ICML 2026 Poster Presentation

AutoVSR: Automatic Visual-to-Symbolic Reasoning for Symbolic Expression Generation from Circuit Schematic

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Introduction

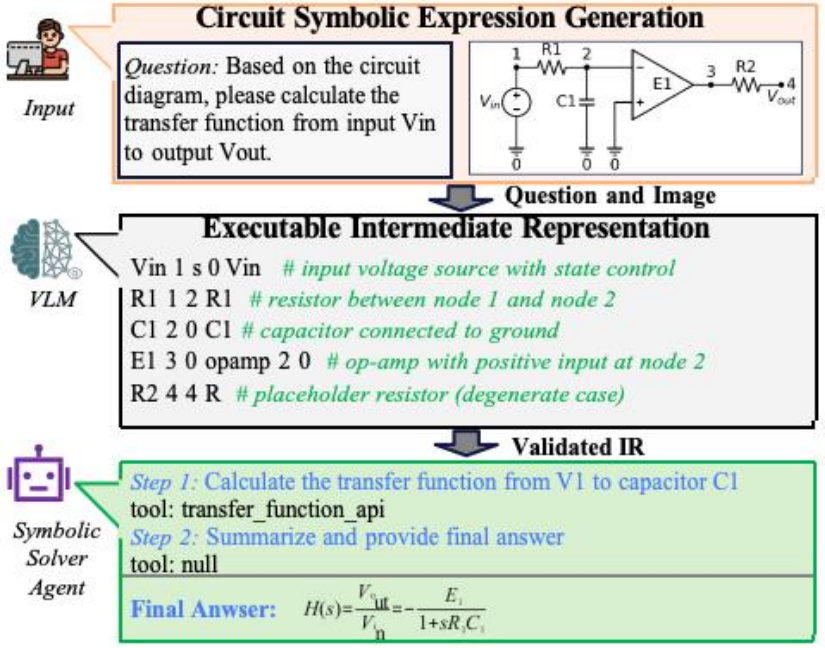
Circuit Symbolic Expression Generation

Goal

- Given a circuit schematic image and a query.
- Generate the target symbolic expression.

Example

- Input: circuit diagram and “Calculate H(s) = Vout / Vin”
- Output: symbolic transfer function.



Introduction

Why Is It Challenging?

Visual-to-symbolic construction

- Circuit images do not directly provide device types, connectivity, or variables.

Multi-step symbolic derivation

- Small errors in signs, nodes, or equations can lead to wrong final expressions.

End-to-end VLMs are unreliable

- Intermediate reasoning is not explicitly verified.

Introduction

Challenge and Solution

Challenge

- How to build a correct circuit representation from visual input?
- How to ensure correct symbolic derivation?

