Entry

In this unit, you will learn how to create buffer polygons around specified input features. Moreover, this unit will introduce how to convert point features to Thiessen or proximal polygons. Distances among features are important too. Calculation of distances among features will also be introduced. Moreover, you will learn how to create buffer regions around grouped input features.

Clarification

Introduction to spatial patterns and neighbourhood features

Refer to the download version of graphic presentation PDF file.

Introduction to spatial patterns and neighbourhood of point features

In this unit, you will learn how to create buffer polygons around specified input features. Moreover, this unit will introduce how to convert point features to Thiessen or proximal polygons. Distances among features are important too. Calculation of distances among features will also be introduced. Moreover, you will learn how to create buffer regions around grouped input features.

Refer to the download version of graphic presentation PDF file.

Look an example of distance calculation of point features

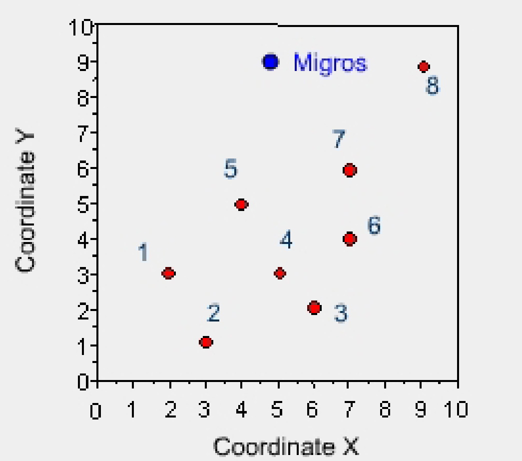
Concept : Point features: Example of a distribution for calculation of distance

Location of 8 houses

Point	X (m)	Y(m)
1	2.0	3.0
2	3.0	1.0
3	6.0	2.0
4	5.0	3.0
5	4.0	5.0
6	7.0	4.0
7	7.0	6.0
8	9.0	9.0

The location of Migros is X = 5 and Y = 9.

Spatial distribution of 8 houses and Migros



The following is the result of calculating distance among point features or houses. The distance between a point and itself is 0.

Concept : Point features: Example of calculation of distance among points

Linear distance among houses

From	To	Distance	From	To	Distance	From	To	Distance	From	To	Distance
1	1	0.000	3	1	4.123	5	1	2.828	7	1	5.831
1	2	2.236	3	2	3.162	5	2	4.123	7	2	6.403
1	3	4.123	3	3	0.000	5	3	3.606	7	3	4.123
1	4	3.000	3	4	1.414	5	4	2.236	7	4	3.606
1	5	2.828	3	5	3.606	5	5	0.000	7	5	3.162
1	6	5.099	3	6	2.236	5	6	3.162	7	6	2.000
1	7	5.831	3	7	4.123	5	7	3.162	7	7	0.000
1	8	9.220	3	8	7.616	5	8	6.403	7	8	3.606
2	1	2.236	4	1	3.000	6	1	5.099	8	1	9.220
2	2	0.000	4	2	2.828	6	2	5.000	8	2	10.000
2	3	3.162	4	3	1.414	6	3	2.236	8	3	7.616
2	4	2.828	4	4	0.000	6	4	2.236	8	4	7.211
2	5	4.123	4	5	2.236	6	5	3.162	8	5	6.403
2	6	5.000	4	6	2.236	6	6	0.000	8	6	5.385
2	7	6.403	4	7	3.606	6	7	2.000	8	7	3.606
2	8	10.000	4	8	7.211	6	8	5.385	8	8	0.000

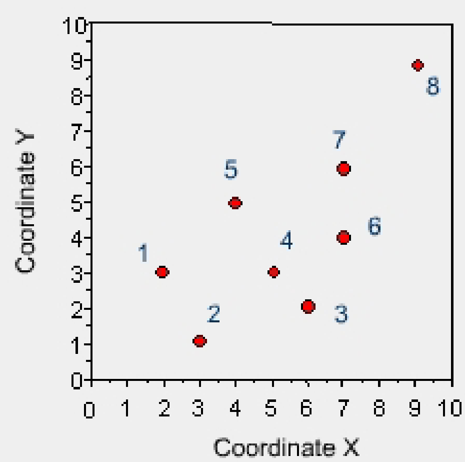
Look an example calculation of Thiessen Polygons

Concept : Point features: Example of a distribution for calculation of thiessen polygon

Location of 8 points

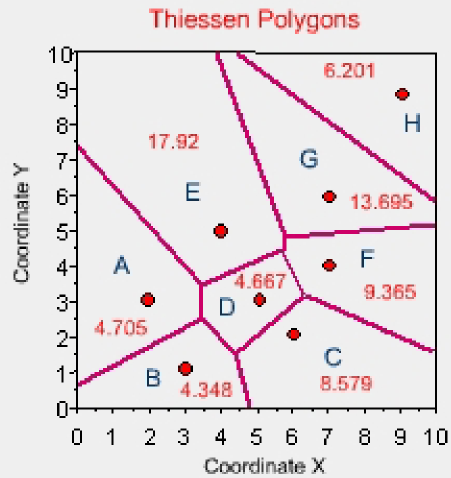
Point	X (m)	Y(m)
1	2.0	3.0
2	3.0	1.0
3	6.0	2.0
4	5.0	3.0
5	4.0	5.0
6	7.0	4.0
7	7.0	6.0
8	9.0	9.0

Spatial distribution of 8 points



First, all points are triangulated into a Triangular Irregular Network (TIN) that meets the Delaunay criterion. Then, the perpendicular bisectors of each triangle edge are generated, forming the edges of the Thiessen polygons. The locations at which the bisectors intersect determine the locations of the Thiessen polygon vertices.

