RANGE : Jurnal Pendidikan Matematika
Dikelolah Oleh Program Studi Pendidikan Matematika Universitas Timor
ISSN Online : 2685-2373
Volume 5, Nomor 2, Januari 2024, pp. 85-94

Application of Nearest Neighbor Analysis Methods for The Distribution of Small Storks (Egretta Garzetta) In The Mangrove AreaNorth Sumatra

Trima Lestari[1]*, Fibri Rakhmawati[2], Ismail Husein[3]
Universitas Islam Negeri Sumatera Utara Medan[1,2,3)]
Email: trimalestari0822@gmail.com

Received: December 23rd, 2024. Accepted: January 19th, 2024. Published: January 30th, 2024.

ABSTRACT

The penetrating waterbird on the east coast of North Sumatra is *Egretta Garzetta*. It is a kind of water bird that lives in water or parts of wetlands. The presence of waterbirds is an important indicator to evaluate the environmental quality and productivity of wetlands. Bird distribution patterns are needed to overcome problems related to habitat, such as food availability and population size. This study aims to apply themethod *Nearest Neigbord Analysis* to the distribution pattern of *Egretta Garzetta* in the Mangrove area of North Sumatra. This study uses a quantitative approach to the type of applied research (*Applied Research*). The type of data used in this research is secondary data. Analysis of the data in this study using *Nearest Neighbor Analysis.* The pattern ofthe spread of *Egretta Garzetta* in the Mangrove areas in North Sumatra have clumped pattern *(clustered).*The results from *Nearest Neighbor Analysis* show that the index value $T = 0{,}06$ of the clustered distribution pattern can be caused by the abundance of food sources in a habitat.

Keywords:*nearest neighbor analysis*, distribution pattern, *egretta garzetta*, mangrove

ABSTRAK

Burung air penembus di pantai Sumatera Utara adalah *Egretta Garzetta*. Ini adalah sejenis burung air yang hidup di air atau bagian dari lahan basah. Keberadaan burung air merupakan indikator penting untuk mengevaluasi kualitas lingkungan dan produktivitas lahan basah. Pola sebaran burung diperlukan untuk mengatasi permasalahan yang terkait dengan habitat, seperti ketersediaan pangan dan jumlah populasi. Penelitian ini bertujuan untuk menerapkan metode *Nearest Neigbord Analysis* terhadap pola penyebaran *Egretta Garzetta* di kawasan Mangrove Sumatera Utara. Penelitian ini menggunakan pendekatan kuantitatif dengan jenis penelitian terapan (*applied research*). Jenisdata yang dipakai dalam penelitian ini adalah data sekunder. Analisis data dalam penelitian ini menggunakan *Nearest Neighbor Analysis. Pola* penyebaran *Egretta Garzetta* di kawasan Mangrove Sumatera Utara memiliki pola mengelompok (*clustered*). Dengan Hasil dari *Nearest Neighbor Analysis* menunjukkan nilai indeks T = 0,06 pola penyebaran mengelompok dapat disebabkan oleh melimpahnya sumber pakan pada suatu habitat.

Kata kunci:*nearest neighbor analysis*, pola penyebaran,*egretta garzetta*, mangrove.

How to Cite: Lestari, T., Rakhmawati, F.& Husein, I. (2024). *Application of Nearest Neighbor Analysis Methods for The Distribution of Small Storks (Egretta Garzetta) In The Mangrove Area North Sumatra*, 5 (2), 97-106.

Introduction

Birds make up the group of animals in aves class, and the feathers are different characteristics of these animals from others. The animal is easy to find because it has a patch of land in any habitat. Birds play a significant role in the ecosystem. Birds are among the animals that live in Indonesia and possess a large variety of types. This species has unique value and beauty in regard to sweet color and voice(Anggriana et al., 2018).

