INFO-F420
- Computational Geometry -

Convex decomposition of simple polygons

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1 Proposal

For our project, we will construct an application demonstrating several algorithms for decomposing a simple polygon. This application will demonstrate the triangulation algorithm seen in class, the algorithm from Chazelle [Chazelle and Dobkin, 1979], a greedy decomposition without Steiner points, an algorithm that decomposes a polygon into slabs along a certain direction and an algorithm that is based on KD-trees to decompose a polygon [Agarwal et al., 2002]. All algorithm will be compared in their effectiveness for the construction of Minkowski sums [Agarwal et al., 2002].

For this project we would like to implement it in *Processing*[1] as it will make it easier to work with without having to worry about the *JavaScript* engine being slow. Doing the project in Java allows us also to get up and running more quickly as our knowledge is better in this language.

We chose `Processing` to still be close to the exercises seen in class, and provide a visual representation of the discussed problem.

2 Work distribution

Celian:

- Algorithm to calculate a Minkowski sum from a convex decomposition [Agarwal et al., 2002]
- Triangulation of simple polygon
- Greedy convex decomposition [Agarwal et al., 2002]

Andreas:

- GUI
- Slab decomposition [Agarwal et al., 2002]
- KD decomposition [Agarwal et al., 2002]

Gilles:

- Polynomial time algorithm for decomposing a polygon in its convex parts [Chazelle and Dobkin, 1979]

References

Agarwal, P. K., Flato, E., & Halperin, D. (2002). Polygon decomposition for efficient construction of Minkowski sums. *Computational Geometry*, *21*(1-2), 39–61. https://doi.org/10.1016/S0925-7721(01)00041-4

Chazelle, B., & Dobkin, D. (1979). Decomposing a polygon into its convex parts. *Proceedings of the eleventh annual ACM symposium on Theory of computing - STOC '79*, 38–48. https://doi.org/10.1145/800135.804396

[1] https://processing.org/