Concept : Point objects: Thiessen polygons based on 8 points

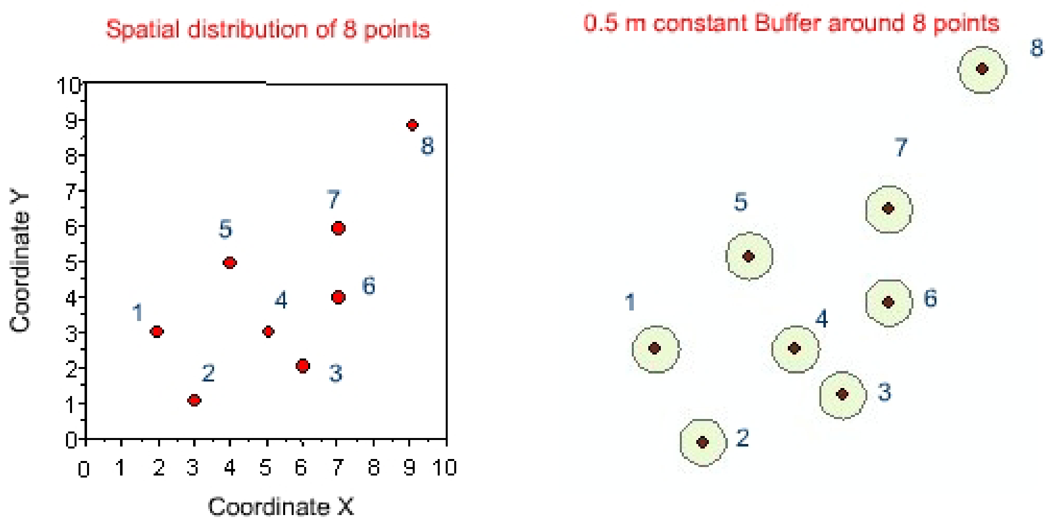


The area of each polygon is illustrated within the polygon.

Areas of largest proximity to the 8 points

Look an example of buffering point features

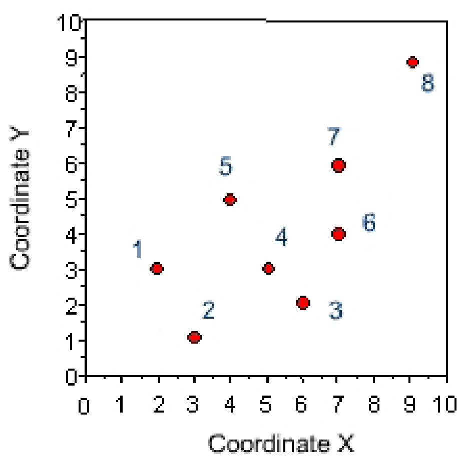
Concept : Point features: Example of constant buffer around a point feature



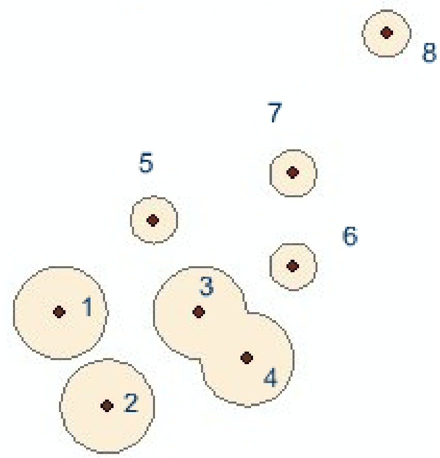
Buffer polygon or polygons can be created by using a constant buffer distance or variable buffer distance around the specified input point feature.

Concept : Point features: Example of variable buffer around point features

Spatial distribution of 8 points



1 m constant Buffer around points 1,2, 3, 4 and
0.5 m constant buffer around points 5, 6, 7, 8

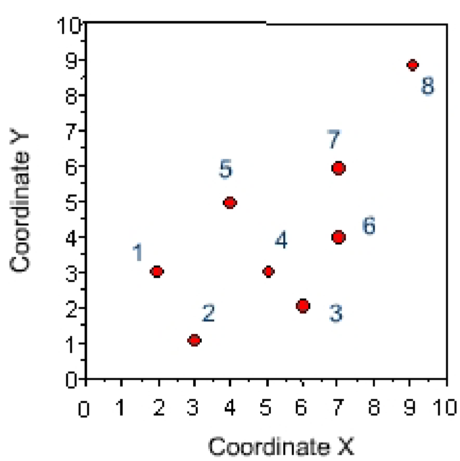


Look the example of calculating closest distance

Closest distances can be calculated from the point features using Euclidian distance. The following example is calculated based on the on the point distribution map illustrated to the 0.5 m raster grid.

