

a recognition system of knot diagram image

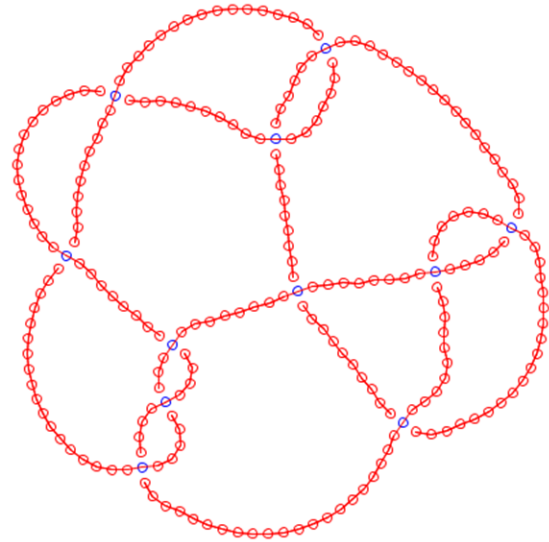
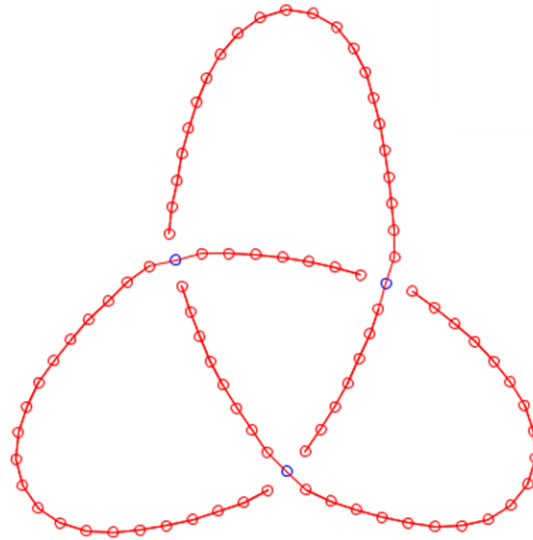
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School of Interdisciplinary Mathematical Sciences
Department of Frontier Media Science
Topology and computer 2016 29/10/2016

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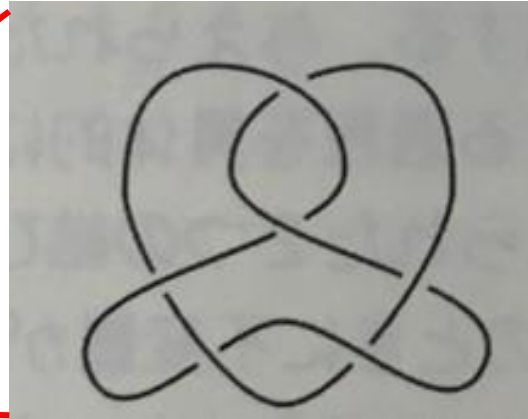
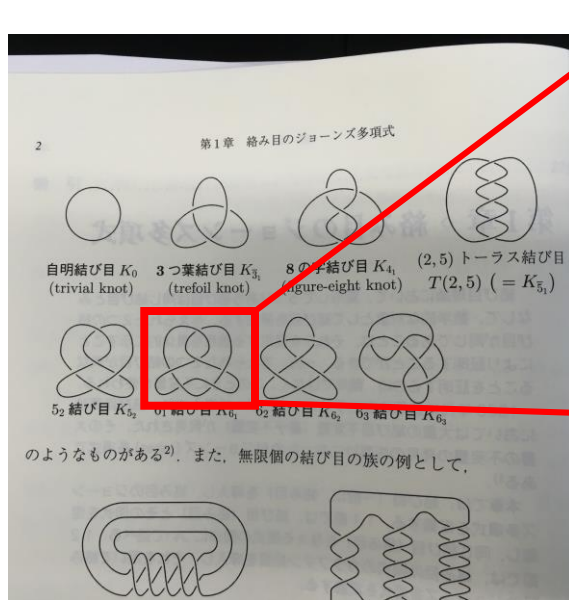
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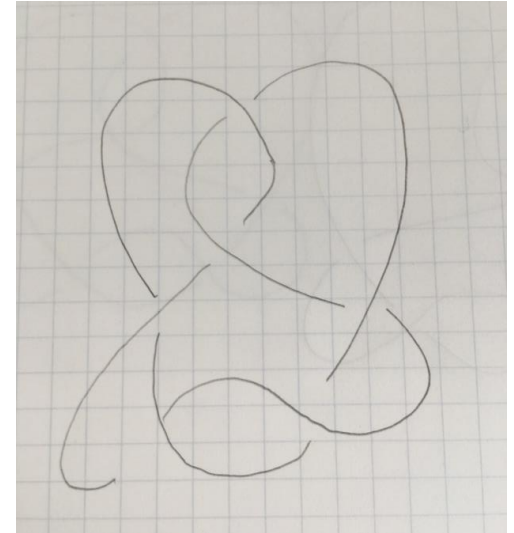


1.Introduction

- For beginners of knot theory, it is difficult to copy a knot diagram on textbooks and papers onto their notebooks.

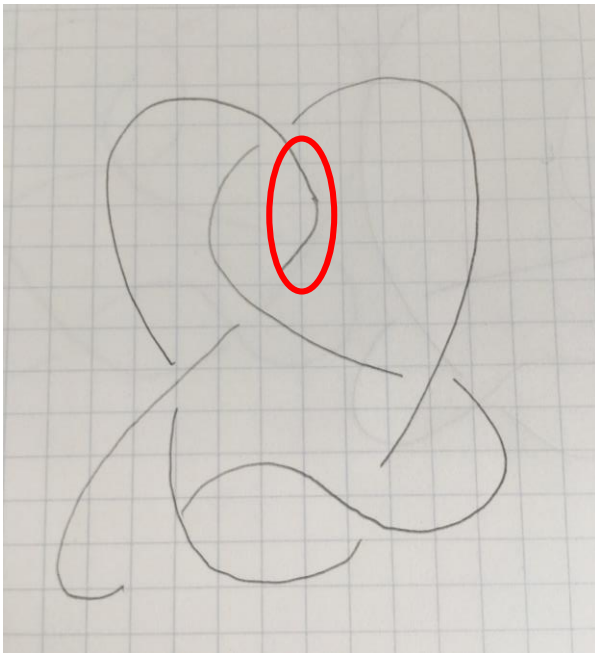


copy by hand

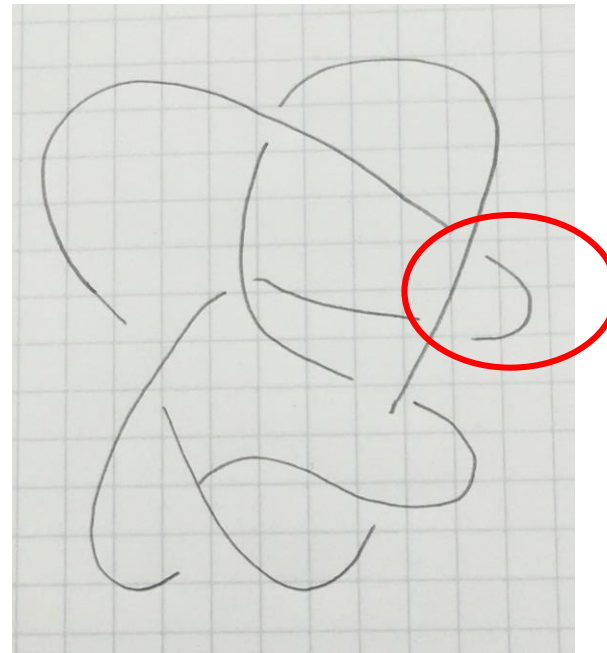


1.Introduction

- It is also confusing for anyone to modify knot diagrams on their notebooks.

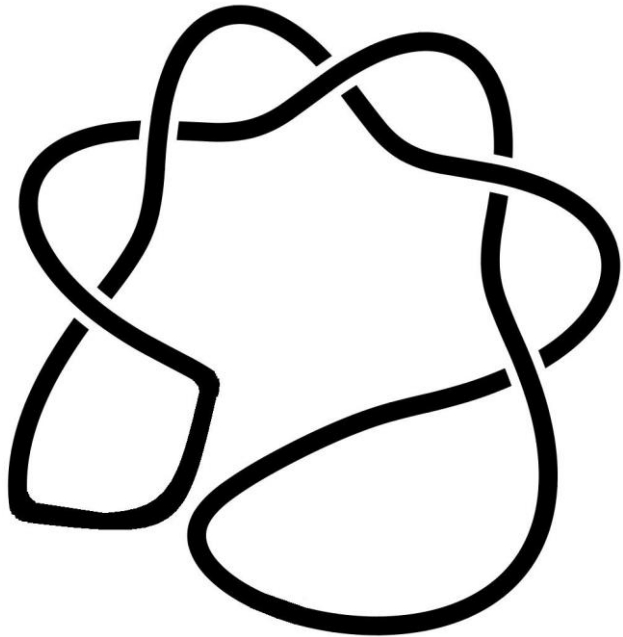


Reidemeister
move by hand

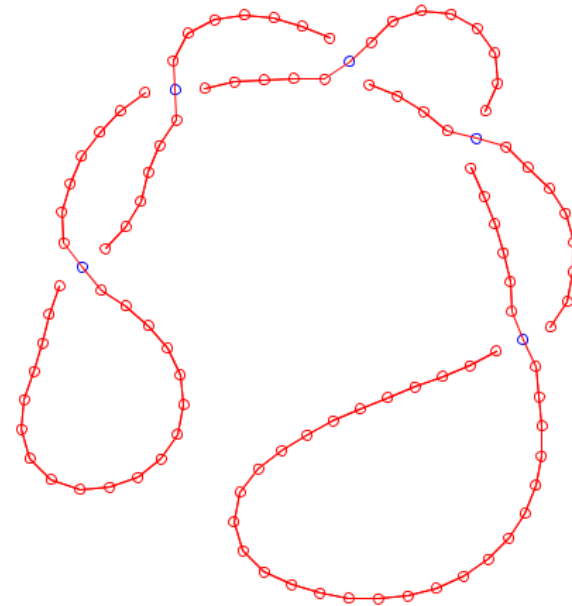


2. Image recognition of knot diagram

- In this study, we propose a system which captures an image and a photo of a knot diagram and recognizes curves and crossings from the image to extract the data of the knot diagram.



