# Segmentation of Pax Ecclesia Junior High School Students Using Deep Embedded Clustering Algorithm to Optimize Marketing Strategy

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**Abstract**

The competition among schools in attracting prospective students is becoming increasingly intense, necessitating a data-driven marketing strategy. This study applies the Deep Embedded Clustering (DEC) algorithm to group Pax Ecclesia Junior High School students based on specific characteristics, such as residence location and school origin. The evaluation was conducted using the Silhouette Index to assess clustering quality. The results identified three main groups: (1) students living around the school, (2) students residing at medium to long distances, and (3) students from specific elementary schools with close ties to Pax Ecclesia Junior High School. Based on this segmentation, more effective marketing strategies can be implemented, such as direct promotion for students near the school and digital marketing for prospective students from distant areas. The implementation of this data-driven strategy enhances the school's competitiveness and promotional effectiveness. Furthermore, this study demonstrates that the DEC algorithm can serve as a reliable tool for student segmentation.

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*Keywords :* *Data Mining, DEC, Student Segmentation, Silhouette Index.*

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# 1 Introduction

Competition in the world of education is increasingly competitive, encouraging schools to develop more targeted marketing strategies. PAX Ecclesia Junior High School faces similar challenges in attracting the interest of prospective students. One approach that can increase the effectiveness of promotions is segmentation of prospective students based on certain characteristics, such as the location of their parents' residence or work.

This research applies the Deep Embedded Clustering (DEC) method, a deep learning-based algorithm that is able to automatically group data in a latent space. DEC is effective in handling data with high dimensions and complexity, making it suitable for student segmentation.(Chan et al., 2016a)

The results of this research are expected to help PAX Ecclesia Junior High School develop a more optimal marketing strategy and increase the school's competitiveness.(Baru et al., 2023)

a. Research Objectives

1. Applying the *DEC algorithm* to group Pax ecclesia junior high school students based on certain characteristics.

2. Identify patterns or groups of students that can provide strategic insights for school managers.

3. Developing data-driven marketing strategy recommendations to increase the attractiveness of Pax Ecclesia Junior High School.

b. Research Contributions

1. Providing data-driven guidance to develop a more targeted marketing strategy for Pax Ecclesia Junior High School.

2. Providing insight into the importance of student segmentation as a dsara in marketing strategy planning.

3. Providing a real example of how data analysis can support strategic decisions in the education sector.

# 2 Literature Review

Segmentation has an important role in marketing strategies, especially in an era of fierce competition. General marketing approaches are often less effective because each individual or group has different needs. With segmentation, educational institutions can develop more relevant marketing strategies, for example by adjusting promotional messages for urban and rural students.

In addition, segmentation helps optimize marketing resources. By identifying specific target groups, schools can allocate budget and energy to the most potential areas, such as promoting technology-based programs to students interested in science and technology.

In education, segmentation is typically based on demographics (age, gender, and geographic location) and behavior (extracurricular interests and academic preferences). For example, students who live near Pax Ecclesia Junior High tend to be more interested in the school's flagship programs than those from farther away.

By implementing demographic and behavioral segmentation, schools can segment prospective students more effectively, improve the success of marketing strategies, and create added value for students and their parents.

a. Marketing Strategies in Education

Marketing in education aims to attract new students, retain old students, and build a positive image of the institution. (Akbar et al., 2024) defines education marketing as a strategy to create a profitable exchange between the institution and the target market. In the context of Pax Ecclesia Junior High School, a marketing strategy is needed to build the school's image and attract new students in the midst of competition with other institutions (Rousseeuw, 1987).

Data mining is the process of extracting useful information and patterns from large amounts of data, including collecting, extracting, analyzing, and statistically analyzing data to produce useful models or knowledge (Wikipedia, 2016). The term is often associated with *Knowledge Discovery from Data* (KDD), which some people consider to be the entire process, while others see data mining as one of the important steps in KDD (Han et al., 2016).

The data mining process consists of several steps that form an iterative cycle. Starting with *Data Collection* to collect data, followed by *Data Preprocessing* for data cleaning and preparation,

and *Data Transformation* to match the required format. The core stage, *Data Mining*, aims to identify useful patterns. The results are then evaluated at the *Evaluation* stage and interpreted in *Knowledge Representation*. This cycle allows for repeated analysis to gain deeper insights (Sarjanako, 2019).
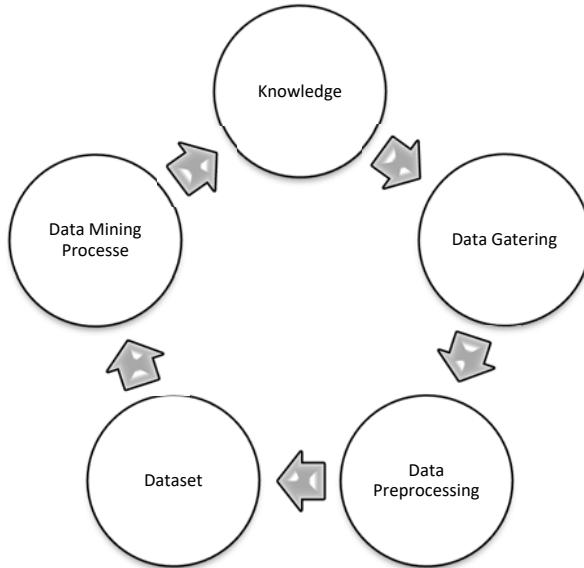


Figure 2. 1 Integrated lifecycle in Data Mining

Although data mining is often considered one step in the process of knowledge discovery, in industry and research, the term often refers to the entire process. Data mining aims to find interesting patterns and knowledge from large amounts of data, which can come from databases, data warehouses, the web, or other sources of information (Han et al., 2011).

b.  Deep Embedded Clustering (DEC)

Deep Embedded Clustering (DEC) is a Deep Learning-based clustering method that integrates dimensional reduction and clustering in a single framework. DEC uses an autoencoder to learn latent representations of lower-dimensional data without losing important information. After the latent representation is obtained, the clustering process is carried out with an objective function based on the Kullback-Leibler (KL) divergence (Wada et al., 2019).

The autoencoder in DEC consists of an encoder that converts the input data into a latent representation and a decoder that reconstructs the original data. Autoencoder pretraining helps understand data structures, improving clustering accuracy (Guo et al., n.d.). After the training, the cluster center is initialized in the latent space, and the optimization process is carried out iteratively until convergence is achieved (Zahrani Putri et al., 2023).

DEC is particularly effective for high-dimensional data with complex and non-linear distributions, such as student data that includes demographic and geographic attributes. By combining dimension reduction and clustering, DEC produces high-quality clusters that are useful for further analysis (Chan et al., 2016b).

## Proses Clustering DEC

Data Asli



→ Pretraining Autoencoder

← Inisialisasi Cluster

← Optimasi Clustering

← Iterasi Hingga Konvergensi

Pusat Cluster Stabil
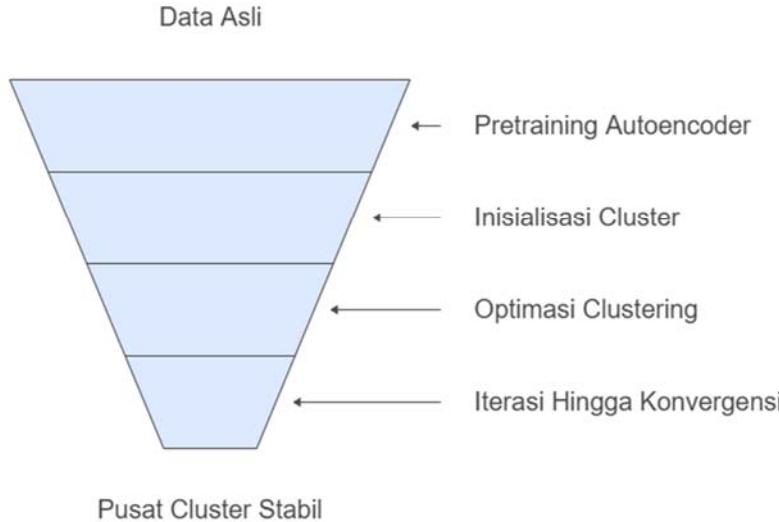
Figure 2. 2 Deep Embedded Clustering Process

Working stages of Deep Embedded Clustering :

1.  Pretraining Autoencoder

    The initial data is processed through an autoencoder to reduce dimensions and maintain relevant features.