Concept : Point features: Calculation of euclidian distance in image mode

Spatial distribution of 8 points



Closest Distance from points at 0.5 m grid

6.4	5.7	5.0	4.5	4.1	4.0	3.6	3.0	2.0	1.0	0.0	1.0	2.0
5.8	5.0	4.2	3.6	3.2	3.0	2.8	2.2	2.0	1.4	1.0	1.4	2.2
5.0	4.5	3.6	2.8	2.2	2.0	2.2	1.4	1.0	1.4	2.0	2.2	2.8
4.2	3.6	3.2	2.2	1.4	1.0	1.4	1.0	0.0	1.0	2.0	3.0	3.6
3.6	2.8	2.2	2.0	1.0	0.0	1.0	1.4	1.0	1.4	2.2	3.2	4.1
3.2	2.2	1.4	1.0	1.4	1.0	1.0	1.0	0.0	1.0	2.0	3.0	4.0
3.0	2.0	1.0	0.0	1.0	1.0	0.0	1.0	1.0	1.4	2.2	3.2	4.1
3.2	2.2	1.4	1.0	1.0	1.4	1.0	0.0	1.0	2.0	2.8	3.6	4.5
3.6	2.8	2.0	1.0	0.0	1.0	1.4	1.0	1.4	2.2	3.2	4.1	5.0
4.1	3.2	2.2	1.4	1.0	1.4	2.2	2.0	2.2	2.8	3.6	4.5	5.4

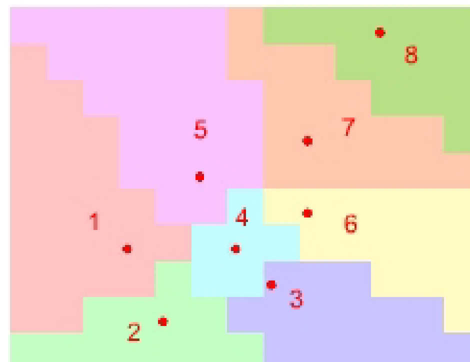
Then raster grid cells are allocated to the properties of point features based on the nearest proximity from the point feature.

Concept : Point features: Allocation of grid cells based on the nearest proximity

Closest Distance from points at 0.5 m grid

6.4	5.7	5.0	4.5	4.1	4.0	3.6	3.0	2.0	1.0	0.0	1.0	2.0
5.8	5.0	4.2	3.6	3.2	3.0	2.8	2.2	2.0	1.4	1.0	1.4	2.2
5.0	4.5	3.6	2.8	2.2	2.0	2.2	1.4	1.0	1.4	2.0	2.2	2.8
4.2	3.6	3.2	2.2	1.4	1.0	1.4	1.0	0.0	1.0	2.0	3.0	3.6
3.6	2.8	2.2	2.0	1.0	0.0	1.0	1.4	1.0	1.4	2.2	3.2	4.1
3.2	2.2	1.4	1.0	1.4	1.0	1.0	1.0	0.0	1.0	2.0	3.0	4.0
3.0	2.0	1.0	0.0	1.0	1.0	0.0	1.0	1.0	1.4	2.2	3.2	4.1
3.2	2.2	1.4	1.0	1.0	1.4	1.0	0.0	1.0	2.0	2.8	3.6	4.5
3.6	2.8	2.0	1.0	0.0	1.0	1.4	1.0	1.4	2.2	3.2	4.1	5.0
4.1	3.2	2.2	1.4	1.0	1.4	2.2	2.0	2.2	2.8	3.6	4.5	5.4

Grid cells are allocated to the nearest proximity to the point



ACT

Calculate the distance in object mode.

1. Calculate the distance among points features using the available GIS software from your GIS Lab based on the point distribution map illustrated.
2. Calculate the linear distance between Migros and individual houses using the available GIS software from your GIS Lab. (See the result on the web.)

Generate the Thiessen Polygons.

1. Generate the Thiessen Polygons using the available GIS software from your GIS Lab based on the point distribution map illustrated. The output area values should be similar to the values mentioned in the example illustration.

Calculate the closest distance in image mode

1. Calculate the closest distance using the available GIS software from your GIS Lab based on the point distribution map illustrated. You may choose the resolution of grid cell as your preference.
2. Then allocate the grid cells to the property of point feature based on proximity using the available GIS software from your GIS Lab.

Clarification

Introduction to spatial patterns and neighbourhood of point features

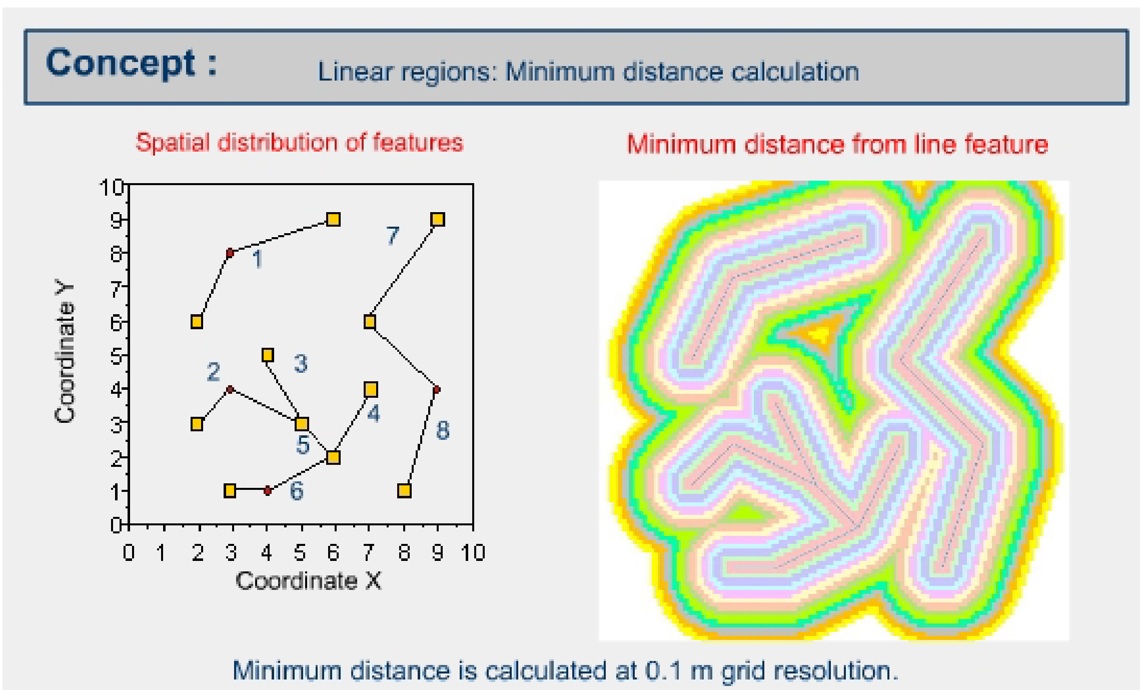
Here we will learn spatial pattern and neighbourhood of line features especially how to measure the distance among line features, how to create a buffer polygon or polygons from a line feature and how to create proximal polygon from the line features.

