

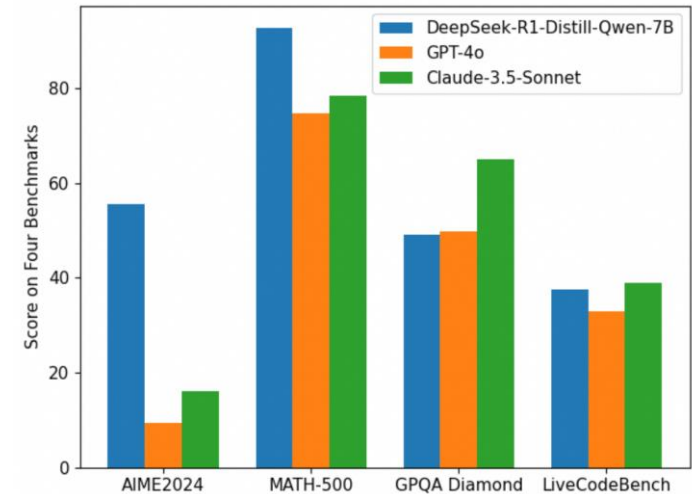
A Short Survey on Small Reasoning Models: Training, Inference, Applications and Research Directions

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Current Challenges & Survey Contribution

- **Challenge:** Large Reasoning Models require extensive resources, limiting practical deployment.
- **Key Innovation:** Small Reasoning Models offer efficient reasoning with a fraction of the parameters, utilizing slow-thinking techniques for enhanced interpretability and performance.
- **Survey Contribution:** This work provides a focused and up-to-date review of SRM techniques, applications, and future directions.

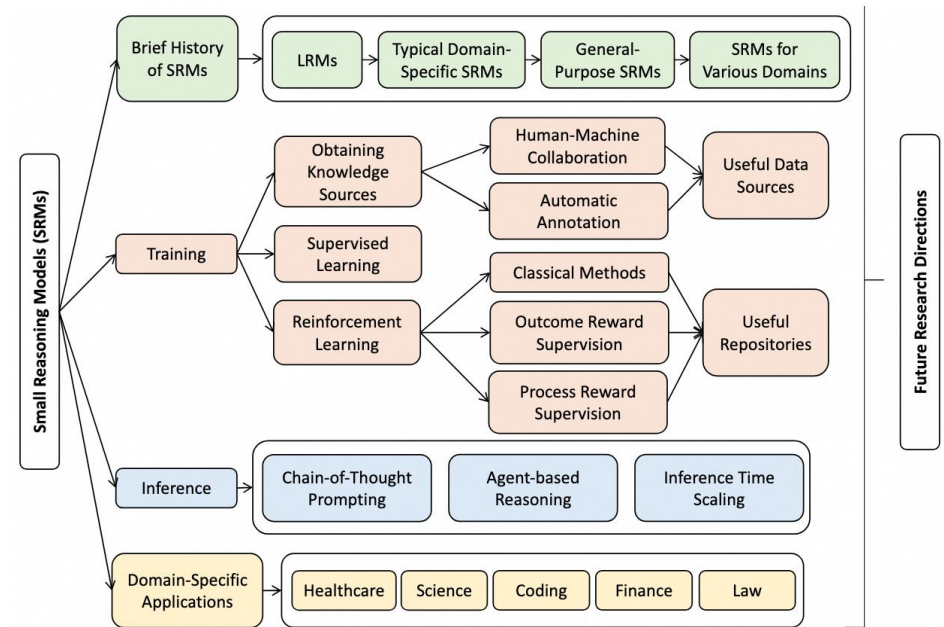


Simple comparison between representative LRMs (GPT-4o and Claude-3.5-Sonnet) and SRMs (DeepSeek-R1-Distill-Qwen-7B) on reasoning benchmarks, including AIME2024, MATH-500, GPQA Diamond and LiveCodeBench.

Survey Roadmap and Future Directions

• Survey Roadmap:

- Brief History of SRMs
- Training (Knowledge Sources, Supervised Learning, Reinforcement Learning)
- Inference (Prompting, Agents, Scaling)
- Domain-Specific Applications (Healthcare, Science, Coding, etc.)



The roadmap of the survey.

• Future Research Directions:

- **Enhanced Distillation Techniques:** iterative knowledge transfer, combining SFT with RL
- **Adaptive Reinforcement Learning:** dynamically balancing exploration and exploitation
- **Low-Resource Learning & Inference:** parameter-efficient approaches, low-bit quantization
- **Agent-Based Efficient Inference:** optimizing communication and coordination
- **Expanding Domain-Specific SRMs:** tailored to domain-specific data and task requirements
- **Multi-Modal Reasoning:** extending SRMs to integrate vision, audio, and video data
- **Edge Deployment:** real-time, low-latency inference, private-sensitive applications