2.  Cluster Initialization

    Once the latent representation is formed, the K-Means algorithm is applied to initialize the cluster center.

3.  Clustering Optimization

    The data are grouped based on the objective function based on the Kullback-Leibler (KL) Divergence, which is continuously updated until convergence is achieved.

4.  Evaluation of Clustering Results

    The clustering results are evaluated using metrics such as the Silhouette Index and Elbow Method.

c.  Evaluation of Clustering with Silhouette Index

    Silhouette index is one of the evaluation methods used to measure the quality of results from clustering algorithms. This method helps determine how well objects in a cluster are grouped, as well as how separate the cluster is from other clusters. In other words, the Silhouette Index helps to evaluate how precisely the clustering algorithm divides the data into different groups (Rousseeuw, 1987).

# 3  Research Methodology

a.  Data Collection Techniques

This study uses data collected through the documentation method from the official document of data collection of Pax Ecclesia Junior High School students. This secondary data includes demographic information, addresses, distance from home to school, and other relevant aspects (Han et al., 2011).

The data is processed in a digital format using Microsoft Excel to facilitate analysis. Before processing, verification of completeness and validity of data is carried out to ensure the accuracy of the results. The main focus of this research is student segmentation using the Deep Embedded Clustering algorithm to support schools in designing more effective marketing strategies.

b.  Research Stages

1.  Data Selection

At this stage, relevant data is selected for analysis. The data used came from Pax Ecclesia Junior High School students, with a sample of tables prepared to illustrate the information to be analyzed.

| No | Name | Jk | Origin School | Address | Distance |
|----|------|----|---------------|---------|----------|
| 1 | Rainhart Binsar Minaldo Sinaga | L | SD Maria Fransiska | Jl. Prambanan IV D85 Jakasampurna Bekasi | 3,5 km |
| 2 | Marcelino Wiranata | L | SDN Pejakyon Jaya VI | KP Pulo Ceger Jl. Palem Raya | 900 m |
| 3 | Queen Wilfy Lay | P | SD Dian Karunia | Jln Taman Edelweis Timur H 27 Galaxy | 900 m |
| 4 | Aldo Pratama | L | SDS Santa Lusia | Pondok Mitra Lesatri E3/ 25 | 2,6 km |
| 5 | Christian Marcello Susanto | L | SD Dian Karunia | Jl. Palapa 2 F11 / 91 Bekasi 17147 | 1,3 km |
| 6 | Shanessa Avisha Sipasulta | P | SDMF | Jatibening Estate, Jl. Camar III F2 No. 17 | 3,9 km |
| 7 | Daniel Yanky Andika | L | SD Jatiasih VIII | Taman Anggrek Bulan II F3 No 6 Galaxy 17147 | 2,0 km |
| 8 | Christian Nathaniel Kalalo | L | SD UNITY | Jl. Lotus Utara 2 D6/10 Galaxy Bekasi 17147 | 600 m |
| 9 | Angelia Megumi Nauli Sihotang | P | SDMF | Jl. Musi Raya F 667 Masnaga Jakamulya | 2,0 km |
| 10 | Hema Rosalind Kosasih | P | | Jl. Pelangi II Blok E 101 Rt 001 / 006 Bekasi 17146 | 2,5 km |
| 11 | Gregorius Maximilian Jethtro T | L | SD Maria Fransiska | Taman Cikas B12/22  Galaxy Rt 001 / 025 Bekasi | 2,5 km |
| 12 | Angelique Paramitha C | P | SD Maria Fransiska | Komp. Bumi Palapa Jl. Palapa Raya F1127 Bekasi | 1,2 km |
| 13 | David Nathan | L | SD Maria Fransiska | Perm. Satwika Permai Jl. Wibawa Mukti | 6,8 km |

| No | Nama | L/P | Asal Sekolah | Alamat | Jarak |
|---|---|---|---|---|---|
| 14 | Laura Anabelle Suryaputra | P | SDMF | Grand Galaxy City Cluster orchid garden 1/12 | 800 m |
| 15 | Arthur Zefanya Ngantung | L | SDMF | Taman Century 2 Jl. Tanjung 3 Blok J No 15 Beaksi | 3,1 km |
| 16 | Bayu Wicaksono | L | SD Unity | Cluster Casanica Gardenia Blok E No 14 | 21,4 km |
| 17 | Devin | L | | Ruko Rose Garden 6 No 5 Galaxy | 98 m |
| 18 | Reno Mario Raphael Sirait | L | SDN Jatirasa III | Jl. Pulo Sirih Barat 4 | 800 m |
| 19 | Darren Woen Dinata | L | SD Maria Fransiska | Perumnas I Rt 007 / 010 | 11,2 km |
| 20 | Keth Jonathan Roring | L | SD UNITY | Cluster Casanica Gardenia Blok E No 14 | 21,4 km |
| 21 | Rachel Anastasia Sihombing | P | SDMF | Villa Galaxy D5 No.10 | 600 m |
| 22 | Michella Chentania | P | SD Strada Kampung Sawah | Jl. Pakis 6 Villa Bukit Safira No. 16 Pekayon | 1,2 km |
| 23 | Ursula Demmi Escanty Sigaz | P | SDMF | Safari Garden Residence B.22 | 6 km |
| 24 | Keira Keilani | P | SDMF | Jl. Arjuna I No. 26 Agalaxy | 9,4 km |
| 25 | Gracio Timotius Taruliasi Gultom | L | SDMF | Jl. Swadaya I No. 1 Jatiasih Bekasi | 4,2 km |
| 26 | Josua Kristianto | L | SDMF | Botanikal Garden BG1 No 20 | 600 m |
| 27 | Josua Fransisco | L | SD Unity | Jl. Medan 3 No. 65 Masnaga | 3,9 km |
| 28 | Ronen Martin Tua Sidabutar | L | SD Santo Paulus Jakarta | Pondok Mitra Lestari Blok A11 No 20 | 1,9 km |
| 29 | Gordon Marulitua Gultom | L | SDMF | Pondok Cikunir Indah | 3,5 km |
| 30 | Manna Triasa Koentjoro | P | SD Harapan Mulia | Pondok Pekayon Indah AA10 / 12A | 1,7 km |
| 31 | Helena Juliani Siagian | P | SD Harapan Mulia | Kemang IFI Graha D2 No. 18 | 4,0 km |
| 32 | Theresia Nadine Eristaputri | P | SMP 3 Minoh Jepang | Jl. Lotus Tengah II Blok E3/5 Galaxy Bekasi | 850 m |
| 33 | Albertus Raynard Taurean | L | SD Unity School | Perum Jati Bening Estate Jl Murai V | 4,0 km |
| 34 | Alfonsus Marvel oslan | L | SDK Pelita Kasih | Pondok Mitra Lestari Blok A15 No. 1 | 1,7 km |
| 35 | Amara Anastasia | P | SD Harapan Mulia | Jln Pekayon Raya No 8 | 1,8 km |
| 36 | Benny Christhoper Aritonang | L | SD MARIA FRANSISKA | Pondok Cikunir Indah Jl Beringin I | 3,5 km |
| 37 | Brigitta Fiore Anastasia | P | SD MARIA FRANSISKA | Komp Graha Indah Jalan Dieng Blok C7/4 | 3,9 km |
| 38 | Clavel Estell Prasela | P | SD MARIA FRANSISKA | Jl. Pulo Sirih Tengah 9 Blok BD No. 46 | 850 m |

