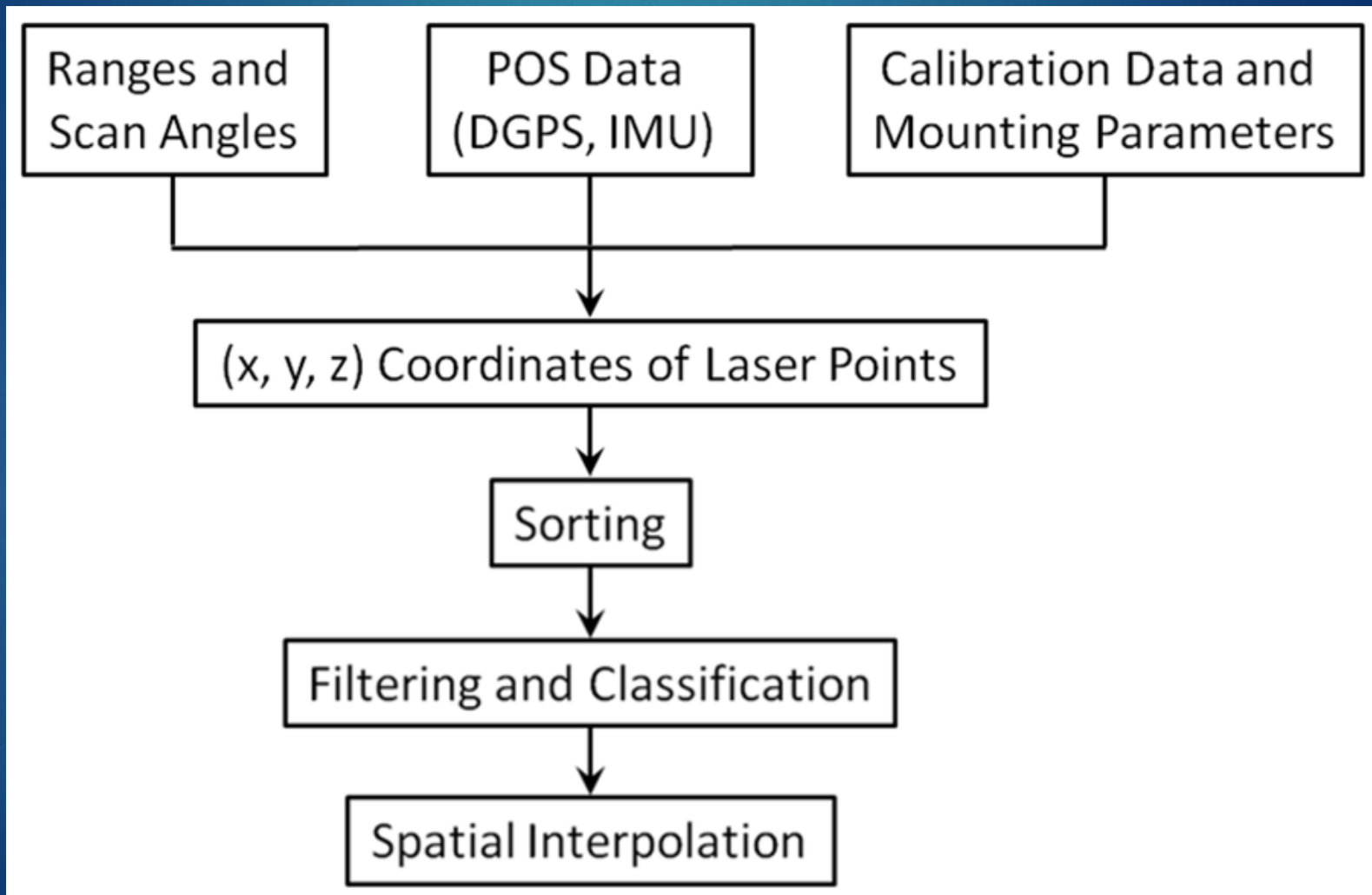
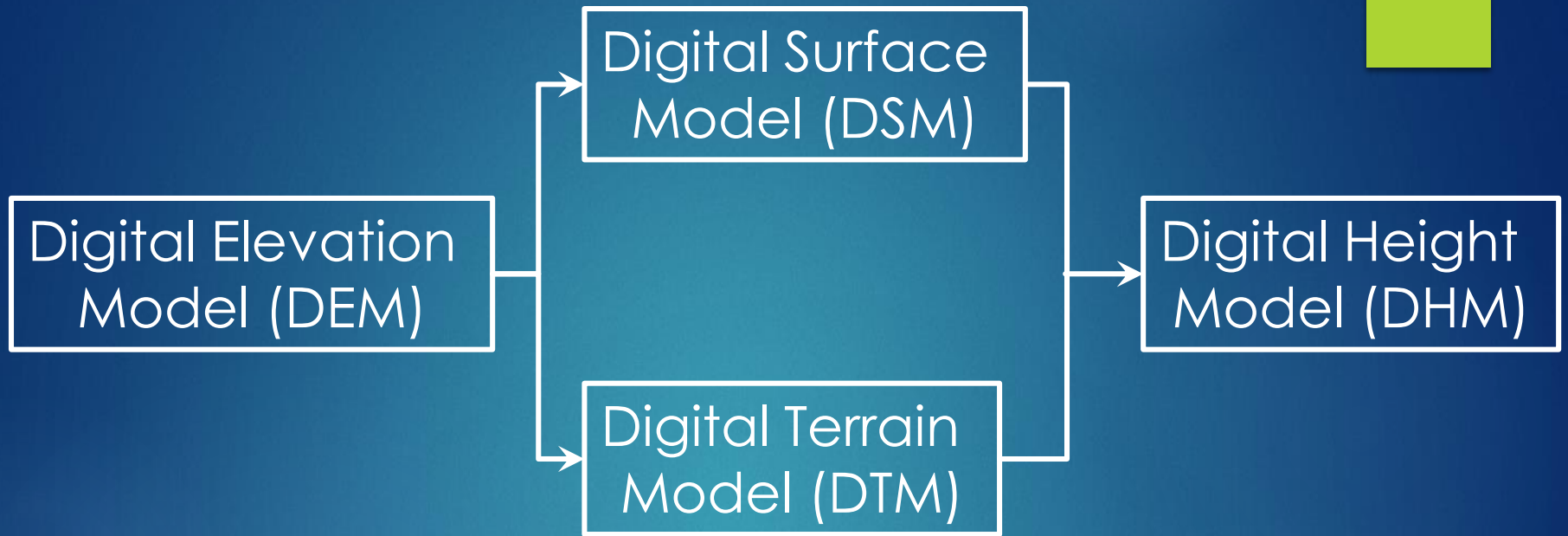


LiDAR Data Processing (1)

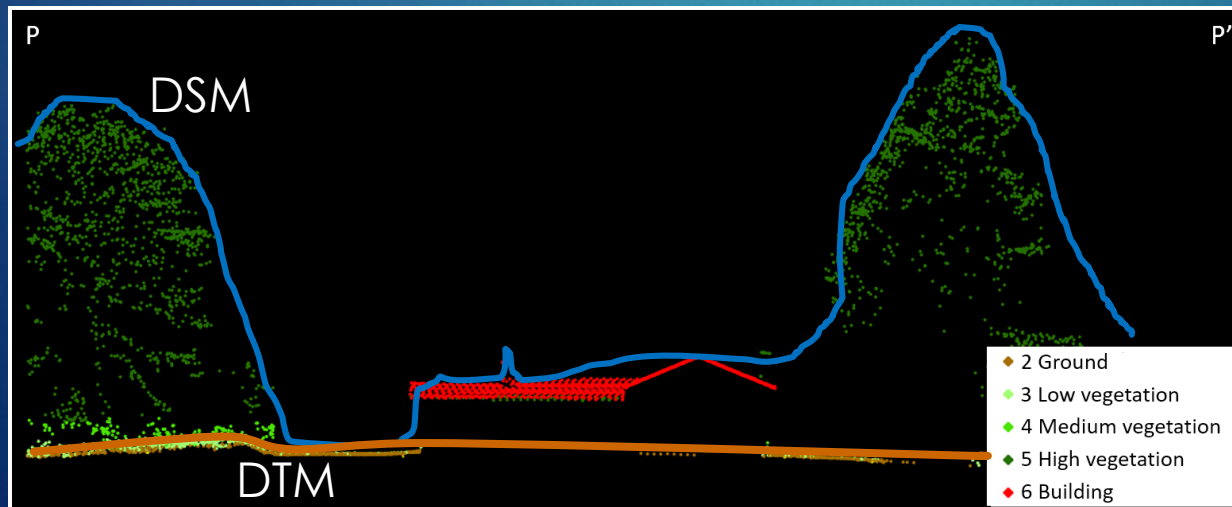
LiDAR Data Processing



Several Important Concepts



$$\text{DHM} = \text{DSM} - \text{DTM}$$



LiDAR Data Filtering

To remove non-ground points so that a DTM can be created.

