PONTIFÍCIA UNIVERSIDADE CATÓLICA DO RIO GRANDE DO SUL
SCHOOL OF TECHNOLOGY
GRADUATE PROGRAM IN COMPUTER SCIENCE
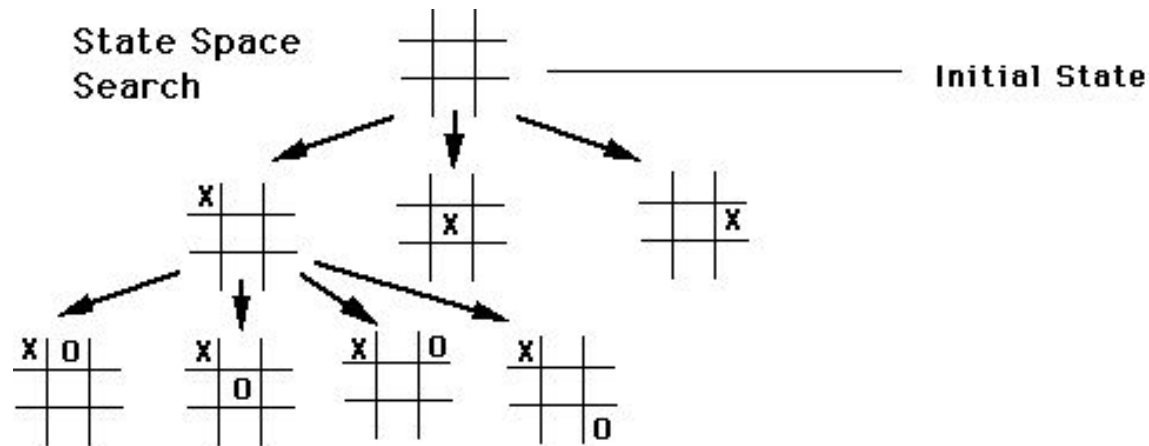
Learning Search Heuristics
by Graph Convolutional Networks

Pedro Ballester

Heuristics

- Searching is computationally expensive

Heuristics

- We try to solve this with heuristics

$$f(x) = g(x) + h(x)$$

Heuristics

- Finding a good heuristic can be quite demanding
- Tradeoff (inefficient x uninformative)
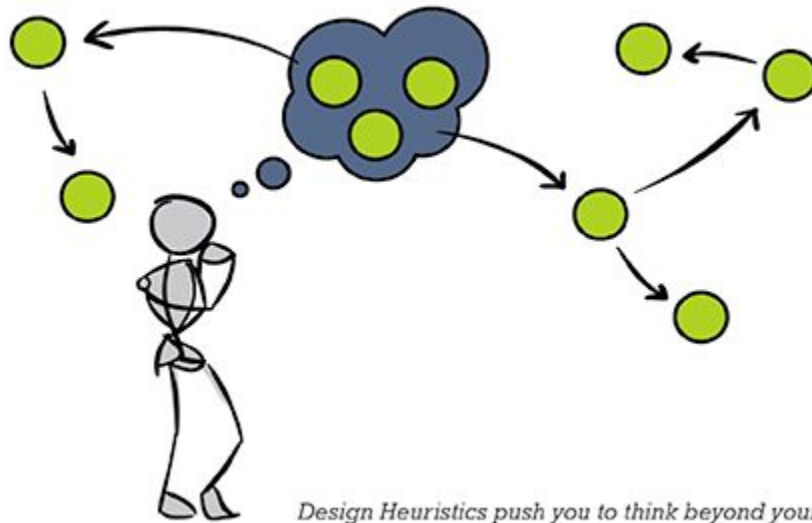
Heuristics

- Off-the-shelf
- Domain Specific

Heuristics

- Off-the-shelf

Heuristics

- Domain Specific

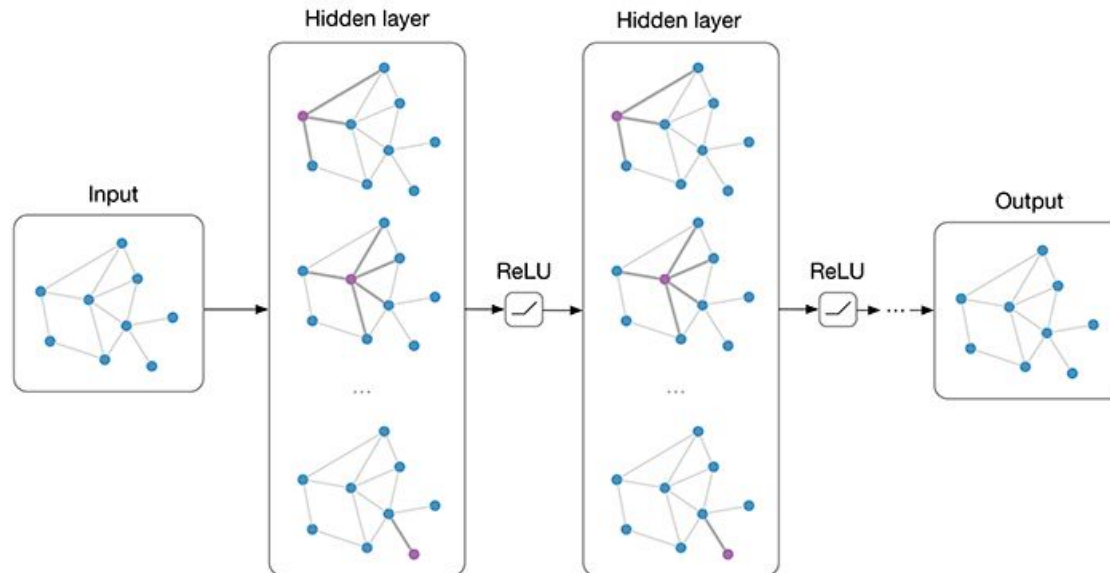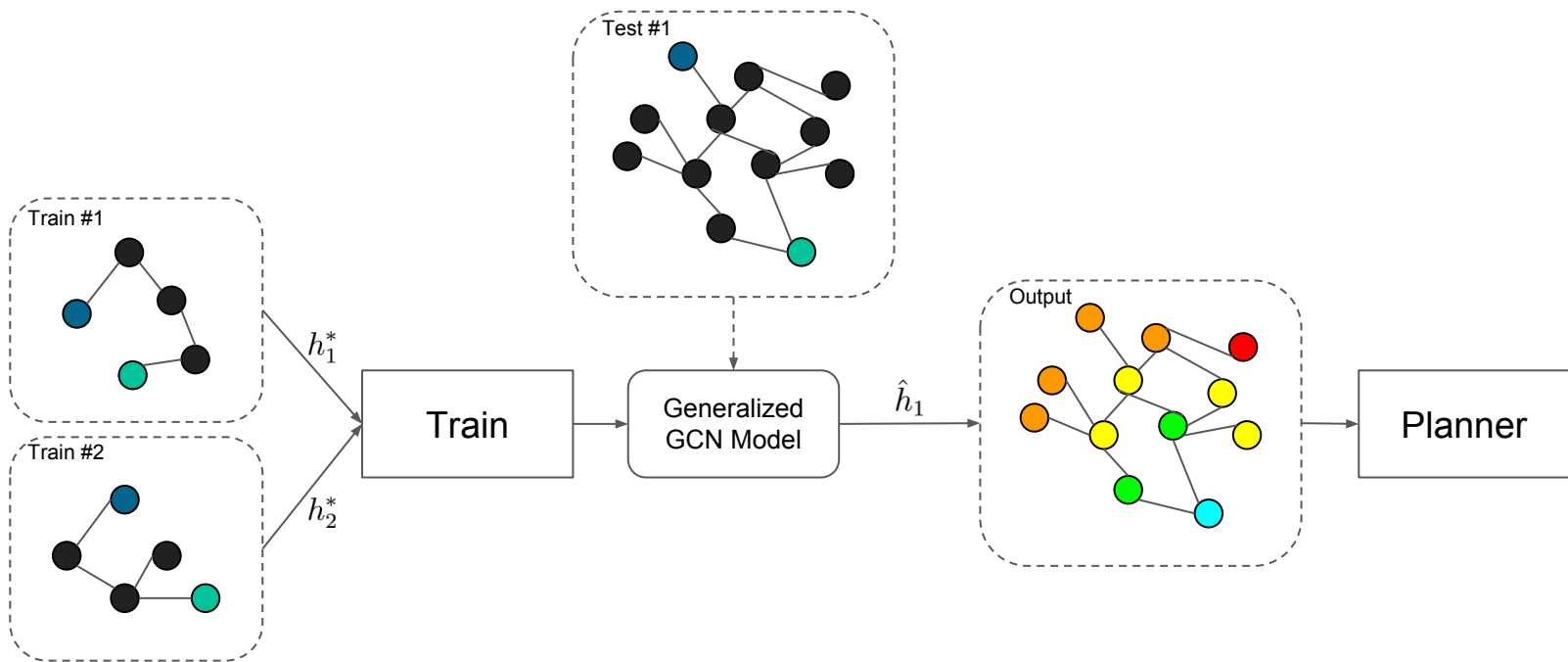Design Heuristics push you to think beyond your initial ideas

