Wifi positioning based on machine learning approach

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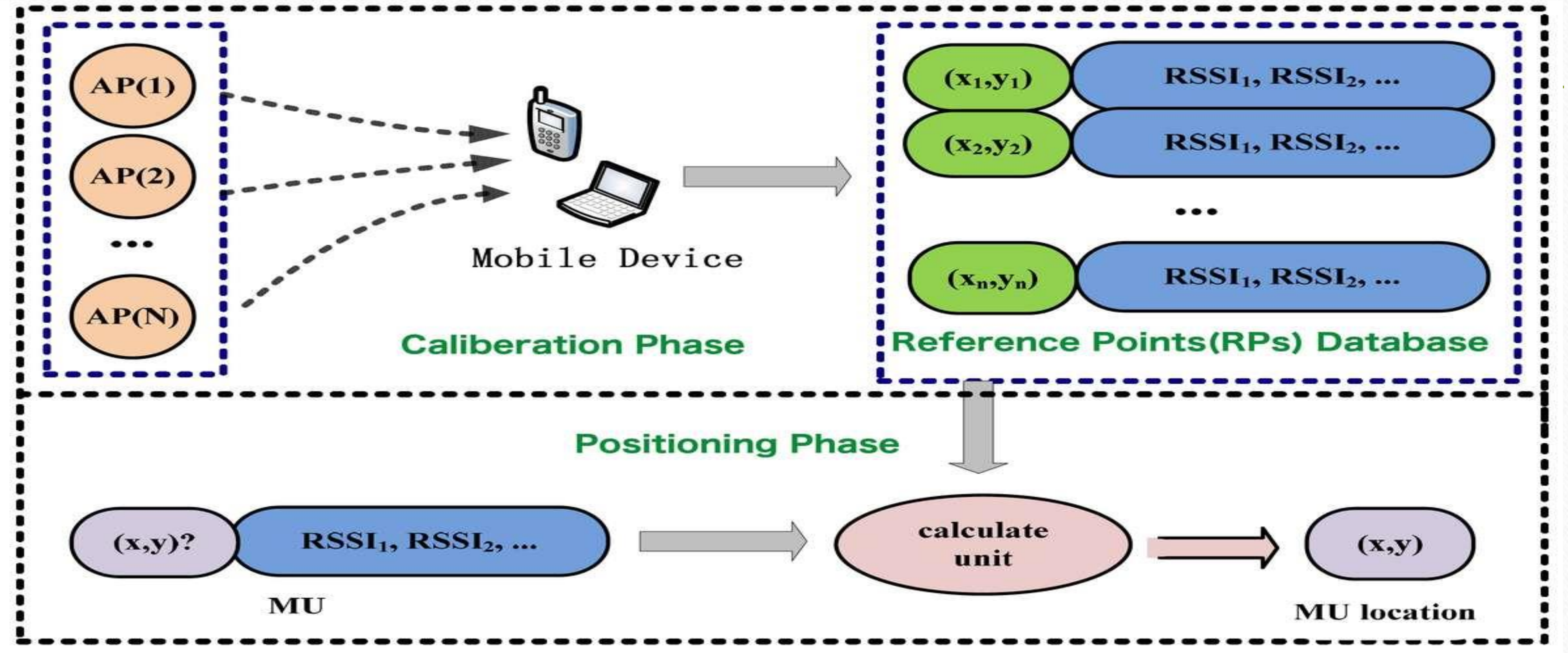
Rssi(reciving singnal strength index)&Ap(access point)&Rps(reference points)



k-nearest neighbors algorithm (*k*-NN)

This method was first proposed by Evelyn Fix and Joseph Hodges in 1951 and later developed by Thomas Cove

A classification (classification) is non-numerical, and here k is the closest fixed value to the test, which is a small and correct number chosen based on the fact that it is close to the majority of test samples.

For example, suppose we have the following mechanisms:

$$(X1,Y1),(X2, Y2),\ldots,(Xn, Yn)$$

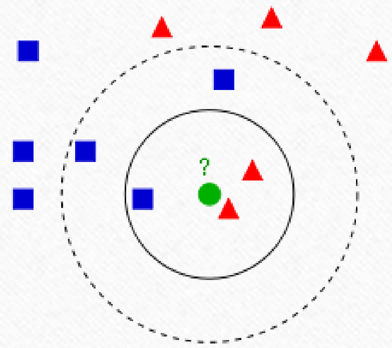
which takes those high values which are our test values to the that Y is the label infinite dimensional environment $R^d \times \{1,2\}$ of class X. That is:

r=1,2 و $X|Y \;= r \sim P_r$

P_r The distribution is probability, so by using the which software suitable for the space, we get X and Y information as follows:

$$|X(1) - x| < |X(2) - x| < |X(3) - x| < \cdots < |X(n) - x|$$

For example, in the figure above, if k=3, the straight line becomes our decision area, and we vote for the triangle, and if k=5, the dotted line becomes our decision area, and we vote for the square, and we vote for the circle. We are green



Distance functions

Euclidean	$\sqrt{\sum_{i=1}^{k}(x_i - y_i)^2}$
Manhattan	$\sum_{i=1}^{k}\lvert x_i - y_i\rvert$
Minkowski	$\left(\sum_{i=1}^{k}(\lvert x_i - y_i\rvert)^q\right)^{1/q}$

To calculate these distances, if the numbers are continuous, we can use face-to-face relationships:

In fact, we are counting their softness

We have used the first relation

X	Y	Distance
Male	Male	0
Male	Female	1

Hamming Distance

$$D_H = \sum_{i=1}^{k} |x_i - y_i|$$

$$x = y \Rightarrow D = 0$$

$$x \neq y \Rightarrow D = 1$$

For categories such as male and female, we use face-to-face relationship:

weighted k-nearest neighbors algorithm (k-NN)

In this method, we weight K nearest neighbors with 1/K weight and the rest with zero weight so that $\sum \omega_{ni} = 1$ It has the following relations

$$\mathcal{R}_{\mathcal{R}}(C_n^{wnn}) - \mathcal{R}_{\mathcal{R}}(C^{Bayes}) = \left(B_1 s_n^2 + B_2 t_n^2\right)\{1 + o(1)\},$$

for constants B_1 and B_2 where $s_n^2 = \sum_{i=1}^{n} w_{ni}^2$ and $t_n = n^{-2/d} \sum_{i=1}^{n} w_{ni}\{i^{1+2/d} - (i-1)^{1+2/d}\}$.

The optimal weighting scheme $\{w_{ni}^*\}_{i=1}^n$, that balances the two terms in the display above, is given as follows: set $k^* = \lfloor Bn^{\frac{4}{d+4}} \rfloor$,

$$w_{ni}^* = \frac{1}{k^*}\left[1 + \frac{d}{2} - \frac{d}{2k^{*\,2/d}}\{i^{1+2/d} - (i-1)^{1+2/d}\}\right]$$ for $i = 1, 2, \ldots, k^*$ and

$w_{ni}^* = 0$ for $i = k^* + 1, \ldots, n$.