

ML pipeline exploration

Do it yourself: <https://github.com/IBM/grammar2pddl>



Tools and links for hands-on exercise

- HTN2PDDL translation: <https://github.com/ronwalf/HTN-Translation>
- K* planner: <https://github.com/ctpelok77/kstar>
- PlanUtils: <https://github.com/AI-Planning/planutils>
- PDDLEditor plugin for VSCode:
<https://marketplace.visualstudio.com/items?itemName=jan-dolejsi.pddl>

Tools and Applications

AI Planning: Theory and Practice

Challenges of using AI planning in applications

- Modeling: Application domain \neq planning domain
- There are very few integrated toolchains for AI planning
- There are few libraries/frameworks that integrate AI planners
- Round-tripping is cumbersome

Pre/post-processing

- What is the similarity/equivalence between what desired output and plans
 - Example: Are ML pipelines like plans and how? What are our 'actions'?
- What are our inputs and is there a close-enough planning formalism?
 - Example: We have data science grammars, that look a lot like HTN specifications
- How do we map input elements to predicates and actions?
 - Example: grammar tokens = actions, grammar rules = methods
- Do we need 'maintenance actions' - how do we need to post-process plans?
 - Example: in the HTN to PDDL translation there are maintenance 'method start' and 'method end' actions that do not produce any pipeline tokens