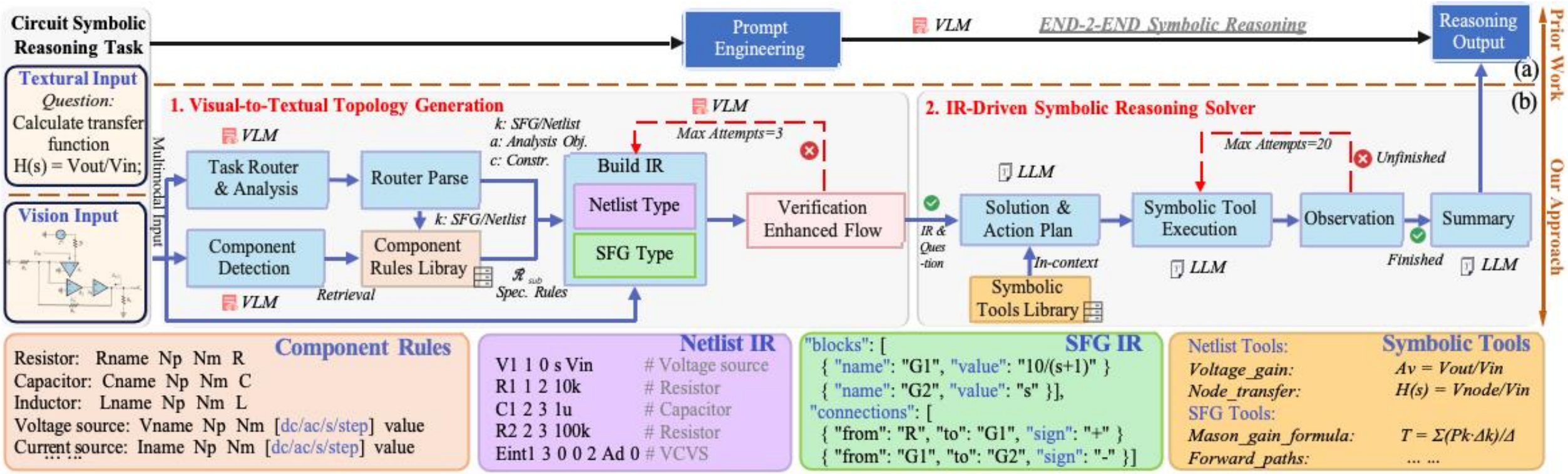
Solution

- Executable Intermediate Representation.
- Verification-based feedback.
- Tool-augmented symbolic solver.

Do not ask the VLM to directly solve the circuit. Make it build a verifiable IR first.

