Neural Execution of Graph Algorithms

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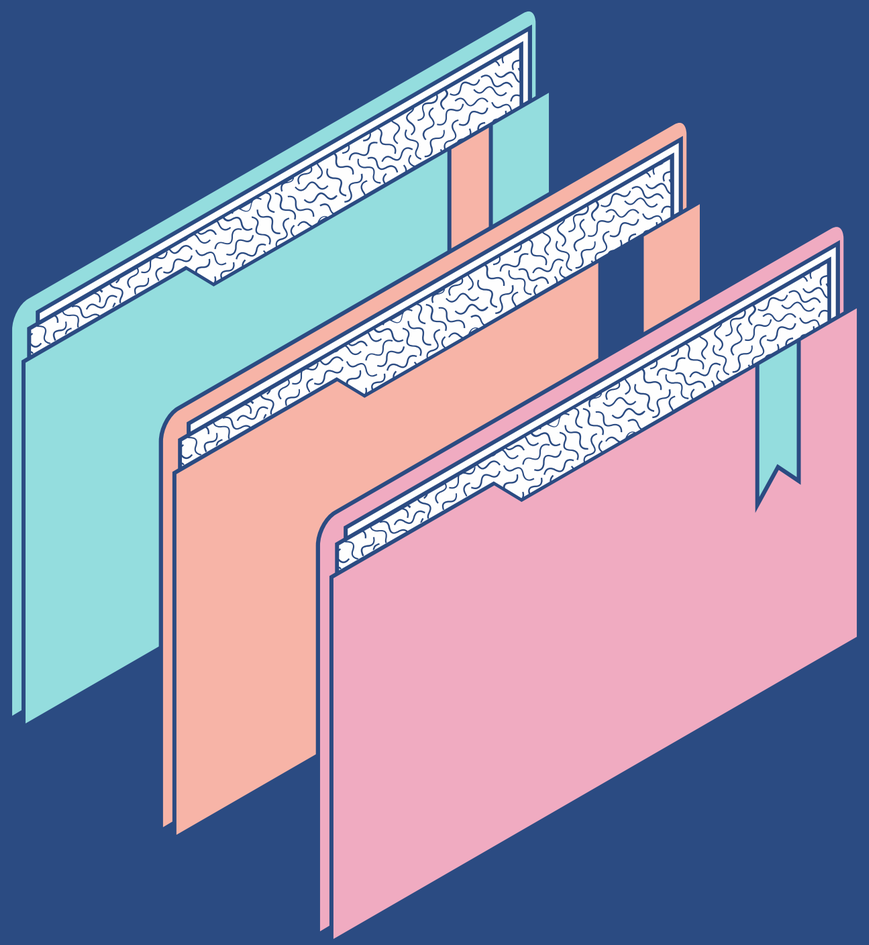
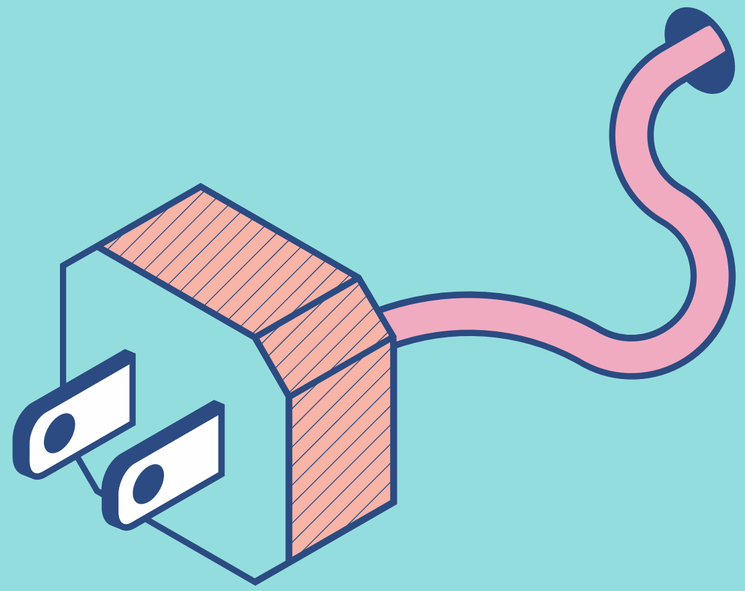


