

Suppose we live in a place where the days are either sunny, cloudy or rainy. The weather transition from one day to the next is:

		tomorrow will be ...		
		sunny	cloudy	rainy
today is ...	sunny	0.8	0.2	0
	cloudy	0.4	0.4	0.2
	rainy	0.2	0.6	0.2

We assume that the weather tomorrow only depends on today's weather. When a new state only depends on the last state, this is called the *Markov assumption*.

Now suppose that we cannot observe the weather directly, but instead rely on a sensor. The problem is that our sensor is noisy. Its measurements are governed by the following measurement model:

		our sensor tells us		
		sunny	cloudy	rainy
the actual weather is	sunny	0.6	0.4	0
	cloudy	0.4	0.6	0
	rainy	0	0	1

The first table gives us the process noise and the second table gives us the measurement noise.

If day 1 is sunny (this is known for a fact) and in the subsequent four days, our sensor observes *cloudy, cloudy, rainy, sunny*, what is the probability that day 2 is cloudy, as predicted by our sensor? What is the probability that day 5 is sunny, as predicted.