Method

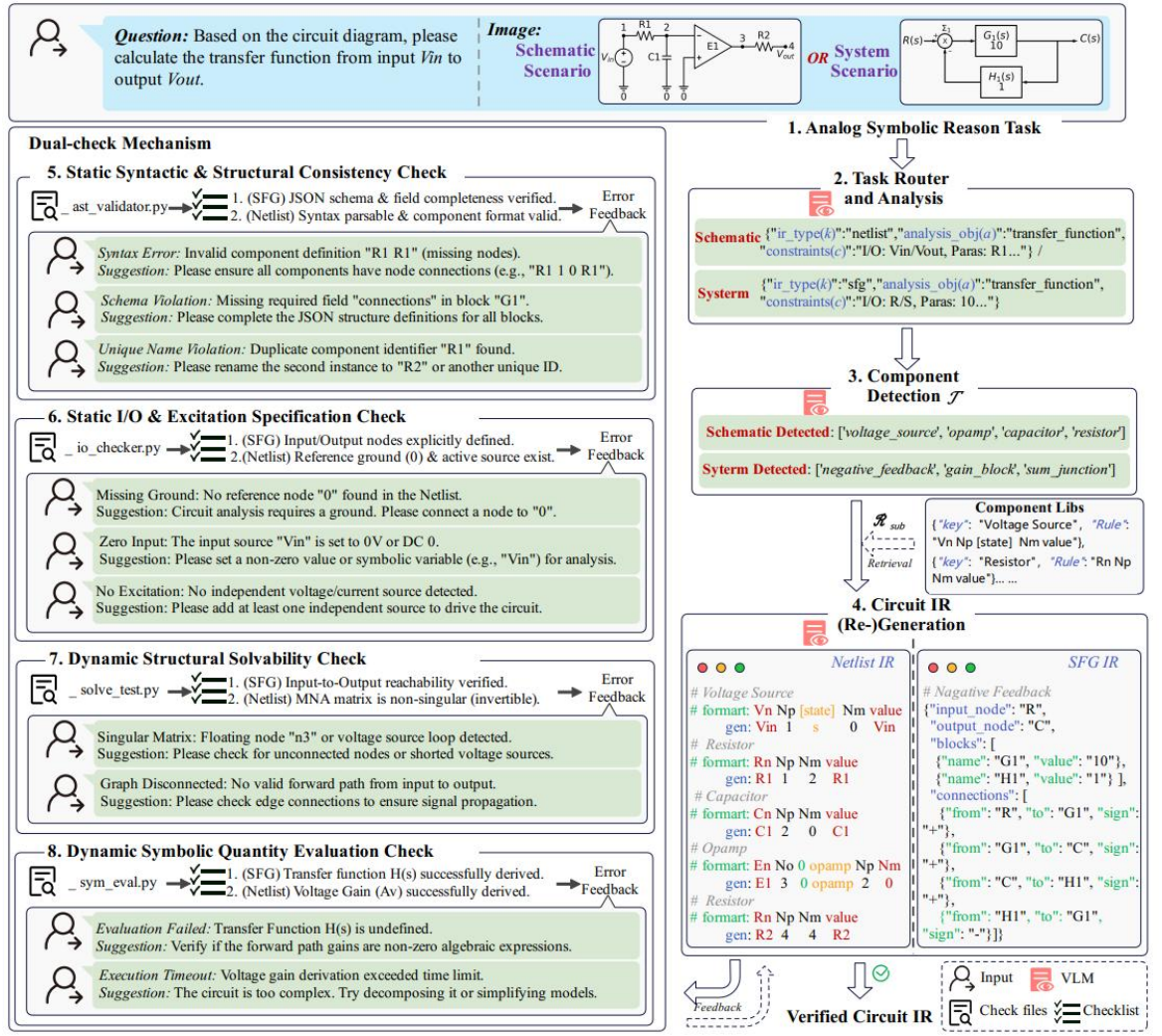
AutoVSR Overview



Method

Executable IR Construction & Verification-Enhanced Feedback

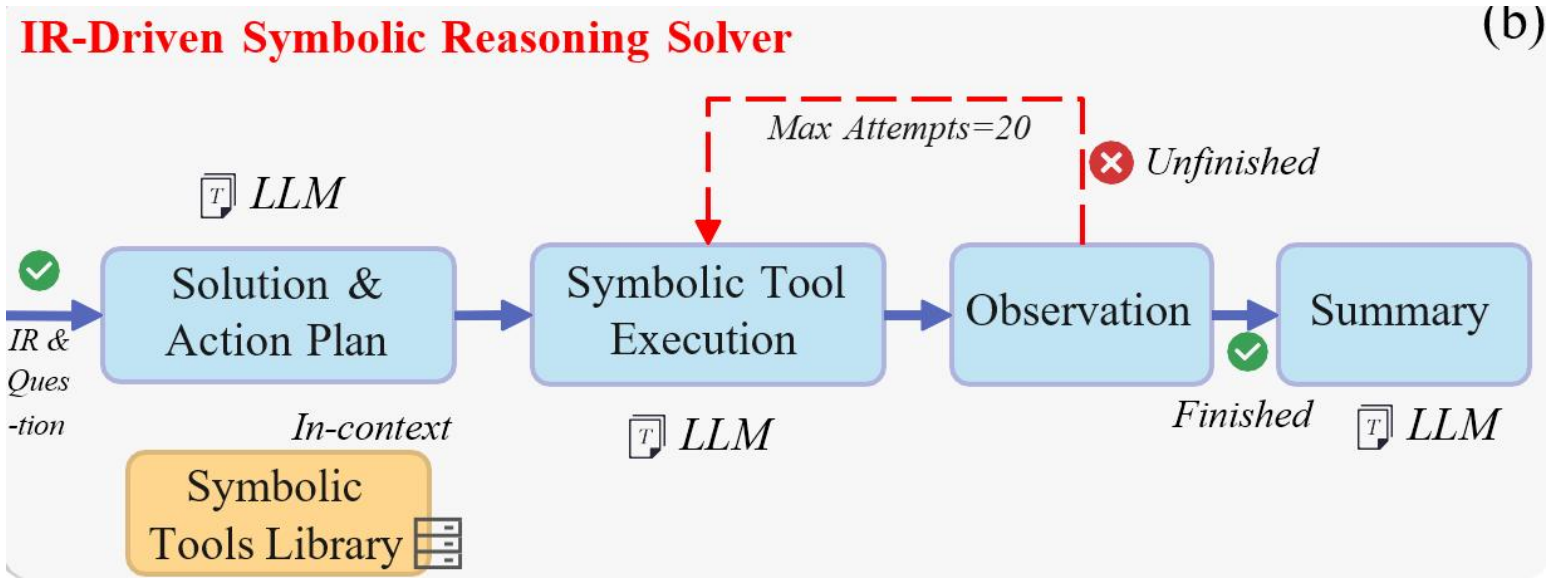
- Task router
- Component detection
- Rule retrieval
- Static checks & Dynamic checks
- Feedback loop