Agenda

KEY TOPICS DISCUSSED
IN THIS PRESENTATION

- Introduction
- Implementation
- Experiments
- Results
- Future work

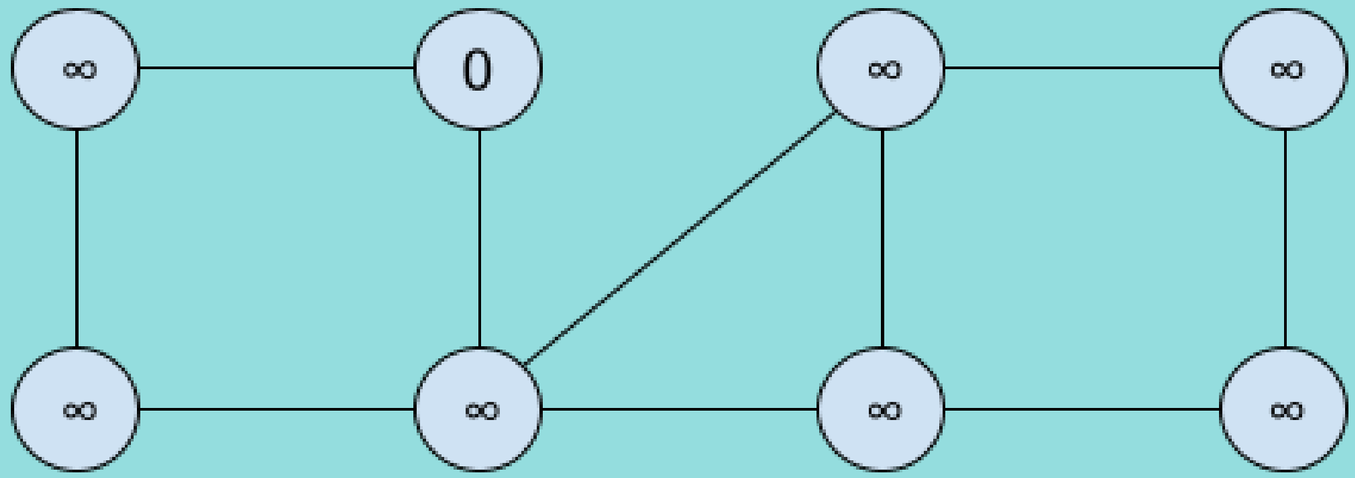
Can we make neural network reasons like an algorithms?



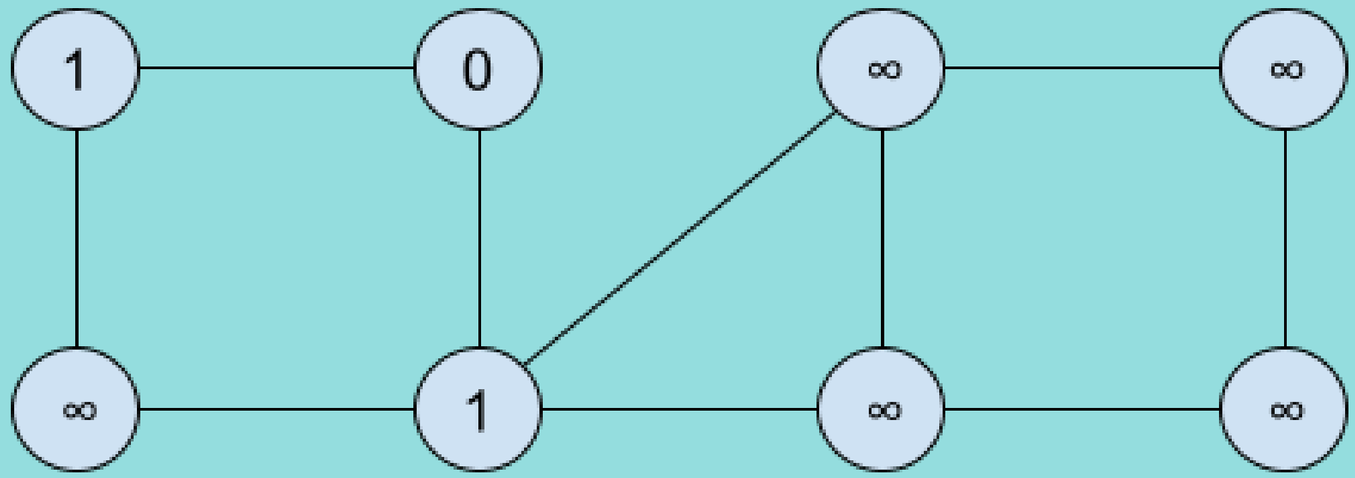
But….
What is an Algorithm?

