

See it in a real dissertation: [Neural Visual Synthesis for Graphics, 4D Gaussians and Videos](#) · Zhan Li · Portland State University · 2025

15. What can a face reveal beyond identity, and how reliably?

See it in a real dissertation: [Face Image and Video Analysis in Biometrics and Health Applications](#) · Na Zhang · West Virginia University · 2023

Data, privacy and security in machine learning

16. Does federated learning protect medical data, or relocate the risk?

See it in a real dissertation: [Federated Learning for Protecting Medical Data Privacy](#) · Abhishek Reddy Punreddy · San Jose State University · 2023

17. Why is it so easy to fool a security model, and what actually defends it?

See it in a real dissertation: [Robust Defenses Against Adversarial Machine Learning in IoT Security](#) · Olakunle Ibitoye · Carleton University · 2024

18. Is adversarial vulnerability in vision the same problem as misalignment in language models?

See it in a real dissertation: [Robustness in Machine Learning: Adversarial Vulnerability in Vision Models & Alignment of Large Language Models](#) · Rajdeep Haldar · Purdue University · 2026

19. How does a model keep learning at the edge without forgetting what it knew?

See it in a real dissertation: [Federated Neuromorphic Intelligence: Advancing Robustness, Efficiency, and Continual Adaptation in Edge Environments](#) · Manh V. Nguyen · Kennesaw State University · 2026

20. What makes a network resilient to an attack it has never seen?

See it in a real dissertation: [Towards resilient cyber networks against adversarial attacks](#) · Alesia Chernikova · Northeastern University · 2024

Fairness, bias and explainability

21. Can a model be interpretable and unbiased at once, or is one traded away?

See it in a real dissertation: [Interpretable and Anti-Bias Machine Learning Models for Human Event Sequence Data](#) · Zihan Zhou · Louisiana State University · 2022

22. Which bias mitigation methods survive contact with real clinical data?

See it in a real dissertation: [Algorithmic fairness and bias mitigation in clinical machine learning for equitable patient outcomes](#) · Jenny Yang · University of Oxford · 2024

23. What does an influence function actually explain about a neural network?

See it in a real dissertation: [Improving Explainability and Interpretability of Neural Networks via Hyperparameter-Extended Influence Functions](#) · William Breslin · Portland State University · 2026

24. Does explainability help an analyst act on a malware alert?

See it in a real dissertation: [Explainable AI for Android Malware Detection](#) · Maithili Mandar Kulkarni · San Jose State University · 2023

25. Can a medical imaging model be trained to base its decision on the right evidence?

See it in a real dissertation: [Learning With Explanations: Explanation-Aware Training for Interpretable Medical Imaging Models](#) · Zubair Faruqi · Missouri State University · 2026

Human-AI interaction and adoption

26. What does an engineer need from an AI collaborator that a tool cannot give?

See it in a real dissertation: [Facilitating Human-ai Collaboration in Product and Engineering Design Through Multimodal Interaction](#) · Runlin Duan · Purdue University · 2026

27. How should a recognition system tell a person that it is uncertain?

See it in a real dissertation: [Human Interfaces with Machine Learning Recognition Systems](#) · Connor Clarkson · Swansea University · 2025

28. What makes an online learning interface genuinely inclusive?

See it in a real dissertation: [Creating Inclusive Interface and Online Learning Environments](#) · Grace Mosher · Dominican University of California · 2023

29. Can keystroke dynamics identify a user reliably enough to trust?

See it in a real dissertation: [Keystroke Dynamics and User Identification](#) · Atharva Sharma · San Jose State University · 2023

30. What has to improve in the hardware before a machine can read a person well?

See it in a real dissertation: [Bio-Integrated Interfaces for Human-Machine Interaction: Sensing, Actuation, and Computing](#) · Pengfei Deng · Purdue University · 2026

Machine learning methods and theory

31. What changes about training a network once you make it very deep?

See it in a real dissertation: [Mastering infinite depths: Optimization and generalization in deeper neural networks](#) · Tianxiang Gao · Iowa State University · 2024