This system



Mr.Rikiishi talked
Reidemeister move later.



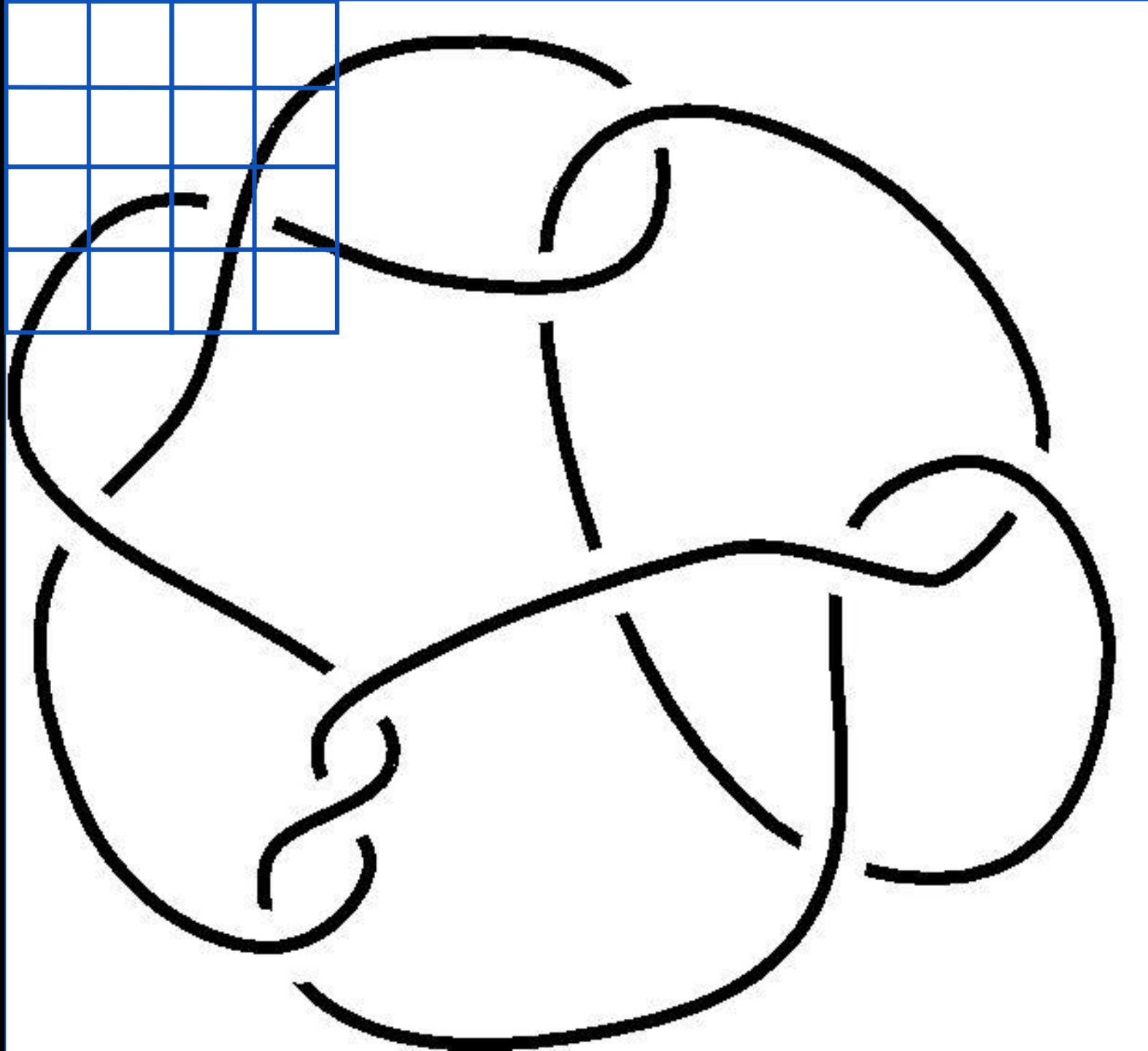
Demonstration

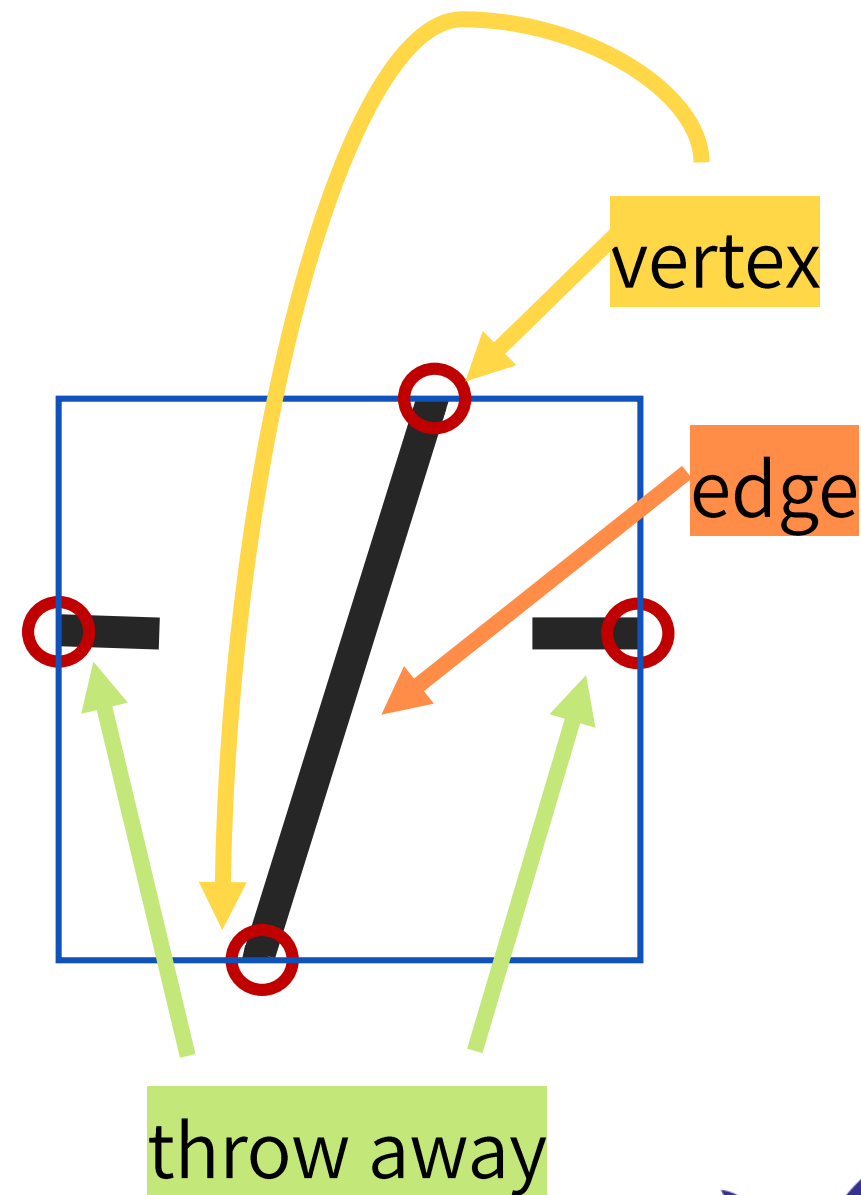
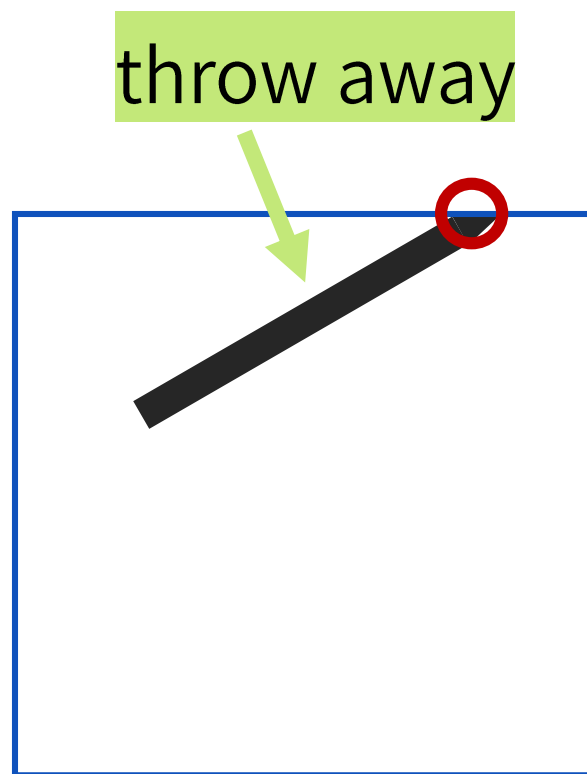
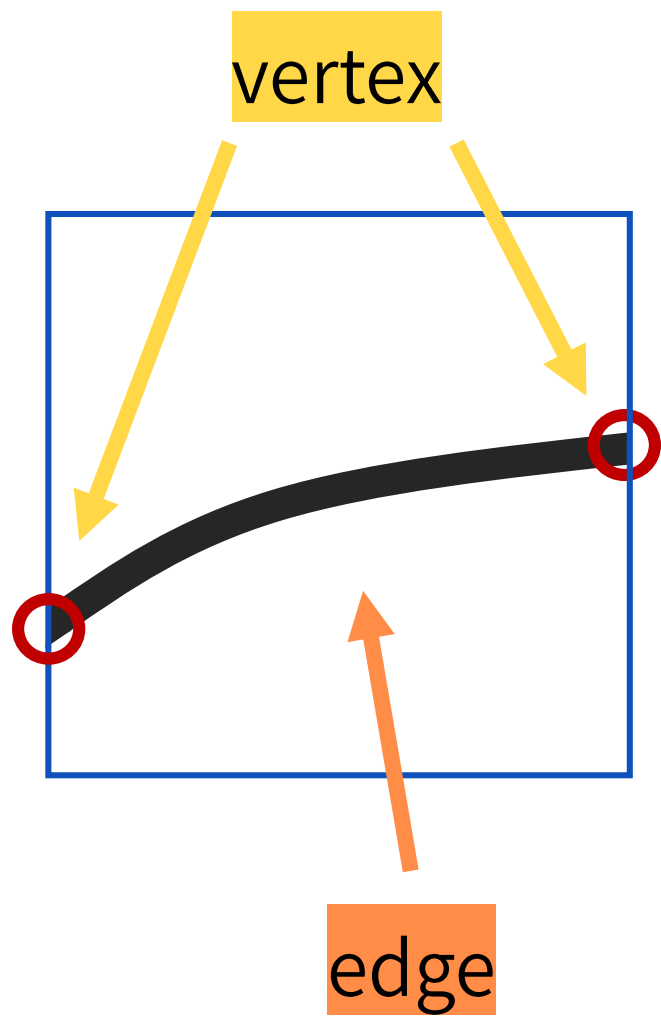