- Triangulated Irregular Network (TIN) based methods
- Raster-based methods

Filtering

- **Definition:** To remove non-ground LiDAR points so that bare-earth digital terrain models can be created from the remaining ground LiDAR points.
- Over 20 filtering methods have been proposed in the past two decades (for example, Axelsson 2000, Sithole and Vosselman 2004, Tóvári and Pfeifer 2005, Chen et al. 2007, Liu 2008, Chang et al. 2008, Meng et al. 2010, Wang and Tseng 2010, Chen et al. 2013, Pingel et al. 2013, Zhang and Lin 2013, Zhang et al. 2016, Nie et al. 2017).
- Most filtering methods are unsupervised classifiers, which means that users do not need to collect training data. However, users may need to provide parameters for a classifier.

Filtering

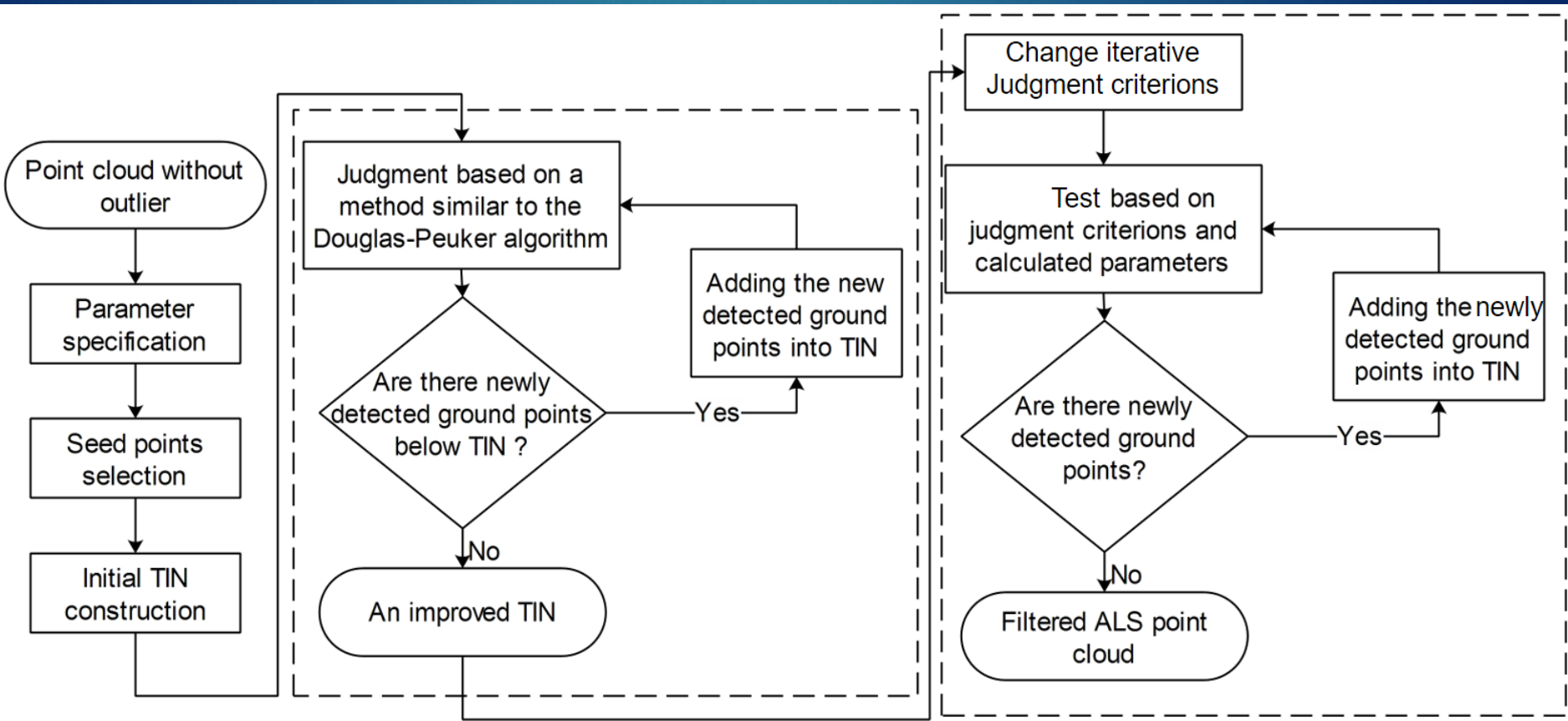
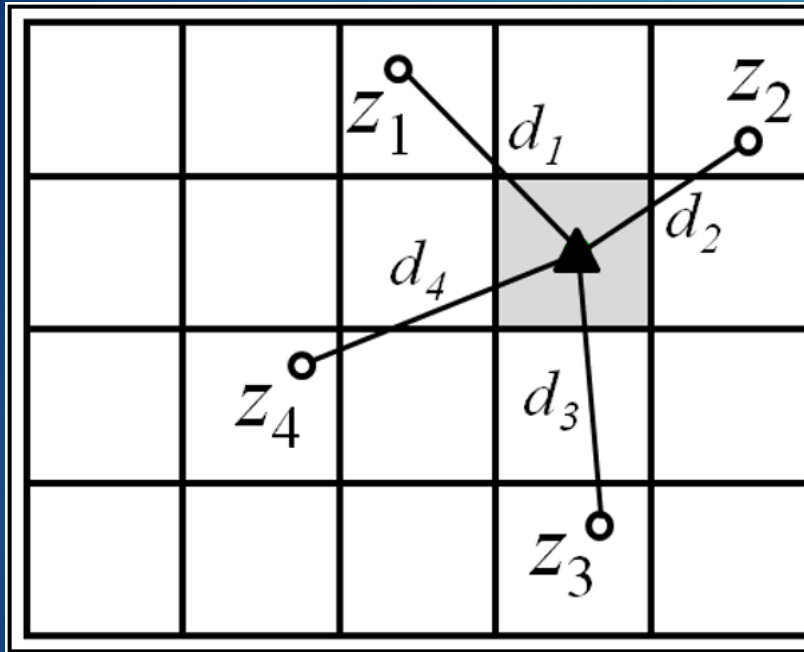