Problem

- How to find good and domain-specific heuristics without human knowledge?
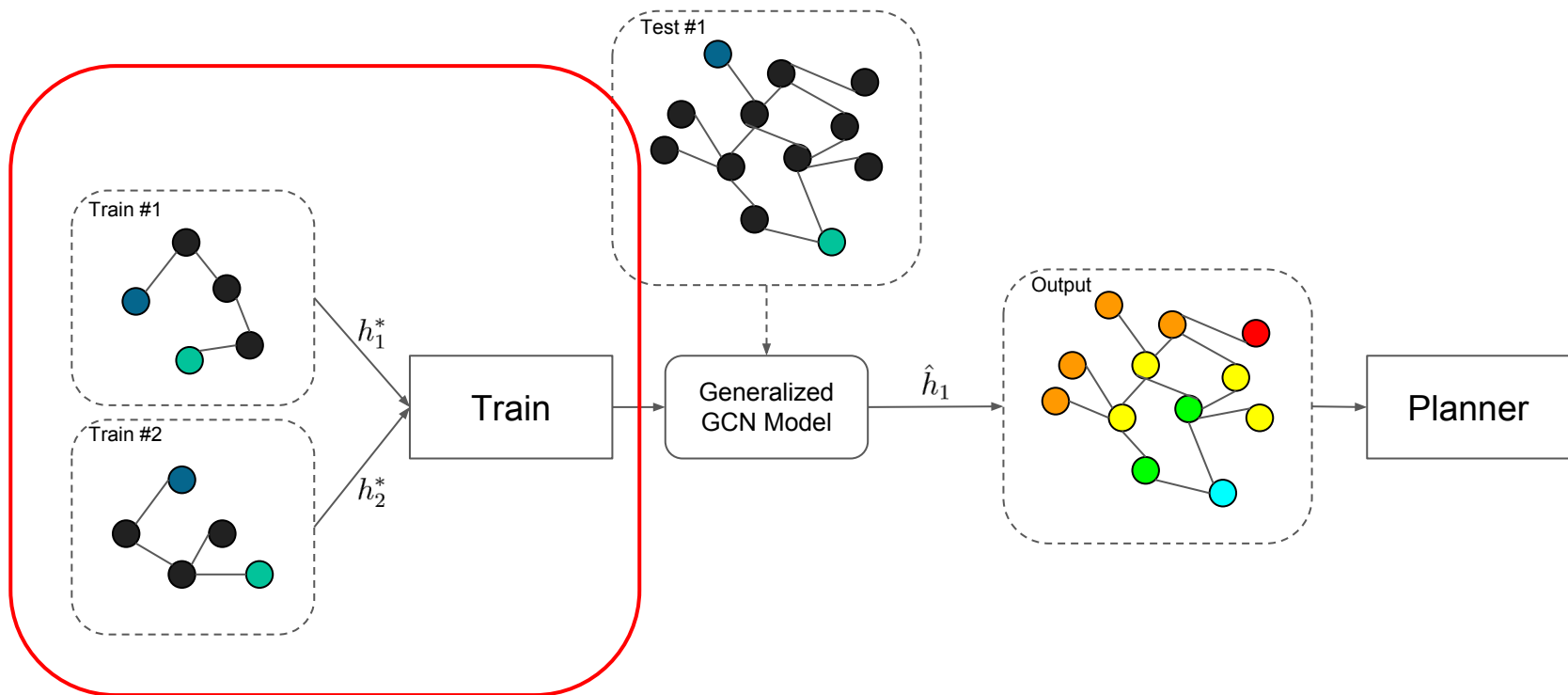
Possible Solution