AutoAI: Automating ML Pipeline Generation



Problem

Space of possible pipelines is huge

Humans can explore only a tiny portion of it

Humans are biased towards the pipelines they already are familiar with

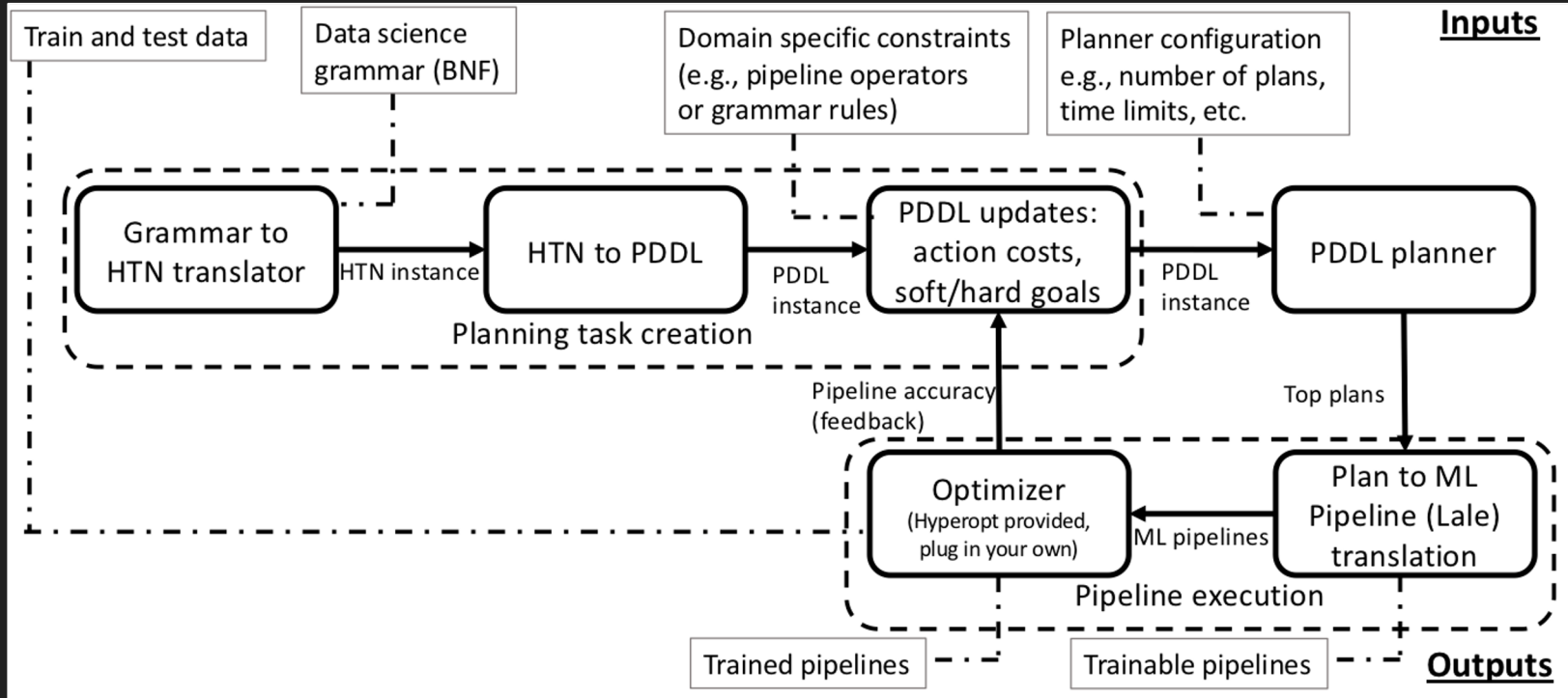
Benefits

- Generation of pipelines of high accuracy automatically
- Reduces the need for human data scientists

Solution

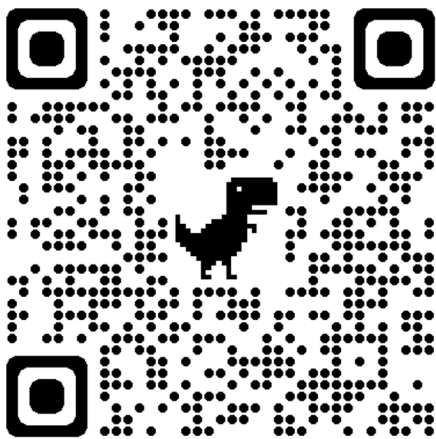
- Use regular grammars to define the possible pipeline compositions
- Translate regular grammars to HTN planning model, and then to classical planning model
- Enrich planning model with user defined constraints
- Use AI Planners to solve the planning model and translate plans to pipelines

ML pipeline generation/exploration walkthrough



ML pipeline exploration

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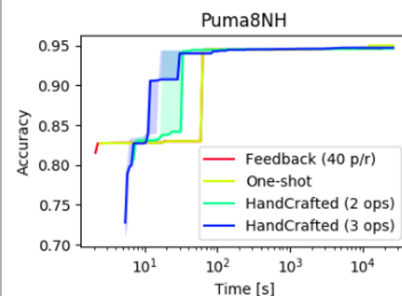
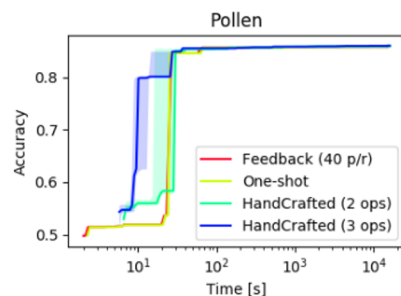
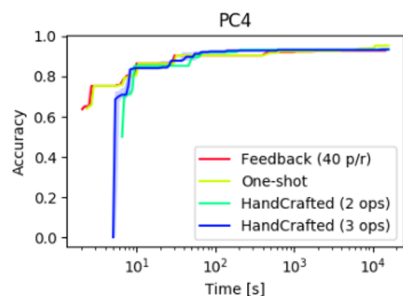
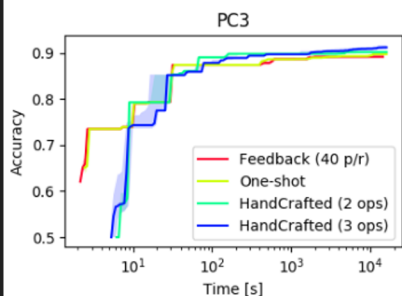
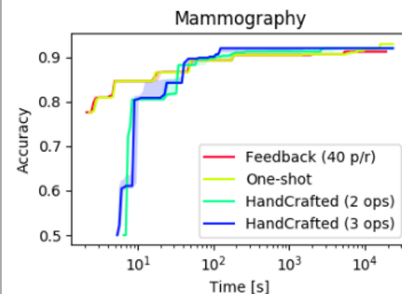
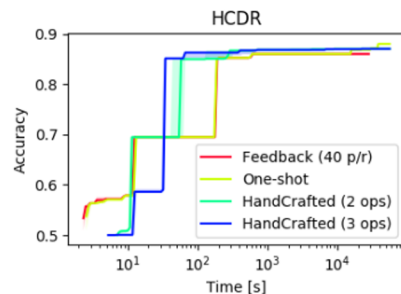
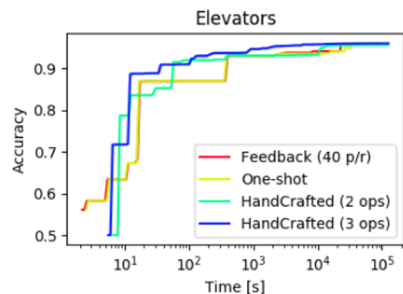
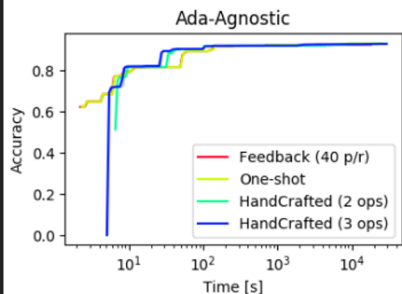