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|---|---|---|---|---|---|
| 39 | David Sam Miracle | L | SD Strada Bhakti Wiyata | Perum Taman Cikas Blok C6 No 10 | 2,3 km |
| 40 | Feby Nikta Ginting | P | SD MARIA FRANSISKA | Perum Pemda Blok B Jl Abimanyu III | 2,8 km |
| 41 | Gilbert Marfris | L | SD MARIA FRANSISKA | Jl H Gamun | 7,9 km |
| 42 | Gracia Giovanca Anabelle | P | SD MARIA FRANSISKA | Pondok Pekayon Indah BB 22 No 8 | 1,7 km |
| 43 | Graciella Rizma Kiding Allo | P | SD HARAPAN MULIA | Vila Nusa Indah V Cluster Walet SE 4 / 16 | 9,5 km |
| 44 | Jonathan Haposan Ambarita | L | SD Unity School | Jl. P. Bawean Blok AA1 / 9 Jatimakmur | 9,3 km |
| 45 | Josiah Julian Makauntung | L | SD Harapan Mulia | Royal Cikunir Residence Blok C No 7 | 2,8 km |
| 46 | Kenzo Hogan | L | SD Driwantie | Jl Patriot No 34 | 4,3 km |
| 47 | Lidwina Stefania Hayuningtyas | P | SD MARIA FRANSISKA | Perumahan Bening Indah A9/15 | 6,7 km |
| 48 | Maria Renata Feani Wulan Rosari | P | SD MARIA FRANSISKA | Perum Graha Indah | 4,2 km |
| 49 | Nasya Stefanie Chandra | P | SD Unity School | KP Pondok Benda No 52 | 2,2 km |
| 50 | Olivia Jeni Sutarman | P | SD MARIA FRANSISKA | Jln Swatantra 1 Kav 8 No 3 | 2,9 km |
| 51 | Rachel Claudia Monica Pangaribuan | P | SD Dian Karunia | Jl Cirata Blok DB 27 | 4,8 km |
| 52 | Raffael Lambok Purba | L | SD MARIA FRANSISKA | Jl. Badar D223 | 3,6 km |
| 53 | Revallyno Hendriawan Triadrian | L | SD HARAPAN MULIA | Taman Permata Cikunir A12/5 | 2,8 km |
| 54 | Ringgo Qolbu Mahdafiqia | L | SD MARIA FRANSISKA | The Green View Blok C No 5 | 2,2 km |
| 55 | Teresa Putri Mahardika | P | SD MARIA FRANSISKA | Jl. Sadewa VII / C 405 JakasampurnaBekasi | 1,5 km |
| 56 | Thomas Alvareno Suryatmojo | L | SD HARAPAN MULIA | Perum Kemang Pratama Blok A No 7 | 5,2 km |
| 57 | Yohanes Bernard Hadianto | L | SDSK Harapan Mulia Jakarta | Jl Medan III F/65 Jaka Mulya | 2,6 km |
| 58 | Alfrido Jonathan | L | SD MARIA FRANSISKA | Jl Patriot No 21 | 4,4 km |
| 59 | Azarya Hotasi Josua Manik | L | SD HARAPAN MULIA | Jl Udang V No 125,Perum 2 | 5,5 km |
| 60 | Cornelius Steven Adi Saputra | L | SD Unity School | Jl Pulo Sirih Selatan IX AE261 | 500 m |
| 61 | Devito Nicolaus | L | SD Maria Fransiska | Jl Pulo Sirih Timur 4 blok CB no 85 | 700 m |
| 62 | Gabrielle Dixon Darmawan | P | SD Maria Fransiska | Jl Lotus Utara 2 blok Ds 128 villa galaxy | 750 m |

| 63 | Gisela Chelsea Lukita | P | SD Maria Fransiska | Taman Cikas blok c18 no 10 | 2,4 km |
|----|----|----|----|----|----|
| 64 | Jessica Natasha Prayitno | P | SD Strada Wiyata | Villa Galaxi AA1 no 58 | 600 m |
| 65 | Larasati Kezia Pangaribuan | P | SD Maria Fransiska | Jl Pulo Sirih Selatan IX AE261 | 500 m |
| 66 | Marc Constantine Lee Tjahjono | L | SD Unity | Jl Tumapel No 8 Jaka Permai | 5,8 km |
| 67 | Marcelinus Mayer | L | SD Driewanti | Victorya Garden G No 88 | 850 km |
| 68 | Nathan Rephael Thansamart L Tobing | L | SDS Edelweiss | Perumahan Mediterania Cikunir blok CB no 24 | 3,0 km |
| 69 | Nicholas Garcia Hutauruk | L | SD Maria Fransiska | Taman Galaxi Indah,jl bougenvile II Blok T/24 | 300 m |
| 70 | Rachel Imanuela | P | SD Maria Fransiska | Jl Sadewa 2 no 50 | 19,2 km |
| 71 | Sunday Nathanael Siregar | L | SD Unity | Safari Garden Residence B.22 | 6 km |
| 72 | Theophilus Nathanael Sihombing | L | SD Maria Fransiska | Pondok Pekayon Indah AA10 / 12A | 1,7 km |
| 73 | Valorie Reine Taruli Sirait | P | SD Maria Fransiska | Jl Swakarya no 2A | 3,3 km |
| 74 | Yeshaya Vidrawata Thanisia | L | SD Maria Fransiska | Pondok Timur Mas Blok H2/9-10 | 2,3 km |
| 75 | Aristo Azario Christyan | L | | PTM F4 jln Jingga Mas III | 2,4 km |
| 76 | Aloysius Andi Reanhart Ongkor | L | SD Global Inbyra School Tegal | Perum Kemang Ifi Graha jln madiun | 4,0 km |
| 77 | Joseph Darren | L | SD Maria Fransiska | Jl. Arjuna I No. 26 Agalaxy | 9,4 km |
| 78 | Cramendo Nafiri Pakasi | L | SD Maria Fransiska | Jl Arjuna I B 25 | 5,5 km |
| 79 | Elita Tjin | P | SD Maria Fransiska | Kp Poncol Pekayon Jaya | 1,7 km |
| 80 | Gaby Gabriella Ajawaila | P | SDN Pekayon Jaya VI | Jl Bintan No 94 Perum JatiAsih Indah | 2,3 km |
| 81 | Gerardus Moreno Andianca | L | SD Maria Bintang Laut | Pulo Sirih Timur 3 CB 25 | 700 m |
| 82 | Glenn Raditya Pratama | L | | Jl Musi 1 Blok F no 521 Komplek Nagamas | 2,0 km |
| 83 | Jason Wijaya Lok | L | SDN Jatiasih XIII | Victorya Garden G No 88 | 850 m |
| 84 | Jessica Liaurencia | P | SD Maria Fransiska | Grand Galaxy City cluster Victoria Garden VG 5 | 700 m |
| 85 | Marcelino Willy Sitompul | L | SD Harapan Mulia | Pondok Mitra Lestari Blok A/6 no 7 | 1,7 km |

