AI Planning:
Theory and Practice


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What is AI Planning...

Task of finding a procedural course of action

for a declaratively described system

to reach its goals

while optimizing overall performance measures

Brief introduction to AI planning

Basic Planning Problem

Given descriptions of

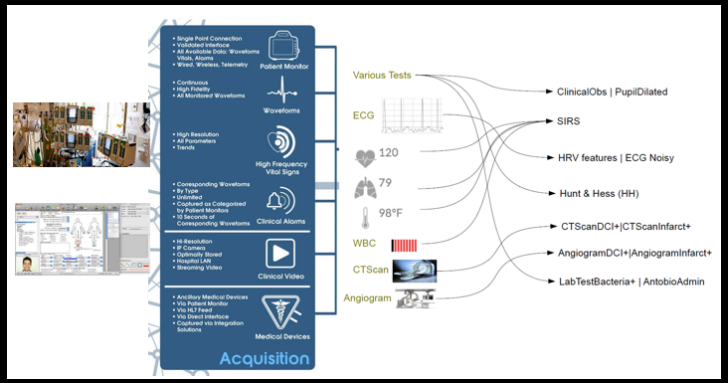
- possible initial states of the world
- desired goals
- a set of possible actions

Synthesize a plan that is guaranteed to generate a state which contains the desired goals.

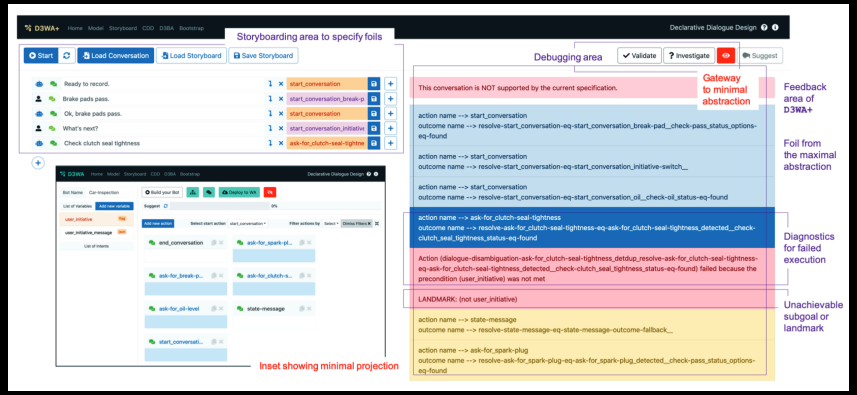
Brief introduction to AI planning

https://www.odtap.com/2018/10/

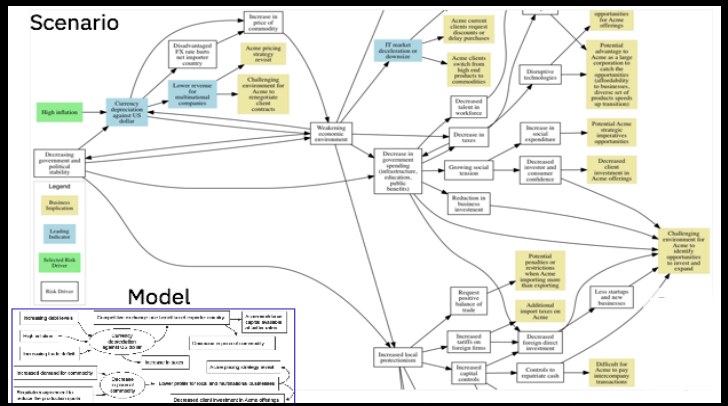
Motivation



[Automated large-scale data analysis, ICAPS 2015]



