Shape Fitting Methodology

Input Image

Microscope image of worms in liquid media

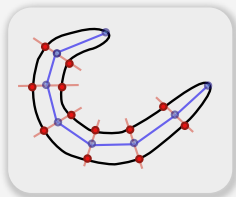
Binary Image

A binary bitmap image that divided the image pixels in object pixels and background pixels

Distance Transf.

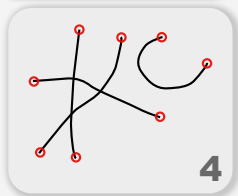
A distance transformation contains the distance of every pixel to the background.
Is useful to trace the contour of isolated worms, automatic generation of shape descriptors and skeletonization

Shape Descriptor



A worm shape is described by N control points and a worm thickness profile. The contour can be calculated by expanding the control points.

Skeletonization



Calculates a 1-px thick path along the body of the worms. Allows to detect endpoints and divide the image into isolated worms and worm clusters

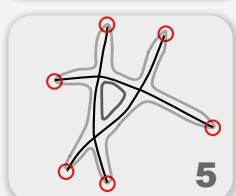
W. Rasterization

The worm shape is rasterized by triangulating the shape and rasterizing every generated triangle

Isolated Worms

The isolated worms are those with exactly two endpoints. Their exact shape can be easily traced. They also allow the automatic generation of shape descriptors

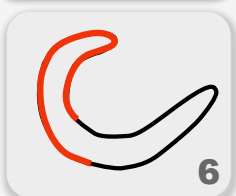
Worm Clusters



Worm clusters are those skeleton connections with more than two endpoints.
A heuristical path guessing algorithm calculates the most likely skeleton paths to optimize the shape fitting process.

Trace Contour

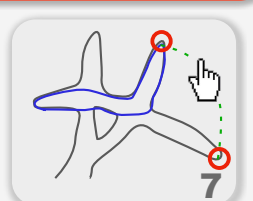
The contour of an isolated worm can be obtained by finding a border pixel from the distance map and following the neighboring border pixels until the shape is closed.



Optimization

A generic shape contour is generated around a worm skeleton path. An optimization algorithm deforms the shape until a match is found. After the match is slightly adjusted, the worm shape is completely fitted.

Manual Adjustment



Incorrect matches can be fixed manually by selecting the correct pair of endpoints