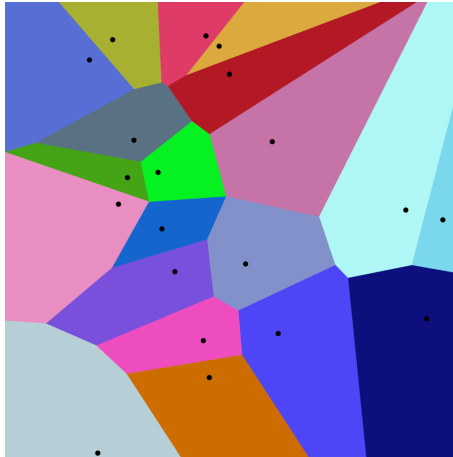**What is...Fortune's algorithm?**

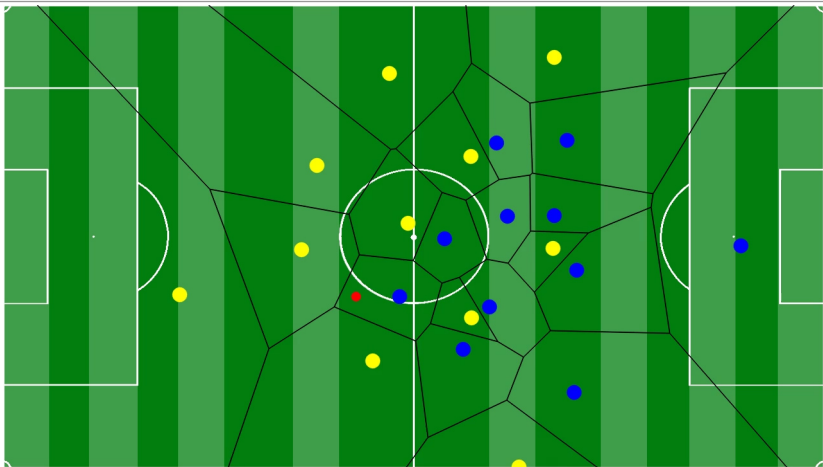Or: Parabolas and distance

A Voronoi diagram (VD)

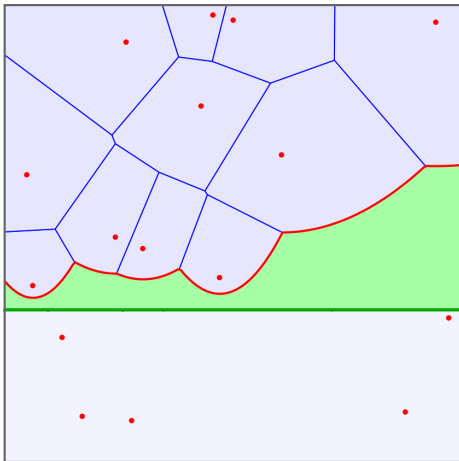- ▶ Fix a number of points in the plane $\boxed{\text{Seeds}}$

- ▶ Each seed gets an associated $\boxed{\text{cell}}$; cells consist of all points closer to that seed than to any other

- ▶ $\boxed{\text{Goal}}$ Find VDs efficiently

Needs from real life

- ▶ VDs play an important role in every day life

- ▶ Above A VD analysis of soccer

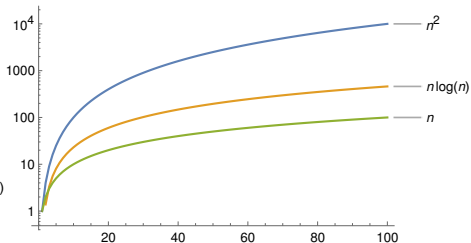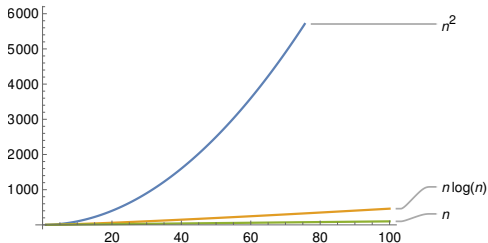- ▶ Goal We really want to find VD efficiently

Parabolas!

▶ The sweep line moves down and only the parts above it are active

▶ The beach line is a sequence of parabolas, one for each active seed

▶ The Voronoi cells are the intersections of the parabolas

Running this algorithm produces VD in $O\big(n\log(n)\big)$ with n=#seeds

- ▶ $O\big(n\log(n)\big)$ "=" worst case runtime is $n\log(n)$

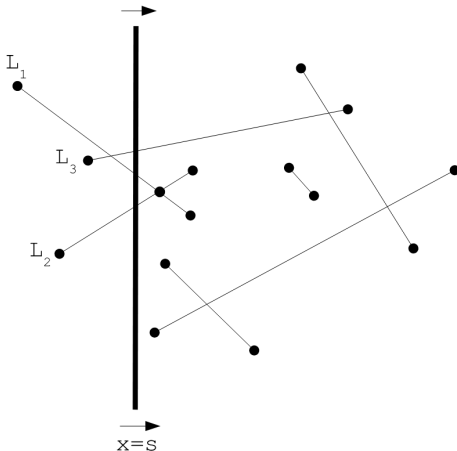- ▶ $n\log(n)$ is "essentially linear" :

The left is a usual plot, the right a logplot

- ▶ The parabolas are given by "fairly ugly" explicit formulas (omitted here)

Sweep line algorithms

- ▶ Fortune's algorithm is a sweep line algorithm
- ▶ The first such algorithm was for line intersections
- ▶ This approach has led to many breakthroughs in computational complexity

Thank you for your attention!

I hope that was of some help.