32. Which optimization choices actually matter when training a network from scratch?

See it in a real dissertation: [Towards Neural Network Optimization](#) · Nick Najafizadeh · San Jose State University · 2026

33. How much acceleration can a network take before accuracy suffers?

See it in a real dissertation: [Deep Learning Optimization and Acceleration](#) · Beilei Jiang · University of North Texas · 2022

34. Can a learned representation be made causal rather than merely predictive?

See it in a real dissertation: [Causal and identifiable deep representation learning](#) · Marian Longa · University of Oxford · 2023

35. Why does the theory of how networks learn keep mispredicting the speed?

See it in a real dissertation: [Label-Kernel Correlation and an Improved Optimization Theory for Neural Networks](#) · Ruchirinkil Marreddy · Purdue University · 2026

Natural language processing and large language models

36. Can a model detect text another model wrote, when the stakes are prescription fraud?

See it in a real dissertation: [AI vs. GenAI: Combating LLM generated prescription fraud with transformer based detection models](#) · Ankitha Vokkaleri Shankarappa · Long Island University · 2026

37. Does adding a knowledge graph pick more representative sentences for a summary?

See it in a real dissertation: [A Deep Learning Approach to Extractive Text Summarization Using Knowledge Graph and Language Model](#) · Yichen Gao · Illinois State University · 2023

38. Where does the cost sit in a text-to-SQL pipeline, and can it be cut?

See it in a real dissertation: [Pipeline Optimization of Agentic LLMs for Text-to-SQL](#) · Peter Conant · San Jose State University · 2026

39. What does a language model learn about chess that a chess engine does not?

See it in a real dissertation: [Predicting Human Chess Moves with Large Language Models](#) · Benjamin Kreiger · University of South Florida · 2024

40. How do you integrate a language model into an agricultural drone workflow?

See it in a real dissertation: [Integration of Uav and LLM in Agricultural Environment](#) · Sudeep Reddy Angamgari · Purdue University · 2024

Reinforcement learning and control

41. How do several agents cooperate to find a radiation source?

See it in a real dissertation: [Multi-Agent Deep Reinforcement Learning for Radiation Localization](#) · Benjamin Totten · Portland State University · 2023

42. Which multi-agent reinforcement learning framework performs as advertised?

See it in a real dissertation: [Empirical Analysis On Multi-Agent Reinforcement Learning Frameworks](#) · Jordan Jiosi · Rowan University · 2026

43. Can an agent learn its safety constraints at the same time as its policy?

See it in a real dissertation: [Joint Learning of Unknown Safety Constraints and Control Policies in Reinforcement Learning](#) · Lunet Yifru · West Virginia University · 2024

44. Can reinforcement learning hold up when the demand pattern stops repeating?

See it in a real dissertation: [Deep Reinforcement Learning for Inventory Management Under High Uncertainty](#) · Hannah Casper · California Polytechnic State University · 2026

45. How many steps ahead can an agent usefully predict when search is not available?

See it in a real dissertation: [Multi-step Prediction using Tree Generation for Reinforcement Learning](#) · Kevin Prakash · San Jose State University · 2022

Time series, forecasting and anomaly detection

46. What actually predicts web traffic, and how far ahead?

See it in a real dissertation: [Web Traffic Time Series Forecasting](#) · Summanth Redde Mulkkalla · San Jose State University · 2023

47. Do deep learning forecasters beat classical time series models in practice?

See it in a real dissertation: [Advanced Techniques in Time Series Forecasting: From Deterministic Models to Deep Learning](#) · Xue Bai · West Virginia University · 2024

48. Does treating data as a graph make anomalies easier to spot?

See it in a real dissertation: [Anomaly Detection Using Graph Neural Network](#) · Bishal Lakha · Boise State University · 2023

49. How do you detect a network anomaly without drowning the analyst in alerts?

See it in a real dissertation: [Enhanced Network Anomaly Detection Using Machine Learning Models](#) · Ousmane Barry · Nova Southeastern University · 2025

50. Which machine learning methods survive the noise in financial time series?

See it in a real dissertation: [On machine learning methods for time series with financial applications](#) · Stefanos Odysseas Bennett · University of Oxford · 2023

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.