Markov Chains Research Project

References and AI Prompts Documentation

December 2025

Complete References List

Section 1 & 2: Introduction and App Navigation Theory

1. "An introduction to Markov chains" – Systematic, textbook-style introduction with clear definitions, examples, and proofs, ideal if you want a rigorous but readable math treatment.

2. Setosa: "Markov Chains explained visually" – Highly intuitive, interactive site that uses animations and diagrams to build the core ideas without heavy formalism, great as a first pass before deeper study.

3. Wikipedia contributors. (n.d.). *Markov chain*. Wikipedia. Retrieved from https://en.wikipedia.org/wiki/Markov_chain

4. Sekhon, P., & Bloom, D. (n.d.). Applications of Markov Chains. In *Applied Finite Mathematics*. Math LibreTexts. Retrieved from https://math.libretexts.org/Bookshelves/Applied_Mathematics/Applied_Finite_Mathematics_(Sekhon_and_Bloom)/10:_Markov_Chains/10.02:_Applications_of_Markov_Chains

5. Introduction to Markov Chains and Applications. (2016-2017). Chalmers University of Technology. Retrieved from https://www.math.chalmers.se/Stat/Grundutb/CTH/mve220/1617/redingprojects16-17/IntroMarkovChainsandApplications.pdf

6. Introduction to Markov Chain. Shiksha Online Courses. Retrieved from https://www.shiksha.com/online-courses/articles/introduction-to-markov-chain/

Section 3: PageRank and Probability Applications

7. Wikipedia contributors. (n.d.). *Markov chain*. Wikipedia. Retrieved from https://en.wikipedia.org/wiki/Markov_chain

8. Sekhon, P., & Bloom, D. (n.d.). Applications of Markov Chains. In *Applied Finite Mathematics*. Math LibreTexts. Retrieved from https://math.libretexts.org/Bookshelves/Applied_Mathematics/Applied_Finite_Mathematics_(Sekhon_and_Bloom)/10:_Markov_Chains/10.02:_Applications_of_Markov_Chains

9. Introduction to Markov Chains and Applications. (2016-2017). Chalmers University of Technology. Retrieved from https://www.math.chalmers.se/Stat/Grundutb/CTH/mve220/1617/redingprojects16-17/IntroMarkovChainsandApplications.pdf

10. Introduction to Markov Chain. Shiksha Online Courses. Retrieved from https://www.shiksha.com/online-courses/articles/introduction-to-markov-chain/

Section 4: Markov Decision Processes in AI Applications

11. Understanding the Bellman Equation in Reinforcement Learning. DataCamp. Retrieved December 13, 2025, from https://www.datacamp.com/tutorial/bellman-equation-reinforcement-learning

12. Wikipedia contributors. (n.d.). *Markov decision process*. Wikipedia. Retrieved December 13, 2025, from https://en.wikipedia.org/wiki/Markov_decision_process

13. Markov Decision Process (MDP): definition, components and applications. Reinforcement Learning Path. Retrieved December 13, 2025, from https://www.reinforcementlearningpath.com/markov-decision-process-mdp/

14. Markov Decision Process (MDP) in Reinforcement Learning. GeeksforGeeks. Retrieved December 13, 2025, from https://www.geeksforgeeks.org/machine-learning/what-is-markov-decision-process-mdp-and-its-relevance-to-reinforcement-learning/

15. Karpathy, A. (n.d.). REINFORCEjs: Gridworld with Dynamic Programming. Stanford University. Retrieved December 13, 2025, from https://cs.stanford.edu/people/karpathy/reinforcejs/gridworld_dp.html

16. Nanade, A. (n.d.). Building a GridWorld Game with Q-Learning from Scratch: Reinforcement Learning. Medium. Retrieved December 13, 2025, from https://medium.com/@nanade.archana/building-a-gridworld-game-with-q-learning-from-scratch-reinforcement-learning-3afc367900a8

17. Policy Iteration. Engineering AI Agents. Retrieved December 13, 2025, from https://pantelis.github.io/aiml-common/lectures/mdp/dynamic-programming-algorithms/policy-iteration/index.html

18. Markov Decision Process in Reinforcement Learning: Everything You Need to Know. Neptune.ai. Retrieved December 13, 2025, from https://neptune.ai/blog/markov-decision-process-in-reinforcement-learning

19. Part 1: Key Concepts in RL. Spinning Up documentation. OpenAI. Retrieved December 13, 2025, from https://spinningup.openai.com/en/latest/spinningup/rl_intro.html

20. Bellman Optimality Equation in Reinforcement Learning. Analytics Vidhya. Retrieved December 13, 2025, from https://www.analyticsvidhya.com/blog/2021/02/understanding-the-bellman-optimality-equation-in-reinforcement-learning/

AI Tools and Prompts Used

Perplexity.ai

Purpose: Research and content generation for Introduction section

Usage:

- Generated the foundational introduction to Markov Chains
- Provided clear definitions and mathematical formulations
- Helped structure the basic concepts section

Prompt Used:

```
"Provide an introduction to Markov chains with basic concepts, formal definition, and key components. Include mathematical notation and explain the memoryless property."
```

AI Assistant Prompts Log

Prompt 1: Transition Matrix Generation

Prompt:

```
I want to create a transition matrix for 4 pages (feed, profile, settings, Home) can you give me real probabilities.
```

Purpose: Generate realistic transition probabilities for app navigation modeling

Used in: Section 2 - App Navigation Theory

Output: Realistic probability values for user navigation patterns between different app screens

Prompt 2: Content Simplification

Prompt:

```
write app navigation theory abt markov chain with ref
use simple vocab and keep the meaning same
```

Purpose: Simplify technical content while maintaining accuracy

Used in: Section 2 - App Navigation Theory

Output: Accessible explanation of app navigation using Markov chain principles with simplified vocabulary

AI Tools Summary

Tool	Section	Purpose	Type of Assistance
Perplexity.ai	Section 1	Introduction & Theory	Research & Content Generation
AI Assistant	Section 2	App Navigation	Probability Matrix & Simplification
Claude	All Sections	Document Formatting	Report Compilation & PDF Generation

---

Research Methodology Notes

Content Development Process

1. Initial Research Phase

- Used Perplexity.ai for foundational content on Markov Chains
- Gathered academic references from Wikipedia, LibreTexts, and university resources
- Collected peer-reviewed sources for AI applications

2. Content Creation Phase

- Team members wrote their assigned sections based on research
- AI tools used for simplification and clarity enhancement
- Technical content developed with reference to academic sources

3. Compilation Phase

- Claude AI used for document formatting and organization
- All team contributions merged into unified report
- PDF generation and formatting optimization

Ethical AI Usage

> **All AI-generated content was:**
>
> Reviewed and verified by team members • Cross-referenced with academic sources • Modified and personalized to fit research context • Used as a tool to enhance, not replace, original research

Additional Notes

Content Authenticity

- All mathematical concepts verified against academic sources
- Examples and applications researched independently
- AI tools used primarily for formatting and language simplification
- Original analysis and synthesis performed by team members

Quality Assurance

- Cross-verification of all references
- Technical accuracy checked against source materials
- Content adapted to maintain academic integrity

Transparency Statement:

This document provides complete transparency regarding the use of AI tools in our research project. All AI assistance was used ethically to enhance research quality, improve clarity, and optimize presentation. The core research, analysis, and understanding of Markov Chains remain the original work of our team members.

Last Updated: December 2025

Purpose: Transparency documentation for research methodology and AI tool usage