The availability of food in the habitat greatly influences the number of birds, especially the Mangrove ecosystem which supports various water birds. In terms of providing habitat that supports the life of water birds, Indonesia is known as one of the important countries. The total length of Indonesia's coast is 95,181 kilometers, which is the second longest coastline in the world with a sea area of 5.8 million square kilometers or 71% of Indonesia's total territory. Some of these mangroves are submerged by Mangroves and many soils, which likely support large numbers of water birds.

The mangrove region on the east coast of northern Sumatra stretches 314 miles [314 km] from langkat to labuhanbatu. In the last 13 years, a lot of things have been badly damaged. At least, 12,565 hectares mangrove has been reduced to another collapse area (apl). To make matters worse, the losses in 2019 hit 9,461 hectares. The major factor behind the damage to the mangrove is 40% of the coconut plantationThe sawite, 35% of the farm, 25% of agriculture and other 5%, either because of fatigue from placer reclamation or other factors.

The penetrating water bird on the East coast of North Sumatra is the Egretta Garzetta. This is a type of water bird that lives in water or parts of wetlands. Egretta Garzetta uses the muddy soil around the Mangrove for food, and some birds use the Mangrove as their habitat during high tide (Putra et al., 2020).

Distribution patterns are used as research objects because they are needed to overcome problems related to habitat, such as food availability and population numbers. These problems are usually inconsistent with the distribution of the little stork, and if food availability in a particular location is not sufficient to achieve the growth of the little stork, it becomes a bird. will move somewhere. This causes an imbalance between food supply and population, leading to specific and different distribution methods.

Egretta garzetta is a bird of prey so it is an integral part of balancing areas in the Mangrove ecosystem. The loss of one of these components will disrupt the stability of the entire Mangrove ecosystem. Disturbances to waterbirds and their functions have made waterbirds the subject of extensive research and research throughout the world.(Ahadi & Ali S, 2018)

Based on the conditions above, to save the population of the little stork, basic information and data about its distribution pattern is needed so that it can be used as a basis for protecting the Egretta Garzetta bird species. Therefore, this research uses the Nearest Neighbor Analysis method, which is used to analyze distribution patterns.

Distribution patterns that are carried out uniformly, clustered, randomly and so on can be given a quantitative dimension. Through this method, comparisons between distribution patterns can be made

well, not only in terms of time but also in terms of space. This approach is called Nearest Neighbor Analysis.

Nearest Neighbor Analysis is an analysis used to interpret the distribution pattern of location points by using calculations that take into account the distance, number and area of points. Nearest analysis can measure the linear distance between two or more specified neighboring locations. Nearest analysis can be applied to behavior that has discrete spatial locations that can be mapped to points (Yusrina et al., 2018).

Recently, various application technologies have also developed that can help solve distribution problems using a spatial approach. One of the technologies that can be used is a geographic information system application that can analyze data resulting from regional distribution. This technology can help obtain information easily and more efficiently. One application that can be used to determine settlement distribution patterns is Nearest Neighbor Analysis.

Therefore, this research uses the Nearest Neighbor Analysis method, which is used to analyze distribution patterns. This research was attempted because there was still a lack of data regarding the distribution pattern of Egretta Garzetta in the Mangrove area of North Sumatra.

Research Method

Nearest Naighbor Analysis

Completion neighbor analysis is one of the analyse used to interpret patterned drop-point layouts by making good use of calculations that account for distance, amount and extent of positives. The end result of this analysis is index calculating (t). Nearest neighbor analysis will produce a number (represented as t), which is used to measure the degree of grouping, random or regular of a particular spread on the map or land(Sumiyati & Si, 2014).

