

Consequence-aware Sequential Counterfactual Generation

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What's the problem?

Assume a person  wants to get a higher salary.

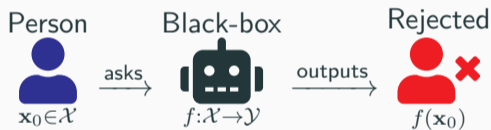
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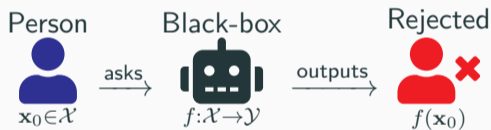


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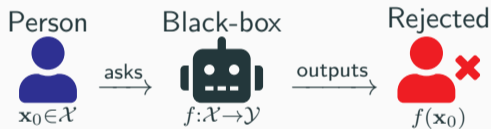
What can  do now?

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What can  do now? Compute a **counterfactual**!

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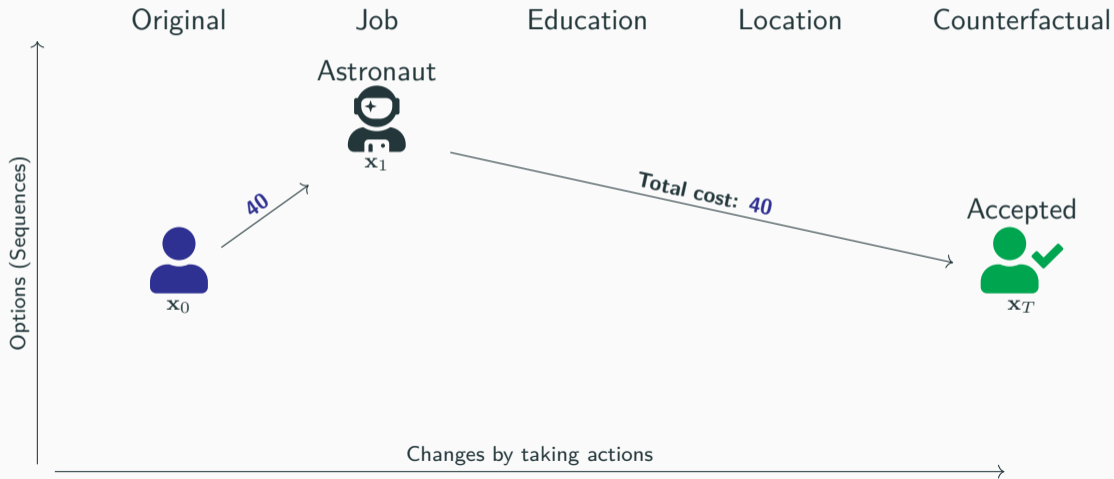
What are the options?

The possibilities of  are limited to changes in *Job*, *Education* and *Location*.



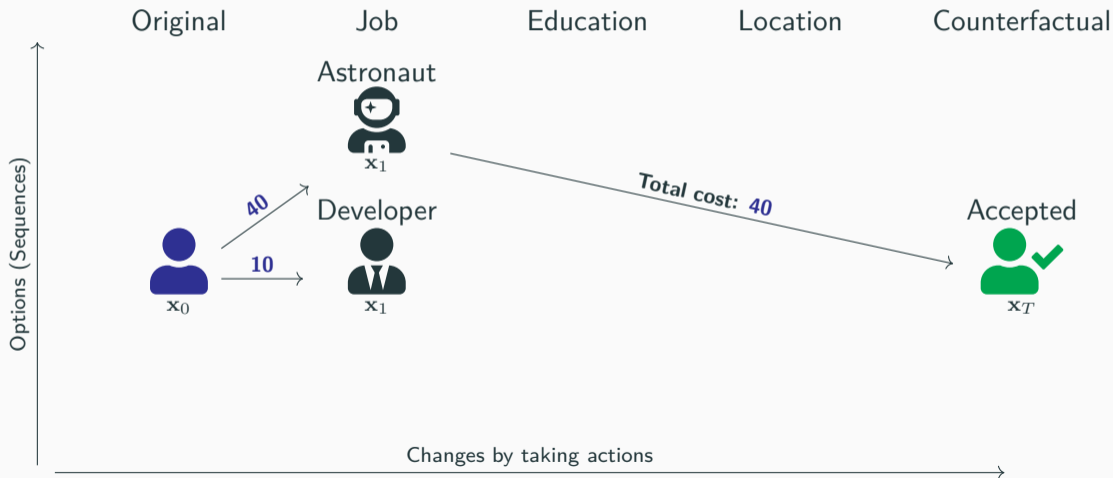
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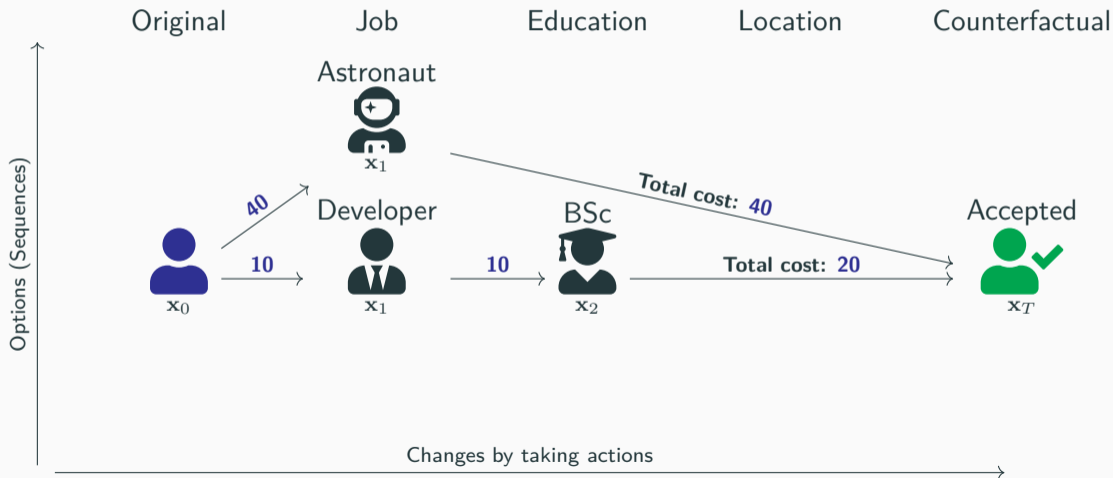
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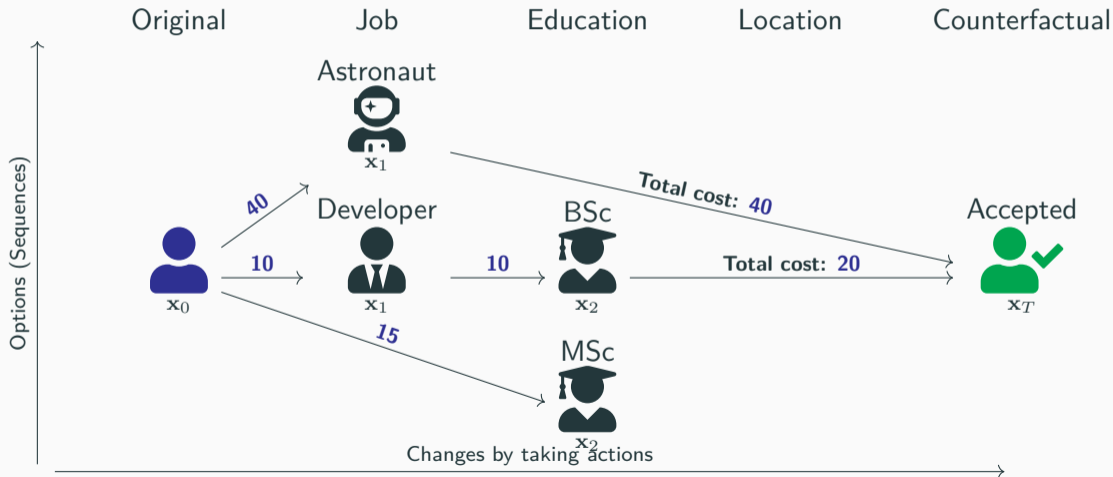
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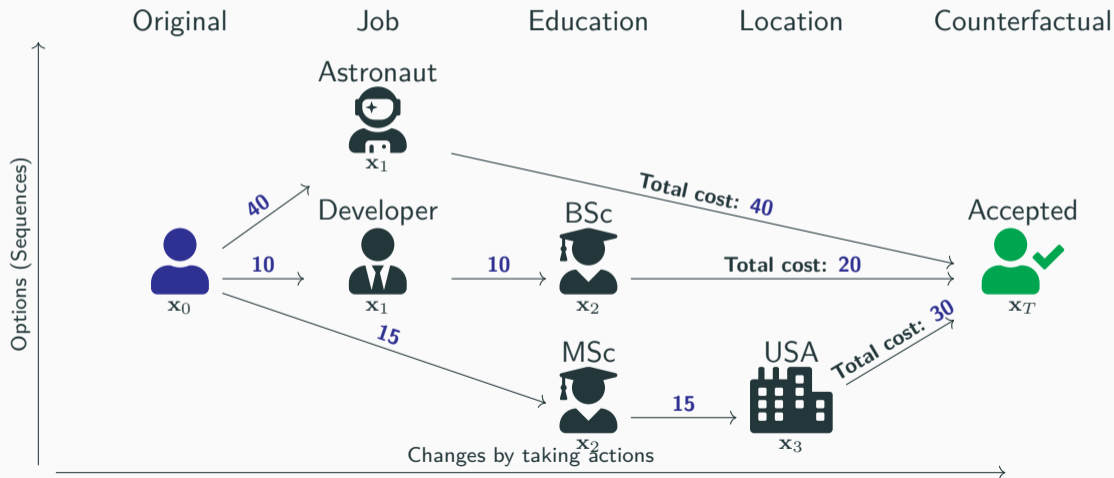
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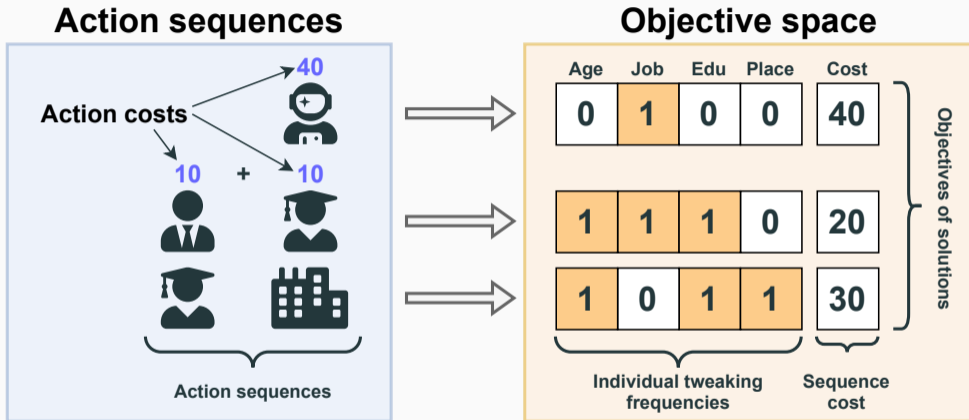
What needs to be done now?

