Theoretical exam: Computational Geometry and Pattern Recognition

Duration: 1h30 / 20 points
NO document, NO internet connection.

1 Voronoi diagram (4 points)

1. Define the Voronoi diagram of a set of points $S \subset \mathbb{R}^n$ and a distance d.
2. Draw a figure to illustrate this diagram. Some specific locations show interesting properties: mention and illustrate them.
3. Cite and roughly explain the principle of an algorithm that can construct such a diagram. What is its complexity?
4. Is there a way to develop a complexity in $O(n)$ in order to compute the Voronoi diagram, while n is the number of points of S?

2 Delaunay triangulation (4 points)

1. What is a triangulation?
2. For a given point set S, is there a unique triangulation?
3. What is a Delaunay triangulation? Is it unique?
4. Mention and illustrate the properties of a Delaunay triangulation on a figure.

3 Alpha shapes (3 points)

1. What is an alpha-shape?
2. What are the limitations of alpha-shapes?
3. What are the solutions for such limitations?

4 Features detectors (9 points)

1. Mention a few features detectors?
2. Explain in detail one of them?
3. Explain the way of performing image registration (panorama reconstruction).