Patterns of falling

The spread pattern describes one characteristic of each species in the habitat. How it depends on the environmental factor or biological characteristics of the organism itself. Sebara is linked to biological and ecological factors that affect individual research.(Ronny et al., 2017)

Egretta garzetta

Egretta garzetta or in English called little egret is a bird of the ardeidae tribe. Bird classifications are divided into three categories of superodo, ratitae, carinatae, tinamae. The ratitae class is large, flightless birds. The carinatae are a type of flying bird. The tinamae are birds that are not good at flying. The basis for bird classification is based partly on the similarities and comparisons of bird types, the characteristics of morphology, its meal and habitat, and its flight ability (nugraha, 2020)

Research approach

There are two things to describe: research methods and research types. Because there is some kind of research in quantitative research that is experimental research and non-experimental research. Research on experimentation is a study conducted to determine the consequences of something that researchers have done intentionally. Whereas non-experiment research is one that observations on a number of subject subjects (variables) according to their natural circumstances, without the manipulation of researchers.(Umam et al., 2012)

Population and samples

The population could be defined as the total or non-person or not person of the same characteristics and would be sufficient to measure up to certain requirements of research and could be used as a source of sampling. The sample could be interpreted as a fraction of the population that represents that population and is used as a source for research data collection(Elfidasari, 2011).

Research instruments

A research instrument is a research tool used to plug research data. In quantitative research, it is generally a tool for research collectors that researchers are using was developed based on theoretical variable descriptions of the research that was brought up and intended to be tested through research activities carried out. When it comes to quantitative research tools, researchers can use three possible research tools: (1) researchers use a standard instrument, one that has been tested and meets the requirements for the validity and reliability tests raised and used by institutions or other researchers; (2) researchers modified existing instruments; (3) researchers improved their own instruments and intended to use them to collect data for research.(Yudhi et al., 2019)

Results of research.

Analysis of Eggretta Garzetta Diffusion Area Limits

The country of north Sumatra, with its capital, is located between 10° -40 ° lu, 980° - 1000° bt. The region consists of beaches and lowlands to the east and west of the province, and the high plateaus of the karo, toba and humbang. Their mountains include sibayak, smoke, weighing, and other factors. Then the rivers are the wampu, attack rods, the deli, asahan, and so on. According to its geographical location, the north Sumatra province is located in the western part of Indonesia. The boundaries of the North Sumatra region are as follows:

Northern border: Aceh Province (NAD)

Eastern boundary: Strait of Malacca

Southern border: Riau Province and Sumatra Province

West Western boundary: Indian Ocean

The area of North Sumatra reaches 18,298,123 ha (182,981.23 km2) consisting of a land area of 7,298.123 km2 and a sea area of 11,000,000 km2. The land area of North Sumatra is around 3.82% of the area of Indonesia with a total of 206 islands. Based on location and natural conditions, North Sumatra is divided into 3 regional groups, namely the West Coast, Highlands and East Coast. The eastern region is relatively flat, the central part is undulating and hilly while the western part is a undulating plain

Analysis Of Eggretta Garzetta's Diffusion Location

The north sumatran coast is 1300 km long and the east coast is 545 km long. The East Coast Coastal Region of North Sumatra has 11 Regencies/Cities which are included in the East Coast region of North Sumatra, namely is Langkat Regency, Binjai City, Serdang Bedagai Regency, Deli Serdang Regency, Asahan Regency, Labuhanbatu Regency, South Labuhanbatu Regency, North Labuhanbatu Regency, Batubara Regency, Medan City, Tanjung Balai City.

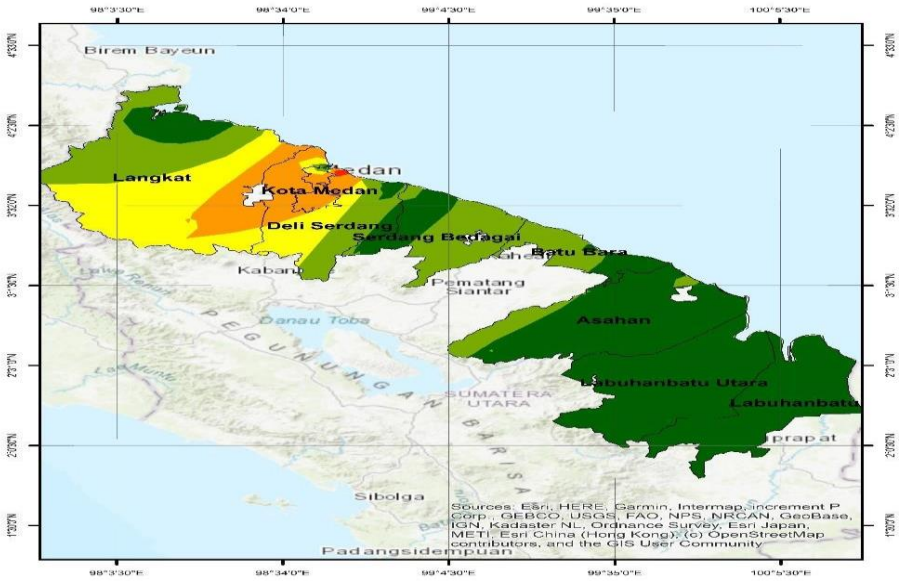

Figure 1. *8 Regencies/Cities of North Sumatra*

Based on the above images it can be seen that the selected research location covers only eight counties/cities: kabupeten langkat, the terrain city, the district district district, the district district district, the district of the district district of bedagai, district of the coal bedagai, district of coal, district of asahan, district of north labuhanbatu, district of labuhanbatu.

Analysis Based on The Dot Which Is His Closest Neighbor

The data to be analyzed in this study are coordinates and Numbers of small stork (eggretta garzetta) in the northern Sumatra province. As for the data it's being treated are as follows.

1. Langkat Regency

Table 1.*Distribution Location Points*

Location	Coordinat	Points	Amount
Kerang Bay Beach	4°6'22.90"N 98°17'52.84"E	1	7
	4°6'23.29"N 98°17'52.95"E	2	3
Lubuk Kertang Mangrove Ecosystem	4°3'35.57"N 98°16'22.37"E	1	1
	4°3'35.57"N 98°16'22.37"E	2	1
Braweh Beach	4°12'37.23"N 98°14'57.48"E	1	15
	4°12'36.64"N 98°14'57.24"E	2	7
Jingo Beach	4°6'36.91"N 98°17'19.08"E	1	1
Amount			**35**

2. Deli Serdang Regency

Table 2.*Distribution Location Points*

Location	Coordinat	Points	Amount
Tanjung Rejo waterss	3°44'57.30"N 98°45'54.09"E	1	55
	3°44'57.30"N 98°45'54.09"E	2	156
	3°44'57.30"N 98°45'54.09"E	3	78
	3°44'3.08"N 98°46'35.44"E	4	4
	3°44'57.30"N 98°45'54.09"E	5	16
	3°44'3.08"N 98°46'35.44"E	6	15
Bagan Percut Waters	3°43'35.50"N 98°47'32.38"E	1	84
	3°43'35.50"N 98°47'32.38"E	2	21
	3°43'35.50"N 98°47'32.38"E	3	15
	3°43'35.50"N 98°47'32.38"E	4	50
Dewi Indah Beach	3°40'48.31"N 98°54'20.05"E	1	19
	3°40'32.33"N 98°52'40.44"E	2	7
	3°40'48.31"N 98°54'20.05"E	3	4
	3°40'48.31"N 98°54'20.05"E	4	2
	3°40'48.31"N 98°54'20.05"E	5	8
Putra Serdang Beach	3°40'47.88"N 98°54'43.48"E	1	5
Muara Indah Beach	3°40'36.40"N 98°56'16.66"E	1	25
	3°40'36.40"N 98°56'16.66"E	2	0
	3°40'14.66"N 98°56'39.36"E	3	10
	3°40'14.66"N 98°56'39.36"E	4	1

