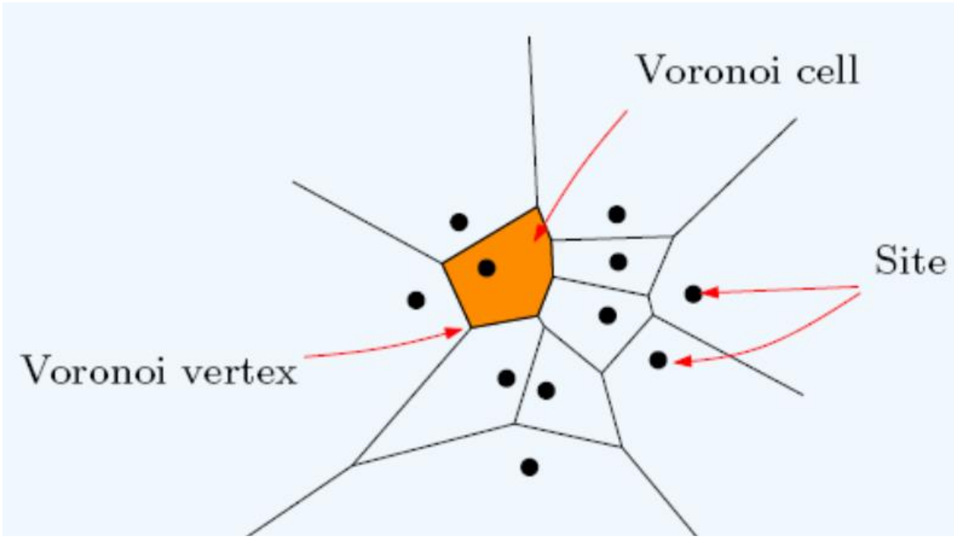
VORONOI DIAGRAM

A plane is divided into areas near each of a given set of objects using a Voronoi diagram. These things are just infinitely many points in the plane in the simplest scenario (called seeds, sites, or generators). There is a region, known as a Voronoi cell, for each seed that is made up of all points in the plane that are closer to that seed than to any other point. A set of points' Voronoi diagram and Delaunay triangulation are identical.

The Voronoi diagram, also known as a Voronoi tessellation, Voronoi decomposition, Voronoi partition, or a Dirichlet tessellation, is named after the mathematician Georgy Voronoi (after Peter Gustav Lejeune Dirichlet). Thiessen polygons are an alternative name for Voronoi cells.



Consider a collection of stores in a city as a straightforward illustration. Let's say we wish to make an estimation of a shop's customer base. When all other factors (pricing, goods, service quality, etc.) are equal, it is acceptable to suppose that customers will choose their preferred store based solely on proximity to them: they will visit the store that is closest to them. In this instance, the Voronoi cell of a given store, displaystyle, can be used to provide an estimation of the number of possible customers visiting this store (which is modeled by a point in our city).

The familiar Euclidean distance may be used to calculate the distance between places in the majority of cities:

Voronoi diagrams, are used to define and to delineate proximal regions around individual data points by using polygonal boundaries. They are employed by many disciplines including weather forecasters, hydrologists and geographers, and by geologists in the mining sector, who use them to estimate resource volumes from exploratory boreholes.

Polygon maps can be used in the data room to create relatively accurate PIIP estimates from the seller's base geomodel. The subsequent model, which is based on reservoir area around each of the wells and extending out to the field oil water contact (OWC), can be used in numerous ways for rapid sensitivity analysis and “what-if” scenarios.

The figure shows a polygon map and outcome for an oil field after the individual well petrophysical analysis results have been applied. The polygon mapping estimate was within 5 percent of the geomodel estimate. The size of polygons in the table gives an idea of how much of the in-place volume is influenced by each well. On an areal basis one might think the southern polygons are more important, but after having applied the relevant petrophysical results it is obvious that the northern polygons contain the lion's share of the PIIP, and polygon-5 in particular.

southern	14	1.28	0.8%	0.5	0.1%	0.4

Note that any major structural faults can be used as boundaries for the polygons (i.e., well parameters of a polygon on one side of the fault are not applied to the polygon on the other side of the fault). License boundaries can also act as boundaries for the polygons, although the polygon crossing the lease line would have the same parameters on either side. This allows PIIP to be broken down by lease and so the resultant polygon map can be used for computing working interest based on PIIP in unitization studies.

The Thiessen polygon model permits different fluid properties to be assigned to different polygons if hydrocarbon quality varies across structure. Different well performance (and associated EUR) can be allocated to different polygons to reflect spatial variation in reservoir quality. Also, the field area itself can be altered if the OWC is uncertain by increasing the areas of the outer polygons accordingly.

The main advantages of a polygon mapping approach (which has been “adjusted” to tolerably match the geomodel's base PIIP) are flexibility and speed to allow the M&A team to make rapid and reasonable judgments on the relative importance of various assumptions made by the seller.

GITHUB LINK: