Simulating the Impact of Interventions

By simulating the impact of interventions, we answer the questions such as:

> What will happen to the variable Z if I intervene on Y?

How to use it

To see how the method works, let's generate some data:

```
>>> import numpy as np, pandas as pd
```

```
>>> X = np.random.normal(loc=0, scale=1, size=1000)
>>> Y = 2*X + np.random.normal(loc=0, scale=1, size=1000)
>>> Z = 3*Y + np.random.normal(loc=0, scale=1, size=1000)
>>> training_data = pd.DataFrame(data=dict(X=X, Y=Y, Z=Z))
```

Next, we'll model cause-effect relationships as a probabilistic causal model and fit it to the data:

```
>>> import networkx as nx
>>> from dowhy import gcm
```

```
>>> causal_model = gcm.ProbabilisticCausalModel(nx.DiGraph([('X', 'Y'), ('Y', 'Z')
>>> gcm.auto.assign_causal_mechanisms(causal_model, training_data)
```

```
>>> gcm.fit(causal_model, training_data)
```

Finally, let's perform an intervention on X. Here, we explicitly perform the intervention $do(X := 1)$

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```
>>> samples = gcm.interventional_samples(causal_model,
>>>                                      {'X': lambda x: 1},
>>>                                      num_samples_to_draw=1000)
>>> samples.head()
       X         Y          Z
    0  1  3.481467  12.475105
    1  1  1.282945   3.279435
    2  1  2.508717   7.907412
    3  1  2.077061   5.506252
    4  1  1.400568   6.097633
```

As we can see, X is now fixed at a constant value of 1. This is known as an atomic intervention. We can also perform shift interventions where we shift the random variable X by some value:

```
>>> samples = gcm.interventional_samples(causal_model,
>>>                                      {'X': lambda x: x + 0.5},
>>>                                      num_samples_to_draw=1000)
>>> samples.head()
              X         Y          Z
    0 -0.542813  0.031771   1.195391
    1  1.615089  2.156833   6.704683
    2  1.340949  1.910316   5.882468
    3  1.837919  4.360685  12.565738
    4  3.791410  8.361918  25.477725
```

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