- Induce graph-based models with Deep Learning (GCN)
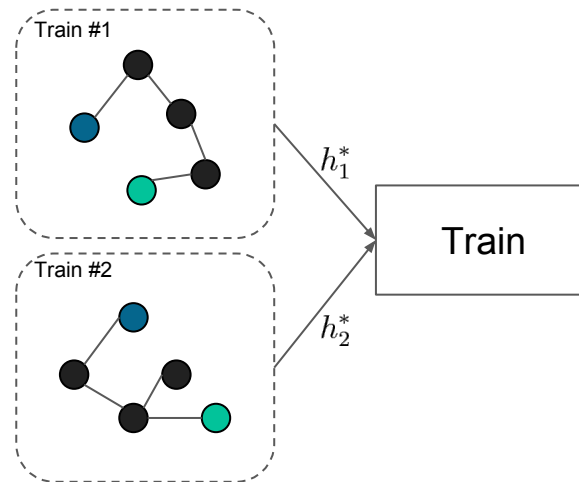- The graph should output the heuristic value for an expanded frontier
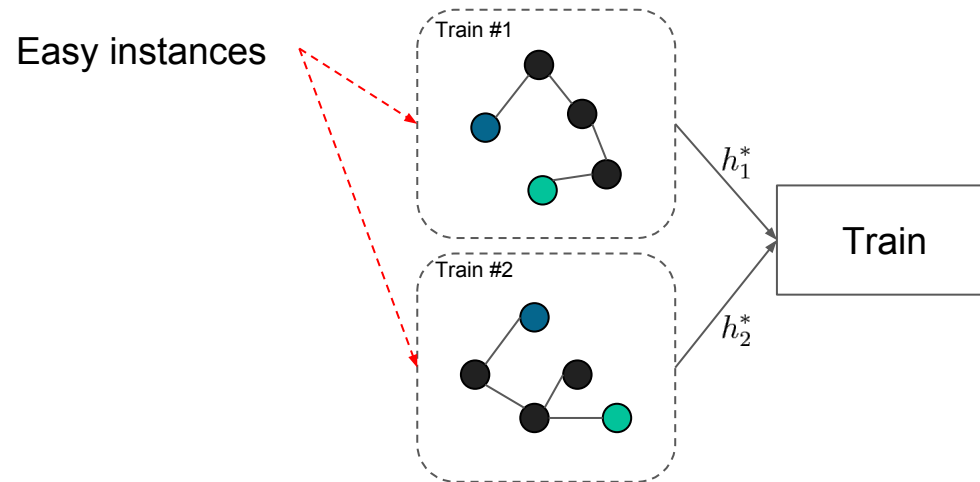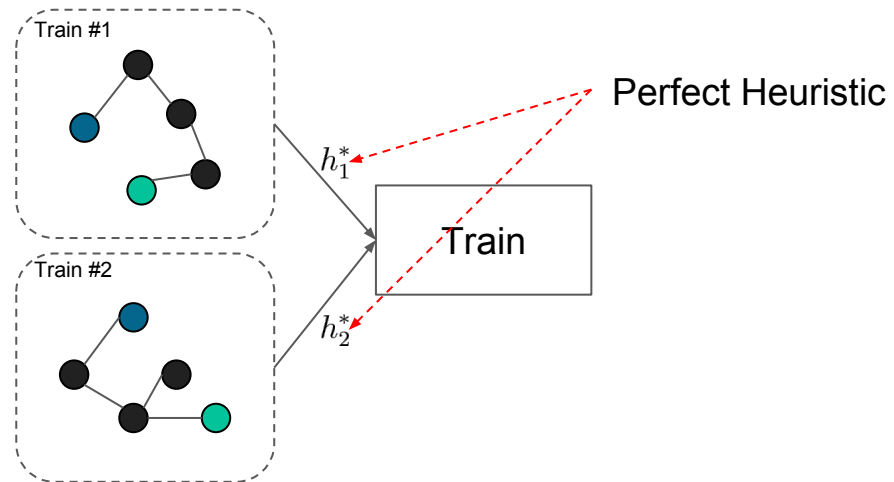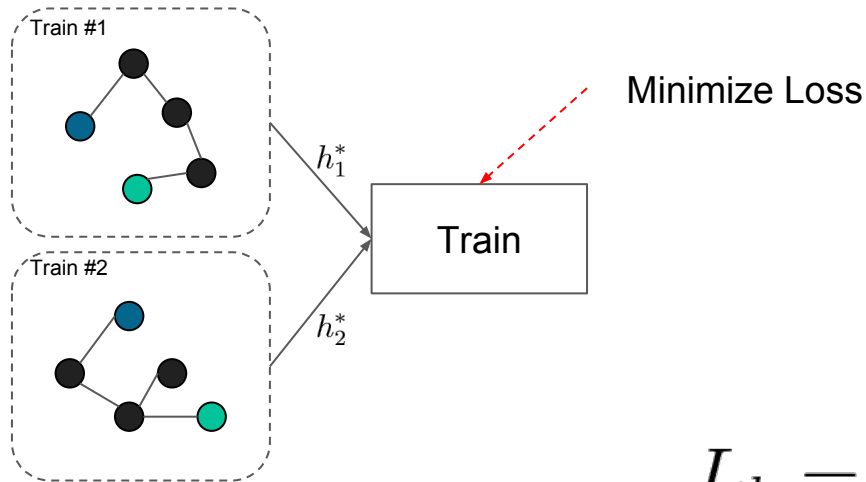
Proposed Method

Training

Training

Training

Training

Training

Train #1

Train #2

h_1^*

h_2^*

Train

Minimize Loss
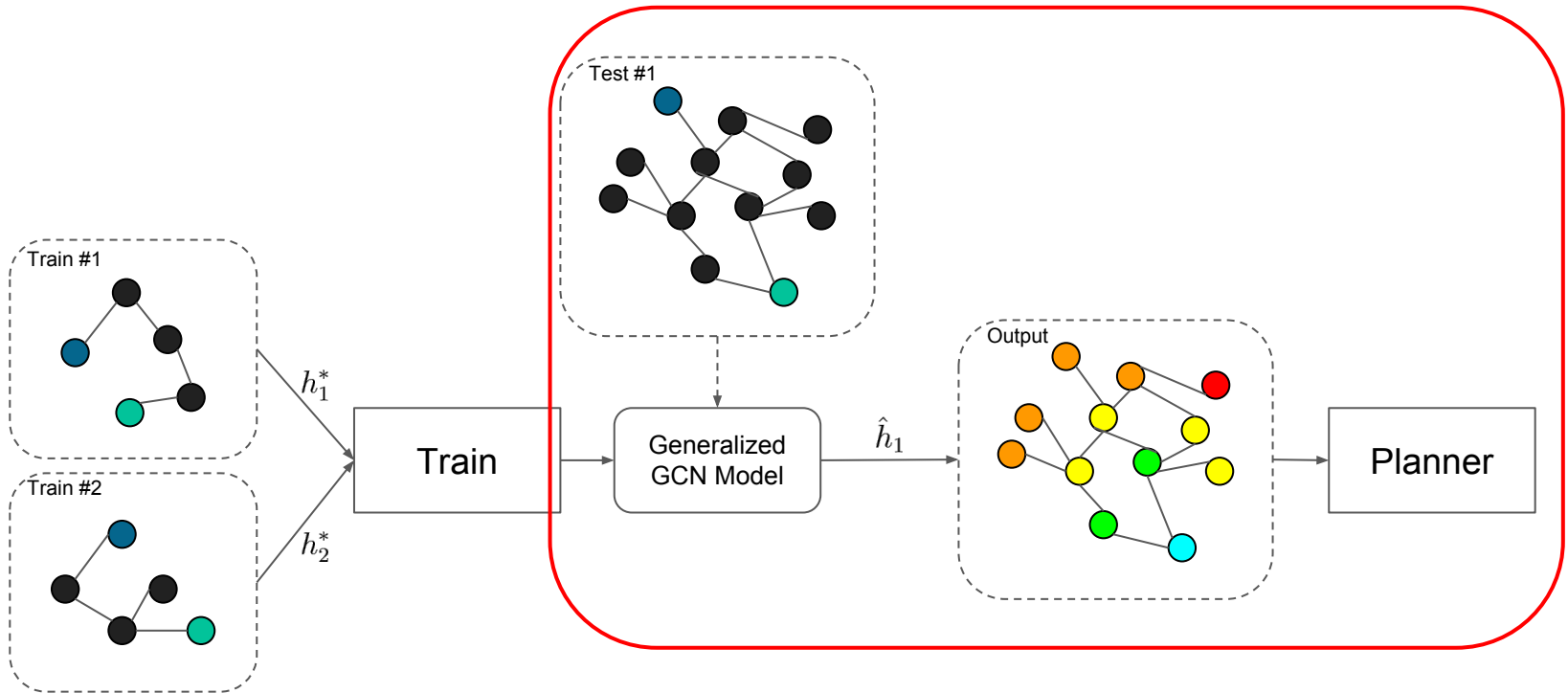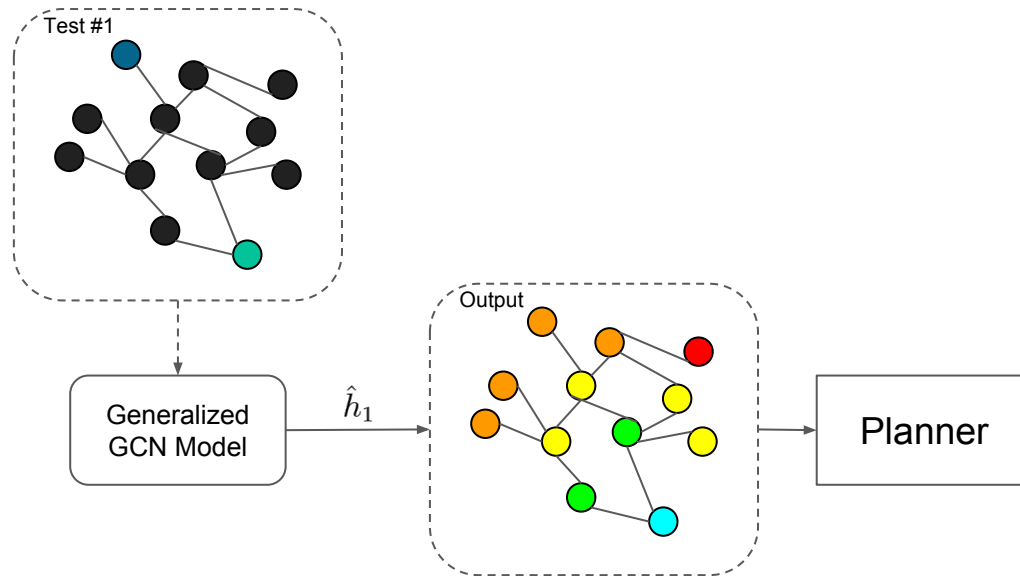
$$L_h = \sum_{i=1}^{N} ||\hat{h}_i - h_i^*||_2$$

