

## Outline

- ✓ A. Intro
- ➡ B. Basic proximity problems
- C. Basic decision and summation problems
- D. Basic 'all'-type problems
- E. Basic counting problems
- F. Further topics

## Two basic types of proximity problems

1. Nearest-neighbor searching  
"Find the  $k$  nearest points to me."
2. Range searching  
"Find all points within radius  $r$  of me."

## Some nearest-neighbor problems in statistics/learning

- Nearest-neighbor classification
- Locally linear embedding (LLE)
- $k$ -means

## Some range-searching problems in statistics/learning

- Kernel density estimation w/ spherical kernel
- Correlation dimension
- $n$ -point correlation

## Single-tree: simple recursive algorithm (k=1 case)

```
NN( $x_q, R, d_{lo}, x_{sofar}, d_{sofar}$ )
{
  if  $d_{lo} > d_{sofar}$ , return.

  if leaf( $R$ ), [ $x_{sofar}, d_{sofar}$ ]=NNBase( $x_q, R, d_{sofar}$ ).
  else,
    [ $R1, d1, R2, d2$ ]=orderByDist( $x_q, R.l, R.r$ ).
    NN( $x_q, R1, d1, x_{sofar}, d_{sofar}$ ).
    NN( $x_q, R2, d2, x_{sofar}, d_{sofar}$ ).
}
```