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Machine Learning for Computer Vision
Winter term 2017

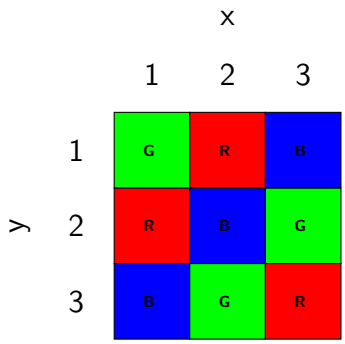
December 4, 2017
Topic: Hidden Markov Models

Exercise 1: Viterbi Algorithm

We play again with our robot from the first homework assignment. As we mentioned back then the robot has a camera with an observation model that looks as follows:

Sensed color \ Actual color	R	G	B
R	0.8	0.1	0.1
G	0.1	0.6	0.2
B	0.1	0.3	0.7

This time we put the robot in a room where the floor looks like this:



a) What is the state space? What is the observation space? Draw the trellis diagram.

b) Assume the robot can only move vertically and horizontally. We let the robot move randomly. If the attempted move leads outside of the bounds of the room the robot stays at its current position. Compute the state transition matrix.

c) After 3 time steps, what is most likely the path that the robot followed if the camera reads $\{z_1 = \text{R}, z_2 = \text{G}, z_3 = \text{G}\}$? Assume the robot's initial position is unknown.