Breadth-First Search

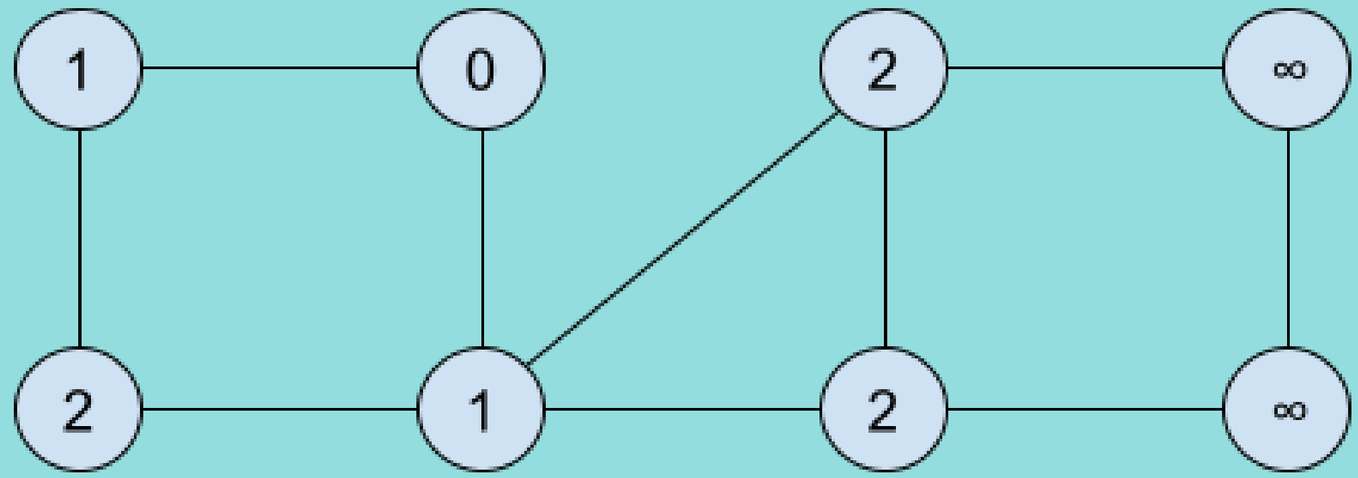
Initially



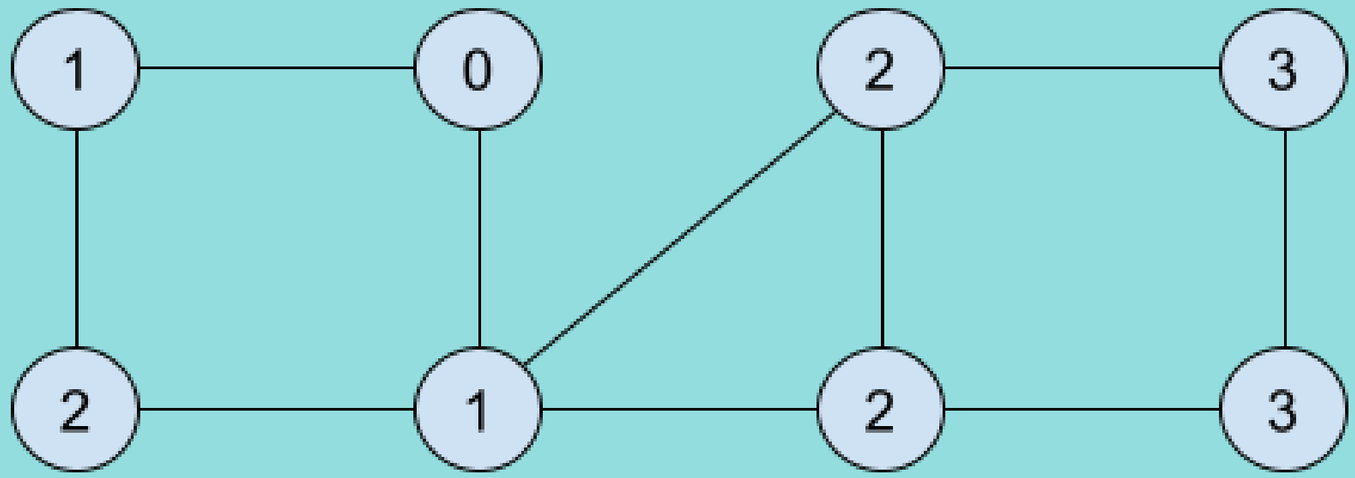
First step



Second step



Third step



Neural Network

- Operate on raw input data.
- Generalize on noisy conditions.
- Reusable across tasks.
- More data.
- Not quite interpretable

Classical Algorithms

- Strongly generalize.
- Interpretable.
- Enables a more personalized kind of learning for students.
- Input must match specifications
- tasks variations

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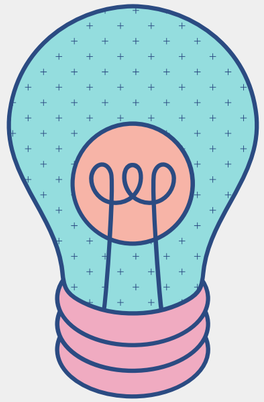

Combine Both!

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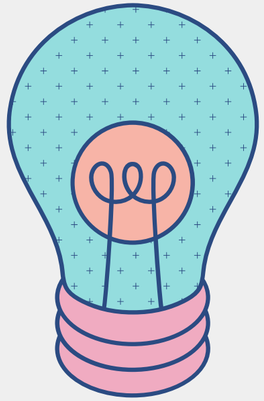

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Can we make neural network reasons like algorithms?

Why?

Strong Generalization

Learning reasoning not a mapping

Multi-task learning

resuse algorithms across tasks

Discovering Novel Algorithms

Improved heuristics for interactable problems

Executor Framework

1 — 2 — 3 — 4

Encoder

Linear projection for raw inputs

Processor

Has the logic of algorithmm

Decoder

Linear projection for output

Terminator

whether to stop or no

Results

Reachability Results

	My Results	Paper Results
GAT	99/100	92.34/99.97
MPNN-max	100/100	99.92/99.8

BellmanFord mean-squared error

Method	My Results	Paper Result
MPNN-max (no reach)	4.24	2.628

Future Work

Multi-task learning between Reachability and Bellman

Implement Prim

Do you have any questions?

Feel free to ask any question