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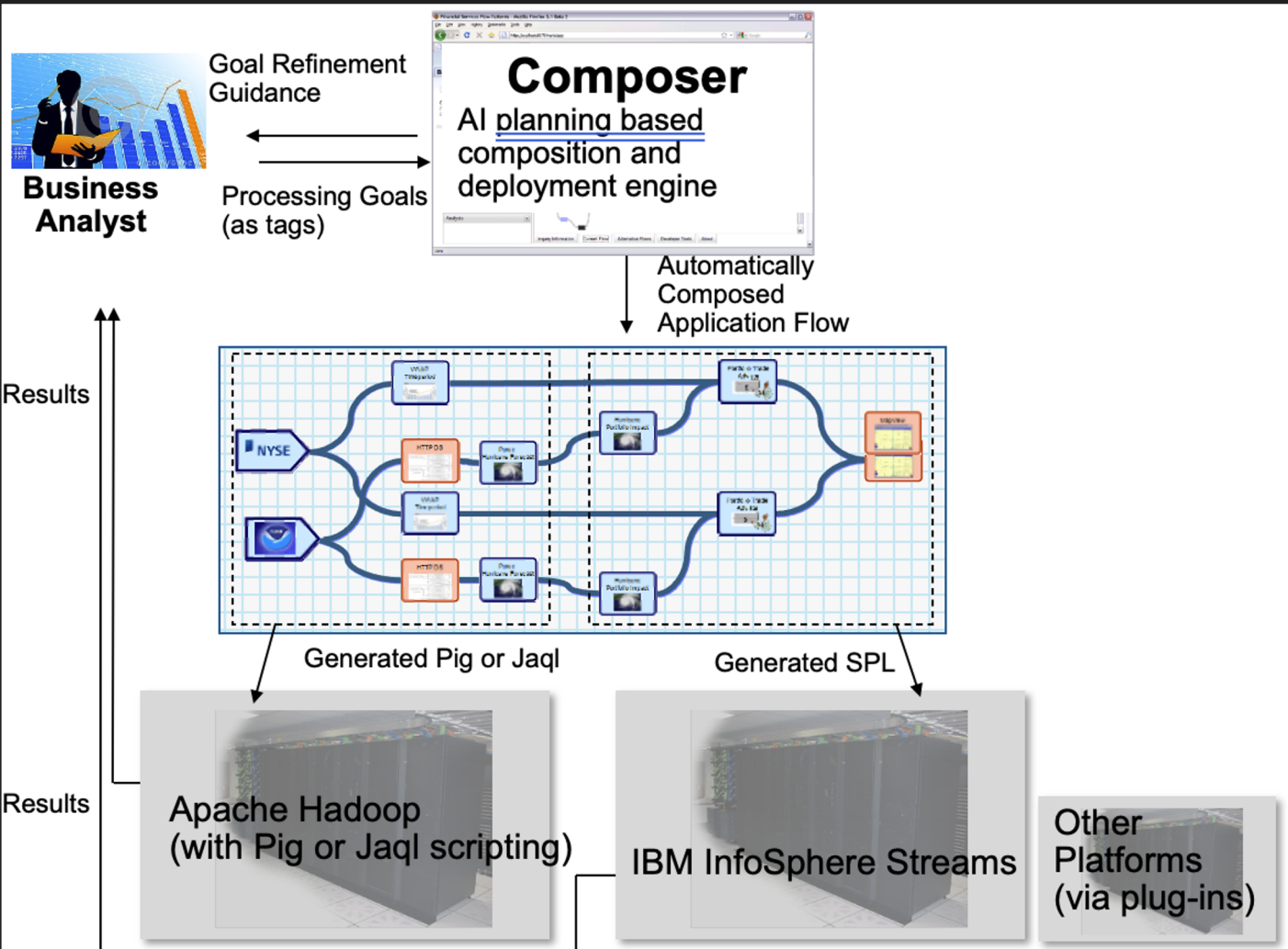
ML pipeline exploration: matching handcrafted pipeline performance