Testing

Testing

Testing

Testing

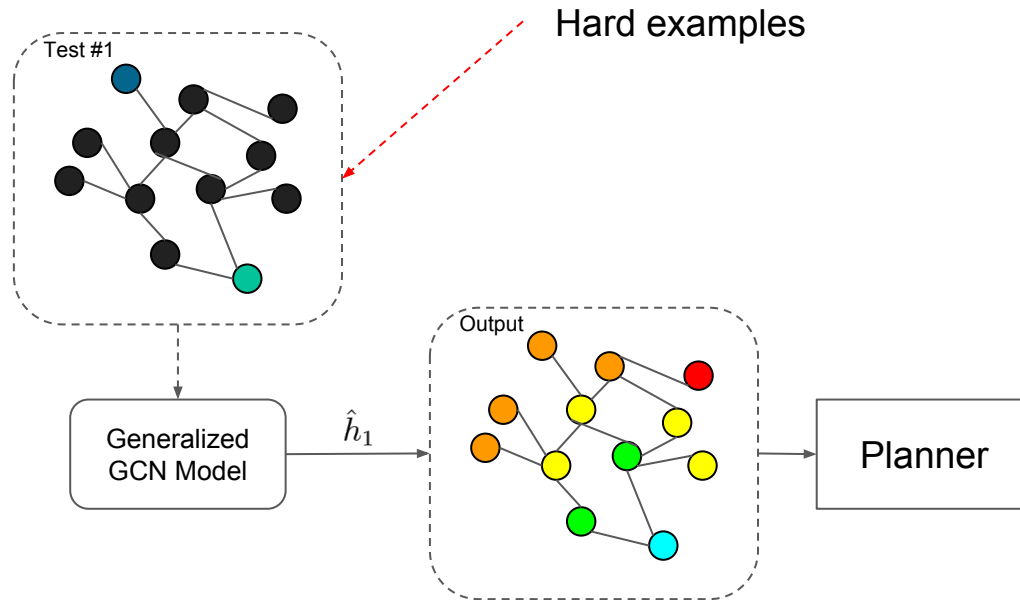# Testing

Node-wise output
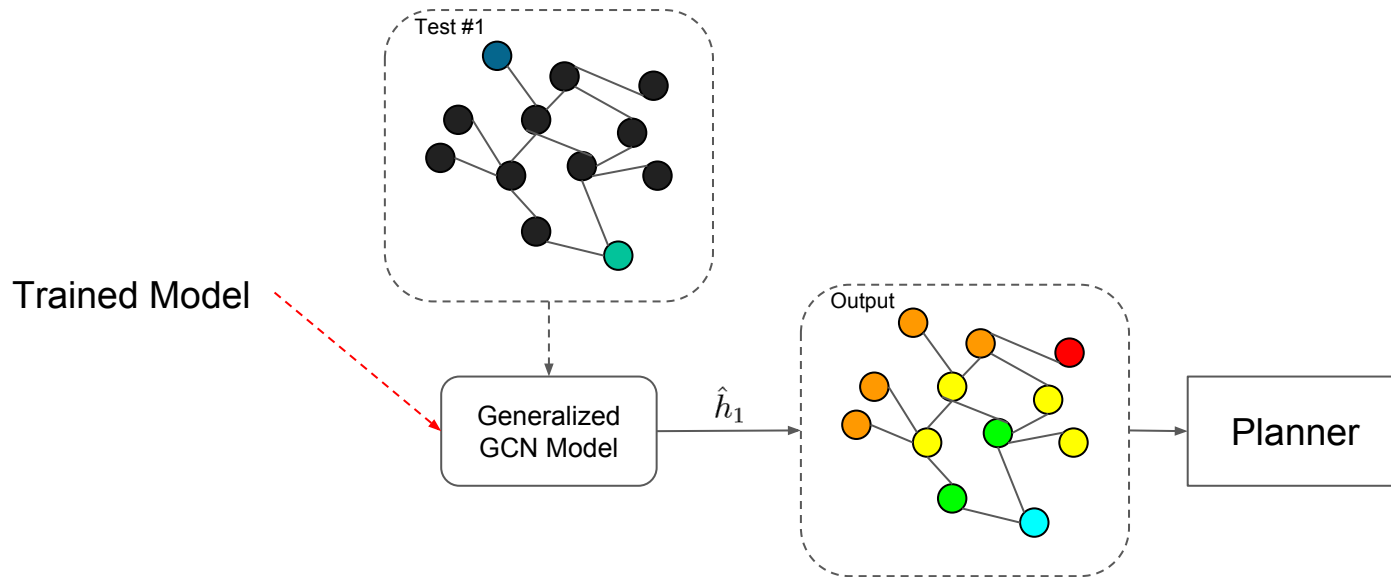