Sei Tuan Waters	3°42'26.87"N 98°49'40.64"E	1	55
	3°42'13.74"N 98°49'39.10"E	2	14
	3°42'26.87"N 98°49'40.64"E	3	7
	3°42'13.74"N 98°49'39.10"E	4	14
	3°42'16.49"N 98°50'22.55"E	5	11
Muara serdang Beach	3°42'8.57"N 98°50'51.51"E	1	7
Amount			**683**

3. Dispersal analysis based on the number of birds and deployment points

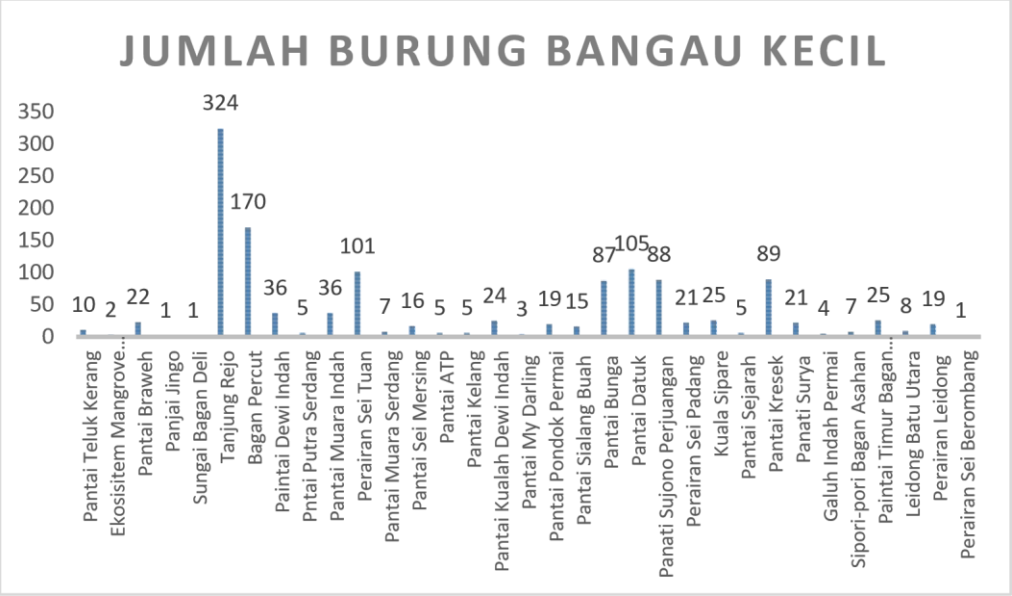

Figure 2.*Diagram of the number of little herons*

4. Diffusion pattern analysis using completion of our analysis

In analysis of the completion analysis analysis by calculating the value of ju, p, jh, and t.

From data it can be known that the amount of distance from the nearest neighbor in km 78.48 and the extent of north Sumatra 72,981 km (72,981 sq mi)

$$Ju = \frac{\sum j}{\sum n} = \frac{78{,}48}{82} = 0{,}95 \quad (1)$$

$$P = \frac{\sum n}{L} = \frac{82}{72.981} = 0{,}0011235801098 \quad (2)$$

$$Jh = \frac{1}{2\sqrt{p}} = \frac{1}{2\sqrt{0{,}0011235801098}} = 14{,}91 \quad (3)$$

$$T = \frac{Ju}{Jh} = \frac{0{,}95}{14{,}91} = 0{,}06 \quad (4)$$

Information:
Ju : The average distance measured between a point and its nearest neighbors
$\sum j$: The total distance to the nearest neighbor
$\sum n$: Number of research location points
P: Point density per square kilometer
L : The size of the area studied
Jh : The number obtained from the area divided by the number of points
T : Nearest neighbor dispersion index

The calculations refer to the theory of starartо and surastopo hadisumarno (1978) when the snap pattern is grouped (clustred) if the distance between one location and another is close together and tends to group at specific places, with an index 0 value (zero), the snap pattern is grouped, if the value t = 0 or value t is close to zero.

