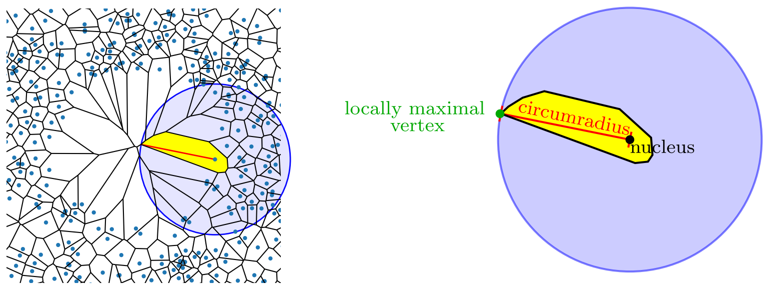
Long and pointy Poisson-Voronoi cells: from the shape to the distribution tail of the circumradius of the typical cell.

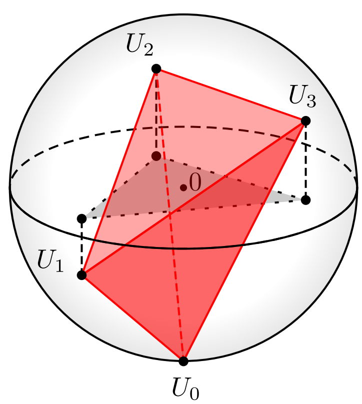
Our model of interest is the *Poisson-Voronoi tessellation* on $\mathbb{R}^d$ in the homogeneous case. It is constructed from a Poisson point process on $\mathbb{R}^d$ with the Lebesgue measure as the intensity measure. Each point of the Poisson process is then associated its *Voronoi cell*, that is, the convex set containing all points of $\mathbb{R}^d$ that are closer to it than to any other point of the Poisson process. The collection of all these cells, each equipped with its *nucleus*, the point of the process that generated it, constitutes the *Poisson-Voronoi tessellation*.

Our object of study is the *typical cell*, which corresponds to a cell chosen uniformly at random from the set of cells intersecting a large window, and more precisely its *circumradius*. The circumradius of a cell is the smallest radius that a ball centered on the nucleus must have to fully cover it, see figure below.



Focusing on the typical cell, we observe that if it realizes a large circumradius, it generally has a thin shape, stretched away from its nucleus in a given direction and culminating with a pointy vertex: we simply call such a vertex *locally maximal*. We show that asymptotically for large circumradii, if a locally maximal vertex at large distance from the nucleus exists, it is unique. As a result, the circumradius equals asymptotically the distance of the unique locally maximal vertex from the nucleus: this correspondence gives us access to the distribution tail of the circumradius of the typical cell.

Moreover, as a locally maximal vertex is determined by random points of the Poisson point process distributed on the surface of a large sphere centered on the vertex and satisfying a precise geometrical condition, our method incidentally leads to the computation of the expectation of the volume of the simplex whose vertices are uniformly random points on the sphere that satisfy this additional geometrical condition, see figure below.



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