Refer to the download version of graphic presentation PDF file.

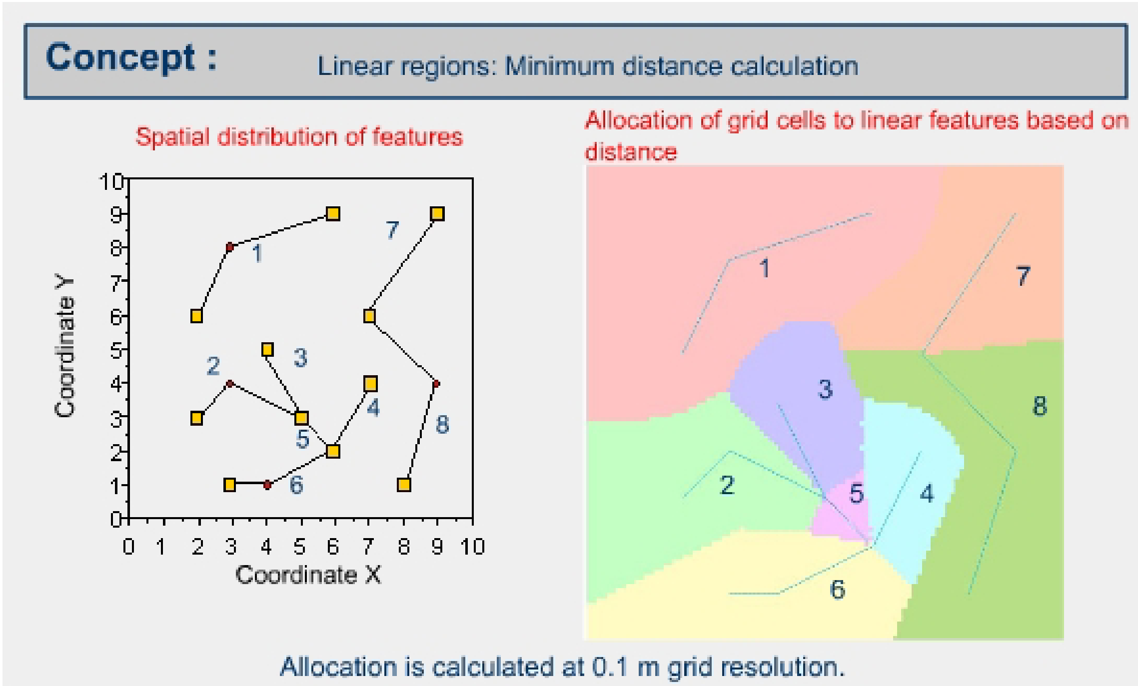
LOOK

Look the example of minimum distance calculation from line feature

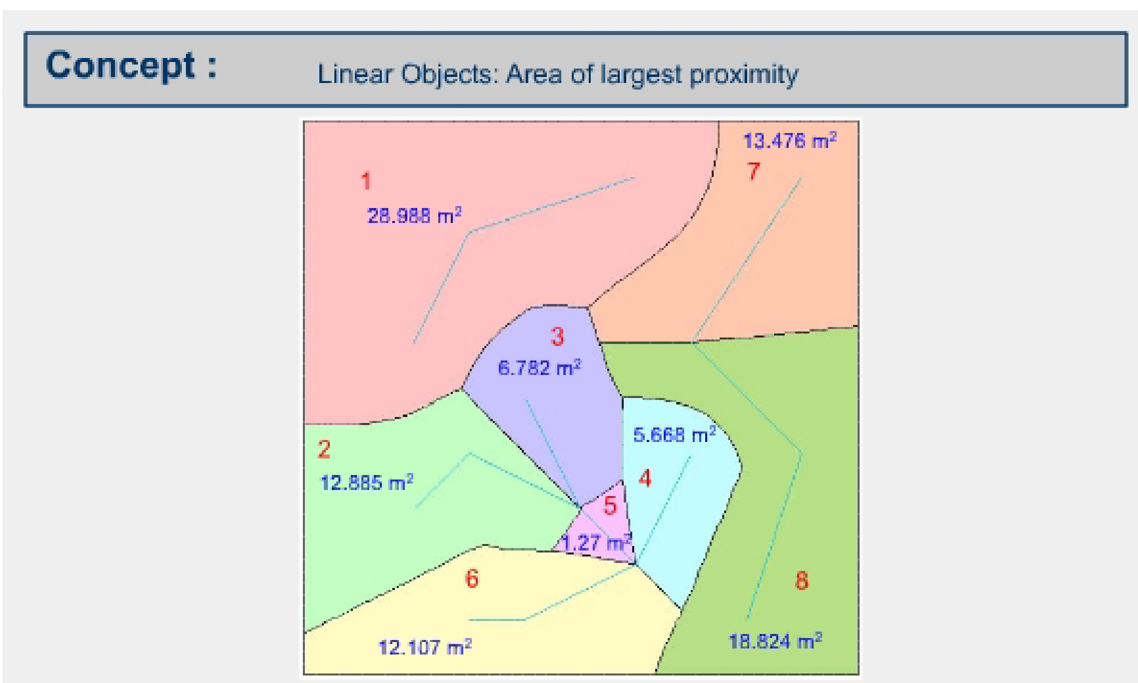
Closest distances are calculated using Euclidian distance formula similar way in calculating distances in point features illustrated above.