Kabupaten Langkat

$$Ju = \frac{\Sigma j}{\Sigma n} = \frac{6{,}99}{7} = 0{,}99 \quad (5)$$

$$P = \frac{\Sigma n}{L} = \frac{7}{6.263} = 0{,}0011176752355 \quad (6)$$

$$Jh = \frac{1}{2\sqrt{P}} = \frac{1}{2\sqrt{0{,}0011176752355}} = 14{,}955887517247 \quad (7)$$

$$T = \frac{Ju}{Jh} = \frac{0{,}99}{14{,}95} = 0{,}06 \quad (8)$$

From the value of t being regulated with continum continum lure analysis analysis is shown that a disproportionate pattern of eggretta garzetta in langkat district tends to group over classments, it is indicated by an increased value of t by 0.06.

Deli Serdang Regency

$$Ju = \frac{\Sigma j}{\Sigma n} = \frac{21{,}1}{26} = 0{,}81 \quad (9)$$

$$P = \frac{\Sigma n}{L} = \frac{26}{2.498} = 0{,}0104083266613 \quad (10)$$

$$Jh = \frac{1}{2\sqrt{P}} = \frac{1}{2\sqrt{0{,}0104083266613}} = 4{,}9009418247139 \quad (11)$$

$$T = \frac{Ju}{Jh} = \frac{0{,}81}{4{,}90} = 0{,}16 \quad (12)$$

From the value of *t* being regulated with continum continum lure analyys the analysis is shown that eggretta garzetta's regulatory pattern in the serdang district district is likely to be clustered as clashed, it is indicated by an increase int value of 0.16.

Table 3*Distribution Pattern for Each Regency*

No	Regency	N	P	Ju	Jh	T	Pattern
1	Langkat	7	0,00	0,99	14,95	0,06	Grouping
2	Medan	1	0,00	7,99	8,09	0,98	Acak
3	Deli Serdang	26	0,10	0,81	4,90	0,16	Grouping
4	Sergeai Bedagai	10	0,00	2,10	6,89	0,30	Grouping
5	Batu Bara	28	0,03	1,25	2,84	0,44	Grouping
6	Asahan	4	0,00	4,72	15,27	0,30	Grouping
7	Labuhanbatu Utara	5	0,00	12,24	13,31	0,16	Grouping
8	Labuhanbatu	1	0,00	19,3	48,01	0,40	Grouping

Conclusion

Based on research that has begun with analysis of area limits, research will then analyze nearby neighbor distribution points and calculate the number of northern bird whole tibes. it could be concluded that eggreta garzetta's overall pattern is clustered (clustered) because of the value-completed analysis analysis (0.06) value The habitat. Implementation of advanced analysis methods can be used not only to look for fold patterns of animals, but it can also be used in search of other occurrence pattern indexing such as settlements, industrial areas, endemic disease cohesion, worship sites, educational facilities.

References

Ahadi, R., & Ali S, M. (2018). Pola Penyebaran Burung Kuntul Kecil (Egretta garzetta L.) di Kawasan Mangrove Alue Naga Banda Aceh. *Prosiding Seminar Nasional Biotik*, 8–11.

Anggriana, P., Dewi, B. S., & Winarno, G. D. (2018). Populasi dan Pola Sebaran Burung Kuntul Besar (Egretta alba) di Lampung Mangrove Center. *Jurnal Sylva Lestari*, *6*(3), 73. https://doi.org/10.23960/jsl3673-80

Elfidasari, D. (2011). Variasi Pola Mencari Makan Tiga Jenis Kuntul di Sekitar Cagar Alam Pulau Dua Serang, Propinsi Banten. *JURNAL Al-AZHAR INDONESIA SERI SAINS DAN TEKNOLOGI*, *1*(2), 54. https://doi.org/10.36722/sst.v1i2.27

Falahi Mubarok. (2020). *Mengenal Burung Kuntul Kecil, Si Penghuni LahanBasah*.Mongabay.Co.Id.https://www.mongabay.co.id/2020/06/28/mengenalburung-kuntul-kecil-si-penghuni-lahan-basah/

Kamal, S. (2017). Keanekaragaman Jenis Burung Di kawasan Pesisir Deudap Pulo Aceh Kabupaten Aceh Besar. *Prosiding Seminar Nasional Biotik*, 252– 259.