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|---|---|---|---|---|---|
| 86 | Marcello Aldi Immanuel Sihaloho | L | SD Maria Fransiska | Jl Intan Raya No 22 Blok 8 BSK | 4,8 km |
| 87 | Neal Matias Simanjuntak | L | SD Maria Fransiska | Jl Swadaya No 1 HKBP Jatiasih | 7,4 km |
| 88 | Salsabilla Naysilla Madinnah Sopi Wanju | P | SD Maria Fransiska | Pondok Timur Mas Blok H2/9-10 | 2,5 km |
| 89 | Setia Kristiani Uli | L | SD Citra Anak Bangsa | Pondok Pekayon Indah B6/9 | 1,7 km |
| 90 | Timotius Jason Lesmana | L | SD Maria Fransiska | Jl Galaxi IV No 356 E | 10,5 km |
| 91 | Viktor Giovany Aron Purba | L | SD Edel Weis | Pulo Permata Sari B5/18 | 1,8 km |
| 92 | Vira Amanda | P | SD Maria Fransiska | Villa Galaxy Blok B7 No 20 | 600 m |
| 93 | Angelia Megumi Nauli Sihotang | P | SD Maria Fransiska | Jl. Musi Raya F 667 Masnaga Jakamulya | 2,0 km |
| 94 | Arthur Zefanya Ngantung | L | SD Maria Fransiska | Taman Century 2 Jl. Tanjung 3 Blok J No 15 Beaksi | 3,1 km |
| 95 | Christian Marcello Susanto | L | SD Maria Fransiska | Jl. Palapa 2 F11 / 91 Bekasi 17147 | 1,3 km |
| 96 | Devin | L | SD Harapan Mulia | Ruko Rose Garden 6 No 5 Galaxy | 400 m |
| 97 | Gordon Marulitua Gultom | L | SD Maria Fransiska | Pondok Cikunir Indah | 3,5 km |
| 98 | Gregorius Maximilian Jethtro T | L | SD Maria Fransiska | Taman Cikas B12/22  Galaxy Rt 001 / 025 Bekasi | 2,5 km |
| 99 | Helena Juliani Siagian | P | SD Unity | Kemang IFI Graha D2 No. 18 | 4,0 km |
| 100 | Hema Rosalind Kosasih | P | SD Tunas Jakasampurna | Jl. Pelangi II Blok E 101 Rt 001 / 006 Bekasi 17146 | 2,5 km |
| 101 | Josua Kristianto | L | SD Maria Fransiska | Botanikal Garden BG1 No 20 | 600 m |
| 102 | Keth Jonathan Roring | L | SD Maria Fransiska | Jl. Palapa 2 F11 / 91 Bekasi 17147 | 1,3 km |
| 103 | Marcelino Wiranata | L | SD Harapan Mulia | KP Pulo Ceger Jl. Palem Raya | 900 m |
| 104 | Queen Wilfy Lay | P | SD Harapan Mulia | Jln Taman Edelweis Timur H 27 Galaxy | 1,7 km |
| 105 | Rainhart Binsar Minaldo Sinaga | L | SD Harapan Mulia | Jl. Prambanan IV D85 Jakasampurna Bekasi | 3,5 km |
| 106 | Reno Mario Raphael Sirait | L | SD Maria Fransiska | Jl. Pulo Sirih Barat 4 | 750 m |
| 107 | Shanessa Avisha Sipasulta | P | SD Maria Fransiska | Jatibening Estate, Jl. Camar III F2 No. 17 | 3,9 km |
| 108 | Ursula Demmi Escanty Sigaz | P | SD Maria Fransiska | Safari Garden Residence B.22 | 6 km |

| No | Nama | L/P | Sekolah | Alamat | Jarak |
|---|---|---|---|---|---|
| 109 | Aldo Pratama | L | SD Driwanti | Pondok Mitra Lesatri E3/ 25 | 1,7 km |
| 110 | Daniel Yanky Andika | L | SDN 173632 Porsea Tobasa Sumut | Taman Anggrek Bulan II F3 No 6 Galaxy 17147 | 2,0 km |
| 111 | Christian Nathaniel Kalalo | L | SD Maria fransiska | Jl. Lotus Utara 2 D6/10 Galaxy Bekasi 17147 | 750 m |
| 112 | Angelique Paramitha C | P | SD Maria Fransiska | Komp. Bumi Palapa Jl. Palapa Raya F1127 Bekasi | 1,2 km |
| 113 | David Nathan | L | SDN Pekayon Jaya VII | Perm. Satwika Permai Jl. Wibawa Mukti E6/6 Rt 001 / 009 | 6,8 km |
| 114 | Laura Anabelle Suryaputra | P | SD Maria Fransiska | Grand Galaxy City Cluster orchid garden 1/12 | 800 m |
| 115 | Bayu Wicaksono | L | SD Rhema Indonesia | Cluster Casanica Gardenia Blok E No 14 | 21,5 km |
| 116 | Darren Woen Dinata | L | SD Maria fransiska | Perumnas I Rt 007 / 010 | 2,5 km |
| 117 | Michella Chentania | P | SD MARIA FRANSISKA | Jl. Pakis 6 Villa Bukit Safira No. 16 Pekayon | 1,2 km |
| 118 | Keira Keilani | P | SD Maria Fransiska | Jl. Arjuna I No. 26 Agalaxy | 9,5 km |
| 119 | Gracio Timotius Taruliasi Gultom | L | SD Maria Fransiska | Jl. Swadaya I No. 1 Jatiasih Bekasi | 4,2 km |
| 120 | Josua Fransisco | L | SD Maria Fransiska | Jl. Medan 3 No. 65 Masnaga | 3,9 km |
| 121 | Ronen Martin Tua Sidabutar | L | SD Maria Fransiska | Pondok Mitra Lestari Blok A11 No 20 | 1,9 km |
| 122 | Manna Triasa Koentjoro | P | SD Maria Fransiska | Pondok Pekayon Indah AA10 / 12A | 1,7 km |
| 123 | Theresia Nadine Eristaputri | P | SD Harapan Mulia | Jl. Lotus Tengah II Blok E3/5 Galaxy Bekasi | 850 m |
| 124 | Abigail Sofie Wardana | P | SD Maria Fransiska | Jl. Enggano No. B23 komp TNI AL Jatibening Rt 003/010 Bekasi | 5,2 km |
| 125 | Adrian Marvel Lasro Manik | L | SD Harapan Mulia | Jl. Udang 5 No. 125 Rt 001/008 Bekasi | 5,5 km |
| 126 | Angel Edward Naibaho | P | SD Unity | Jl. Lumba - lumba Blok D14 Bekasi2,2 km | 2,2 km |
| 127 | Danella Luvena Putri Permana | P | SD Harapan Mulia | Green Royale Residence Blok D7 Bekasi | 15,0 km |
| 128 | Darius Willy Kerta Jaya | L | SD Maria Fransiska | Apartemen Kemang View | 3,3 km |
| 129 | Delbert Joshua Wungkana | L | SD Maria Fransiska | Jl. Pramuka Komp Mutiara Baru Blok J/7 Rt 003/012 Bekasi | 5,4 km |
| 130 | Felicia Yiwenny | P | SD Maria Fransiska | Jl. Manggis 1 No. 19 D Rt 004/017 Jakasetia  Bekasi | 750 m |
| 131 | Inez Valentine Mulia | P | SD Citra Anak Bangsa | MRC Cluster Penrose Blok G9/5 Rt 005/012 Bekasi | 3,2 km |
| 132 | Jeanne Kanaya Fardiansyah | P | SD Harapan Mulia | Villa Galaxy Jl. Gardenia Utara BA2/31 Rt 02/019 Bekasi | 600 m |