Method

IR-Driven Symbolic Solver

- Planning
- Execution
- Tool library



Experiment

Performance on Symbolic Expression Generation

Model Type	Method	Type 1		Type 2		Type 3		Type 4		Type 5		Overall	
		Acc. (%)	Imp. ↑	Acc. (%)	Imp. ↑	Acc. (%)	Imp. ↑	Acc. (%)	Imp. ↑	Acc. (%)	Imp. ↑	Acc. (%)	Imp. ↑
Closed Source	Gemini-3-Flash	37.95	+46.99	35.67	+53.51	23.06	+51.29	11.93	+72.73	3.95	+83.77	23.40	+59.45
	AutoVSR(Gemini-3-Flash)	**84.94**		**89.18**		**74.35**		**84.66**		**87.72**		**82.85**	
	GPT-5-mini	9.04	+83.13	9.36	+68.13	7.97	+23.50	13.64	+40.34	16.23	+14.91	10.54	+42.51
	AutoVSR(GPT-5-mini)	**92.17**		**77.49**		**31.47**		**53.98**		**31.14**		**53.05**	
	Qwen3-VL-Plus	18.07	+74.70	19.30	+74.85	13.36	+35.78	19.89	+50.00	15.79	+32.02	16.64	+51.38
	AutoVSR(Qwen3-VL-Plus)	**92.77**		**94.15**		**49.14**		**69.89**		**47.81**		**68.02**	
	Claude-Haiku-4.5	9.64	+64.46	10.53	+68.71	10.56	+18.10	9.09	+15.91	5.70	+14.04	9.67	+35.10
	AutoVSR(Claude-Haiku-4.5)	**74.10**		**79.24**		**28.66**		**25.00**		**19.74**		**44.77**	
Open Source	Qwen3-VL-32B-Instruct	15.06	+78.31	13.74	+75.73	7.11	+28.67	11.93	+58.52	17.98	+25.44	12.14	+49.63
	AutoVSR(Qwen3-VL-32B-Instruct)	**93.37**		**89.47**		**35.78**		**70.45**		**43.42**		**61.77**	
	Llama-4-17B-128E	10.84	+42.77	10.23	+45.33	6.47	+18.53	7.39	+28.41	13.16	+22.37	9.16	+30.01
	AutoVSR(Llama-4-17B-128E)	**53.61**		**55.56**		**25.00**		**35.80**		**35.53**		**39.17**	
	GLM-4.6V-Flash	3.61	+74.70	8.19	+65.20	6.25	+30.17	8.52	+34.09	10.09	+16.66	7.34	+42.51
	AutoVSR(GLM-4.6V-Flash)	**78.31**		**73.39**		**36.42**		**42.61**		**26.75**		**49.85**	
Avg.	Base Model	14.89	+66.43	15.29	+64.49	10.68	+29.44	11.77	+42.86	11.84	+29.89	12.70	+44.37
	AutoVSR	**81.32**		**79.78**		**40.12**		**54.63**		**41.73**		**57.07**	

Experiment

Performance Comparison between AutoVSR and CircuitSense

Task	Method	Model	Acc. (%)	Imp.↑
Transfer Function	CircuitSense	Gemini-3-Flash	40.89	-
		Qwen3-VL-Plus	16.18	-
		GLM-4.6V-Flash	7.80	-
	AutoVSR	Gemini-3-Flash	**82.85**	41.96
		Qwen3-VL-Plus	**68.02**	51.84
		GLM-4.6V-Flash	**49.85**	42.05
Transient Response	CircuitSense	Gemini-3-Flash	3.10	-
		GLM-4.6V-Flash	1.02	-
	AutoVSR	Gemini-3-Flash	**85.84**	82.74
		GLM-4.6V-Flash	**63.25**	62.23

Practical Applicability and Efficiency Analysis

Method	Model	Acc. (%)	Token Usage	Runtime (s)
AutoVSR w/ Lightweight Models	Gemini-3-Flash	**89.3**	**4,563**	**17.0**
	Qwen3-VL-Plus	74.8	5,487	35.5
	GLM-4.6V-Flash	56.3	8,490	50.6
E2E w/ Frontier Models	Gemini-3-Pro	52.4	13,412	118.0
	GPT-5	45.6	7,152	148.4
	Claude-Sonnet-4.5	26.2	7,033	89.5

Conclusion

We propose AutoVSR for visual-to-symbolic circuit reasoning.

AutoVSR builds a verifiable Executable IR from circuit schematics.

AutoVSR uses symbolic tools to perform reliable multi-step derivation.

Experiments show higher accuracy, lower token usage, and faster inference.

AutoVSR turns circuit images into reliable symbolic expressions through verifiable IR and tool-based reasoning.

Thanks for listening!

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