Then the grid cells are allocated based on proximity distance.



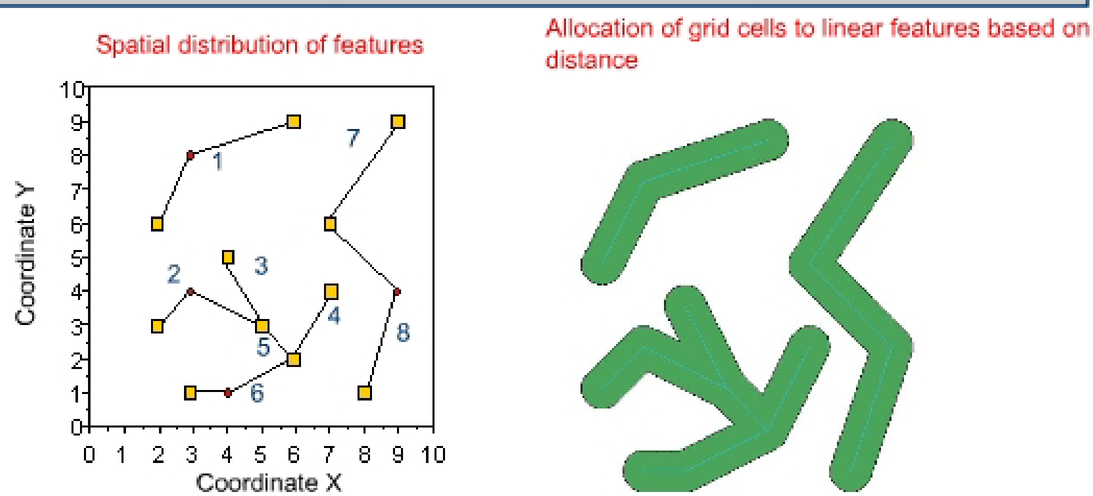
The following figure illustrated the result in vector or object mode.



Look the example of buffering line features

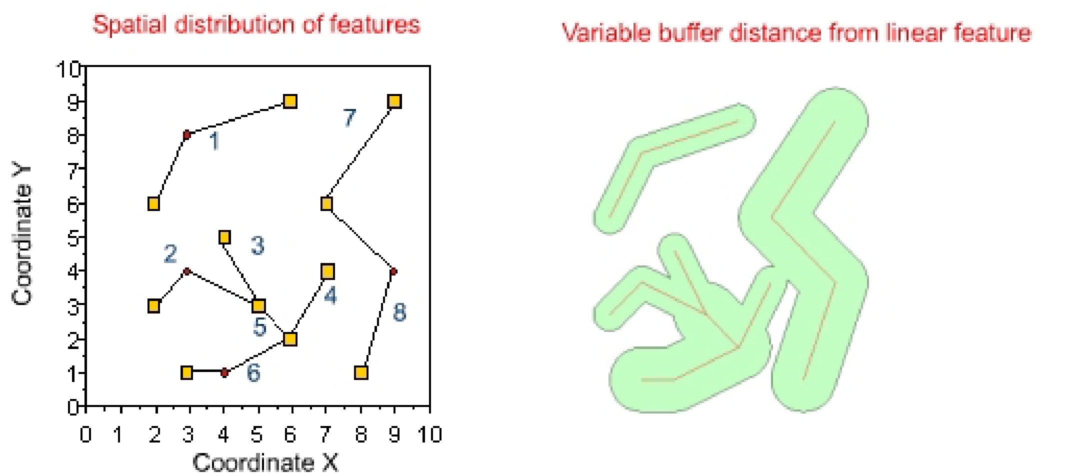
Buffer polygon or polygons can be created by using a constant buffer distance or variable buffer distance around specified input line feature.

Concept : Linear regions: Constant buffer from line feature



The 0.5 m buffer is created from the linear feature.

Concept : Linear regions: Variable buffer from line feature



The 0.5 m buffer from 1, 2, 3, 4 and 1 m buffer from 5, 6, 7, 8.

ACT

Calculate the minimum distance of line features

1. Calculate the closest distance using the available GIS software from your GIS Lab based on the line distribution map illustrated. You may choose the resolution of grid cell as your preference.

2. Then allocate the grid cells to the property of point feature based on proximity using the available GIS software from your GIS Lab.

Create Buffers from linear features

1. Create the 0.5meter constant buffer using the available GIS software from your GIS Lab based on the linear feature map illustrated.
2. Create the 1 m buffer around the linear feature 1, 2, 3, and 4 and 0.5 m buffer around the linear features 5, 6, 7, and 8 at the same time using the available GIS software from your GIS Lab based on the linear feature map illustrated.