Problems to be solved

1. Find an **optimal subset of actions**
2. Find **optimal tweaking values** for the actions
3. Find the **optimal order** of applying the actions

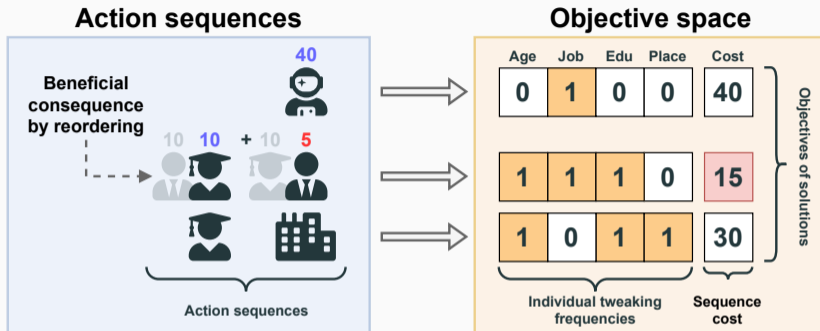
Can be solved *at once* by using a **Biased Random-Key Genetic Algorithm (BRKGA)** with **appropriate encoding!**

1. Multiple options for the user

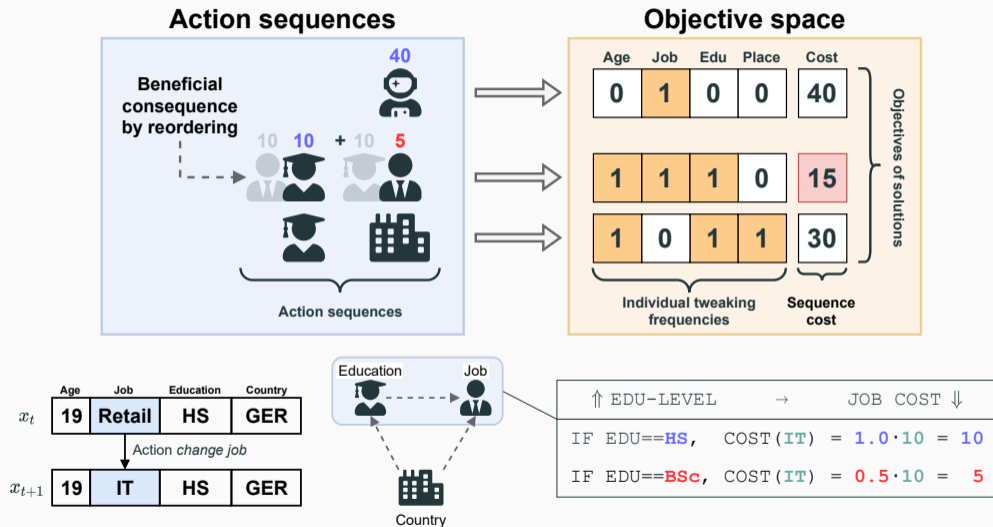


Use **individual feature tweaking frequencies** to cover different options.

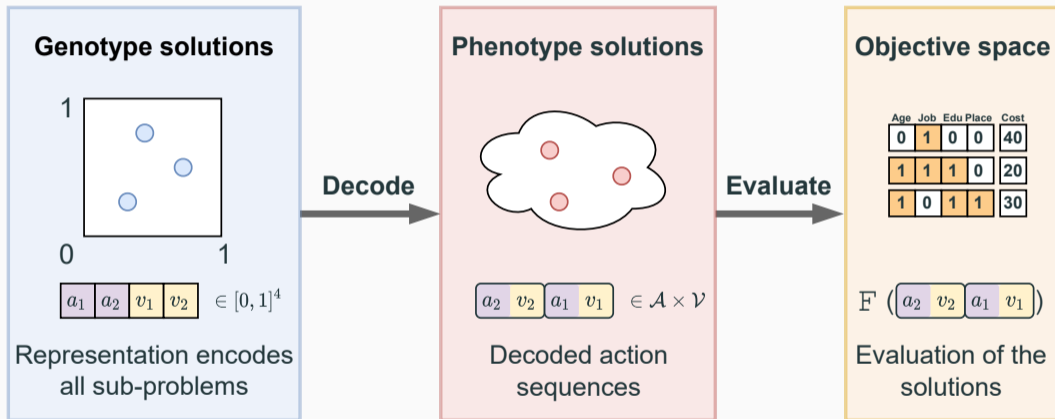
2. Consequence awareness



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3. An efficient and model-agnostic optimization



Main findings

- More efficient than SOTA¹ and finds sequences of any length
- Find multiple sequences compared to only a single one of SOTA
- Sequence costs are on par with SOTA
- Consequences are considered and produce more meaningful sequence orderings

¹Ramakrishnan, Goutham, Yun Chan Lee, and Aws Albarghouthi. "Synthesizing action sequences for modifying model decisions." *Proceedings of the AAAI Conference on Artificial Intelligence*. Vol. 34. No. 04. 2020.

In a nutshell

- Consequences of actions matter in reality, so they should be considered
- Diverse options can be enforced through individual feature tweaking frequencies
- The genotype representation allows to solve the sub-problems efficiently and at once

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Next steps

- Using causal models for consequences (in objective and feature space)
- Probabilistic modelling of consequences