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|---|---|---|---|---|---|
| 133 | Magdalena Phoebe Rosemary Tirtaatmadja | P | SD Maria Fransiska | Jl. Cikas Tengah 3 B12/22 Taman Cikas Rt 001/025 Bekasi | 2,5 km |
| 134 | Matthew Angelo Tjahyana | L | SD Harapan Mulia | Pondok Timur Mas Blok H5/14 Ri 009/03 Bekasi | 2,5 km |
| 135 | Mikael Garicoits Matthew Atmaja | L | SD Maria Fransiska | Jl. Cendrawasih A/5 Rt 002/009 Jakamulya Bekasi | 2,7 km |
| 136 | Novando | L | SD Maria Fransiska | Jl. Taman Aster Blok N4/21 Rt 009/014 Bekasi | 1,3 km |
| 137 | Pandito Abram Bagas Susilo | L | SD Maria Fransiska | Royal Cikunir Residence Blok A7 Rt 008/013 Bekasi | 2,0 km |
| 138 | Raphael Gallen Tan | L | SMP Tamiang Layang Kalteng | Jl. Pondok Mas Raya B2/12 Rt 001/013 Jakasetia Bekasi | 2,0 km |
| 139 | Ruth Angelina Nathania Pasaribu | P | SD Harapan Mulia | Pondok Pekayon Indah B2/4 Rt 004/011 Bekasi | 1,7 km |
| 140 | William Mikhael Putra Setyawan Siregar | L | SD Strada Nawar Bekasi | Pondok Mitra Lestari Blok C5/07 Rt 014/013 Bekasi | 1,7 km |
| 141 | Yovita Linardi | P | SD Santa Maria Monica | Griya Jatisari DU 12 /6 Rt 002/014 Bekasi | 5,1 km |
| 142 | Margareta Orlin Matta Rompas | P | SD Royal Wells | Kp Poncol Bulak Rt 004/017 Jakasetia Bekasi Selatan | 650 km |
| 143 | Riza Avian Setiadi | L | SD Harapan Mulia | Jl. Jingga Mas 7 zBlok R2 | 2,5 km |
| 144 | Aurelia Hon | P | SD Maria Fransiska | Jl. RH Umar Kp Utan Rt 004/002 Jakasetia Bekasi Selatan | 1,2 km |
| 145 | Claudius Joshe Franklyn Candra Fanny Sinaga | L | SD Unity | Jl. Padang Raya Blok F/ 260 Rt 004/005 Bekasi | 2,7 km |
| 146 | Florencia Chandra Winata | P | SD Maria Fransiska | Jl. Pulosirih Selatan 5 /AE-189 Rt 011/13 Pekayon Jaya Bekasi | 500 m |
| 147 | Gabriel Pangihutan Tampubolon | L | SD Unity | Pondok Timur Mas Rt 006/ 013 Bekasi | 11,6 km |
| 148 | Ignatius Manggala Wisnu | L | SD Citra Anak Bangsa | Jl. Bulus No. 5 Rt  Kp Pulo Ceger Bekasi | 950 m |
| 149 | Jefferson Hinca Ambarita | L | SD Maria Fransiska | Jatibening Estate Jl. Murai VI | 4,0 km |
| 150 | Jeremy Patrick Situmeang | L | SD Maria Fransiska | Patricia & Patrick Palace Jl H. Banir No. 213 Rt 005 / 03 | 2,7 km |
| 151 | Jonathan Kevin | L | SDK Petra Madiun | Jl. Pondok Jingga Mas VII Blok R2/7 Bekasi | 2,3 km |
| 152 | Kefin Trixie Sembiring | L | SD Maria Fransiska | Cluster De Flamboyan No.3 Jl. Dr. Ratna Jatikramat Bekasi | 3,4 km |
| 153 | Lyonel Marthin Siregar | L | SD Maria Fransiska | Jl. Berlian Blok D No. 495 Rt 01 RW 09 Jakasampurna Bekasi | 3,6 km |
| 154 | Michael Gerald Sidabutar | L | SD Unity | Komp BSK Jl. Nakula VI No.10 Rt 005/022 Bekasi | 5,8 km |
| 155 | Nilia Jowannibie Tobing | P | SD Citra Anak Bangsa | Jl. California IV Blok H3/36 Jatikramat Jatiasih Bekasi | 3,3 km |

| No | Nama | L/P | Asal Sekolah | Alamat | Jarak |
|---|---|---|---|---|---|
| 156 | Quinnsha Morcilia Marika Simarmata | P | SD Maria Fransiska | The Swatantra Town House Blok B/6 Rt 004/005 Bekasi | 3,4 km |
| 157 | Rahel Sendler Sianturi | P | SD Maria Fransiska | Pondok Surya Mandala Bok i 1 No. 17 Rt 005/013 | 2,6 km |
| 158 | Rellyn Ruth Magdalena | P | SD Harapan Mulia | Jl. Flores Blok D/ 34 Komp AL Rt 011/012 Bekasi | 4,1 km |
| 159 | Rory Abraham Hutagalung | L | SD Maria Fransiska | Komplek Depnaker Trans Blok D.93 Rt 011/05 Bekasi | 3,0 km |
| 160 | Sonia Mireille Marpaung | P | SD Harapan Mulia | Jl. Edelweis Barat 3 Blok C5 / 20 Rt 003/019 | 700 m |
| 161 | Stephanie Christy Gunardi | P | SD Maria Fransiska | Jl. Pulo Sirih Barat Raya FE 454 Rt 002 / 015 | 800 m |
| 162 | Theodore Regid Wungkana | L | SD Maria Fransiska | Jl. Kelud No. 111A Perm Masnaga Rt 007/009 Bekasi | 3,0 km |
| 163 | Vanessa Florencia | P | SD Maria Fransiska | Jl. Patriot Raya No. 21 Rt 009/02 Bekasi | 4,6 km |
| 164 | ANTHONY ABEDNEGO CHRISTIAN | L | SD Maria Fransiska | Pulo Permatasari blok B4 No 25 Bekasi | 1,9 km |
| 165 | AZARYA JUNIOR WIJANARKO | L | SD Maria Fransiska | Pondok Kelapa IF Blok A4 No.16 | 7,5 km |
| 166 | CARISSA AUREL | P | SD Maria Fransiska | Jl Pulo Sirih Selatan AE 2 No 123 | 400 m |
| 167 | GABRIEL ALESSANDRO ARIO | L | SD Harapan Mulia | Jl. Matahari I / 25 Jakasetia | 1,2 km |
| 168 | GADING ARGASATYA PUTRA | L | SD Harapan Mulia | Jl. Musi I Blok F No. 521 Masnaga Jakamulya Bekasi | 2,0 km |
| 169 | GARY FIDDEL RYSZARD | L | SD Harapan Mulia | Jl. Nakula 7A No. 106 Jakasetia Rt 003/07 Bekasi | 1,8 km |
| 170 | HANABEL CHRISTY | P | SD Maria Fransiska | Taman Cikunir Indah, Jl. Nusantara Raya E6 No 19 | 1,5 km |
| 171 | ICHA FIDELYA CALLYSTA | P | SD Maria Fransiska | Jl. Siput 5 No.54 Kayuringin Bekasi | 4,9 km |
| 172 | INTAN EPIP HANIAT LAWOLO | P | SD Maria Fransiska | Jl. Surya Raya Blok B No. 390 | 2,1 km |
| 173 | JESSYCA ANGELYNE TEREZIA | P | SD Driwanti | Jl. Arjuna 3 Blok B No 94 Jakasetia Bekasi | 2,6 km |
| 174 | KAYLEEN JOSHUA SOEGIANTO | P | SDN 173632 Porsea Tobasa Sumut | Komp The Green View C - 18 | 2,2 km |
| 175 | LILIA WODNA KOSASIH | P | SD Maria fransiska | Jl. Pelangi 3 Blok E No. 83 Bekasi | 2,6 km |
| 176 | LIONER CU | L | SD Maria Fransiska | Lotus Garden 2 No. 52 Galaxy | 450 m |

| 177 | MENSIUS YIVENT | L | SDN Pekayon Jaya VII | Jl. Manggis 1 No 190 | 900 m |
|---|---|---|---|---|---|
| 178 | MIKHAEL MALVINO ANDREAS JUWANTO | L | SD Maria Fransiska | Jl. Barito 3 Blok F / 625 Rt 003/07 | 2,1 km |
| 179 | NATHAN LEAW | L | SD Rhema Indonesia | Grand Galaxy RSN 2 No 31 Galaxy Bekasi | 1,9 km |
| 180 | NEIL DEVANO KASALI | L | SD Maria fransiska | Kp. Jaha Jl. Rambutan No. 29 Bekasi | 3,4 km |
| 181 | RAFAEL STEVANO LINARDI | L | SD MARIA FRANSISKA | Jl Cirata Blok DB 27 | 4,8 km |
| 182 | RAYMOND SALVATOR KARTADINATA | L | SD Maria Fransiska | Jl. Taman Akasia Blok C2 No 2 | 2,1 km |
| 183 | REBECCA OKTARIANA LAMTIUR TAMBUNAN | P | SD Maria Fransiska | Pondok Timur Mas Blok H3 No 5 Bekasi | 2,5 km |
| 184 | RITCHE DIEGO STYSHA LIE | L | SD Maria Fransiska | Villa Jatibening Tol Blok KH 7 Bekasi | 4,2 km |
| 185 | SAMANTHA JEANE LUCIANE MATONDANG | P | SD Maria Fransiska | Jl. Pulo Sirih Barat X FE-489 Bekasi | 1,0 km |
| 186 | TIFFANY CHRISTIE ONG | P | SD Maria Fransiska | Perm Taman Cikas Jl. Cikas Timur 2 Blok C10 No. 7 | 2,5 km |
| 187 | URIEL NOAH OLOAN SIDABUTAR | L | SD Harapan Mulia | Pondok Mitra Lestari Blok A11No. 20 Rt 013/13 Bekasi | 1,9 km |
| 188 | YANTI AULIA | P | SD Maria Fransiska | Jl. Raya Pekayon Jaya Kav II No. 1 | 2,1 km |
| 189 | YEHEZKIEL RADEN BATISTUTA SIPAHUTAR | L | SD Harapan Mulia | Jl. Kp.Pondok Benda | 2,2 km |
| 190 | YOSIA GAVRIEL SIANTURI | L | SD Unity | Perm: Pondok Surya Mandala Blok I No. 17 | 2,6 km |
| 191 | IMMANUEL EVRIAGSA SIDABUTAR | L | SD Harapan Mulia | Taman Cikas Blok B16 / 21 Rt 005/025 | 2,5 km |
| 192 | Alvaro Reynard Vito Marbun | L | SD Maria Fransiska | Jl. Sepakat Raya Perum Emerald Residence | 4,3 km |
| 193 | Alvieza Van Devan | L | SD Maria Fransiska | Jl. Merpati Pos No A/31 Rt 001/09 Jakamulya Bekasi Selatan | 10,9 km |
| 194 | Amanda Pangtambing | P | SD Maria Fransiska | Jl. Pulo sirih Tengah 17 EB 242 Rt 009/014 Pekayon Bekasi Selatan | 1,3 km |
| 195 | Andrew Koji Maduma Sihotang | L | SD Citra Anak Bangsa | Jl. Musi Raya F 667 Rt 005/007 Jakamulya Bekasi Selatan | 2,0 km |

| 196 | Angelica Ghisela Novanda | P | SD Harapan Mulia | Jl. Al Ihksan Rt 004/018 Jatibening Pondokgede | 6,3 km |
| 197 | Carlen Quenishia Cool | P | SD Maria Fransiska | Jl. HJ. Moh Zain No. 60 Rt 008/04 Jatibening Pondokgede 17412 | 7,4 km |
| 198 | Chiko Candra | L | SD Harapan Mulia | Jl. Pulo Ribung Gg Manggis I Rt 004 / 017 Jakasetia Bekasi Selatan | 450 m |
| 199 | Desindah Mastiur Manurung | P | SD Maria Fransiska | Jl. Seruni 6 Blok 05 No.14 Rt 005/014 Jakasetia Bekasi Selatan | 1,6 km |
| 200 | Elisabeth Yanky Andhika | P | SD Maria Fransiska | Taman Anggrek Bulan II F3/6 Rt 002/014 Jakasetia Bekasi Selatan | 2,0 km |
| 201 | Felix Brema Sitepu | L | SD Maria Fransiska | East Point Residence Jl. Caman Raya  Pondokgede | 4,9 km |
| 202 | Firalda Lambe Kamoda | P | SMP Tamiang Layang Kalteng | Jl. Pulo Sirih Tengah 19 EB 300 Rt 009 / 014 Pekayon Bekasi | 1,3 km |
| 203 | Gabrielle Justine Kidding Allo | L | SMP Santa Lusia Dolok Sanggul | Jl. Badar D223 Rt 003/ 009 Jakasampurna Bekasi Barat | 3,6 km |

Tabel 3. 1 Data Selection

2. Preprocessing

3. Transformation

Data transformation is carried out through several steps to ensure data readiness in  the data mining process. Based on the data that has been processed previously, this transformation stage is implemented to improve the quality and relevance of the data for further analysis:

° Normalization of Distance Columns

° Categorical Data Coding

° Handling of Address Data

° Data Validation

The following is the result of the data after the transformation :

| Name | Jk | Origin School | Distance |
|---|---|---|---|
| Siswa 1 | 1 | 2 | 3,5 |
| Siswa 2 | 1 | 1 | 900 |
| Siswa 3 | 0 | 2 | 900 |
| Siswa 4 | 1 | 2 | 2,6 |
| Siswa 5 | 1 | 2 | 1,3 |
| Siswa 6 | 0 | 2 | 3,9 |
| Siswa 7 | 0 | 2 | 2 |
| Siswa 8 | 1 | 2 | 600 |
| Siswa 9 | 0 | 2 | 2 |
| Siswa 10 | 0 | 2 | 2,5 |

| | | | |
|---|---|---|---|
| Siswa 11 | 1 | 2 | 2,5 |
| Siswa 12 | 0 | 2 | 1,2 |
| Siswa 13 | 1 | 2 | 6,8 |
| Siswa 14 | 0 | 2 | 800 |
| Siswa 15 | 1 | 2 | 3,1 |
| Siswa 16 | 1 | 2 | 21,4 |
| Siswa 17 | 1 | 2 | 98 |
| Siswa 18 | 1 | 1 | 800 |
| Siswa 19 | 1 | 2 | 11,2 |
| Siswa 20 | 1 | 2 | 21,4 |
| Siswa 21 | 0 | 2 | 600 |
| Siswa 22 | 0 | 2 | 1,2 |
| Siswa 23 | 0 | 2 | 6 |
| Siswa 24 | 0 | 2 | 9,4 |
| Siswa 25 | 1 | 2 | 4,2 |
| Siswa 26 | 1 | 2 | 600 |
| Siswa 27 | 1 | 2 | 3,9 |
| Siswa 28 | 1 | 2 | 1,9 |
| Siswa 29 | 1 | 2 | 3,5 |
| Siswa 30 | 0 | 2 | 1,7 |
| Siswa 31 | 0 | 2 | 4 |
| Siswa 32 | 0 | 2 | 850 |
| Siswa 33 | 1 | 2 | 4 |
| Siswa 34 | 1 | 2 | 1,7 |
| Siswa 35 | 0 | 2 | 1,8 |
| Siswa 36 | 1 | 2 | 3,5 |
| Siswa 37 | 0 | 2 | 3,9 |
| Siswa 38 | 0 | 2 | 850 |
| Siswa 39 | 1 | 2 | 2,3 |
| Siswa 40 | 0 | 2 | 2,8 |
| Siswa 41 | 1 | 2 | 7,9 |
| Siswa 42 | 0 | 2 | 1,7 |
| Siswa 43 | 0 | 2 | 9,5 |
| Siswa 44 | 1 | 2 | 9,3 |
| Siswa 45 | 1 | 2 | 2,8 |
| Siswa 46 | 1 | 2 | 4,3 |
| Siswa 47 | 0 | 2 | 6,7 |

| Siswa 48 | 0 | 2 | 4,2 |
|---|---|---|---|
| Siswa 49 | 0 | 2 | 2,2 |
| Siswa 50 | 0 | 2 | 2,9 |
| Siswa 51 | 0 | 2 | 4,8 |
| Siswa 52 | 1 | 2 | 3,6 |
| Siswa 53 | 1 | 2 | 2,8 |
| Siswa 54 | 1 | 2 | 2,2 |
| Siswa 55 | 0 | 2 | 1,5 |
| Siswa 56 | 1 | 2 | 5,2 |
| Siswa 57 | 1 | 2 | 2,6 |
| Siswa 58 | 1 | 2 | 4,4 |
| Siswa 59 | 1 | 2 | 5,5 |
| Siswa 60 | 1 | 2 | 500 |
| Siswa 61 | 1 | 2 | 700 |
| Siswa 62 | 0 | 2 | 750 |
| Siswa 63 | 0 | 2 | 2,4 |
| Siswa 64 | 0 | 2 | 600 |
| Siswa 65 | 0 | 2 | 500 |
| Siswa 66 | 1 | 2 | 5,8 |
| Siswa 67 | 1 | 2 | 850 |
| Siswa 68 | 1 | 2 | 3 |
| Siswa 69 | 1 | 2 | 300 |
| Siswa 70 | 0 | 2 | 19,2 |
| Siswa 71 | 1 | 2 | 6 |
| Siswa 72 | 1 | 2 | 1,7 |
| Siswa 73 | 0 | 2 | 3,3 |
| Siswa 74 | 1 | 2 | 2,3 |
| Siswa 75 | 1 | 2 | 2,4 |
| Siswa 76 | 1 | 2 | 4 |
| Siswa 77 | 1 | 2 | 9,4 |
| Siswa 78 | 1 | 2 | 5,5 |
| Siswa 79 | 0 | 2 | 1,7 |
| Siswa 80 | 0 | 1 | 2,3 |
| Siswa 81 | 1 | 2 | 700 |
| Siswa 82 | 1 | 2 | 2 |
| Siswa 83 | 1 | 1 | 850 |
| Siswa 84 | 0 | 2 | 700 |