4. Algorithm

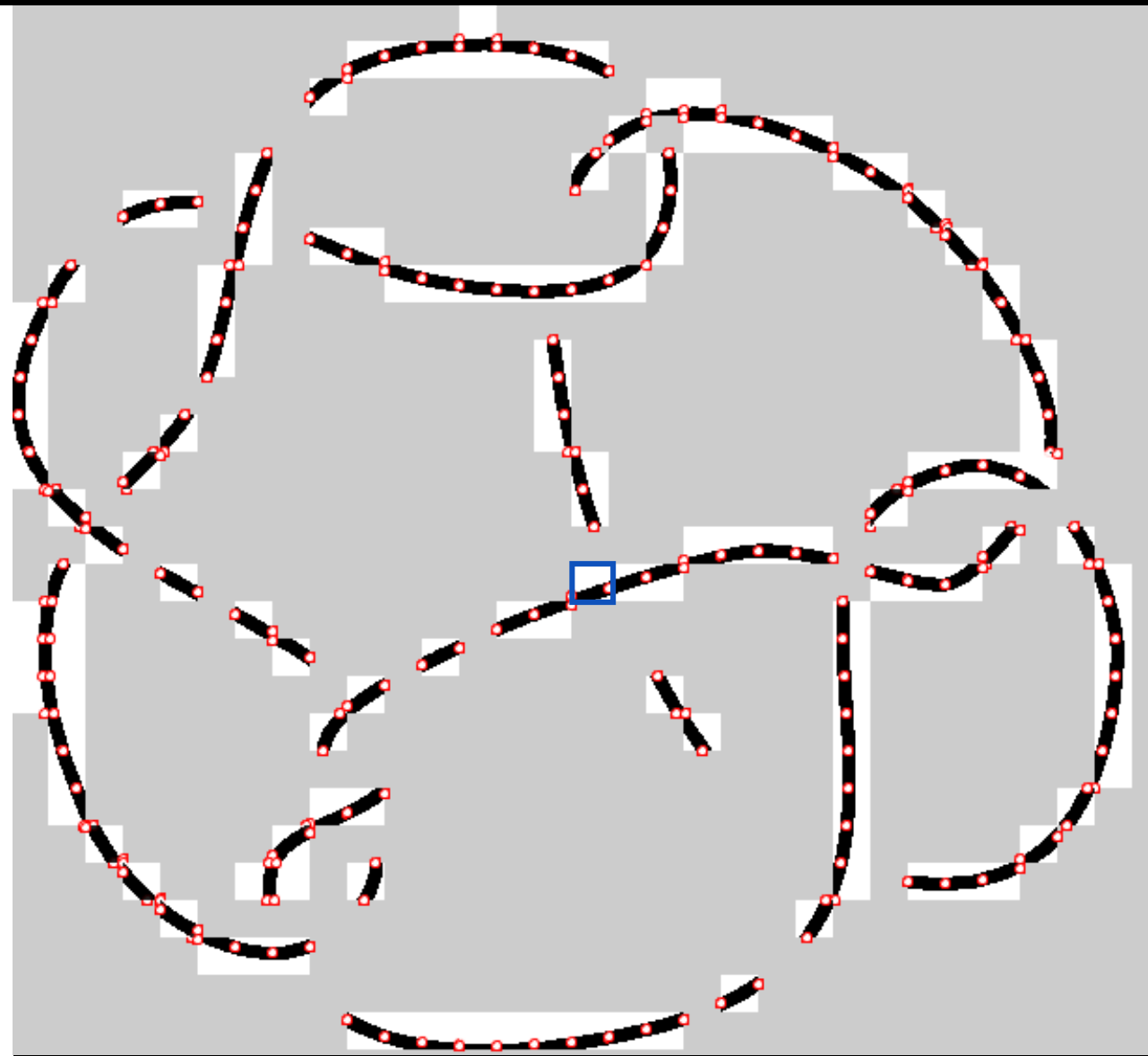
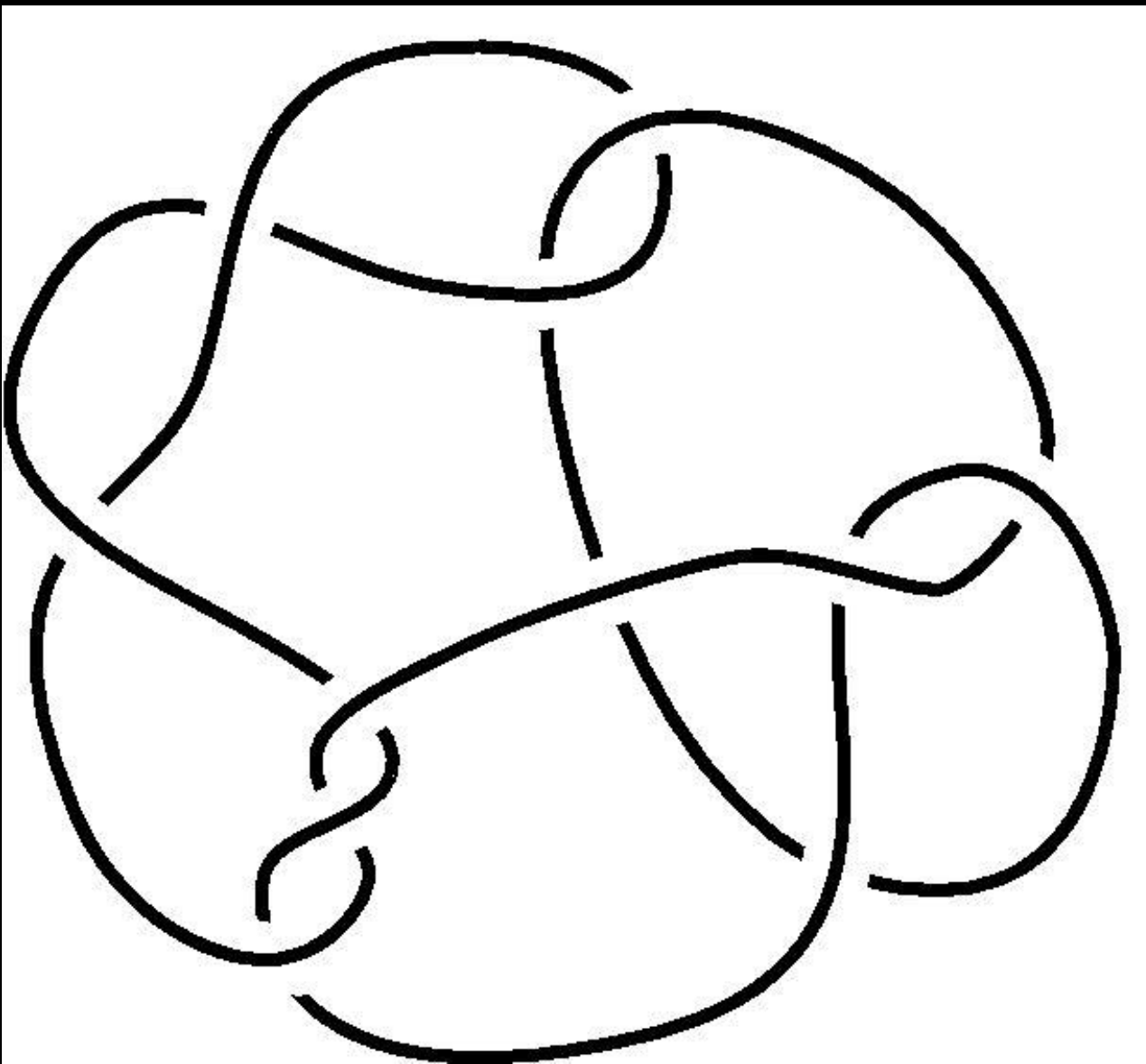
- First, this system divides the image into small squares and recognizes a line segment which is appeared in each square to get the graph structure.

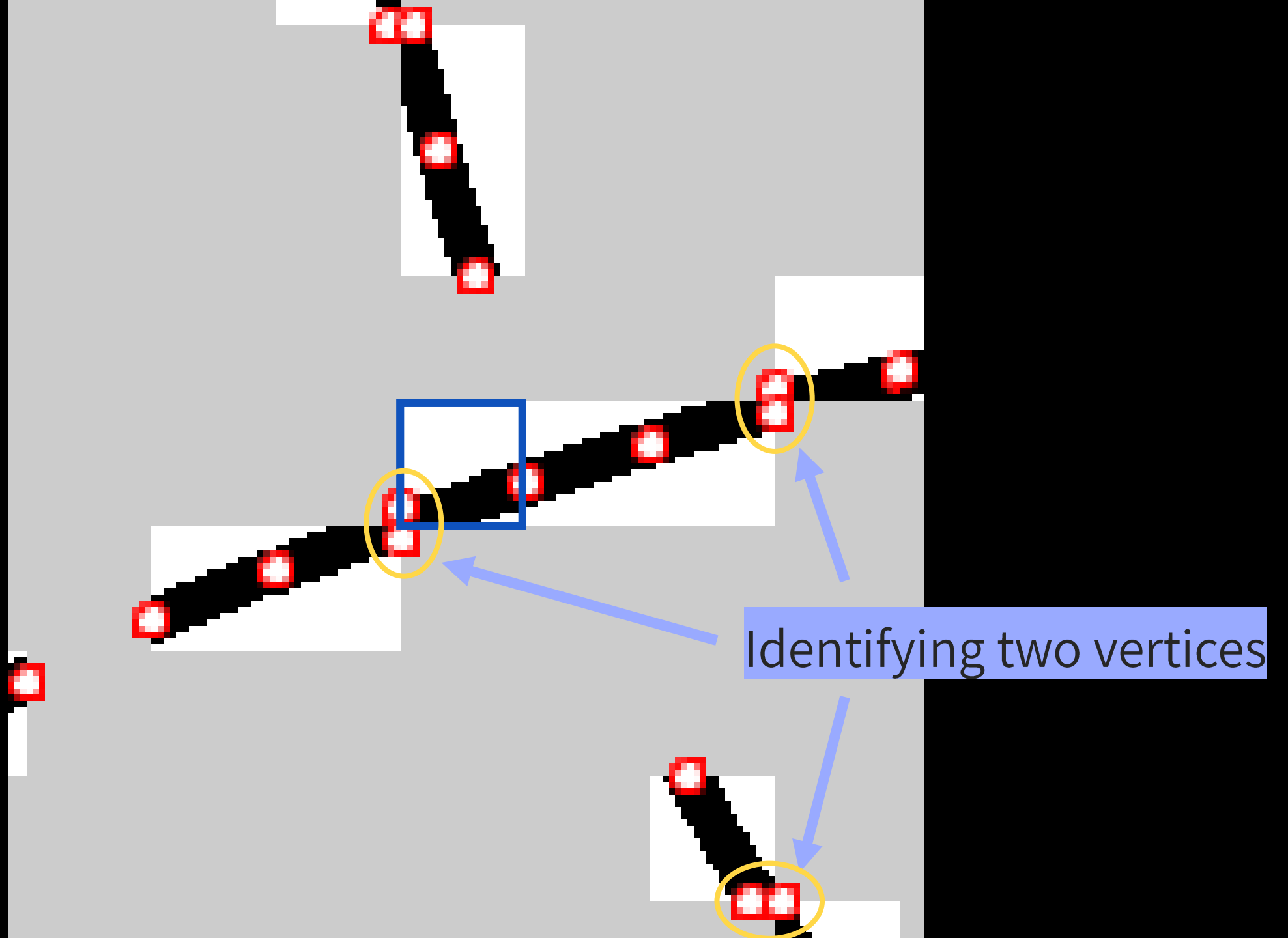






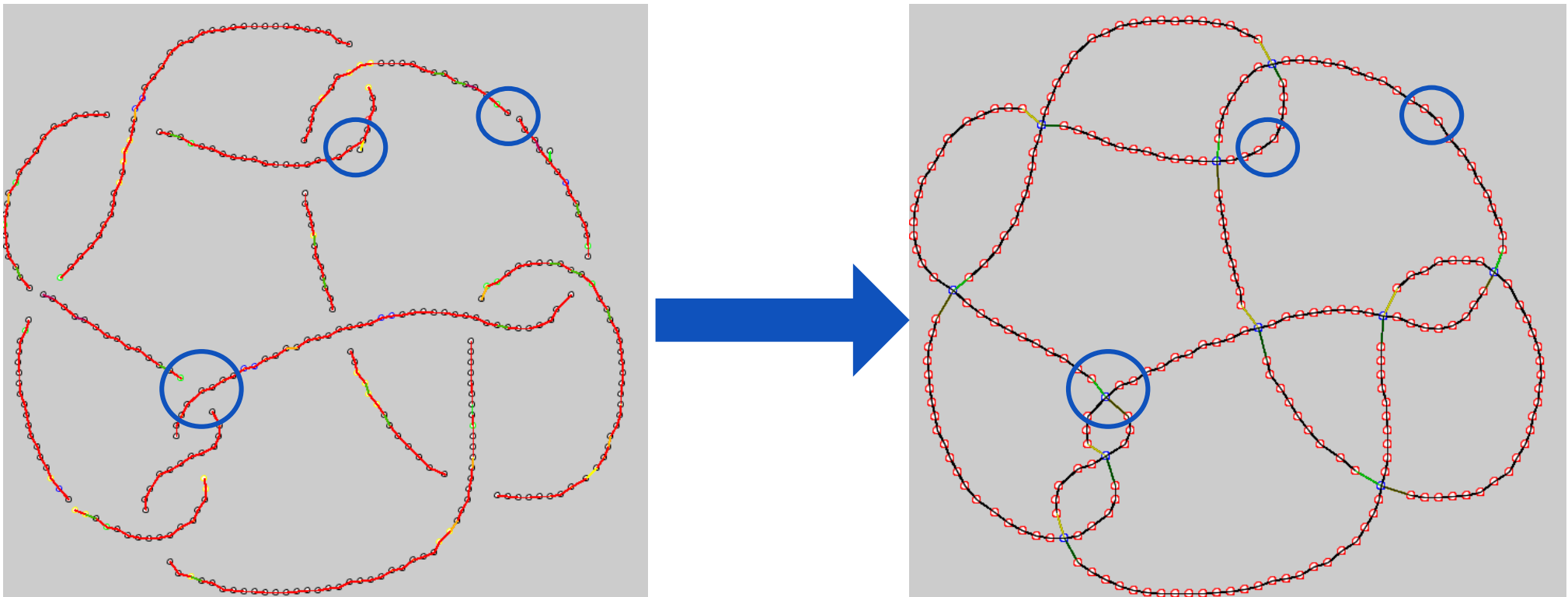
recognizing some fragments of waves



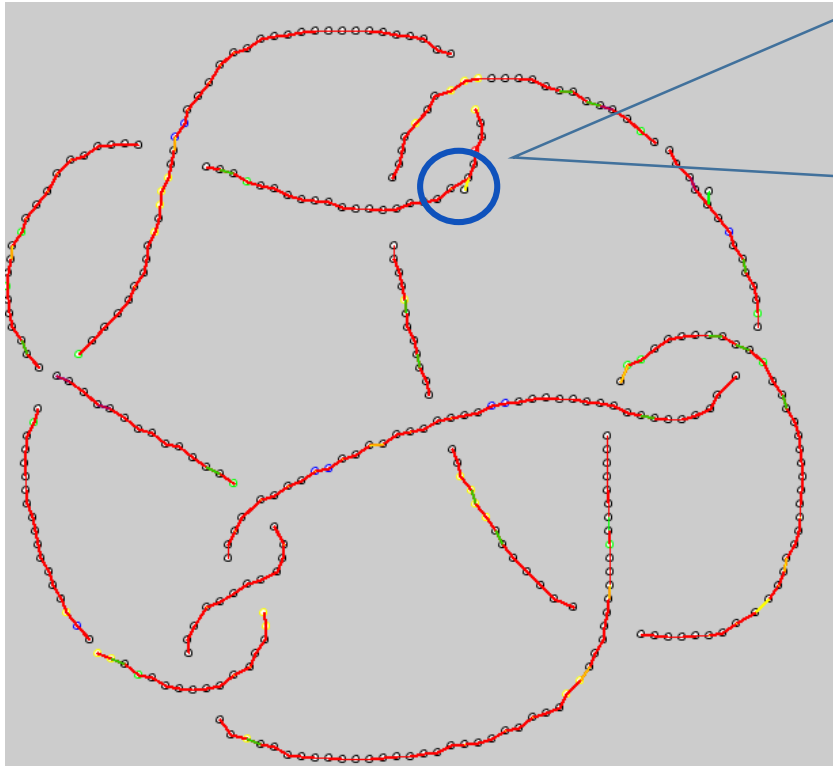


4. Algorithm

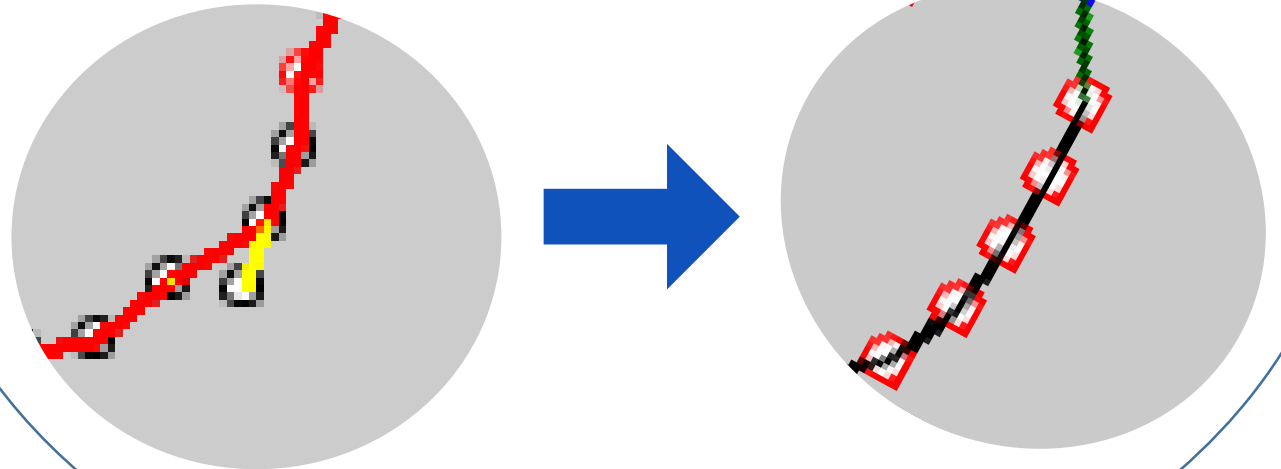
- Next, it removes thorn shaped segments and adds a segment at a gap and recognizes the shapes of crossings.