Figure 3.2. Flowchart of the revised progressive TIN densification method for filtering airborne LiDAR points (adapted from Nie et al. 2017).

Interpolation

To calculate unknown values from limited sample values.

Inverse Distance Weighting



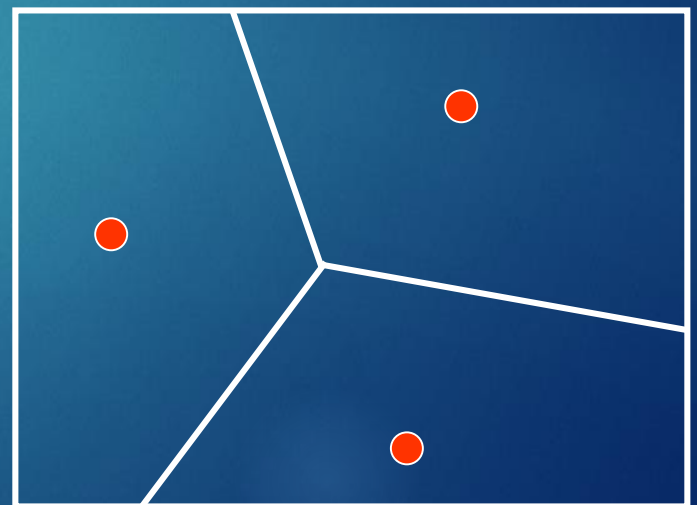
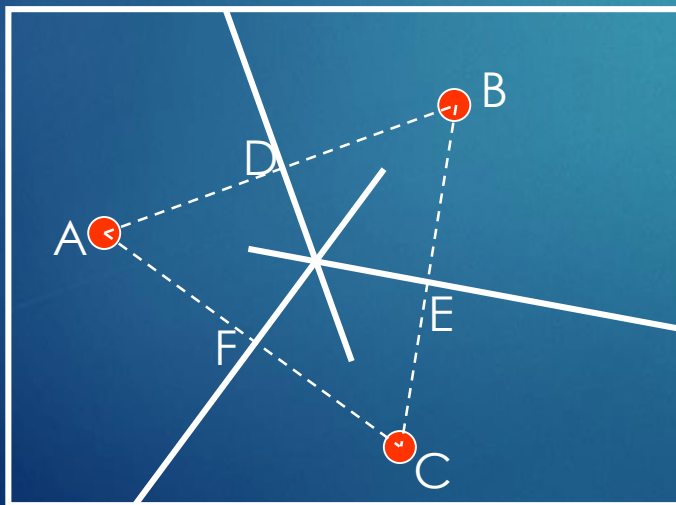
$$Z_j = \frac{\frac{z_1}{d_1^2} + \frac{z_2}{d_2^2} + \frac{z_3}{d_3^2} + \frac{z_4}{d_4^2}}{\frac{1}{d_1^2} + \frac{1}{d_2^2} + \frac{1}{d_3^2} + \frac{1}{d_4^2}}$$

