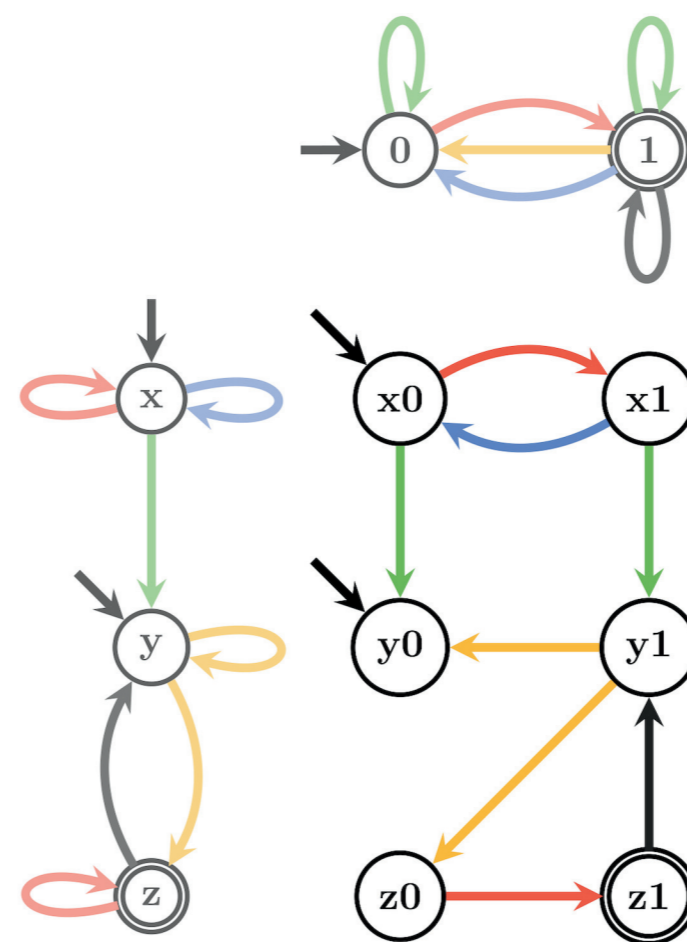


Pushing the limits of abstraction heuristics: WHICH PROBLEMS CAN (OR CANNOT) BE ABSTRACTED EFFICIENTLY?



Factored Tasks

- generalization of SAS⁺
- **independent variables** but otherwise as general as possible
 - multiple initial states
 - disjunctive preconditions
 - conditional effects
 - angelic nondeterminism

Abstractions for Factored Tasks

conservative and **induced** abstractions

- projections / pattern databases^{T,I}
- domain abstractions^{T,I}
- Cartesian abstractions^{T,I}
- merge-and-shrink abstractions^I

our contribution: ^Ttheory ^Iimplementation

Why Possible Efficiently?

projection and **domain abstraction**:

- syntactic \equiv semantic abstraction

Cartesian CEGAR:

- initial states
 - goal states
 - preconditions
 - postconditions
- } Cartesian sets

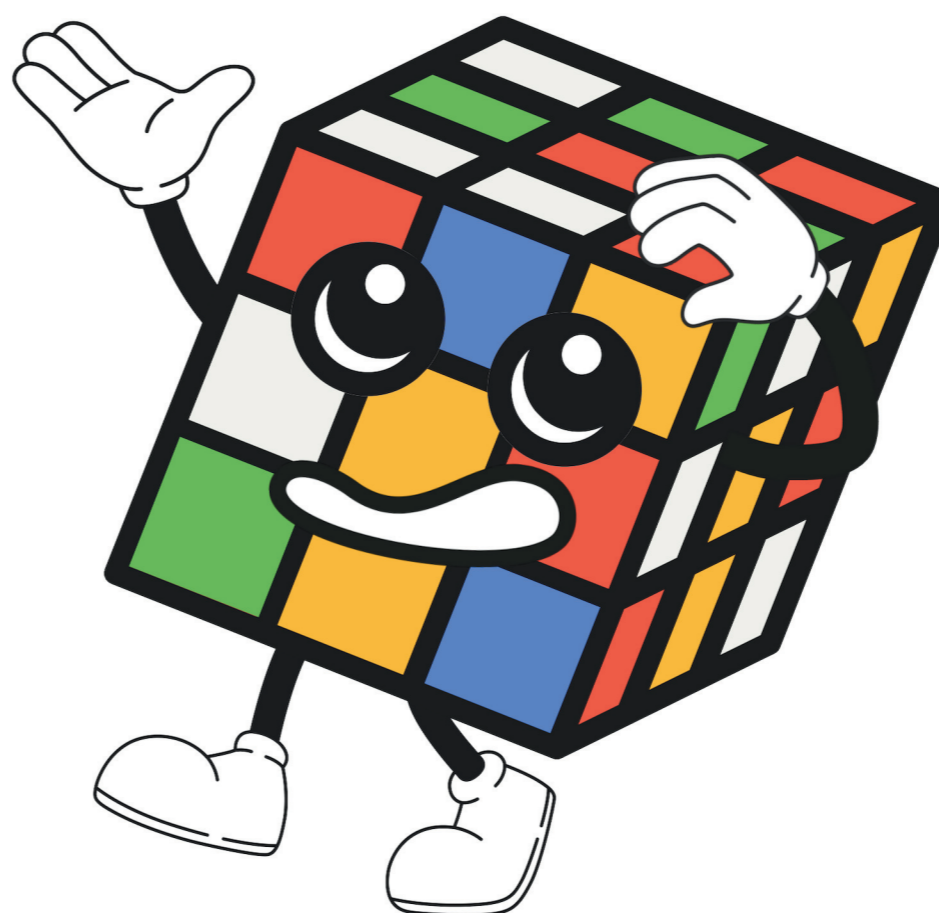
What's Not Possible Efficiently?

Consider projection on $\{V\}$ and operator o with general conditional effect:

$$\varphi \triangleright (V := d')$$

Does abstract transition $d \xrightarrow{o} d'$ exist?

- only if $\varphi|_{\{V=d\}}$ satisfiable
- **NP-complete** already for φ in 3CNF



Abstraction Heuristics for Factored Tasks



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