**Hot spot- KDE for lectures..**

**Brunsdon, C. Estimating probability surfaces for geographical point data: An adaptive kernel algorithm. Comput. Geosci. 1995, 21, 877–894.**

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Kernel-based approach to **probability density function (PDF)** estimation (Silverman, 1986; Diggle, 1985, 1990) provides a tool for determining the shape of a probability density distribution given a set of points that have been drawn from that distribution

Redwood seedlings data

**Figures in p. 883** are good (3 types of visualisation of KDE application results figures below)

Here, the location of the trees will be considered as a random process: in some regions trees are more likely to survive than others. The actual location of the trees therefore can be thought of as a realization of a random spatial process. **The task for this case study** is **to estimate the probability density function** associated with this process.

--looking at fig. 7-8 to grasp how to produce these visualisations: for each point a KDE i porformed and with the obtained values of pdf function (the formula of chainey the value at x,y poisiton..)

--hot spots and a KDE most dense points: most dense point in kDE : are they mean or peak values? If it is the latter than KDE=HSA points

There are many types of graphical technique used to represent **two-dimensional surfaces in three-dimensional space**. –tersi bence-- Because these all have notably different appearances, some thought must be given to the selection of method when presenting results of this sort. **Three possible presentation methods** are suggested here:

1. Contouring (Fig. 7)
2. Three-dimensional perspective drawing (Fig. 8) lProportional area ‘bubbles’ on a regular grid (Fig. 9)
3. A gray-scale map (Fig. 10)-as used for example in Gatrell (1994).

Although usually the most popular method, the perspective drawing has the disadvantage that **when viewed from some directions, part of its features are obscured.**

--this generally is the case with perspecive views but perspektive neresinde göremedik henüz.

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A particularly important factor when considering any statistical technique for linkage are the assumptions that are made when it is applied. For example, **statistical methods** which assume a **Gaussian distribution** in their study data at least **will have to be checked for robustness** in **situations where this assumption is violated**. More fundamentally, techniques which “assume away” the geography of the situation should be avoided-in particular, the supposition that **observations related to a set of geographical zones are distributed independently is unlikely to be true** in many geographical contexts.

[. Adaptive KDE—880

**some system for reducing the hi values in high-density regions, and increasing them in low-density regions**

**should be sought**. A plausible way of achieving this may be set out in two steps:

1. Compute a fixed-h estimate of density for each x,
2. Use these estimates to obtain an h, at each of these points

GPU based..

Zhang, G.; Xu, J. **Multi-GPU-Parallel** and **Tile-Based** Kernel Density Estimation for Large-Scale Spatial Point Pattern Analysis. *ISPRS Int. J. Geo-Inf.* **2023**, *12*,31.

**Abstract:** Kernel density estimation (KDE) is a commonly used method for spatial point pattern analysis, but it is computationally demanding when analyzing large datasets. GPU-based parallel computing has been adopted to address such computational challenges.

--abst zayıf..

İn the formulae there is “ei” which does not exist in other main lit.

İntro is good ..

**Heatmap- KDE- hot spot differences**

A heatmap is typically renderer (qgis doc) using a yellow–to-red or white–to-red color ramp where higher con‐

centration of points result in more heat. Click the Color ramp dropdown menu and select Reds color ramp.

8. deki açıklamalar misleading and not understandable…purpled parts..

8. Next you need to choose a Radius. This parameter determines the circular neighborhood around each

point where that point will have an influence. This value will largely depend on the type of your input

data. For our data, let’s assume a crime incident will have an influence upto 5 Kilometers from the lo‐

cation. Notice that the current project CRS is set to EPSG: 3857 in the bottom-right corner. This CRS

has a unit of meter, so we should specify 5000 meters as the radius. Another parameter that is hidden

from this menu is the Kernel shape. This is a function that determines how the influence of a point

should be spread out over the given radius. The Heatmap renderer uses the Quartic function for this

calculation. There are other types of kernels such as Triangular , Uniform , Triweight and

Epanechnikov that can be specified in when using a different heatmap creation method described

later in this tutorial. See this post (https://www.geodose.com/2017/11/qgis-heatmap-using-kernel-

density.html) for a good explanation and guidance for select the right radius and kernel shape.

**…..projection-datum difference …**

“For our data, let’s assume a crime incident will have an influence upto 5 Kilometers from the lo‐

cation. Notice that the current project CRS is set to EPSG: 3857 in the bottom-right corner. " **what is EPS:3857** ?

ChatGPT

EPSG: 3857 refers to the coordinate reference system (CRS) known as "Web Mercator." It is a widely used CRS for web mapping and is commonly used by mapping services like Google Maps, Bing Maps, and OpenStreetMap.

Web Mercator (EPSG: 3857) uses a spherical model of the Earth and represents locations using two-dimensional Cartesian coordinates (x, y), where the unit of measurement is in meters. This projection is particularly useful for displaying maps on computer screens because it preserves angles and shapes well, making it suitable for interactive online maps.

However, it's important to note that using Web Mercator for distance calculations can lead to distortions, especially as you move away from the equator. The distortion increases with latitude, so measurements in EPSG: 3857 may not be accurate for large distances or near the poles.

In the context of your project, if the CRS is set to EPSG: 3857, any distance measurements or spatial analyses should take into account the characteristics and limitations of the Web Mercator projection.

**Geodose article..** <https://www.geodose.com/2017/11/qgis-heatmap-using-kernel-density.html> (looks like a good resource ..

QGIS is an open source GIS software that can be used to produce a heatmap from a set of data point with [Heatmap Plugin](http://docs.qgis.org/2.18/en/docs/user_manual/plugins/plugins_heatmap.html%22%20%5Ct%20%22_blank). The plugin is using Kernel Density Estimation algorithm for creating a heatmap. Because of that I will discuss how this algorithm(Kernel Density Estimation) is applied to process an input point dataset into a heatmap.



References

(qgis doc) Creating Heatmaps (QGIS3) — QGIS Tutorials and Tips A heatmap is typically renderer using a yellow–to-red or white–to-red color ramp where higher con‐

centration of points result in more heat. Click the Color ramp dropdown menu and select Reds color-

ramp.