# Autonomous Robotic Systems
# Bayes Filter

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## 3 The Bayes Filter

Starts with a uniformly distributed belief state

### 3.1 Update step

The update step is executed whenever the robot moves forward or makes a 180 degree turn. To calculate the probability for being in a state $x$ after a motion command, the probabilities of all possible starting states is weighted according to the given transition probabilities and summed up. For the *move forward* command, this equates to:

$$p(x_i) = 0.8 \times p(x_{i-1}) + 0.1 \times p(x_{i-2}) + 0.1 \times p(x_i)$$

Similarly, for the *turn* command, this results in:

$$p(x_i) = 0.9 \times p(x_{N-1-i}) + 0.1 \times p(x_i)$$

### 3.2 Measurement step

The probability for being in a state that is conform with the measurement is multiplied by a factor of 0.6, the probability for every other state is multiplied by 0.2.

## 4 Results

Most states in the corridor have a wall on both sides, which makes them indistinguishable. When issuing the *measurement* command in a state that has a door, the probabilities of the three states containing a door raises. Multiple continuous measurements cause the robot's confidence for being in one of these three states to grow.

## 5 Conclusion