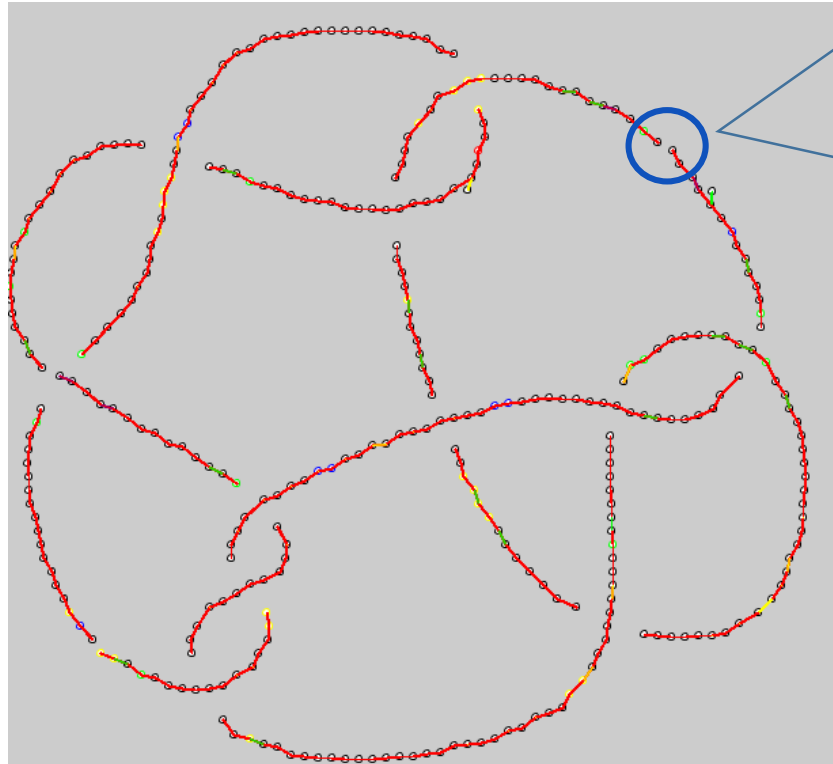
Removing a throne shaped segment



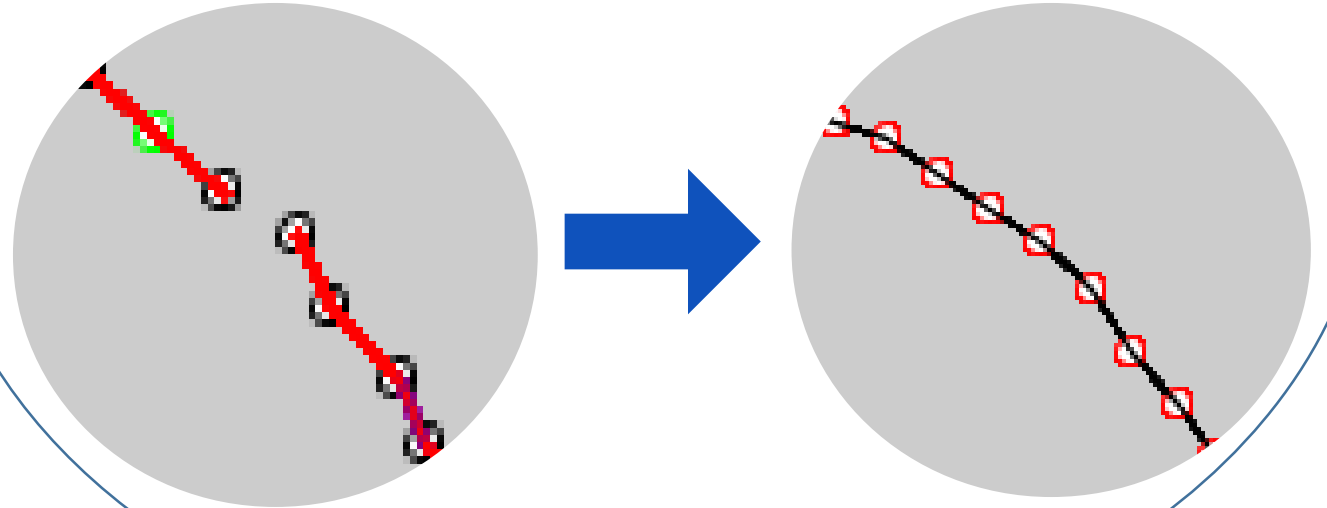
Remove a yellow segment



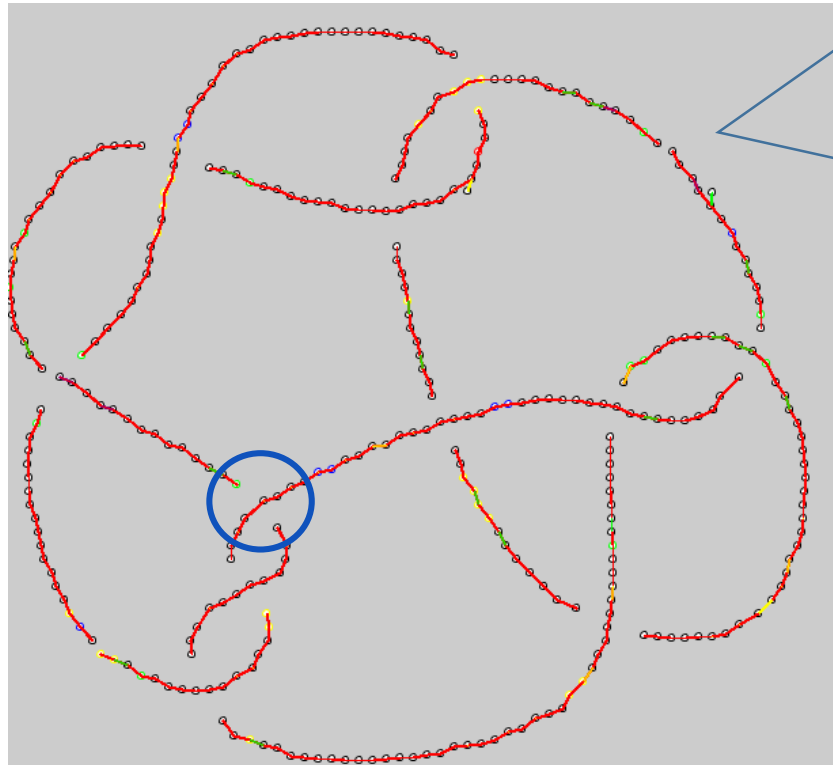
Filling a gap



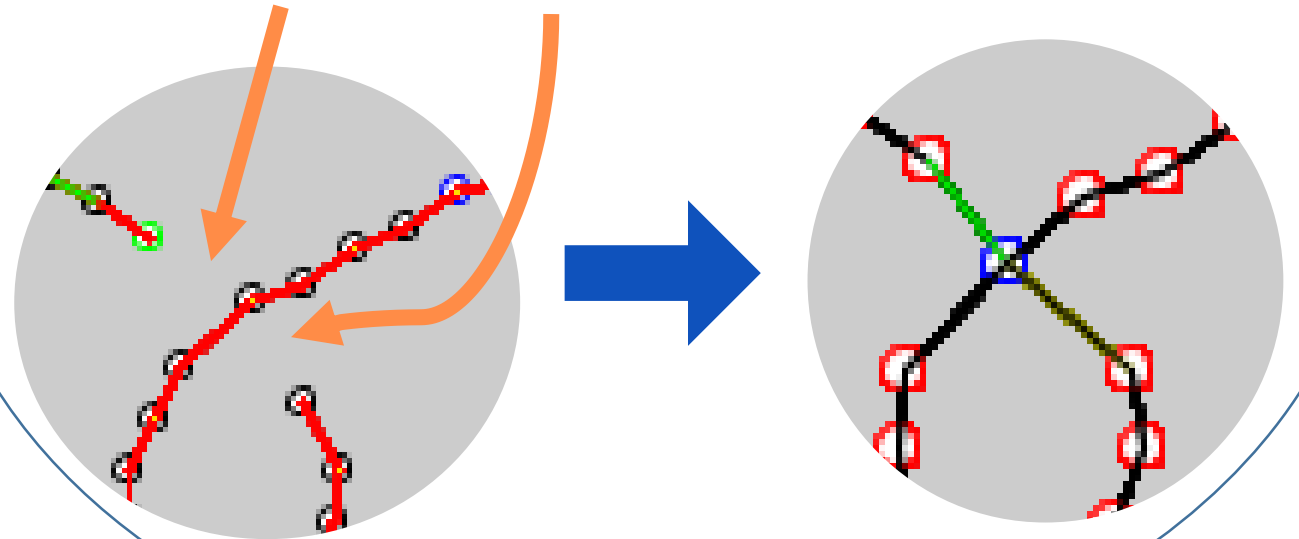
add a segment here



Finding a crossing



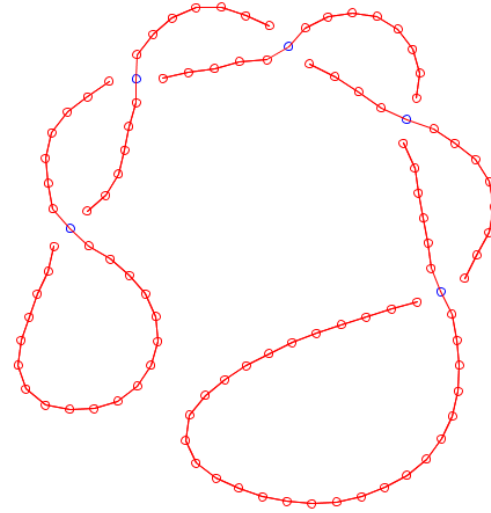
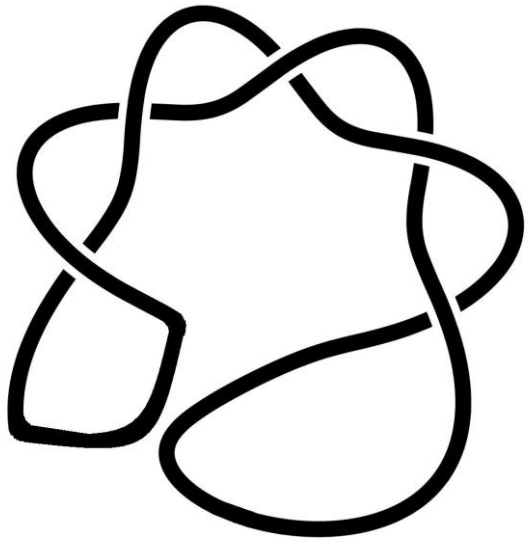
recognizes as an undercrossing