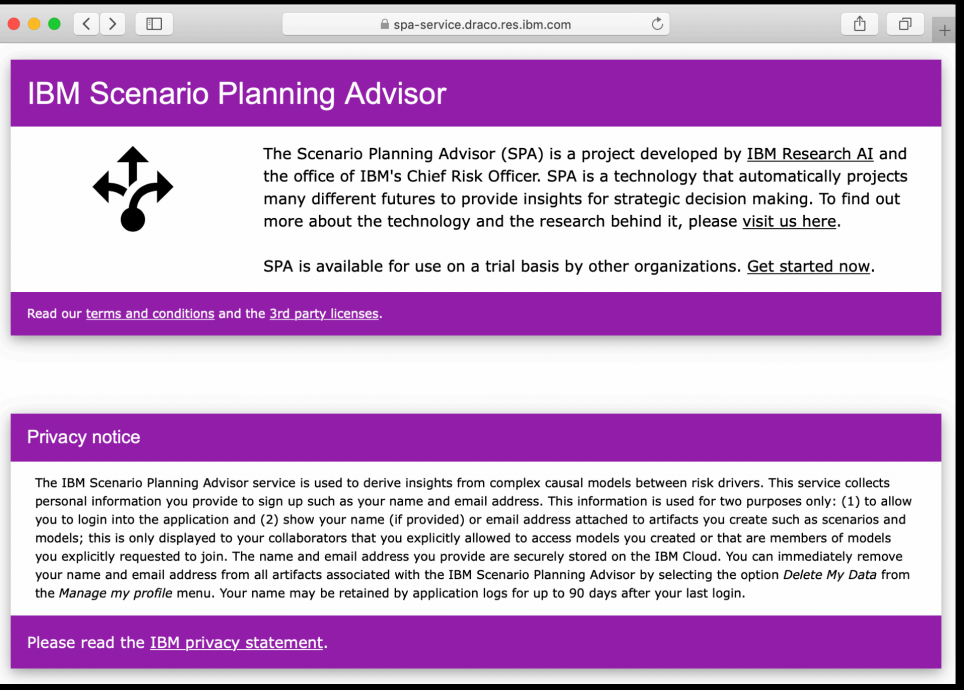
[D3WA+: A Case Study of XAIP in a Model Acquisition Task, ICAPS 2020]



[Scenario planning for enterprise risk management, AAAI 2018]

[Exploring Context-Free Languages via Planning: The Case for Automating Machine Learning, ICAPS 2020]

Scenario Planning Advisor



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

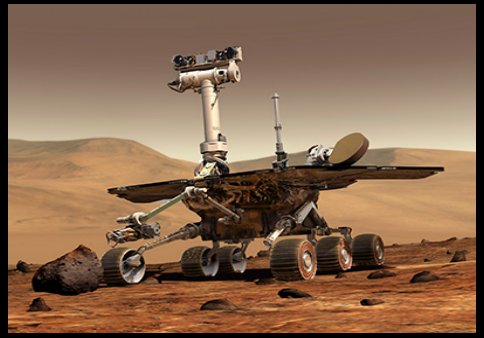
Solution

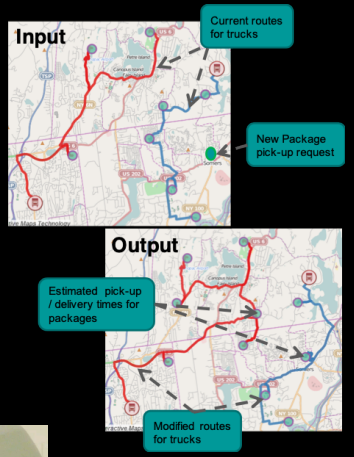
– Exploit NLU techniques to semi-automatically construct scenario planning models

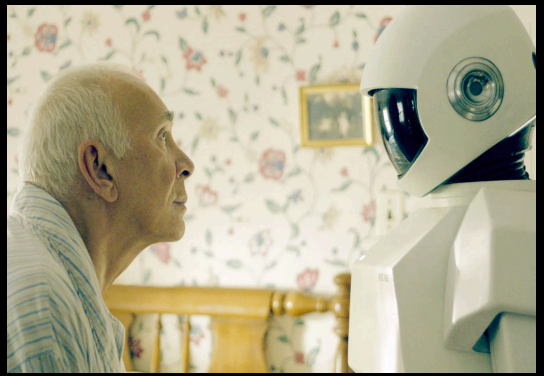
– Automatically explore the space of possible scenarios with an AI Planner

– Choose scenarios of high relevance to a client at a particular time

Why AI Planning is Important?