| | | | |
|---|---|---|---|
| Siswa 85 | 1 | 2 | 1,7 |
| Siswa 86 | 1 | 2 | 4,8 |
| Siswa 87 | 1 | 2 | 7,4 |
| Siswa 88 | 0 | 2 | 2,5 |
| Siswa 89 | 1 | 2 | 1,7 |
| Siswa 90 | 1 | 2 | 10,5 |
| Siswa 91 | 1 | 2 | 1,8 |
| Siswa 92 | 0 | 2 | 600 |
| Siswa 93 | 0 | 2 | 2 |
| Siswa 94 | 1 | 2 | 3,1 |
| Siswa 95 | 1 | 2 | 1,3 |
| Siswa 96 | 1 | 2 | 400 |
| Siswa 97 | 1 | 2 | 3,5 |
| Siswa 98 | 1 | 2 | 2,5 |
| Siswa 99 | 0 | 2 | 4 |
| Siswa 100 | 0 | 2 | 2,5 |
| Siswa 101 | 1 | 2 | 600 |
| Siswa 102 | 1 | 2 | 1,3 |
| Siswa 103 | 1 | 2 | 900 |
| Siswa 104 | 0 | 2 | 1,7 |
| Siswa 105 | 1 | 2 | 3,5 |
| Siswa 106 | 1 | 2 | 750 |
| Siswa 107 | 0 | 2 | 3,9 |
| Siswa 108 | 0 | 2 | 6 |
| Siswa 109 | 1 | 2 | 1,7 |
| Siswa 110 | 0 | 1 | 2 |
| Siswa 111 | 1 | 2 | 750 |
| Siswa 112 | 0 | 2 | 1,2 |
| Siswa 113 | 1 | 1 | 6,8 |
| Siswa 114 | 0 | 2 | 800 |
| Siswa 115 | 1 | 2 | 21,5 |
| Siswa 116 | 1 | 2 | 2,5 |
| Siswa 117 | 0 | 2 | 1,2 |
| Siswa 118 | 0 | 2 | 9,5 |
| Siswa 119 | 1 | 2 | 4,2 |
| Siswa 120 | 1 | 2 | 3,9 |
| Siswa 121 | 1 | 2 | 1,9 |

| | | | |
|---|---|---|---|
| Siswa 122 | 0 | 2 | 1,7 |
| Siswa 123 | 0 | 2 | 850 |
| Siswa 124 | 0 | 2 | 5,2 |
| Siswa 125 | 1 | 2 | 5,5 |
| Siswa 126 | 0 | 2 | 2,2 |
| Siswa 127 | 0 | 2 | 15 |
| Siswa 128 | 1 | 2 | 3,3 |
| Siswa 129 | 1 | 2 | 5,4 |
| Siswa 130 | 0 | 2 | 750 |
| Siswa 131 | 0 | 2 | 3,2 |
| Siswa 132 | 0 | 2 | 600 |
| Siswa 133 | 0 | 2 | 2,5 |
| Siswa 134 | 1 | 2 | 2,5 |
| Siswa 135 | 1 | 2 | 2,7 |
| Siswa 136 | 1 | 2 | 1,3 |
| Siswa 137 | 1 | 2 | 2 |
| Siswa 138 | 1 | 2 | 2 |
| Siswa 139 | 0 | 2 | 1,7 |
| Siswa 140 | 1 | 2 | 1,7 |
| Siswa 141 | 0 | 2 | 5,1 |
| Siswa 142 | 0 | 2 | 650 |
| Siswa 143 | 1 | 2 | 2,5 |
| Siswa 144 | 0 | 2 | 1,2 |
| Siswa 145 | 1 | 2 | 2,7 |
| Siswa 146 | 0 | 2 | 500 |
| Siswa 147 | 1 | 2 | 11,6 |
| Siswa 148 | 1 | 2 | 950 |
| Siswa 149 | 1 | 2 | 4 |
| Siswa 150 | 1 | 2 | 2,7 |
| Siswa 151 | 1 | 2 | 2,3 |
| Siswa 152 | 1 | 2 | 3,4 |
| Siswa 153 | 1 | 2 | 3,6 |
| Siswa 154 | 1 | 2 | 5,8 |
| Siswa 155 | 0 | 2 | 3,3 |
| Siswa 156 | 0 | 2 | 3,4 |
| Siswa 157 | 0 | 2 | 2,6 |
| Siswa 158 | 0 | 2 | 4,1 |

| | | | |
|---|---|---|---|
| Siswa 159 | 1 | 2 | 3 |
| Siswa 160 | 0 | 2 | 700 |
| Siswa 161 | 0 | 2 | 800 |
| Siswa 162 | 1 | 2 | 3 |
| Siswa 163 | 0 | 2 | 4,6 |
| Siswa 164 | 1 | 2 | 1,9 |
| Siswa 165 | 1 | 2 | 7,5 |
| Siswa 166 | 0 | 2 | 400 |
| Siswa 167 | 1 | 2 | 1,2 |
| Siswa 168 | 1 | 2 | 2 |
| Siswa 169 | 1 | 2 | 1,8 |
| Siswa 170 | 0 | 2 | 1,5 |
| Siswa 171 | 0 | 2 | 4,9 |
| Siswa 172 | 0 | 2 | 2,1 |
| Siswa 173 | 0 | 2 | 2,6 |
| Siswa 174 | 0 | 1 | 2,2 |
| Siswa 175 | 0 | 2 | 2,6 |
| Siswa 176 | 1 | 2 | 450 |
| Siswa 177 | 1 | 1 | 900 |
| Siswa 178 | 1 | 2 | 2,1 |
| Siswa 179 | 1 | 2 | 1,9 |
| Siswa 180 | 1 | 2 | 3,4 |
| Siswa 181 | 1 | 2 | 4,8 |
| Siswa 182 | 1 | 2 | 2,1 |
| Siswa 183 | 0 | 2 | 2,5 |
| Siswa 184 | 1 | 2 | 4,2 |
| Siswa 185 | 0 | 2 | 1 |
| Siswa 186 | 0 | 1 | 2,5 |
| Siswa 187 | 1 | 1 | 1,9 |
| Siswa 188 | 0 | 1 | 2,1 |
| Siswa 189 | 1 | 1 | 2,2 |
| Siswa 190 | 1 | 1 | 2,6 |
| Siswa 191 | 1 | 2 | 2,5 |
| Siswa 192 | 1 | 2 | 4,3 |
| Siswa 193 | 1 | 2 | 10,9 |
| Siswa 194 | 0 | 2 | 1,3 |
| Siswa 195 | 1 | 2 | 2 |

