Moderovacie a renderovacie techniky

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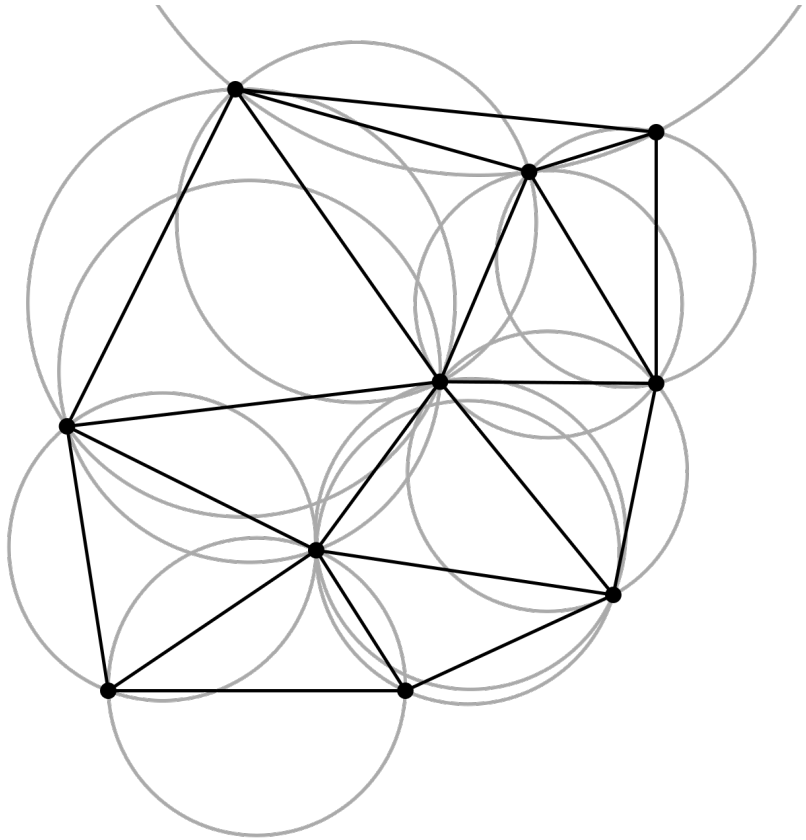
https://github.com/frantisekdracek/Prezentacie/tree/main

Delaunay triangulation

- set of points p_i.
- creates triangle mesh, such that no triangle is inside the circumcircle of any triangle in the DT
- Delaunay triangulation maximize the minimum of all the angles of the triangles in the triangulation



Algorithm

- start: create super triangle enclosing all points :
- initialize list of triangles, list of points and list of bad triangles
- at start triangles contain one super triangle, points contain 3 super points(vertices of supertriangle) and bad triangles are empty
- for point p in list of points:
  - create empty list : polygon
  - for triangle in triangles: check if triangle contains point, if yes add triangle to bad triangles list
  - iterate over bad triangles: for bad triangle in bad triangles:
  - iterate over edges in bad triangle, if edge is NOT shared with other bad triangles, add it to polygon list
  - this gives us polygon that defines outer boundary of bad triangles
  - remove bad triangles from triangles list
  - form new triangles by connecting every edge in polygon to point p
  - add new triangles to triangles list
- remove every triangle that contains any of super points

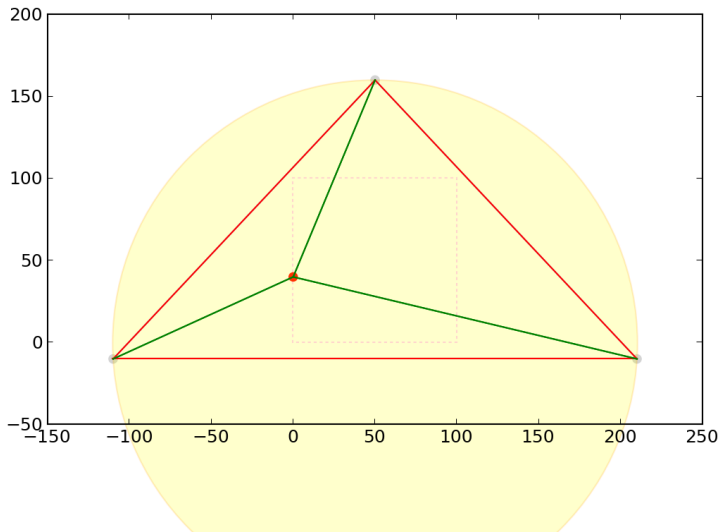
Point in triangle's circumcentre

$$\begin{vmatrix} A_x & A_y & A_x^2 + A_y^2 & 1 \\ B_x & B_y & B_x^2 + B_y^2 & 1 \\ C_x & C_y & C_x^2 + C_y^2 & 1 \\ D_x & D_y & D_x^2 + D_y^2 & 1 \end{vmatrix}$$

$$= \begin{vmatrix} A_x - D_x & A_y - D_y & (A_x - D_x)^2 + (A_y - D_y)^2 \\ B_x - D_x & B_y - D_y & (B_x - D_x)^2 + (B_y - D_y)^2 \\ C_x - D_x & C_y - D_y & (C_x - D_x)^2 + (C_y - D_y)^2 \end{vmatrix} > 0$$