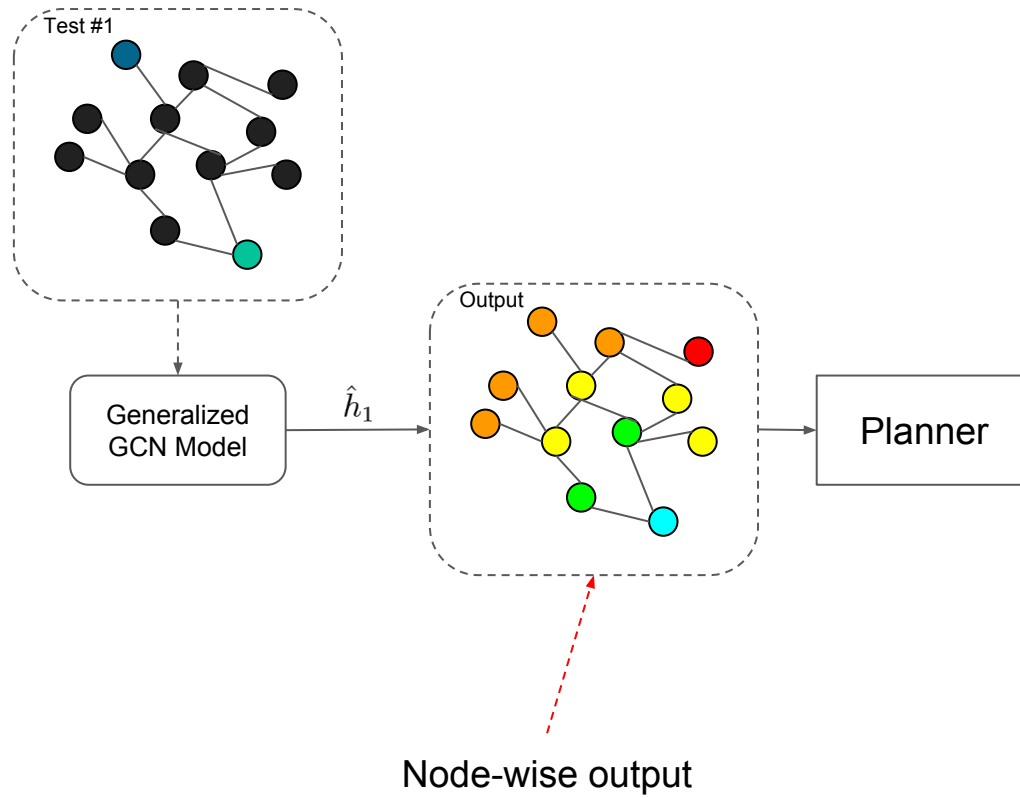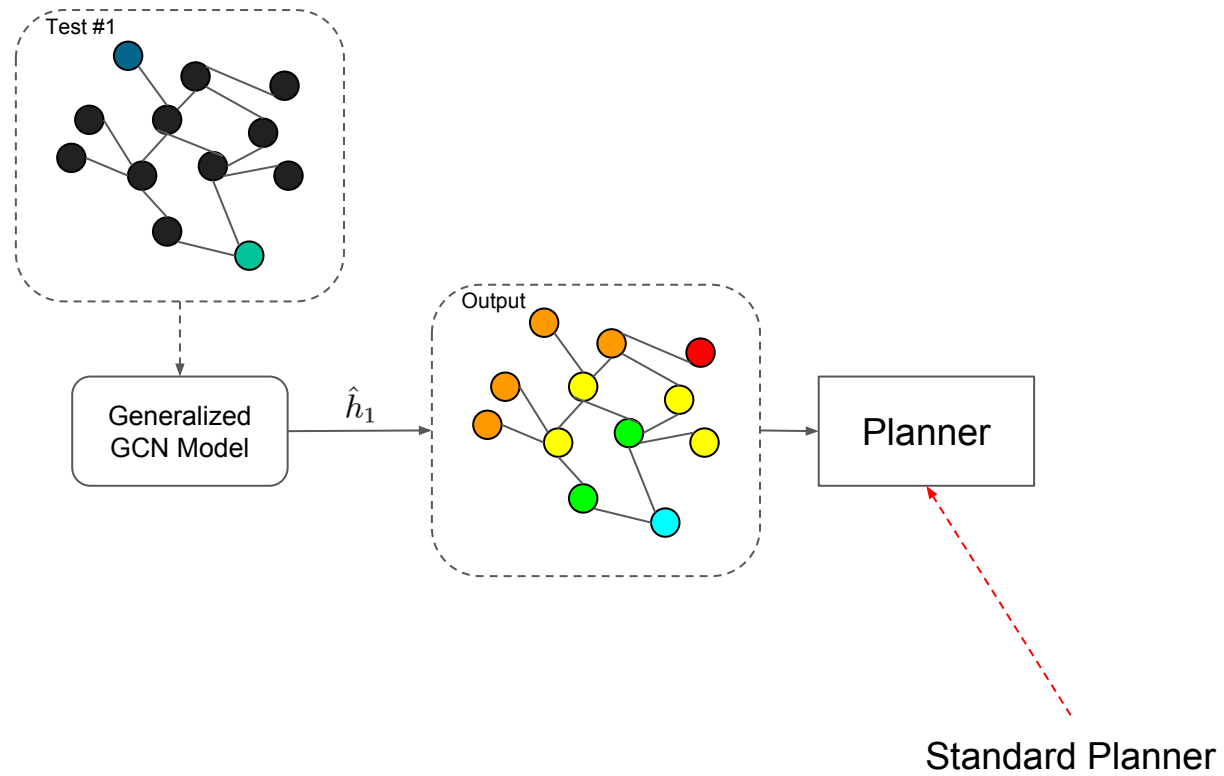
Testing

Challenges

- Encode state information without exploding vector size;
- Classify the heuristic in planning definitions (Safe, Goal-aware, …)
- Understand heuristic generalization (becoming an off-the-shelf heuristic)