| | | | |
|---|---|---|---|
| Siswa 196 | 0 | 2 | 6,3 |
| Siswa 197 | 0 | 2 | 7,4 |
| Siswa 198 | 1 | 2 | 450 |
| Siswa 199 | 0 | 2 | 1,6 |
| Siswa 200 | 0 | 2 | 2 |
| Siswa 201 | 1 | 2 | 4,9 |
| Siswa 202 | 0 | 2 | 1,3 |
| Siswa 203 | 1 | 2 | 3,6 |
| Siswa 204 | 1 | 2 | 5,6 |
| Siswa 205 | 1 | 2 | 1,8 |
| Siswa 206 | 0 | 2 | 2,5 |
| Siswa 207 | 0 | 2 | 2,3 |
| Siswa 208 | 1 | 2 | 2,5 |
| Siswa 209 | 0 | 2 | 2,5 |
| Siswa 210 | 1 | 2 | 1,3 |
| Siswa 211 | 1 | 2 | 1,7 |
| Siswa 212 | 1 | 2 | 1,7 |
| Siswa 213 | 1 | 2 | 1,2 |
| Siswa 214 | 1 | 2 | 2,6 |
| Siswa 215 | 0 | 2 | 850 |
| Siswa 216 | 0 | 2 | 1,3 |
| Siswa 217 | 1 | 2 | 6,4 |
| Siswa 218 | 1 | 1 | 2,6 |
| Siswa 219 | 1 | 2 | 1,6 |
| Siswa 220 | 1 | 2 | 9,1 |
| Siswa 221 | 0 | 1 | 700 |
| Siswa 222 | 0 | 2 | 600 |
| Siswa 223 | 1 | 2 | 900 |
| Siswa 224 | 1 | 2 | 1,8 |
| Siswa 225 | 1 | 2 | 2 |
| Siswa 226 | 1 | 2 | 1,8 |
| Siswa 227 | 1 | 2 | 1,1 |
| Siswa 228 | 0 | 2 | 1,8 |
| Siswa 229 | 1 | 2 | 9,7 |
| Siswa 230 | 1 | 2 | 13,3 |
| Siswa 231 | 1 | 2 | 6 |
| Siswa 232 | 0 | 1 | 2,4 |

| | | | |
|---|---|---|---|
| Siswa 233 | 0 | 1 | 5 |
| Siswa 234 | 0 | 2 | 900 |
| Siswa 235 | 0 | 1 | 6,4 |
| Siswa 236 | 1 | 2 | 1,3 |
| Siswa 237 | 0 | 1 | 9,1 |
| Siswa 238 | 1 | 2 | 2,3 |
| Siswa 239 | 1 | 2 | 1,4 |
| Siswa 240 | 1 | 2 | 1,7 |
| Siswa 241 | 0 | 2 | 5,7 |
| Siswa 242 | 0 | 2 | 2 |
| Siswa 243 | 0 | 2 | 900 |
| Siswa 244 | 0 | 2 | 3,8 |
| Siswa 245 | 0 | 2 | 1,4 |
| Siswa 246 | 0 | 2 | 6,2 |
| Siswa 247 | 0 | 2 | 350 |
| Siswa 248 | 1 | 2 | 2,1 |
| Siswa 249 | 1 | 2 | 1,3 |
| Siswa 250 | 1 | 2 | 3 |
| Siswa 251 | 1 | 2 | 800 |
| Siswa 252 | 1 | 2 | 7,5 |
| Siswa 253 | 1 | 2 | 1,4 |
| Siswa 254 | 0 | 2 | 350 |
| Siswa 255 | 1 | 2 | 2 |

Tabel 3. 2 Data Transformation

c. Programming language

The programming language used for data analysis is *Python.*

# 4 Results and Discussion

a. Segmentation Results

Visualization of clustering results is used to understand the distribution pattern of students in each cluster. The following graph presents the results of student segmentation obtained using Deep Embedded Clustering (DEC)).
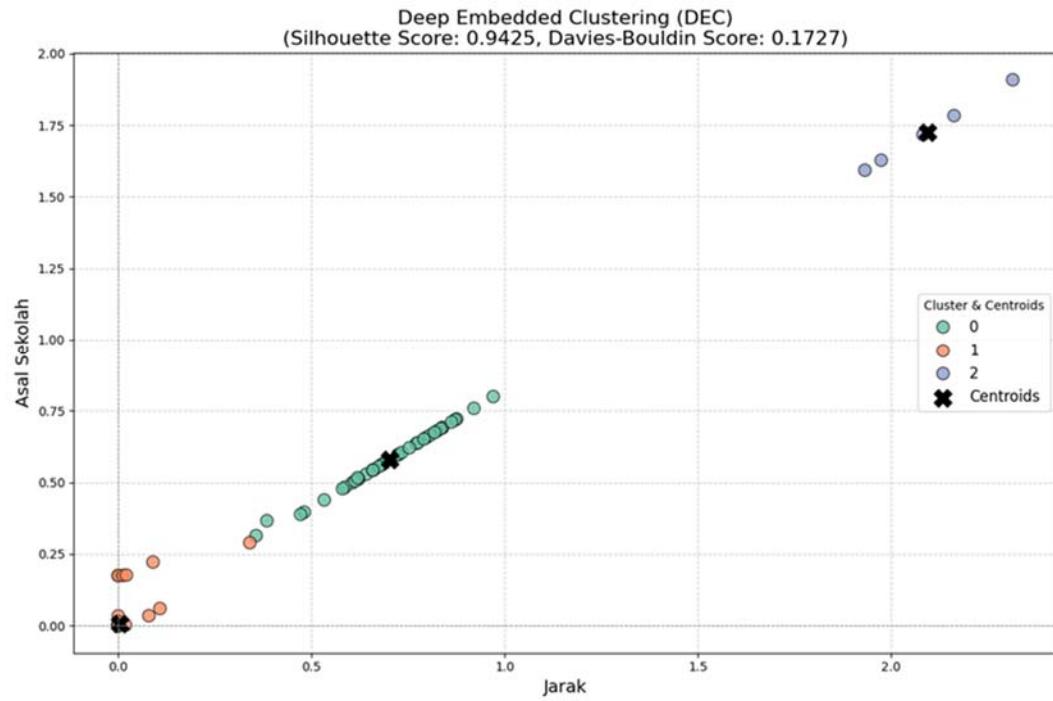
**Figure 4. 1 Student Segmentation Results**

b.  Interpretation of Results

This study uses the Deep Embedded Clustering (DEC) method to group prospective students based on characteristics that are relevant to the promotion strategy of PAX Ecclesia Junior High School. The clustering results divided students into three main groups with optimal separation, supported by a Silhouette Score of 0.9425 and a Davies-Bouldin Score of 0.1727, which indicates excellent clustering quality.

1.  Cluster 1 (Red): Students who live very close to the school, have great potential to apply. Suggested promotional strategies include open houses, educational seminars, and collaboration with the nearest elementary school.

2.  Cluster 0 (Green): Students with moderate to long distances, but have a certain connection to the school. Suitable strategies include a community approach, scholarship programs, and cooperation with the home school.

3.  Cluster 2 (Blue): Students from more distant areas or schools with specific academic relationships. Effective strategies include digital marketing, out-of-town scholarships, and partnerships with other educational institutions.

c.  Impact on Promotion Strategy

The application of the Dec method can assist schools in optimizing their marketing strategies by understanding the characteristics of prospective students. With this information, schools can:

1.  Tailor the promotion approach to prospective students based on the characteristics of their cluster.

2. Offer specialized programs that suit the profile of students in each cluster.

3. Allocate marketing resources more efficiently.

# 5 Conclusion and Advice

a. Conclusion

Cluster 1 : students nearby area with easy transportation access.

Open houses, visits to nearby elementary schools, as well as scholarship programs for local students.

Cluster 2 : students from further areas

Digital campaigns through social media and webinars to reach a wider area.

Cluster 3 : students from a particular elementary school with a strong connection to that school.

Cooperation with elementary schools that have high registrations, as well as socialization programs for grade 6 students.

b. Suggestion

This study proves that *Deep Embedded Clustering* (DEC) is effective in grouping students based on certain characteristics, helping Pax Ecclesia Junior High School in developing a more appropriate marketing strategy. However, several aspects can still be developed to improve the accuracy and application of this method in the future, including:

1. DEC Algorithm Enhancement

   Further parameter optimization can improve clustering accuracy.

2. Use of Additional Variables

   Incorporating factors such as academic interests, extracurriculars, and socioeconomic background can provide more comprehensive segmentation.

3. Testing with Wider Datasets

   Use data over a longer period or with a larger scope to make the results more representative.

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