ThesisProgress

Darina Dementyeva

February 13, 2017

1 08.02.2017 Step 1

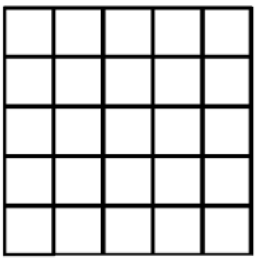

Figure 1: Map of the room.

Let's assume that we have rectangle room with is divided into cells so we have n cells in the row and m cells in the column (for example, as it is shown at Fig. 1). A WiFi access point is placed somewhere in this room (we do not care about its position now).
Task: receiving signal strength x from the user decide in which cell the user is located.
Prior information:

- $(i, j) \forall i = \overline{1, n}; j = \overline{1, m}$ - cells in the room. For further simplicity let's assume that $(i, j) = k$.
- $p(k)$ - the probability of that when user is in the room he will stand at cell k.
- μ_k - the signal strength that can be observed at cell k (at this step we suppose that there is no noise in signal and that we can only observe some particular signal strength in each cell).

Input: x - received signal strength.
Output: $\hat{k}$ - the cell where the user is standing.

Comment: The prior information about cells probability $p(k)$ on this step is gotten by this expression [1]:

$$P_{received}(d) = P_{received}(d_0) - 10 * \alpha * log(\frac{d}{d_0})$$

where $\alpha = 3, d_0 = 4, P_{received}(d_0) = -53$.

Solution:

$$\hat{k} = argmax_k p(x,k) = argmax_k p(k|x)p(x) = argmax_k p(k|x)$$

where $p(k|x)$ can be found as $p(k|x) = \frac{p(x|k)p(k)}{p(x)}$.

2 10.02.2017 Step 2

We should define $p(x|k)$ to find the distribution of signal inside each cell. For beginning, let's take normal distribution $N(\mu_k, \sigma_k^2)$ for each cell k. So, $p(x|k)\tilde{}N(\mu_k, \sigma_k^2)$.
Also, for the simplification we will assume that $\mu_k = P_{received}(d)$ and $\forall k$ $\sigma_k^2 = 1$.
Next step: define the way to calculate variance for each cell (obviously, they cannot be equal to 1 and be also equal to each other in common case).

3 12.02.2017 Step 3

Idea - apply particle filtering for $p(x|k)$ approximation.

References

[1] Frédéric Evennou and Francois Marx. Advanced integration of wifi and inertial navigation systems for indoor mobile positioning. *Eurasip journal on applied signal processing*, 2006:164–164, 2006.