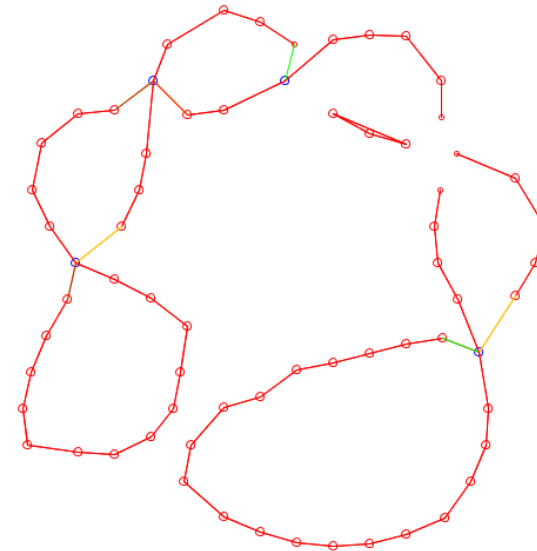
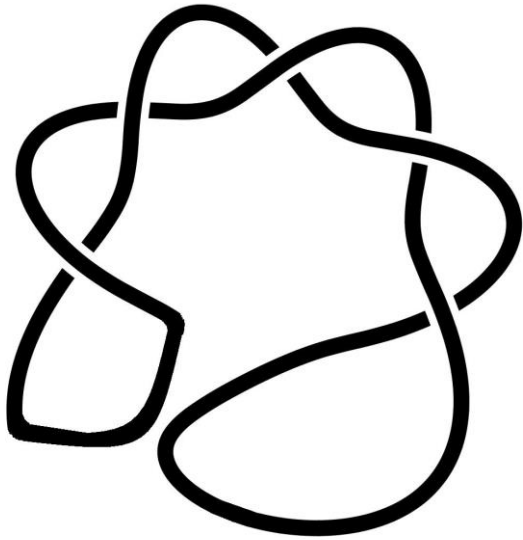
4. Algorithm

- Here, this procedure might fail because of the size of division, the system estimates the thickness of lines from the original image and tries the process several times by changing the size of squares.



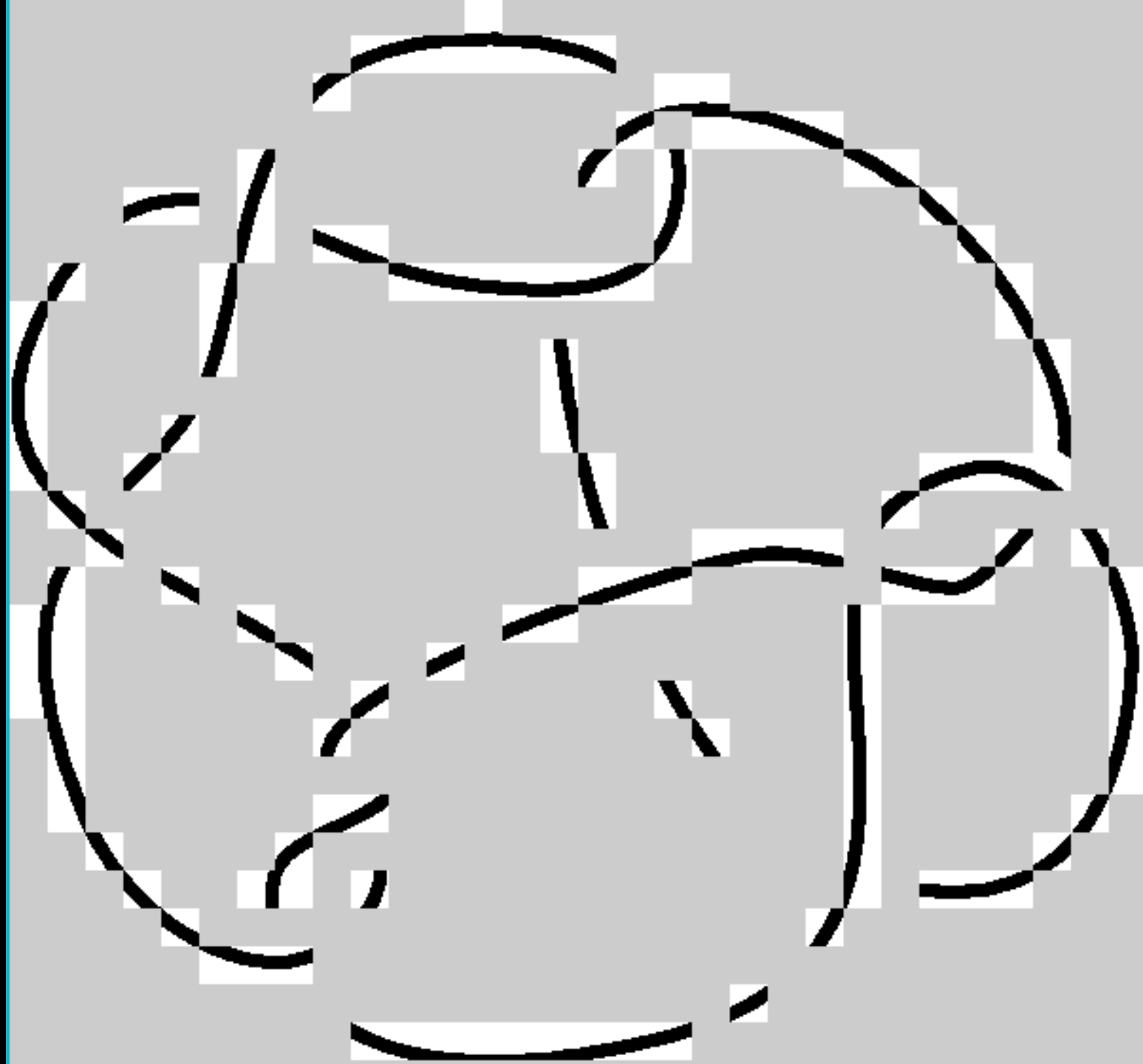


success!!