Clarification

Spatial pattern and neighbourhood of areal features

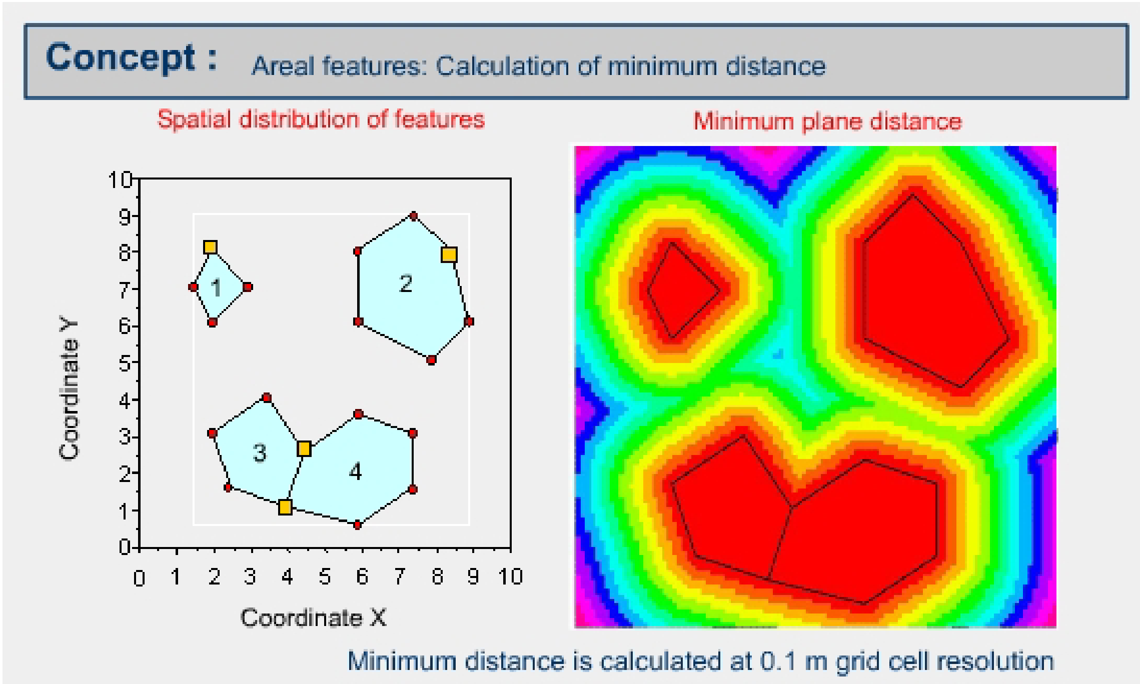
Here we will learn spatial pattern and neighbourhood of aeral features especially how to measure the distance among aeral features, how to create a buffer polygon or polygons from aeral feature and how to create proximal polygon from the aeral features.

Refer to the download version of graphic presentation PDF file.

