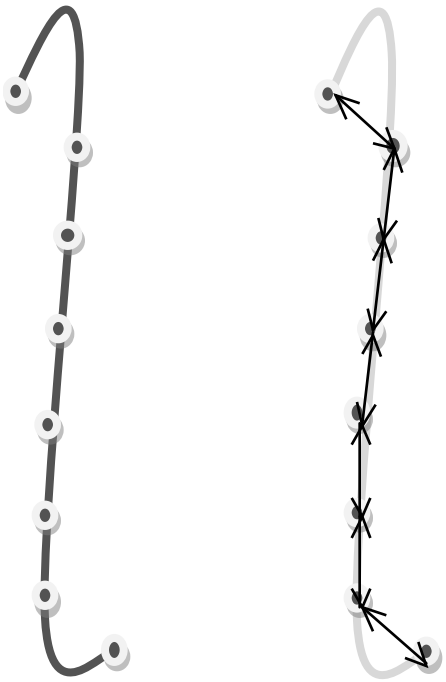
Sampling of Regularly Spaced Points on a Curve

This problem is proposed by A. Lina (R&D manager of the *Imaging Software Processing Group* at Matrox) and V. Zalzal (designer of computer vision algorithms in the *Imaging Software Processing Group* at Matrox). One will study the sampling (or selection) of points that belong to a given curve but must be spaced in a regular fashion in the plane. With no additional constraint, it is easily shown that there exist many solutions (and indeed an infinity of them). We propose several objective functions (to be maximized or minimized) for the case of a polyline, but other criteria may be used as well.

Description

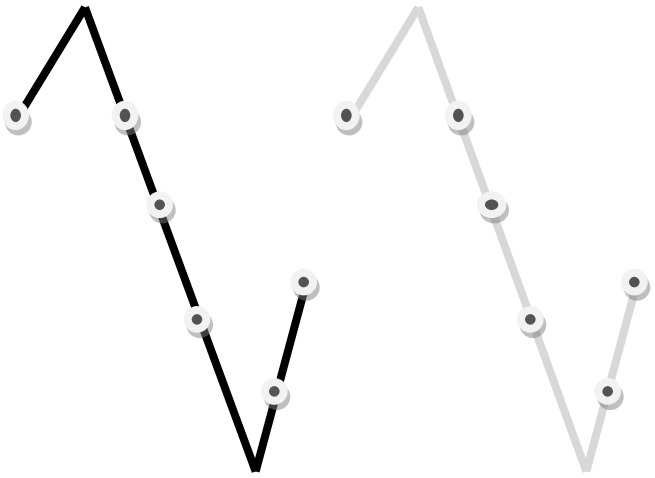
The objective of the team will be to propose an analytical, algorithmic, or geometric method for sampling points on a given curve, with the following properties:

- the solution must contain exactly $N > 2$ points on the curve;
- the endpoints of the curve must be part of the solution;
- the Euclidian distance between two consecutive points on the curve (not the distance computed on the curve!) must be constant.



Proposed problem

The team's challenge will be to find an analytical, geometric, or analytical solution in the case of sampling from a polyline with K segments.



The sampling will result in a new polyline verifying one of the following properties.

- The new polyline is of minimal length.
- The new polyline is of maximal length.
- The new polyline minimizes the error with respect to the length (compared with the length of the original polyline).
- The new polyline minimizes the mean quadratic error (computed with respect to the original polyline).

At the beginning of the workshop, two particular solutions will be presented: first, a geometric solution for the case $N = 3$ when the original curve is arbitrary; second, an analytical solution for any N when the polyline (the original curve) has two segments.