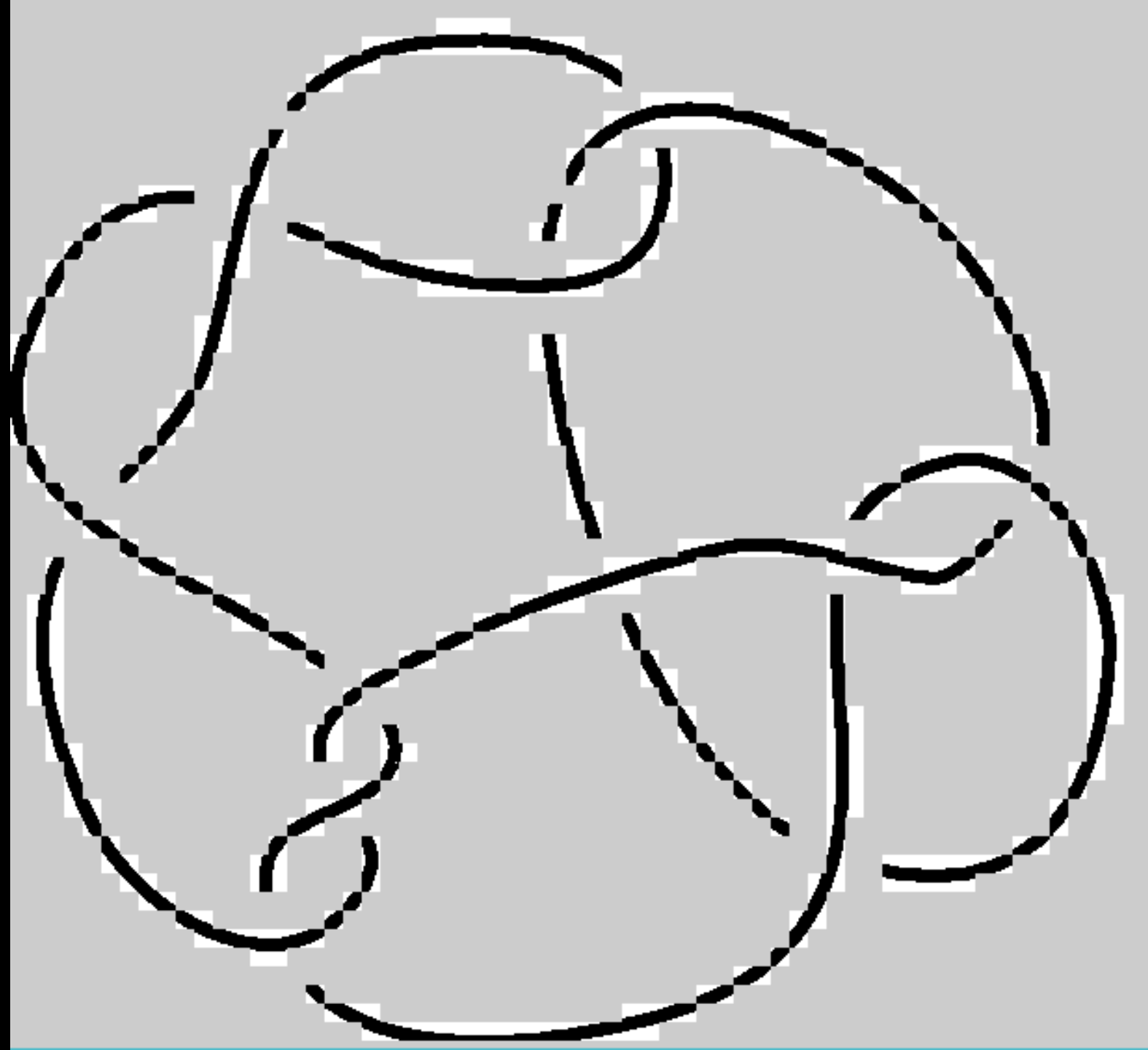


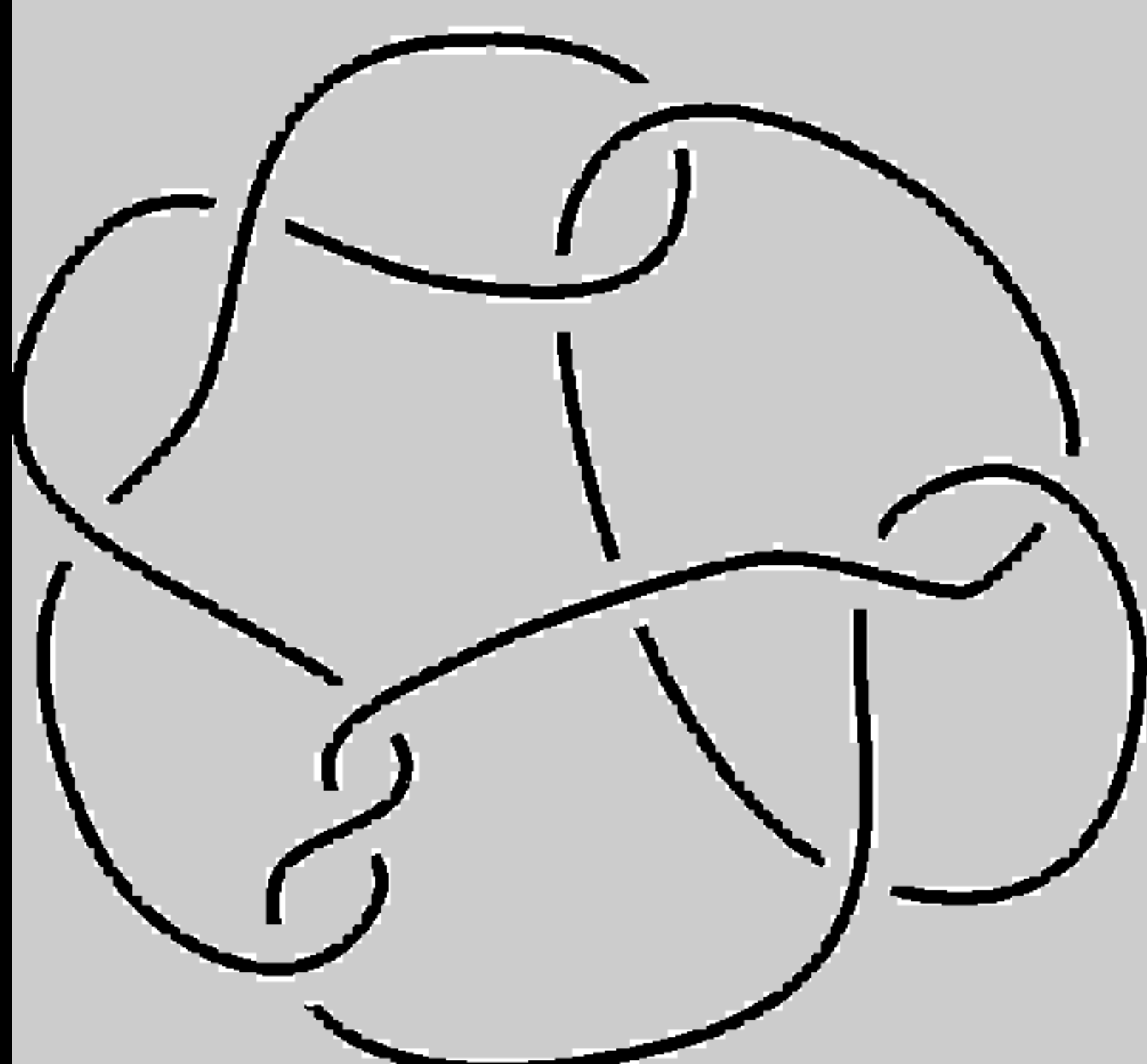
failure...