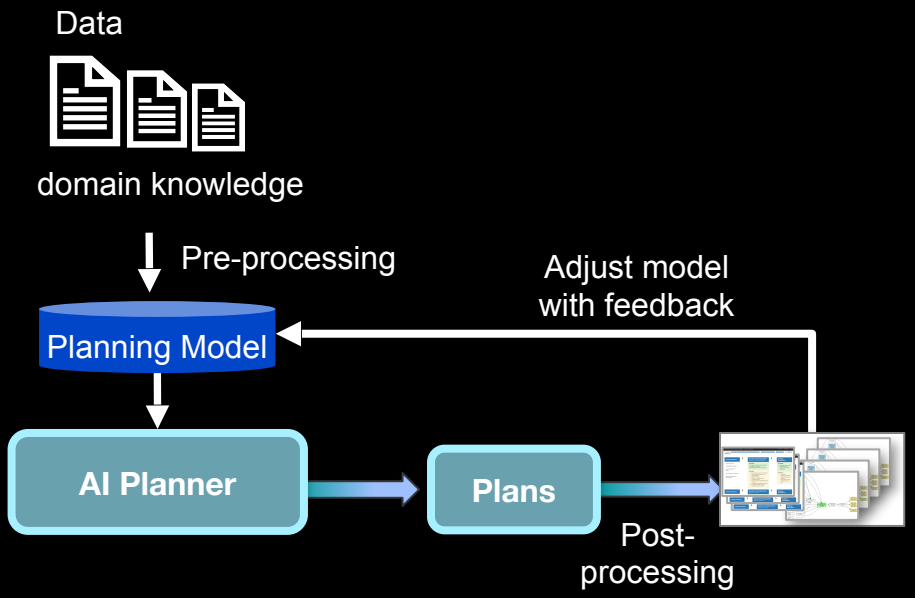


Source: https://www.livemint.com/Opinion/tijzm8fIw2RY98Jvdm8LzJ/Opinion--Cyber-security-a-complex-behaviour-problem.html
Source: https://www.rigzone.com/news/schlumberger_in_400mm_deal_to_sell_drilling_assets-15-may-2019-158842-article/

How to Spot a Planning Problem

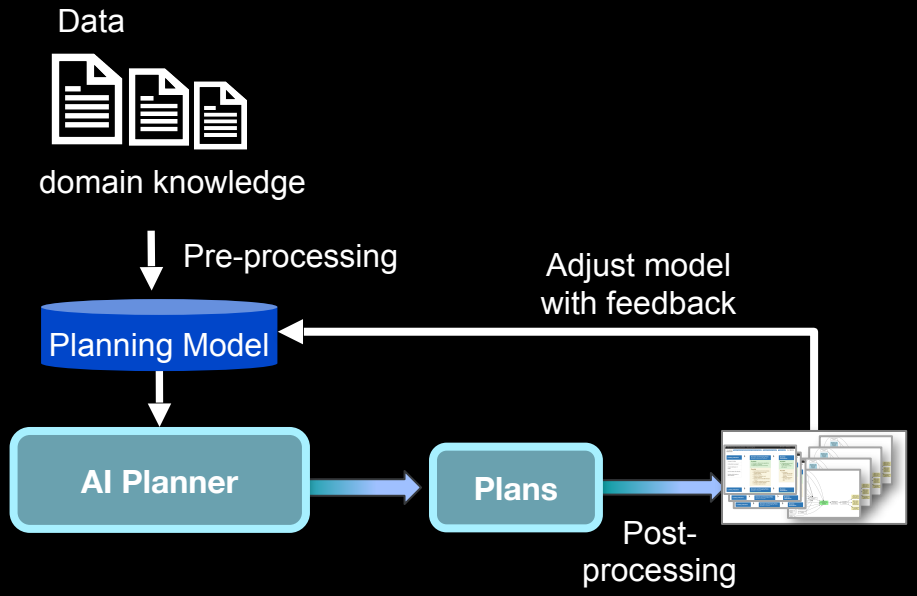
1) Your problem can be described in a declarative way
2) You have domain knowledge that should not be ignored
3) Pure learning techniques are difficult to use either because there is a structure of the problem that cannot be learned by training or that there is little to no available training data
4) You want to be able to explain a particular course of action the system took
5) You can leverage the existing relationship between a problem that is similar to yours to AI Planning

AI Planning



1. Create an initial planning model for the problem domain of interest
2. Run an appropriate planner on the model to solve the model
3. Translate the solution for the model into a solution for the problem of interest and inspect the solution
4. Adjust the model, if needed and go to step 2

Plan



1. Theory 10:15 AM EST
2. Modeling 11:30 AM EST
3. Tools 1:00 PM EST