- 27 datasets from OpenML (shown datasets with max accuracy $\leq 95\%$)
- Two hand-crafted baselines: manually chosen by experts chains of 2 or 3
- W.o. feedback: one-shot 1000 plans
- With feedback: 40 plans per iteration

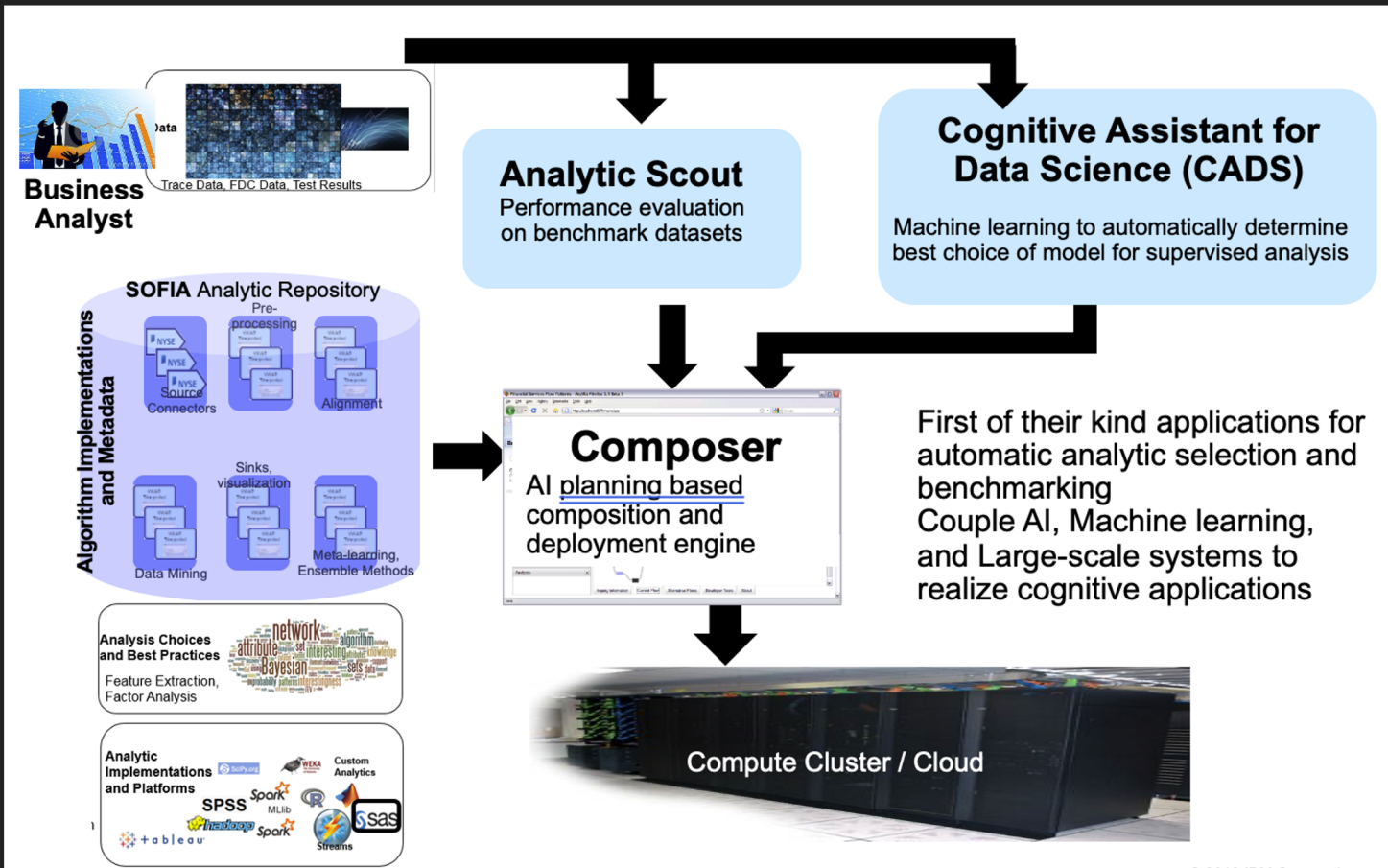


Other Applications:

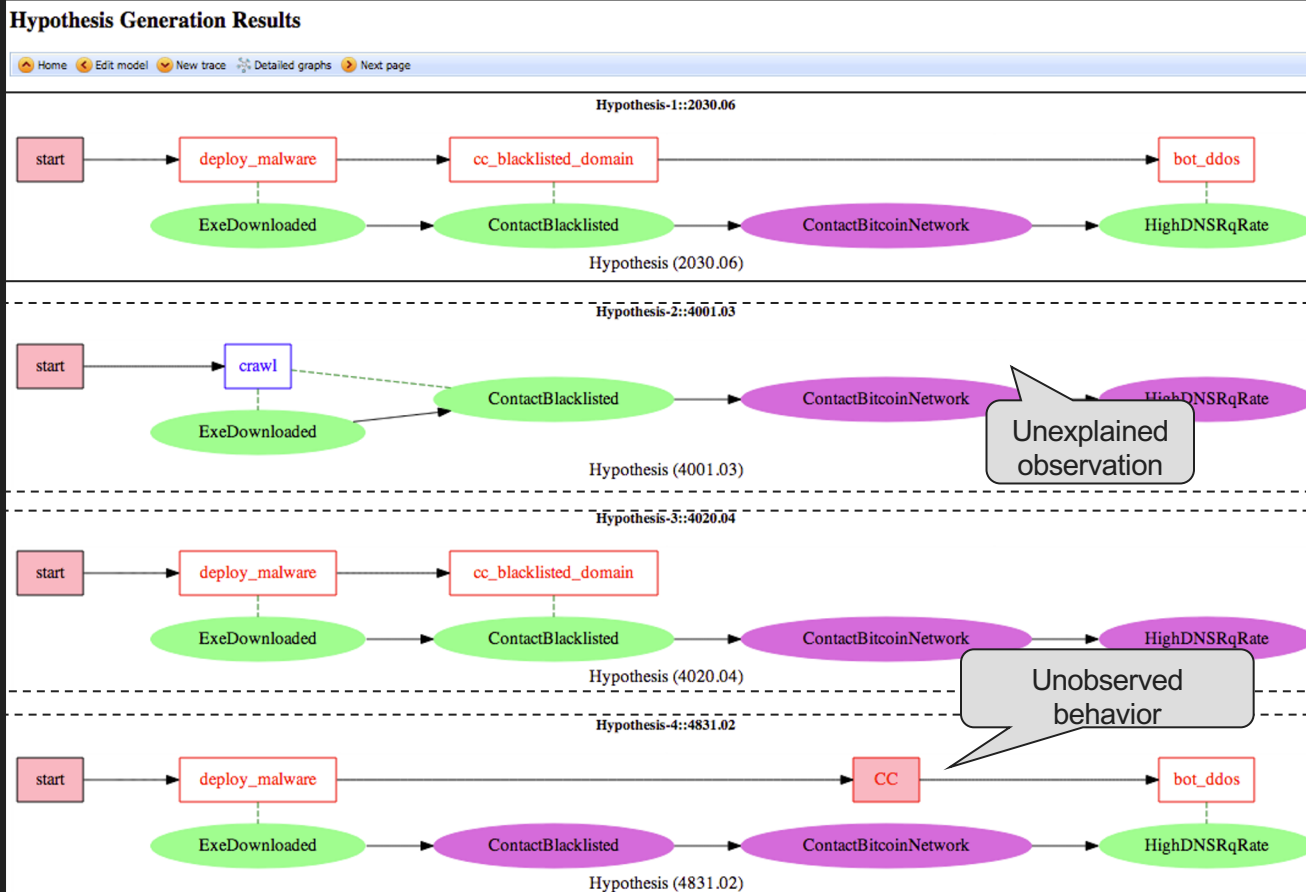
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Automated
Analytics
Composer



Other Applications: DS automation via Scout and CADS




Other Applications: Hypothesis generation in cyber



Scenario Planning Advisor

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IBM Scenario Planning Advisor



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Problem

Scenario Planning for risk mitigation is a mostly manual process

Only a few scenarios can be constructed manually and explored

High impact low likelihood events are overlooked

Benefits

- Reduction in time for building scenarios from months to hours
- Exploration of orders of magnitude more scenarios than possible if built manually

Solution

- Exploit NLU techniques to semi-automatically construct scenario planning models
- Automatically explore the space of possible scenarios with an AI Planner
- Choose scenarios of high relevance to a client at a particular time