Investigating Geometric Multicuts

When the fence is a single polygon and there are only two colours

Minimizing the number of links when each colour has one polygon

- An $O(n \log n)$-time algorithm for finding an optimal fence (Wang; 1991)
  - This paper finds a polygon between two nested polygons
  - The reduction does not seem obvious (investigate)
- A linear time algorithm that finds a polygon with OPT + k edges
  - k can be 1 (Wang; 1991), or 2 (Baum, Bläsius, Gemsa, Rutter, Wegner; 2018)

Minimizing the number of links when one of the colours can have more than one polygon

- The complexity of the problem not known (Baum, Bläsius, Gemsa, Rutter, Wegner; 2018)
- A heuristic algorithm (Baum, Bläsius, Gemsa, Rutter, Wegner; 2018)

Minimizing the number of links when both colours can have more than one polygon

- Claimed to be NP-hard by Baum, Bläsius, Gemsa, Rutter, Wegner (2018)
  - Cites a paper by Guibas, Hershberger, Mitchell, Snoeyink (1993)
  - The reduction does not seem obvious (investigate)

When the fence is a single polygon and there are two point sets of different colours

Minimizing fence length

- Proved NP-hard (Eades, Rappaport; 1993)

When the fence can consist of multiple polygons

Minimizing fence length with only two colours

- An $O(n^4 \log^3 n)$-time algorithm (Abrahamsen, Giannopoulos, Löffler, Rote; 2019)
  - Converts the problem to finding a minimum cut in a flow network

Minimizing fence length with k colours ($k > 2$)

- Proved NP-hard (Abrahamsen, Giannopoulos, Löffler, Rote; 2019)
- A $(2 - 4/3k)$-approximation algorithm (Abrahamsen, Giannopoulos, Löffler, Rote; 2019)

Problem variations

Fence shape: single/multiple polygons; a convex polygon

- Other possibilities
  - Polygons with orthogonal edges
  - Polygons with monotone upper and lower curves

Number of colors

- Results on one colour are not included in this document

Number of polygons in each colour