Indoor Relative Position Analysis Based on MDS

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Indoor positioning group

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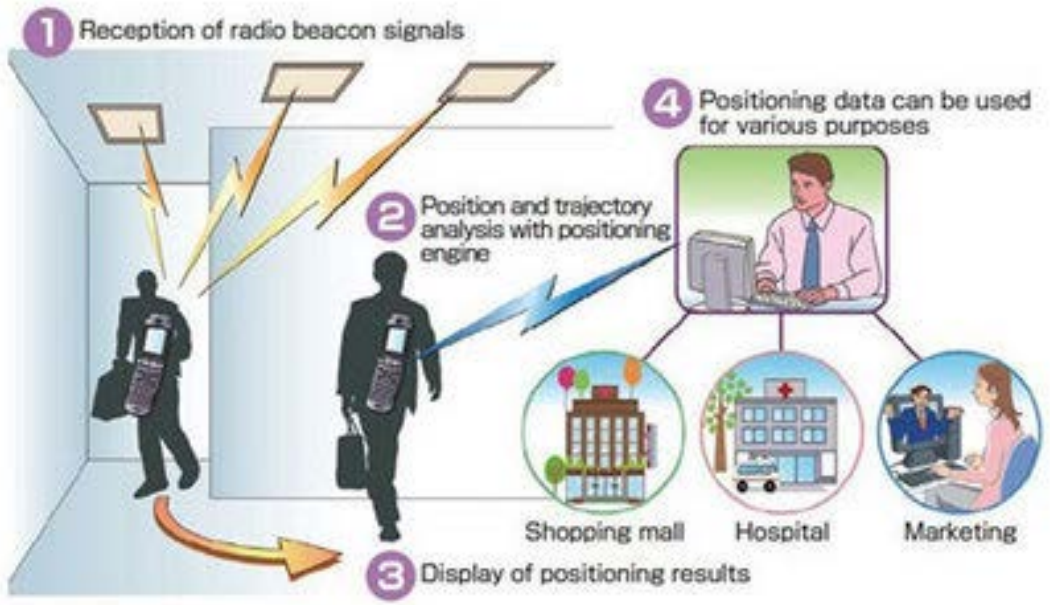
outline

- Background
- Project work
- Future work

Background

- Indoor positioning



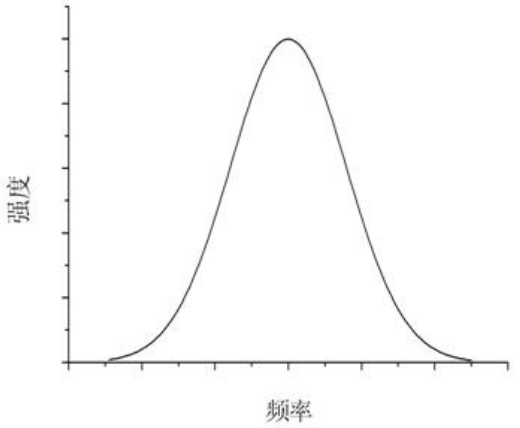
- Smart home

- Multidimensional scale(MDS)

Project work

- wifi indoor positioning

  received signal strength indication(RSSI)



Project work

- build a propagation model to determine the distance between the client device and the access points

$$P_r(d) = \frac{P_t G_t G_r \lambda^2}{(4\pi d)^2}$$

$$P_r(d) = RSSI = 10log\left[\frac{P_r(d_0)}{P}\right] + 20log\left[\frac{d_0}{d}\right] (general\ d_0 = 1)$$

Project work

- now we are trying the algorithm of mix the different distances together and distinguish the first half and the second half belong to which integer position. Then the mobile device can obtain the Gaussian distribution of a wifi to estimate the distance.

Project work

- MDS

get the relative position information of the entire space after passing the MDS processing by the matrix of the overall distance.

Given the distance between all the network in a matrix, where is the distance between the coordinates of i and j

$$Strain_D(x_1, x_2, ..., x_N) = \left(\frac{\sum (b_{ij} - \langle x_i, x_j \rangle)^2}{\sum b_{ij}^2} \right)^{1/2}$$

Where bij are the terms of the matrix

Project work

- MDS

1.Set up the squared proximity matrix $D^{(2)} = \left[d_{ij}^2\right]$

2.Apply double centering:$B = -\frac{1}{2}JD^{(2)}$using the centering matrix $J = I - \frac{1}{n}11'$, where n is the number of objects.