d_i – distance, z_i – input values, z_j – output value.

Construction of Voronoi diagrams:

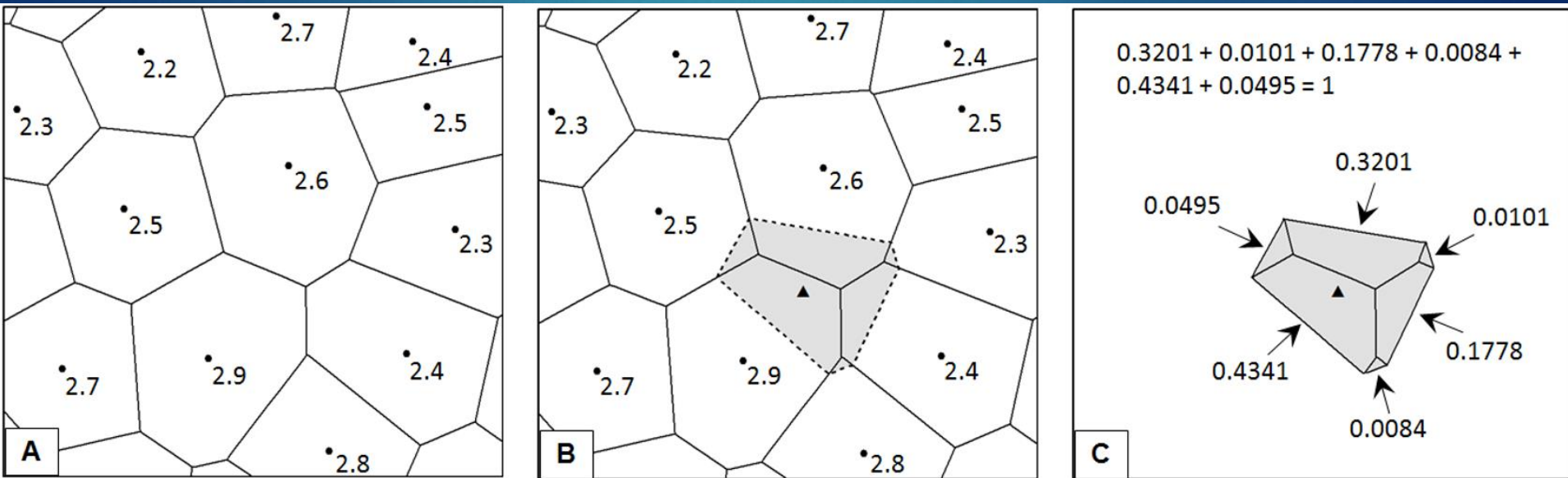
- connecting points to make triangles.
- connecting perpendicular bisectors.

$$AD = BD, BE = CE, AF = CF$$



Natural Neighbor

The proportion of overlap between the new Voronoi polygon and the initial Voronoi polygons are used as the weights w_i .



$$g(x, y) = \sum_{i=1}^n w_i f(x_i, y_i)$$

