Fingerprint Matching Algorithm by Unit Circle Parameterization

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What is Fingerprint?

Fingerprints and a fingerprint classification scheme involving six categories: (a) arch, (b) tented arch, (c) right loop, (d) left loop, (e) whorl, (f) twin loop.

A fast expected time algorithm


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Input two point sets P and Q and the parameters $r, i, j, l, k, t$.

Step 1. Precomputations

a) For each point in P find the $i$ nearest neighbors (in order of closeness) and store in nearest neighbor list. Do the same for Q.
b) Divide the smallest square into which Q fits into a two dimensional array of squares of side length $\sqrt{\frac{1}{ni}}$. Let each entry in the array contain a list of the points in Q that lie in that square. This will allow us to quickly check whether there is a point in Q at a given coordinate.

Step 2. until a global match is found, for each $i$ and $j$ determine whether the $k$ nearest neighbors of $p$ matches the $k$ nearest neighbors of $q$. Let $T$ be the similarity transformation that gave the local match. Check whether $T$ can be improved to give a global match.

Setp3. output $T$ (that is $s$, $\theta$, $t_x$, and $t_y$) and the matching pairs.

Delaunay Triangulation


Result of Experimentation

* Time

- Current Algorithm $\alpha C_n \times C_m$
- Our Algorithm $\alpha_i \times \alpha_i$

Accuracy

- $P$
- $Q$
- $n_i$ Ps Interior
- $m_i$ Qs Interior

Fingerprint Feature Points

* Input Data

Point Set P

Point Set Q

Delaunay Triangulation


Delaunay Triangulation


Local Matching

Comparison - Area Method

Extra Area = AreaP set - AreaQ set - Minimum

If Extra Area is 0
Then AreaP set and AreaQ set are same.

Parametrization


```latex
\begin{array}{c}
\begin{array}{c}
\begin{array}{c}
\text{Point Set P} \\
\text{Point Set Q}
\end{array}
\end{array}
\end{array}
\end{array}
```