3.Determine the m largest eigenvalues $\lambda_1, \lambda_2, ..., \lambda_m$ and corresponding eigenvectors of $e_1, e_2, ..., e_m$ of B(where is the number of dimensions desired for the output).

4.Now,$X = E_m\Lambda_m^{1/2}$, where E_m is the matrix of m eigenvectors and Λ_m is the diagonal matrix of m eigenvalues of B.

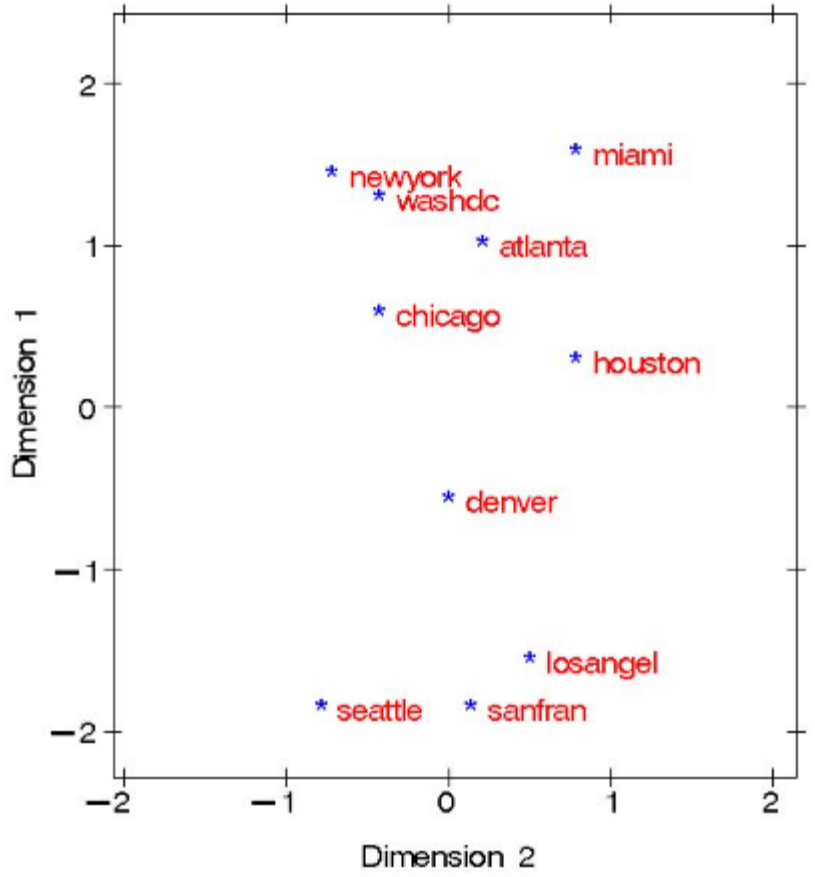
We could call MDS function directly in MATLAB to calculation. After that, we will reached a accurate position.

Project work

- MDS

Application

	Atlanta	Chicago	Denver	Houston	Los Angeles	Miami	New York	San Francisco	Seattle	Wanshington D.C.
Atlanta	0	.	.	.	.	.	.	.	.	.
Chicago	587	0	.	.	.	.	.	.	.	.
Denver	1212	920	0	.	.	.	.	.	.	.
Houston	701	940	879	0	.	.	.	.	.	.
Los Angeles	1936	1745	831	1374	0	.	.	.	.	.
Miami	604	1188	1726	968	2339	0	.	.	.	.
New York	748	713	1631	1420	2451	1092	0	.	.	.
San Francisco	2139	1858	949	1645	347	2594	2571	0	.	.
Seattle	2182	1737	1021	1891	959	2734	2408	678	0	.
Wanshington D.C.	543	597	1494	1220	2300	923	205	2442	2329	0



Future work

- solve the problem of indoor multi-diameter effects, obstruction and reflection of obstacles.

- the operating calculation is large and the mobile device may not be able to handle it.


Thanks!
Simple
powerful
free