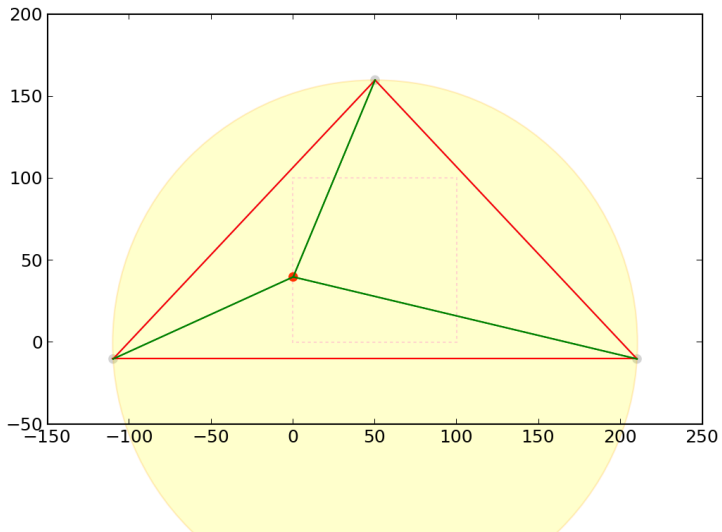
Obr.: Determinant calculation is fast and efficient method to check whether point is inside triangle circumcircle. Determinant is positive only if point lies inside of circumcircle

Example



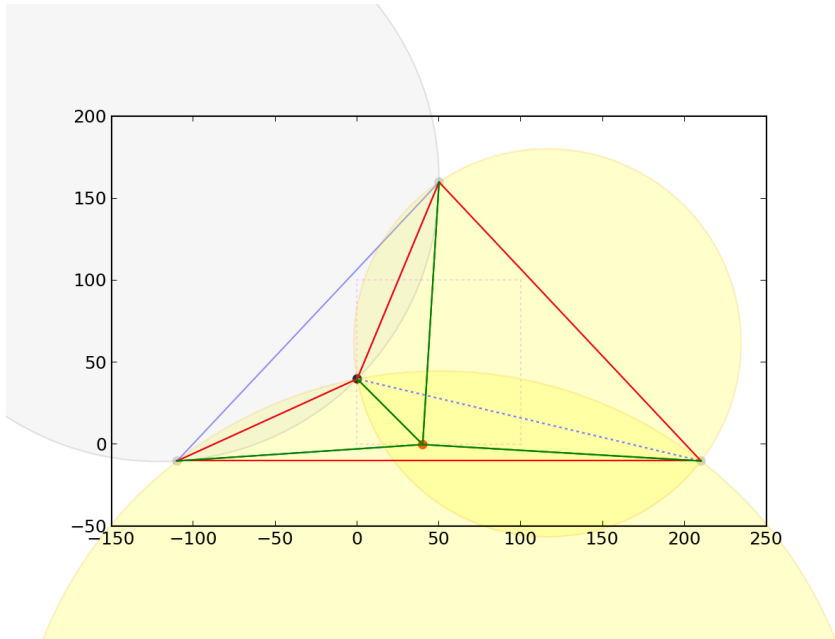
Obr.: insert 1st point

Example



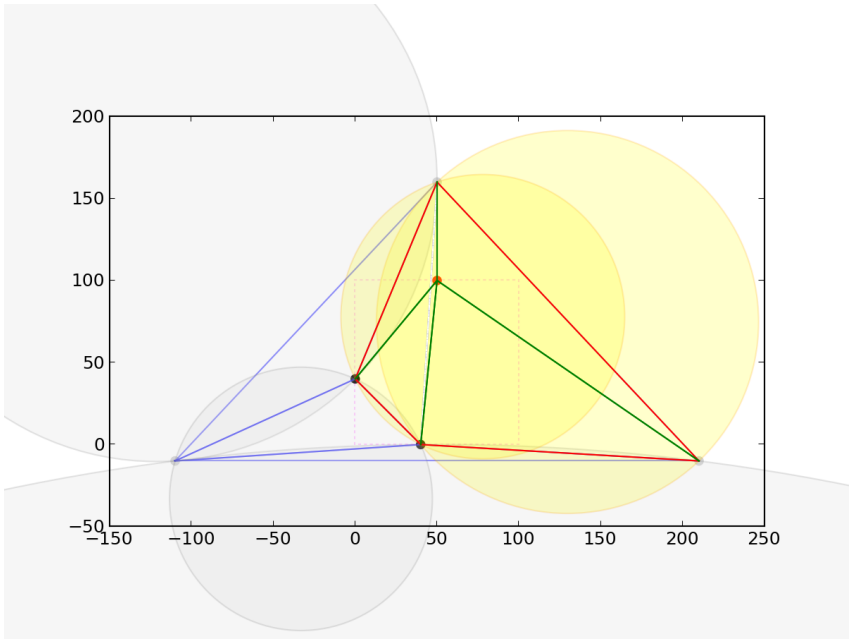
Obr.: Insert 1st point

Example



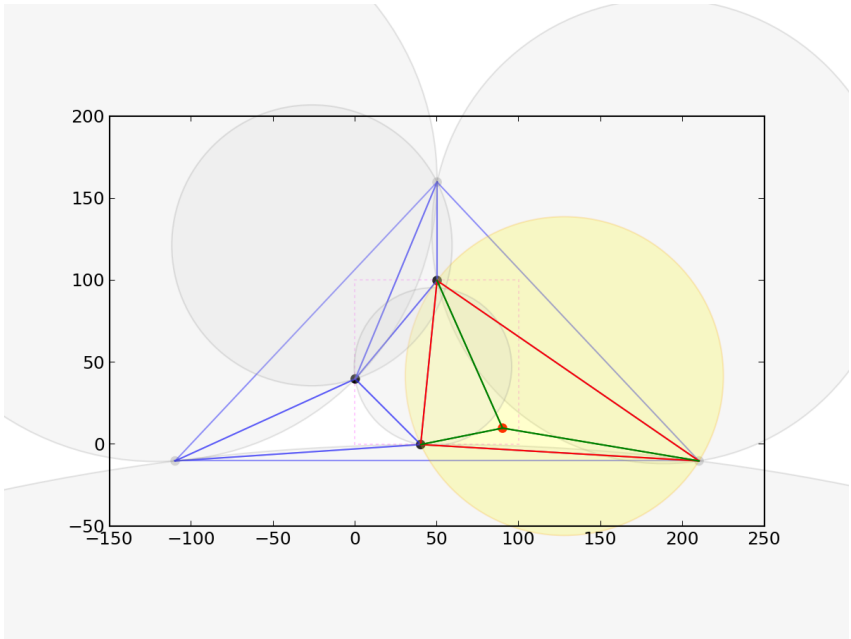
Obr.: Insert 2nd point

Example



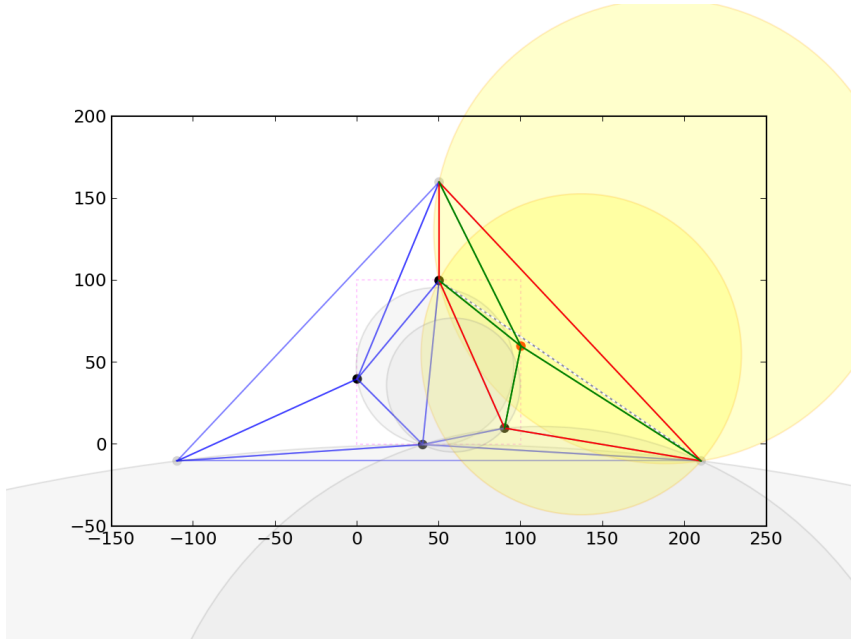
Obr.: Insert 3rd point

Example



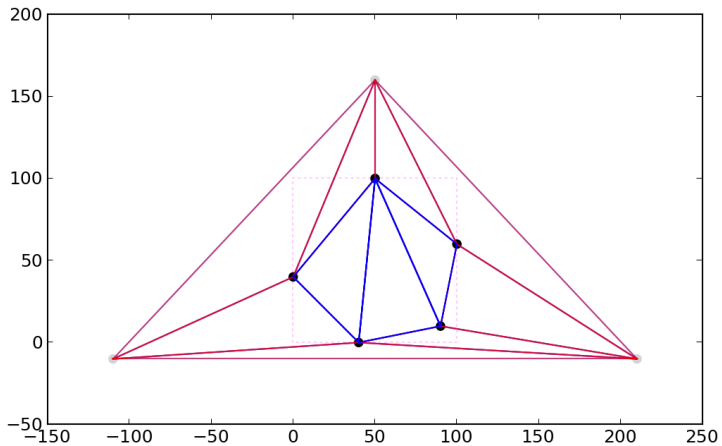
Obr.: Insert 4th point

Example



Obr.: Insert 5th point

Example



Obr.: remove super points and associated triangles

Thank you!