Margareth, T. (2020). Sistem Informsdi Geogrsfid Pengertian Dan Aplikasinya. *Sistem Informasi Geografis Pengertian Dan Aplikasinya*.

Martuti, N. K. T., Setyowati, D. L., Nugraha, S. B., & Universitas Negeri Semarang. Lembaga Penelitian dan Pengabdian Kepada Masyarakat. (2018). *Ekosistem Mangrove (Keanekaragaman, Fitoremidiasi, Stok Karbon, Peran dan Pengelolaan)*.

Mukhlis, M., & Harudu, L. (2019). Pola Persebaran Dan Keterjangkauan Lokasi Sekolah Terhadap Pemukiman Dengan Menggunakan Sistem Informasi Geografi Kecamatan Batauga Kabupaten Buton Selatan. *Jurnal Penelitian Pendidikan Geografi*, *4*(4), 226

Pitopang, R., & Ihsan, M. (2017). *Pola Penyebaran Burung di Kawasan Taman Wisata Alam Wera , Sigi , Sulawesi Tengah , Indonesia Bird Distribution Pattern in Wera Natural Park , Sigi , Central Sulawesi , Indonesia*. *6*(3), 301–312.

Putra, C. A., Arico, Z., Triwibowo, K., & Azmi, N. (2020). Studi biodiversitas burung air dan hutan mangrove sebagai potensi ekowisata di bagan percut, Kabupaten Deli serdang, Propinsi Sumatra Utara. *Jurnal resolusi konflik, dan pemberdayaan*, *5*(1), 30–42.

Ronny, A., Gunawan, H., Yoza, D., Biologi, J., Matematika, F., Alam, P., Riau, U., Kehutanan, J., Pertanian, F., & Riau, U. (2017). *Penentuan Tingkat Kepadatan dan Sebaran Populasi Bangau Bluwok (Mycteria cinerea) Menggunakan Drone di Pulau Basu , Indragiri Hilir*. *2*(September), 81–89.

Sumiyati, D. S., & Si, M. (2014). *LAPORAN PENELITIAN LANJUT FUNDAMENTAL Prototipe Sebaran Lokasi Ujian dengan Metode (Nearest-neighbour Analysis) di UPBJJ-UT Bogor dan Bandung*. 0–27.

Supuwingsi, N. N. (2020). *Implementasi Sistem Informasi Geografi Pada Penyebaran Perguruan Tinggi*. Media Sains Indonesia

Umam, K., Hayati, R., & Indrayati, A. (2012). Pola Distribusi Spasial Dan Daya Layan Fasilitas Perbankan Di Kabupaten Kudus. *Geo Image*, *1*(10), 50–56.

Yudhi, Wulandari, D. A., & Kusnandar, D. (2019). Bagging Classification Trees Untuk Klasifikasi Tingkat Kesejahteraan Rumah Tangga Di Kalimantan Barat. *Bimaster : Buletin Ilmiah Matematika, Statistika dan Terapannya*, *8*(4), 765–772. https://doi.org/10.26418/bbimst.v8i4.36035

Yusrina, F. N., Sari, M. I., Chomsa, G., Hudaya, A., Hidayat, D. W., Jordan, E., & Febriyanti, D. (2018). Analisis Pola Permukiman Menggunakan Pendekatan Nearest Neighbour Untuk Kajian Manfaat Objek Wisata Di Kecamatan Prambanan Kabupaten Klaten. *Jurnal Geografi, Edukasi dan Lingkungan*, *2*(1), 46–55.