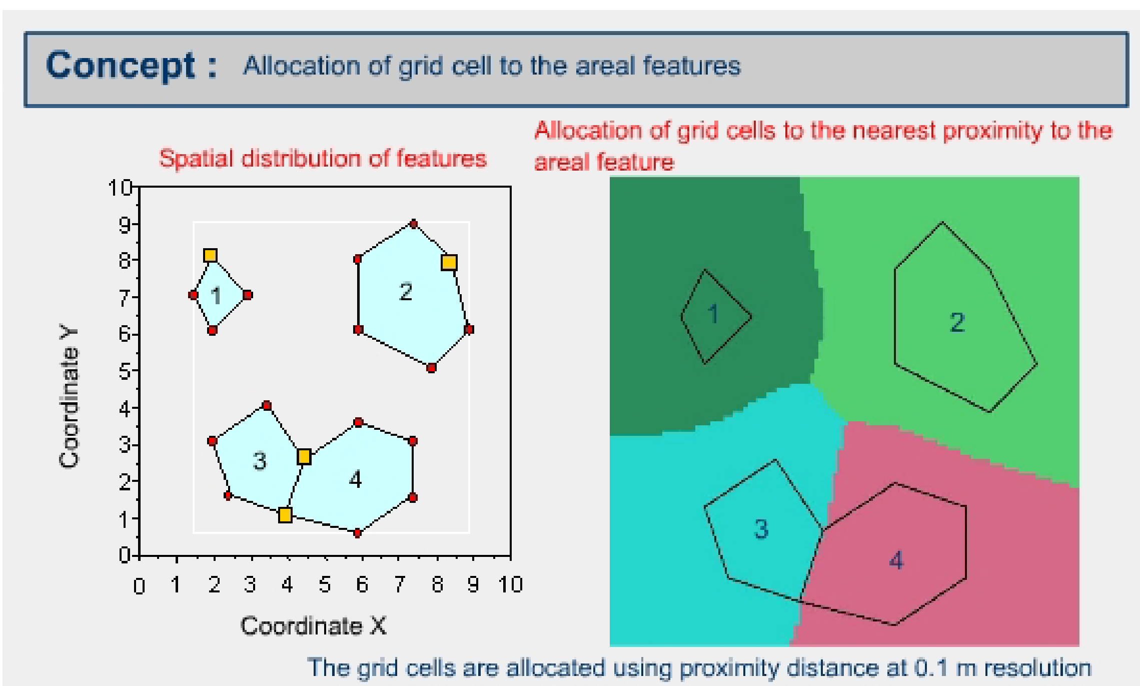
LOOK

Look the example of minimum distance calculation from the areal features

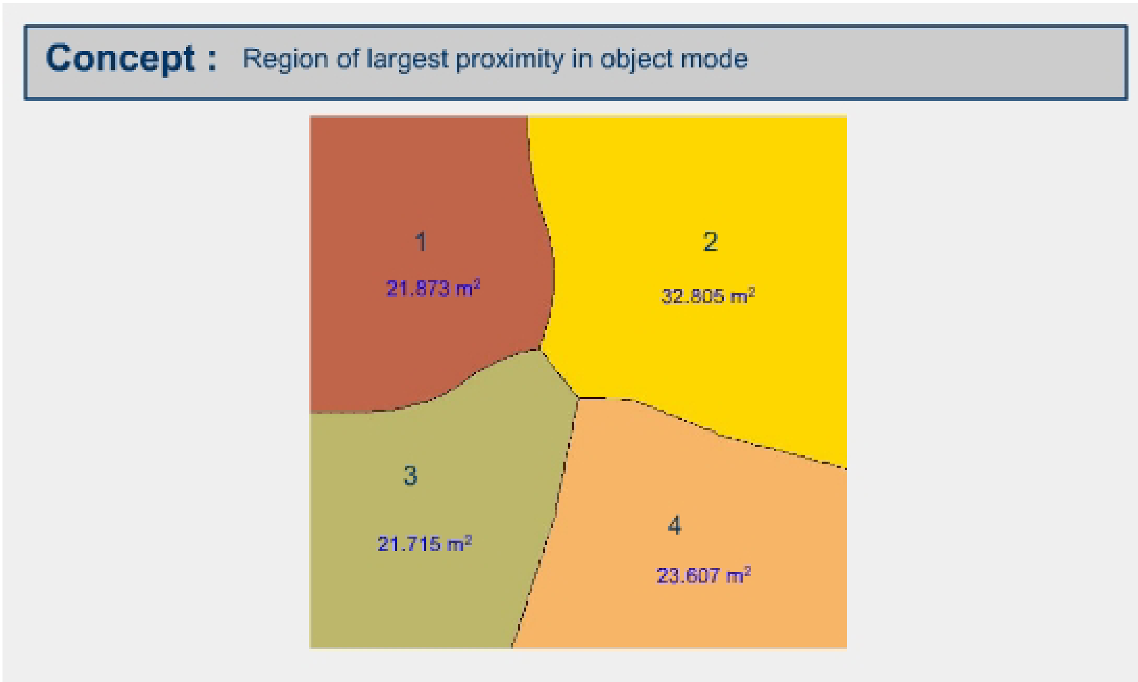
The distance value of each cell is not illustrated for the clarity of presentation. The Euclidean distance is applied in a similar way to the distance calculation for point and linear features.



Then the grid cells are allocated to the properties of areal features based on the nearest proximity distance between the cell and areal feature. The result should be similar to the following.

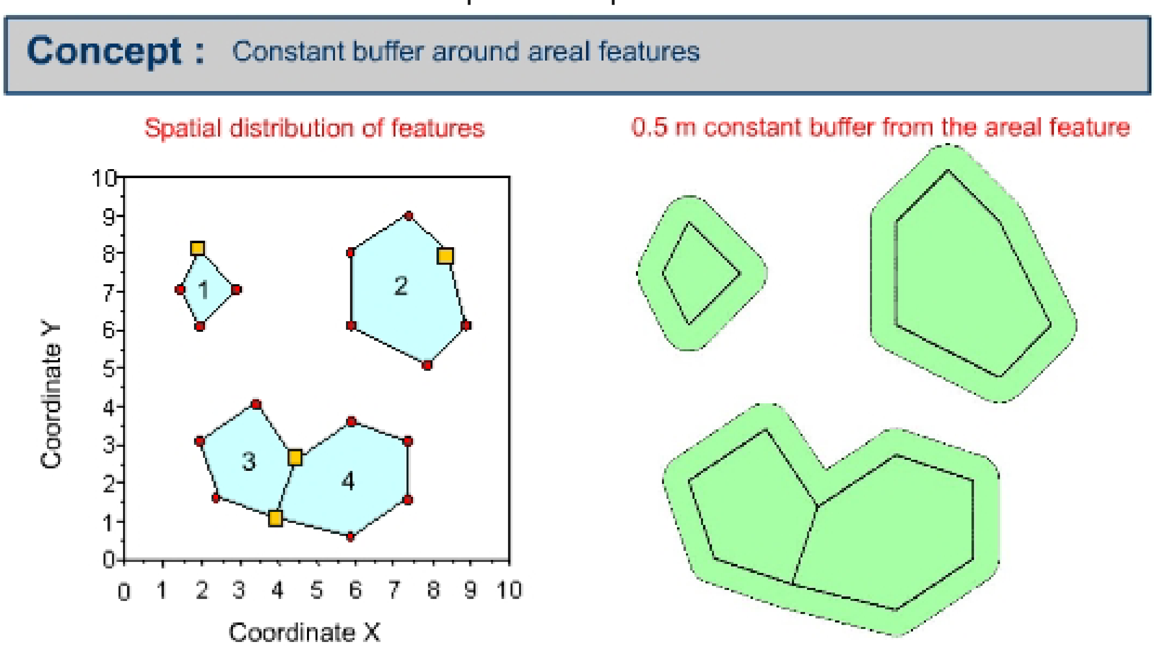


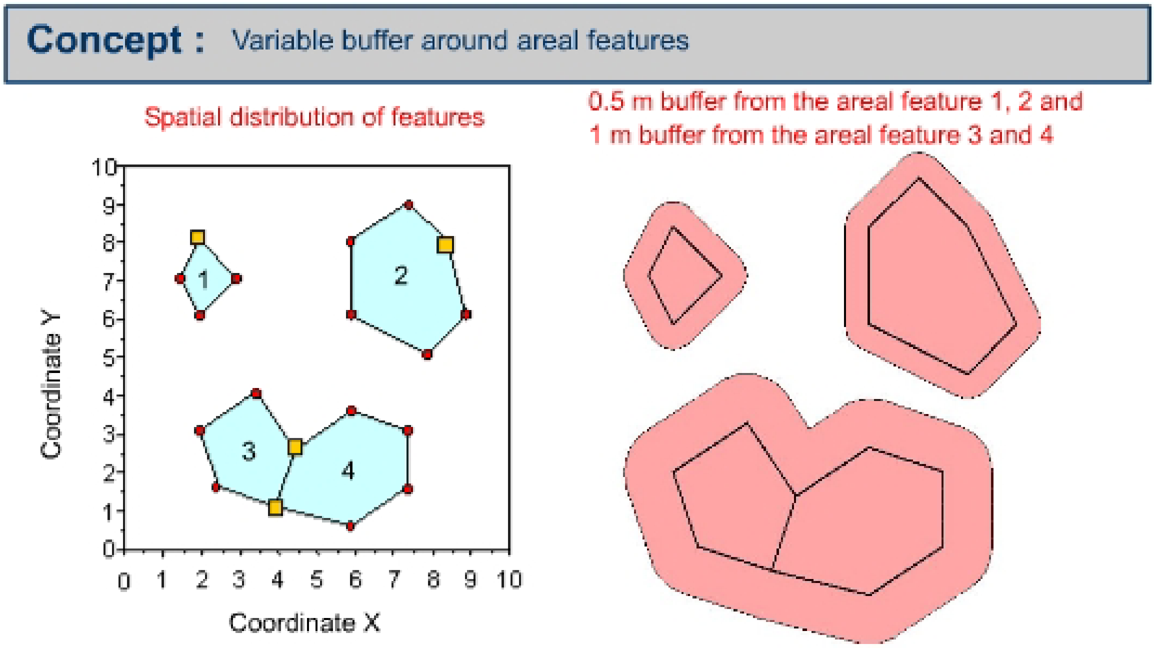
The following figure illustrated the result in vector or object mode.



Look the example of buffering areal features

Buffer polygon or polygons can be created by using a constant buffer distance or variable buffer distance around specified input areal feature.





ACT

Calculate the minimum distance of areal feature (image mode)

1. Calculate the closest distance using the available GIS software from your GIS Lab based on the areal feature distribution map illustrated. You may choose the resolution of grid cell as your preference.
2. Then allocate the grid cells to the property of areal feature based on proximity using the available GIS software from your GIS Lab.

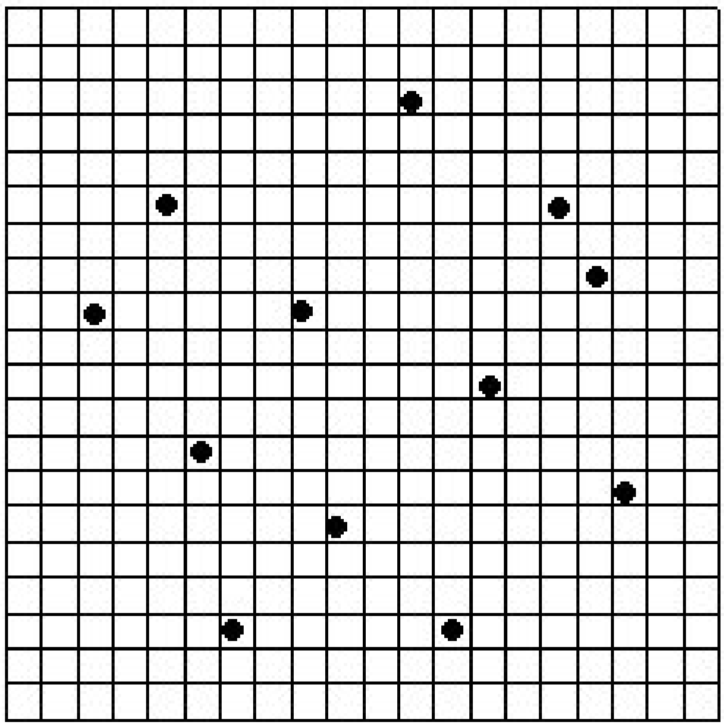
Create buffers around the areal features

1. Create the 0.5meter constant buffer using the available GIS software from your GIS Lab based on the areal feature map illustrated.
2. Create the 1 m buffer around the linear feature 1 & 4 and 0.5 m buffer around the linear features 2 & 3 at the same time using the available GIS software from your GIS Lab based on the areal feature map illustrated.

Self-Assessment

1. Explain the method of Euclidian distance calculation in object mode and image mode. Calculate the distance between Migros and House No.1 manually based on the example presented in this unit.

2. Create Thiessen polygons based on the following graphics. Find out the errors on the example result with respect to your result.



See the Delaunay triangulation and creation of Thiessen polygons on the web.

Share

Submit and share your answer and results of 1uestion 1 and 2 among the class and to the instructor through email.