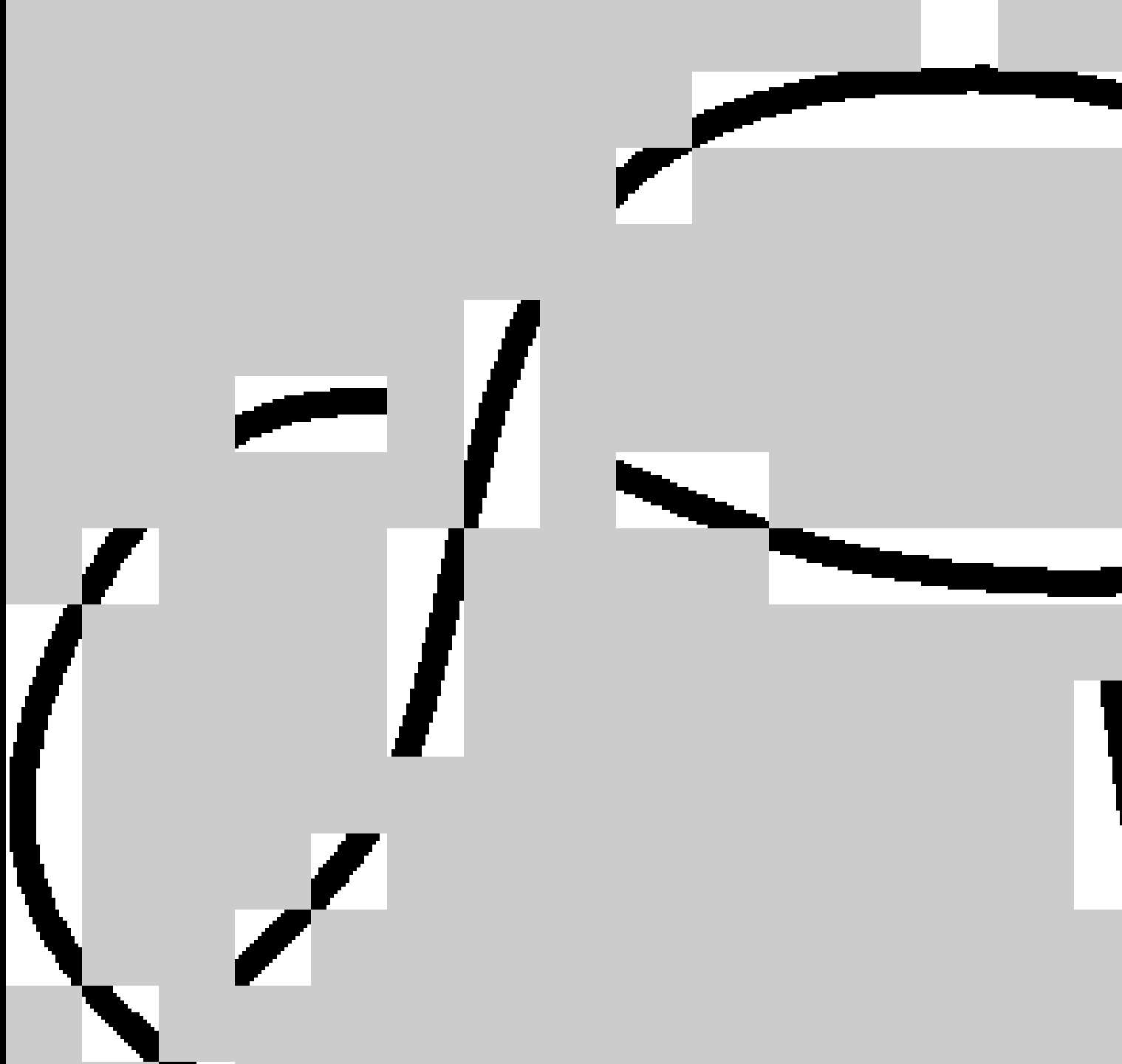


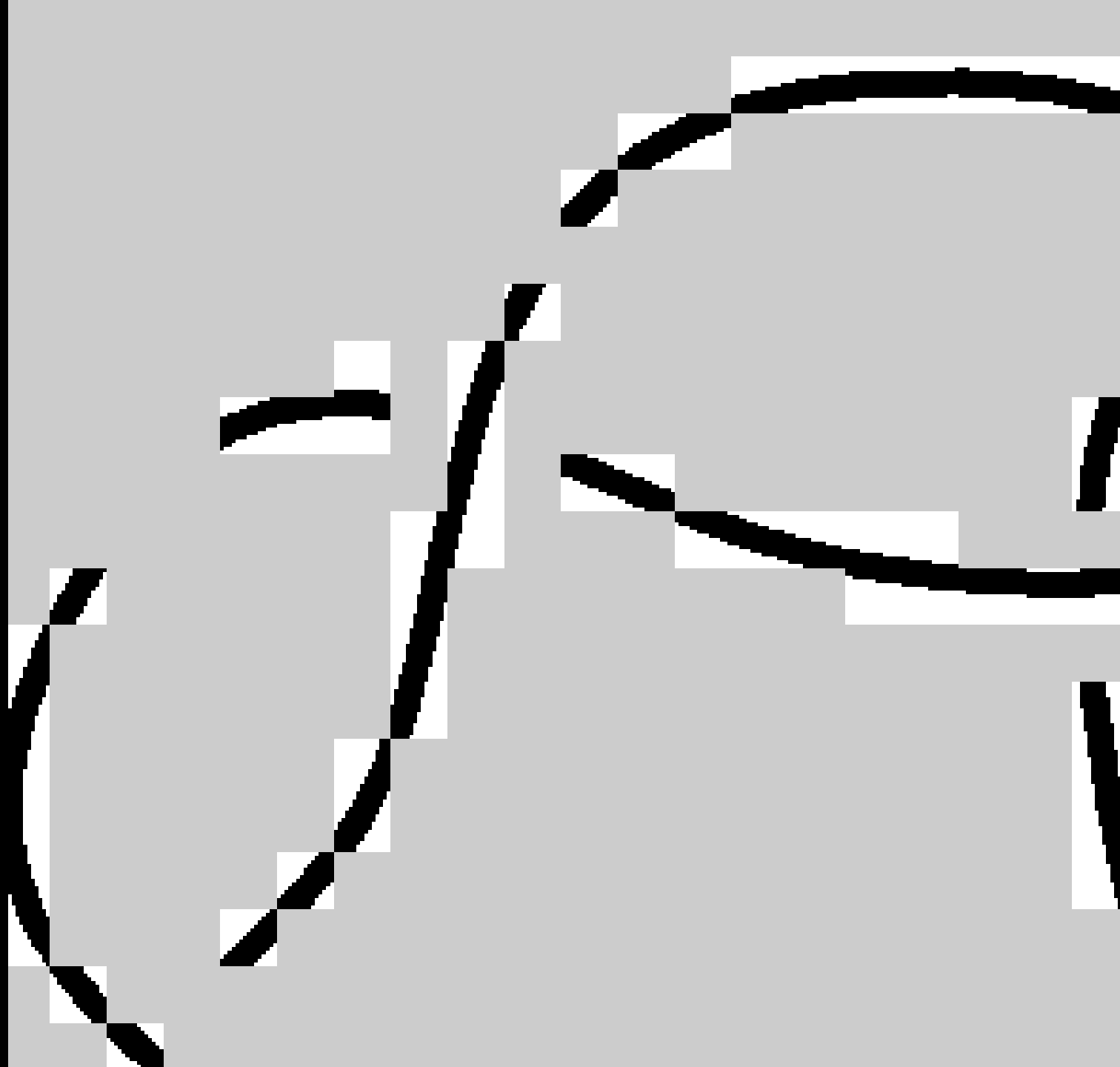










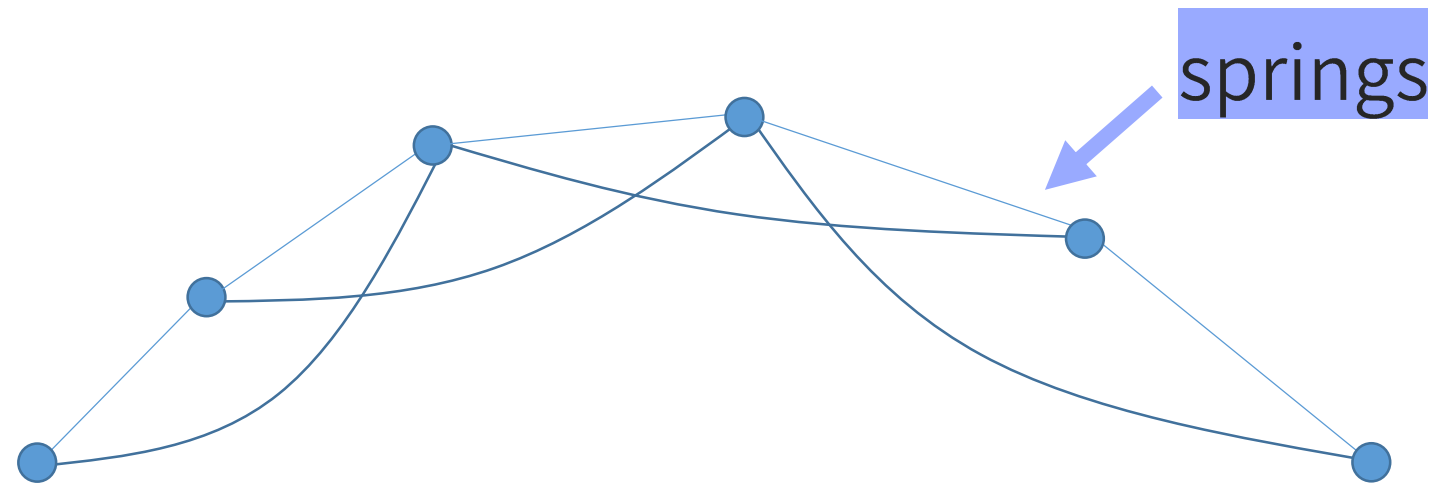






4. Algorithm

- Thus it modifies the obtained picture of the knot with double spring scheme devised by Mr. Rikiishi.



Demonstration



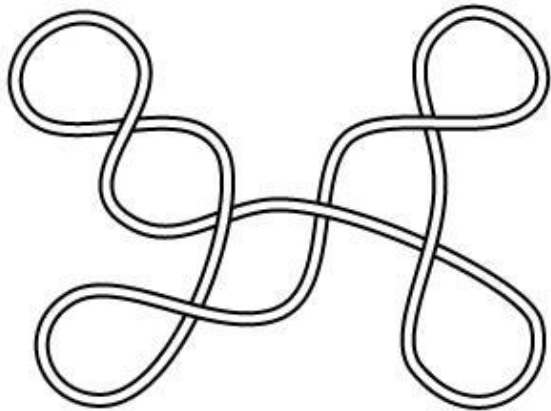
5. Future plans

- In the future, we develop an integrated editor of knot diagram which allows learners of knot theory to manipulate knot diagrams on the screen over our system.

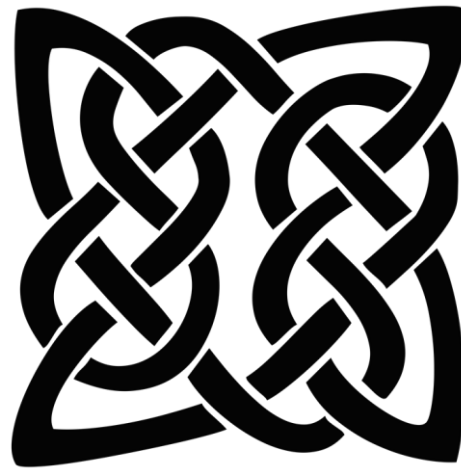


5. Future plans

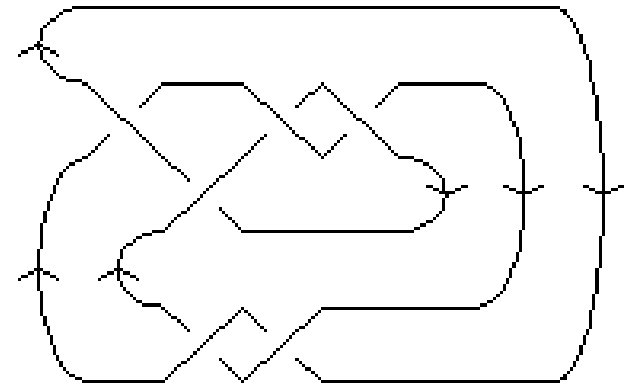
- There are some way of representing knot diagram on the plane.



double line



a knot with
thick line

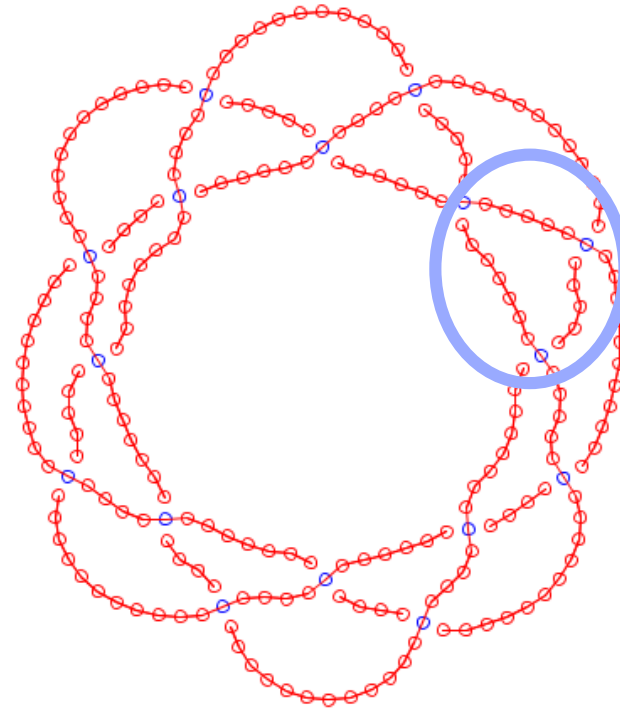
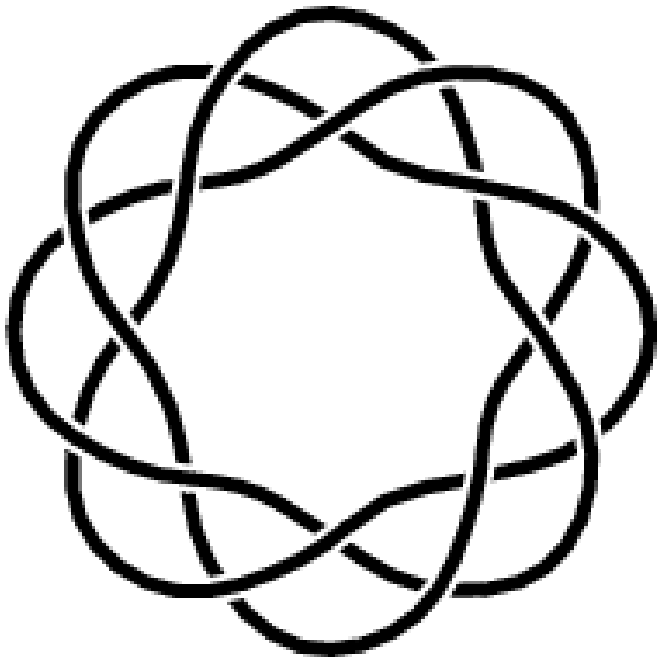


oriented



5. Future plans

- We don't have the best algorithm to obtain a 'good' configuration.



Thank you for listening.

