1D Traffic Flow

October 8, 2019

[87]:
```
import numpy as np; import matplotlib.pyplot as plt
import random
```

[112]:
```
def road_init(n, n_cars):
    road = np.zeros(n)
    i=0
    while i<n_cars:
        x = random.randint(0,n-1)
        if road[x]!=1:
            road[x]=1
            i = i+1
    return road


def update_road(road):
    n = np.size(road)
    road_updated = np.zeros(n)
    for i in range(n):
        if ([road[(i-1)%n], road[i%n], road[(i+1)%n]]==[1,1,1] or␣
 ↪[road[(i-1)%n], road[i%n], road[(i+1)%n]]==[1,0,1] or
            [road[(i-1)%n], road[i%n], road[(i+1)%n]]==[1,0,0] or␣
 ↪[road[(i-1)%n], road[i%n], road[(i+1)%n]]==[0,1,1]):
            road_updated[i] = 1
        else:
            road_updated[i] = 0
    return road_updated

def cal_aver_sp(road_t, n_cars):
    [T, n] = road_t.shape
    D = 0
    for i in range(T-1):
        x = np.sum((road_t[i+1,:]-road_t[i,:])==[1]*n)
        D += x
    v = D/(T-1)/n_cars
    return v
```

[140]:
```
n = 20
n_cars = 10
```

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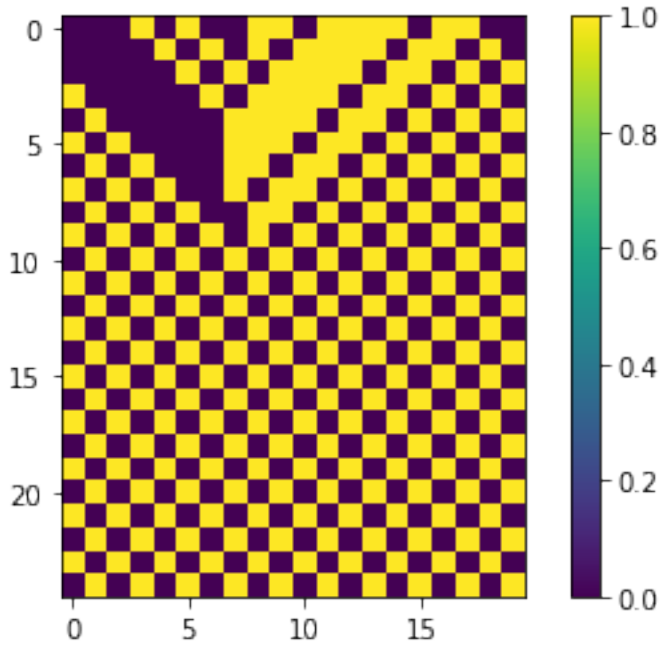
T = 25


road = road_init(n, n_cars)
road_t = [road]
for t in range(T-1):
    road = update_road(road)
    road_t.append(road)

road_t = np.array(road_t)
cal_aver_sp(road_t, n_cars)
```

[140]: 0.8833333333333334

[141]:
```
plt.imshow(road_t)
plt.colorbar()
plt.savefig('%d_%d.pdf'%(n,n_cars))
```



[142]:
```
dens = np.linspace(0.1,1,10)
v = [1.0, 1.0, 0.958, 0.958, 0.883, 0.625, 0.417, 0.247, 0.111, 0.0]␣
 ↪#f_sites_with_diff_c

plt.scatter(dens, v)
plt.xlabel('density');plt.ylabel('velocity');plt.legend()
plt.savefig('v-dens.pdf')
```

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No handles with labels found to put in legend.
```

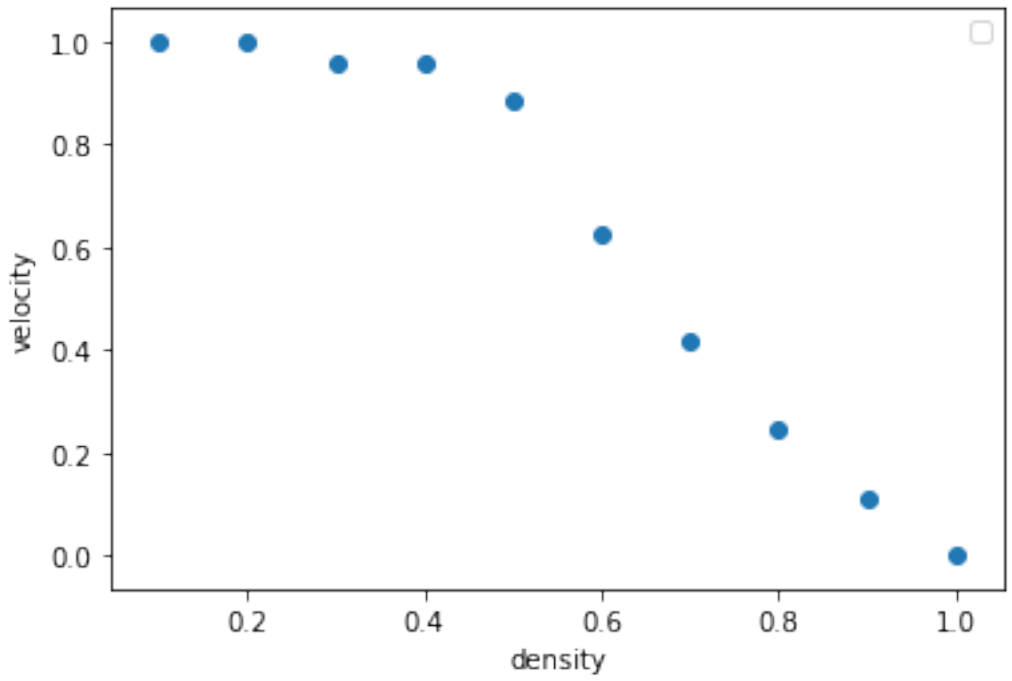
1.0
0.8
0.6
0.4
0.2
0.0
velocity
0.2
0.4
0.6
0.8
1.0
density

[ ]: